

Renewable Energy Implementation at State DOTs Peer Exchange

March 13-14, 2018
Salt Lake City, UT

Summary Report



U.S. Department of Transportation
Federal Highway Administration

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Cover image: Peer exchange participants stand in front of a Salt Lake City-owned 1 megawatt ground-mounted solar array (Source: Volpe Center).

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Introduction

This report summarizes a Federal Highway Administration (FHWA) peer exchange that was held on March 13-14, 2018 at the Utah Department of Transportation in Salt Lake City, Utah. 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. This was the third in a series of FHWA peer exchanges on the topic in 2017-2018.

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 several solar installations in Salt Lake City, including rooftop, canopy, and ground-mounted installations that the Utah DOT, Salt Lake City, and the University of Utah own.

Peer exchange participants included: DOTs from Arizona, California, Colorado, Hawaii, Nevada, New Mexico, and Utah; several FHWA Division Offices; FHWA's Office of Natural Environment; FHWA's Office of Real Estate Services; the National Renewable Energy Laboratory (NREL); the Utah Solar Energy Association; 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 previous peer exchanges, including one held in [Cambridge, MA](#) in July 2017.

State DOT Presentations

Utah DOT and Utah Solar Energy Association

Stacy Deru of the Utah Solar Energy Association provided an overview of the solar industry and relevant policies in Utah. Over 100 solar companies operate in the state, and 6,000 people are employed in the industry (the 4th most per capita solar jobs in the U.S.). Utah has 1,528 megawatts (MW) of solar installed (the 8th most nationally). It obtains five percent of its electricity generation from large-scale solar, and an additional 1.5 percent from commercial/residential-scale installations. Several recent and

proposed policy changes at the State level have altered the incentives for solar power. For example, a 2017 settlement between Rocky Mountain Power, solar advocates, and several State agencies slightly lowered the value of the net metering credit that solar customers get for sending energy back to the grid.

Tim Ularich described Utah DOT (UDOT) efforts to install renewable energy over the last 10 years. The agency has used renewable energy since 2006, when UDOT Director John Njord, with support from Governor Jon M. Huntsman, asked the DOT to investigate options for wind power at the south end of the Salt Lake Valley. Although that project was not feasible at the time due to lack of available land, UDOT moved forward in pursuing several smaller pilot projects, including a small wind turbine at a rest area and solar panels on maintenance facilities, UDOT buildings, and on parking lot canopies. UDOT also pursued numerous LED lighting upgrades at maintenance stations, region headquarters, and rest areas, and installed electric vehicle (EV) charging stations at UDOT offices.



Solar panels on a UDOT construction office (Image source: UDOT).

These projects were successful and helped UDOT reduce its electricity bills with the renewable energy produced. However, as a public entity unable to take advantage of tax incentives, UDOT found it difficult to get funding for larger projects. In 2017, UDOT began to consider ROW solar. It issued a Request for Information (RFI) in December 2017 asking about the feasibility of pursuing solar projects in UDOT ROW (using a Maryland DOT RFI as a template). UDOT received six responses, all of which supported putting renewable energy on UDOT ROW and reported that UDOT could break even or save money. Most of the responses focused on solar photovoltaics (PV) through power purchase agreements (PPA), although geothermal was also mentioned.

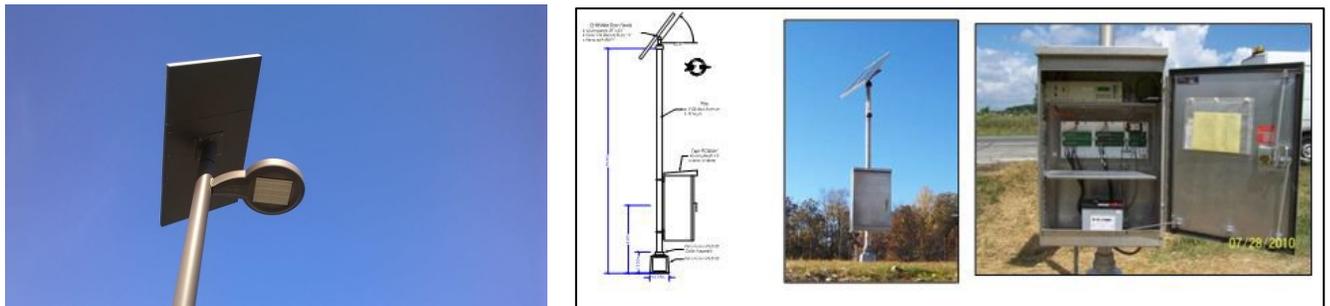
UDOT is now moving forward with developing a Request for Proposals (RFP) for a PPA, and is collecting data and determining what content should be included in the RFP. It has identified several potential sites for ROW solar projects, including high visibility sites along Interstate 80 near a rest area or near Salt Lake City International Airport. UDOT is also considering the possibility of putting solar within the highway median, although would have to address issues of access to these sites.

Arizona DOT

The Arizona DOT (ADOT) considers energy efficiency and renewable energy as part of its Sustainable Transportation Program. Steve Olmsted of ADOT described how in recent years ADOT has moved from the early stages of identifying sustainable strategies to operationalizing a sustainable transportation program into core administrative, planning, design, construction, operations and maintenance activities. ADOT uses [INVEST](#), FHWA's sustainability self-assessment tool, to identify potential sustainability improvements.

ADOT has pursued energy efficiency by replacing existing roadway lights with LED lighting. ADOT issued an RFP for a public private partnership to replace 19,000 lights with LEDs in the Phoenix metro area. ADOT is now developing parallel life-cycle costing (LCCA) and environmental life-cycle assessments (LCA) to estimate the potential monetary and environmental benefits of this shift.

ADOT has small-scale solar panels to power specific devices, including Weigh in Motion (WIM) systems for truck weight enforcement across the state, and solar-powered street lamps in an ADOT equipment storage area. Moving forward, the agency is starting to consider larger projects such as ROW solar and PV noise barriers. Although it has not yet identified sites, ADOT believes there are many possibilities since many ADOT roads connect rural areas and have significant ROW width. In addition, due to urban growth near Phoenix there is likely a need for additional noise barriers, which could be potential locations for PV noise barriers.



ADOT has installed solar powered street lamps (left) and Weigh in Motion systems (right). (Image source: Arizona DOT).

Colorado DOT

The Colorado DOT (CDOT) RoadX program aims to use emerging transportation technologies to solve current infrastructure challenges, such as the limited capacity of the current roadway system. Peter Kozinski, director of RoadX, described how CDOT is using this program to test out innovations and ways of financing them through public private partnerships. For example, CDOT is considering how it can repurpose its rest areas as locations for fast electric vehicle charging.

CDOT has some small-scale solar applications on traffic cameras and lights. A shift to electric vehicles is motivating CDOT to consider how these vehicles will be powered and to look into power generation at a larger scale. The RoadX program also sees ROW energy generation as a potential source of revenue that could be used to address infrastructure maintenance needs. CDOT is interested in asking industry how to best use DOT assets to address some of these challenges. However, it wants to make sure this is done within the context of current laws and regulations.

Hawaii DOT

Hawaii has the highest electricity rates in the country, and in 2003 more than 90 percent of the State's energy came from foreign oil. In 2015, Hawaii committed to achieving 100 percent renewable electricity generation by 2045; if the State achieves this goal, it will be the first in the Nation that is completely renewably powered. To reach this goal, Hawaii is relying on a combination of wind, solar, geothermal, hydropower, and biofuels. The State currently obtains about 20 percent of its electricity from renewables.

Kevin Simon of the Hawaii DOT (HDOT) described actions that HDOT's four districts are pursuing to increase renewable energy usage. These actions include installing solar-powered radar sensors, signs,



Solar canopy at a maintenance baseyard on Maui. (Image source: Hawaii DOT).

and pavement markers, installing solar canopies at maintenance base yards, and using biodiesel (B-20) in maintenance vehicles. At its harbor facilities, HDOT has installed 2,500 solar panels and retrofitted lights with LED lights. At Honolulu International Airport, 9,000 solar panels and small-scale wind turbines generate onsite over 11 percent of the electricity used. The airport plans to begin using electric shuttle buses.

consider ROW solar is that land in Hawaii is expensive and limited, and there are sensitive ecosystems and wildlife impacts to consider.

One challenge HDOT faces as it continues to expand its use of renewable energy and



Figure 1: Solar panels and wind turbines at Honolulu International Airport (Image source: Hawaii DOT).

New Mexico DOT

New Mexico has abundant solar resources and wide highway ROWs, but the DOT does not currently have any ROW solar projects. Steve Gisler of the New Mexico DOT (NMDOT) described the DOT's process to assess the feasibility of ROW solar. Mr. Gisler originally asked the NMDOT Research Bureau for \$200,000 to study developing two shovel-ready ROW solar projects for each of NMDOT's six districts. DOT management decided not to fund the proposal, believing that it required higher investment than practicable at the time, and that the districts were not yet financially equipped to select sites and implement and maintain projects. The proposal was revised to an \$80,000 feasibility study to identify "no-cost," developer-maintained options for ROW solar in New Mexico. It will not include the selection of specific sites, but will describe most advantageous approaches for each of the six districts (e.g., where ROW solar would make sense regionally within the district).

A consultant is currently conducting the study, which has an expected summer 2018 completion date. In addition to the feasibility study component, it will also include information on lessons learned from other States' efforts, identify any legal and policy constraints, and survey New Mexico utility providers, solar developers, and State programs to identify partnership opportunities and agreement types. After

reviewing the results of the feasibility study, NMDOT plans to decide whether to move forward with an RFP for a ROW solar project.

California DOT

Barbara Marquez of Caltrans District 12 (Orange County) described Caltrans' sustainability program and current and planned renewable energy projects. 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. A 2012 Executive Order ([B-18-12](#)) requires State agencies to reduce the environmental impacts of State operations by reducing greenhouse gas emissions, managing energy and water use, improving indoor air quality, generating onsite renewable energy when feasible, implementing environmentally preferable purchasing, and developing the infrastructure for electric vehicle charging stations at state facilities. One of the ways in which Caltrans is complying with the Executive Order is by pursuing renewable energy projects.

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



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

In terms of ROW solar, in 2011 Caltrans did a study on linear parcels and third party agreements. It partnered with the Sacramento Municipal Utility District (SMUD) to release an RFP. However, the only bid received was above the estimated price, and the project was put on hold.

In 2017, the Caltrans Division of Research did a preliminary investigation looking at California public agencies' experiences with utility-scale solar on non-linear parcels. Now, Caltrans is using that information to research establishing a ROW solar project, with District 12 as a pilot. Staff members are currently working on a white paper that will include a parcel inventory, feasibility analysis, recommendation, and

implementation strategy for ROW solar in District 12. Caltrans expects to complete the white paper in

summer 2018, and is aiming to have a pilot project begin in fiscal year 2019. If this project is successful in District 12, it could be expanded to other Caltrans districts.

National 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

For Federal-aid highway projects, ROW property must be devoted exclusively to public highway purposes,¹ 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.²

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.³ 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.⁴ 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 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),⁵ 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.

¹ 23 CFR 1.23(b)

² 23 U.S.C. 111

³ 23 CFR 645.207

⁴ 23 CFR 645 Subpart B

⁵ 23 CFR 710.405

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.

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. She also described the variety of reference resources that FHWA has developed over 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. Peer exchange participants were encouraged to submit projects in their States for inclusion on the map.



Solar **Safety rest area solar** **Wind** **Hydro**

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.

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.⁶ 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.

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

⁶ Oregon DOT's guidebook is available at <http://www.oregon.gov/ODOT/Programs/Solar%20Highway%20documents/Solar-Highway-Program-Guidebook.pdf>.

metering policy in which the agency sells power back to the grid at the retail rate. 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

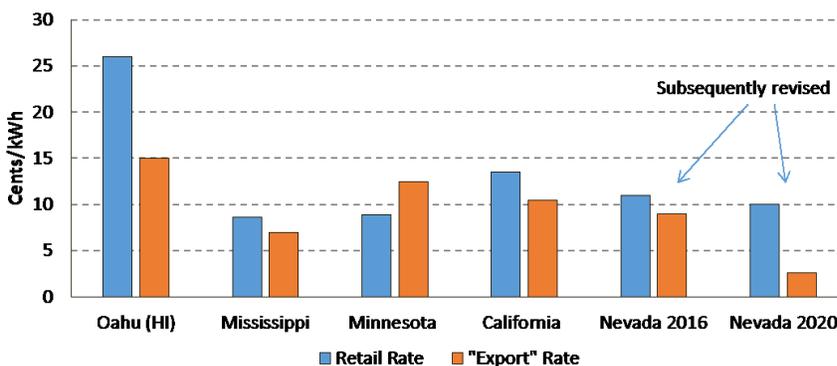
- **The Ray.** In 2014, the Georgia legislature named an 18-mile stretch of Interstate 85 in west Georgia in honor of the late Ray C. Anderson, a leader in industrial sustainability. To align with its goals of enhancing environmental stewardship and sustainability, the Ray C. Anderson Foundation (Foundation) labeled the I-85 section "The Ray" to be a living laboratory for emerging innovations related to sustainable transportation. The Foundation set a goal for The Ray to become a "net zero" highway that eliminates all deaths, waste, and carbon emissions. It has partnered with the Georgia DOT and other stakeholders to test innovations along the highway and at a visitor center on the highway segment.
- **Maryland DOT.** In 2016, the Maryland DOT conducted a preliminary solar evaluation in which it identified 86 sites for potential solar development, representing 60 MW of capacity. In June 2017, Maryland DOT released an RFP through which it will prequalify master contractors to develop solar, geothermal, and micro-hydro projects on DOT property. In February 2018, Maryland DOT selected six master contractors who will compete to provide renewable solar energy for MDOT's headquarters and the facilities of its business units. Through power purchase agreements, solar panels could be installed at up to 35 MDOT sites within 18 months. Maryland DOT plans to incur no upfront costs, and the selected contractors will be responsible for operations and maintenance of the systems. More information on Maryland DOT's recent activities in this area is available at <https://news.transportation.org/Pages/022318mdsolar.aspx>.
- **Texas DOT.** Texas has abundant solar resources and volatile natural gas prices, which have motivated the Texas DOT (TxDOT) to explore renewable energy project possibilities. Since 2006, State agencies in Texas have utilized a State procurement contract to purchase electricity in the deregulated market from retail electric providers—typically using contract terms of up to four years. In 2015, TxDOT partnered with other state agencies to request a new state contract or changes to the current contract to allow expanded purchasing opportunities. In the meantime, TxDOT negotiated a new contract at a historic low rate (\$0.03/kilowatt-hour [kWh] for electricity, not including transmission charges) for 100 percent renewable sourced energy with the renewable energy credits to be placed in Texas. This led to TxDOT savings of \$5 million over the previous year. In 2017, a new statewide contract was implemented, including opportunities for PPAs for wholesale renewable energy, coordinating on-site solar with energy contracts, and financial incentives for conserving energy during times of peak demand. With the new electricity procurement contract in place, TxDOT can now more easily pursue ROW renewable energy opportunities. Accordingly, 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.

NREL: Solar Market Trends and Policies

Erin Nobler of the National Renewable Energy Laboratory discussed renewable energy trends, policies, and financing options. Electricity generation from renewable energy has increased in recent years and is expected to continue to do so. Twenty-nine percent of all new electricity generating capacity came from solar installations in 2017, second only to natural gas. State policies and incentives are helping to drive this increase in renewable energy. For example, 29 states and the District of Columbia have a renewable portfolio standard (RPS), which requires a certain amount of electricity to be generated by renewables by a certain date (e.g., 20 percent by 2020). Of the States participating in the peer exchange, Utah has a voluntary goal and the rest have an RPS policy in place.

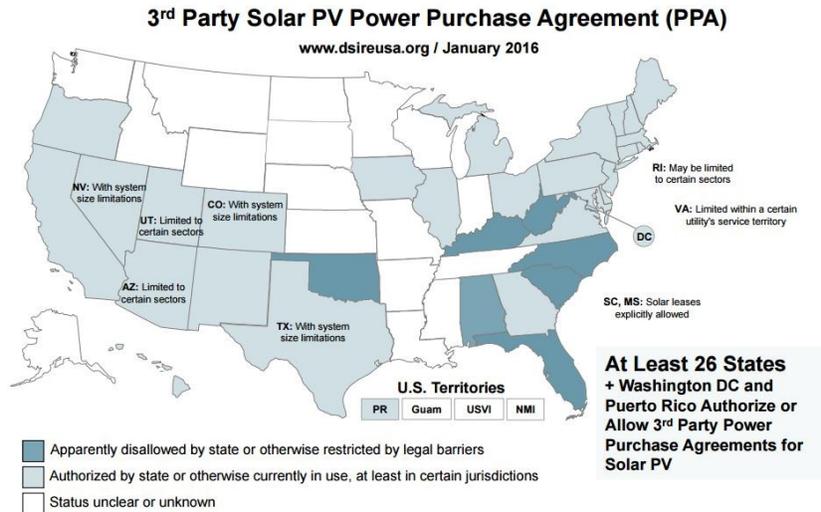
A number of financial incentives can also help make installing renewable energy more attractive. These include:

- Incentives for electricity generation, such as net metering or another bill credit mechanism that allows producers of renewable energy to sell electricity back to the utility. The prices received under these bill credit mechanisms are typically lower than the retail rate, so it is often better to use the electricity generated on-site if possible.
- Federal tax benefits, including a tax credit worth 30 percent of the system⁷ and a 5-year accelerated depreciation schedule (MACRS) that allows owners to write-off a significant amount of the expense in a very short amount of time, rather than over the life of the asset. Note that State governments are not able to directly take advantage of this incentive since they do not pay taxes.
- State and local incentives, which could include tax credits and exemptions, grants, and Renewable Energy Certificates (RECs).



Comparison of residential solar bill credit mechanisms. A higher export rate means that entities get a higher price for selling electricity produced by solar back to the grid. (Image source: NREL).

⁷ This is scheduled to phase down starting in 2020.



State policies for 3rd party PPAs (Image source: DSIRE)

One business model for solar that may be attractive for State DOTs is third-party ownership through a power purchase agreement (PPA). This model helps address several challenges that State DOTs face: the fact that renewable energy requires a large amount of funding upfront to install the system, and the fact that State government entities are unable to take advantage of tax incentives. Under a PPA, a State DOT would buy power at a negotiated PPA rate (\$/kWh) for a specific PPA term without

taking ownership of the solar system. The project developer or a tax equity investor would own the system, and the developer would be responsible for all permitting, installation, maintenance, and decommissioning. Not all States allow third party PPAs, but it is allowed (with some limits) by all of the States at the peer exchange.

NREL offers a number of tools and resources that can help organizations decide whether and how to pursue renewable energy projects. The [System Advisory Model \(SAM\)](#) is a performance and financial model to give users a look into the potential costs and savings of a future renewable energy project. The tool allows users to look at a number of different financial models (e.g., PPA, lease, or customer owned) as well as different technologies. [REopt](#) is an energy planning platform that evaluates the economic value of grid tied PV, storage, or both, and creates an optimal system size given the economic interests of the user. NREL's [technical assistance website](#) for State, local, and tribal governments provides additional resources, such as example RFPs and PPAs.

Site Visits

The peer exchange included site visits to three locations in Salt Lake City with solar installations. First, the group looked at a parking lot canopy with solar at the UDOT headquarters building. This includes a 95kW system installed in 2017 (15 percent grant funded) and a 167kW system installed in 2018 (66 percent grant funded). UDOT installed and operates the systems, and uses it to offset its electricity bill for the headquarters building. The solar panels were set up to allow for EV chargers to be installed at a later date; so far, four charging stations are available for UDOT employees, and UDOT is considering adding additional chargers.



Solar parking lot canopy at UDOT headquarters (Image source: Volpe Center).

The group also visited a 3,000 panel, 1 MW ground-mounted solar array at a Salt Lake City maintenance yard near the highway. This project is an example of virtual net metering; the power generated is used to offset



Salt Lake City-owned solar array (Image source: Volpe Center).

energy at a new Public Safety Building downtown that was seeking to reduce energy usage (the city had to get a waiver from the utility in order to do this). The system produces about 750 kWh per day.

Finally, the group visited several sites at the University of Utah. Hunt Electric, the developer that installed and operates the solar installations, showed the group the sites and answered questions from a developer perspective. The university did an RFP to develop five solar arrays across two sites. These include solar carports, a ground-mounted array, and rooftop systems. Hunt developed the systems through a PPA, and they are all grid-connected. Utah has one of the lowest rates of electricity in the country – about 5 cents per kWh – but these projects have still been cost-effective.

The group discussed considerations for developing a solar carport, including designing the system appropriately to account for clearance for trucks (if necessary) and emergency responders, determining whether to design a watertight system (which will add to the cost), and determining how many foundations or support structures are necessary. Planning for EV chargers is helpful to do ahead of time if there is a possibility that they will be added to the carport in the future.

For ground-mounted systems, Hunt recommended following natural slopes to minimize costs, and storing spare panels onsite to make maintenance easier. The carport has had minimal maintenance needs since the system was installed, and Hunt staff are able to use a smartphone app to see if and when an inverter stops working (which has not been an issue so far). There have not been any issues with vandalism or theft to date.



University of Utah ground-mounted array and solar carport (Image source: Volpe Center).

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

The group discussed potential ways to structure a ROW solar development; several States were considering the strategy of issuing an RFP for a PPA. Hunt Electric noted that State government entities are ideal partners from a developer perspective since they have a good credit rating and pay their bills on time. Therefore, State DOTs may be able to negotiate a good PPA rate. In addition, States discussed how PPAs can allow them to pursue projects without putting down significant up-front financing, and allow them to benefit from tax credits that they would not be able to access alone.

Participants discussed how to structure an RFP, and whether it is preferable to select sites before the RFP or to let a developer select the sites. Allowing a developer to select sites could limit the work the DOT has to do before issuing an RFP. However, letting a developer select sites could mean that there is not internal buy-in for the sites selected, or that some of the selected sites may not actually be feasible (e.g., if the DOT needs to use the land for a different purpose). One participant suggested a hybrid model, where the State DOT would select some sites before issuing the RFP but allow a developer to select additional sites that it deems feasible. The Utah DOT is actively exploring what to include in their RFP, and offered to share the RFP and lessons learned with the group.

The group also discussed some of the potential benefits of highway renewable energy, including the ability to save State DOTs money and to support the goals of existing DOT sustainability programs. The Colorado DOT is interested in how to monetize its assets to bring new revenue to the DOT (beyond savings on an electricity bill), and sees energy development as one possible way to reach that goal.

Finally, participants discussed the importance of building support within the agency. Having a champion at the staff and leadership levels can help projects move forward and be successful. Strategies that can help build support within an agency include using real world examples to show that ROW solar projects can be successful, and emphasizing the benefits of renewable energy, including saving energy and money.

Challenges

One challenge that many States face is understanding the regulatory environment and what they are allowed to do based on FHWA and State requirements. FHWA staff suggested that a first step in understanding a State's regulatory context could be looking at the State UAP and seeing if it includes renewable energy. If not, the UAP could be updated to include renewable energy, or States could pursue renewable energy through a ROW Use Agreement. One DOT raised the possibility of States coming together to ask FHWA for additional flexibilities or to advocate for legislative changes, such as allowing States to charge for EV charging at rest areas.

Participants also discussed the challenge of limited funding. Although DOTs can save money through a solar project and avoid putting down significant money upfront through a PPA, they still need funding for feasibility studies and site selection. FHWA staff stated that MassDOT used money from excess land

sales to fund a site selection study, and UDOT suggested using extra money in a maintenance budget in a light snow year to fund upfront renewable energy costs.

Technical Assistance

Participants discussed resources that would be helpful for FHWA or others to provide that would help them advance highway renewable energy projects. These include:

- A fact sheet on the benefits of solar for State DOTs, emphasizing the economic benefits and the fact that States can do projects with minimal upfront cost through PPAs or other 3rd party ownership.
- A flow chart showing the different regulatory options and business models for ROW renewable energy.
- Examples of NEPA documents for ROW solar projects, or additional information on the environmental impacts of highway solar.
- A centralized place for sharing resources such as example RFIs.

After the peer exchange, several resources were shared with the group, including FHWA's [highway renewable energy website](#) and a [website from the State Smart Transportation Initiative](#) that includes some example documents such as RFIs and PPAs.

Appendix A: Participant List

Agency	Name
Arizona DOT	Steven Olmsted
Caltrans	Barbara Marquez
Colorado DOT	Peter Kozinski
Hawaii DOT	Kevin Simon
Nevada DOT	Jessica Biggin
New Mexico DOT	Steven Gisler
Utah DOT	Jordan Backman Kelly Burns CJ Connor Patrick Cowley Shane Marshall Alana Spendlove Tim Ularich Abdul Wakil
Utah Department of Administrative Services	Michelle Brown
Utah Solar Energy Association	Stacy Deru
National Renewable Energy Laboratory	Erin Nobler
FHWA Arizona Division	Toni Whitfield
FHWA Colorado Division	Brian Dabling
FHWA Hawaii Division	Kelly Okumura
FHWA Nevada Division	Del Abdalla
FHWA Utah Division	Ivan Marrero Ed Woolford
FHWA HQ (Office of Realty)	Lindsey Svendsen
FHWA HQ (Office of Natural Environment)	Tina Hodges
U.S. DOT Volpe Center	Amy Plovnick

Appendix B: Agenda

Renewable Energy Implementation at State DOTs Peer Exchange March 13-14, 2018

AGENDA

Utah Department of Transportation
4501 Constitution Blvd
Salt Lake City, Utah

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

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

Tuesday, March 13

Welcome and Introductions

9:00-9:15 am

- Welcome remarks - Shane Marshall, Deputy Director, Utah Department of Transportation and Ivan Marrero, FHWA Utah Division Administrator

State Presentations

9:15-10:30

(15 minutes per state)

- Highway Renewable Energy in Utah – Tim Ularich, UDOT
- Highway Renewable Energy in Arizona – Steve Olmsted, ADOT
- Highway Renewable Energy in Colorado – Peter Kozinski, CDOT

Break

FHWA Presentation: Regulatory Environment and Other States' Highway Renewable Energy Activities

10:45-11:30

Lindsey Svendsen, FHWA Office of Realty and Tina Hodges, FHWA Office of Natural Environment

Discussion

11:30-12:00

- State and Federal regulatory requirements
- Drivers for highway renewable energy efforts
- Building internal support

Lunch

12:00-1:00

Site Visits

1:00-5:00

Site visits to rooftop, ground mount, and carport solar installations on UDOT and University of Utah property, as well as to potential sites for right-of-way solar. Transportation provided.

Wednesday, March 14

Day 1 Recap	9:00-9:15 am
National Renewable Energy Laboratory (NREL) Presentation Erin Nobler	9:15-10:00
State Presentations <i>15 minutes per state</i>	10:00-11:00
<ul style="list-style-type: none">• Highway Renewable Energy in Hawaii – Kevin Simon, HDOT• Highway Renewable Energy in New Mexico – Steve Gisler, NMDOT• Highway Renewable Energy in California – Barbara Marquez, Caltrans	
Break	
Discussion	11:15 – 11:45
<ul style="list-style-type: none">• 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	11:45 – 12:00
Adjourn 12 p.m.	