FHWA Renewable Energy Implementation at State DOTs Peer Exchange

September 25-26, 2018

Hanover, MD

Summary Report

U.S.Department of Transportation

Federal Highway Administration

Contents

Cover image: Staff at Baltimore/Washington International Thurgood Marshall (BWI) Airport walking under a solar canopy located on a BWI parking deck (Source: Volpe Center).

Introduction

This report summarizes a Federal Highway Administration (FHWA) peer exchange that was held on September 25-26, 2018 at the Maryland Department of Transportation headquarters in Hanover, Maryland. The purpose of the peer exchange was to bring together practitioners to discuss issues related to and approaches for accommodating renewable energy technologies in highway rights-of-way (ROWs) and on other State department of transportation (DOT) properties. The meeting was the fourth in a series of four FHWA peer exchanges convened between June 2017 and September 2018 on the topic.

This report summarizes the presentations and discussions at the peer exchange. Presenters from State DOTs discussed existing and planned DOT renewable energy projects in their respective States. Participants also discussed challenges and lessons learned from these projects. The peer exchange included a site visit to solar canopies that Maryland DOT deployed on a parking deck at Baltimore/Washington International Thurgood Marshall Airport (BWI).

Peer exchange participants included: DOTs from Maryland, California, Delaware, Florida, Georgia, North Carolina, Pennsylvania, and West Virginia; one private family foundation from Georgia; FHWA Division Offices from six States; FHWA's Office of Natural Environment; FHWA's Office of Real Estate Services; and the U.S. DOT Volpe Center. Appendix A lists the peer exchange participants, and Appendix B provides the agenda.

The peer exchange was one of many efforts of the FHWA Office of Real Estate Services and FHWA Office of Natural Environment to provide information and technical assistance to State DOTs about generating renewable energy in highway ROWs. FHWA's work has included the development of a number of resources, such as:

- A report, briefing book, and a question and answer quick guide on renewable energy in the ROW;
- A map of highway ROW renewable energy projects in the United States to which practitioners can submit projects for inclusion;
- White papers on photovoltaic noise barriers and sustainable rest area design and operations; and,
- Summaries of three previous peer exchanges (See "Peer Exchanges").

State Presentations

At the peer exchange, most of the State DOT representatives in attendance gave short presentations about their State's existing and planned renewable energy efforts and how they are thinking about these issues. The presentations from Maryland, Georgia, California, Delaware, and North Carolina are summarized below.

Maryland DOT

Laura Rogers of Maryland DOT (MDOT) described efforts to implement solar projects at DOT-owned sites around the State. MDOT was motivated by the social, environmental, and economic benefits of increasing their solar energy production. Favorable State and Federal policies and incentives for solar power also encouraged MDOT to pursue solar power. These include a State renewable portfolio standard to reach 25 percent renewable energy by 2020, community solar and net metering policies at the State level, and the Federal 30 percent Investment Tax Credit for solar power.

In 2017, MDOT issued a request for proposals (RFP) to select contractors for the development of solar projects at MDOT sites. Through the RFP, MDOT selected six contractors for a master services agreement, a 5-year contract with the option of a 2-year renewal. These six contractors will compete for tasks under the master services agreement to develop solar power at sites MDOT identified. MDOT expects that the projects will be financed through power purchase agreements (PPAs), whereby the contractors finance, develop, construct, operate, maintain, and decommission the solar installations. In turn, MDOT will provide the land and purchase the solar power at a fixed rate for a period of 25 years, or the power will be sold to the community through Maryland's community solar program. MDOT will face zero upfront costs for these projects. The master services agreement was written to maintain flexibility. The contractors may propose other financing options, and the projects could include energy performance, storage, microgrids, or electric vehicle (EV) charging.

MDOT's current solar power installations produce 2,300 MWH a year, a small fraction of the agency's 395,000 MWH in annual electricity usage and $40 million in annual energy costs. For Phase I of Maryland's solar program, MDOT has identified 35 sites at MDOT facilities totaling 35 MW (46,000 MWH/year). MDOT expects that these projects will generate 326 jobs. Phase II of the program will include more complicated sites, including locations at BWI, ports, transit-oriented development, noise barriers, and unimproved land.

MDOT faced several challenges in implementing its solar program, including competing uses of DOT property, the structural integrity of older buildings and whether they could support solar panels, and grid interconnection issues. Maryland also has State laws to promote planting trees on unimproved land to improve water quality in the Chesapeake Bay, a use that may conflict with developing solar power on these sites. MDOT benefited from coordinating within the agency to form a multi-disciplinary team. They also consulted with other State agencies to share technical expertise and get support. MDOT also learned from other State DOTs that have implemented solar projects. MDOT is planning to make the documents it used to set up this program, including its RFP, license, and power purchase agreements, available to other State DOTs once they are finalized.

The Ray (Georgia)

In 2014, the Georgia legislature named an 18-mile stretch of Interstate 85 (I-85) in west Georgia in honor of the late Ray C. Anderson, a leader in industrial sustainability, and directed the Georgia State Transportation Board to work in coalition with the Ray C. Anderson Foundation (Foundation) to achieve common environmental stewardship goals. Accordingly, the Foundation labeled the I-85 section "The Ray" to be a living laboratory for emerging innovations related to sustainable transportation. In doing so, the Foundation set a goal for The Ray to become a "net zero" highway that eliminates all deaths, waste, and carbon emissions. Since that time, The Ray has collaborated with the Georgia DOT (GDOT) and other interested groups to test innovations along the highway and at a visitor center on the I-85 segment.

Several of these innovations relate to renewable energy. At the I-85 Visitor Information Center, The Ray has piloted a grid-connected solar electric vehicle charging station to offer free charging. It has also partnered with the French government and Colas to test a drivable solar road surface called the Wattway in what is the first deployment of the technology outside of France (see Figure 1). Similarly, The Ray has been developing a new in-pavement safety technology called the "smart road dot". A potential future alternative to road reflectors, the smart road dot is a solar-powered LED light that can

autonomously change colors in real-time to reflect information about the roadway, such as black ice, heavy fog, or accidents ahead.

Figure 2: The Wattway drivable solar road surface at the I-85 Visitor Information Center along The Ray (Source: The Ray)

The Ray also facilitated a planned GDOT project for a 1 megawatt ROW solar project featuring 2,600 high-efficiency panels (see Figure 2). The approximately $2.86 million project will be financed and constructed by Georgia Power. The project proposes to have a solar array that will supply electricity to the grid for 35 years. The proposed site is located behind a crash barrier, set back 40 feet from the road, and behind an 8-foot tall fence. The proposed solar array will benefit the highway system by providing rampway lighting for all four corners of rural Exit 14 for the first time. The Ray would like to design the project as a pollinator-friendly pilot project, which will involve planting seed mixes that attract pollinators around the panels, rather than planting the typical turfgrass understory or covering the area with gravel.

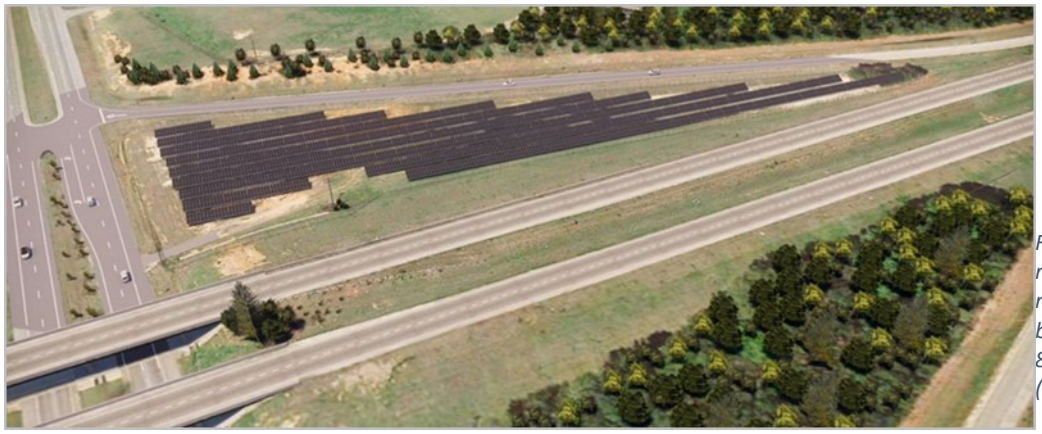

Figure 1: Computer rendering of planned 1 megawatt solar array to be located at Interstate 85 Exit 14 in Georgia (Source: The Ray)

The Ray has been able to encourage GDOT to test strategies that it may not otherwise have had the funding or capacity to try. GDOT has also permitted these projects; for example, it allowed the Wattway through an encroachment permit. In the future, The Ray would like to move toward a formal charter with GDOT and FHWA in order to facilitate the exploration of additional innovations, such as ROW wind generation.

California DOT

Desiree Fox of Caltrans discussed the agency's efforts to expand renewable energy usage. Approximately 10 percent of California's power usage came from solar power in 2017[1], and the State recently passed legislation with the goal of using 100 percent zero emissions electricity sources by 2045. During peak production times, the amount of solar produced exceeds current demand, and utilities are

[1] https://www.energy.ca.gov/almanac/electricity_data/total_system_power.html

selling the excess electricity to other States.[2] The State's utilities are also changing the peak period when the electricity rate is higher from mid-afternoon to early evening to account for this excess solar.

State policy is motivating Caltrans to increase its use of renewable energy. Solar power currently accounts for about nine percent of Caltrans' electricity usage. A 2015 Caltrans Policy Directive encouraged the agency to address sustainability in a variety of ways, including championing active transportation, advancing clean vehicles, fuels, and materials, and preparing for climate change and extreme weather. The State also has goals for constructing zero net energy (ZNE) buildings, including that by 2025 all new construction and major renovations will be ZNE. Caltrans has one building that is part of a ZNE pilot, and its status as a ZNE building will be confirmed once one full year of energy data has been logged.

Most of the solar that Caltrans has installed to date are facility-based projects. A Clean Renewable Energy Bonds Program funded the installation of solar panels at 70 Caltrans facilities, including park and rides, for a total of 2.4 MW. However, this funding source is no longer available. Recently, solar projects have been installed or are in progress in several districts:

- District 3 – A solar canopy in a parking lot (see Figure 3)
- District 5 – Mobile EV chargers with solar panels at three locations
- District 7 – A solar pavement pilot project at a district office building, working with a company from the Netherlands on the technology
- District 8 – A 1 MW Facility at Caltrans-owned and operated Southern Regional Lab
- District 12 – Mobile EV chargers with solar panels, and solar canopies/EV charging stations at Park and Ride lots

In terms of ROW solar, in 2011 Caltrans did a study on linear parcels and third party agreements. However, the study determined that pursuing ROW solar was not financially feasible. At that time Caltrans did not consider a power purchase agreement to finance the projects, but it is now revisiting that possibility.

Figure 3: Installation of a solar canopy at a Caltrans parking lot (Image source: Caltrans).

The Caltrans Division of Research is planning a preliminary investigation looking at California public agencies' experiences with utility-scale solar on non-linear parcels. Caltrans may use that research in an effort to establish a ROW solar project in District 12 (Orange County). District 12 is also researching potential EV charging infrastructure for a new park and ride lot that is currently under construction.

[2] An alternative to selling excess solar to other States would be to store it onsite for later use, but large-scale energy storage systems may not yet be cost-effective.

Delaware DOT

Robert McCleary of the Delaware DOT (DelDOT) discussed considerations that his agency is facing for accommodating renewable energy transmission infrastructure in the ROW. Delaware is an attractive location for offshore wind power, but a challenge is building transmission lines to connect the power produced offshore to the grid. There are also several large-scale solar projects in the state that require grid interconnection, such as a 10MW array near Dover. Oftentimes the most efficient route for these transmission lines is in the highway ROW.

DelDOT's renewable energy activities to date have involved small-scale solar to power variable message signs, traffic cameras, and other portable infrastructure. DelDOT has also installed several electric vehicle charging stations: two stations at the DelDOT administration building for charging DelDOT fleet vehicles, and two stations at the I-95 Welcome Center that are free for the public to use. The Welcome Center chargers were installed by the University of Delaware under a third party agreement with no upfront cost to DelDOT. While DelDOT does not have plans for any large-scale renewable energy projects, its interest in this topic is driven by controlling the agency's operating costs as well as meeting State renewable energy goals (25 percent renewable energy by 2025).

Delaware has recently been allowing alternative uses on State ROW. Legislation passed in 2017 gives wireless providers access to the State ROW, subject to certain requirements.[3] Recently, DelDOT has received inquiries from renewable energy companies and electric utilities that are interested in placing transmission lines along the ROW. DelDOT is proceeding cautiously to ensure safety and limit the delays to projects that utilities in the ROW may cause. DelDOT can accommodate transmission lines in the ROW if the entity looking to install the lines becomes a public utility under the State definition[4], or if it gets special accommodation through the legislature. Alternatively, the company could contract with DelDOT to install equipment that DelDOT owns, or form a public private partnership for the purposes of installing the transmission lines.

DelDOT has proposed changing the legal framework around accommodating renewable energy transmission in the ROW, which would require a change by the State legislature. Currently, the DOT has absolute care, management, and control of State ROW. Private companies do not have access to State ROW, and can only cross the ROW through use and occupancy agreements. Under the proposed legal framework, State legislation would authorize DelDOT to accommodate renewable energy transmission lines in the ROW. DelDOT would utilize use and occupancy agreements to allow for longitudinal occupation of the ROW, and limit accommodation to the shortest feasible route. DelDOT would issue construction permits to address plan reviews, adherence to standards, and traffic safety issues during the installation of transmission lines. DelDOT would charge permit fees and a fair market rental rate for use of the ROW. Its goal would be cost recovery, not revenue generation.

North Carolina DOT

David Harris of the North Carolina DOT (NCDOT) Roadside Environmental Unit described some of the challenges the department has faced in considering renewable energy projects in the wake of its successful Wilkes County rest area modernization efforts, which included a solar array. NCDOT had developed site plans for a few solar arrays, including one at a maintenance yard that was not located on

[3] https://legis.delaware.gov/BillDetail/25823

[4] In Delaware a utility is defined under 17 *Del.C.* §143, Title 17 as "a private business organization, subject to governmental regulation, that provides an essential commodity or service, such as water, gas, electricity, wastewater, or telecommunications, to the public."

Federal of ROW. Some decision-makers questioned how NCDOT would pay for the installation since tax dollars designated for highway purposes could not be used. Another proposed array at a visitor center, which developers had agreed to finance, lost traction when the FHWA Division Office had concerns about the developer selling power from the array for a profit. Similarly, the private sector has approached NCDOT to discuss the concept of placing small wind turbines along highway shoulders to catch ambient airflow, but concerns about funding and revenue generation remain prominent in NCDOT decision-makers' thoughts. NCDOT's power needs are relatively small (i.e., small, energy-efficient buildings) and the major energy utility in the State has met its renewable energy goals; these issues have moderated the department's current enthusiasm for highway renewable energy projects.

NCDOT officials also continue to explore options for EV charging stations, as the growth of EVs in North Carolina has been significant in recent years. As a result of the peer exchange, NCDOT participants also thought the solar carport idea, especially if it could be paired with an innovative financing vehicle such as an energy savings performance contract, could be an appealing option to consider.

FHWA Presentations

FHWA: Regulatory Environment

Lindsey Svendsen of the FHWA Office of Real Estate Services presented on Federal regulatory requirements that guide alternative uses of the highway ROW. The presentation covered:

- Federal interest in the ROW
- Federal statutory and regulatory requirements affecting the use of the ROW
- Utility Accommodation Policy (UAP) and ROW use agreement provisions
- The importance of collaborating among disciplines

For Federal-aid highway projects, ROW property must be devoted exclusively to public highway purposes,[5] but some exceptions exist. Non-highway uses may be approved by FHWA if the use is in the public interest, will not impair the highway, and will not impede the free and safe flow of traffic on the highway.[6]

The Federal definition for "utility" is broad in scope, and includes facilities that produce, transmit or distribute power and electricity which directly or indirectly serves the public. A small utility company servicing a small community or limited number of neighborhoods would normally meet the test of providing service to the public. In contrast, if a facility provides direct, dedicated services to a private corporation with no service to the public at large, the line would be considered private. If the line is for the use of a State or local governmental unit, then the line would be viewed as a utility facility.[7] Since the Federal definition for "utility" is so broad, FHWA allows a State's more restrictive definition to determine qualification.

The FHWA-approved State Utility Accommodation Policy (UAP) regulates utility installations within the ROW of Federal-aid or direct Federal highway facilities.[8] If the State definition of a utility includes renewable energy projects, a State can approve installation of these projects in accordance with the process outlined in the UAP without referral to FHWA. The State DOT then enters into written

[5] 23 CFR 1.23(b)
[6] 23 U.S.C. 111
[7] 23 CFR 645.207
[8] 23 CFR 645 Subpart B

arrangements with a utility (generally in the form of special use permits or joint use agreements). The FHWA Division Office reviews and approves new UAPs and revisions to UAPs for compliance with Federal requirements.

If a project does not qualify as a utility under State law, the project may request to use the ROW through a ROW Use Agreement (previously called Air Space Agreement),[9] which involves a site-specific Federal approval. Fair market rent is required for the use, unless the State demonstrates, and FHWA approves, that the project is in the public interest based on social, environmental, and economic considerations. An application for a ROW Use Agreement approval must include planning and design details about the project, including provisions for maintenance access, terms of use, maps, plans, and sketches.

State DOTs should determine whether accommodation as a utility or using ROW Use Agreements better suits the conditions in their respective States. If renewable energy is not currently included in a State's UAP, the State could consider including it during a UAP update. ROW Use Agreement processes should be included in the State DOT's ROW Manual.

Regardless of the approach followed, it is generally good practice to collaborate with all disciplines when alternative uses of ROW are being considered. The projects are multidisciplinary by nature and can be influenced by and/or influence many aspects of the transportation decision-making process. Accordingly, FHWA's Office of Real Estate Services currently has a research project underway to develop a more current understanding of the state of the practice for alternative uses of ROW, including how States are identifying potential sites for alternative uses. The project will likely involve a survey, and peer exchange participants were encouraged to contribute responses when it becomes available.

One question peer participants had related to whether discussions were ongoing at FHWA about the prohibition of commercial activity at rest areas within Interstate ROW. FHWA representatives noted that the public may not be charged for goods and services at rest areas within the Interstate ROW, except for telephone and articles dispensed by vending machines.[10] That fact could change, but it would require Congressional action. At present, the definition of "vending" has not been expanded to include EV charging. FHWA previously published a Federal Register notice requesting views on whether vending should include EV charging. Results from the comment period were inconclusive: approximately half wanted to expand the definition, while the other half did not. The topic is one FHWA continues to consider.

Another question related to whether uneconomic remnants (i.e., pieces of land that would otherwise be landlocked or inaccessible) were subject to the same rules as other DOT property regarding commercial activities. Under the Uniform Act, when a transportation agency acquires private property it is required to offer to purchase any surplus land not needed for transportation use that would have little or no value to the property owner. These uneconomic remnants are not considered to be in the ROW and could potentially be good sites for alternative uses.

FHWA: Other States' Activities

Tina Hodges of the FHWA Office of Natural Environment presented on case study examples of renewable energy projects that other State DOTs have underway or have completed. She also described

[9] 23 CFR 710.405
[10] 23 CFR 752

the variety of reference resources that FHWA has developed in recent years to help State DOTs interested in developing their own renewable energy projects.

Generally, there is significant and growing interest among State DOTs about what their peers are doing in terms of renewable energy implementation and alternative uses of ROW. To date, most State DOT renewable energy projects have involved deploying solar technologies along highway ROW and at rest areas. Currently, there is approximately 5.25 MW of solar installed across all DOTs, with at least 2 MW more planned in the next 12-24 months. The FHWA Office of Real Estate Services maintains a map of ROW renewable energy projects, including solar, wind and hydroelectric projects (see Figure 4). Peer exchange participants were encouraged to submit projects in their States for inclusion on the map.

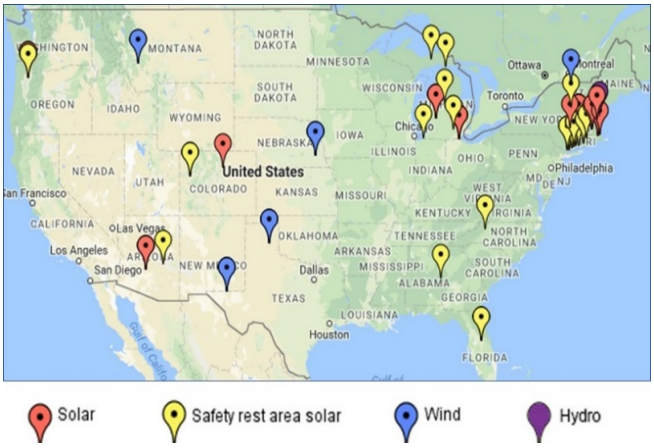

Figure 4: To date, most state DOT renewable energy projects have involved deploying solar technologies along the ROW and at rest areas. FHWA maintains a map of known highway renewable energy projects at https://www.fhwa.dot.gov/real_estate/right-of-way/corridor_management/alternative_uses.cfm.

States have found it financially advantageous to implement solar projects. A key reason for this is that the price of solar panels has dropped by 60 percent since 2010. State policies, including net metering, meter aggregation, and renewable portfolio standards also promote renewable energy generation. At the Federal level, the Investment Tax Credit for solar panels as well as an accelerated depreciation schedule help to make solar projects financially feasible. Several States have found success through using power purchase agreements, where a developer finances and installs solar panels and the State DOT agrees to buy the power generated at a fixed rate for a period of approximately 20 years. Not all States allow third-party PPAs.

The DOTs in Oregon and Massachusetts have been early adopters of highway renewable energy projects and have deployed the most capacity among DOTs. As a result of its two demonstration projects, Oregon DOT developed a *Guidebook for Departments of Transportation to Develop Solar Photovoltaic Systems in the Highway Right-Of-Way* (revised 2016). The book is intended to help other transportation agencies navigate the process towards a successful solar PV installation by providing step-by-step information, case studies and additional resources.[11]

In 2013, the Massachusetts DOT (MassDOT) issued a request for response (RFR) for the development of 6 MW of ROW solar projects across multiple sites. In October 2014, MassDOT awarded a contract and worked with the contractor to establish a master license agreement and PPA. The projects, each of which was implemented as a public private partnership whereby the developer is responsible for project design, construction, operations, maintenance, and decommissioning of the solar panels at the contract's end, include site-specific addenda within the broader master license agreement.

[11] Oregon DOT's guidebook is available at http://www.oregon.gov/ODOT/Programs/Solar%20Highway%20documents/Solar-Highway-Program-Guidebook.pdf.

MassDOT did not put down any money up front; instead, the DOT leased the sites to the developer for 20-years, and agreed to purchase all of the energy generated. MassDOT also benefits from a net metering policy in which the agency receives credits equivalent to the retail rate for any electricity sent to the grid to offset its electricity bills. The developer benefits through the guaranteed sale of electricity to MassDOT and by taking advantage of State RECs and Federal tax incentives. Most of MassDOT's current solar projects are on the Massachusetts Turnpike, which was built before January 1, 1960, and thus did not require FHWA approval. One project in Plymouth, MA (Route 3, exit 5), however, did proceed with FHWA's approval. That site is within a ramp with local street access and is close to a service plaza and Park and Ride lot.

Examples in the Works

- **Utah DOT.** The Utah DOT (UDOT) has several small-scale solar projects on maintenance facilities and carports that they installed over the last 10 years. Now, UDOT is looking at opportunities for ROW solar, with the goal of eventually obtaining 100 percent of UDOT's electricity from renewable energy at lower than current rates and at no upfront costs. UDOT issued a request for information (RFI) in November 2017, and received responses that indicated that ROW solar is financially feasible through a power purchase agreement. UDOT is currently developing an RFP for the development of ROW solar, and has identified several potential sites.
- **Texas DOT**. TxDOT is currently planning a ROW solar project in partnership with the Central Texas Regional Mobility Authority adjacent to Austin Bergstrom International Airport at the intersection of two State highways. The project will be the first highway ROW solar project in the State.
- **Minnesota DOT** is developing an RFP for one ground mount and one rooftop solar system.

Site Visit

The peer exchange included a site visit to Baltimore/Washington International Thurgood Marshall Airport (BWI) to view a 505-kilowatt solar project installed on a canopy system on the top level of the nine-story BWI Daily Garage (Figure 5). The array, which was designed to produce over 600,000 kilowatt hours of electricity each year, ties directly to the Airport's electrical distribution system and is expected to reliably produce energy for more than 20 years. The BWI solar canopy project was part of a broader energy efficiency program at the airport. In 2010, BWI initiated a contract with Pepco Energy Services to develop a program that would create significant energy and operational savings. The airport estimates that it has saved between $50,000 and $100,000 per year in electricity costs due to this project.

Figure 5: Solar canopies at BWI Airport in Baltimore, MD (Source: Volpe Center).

MDOT overcame several challenges when implementing this project. Because the solar panels were placed on a parking deck with internal post-tension cables, special

attention had to be paid to where to place the panels. The panels had to be spaced evenly across the deck and placed at an angle so that wind uplift would not be an issue. There is space on the garage to put an additional 500kW of solar panels in the future.

Discussion and Takeaways

During the peer exchange, participants were asked to consider opportunities for highway renewable energy in their State, challenges that they still face, and additional resources or technical assistance that would be helpful moving forward.

Opportunities

Several of the State DOTs in attendance saw opportunities for implementing renewable energy projects. In addition to the State DOTs that presented, DOTs from Florida and West Virginia shared that they were interested in discussing the information from the peer exchange with their DOT colleagues. In particular, a representative from the Florida DOT mentioned that the agency may be interested in exploring opportunities for solar noise barriers. Similarly, West Virginia DOT may be interested in putting solar canopies at park and ride lots, particularly if it can identify an eligible source of funding.

Several States also see opportunities for using the ROW to accommodate renewable energy transmission lines. In addition to the issues described in the Delaware presentation summary above, the Maine State legislature is interested in leasing the ROW for long-distance transmission lines running from Canada to States in the northeast. Issues to consider when determining whether the ROW can be used for transmission lines include ensuring safety and access to the ROW and using any revenue generated for transportation purposes.

State DOTs that have pursued renewable energy projects, including Maryland and California, have found that engaging the right stakeholders is key to making the projects a success. Stakeholders to involve include other offices within the DOT, DOT leadership, local legislators, and other States that have experience with this topic. Maryland DOT noted in particular that they benefited from learning from the experiences of other States, including Massachusetts and Oregon. In turn, Maryland is willing to share its experience and relevant documents (e.g., the RFP and contract documents) with interested States.

Challenges

Participants discussed several challenges in expanding the use of renewable energy along the ROW and at other DOT-owned properties. One challenge, especially in places like California where there is a large amount of renewable energy, is storing the electricity for use during non-sunny or night-time hours. Having battery storage would allow DOTs to use more of the renewable energy produced onsite, without supplementing it with as much with power from the grid. While none of the States participating in the peer exchange have implemented energy storage projects, Maryland DOT left flexibility in its master contract to allow for new technologies, including battery storage, in the event they become more cost effective in the future.

Another challenge is that State DOTs are interested in expanding EV charging infrastructure, but current Federal law indirectly limits the way that EV chargers can be implemented at rest areas. In particular, since commercial activity is prohibited on the Interstate ROW, State DOTs are not allowed to charge users for the power they obtain from them. Giving away free electricity is unlikely to be cost-effective long-term for DOTs or their partners. A change to the relevant laws would require Congressional action.

Finally, some DOTs face challenges in financing their renewable energy projects. Several States have had success in leasing land to a solar developer and using PPAs to purchase the electricity produced, with no upfront cost to the DOT. However, third party solar PPAs are not allowed in at least nine States, including several of the States participating in the peer exchange.[12] A number of other options for third party business models exist, and are described in the Oregon DOT Guidebook.[13]

[12] DSIRE. NC Clean Energy Technology Center. "3rd Party Solar PV Power Purchase Agreement (PPA)", March 2018. http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/03/DSIRE_3rd-Party-PPA_March_2018.pdf

[13] http://www.oregon.gov/ODOT/Programs/Solar%20Highway%20documents/Solar-Highway-Program-Guidebook.pdf

Appendix A: Participant List

Organization	Name	Title
Caltrans	Desiree Fox	Environmental/Energy and Sustainability Program Coordinator
Delaware DOT	Brad Eaby	Deputy Attorney General
Delaware DOT	Robert (Bob) Cunningham	Chief, Right of Way
Delaware DOT	Robert (Rob) McCleary	Director/Chief Engineer, Transportation Solutions
Florida DOT	Derrick Brown	Deputy Director, Production
Georgia DOT	Katrina Anderson	State ROW Assistant Administrator
Maryland DOT	R. Earl Lewis	Deputy Secretary for Policy, Planning & Enterprise Services
Maryland DOT	Laura Rogers	Program Manager, Office of Environment
Maryland DOT	Dorothy Morrison	Director, Office of Environment
Maryland DOT	Rich Louis	Engineer, Office of Environment
Maryland DOT	Nelson Smith	Statewide Utility Engineer, State Highway Administration
Maryland DOT	William Jackson	Assistant Statewide Utility Engineer, State Highway Administration
Maryland DOT	Kevin Pippin	Utilities Section Manager, Maryland Aviation Administration
North Carolina DOT	David Harris	State Roadside Environmental Engineer
North Carolina DOT	Robert Woodard	State Relocation Director
Pennsylvania DOT	Evan Pursel	Civil Engineer
The Ray (Georgia)	Allie Kelly	Executive Director
The Ray (Georgia)	Harriet Langford	Trustee
West Virginia DOT	David Cramer	Engineer
FHWA - California Division	Melani Millard	Realty Officer
FHWA - DC Division	Daniel Hawk	Realty Specialist
FHWA - Georgia Division	Trevor Smart	Civil Engineer
FHWA - Maine Division	Mark Hasselmann	Environment and Right of Way
FHWA - North Carolina Division	Michael Dawson	Realty Officer
FHWA - West Virginia Division	Jeffrey Robinette	Realty/Civil Rights Specialist
FHWA - Office of Natural Environment	Tina Hodges	Environmental Protection Specialist
FHWA - Office of Real Estate Services	Lindsey Svendsen	Realty Specialist

Organization	Name	Title
FHWA - Office of Real Estate Services	Maggie Duncan-Augustt	Realty Specialist
FHWA - Office of Real Estate Services	Mark Ferroni	Acting Director
U.S. DOT Volpe Center	Amy Plovnick	Community Planner
U.S. DOT Volpe Center	Carson Poe	Transportation Industry Analyst

Appendix B: Agenda

Maryland DOT Headquarters
7201 Corporate Center Drive, Hanover, MD

Objective: Meaningful exchange among practitioners on issues and approaches for accommodating renewable energy technologies in highway rights-of-way.

Goals: Increased awareness of current practice and considerations related to accommodating renewable energy technologies in highway rights-of-way; enhanced community of practice.

Tuesday, September 25

Introductions 9:00–9:15 am
- Welcome remarks

State Presentations 9:15–10:15
Presentations from State DOTs on highway renewable energy efforts.
- Highway Renewable Energy in Maryland
- Innovation on "The Ray" in Georgia
- Highway Renewable Energy in California

Break

FHWA Presentation: Regulatory Environment and Other States' Highway Renewable Energy Activities 10:30–11:15

Lunch 12:00–1:00

Site Visit – BWI Solar Canopy 1:00–3:00

Wednesday, September 26

Day 1 Recap 9:00 am

State Presentations (continued) 9:15–10:15
- Highway Renewable Energy in Delaware
- Highway Renewable Energy in North Carolina

Break

Discussion 10:30–11:15
State and Federal regulatory requirements
- Drivers for highway renewable energy efforts
- Building internal support
- Constraints and challenges
- Opportunities, gaps/needs analysis
- Business models (including public private partnerships)
- Revisit issues & questions from presentations and site visits

Closing Remarks and Next Steps 11:15–11:30