Workshop:
State and Local Planning for Energy (SLOPE) Training

Midwest Building Energy Codes Conference

November 8, 2022

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Housekeeping

- Enter all questions you have for speakers in the Q&A feature
- Enter any other questions or comments in the chat
- Slides and recordings will be made available to participants after the conference
- Continuing Education Credits are available to participants – information will be shared at the end of the presentation
- Email Corie Anderson, Building Policy Associate, at canderson@mwalliance.org with questions

Agenda

- Introductions
- SLOPE Training
- Q&A Session

Speakers

Shannon Zaret

Energy Technology Program Specialist

U.S. Department of Energy

Rachel Scroggins

ORISE Fellow

U.S. Department of Energy

Katie Richardson

Group Manager

Innovation and Entrepreneurship Center, NREL

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The State and Local Planning for Energy (SLOPE) Platform:
The Ultimate Toolbox for Planning Your Clean Energy Future

November 8th 2:00 – 3:30pm ET

Agenda

How SLOPE Can Help Your Jurisdiction

Welcome & Introduction to the State and Local Planning for Energy (SLOPE) Platform **01**

SLOPE Demo: 'Scenario Planner' Tool, Transportation Data, and EEJ Data **02**

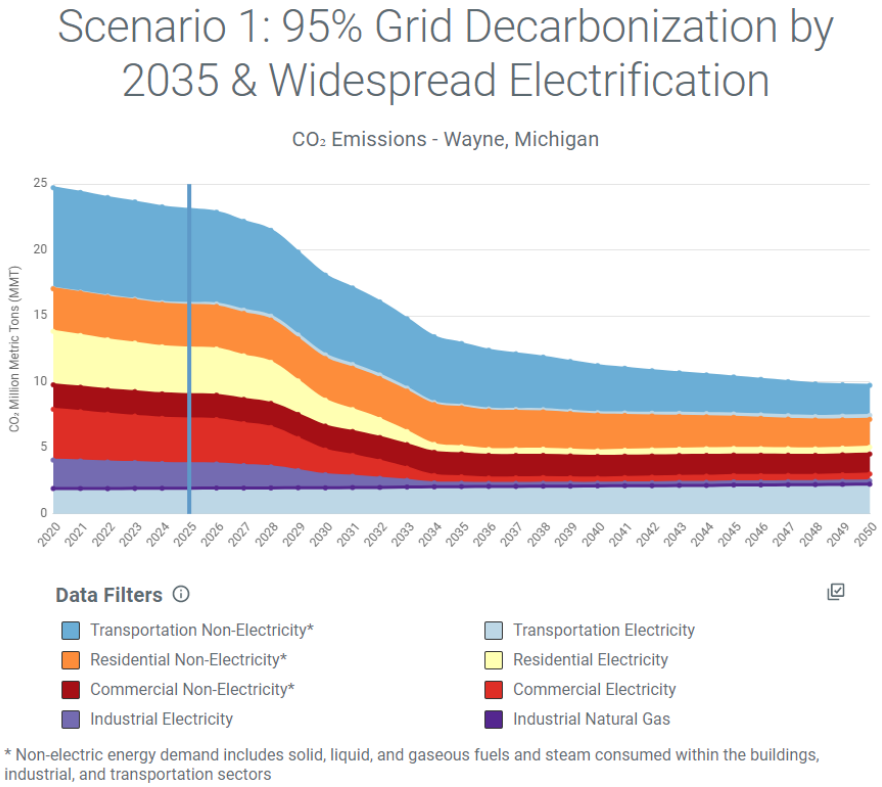
SLOPE Demo: Integrating Other DOE Tools **03**

How States and Local Governments Are Using SLOPE **04**

Q&A **05**

State and Local Planning for Energy (SLOPE) Platform

SLOPE is a free, easy-to-use online platform to support data-driven state and local energy and decarbonization planning.



- Integrates **energy data and tools in one place** to help jurisdictions understand the various cost-effective options to meet their clean energy and climate goals
- Enables data-driven **economy-wide decarbonization planning**
- Delivers state-, county-, city-, and/or census tract-level data, depending on the data set

NREL Transforming ENERGY

U.S. DEPARTMENT OF ENERGY
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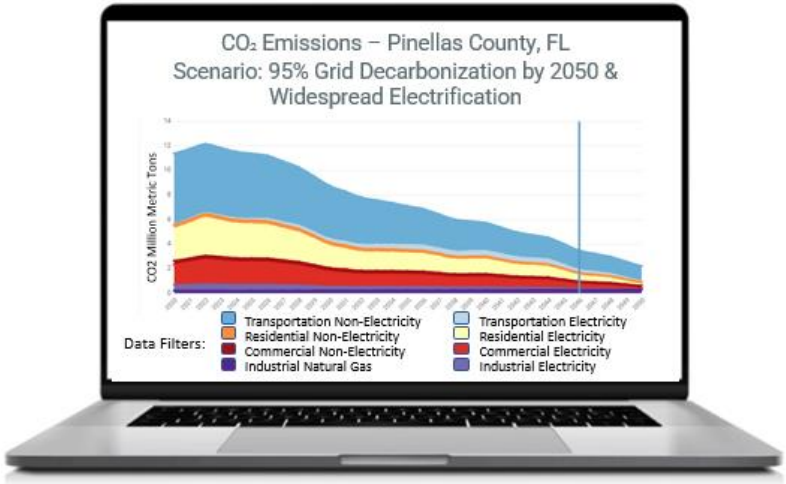
Visit SLOPE: maps.nrel.gov/slope

Two Tools Within SLOPE to Support Planning

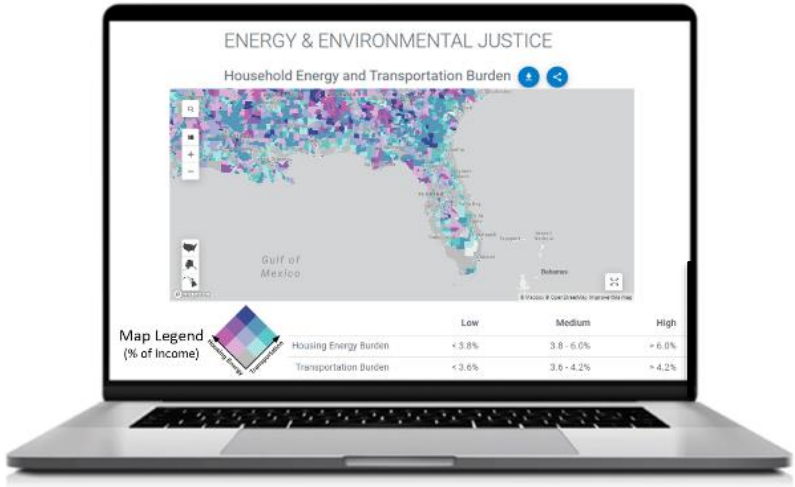
Scenario Planner

Build, visualize, and compare the impacts of different energy scenarios for your state or county's future energy consumption, CO2 emissions, and system costs. The scenarios available reflect different clean energy strategies like energy efficiency deployment, grid decarbonization, and electrification.



Data Viewer

Explore interactive maps and charts of energy efficiency, renewable energy, sustainable transportation, energy equity, energy cost data, and more at the state-, county-, city-, and census tract-levels.

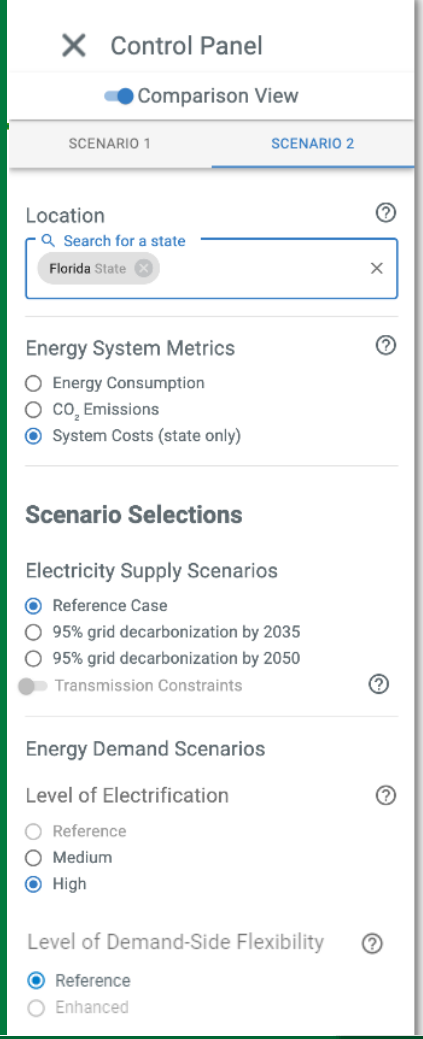


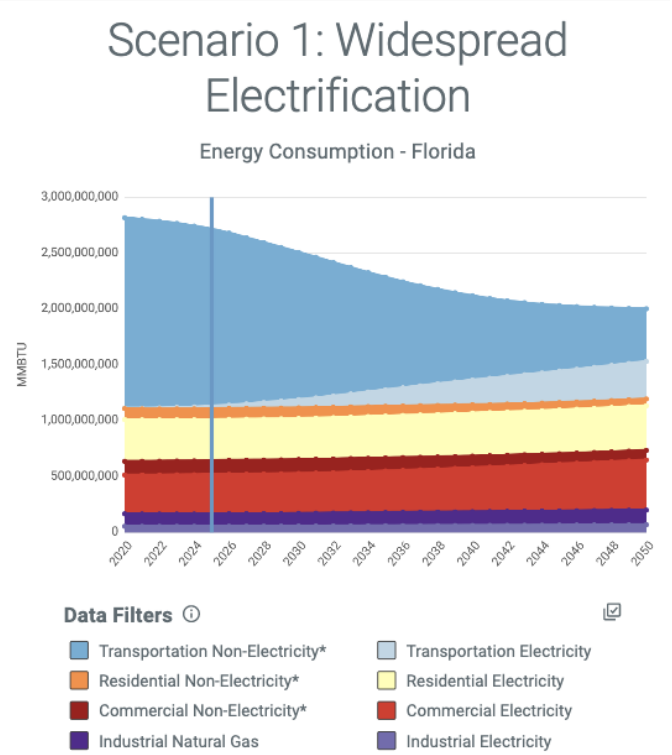
‘Scenario Planner’ Tool

A ground-breaking planning tool that visualizes scenarios for future energy consumption, CO_2 emissions, and system costs of a selected county or state. Users can select and explore various energy planning pathways in isolation and in combination.

Functionality will allow users to layer the following scenarios to showcase how these scenarios interact:

- Level of Electric Grid Decarbonization
- Presence of Transmission Constraints
- Level of Building Energy Efficiency
- Level of Electrification
- Level of Demand-Side Flexibility



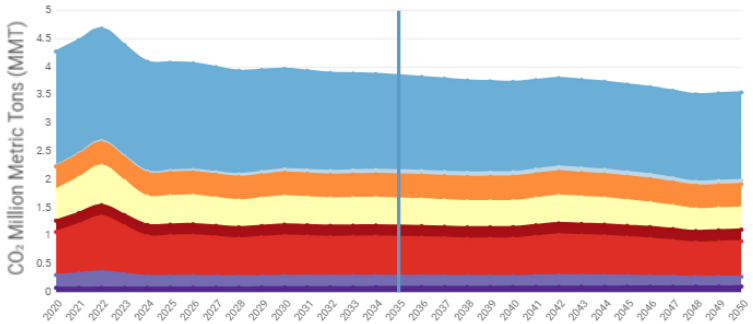


* Non-electric energy demand includes solid, liquid, and gaseous fuels and steam consumed within the buildings, industrial, and transportation sectors

Example ‘Scenario Planner’ Application

Scenario 1: Reference Case

CO_2 Emissions - Hamilton, Indiana



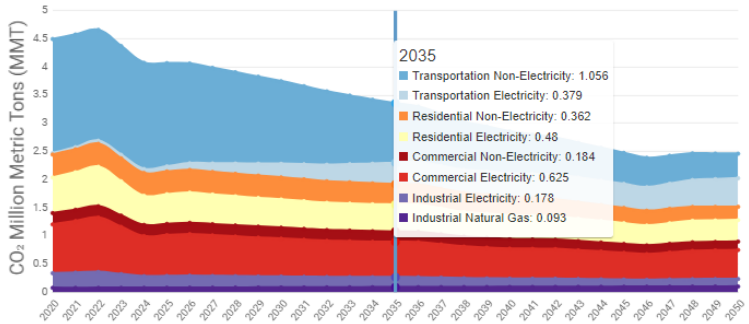
2035 Planning Metrics

State-level data only

Share of Space Heating Services Supplied by Electricity (%)	BEV and PHEV Share of Light-Duty Vehicles (%)
5.727%	9.004%

Scenario 2: Widespread Electrification

CO_2 Emissions - Hamilton, Indiana



2035 Planning Metrics

State-level data only

Share of Space Heating Services Supplied by Electricity (%)	BEV and PHEV Share of Light-Duty Vehicles (%)
23.01%	47.14%

Data Filters

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

Datasets Available on the Scenario Planner

Projected Outputs (2020-2050)	Description
Energy Consumption	Energy consumption if your jurisdiction were to pursue significant investments in building energy efficiency, electrification, and/or demand-side flexibility (e.g., load shifting).
CO_2 Emissions	CO_2 emissions if your jurisdiction were to pursue significant investments in grid decarbonization, building energy efficiency, electrification, and/or demand-side flexibility.
System Costs	Capital and operational costs and savings if your state were to pursue significant investments in grid decarbonization. building energy efficiency electrification, and/or demand-side flexibility.

Data Available in SLOPE's 'Data Viewer' Tool

Energy Consumption*

- Electricity and natural gas consumption and expenditures: projected in a business-as-usual case for the residential, commercial, and industrial sectors through 2050

Transportation

- Current and projected on-road vehicle fuel consumption and vehicle miles traveled
- Current and projected vehicle registration data by fuel type

Energy Efficiency

- Electricity savings potential for residential, commercial, and industrial sectors through 2035
- Electricity and fuel savings potential from cost-effective energy improvements for single-family homes and commercial buildings

Solar

- Utility-scale photovoltaic (PV), floating PV, residential rooftop PV, and commercial rooftop PV technical potential
- Concentrating solar power utility-scale technical potential

Wind

- Land-based, offshore, and distributed wind technical potential

Bioenergy

- Biopower technical potential

Geothermal

- Utility-scale geothermal technical potential
- Geothermal district heating economic potential in new construction and existing buildings
- Geothermal heat pump economic potential

Hydropower

- Utility-scale hydro generation potential
- New stream reach and non-powered dam generation potential

Generation Scenarios

- Modeled current and projected electricity generation mix through 2050 by state under 12 scenarios

Cost of Energy

- Levelized cost of energy: projected electricity costs for 16 generation technologies plus battery storage through 2050
- Program administration cost of saved electricity

Demographics*

- Population: past and projected population from 2015-2050

Commercial Buildings*

- Commercial building count and area by size and property type for 2020

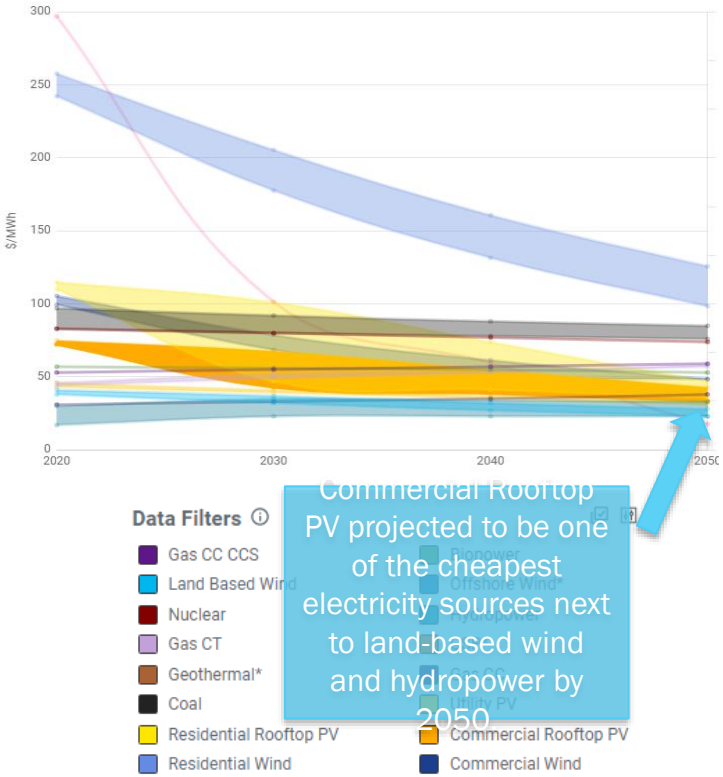
Energy & Environmental Justice^

- Energy burden from housing and transportation energy expenditures
- LMI Energy Efficiency Bill Savings Potential
- CDC's Social Vulnerability Index

**City-level data available for ~6,000 cities*
^Census-tract level data
Other datasets provide state- and/or county-level data

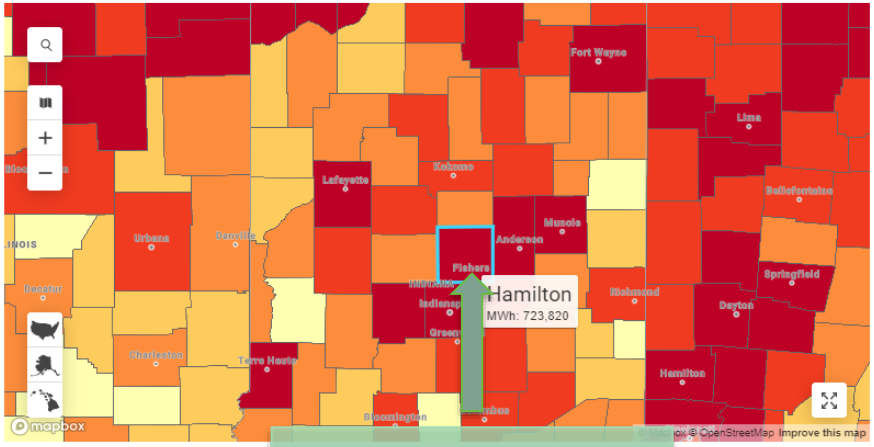
Example ‘Data Viewer’ Application

Projected Levelized Cost of Energy by Technology - Hamilton County, IN



Commercial Rooftop PV projected to be one of the cheapest electricity sources next to land-based wind and hydropower by 2050

Modeled Annual Technical Generation Potential - Commercial Rooftop PV



Map & Graph Resolution: County

County: Hamilton

Map Legend

(MWh)

270,680+ MWh

25,800 - 56,730 MWh

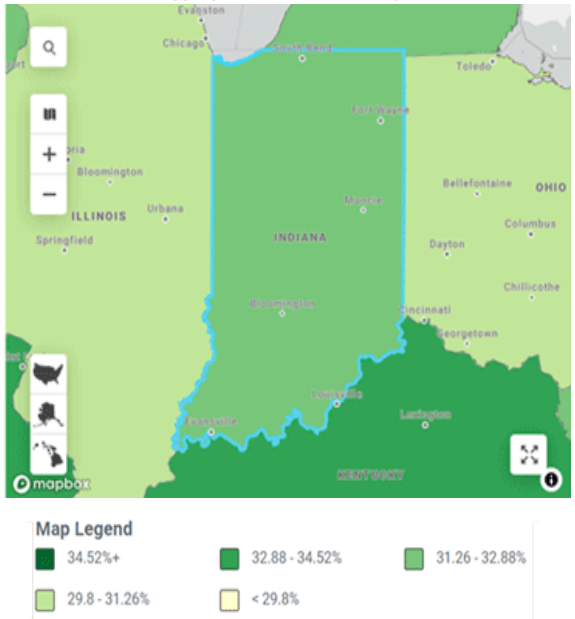
- Hamilton County, IN

Hamilton County’s Commercial Rooftop PV potential is high relative to its neighboring counties, and commercial rooftop PV could generate over 41% of the county’s 2050 commercial electricity demand.

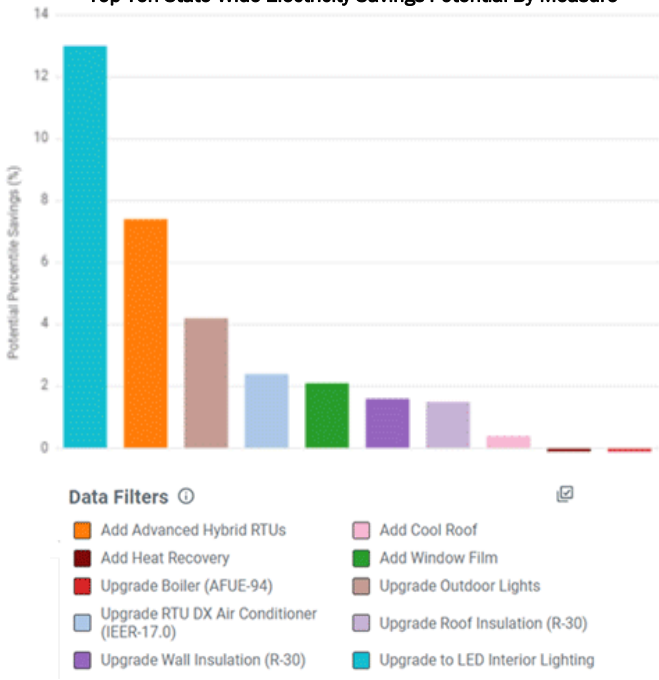
New Energy Efficiency Data

Energy efficiency scenarios enable users to visualize the impacts of “aggressive” energy efficiency improvements.

Commercial Aggregate Electricity Savings Potential



Top Ten State-Wide Electricity Savings Potential By Measure



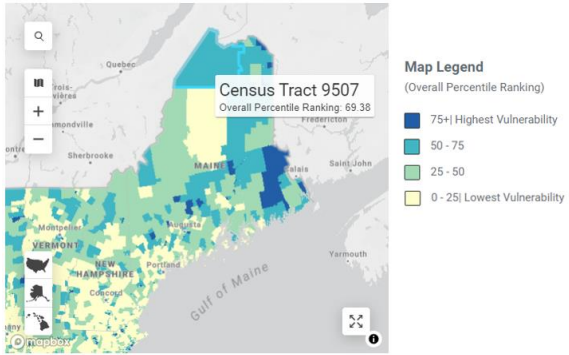
- Allows users to view the projected changes, systems-wide costs, and savings in energy consumption and CO2 emissions if their selected state or county pursues a high level of energy efficiency deployment within their building stock (**Scenario Planner**)
- Statewide commercial energy efficiency savings potential additions help users understand the total energy savings potential available within their commercial building stock for electricity and natural gas sources (**Data Viewer**)
- Provides the top ten savings measures within a state such as LED lighting, window films, or boiler upgrades for the residential sector

New Energy and Environmental Justice Data

CDC's Social Vulnerability Index (SVI)

SVI scores census tracts based on their relative social vulnerability. Each score is based on 15 social factors (e.g., unemployment rate, minority status, vehicle access). Users can also view vulnerability scores within certain sub-categories (e.g., socioeconomic status, housing type).

Social Vulnerability Index by Census Tract

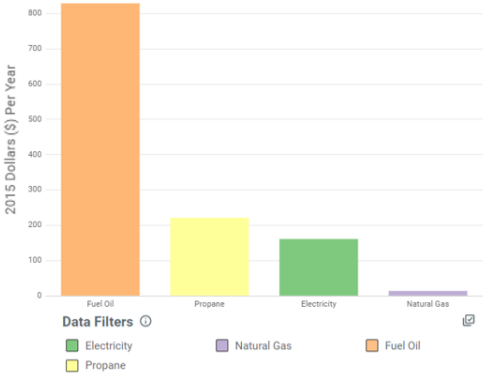


If a jurisdiction wants to target their clean energy programs, policies, or deployment to communities that may benefit the most, they can use SVI as a proxy to identify disadvantaged communities.

LMI Single Family Homes Bill Savings Potential

This layer displays the average bill savings (as a percent) that Low-to-Moderate Income (LMI) households would realize if they got an energy efficiency retrofit.

Average Annual Bill Savings Per LMI Single Family Home

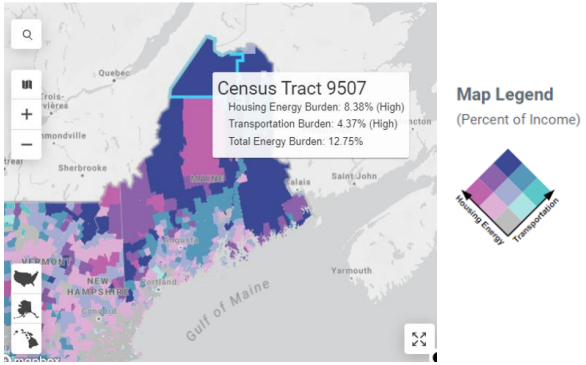


Jurisdictions considering energy efficiency programs or deployment can use SLOPE data to conceptualize the monetary benefits that LMI households would realize if retrofitted.

Household Energy and Transportation Burden

Energy burden represents the percentage of household income spent on energy costs. SLOPE provides energy burden data on housing energy costs and transportation energy costs.

Household Energy Burden by Census Tract

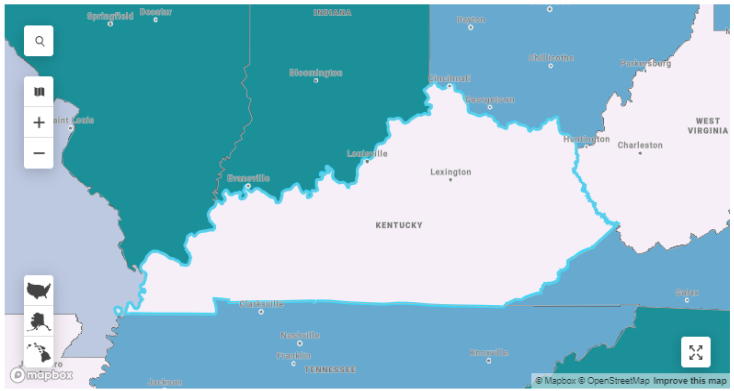


Energy burden data can be leveraged to help target programs, policies, or deployment that can reduce energy costs to communities that are in greatest need.

New Clean Energy Job Estimates

- The graphs below show a range of potential jobs for four key clean energy technology sectors: solar, wind, battery energy storage (BES), and energy efficiency measures.
- This information was published in a 2022 NREL Report on [State-Level Employment Projections for Four Clean Energy Technologies in 2025 and 2030.]

Job Estimates for Clean Energy Technologies



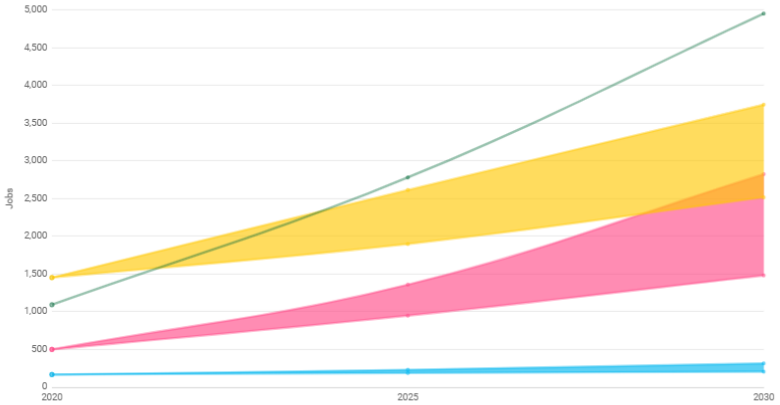
Map & Graph Resolution: State **State:** Kentucky

Map Legend

(Business-as-usual jobs total for clean energy technologies - 2020)

- 19,383+ jobs
- 11,765 - 19,383 jobs
- 6,856 - 11,765 jobs
- 3,279 - 6,856 jobs
- 0 - 3,279 jobs

Clean Energy Jobs Estimates by Technology - Kentucky



Data Filters

- Utility Energy Efficiency Jobs
- Solar PV Jobs
- Land-Based Wind Jobs
- Battery Energy Storage Jobs

SLOPE Demonstration:

‘Scenario Planner’ Tool, Building and Efficiency Data, Energy and Environmental Justice Data

Standard Energy Efficiency Data (SEED) Platform: How SLOPE Integrates with Other DOE Tools

SEED: Background Understanding

SEED
STANDARD ENERGY EFFICIENCY DATA PLATFORM™
U.S. DEPARTMENT OF ENERGY

Benefits:

- **Portfolio-level & program-level building characteristics and energy data management tool**
  - Combines, cleans, validates, and generates reports on data from multiple sources
  - Easy, flexible, and cost-effective method to improve data quality and help manage building-related programs
  - Interconnects with various DOE and external tools (e.g., Salesforce)
- **Web-based platform**
- **Open source and community-driven development focused**

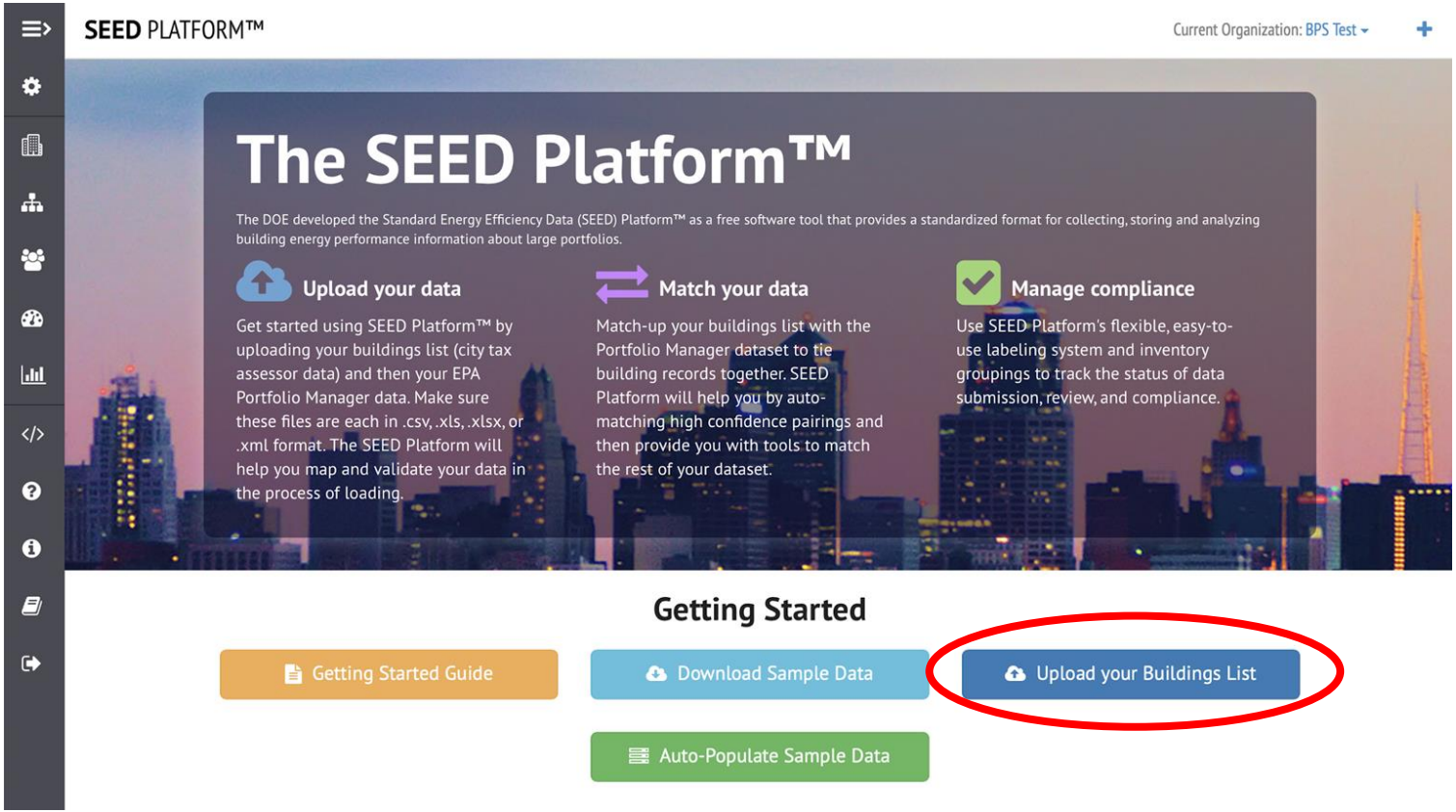
Acknowledgments:

Many people have contributed to this work, including:

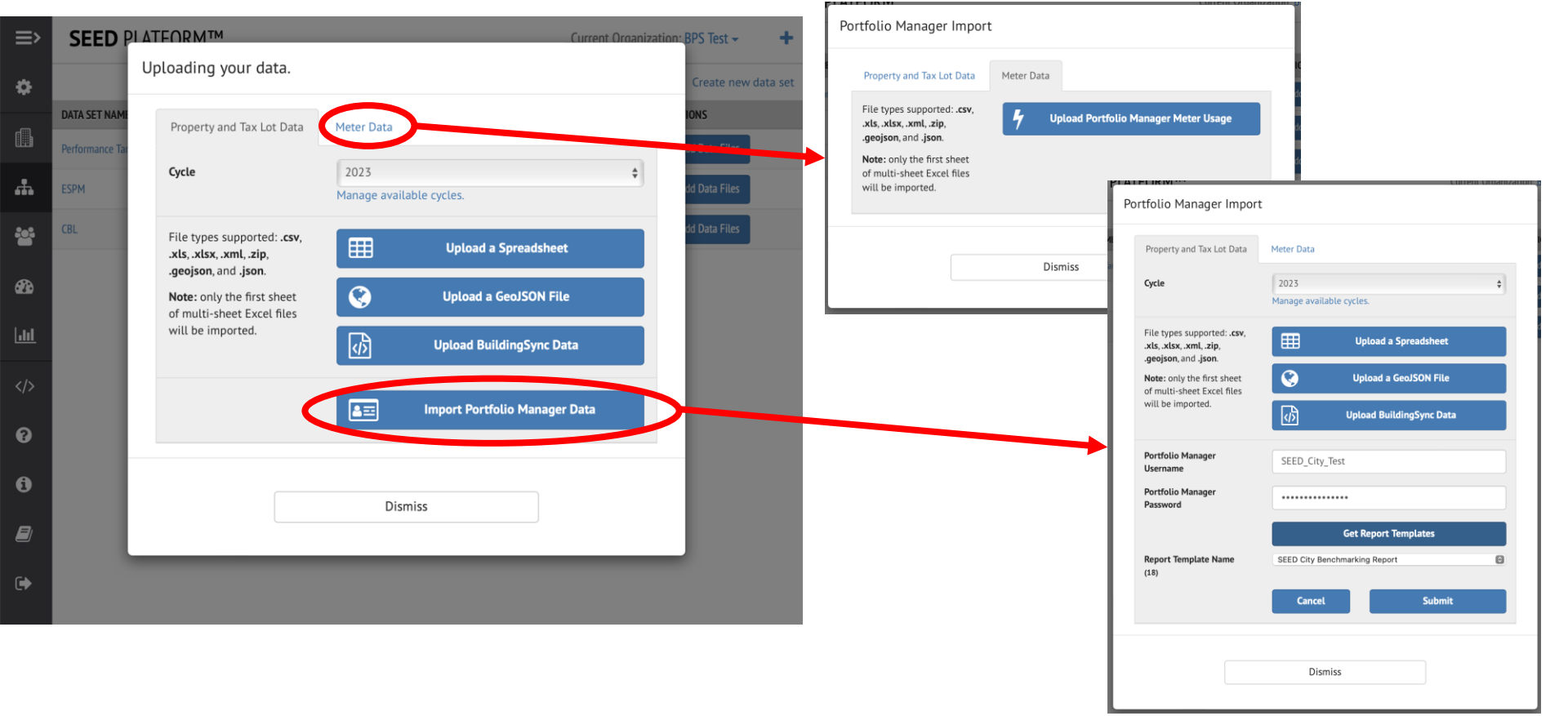
- **NREL: Nicholas Long, Alex Swindler, Katherine Fleming, Lauren Adams, Alex Chapin, Hannah Eslinger, Isabel Langlois-Romero**
- **LBNL: Robin Mitchell, Paul Mathew, Carolyn Szum, Han Li**
- **PNNL: Mark Borkum, Supriya Goel**
- **Devetry: Ryo Schultz, Ross Perry, Ted Summer**
- **Former Project Members: Adrian Lara, Lin Ainsworth, Austin Viveiros, Daniel McQuillen, Sarah Newman**

2022 R&D 100 WINNER

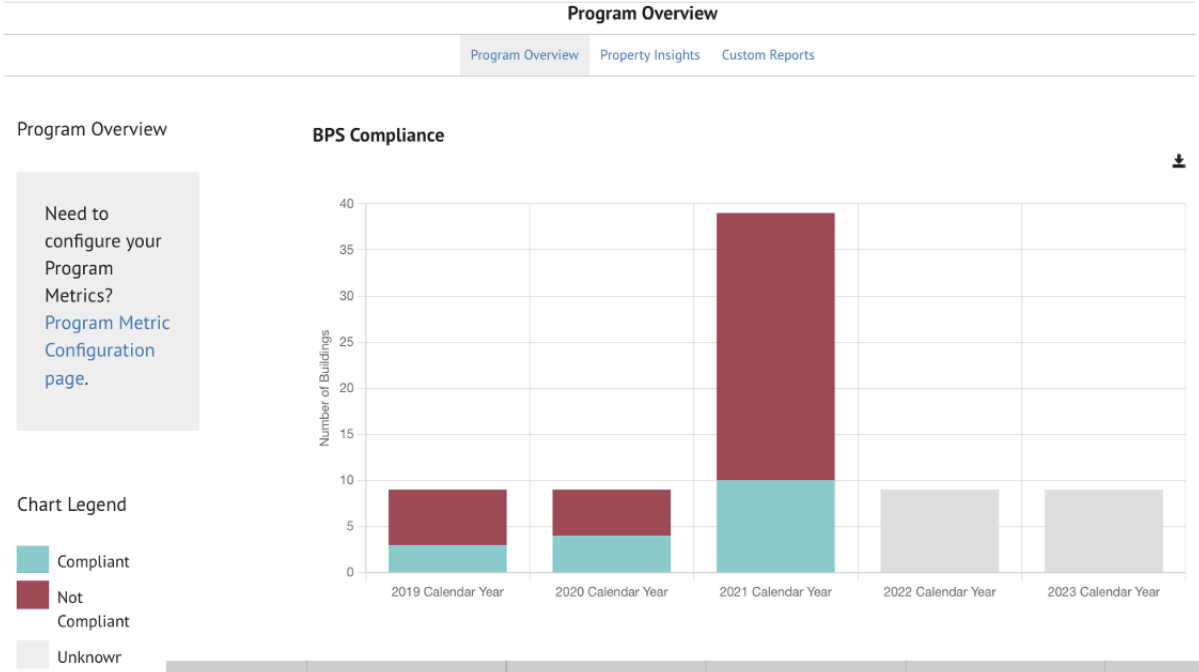
SEED Demonstration: Uploading Data



SEED Demonstration: Importing from ESPM

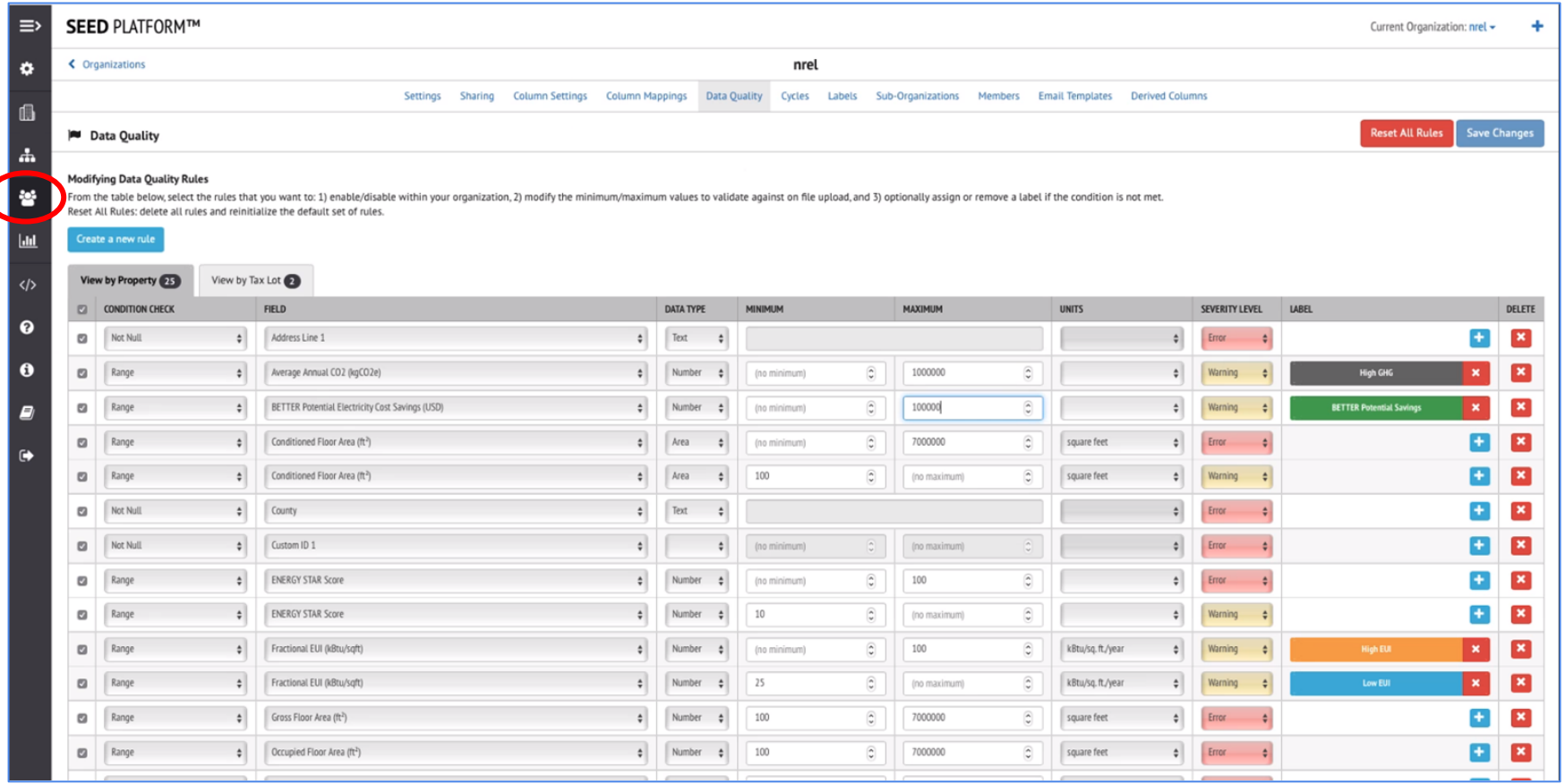


Dashboard



CYCLES	2019 CALENDAR YEAR	2020 CALENDAR YEAR	2021 CALENDAR YEAR	2022 CALENDAR YEAR	2023 CALENDAR YEAR
Compliant	3	4	10	0	0
Non-Compliant	6	5	29	0	0
Unknown	0	0	0	9	9

SEED Demonstration: Data Quality



SEED Demonstration: BETTER Results

BETTER V1.0 Building Summary Report

Campos, Flynn and Douglas

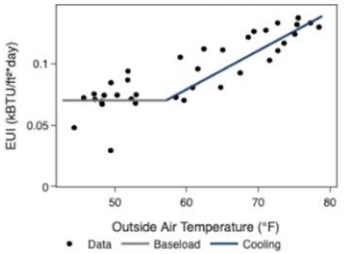
Generated at

Overview

Building Type: **Office**	Gross Floor Area (ft^2): **229,512.7**
Building Location: **3827 West Chapman Avenue, Orange, California**	Closest Weather Station: **Station: 722977-93184 : J. Wayne Apt-Orange Co Apt**
Potential Cost Savings: **$1,109,555** **80.9%**	Potential Energy Savings: **30,195,347 kBTU** **83.1%**
Electricity Energy/Cost Savings: **80.2%**	Fossil Fuel Energy/Cost Savings: **92.8%**
GHG Emissions Reduction ($MTCO_2e$): **1,899.8** **82.7 %**	GHG Emissions Intensity Reduction ($MTCO_2e/ft^2$) **0.008**

Electricity Model: Your consistent baseload is 0.07 kBTU/(ft^2)*day ,or 25.6 kBTU/(ft^2)*yr ,**[Baseload]**. The building's energy consumption start to increase as the outside air temperature goes above 57.1 °F **[Cooling Change-Point]**. Beyond the cooling change-point, the daily energy consumption increases by 115 (kBTU) when outdoor air temperature increases by 1 °F **[Cooling Sensitivity]**.

Electricity Change-point Model (R^2 = 0.83)



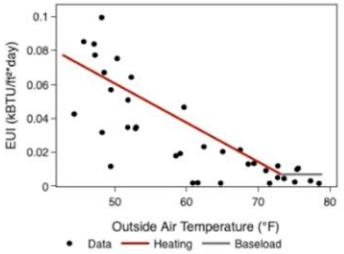
Electricity Consumption Benchmarking

Note: % indicates the percentage of buildings your building is superior to.

Fossil Fuel Model: Your consistent baseload is 0.007 kBTU/(ft^2)*day , or 2.6 kBTU/(ft^2)*yr , **[Baseload]**. The building's energy consumption start to increase as the outside air temperature goes below 73.2 °F **[Heating Change-Point]**. Below the heating change-point, the daily energy consumption increases by 84.5 (kBTU) when outdoor air temperature decreases by 1 °F **[Heating Sensitivity]**.

Fossil Fuel Change-point Model

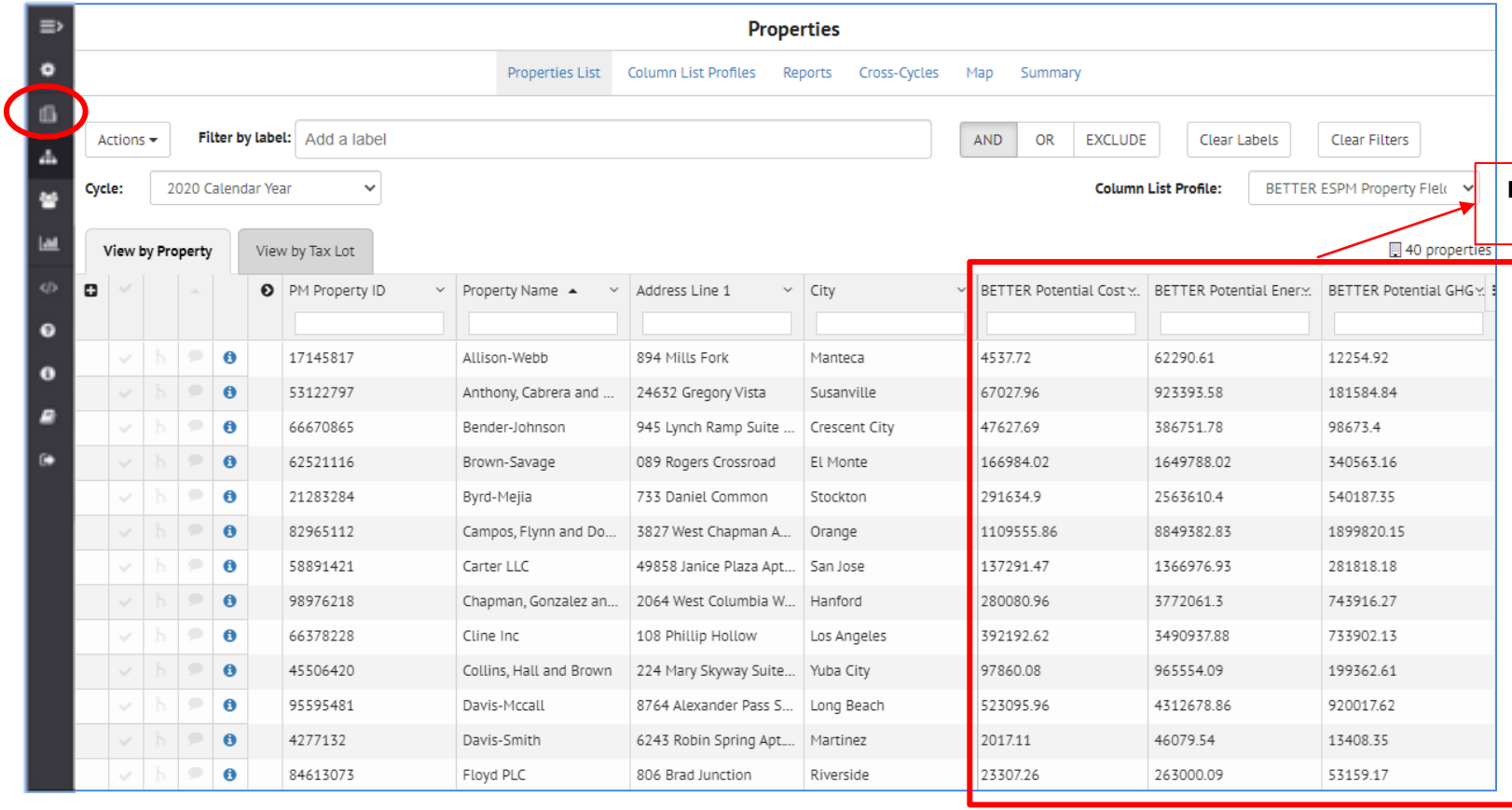
(R^2 = 0.82)



Fossil Fuel Consumption Benchmarking

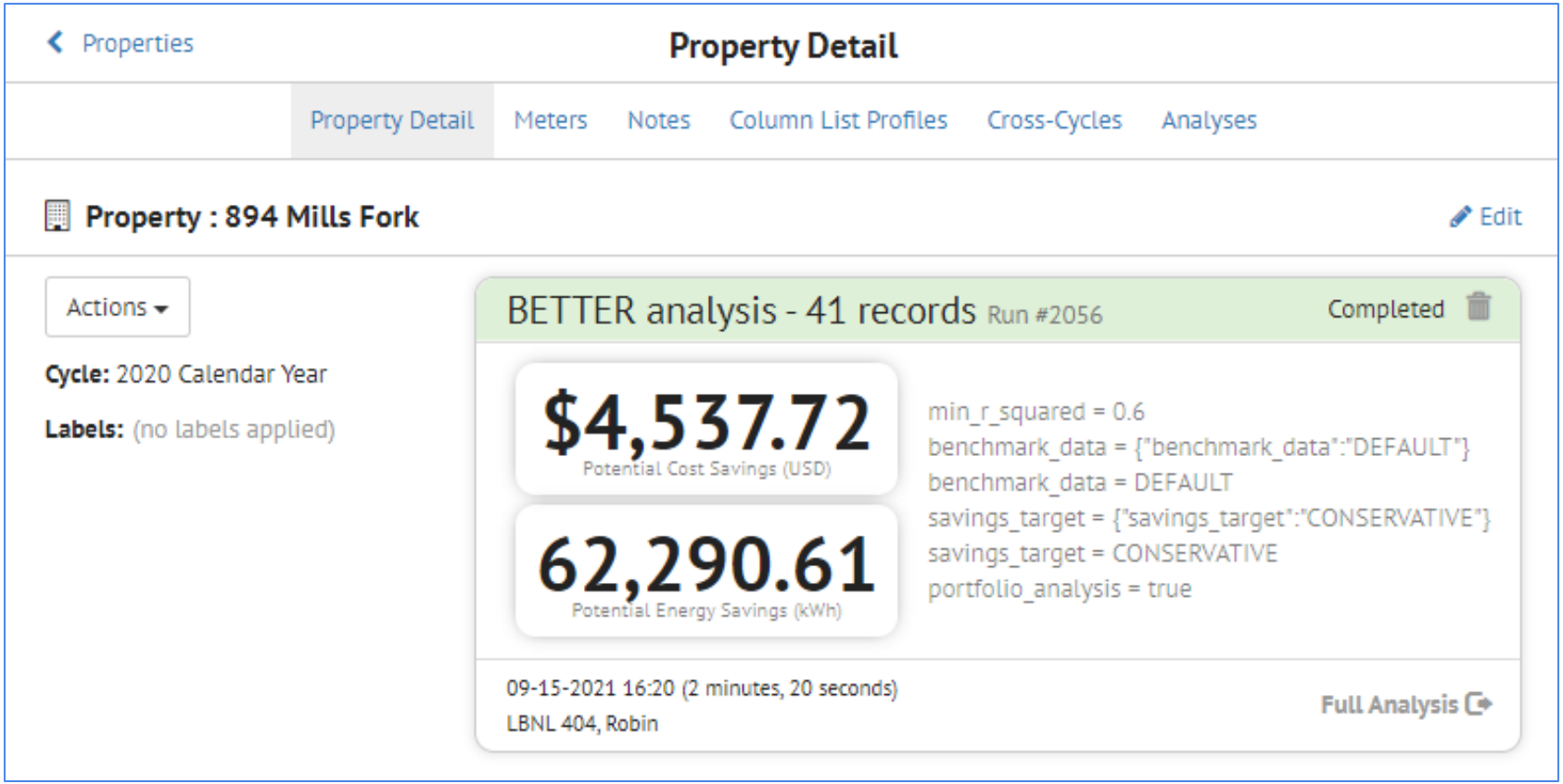
Note: % indicates the percentage of buildings your building is superior to.

SEED Demonstration: BETTER Results

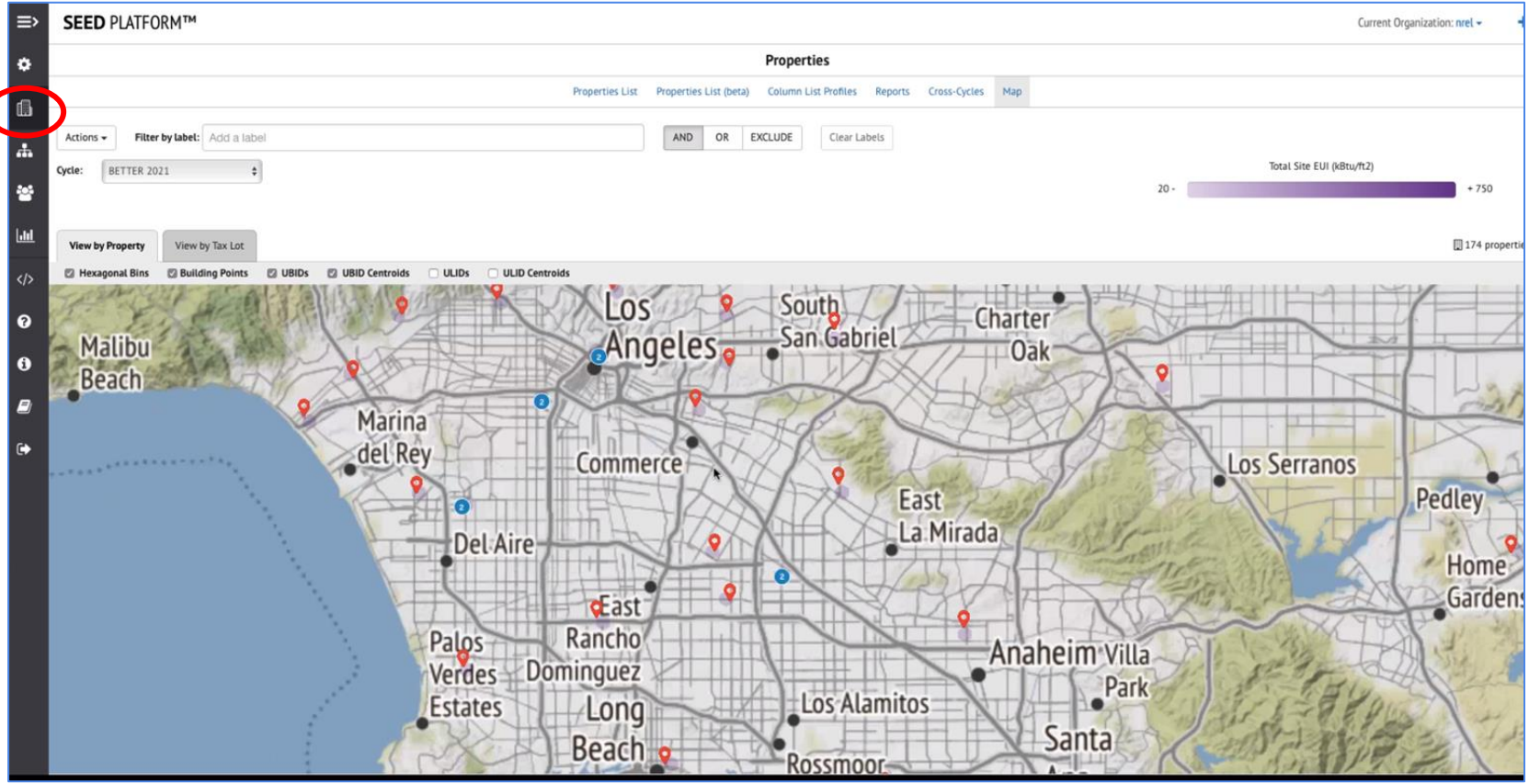


PM Property ID	Property Name	Address Line 1	City	BETTER Potential Cost	BETTER Potential Ener	BETTER Potential GHG
17145817	Allison-Webb	894 Mills Fork	Manteca	4537.72	62290.61	12254.92
53122797	Anthony, Cabrera and ...	24632 Gregory Vista	Susanville	67027.96	923393.58	181584.84
66670865	Bender-Johnson	945 Lynch Ramp Suite ...	Crescent City	47627.69	386751.78	98673.4
62521116	Brown-Savage	089 Rogers Crossroad	El Monte	166984.02	1649788.02	340563.16
21283284	Byrd-Mejia	733 Daniel Common	Stockton	291634.9	2563610.4	540187.35
82965112	Campos, Flynn and Do...	3827 West Chapman A...	Orange	1109555.86	8849382.83	1899820.15
58891421	Carter LLC	49858 Janice Plaza Apt...	San Jose	137291.47	1366976.93	281818.18
98976218	Chapman, Gonzalez an...	2064 West Columbia W...	Hanford	280080.96	3772061.3	743916.27
66378228	Cline Inc	108 Phillip Hollow	Los Angeles	392192.62	3490937.88	733902.13
45506420	Collins, Hall and Brown	224 Mary Skyway Suite...	Yuba City	97860.08	965554.09	199362.61
95595481	Davis-Mccall	8764 Alexander Pass S...	Long Beach	523095.96	4312678.86	920017.62
4277132	Davis-Smith	6243 Robin Spring Apt...	Martinez	2017.11	46079.54	13408.35
84613073	Floyd PLC	806 Brad Junction	Riverside	23307.26	263000.09	53159.17

SEED Demonstration: BETTER Results



Map Analysis & Justice40 Tracking



How States and Local Governments Are Using SLOPE

How States and Local Governments Are Using SLOPE

Milwaukee, Wisconsin

- Identify the sectors with the biggest impact on reducing costs and emissions
- Determine what renewable technologies are most cost-effective over time
- Assess how much of Milwaukee's energy consumption could be met by locally generated renewable energy

New Mexico

- Determine potential for local, distributed generation and energy efficiency to meet NM's energy needs
- Identify technologies that can help support energy affordability
- Assess impacts that vehicle electrification will have on electricity demand and how NM can prepare for this transition

Sarasota, Florida

- Set incremental targets to reach ambitious greenhouse gas emissions reduction goals
- Assess the impacts of electrification on their building and transportation sectors' energy consumption and CO_2 emissions
- Ensure that LMI communities have access to electric vehicle charging infrastructure

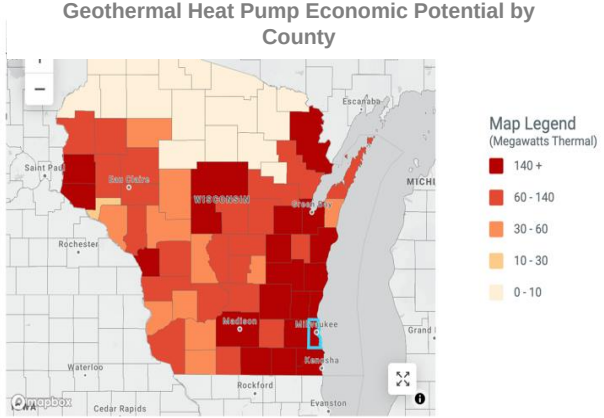


Figure 1: Geothermal heat pump economic potential by county in Wisconsin in 2020 (SLOPE 2021)

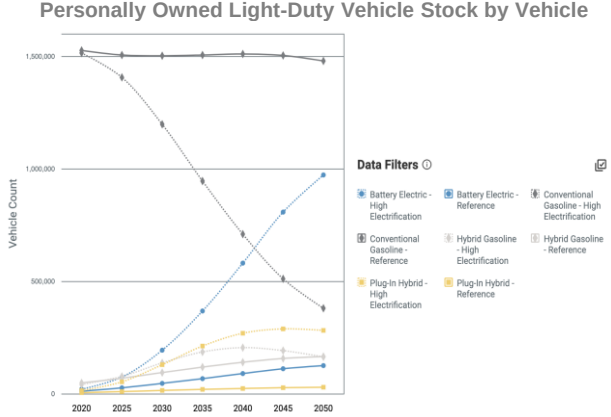


Figure 2: Personally owned light-duty vehicle stock in New Mexico 2020-2050 (SLOPE 2021)

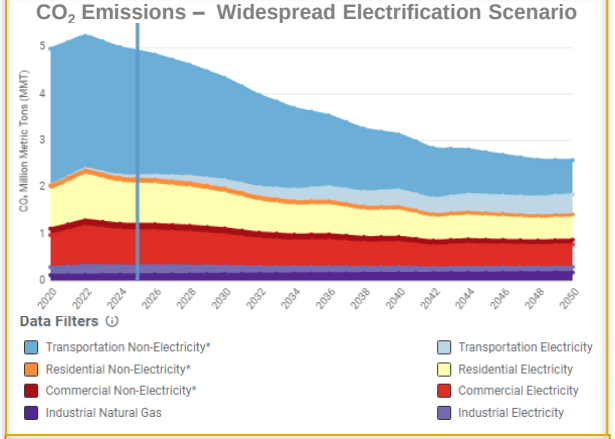
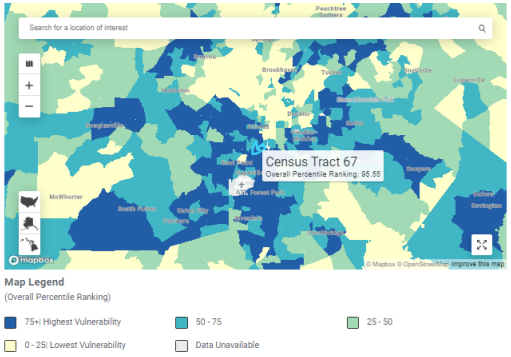


Figure 3: CO_2 Emissions Under a Widespread Electrification Scenario in Sarasota, FL 2020-2050 (SLOPE 2022)

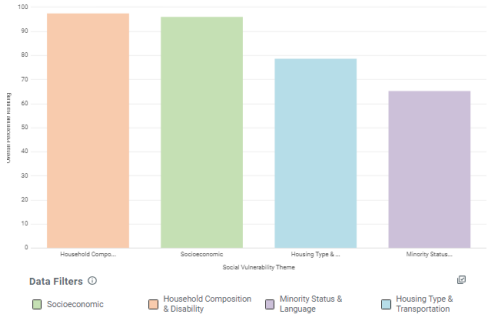
Case Study – Atlanta Regional Commission

Atlanta Regional Commission (ARC) is using SLOPE to inform and integrate equity considerations into planning surrounding its transition to electric vehicles (EVs)

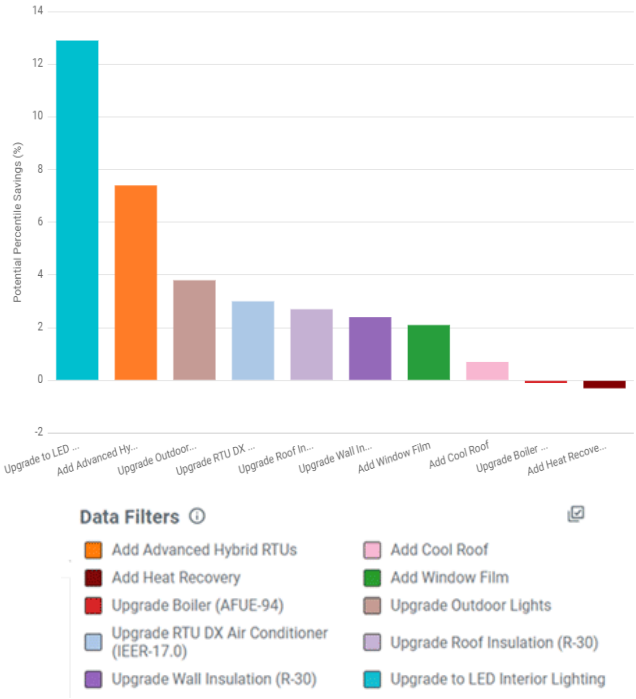
Overall Social Vulnerability Index



Social Vulnerability Index Rankings



Top Ten State-Wide Electricity Savings Potential By Measure



SLOPE Helped Atlanta Regional Commission:

- Understand multifamily housing and opportunities to co-locate charging infrastructure while ensuring equitable access.
- Explore opportunities to help the region reach carbon reduction milestones.
- Explore possible rates of adoption of electric vehicles (EVs) while considering the transportation burden of underserved populations.

Types of Questions SLOPE Can Answer

Consumption

What sectors (e.g., commercial, industrial, residential) should my city focus on to have the biggest impact on reducing GHG emissions?

Efficiency

What is the energy efficiency savings potential in my jurisdiction and what are the most cost-effective savings measures in my state?

System Costs and CO_2 Emissions

How do the system cost and emission impacts of various energy strategies compare?

Buildings

How many commercial buildings over 20,000 ft^2 are in my city and what is the total square footage broken down by property type?

Renewables

How much of my county's energy consumption can be met by locally generated renewable energy?

Sustainable Transportation

How might the number of EV, conventional gasoline, hybrid gasoline, and PHEV personal vehicles change in the future?

Cost of Energy

How do the costs of utility-scale and distributed renewables, fossil fuels, energy storage, and efficiency compare in my jurisdiction?

Decarbonization Planning

How can various energy strategies help my community achieve its decarbonization goals?

Defining SLOPE in the Era of BIL

SLOPE can play an integral role in the pre-implementation stage of deployment.

In the era of the Bipartisan Infrastructure Legislation, SLOPE fills the role of identifying high-impact technologies, sectors, and communities to help prioritize investments and planning strategies that present the greatest opportunities to reduce emissions, costs, and consumption. SLOPE allows for the creation of customized maps, charts, and scenario models that can be easily shared with key decision makers while integrating over 25 leading data sources.

Office of State & Community Energy Programs

SLOPE can be leveraged to explore priority data sets for BIL grantees.

The new Office of State & Community Energy Programs (SCEP) presents an opportunity to work with communities to understand their needs and the types of data and analysis that can support them with implementation. SLOPE has the capability to support decarbonization, renewable energy integration, electrification applications, and energy planning both locally and state-wide.

How Can SLOPE Help Your Jurisdiction?

- Saves you time and resources by providing a free, web-based tool to support your energy planning
- Identifies high-impact technologies, sectors, and communities to help you prioritize investments and planning strategies that present the greatest opportunities to reduce emissions, costs, and consumption
- Offers additional tools and resources you can leverage in developing policies and programs to meet your energy and climate goals

Check Out Our "SLOPE Stories"

https://maps.nrel.gov/slope/stories

SLOPE Informs Climate and Equity Planning in Milwaukee, Wisconsin

SLOPE Informs Grid Modernization and Transportation Planning in New Mexico

(Coming Soon!) *SLOPE Informs Equitable Transition to Electric Vehicle Infrastructure in the Atlanta Metropolitan Area*

If you have used SLOPE and are willing to share your experiences with our team OR if you think your jurisdiction would benefit from additional outreach or assistance:

please enter your email in the chat or reach out to us at slope@nrel.gov so we can follow-up and learn more.

Questions?

Thank you for your interest in SLOPE!

Additional Questions?

Contact Us at slope@nrel.gov

Visit SLOPE at maps.nrel.gov/slope

And check out SLOPE's new energy and environmental justice data!

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Upcoming MEEA Events

Early Bird Registration Now Open!

January 31 - February 2, 2023

Chicago, IL

www.meeaconference.org

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