



**Hawaiian Electric**  
**Maui Electric**  
**Hawai'i Electric Light**

## Modern Grid Technology Workshop

May 10, 2017

# Integral Analytics: Profile



Utility Customers

40+

Customer Load Shapes

500 million+

- Market leader in Distribution Grid Analytics software for Planning, Operations, Demand-Side Management, DER Valuation
- Products deliver **granular, actionable intelligence** to utilities and others to bridge long-range forecasting with near-term operational needs
- Patented architecture and methodology, based on least-cost principles
- Scalable platform for emerging system regulations in California, New York, Massachusetts, Texas, Arizona, Hawaii and other jurisdictions
- **2016 Greentech Media Grid Edge Winner/2015 Fierce Innovation Award**

Customers Include:



# Comprehensive Grid Planning for Hawaii

## HPUC Order:

- “...necessary to look at the grid in the context of the **entire value chain** of the electric system”
- The aim of this process is for the HECO Companies to file a **detailed, holistic, and scenario-based** Grid Modernization Strategy for each of the utilities
- “Such investments must be **strategically calibrated** and prioritized to meet clearly defined goals in order to achieve the vision for Hawaii’s integrated grid of the future. Each project or series of projects must **methodically and cost-effectively** advance this ultimate objective.”

## Business Requirement:

- A **granular, dynamic** distribution planning and valuation application through which HECO may forecast, capitalize and visualize network growth and manage reliability, inclusive of DER proliferation.

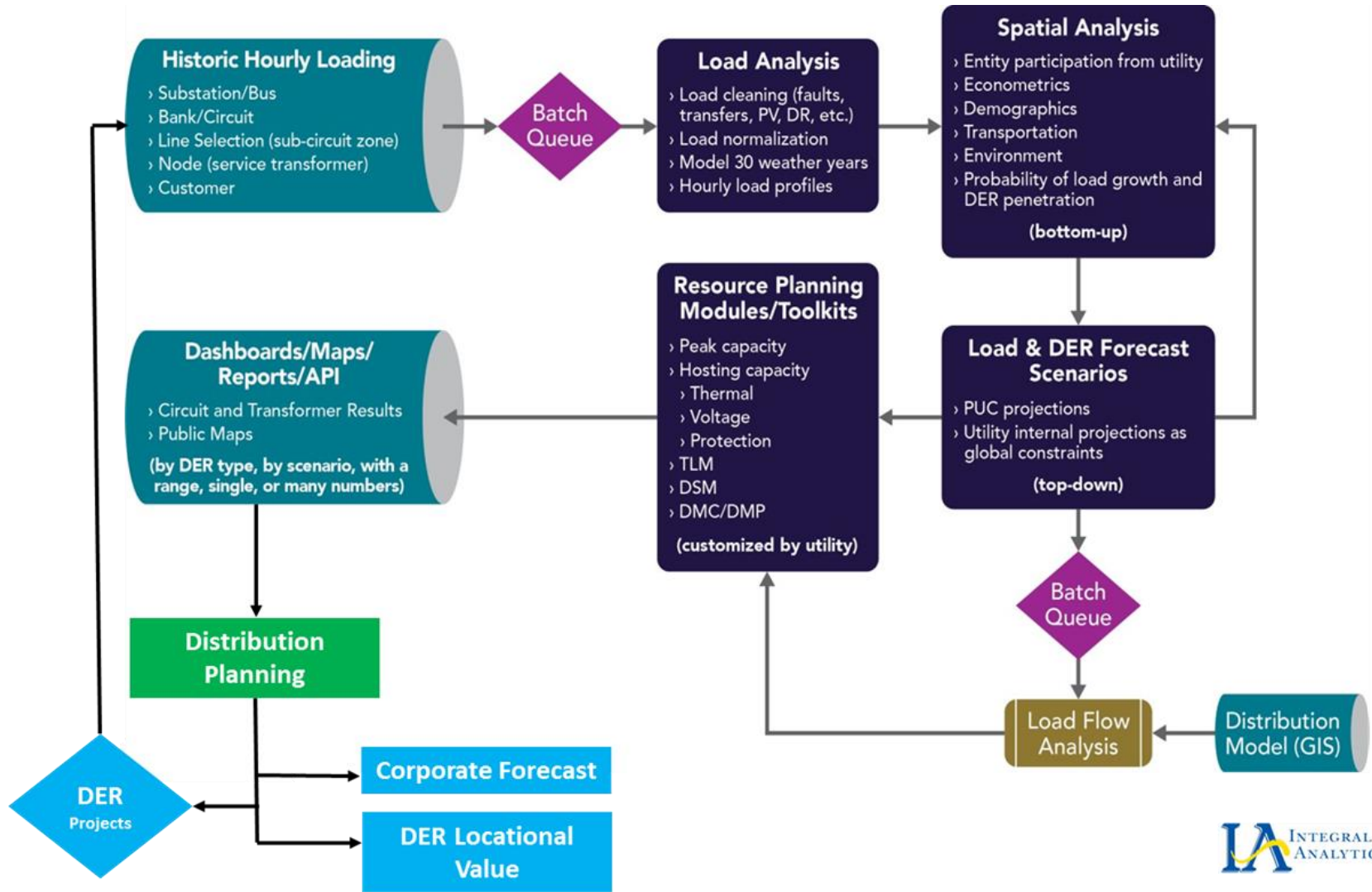
# Emerging Planning Requirements: 2017

- “It’s all about the load shape”
- Corporate/System Forecasting must change
  - Top-down must reconcile with granular/feeder-level
- DER proliferation requires nodal valuation, constrained by grid ops/powerflow
- Data-to-Intelligence loop must be closed
  - 1 million customer utility may produce > 500 million records per day
- Planning-to-Ops Analytics bridge must be built
  - “4 seconds to 20 years”
- Dynamic forecasting requires elastic computing

# Attributes of Future-Proof Grid Edge Planning

1. Built-to-Scale: Software, not Studies
2. Dynamic: IRPs to DRPs to ICAs to DERMS
3. Scenario Engine at the Core
4. Interoperability with powerflow/GIS/SCADA
5. Unified Platform to support many stakeholders:
  - Transmission/Distribution/Ops/Fuels
  - Corporate Forecasting
  - Regulators
  - Market Participants
6. Drive to the Premise

# Integrated Planning Software-Enabled Flow

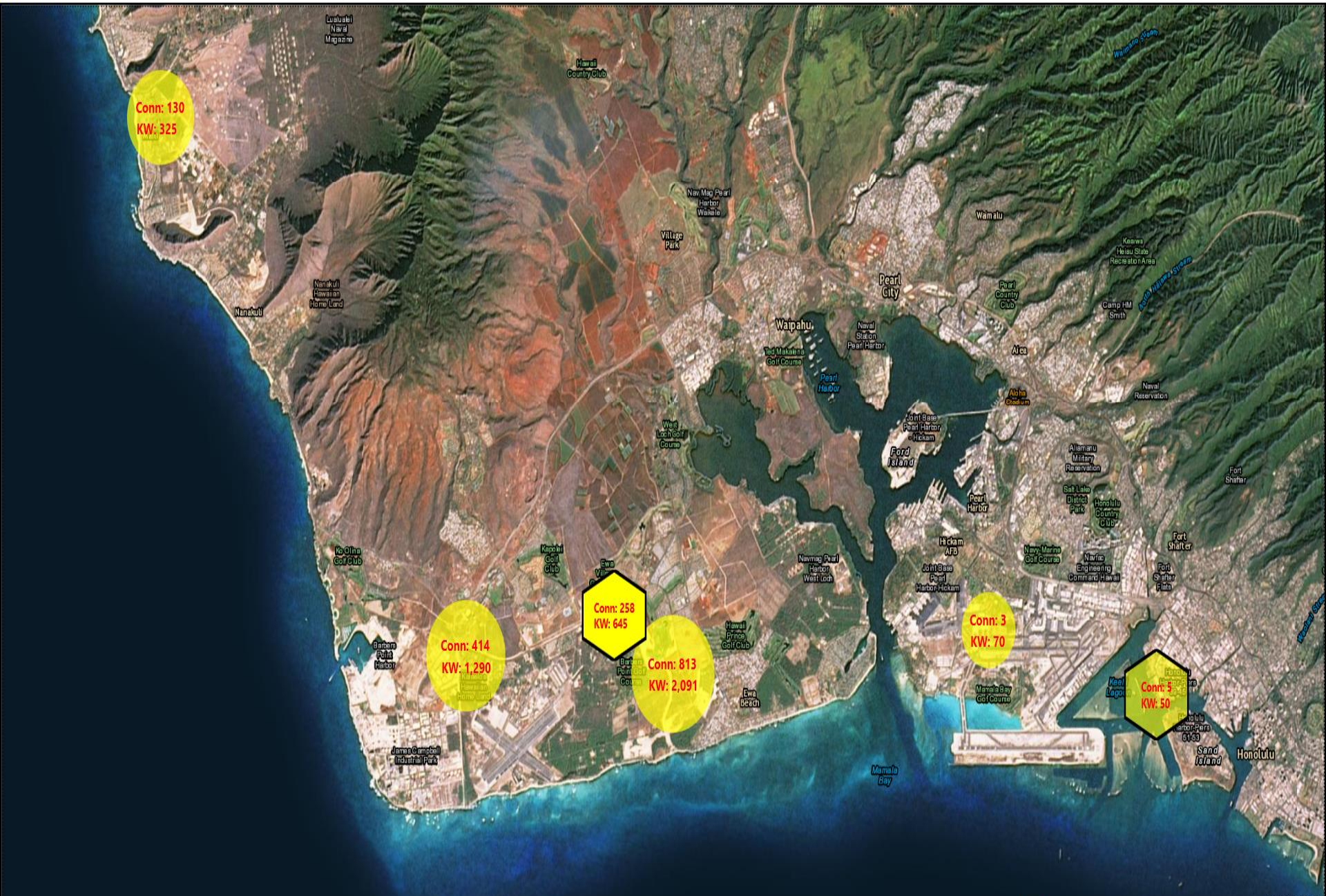


# Result: Intuitive, Multi-Stakeholder Platform

The screenshot displays the LOADSEER platform interface. On the left is a dark sidebar menu with the following items: Home, Explorer, Forecast, Grid, Scenario, Valuation, Tests, Portfolios, Operations, Optimizations, Library, Reports, Settings, Data, and FAQ. The main area is split into two panels. The left panel, titled 'GIS Data: SYCAMORE CREEK 1101', shows a map of a city area with roads and a network of blue and red lines. The right panel, titled 'GIS Data: SYCAMORE CREEK 11C', shows a network diagram with nodes and edges. At the bottom is a table with columns: Projects, Comments, Status, Forget & Print, ID Dates, ID Ends, and Tracker.

Projects	Comments	Status	Forget & Print	ID Dates	ID Ends	Tracker
Alameda St. Urban and development Route: 1101		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Arts Center Route: 1102		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
CA 99 and 99A Route: 1103		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Central Business District Route: 1104		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
IT Park Route: 1105		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 1: North Route: 1106		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 2: South Route: 1107		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 3: East Route: 1108		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 4: West Route: 1109		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 5: North Route: 1110		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 6: South Route: 1111		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 7: East Route: 1112		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 8: West Route: 1113		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 9: North Route: 1114		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 10: South Route: 1115		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 11: East Route: 1116		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 12: West Route: 1117		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 13: North Route: 1118		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 14: South Route: 1119		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 15: East Route: 1120		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012
Phase 16: West Route: 1121		Completed	1/1/2012	1/1/2012	1/1/2012	1/1/2012



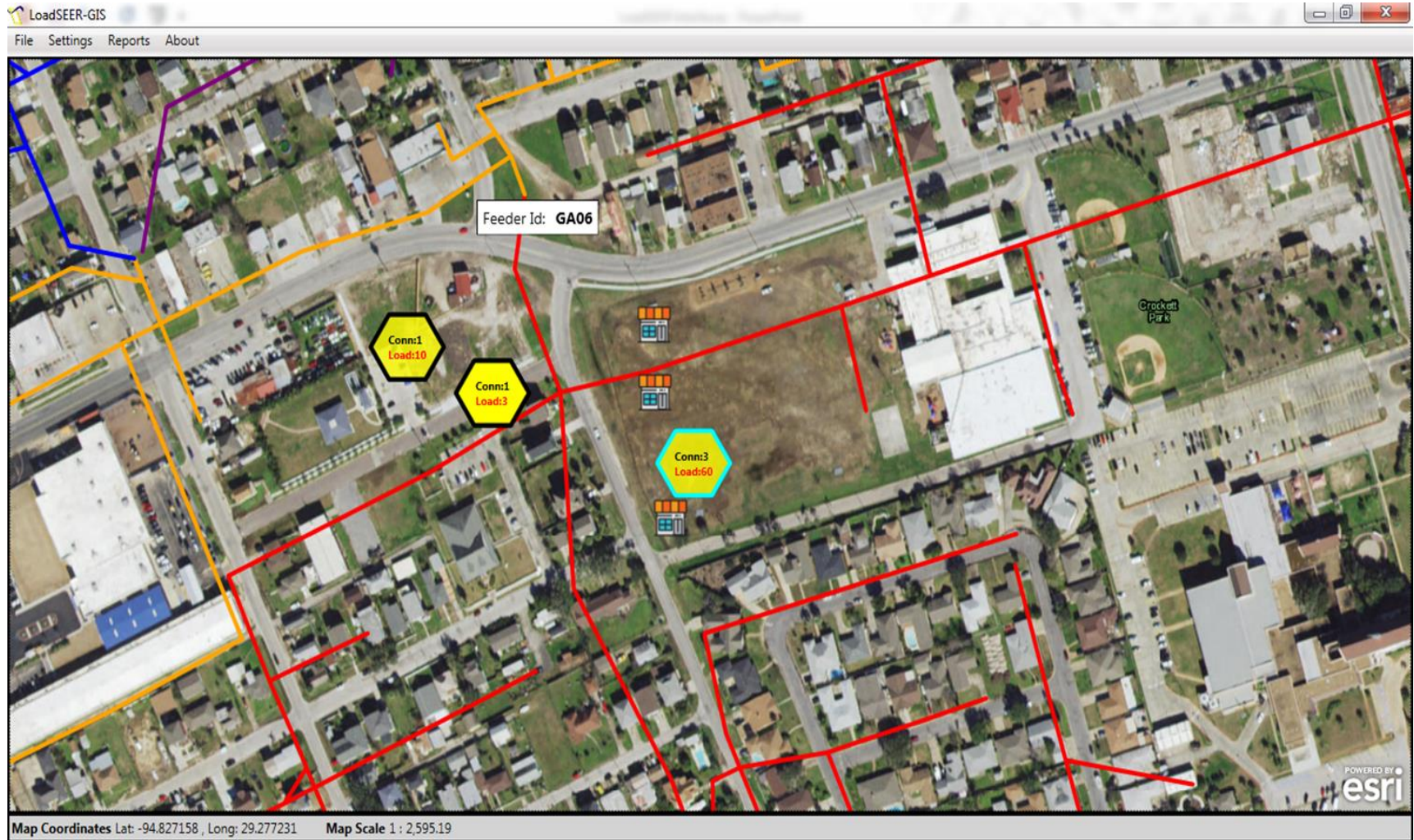








# Nodal Growth + DER + Powerflow = Holistic





# Scenario-Driven DER Planning

The screenshot displays the LoadSEER-GIS software interface. On the left, the 'Add Polygon' configuration panel includes the following settings:

- CUSTOMER CLASS:** PV (User Confidence: 70)
- HORIZON TIME:** Short Term: 3 - 5 years (User Confidence: 70)
- LOAD ESTIMATE:** LOW, MEDIUM, HIGH (User Confidence: 70); Load Per Connection (kW): 10
- CONNECTIONS:** LOW, MEDIUM, HIGH (User Confidence: 60); Number of New Connections: 5; Parcel Size Per Connection (Acres): 0.3288206208326740
- FEEDERS:** Each point its nearest feeder (radio button), All points the same feeder (radio button, selected), GL01 (dropdown menu) (User Confidence: 50)
- COMMENTS:** (text input field)
- Validation:** Validated (checkbox), Known Adjustment (checkbox)
- Buttons:** SAVE, CANCEL

The central map shows an aerial view of a residential area with several solar panel icons. One icon is highlighted with a yellow hexagon and labeled 'Conn:5 Load:50'. The bottom status bar displays 'Map Coordinates Lat: -94.805018, Long: 29.291634' and 'Map Scale 1 : 1,328.74'.

On the right, the 'LoadSEER Scenario Probability' gauge shows a probability range of 41 - 51%. The gauge is a circular dial with a red needle pointing to approximately 45% on a scale from 0 to 100. The scale is color-coded: green (0-30%), yellow (30-60%), and red (60-100%).

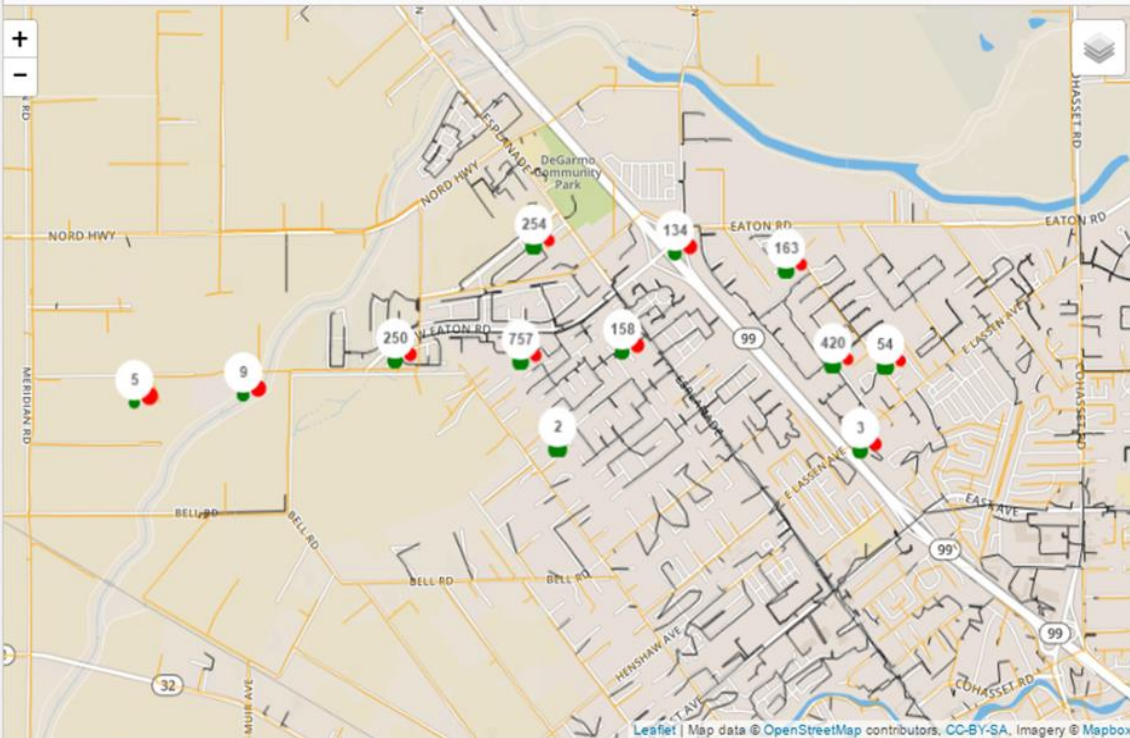
POWERED BY esri

# Nodal Value of DER...Integrated to Planning



## Node Viewer

Node Financials Zoomlevel: 14 active Layer:



Visible Extent

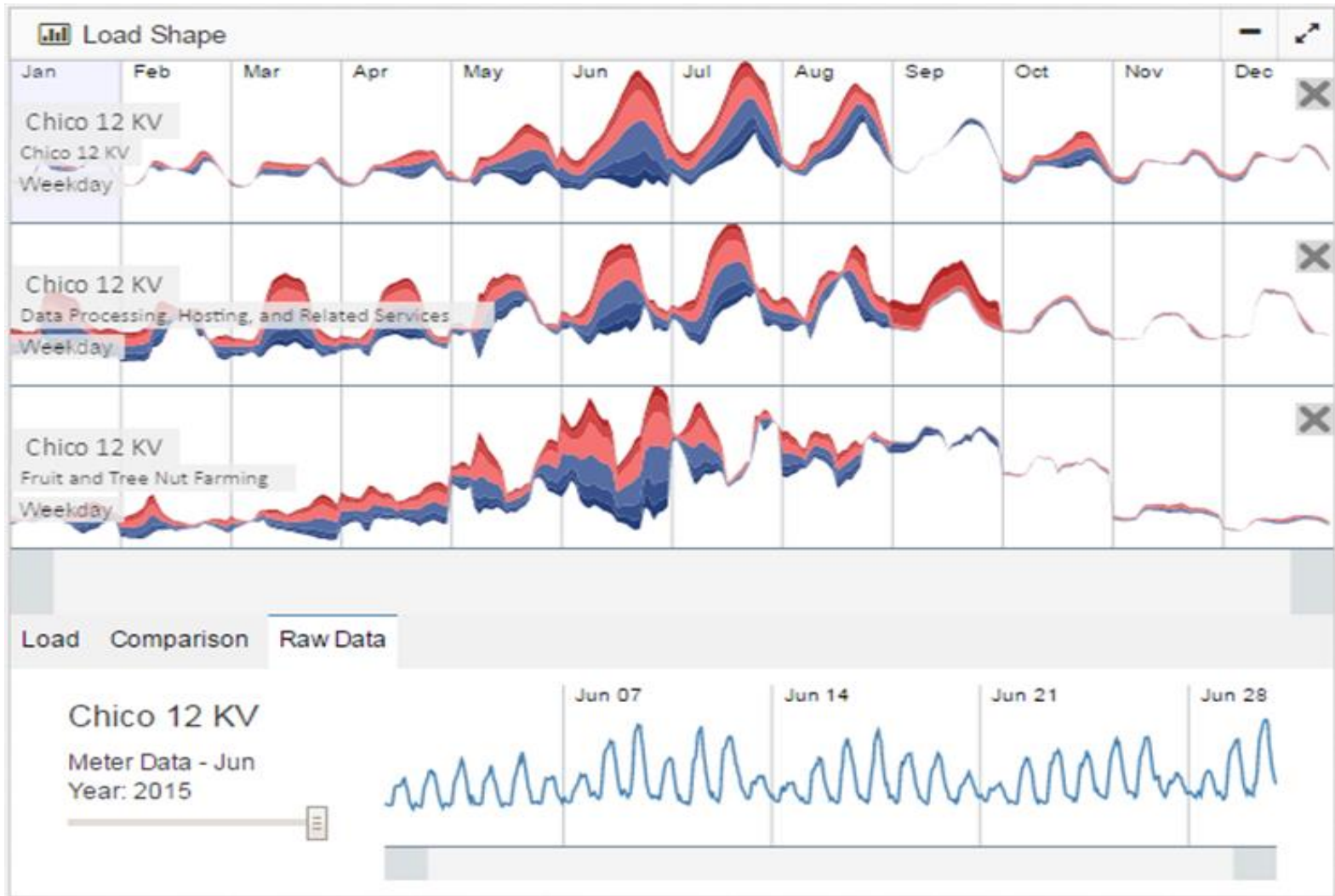
Measures

	Solar	HVAC	Lighting	Total
<b>Avoided Capacity Cost (\$Kw):</b>	2,094,950	2,254,595	2,512	4,352,057
<b>Avoided Energy Cost (\$Kwh):</b>	937,762	857,790	26,830	1,822,382
<b>Avoided Kwh (x yrs):</b>	1,578,374	1,411,724	41,235	3,031,333
<b>Avoided T&amp;D (\$):</b>	411,843	666,980	1,224	1,080,047
<b>Bill Savings (\$):</b>	7,133,133	7,232,972	157,677	14,523,782
<b>Participant Test (Avg):</b>	0.42	1.24	24.60	8.75
<b>Trc Test (Avg):</b>	0.53	1.70	29.07	10.43
<b>Adoption Probability (Avg):</b>	0.63	0.64	0.39	0.56

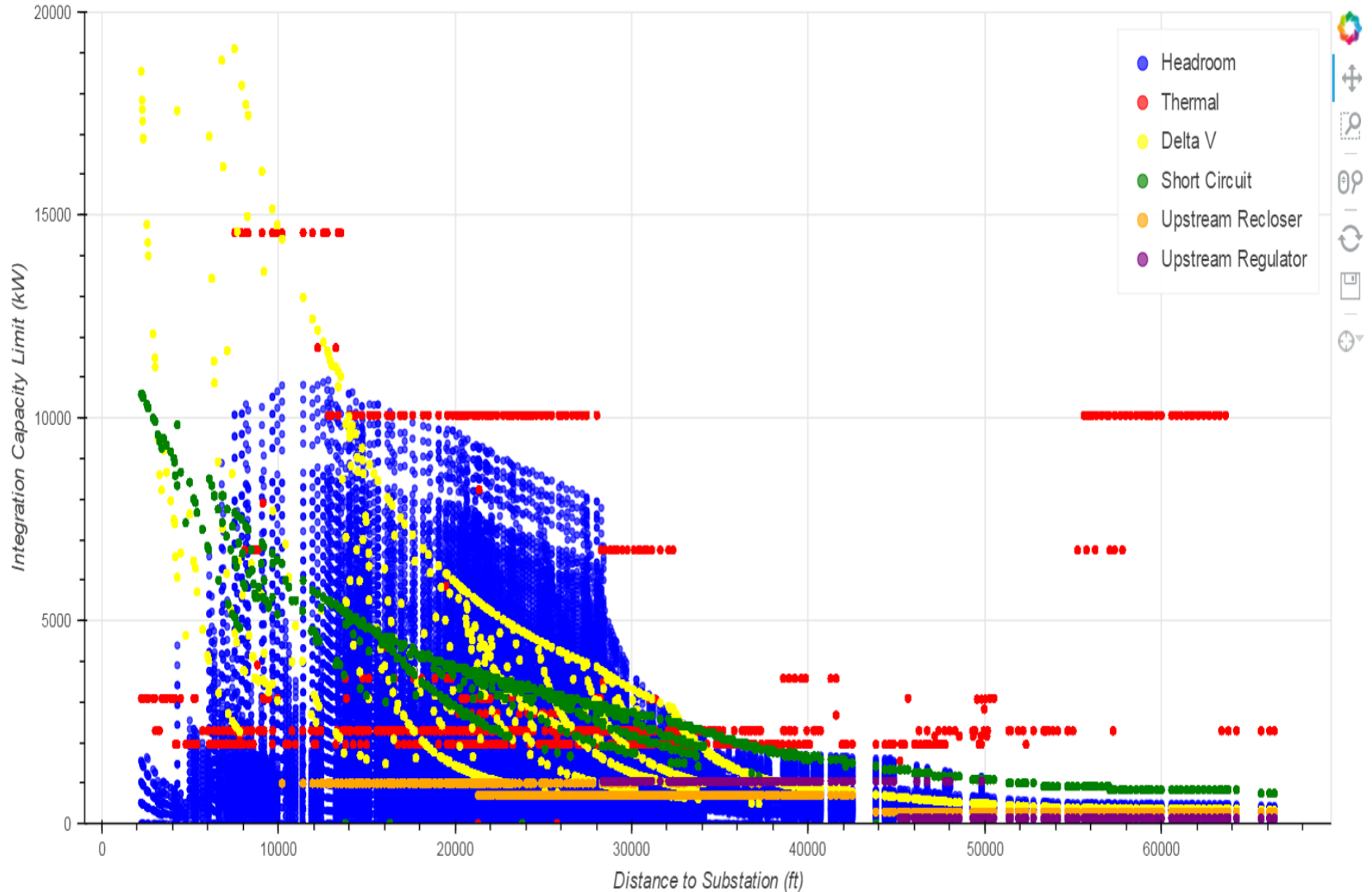
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox



# Importance of Load Shapes



# Hosting Capacity: Single Feeder, Hourly Impact



# Integrated Planning Tenets

- Flexibility
- Interoperability
- Scalability
- Driven by Cost-Effectiveness/Valuation
- Serving Multiple Stakeholders