Clean Energy Planning with SLOPE
The State and Local Planning for Energy Platform

EECBG Webinar
October 2023
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SLOPE is 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, carbon dioxide (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 as well as jobs and equity data.

SLOPE is an Office of State and Community Energy Programs (SCEP)-led, cross-U.S. Department of Energy collaboration.

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[maps.nrel.gov/slope](http://maps.nrel.gov/slope)
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Scenario Planner

Google: NREL SLOPE
Or
https://maps.nrel.gov/slope
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
Scenario Planner: Analysis Architecture

Key Sources

- U.S. Energy Information Administration Data
- Electrification Futures Study
- NREL Models
- SLOPE Scenario Planner

Buildings (Commercial/Residential)
- Natural Gas Demand (Annual)
- Other Fuels
- Electricity Demand (Hourly/Annual)

On-Road Transportation
- Natural Gas Demand (Annual)
- Other Fuels
- EV Charging (Hourly/Annual)

Industry
- Natural Gas Demand (Annual)
- Electricity Demand (Hourly/Annual)

Scenario Planner Strategy
- Electrification Levels (EnergyPATHWAYS)

Scenario Planner Strategy
- Demand-Side Flexibility Levels

Scenario Planner Strategies from Standard Scenarios
- Grid Decarbonization Trajectories (ReEDS, dGen)*
- Transmission Expansion Availability (ReEDS)*

Outcomes for 25 Unique Scenario Strategy Combinations
- County-level energy consumption through 2050
- County-level CO₂ emissions through 2050
- State-level system cost impacts through 2050
- Annual, State-Level Planning Metrics

*Previous R&D 100 winners

Represents 74% of U.S. primary energy demand in 2015
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Data Viewer
Consumption
What sectors (e.g., commercial, industrial, residential) should my city focus on to have the biggest impact on reducing greenhouse gas 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 CO₂ Emissions
How do the system cost and emission impacts of various energy strategies compare?

Buildings
How many commercial buildings over 20,000 ft² 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 electric vehicles (EVs), conventional gasoline, hybrid gasoline, and plug-in hybrid EV 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?
What Is Technical Generation Potential?

The technical generation potential of a renewable technology is an upper bound of achievable energy generation given system performance, topographic, environmental, and land-use constraints.

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Scenario Planner and Data Viewer: Live Demo
Transportation fuels and residential and commercial electricity consumption generate ~80% of carbon emissions in Fulton County, GA. The 2050 business-as-usual scenario projects a 22% emissions reduction from 2020 levels.
95% electricity grid decarbonization would reduce emissions by **24% by 2050** relative to reference. Transportation is the most significant remaining contributor to emissions in 2050.

Widespread adoption of EVs and electric heating and cooking achieves **75% emissions reductions by 2050** relative to reference.
Under a widespread electrification scenario, 84% of light-duty vehicles are electric compared to 11% under a reference case in Georgia.
Net annual savings of widespread electrification plus grid decarbonization begin to be realized in 2037 in Georgia.
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Energy and Environmental Justice Data
Center for Disease Control

Social Vulnerability Index

Variables Used:
American Community Survey (ACS), 2014-2018 (5-year) data
Which Factors Contribute to Social Vulnerability in Our Community?

Takeaway: This census tract also scores high on the Social Vulnerability Index—greater than 91% of other census tracts in the U.S. for the overall Social Vulnerability Index ranking and greater than at least 70% of other census tracts for each individual Social Vulnerability Index theme.
Some census tracts experience high housing energy burdens, paying more than 6% of annual household income on energy bills. SLOPE identifies where housing energy burdens overlap with high transportation energy burdens. Programs and infrastructure investments could help alleviate energy and transportation costs for low-income households in these areas.
The highest savings would come from annual electricity savings of $485, followed by $114 annual savings potential on natural gas. Low-to-moderate income households in Fulton County, Georgia that implement cost-effective energy efficiency upgrades can save up to 41% on energy bills.
Takeaway: The U.S. Department of Energy uses 36 burden indicators to calculate disadvantaged community status, reflecting fossil fuel dependence, energy burden, environmental and climate hazards, and socioeconomic vulnerabilities. This census tract has a high number and percentage of low-to-moderate income households.
How Can Rooftop Solar Investments and Programs Serve Low-Income Communities?
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Economic Indicators – Clean Energy Jobs
Which Clean Energy Jobs Will Increase the Most in My State?

Takeaway: In Colorado, solar energy jobs are projected to increase the most. Increasing job training and education, particularly in communities with underemployment or high unemployment and high solar generation potential, can boost local economic development.
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Sustainable Transportation Data
How Will Energy Use for Transportation Change if Our Community Adopts EVs?

**Takeaway:** Widespread adoption of EVs in Larimer County could reduce the total energy demand by more than 7 million MMBTU (36%) in 2040 with the same number of cars on the road due to the higher efficiency of EVs.
What Might EV Adoption Trends Look Like in Our County?

Under a high electrification scenario, Fulton County could see up to 590,573 personally owned EVs by 2050.

Under a reference/business-as-usual case, the county could see 199,886 personally owned EVs by 2050.

Range of possibility: Difference of 390,687 EVs
What Level of Charging Infrastructure Is Needed To Support Vehicle Electrification?

Charging infrastructure needed to support 590,573 personally owned EVs by 2050

- 12,314 Workplace Level 2 Charging Plugs
- 7,293 Public Level 2 Charging Plugs (Currently 2,100 plugs)
- 844 Public DC Fast Charging Plugs (Currently 366 plugs)

Charging infrastructure needed to support 199,886 personally owned EVs by 2050

- 4,484 Workplace Level 2 Charging Plugs
- 2,768 Public Level 2 Charging Plugs
- 409 Public DC Fast Charging Plugs

SLOPE Data Viewer: https://maps.nrel.gov/slope/
EVI-Pro Lite: https://afdc.energy.gov/evi-pro-lite
How Might Vehicle Electrification Impact Fuel Consumption and Emissions?

Personally Owned Light Duty Vehicle Fuel Consumption

Under a high electrification scenario, Fulton County could see **147 million fewer gallons of gasoline** consumed in 2050 than in a reference/business-as-usual scenario.

1.3 million metric tons CO₂ reduction = carbon reduction from 1.5 million acres U.S. forests

SLOPE Data Viewer: [https://maps.nrel.gov/slope/](https://maps.nrel.gov/slope/).
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Energy Efficiency Data
How Much Energy Could We Use in the Future?

Takeaway: Under a business-as-usual/Reference scenario, on-road vehicles are expected to remain the largest source of energy demand in Larimer County, CO in 2050.

Note: Transportation non-electricity = fuel consumed by on-road vehicles.
How Much Electricity Can Single-Family Homes Save Through Energy Efficiency Measures in Our State?

Takeaway: Cost-effective energy efficiency measures in Colorado single-family homes could reduce annual statewide electricity use by as much as 2,331 GWh.
Which Energy Efficiency Measures Could Have the Greatest Impact on Reducing Household Electricity Use in Our State?

Takeaway: Upgrading to LED lighting and variable speed heat pumps when electric furnaces wear out have the highest residential electricity savings potential in Colorado.
Which Energy Efficiency Measures Could Have the Greatest Impact on Reducing Electricity Use in Commercial Buildings in Our State?

Takeaway: Upgrading to LEDs and adding advanced hybrid rooftop HVAC units in commercial buildings have the greatest cost-effective commercial electricity savings potential in Colorado.
How Can We Design Policies for Our Local Commercial Building Stock?

Takeaway: If Fort Collins established a building energy benchmarking policy for buildings 50,000 sf and larger and included multifamily buildings, it would apply to a majority of the commercial building space in our jurisdiction, while impacting less than 300 buildings, and encourage efficiency upgrades in multifamily housing.
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Renewable Energy Data
Which Renewable Energy Technologies Have the Greatest Generation Potential in Our Region?

Modeled Annual Technical Generation Potential - Utility PV

Annual Technical Generation Potential - Multiple Technologies - Larimer

Takeaway: Utility solar has the highest technical generation potential in Larimer County, CO. Surrounding counties have higher potential.
How Is Residential Rooftop Solar Potential Distributed Across Residential Buildings by Household Income, Household Tenure, and Building Type?
What Portion of Annual Electricity Consumption in Low- and Moderate-Income Households Could Be Offset With Behind-the-Meter Solar?
Does My Jurisdiction Have Hydropower Generation Potential?

NOTE: Non-powered dams are those that do not produce electricity but provide services ranging from water supply to inland navigation and other water conveyance infrastructures such as irrigation canals. Estimates factor technical characteristics described in the U.S. Department of Energy/Oak Ridge National Laboratory Assessment of Energy Potential at Non-Powered Dams in the United States report.
What Are the Lowest-Cost Electricity Generation Technologies in Our Area, Now and in the Future?

Takeaway: Hydropower from new stream reach and non-powered dam development could generate the lowest-levelized-cost electricity now and through 2050 in Larimer County, followed by utility wind and photovoltaics.
Thank you! Questions?

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

NREL/PR-6A20-87612

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of State and Community Energy Programs. The views expressed in the presentation do not necessarily represent the views of the DOE or the U.S. Government.