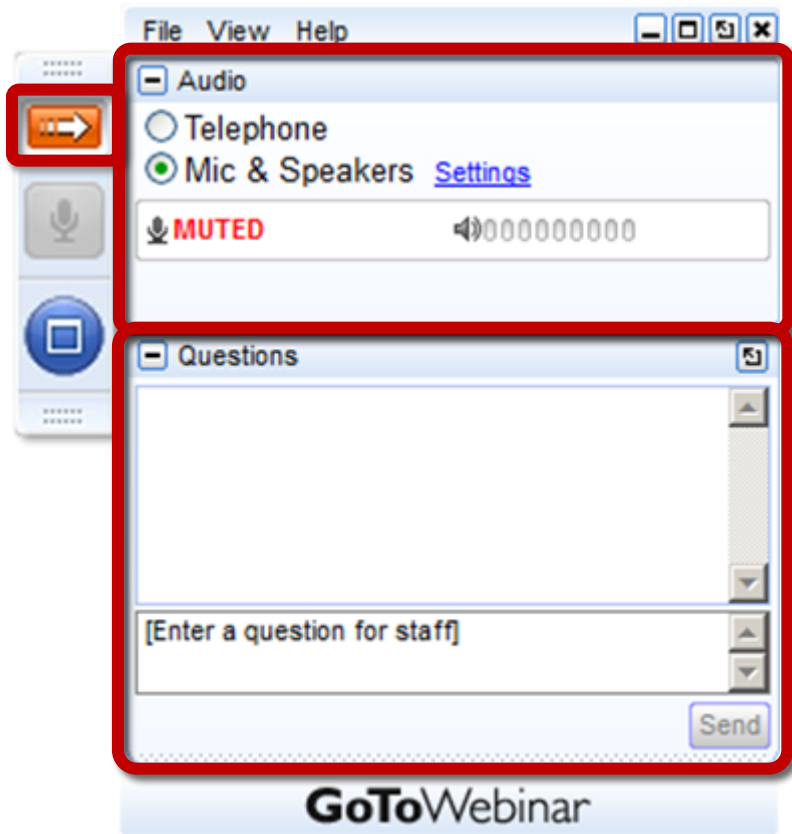


Visualizing Equitable Energy Transitions with SLOPE

April 26, 2022

Webinar Logistics



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Clean Energy States Alliance



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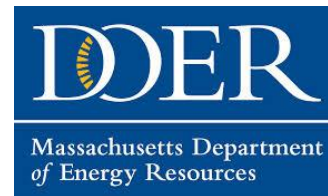
Maryland
Energy
Administration



MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY



NYSERDA



Webinar Speakers



Megan Day
National Renewable
Energy Laboratory



Daren Zigich
New Mexico Energy,
Minerals, and Natural
Resources Department



Abbe Ramanan
Clean Energy States
Alliance (moderator)





Visualizing Equitable Energy Transitions with SLOPE

Clean Energy States Alliance
April 26, 2022 Webinar

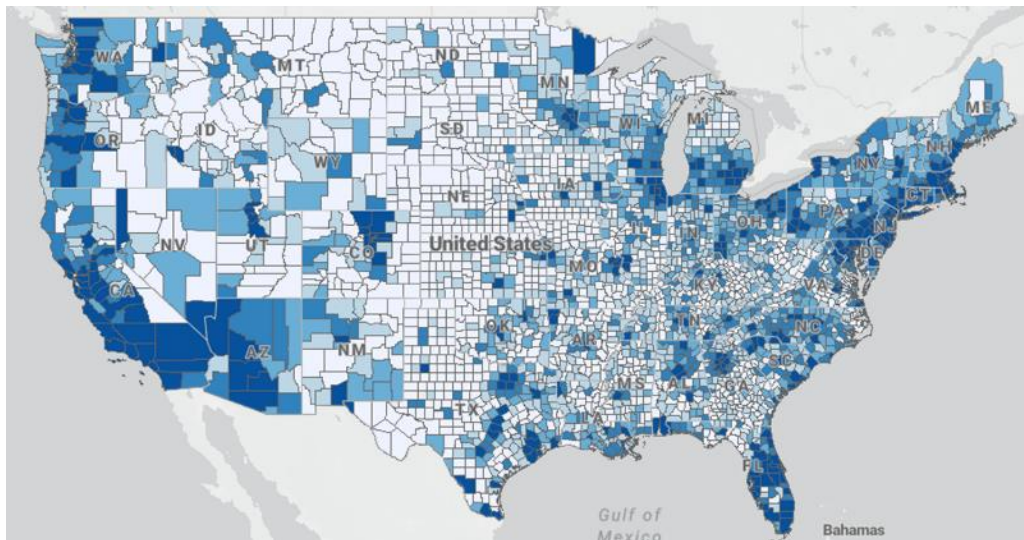
Megan Day – National Renewable Energy Laboratory

Daren Zigich – New Mexico Energy, Minerals and Natural Resources Department

State and Local Planning for Energy (SLOPE)

A free and easy-to-access online platform that helps energy planners at state and local levels make data-driven decisions to achieve their communities' energy goals.

- **Scenario Planner:** Explore the impacts of different energy transition scenarios on the energy consumption, CO₂ emissions, and system costs at county, state, and national scales.
- **Data Viewer:** Dive into city, county, and state data on renewable energy, energy efficiency, and sustainable transportation potential and projections.



Data Viewer: Personally Owned Light Duty Vehicle Stock - High Electrification Scenario (2020)



maps.nrel.gov/slope



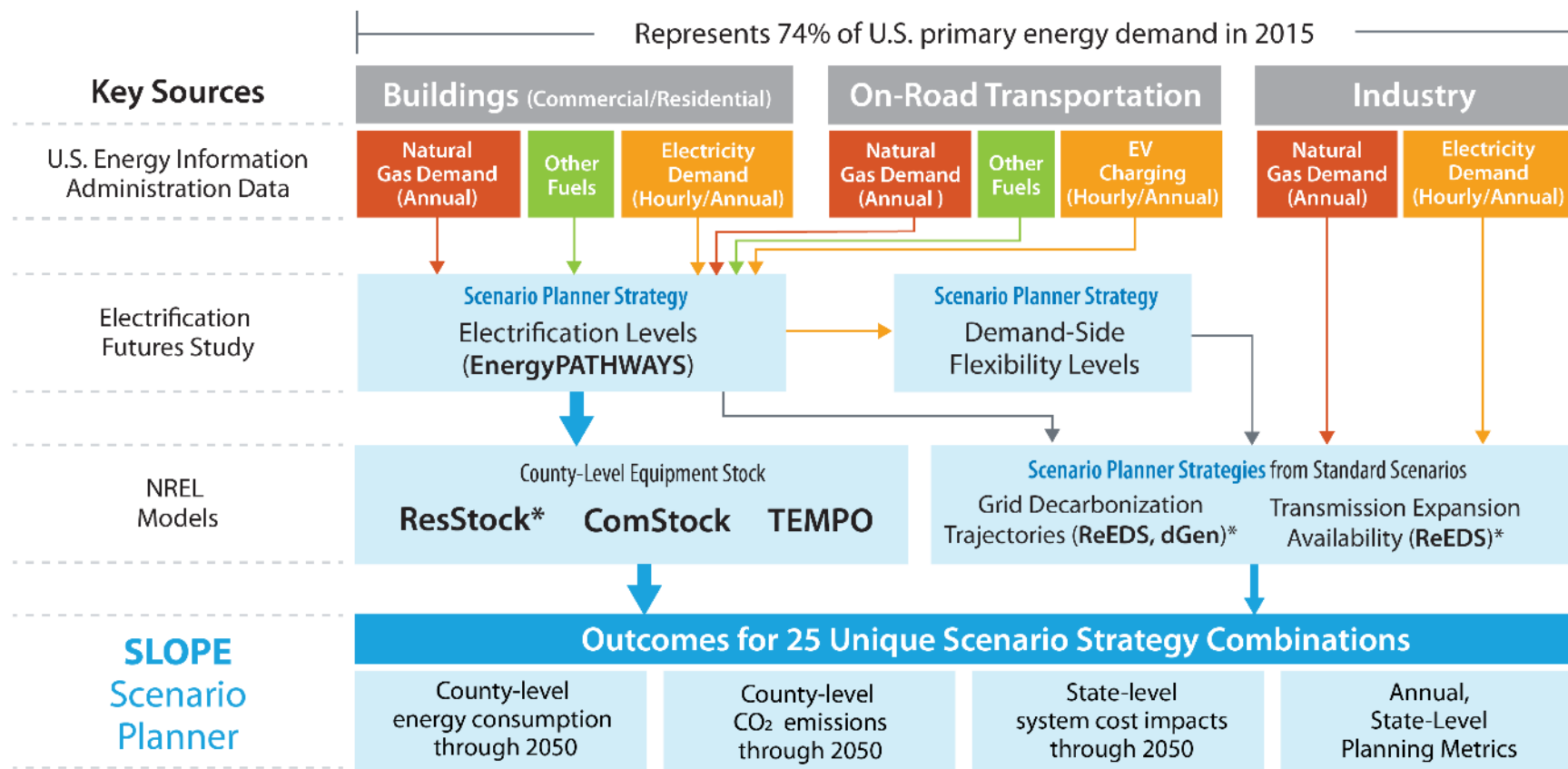
slope@nrel.gov



U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

Scenario Planner: Analysis Architecture



**Previous R&D 100 winners*

Localized Energy System Scenarios

To deliver county-level scenario results, the SLOPE team integrated results from five of NREL's flagship models, along with scenarios from two of NREL's innovative energy sector analyses:



Regional Energy Deployment
System (ReEDS)



Distributed Generation Market
Demand (dGen™)



ResStock™



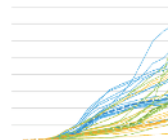
ComStock™



Transportation Energy & Mobility
Pathway Options™ (TEMPO)



Electrification Futures Study



2021 Standard Scenarios

New Mexico Clean Energy Transition Goals

New Mexico is developing a grid modernization plan for 100% zero-carbon electricity resources by mid-century in accordance with the Energy Transition Act


Economy-wide carbon reduction goal: 45% by 2030
driving accelerated adoption of:

- Energy efficiency measures in buildings
- Distributed energy resources including storage
- Electric vehicles

Renewable Energy Goals:

- Investor-Owned Utilities – 100% by 2045
- Rural Electric Coops – 100% by 2050





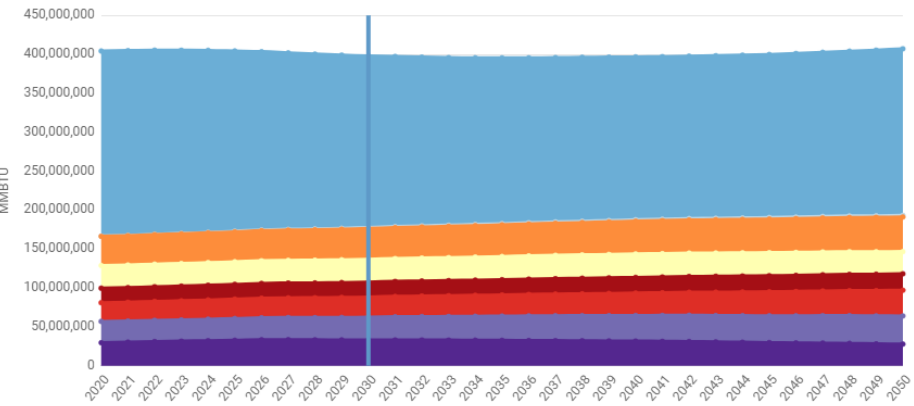
New Mexico's Energy Planning Questions:

- Does electrification of buildings and transportation result in energy savings?
 - Electrification versus energy efficiency
- Does building efficiency or building electrification result in greater greenhouse gas emissions reductions?
- New low-income energy efficiency grant program:
 - How can SLOPE and the Scenario Planner help prioritize communities in need and measures that provide the best results?

SLOPE Scenario Planner: Electrification vs. Energy Efficiency

Scenario 1: Reference Case

Energy Consumption - New Mexico

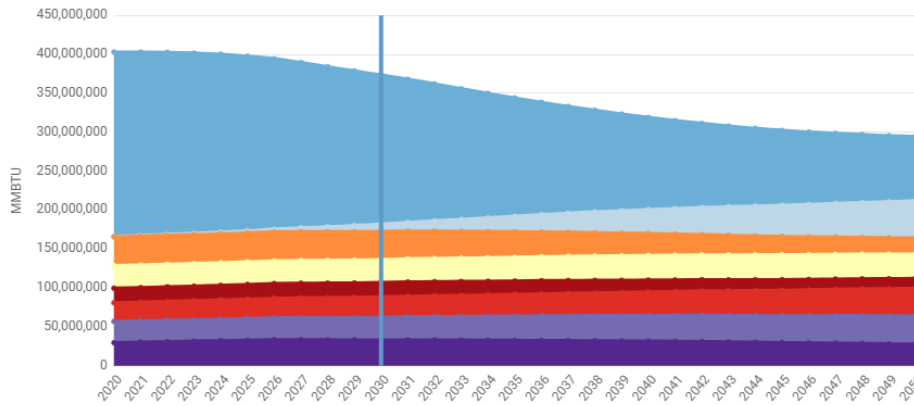


Data Filters ⓘ

- Transportation Non-Electricity*
- Residential Non-Electricity*
- Commercial Non-Electricity*
- Industrial Natural Gas
- Transportation Electricity
- Residential Electricity
- Commercial Electricity
- Industrial Electricity

Scenario 2: Widespread Electrification

Energy Consumption - New Mexico



Data Filters ⓘ

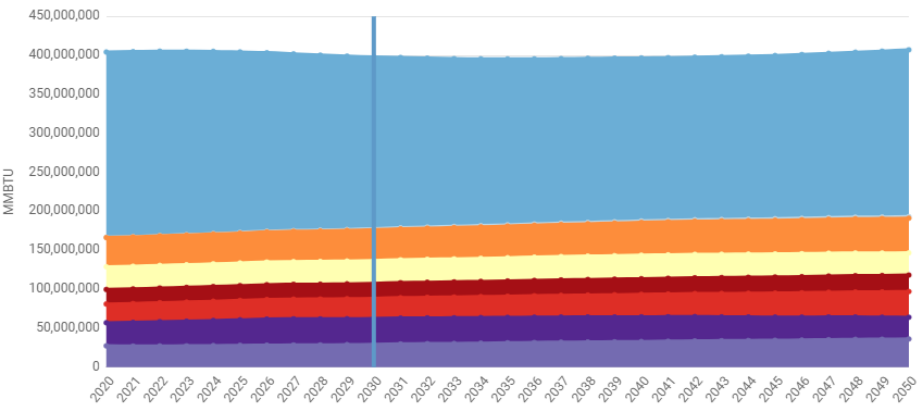
- Transportation Non-Electricity*
- Residential Non-Electricity*
- Commercial Non-Electricity*
- Industrial Natural Gas
- Transportation Electricity
- Residential Electricity
- Commercial Electricity
- Industrial Electricity

Compared to a reference case, widespread electrification reduces energy consumption 6% by 2030 and 28% by 2050 in New Mexico.

SLOPE Scenario Planner: Electrification vs. Energy Efficiency

Scenario 1: Reference Case

Energy Consumption - New Mexico

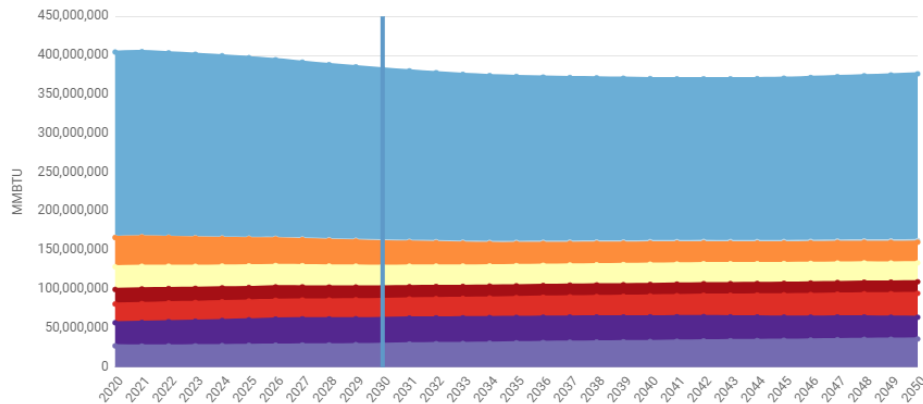


Data Filters ⓘ

- Transportation Non-Electricity*
- Residential Non-Electricity*
- Commercial Non-Electricity*
- Industrial Natural Gas
- Transportation Electricity
- Residential Electricity
- Commercial Electricity
- Industrial Electricity

Scenario 2: Best-Available Energy Efficiency in Buildings

Energy Consumption - New Mexico



Data Filters ⓘ

- Transportation Non-Electricity*
- Residential Non-Electricity*
- Commercial Non-Electricity*
- Industrial Natural Gas
- Transportation Electricity
- Residential Electricity
- Commercial Electricity
- Industrial Electricity

Compared to a reference case, best-available energy efficiency in buildings reduces energy consumption 4% by 2030 and 8% by 2050 in New Mexico.

Energy savings: electrification vs. energy efficiency






Scenario 1: Widespread Electrification

Energy Consumption - New Mexico

Details for Year 2030

	Residential	Commercial	Industrial	Transportation	Total
Electricity - MMBTU	2.943e+7	2.617e+7	2.931e+7	9.541e+6	9.445e+7
Non-Electricity - MMBTU	3.617e+7	1.844e+7	3.306e+7	1.913e+8	2.790e+8
Total - MMBTU	6.560e+7	4.461e+7	6.236e+7	2.009e+8	3.734e+8

Planning Metrics ?

				
23.31%	27.02%	63.32%	49.87%	\$6.159
Share of Space Heating Services Supplied by Electricity (%)	BEV and PHEV Share of Light-Duty Vehicles (%)	Share of Electricity Provided by Renewable Energy (%)	Reduction in Energy-Related CO2 Emissions from 2005 (%)	Net Change in System Cost from Reference Scenario (Billions 2020 \$)






Scenario 2: Best-Available Energy Efficiency in Buildings

Energy Consumption - New Mexico

Details for Year 2030

	Residential	Commercial	Industrial	Transportation	Total
Electricity - MMBTU	2.658e+7	2.451e+7	2.931e+7	1.249e+6	8.165e+7
Non-Electricity - MMBTU	3.138e+7	1.597e+7	3.306e+7	2.205e+8	3.009e+8
Total - MMBTU	5.796e+7	4.048e+7	6.236e+7	2.217e+8	3.825e+8

Planning Metrics ?

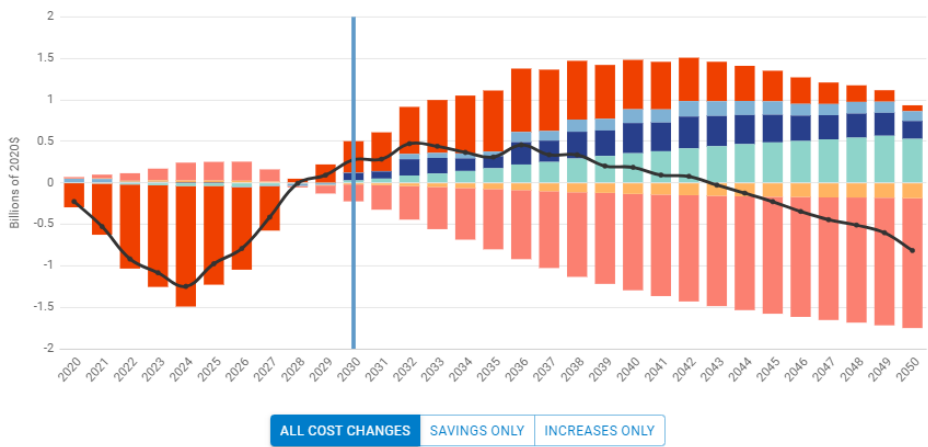
				
13.08%	6.715%	71.50%	47.64%	\$0.5369
Share of Space Heating Services Supplied by Electricity (%)	BEV and PHEV Share of Light-Duty Vehicles (%)	Share of Electricity Provided by Renewable Energy (%)	Reduction in Energy-Related CO2 Emissions from 2005 (%)	Net Change in System Cost from Reference Scenario (Billions 2020 \$)

In New Mexico, a building energy efficiency scenario has a lower total system cost than a widespread electrification scenario.

Cost savings potential: electrification vs. energy efficiency

Scenario 1: Widespread Electrification

Change in System Costs Relative to Reference Scenario (Billions of 2020\$) - New Mexico

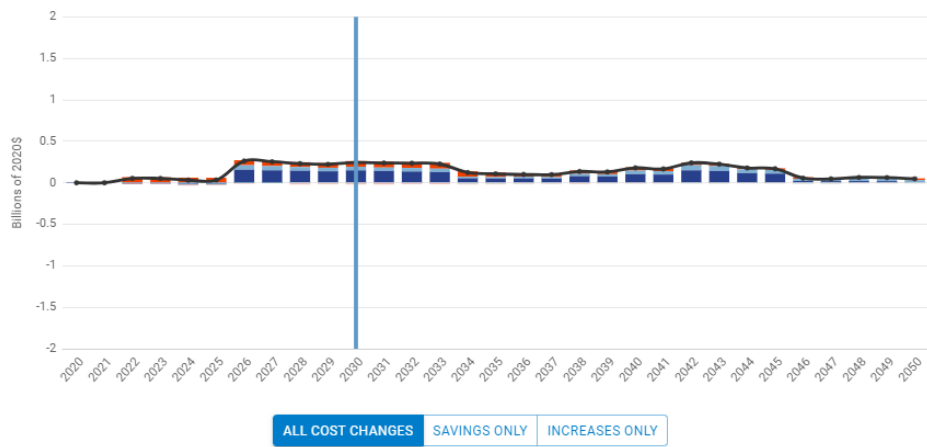


Data Filters

- Demand: Equipment Capital
- Demand: Fuel Consumption and O&M
- Demand: Fuel Infrastructure
- Electricity Supply: Generation and Storage
- Electricity Supply: Fuel and O&M
- Electricity Supply: T&D (Wires)
- Net System Cost

Scenario 2: Best-Available Energy Efficiency in Buildings

Change in System Costs Relative to Reference Scenario (Billions of 2020\$) - New Mexico



Data Filters

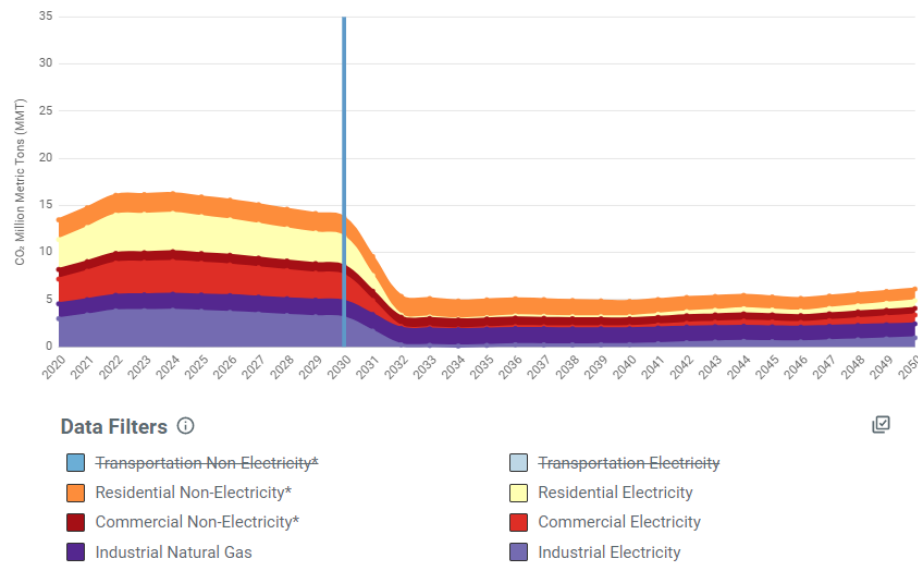
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- Net System Cost

In 2030, net change in system costs for building energy efficiency relative to business-as-usual is roughly **\$32.3 million (12%) less** than the net change in costs for widespread electrification

GHG reductions: electrification vs. efficiency

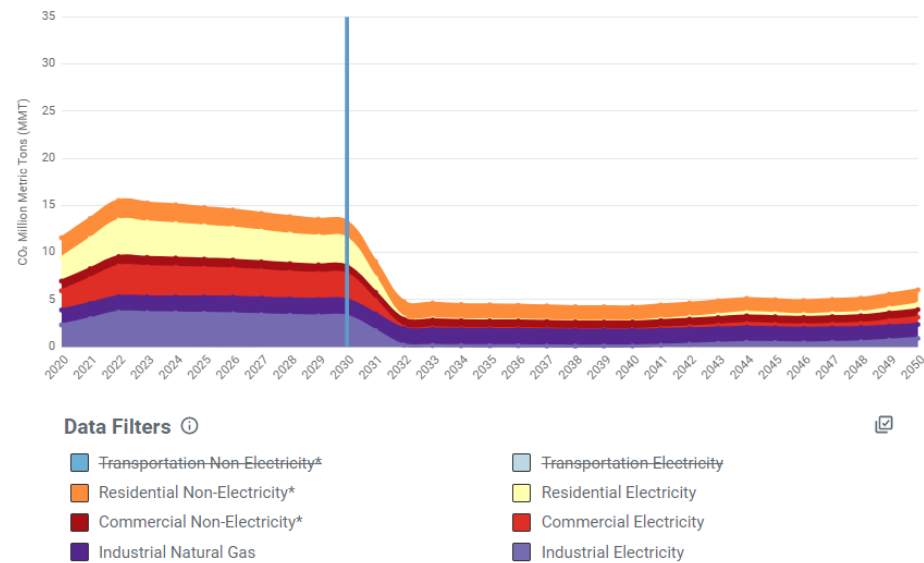
Scenario 1: Widespread Electrification

CO₂ Emissions - New Mexico



Scenario 2: Best-Available Energy Efficiency in Buildings

CO₂ Emissions - New Mexico



* Non-electric energy demand includes solid, liquid, and gaseous fuels and steam consumed within the buildings, industrial, and transportation sectors

* Non-electric energy demand includes solid, liquid, and gaseous fuels and steam consumed within the buildings, industrial, and transportation sectors

In New Mexico, best-available building energy efficiency strategies could achieve **8% lower emissions in residential sector** and **5% lower emissions in commercial sector** in 2030 compared to strategies for building electrification.

GHG reductions: electrification vs. efficiency






Scenario 1: Widespread Electrification

CO₂ Emissions - New Mexico

Details for Year 2030

	Residential	Commercial	Industrial	Transportation	Total
Electricity - CO ₂ Million Metric Tons (MMT)	3.084	2.742	3.071	0.9996	9.896
Non-Electricity - CO ₂ Million Metric Tons (MMT)	2.050	1.008	1.754	13.76	18.57
Total - CO ₂ Million Metric Tons (MMT)	5.134	3.750	4.825	14.76	28.47

Planning Metrics ?

				
23.31%	27.02%	63.32%	49.87%	\$6.159
Share of Space Heating Services Supplied by Electricity (%)	BEV and PHEV Share of Light-Duty Vehicles (%)	Share of Electricity Provided by Renewable Energy (%)	Reduction in Energy-Related CO ₂ Emissions from 2005 (%)	Net Change in System Cost from Reference Scenario (Billions 2020 \$)






Scenario 2: Best-Available Energy Efficiency in Buildings

CO₂ Emissions - New Mexico

Details for Year 2030

	Residential	Commercial	Industrial	Transportation	Total
Electricity - CO ₂ Million Metric Tons (MMT)	2.933	2.705	3.235	0.1378	9.011
Non-Electricity - CO ₂ Million Metric Tons (MMT)	1.773	0.8722	1.754	15.85	20.25
Total - CO ₂ Million Metric Tons (MMT)	4.707	3.578	4.989	15.99	29.26

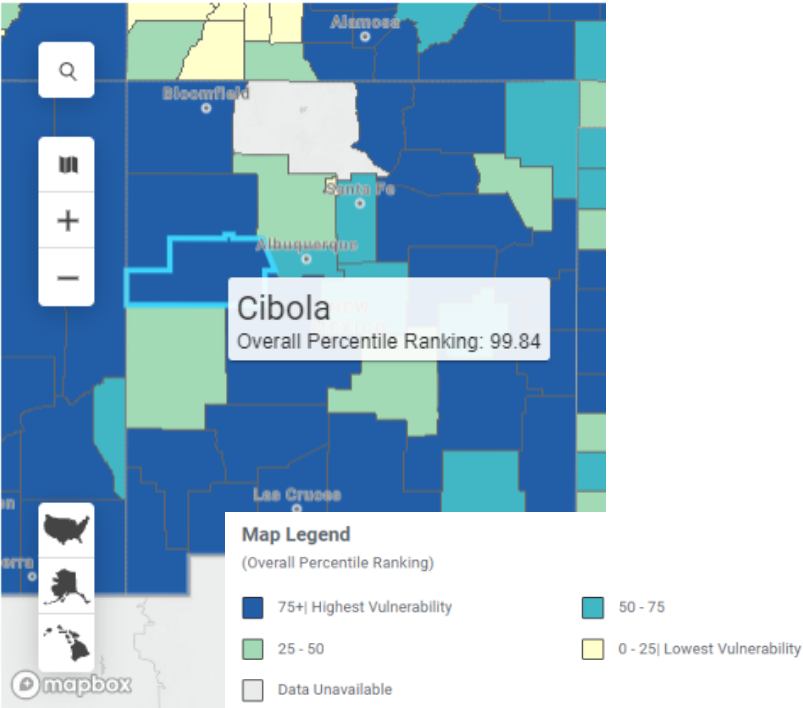
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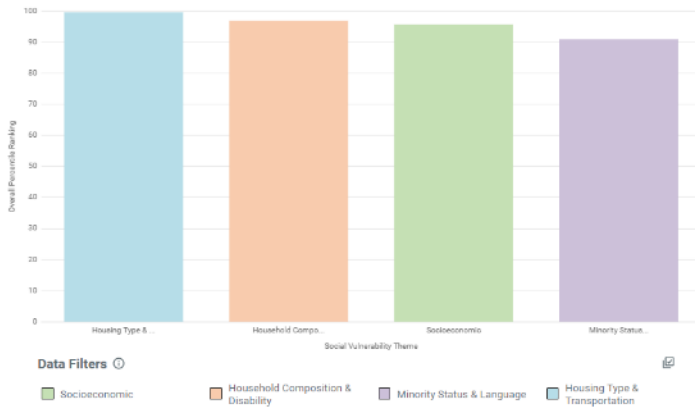
Emissions are reduced 2% more in a widespread electrification scenario than a building efficiency scenario by 2030 and 13% more by 2050

How can we identify and prioritize communities in need of energy efficiency grants and assistance, and which measures provide the best results?

Overall Social Vulnerability Index



Social Vulnerability Index Rankings



Overall Vulnerability

Socioeconomic Status

Below Poverty

Unemployed

Income

No High School Diploma

Household Composition & Disability

Aged 65 or Older

Aged 17 or Younger

Older than Age 5 with a Disability

Single-Parent Households

Minority Status & Language

Minority

Speaks English "Less than Well"

Housing Type & Transportation

Multi-Unit Structures

Mobile Homes

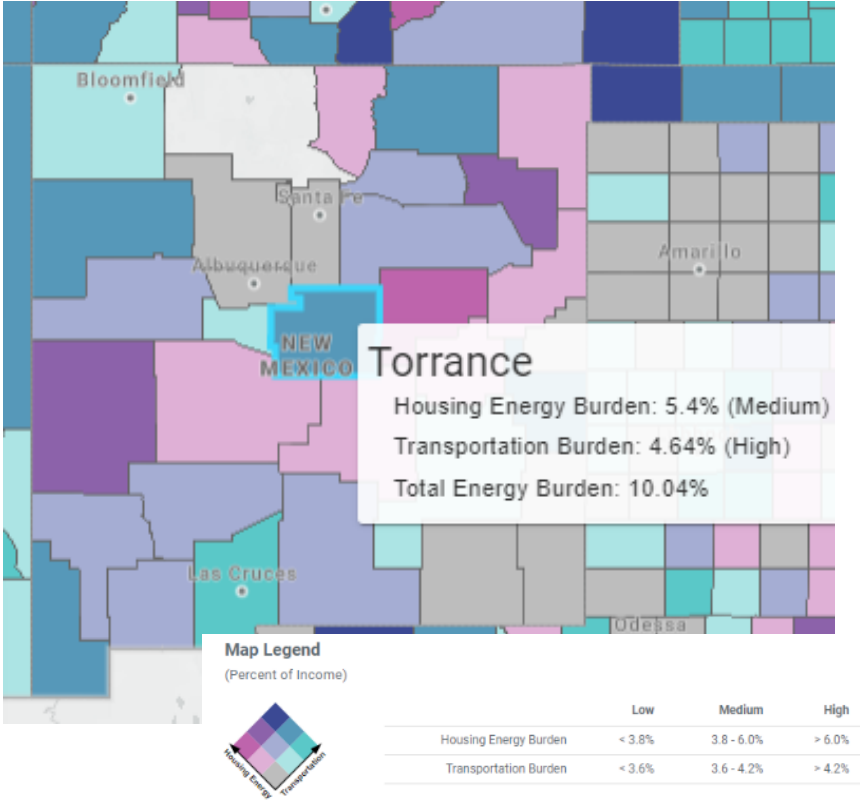
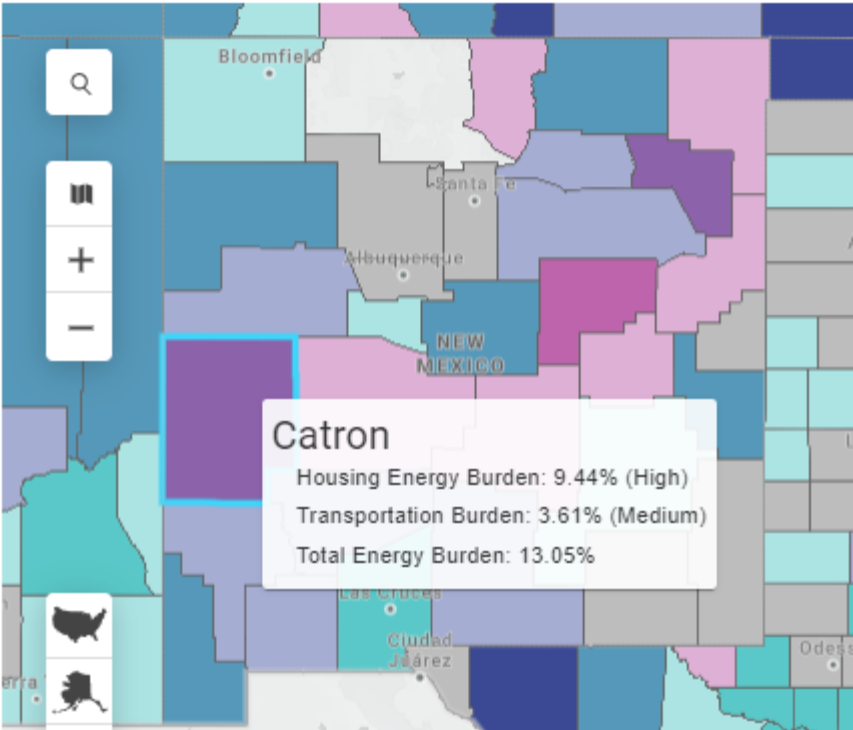
Crowding

No Vehicle

Group Quarters

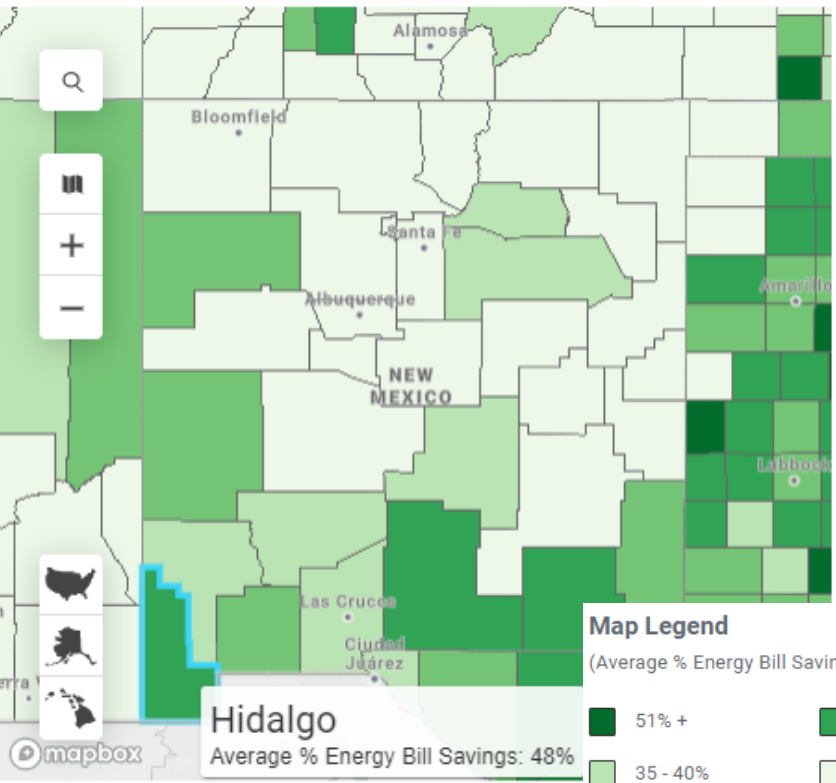
How can we identify and prioritize communities in need of energy efficiency grants and assistance, and which measures provide the best results?

Household Energy and Transportation Burden

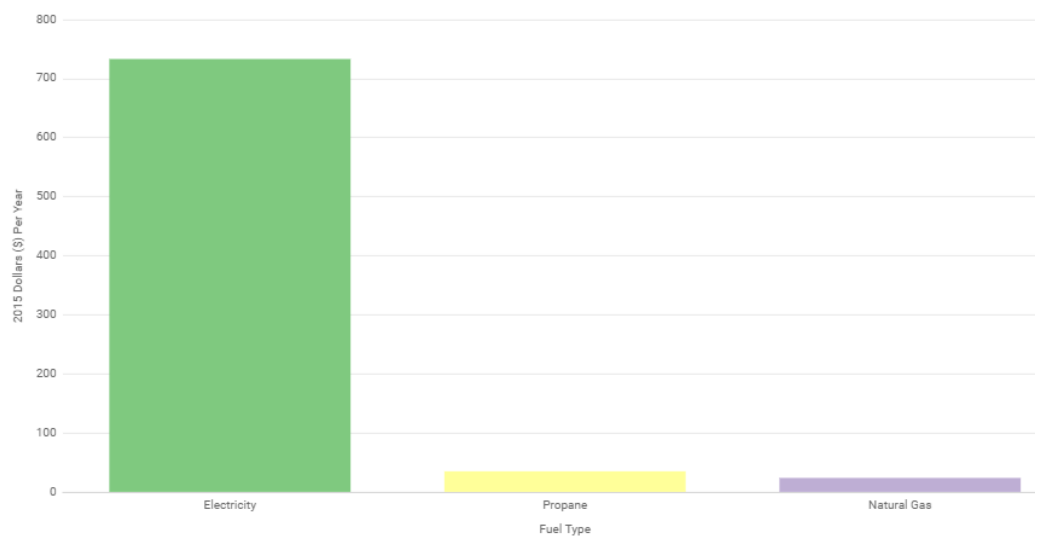


How can we identify and prioritize communities in need of energy efficiency grants and assistance, and which measures provide the best results?

Average % Bill Savings from Efficiency Upgrade Package for LMI Households



Average Annual Energy Bill Savings Per LMI Single Family Home



Data Filters ⓘ

☒ Electricity

☐ Natural Gas

☐ Fuel Oil*

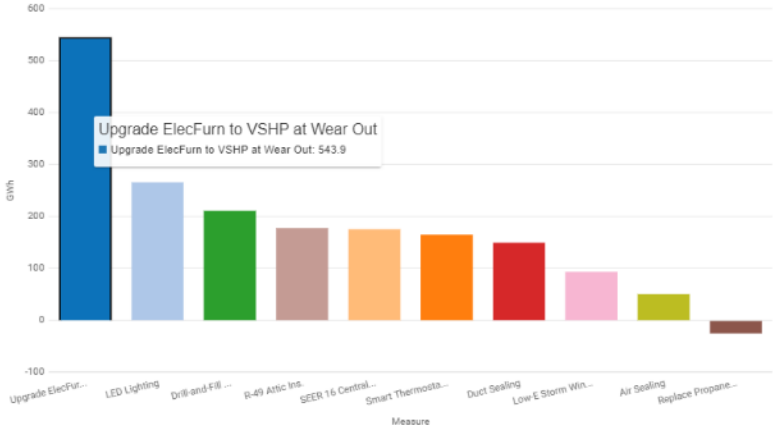
☐ Propane

*Category included in map only

How can we identify and prioritize communities in need of energy efficiency grants and assistance, and which measures provide the best results?

Electricity savings potential for single-family homes

Top Ten State-Wide Electricity Savings Potential by Measure



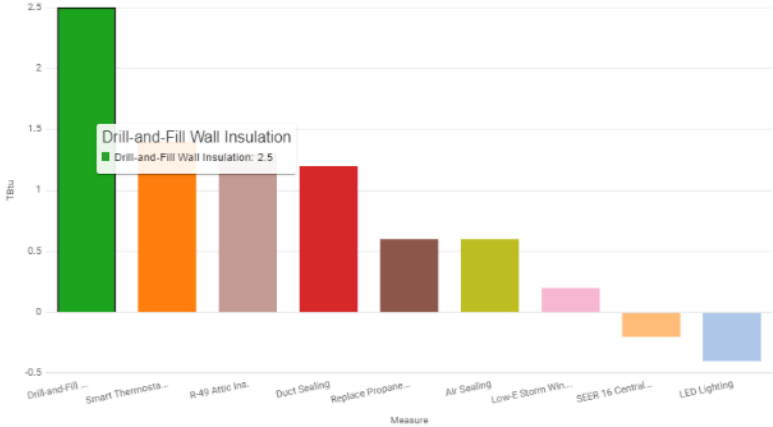
Data Filters ⓘ

- | | | | |
|--------------------------------------|-------------------------------------------|-----------------------------------|--------------------------------|
| Smart Thermostat | Low-E Storm Windows (DIY) | SEER 18 Central AC* | Drill-and-Fill Wall Insulation |
| Duct Sealing | R-49 Attic Ins. | LED Lighting | ENERGY STAR Room AC (EER 12)* |
| Upgrade Electric WH to HPWH* | R-10 Crawlspace Walls* | Replace Propane Furnace with VSHP | Air Sealing |
| Upgrade ElecFurn to VSHP at Wear Out | DHP (displaces electric baseboard today)* | R-60 Attic Ins.* | SEER 16 Central AC |
| R-5 Wall Sheathing* | R-10 Basement Wall Insulation* | Replace Oil Furnace with VSHP* | ENERGY STAR Boiler - Oil* |
| ENERGY STAR Furnace - Propane* | R-38 Attic Ins.* | ENERGY STAR Furnace - Oil* | |

*Category included in map only

Fuel savings potential for single-family homes

Top Ten State-Wide Fuel Savings Potential by Measure



Data Filters ⓘ

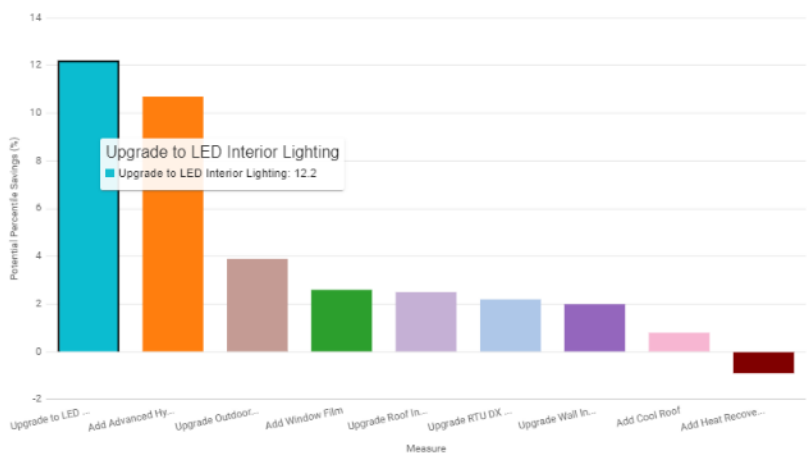
- | | | | |
|---------------------------------------|-------------------------------------------|-----------------------------------|--------------------------------|
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*Category included in map only

How can we identify and prioritize communities in need of energy efficiency grants and assistance, and which measures provide the best results?

Electricity savings potential for commercial buildings

Top Ten State-Wide Electricity Savings Potential by Measure



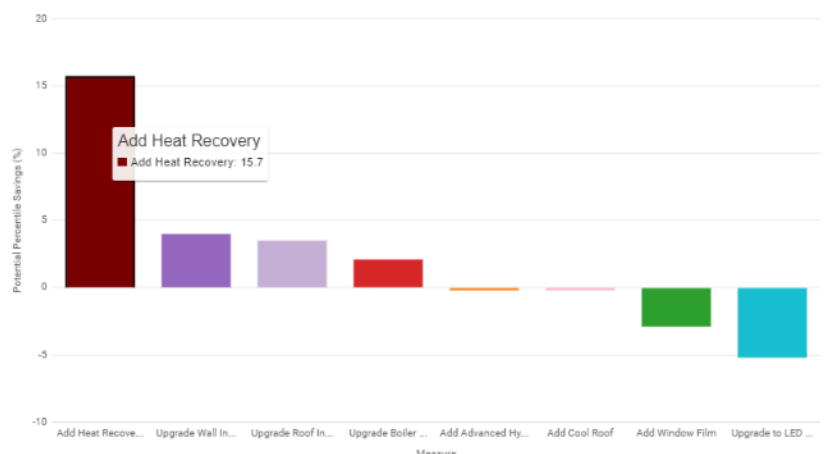
Data Filters ⓘ

- Add Advanced Hybrid RTUs
- Add Cool Roof
- Add Heat Recovery
- Add Window Film
- Upgrade Boiler (AFUE-94)*
- Upgrade Outdoor Lights
- Upgrade RTU DX Air Conditioner (IEER-17.0)*
- Upgrade Roof Insulation (R-30)
- Upgrade Wall Insulation (R-30)
- Upgrade to LED Interior Lighting

*Category included in map only

Fuel savings potential for commercial buildings

Top Ten State-Wide Natural Gas Savings Potential by Measure



Data Filters ⓘ

- Add Advanced Hybrid RTUs
- Add Cool Roof
- Add Heat Recovery
- Add Window Film
- Upgrade Boiler (AFUE-94)*
- Upgrade Outdoor Lights
- Upgrade RTU DX Air Conditioner (IEER-17.0)*
- Upgrade Roof Insulation (R-30)
- Upgrade Wall Insulation (R-30)
- Upgrade to LED Interior Lighting

*Category included in map only



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Recommended Citation: National Renewable Energy Laboratory. "[Data Set Title (e.g., Battery Storage Capital Costs)]," *State and Local Planning for Energy*, accessed [Date], <https://maps.nrel.gov/slope>.

Thank you Presenter email



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Abbe Ramanan

Project Manager

Clean Energy States Alliance

abbe@cleanegroup.org

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- **Building Community Resilience with Green Mountain Power (5/18)**
- **Quantifying the Health Benefits of Clean Energy Policies with EPA's AVERT and COBRA Tools (5/19)**
- **Exploring Peaker Power Plant Inequities with Clean Energy Group's New Mapping Tool (6/23)**

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