LoadSEER™
Spatial Electric Expansion & Risk

**LoadSEER™**
*Spatial Electric Expansion & Risk*

The Hybrid Solution for Accurate, Traceable Spatial Load Forecasting

# The Proof is in Distribution Planning

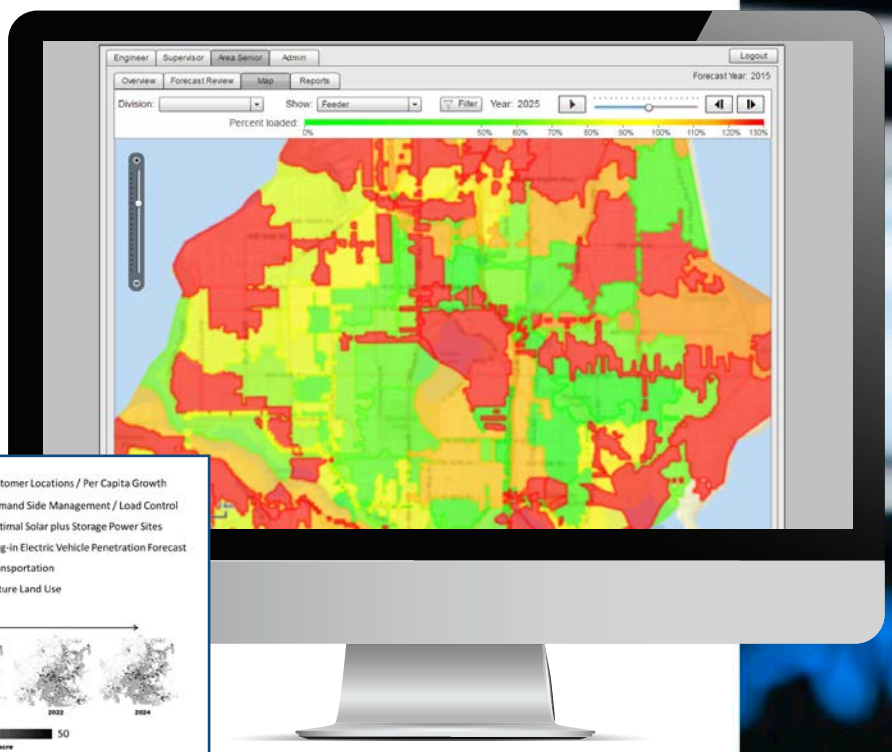
Providing reliable electrical service has always been a key focus for distribution planners. Traditional forecasting and planning approaches have historically used average load growth over wide areas, basic analysis of weather impacts, and little, if any, attention to changing economic, resource deployment, or network topology changes. Exactly how resources and loads operate, interact, and provide power and reliability within the service territory must be analyzed in greater detail to adequately plan for, and integrate emerging distributed resources with changing load trends. And with emerging distributed energy resources (e.g., solar, storage, electric vehicles, demand response), the diversity of forecasted peaks on the T&D systems are changing in a significant way. These supply-side and demand-side resources emerging at the grid edge present new operational challenges which require more detailed and granular planning tools.

LoadSEER, developed by Integral Analytics, is a spatial load forecasting tool which is used by electric distribution system planners to predict load and power changes, where on the grid the loads will occur, how DG changes the load shape, and when it must be supplied. LoadSEER spatial load forecasts address both short-term circuit trends and long-term grid expansion, while remaining consistent with the overall corporate load forecast for energy and peak demand. The resulting forecast provides system planners with substation, circuit and small-area resolution time-series load growth and load shape changes.

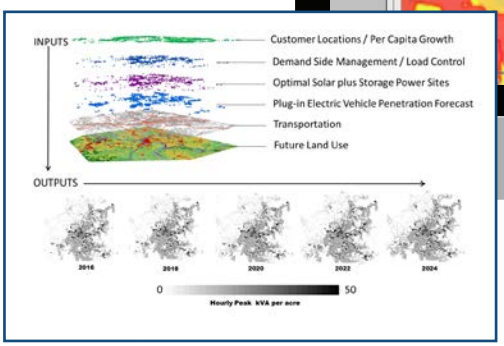
## LoadSEER has the Answers

- How will EVs and DG change my peak coincident hours over the next 10 years?
- What if the economy rebounds during an extreme weather year?
- What's the value if I can get new resources to locate where I need them?
- How can I use distributed resources to mitigate risk?

*LoadSEER produces a powerful time-series analysis for future load growth based on the forecast scenarios. The tool specifically highlights circuits at risk from changes in demand and capacity. Red areas are circuits over capacity and are most cost-effective candidates for EE, DR, and DERs while green areas have surplus capacity and are least cost load building, such as EV charging stations or new economic development. (The map to the right is simulated data for a Northeast US utility and used for presentation purposes only)*




*LoadSEER uses a rich set of geospatial data layers and rule-based land use simulation to determine where new load growth is likely to occur.*





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# Giving Sight to Spatial Change and Time

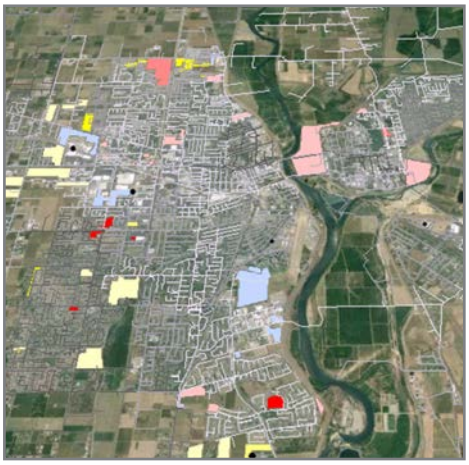
LoadSEER (Spatial Electric Expansion & Risk) is a spatial load forecasting software tool designed specifically for transmission and distribution (T&D) planners who face increasingly complex grid decisions caused by emerging microgrid technologies, extreme weather events, and new economic activity. The objective of LoadSEER is to statistically represent the geographic, economic, distributed resources, and weather diversity across a utility's service territory, and use that information to forecast circuit and bank level peak loads, sub-sections of the circuit, acre-level changes, and impacts from various scenarios over the planning horizon. Planners are able to decompose system impacts using map layers superimposed on the spatial representation of the T&D infrastructure.

## The LoadSEER Advantage

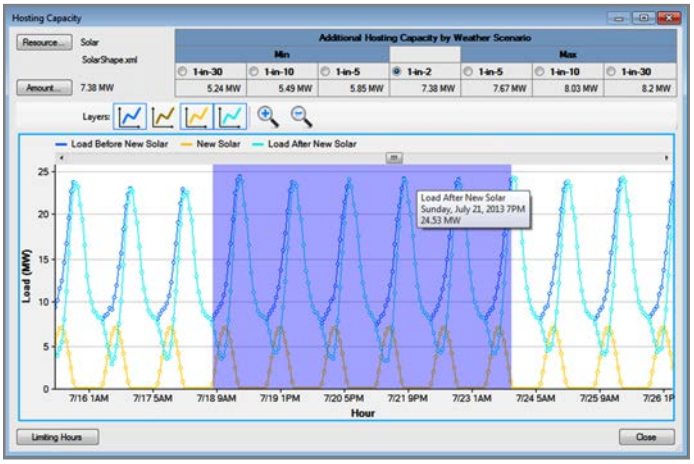
| | |
|---|---|
| **Accuracy** | Acre level detail, necessary for resources at the grid's edge |
| **Traceability** | All loads are tracked from the bottom up, reconciled to Corporate |
| **Documentation** | Clear, transparent and highly defensible results and reporting |

The strategic benefits of LoadSEER are many:

- Leverages up to 100 economic factors, by circuit, in addition to weather. Economic risk often trumps weather risk at the circuit level.
- Automated forecast model fitting, with recommended forecast results, so planning engineers can minimize the time spent developing forecasts, yet still incorporate their local knowledge of known or expected growth.
- A GIS spatial forecast, based on 20 years of NASA satellite histories, modeling geographic influences unique to the regional customer base and the landscape.
- Ability to target DSM or DG to target circuits, without jeopardizing reliability.
- Comprehensive quality checking, process review, and log history for use in data requests and defensibility, as well as oversight and management during the forecast period.
- Ability to directly integrate solar forecasts, EV forecasts or other microgrid impacts, down to the customer level.
- Quick export to your power flow analysis tool, or DMS (Distribution Management System), with full hourly load shapes across all weather scenarios.
- Leverages multiple forecasting methods to triangulate on the truth.
- Very sophisticated approach to scenario analysis, especially for factors that do not exist in the past load history (new DG, EV, commuter rail lines, new economic centers, etc.)
- Provides the analytical detail needed for DMS, optimal switching/transfers, improved power flow modeling, forecasting future LMP congestion and detailed calculation of distributed marginal costs and prices.
- Accounts for historical transfers of load between circuits. Statistical finds transfers, fault, imputes missed reads, and weather adjusts SCADA loads.
- Ease of use, and increased productivity, due to automation of forecasting process.
- Significantly more defensible within regulators and management.



*LoadSEER connects local load increases (shown in color) to line sections for improved power flow analysis in other modeling software, such as CYME, Synergi and Milsoft.*




*LoadSEER accommodates DER plans, including Integration Capacity Analysis, subsequent changes in load shapes, and calculating the maximum allowable amount of specific DERs, such as PV.*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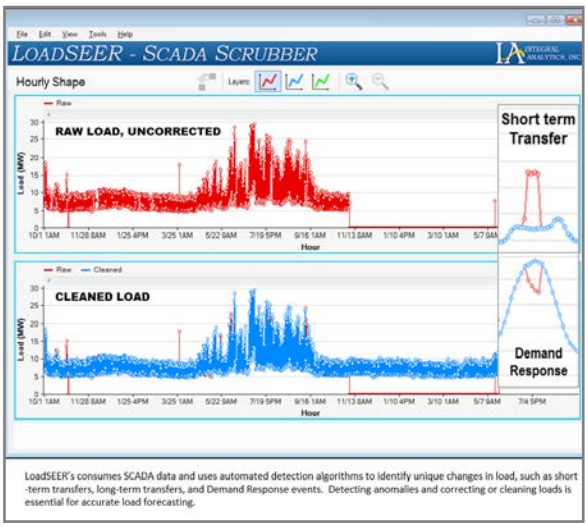
# Simulation that Delivers Non-Linear Locational Behavior

## Scenario-Driven Forecasting

The core algorithms automatically model geographic and economic drivers, along with weather, to provide engineers with the most representative circuit by circuit forecast models.

In some cases, one circuit might respond to retail sales, while another might be sensitive to employment, personal income, housing starts, or various combinations.



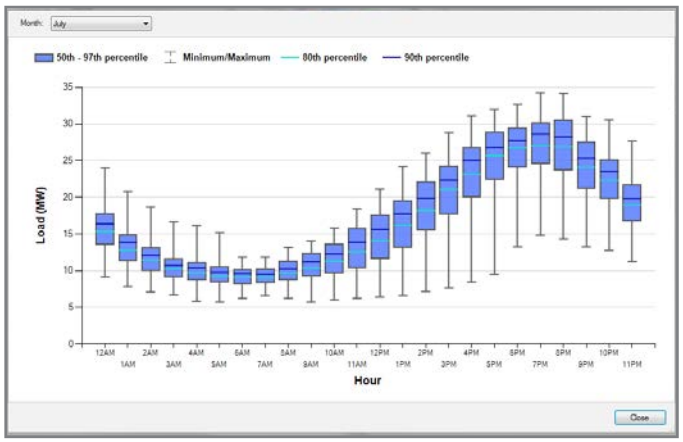

*LoadSEER's load cleaning tool imports SCADA data and uses automated detection algorithms to identify unique changes in load to improve model performance.*

LoadSEER houses two distinct modules, the FIT (Forecast Integration Tool) module and LoadSEER-GIS (Geographic Information System) module.

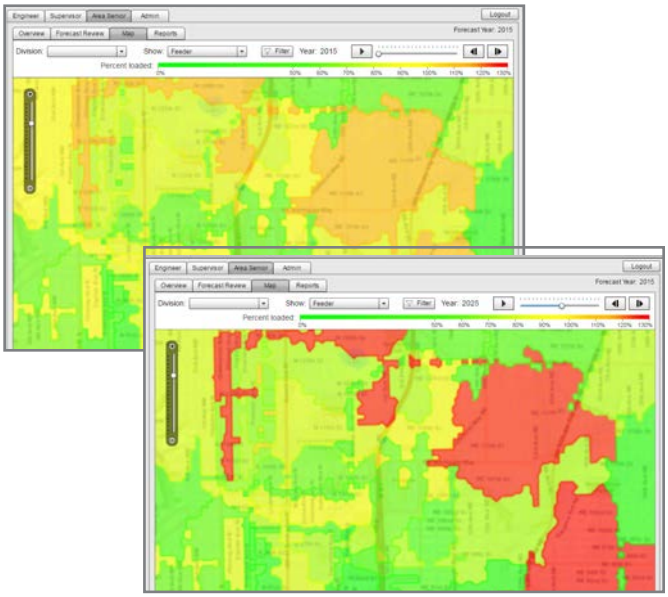
1. LoadSEER-FIT employs three methods for forecasting loads, is housed within a web services user interface and is the place where distribution planners conduct most of their forecasting and data management tasks.
2. The LoadSEER-GIS module houses the spatial data information and analytics. Includes hundreds of GIS layers so users can overlay multiple scenarios and results for further analysis or impressive displays of results.

LoadSEER employs three different types of load forecasting including a regression of peak circuit loads on weather and economic variables, an econometric forecast of energy using these same or similar independent variables, and a spatial load forecast using GIS land use and geographic

This process enables planners to analyze specific future scenarios such as transportation network expansion, suburban sprawl, urban redevelopment, new manufacturing, various mixes of solar, electric vehicles, demand response, energy efficiency or additional employment centers. The final forecast results can be leveraged to enhance an existing suite of planning tools, including direct exports to power flow analysis tools, used in forecasting future transmission congestion, calculation of local avoided costs for optimal DER integration, and Distribution IRP requirements.




*LoadSEER houses hourly load profiles that are weather normalized and itemized by customer class and in aggregate to create unique substation, circuit and line section shapes.*



*LoadSEER's distinctively designed to handle multiple scenarios. For instance, the adoption of DERs will affect feeder load shapes and may either exceed feeder capacity from increased load (EV charging station) or may help defer a capacity addition from decreased load (EE/DR/PV). LoadSEER models adoption probabilities for DERs, highlighting which circuits may be at further risk or may benefit from incentivized participation in utility programs.*

information. The use of three different methods provides increased convergent validity where two or more of the distinct forecasts produce similar forecast results. In addition, the local distribution planner's knowledge of the local load situation can be incorporated to further enhance the forecast accuracy of any of the three methods.

LoadSEER also provides an option to statistically blend the three forecasts based on the statistical goodness of fit diagnostics for each method. Alternatively, if the local distribution planner has unique, local knowledge that one of the three forecasts is likely to be more accurate than the others, more weight can be placed on that forecast. LoadSEER not only provides a weather normal forecast of loads, but also incorporates a forecast overall all possible weather conditions, circuit by circuit.

*Produce an accurate, traceable, long-term load forecast that actually improves the value of short-term decisions!*

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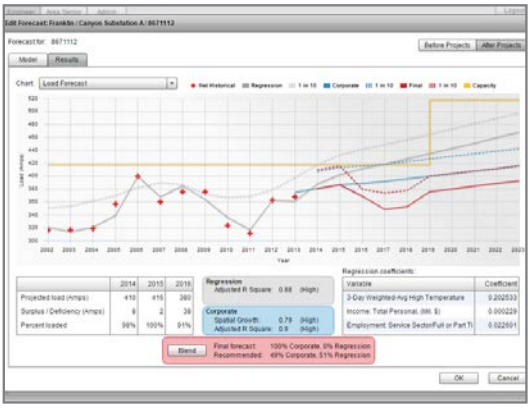

## The LoadSEER Advantage

### *Consistency*

LoadSEER visualizes a utility's corporate forecast given a full set of growth rules, then follows them to allocate growth. For every model generated, it produces tabular results for each substation area separately, and summarizes the change in load and customer profiles for each substation area respectively.

### *Traceability*

LoadSEER shows planners, managers and customers where all conclusions came from for each interim result and each interim decision. During model-building, running, and calibration, LoadSEER's user interface saves full sets of growth rules and corresponding map documents for review.

### *Documentation*

LoadSEER is self-documenting in order to prove consistency and traceability. Planners can quickly change and apply growth assumptions and rule sets across an entire service territory, preserving old parameters for comparison and calibration.

## LoadSEER Services

- Model Set-up, calibration, and simulation
- Database creation, data hosting services
- LoadSEER architecture
- Training workshops, site visits
- Technical Support

## About Integral Analytics, Inc.

Integral Analytics (IA) is an analytical software and consulting firm focused on operational, planning, and market research solutions for every aspect of the energy industry. Its proprietary analytical, programming, and statistical methods offer clients more precise valuation, faster and more affordably.

**DSMore™**

*2007 AESP Winner of "Outstanding Achievement in New Product Innovation"*

Demand Side Management Option Risk Evaluator (DSMore) is a powerful financial analysis tool designed to evaluate the costs, benefits and risks of demand-side management (DSM) programs and services. Its power lies squarely in its ability to process millions of calculations within seconds, resulting in thousands of cost-effectiveness results that vary with weather and/or market prices.

By viewing DSM performance and cost-effectiveness over a wide variety of conditions, managers and regulators can better measure the risks and benefits of employing DSM measures versus traditional generation capacity additions.

**IDROP™**

Integral Analytics' Integrated Dispatchable Resource Optimization Portfolio (IDROP) uses the Smart Grid in a completely novel approach – to allow a utility to proactively manage customers within the Smart Grid in a manner much like it has treated their generation resources. Specifically, IDROP allows a utility to optimize at a systems level the micro-dispatch of appliances, electric vehicles, photovoltaic generation, wind generation, and distributed storage units, such that the utility can maximize its value given customer-established constraints, cost of service, compliance histories, expected load, and market prices.

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