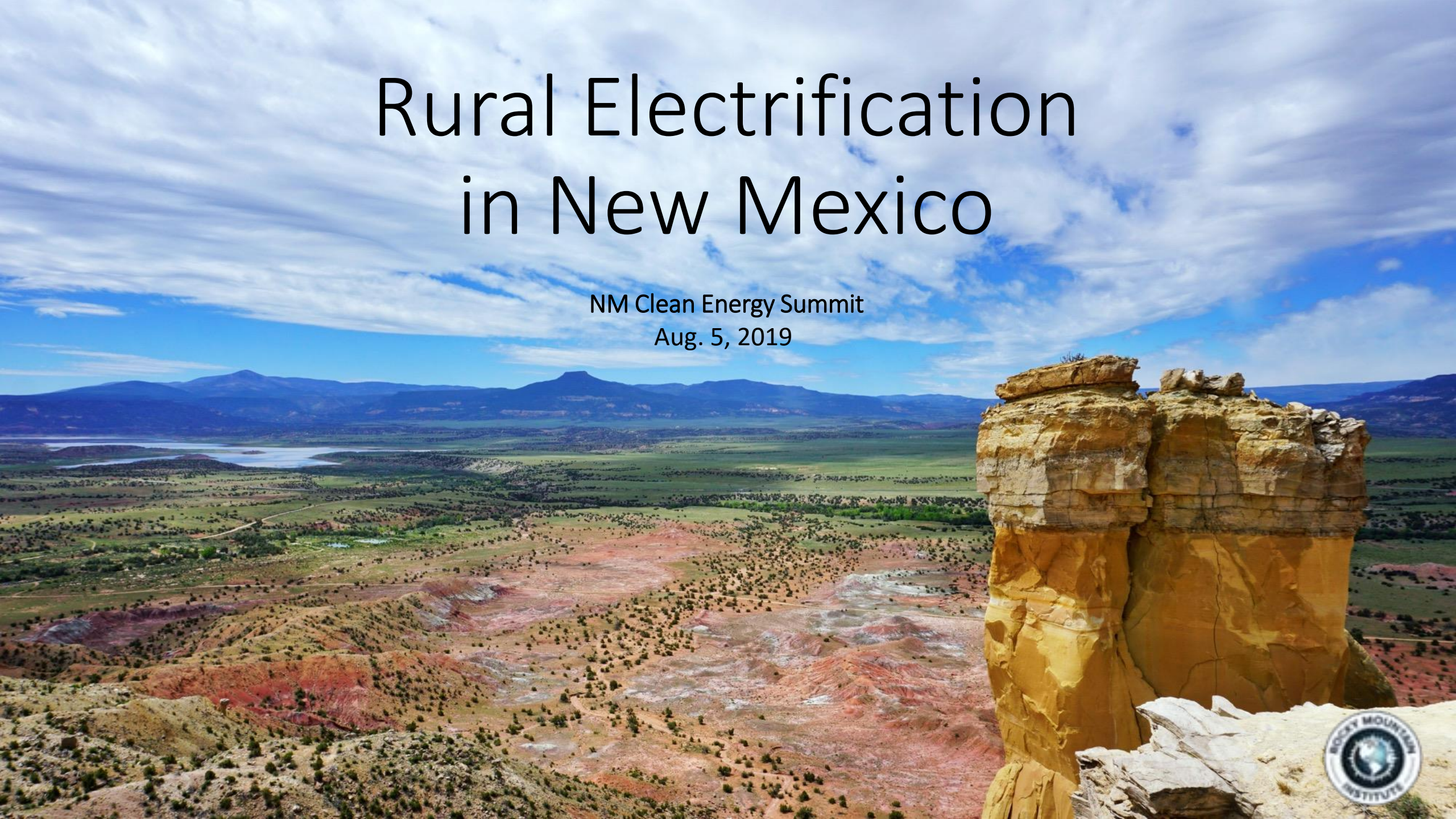
Rural Electrification in New Mexico

NM Clean Energy Summit
Aug. 5, 2019



Rural Electrification

A Case Study: Hyde Memorial State Park

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Hyde Memorial State Park

- 350-acre state park located on the scenic byway State Highway 475 that runs to the Santa Fe Ski Basin.

Hyde Memorial State Park

- 2018, Hyde Park's State owned powerline failed.
- The powerline is underground and over three miles long snaking under the highway.
- Park currently self-generating electricity with a diesel generator.

Hyde Memorial State Park

- The Energy, Minerals and Natural Resources Department (EMNRD) commissioned an microgrid study and an investment grade energy audit of Hyde Park's buildings and service facilities.
- The microgrid study determined the potential for developing a micro-grid system utilizing solar + storage for the Park's energy needs.

Hyde Memorial State Park

- The study found:
  - a micro-grid utilizing Solar + Storage and backup propane generation is a feasible option for the Park; and
  - the cost of constructing a fully redundant, off-grid, micro-grid system would be around $1.2 million or roughly $0.60 per kilowatt-hour (kWh) over 25 years, assuming zero interest and zero O&M costs.
  - less than earlier estimates for replacing the current underground powerline.

Hyde Memorial State Park

- The development of a such a micro-grid system was estimated to take three months for design and six months for construction.
- The project would include:
  - a 76.8 kW solar system;
  - 352 kWh of battery storage; and
  - a 100 kW backup power propane generator.

Questions

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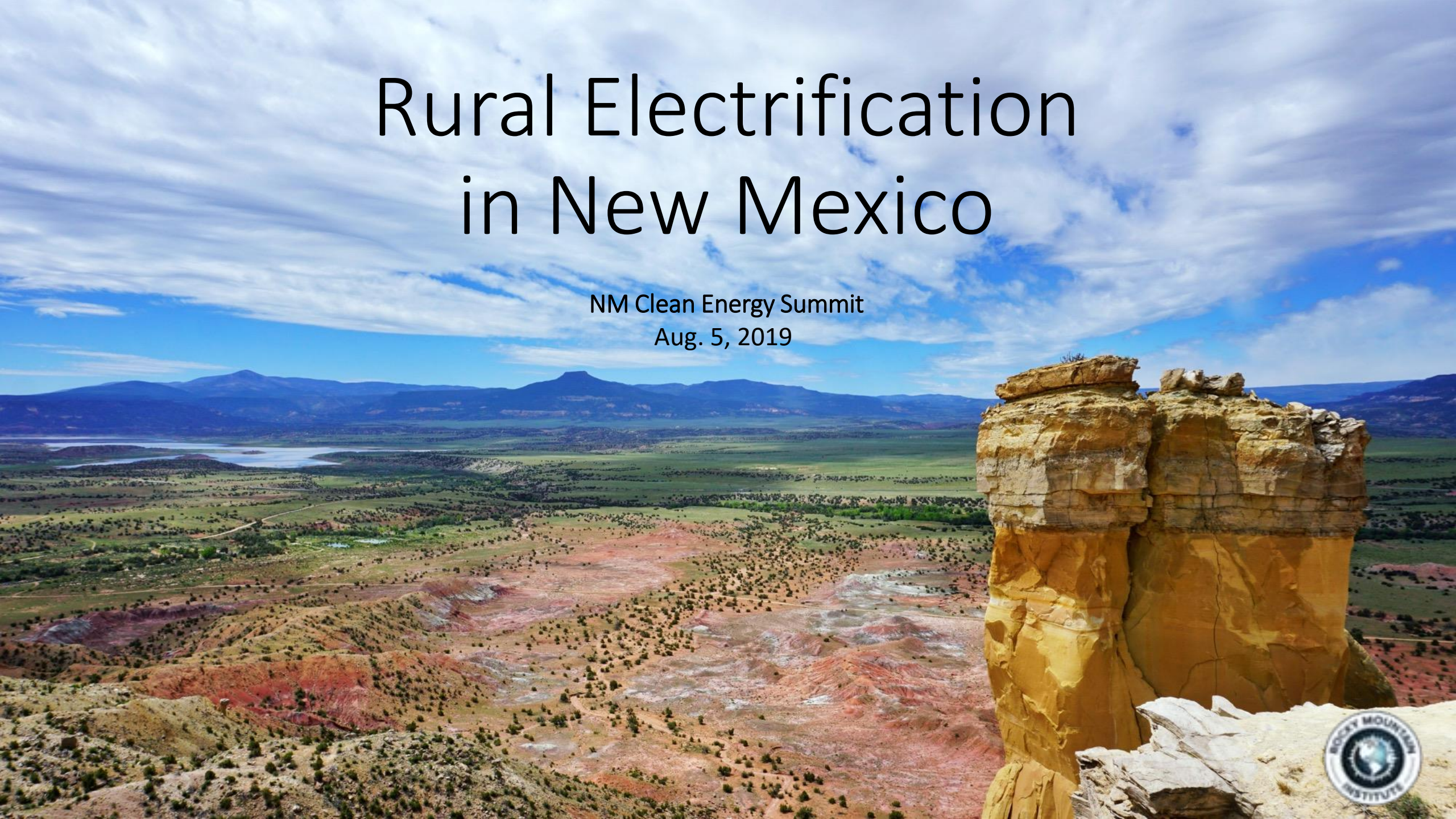

USDA United States Department of Agriculture

Rural Development

August 5, 2019

ENERGY SUMMIT

Larry McGraw, General Field Representative

Rural Utilities Service

RUS RENEWABLE ENERGY FINANCING

- THE RURAL ELECTRIFICATION ADMINISTRATION(REA) WAS ESTABLISHED ON MAY 11, 1935, WHEN PRESIDENT FRANKLIN D. ROOSEVELT SIGNED EXECUTIVE ORDER 7037.
- REA WAS GIVEN STATUTORY AUTHORITY BY THE RURAL ELECTRIFICATION ACT OF MAY 20, 1936.
- REA BECAME PART OF USDA ON JULY 1, 1939.
- REA BECAME THE RURAL UTILITIES SERVICE ON OCTOBER 20, 1994, PURSUANT TO THE AGRICULTURE REORGANIZATION OF 1994.

RUS RENEWABLE ENERGY FINANCING

- RUS MAKES LOANS TO CORPORATIONS, STATES, TERRITORIES AND SUBDIVISIONS AND AGENCIES THEREOF, MUNICIPALITIES, PEOPLE'S UTILITY DISTRICTS AND COOPERATIVE, NON-PROFIT, LIMITED DIVIDEND, OR MUTUAL ASSOCIATIONS.

RUS RENEWABLE ENERGY FINANCING

- RUS LOAN GUARANTEE WITH FUNDS FROM THE FEDERAL FINANCING BANK(FFB).
- AMORTIZATION PERIOD BASED ON USEFUL LIFE OF ASSET.
- PV USEFUL LIFE IS DETERMINED TO BE 25 YEARS.
- INTEREST RATE CHANGES DAILY UNTIL LOAN FUNDS ARE ADVANCED.
- CURRENT INTEREST RATE IS 2.34% PLUS 1/8 TH OF 1.0% FOR RUS PROCESSING FOR A 25-YEAR INTEREST RATE TERM.
- THE INTEREST RATE FOR THE 90-DAY INTEREST RATE TERM IS 2.10%.

RUS RENEWABLE ENERGY FINANCING

- PROJECT MUST BE COMMERCIAL TECHNOLOGY. RUS WILL NEED TECHNICAL INFORMATION ON TECHNOLOGY AND OPERATING HISTORY TO BE REVIEWED BY THE ENGINEERING STAFF.
- PROJECT MUST SATISFY ENVIRONMENTAL REQUIREMENTS OF 7 CFR 1970 PRIOR TO START OF CONSTRUCTION.
- ADVANCE OF LOAN FUNDS AFTER PROJECT IS CONSTRUCTED AND OPERATING ADEQUATELY.

RUS RENEWABLE ENERGY FINANCING

- RUS APPROVED A LOAN TO THE NAVAJO TRIBAL UTILITY AUTHORITY TO PROVIDE 350 PV UNITS OF 640 WATTS EACH IN 2001 TO PROVIDE ELECTRIC SERVICE TO CUSTOMERS WHO ARE LONG DISTANCES FROM THE GRID.
- THE COST TO THE CUSTOMER WAS $95 PER MONTH.
- MOST CUSTOMERS ARE ABLE TO HAVE A REFRIGERATOR AND SOME LIGHTING.

RUS RENEWABLE ENERGY FINANCING

- RUS APPROVED A LOAN TO THE NAVAJO TRIBAL UTILITY AUTHORITY GENERATION FOR THE KAYENTA PHASE 1 AND 2 SOLAR FARM IN 2019 WITH THE ENERGY PURCHASED BY THE NAVAJO TRIBAL UTILITY AUTHORITY WITH A PURCHASED POWER AGREEMENT. EACH PHASE IS APPROXIMATELY 27.3 MW.
- RUS DID NOT PROVIDE THE CONSTRUCTION LOAN, BUT PROVIDED THE LOAN TO PAY OFF THE CONSTRUCTION LOAN. NAVAJO TRIAL UTILITY AUTHORITY GENERATION HAD TO PROVIDE 25 PERCENT EQUITY IN THE PROJECT, WHICH IS OUR STANDARD EQUITY REQUIREMENT.

RUS RENEWABLE ENERGY FINANCING

- RUS APPROVED A LOAN TO AN LLC FOR A 1.2 MW SOLAR FARM IN EAGLE NEST, NM, WITH THE OUTPUT BEING PURCHASED BY KIT CARSON ELECTRIC COOPERATIVE THROUGH A PURCHASED POWER AGREEMENT.
- THAT LLC IS PLANNING TO SUBMIT THREE ADDITIONAL LOAN APPLICATIONS IN WHICH THE OUTPUT WILL BE PURCHASED BY KIT CARSON ELECTRIC COOPERATIVE.
- THE LLC AND OTHERS ARE REQUIRED TO PROVIDE 25% EQUITY IN EACH PROJECT AND SECURE NON-RUS CONSTRUCTION FINANCING.

RUS RENEWABLE ENERGY FINANCING

- PLEASE LET ME KNOW IF WE CAN HELP YOU OBTAIN ELECTRIC SERVICE.

USDA United States Department of Agriculture

Rural Development

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USDA Rural Development is committed to the future of rural communities.

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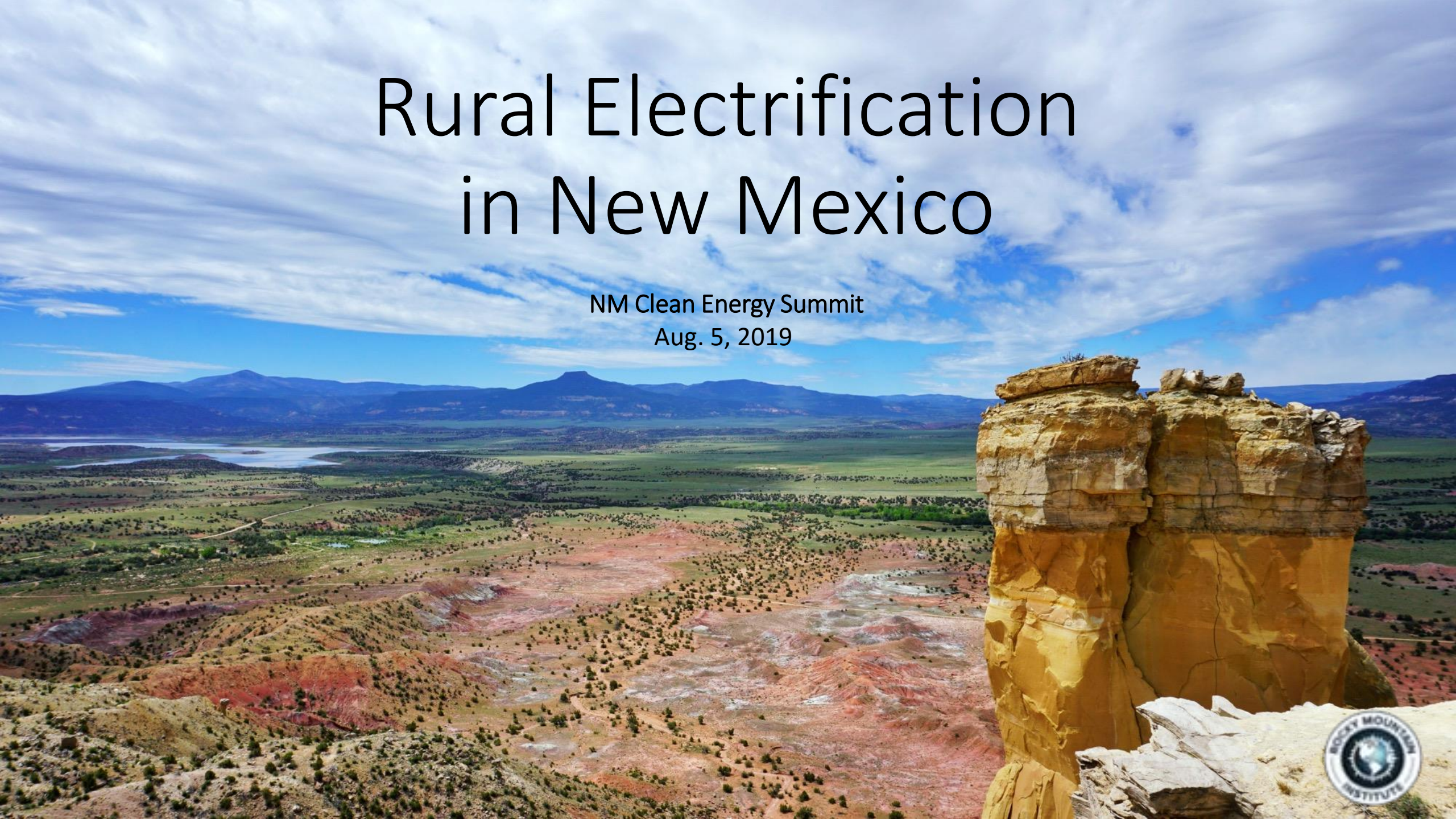
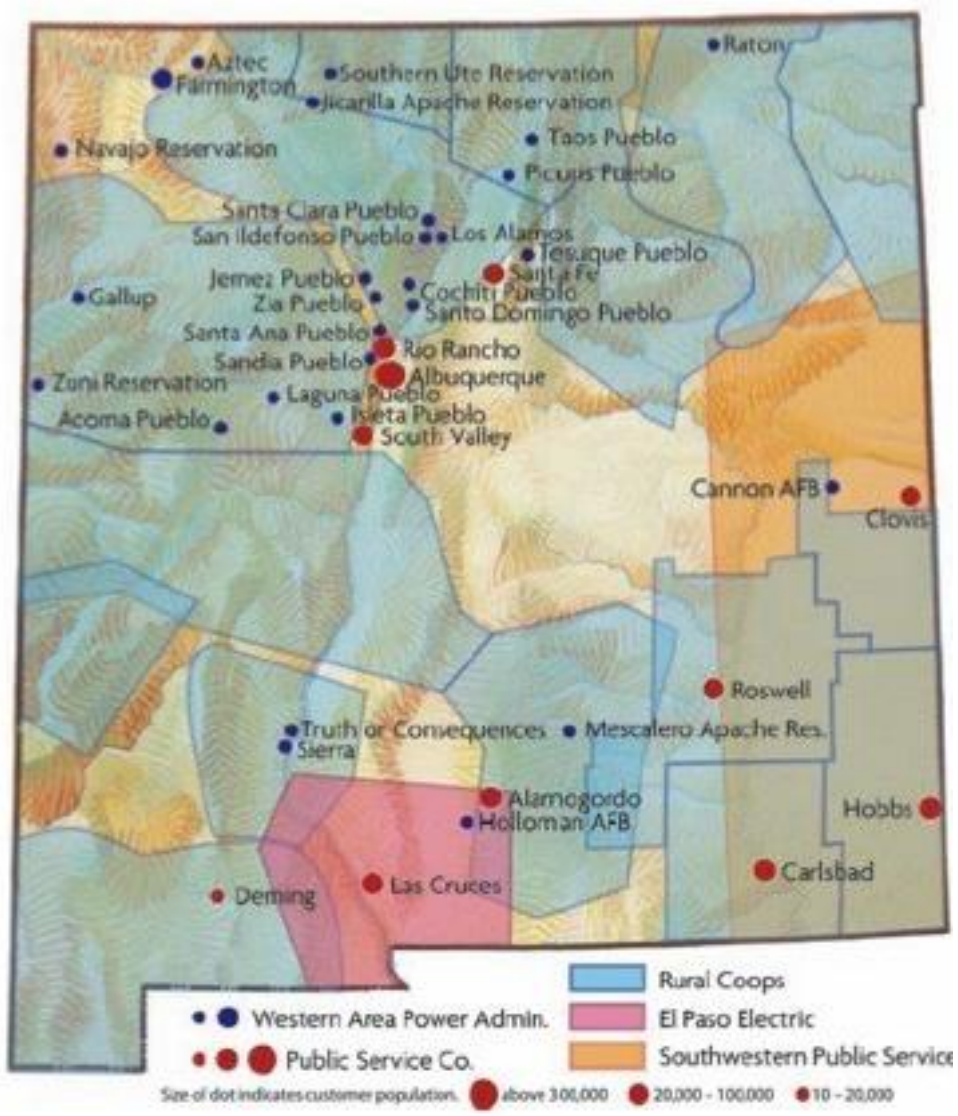


Opportunities and key considerations—off-grid electrification in rural New Mexico

- Context
- Exploring off-grid options
- On vs. off-grid
- Building energy solutions
- Barriers to rural electrification
- Key questions



New Mexico's energy transition has unique implications for rural areas

- **Retiring coal plants** (Navajo, San Juan) will have large impact on rural economies, livelihoods
- 100% clean electricity goal passed this spring
- Declining cost of solar PV and storage: ~80% over 10y[1]
- Solar PV can provide **off-grid electricity access**
- Off-grid solar PV now serving 133M people globally[1]

[1] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Off-grid_RE_Access_2019.pdf

Rural New Mexico faces energy access, reliability, and poverty challenges

- 15,000 households on Navajo Nation lack electricity access[2]
- Grid reliability issues for some tribes and rural areas
- Many Navajo households located near the grid can't afford service
- Avg. energy burden for LMI households in NM is 15.2% (higher than national avg.)[3]

[2] https://www.publicpower.org/LightUpNavajo
[3] https://maps.nrel.gov/solar-for-all/

Grid extension and off-grid systems are helping to fill the electrification gap

- **Light Up Navajo** goal of connecting 300 homes to the grid this summer, but grid extension can be expensive (~$35k/mile)[4]
- NTUA rents **off-grid solar PV** systems to unelectrified households (~$85/month) [5]
- **Nonprofits** (GRID Alternatives, Native Renewables, Tewa Energy Services) offer solar PV home installs, trainings for local O&M providers
- EMNRD "PV on a Pole" LMI initiative
- Household needs vary: some prefer grid connection or choose not to connect

Photo Credit: GRID Alternatives

[4] https://www.azcentral.com/story/news/local/arizona/2019/05/22/arizona-light-up-navajo-project-tribal-utility-authority-srp-brings-electricity-reservation-homes/3741873002/
[5] http://www.ntua.com/renewable-energy.html

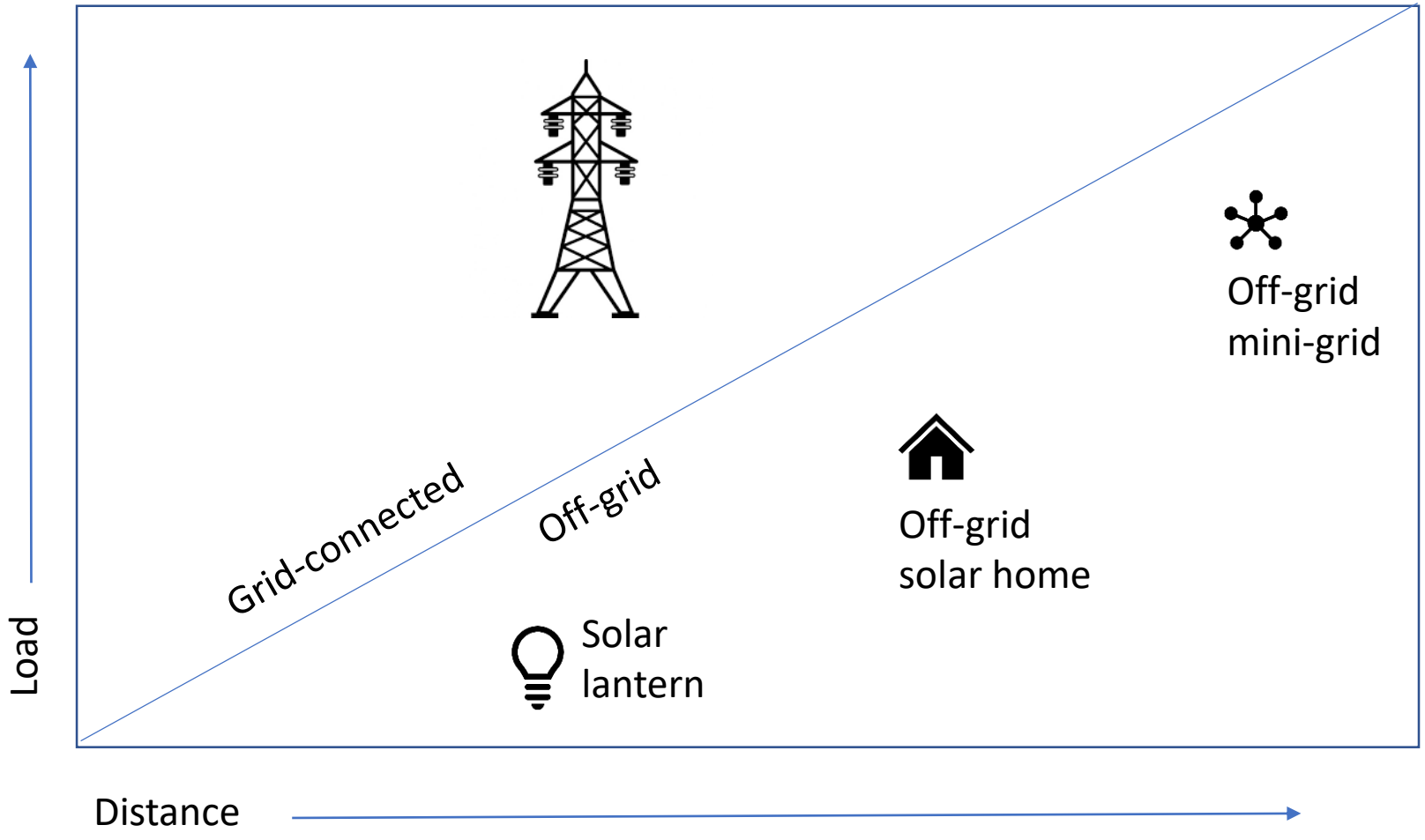
DERs and community solar can provide resiliency and affordability to rural systems

- First-of-its kind Picuris Pueblo 1-MW community solar project allowed the tribe to lower members' energy bills
- Local generation can improve reliability
- Funded by DOE Office of Indian Energy grant

Photo credit: Picuris Pueblo presentation to DOE

Distance from grid and load size are key determinants of electricity solutions

- Off-grid becomes more attractive as distance to the grid increases
- Productized/ standalone kits a good fit for smaller loads (?)



Off-grid systems offer an array of solutions for rural electricity access…

Productized **solar home solutions**

- Low-cost and easy to install
- Fast deployment, reconfigurable
- Low-maintenance
- Typically for smaller loads/service

Off-grid solar PV

- Customizable
- Larger systems
- More expensive equipment and more labor-intensive to install
- Battery is major cost driver
- Proper maintenance is critical

… and electricity reliability

Microgrids

- Best suited for larger, clustered loads
- Usually centralized generation
- Often include generators for backup
- Operation is more complex
- Need larger loads to justify higher cost

Generators

- Low upfront cost
- Expensive to run
- Require refueling (variable fuel costs)
- Noisy, polluting

Choosing the right system depends on 4 key criteria

Option	Service Provided	Cost	Speed of deployment	Risks
Productized Solar Home Solution (0.5–1kW)	• Smaller loads • Weather dependent	Upfront: $500–1250 PAYG: $50–100/month Cost per kWh: High	Fast	Unreliable level of service
Off-grid Solar (2kW)	• Customizable to reliably meet load • Weather dependent (w/out storage)	Upfront: $5,000–10,000+ Cost per kWh: $0.10–0.30	Medium	Maintenance
Microgrids (~50kW)	• Serve larger loads • Backup generator	Upfront: $5–10k/house Cost per kWh: $0.25–0.60	Medium	Maintenance
Generators	• Reliable, but need refueling	Upfront: $500–1000 Cost per kWh: $0.20–0.40	Fast	Variable fuel costs, noisy and polluting
Grid	• Reliable service (?) regardless of load/weather	Grid extension: $35–55k/mi Connection fee: $40k/home Cost per kWh: $0.09	Slow	Could be waiting years for interconnection

Addressing non-technology barriers is critical for success

MAINTENANCE

UPFRONT **COST**

REGULATORY ARCHITECTURE

COMPLEX STAKEHOLDER RELATIONSHIPS

Barrier: Maintenance

- Off-grid systems require regular maintenance by trained professional, once or twice a year
- Lack of maintenance can destroy equipment, Pb-acid batteries in particular

Possible solutions: Technology & Workforce Fixes

- New battery tech and productized solutions are reducing maintenance needs
- Maintenance/service agreement can be included in the contract from the start
- Installation and maintenance needs are a workforce development opportunity for rural communities

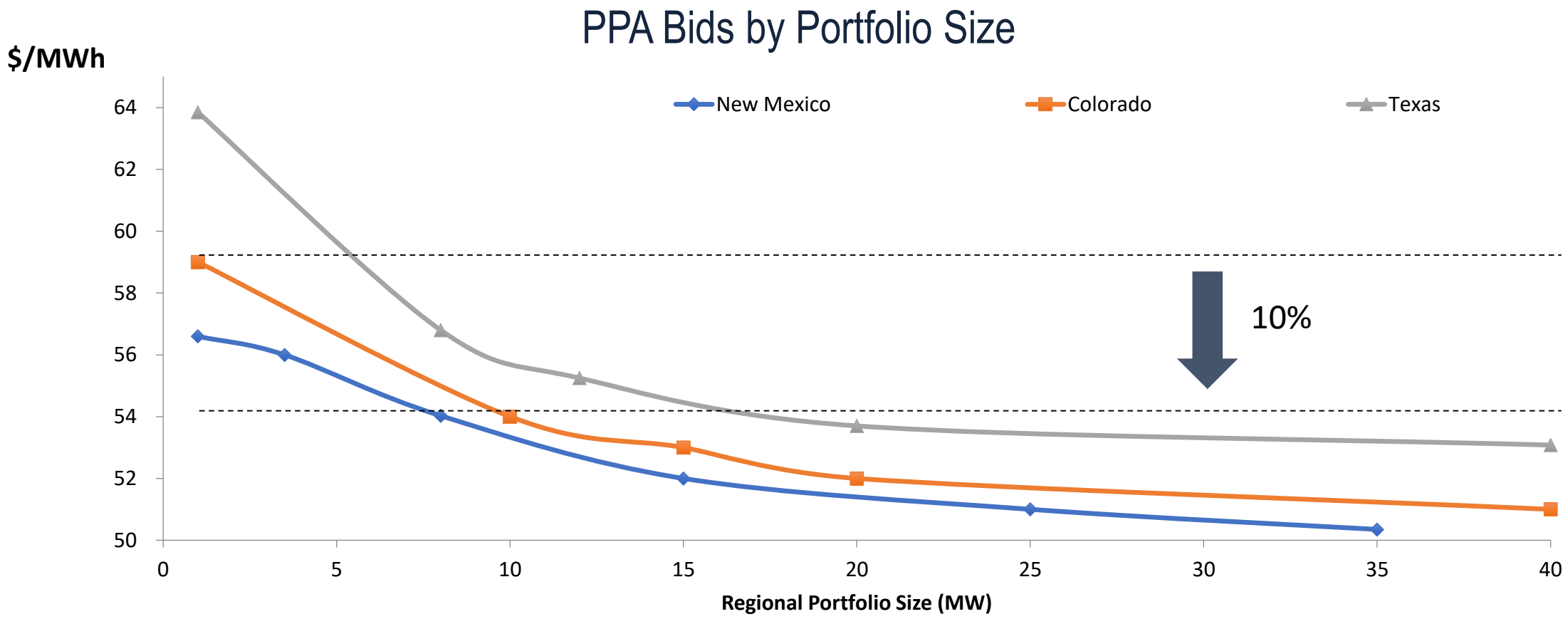
Barrier: Upfront Costs

- Solar PV trades upfront cost for future savings
- Lack of access to capital/financing at multiple scales (homeowner, local installer, co-op, etc.)

Possible Solutions: Public & Private Funding Options

- Subsidies and grants
  - NM 2019 Capital Outlay fund increased state funds available for public infrastructure projects
  - DOE Office of Indian Energy funds small projects
- Innovative business models/financing (PAYG, leasing)
- Cost reduction with aggregated demand, optimized system design, and competitive procurement

Project aggregation and scale reduces costs



Barrier: Regulatory Architecture

- Rural electrification policies historically left gaps on tribal lands
- Lack of tailored policies to support full range of distributed energy resource (DER) solutions
- Off-grid offers from the utility are uncommon/only recently available. Cost can be reduced while scaling up.

Possible Solutions: New Policy Opportunities

- New Mexico Energy Transition Act provides policy direction and includes tribal engagement
- Opportunity for future policies to incent small-scale projects that serve rural areas
- Some policy/regulation needs to be adjusted/clarified for off-grid

Barrier: Complex Stakeholder Relationships

- Solutions requires coordinated effort between governments, regulators, utility, private sector, customers, and funders
- Hard-to-navigate landscape of funders and application processes

Possible Solutions: Find Common Ground Projects

- Understand local needs and how they vary geographically
- Work with community or trusted groups to implement electrification solutions
- Stakeholder alignment is a primary goal of this workshop

Emerging ideas

Based on recent interviews and previous RMI experience in NM and elsewhere:

- Off-grid is an attractive option for some major subset of customers without electricity today—i.e., much cheaper than grid extension, competitive with generator, and can be deployed rapidly
- Standard productized system saves money and allows fast deployment, but larger ~2–3kW scale, plug-and-play with main panel
- Monthly payment including service can overcome upfront cost and maintenance challenges while creating local jobs
- Bulk purchasing/aggregated demand with best-practice competitive procurement can reduce cost along with subsidies
- Program with alignment between tribal government, customers, utilities, and regulators should be attractive and interesting for funders, senator's office, etc.

Key questions for discussion

- Where does off-grid make sense vs. grid extension?
- What price and level of service is required by customer?
- How can programs be designed to address maintenance, upfront cost, and funding challenges?
- How do we align diverse stakeholders for success?
- How do we also meet goals for economic development, cultural preservation, environmental protection, and sovereignty?