



THE POWER OF PEOPLE



INTEGRATED RESOURCE PLAN (IRP) Final Report Update

NPPD Board of Directors Strategic Session
August 10, 2023

Jim Fehr, Jason Rosenkranz
Managers, Resource Planning & Risk



Nebraska Public Power District
Always there when you need us

Objective

- Provide the Board with a summary of the IRP Report and an overview of the changes made to it from the draft version provided in January.
- Prepare the Board to consider approval of the Final IRP Report next month.

The IRP provides...

Insight as to the most favorable approach for adding resources to meet future native load requirements while minimizing costs and risks



The IRP is a “directionally correct” vision of the future for decision making.



The IRP does NOT provide an exact expansion plan to follow for the next 30 years.

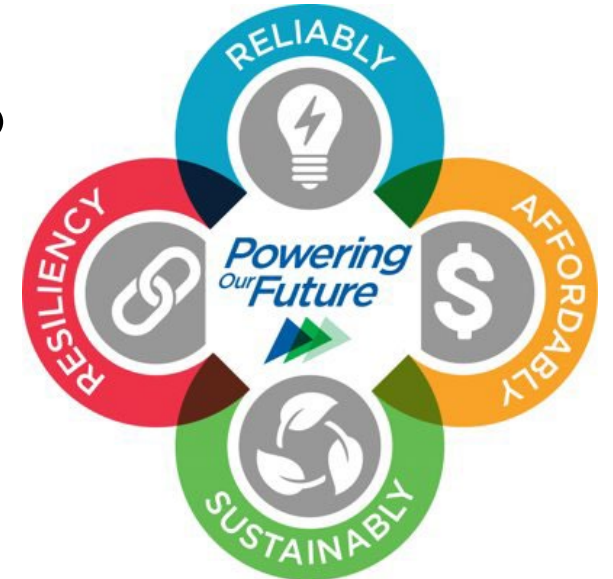
The IRP fulfills...

- WAPA’s IRP requirements
- Nebraska Revised Statutes Section 66-1060 requirements
- NPPD’s Wholesale Power Contract requirements

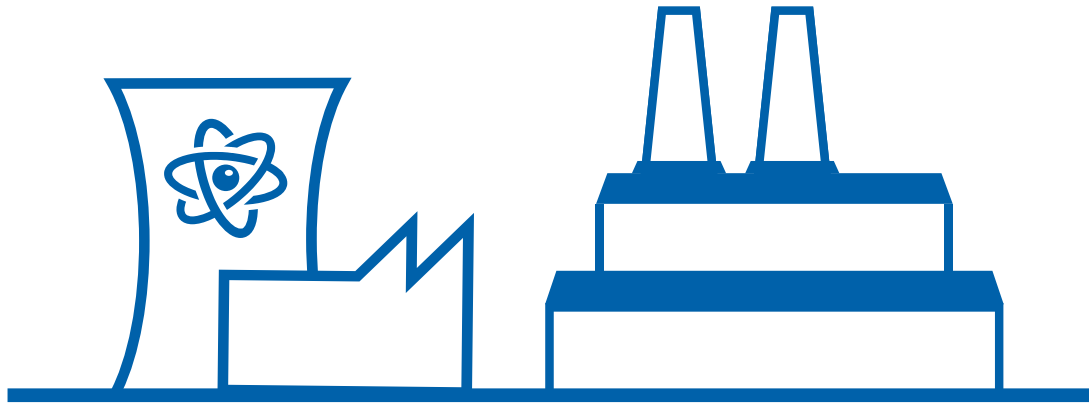
Assumptions

IRP Planning Principles

- Must align with NPPD’s Vision, Mission, and Strategic Directives
- **BP-SD-03** (Reliable and Resilient) requires NPPD to reliable and resilient generation portfolio to meet the needs of NPPD’s customers
 - With the resiliency to mitigate, survive, and/or recover from high impact events
- **BP-SD-04** (Cost Competitiveness) is committed to cost competitiveness in service to our wholesale and retail customers
- **BP-SD-05** (Carbon Emission Reductions) recognizes the business risk of carbon emissions and emissions regulations, and establishes the goal of achieving “net zero” carbon emissions from NPPD’s generation resources by 2050



Options Assumed for Existing Resources



Cooper Nuclear Station - CNS

1. Pursue 2nd license extension (operation until 2054)
2. Shutdown at the end of the current operating license (2034)

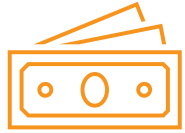
Gerald Gentleman Station - GGS

1. Continue to operate on Coal
2. Allow installation of Carbon Capture & Sequestration (CCS) equipment on Unit 2, starting in 2028
3. Early shutdown (no sooner than 2030)

Sheldon Station

1. Continue to Operate on Coal
2. Restore Natural Gas (NG) as primary fuel beginning in 2028
3. Early shutdown in 2028

Resource Considerations



COST

Stability and maturity of **initial capital cost**

Favorability of **operating costs** compared to potential substitutes



RISK

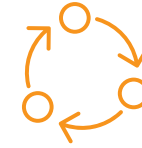
Maturity of the **underlying technology**

Ability to construct and operate on time



CO₂

Level of **CO₂ emissions**



OPERATING FLEXIBILITY

Ability to be dispatched

Flexibility to respond to changing loads



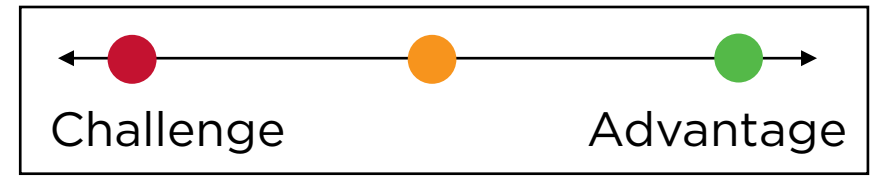
CAPACITY






Comparison of **nameplate capacity vs. accredited capacity**

Certainty of availability when needed

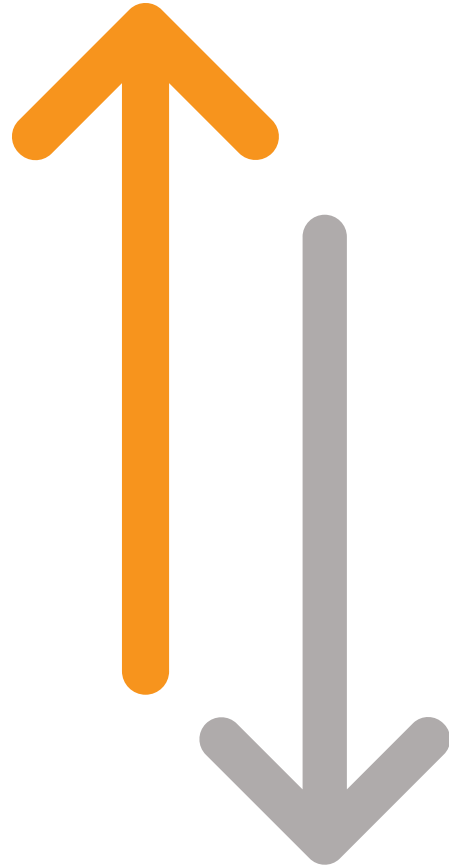
Assumptions for New Resource Options

LEGEND



New Resource Type	 Cost	 Risk	 CO ₂	 Operating Flexibility	 Capacity
Combined Cycle	●	●	●	●	●
Combined Cycle w/Carbon Capture	●	●	●	●	●
Combustion Turbine	●	●	●	●	●
Reciprocating Internal Combustion Engine	●	●	●	●	●
Small Modular Reactor	●	●	●	●	●
Wind	●	●	●	●	●
Solar	●	●	●	●	●
Battery	●	●	●	●	●

Potential credits from the Inflation Reduction Act (IRA) were not included in the assumptions



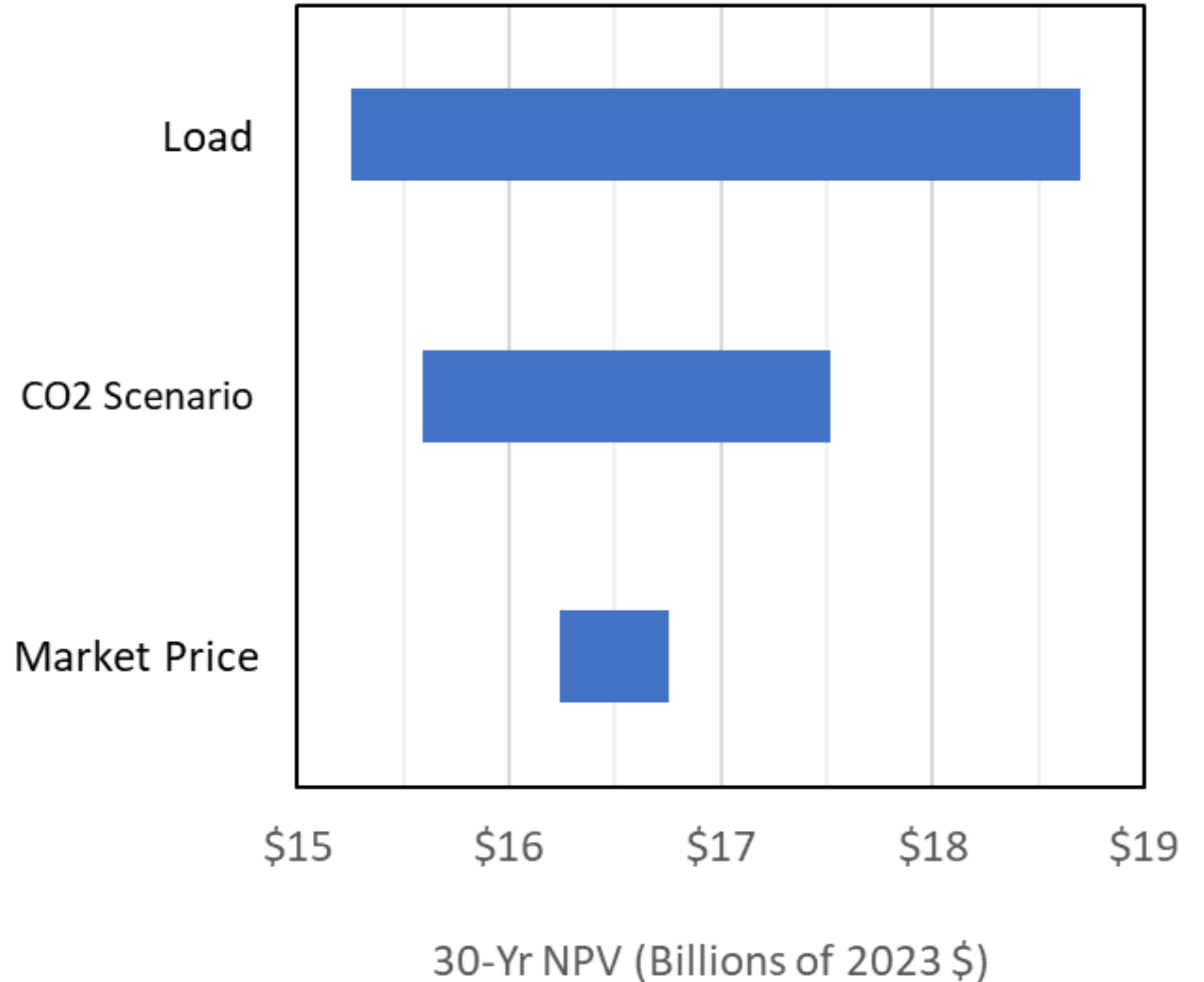
The model did not take possible IRA credits into account.

- NPPD continues to learn more on these credits as additional information is provided by the federal government.
- We performed high-level estimates to help understand the potential financial benefits in the draft IRP.
- The **IRA credits will be analyzed in any subsequent analyses.**

Results & Action Plans

3 Major Variables Impacted the Results

Variation in load had the greatest impact on the NPV in the scenarios.



RESULTS

CO2 Emissions of various scenarios

- SD-05 Emissions
- NZ 2035 Glide Path Emissions
- Net Zero 2035 Glide Path Target
- NZ 2050 Glide Path Emissions
- Net Zero 2050 Glide Path Target

NZ – Net Zero

Projected Carbon Emissions vs. Emission Reduction Targets



Cooper Nuclear Station CNS



RESULTS

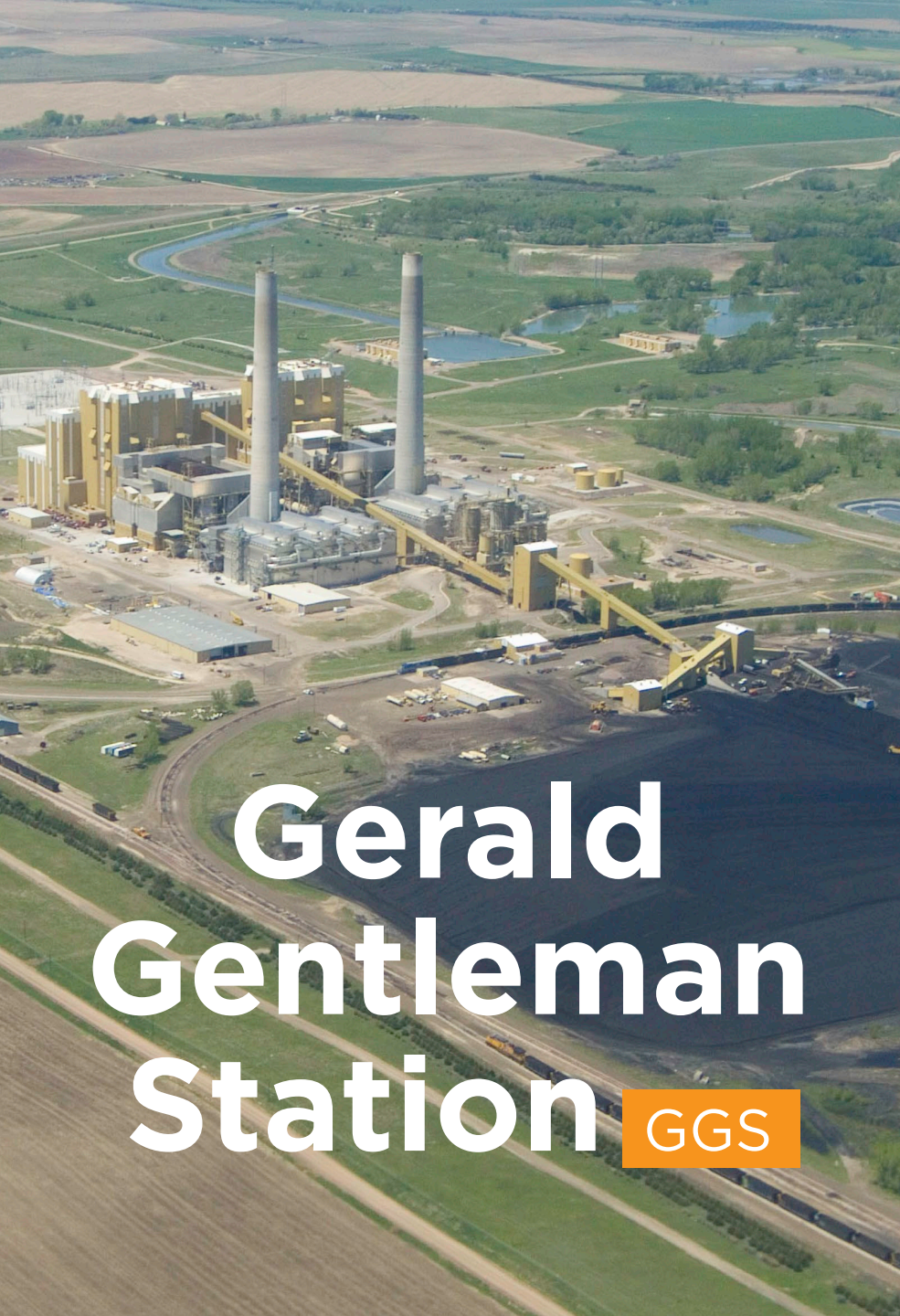
- Not always the absolute minimum NPV value, but the **2nd relicense reduces CO2 restriction risk** and provides resiliency and generation diversity
- **Least risky of the low carbon coal or nuclear options**

Cooper Nuclear Station CNS



PROPOSED ACTION PLAN

- Start proceeding with the **second relicense renewal process**, plus **refine the capital costs** needed for the relicensing
- Continue to **monitor CNS operating costs** and reevaluate license renewal if projected costs are significantly higher than assumptions in the IRP model

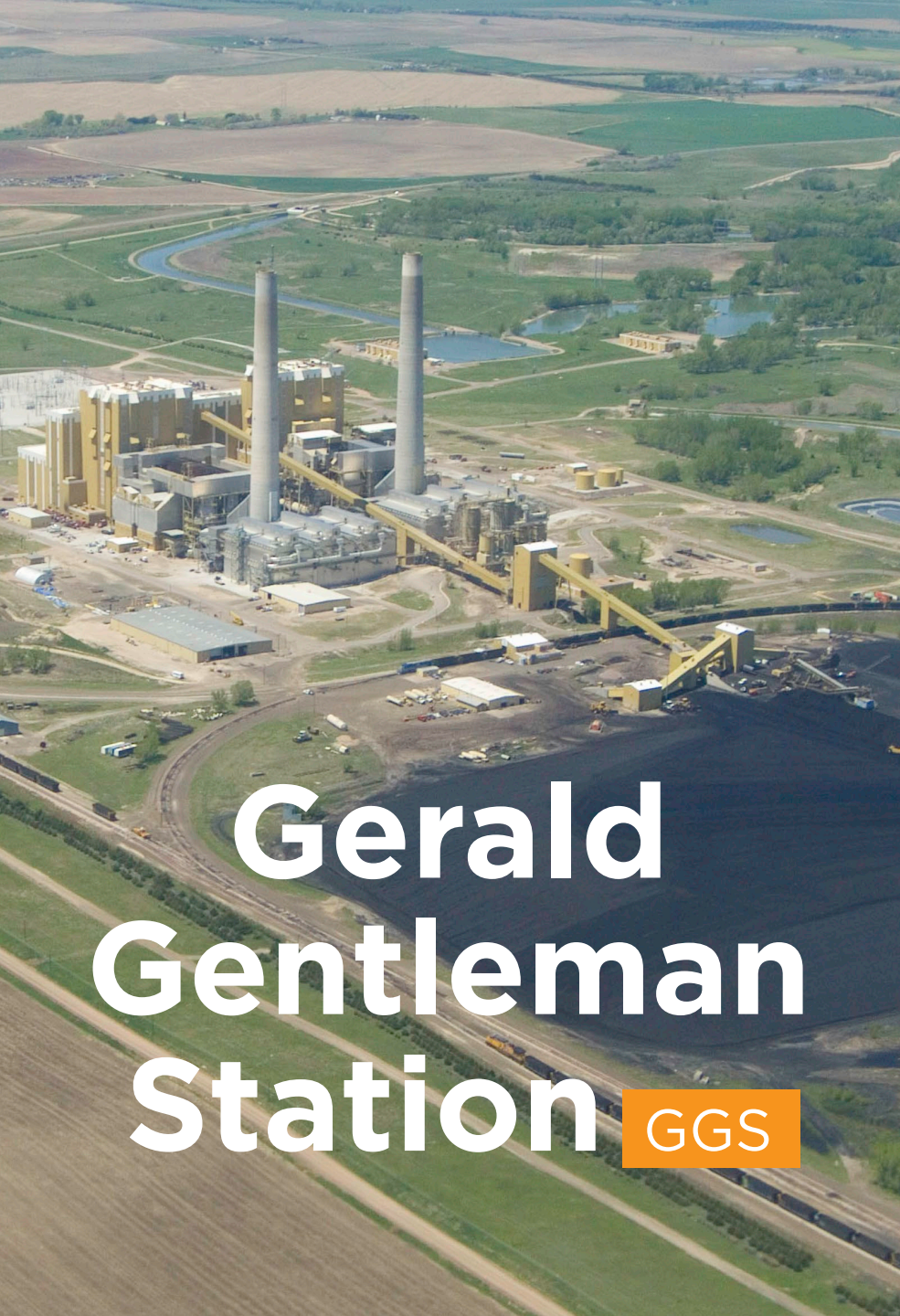


Gerald Gentleman Station

GGS

RESULTS

- **Currently a cost-effective solution** for NPPD's customers
- Carbon Capture & Sequestration (CCS) could be a cost-effective, resilient solution under restrictive CO2 scenarios & with IRA credits
 - But CCS is riskier than a 2nd relicense at CNS



Gerald Gentleman Station

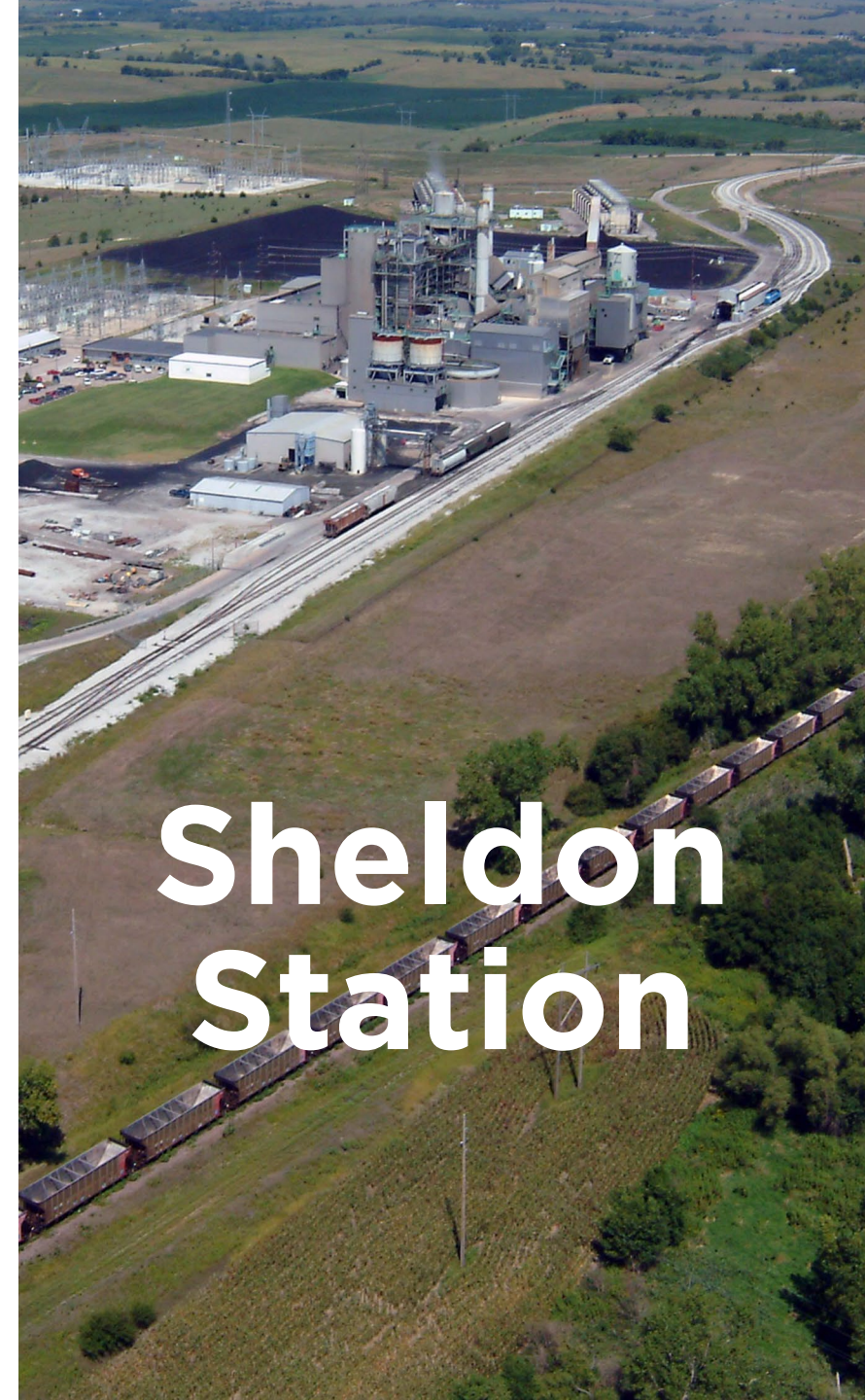
GGS

PROPOSED ACTION PLAN

- **Continue to operate GGS on coal**, while monitoring potential risks to continued GGS operation
- **Continue to investigate CCS for potentially lower cost options and impacts from the IRA credits**, as well as other options for the GGS site

RESULTS

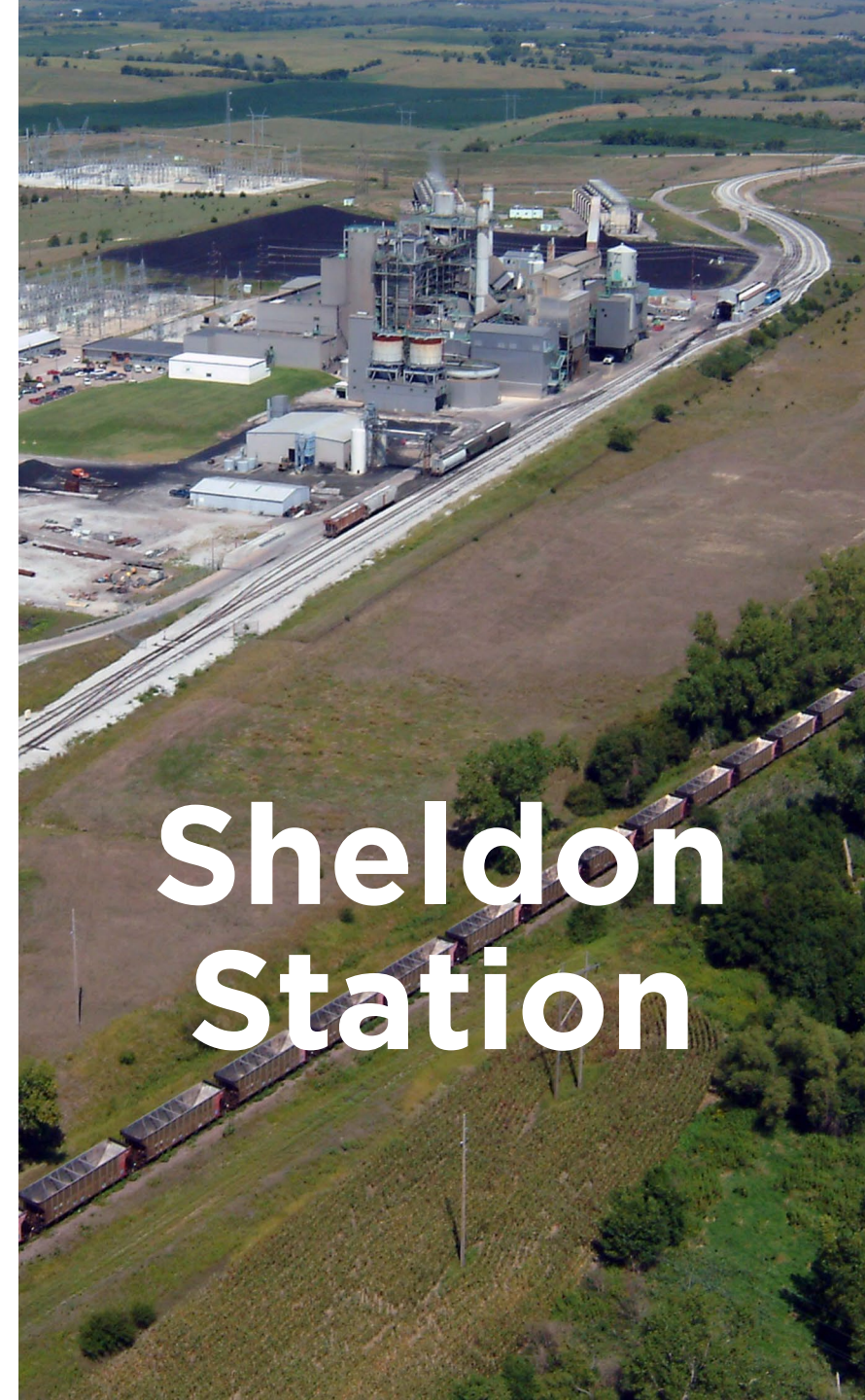
- A very **good location** for generation
- **Restoring natural gas as primary fuel** for Sheldon could be beneficial



Sheldon
Station

PROPOSED ACTION PLAN

- Continue to **pursue required modifications** at Sheldon for compliance with Effluent Limitation Guideline rule requirements, and
- **Investigate potential** restoration of the site to **natural gas operation**
- **Obtain better estimates** for natural gas restoration vs. a dual-fuel combustion turbine or reciprocating internal combustion engine facility **before making a final decision on any modifications.**



Sheldon
Station



RESULTS

- SMR was not selected in any of the cases due to cost and,
 - IRA benefits weren't included
 - Assumptions in model based on 1st of kind costs

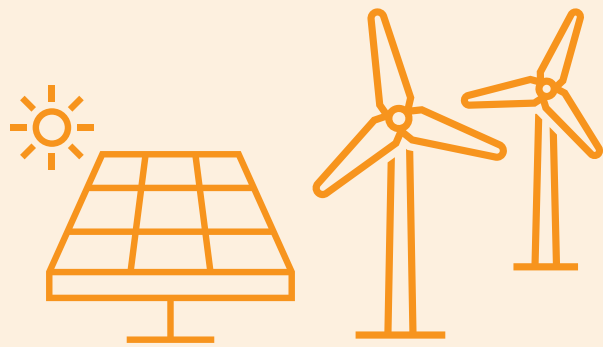
PROPOSED ACTION PLAN

- Continue to monitor progress and complete preliminary siting studies

Additional Results & Actions

ENERGY EFFICIENCY AND DEMAND RESPONSE

- **Results** - Larger amounts show benefit, especially in high load / restrictive CO₂ scenarios.
- **Action Plan** - Evaluate additional opportunities with our customers



EARLY INSTALLATION OF RENEWABLE GENERATION

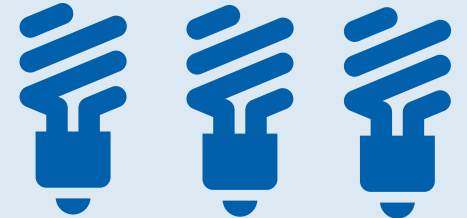
- **Results** - Installation of new renewables tends to occur if a unit is retired, or new load is added.
- **Action Plan** - Explore the possibility of early renewable installation utilizing Inflation Reduction Act (IRA) credits.

Load Growth Development



The latest projections indicate load may increase in the next few years more than prior projections due to the addition of large loads.

Load growth projections are tracking at or above the High Load Forecast scenario examined in the IRP.



Action Plan - Investigate resource options due to the higher near-term projected loads.

Capital Requirements

- Capital requirements for new resources and major upgrades/changes to existing facilities were reviewed for several of the cases.
- The capital requirements through 2035:
 - Ranges from
 - As low as \$0.2 billion with the 2nd license at CNS for a base load scenario & a 2050 Net Zero Glide Path.
 - As high as \$6.4 billion for a base load scenario & a 2035 Net Zero Glide Path.
 - \$4.8 billion for a case where CCS at GGS 2 was installed before 2035

NOTE: NPPD's current Wholesale Power Contract (WPC) expires at the end of 2035. While not part of the IRP discussion, it is understood that financing requirements of the new resources will require revisiting the terms & conditions of the WPC with our customers.

Public Interface

Public Interface Timeline

- January - Draft report discussion with Board and PRAB
- March
 - Recap of draft report with PRAB
 - Public sessions
 - Public survey
- April – Recap of public sessions at the Board Retreat

Written Comments

- Wholesale Customers
 - Two (2) written comments received from Southern and Nebraska Generation & Transmission
 - Both in general agreement with the IRP report, although both believe more discussion is necessary regarding the potential for increased funding of our Energy Efficiency (EE) program.
- Other Interested Parties
 - Midwest Energy Efficiency Alliance - Supportive for the IRP process to include EE to help meet BP-SD-05 goals.
 - Wärtsilä - Suggested the IRP model undervalued RICE units
 - Monolith, an end use customer of one of our wholesale customer - Suggested a recent Levelized Cost of Energy analysis could be utilized in the model

Stakeholder Meeting Comments

- Most of the questions/feedback were regarding modeling assumptions, although some comments on carbon
- Carbon
 - Carbon business risk
 - Choice of the CO2 scenarios
 - Some dissatisfaction setting CO2 limits (SD-05)
 - Customers of one business have been asking about their carbon footprint
- Load
 - Cost/benefit of new load
 - Net metering
 - EV load vs. irrigation
- Resources
 - Renewables – negative prices, IRA credits, are they really cheaper, % of present resource mix, capacity of solar vs. wind, battery storage hours, battery material
 - CNS vs CCS at GGS costs
 - Federal regulation for natural gas from Winter Storm Uri
- Other
 - Who developed the software
 - How far out until hydrogen & ammonia are reliable
 - Keep cost & reliability in mind / concern / resiliency metrics

Stakeholder Survey Comments

- 54 responses, 30 from NPPD's service territory
- Survey asked for zip code, utility & open-ended question on NPPD's IRP
- The survey did not utilize a scientific sampling method
- Themes
 - Top two (2) centered around reliability & affordability.
 - The next two (2) were regarding early deployment of renewables and the support for decarbonization efforts.
 - Unlike previous IRPs, the themes were similar between NPPD's customers and those outside of our service territory
- Given the outreach effort, the small number of completed surveys may indicate the public feels their opinions have been heard by NPPD
- The IRP survey results are generally consistent with results from previous scientific surveys

Changes made to Final Report & Next Steps

Summary of Changes to the Final-Proposed IRP Report

- Added an action item to investigate resource options due to the higher near-term projected loads discussed in the Executive Summary (ES) & added description in the Load Forecast section that present load projections are greater than the high load forecast in the IRP
 - This ties to the presentation in the public sessions stating similar intent.
- Reduced the ES in length, moving most of the introduction to a separate section, removing all exhibits in the ES
 - Included links to the exhibits in the other sections
- Revised the Public Interface section to describe the public process, general comments received from the sessions, and from our wholesale customers.

Summary of Changes to the Final-Proposed IRP Report

- Other minor changes:
 - Wordsmithing throughout
 - Update 2021 historical resource data with 2021-22 data
 - Update data from the 2021 Annual MMU Report to the 2022 Annual MMU Report
 - Added more acronyms to the List of Abbreviations
 - Changes to Appendices
 - Table updates
 - Removal of SD-05 Public Interface supporting information
 - Addition of letters received from stakeholders

MMU – Market Monitoring Unit

Next Steps

- August
 - Add clean and redline version of Final-Proposed IRP Report to website (nppd.com/irp)
- September
 - Board to consider approval of Final IRP Report
 - Submittal to WAPA (if approved by Board)
- After Board Approval
 - Final IRP Report Presentation to the Nebraska Power Review Board
 - Additional analyses of resources needed to meet future growth



THE POWER OF PEOPLE



Questions

Stay connected with us.



Nebraska Public Power District

Always there when you need us

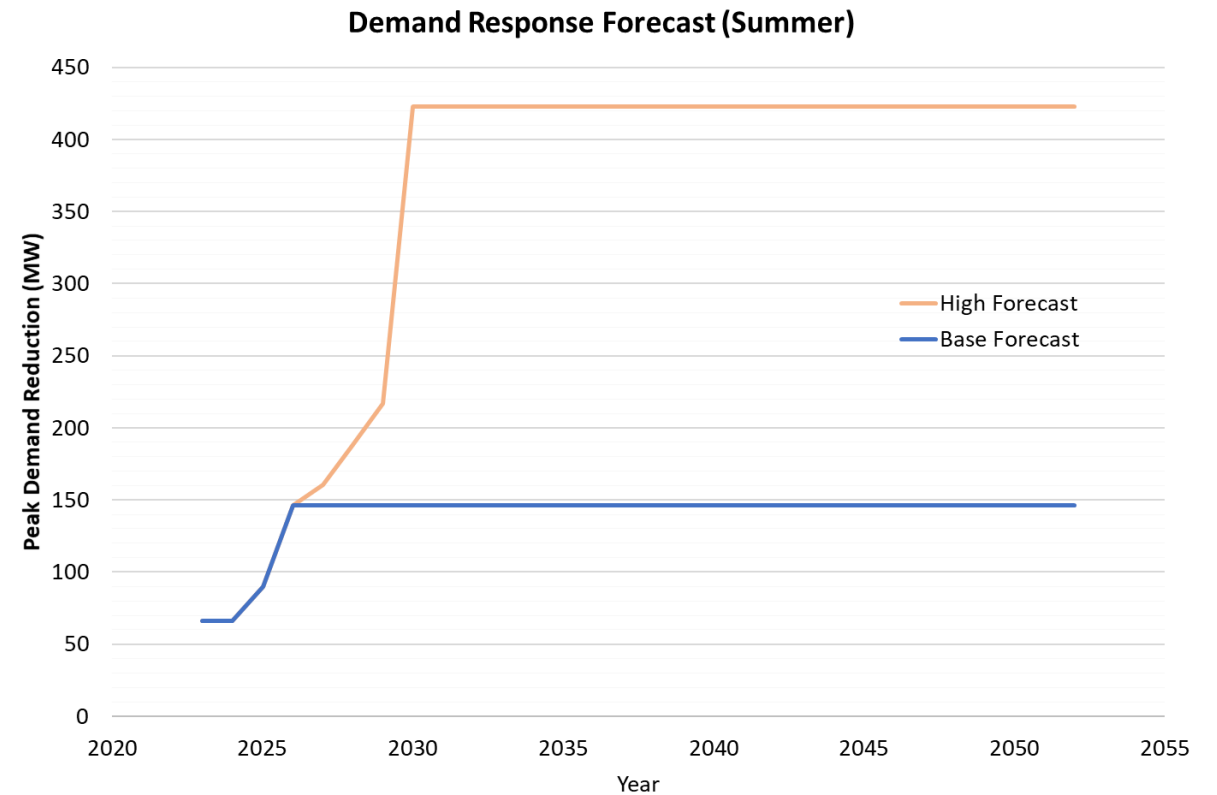
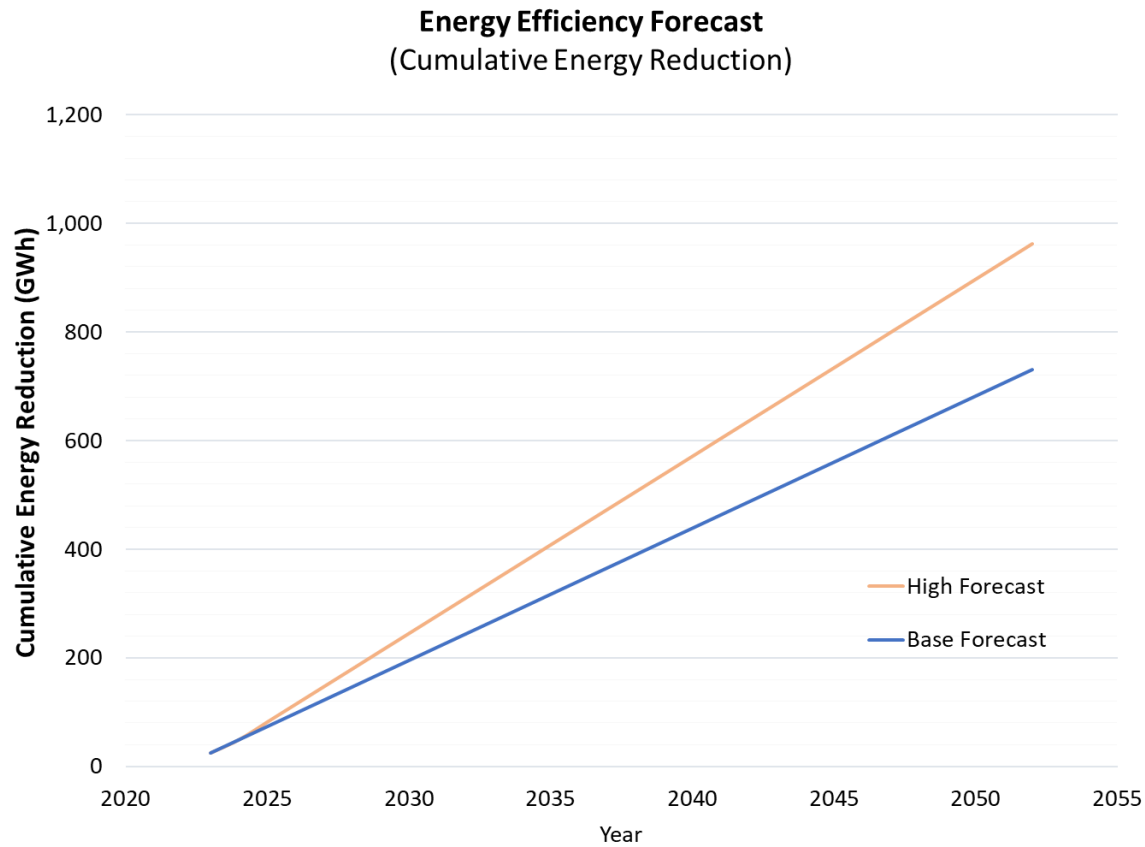
Backup Slides

Assumption – New Resources

Resource	Capacity (MW)	Economic Life (years)	Capital (\$/kW)	Capital Escalation	1st Year \$/MWh	Assumed C.F.
Combined Cycle (CC) – 1x1	386	30	\$1,174	2%	\$46	50%
CC – 2x1	1,000	30	\$1,032	2%	\$43	50%
CC - CO2 Capture	348	30	\$2,822	2%	\$78	50%
Combustion Turbine	207	30	\$809	2%	\$104	10%
RICE	216	30	\$1,464	2%	\$111	15%
Small Modular Reactor	600	30	\$8,220	1.5%	\$82	90%
Wind	200	20	\$1,336	1%	\$30	50%
Solar	125	20	\$1,130	(0.5%)	\$45	25%
Battery (4 hour)	50	10	\$1,233	(0.5%)	\$160	12.5%

Note: Potential financial benefits from the Inflation Reduction Act (IRA) and the Infrastructure and Investment Job Act (IIJA) are not factored in this table.

Assumptions – Energy Efficiency (EE) & Demand Response (DR)



Results – Generation Capital Costs

CO2 Scenario	Load Scenario	Other	Capital Requirements (Billions of Dollars)*	
			Through 2035	Through 2052
SD-05	Base		\$0.9	\$7.4
2050 Net Zero Glide Path	Base		\$3.5	\$6.2
2035 Net Zero Glide Path	Base		\$6.4	\$6.9
2050 Net Zero Glide Path	High		\$4.5	\$8.8
2050 Net Zero Glide Path	Low		\$2.8	\$3.7
2050 Net Zero Glide Path	Base	2 nd Relicense at CNS	\$0.2	\$4.1
2050 Net Zero Glide Path	Base	CCS at GGS 2	\$4.8	\$9.9

* This table reflects estimated capital costs for new resources and major upgrades/changes to existing facilities only. Annual on-going capital expenses to maintain existing resources are not included.