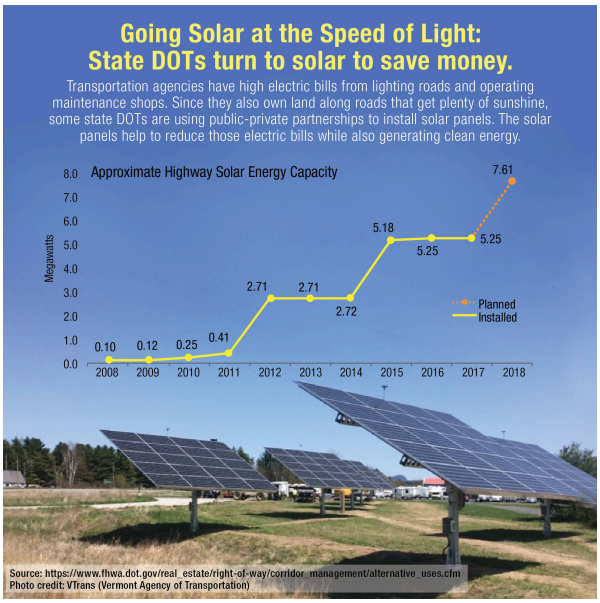
Renewable Energy in Highway Right-of-Way

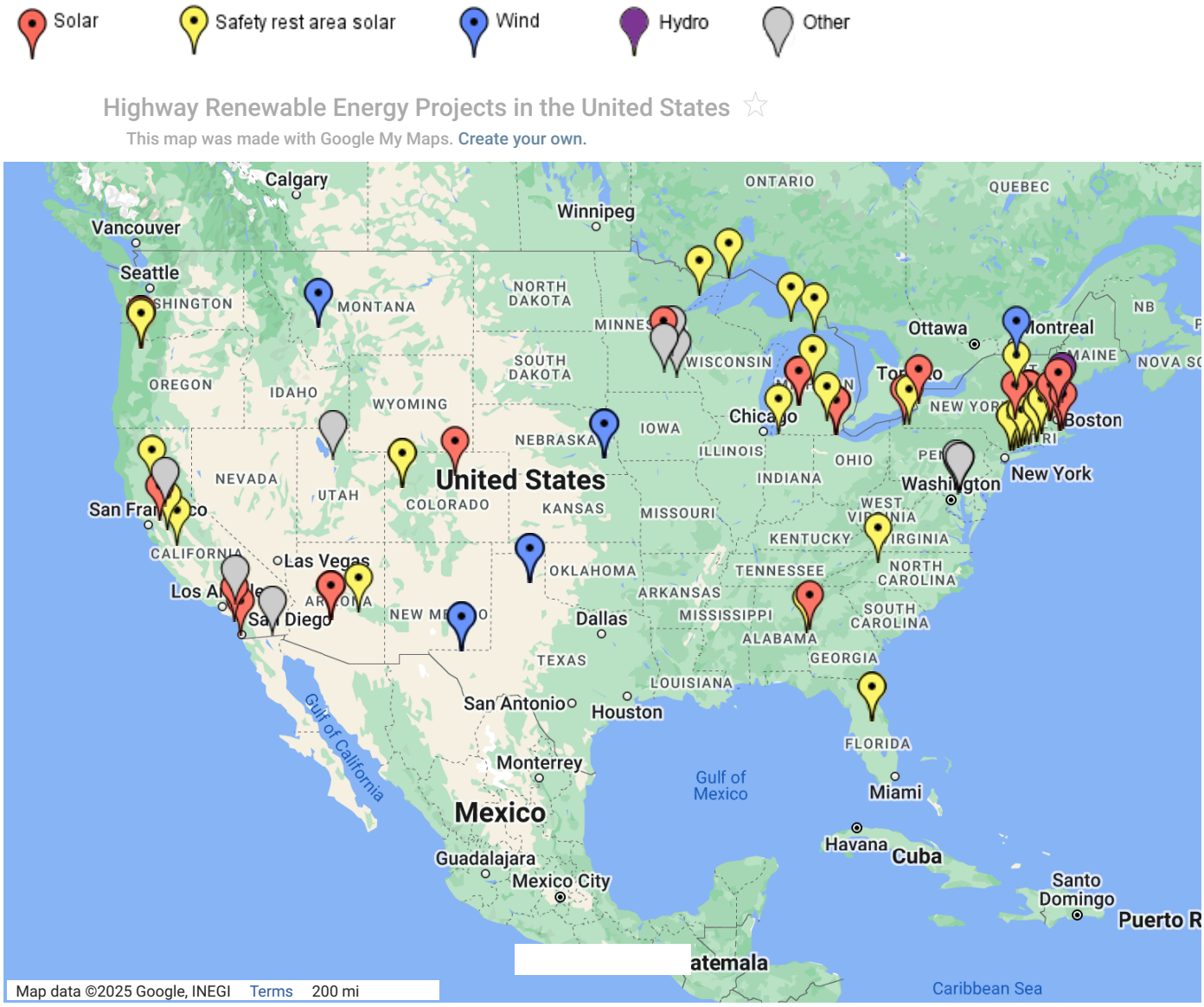
State Departments of Transportation are increasingly exploring the use of highway right-of-way (ROW) to accommodate renewable energy technologies. The ample lands DOTs manage are often close to electrical loads and have sometimes already been disturbed, potentially making these properties ideal locations for renewable energy applications.



Highway ROW renewable energy projects can:

- Add value to ROW assets and create a revenue source for State DOTs
- Reduce greenhouse gas and other pollutant emissions
- Promote energy security by diversifying energy generation and delivery methods
- Foster the creation of a local green job market that enhances the viability of the Nation's renewable energy industry

Renewable Energy Projects Map
The following map provides a snapshot of existing highway renewable energy projects from around the country. Click on an icon for more information about a project. Please contact Carson Poe to recommend additional projects to include in the map.



View Highway Renewable Energy Projects in the United States in a larger map

Related Resources from FHWA:

- **Peer Exchanges**
  These reports summarize the results of peer exchanges that brought together practitioners to discuss accommodating renewable energy technologies such as solar in highway rights-of-way. They were held in diverse regions of the country during 2017 and 2018.
  - **Hanover, MD**. Held September 25-26, 2018 with participation from the transportation departments of Delaware, Florida, Georgia, Maryland, North Carolina, Pennsylvania, West Virginia, and California. (PDF , 1.2 MB)
  - **Salt Lake City, UT**. Held March 13-14, 2018 with participation from the transportation departments of Arizona, California, Colorado, Hawaii, Nevada, New Mexico, and Utah. (PDF , 2.8 MB)
  - **St. Louis, MO**. Held February 27-28, 2018 with participation from the transportation departments of Arkansas, Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Oklahoma, and Tennessee. (PDF 1.3 MB)
  - **Cambridge, MA**. Held July 11-12, 2017 with participation from the transportation departments of Massachusetts, Minnesota, Maryland, Texas, Georgia, and Vermont. (PDF 1.6 MB)
- **References and Handouts**
  - **Two-Page Fact Sheet - Roadside Renewables: Exploring Alternative Uses of Highway Right-of-Way to Reduce Costs** (PDF 776 KB)

- **Quick Guide: FHWA Requirements for Renewable Energy Projects in Highway Right-of-Way** (Updated December 2018): Points transportation agencies to the relevant regulations, including 23 CFR 645 Accommodation of Utilities if the State considers renewable energy projects as utility facilities that serve the public, or 23 CFR 710 Right-of-Way Use Agreements otherwise. (PDF 382 KB)
- **Renewable Energy Generation in the Highway Right-of-Way Briefing Book**: The briefing book provides a high level overview of Renewable energy highway projects, including potential business models and funding sources, and applicable federal and state regulatory requirements. (PDF 463 KB)

- **Research Reports**
  - **Sustainable Rest Area Design and Operations** (October 2017) describes practices that transportation departments have pursued at their rest areas, including green building design, changing operations procedures, using on-site renewable energy, tracking rest area performance and educating the public about sustainability. Provides examples from Florida, North Carolina, Colorado, Georgia, and Vermont. (PDF 1.5 MB)
  - **Highway Renewable Energy: Photovoltaic Noise Barriers** (August 2017): Highway photovoltaic noise barriers (PVNBs) represent the combination of noise barrier systems and photovoltaic systems in order to mitigate traffic noise while simultaneously producing renewable energy. This report provides evidence suggesting that noise barriers can be designed to produce renewable energy without compromising their abilities to reduce noise, and do so safely. It also estimates the potential for PVNB deployment in the United States. (PDF 1.8 MB)
  - **Alternative Uses of Highway Right-of-Way Report** (January 2012): FHWA published this report to better enable State DOTs and local public agencies to evaluate the feasibility of accommodating renewable energy technologies in the ROW. The report includes a **program checklist** consisting of questions that DOTs might consider in contemplating a program to accommodate renewable energy or alternative fuel facilities
  - **Carbon Sequestration Pilot Program Results** (May 2010): FHWA established the Carbon Sequestration Pilot Program in 2008 to assess whether a roadside carbon sequestration effort through modified maintenance and management practices is appropriate and feasible for state DOTs when balanced against ecological and economic uncertainties. Findings are expected to inform DOTs that may be considering the implications of future climate change legislation or that independently want to evaluate the cost effectiveness of using National Highway System ROW to generate revenue from the sale of carbon credits, offset their own emissions, or meet statewide greenhouse gas emissions objectives. (PDF 424 KB)

- **Example Agreements**
  FHWA has compiled examples of lease agreements, power purchase agreements, Request for Proposals, and other related documentation that agencies have used to implement highway renewable energy projects. Please contact Carson Poe for example documents.

- **Other**
  - **Renewable Roadsides** (Winter 2019). This article in FHWA's Public Roads magazine discusses current trends in accommodating solar energy projects in highway right-of-way and FHWA activities to support state efforts.
  - **Guidance on Utilization of Highway Right-of-Way** (March 2009): In response to an increasing number of proposals to use the highway system ROW to accommodate renewable energy facilities, in FHWA issued guidance to clarify the applicability of Federal laws and regulations to such proposals.
  - **Program Guide on Utility Relocation and Accommodation on Federal-Aid Highway Projects** (January 2003): FHWA developed this program guide to assist individuals administering Federal-aid highway programs that involve: use of Federal-aid highway funds for the relocation and adjustment of utility facilities, and the accommodation of utility facilities and private lines on Federal-aid highway ROW.
  - **Alternative Uses of Highway ROW Webinar** (August 2012): FHWA hosted a webinar on accommodating renewable energy technologies and alternative fuel facilities in the highway ROW. The webinar includes presentations from three states that have implemented renewable energy projects in the ROW: Oregon DOT's solar highway projects; Freeway to Fuels pilot projects; and North Carolina DOT's biocrop projects.
  - **FHWA's Exploratory Advanced Research (EAR) Program**. This program addresses the need to conduct research on longer term and higher risk breakthrough research with the

potential for transformational improvements to plan, build, renew, and operate safe, congestion free, and environmentally sound transportation systems.

- **Roadway Wind-Solar Hybrid Power Generation and Distribution System Towards Energy-Plus Roadways**. The aim of this project is to develop a novel Roadway Wind/Solar Hybrid Power Generation and Distribution System towards energy-plus roadways, where energy-plus stands for annual energy consumption that is less than production.
- **Kinetic-to-Electric Energy Conversion:** The key objective of this project is to utilize piezoelectric generators embedded in the pavement to harvest electricity from the passage of traffic loads.

Other Related Domestic Resources

- **New Mexico Department of Transportation Free Energy Solar Highway Program** (October 2018). This report identifies best practices nationally and analyzes the financial feasibility of generating solar power on NMDOT property. It describes experiences at eleven solar highway projects in the United States, providing samples of types of legal agreements used by state DOTs, including power purchase agreements, airspace/land lease agreements and energy savings performance contracts. The study also examines best practices for maintenance, security, liability, and long-term ownership of photovoltaic systems. The feasibility section examines district-specific opportunities for NMDOT to develop solar power generation in state right-of-way and includes financial analyses to determine which opportunities promise the greatest revenues or savings.
- **Vermont Agency of Transportation Solar Development Plan** (December 2016): The Vermont Agency of Transportation Solar Development Plan provides an overview for the agency, potential partners, stakeholders, and the general public of why the agency should invest in solar photovoltaics (PV), and the process of developing solar PV projects on VTrans properties and highway right-of-way (ROW). The goal is to help the agency and others understand and navigate the processes towards a successful solar installation by providing step-by-step information regarding those processes and the resources that will assist in moving forward and avoiding project pitfalls.
- **Solar Highway Program: From Concept to Reality: A Guidebook for Departments of Transportation to Develop Solar Photovoltaic Systems in the Highway Right-Of-Way** (November 2016 update): The Oregon Department of Transportation developed this guidebook to provide an overview for state Departments of Transportation (DOTs) of the process for developing solar photovoltaic (PV) projects in the highway right-of-way. The goal is to help others navigate the process towards a successful solar PV installation by providing step-by-step information, case studies and additional resources. The information presented in the guidebook is based on the experience of the Oregon Solar Highway Program as well as industry best practices.
- **Solar energy in the highway right of way** (November 2016): In this webinar, sponsored by the State Smart Transportation Institute (SSTI), you can hear from Allison Hamilton, the Oregon Solar Highway Program Manager for the Oregon DOT; and Lily Oliver, Solar Photovoltaic Energy Program Manager at Massachusetts DOT about their states' experiences with solar energy along highways. Rosemary Jones from the FHWA Office of Planning, Environment & Realty also joined to answer questions about federal resources and support for these programs.
- **Virginia DOT Solar Energy Development Project.** VDOT is working with the Virginia Office of Public Private Partnerships to explore opportunities to optimize the use of state-owned property, and become more environmentally responsible through the implementation of solar energy systems on real estate parcels that VDOT administers. This website includes a high-level and detail-level screening reports, responses to a request for information , and a report on a risk workshop convened in September 2015.
- **An Array of Possibilities** (Public Roads Magazine, September/October 2015): This article discusses the environmental and economic benefits that some DOTs are beginning to realize by using clean, renewable sources of electricity.
- **National Cooperative Highway Research Program (NCHRP) Report 751: Renewable Energy Guide for Highway Maintenance Facilities** (2013): Offers guidance for the application of renewable energy technologies for the heating and cooling, lighting, and electrical power requirements of highway maintenance facilities.
- **Opportunities on the State Highway System to Generate Revenue or Offset Expenditures for the State of Florida** (October 2013): This report presents the state-of-the-practice of value extraction projects and initiatives in highway ROW in Florida. It also offers a screening tool for Florida

DOT to use in implementing three high-priority value extraction projects chosen including (i) solar photovoltaic, (ii) LED lighting, and (iii) haying or planting in highway ROW.

- **Guidance on extracting value from Texas DOT's land holdings** (July 2012): This report identifies when, where, and under what circumstances Texas DOT should pursue the implementation of value extraction applications and how to effectively recognize and involve key stakeholders.
- **Alternative Energy Resources for the Missouri DOT** (January 2011): This research investigates environmentally friendly alternative energy sources that could be used by MoDOT in various areas, and develops applicable and sustainable strategies to implement those energy sources.
- **Guidebook for Designing and Managing Rights-of-Way for Carbon Sequestration and Biomass Generation** TRB's National Cooperative Highway Research Program Report 804 explores the operational concerns, programmatic issues, and market conditions associated with utilizing highway ROWs to develop carbon sequestration projects. These projects are designed to generate saleable carbon offsets or to grow marketable biomass for sale into bioenergy markets. The Guidebook is accompanied by a Feasibility Toolkit, available on CD-ROM, which may assist users with modeling a proposed project's financial viability that the user can modify to develop a customized analysis.
- **Massachusetts DOT Solar Photovoltaic Energy Program Overview** - The MassDOT is working to implement a state-wide Solar Photovoltaic (PV) Energy Program. The purpose of the program is to build ground-mount solar PV generation facilities at multiple state-owned properties within the state highway layout throughout Massachusetts. A minimum of 6 MW of solar power generation systems will be provided from this multi-site project.
- **Assessment of Colorado DOT Rest Areas for Sustainability Improvements and Highway Corridors and Facilities for Alternative Energy Source Use** One element of this study evaluated the potential use of Colorado DOT ROW for alternative energy applications, including solar, wind, biomass, geothermal, and hydropower sources. Total potential for energy production was calculated for Colorado DOT Regions.

Related International Resources

- **Energy Production from Roads and Road Environments: A Literature Review** (May 2014): This report from the Swedish National Road and Transport Research Institute identifies new technologies for energy harvesting and for planning an environmentally-friendly, renewable energy infrastructure. This report is written Swedish and contains a summary in English.
- **The Feasibility of Trials of Renewable Energy Generation in Highways** (UK Highways Agency, 2003)