NREL
Transforming ENERGY

SCEP
STATE & COMMUNITY ENERGY PROGRAMS

ResStock™ Data Visualization Tools

How to Use Them: a Demonstration

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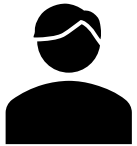
National Renewable Energy Laboratory (NREL)

Photo from iStock-627281636

Brainstorming Questions and Use Cases

What kind of housing is most common in my region?

Do I want to focus on housing types with high energy consumption or high energy burden?



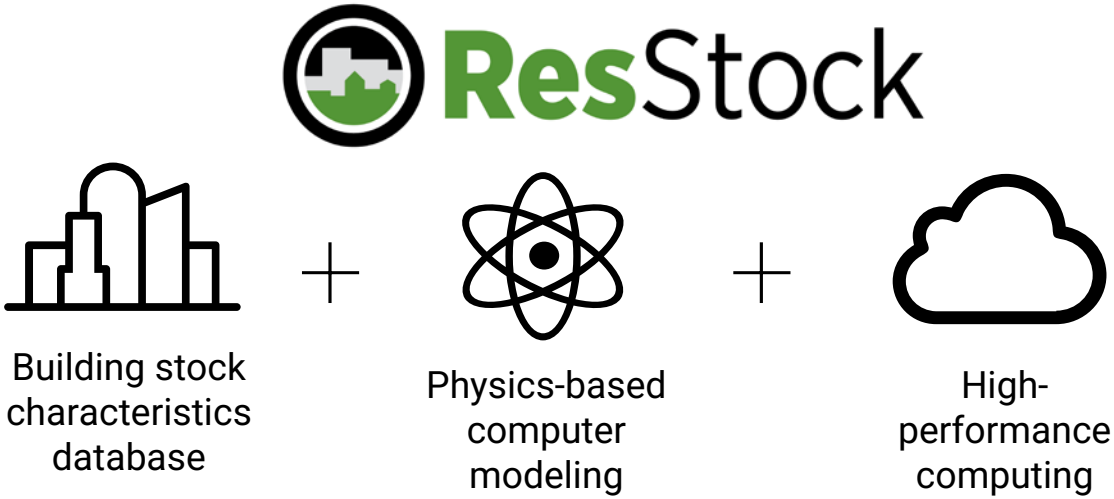
How much money can people save by installing more insulation and weatherization measures?

What type of information will the policymakers in my area care about?

What we look at with ResStock

- Housing characteristics:
  - Heating fuel, wall insulation level, energy consumption, renter or owner occupied.
- Energy characteristics:
  - Energy bill savings, energy savings by fuel type, emission savings, and energy burden.
- Efficiency Measures:
  - 16 different energy efficiency measures including: Heat pumps, insulation, electric dryers, and whole-home measures too!
- Outputs are broken out by income level (area median income), state, housing type, and more.

Physics-Simulation Models Statistically Representing the U.S. Building Stock



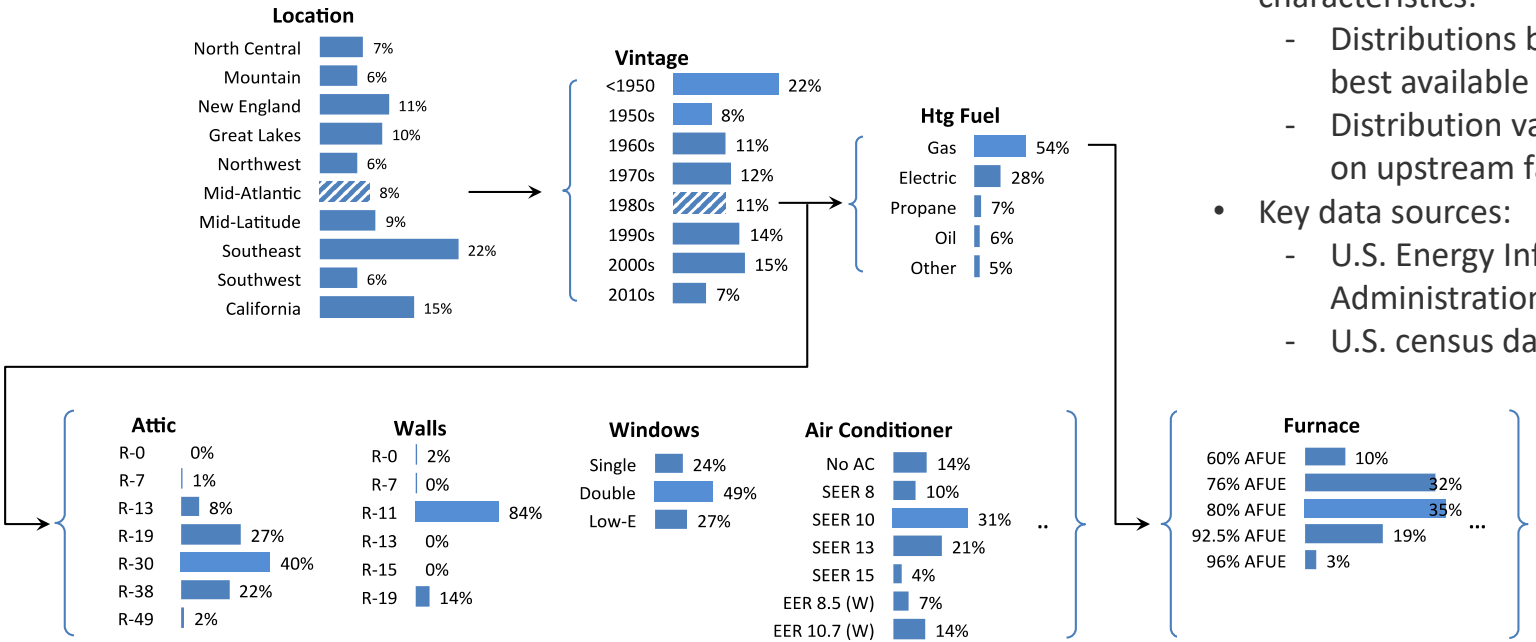
1. Describe the U.S. building stock quantitatively.
2. Sample the description.
3. Model the samples.
4. Model changes to the samples: energy efficiency, electrification, etc.
5. Publish description, samples, models, results, aggregations, visualizations, and documentation.

ResStock data is used in the State and Local Planning for Energy Platform.

ResStock uses similar datasets as the Low-Income Energy Affordability Data Tool, and many more sources too!

ResStock and Other NREL Tools

Describe the U.S. Housing Stock Quantitatively



- More than 100 home characteristics:
  - Distributions based on best available data.
  - Distribution varies based on upstream factors.
- Key data sources:
  - U.S. Energy Information Administration.
  - U.S. census data.

How Representative Is the Dataset?

Real Life:
Every pixel is a building.

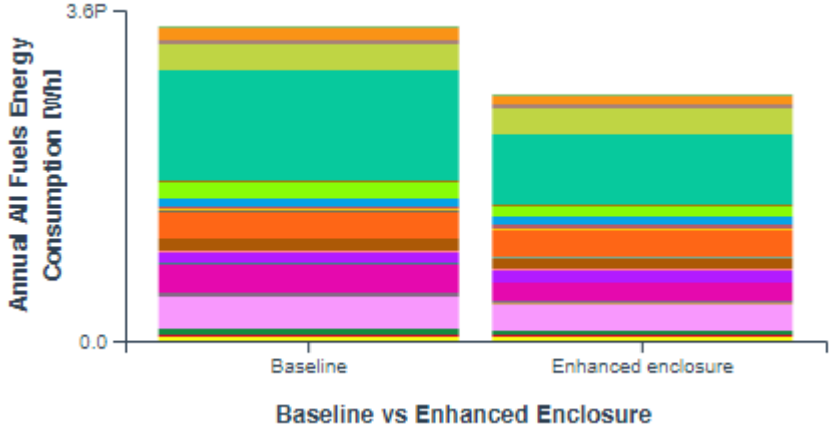
ResStock:
Every pixel is a model.

The low-resolution puppy picture is great for many use cases, but not all (e.g., counting whiskers).

Puppy image by Jonathan Kriz, 2010: https://www.flickr.com/photos/27587002@N07/5170590074

YouTube Training Series

- ✓Data visualizer demo.
- ✓State dashboard training.
- ✓How to apply custom utility rates.
- ✓Changing weights of different building samples.
- ✓…and more!



Example of a bar chart shown in the training series.

https://www.youtube.com/playlist?list=PLmIn8Hncs7bEYCZiHaoPSovoBrRGR-tRS

Example ResStock Analysis

LEARN MORE: https://www.elevatenp.org/wp-content/uploads/Achieving-50-Energy-Savings-in-Chicago-Homes.pdf

Goal: Actionable, city-scale analysis of building energy retrofits using housing stock information.

ResStock was used to:

- ✓Accurately model gas and electricity use.
- ✓Analyze the energy bill savings change based on utility rates.
- ✓Inform municipal policy decisions.

(Photo from iStock #92462852)

"…we are excited to apply NREL's ResStock models to Chicago to develop the road map for equitable home energy upgrades that will bolster community health, wealth, and resiliency."

– Angela Tovar, chief sustainability officer for the City of Chicago

ResStock Limitations

Modeling limitations:

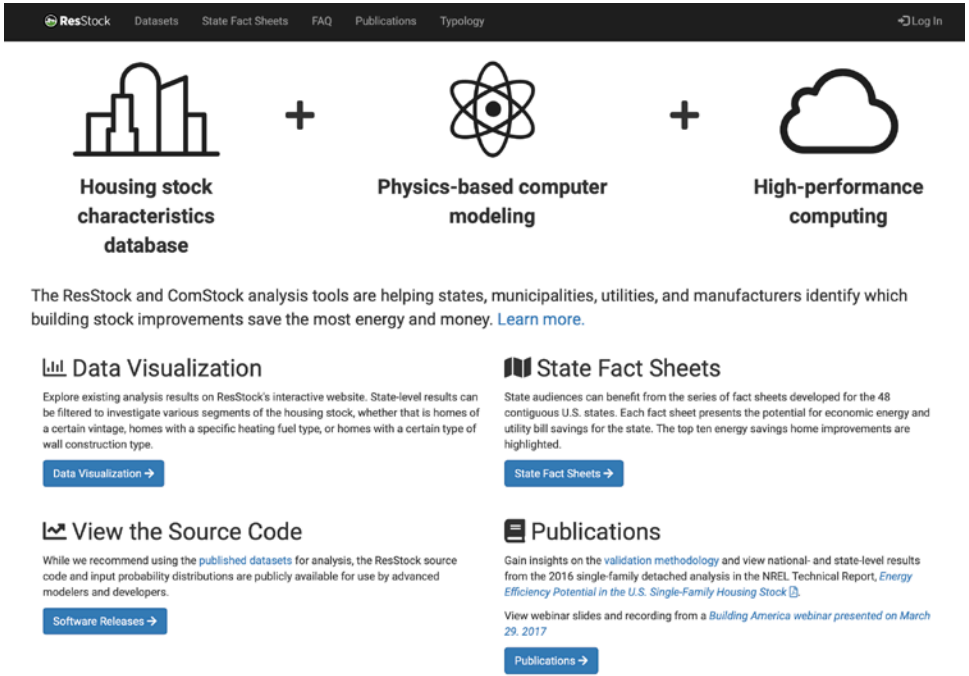
- Building load projections and technology turnover.
- Geographic resolution at census tract-level or below.
- High data quality on mobile homes.
- Tribal lands and U.S. Department of Housing and Urban Development/Section 8 housing.
- Building degradation and rehabilitation, such as mold remediation and lead abatement.
- Indoor air quality and thermal resilience metrics.
- Alaska, Hawaii, and electric vehicles.

Upgrade measures not present in ResStock:

- Rooftop photovoltaics and community solar.
- Electric vehicle charging and energy storage (estimated to arrive September 2024).
- Ground-source heat pumps and evaporative coolers (estimated to arrive September 2024).
- Smart thermostats, home energy management systems, smart electrical panels, and other load-controlling devices.

ResStock Documentation

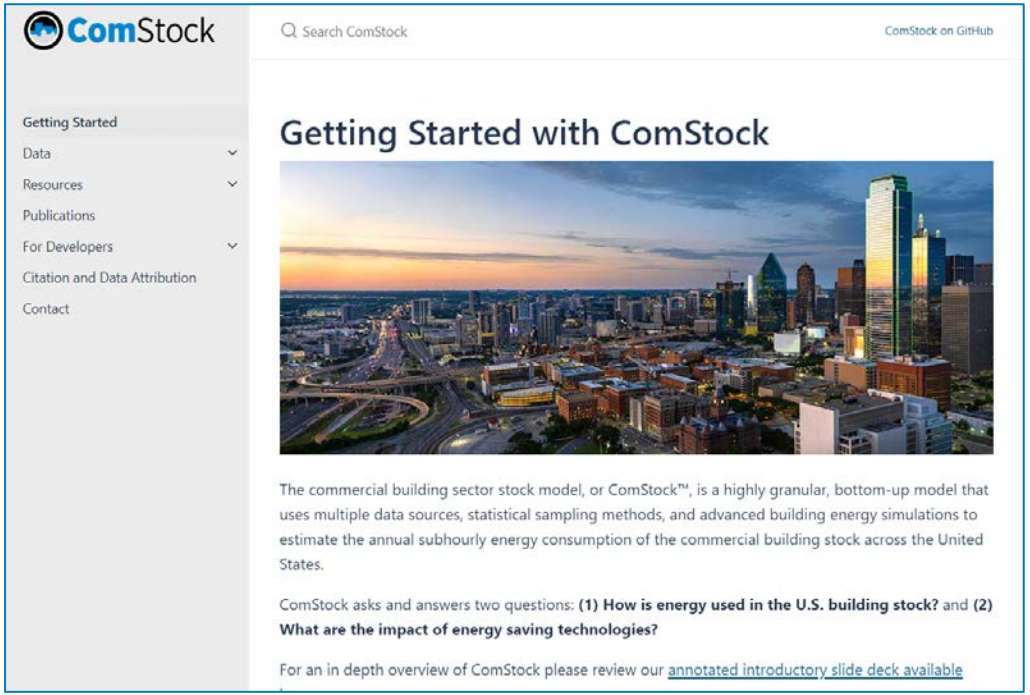
Landing page: https://resstock.nrel.gov

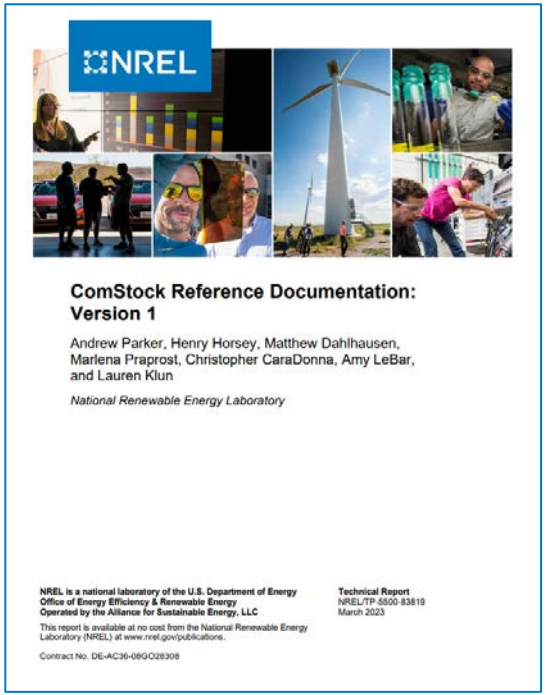


Documentation:

- Refer to dataset-specific documentation first.
- Modeling method, including calibration and validation: https://www.nrel.gov/docs/fy22osti/80889.pdf.
- Parameter details on metadata and measures: https://github.com/NREL/resstock/blob/main/resources/options_lookup.tsv.
- Find default modeling assumptions in Openstudio-HPXML: https://openstudio-hpxml.readthedocs.io/en/latest/ .

ComStock™
Sister Tool Used for Commercial Buildings





https://comstock.nrel.gov/

Example ComStock Analysis

LEARN MORE:
https://www.nrel.gov/news/program/2023/boosting-building-efficiency-in-unincorporated-norcross-georgia.html

Goal: Improve affordability for business owners and tenants while reducing greenhouse gas emissions.

ComStock was used to evaluate:

✓Energy usage patterns.

✓End uses of energy.

✓Energy efficiency measures and strategies.

Photo from Marvin Lim

"Having evidence-based information is going to be really valuable to promote planning for building modernization and future infrastructure developments."

– NREL researcher and project coordinator for Norcross, Georgia

State-Level Residential Building Stock and Energy Efficiency and Electrification Packages Analysis

How much energy could be saved by switching out the existing heating system for a heat pump?

What about energy bill and carbon savings?

What percentage of homes would need a mini-split heat pump because of the ductwork in their home?

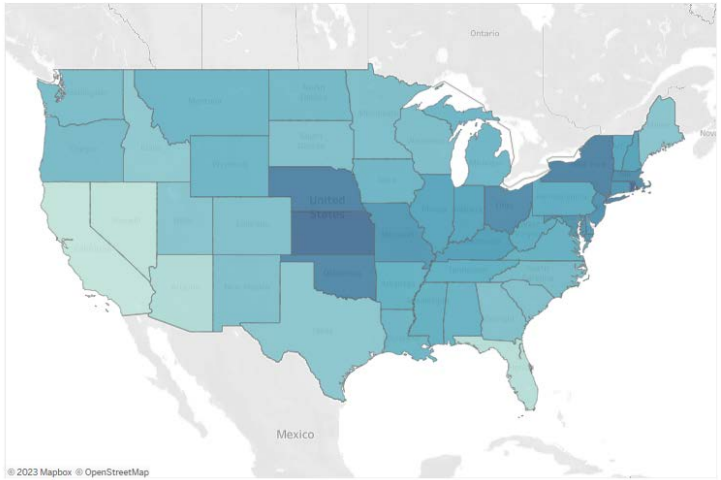
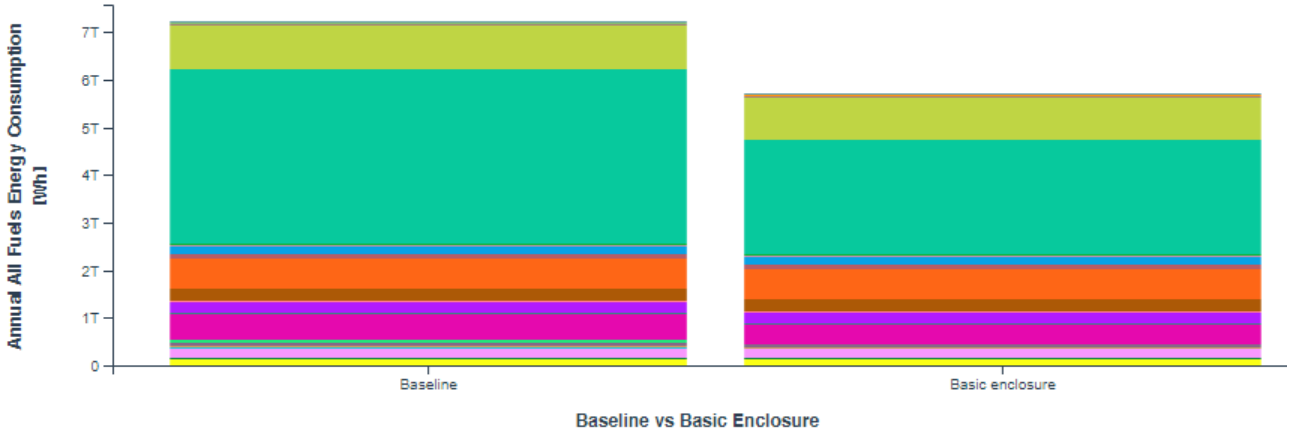


Image from:
https://public.tableau.com/app/profile/nrel.buildingstock/viz/StateLevelResidentialBuildingStockandEnergyEfficiencyElectrificationPackagesAnalysis/Introduction

- Annual results.
- Timeseries results.
- Energy consumption by dwelling unit.



Data Viewer* Example

How much energy does my city save based on different energy efficiency and electrification upgrades?

*You will need to create an account to access this information.

Thank You!

www.nrel.gov

NREL/PR-5500-88924

ResStock@nrel.gov

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