Presented to:

NM RETA Energy Storage Workshop

Santa Fe, NM

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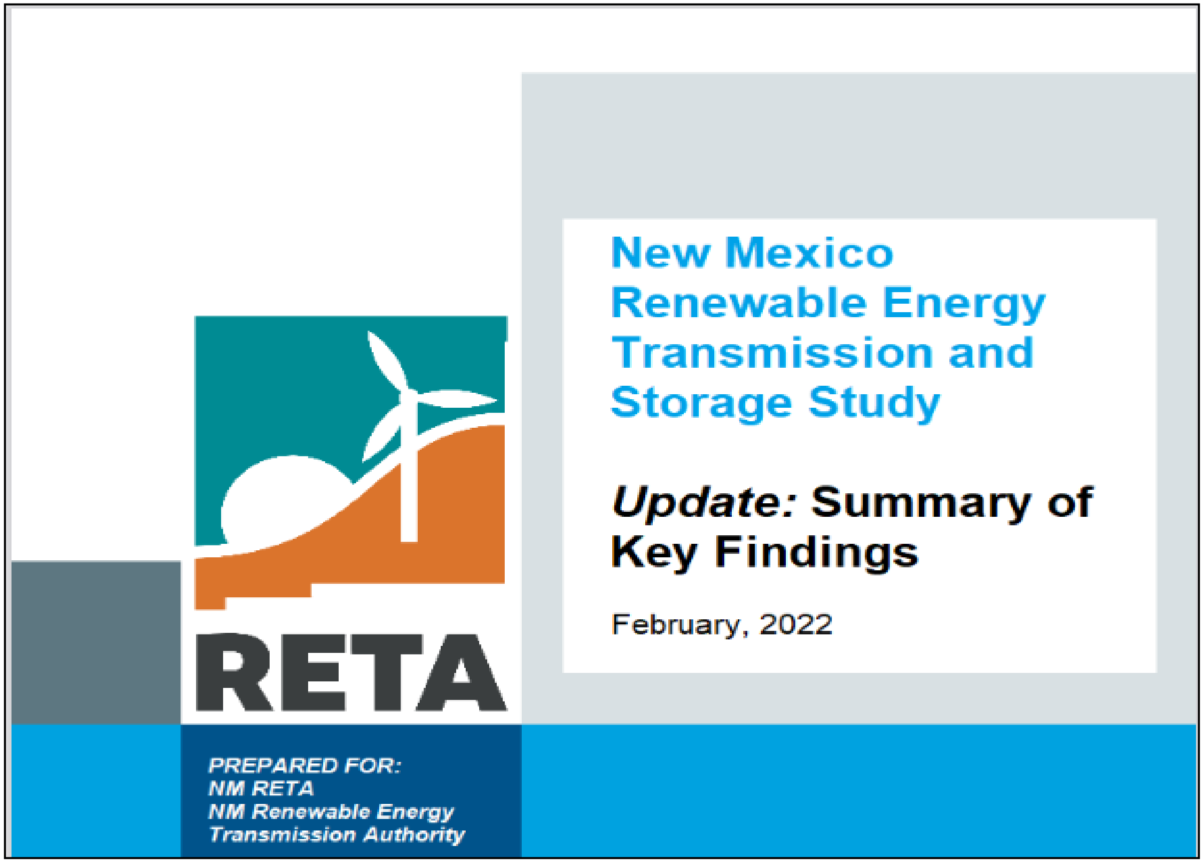
Overview

- Since mid-2021, NM RETA has conducted ***two technical studies*** that potentially impact New Mexico's energy storage future
  - Both studies utilize planning assumptions reported in a 2020 baseline study issued by ICF International, Inc. Fairfax, Va.
  - The planning horizon represents ***2030 peak summer conditions***
  - ***Topics include***: update of key study parameters; developable renewable (VRE) capacity; transmission plan design and system robustness; utility-scale energy storage technologies

Study 1 URL- NMRETA website



https://nmreta.com/wp-content/uploads/2022/03/RETA_2022_UPDATE_TransmissionStudy21.pdf

ICF Planning Scenarios

<table>
<tr><th>Component</th><th>BAU</th><th>Cleaner Economy</th><th>RTO Proxy</th><th>High Renewable Deployment</th></tr>
<tr><td>Regional Electric Load</td><td>Reference load</td><td>Electrification of other sectors</td><td>Reference load</td><td>Electrification of other sectors</td></tr>
<tr><td>State Policy (ETA)</td><td colspan="3">Meet 2030 target</td><td>Exceed 2030 target by 10%</td></tr>
<tr><td>Federal Tax Credits</td><td colspan="3">Project eligibility extends to the end of 2020</td><td>PTC extended through 2030</td></tr>
<tr><td>Transmission Costs</td><td colspan="2">Tariff pancaking</td><td colspan="2">No tariff pancaking</td></tr>
<tr><td>Transmission Constraints</td><td colspan="4">a. Limited Capacity or b. Unlimited Capacity</td></tr>
</table>

Energy Transition Act (ETA) requires **50%** of IOU retail energy sales sourced from renewables by **2030**

Regional Generating Capacity

- Planned changes to renewable and conventional generating capacity in the four-state region AZ, CO, UT and NM were modeled

Thermal Additions, Retirements

State	Addition MW	Retired MW	Net MW
New Mexico	670	-1,522	-852
Arizona	996	-2,137	-1,141
Colorado	494	-1,300	-806
Utah	490	-75	415

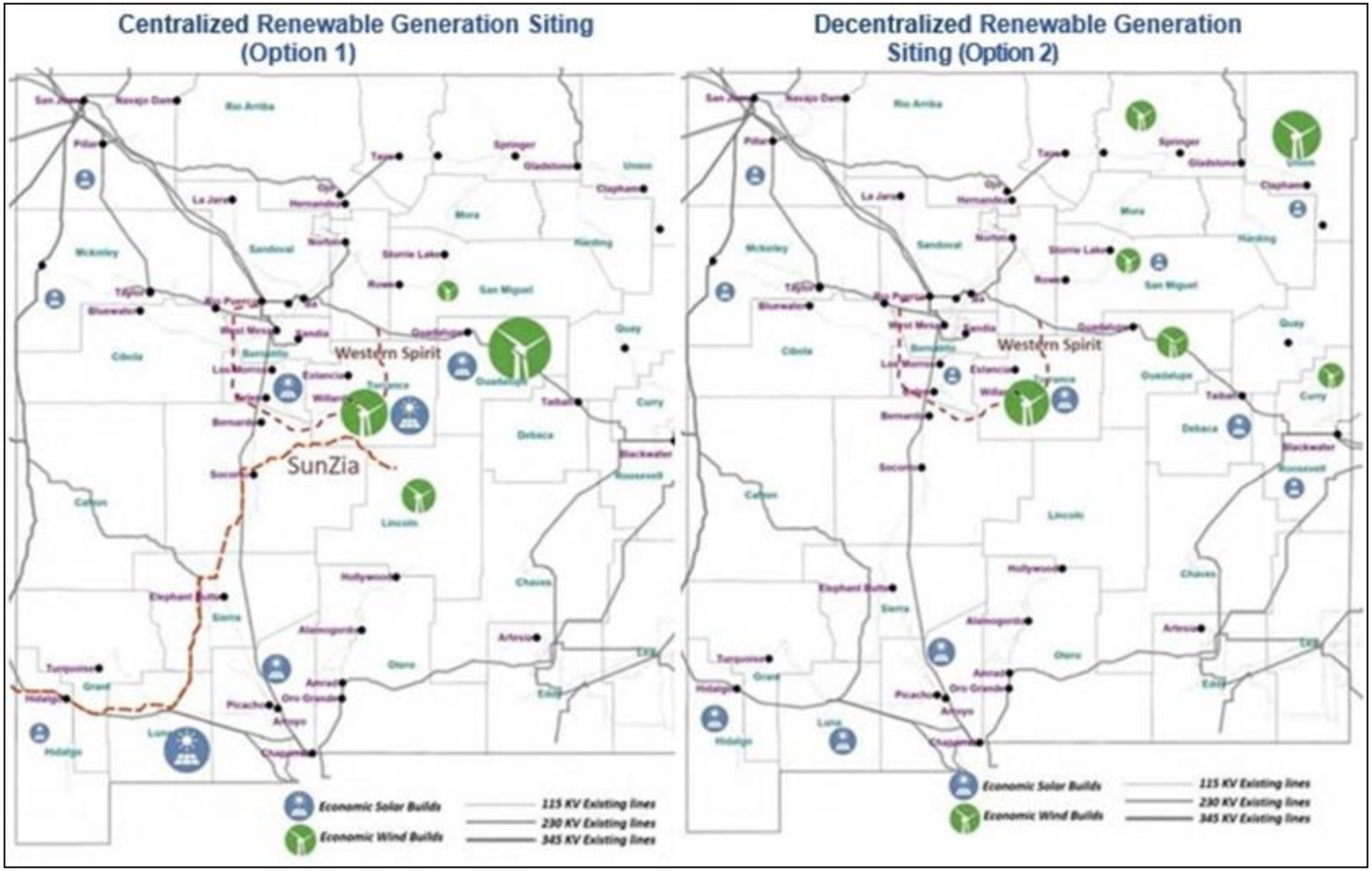
VRE Additions

State	Solar MW	Wind MW	Net MW
New Mexico	3,800	3,149	6,949
Arizona	6,567	446	7,013
Colorado	2,047	3,376	5,423
Utah	2,987	505	3,491

- ICF assumed <u>complete retirement of Four Corners and San Juan plants</u>

Renewable Siting Scenarios

- By 2030 11,500 MW renewable capacity added



Collector Plan Features

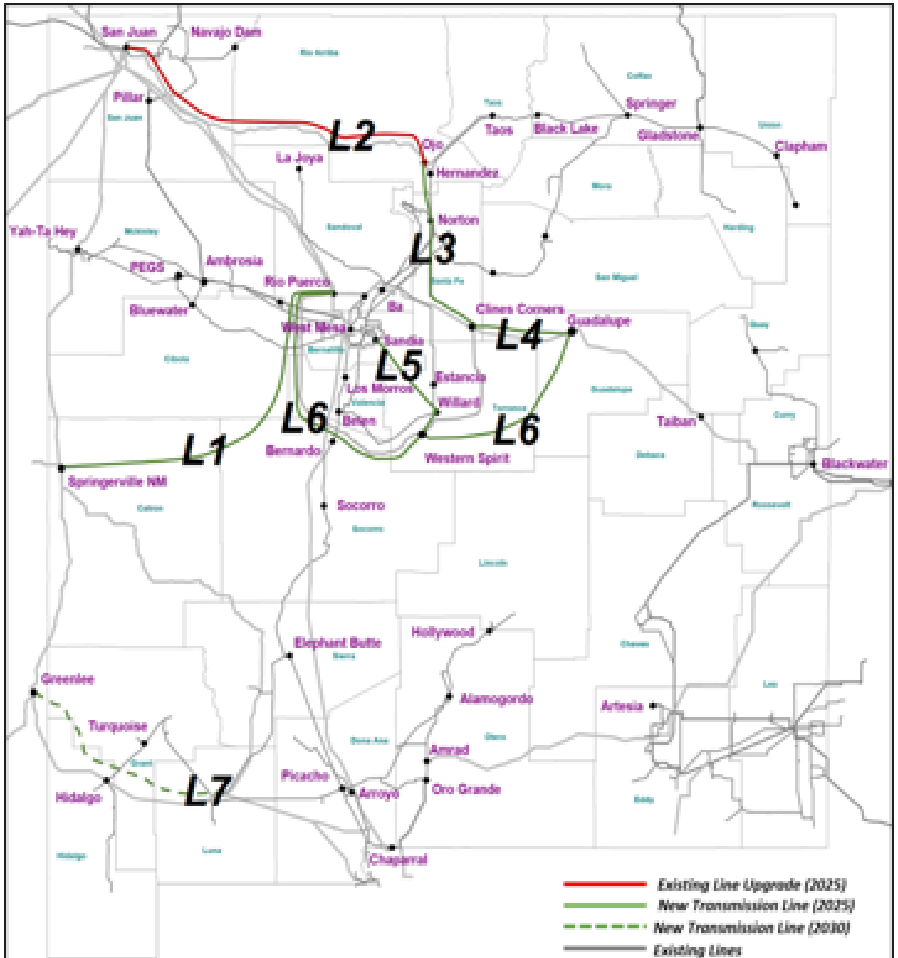
- A Collector Plan is defined by a <u>renewable siting scenario</u> ***and*** associated <u>high-voltage grid additions</u> which consist of: New transmission lines, Upgrades of existing lines, New substations, Control devices and Transformers

- These additions require multiple development stages extending over a series of years

Red indicates upgrades of existing lines, ***Green*** indicates new construction

Collector Plan 1 (Centralized Renewables)

Figure 3. Transmission Additions: Collector Plan 1



(L) Transmission Line; (SS) Substation; (T) Substation transformer

Table 11. Proposed Collector Plan 1 Additions

Addition	Function	Rank	Type	Miles	By Year
(L1) 345 kV Rio Puerco to Springerville	Hub	1	New	172	2025
(L2) 345 kV Ojo to San Juan	Collector	2	Uprate	157	2025
(L3) 345 kV Clines Corner to Ojo	Collector	3	Uprate	79	2025
(L4) 345 kV Guadalupe to Clines Corner	Collector	4	Uprate	40	2025
(L5) 345 kV Western Spirit to Sandia	Collector	5	New	84	2025
(L6) 345 kV Guadalupe to Rio Puerco	Collector	6	Uprate	268	2025
(L7) 345 kV Luna to Greenlee NM	Collector	7	Uprate	110	2030
(SS) 345 kV Springerville Substation; (SS) 345 kV Greenlee Substation; (T) 345-115 kV Willard	Ancillary	-	New/ Uprate	-	2025-2030
TOTAL				911	-

Additional Study Topics

- All topics were selected by NM RETA for ICF's "Update" study; they include ***technical, administrative and project development issues***
- All issues relate to New Mexico's 2030 planning horizon
- Each topic reported a list of possible Legislative or Agency-specific Actions to be taken
  - Total of 24 Actions are listed
  - 10 Actions are identified as "most effective to implement early"

Utility-scale Energy Storage Technologies

Item; Page Reference	Technical Findings
ETA, Renewables and Storage (Utility-scale energy storage technologies); ***Pages 23-29***	***The energy storage market in New Mexico could increase to over 525 MW by 2030***. Each storage technology is positioned in different development phases, with batteries probably offering the most economic near-term option for deployment.

- Actions to Support Energy Storage Development
  - Mandate development of energy storage interconnection standards ref. NMAC 17.9.569
  - Establish state administrative policies to incentivize energy storage investments

Storage Development Factors

- NM RETA's transmission projects may be selected to include storage which could ***defer, reduce or eliminate the need for new line capacity***
  - Reduction of capacity is the most likely near-term outcome
  - Storage interconnection will be affected by factors such as operating voltage, queue access and ownership rights
  - ***Favorable siting*** includes co-location with existing or proposed transmission lines and higher projected renewable capacity; access to a host substation

Study 2 URL- NMRETA website

https://nmreta.com/wp-content/uploads/2022/10/RETA-Energy-Storage_-0922.pdf

Overview

- Assess ***energy storage market status and anticipated growth*** to meet New Mexico's Renewable Portfolio Standard (RPS) goals
  - Storage co-located with large-scale renewable generation, connected to the transmission system at least 100 kilovolts (kV) or higher
  - In-development by 2026 and ***operating by 2030***
  - Planning assumptions are based on the 2022 "Update" Study 1

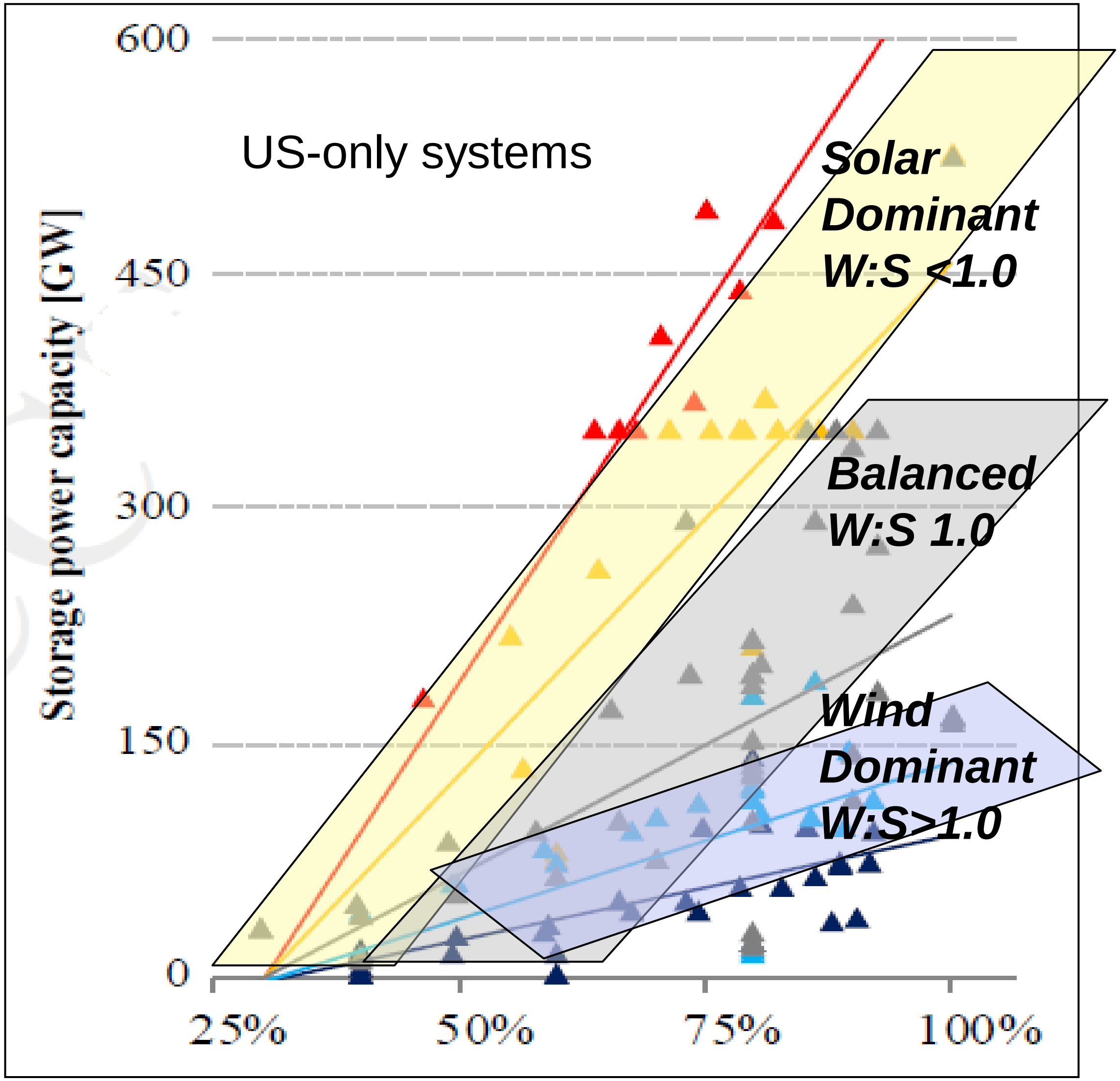
VRE Build

- ICF's ***Business as Usual (BAU)*** forecast assumes a status quo outlook for the key parameters, with no changes to current policy, transmission access or cost, and normal expected demand growth
  - VRE Build is defined by the BAU forecast ***with or without*** ICF's Economic Additions of renewables
  - Storage applications considered in Study 2 assume ICF's lower-bound VRE Build
  - Development will be limited by the rate of <u>energizing new transmission circuits</u>

Storage Capacity *versus* VRE Share

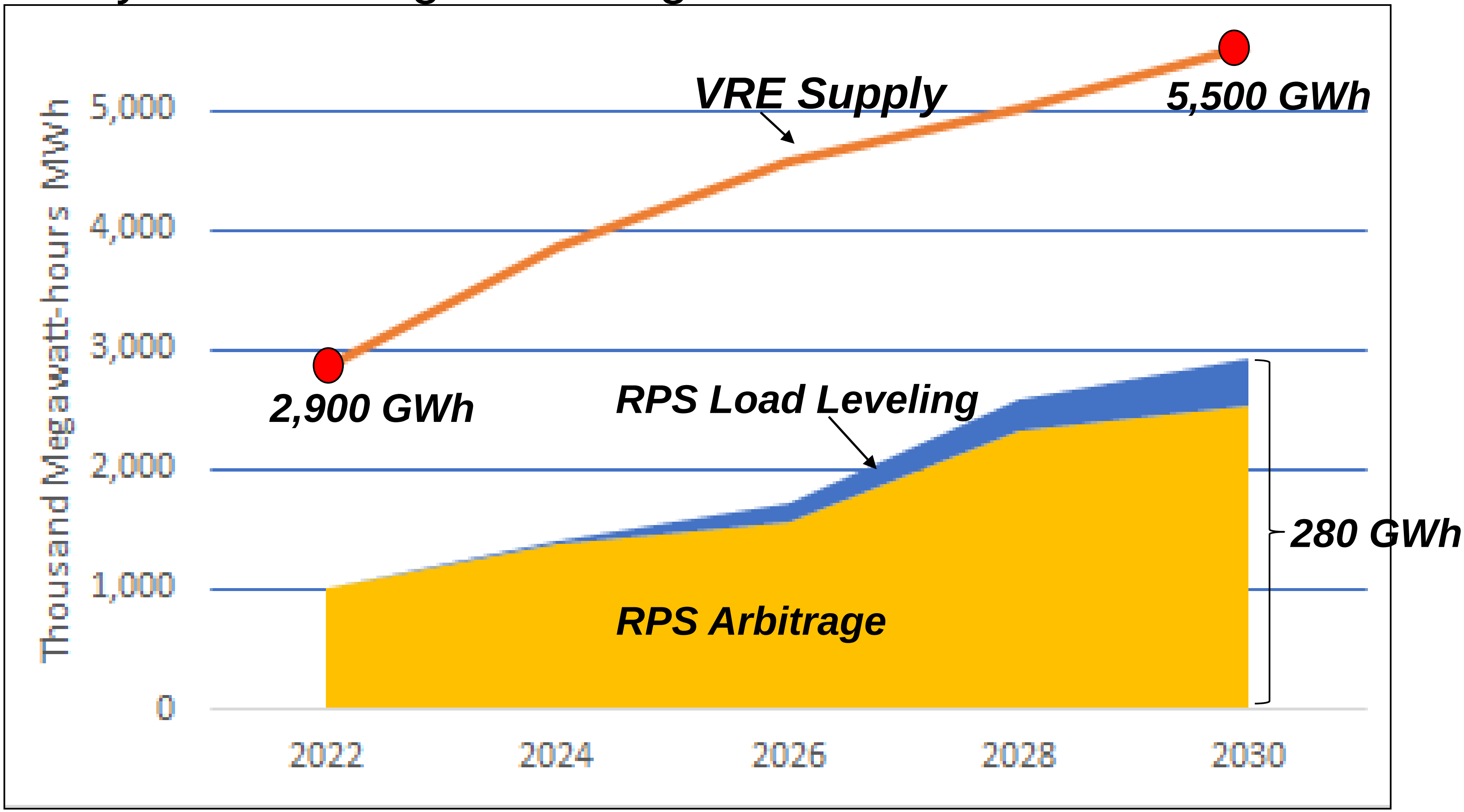
- Reference study* surveyed results from over 400 capacity planning cases reported in the US, Europe
- New Mexico's projected W:S ratio <u>1.5-1.6 through 2030</u>

*https://www.osti.gov/pages/biblio/1425569



RPS Storage Market

- By 2030 storage discharge could exceed 280 GWh



Storage Model and Constraints

Model**:** Identifies ***"feasible"*** storage growth profiles but may not identify optimal profiles; lacks a power flow solver, so transmission limits aren't considered; storage capital costs are reported but don't constrain results

Constraints:

-Storage unit MWh/MW ratios up to value 8.0

-Storage power rating not to exceed 250 MW

-Storage (discharge) duration up to 1,350 hours per MW

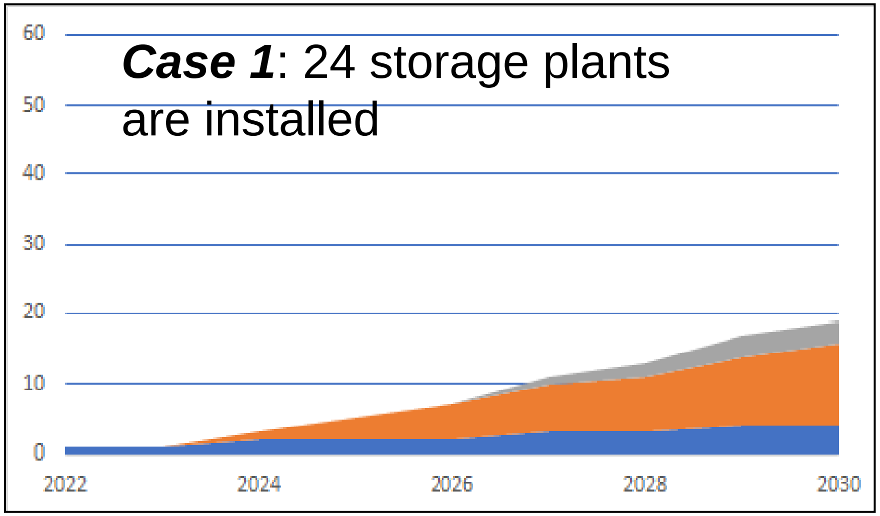
Storage Buildout: Cases 1,2

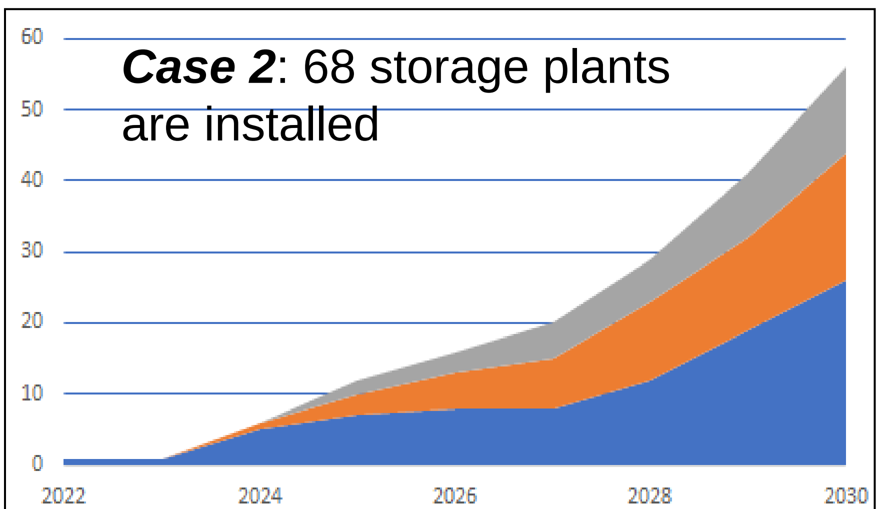
***Case 1*:** Unit capacities up to 9 MW, 25 to 70 MWh; a total of 24 storage plants are installed by 2030

Case 2: Unit capacities up to 3 MW, 10 to 25 MWh; a total of 68 storage plants are installed by 2030

Both cases contribute similar levels of storage power and energy to the grid but their unit capacities differ by a factor of 3; assumes installation of BESS (lithium-ion)

Storage Duration versus Unit Capacity





	2.5-hour	*5.0-hour*	*7.5-hour*
Units	4	12	3
Charge/ discharge	Up to 760 cycles per year		

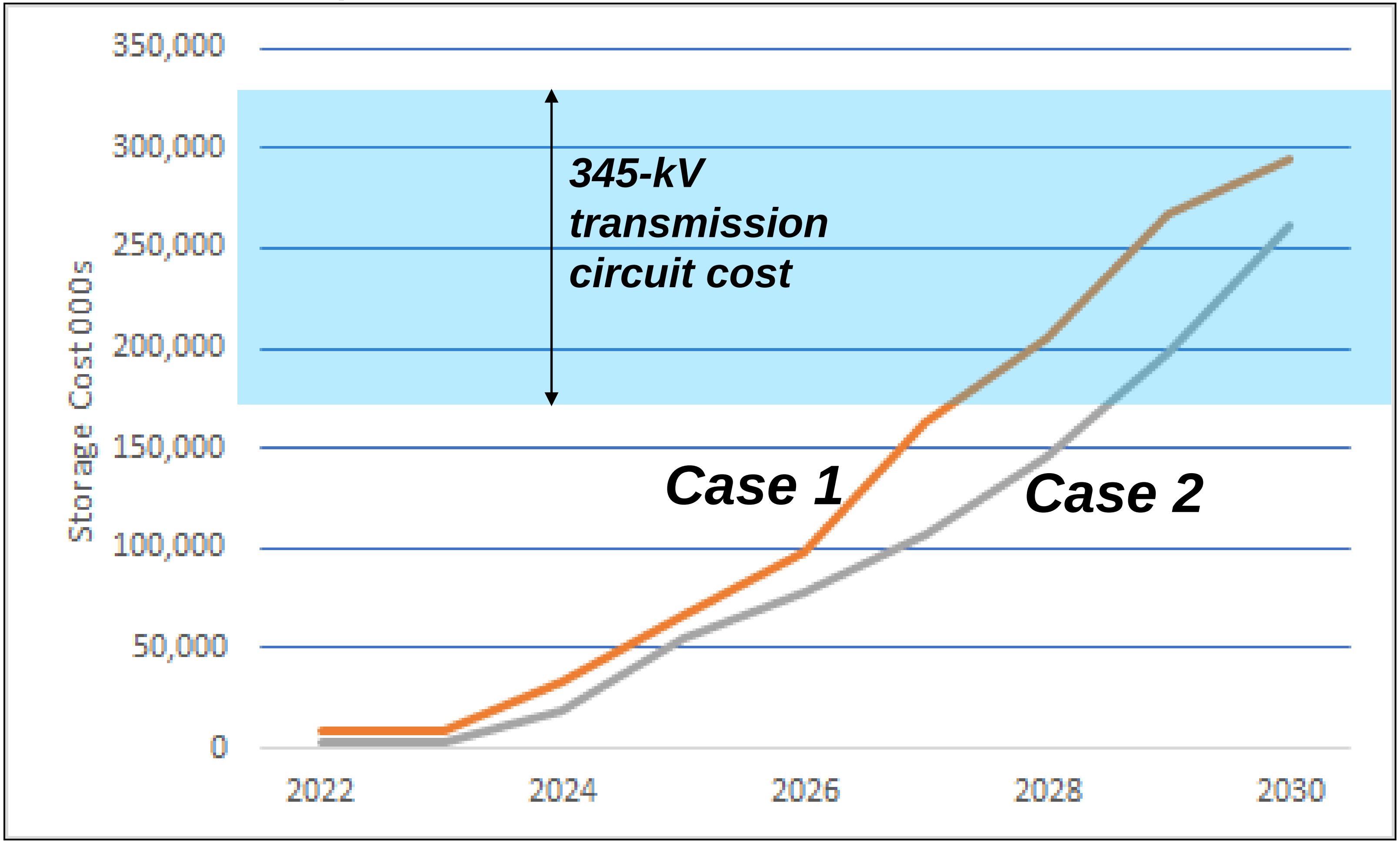
Legend

■ 2.5 hour ■ 5.0 hour ■ 7.5 hour

	2.5-hour	*5.0-hour*	*7.5-hour*
Units	26	18	12
Charge/ discharge	Up to 1330 cycles per year		

Storage Capital Cost

- Cost comparable to ***one*** 345-kV transmission circuit



Summary: 2030 Energy Storage

- ***RPS Market:*** Possible opportunity for nearly 70 utility-scale storage plants; discharged energy could exceed 280 GWh per year by 2030
- ***Scenario:*** Two storage development cases were derived based on ICF's lower-bound level; each case utilizes a mix of 2.5-, 5- and 7.5-hour storage units
- ***Investment:*** Assuming installation of utility-scale batteries, storage capital cost equals or exceeds $261 Million

SUPPLEMENT

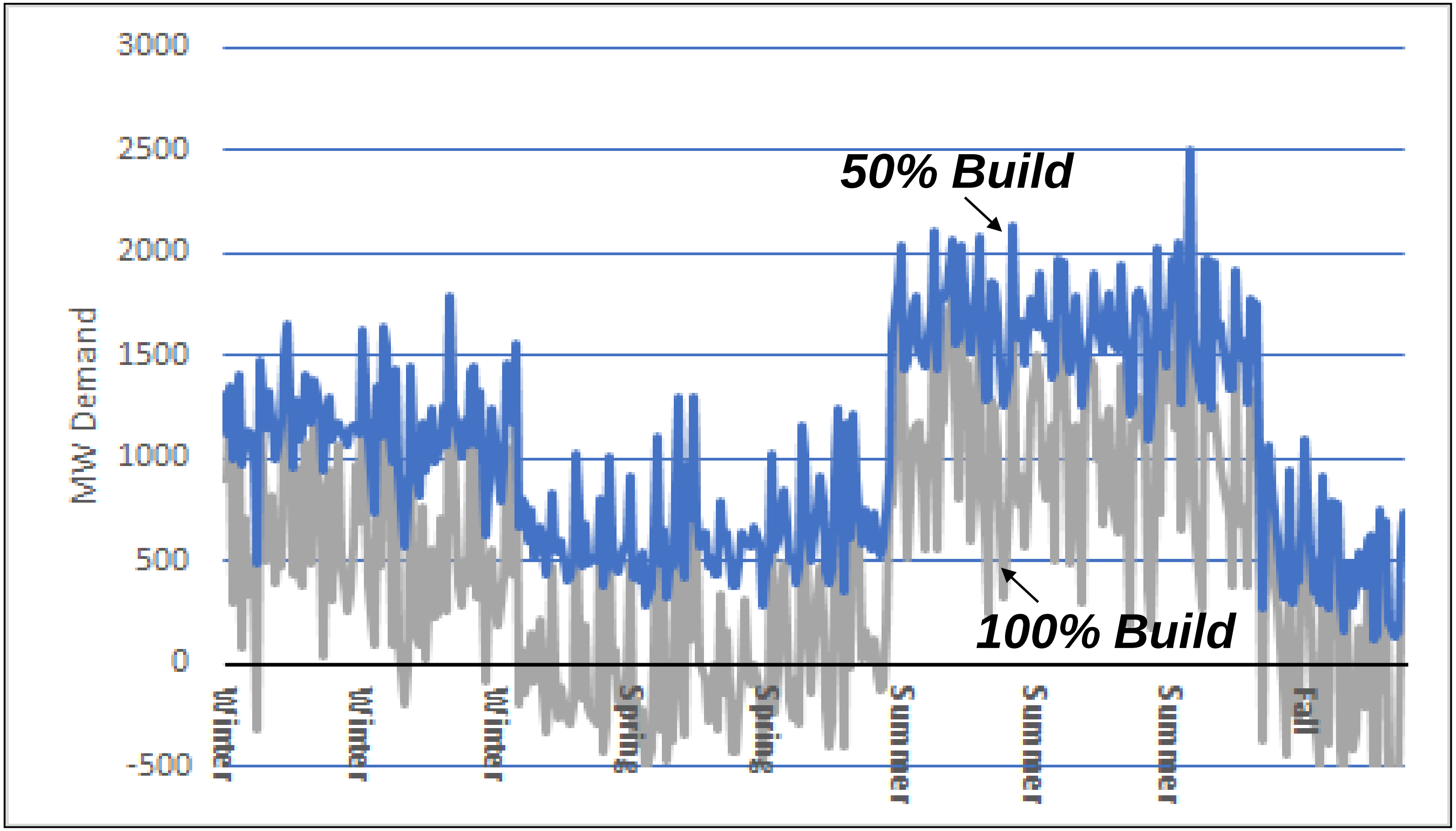
- Demand Profile
- Hourly Net Demand
- Load Leveling

New Mexico’s Demand Profile

- Hourly metered data representing four ***typical weeks*** was used to construct a state-wide net demand profile
- Combined into a chronological sequence and adjusted to fit New Mexico’s forecasted 2030 annual peak, energy, and load factor
- The demand profile contains 1,753 hours
- Additional data will be needed to improve modeling accuracy during off-peak hours since it is not sufficient to capture requirements for long duration storage

Hourly Net Demand- 2030

- Due to the impact of renewable generation, New Mexico's demand profile will exhibit higher ***variability***



Load Leveling- 2030

- Sample of 85 large up-ramp/down-ramp events
  - The average interval between events is 40 hours; sufficient re-charge time is available to prepare for the next up-ramp
  - Prior to storage discharge, sample hours exhibit a maximum up-ramp of 380 MW; ramps can be ***reduced 50% or more*** through a coordinated storage control strategy
  - Storage operates at an average power of 85 MW (maximum 216 MW)