ON-SITE SOLAR

Key Considerations & Soft Cost Reduction

Objectives

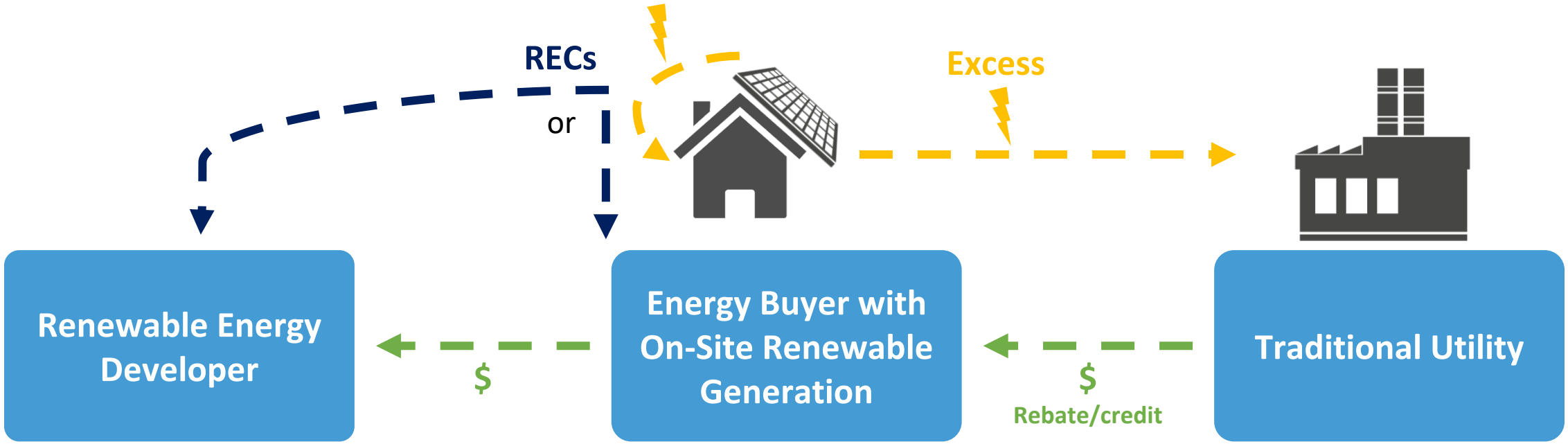
1. Review the current status of on-site solar in New Mexico
2. Identify and discuss key issues and considerations
3. Review pathways to reduce cost of on-site solar
4. Outline the initial steps to pursue an on-site project

CHECK IN

Agenda

- Setting context & why on-site solar
- Key considerations for New Mexico
- Reducing soft costs
- How to procure on-site solar

How on-site solar works



1. Customer pays RE developer for each unit of energy produced per fixed price in PPA contract. RECs may be given to customer or held by developer (depending on deal)

2. Where net metering is permitted, if the on-site system produces more energy than the customer uses, excess energy is sent back to the grid and customer gets credit on bill

There are three main locations for on-site solar

Potential Sites

Rooftops

- Aggregate buildings to realize scale
- Screen to identify highest potential roofs
- NREL estimates New Mexico can offset 10% of electricity sales with rooftop solar on Med-Lg buildings[1]

Parking Lots

- Typically cover ~20% of a city's surface[2]
- Higher upfront costs relative to rooftop PV but with additional benefits for drivers (e.g. shade, rain protection, EV-ready)

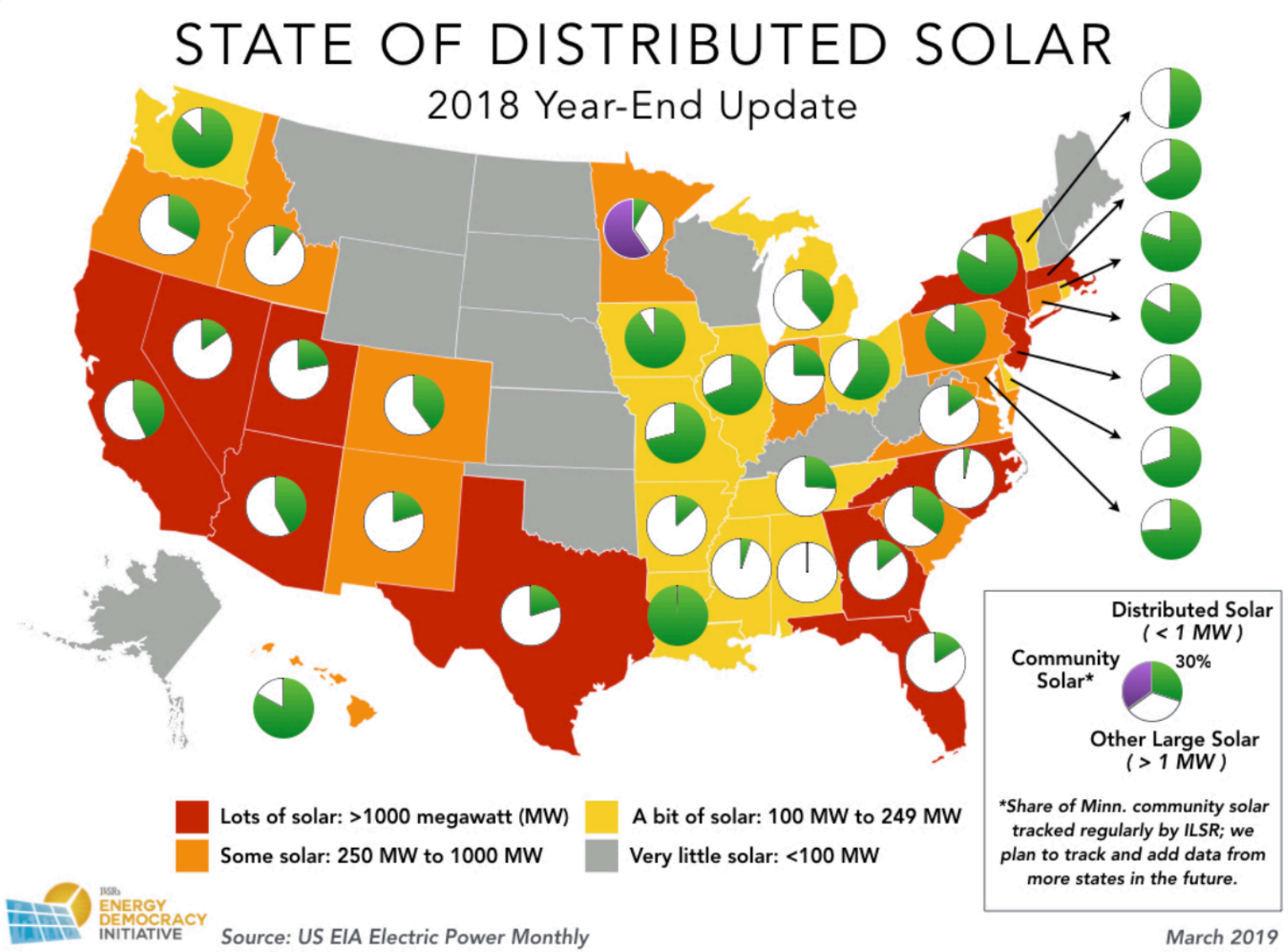
Ground Mounted

- Large PV arrays on city owned property such as
  - Landfills
  - Brownfields
  - Water treatment
- Identify local virtual net metering rules

[1]NREL https://www.nrel.gov/docs/fy16osti/65298.pdf.

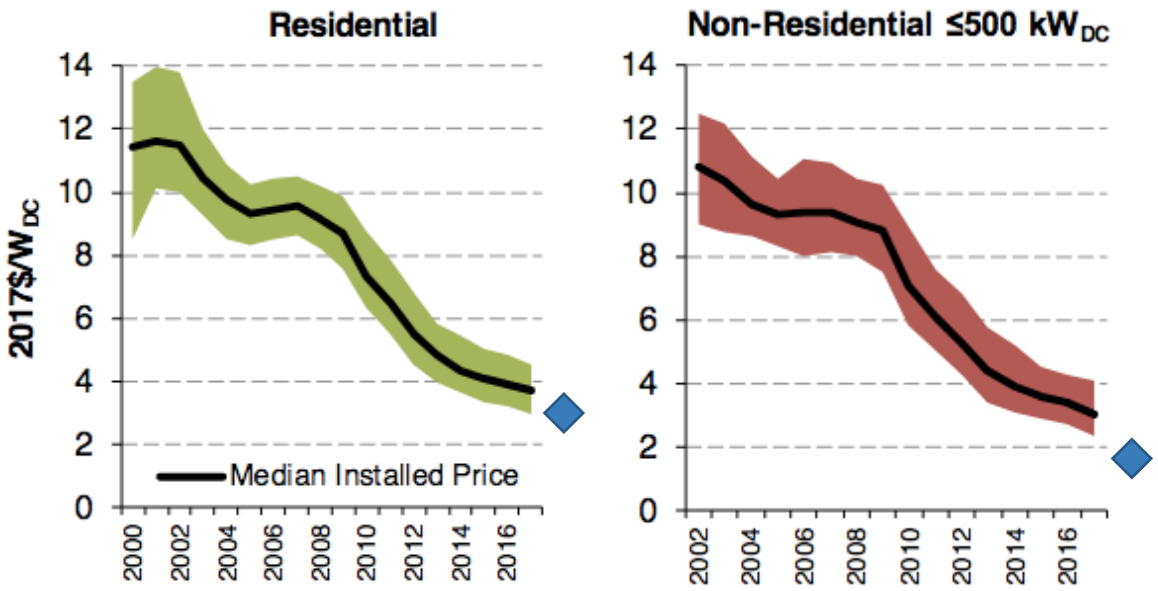
[2]LBNL https://newscenter.lbl.gov/2012/09/13/parking-lot-science/

Distributed solar represents a sizeable portion of the total solar capacity in the US



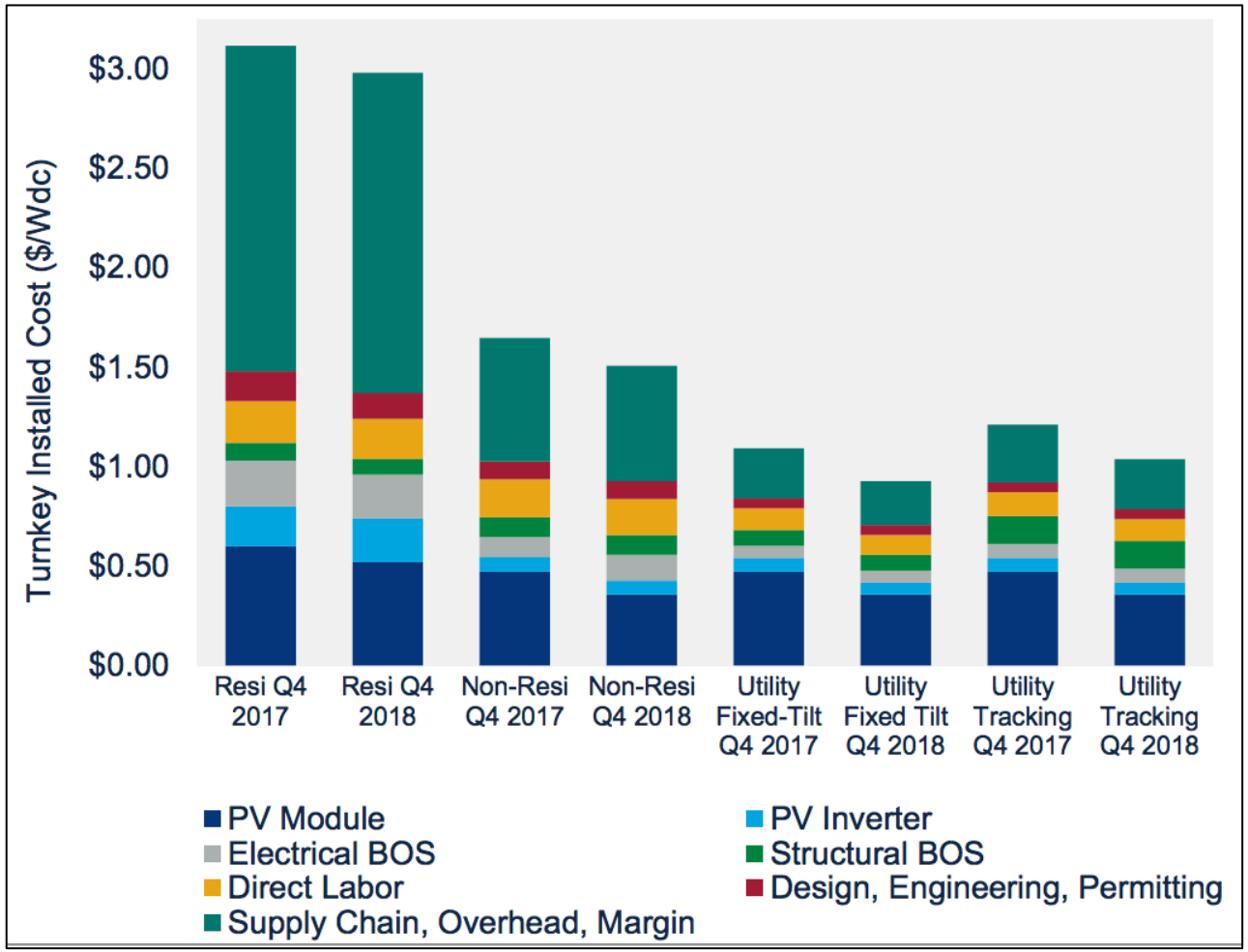
The solar market has been driven by dramatic cost reductions

Costs have declined over time…



Source: Tracking the Sun, *Lawrence Berkeley National Laboratory*, 2018.

… and are continuing to fall even now



Source: Wood Mackenzie Power & Renewables.

On-site solar projects provide local benefits

Electricity cost savings and price stability

$$$

PNM's Prosperity Energy Storage Project

Can provide resiliency & reliability at emergency and/or important facilities (hospitals, fire stations, etc.) during power outages if paired with storage

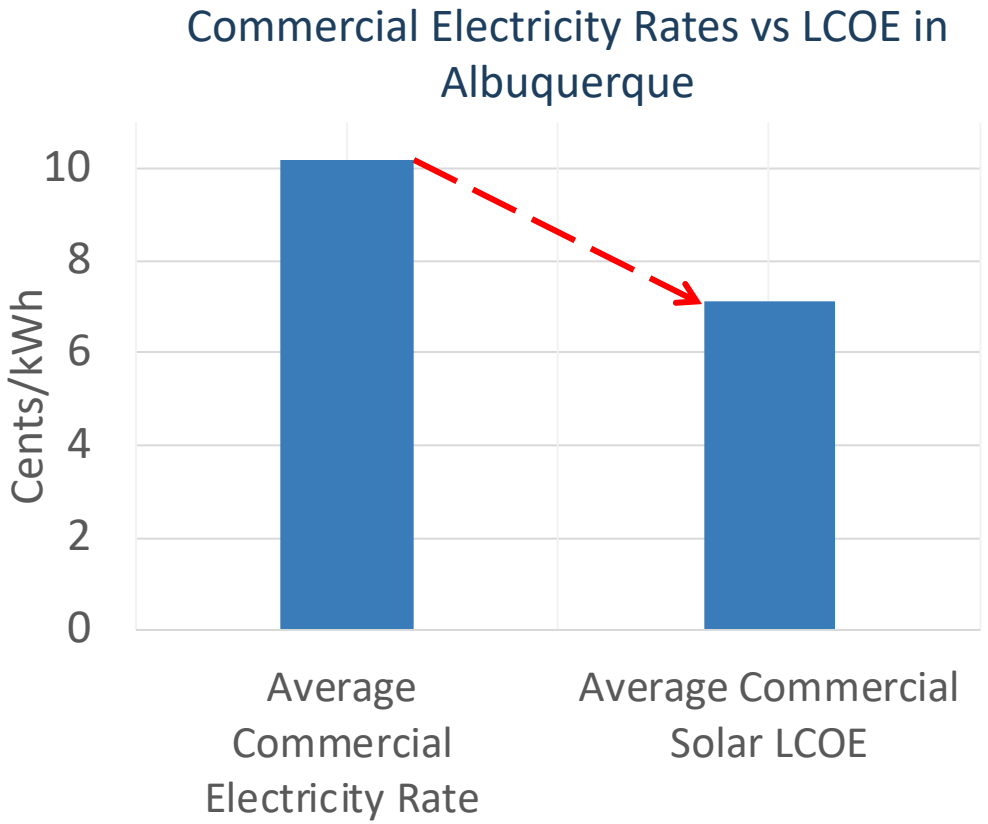
Visible progress towards renewable and GHG reduction goals, including LEED certification

Project Objective

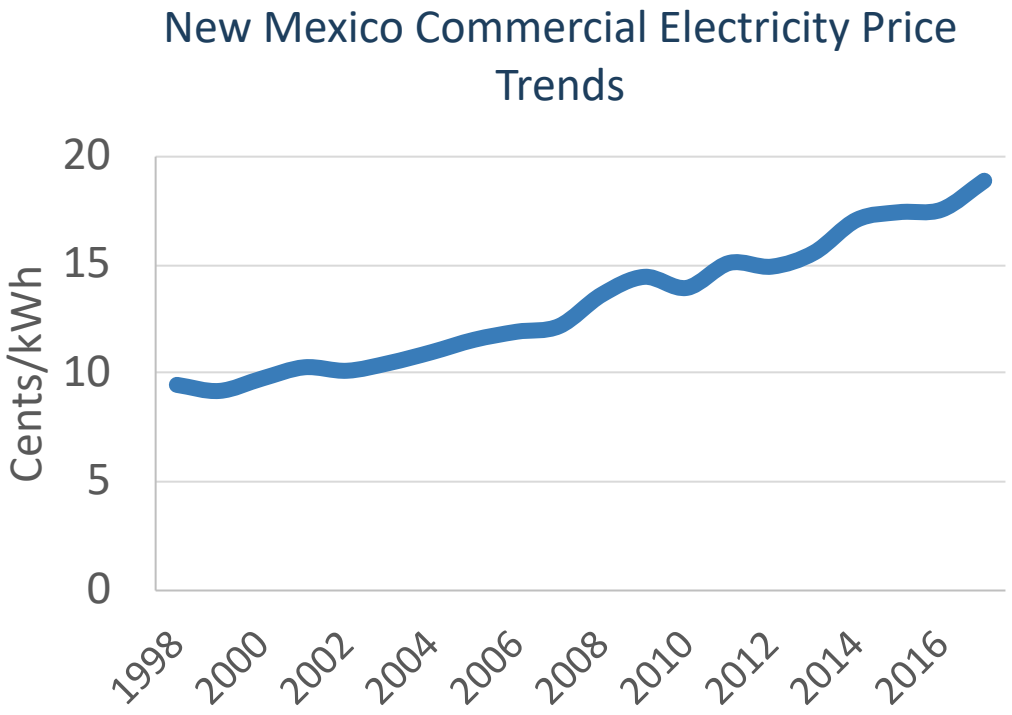
To develop a new utility business model, including a significant behind the meter energy strategy, to transition North Central New Mexico to 100% renewable energy.

Municipal on-site solar can result in lower and more stable energy bills for the city

Potential, immediate, or long term electricity bill savings

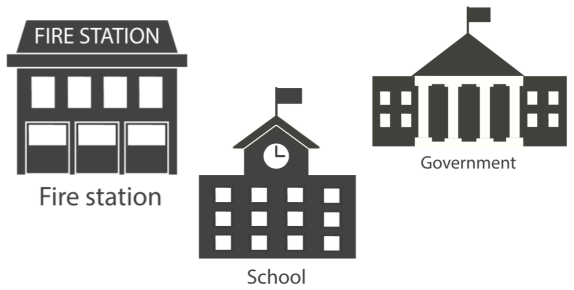


Hedge against future price fluctuations and carbon pricing



https://www.nrel.gov/docs/fy19osti/72399.pdf
EIA

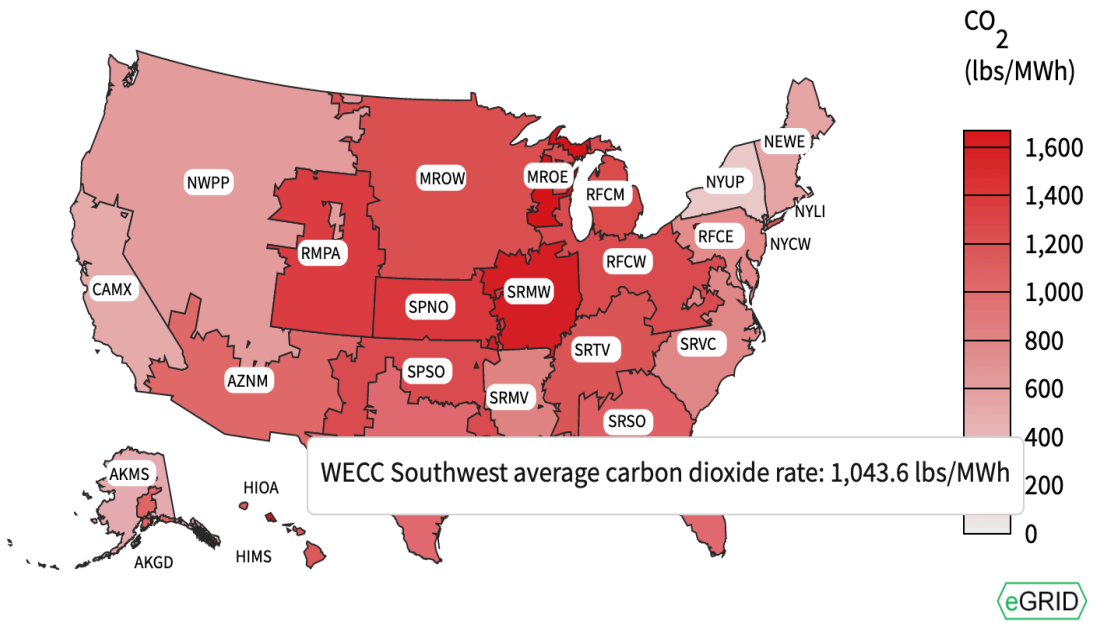
Projects funded by local governments, tribes, or institutions can also have benefits for the wider community



- Can provide educational opportunities for students

- Studies show that each solar install results in an additional 0.44 projects[1]
- 1/3 of referrals for Solar City come from recently installed projects[2]

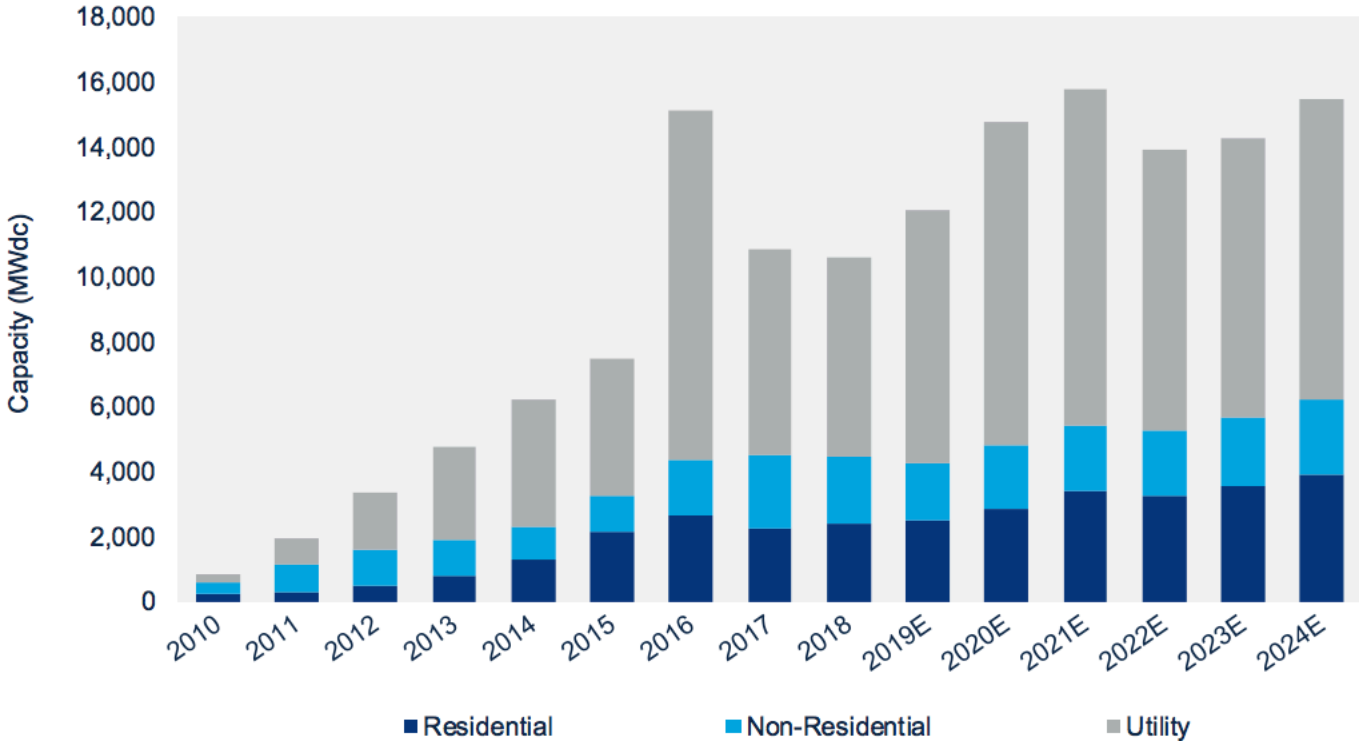
- Provide local health benefits by avoiding emissions of criteria air pollutants (including NOx, SO_2 and $PM_{2.5}$)
- And local environmental benefits by reducing CO_2, CH_4, and HFCs

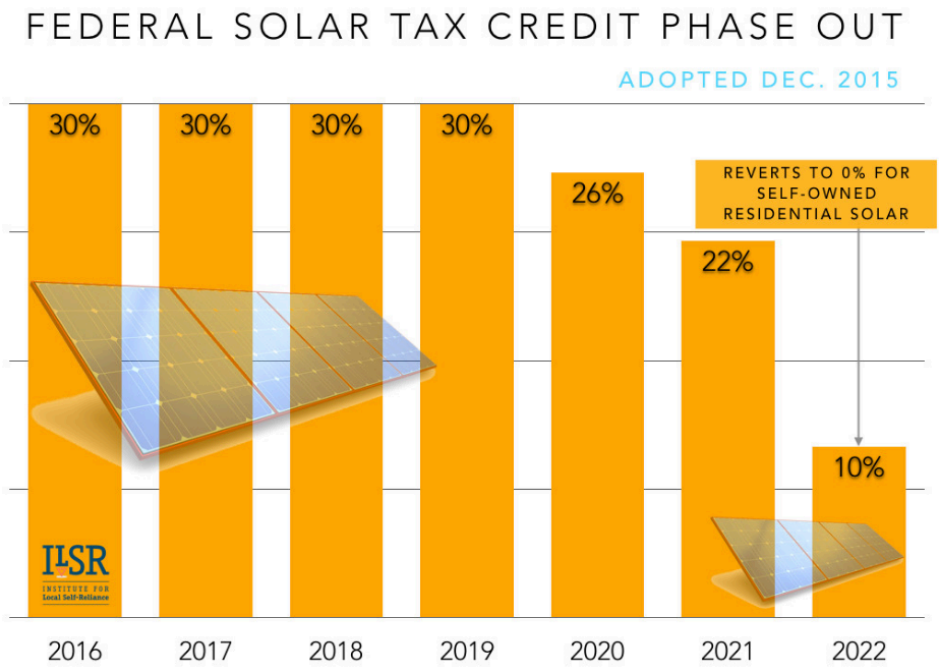


- Boost local job creation: 14 jobs created per $1 million invested (versus 7 for coal and 5 for oil and natural gas) [3]
- Keeps economic development and energy investments local

[1] M. Graziano and K. Gillingham, "Spatial patterns of solar photovoltaic system adoption: The influence of neighbors and the built environment," *Economic Geography,* vol. 15, no. 4, pp. 815-839, 2015.
[2] https://www.vox.com/2016/5/4/11590396/solar-power-contagious-maps
[3] https://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF

Total solar capacity in the US has been aided by the Incentive Tax Credit (ITC), but reductions in the ITC may impact project timing





Source: Wood Mackenzie Power & Renewables.

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- Key considerations in New Mexico
- Reducing soft costs
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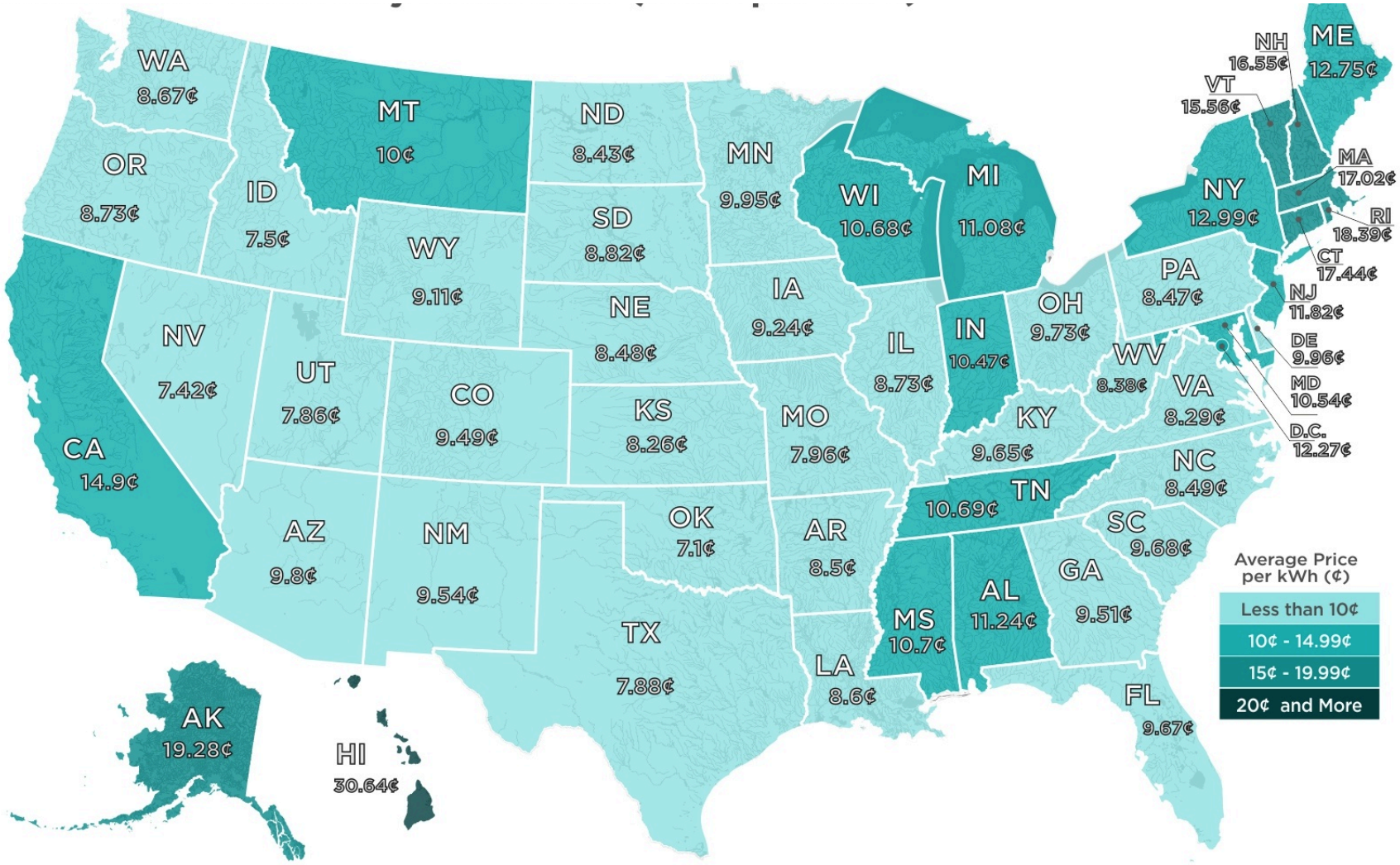
How New Mexico compares



How Much Americans Pay in Electricity Rates in Each State

Commercial Electricity Rates 2019 (cents per kWh)

New Mexico is…

#32 for commercial electricity prices

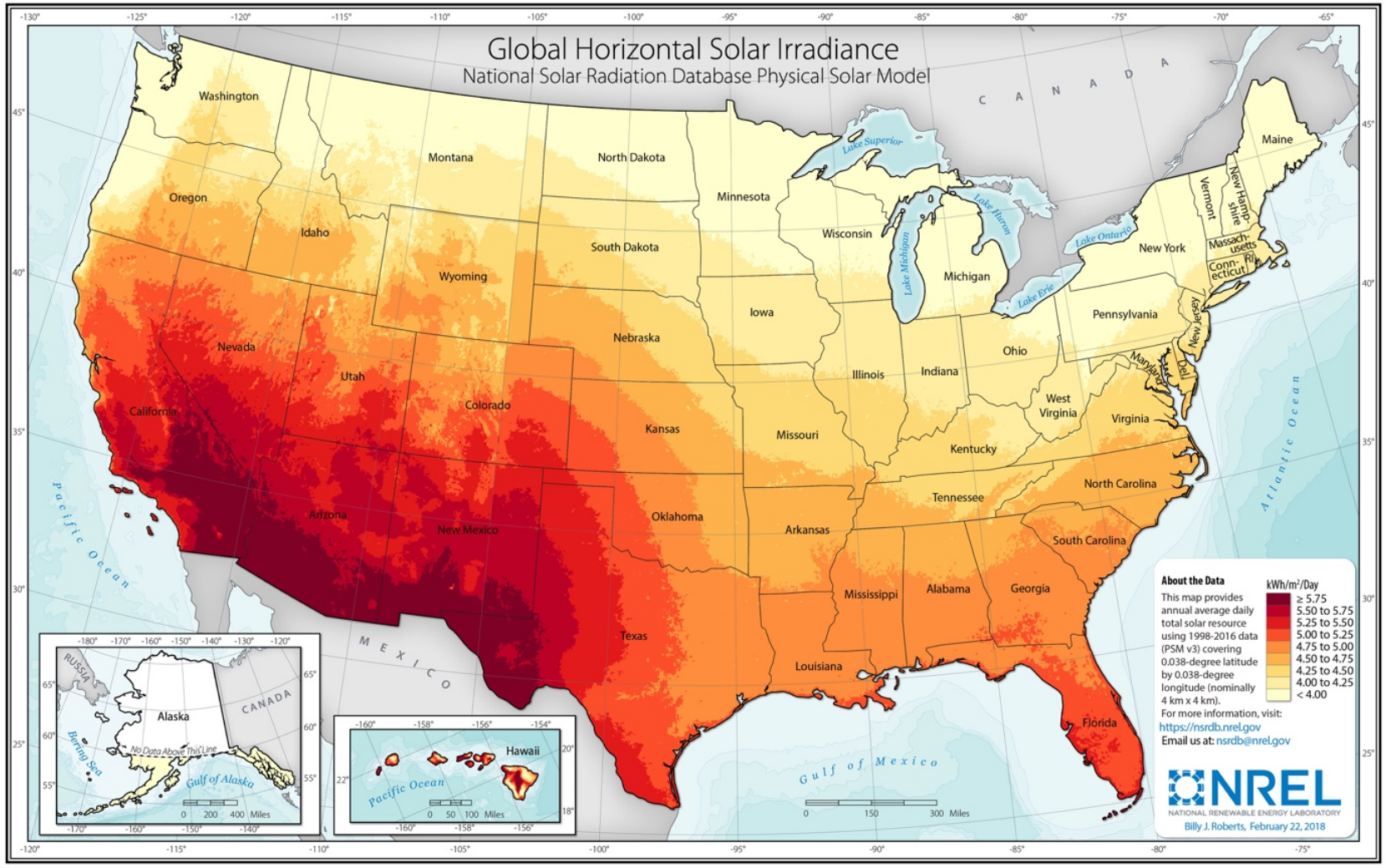
#29 for residential electricity prices

Article & Sources:
https://howmuch.net/articles/how-much-americans-pay-in-electricity-rates-in-each-state-2019
U.S. Energy Information Administration - https://www.eia.gov/

howmuch.net

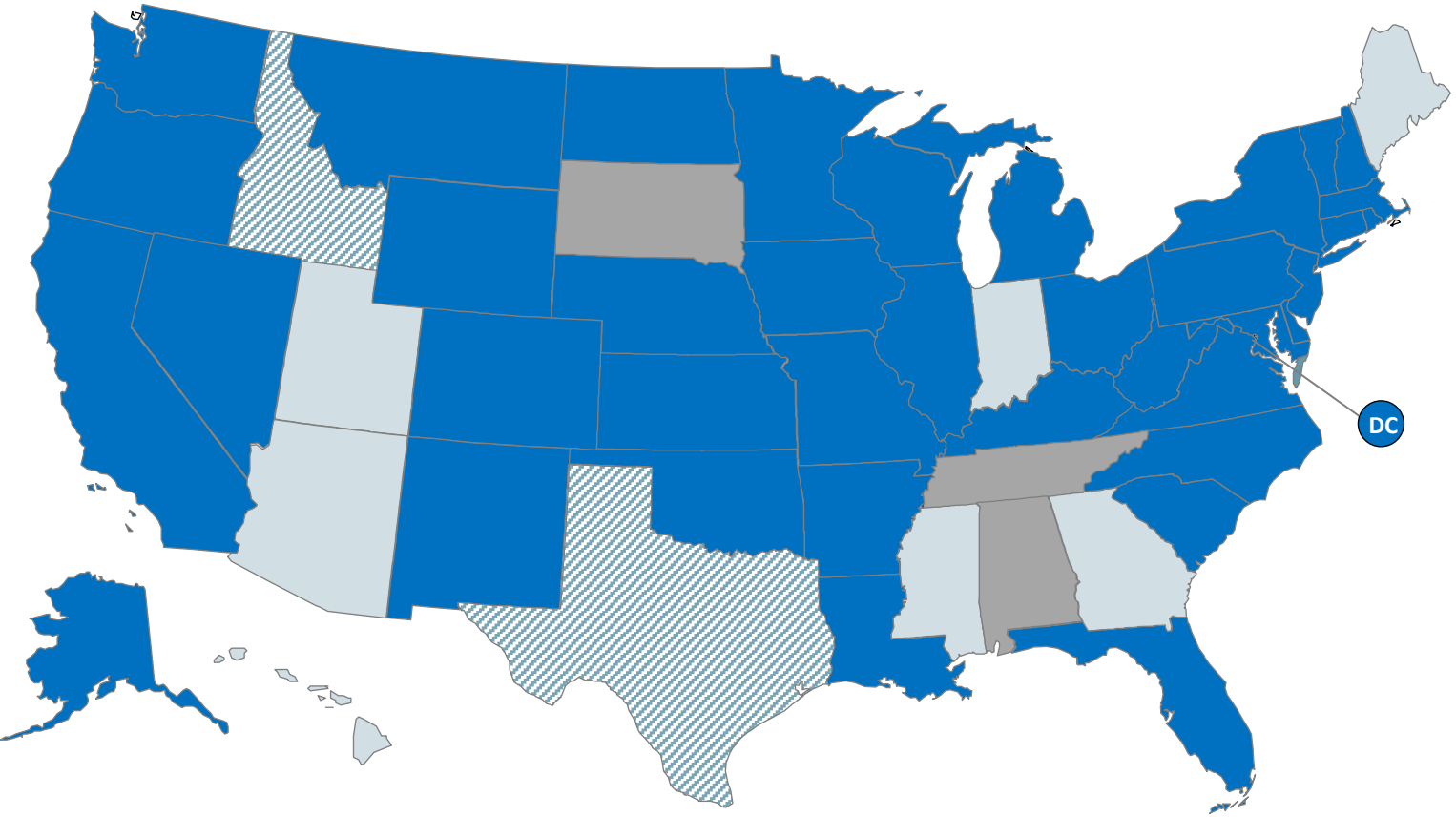
How New Mexico compares

- New Mexico has the **2nd highest solar resource** (6.45 kWh/m2/day) in the US behind Arizona[1]
- NM solar resource is **50% higher than** in New York or Michigan (4.3 kWh/m2/day)



[1]https://www.nrel.gov/gis/data-solar.html

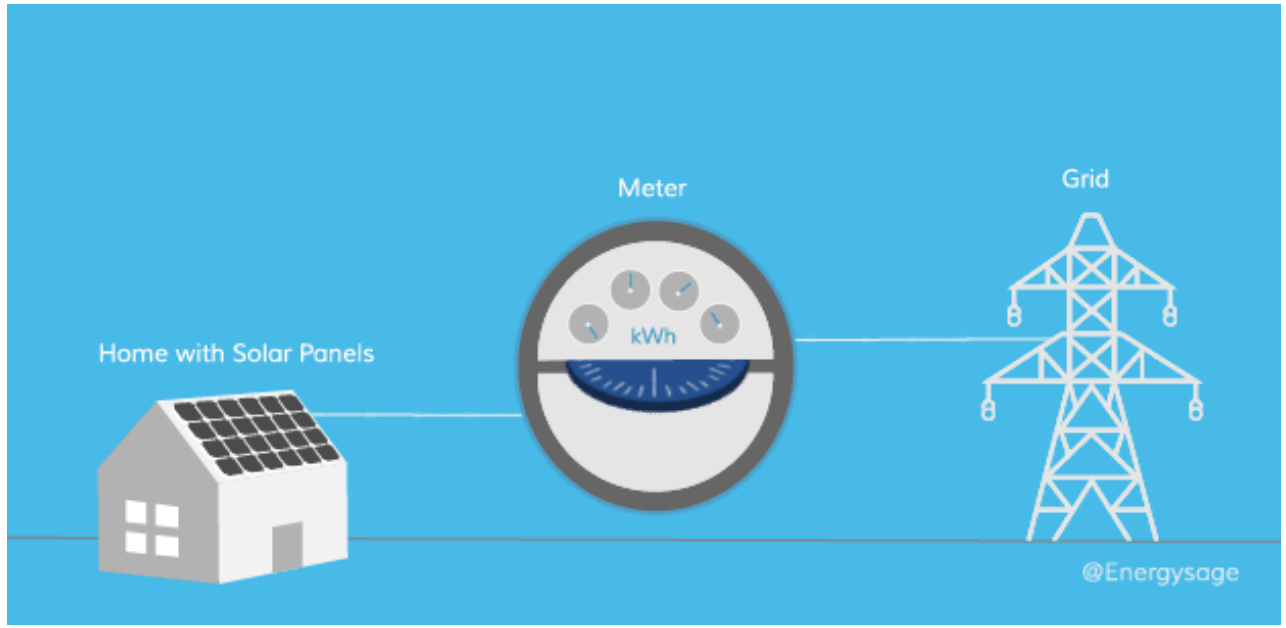
Net metering laws allow for excess solar generation to be credited to the system owner's account at the retail rate



- State-developed mandatory rules for certain utilities (38 states + DC)
- No statewide mandatory rules, but some utilities allow net metering (2 states)
- Statewide distributed generation compensation rules other than net metering (7 states)
- No statewide distributed generation compensation rules (3 states)

Source: www.dsireusa.org, November 2017.

Net Metering in New Mexico



- Net metering rules are developed by New Mexico Public Regulation Commission (**NMPRC**)
- Apply to both IOUs and electric cooperatives
- Individual **system cap at 80MW** (but different compensation for systems sizes)
- **Aggregated net metering not enacted**
- There is currently **no statewide or program cap**

10kW or less:

- **Excess kWh** credited towards customers next bill (at their full retail rate) or customer can choose to get payout at avoided cost.
- Eligible for ”Simplified Process”

10kW to 80MW:

- Customers receive **credit on their bill at the utility’s avoided cost rate**. If customers leave utility they are paid out at avoided cost.
- Up to 2MW eligible for “Fast Track”, larger require full study

Energy sage
https://www.pnm.com/solar

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SOLAR ENERGY TECHNOLOGIES OFFICE

Day 1: Residential Solar and Soft Costs

Michele Boyd, Senior Advisor (contractor)

Solar Energy Technologies Office

WHAT WE DO

The Solar Energy Technologies Office funds early-stage research and development in three technology areas: photovoltaics, concentrating solar power, and systems integration with the goal of improving the **affordability**, **reliability**, and **performance** of solar technologies on the grid.

HOW WE DO IT

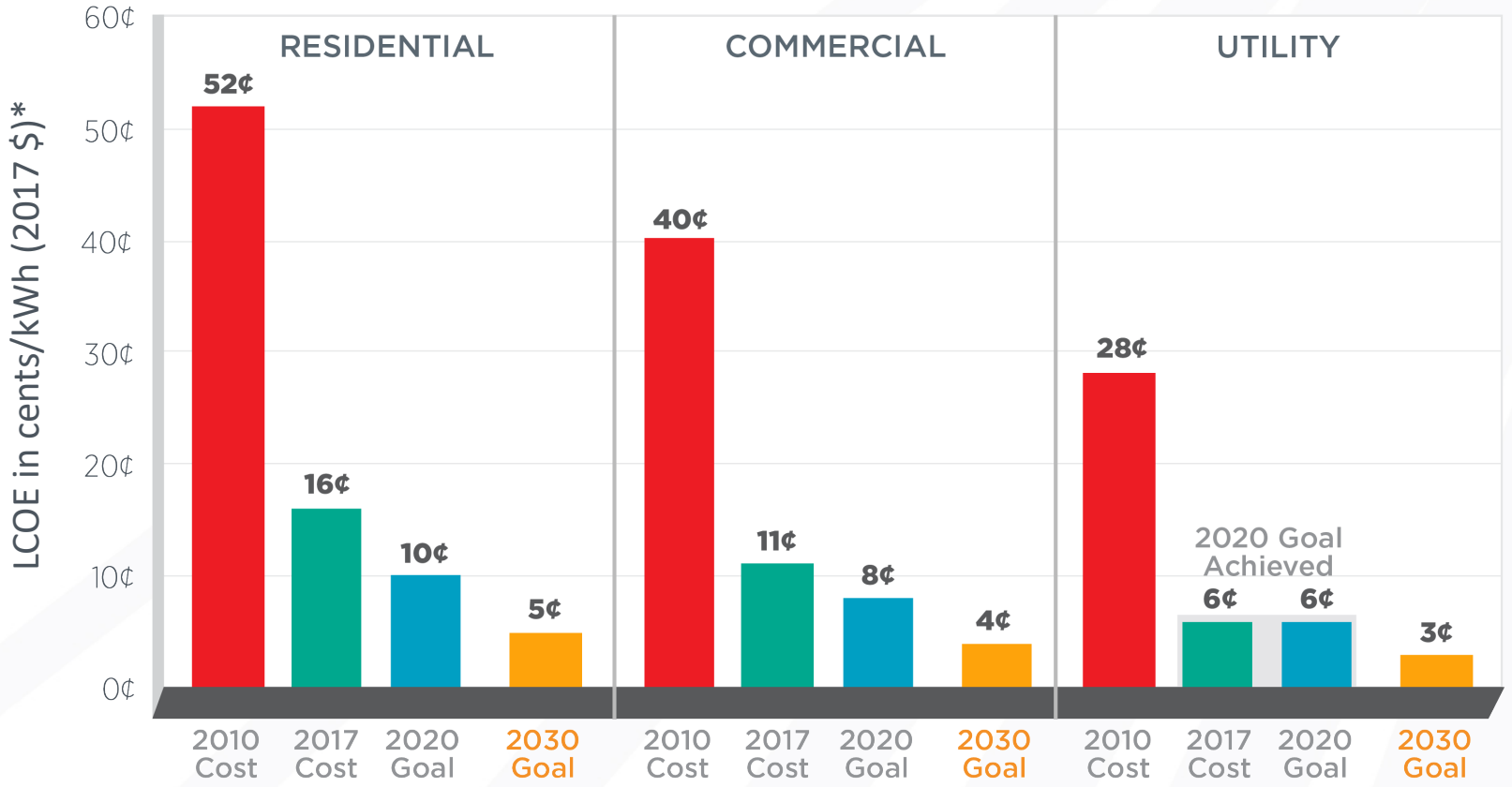
Cutting-edge **technology development** that drives U.S leadership and supports a growing and skilled workforce.

Research and development to **address integration of solar** to the nation's electricity grid.

Relevant and objective technical information on solar technologies to stakeholders and decision-makers.

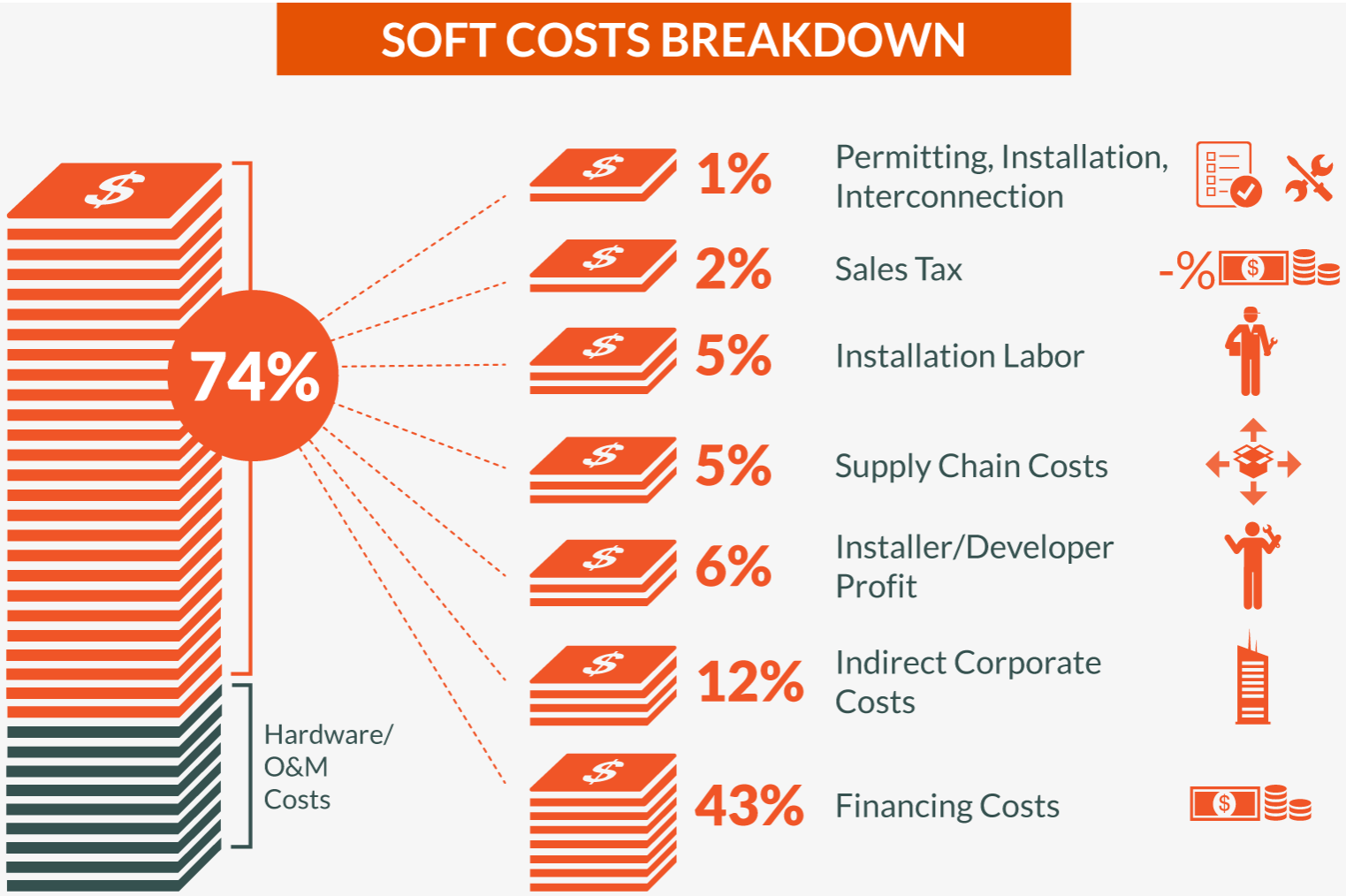
Progress and Goals: 2030 Photovoltaics Goals

The office invests in innovative research efforts that securely integrate more solar energy into the grid, enhance the use and storage of solar energy, and lower solar electricity costs.



*Levelized cost of electricity (LCOE) progress and targets are calculated based on average U.S. climate and without the ITC or state/local incentives. The residential and commercial goals have been adjusted for inflation from 2010-17.

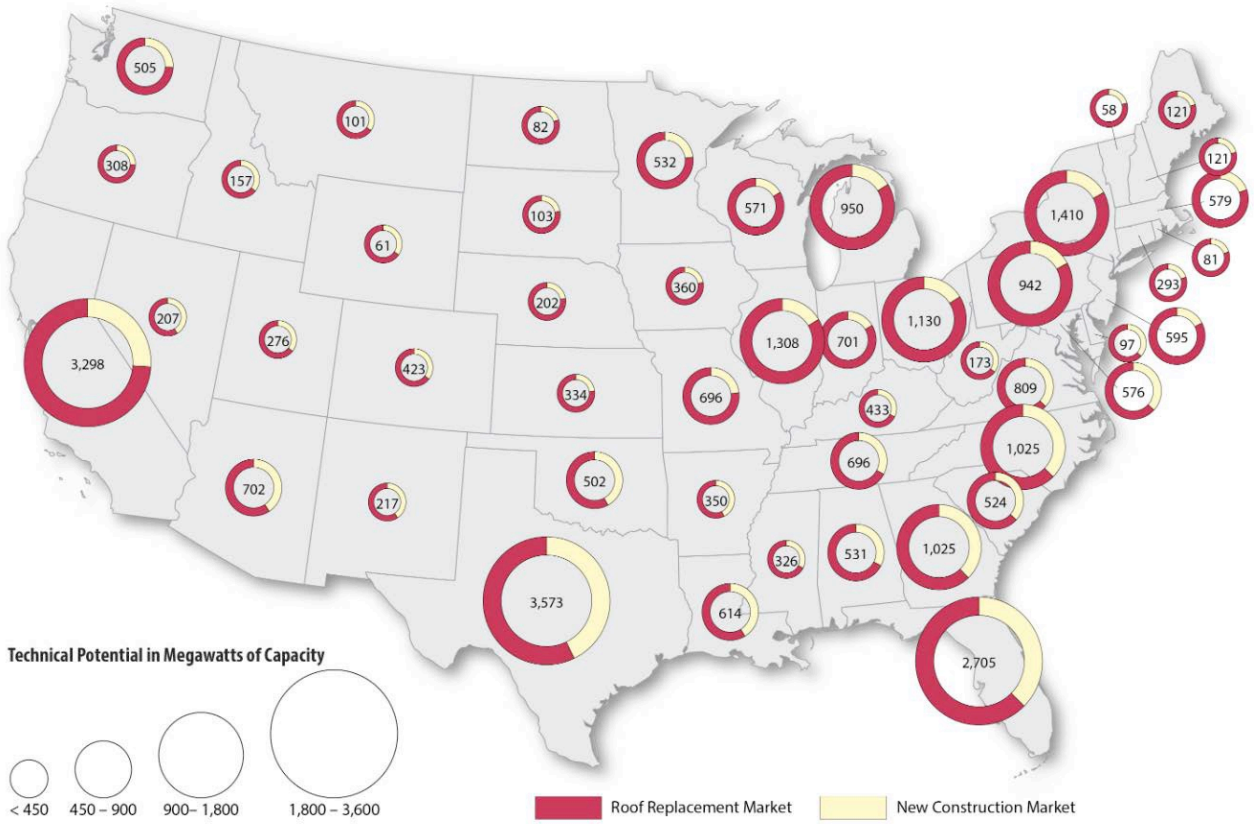
Soft Costs of Residential Solar



Source: Fu et al. "U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018."

Cost-Reduction Roadmap for Residential Solar PV (2017-2030)

- Achieving DOE's 2030 levelized cost of energy (LCOE) targets for residential PV (5¢/kWh) will require cost reduction beyond business-as-usual
- NREL found two key market segments have significant opportunities for cost savings and market growth:
  - Installing PV at the time of roof replacement,
  - Installing PV as part of new home construction.
- Between 2017 and 2030, an average of 3.3 million homes/year will be built or require roof replacement (~30 GW/year).
- NM potential residential PV market through roof replacement and new build is 217 MW/year



NREL, *Cost-Reduction Roadmap for Residential Solar Photovoltaics (PV), 2017–2030*, January 2018

SolSmart

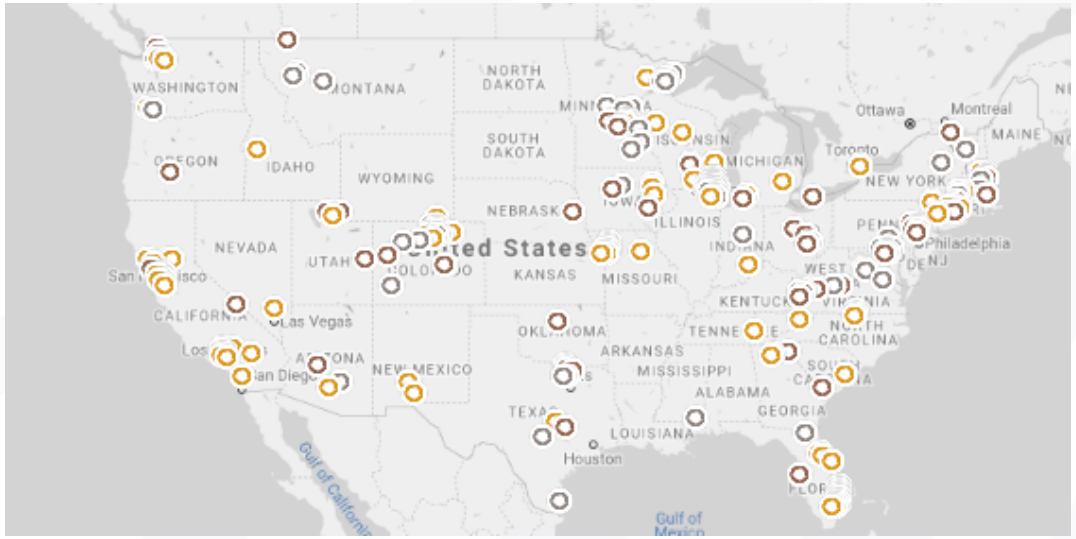
SOLSMART
NATIONALLY DISTINGUISHED. LOCALLY POWERED.

SolSmart is a five-year national recognition and technical assistance program for local governments

- Cities and counties can apply for national recognition for their efforts to streamline processes and make it easier for residents and businesses to go solar in their community.

Designation

- SolSmart uses objective criteria to designate communities that have successfully met these goals.
- **Over 275 cities and counties** have received designations of SolSmart Gold, Silver, and Bronze, including **Las Cruces, NM (Gold)**



Technical Assistance

- Program participants are eligible for **technical assistance** from a team of national experts to help achieve the SolSmart designation.
- A select number of communities also have the opportunity to host **SolSmart Advisors**, who provide on-the-ground support for up to 6 months for communities striving to become SolSmart.

SolSmart is led by: The SOLAR FOUNDATION™ | ICMA INTERNATIONAL CITY/COUNTY MANAGEMENT ASSOCIATION

U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY
SOLAR ENERGY TECHNOLOGIES OFFICE

SolSmart Criteria

- SolSmart uses objective criteria to measure local government progress toward creating a solar-friendly community.
- These criteria span eight solar-specific categories:
  - Permitting
  - Planning, Zoning, & Development Regulations
  - Inspection
  - Construction Codes
  - Solar Rights
  - Community Engagement
  - Utility Engagement, and
  - Market Development & Finance

Bronze	Silver	Gold
1. Provide solar statement outlining solar goals 2. Fulfill the two required actions in the two foundational categories: a. Permitting b. Planning, zoning, and development 3. Earn 20 points in the two foundational categories 4. Earn 20 points from actions across six special focus categories (inspection, construction codes, solar rights, utility engagement, community engagement, market development and finance)	1. Fulfill the requirements to become a SolSmart Bronze community 2. Complete two Silver required actions in the planning, zoning, and development regulations and inspection categories 3. Earn 100 points overall from actions taken in any combination of categories	1. Fulfill the requirements to become a SolSmart Silver community 2. Complete two Gold required actions in the permitting and the planning, zoning, and development regulations categories 3. Earn 200 points overall from actions taken in any combination of categories 4. Communities that earn 60% of the points in a given category are eligible for special recognition

- For more information about the program: www.solsmart.org

Solar Energy Innovation Network

SOLAR ENERGY INNOVATION NETWORK
U.S. DEPARTMENT OF ENERGY

The Solar Energy Innovation Network is a collaborative research program that supports multi-stakeholder teams to research and share solutions to real-world challenges associated with solar energy adoption.

APPROACH

- Teams identify local, tribal, and regional challenges, and receive technical and financial assistance to formulate and test innovations, and validate new models
- Teams meet in person for several multiday work sessions to further refine solutions and learn from other teams
- Research and innovative solutions shared through peer network

OBJECTIVE

- Develop innovative solutions that make solar energy adoption easier and enable stakeholders across the United States facing similar challenges to replicate them.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

BERKELEY LAB
Lawrence Berkeley National Laboratory

ROCKY MOUNTAIN INSTITUTE

See https://www.nrel.gov/solar/solar-energy-innovation-network.html for more information.

Innovation Network – Round 1

SOLAR ENERGY INNOVATION NETWORK
U.S. DEPARTMENT OF ENERGY

ROUND 1 TOPICS *(January 2018 – June 2019)*

- **Improving Reliability and Affordability of Solar Energy through Options Analysis and Systems Design**
  - Grid impacts and costs anticipated for various penetration levels of solar and other DERs
- **Improving Grid Flexibility and Resiliency through Advanced Siting and Operations of Solar + DER**
  - Value of combining solar and other DERs, such as storage, for grid flexibility, reliability, and resiliency

ACTIVITIES

- Identified solar potential on a city-wide scale to inform planning
- Modeled the economics of novel applications of PV, such as pairing it with electric vehicle charging at workplaces or with storage for peak demand reduction
- Produced a distribution system modeling tool to support distribution utility decisions by identifying the benefits and impacts of adding DERs to specific locations on the grid
- Worked with stakeholders to prioritize energy goals and design pilot projects that demonstrate novel, cost-effective solar and DER solutions
- Assessed the resiliency value of DERs and other value streams.

Products and tools from Round 1 will soon be available at
https://www.nrel.gov/solar/solar-energy-innovation-network.html

Innovation Network – Some Round 1 Teams

SOLAR ENERGY INNOVATION NETWORK
U.S. DEPARTMENT OF ENERGY

Orlando: Renewable and Resilient

- *Team Members:* City of Orlando, Orlando Utility Commission, UCF Florida Solar Energy Center, Greenlink
- Identified the total solar potential available city-wide and conducted more detailed analysis for municipal facilities and distribution grid modeling.
- Producing insights on municipal-level solar policies and building guidelines to share with other municipalities

Analysis of Distributed Solar Potential

- *Team Members*: City of San Diego, Clean Coalition
- Estimated the total potential for solar deployment across the city, designed a program proposal for utilizing the total solar potential, completed an economic analysis of solar options on municipal facilities, and conducted stakeholder workshops to explore solar compensation options.

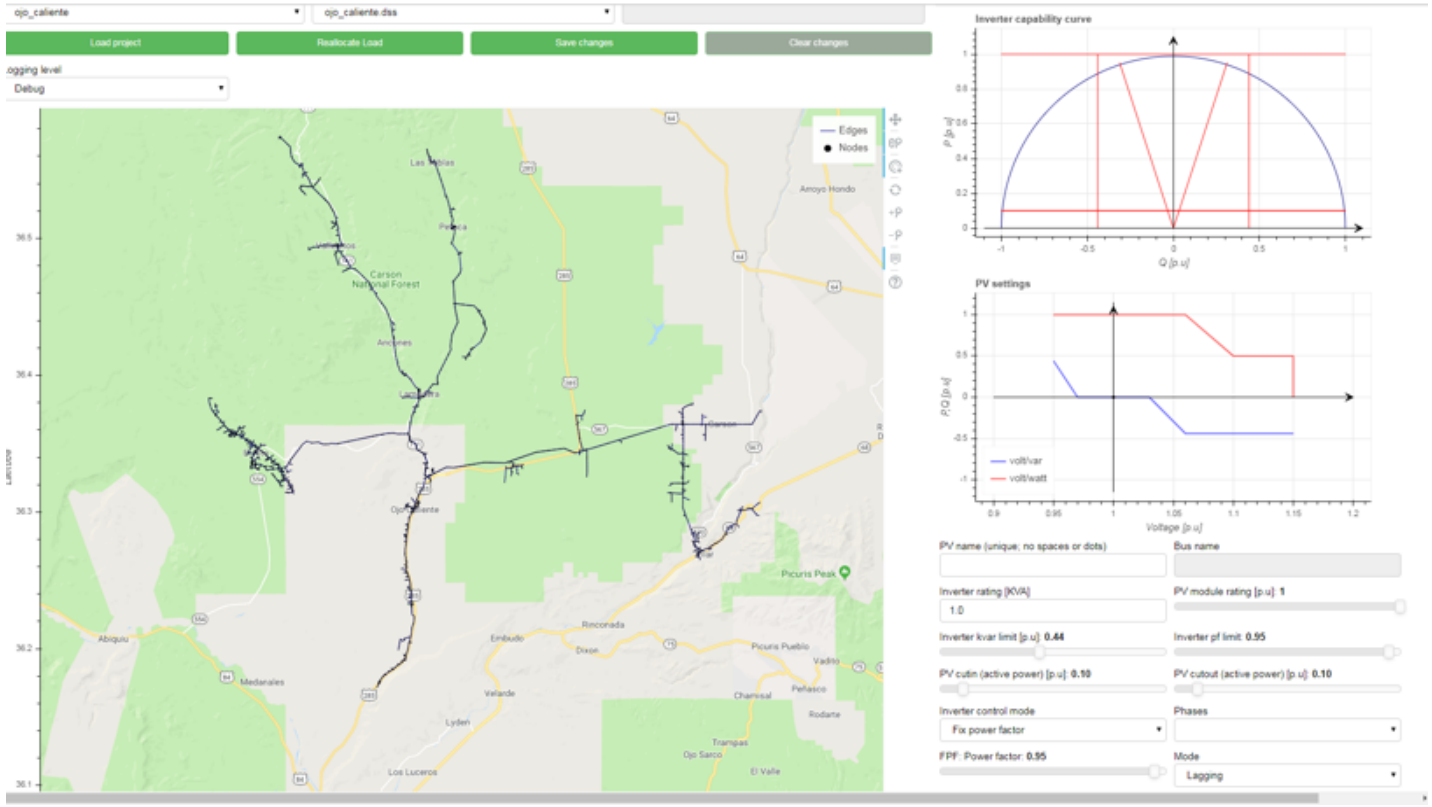
Renewable Energy Impacts and Solutions in Utah

- *Team Members*: Utah Clean Energy, City of Moab, Park City, Salt Lake City, Rocky Mountain Power
- Conducted scenario analysis to evaluate the potential of energy efficiency, solar, and storage to support city-level energy goals and complement utility-scale solar being planned by their utility.

Innovation Network – Kit Carson Electric Cooperative

SOLAR ENERGY INNOVATION NETWORK
U.S. DEPARTMENT OF ENERGY

- Distributed Energy on Distribution Grids Tool $(DG)^2$ was developed by NREL
- Open-source tool with a licensing agreement
- The primary audience are the 900 U.S. cooperatives and municipal energy utilities



Screenshot of the tool

$(DG)^2$ addresses core utility challenges:

- Strategic siting – Renewable Energy Zones
- Modeling the economic value DERs
- Conducting a base-case analysis and a system impact study
- Identifying lowest-cost grid infrastructure upgrades and/or cost-deferral opportunities
- Answering such technical questions as:
  - What system weaknesses do we have?
  - Does it meet our engineering standards?
  - Does it create a voltage/disturbance issue?
  - Does it require upgraded equipment?

Innovation Network - Round 2 Open Solicitation

SOLAR ENERGY INNOVATION NETWORK
U.S. DEPARTMENT OF ENERGY

ROUND 2 TOPICS

- **Solar in Rural Communities**
  - Proposals will support cooperative utilities, counties, tribes, and other rural community stakeholders by analyzing and testing the potential for solar PV to improve energy affordability and resilience in rural contexts.
  - Topic includes solar in combination with other technologies, such as storage, and in microgrids.
- **Commercial-Scale Solar**
  - Proposals will address barriers and how to reduce the costs of solar energy for the commercial-scale solar market, which includes commercial buildings (e.g., offices, warehouses, hospitals, hotels, retail stores, schools, or higher-education facilities) and multifamily residential buildings.
  - Topics on rooftop PV and community solar are eligible.

APPLICATION DEADLINE

- Stage 1 Proposals (Concept Papers) due no later than 4:00pm MDT on September 4, 2019

Learn more at www.nrel.gov/solar/solar-energy-innovation-network-round-2.html.

Agenda

- Setting context & why on-site solar
- Key considerations
- Reducing soft costs
- How to procure on-site solar

We will focus on the steps leading up to contract negotiation, which tend to follow a standard process

1

Gain Internal Alignment (3-9 Months)

- Identify and engage with key decision-makers and project stakeholders
- Provide learning opportunities and keep them informed during the evaluation phase

2

Evaluate On-Site Solar Opportunities (2-4 Months)

- Compile building inventory and identify solar feasibility using geospatial tools like Project Sunroof
- Complete techno-economic feasibility inputting energy usage and rates into tools like NREL's REopt Lite

3

Determine Ownership Structure & Financing (3-6 Months)

- Understand available ownership structures given state regulations and their associated risks
- Determine economic priorities, access to capital, and necessary funding for ownership

4

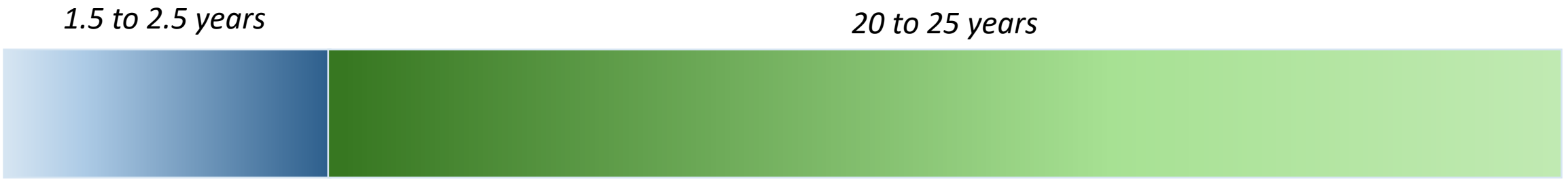
Conduct the RFP Process (3-5 Months)

- Develop and distribute an RFP and then evaluate proposals given an RFP evaluation decision matrix
- Negotiate and award a contract

Please take a picture of your booklet and email it to

AROTATORI@RMI.ORG

On-site solar projects can require significant upfront work but will normally generate benefits for a long time



Procurement Process

1. Gain Internal Alignment
2. Evaluate Solar Sites
3. Consider Ownership & Financing Structures
4. Conduct an RFP

There are several key stakeholders that you will need to align with to successfully complete a project

1	Elected officials
2	City Manager
3	**Finance**
4	**Facilities management**
5	**Legal and/or procurement department**
6	Sustainability advocates (internal and external)

Procurement Process

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There are three main locations for on-site solar

Potential Sites

Rooftops

- Aggregate buildings to realize scale
- Screen to identify highest potential roofs
- Determine accurate avoided costs and net metering rules

Parking Lots

- Typically cover ~20% of a city's surface[1]
- Higher upfront costs relative to rooftop PV but with additional benefits for drivers (e.g. shade, rain protection, EV-ready)

Ground Mounted

- Large PV arrays on city owned property such as
  - Landfills
  - Brownfields
  - Water treatment
- Identify local virtual net metering rules

[1] LBNL https://newscenter.lbl.gov/2012/09/13/parking-lot-science/

There are several important variables to consider when evaluating a site's techno-economic potential

There are several important variables to consider when evaluating a site's techno-economic potential

1. **Simple remote assessments to remove sites due to:**
   - Shading from trees, other buildings, power lines etc
   - HVAC or other equipment in the way
   - North facing roof or unfavorable tilt (if applicable)
2. **Calculate rough system size**
   - Review state and utility interconnection & net metering limits
   - Rough estimate is 75-100sq ft per kW

Tools for virtual roof assessments
- Google's Project Sunroof
- NREL's PVWatts

Project Sunroof: https://www.google.com/get/sunroof
NREL's PVWatts: https://pvwatts.nrel.gov/

There are several important variables to consider when evaluating a site's techno-economic potential

Techno-

1. Collect data on annual site electricity usage
2. Input historical annual data to NREL tools to refine the max project size (kW) and output (kWh)

-Economic

1. Use online or excel tools to evaluate potential project economics

Tools for techno-economic assessment:

- NREL's PVWatts
- NREL's System Advisor Model
- NREL's Reopt Lite

NREL's: PVWatts (https://pvwatts.nrel.gov/)
System Advisor Model (https://sam.nrel.gov/)
REopt Lite (https://reopt.nrel.gov/tool/)

There are several important variables to consider when evaluating a site's techno-economic potential

Unlike the first two steps, which can be completed by anyone remotely, you will likely need an engineer or solar contractor to do this analysis

In person site evaluation to:

- Complete structural and electrical evaluation
- Determine roof type, age, and weight bearing ability
- Locate interconnection points
- Outline any construction concerns or considerations
- Confirm shading and other equipment is not in the way of system design

Project Sunroof: https://www.google.com/get/sunroof

NREL's PVWatts: https://pvwatts.nrel.gov/

Procurement Process

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Each ownership structure has pros and cons

	Direct Ownership	Third Party Ownership	Energy Performance Contracting
Define	- The owner purchases the system outright and accepts all financial and operational responsibility and risks	- A third-party pays for the system; the energy user pays the third party either via a PPA (in ¢/kWh) or a lease payment	- An ESCO installs the project and is compensated by taking a cut of the total cost savings - Can be direct or TPO
Pros	- City's ability to raise low-cost municipal debt can lower financial costs - City will inherently own RECs - City can control design	- Low/no upfront cost - Less operational risk - Owner can take advantage of tax incentives	- Low/no upfront cost - Guaranteed energy savings / low risk - Can be combined with energy efficiency projects
Cons	- City must pay upfront costs - More operational risk - City cannot use tax incentives - Raising municipal debt may require voter approval	- May have lower long-term economic returns - May have restrictive clauses	- May have lower economic returns - Requires a robust measurement and verification process

Options to capture tax credits and lower-cost financing

Power Purchase Agreement	Tax-Exempt Municipal Bonds	Tax-Exempt Lease
Contractual form of third party ownership which allows the investors/owners of the solar project to directly capture federal and state tax incentives, including the Investment Tax Credit (ITC).	Cities are able to offer bonds for which the cash interest payments to debt providers are exempt from federal income tax; this exemption allows investors to offer interest rates that are lower than those for a corporate bond of similar credit rating.	This financing structure allows a public organization to pay for efficiency and renewables using its annual revenues. This option is an alternative to traditional debt financing and the lessor may claim a federal income tax exemption on the interest they receive from the customer allowing them to offer a lower rate.

Key considerations when developing an RFP

What to do before releasing an RFP	• Understand and describe financing preferences with rationale • Clarify evaluation criteria and whether you are open to the possibility of multiple awards • Align procurement processes with solar-related projects • Review RFP templates and examples from other municipal procurement efforts • Conduct training for evaluation team on criteria, likely submissions, and industry best practices
What to provide in the RFP	• A clear statement of project goals and scope with details and visuals • A clear description of the evaluation criteria • Detailed site information gathered during the evaluation phase • A realistic timeline for the RFP process, evaluation, contracting and construction • Submittal requirements that align with the project scope and financing preferences

Procurement Process

1. Gain Internal Alignment
2. Evaluate Solar Sites
3. Consider Ownership & Financing Structures
4. Conduct an RFP

Key steps to encourage industry awareness and participation

1. Provide a demonstration of serious interest from leaders within the local governments or tribes
2. Allow adequate time for developers to prepare submissions
3. Avoid burdensome submission requirements
4. Coordinate well-organized site visits
5. Send out a pre-notice before RFP release and conduct outreach through industry groups
6. Demonstrate willingness to consider creative solutions (that still meet RFP requirements)
7. Negotiate for equitable contract terms
8. Be consistent in communications and provide thoughtful responses to bidder questions

CHECK OUT