City Decision Analysis Resources and Tools

State and Local Planning for Energy Platform

The State and Local Planning for Energy (SLOPE) Platform delivers jurisdictionally resolved potential and projection data on energy efficiency, renewable energy, and (coming in 2021) sustainable transportation in an easy-to-access online platform to enable data-driven state and local energy planning and decision making.

Who it is for:

- State and local energy planners
- State and local governments and policymakers
- Energy planning stakeholders

What it is for:

- Generating maps and charts on state and local:
  - Energy efficiency potential by sector
  - Business-as-usual electricity and natural gas consumption and expenditures by sector
  - Renewable energy generation potential for 15 technologies and scales
  - Projected levelized cost of energy (LCOE) for 17 renewable and fossil technologies and scales
  - Commercial building area and count by building type
  - Population projections
  - Electricity generation scenarios through 2050

Critical questions/needs it addresses:

How much of my community's energy consumption could be met by locally generated renewable energy?

What portion of my state's electricity might be generated by renewable energy in the future under different scenarios?

How much could my jurisdiction reduce energy consumption in the residential sector and which efficiency measures have the greatest impact?

How do energy costs and generation potential compare across technologies, jurisdictions, and regions?

How might electric vehicle adoption change our electricity demand over time? (coming 2021)

Quick links:

Website: https://gds.nrel.gov/slope/about

Factsheet: https://www.energy.gov/sites/prod/files/2019/12/f70/SLOPE-fact-sheet-final.pdf

For more information, contact stat@nrel.gov.

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Low-Income Energy Affordability Data Tool

The Low-Income Energy Affordability Data (LEAD) tool provides estimated low-income household energy data based on income, energy expenditures, fuel type, and housing type. Users can create and save their own profile and make side-by-side comparisons with other geographies. Users can also download visuals and data associated with various geographies, housing, and energy characteristics.

Who it is for:

- Utilities
- State and local energy planners
- State and local governments and policymakers
- Nonprofit and policy institutions
- Developers, financers, and consultants

What it is for:

- Targeted energy affordability services and identification of customers likely to meet program eligibility criteria
- Accessing data and generating maps and graphs to better understand housing and energy characteristics for low- and moderate-income households
- Achieving building efficiencies for low-income households
- Reducing energy burden for low-income households
- Assessing energy use, average energy cost, and energy burden characteristics across geographies, household characteristics (e.g., tenure, housing unit fuel source, building age, and type), and income categories

Critical questions/needs it addresses:

How many customers within a given utility service territory are likely to meet certain program eligibility criteria, such as household income level or housing type?

How do household energy characteristics at the county, city, and census tract levels compare with neighboring jurisdictions and state or national averages?

Which areas of a state or jurisdiction experience the highest energy burden?

How does average energy burden for low-income households compare to average energy burden for non-low-income households?

Quick links:

Website: https://www.energy.gov/eere/slsc/low-income-energy-affordability-data-lead-tool

Factsheet: https://lead.openei.org/assets/files/LEAD-Factsheet.pdf

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Annual Technology Baseline

Each year, the National Renewable Energy Laboratory's (NREL's) Annual Technology Baseline (ATB) data are presented in an Excel workbook of detailed cost and performance data (both current and projected) for renewable and conventional technologies. The workbook summarizes in database-friendly form the capital expenditures, operations expenditures, and capacity factor, as well as the financial assumptions and the levelized cost of energy, for each technology. The Transportation ATB provides a set of assumptions that can be used in analyses and projections across the electricity and transportation sectors. Projections are presented through the year 2050.

Who it is for:

- Electricity and transportation sector planners and modelers
- Researchers and policymakers seeking to understand nationwide technology cost and performance across energy sectors
- Grid operators
- Utilities
- State energy offices and federal agencies (e.g., Bureau of Land Management [BLM], U.S. Department of Energy [DOE], and U.S. Environmental Protection Agency [EPA])
- Consultants and nonprofits interested in energy and transportation system development, management, efficiency, and sustainability

What it is for:

- Transparent, normalized, consistent technology cost and performance assumptions to use as inputs for scenario analyses and models
- Detailed current and projected (through 2050) cost and performance data for renewable and conventional electricity and transportation technologies
- Determinations of potential pathways for impacts of R&D on renewable energy technologies
- Identification of technology-specific cost and performance parameters or other investment decision metrics across a range of fuel price conditions
- Identification of current and projected site-specific conditions for electric generation technologies

Critical questions/needs it addresses:

How are cost and performance characteristics of various vehicle technologies, transportation fuels, and renewable and conventional electricity generation technologies projected to evolve over time?

What are the major technological and financial assumptions driving scenario modeling and analysis such as that done using the Regional Energy Deployment System (ReEDS) model, the System Advisor Model (SAM), and NREL's Standard Scenarios?

Quick links:

Website: https://atb.nrel.gov/

Webinar slides: https://www.nrel.gov/docs/fy20osti/76814.pdf

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Standard Scenarios

NREL's Standard Scenarios are a suite of forward-looking scenarios of the U.S. power sector that support and inform energy analysis. They are simulated using the ReEDS and Distributed Generation Market Demand Model (dGen) capacity expansion models, and they are updated annually to provide timely information about power sector evolution. The Standard Scenarios have been designed to capture a range of possible power system futures and to consider a variety of factors from high vehicle electrification to major cost declines for electricity generation technologies (e.g., using cost inputs from the ATB).

Who are they for:

- Energy system planners and analysts
- Electricity and transportation sector planners and modelers
- Researchers and policymakers seeking to understand nationwide technology cost and performance across energy sectors
- Grid operators
- Utilities
- State energy offices and federal agencies (e.g. BLM, DOE, and EPA)
- Consultants and nonprofits interested in energy and transportation system development, management, efficiency, and sustainability

What they are for:

- Quantitative examination of how various assumptions impact the future development of the power sector
- Context, discussion, and data to inform stakeholder decision-making regarding the future evolution of the U.S. power sector
- Forward-looking scenarios for electricity generation, storage, renewable energy penetration, energy prices, capacity credit, system cost and losses, and emissions through 2050
- Ability to view, graph, and download hourly marginal emission, cost, and operational metrics for select scenarios

Critical questions/needs they address:

How do different assumptions, policies, or technologies impact the projected fuel mix in my state's power sector in 2030, 2040, or 2050?

How are energy storage, renewable energy penetration, energy prices, system costs and losses, and emissions projected to change over time under different scenarios?

Quick links:

Website: https://www.nrel.gov/analysis/standard-scenarios.html

Presentation slides: https://www.nrel.gov/docs/fy21osti/78689.pdf

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Technical Resilience Navigator

The Department of Energy Federal Energy Management Program's (FEMP's) Technical Resilience Navigator (TRN) helps organizations manage risk to critical missions from disruptions in energy and water services. The TRN provides a risk-informed approach to identifying vulnerabilities and inefficiencies within a site's energy and water systems. The TRN's unique focus on energy and water disruptions is intended to integrate with broader energy and water management, sustainability, and security efforts, to strengthen the way those programs plan for energy and water resource availability.

Who it is for:

- Site/facility planners and operators
- Critical mission leaders
- Energy and water managers
- Continuity of operations planning (COOP) officers
- Emergency response managers
- Other resilience stakeholders

What it is for:

- Site-level planning to proactively identify and address vulnerabilities in critical energy and water systems and operations
- Establishment of relative risk from different sources and determine how solutions reduce risk
- Building of detailed understanding of plans, priorities, and baseline conditions related to energy and water systems
- Identification and integration of related organizational priorities (e.g., sustainability and energy efficiency) into resilience assessments and prioritize resilience solutions
- Actionable results that address a site's most important energy and water resilience risks and enhance the ability to maintain critical missions in the case of a disruptive event

Critical questions/needs it addresses:

Which critical functions need to be maintained in the event of a disruption to energy or water services?

Which systems require energy or water to support critical functions, what is the tolerable outage duration for each critical load? And are adequate redundant systems in place to ensure continuity of services during a disruption?

What are the drivers of risk at the site. What is the relative risk across critical loads, hazards, and types of vulnerabilities. And how do different solutions compare in their abilities to address these risks?

Quick links:

Website: https://trn.pnnl.gov/about

Module Quick Reference Guide: https://trn.pnnl.gov/modules/quick-reference

For more information, contact stat@nrel.gov.

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Resilience Roadmap

The Resilience Roadmap offers comprehensive guidance for federal, state, and local entities to effectively convene at the regional level for adaptable and holistic resilience planning. This multijurisdictional approach emphasizes cooperation across boundaries, considerable reliance on partnerships and multiagency collaborations, and significant use of interdisciplinary teams. The stepwise process outlines replicable procedures for regional resilience planning across multiple jurisdictions and potential solutions for enhancing resilience to all hazards in critical infrastructure and facilities.

Who it is for:

- Federal, state, and local planners
- Local representatives
- State representatives
- Federal regional representatives
- Utility service providers
- Regional planning organizations

What it is for:

- Adaptable and holistic resilience planning across jurisdictions
- Coordinated intergovernmental resilience planning, strategy development, and implementation
- Solutions to proactively enhance resilience to all hazards in energy and water infrastructure, critical infrastructure, and critical facilities
- Identification of stakeholder priorities in resilience planning, interdependencies among different jurisdictions around critical infrastructure, hazards, and threats with the potential to impact critical infrastructure; development of multistakeholder, cross-jurisdictional, interagency resilience plans outlining goals, roles, responsibilities, and timelines
- Coordination of intergovernmental resilience and preparedness planning workshops
- Discussion guides for setting performance goals, determining and prioritizing appropriate resilience strategies, and gaining necessary buy-in from stakeholders
- Creation of action plans, identification of funding sources, and the design of monitoring and evaluation plans

Critical questions/needs it addresses:

Which local, state, federal, and nongovernmental representatives need to be involved in regional resilience planning activities. What roles do they play in supporting operations within the defined geographic area of the resilience planning exercise?

What data are available across a region that are related to emergency and community plans, ordinances and codes, the location of critical infrastructure systems or facilities, community utility needs, and climate preparedness evaluations?

How do all involved stakeholders define and understand resilience?

Which shared infrastructure systems serve critical operations and functional performance across multiple jurisdictions, and which natural hazards, technological hazards, or threats pose risks to those critical infrastructure systems?

What are current infrastructure recovery times (i.e., length of time for infrastructure systems to recover and regain operations given certain hazards or system shock events)? How do those times compare with performance goals for infrastructure-wide recovery?

How do regional stakeholders evaluate the feasibility of different resilience strategies and reach consensus on focused strategies?

What funding strategies are available to implement resilience plans and strategies?

Quick links:

Website: https://www.nrel.gov/resilience-planning-roadmap/

Technical Report: https://www.nrel.gov/docs/fy19osti/73509.pdf

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Distributed Energy Resources Cybersecurity Framework

The Distributed Energy Resources Cybersecurity Framework (DERCF) is a web-based application that presents users with questions regarding their organization's security controls, practices pertaining to the use of such controls and application to DERs in cybergovernance, cyberphysical technical management, and physical security of DER devices. The DERCF application then draws from users' responses to generate a score that gauges the current state of DER cybersecurity in an organization and prioritizes recommended action items to help improve its security controls and practices. The evaluation can be taken repeatedly by any organization aiming to measure cybersecurity maturity levels over time.

Who it is for:

- Planners and managers for federal, private, and utility sites with DERs
- Researchers from federal facilities and industry

What it is for:

- Identification and targeting of security risks that DERs might pose to the local grid or beyond
- Gauging of current state of DER cybersecurity in organizations and measurement of cybersecurity maturity levels over time
- In-depth assessment of physical DER devices and the immediate systems that control them, quantitative score of existing cybersecurity posture across three pillars (governance, technical, and physical security), and prioritized lists of action items

Critical questions/needs it addresses:

What security risks do existing solar PV, wind, EV charging, and distributed energy storage systems pose to the local grid?

What settings and procedures related to system operation could contribute to technical management risks?

How do the distributed nature, control, and communication requirements, and large number of devices and access points for DERs contribute additional risks?

Quick links:

Website: https://dercf.nrel.gov/

Video: https://www.youtube.com/watch?v=cvLbNXKOBC0&feature=emb_title

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Electric Vehicle Infrastructure Projection Lite

The Electric Vehicle Infrastructure Projection (EVI-Pro) Lite is a tool for projecting consumer demand for EV charging infrastructure. EVI-Pro uses detailed data on personal vehicle travel patterns, EV attributes, and charging station characteristics in bottom-up simulations to estimate the quantity and type of charging infrastructure needed to support regional adoption of EVs. The tool highlights key variables affecting coevolution of regional EV fleets and charging infrastructure to inform stakeholder decision-making.

Who it is for:

- Public and private organizations investing in EV charging infrastructure

What it is for:

- Estimations of consumer demand for EV charging infrastructure across a state or city/urban area
- Estimations of the quantity and type of charging infrastructure needed to support projected regional adoption of EVs
- Modeling of weekday and weekend electric load profiles for a city/urban area under different EV adoption, vehicle mix, and home or workplace charging scenarios
- Comparisons of charging load profiles under best case, worst case, and custom EV charging scenarios

Critical questions/needs it addresses:

How much EV charging do I need in my state or city to support a desired number of plug-in EVs?

How many workplace Level 2 charging plugs, public Level 2 charging plugs, and public DC fast charging plugs are needed to support a given number of plug-in EVs?

How do changing assumptions about vehicle mix, support for plug-in hybrid EVs, and percentage of drivers with access to home charging affect the projected charging infrastructure needed to support regional EV adoption?

How does vehicle charging affect weekday and weekend electric charging load profiles for a city or urban area?

How do changing assumptions about average daily vehicle miles traveled (VMT), average ambient temperature, percentage of all-electric plug-in vehicles, access to and preference for home versus workplace changing, and home or workplace charging strategies influence weekday and weekend electric charging load profiles for a city or urban area?

Quick links:

Website: https://afdc.energy.gov/evi-pro-lite

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The Alternative Fuels Data Center

The Alternative Fuels Data Center (AFDC) provides information, data, and tools to help fleets and other transportation decision makers find ways to reach their energy and economic goals through the use of alternative and renewable fuels, advanced vehicles, and other fuel-saving measures.

Who it is for:

- Vehicle fleet managers
- Transportation planners
- Drivers
- Lawmakers
- Corporate and municipal sustainability managers

What it is for:

- Comprehensive information by state, fleet applications, fuels and vehicles
- Alternative fuel and vehicle basics, benefits, considerations, laws, and incentives
- Locating of alternative fueling stations, map routes, and learning about alternative fueling infrastructure
- Tools, publications, case studies, maps, and data
- Fuel conservation resources and strategies

Critical questions/needs it addresses:

What are the benefits of different alternative fuels and vehicles? What guidance and case studies are available for using alternative fuels and installing alternative fuel infrastructure?

What are examples of existing laws, regulations, and incentives in peer cities that have been successful in encouraging or requiring individual or public and private organizations to use alternative fuels, advanced vehicles, and strategies to improve fuel economy?

What tools, calculators, interactive maps, and databases are available to assist transportation decision makers in advancing alternative fuels and energy-efficient vehicle technologies?

Can fleet rightsizing, changes in driving behavior, and reduced idling improve the sustainability and fuel efficiency of my vehicle fleet?

How can transportation system efficiency strategies like ridesharing, public transportation, micromobility, integrated and multimodal transportation, and intelligent transportation improve fleet and consumer mobility potential while minimizing time, cost, and energy?

Quick links:

Website: https://afdc.energy.gov/

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REopt Lite

NREL's REopt Lite™ web tool evaluates the economics of grid connected photovoltaics (PV), wind, and battery storage at a site. It allows users to identify the system sizes and battery dispatch strategy that minimize a site's life cycle cost of energy, and it estimates the amount of time a PV, wind, battery, and diesel generator system can sustain the site's critical load during a grid outage.

Who it is for:

- Researchers
- Developers
- Building owners
- Utilities
- Industry
- State, local, and federal governments

What it is for:

- Evaluations of economic viability of grid-connect PV, wind, and battery storage at a site
- Identification of system sizes and battery dispatch strategies to minimize energy costs
- Estimation of how long system can sustain critical load during grid outages

Critical questions/needs it addresses:

Which sizes of PV, wind, and storage are cost-effective for my site?

What percentage of my energy needs can PV and wind cost-effectively provide at my site?

How can I use storage to reduce demand charges at my site?

When should I charge and discharge my battery to minimize my energy costs?

How long can PV, wind, and storage power my critical site energy load during a grid outage?

Quick links:

Website: https://reopt.nrel.gov/tool/

Factsheet: https://www.nrel.gov/docs/fy20osti/76358.pdf

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System Advisor Model (SAM)

SAM is a free software model that enables detailed performance and financial analysis for renewable energy systems. It is the only tool that provides detailed, time-based financial modeling across multiple market sectors, including complex utility rates, combined with detailed performance modeling. And it is the only publicly available tool with a detailed battery model that accounts for voltage characteristics, and calendar and cycle degradation. The online PVWatts Calculator is one example of a web application built from the SAM software development kit (SAM SDK).

Who it is for:

- Utilities
- Developers
- Engineers
- Researchers
- Students

What it is for:

- Grid integration studies
- Studies of renewable energy futures
- Determinations of LCOE of breakthrough technologies
- Policy and utility rate design
- Technical potential studies
- Commercial applications

Critical questions/needs it addresses:

How would a proposed policy affect the economics of different system types?

What is the optimal utility rate structures for renewables in my jurisdiction?

How do system output, capacity factor, LCOE, NPV, and payback compare across potential technologies, sites, or configurations?

What is the expected LCOE for proposed system?

How can innovative concepts lower LCOE for renewables?

What is the technical potential of different technologies in a region?

Quick links:

Website: https://sam.nrel.gov/

Webinar slides: https://sam.nrel.gov/images/webinar_files/sam-webinars-2020-intro-to-sam.pdf

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