Pacific Northwest
NATIONAL LABORATORY

Storage as Transmission: NM Policy and Regulatory Issues

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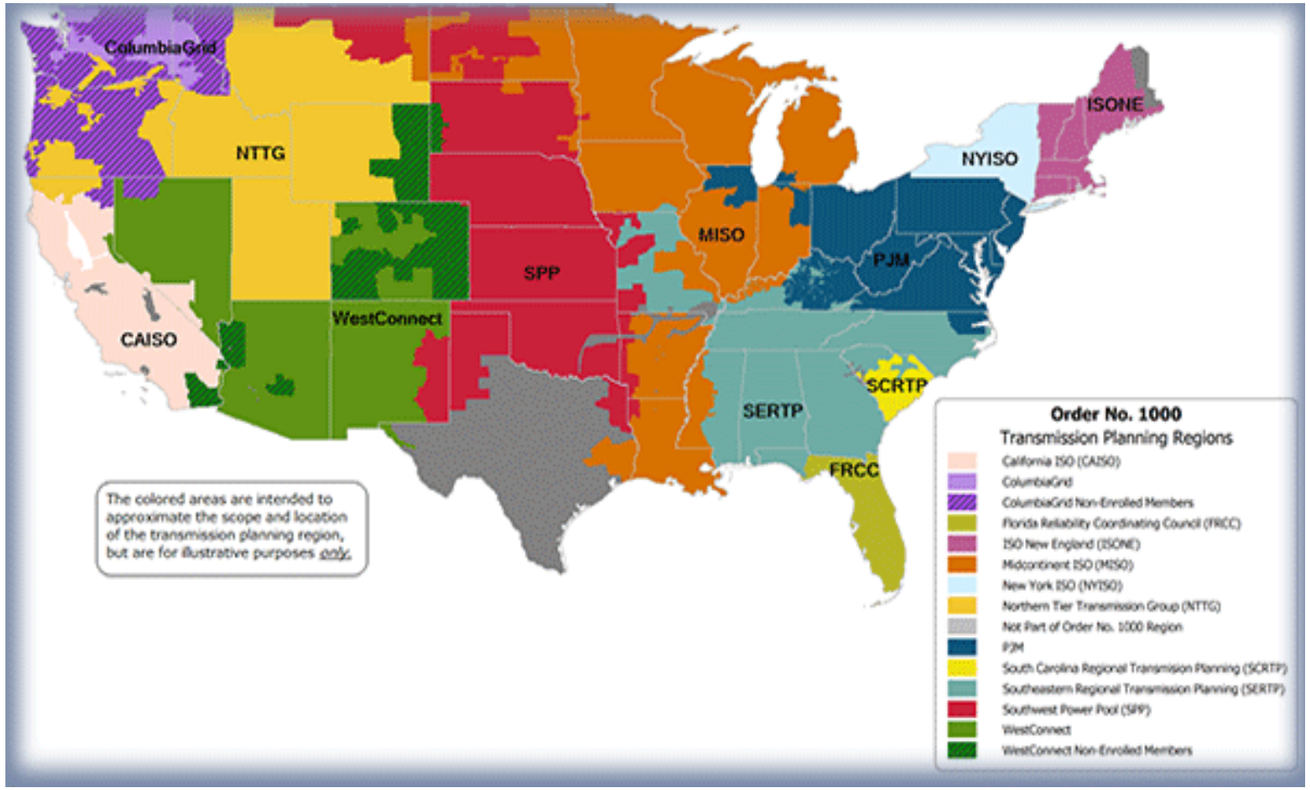
Agenda

- Storage as a Transmission Asset
- Case Studies
- NM Transmission Futures
- Questions for Regulators, Utilities and Stakeholders to Consider

Storage as a Transmission Asset

Storage as Transmission – Policy Background

- **Energy Policy Act of 2005**
  - Defines energy storage as an “advanced transmission technology,” which “increases the capacity, efficiency, or reliability of an existing or new transmission facility”
- **FERC Order 890 (2007)**
  - Transmission owners must conduct transparent transmission planning processes
  - Demand response a viable transmission alternative
- **FERC Order 1000 (2011)**
  - Requires coordinated, regional transmission planning; establishes cost allocation
  - Non-transmission alternatives must be considered (tech neutral)



FERC

Key Principle: Thermal Limits

- **Because the metals used in transmission lines are not perfect conductors, they heat up as electrical current moves through them**
  - This is what causes line losses
  - As lines heat up, they expand and begin to sag
  - Because of this phenomenon, the operational limits of transmission lines are set as a function of heat (not necessarily electric load)
- **Energy storage is a potential alternative for alleviating thermal overloading on transmission lines**
  - By siting storage or generation resources within load centers, less energy needs to be delivered over the transmission system
  - Storage can also be used to protect and support transmission infrastructure by maintaining voltage, managing power flows, and absorbing excess power
  - Where feasible, this approach can extend the life of existing assets and defer or displace the need for new transmission infrastructure
  - Storage may be deployed **as** a transmission asset or **in place of** transmission assets

Key Principle: Transmission Utilization

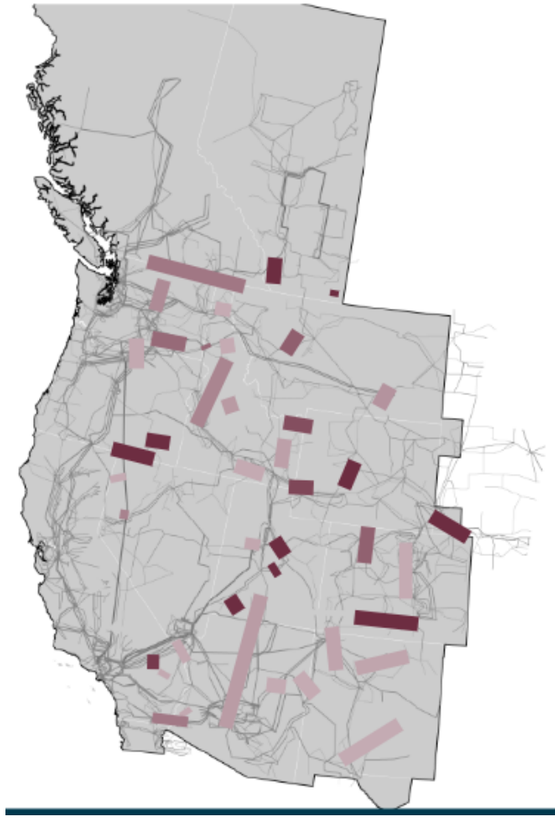
- **Key principle: Even on fully contracted, heavily utilized transmission lines, there is unused capacity *most of the time*.**

- These numbers mean that regionwide, for 93.8 percent of the time in 2018, less than 75 percent of the average transmission line's capacity was being used.

- Conversely, the average line exceeded 90 percent of its rated capacity just 1.3 percent of the time.

- Implication: If deployed as transmission, energy storage would likely have significant opportunities to provide other grid services outside of peak periods.

2018 Path Utilization



Season
- All
- Winter
- Spring
- Summer
- Fall

2018 Path Utilization Statistics

Path	U75	U90
Path 1	19.5%	4.1%
Path 3	5.5%	0.7%
Path 4	3.4%	0.3%
Path 5	0.3%	0.0%
Path 6	0.0%	0.0%
Path 8	8.0%	1.2%
Path 14	4.1%	1.6%
Path 16	0.1%	0.1%
Path 17	1.2%	0.1%
Path 18	9.8%	0.0%
Path 19	20.7%	4.0%
Total	**6.2%**	**1.3%**

WECC, 2019 State of the Interconnection, https://www.wecc.org/epubs/StateOfTheInterconnection.

FERC Policy Statement on Dual-Use Storage (2017)

- **Policy Statement: Once deployed as a transmission asset, energy storage will likely have significant opportunities to provide energy services in the market, thereby generating offsetting revenue that can be shared with customers to reduce system costs.**
- **Therefore, energy storage can be a dual-use (transmission and generation) asset, subject to three clarifying principles:**
  - Avoid double recovery of costs
  - Minimize adverse impacts on markets
  - ISO/RTO independence must not be compromised
- **A policy statement is a nonbinding document; no action required**
  - The California Independent System Operator (CAISO) and Midcontinent Independent System Operator (MISO) are the only entities to initiate a direct response to the statement

Dual-Use Storage – Two Paradigms

Vertically Integrated

Deregulated

Planning: Common to Both

Individual Utility Transmission Plan

↓

Order 1000 Regional Transmission Plan

↓

Project Selection and Construction

Key Challenges:

- Creating entry points for storage
- Accounting for non-transmission benefits

Operations: Specific to Each

Transmission Operations: Utility (Regulated)

Generation Operations: Utility (Regulated)

Transmission Operations: ISO (Regulated)

Generation Operations: Utility/3rd Party (Competitive)

Key Implications:

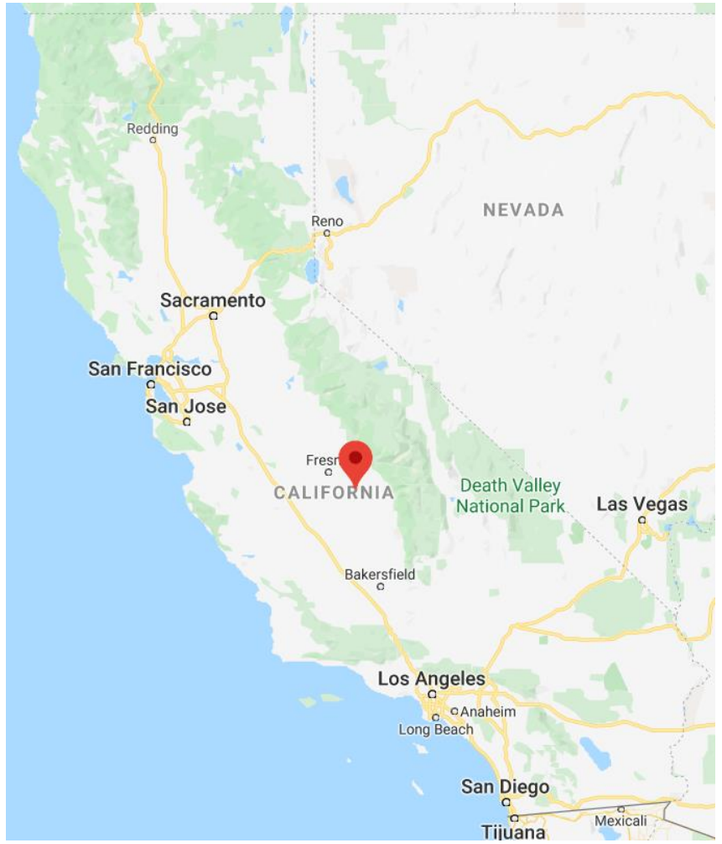
- No operational distinction between transmission/ generation
- Lack of clear external price signals may complicate dispatch

Key Challenges:

- Operational distinction between transmission and generation; no mechanism for dual participation
- "Missing money:" Markets may not fully compensate resource for what it can do

Case Studies

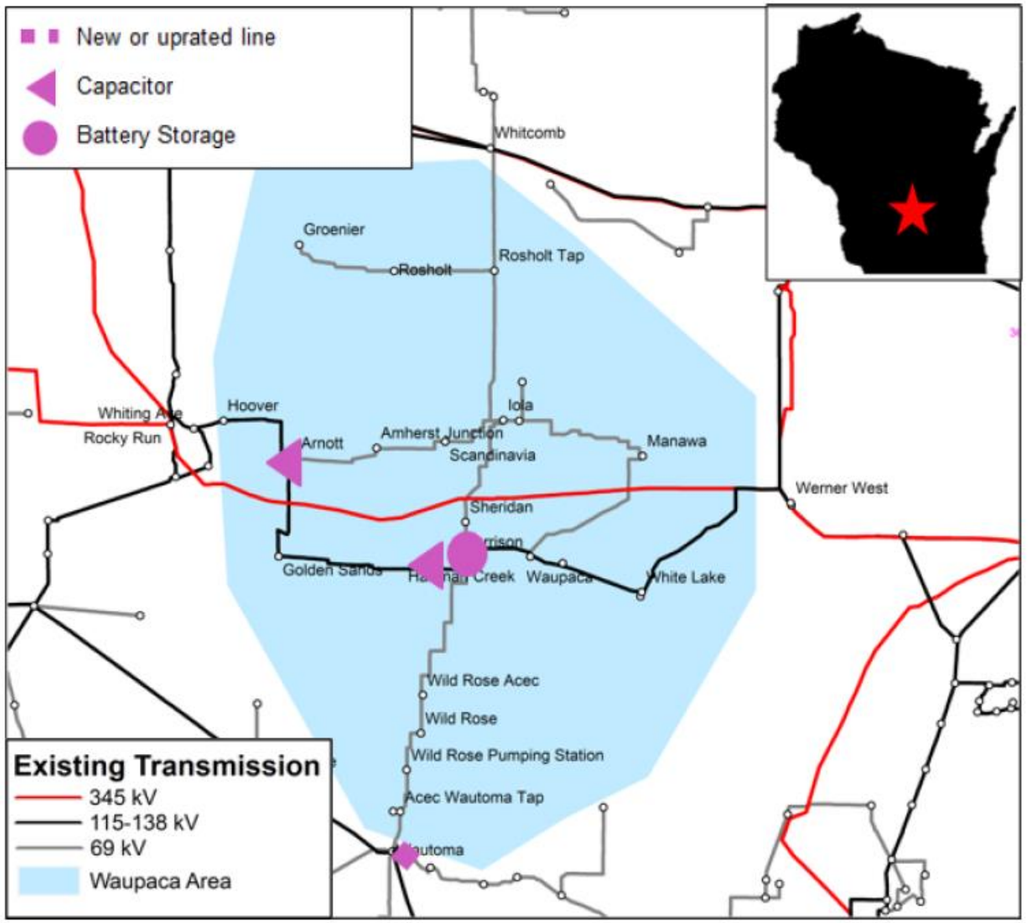
Storage as Transmission: CAISO



- **The California Independent System Operator (CAISO) became the first region to identify storage in a regional transmission plan, identifying two projects (one as transmission, one in place of transmission) in its 2018 plan.**
- **Storage as Transmission: Dinuba, CA**
  - 2010 Plan: A potential contingency scenario that would overload the local transmission system would require $16M to reconductor (install new lines) for 10 miles
  - 2018 Plan: Overloads could be managed by an energy storage system at an estimated cost of $14M
  - Utility Pacific Gas & Electric solicited bids for a 7 MW / 28 MWh storage system in February 2019; no public announcement yet
- **As a transmission asset, the storage system's costs will be recovered through CAISO's FERC-approved transmission system rates, and it will not participate in energy markets**

Storage as Transmission: MISO

- **The 2019 MISO Transmission Expansion Plan (MTEP) was the second regional transmission plan to select energy storage as a transmission asset**
- **Storage as Transmission: Waupaca, WI**
  - Under certain N-1 contingency scenarios, the Waupaca area would be cut off
  - At $12.2 million over 40 years, a 2.5 MW/5 MWh energy storage system, coupled with line sectionalization, was selected over a $13.1 million project to install an additional circuit
  - Expected in-service date: December 2021
- **As a transmission asset, the storage system's costs will be recovered through MISO's FERC-approved transmission system rates, and it will not participate in energy markets**



MTEP 2019

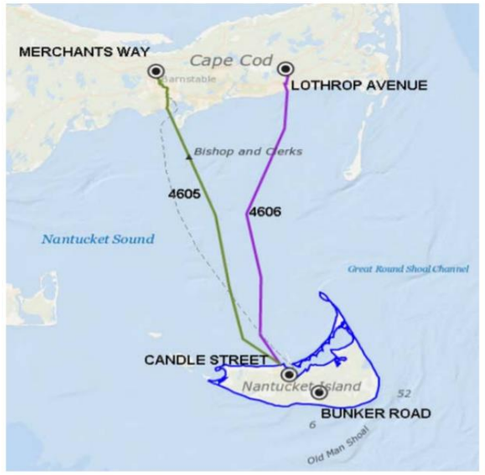
Storage in Place of Transmission: Oakland Clean Energy Initiative

California Energy Commission

- **The Jack London Power Plant ("Oakland Power Plant" in the map) is a 165 MW, jet fuel-powered combustion turbine**
  - Identified for retirement in 2017, but local transmission system would exceed thermal limits to serve Oakland loads without the plant
  - Alternatives: transmission system upgrades, new local generation (up to 45 MW); energy storage selected as least-cost option in CAISO's 2018 transmission plan

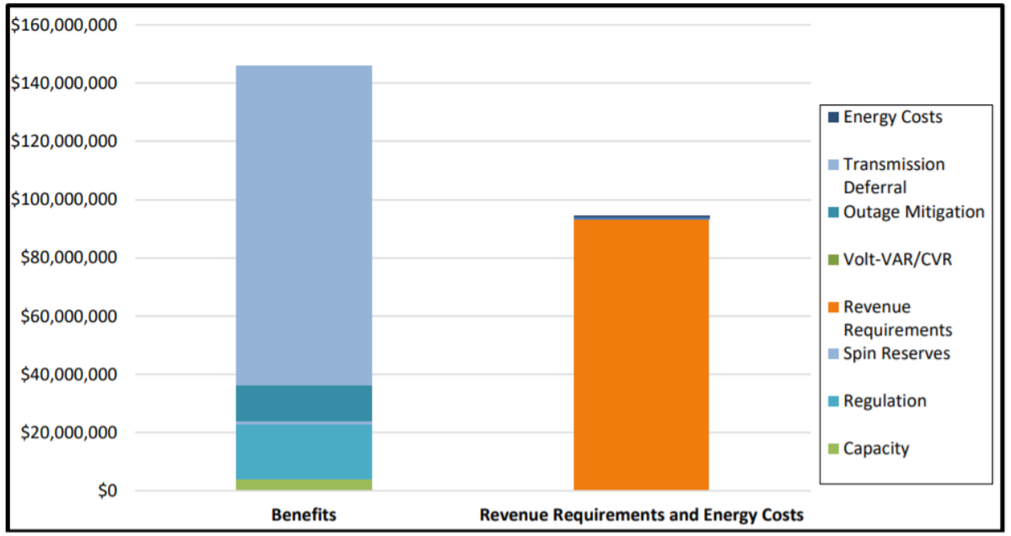
- **Transmission system owner Pacific Gas & Electric worked with local community choice aggregator East Bay Community Energy to procure clean energy resources to meet the local generation need**
  - PG&E selected two energy storage projects totaling 43.25 MW/173 MWH; proposed projects to the California Public Utilities Commission in April 2020; EBCE procuring additional BTM resources
  - None of this storage would be a regulated transmission asset; all dispatch and recovery would happen through energy markets and utility programs (net metering and other incentives)

Storage in Place of Transmission: Nantucket Island



- **Load growth and reliability requirements would soon require a third undersea cable to meet peak demand on Nantucket Island, MA**
  - Permanent population is 11k residents, but it swells to 50k during summer
  - Two existing transmission lines provide 71 MW; two combustion turbines on the island provide another 6 MW
  - Under a contingency scenario in which one of the lines is out of service, remaining assets would not be able to meet load during high-demand periods

- **Replacing the onsite generation with a new, 16 MW combustion turbine and a 6 MW/48 MWH battery, can cost effectively defer the third cable for 13 years**
  - Peaker + Storage: $93.9M, with $122M in benefits (including NPV of transmission deferral)
  - Transmission deferral only needed for 145 hours per year, leaving significant opportunities for market participation
  - Reduced outages valued at $240k/year

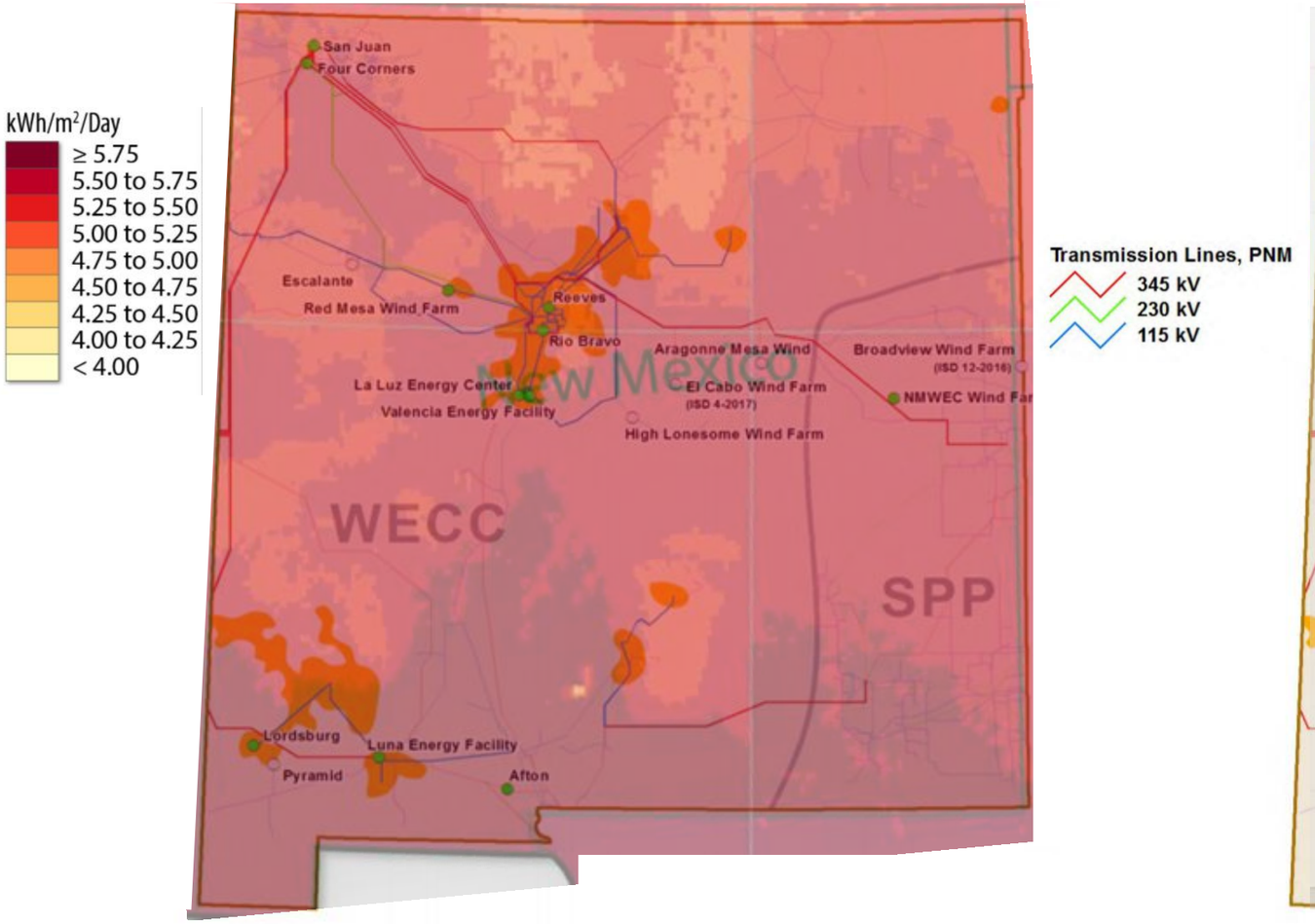


Balducci et al, "Nantucket Island Energy Storage System Assessment." 2019.

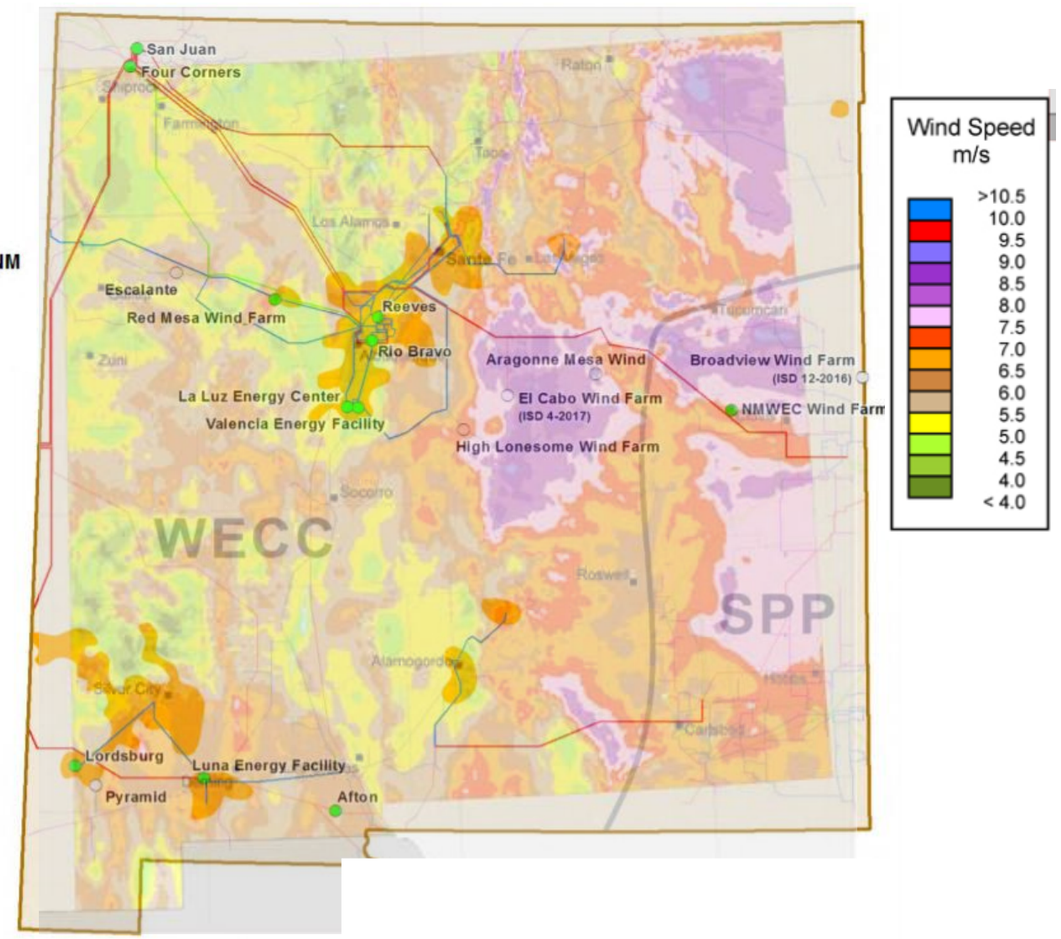
New Mexico Transmission Futures

Mapping PNM's Transmission System to NM's Renewable Energy Potential

NM Solar Potential



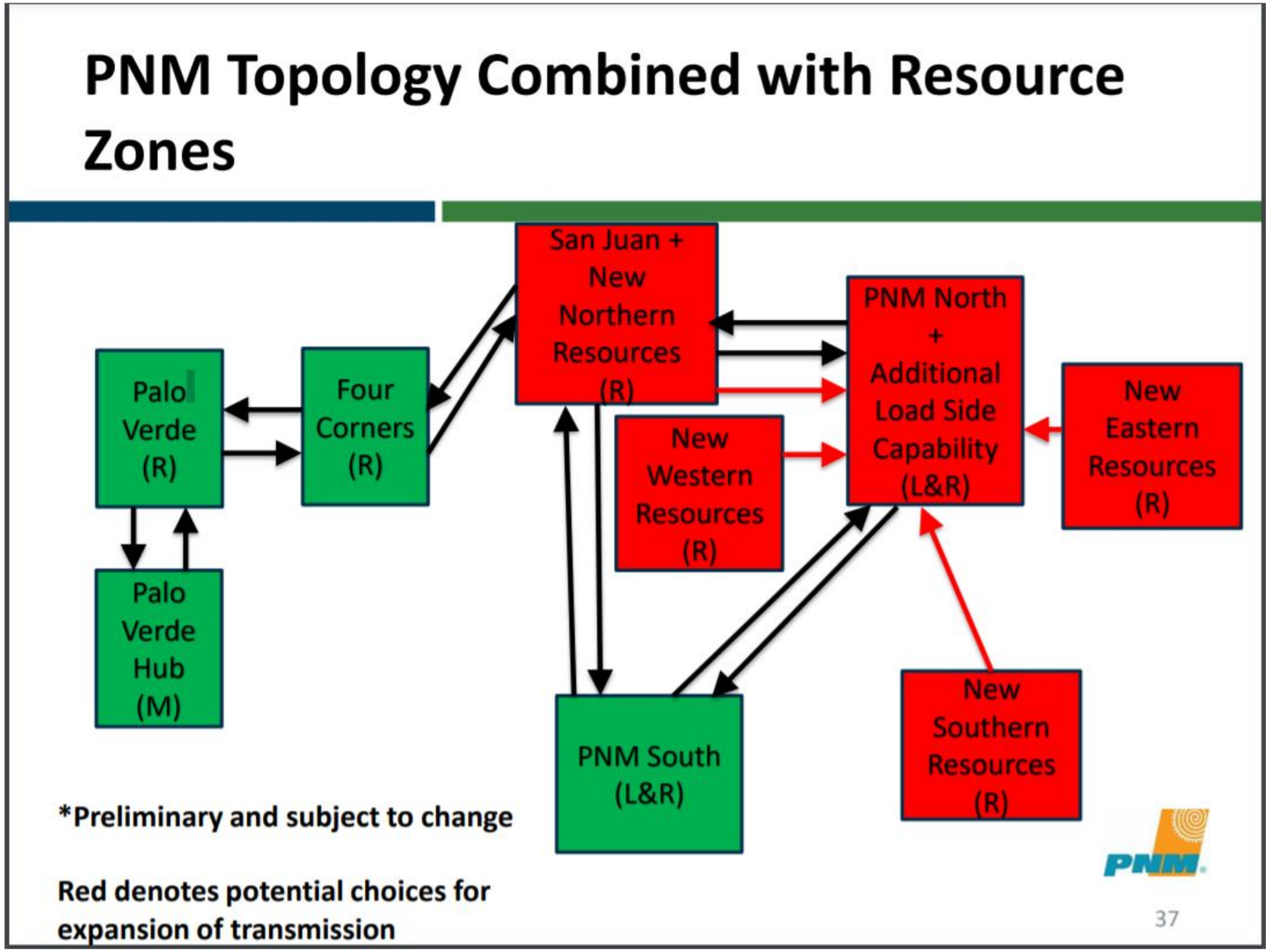
NM Wind Potential



Transmission Map: PNM; Solar Potential Map: NREL; Wind Potential Map: U.S. DOE WindExchange

PNM's Transmission Planning Paradigm

- Providing 100% clean energy by 2045 will be a complicated combination of acquiring new generation within the existing transmission footprint and increasing access
- Meeting the standard will likely require significant changes to PNM's transmission system



PNM Integrated Resource Plan Stakeholder Presentation, Aug. 25, 2020

The Role of Storage in Transmission System Expansion

Energy storage **cannot** move electricity through space; connecting new generation resources to the grid will require wires

Energy storage **can** move electricity through time, enabling it to optimize and extend the life of existing transmission assets by:

- Protecting infrastructure and maintaining service during contingency events
- Being sited in load pockets to serve peak demand, thereby deferring/displacing new infrastructure
- Being paired with generators to optimize output and reduce interconnection capacity requirements (FERC Order 845)

Questions for Regulators, Utilities, and Stakeholders to Consider

Questions to Consider

- **Are sufficient transmission expansion scenarios being studied in the IRP?**
  - PacifiCorp 2013 IRP: 19 scenarios each applied to five different transmission expansion options – every transmission configuration subjected to every sensitivity (95 total portfolios)
  - PacifiCorp 2015 IRP: Transmission options studied as distinct scenarios, subject to two different regional haze compliance options – only most likely transmission configurations studied under most likely scenarios (38 total portfolios)
- **Are regulators and stakeholders participating in transmission planning processes, both PNM's and WestConnect's?**
- **Do those transmission planning processes have clear procedures for considering energy storage and other non-wires alternatives?**
- **Would pilot programs be useful in helping PNM develop operational experience with multi-use energy storage technologies?**
- **What will the role of distribution system planning be as the state moves toward its clean energy goals?**

Thank you

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