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2021 SPS New Mexico Integrated Resource Plan: 5th Public Advisory Meeting

May 13, 2021

Topics For Discussion

- Energy Storage
- Generator Interconnection Agreement Issues
- Questions and Discussion

Energy Storage Overview

SPS New Mexico IRP Public Advisory Meeting

May 13, 2021

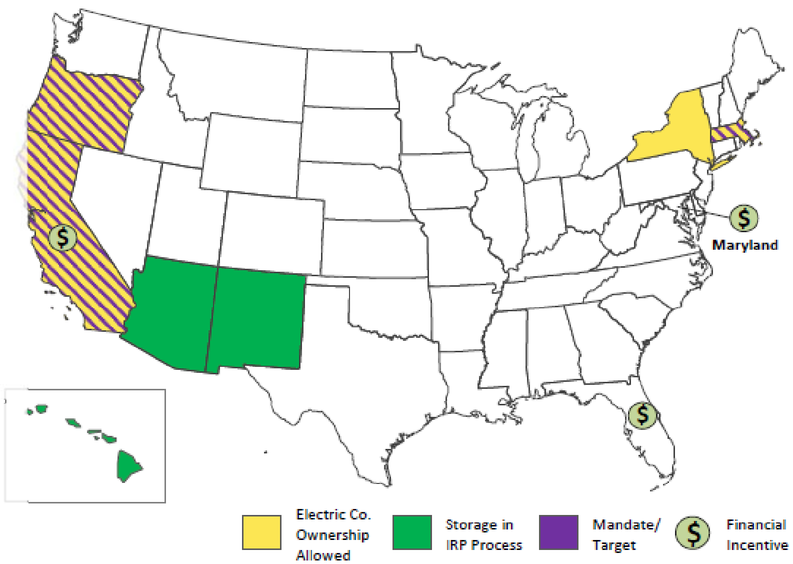
National Storage Policy Trends

Legislative:

- Climate Change Mandates/Target
- Tax Credits/Incentives
- Study/Investigative Proceeding
- Ownership Rules
- Clean Peak Standards

Regulatory/Rate Design:

- Resource Planning/Procurement Requirement
- Grid Modernization/Distribution Planning Proceeding
- Interconnection Rules
- Value of Storage/DER
- Demand Charges



- **RTO/ISO Activity:** FERC NOPR on storage participation in markets and DER Aggregation, MISO Energy Storage Task Force
- **National Stakeholders:** Energy Storage Association, Interstate Renewable Energy Council (IREC), Advanced Energy Economy, Energy Freedom Coalition of America (EFCA)

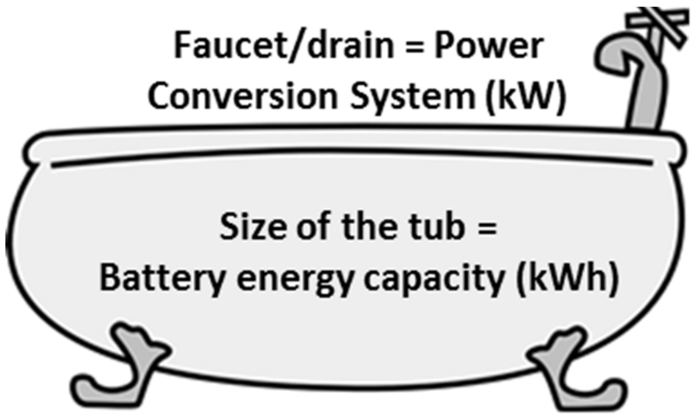
Source: Edison Electric Institute

What's Changed Since 2018?

- There are technologies that are not commercially feasible today that are needed to achieve a carbon-free generation fleet by 2045 (pursuant to Energy Transition Act)
- Degree to which storage can contribute to decarbonization is weighted on par with the economic and reliability benefit to the grid system
- Storage will be able to capture more carbon-free electricity that would otherwise be curtailed to support grid balancing
- Longer duration storage will be needed to enable greater penetrations of variable renewable energy – More storage with >10 hours and up to seasonal scale (>100 hours duration)
- Shorter duration storage is still needed for faster grid response applications
- Several new advanced storage technologies are becoming commercially available in the near to mid-term

Energy Storage as a Bathtub

- The size of the tub (or reservoir in the case of a pumped hydro facility), and therefore how much water or energy it can store, determines the **kWh (energy storage capacity)**
- The Power Conversion System works like the faucet/drain in the tub. It determines how quickly the tub will drain and then refill, and therefore determines the **kW (power)** metric
- The cost of the tub as a resource can be described in terms of **$/kW-month (system capacity cost)**
- Duration is one of the most important drivers of the value of a particular storage system **(hours)**

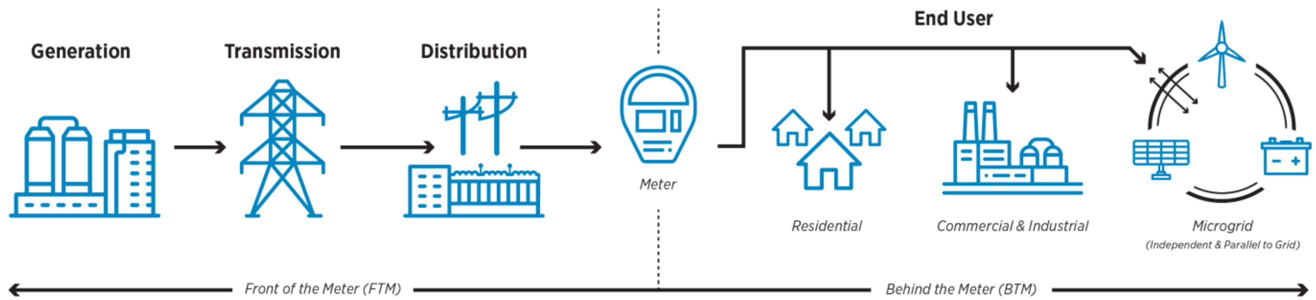


Fixed Cost of the Bathtub, levelized over the life = System Capacity Cost ($/kW-month)

Stored Energy (kWh) = Power (kW) * Discharge time (hrs)

Why Energy Storage?

Energy storage can be deployed in all parts of the grid, and has applications in all parts of the value chain.



Enhance Utility Operations

- Alleviate high energy prices through time shifts
- Reduce the need for new generation
- Reduce Carbon Emissions

Provide Grid Support

- Regulate frequency
- Reduce spinning, non-spinning and supplemental reserve requirements
- Voltage support
- Black start electricity restoration

Optimize Power System

- Defer transmission and distribution upgrades
- Relieve electricity congestion

Enhance Customer Experience

- Higher power quality and reliability
- Retail electric energy time shift

FERC REGULATED (Enhance Utility Operations; Provide Grid Support)

STATE REGULATED T&D (Optimize Power System)

END USE (Enhance Customer Experience)

Source: Adapted from DOE/EPRI Handbook, EEI (graphic)

What is Energy Storage?

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Definition

- Technology capable of storing previously generated electric energy and releasing it at a later time.
- Can occur as potential, kinetic, chemical, or thermal energy.
- Release of energy can be in forms that include electricity, gas, thermal energy and other energy carriers.
- Can be deployed in all parts of the grid – helps to enable a smarter, stronger, cleaner, and more reliable energy grid for all customers.

Asset Categories

- Electric generation asset
- Transmission asset
- Distribution asset
- DSM asset

Uses

- Capacity
- Flexibility
- Reliability/resiliency
- Microgrids and community projects

Technologies

Electrochemical Storage: Includes advanced chemistry batteries and capacitators – sodium sulfur, lead acid, lithium ion, metal air, solid state, etc.

Flow batteries: Energy is stored in electrolyte solution for longer life cycle and quick response

Hydrogen: Hydrogen or hydrogen carriers are compressed or stored as liquids to provide long duration energy reserves, carbon-free fuels, and/or feedstocks for other industries

Compressed air energy storage: Compressed air is used to create a potent energy reserve

Thermal: Heat and cold are captured to create energy on demand

Pumped hydro power: Large scale reservoirs of energy are created with water

EEI

Storage Technologies

Technology	Benefits	Challenges	Applications
Lithium-Ion Battery	• Energy density • Power density	• Cycle life constraints • Safety concerns	Peak shaving, T&D investment deferral, renewable integration, ancillary services
Lead Acid Battery	• Familiar • Inexpensive	• Relatively low energy & power density • Poor cycle life • Often requires maintenance • Environmental impacts	Best suited for relatively limited-cycle applications requiring shallow depth of discharge such as backup power and limited peak shaving.
Sodium Sulfur Battery	• High energy density	• High temps required • Limited power capabilities	Peak shaving, T&D investment deferral, renewable integration
Flow Batteries	• Decouple power (reactor size) from energy (tank size) • Improved cycle life	• Low energy density • Added components with pumping	Peak shaving, T&D investment deferral, renewable integration, ancillary services
Flywheels	• Fast Response • High Power	• Low Energy/duration • High self discharge rates	Power quality, frequency regulation, wind generation stabilization
Compressed Air Energy Storage (CAES)	• Reliable bulk storage	• Geologically limited	Capacity/energy services, ancillary services, renewable integration
Pumped hydro	• Reliable Bulk Storage	• Geographical limits • Capital intensive	Capacity/energy services, ancillary services, renewable integration

Carbon-Free Innovations Further Enabled through External Engagements

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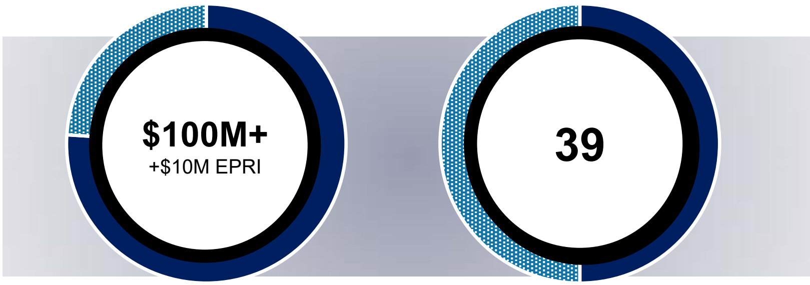
EPRI & GTI: LCRI Sponsors



Others | EIP, DOE, Universities

*Funding & Membership | Research | Research

* **Energy Impact Partners (EIP) – Summary of Funds Managed**

EIP Energy Impact Fund (EIF):
Energy Impact Partners (EIP) is a global investment platform leading the transition to a sustainable energy future. EIP brings together entrepreneurs and the world's most forward-looking utilities and operating companies to advance innovation. With over $1.5 billion in assets under management, EIP invests globally across venture, growth, credit and infrastructure – and has a team of more than 50 professionals based in its worldwide offices.

EIP Deep Decarbonization Frontier Fund (Frontier Fund):
Leveraging the industry and investing experience of the EIF, the Frontier Fund focuses on revolutionary technologies driving to net-zero emissions and mitigating climate change. This fund's target sectors include: zero carbon generation, carbon capture, hydrogen, energy storage, materials and industry, and transportation electrification.

EIP Elevate Diversity Impact Fund (Elevate Fund):
The Elevate Fund aims to increase diversity in the energy industry by investing in innovative companies founded or run by under-represented talent (e.g., black, latinx, women, LGQBT+, etc.). Elevate will help equalize the typically disproportional access to the venture capital ecosystem, as well as offer opportunities to positively affect disadvantaged communities.

Why is This Important in the Future?

Grid needs ➕ **Market and policy drivers**

Carbon-free generation resources

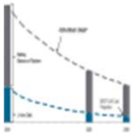
Integration of variable carbon-free resources

Grid operations and grid modernization

Resiliency improvements

Policy changes

Technology advances



Cost declines

Where We Are Going

Pre-2017

Backup only

TODAY

Primary use for grid stability and resiliency

Other options:
- Rate management
- Commercial DR
- Voluntary solar time shifting
- Backup

- Interconnection options

FUTURE

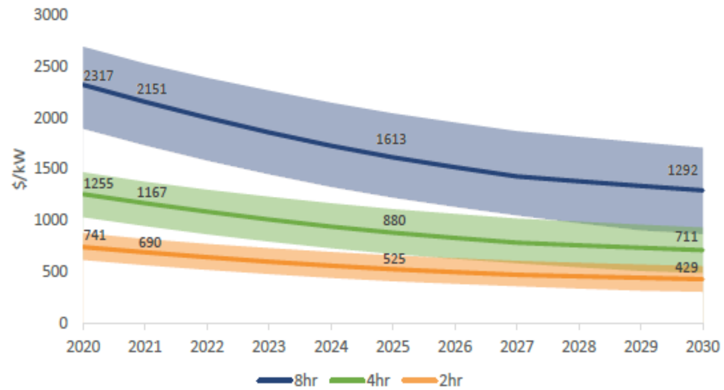
Primary use shared between grid, customer and decarbonization objectives

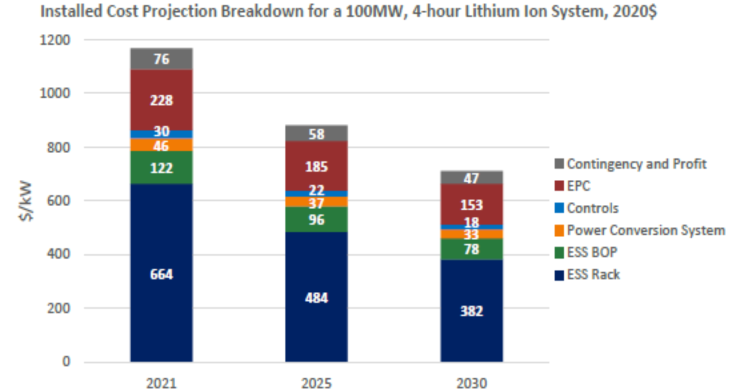
Integrated, optimized with other technology

Grid Examples:
- Capture of carbon-free energy
- Demand response
- Renewable integration
- Distribution deferral
- Ancillary services

Customer examples:
- Rate management
- Backup

Lithium Ion BESS Installed Cost Projections





Lithium ion installed costs are projected to decrease by over 40% by 2030. The top figure illustrates projected installed cost for a 100 MW system with upper and lower bounds based on the potential differences in costs captured in the bottom figure. The longer duration systems have a larger range due to the cost sensitivities of the battery portion which makes up a larger percentage of the installed cost.

The bottom figure illustrates an example breakdown of installed cost for a 100MW, 4hr system through 2030. Cost reductions will likely be accomplished across all major cost categories.

Battery cost declines are based on electric vehicle battery pack cost projections with adjustments for stationary racks. The gap between electric vehicle packs and stationary racks is assumed to decrease over time as stationary energy storage grows in manufacturing scale. Battery cost projections are lower than previous EPRI estimates which included some uncertainty around material prices. However, in the last two to three years battery manufacturers have adjusted their formulas and managed their supply chains to minimize impact of changes in the metals markets.

ACCREDITATION OF ENERGY STORAGE IN THE SOUTHWEST POWER POOL

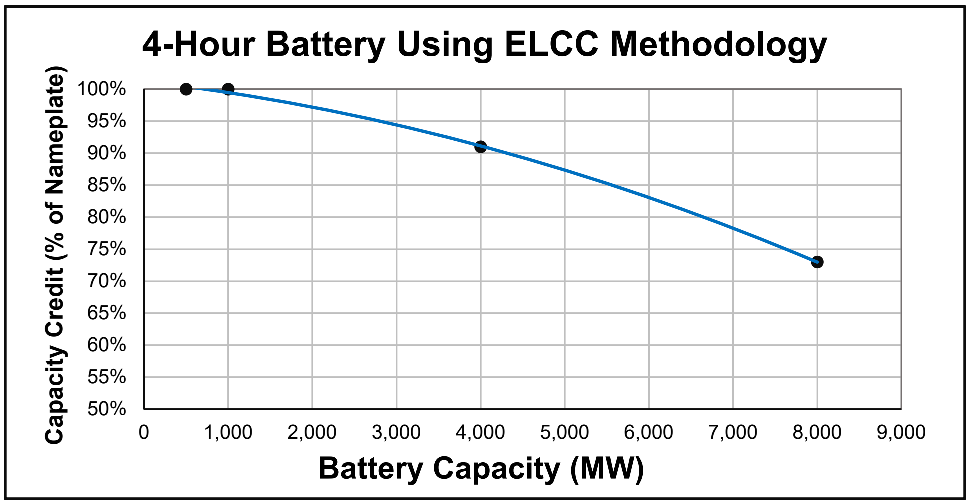
Ashley Gibbons | Resource Planning Analyst

May 13, 2021

SPP PROPOSED ACCREDITATION OF STANDALONE ENERGY STORAGE RESOURCES (ESRs)

Beginning 2023

- SPP will implement the Effective Load Carrying Capability ("ELCC") methodology for determining accredited capacity for standalone ESRs
- Batteries with a 4-hour or greater duration will initially qualify for 100% accredited capacity
- The amount of accredited capacity for energy storage resources will decrease as the penetration of energy storage increases across the SPP footprint (e.g. accredited capacity is reduced to 73% at 8,000MW of ESR)
- SPP will update ELCC study every two years



Nameplate Battery Size (MW-hour)	Nameplate Battery Duration	Nameplate Battery Capacity (MW)	Capacity value evaluated for ELCC Study (MW)
120 MW-hour	2 -hour	60MW	30MW
120 MW-hour	4-hour	30MW	30MW
120 MW-hour	6-hour	20MW	20MW
120 MW-hour	8-hour	15MW	15MW

QUEUED UP?
CLEARING THE SPP DISIS BACKLOG

Kevin Pera, P.E. | Transmission Analyst

May 13, 2021

MOVING THROUGH THE QUEUE

Past:	**Plenty of headroom in SPS territory**
Present:	**Clearing out the MW**
Future (??):	**Changing study structures**

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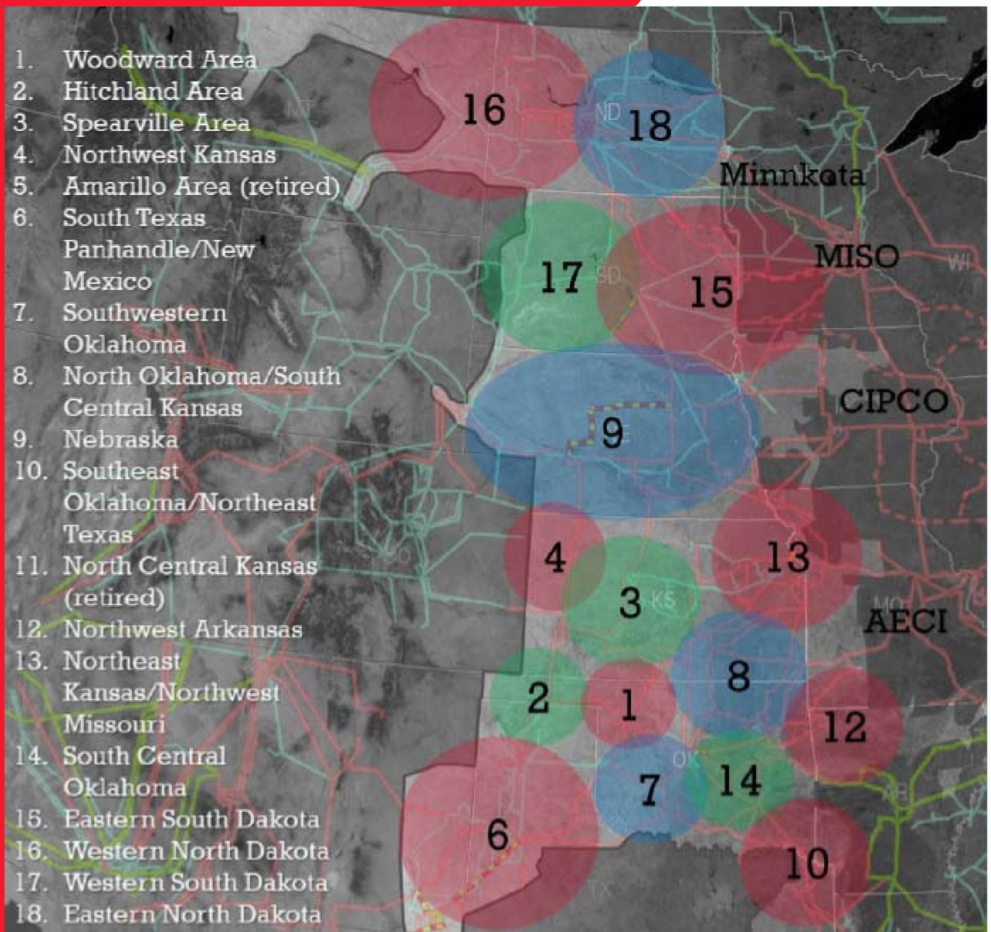

HOW DID WE GET HERE?

1. Old way—individual requests, studied in queue order
2. DISIS (2009-pres.)—clusters of requests
   - Same cluster—equally-queued
   - ←Studied in Groups
3. Each group exports all generation

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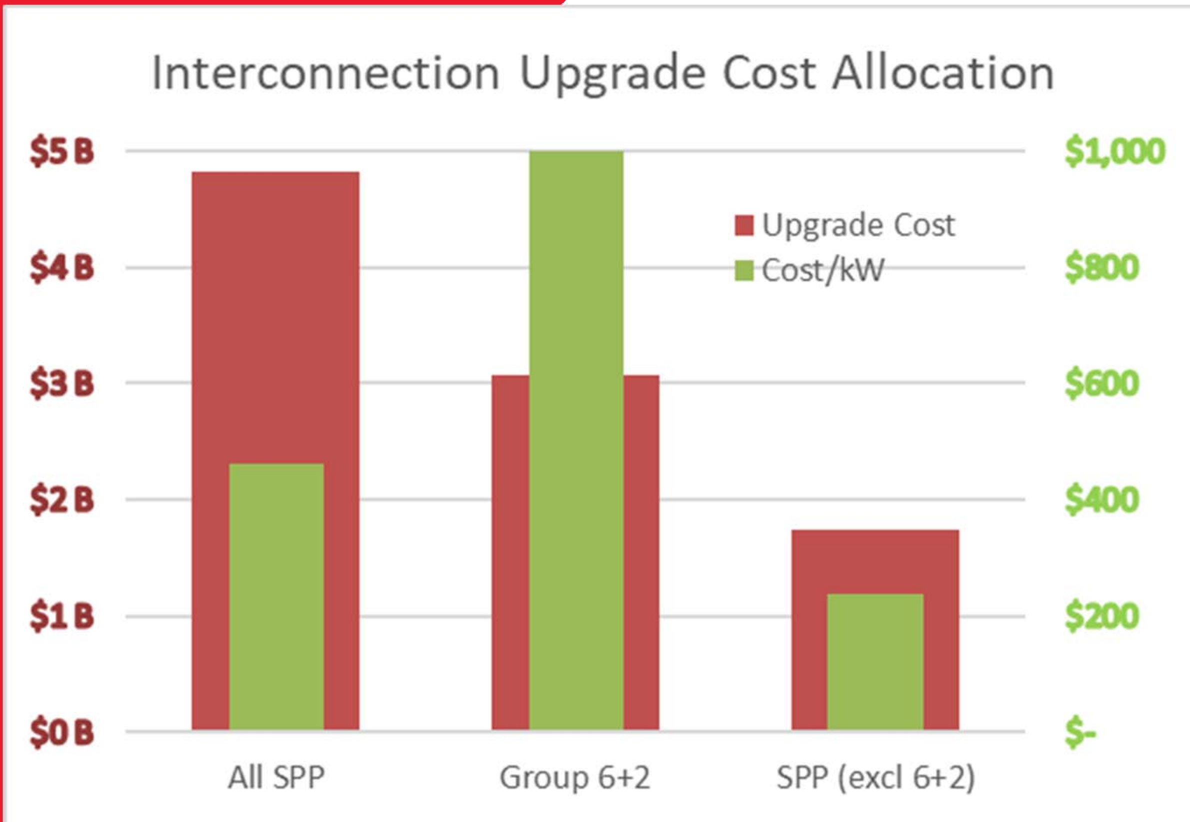
17-2 GROUP REDUCTION

- SPP North
- SPP North Central
- SPP Central
- SPP Southeast
- SPP Southwest



UPGRADES—THE MAIN ISSUE

1. All active requests and those with a GIA remain in future studies
2. Too many megawatts—too many upgrades
3. MW expire—SPP reconsiders their upgrades

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WHERE ARE WE NOW?

1.GENERAL

SPP working on 17-1, just announced 16-2 restudy

2.SPECIFIC

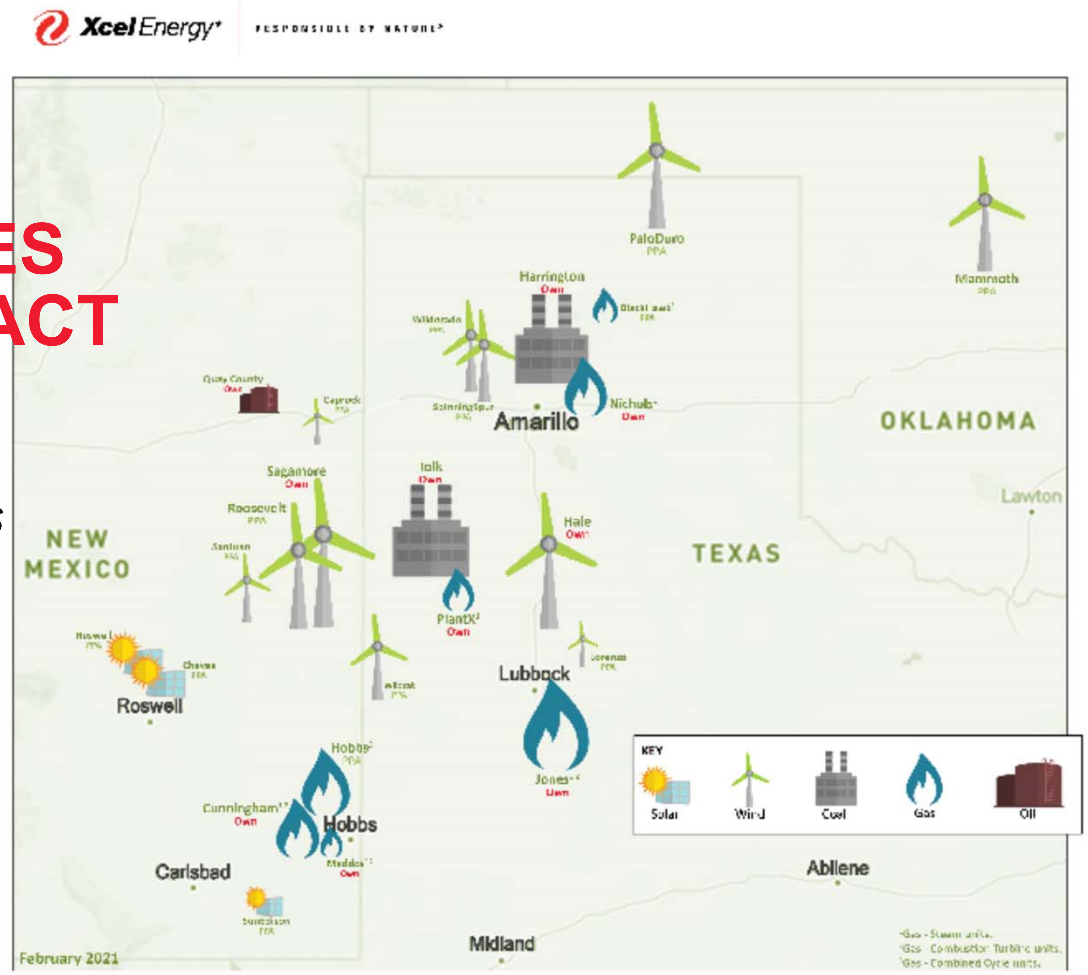
Decision Point 2 (DP2)

$930 million in at-risk deposits due today (May 13th)

$500 million in Group 6, to cover $2.5 billion in upgrades

HOW DOES THIS IMPACT SPS?

1. *Opportunities*
2. *Cost*
3. *Timing*



QUESTIONS & DISCUSSION

NM IRP DETAILS

- Web Page -

  https://www.xcelenergy.com/company/rates_and_regulations/resource_plans/2022_new_mexico_integrated_resource_plan

  ** Note: For the Service Area, click on New Mexico. At the bottom of the page click on the Public Advisory Meeting tab, then click on the date for the first public meeting*

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