Los Angeles Department of Water & Power

LA100, Building Stock Modeling & Lessons Learned

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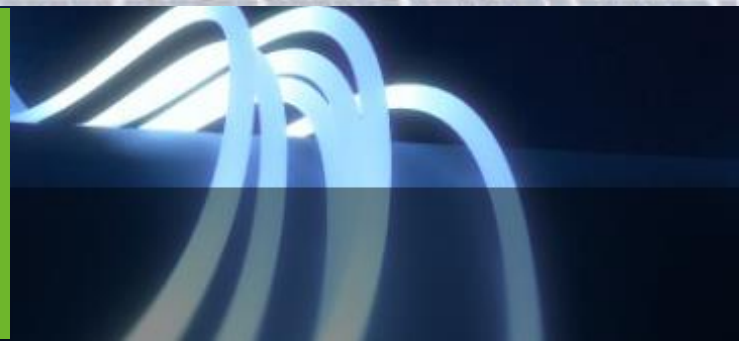
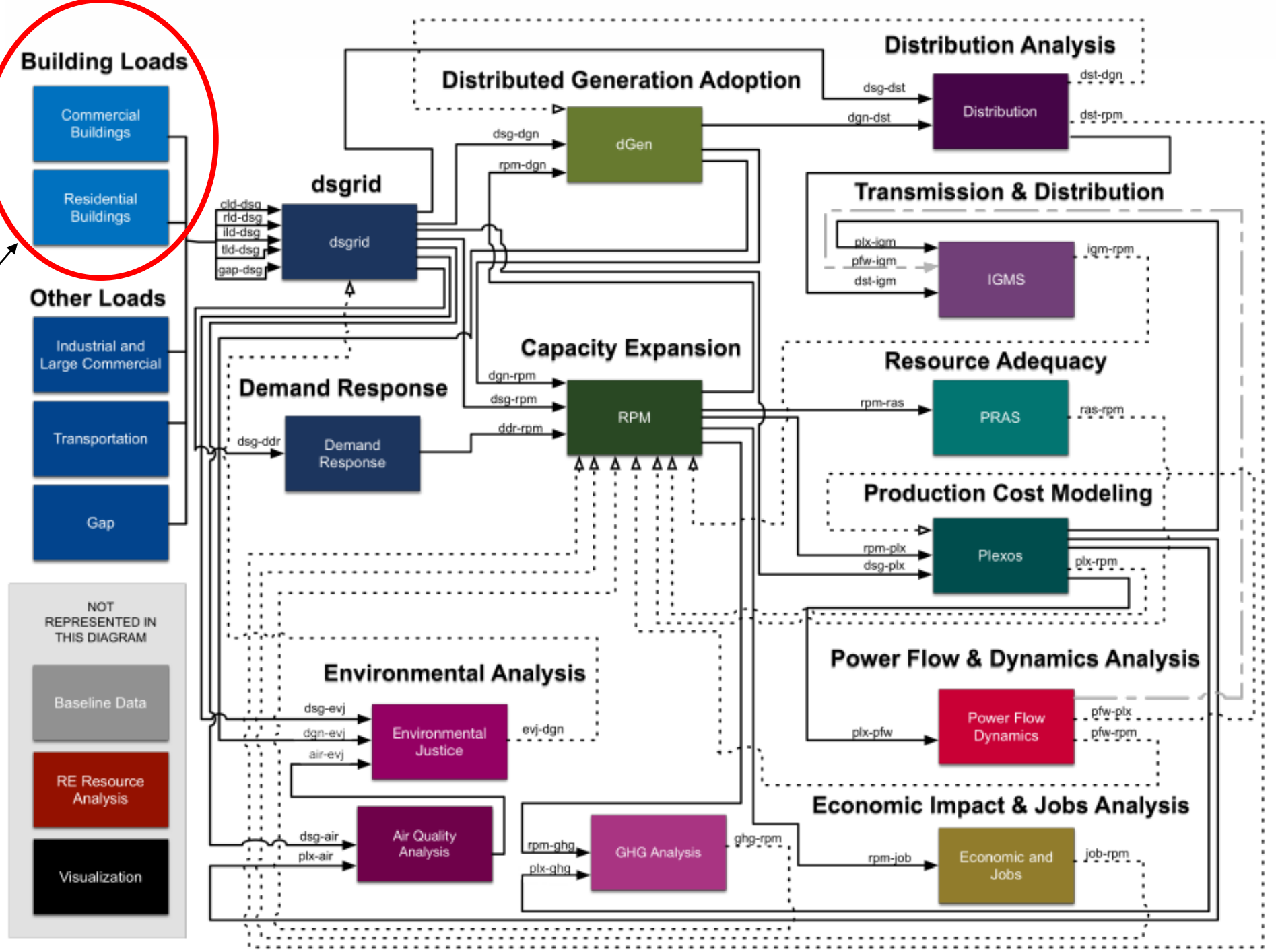
Key Drivers

- **100% Renewable Energy Study (LA100)**
  - Stakeholder Driven
- **Power System Strategic Long Term Resource Plan (SLTRP):**
  - Energy Efficiency + Building Electrification Potential Studies
  - Load Forecasting
  - Distributed Energy Resource + Electric Vehicle Charging Projections
- **Distribution Planning:**
  - Distribution Load Forecast
  - Distribution Resource Plan



LA100 Model Framework & Dataflow

ComStock & ResStock



ComStock & ResStock Framework & Data Sources

ResStock ComStock

Building stock characteristics database + Physics-based computer modeling + High-performance computing

Building Characteristics 	EIA NAHB IECC *Other national, regional, and local audit databases*	**Res/Com Energy Consumption Survey** **Homebuilder Surveys** **Historical Energy Codes**
Census Data 	Census	**American Community Survey (ACS)**
Costs 	EIA NREL NREL/Navigant	**Electricity and fuel costs** **OpenEI.org Utility Rate Database** **Measure Cost Database**
Climate Locations 	NREL	**TMY3 weather data**

EnergyPlus OpenStudio

Customization for Los Angeles

Los Angeles City/County

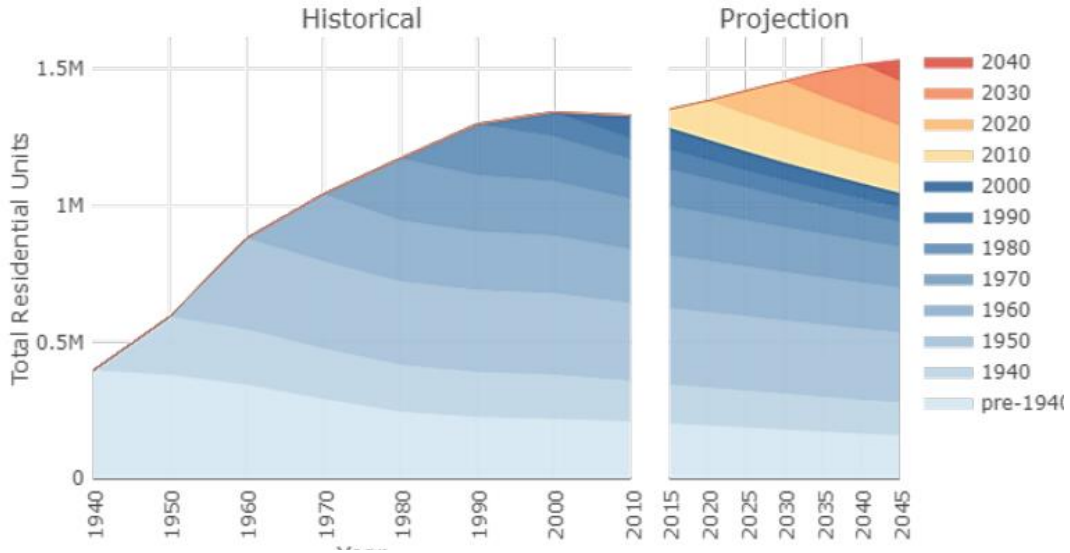
- Los Angeles Region Imagery Acquisition Consortium (LAR-IAC)
- LA County GIS Data Portal - various
- Los Angeles County Assessors Database
- LA DBS Existing Buildings Energy & Water Efficiency Program'
- Dodge Data and Analytics – Metropolitan Construction Insight

California (filtered to LA/DWP when possible)

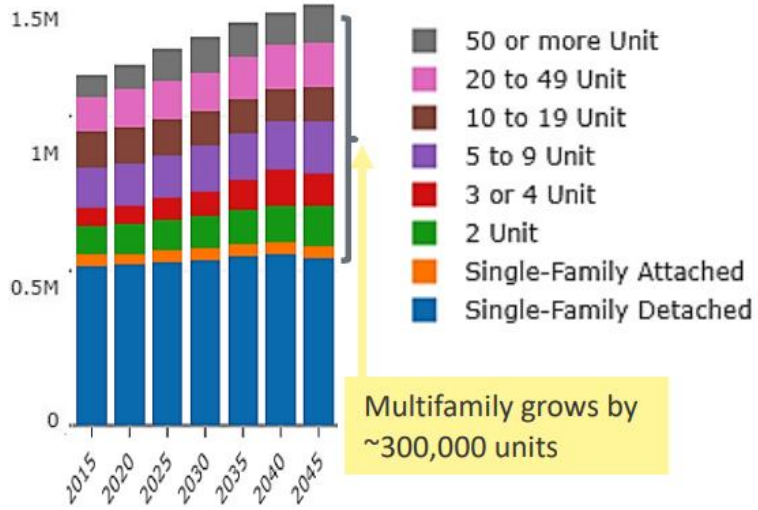
- California Title 24 (current and historical building energy codes)
- California Database for Energy Efficiency Resources (DEER)
- California End Use Survey (CEUS)
- California Commercial Saturation Survey - Report for the California Public Utilities Commission
- 2009 California Residential Appliance Saturation Study (RASS), 2012 California Lighting and Appliance Saturation Survey (CLASS)
- Report on Complete Schools & 2015 Student Audit - California Department of Education
- California Department of Finance Population Projections for LA County
- Weather data from multiple weather stations covering LA microclimates

LA100 Model Assumptions

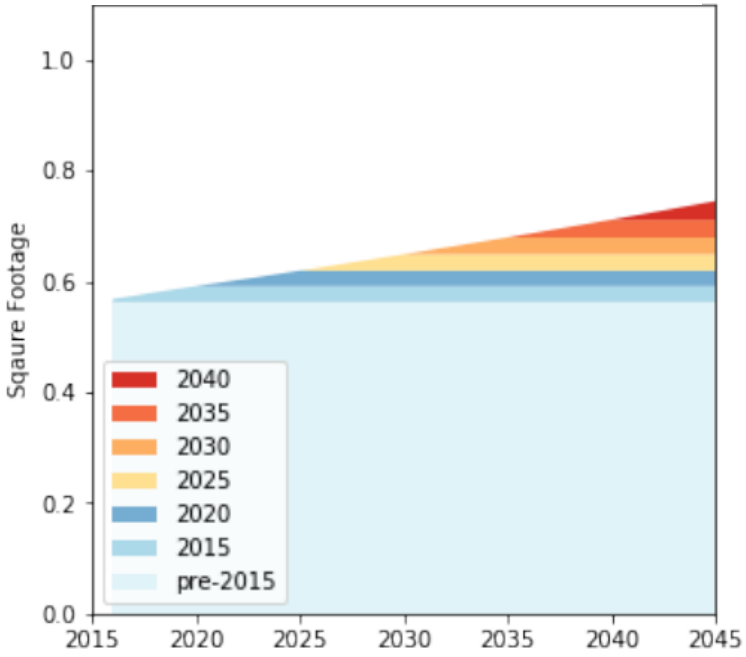
Residential Buildings by Vintages



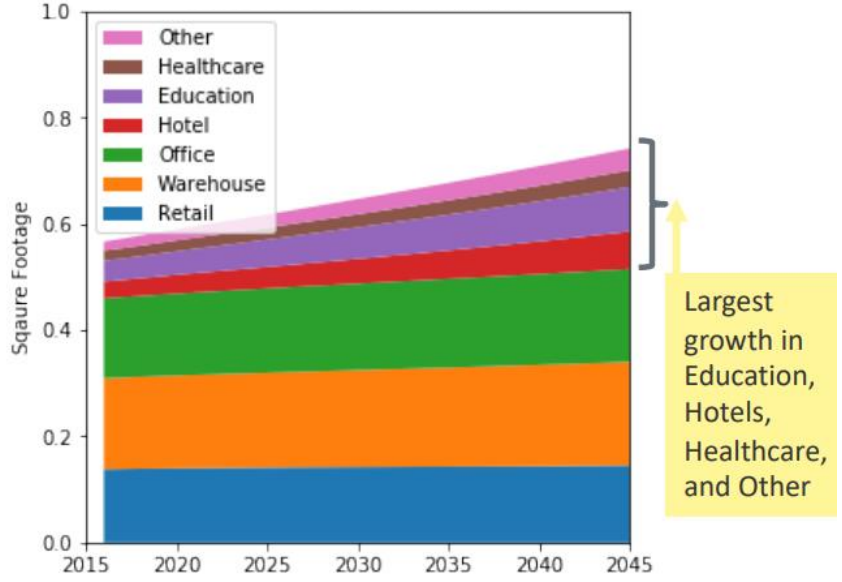
Building Types



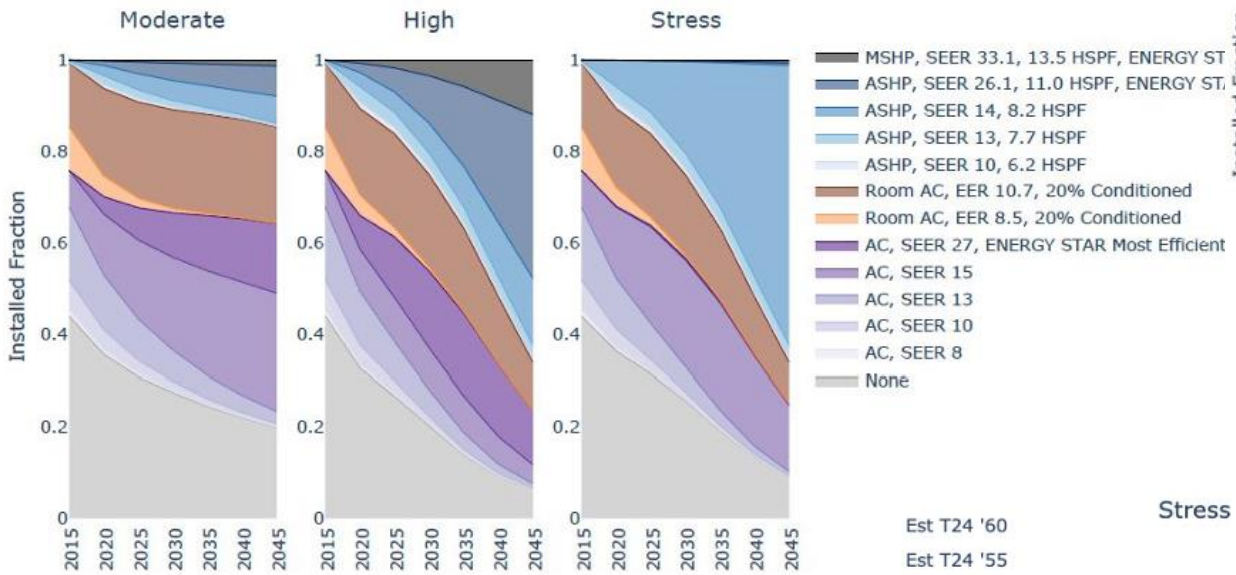
Commercial Buildings by Vintage



Buildings Types



LA100 Model Assumptions



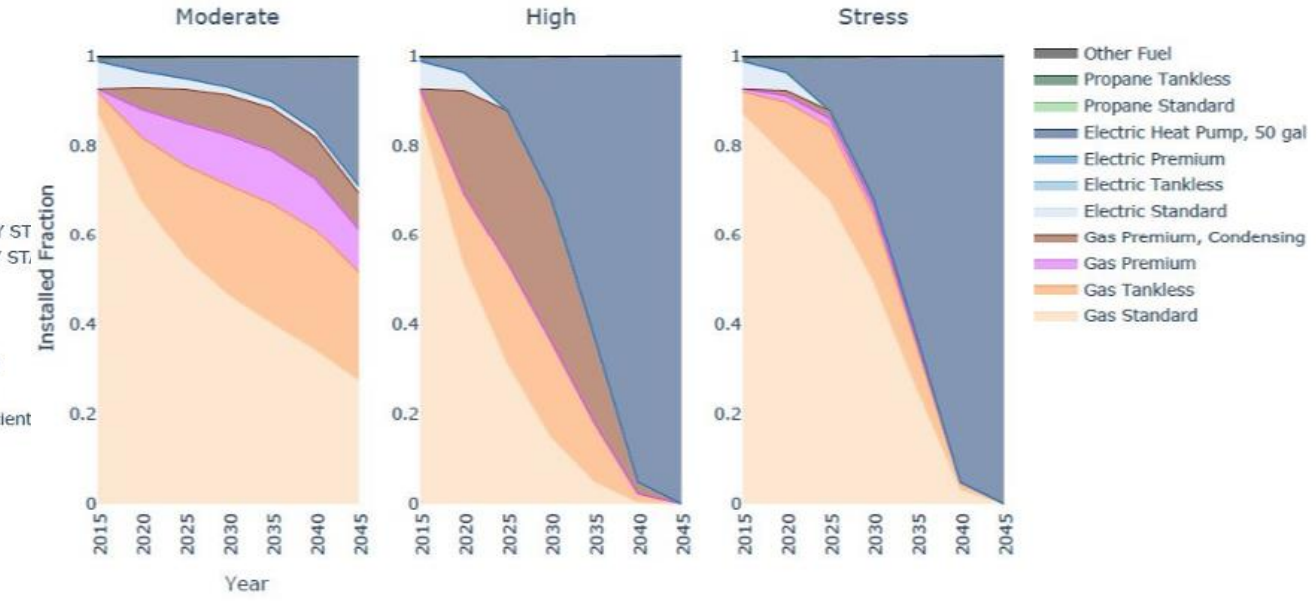


Figure 74. Installed percentage of water heater types and efficiency levels, by projection-year

Results are driven by scenario based assumptions made in building and equipment stock turnover rates.

Not by a consumer adoption modeling.

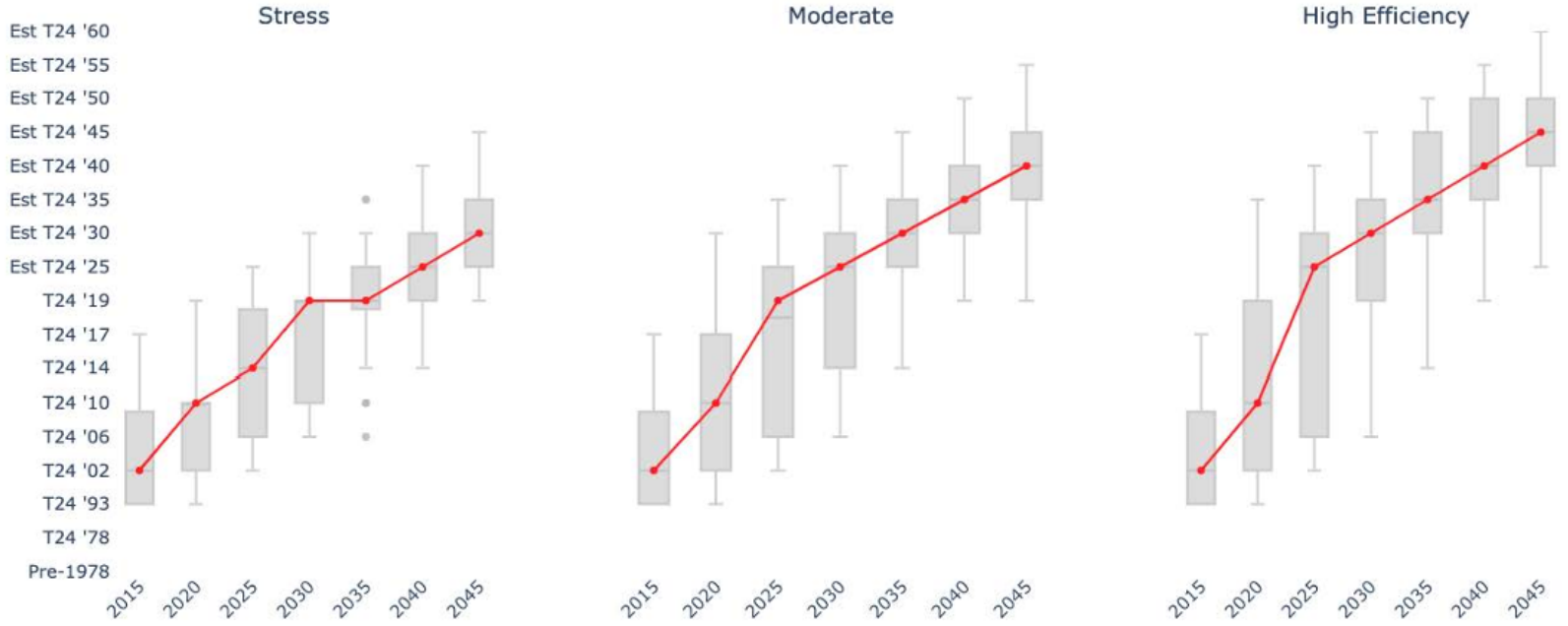
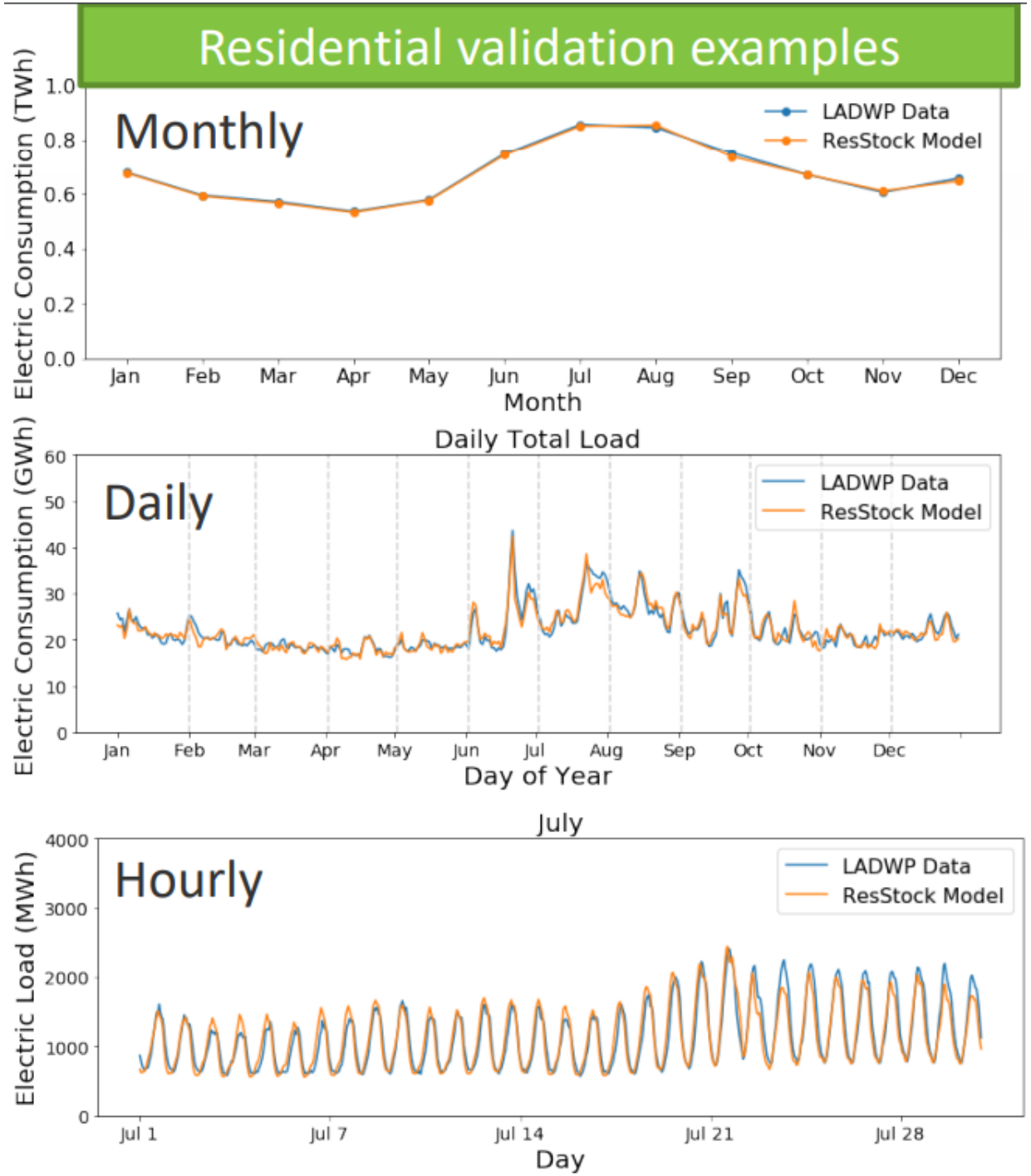


Figure 86. HVAC energy efficiency adoption rate

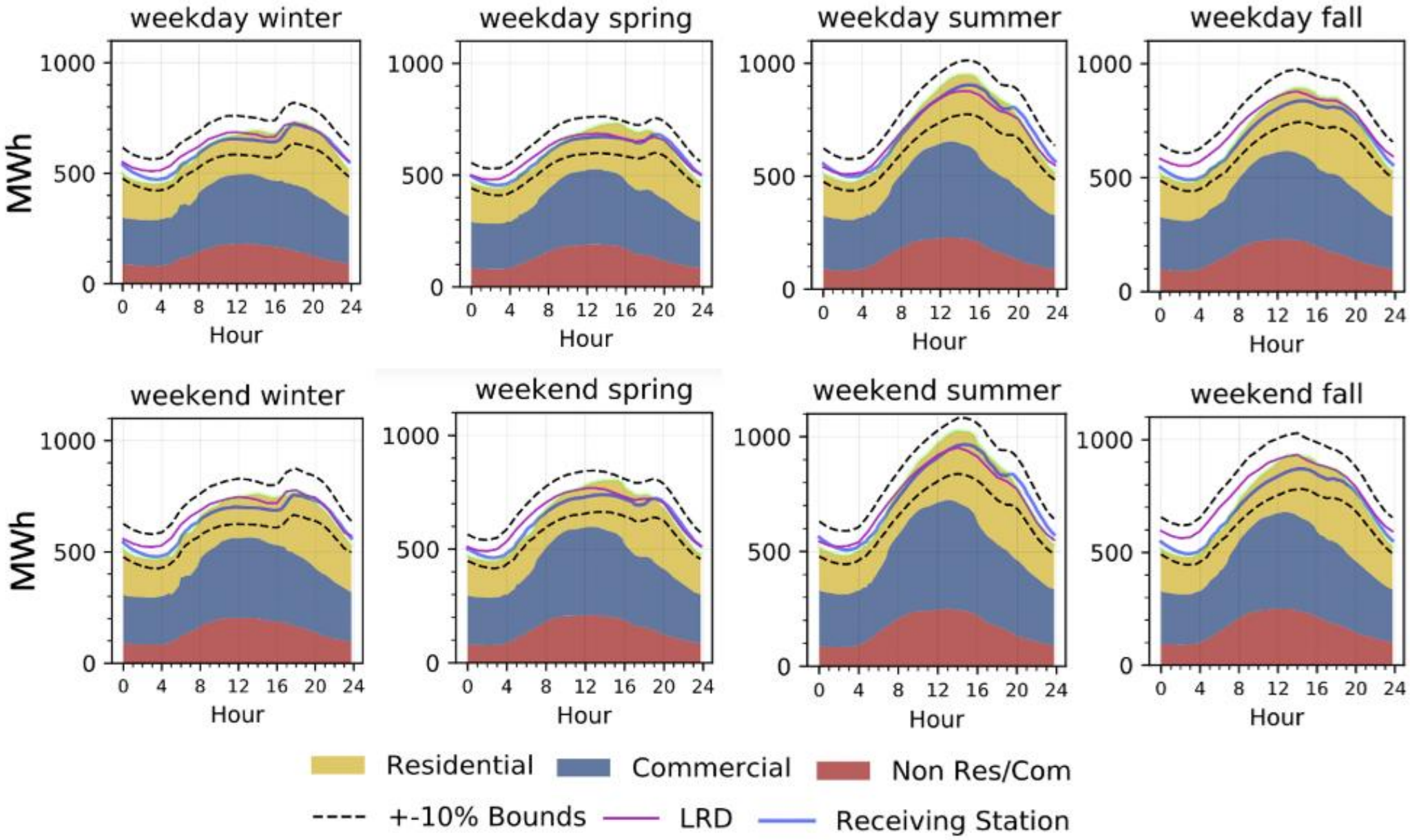
LA100 Results & Calibration

Calibration/validation data sources

- LADWP **customer billing data**
  (monthly; all customers)
- LADWP **load research data**
  (hourly; residential/commercial sectors)
- LADWP **smart meter data**
  (15-minute; subset of customers)

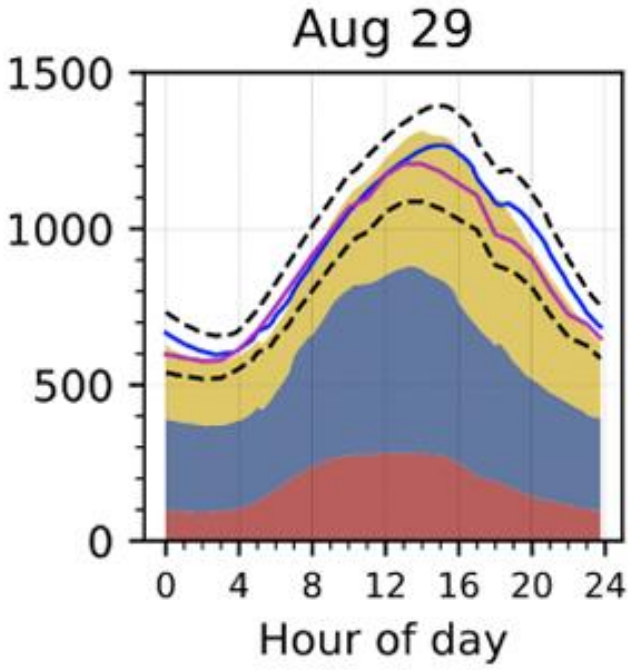


LA100 Results & Calibration



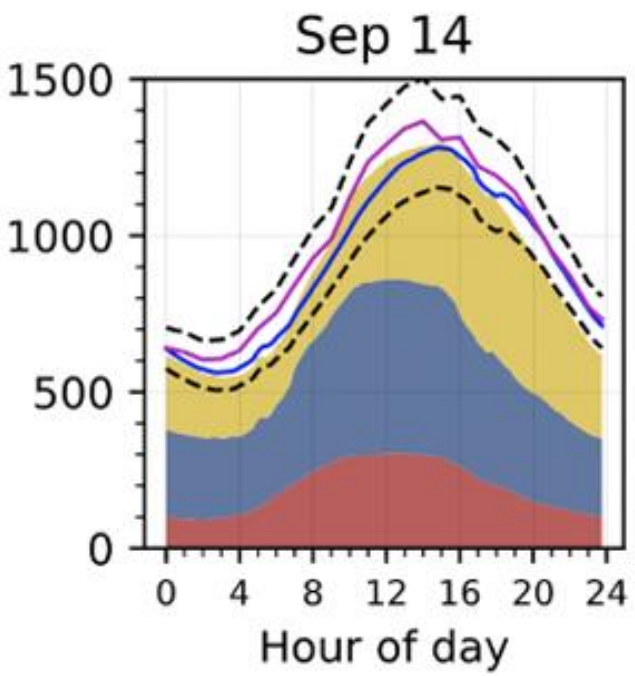
LA100 Results & Calibration

RS – Data Peak Day



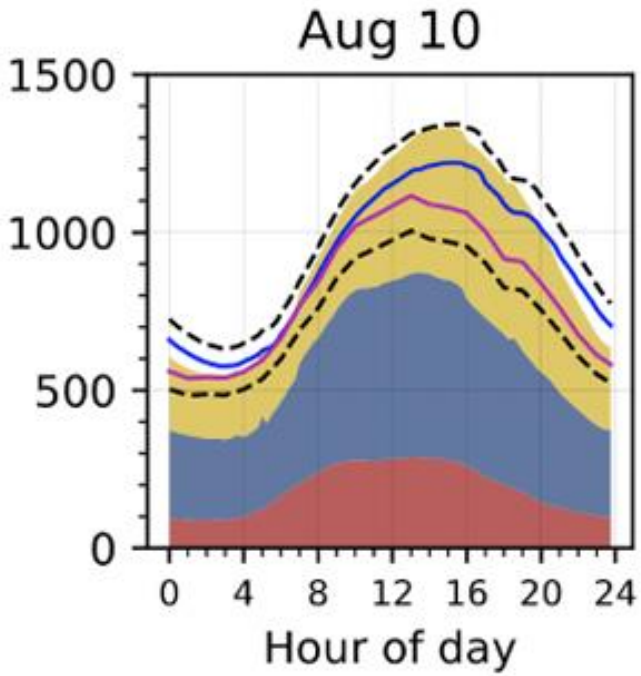
Model: 1314 MWh
LRD: 1207 MWh (9%)
RS: 1267 MWh (4%)

NEL & LRD – Data Peak Day



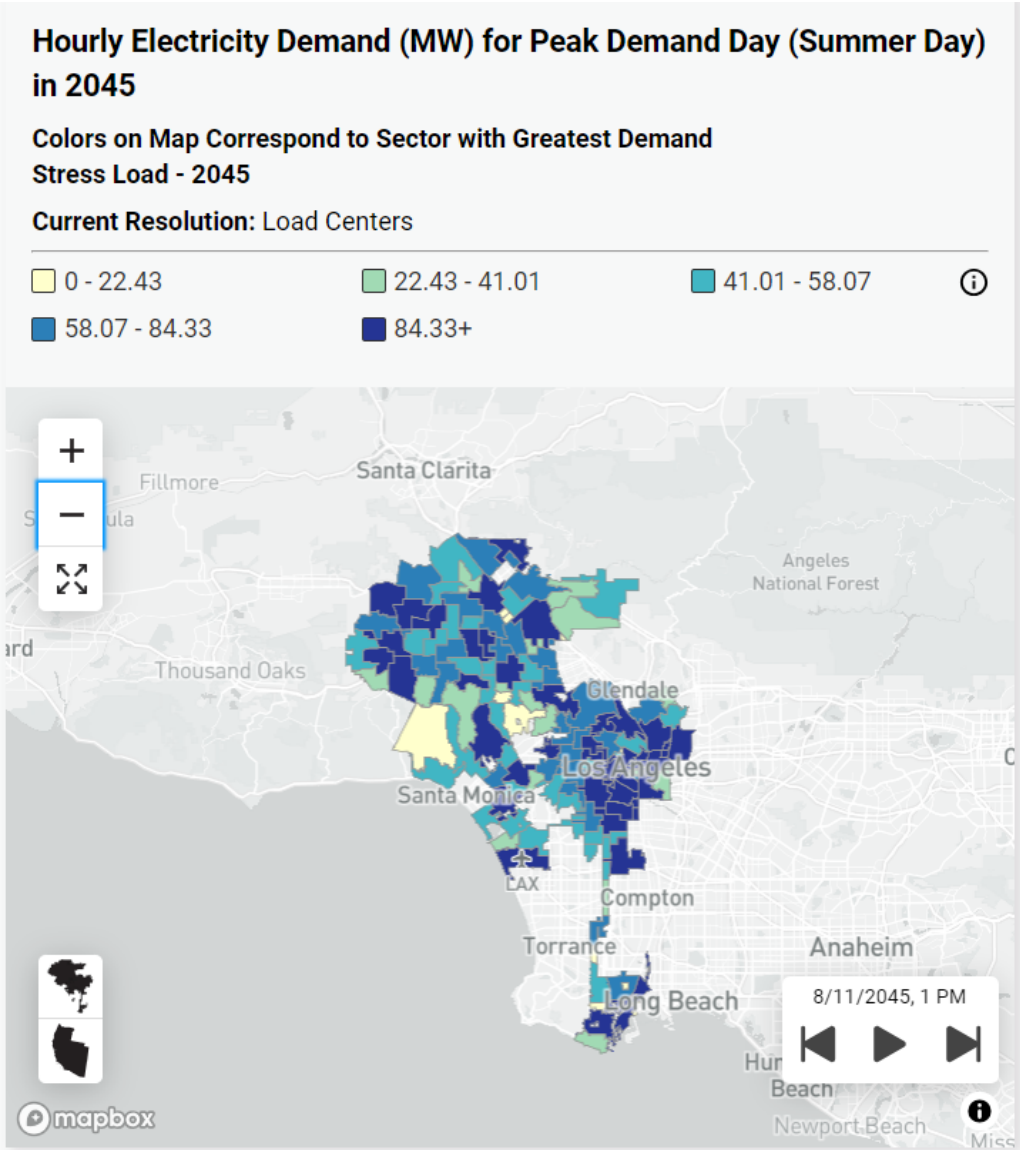
Model: 1296 MWh
LRD: 1364 MWh (5%)
RS: 1281 MWh (1%)

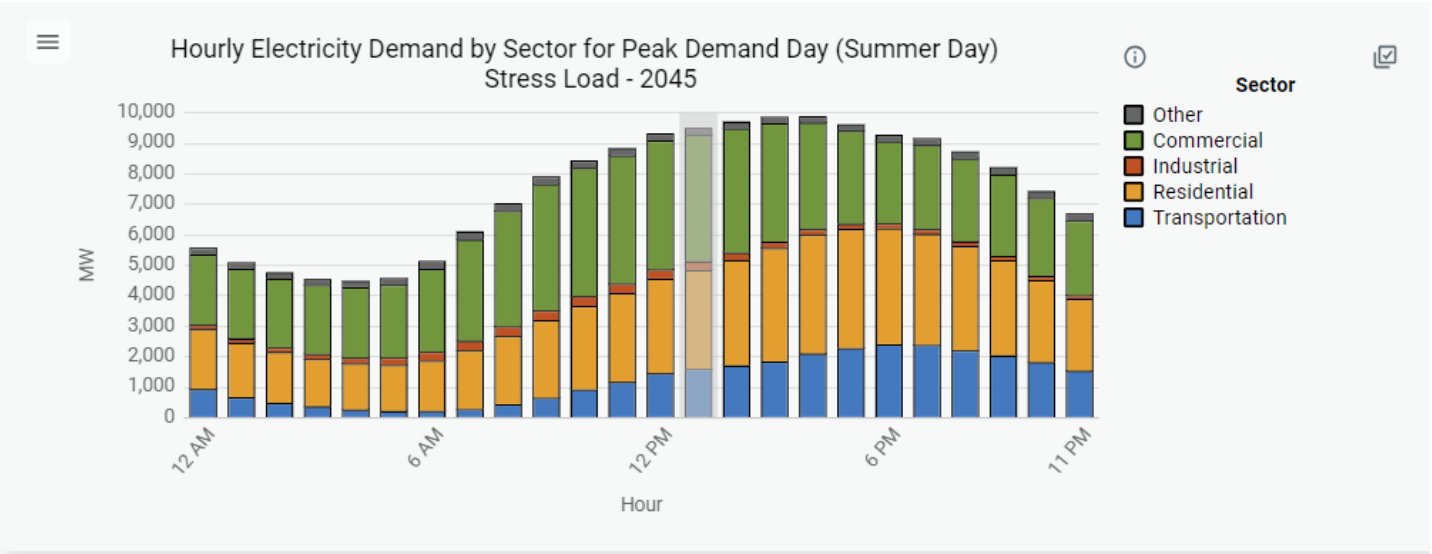
Model Peak day

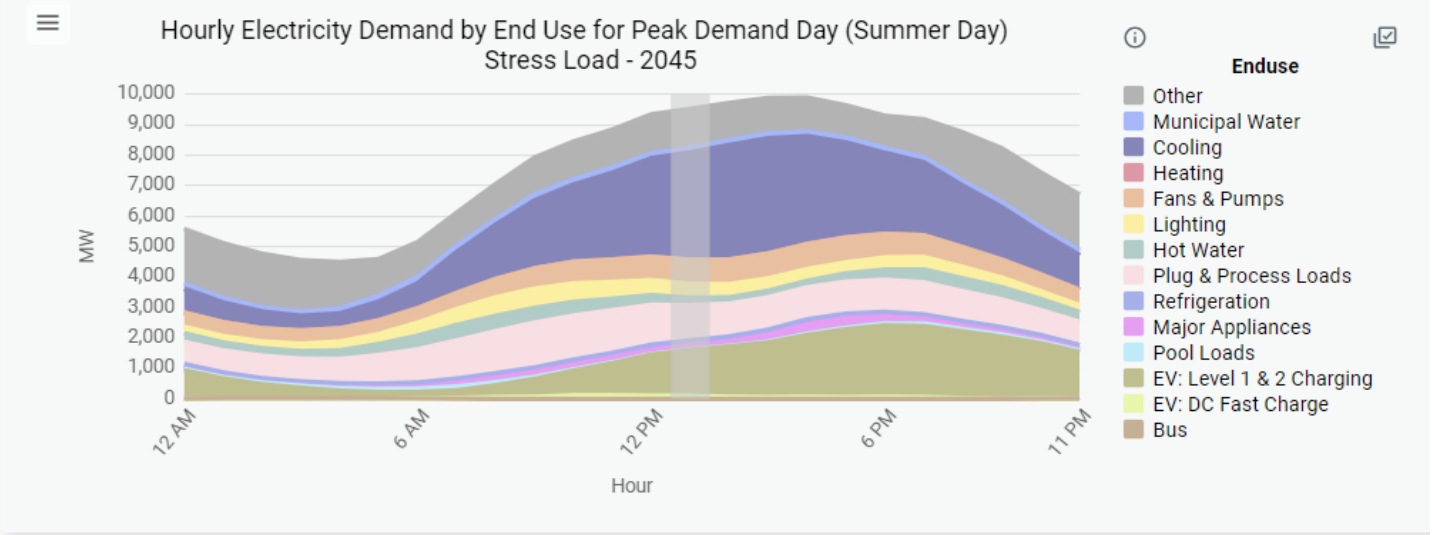


Model: 1335 MWh
LRD: 1116 MWh (20%)
RS: 1221 MWh (9%)

LA100 Data Viewer

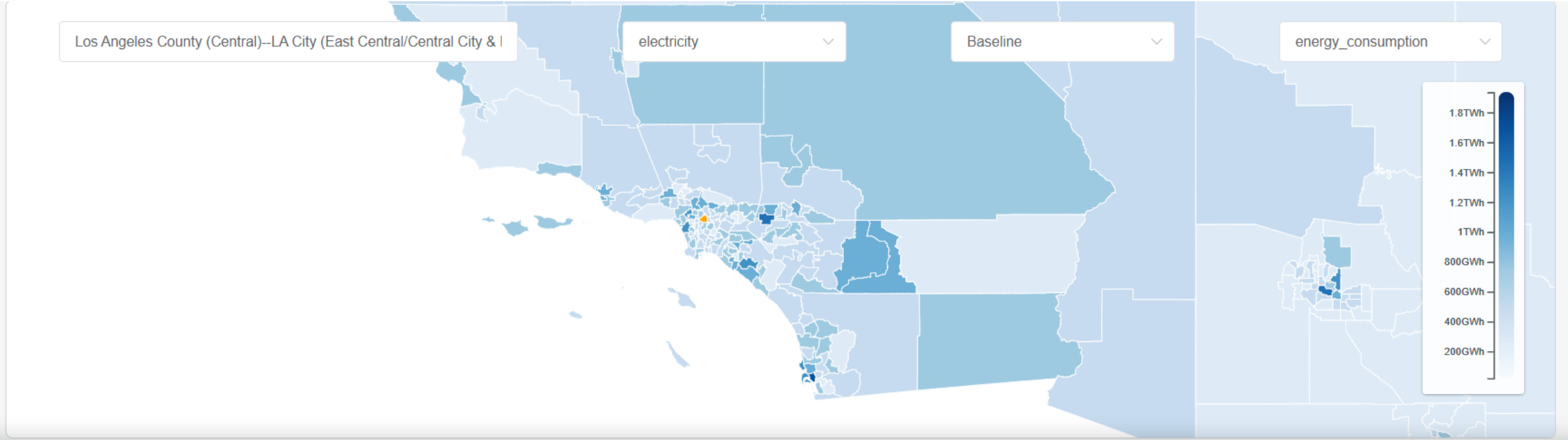






https://maps.nrel.gov/la100/la100-study/data-viewer

ComStock Data Viewer



Los Angeles County (Central)--LA City (East Central/Central City & Boyle Heights) PUMA

Fuel Type: Electric **Upgrade:** Baseline **Output:** Energy Consumption [Wh]

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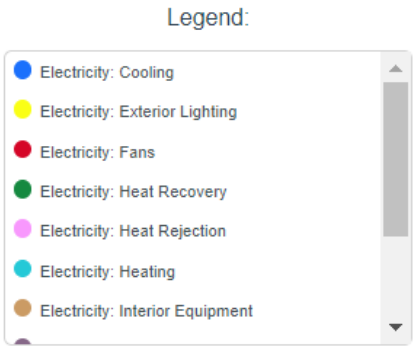
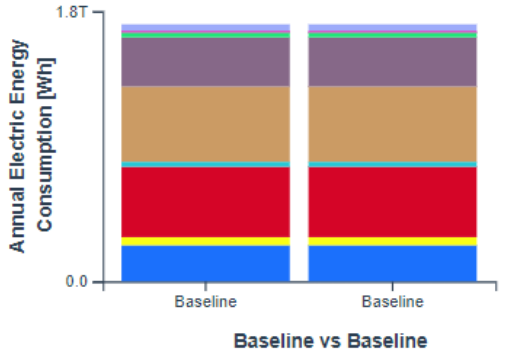
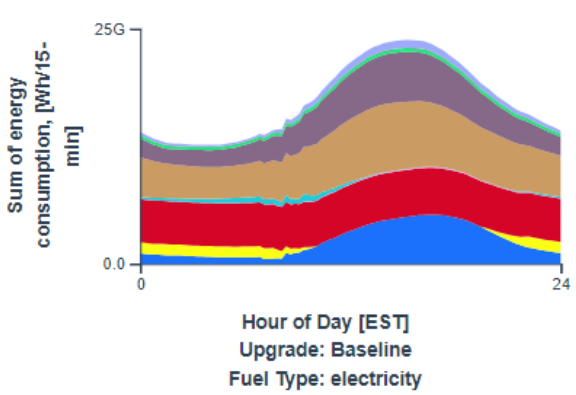
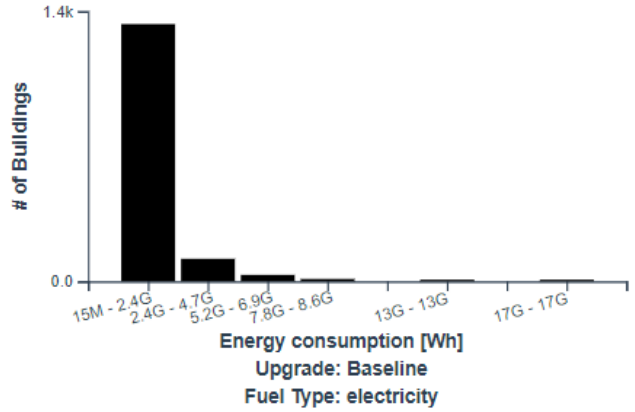


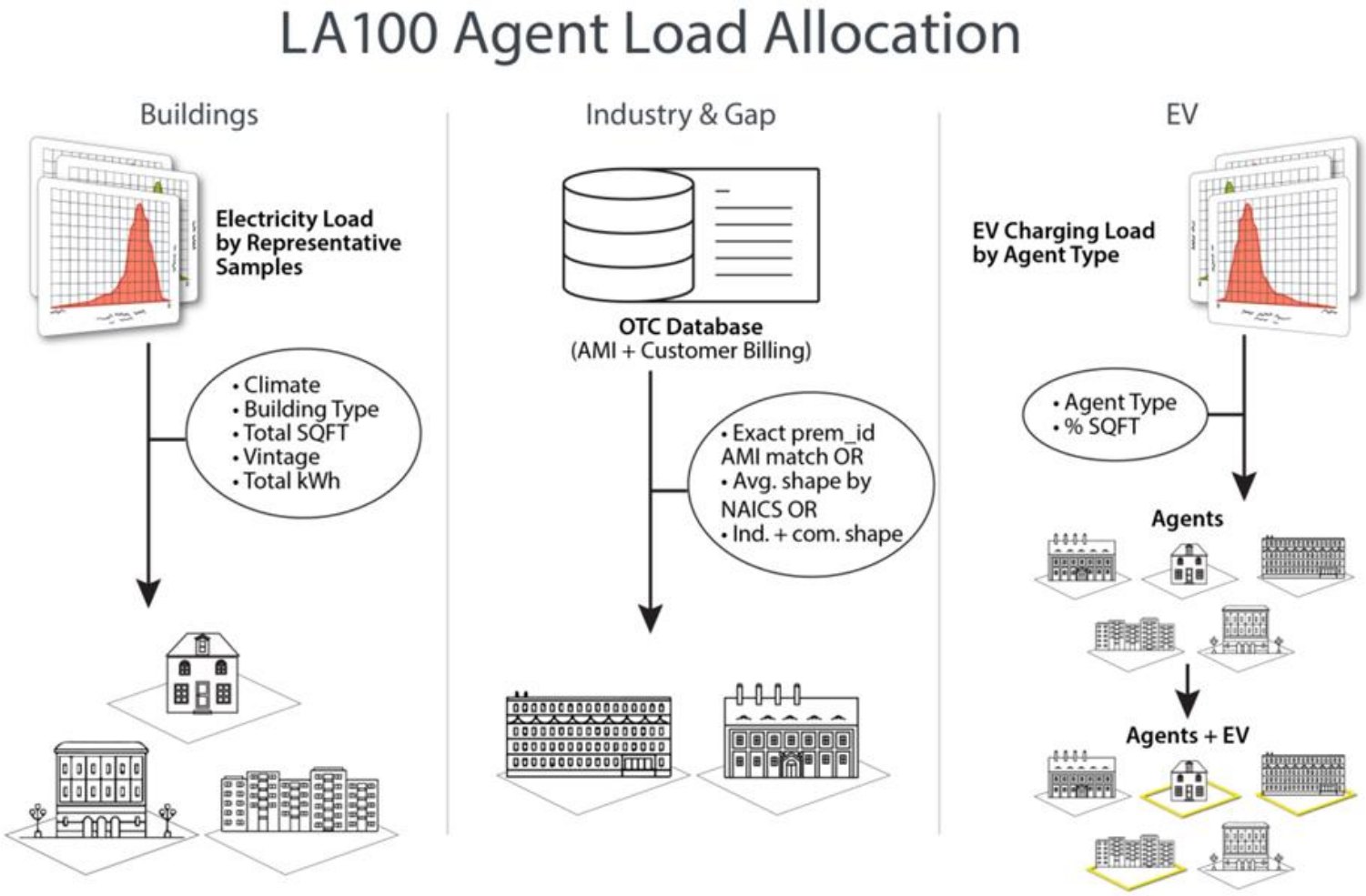






https://comstock.nrel.gov

Lessons Learned



Although sound in concept, the agent allocation approach proved to be problematic especially when diving into more granular data points:

- Calibration was conducted at System level;
- Lower level results at DS stations and circuits proved to be less reliable.
- Individual buildings may possess characteristics that may not line up with actual conditions.

Lessons Learned

- Updating Baseline Data and adding new technologies can be a rather time consuming task and also requires specialized knowledge & skills

- Projections are based on assumptions of building stock changes
  - The model predictions are not economically driven which can render the results less receptive by stakeholders
  - Final results did not include the cost of implementing EE and BE Programs

Next Steps

- Get LADWP staff trained on Comstock platform in order to maintain future updates to baseline data and add new technologies for consideration.
- Develop automation where possible to streamline the process.

- Tie technical potential from ComStock outputs to consumer adoption model in order to develop various scenarios for economic interventions and program design.
- Calibrate and refine allocation approach to more granular geographic areas such as DS stations, specific feeders or neighborhoods, DACs.