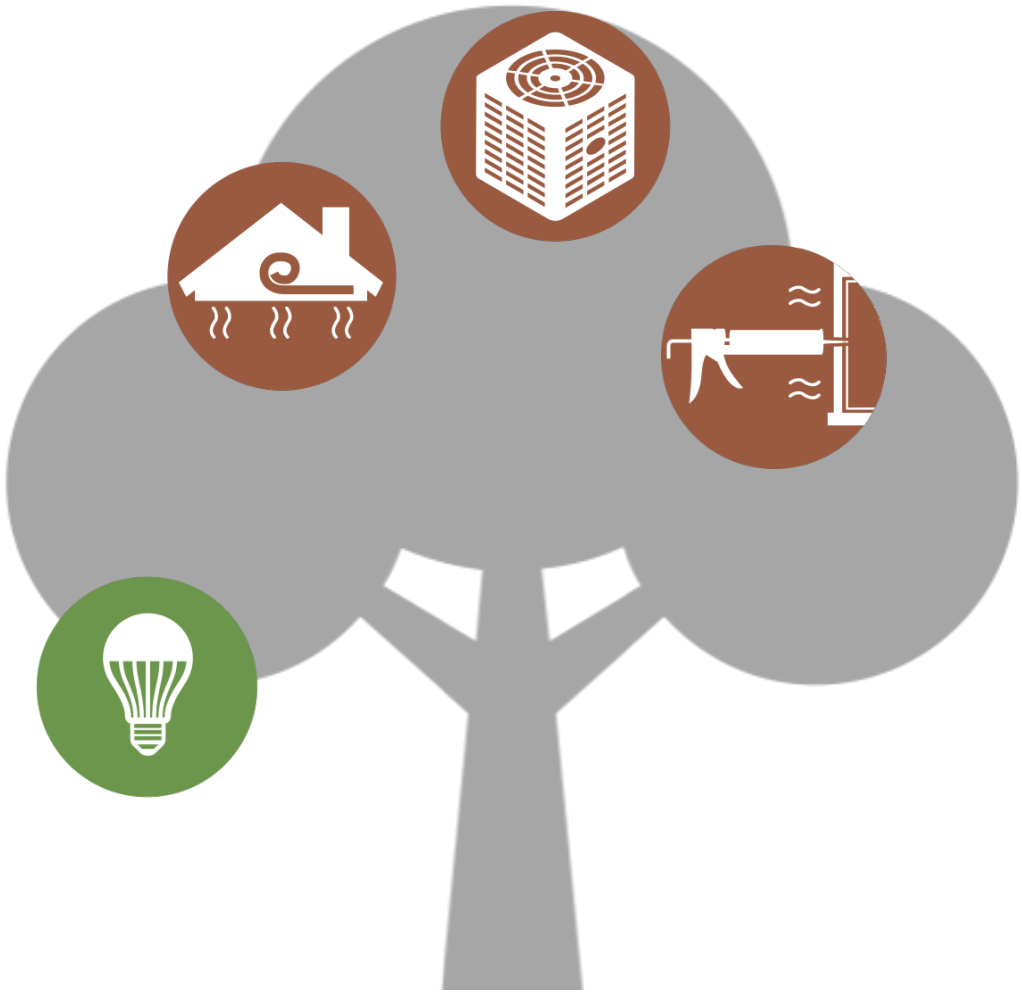
NREL
NATIONAL RENEWABLE ENERGY LABORATORY






Energy efficiency resource planning tools for the 21st century

Eric Wilson, National Renewable Energy Laboratory
October 31, 2017



Tree icon by Tjaša Kimovec
from Noun Project (creative commons)

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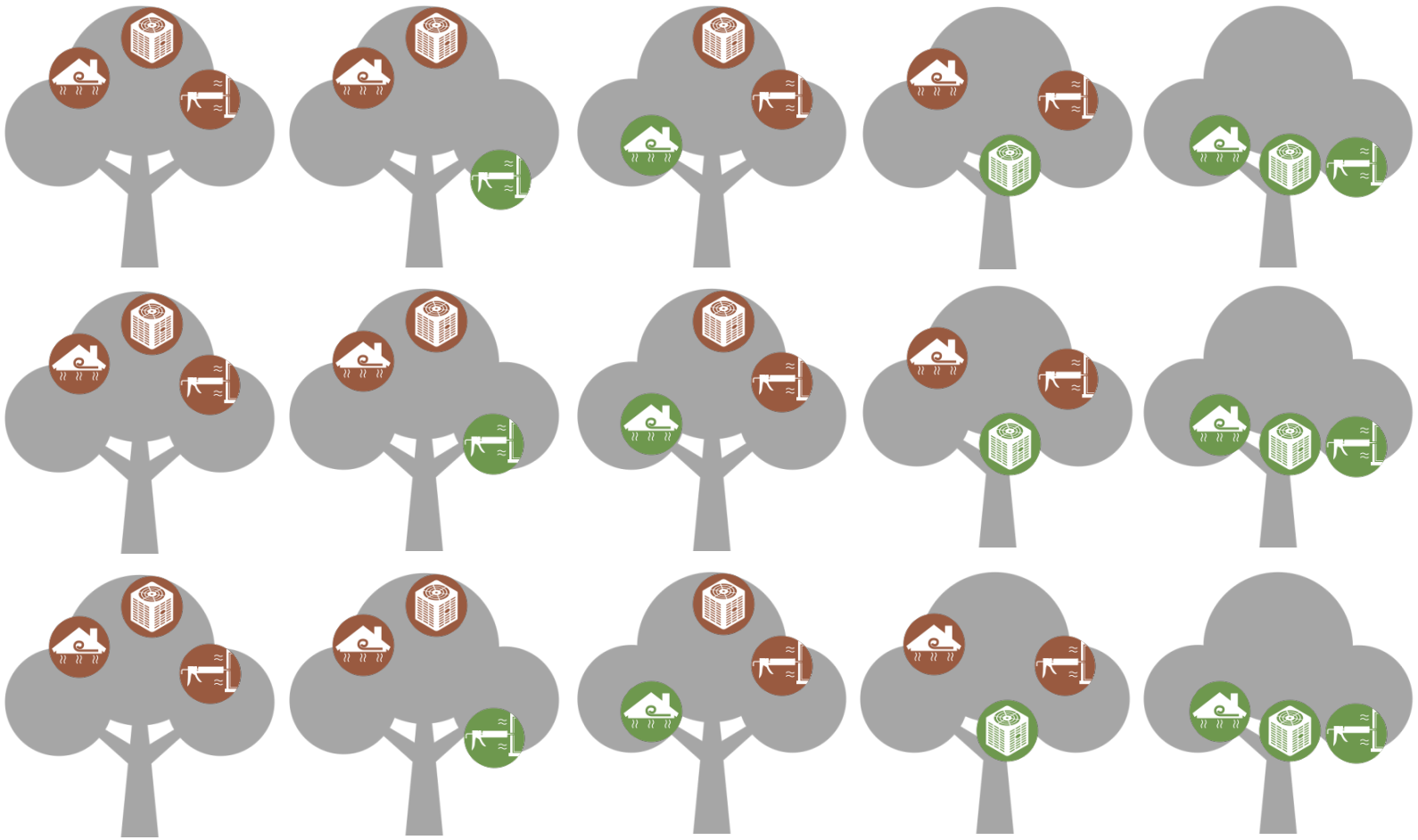

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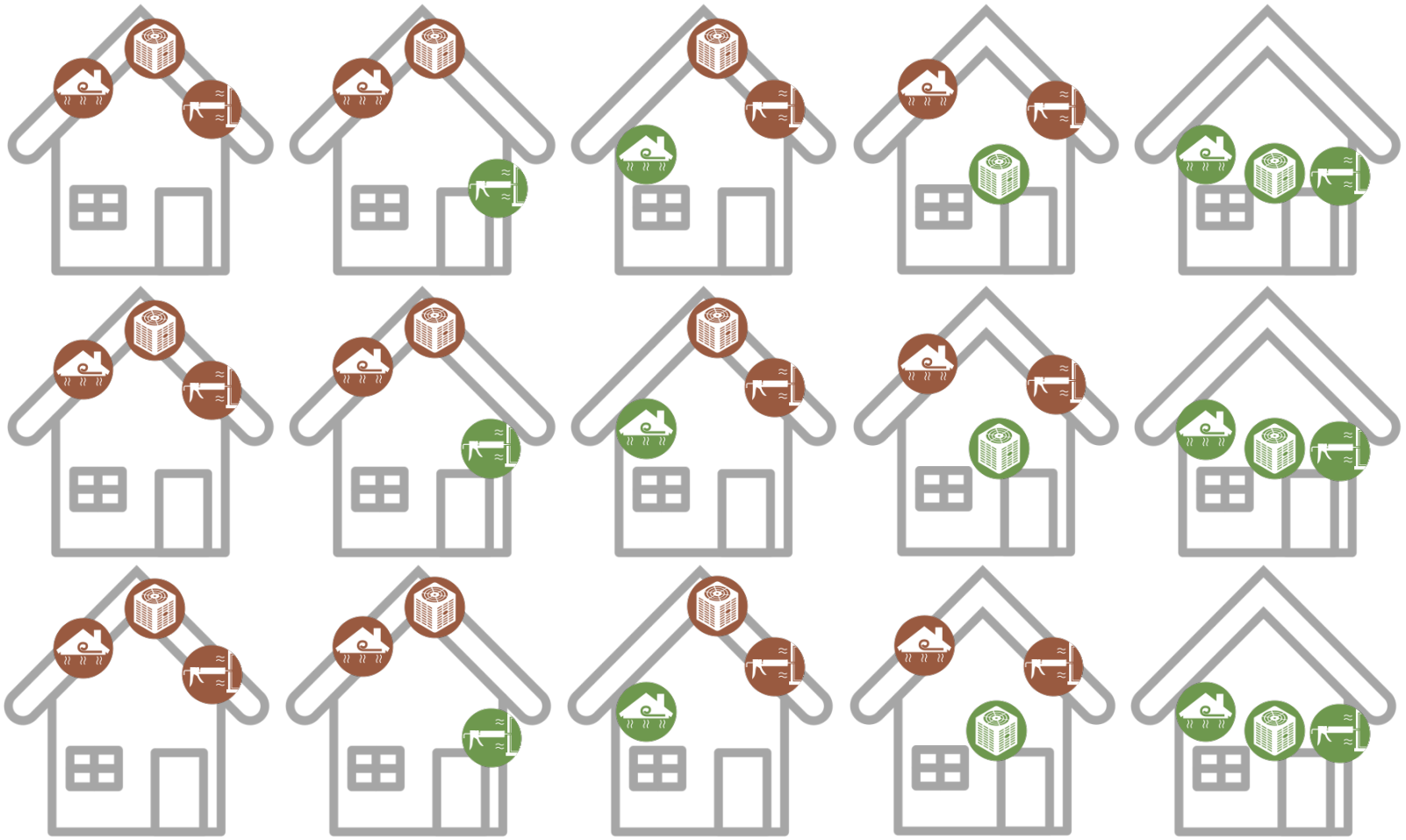

House icon by UNiCORN
from Noun Project (creative commons)

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House icons by HAWRAF
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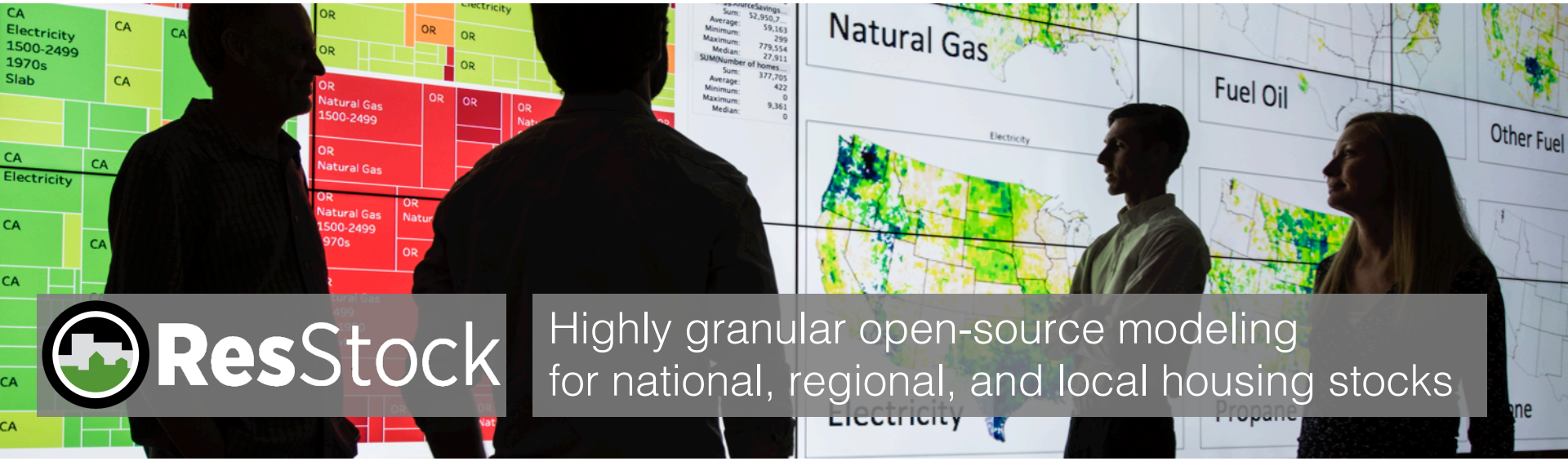
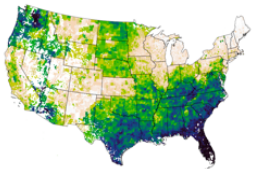
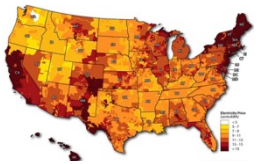
How do we find the best opportunities?

House icons by HAWRAF
via autodraw.com

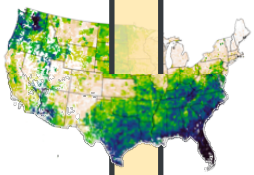
Housing stock characteristics database + **Physics-based computer modeling** + **High-performance computing**

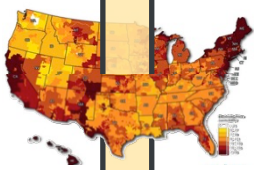


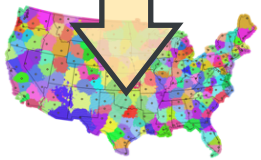
Housing stock characteristics database + Physics-based computer modeling + High-performance computing

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

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







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Other national, regional, and local audit databases

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NREL	**TMY3 weather data**

Housing stock characteristics database

+

Physics-based computer modeling

+

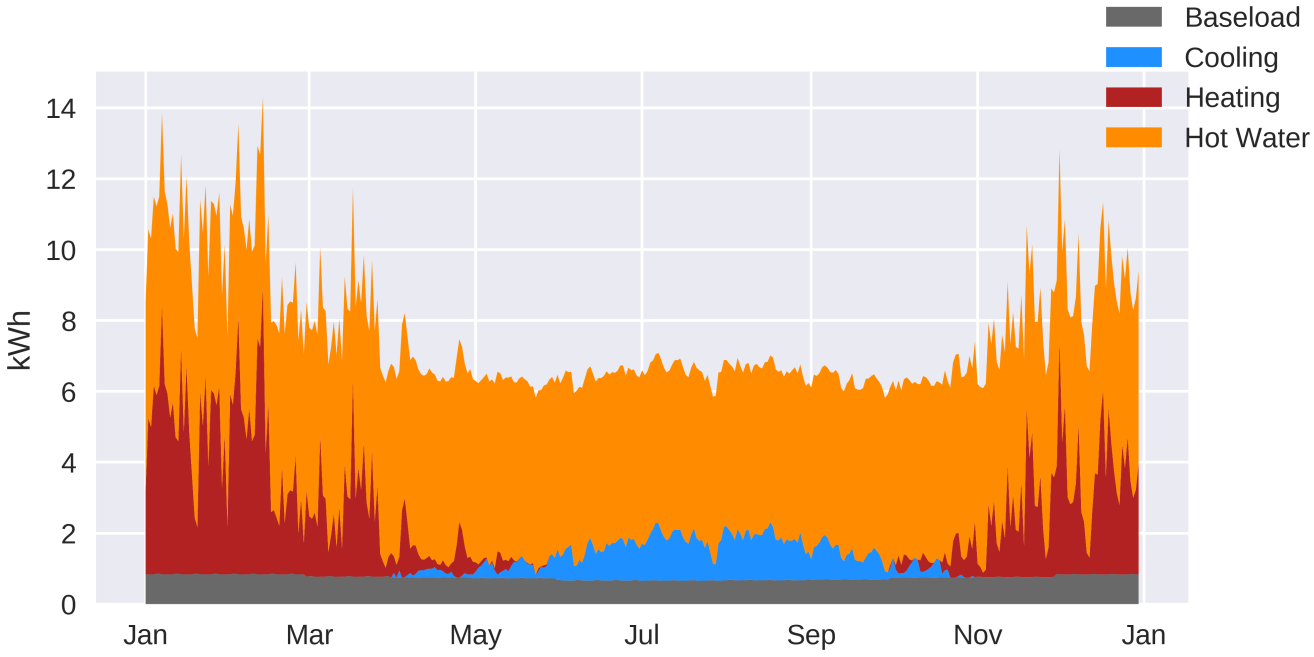
High-performance computing

U.S. DOE Tools

OpenStudio

EnergyPlus

Detailed sub-hourly energy simulations



Housing stock characteristics database

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Physics-based computer modeling

+

High-performance computing

U.S. DOE Tools

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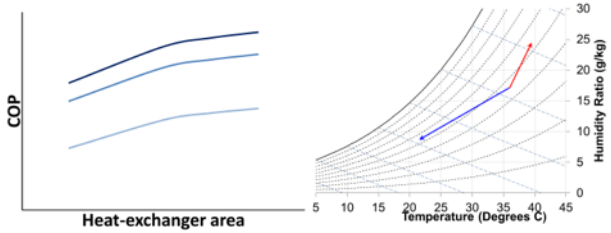
EnergyPlus

Ability to simulate emerging technologies

Emerging technology



ResStock

System performance characterization

Detailed open-source component models

Housing stock characteristics database

+

Physics-based computer modeling

+

High-performance computing

U.S. DOE Tools

OpenStudio

EnergyPlus

Many Partners: Shared Development Resources

Xcel Energy
AUSTIN ENERGY
PERFORMANCE SYSTEMS DEVELOPMENT
STATE OF CALIFORNIA ENERGY COMMISSION
nationalgrid
Group 14 ENGINEERING
bigladder SOFTWARE
EnergyTrust of Oregon, Inc.
DUKE ENERGY
NORESCO
ambient energy
wrightsoft
BONNEVILLE POWER ADMINISTRATION
NYSERDA
SketchUp
concept3D Location. Web. 3D.
Johnson Controls
CBEI CONSORTIUM for BUILDING ENERGY INNOVATION
FLUX
ICF INTERNATIONAL
LG
United Technologies Research Center
CALIFORNIA TECHNICAL FORUM
CARMEL SOFTWARE
Pacific Northwest
BERKELEY LAB
Nexant
MITSUBISHI ELECTRIC
NIST
OAK RIDGE
Argonne NATIONAL LABORATORY
Natural Resources Canada
GENABILITY
GARD Analytics

Housing stock characteristics database

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Physics-based computer modeling

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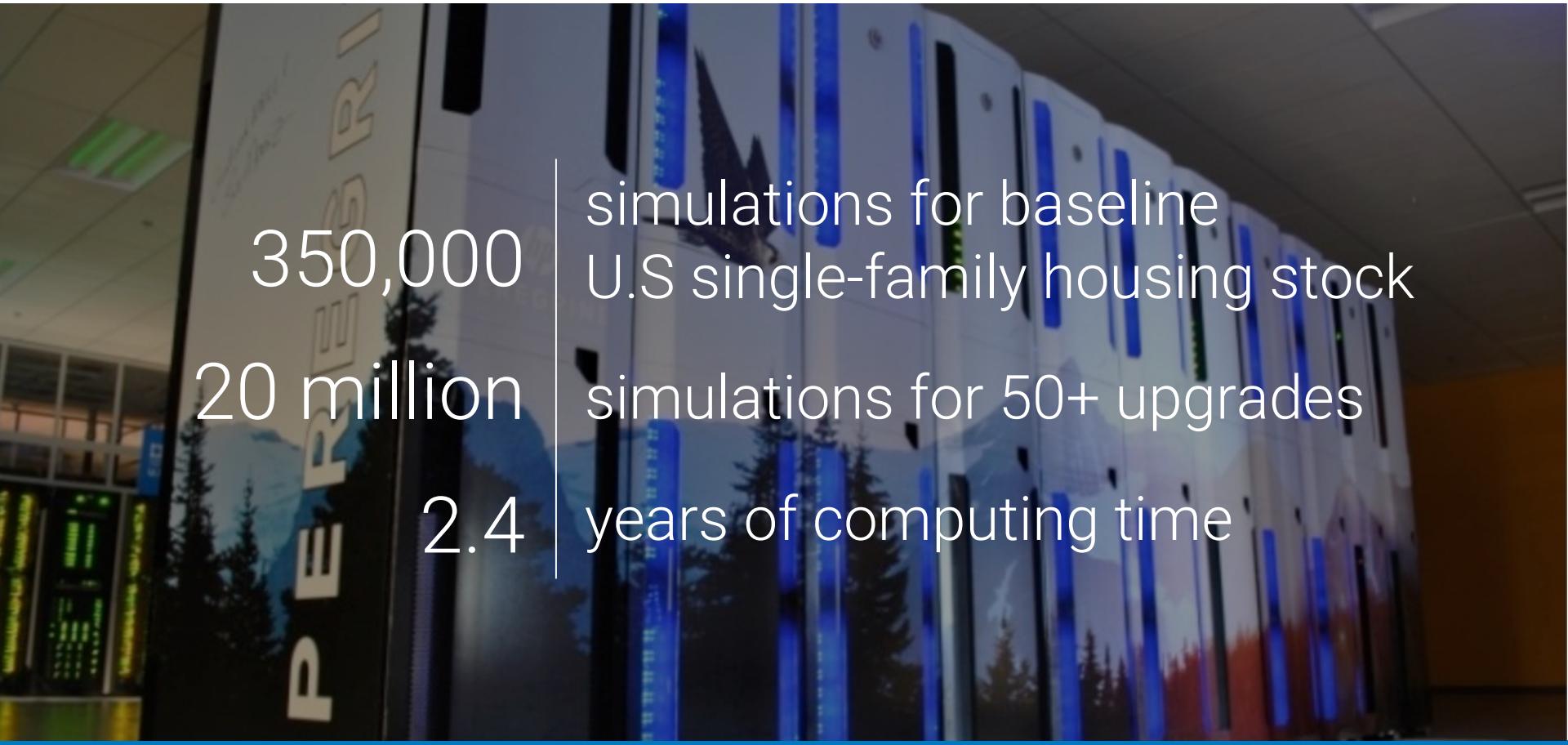
High-performance computing



350,000	simulations for baseline U.S single-family housing stock
20 million	simulations for 50+ upgrades
2.4	years of computing time

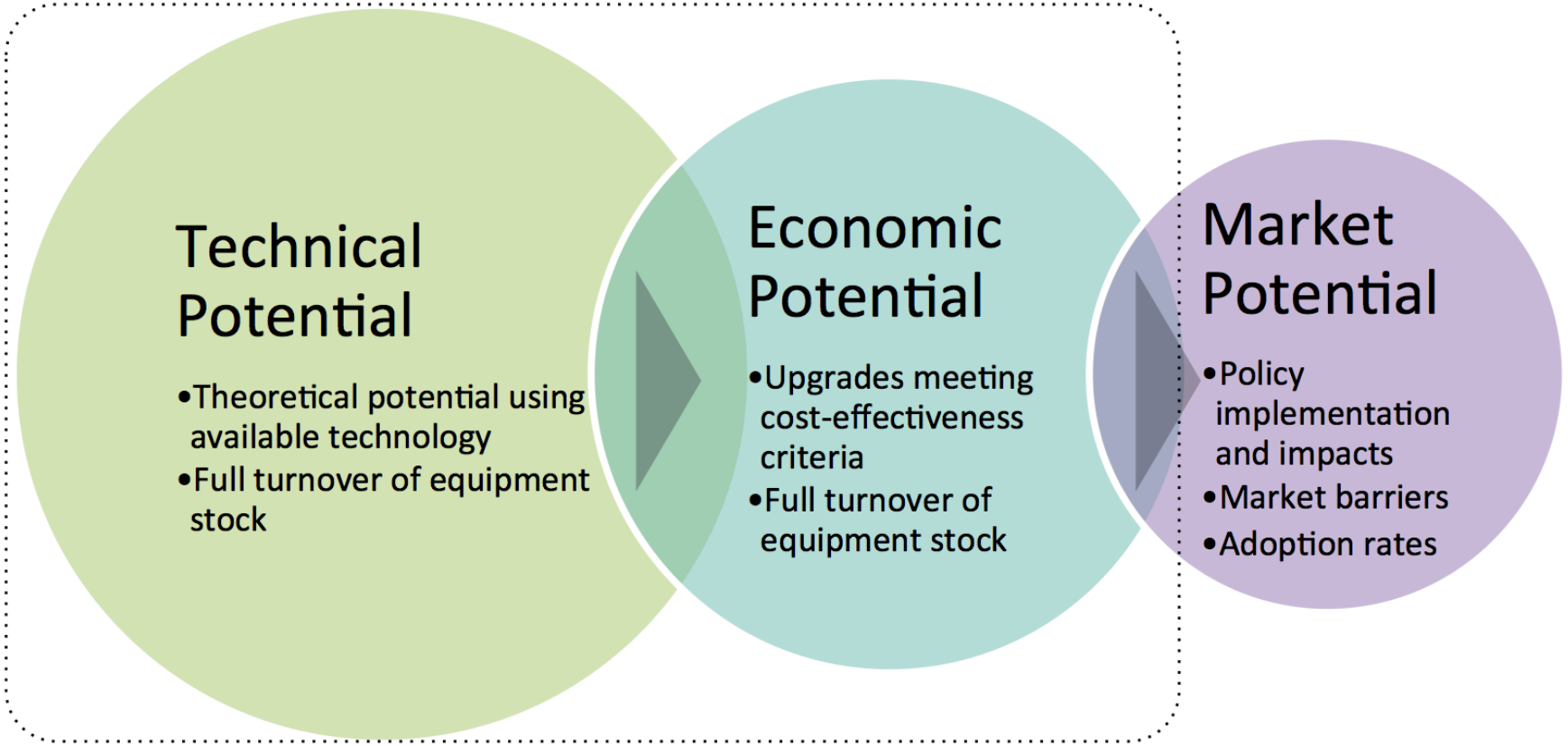
Housing stock characteristics database

+

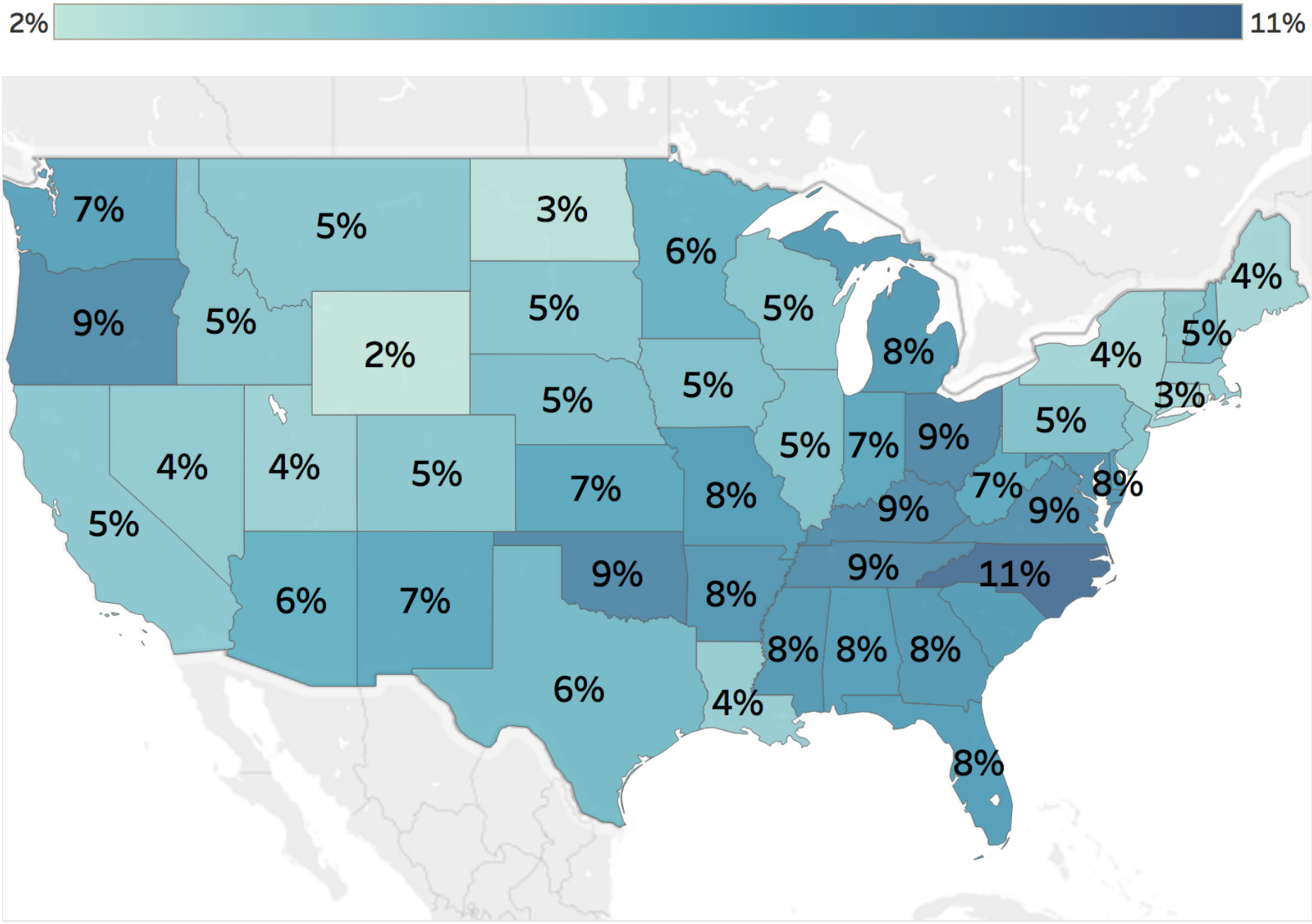
Physics-based computer modeling

+

High-performance computing

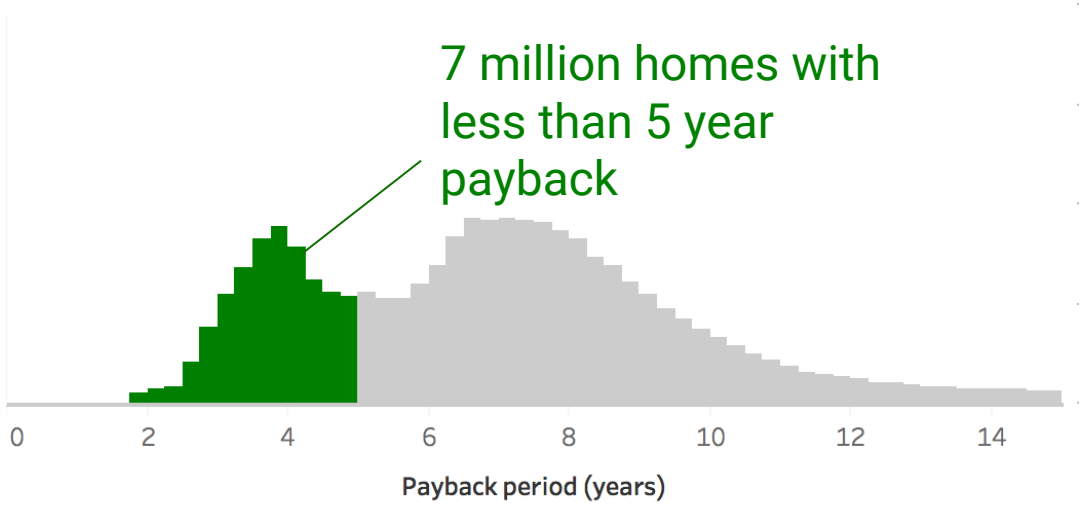


Cost-Effective Residential Electric EE Potential (% of annual kWh sales)



Evaluate incentives – Drill-and-Fill Wall Insulation

With no rebate



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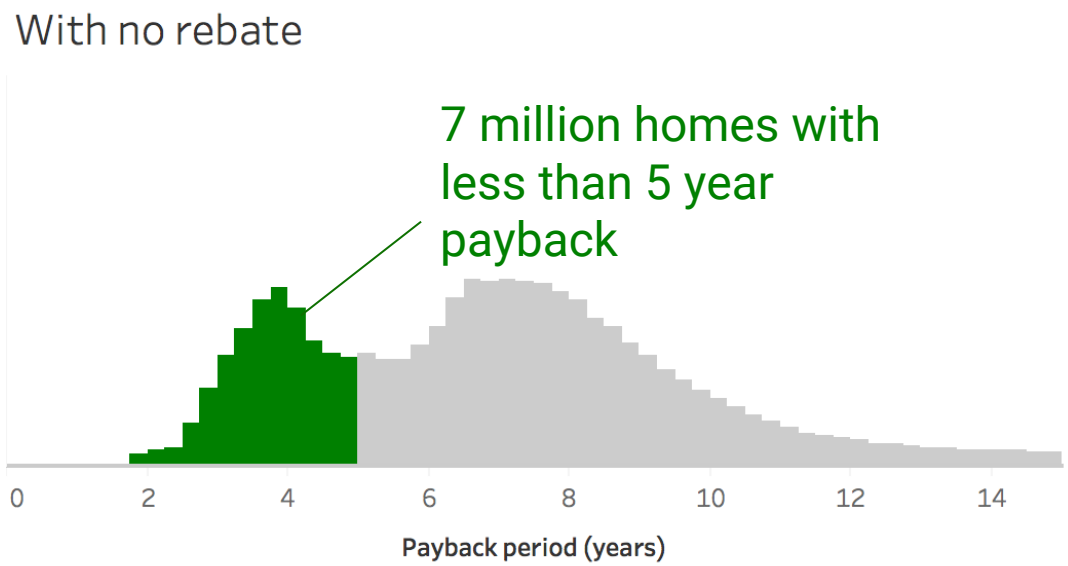

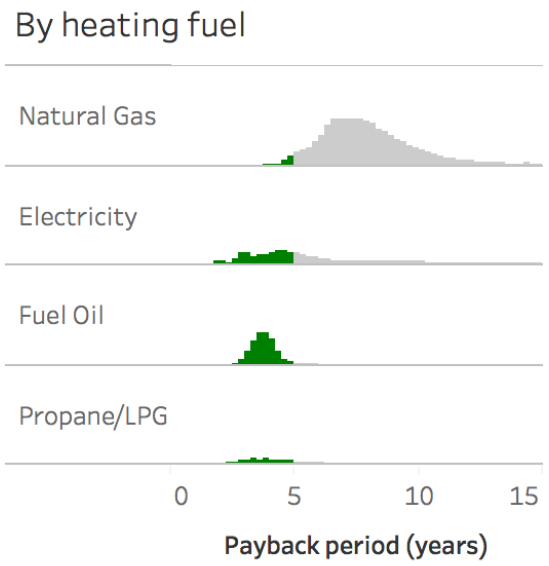

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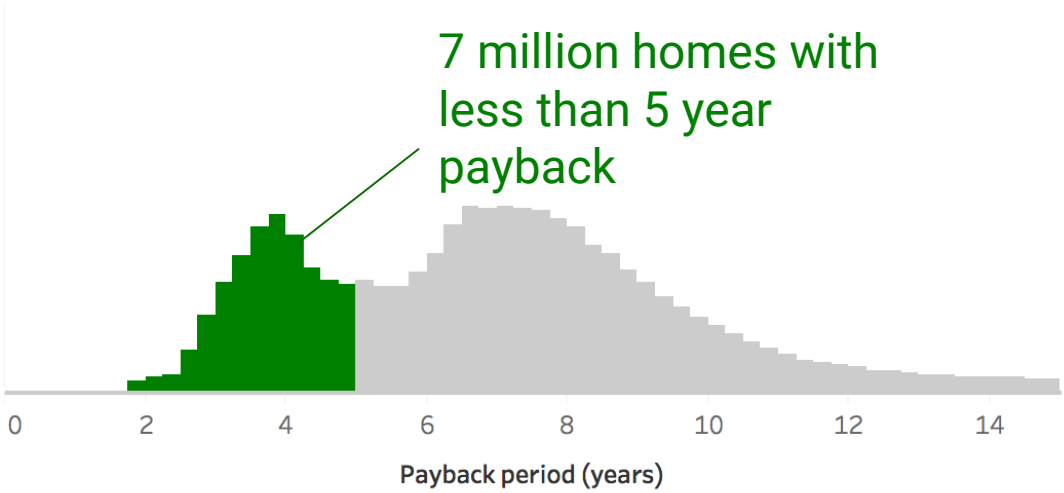
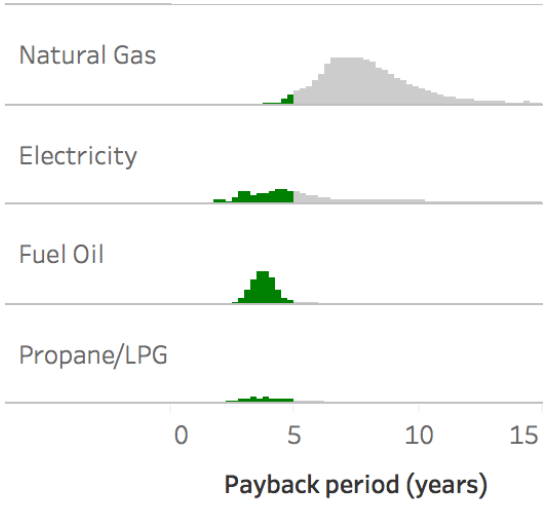
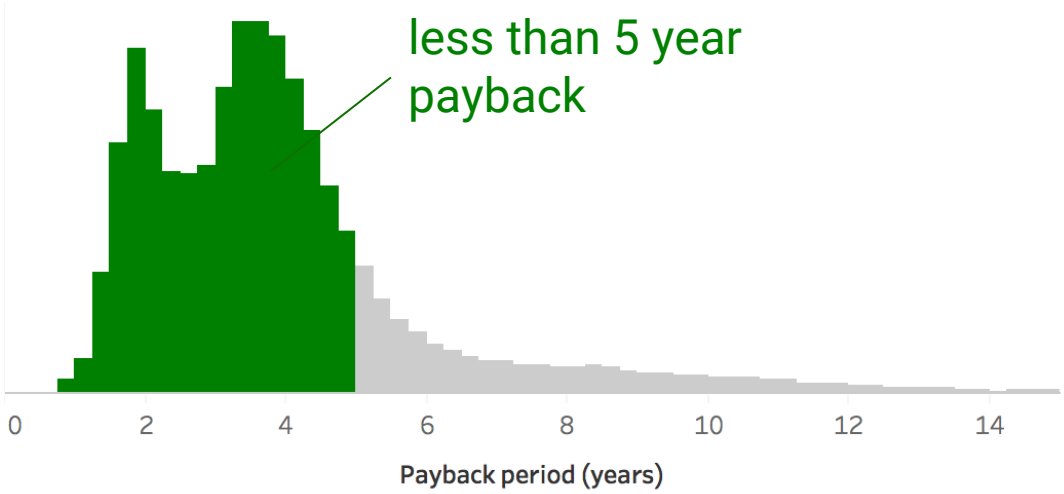
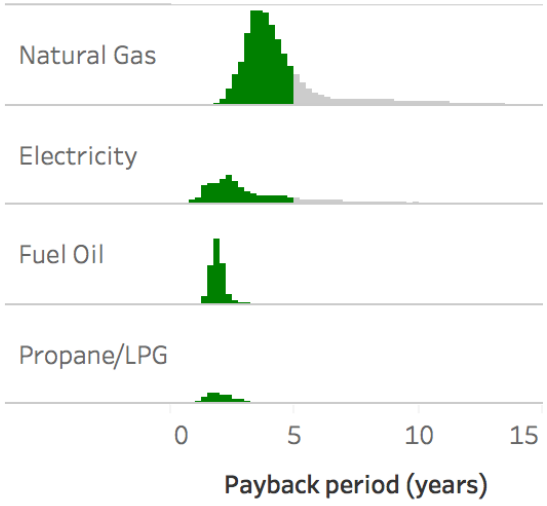


By heating fuel



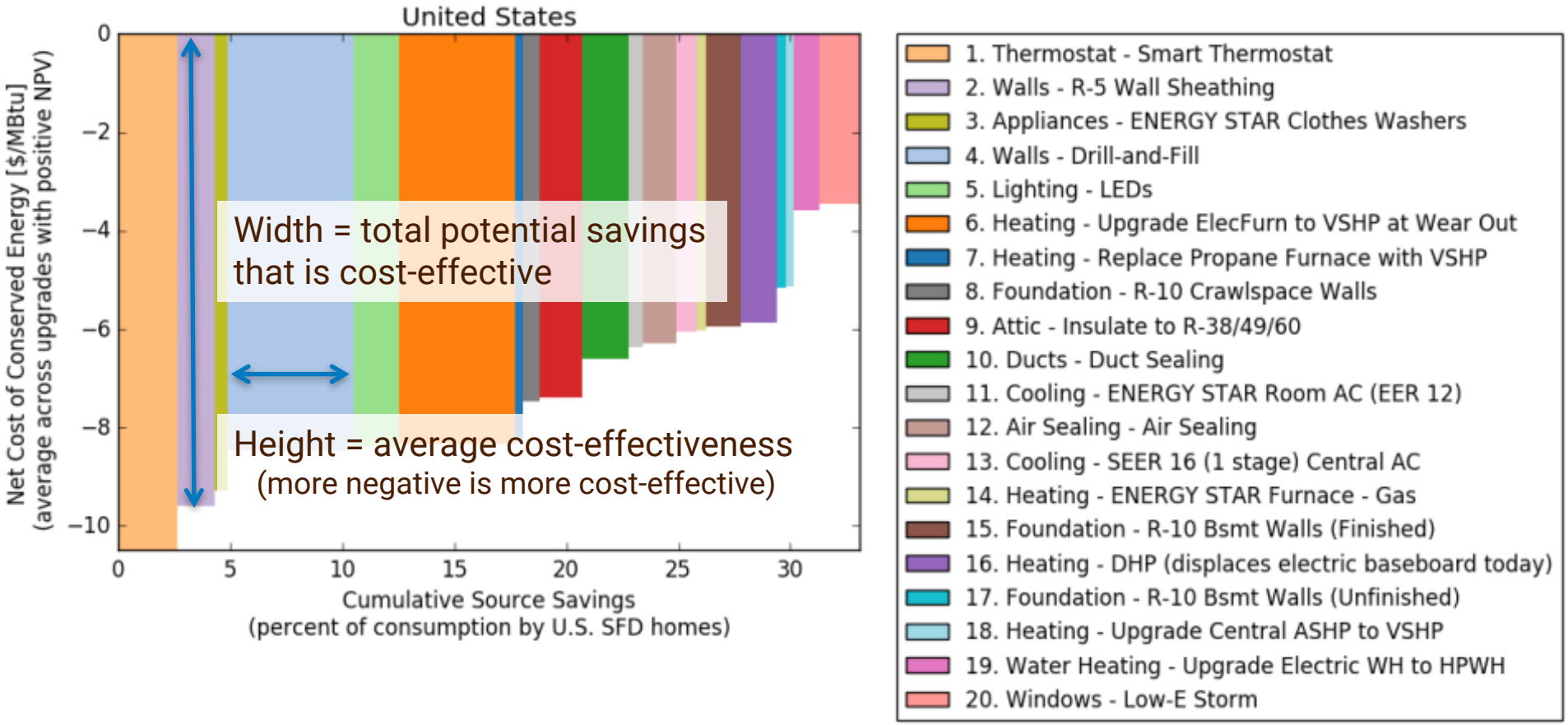
With 50% rebate





Economic Potential (NPV > 0) Supply Curve

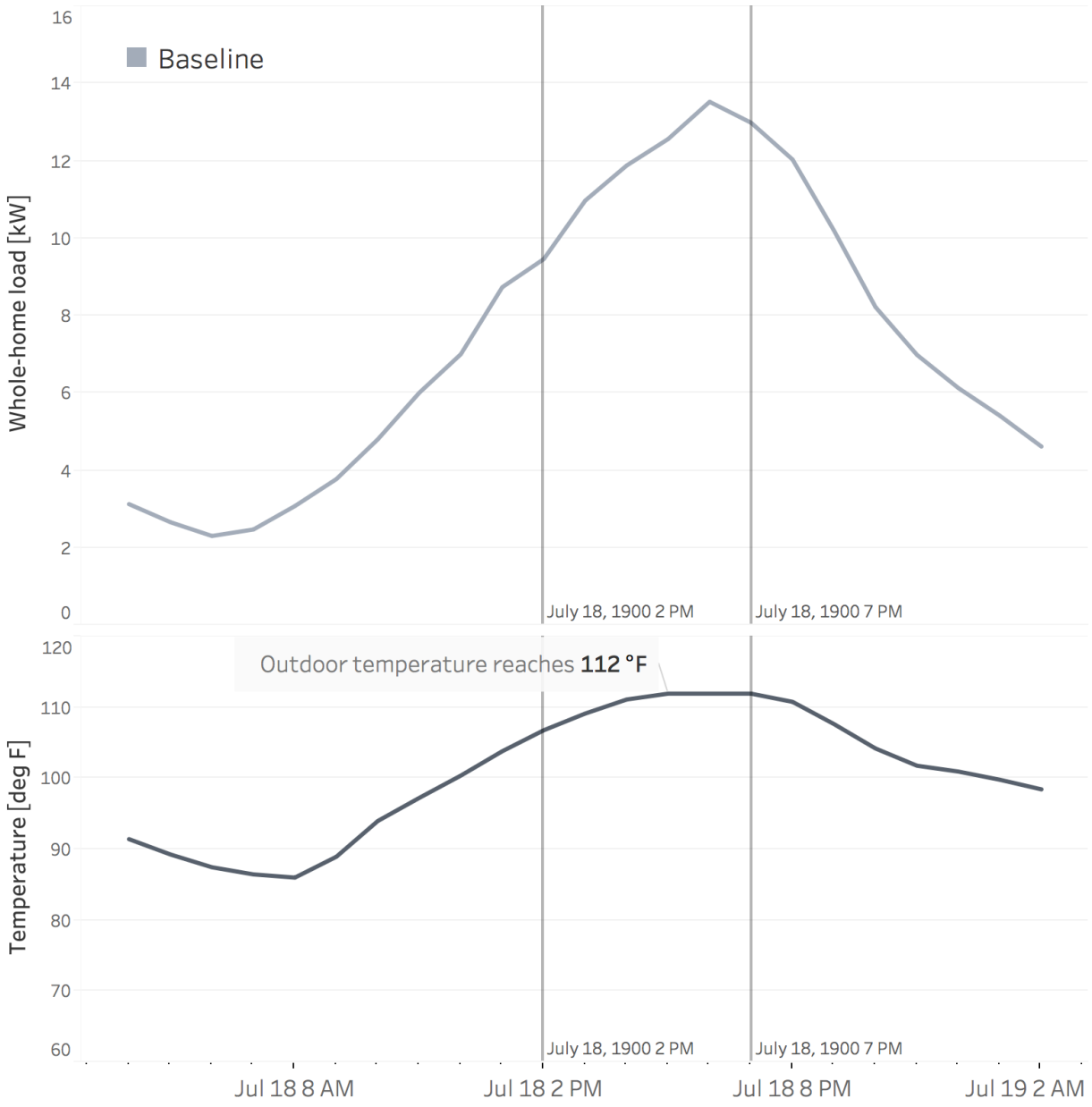
Supply Curves



All values are primary/source energy (i.e., raw fuel burned to create heat and electricity).

Application: Buildings-to-Grid Analysis

Simulated **peak shifting potential** across a segment of housing stock (1950s homes in Phoenix)



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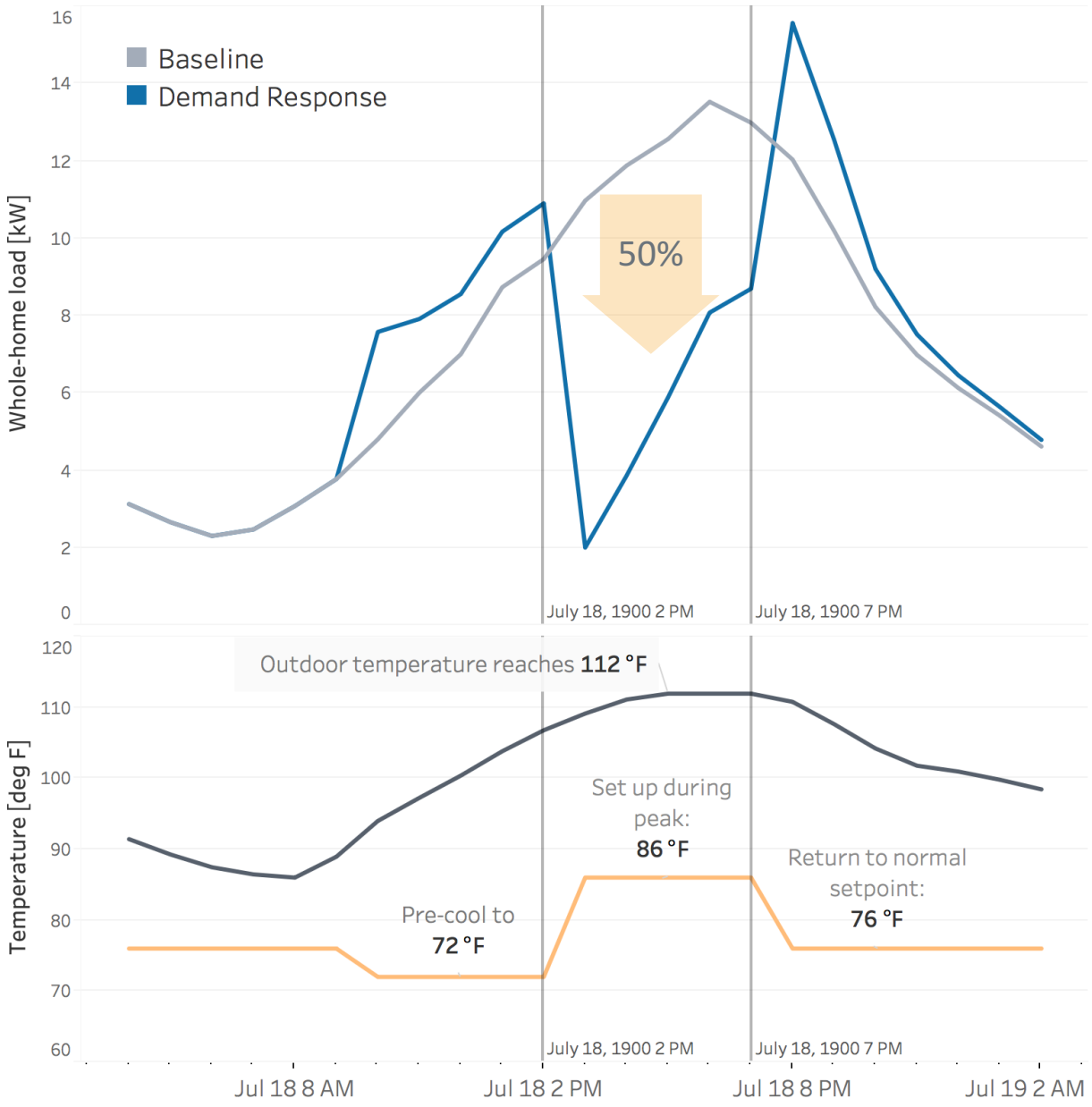

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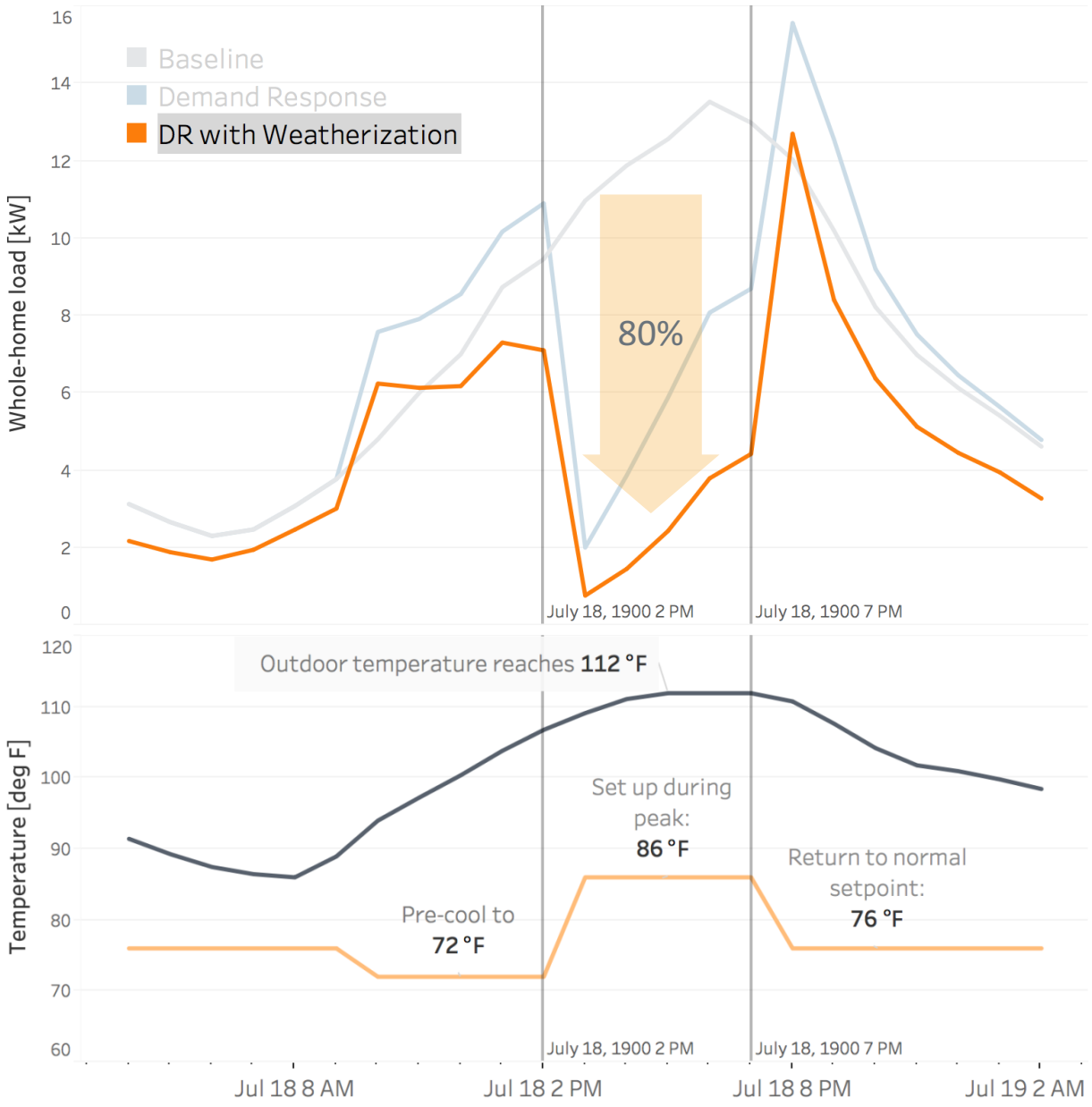

Application: Market engagement

Hyperlocal data
e.g., assessors' databases, utility bills

ResStock workflow and regional characteristics

Market engagement tools & analytics

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Hyperlocal data
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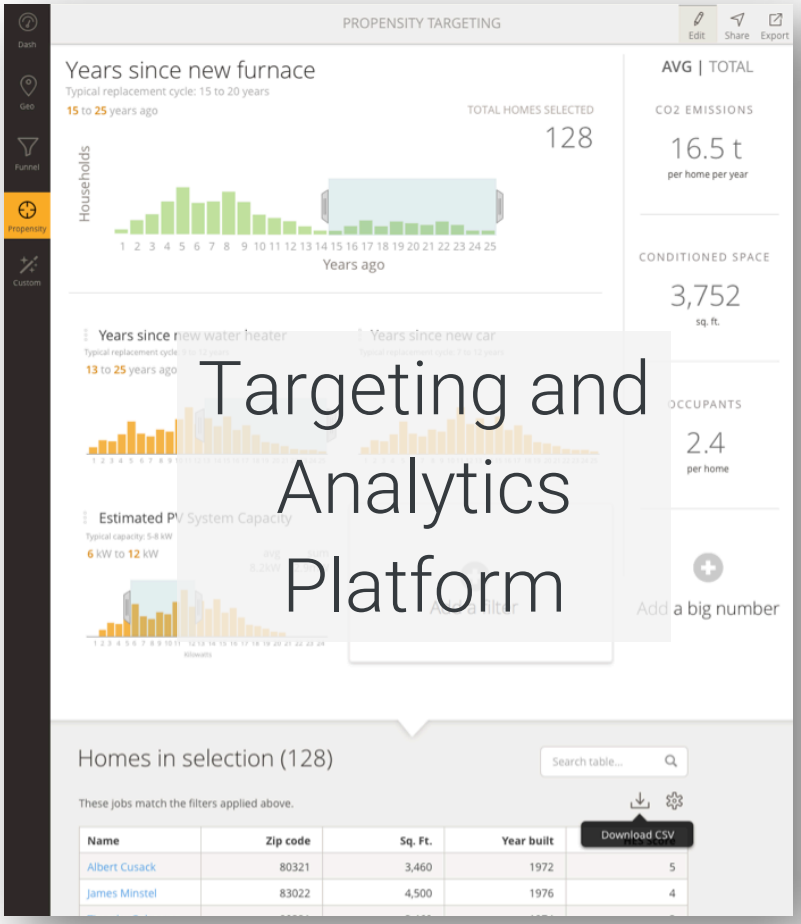
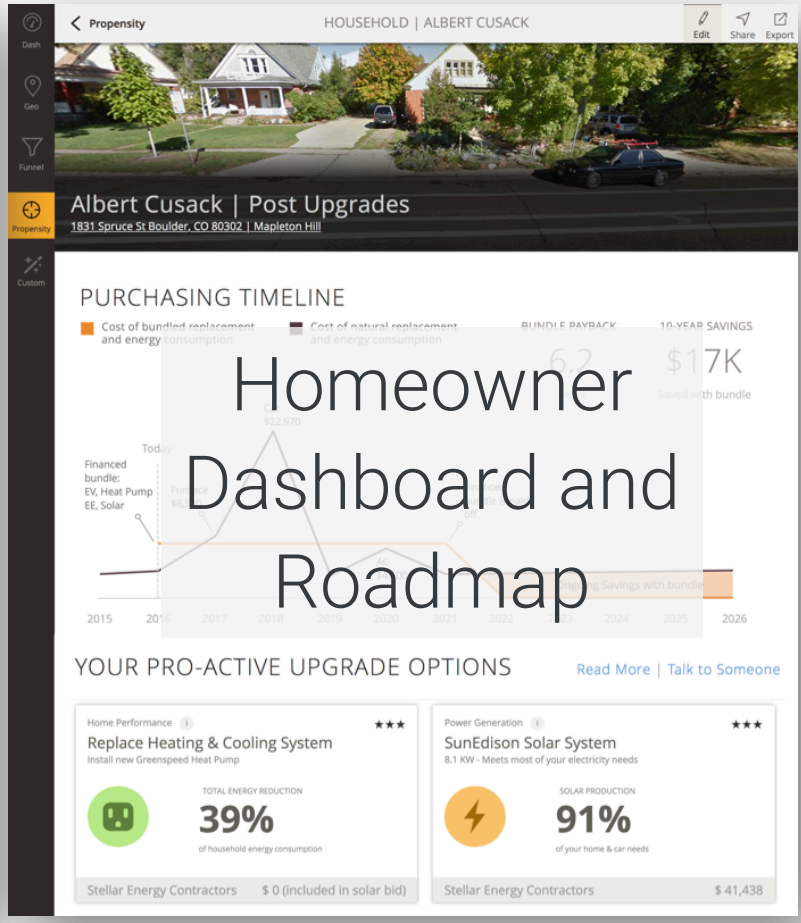
ResStock workflow and regional characteristics

Market engagement tools & analytics

City of Boulder

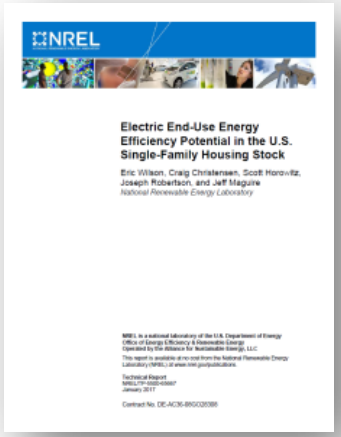
Radiant Labs





Ways to benefit from ResStock

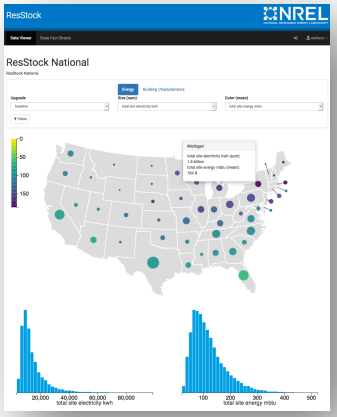
Read the Report



Energy Efficiency Potential in the U.S. Single-Family Housing Stock

Download State Factsheets

Explore Results



Interactive Data Viewer

Analyze Your Scenario BETA

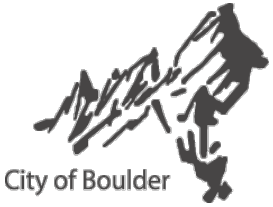
Use the open-source software yourself or work with NREL or other trained consultants

Visit **resstock.nrel.gov** to get started

Acknowledgements

EERE Building Technologies Office
EERE Office of Strategic Programs
Office of Energy Policy and Systems Analysis
Office of Electricity

United States
Environmental Protection
Agency
Regions 8 & 10



Contact Eric.Wilson@nrel.gov

to learn how ResStock can benefit your organization.