Agenda

- Project overview

- Technical Advisory Group **use case priorities**

- **Data requirements** for top use cases

- **Potential insights** for business customers

- **Data sources** for validating load profile models
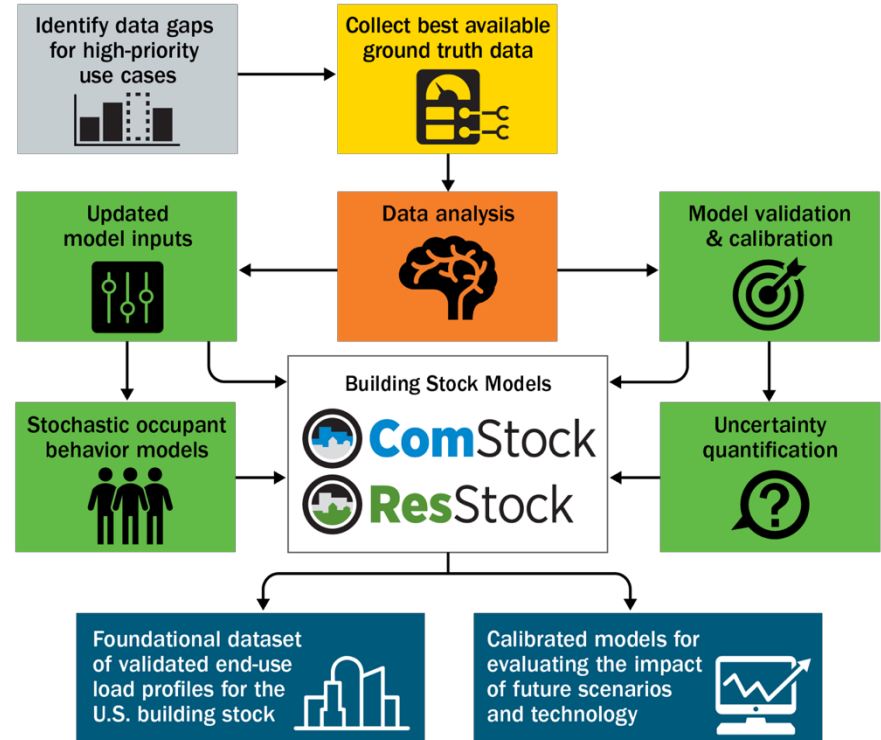
- **Conclusions**

Project Overview

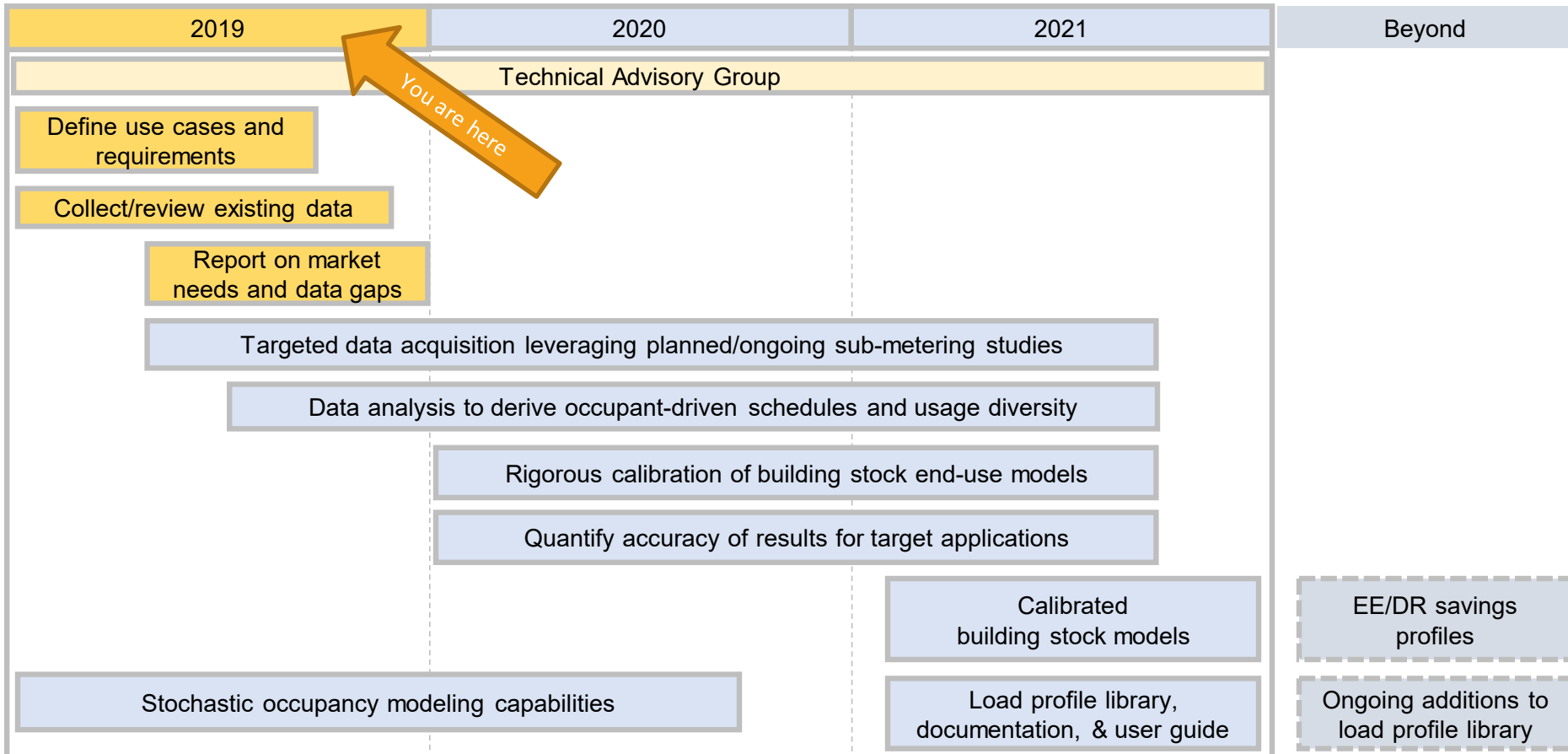Hybrid approach combines best-available ground-truth data—

- submetering studies,
- statistical disaggregation of whole-building interval meter data, and
- other emerging data sources

—with the reach, cost-effectiveness, and granularity of physics-based and data-driven building stock modeling capabilities

The novel approach delivers a nationally-comprehensive dataset **at a fraction of the historical cost**.

Project Timeline

2019	2020	2021	Beyond

You are here

Technical Advisory Group

- Define use cases and requirements
- Collect/review existing data
- Report on market needs and data gaps
- Targeted data acquisition leveraging planned/ongoing sub-metering studies
- Data analysis to derive occupant-driven schedules and usage diversity
- Rigorous calibration of building stock end-use models
- Quantify accuracy of results for target applications
- Calibrated building stock models
- EE/DR savings profiles
- Stochastic occupancy modeling capabilities
- Load profile library, documentation, & user guide
- Ongoing additions to load profile library

Technical Advisory Group
Use Case Priorities

Top three use cases identified by TAG

Use Case Ranking   n =33

Legend: ■ 1st ■ 2nd ■ 3rd
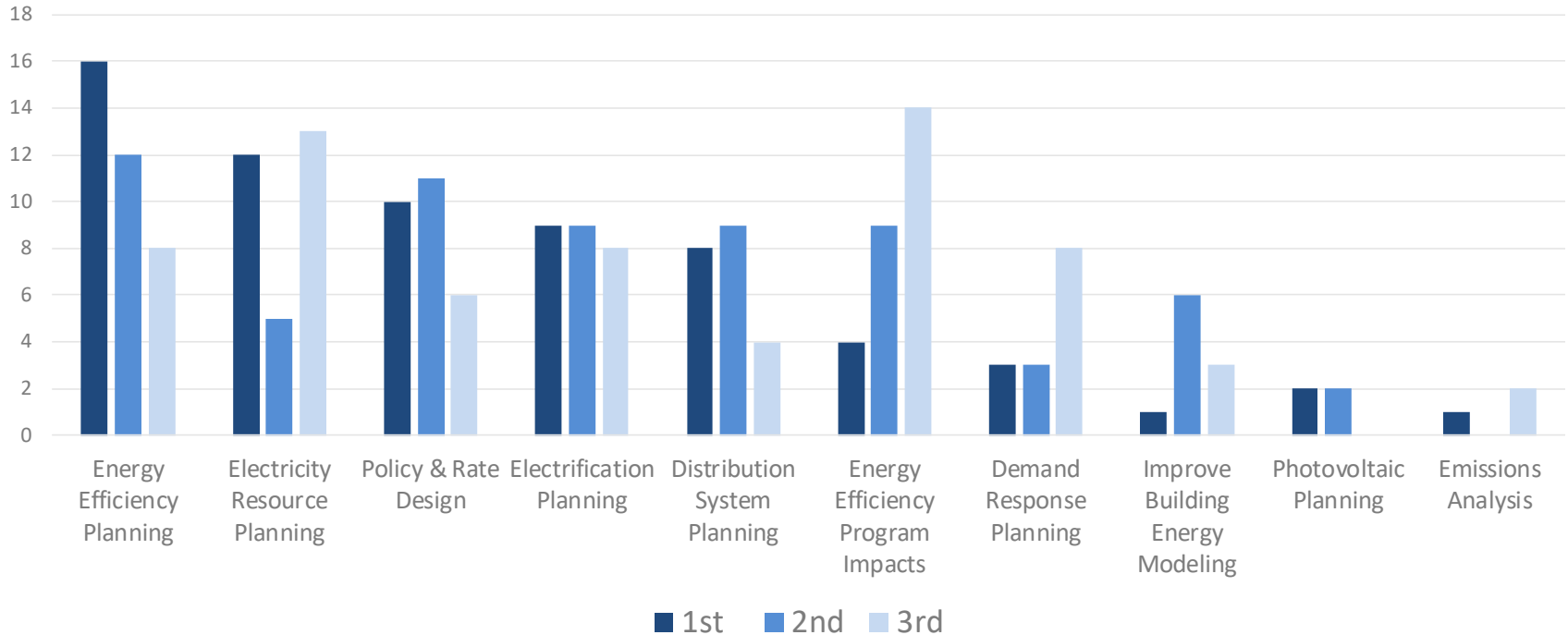
Use cases in survey (1)

1. **Energy efficiency planning**: Benefit-cost analysis, estimating potential, planning, design and implementation of energy efficiency programs.

2. **Electricity resource planning**: Long range planning such as integrated resource planning or long range load or avoided cost forecasting.

3. **Policy and rate design**: Support for utility, local, state or federal policy decision-making. Examples include codes and standards development, electricity rate design including evaluating time-based rates and climate policy.

4. **Electrification planning**: Evaluation of electrifying technologies at the building stock level. Examples include heat pump water heaters.

5. **Distribution system planning**: Assessing needed physical and operational changes to the distribution grid. Examples include non-wires alternatives.

Use cases in survey (2)

6. **Energy efficiency program impacts**: Improving assumptions used in efficiency impact evaluations.

7. **Demand response planning**: Estimating potential, planning, design and implementation of demand response programs.

8. **New building design/modeling/rating**: Improving default assumptions at the building level for new building design and identifying major regional differences for multi-building modeling.

9. **Photovoltaic planning**: Assessing viability of new photovoltaic systems for utilities and the solar industry.

10. **Emissions analysis**: Evaluation of emissions profiles correlated with end uses for developing abatement strategies.

Data requirements
for top use cases

Data requirements for top use cases

Use Case	Rank	Time resolution	Geographic resolution	End-uses	Stochastic Occupancy	Electrical Characteristics
Energy Efficiency Planning	1	Hourly or peak day	Service territory	Yes	No	Real power
Electricity Resource Planning	2	Hourly or peak day	Service territory	Yes	No	Real power
Policy & Rate Design	3	15-min	Service territory or smaller	Yes	Yes	Real power
Electrification Planning	4	Hourly	Service territory or smaller	Yes	Yes (for distribution)	Real power
Distribution System Planning/Non-Wires Alternatives	5	15-min	Distribution feeder	Yes	Yes	Real, reactive power, voltage
Energy Efficiency Program Impacts	6	Hourly or peak day	Service territory	Yes	No	Real power
Demand Response Planning	7	15-min	Feeders to markets	Yes	Yes	Depends on application
New Building Design/Modeling/Rating	8	15-min to hourly	Weather station	Yes	Yes	Real power
Photovoltaic Planning	9	1-min	Weather station	No	Yes	Real power
Emissions Analysis	10	Hourly	Service territory or larger	Yes	No	Real power

■ = beyond status quo of available data

Data requirements for use cases

Time Resolution

15-minute

- Highest impact cases require only hourly results

- PV Planning is the only top use case that requires less than 15-minute data

Geographic Resolution

Utility territory

- Distribution System Planning requires feeder-level data

- A "mix-and-match" approach from a bank of load profiles could help build specific utility and feeder level information

Occupancy

Stochastic

- This is a significant gap and will require new modeling techniques

Electrical Characteristics

Real power

- Some distribution system planning use cases might benefit from reactive power

- Data requirements for some use cases are not well understood

Potential insights for business customers

Potential insights for business customers

End-use load profiles—and savings shapes—can profile **valuable insights for business customers:**

- Which end uses should be targeted for reducing demand charges in my customer segment ($/kW)?

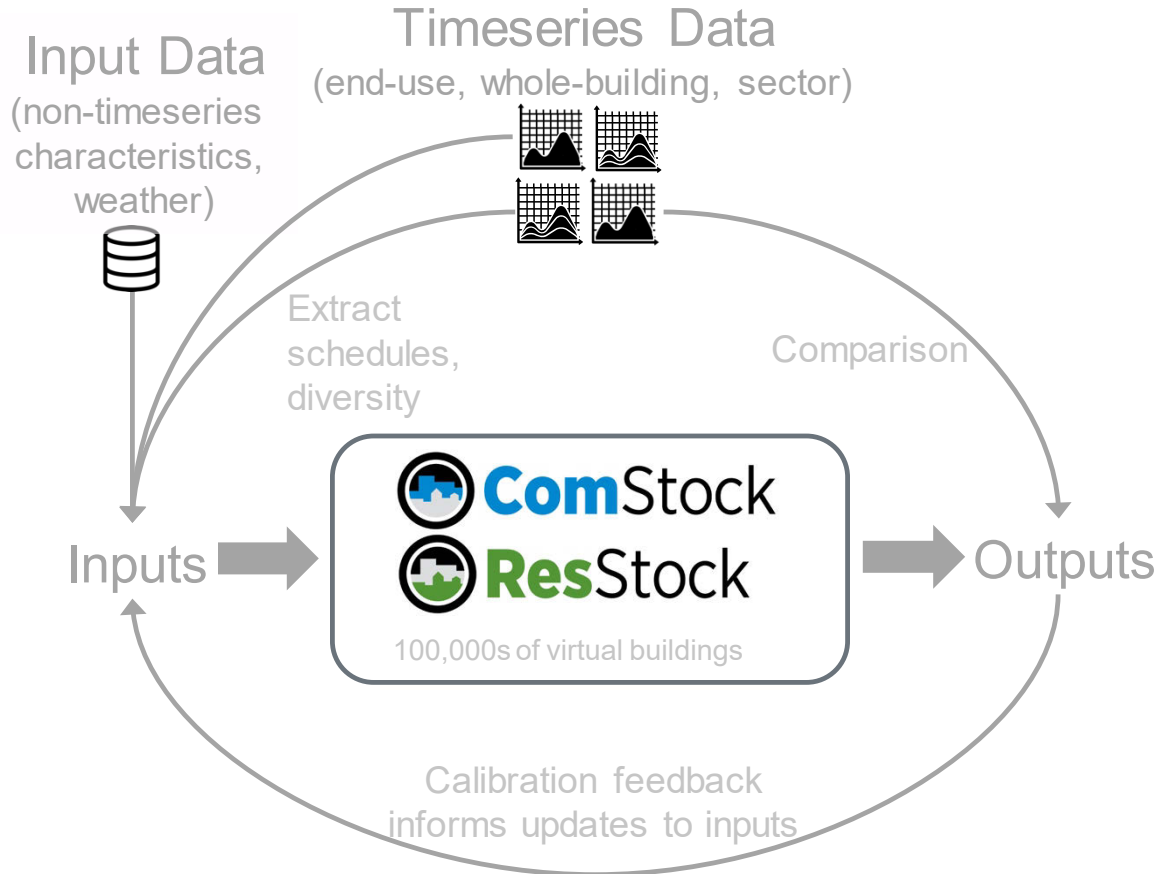- Which EE or DR measures are most valuable in my utility territory?

Example office end-use load profiles – peak day

Legend: WaterHeating, LightingInternal, OfficeEquipment, Ventilation, Heating, Cooling
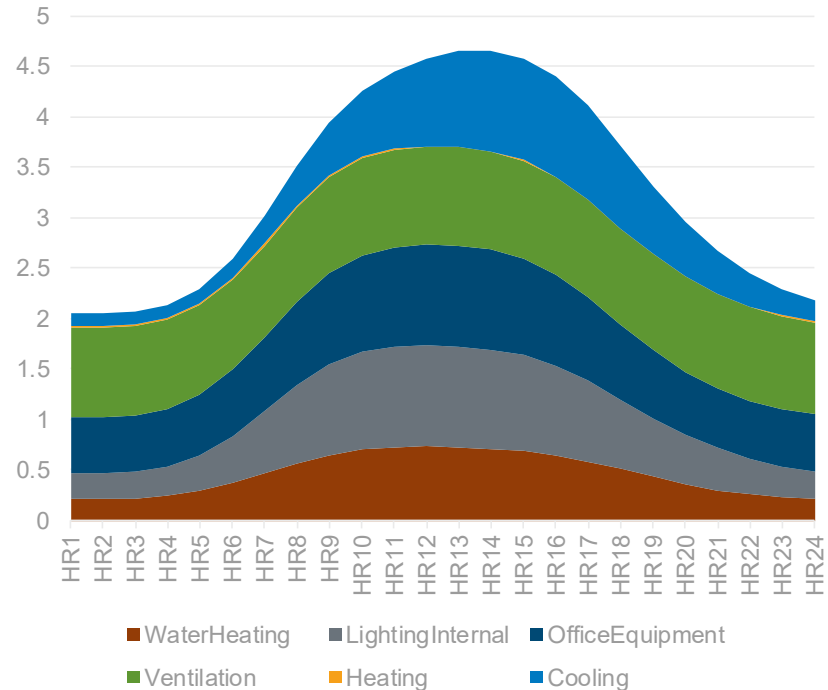
Source: EPRI Load Shape Library

Data sources for validating load profile models

How are we using data?

Input Data
(non-timeseries characteristics, weather)

Timeseries Data
(end-use, whole-building, sector)

Extract schedules, diversity

Comparison

ComStock
ResStock
100,000s of virtual buildings

Inputs

Outputs

Calibration feedback informs updates to inputs

How are we using data?

Input Data
(non-timeseries characteristics, weather)

Timeseries Data
(end-use, whole-building, sector)

Validation using holdout datasets

Extract schedules, diversity

Comparison

ComStock
ResStock

100,000s of virtual buildings

Inputs

Outputs

Accuracy Assessment

Calibration feedback informs updates to inputs

Types of data we're looking for

- Whole-building 15-min meter data (AMI)

- Customer class hourly load shapes (load research data)

- EM&V study data

- Commercial building automation system (BAS) data

- Power quality monitoring program data

Example data sources
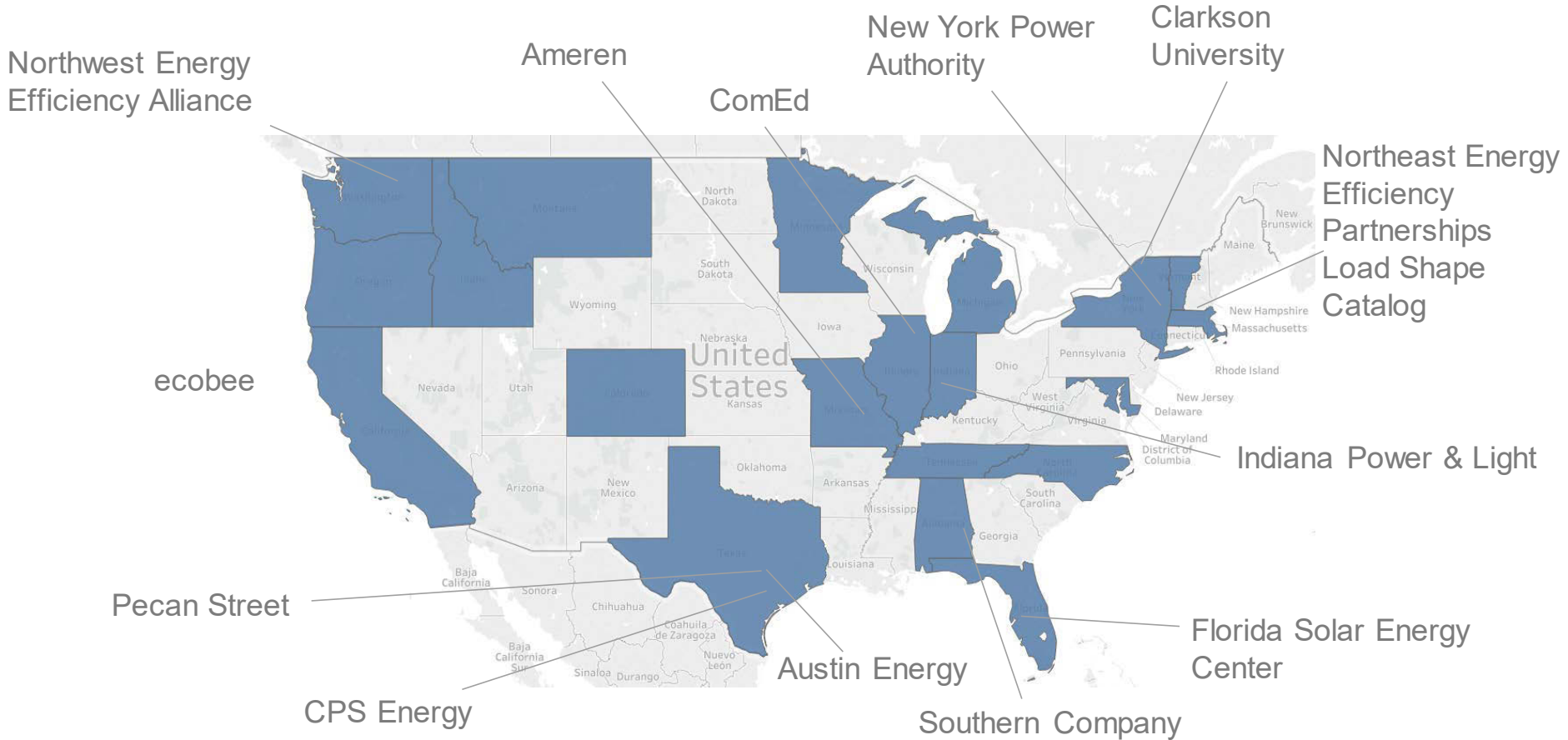
Conclusions

- End-use load profiles can profile **valuable insights for business customers**

- The DOE End-Use Load Profile project will result in:
  - Publicly available data set of end-use load profiles for the U.S. building stock,
  - Calibrated models for evaluating the impact of future scenarios and technologies

- **First report to be published Fall 2019:**
  End Use Load Profiles for the U.S. Building Stock:
  Market Needs, Use Cases and Data Gaps

- **Still seeking data—maybe yours?**

Project website:
https://www.nrel.gov/buildings/end-use-load-profiles.html

Thank you

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NREL/PR-5500-74818

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