APS RPAC Meeting

10/25/2023

MEETING AGENDA

Welcome & Meeting Agenda
Matt Lind
1898 & Co.

IRP Portfolio Process
Mike Eugenis
APS

Rocky Mountain Institute (RMI)

Western Resource Advocates,
Southwest Energy Efficiency Project,
GridLab, and Energy Strategies

Break

IRP Preferred Portfolio
Mike Eugenis
APS

Next Steps & Closing Remarks
Matt Lind
1898 & Co.

Meeting Guidelines

Member Engagement

RPAC Member engagement is critical. Clarifying questions are welcome at any time. There will be discussion time allotted to each presentation/agenda item, as well as at the end of each meeting.

Action Items

We will keep a parking lot for items to be addressed at later meetings.

Meeting Minutes

Meeting minutes will be posted to the public website along with pending questions and items needing follow up. We will monitor and address questions in a timely fashion.

Preliminary Content

Meetings and content are preliminary in nature and prepared for RPAC discussion purposes. Litigating attorneys are not expected to participate.

September Meeting Recap

- APS discussed the latest updates to the ongoing 2023 All-Source RFP.
- Results from the Western Markets Exploratory Group(WMEG) Western Day-Ahead Market Production Cost Impact Study were presented.
- E3 talked about the importance of new transmission for increased renewables and highlighted factors that impact the timing of transmission projects.
- APS shared an update on the current IRP modeling results and reiterated the key themes from the study.

Following Up

- Action Items from Previous Meetings:

- Ongoing Commitments:
  - Distribute meeting materials in a timely fashion (3 business days prior)
  - Transparency and dialogue

IRP Portfolio Process

Mike Eugenis, APS

The IRP Portfolio Process

Overview of the Progressive Process

1. Reference (Baseline Case)
2. Four Corners Coal Exit Cases*
3. Technology Neutral Case*
4. Low & High Renewable Capital Costs/High Gas Price Cases
5. Low & High Load Cases*

Objectives of Each Case

1. Benchmarking
2. Reliability and cost impacts
3. Impact of emission reduction goals or renewable/carbon emission standards
4. Robustness assessment of portfolios
5. Identifying high-value resources

*Represents Cases Required by the Arizona Corporation Commission

The IRP Portfolio Process

Reference Case

Baseline for benchmarking and comparison

Sensitivities

Overview of the progressive modeling process and learnings from results

Resource Value & Constraints

Identifying most valuable resources and influential constraints

Preferred Plan

How results from other cases informed the Preferred Plan

What is a Preferred Portfolio

Reliable

Least-Cost

Robust

The Preferred Portfolio is:

- A diverse mix of technologies
- Informed by key trends from other scenarios
- Reliable and least-cost to customers

And it includes impacts of:

- Weather & variable energy resources on PRM & resource need
- Inflation Reduction Act (ITC/PTC)
- Customer-Sided Resources w/ varying levels of investment in EE
- Economic Cycling of Coal Units
- Transmission Availability and Build Times

Results will be shared in the IRP Preferred Portfolio section of today's meeting

RPAC Member Presentations

- Members of the RPAC will be presenting findings from their analysis of the 2023 IRP cases.


aps
Rocky Mountain Institute

Arizona Resource Planning Review: Arizona Public Service 2023 IRP

RMI
ENERGY. TRANSFORMED.

Presented to APS Resource Planning Advisory Council
October 25, 2023

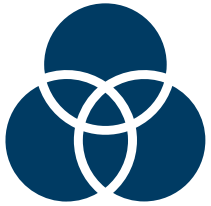
RMI's Role

- RMI partnered with AriSEIA, Advanced Energy United, and Vote Solar to participate in the RPAC process and identify opportunities to improve the utility's approach to resource planning.

- Our review is based on materials shared by Arizona Public Service (APS) during Resource Planning Advisory Council meetings, January – September 2023.

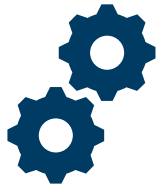
- **As a note, all information in this presentation is from APS publicly-shared RPAC meetings.**

RMI’s Assessment Objectives:



- Understand how APS's IRPs address **emerging resource planning challenges and opportunities.**

- Marshal learnings from **case studies and leading practices** from resource plans across the country



- Make **accessible and actionable recommendations** to improve resource planning outcomes

RMI's Approach: Critical Topics

Our review focuses on three critical topics in resource planning:

Key Topic	Implications for Resource Planning
Adoption, selection, and operation of **Distributed Energy Resources (DERs)**	• Proliferating DERs can provide cost-effective grid services or defer & avoid new generation capacity, but require detailed understanding of location of DER deployment and timing of generation
Approach to modeling **Reliability and Resource Adequacy**	• Increases of variable renewable and energy-limited resources, as well as changing weather trends and regional coordination, require new approaches to resource adequacy
How **Inflation Reduction Act (IRA) provisions** are reflected in the plans	• Inflation Reduction Act promise to transform the economics of new generation resources, retiring conventional capacity, and deploying electrification and energy efficiency

Overview: Distributed Energy Resources in Resource Planning

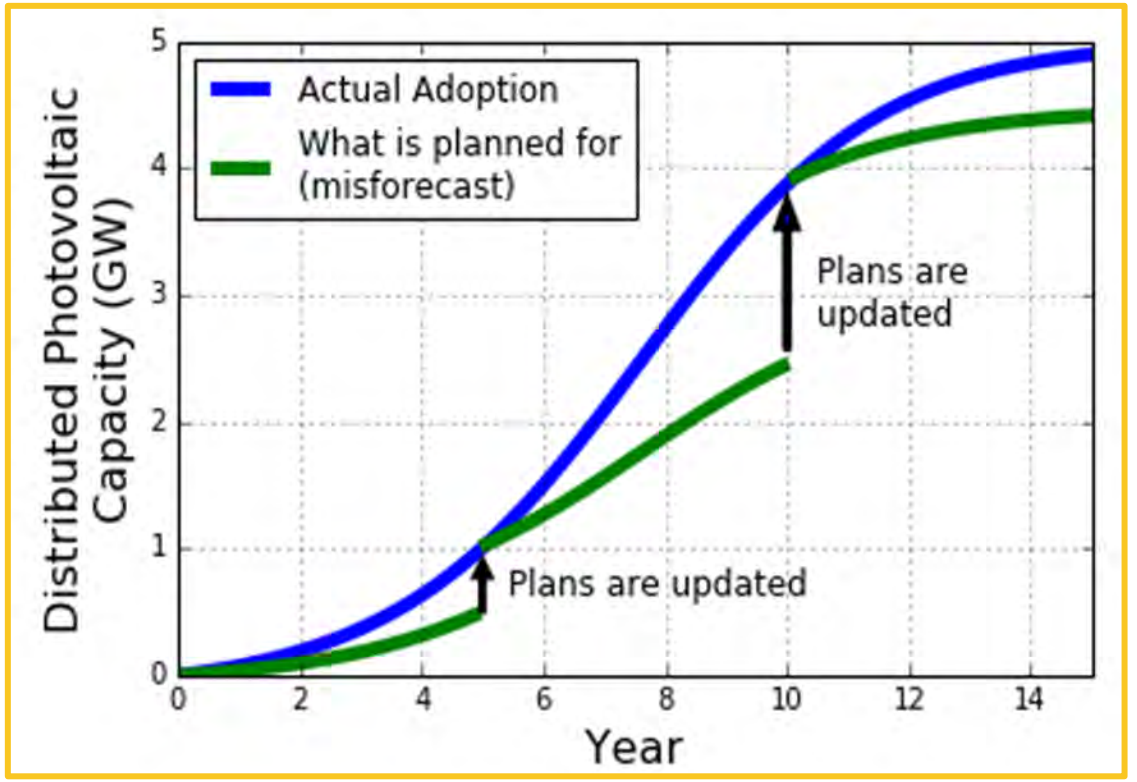
Specific Topic Areas:

Anticipating DER Adoption: Forecasts & Scenarios

Selecting DERs in Planning & Procurement

Valuing Grid Benefits of DERs

Potential mismatch between DER forecasts and adoption



Lawrence Berkeley National Lab, "Estimating the Value of Improved Distributed Photovoltaic Adoption Forecasts for Utility Resource Planning."
Graph shows an example when adoption is systematically under-forecasted.

Overview: Distributed Energy Resources in Resource Planning

	Anticipating DER Adoption: Forecasts & Scenarios	Selecting DERs in Planning & Procurement	Valuing Grid Benefits of DERs
Emerging Challenges	• New adoption drivers & more diverse technologies. • More sophisticated availability modeling.	• New market structures & accessibility. • Emerging Aggregated DERs & Virtual Power Plants.	• DERs can play a role in resource adequacy. • Connection between distribution-level and bulk-power system benefits.
Resource Planning Practices	• Customer-focused, probabilistic & locational forecasts. • Combined DER Scenario Planning.	• Including DER candidates in resource planning. • Flexible, all-source procurement.	• Accredit resource adequacy value of DERs using ELCC. • Evaluate & represent the locational value of DERs in grid planning.

DERs in Resource Planning: Evaluating APS's Approach

Short-Term, IRP Model	• Combined DER forecasts. • Integrate DER Bids.
Short-Term, Non-IRP	• Flexible, all-source procurement. • Update EE/DSM plans to reflect IRA economics.
Long-Term	• Detailed, locational forecasts. • Selectable DER Resources in Portfolio Selection. • Integrated Distribution System Planning.

Ensuring Resource Adequacy in an Evolving Energy System

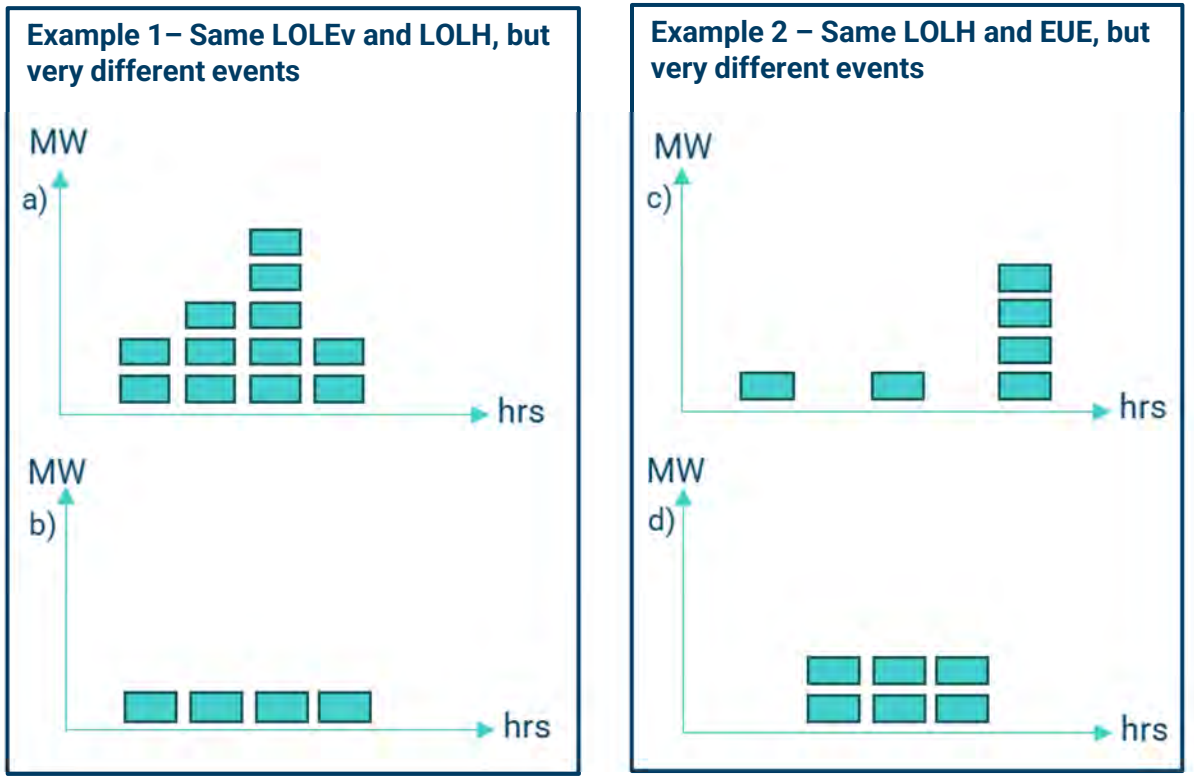
Key Topic Areas

Defining Resource Adequacy (RA) Goals and Metrics

Accrediting Resources

Integrating Weather & Climate Trends

Comparing reliability metrics with different shortfall events

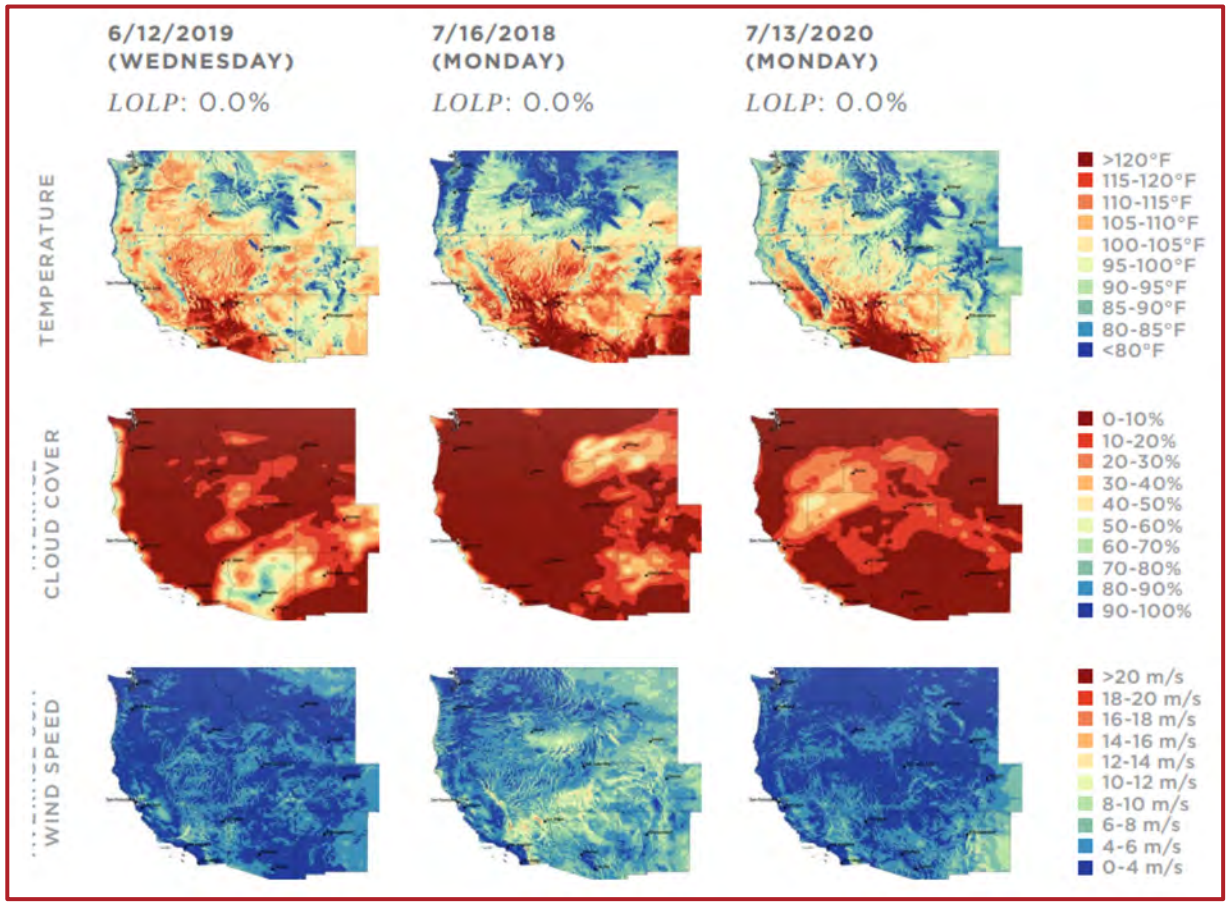


Adapted from: Energy System Integration Group (ESIG) Redefining Resource Adequacy for Modern Power Systems

Ensuring Resource Adequacy in an Evolving Energy System

Key Topic Areas

- **Defining Resource Adequacy (RA) Goals and Metrics**
- **Accrediting Resources**
- **Integrating Weather & Climate Trends**



In the above examples, high temperatures and little cloud cover drive substantial heat and electricity load, but ideal wind and solar conditions allow those resources to contribute and avoid risk of outage.
From GridLab Advancing resource adequacy with the GridPath RA Toolkit

Overview: Resource Adequacy in Resource Planning

	Defining Resource Adequacy (RA) Goals and Metrics	Accrediting Resources	Integrating Weather & Climate Trends
Emerging Challenges	• Diversifying causes of outage events • Lack of transparency of traditional approach	• Better understanding value of existing generation units. • Synergies across variable renewable and energy-limited resources.	• Renewable-weather energy correlation. • Extreme weather driving outage events.
Resource Planning Practices	• Multi-metric resource adequacy goals. • Holistic resource adequacy evaluation.	• Interactive effects between storage and renewables • Updating RA values based on evolving portfolios.	• Updated load and generation forecast techniques. • Understanding regional impacts of weather events.

Resource Adequacy: Evaluating APS's Approach

Short-Term

- Calculate and report out on multiple resource adequacy metrics, including qualitative results.
- Integrate an understanding of regional coordination scenarios across all resource planning analyses.
- Integrate climate impacts into load and generation forecasts.
- Ensure that thermal resources' capacity is appropriately accredited.

Long-Term

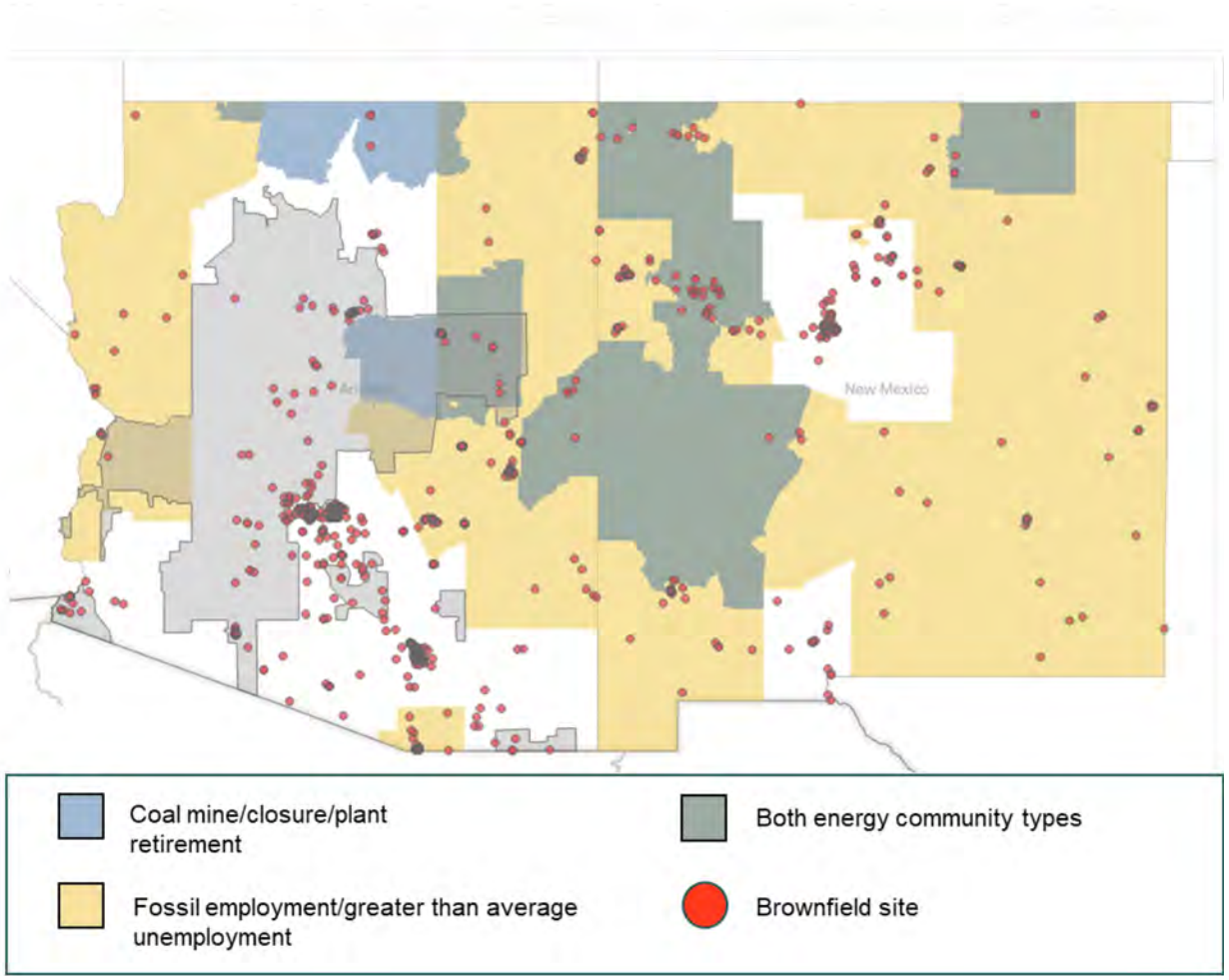
- Define an updated resource adequacy standard with a holistic review.
- Use iterative approaches to understand resource adequacy contributions of individual resources.
- Detailed high-impact, low-probability event analysis.

The Inflation Reduction Act Will Transform the US Energy Landscape

Key Topic Areas

- **Clean Energy Tax Credits**
- **Coal Unit Transition via Energy Infrastructure Reinvestment**
- **Load Forecast integrating new EE Economics**

The Inflation Reduction Act Will Transform the US Energy Landscape



Key Topic Areas

- **Clean Energy Tax Credits**
- **Coal Unit Transition via Energy Infrastructure Reinvestment**
- **Load Forecast integrating new EE Economics**

The Inflation Reduction Act Will Transform the US Energy Landscape

RMI conducted an analysis of retirement and clean repowering of Four Corners using the EIR program and found that, as opposed to using EIR could:

- **Retire Four Corners in 2027 or 2028**
- **Avoid 22.5 million metric tons of emissions**
- **Reduce up to ~$400 million in ratepayer costs**
- **Drive ~$100 million in additional shareholder value**

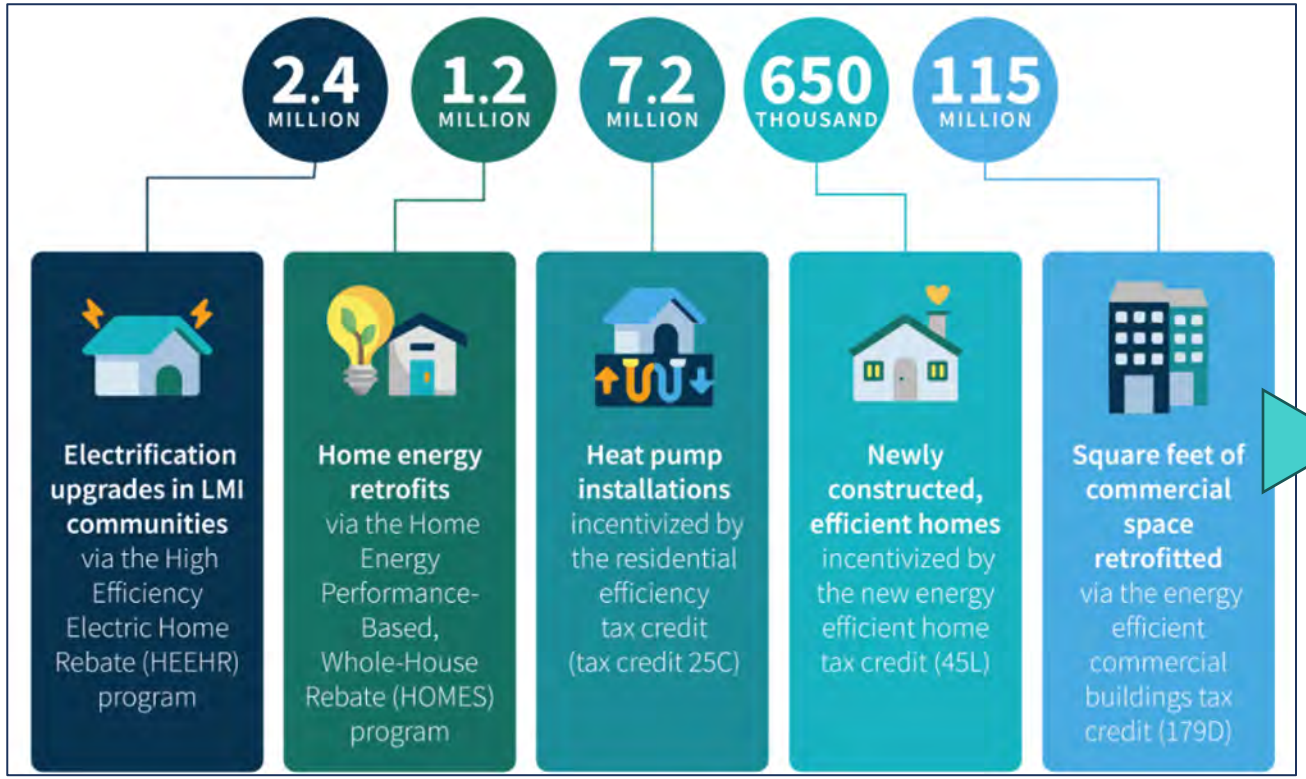
Key Topic Areas

Clean Energy Tax Credits

Coal Unit Transition via Energy Infrastructure Reinvestment

Load Forecast integrating new EE Economics

The Inflation Reduction Act Will Transform the US Energy Landscape



RMI, "The Inflation Reduction Act Could Transform the US Buildings Sector"

Key Topic Areas

- **Clean Energy Tax Credits**
- **Coal Unit Transition via Energy Infrastructure Reinvestment**
- **Load Forecast integrating new EE Economics**

Inflation Reduction Act: Evaluating APS's Approach

Short-Term, IRP Model	• Integrate consideration of the Energy Communities bonus adder into resource costs. • Model EIR financing for retirement and clean repowering of the Four Corners plant.
Short-Term, Non-IRP	• Ensure that procurement processes highlight the opportunity of the Energy Communities adder and build bidder transparency. • Update EE/DSM programs to reflect IRA credits and economics.
Long-Term	• Detailed Energy Communities Analysis. • New EE/DSM Programs. • Application for EIR Funding.

Thank you!

If you're interested in our work on resource planning, check out Reimagining Resource Planning and Power Planning for the People.

If you have additional questions or thoughts, don't hesitate to reach out to our team:

- *Tyler Fitch – tyler.fitch@rmi.org*
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- *Lauren Shwisberg – lshwisberg@rmi.org*

WRA, SWEEP, GridLab, and Energy Strategies

2023 APS Preferred Portfolio

Aurora Model Review and Alternative Scenarios

October 2023

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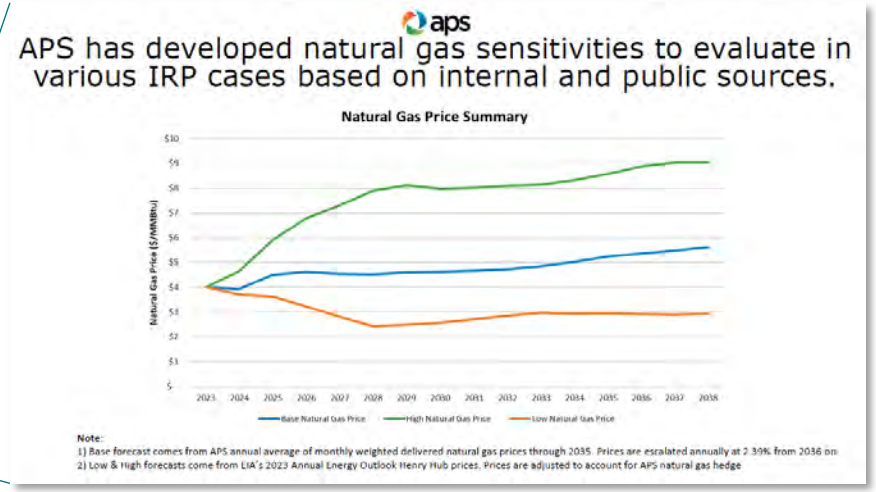
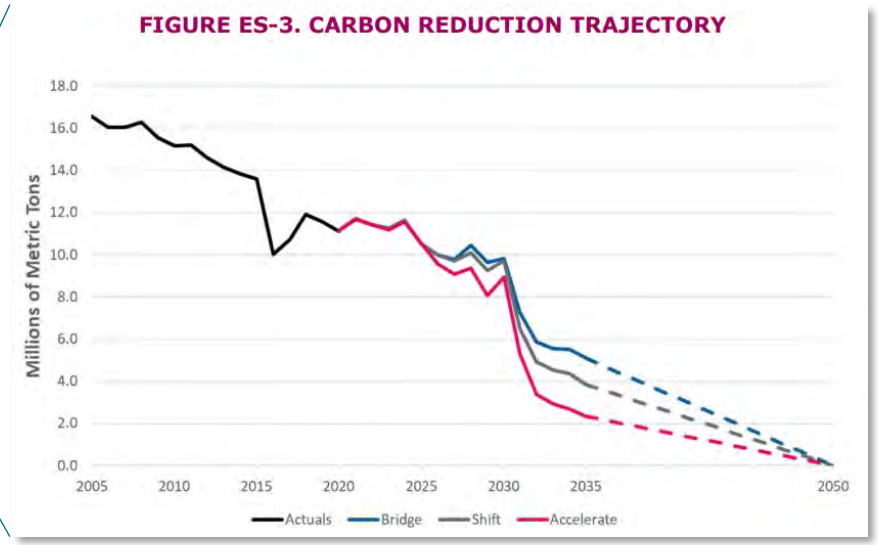
Modeling alternatives

- **Early Four Corners Retirement:**
  - Retires Four Corners 3 years early in 2028.
    - Caveat: Scenario costs include only those inputs provided in the APS reference model. Accordingly, retirement costs and coal contract commitments are not considered.
- **High Gas Price**
  - Scales up natural gas prices by the ratio of the "High Gas Price" trajectory and the Model's AZ Monthly NG Price.
    - Based on the May 17 RPAC Natural Gas Price Summary presentation.
- **Market Expansion**
  - Doubles the 2023 Import Limit from 700 to 1400.
- **No Fossil**
  - Retires Four Corners 3 years early in 2028 and limits expansion candidate resources to non-Fossil options.
- **Carbon Reduction**
  - Zero CO_2 by 2050: Imposes an annual CO_2 emissions constraint compliant with the 2020 IRP.





Scenario summary

- **The IRP reference case results in moderate costs, but high CO_2 emissions when compared to the alternatives reviewed**
  - Retiring Four Corners 3 years early reduces CO_2 emissions and costs.
    - Over the study horizon, Four Corners can be retired early with minimal impact to the resource plan.
  - The High Gas Price scenario illustrates the limited effectiveness of fuel prices to reduce CO_2 emissions.
    - Results indicate only a slight to moderate reduction in CO_2 emissions with a significant impact on scenario costs.
  - Increasing market imports offers the APS system significant cost and moderate emissions savings.
  - Limiting resource expansion to non-fossil resources results in reduce costs and significant reductions in CO_2 emissions.
  - The Zero CO_2 2020 IRP scenario represents significant emissions savings consistent with the 2020 IRP trajectory and increased costs.
    - Note: Increased costs are driven by the adoption of expensive, non-emitting nuclear facilities at the very end of the study horizon.

Scenario	Total Portfolio Cost ($B)	Storage Generation (TWh)	CO2 Reduction (% 2005)	Carbon Abatement ($/mT)
IRP Reference	34.20	64.45	53.64	0.00
Early FC (2028)	33.73	56.63	57.00	-29.29
High Gas Price	39.79	64.17	58.39	522.98
Market Exp (2x)	32.37	62.13	62.24	-86.47
No Fossil	39.10	85.66	68.62	181.77
Zero CO2 by 2050	43.97	74.66	85.04	234.48

(1) APS emitted 16.6 mmT of CO_2 in 2005 according to their 2020 IRP.

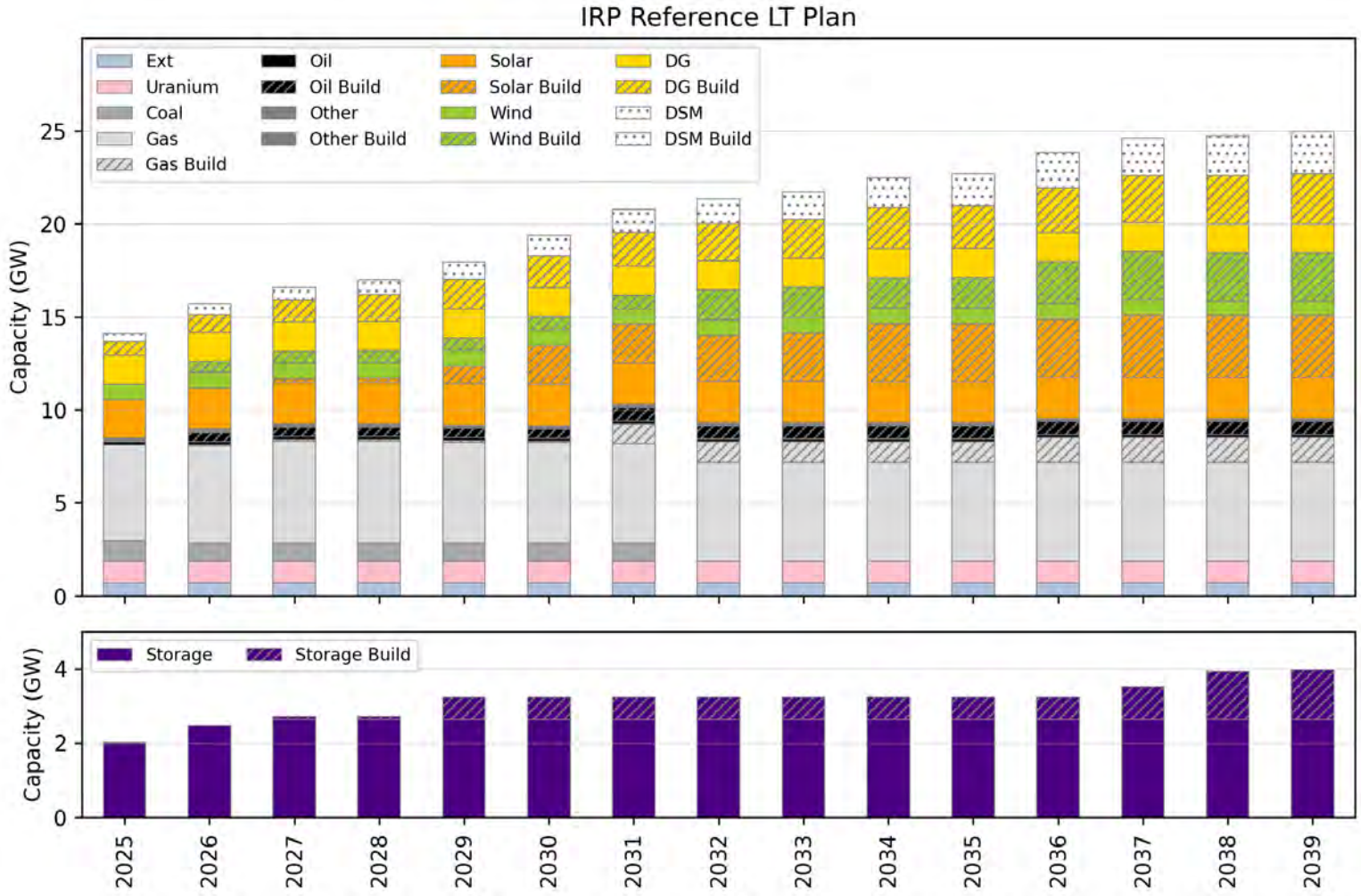
(2) Carbon abatement is the amount of carbon removed relative to the IRP reference divided by the total portfolio cost difference (measured in $ per metric Ton CO2).

Takeaways from alternative portfolios

1. **Four Corners can be retired early in 2028 without regret. Doing so reduces portfolio costs and CO_2 emissions. Four Corners is retired early in both the "Early FC (2028)" scenario and the "No Fossil" scenario.**
   - In the "Early FC" scenario, the model compensates for the loss of firm capacity in 2028 by expanding natural gas capacity earlier in the study horizon. Despite the earlier build of natural gas resources, the "Early FC" scenario results in lower total carbon emissions and a slightly smaller natural gas fleet by 2039.
   - In the "No Fossil" scenario, the model compensates for the loss of firm capacity in 2028 by expanding storage capacity earlier in the study horizon.
   - Portfolio cost results show a negative cost (savings) to retiring Four Corners early.
2. **New storage, with wind, will be crucial to achieve carbon emissions consistent with the 2020 IRP trajectory. Low carbon futures will rely more on wind + storage than on new solar expansion. Expansion results illustrate the complementary nature of new wind with storage.**
   - The "Zero CO_2 by 2050" scenario builds ~2.5x as much wind, ~3.0x as much storage and 1/3 of the solar capacity when compared with the IRP Reference.
   - In a solar rich state such as Arizona, the combination of wind + storage offers resource diversity to help meet system needs.
3. **Aggressive Energy Efficiency adoption is selected by all scenarios but the "IRP Reference" and the "Market Expansion" scenarios.**
   - The aggressive adoption results in 50% more DSM capacity (~1 GW). This selection indicates the role of demand side management across a diversity of futures.
   - The lack of aggressive demand side management expansion in the "Market Expansion (2x)" scenario suggests DSM's function as a capacity resource to the APS system.
4. **Lowest cost carbon reductions can be best achieved by early action.**
   - Over the first 10 years of the study (2025-2034), the "Zero CO_2 by 2050" scenario costs 12% more than the IRP reference while reducing CO_2 emissions by 25%.
   - Beyond 2034, the model has limited information regarding the reality of candidate, non-emitting resources. In these final years, the "Zero CO_2 by 2050" scenario accrues 76% of its cost premium.
5. **Limiting expansion candidates to non-emitting resources, as in the "No Fossil" scenario, provides a hedge against gas price risk and volatility.**
   - The cost parity of the "No Fossil" and "High Gas" scenarios, $39.10B and $39.79B respectively, illustrates how APS can reduce its exposure to fuel prices and reduce emissions by leveraging clean generation resources.

Establishing a baseline

- **The IRP Reference plan represents APS expectation for resource expansion over the study horizon.**
  - Resource capacities presented illustrate the out-of-the-box results of the APS v4 Aurora Model.
- **Capacity expansion highlights:**
  - Retire 1.1 GW of Coal capacity (Four Corners) in 2031.
  - Builds 1.3 GW of Natural Gas capacity.
  - Builds 3.3 GW of Solar capacity.
  - Builds 2.6 GW of Wind capacity.
  - Builds 2.3 GW of Distributed Generation.
  - Builds 1.3 GW of Storage capacity.
  - Expands Energy Efficiency Programs by 2.3 GW.
  - Peak Load increased 3.9 GW.

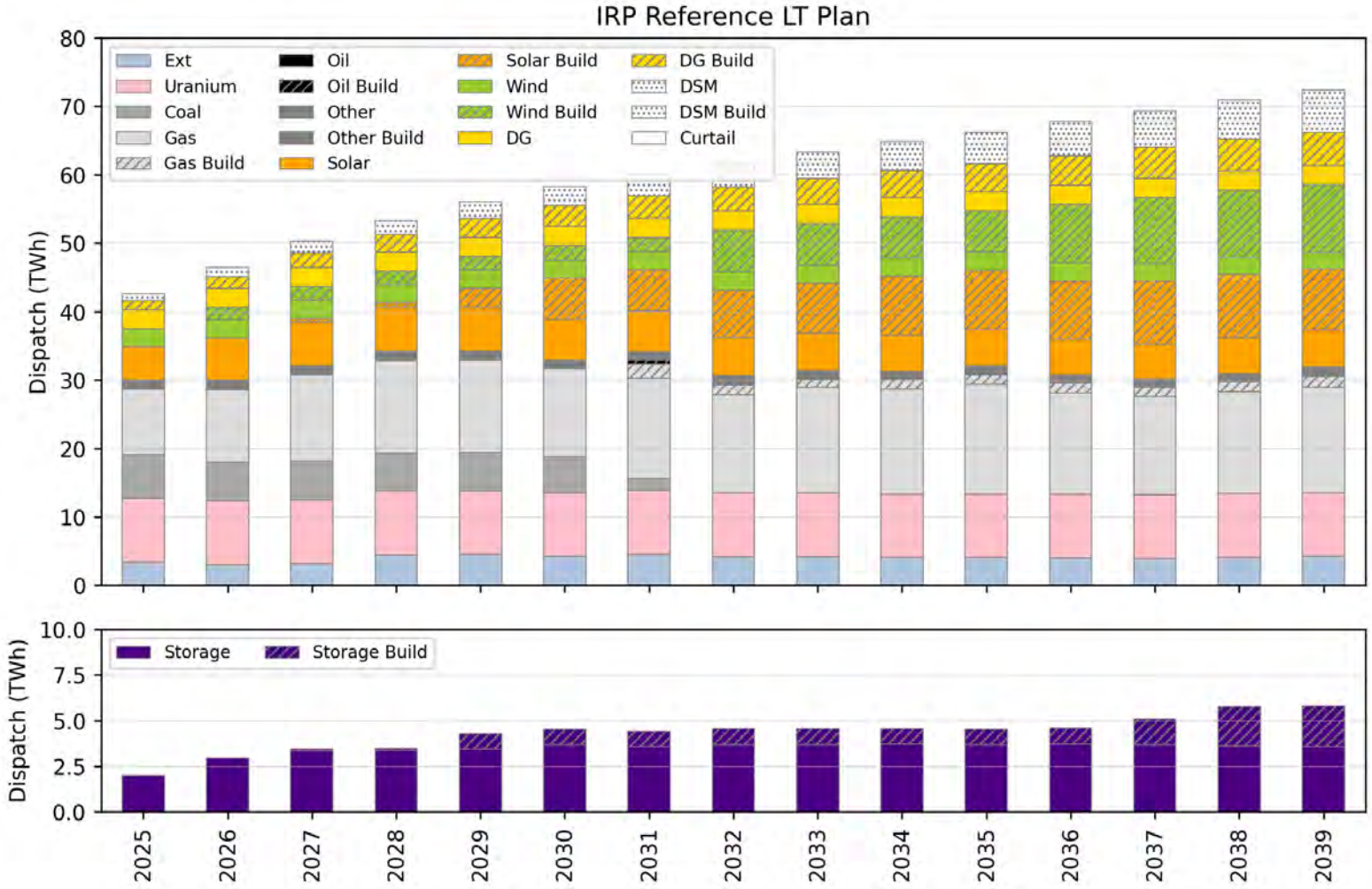


Establishing a baseline

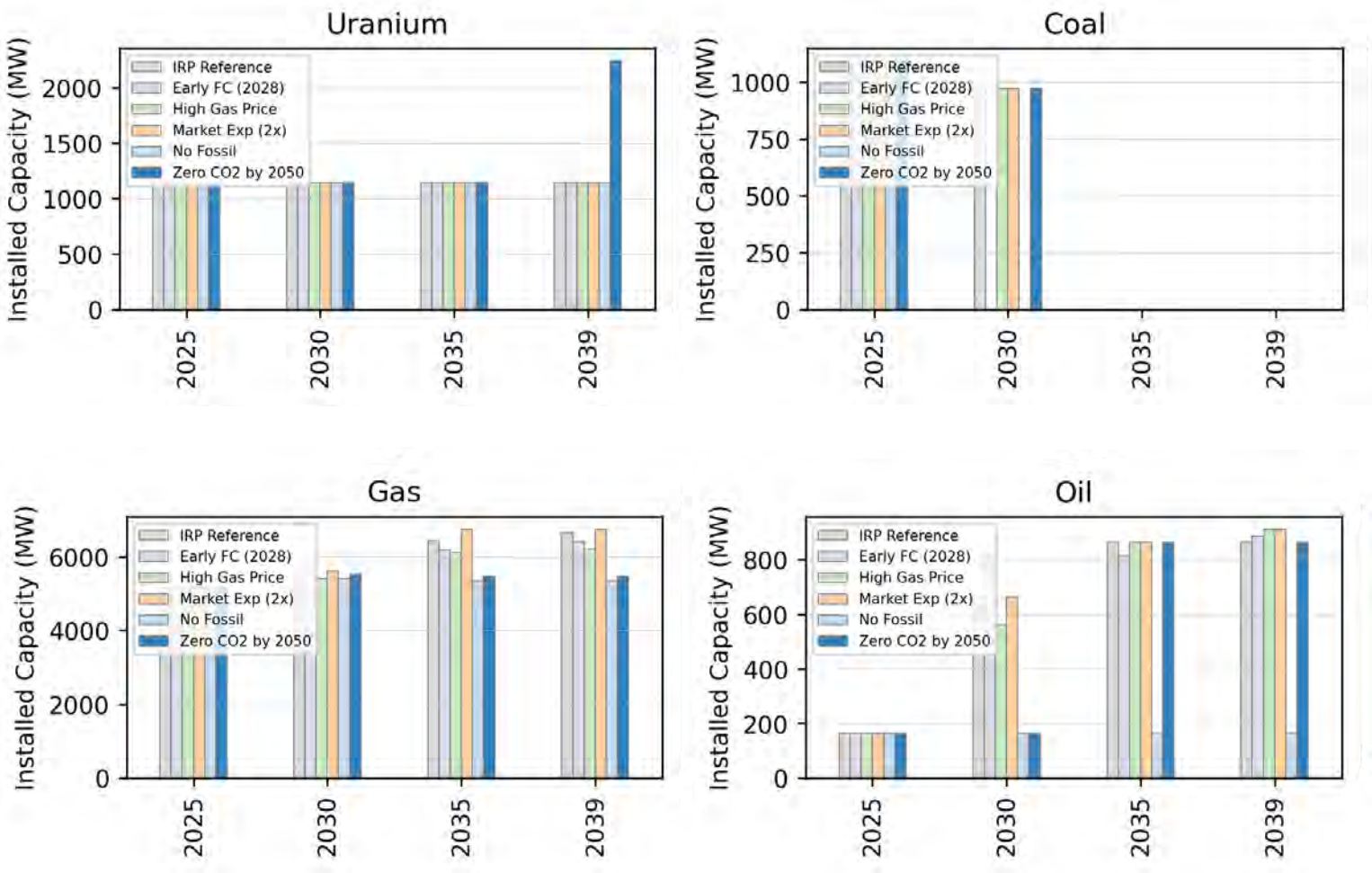
- **The dispatch of each resource type illustrates how the system utilizes the installed capacity.**
  - From 2025 to 2039, the APS system reduces the generation share of dispatchable resources and increases its utilization of Solar, Wind, Distributed Generation, Demand Side Management, and Storage.

Year	Ext	Uranium	Coal	Gas	Oil
2025	8%	21%	14%	21%	0%
2030	7%	15%	8%	20%	0%
2035	6%	13%	0%	25%	0%
2039	5%	12%	0%	22%	0%

Year	Other	Solar	Wind	DG	DSM	Storage
2025	3%	11%	6%	9%	2%	4%
2030	2%	19%	8%	9%	4%	7%
2035	2%	20%	12%	10%	7%	6%
2039	1%	18%	16%	10%	8%	7%

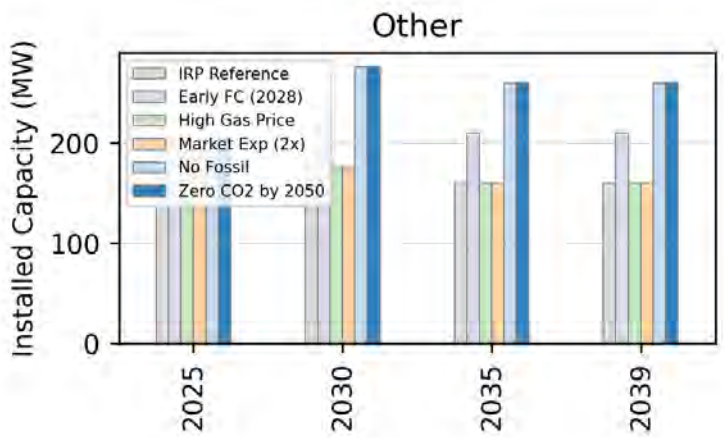


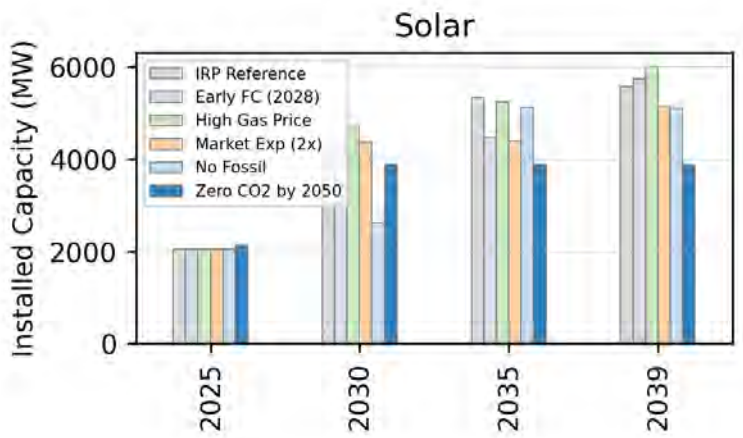
Resource build comparisons

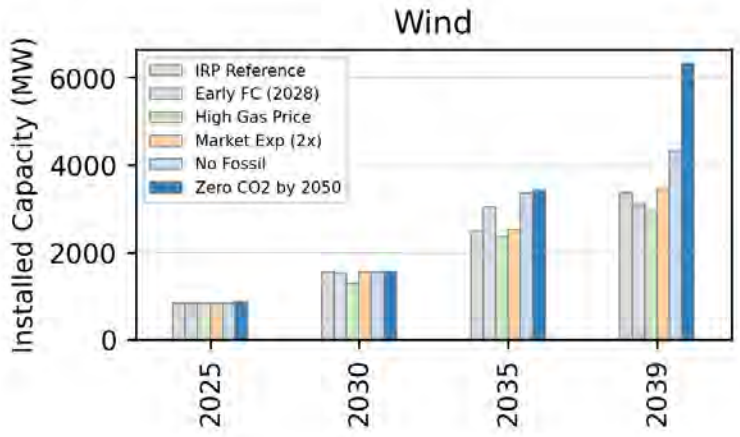


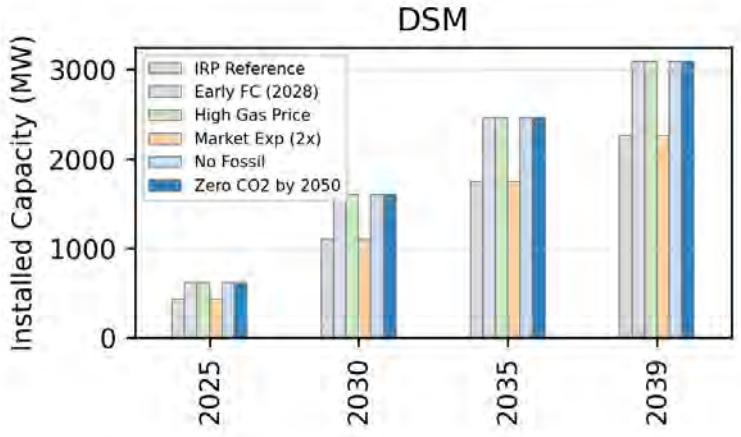
- **The Zero CO_2 by 2050 scenario builds additional advanced nuclear facilities to meet CO_2 emissions constraints late in the study horizon.**
- **Otherwise, conventional resource build outs are consistent**
  - The Early Four Corners retirement (2028) demonstrates the reduction in coal capacity in 2030
  - Oil capacity expansion is eliminated in the No Fossil case.
    - Note: Oil resources represent micro grid facilities.

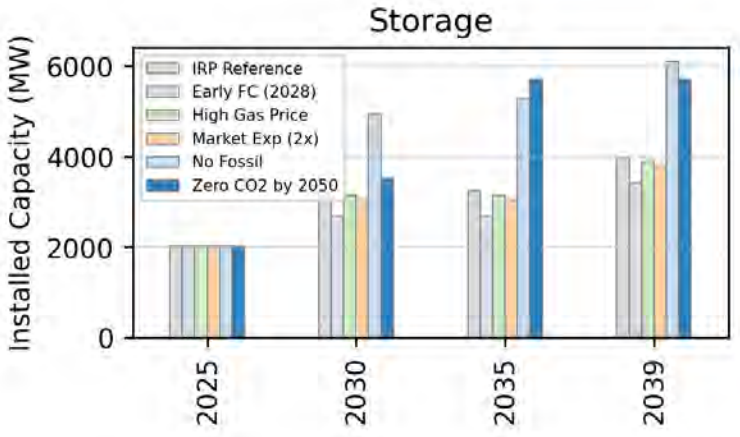
Resource build comparisons





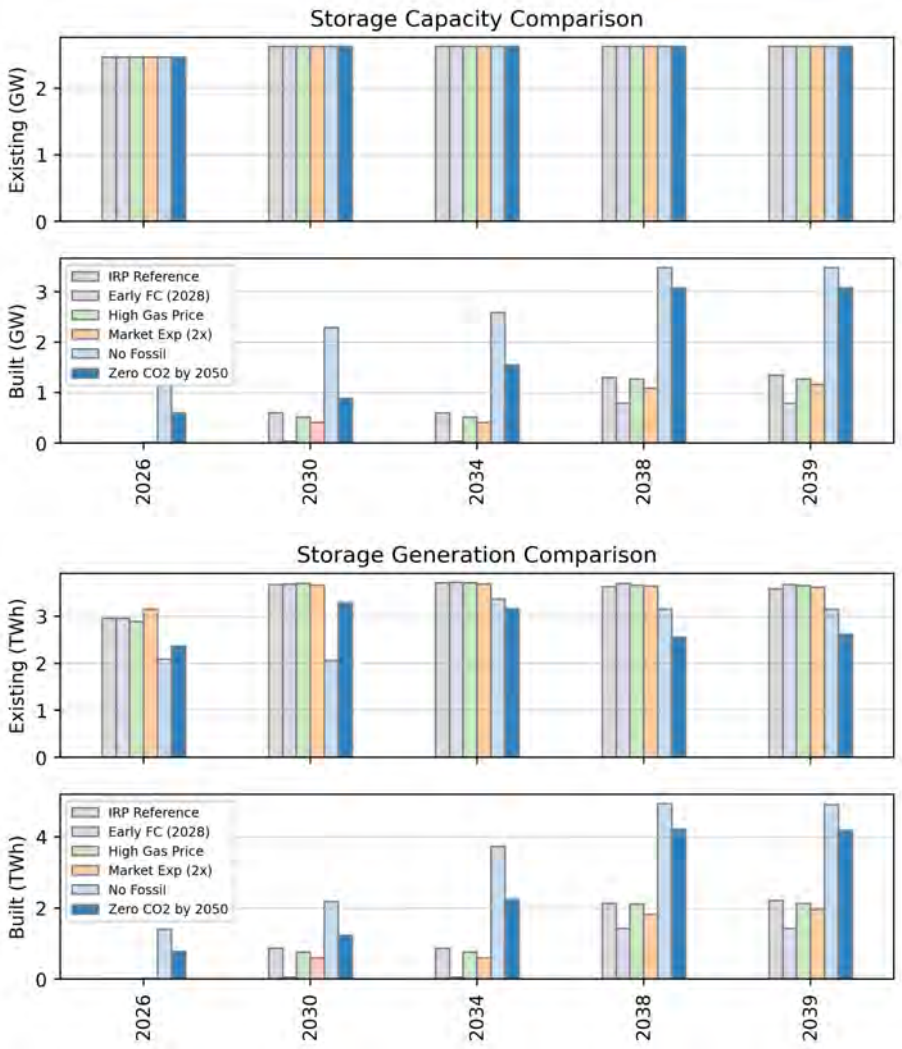






- **Builds are more varied across non-conventional resources**
  - Additional "Other" resources are built in response to the loss of firm capacity in the Early Four Corners retirement and low carbon scenarios (reduced gas)
    - Note: "Other" resource include biogas, geothermal, and purchase contract resources
  - The low carbon scenarios demonstrate the complementary nature of wind, DSM, and battery storage expansion
    - Storage buildout is a keystone of a low carbon future.
  - The DSM build out depicts two discrete capacity trajectories (moderate and aggressive EE program adoption)

A closer look at storage capacity and generation



2039 Capacity Comparison to IRP

Scenario	Existing	Built
Early FC	0.00 GW	-0.51 GW
High Gas Price	0.00 GW	-0.07 GW
Market Exp (2x)	0.00 GW	-0.18 GW
No Fossil	0.00 GW	2.13 GW
Zero CO2 by 2050	0.00 GW	1.73 GW

2039 Generation Comparison to IRP

Scenario	Existing	Built	Total
Early FC	0.07 TWh	-0.73 TWh	-0.66 TWh
High Gas Price	0.06 TWh	-0.08 TWh	-0.02 TWh
Market Exp (2x)	0.03 TWh	-0.25 TWh	-0.23 TWh
No Fossil	-0.44 TWh	2.70 TWh	2.26 TWh
Zero CO2 by 2050	-0.97 TWh	1.99 TWh	1.01 TWh

Resource generation comparisons

- **Generation by resource type offers a high-level view of each scenario's portfolio operation**
  - The Zero CO_2 scenario reduces annual natural gas generation by 14% as a share of total generation >
  - The Zero CO_2 scenario build approximately 1 GW of new nuclear capacity (SMR and Advanced Nuclear units). >
  - The Market Expansion scenario realizes a doubling in market imports (as designed) >
  - Solar generation is depressed in the Zero CO_2 scenario due to significant wind and storage participation (previously observed) >
  - Wind generation increases in the No Fossil and Zero CO_2 scenarios (in concert with the capacity expansion trends previously observed) >
  - The IRP Reference and Market Expansion scenarios rely the least upon DSM generation >

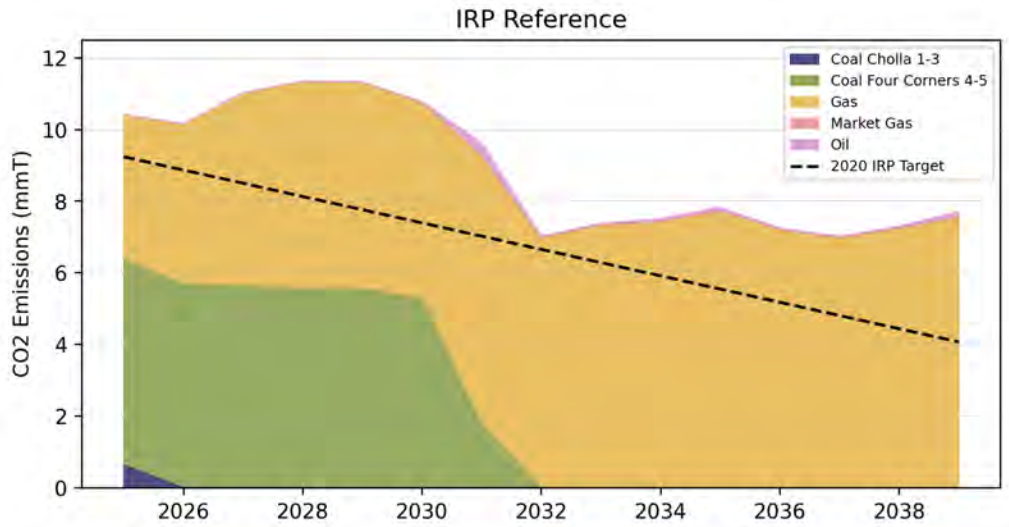
2039 Generation Share

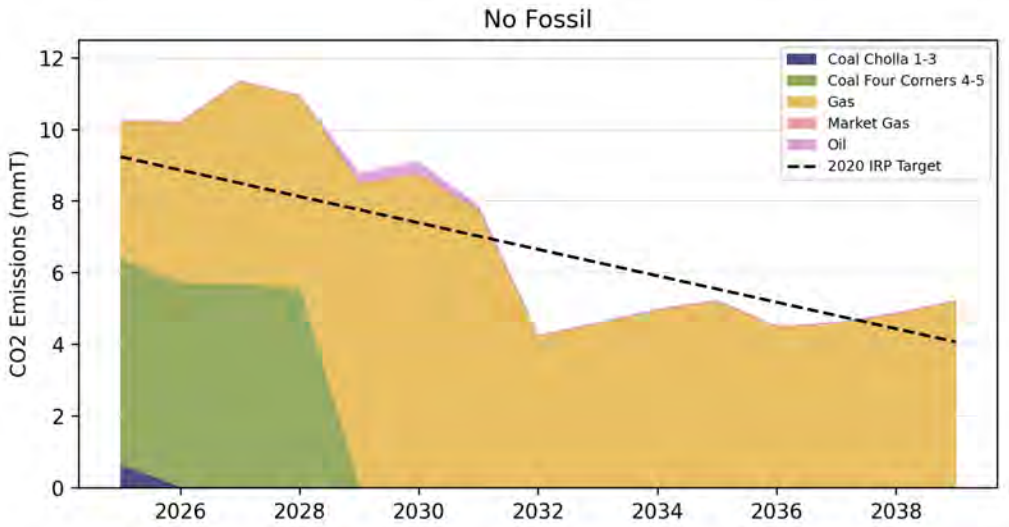
Generation Share (%)	IRP Reference	Early FC (2028)	High Gas Price	Market Exp (2x)	No Fossil	Zero CO2 by 2050
Coal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oil	0.3%	0.1%	0.1%	0.0%	0.0%	0.0%
Gas	23.5%	22.2%	21.7%	19.6%	16.6%	8.1%
Uranium	12.8%	12.9%	12.8%	12.8%	12.8%	25.8%
Other	1.6%	1.8%	1.6%	1.6%	2.0%	2.0%
Ext	5.9%	5.7%	5.9%	11.5%	5.4%	3.2%
DG	10.6%	10.6%	10.6%	10.6%	10.5%	10.6%
Solar	19.9%	19.6%	20.5%	18.1%	18.9%	10.5%
Wind	17.0%	15.5%	15.2%	17.4%	22.4%	28.1%
DSM	8.5%	11.6%	11.6%	8.5%	11.5%	11.6%

Carbon emissions

- **In their 2020 IRP, APS committed to goal of zero CO_2 emissions by 2050.**
  - Explicitly: “In 2019, APS had reduced its carbon dioxide emissions to 12.3 million metric tons, a 26% decline from 2005 levels (16.61 MMT). The Company expects to further reduce emissions by another 7-8 million metric tons by 2030 and totally eliminate them by 2050.”
  - The IRP Reference Case does not align with APS’ 2020 IRP goals for CO_2 emissions reduction.
    - By 2039, the IRP Reference Case reduces CO_2 emissions by 54% and emits 34 mmT more CO_2 than the 2020 IRP trajectory.

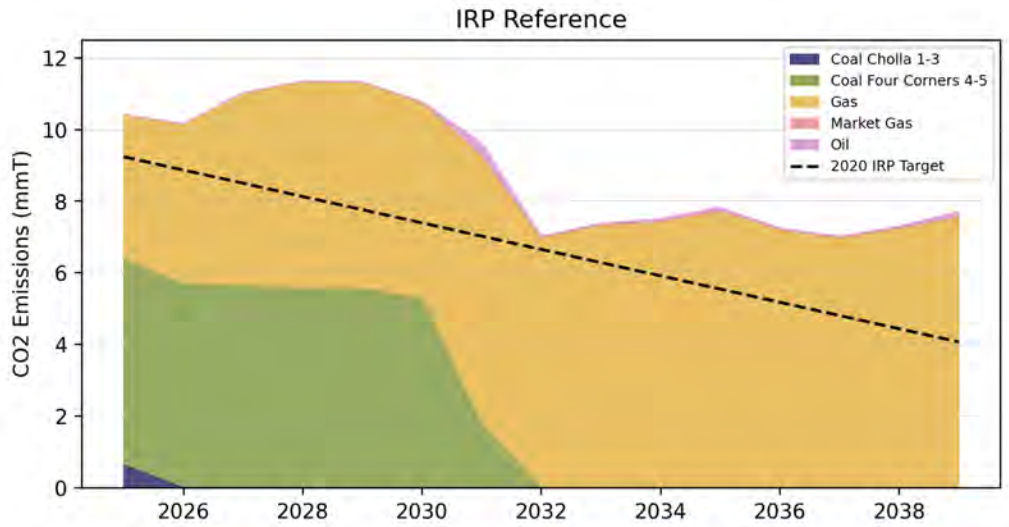
- **The No Fossil case restricts build candidates to only non-emitting resources.**
  - The No Fossil Case partially aligns with the APS’ 2020 IRP goals for CO_2 emissions reduction.
    - By 2039, the No Fossil cases reduces CO_2 emissions by 69% (compared to a 2005 baseline) and emits 7 mmT more CO_2 than the 2020 IRP trajectory over the study horizon.
    - A reduction of 27 mmT CO_2 at an increased cost of $4.9B.



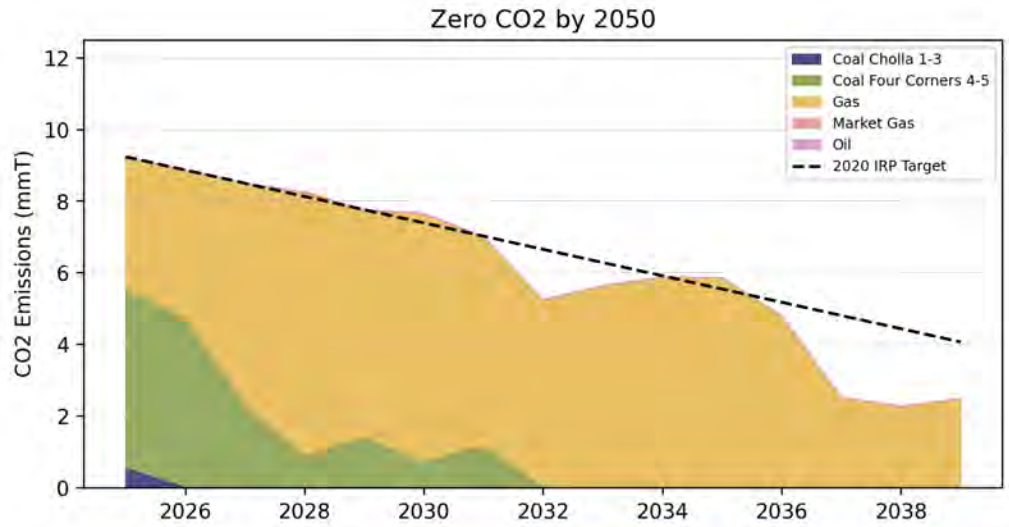


Carbon emissions

- **In their 2020 IRP, APS committed to goal of zero CO_2 emissions by 2050.**
  - Explicitly: “In 2019, APS had reduced its carbon dioxide emissions to 12.3 million metric tons, a 26% decline from 2005 levels (16.61 MMT). The Company expects to further reduce emissions by another 7-8 million metric tons by 2030 and totally eliminate them by 2050.”
  - The IRP Reference Case does not align with APS’ 2020 IRP goals for CO_2 emissions reduction.
    - By 2039, the IRP Reference Case reduces CO_2 emissions by 54% and emits 34 mmT more CO_2 than the 2020 IRP trajectory.



- **The Zero CO_2 by 2050 case imposes an annual emissions limit consistent with the 2020 IRP trajectory.**
  - The Zero CO_2 Case predominately aligns with the APS’ 2020 IRP goals for CO_2 emissions reduction (save for 2 years where the CO_2 limit constraint was relaxed slightly).
    - By 2039, the Zero CO_2 cases reduces emissions by 85% (compared to a 2005 baseline) and emits 8 mmT LESS CO_2 than the 2020 IRP trajectory over the study horizon.
    - A reduction of 42 mmT CO_2 at an increased cost of $9.8B.



Takeaways from alternative portfolios

1. **Four Corners can be retired early in 2028 without regret. Doing so reduces portfolio costs and CO_2 emissions. Four Corners is retired early in both the "Early FC (2028)" scenario and the "No Fossil" scenario.**
   - In the "Early FC" scenario, the model compensates for the loss of firm capacity in 2028 by expanding natural gas capacity earlier in the study horizon. Despite the earlier build of natural gas resources, the "Early FC" scenario results in lower total carbon emissions and a slightly smaller natural gas fleet by 2039.
   - In the "No Fossil" scenario, the model compensates for the loss of firm capacity in 2028 by expanding storage capacity earlier in the study horizon.
   - Portfolio cost results show a negative cost (savings) to retiring Four Corners early.
2. **New storage, with wind, will be crucial to achieve carbon emissions consistent with the 2020 IRP trajectory. Low carbon futures will rely more on wind + storage than on new solar expansion. Expansion results illustrate the complementary nature of new wind with storage.**
   - The “Zero CO_2 by 2050” scenario builds ~2.5x as much wind, ~3.0x as much storage and 1/3 of the solar capacity when compared with the IRP Reference.
   - In a solar rich state such as Arizona, the combination of wind + storage offers resource diversity to help meet system needs.
3. **Aggressive Energy Efficiency adoption is selected by all scenarios but the "IRP Reference" and the "Market Expansion" scenarios.**
   - The aggressive adoption results in 50% more DSM capacity (~1 GW). This selection indicates the role of demand side management across a diversity of futures.
   - The lack of aggressive demand side management expansion in the "Market Expansion (2x)" scenario suggests DSM's function as a capacity resource to the APS system.
4. **Lowest cost carbon reductions can be best achieved by early action.**
   - Over the first 10 years of the study (2025-2034), the “Zero CO_2 by 2050” scenario costs 12% more than the IRP reference while reducing CO_2 emissions by 25%.
   - Beyond 2034, the model has limited information regarding the reality of candidate, non-emitting resources. In these final years, the “Zero CO_2 by 2050” scenario accrues 76% of its cost premium.
5. **Limiting expansion candidates to non-emitting resources, as in the “No Fossil” scenario, provides a hedge against gas price risk and volatility.**
   - The cost parity of the “No Fossil” and “High Gas” scenarios, $39.10B and $39.79B respectively, illustrates how APS can reduce its exposure to fuel prices and reduce emissions by leveraging clean generation resources.

Thanks

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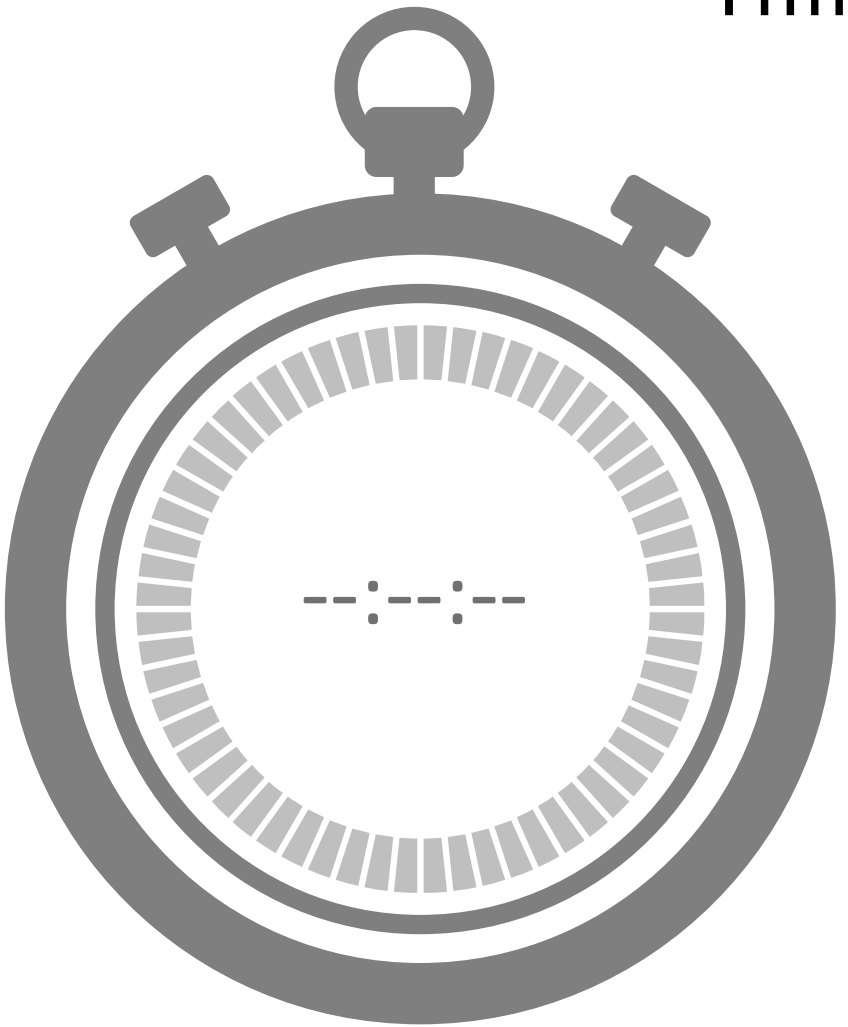
aps
Break

Time for a Break



Break Duration 10 min.

Meeting will resume at hh:mm

IRP Preferred Portfolio

Mike Eugenis, APS

APS Preferred Portfolio

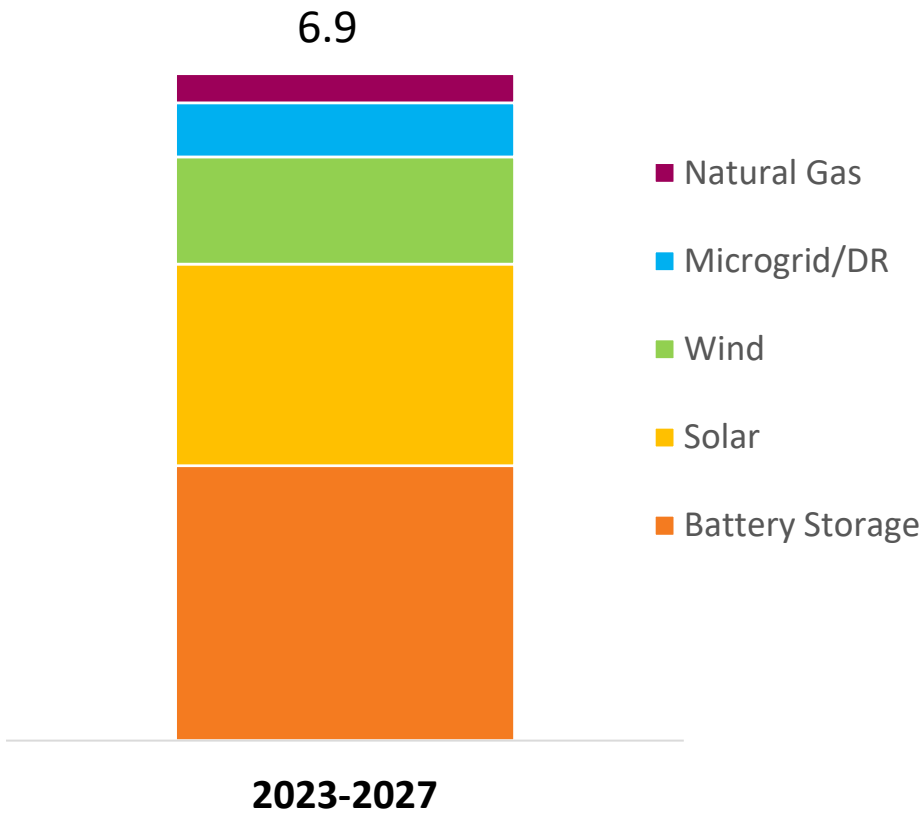
Preferred Portfolio: Investment in cost-effective clean technologies, incremental natural gas combustion turbines at existing sites, and continued adoption of demand side technologies.

Our Preferred Portfolio meets the following objectives

- **Least Cost (Affordability)**
- **45% Renewable Energy in 2030 (Sustainability)**
- **Leverages multiple technology types (Reliability)**

Preferred Portfolio Action Plan Resources

Nameplate capacity additions (in GW)



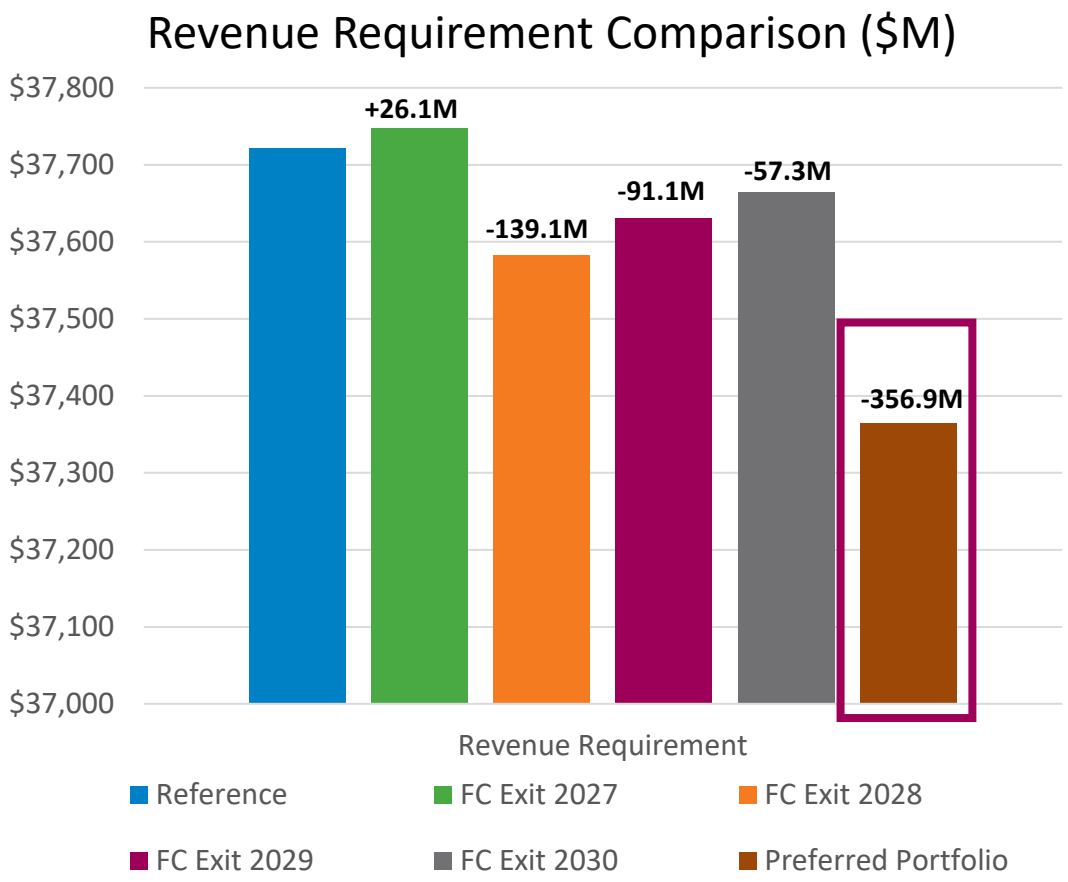
Plan Attributes

- Battery Energy Storage: 2,842 MW
- Solar: 2,083 MW
- Wind: 1,109 MW
- Microgrid: 558 MW
- Natural Gas: 302MW

Resources are inclusive of all signed contracts in 2022 & previous ASRFPs

Energy Efficiency and Distributed Energy not shown, but an important piece of our resource mix going forward

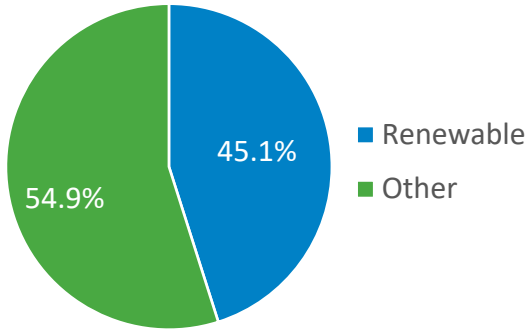
Revenue Requirements Comparison



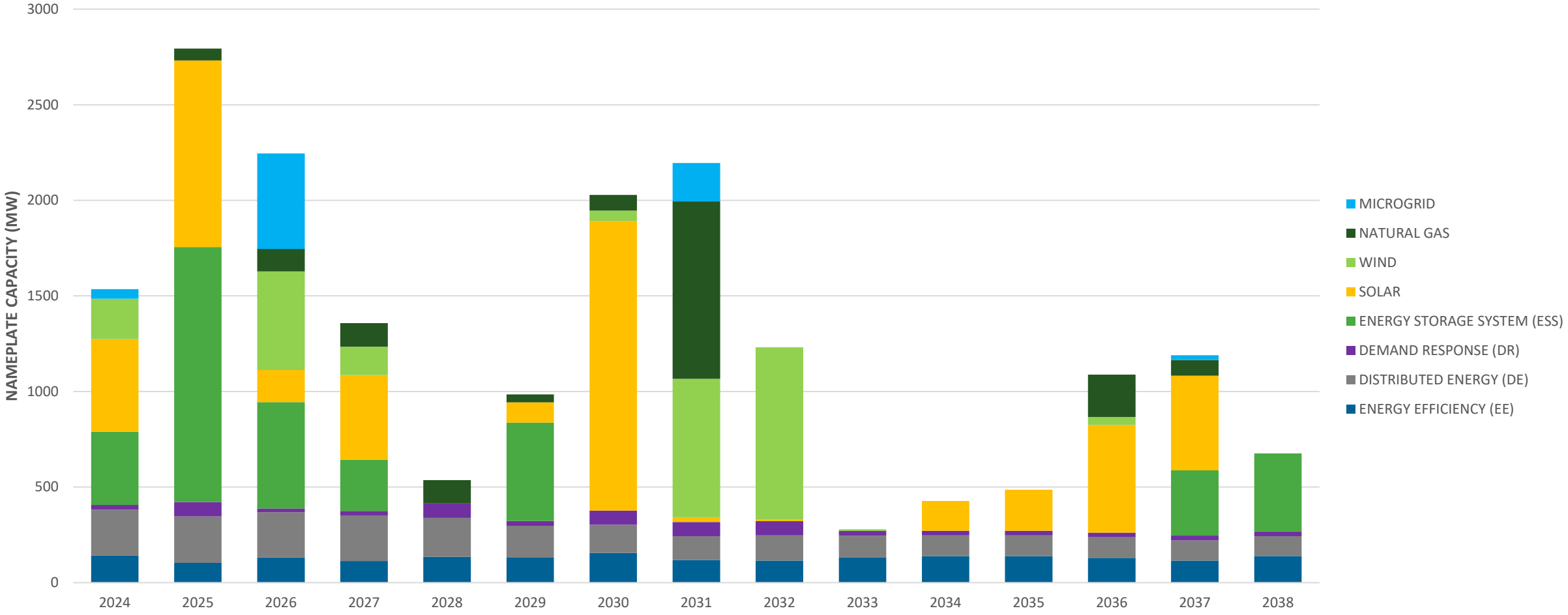
Key Considerations

- Preferred Portfolio **most cost-effective case** and **meets Clean Energy Commitment in 2030 organically**
- Four Corners Early Exit cases show value compared to reference, **but less than Preferred Portfolio**
  - Preferred Portfolio **maintains reliable Four Corners operation until 2031**, with value being driven by **wind firmed by gas transmission sharing construct.**

Preferred Portfolio Renewable Percentage in 2030

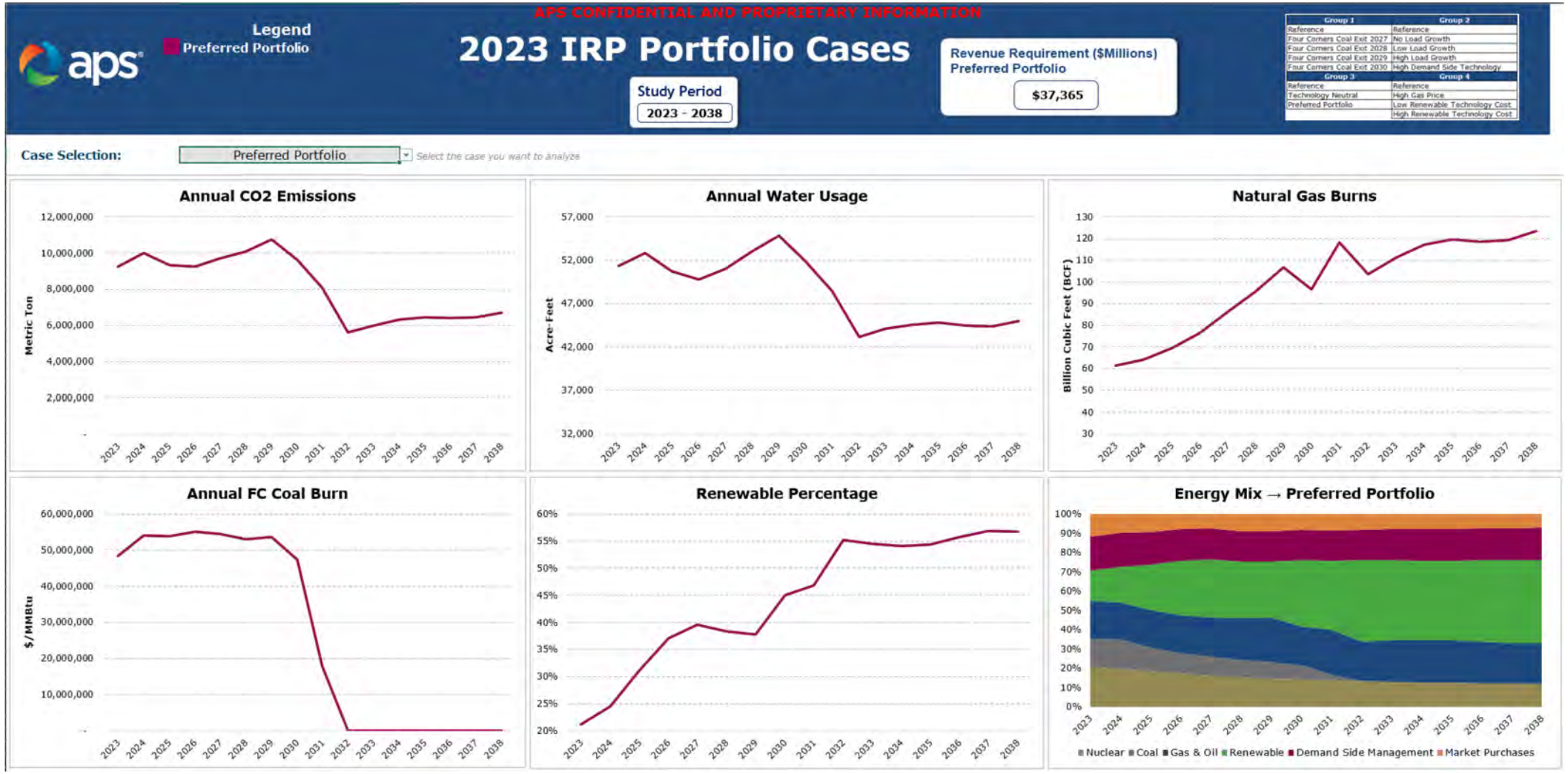


Annual Capacity Additions | Preferred Portfolio



Let's walk through the Dashboard and look at the Preferred Portfolio!

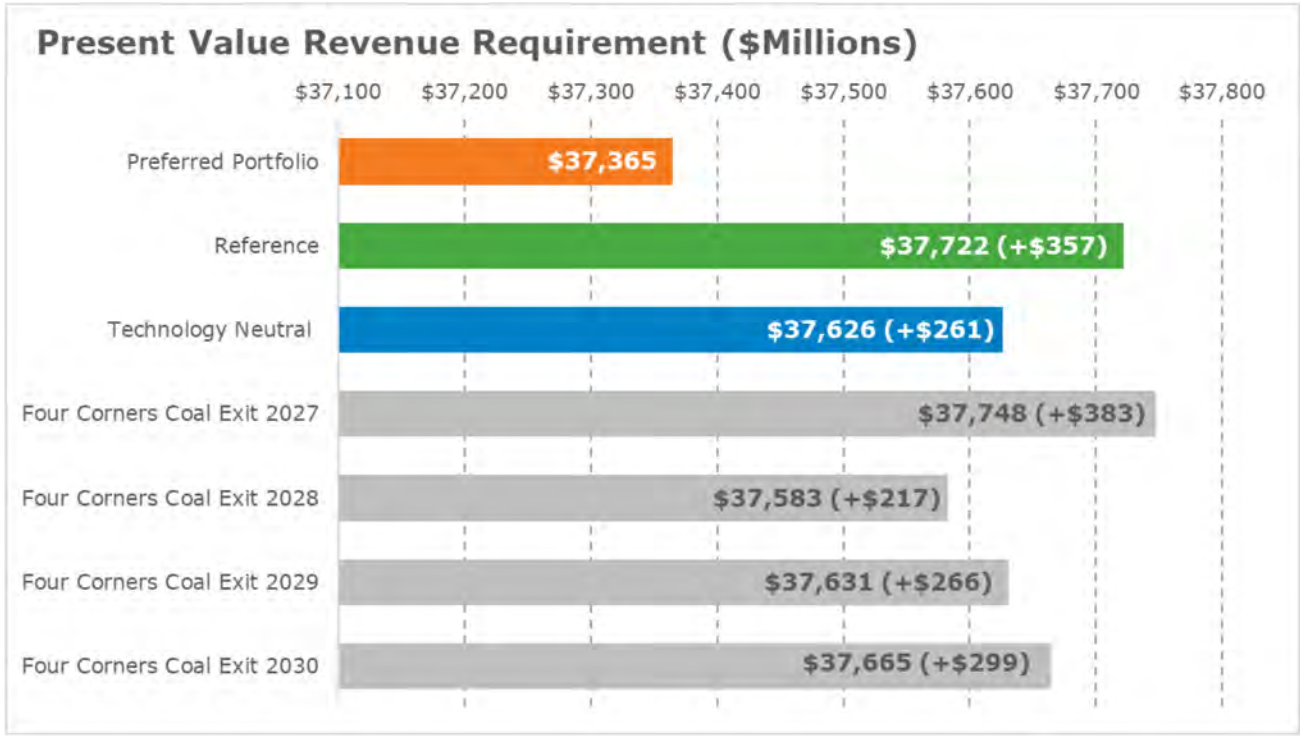
Dashboard Review



Benefits of the Preferred Portfolio

- Reflects APS customers' needs and preferences, limits costs while maintaining reliability, and increases the diversity of APS's portfolio through investment in clean resources.

- Least Cost
- Reliable
- Clean Energy Commitment is met
- Contains proven technologies



Appreciation for Stakeholder Involvement

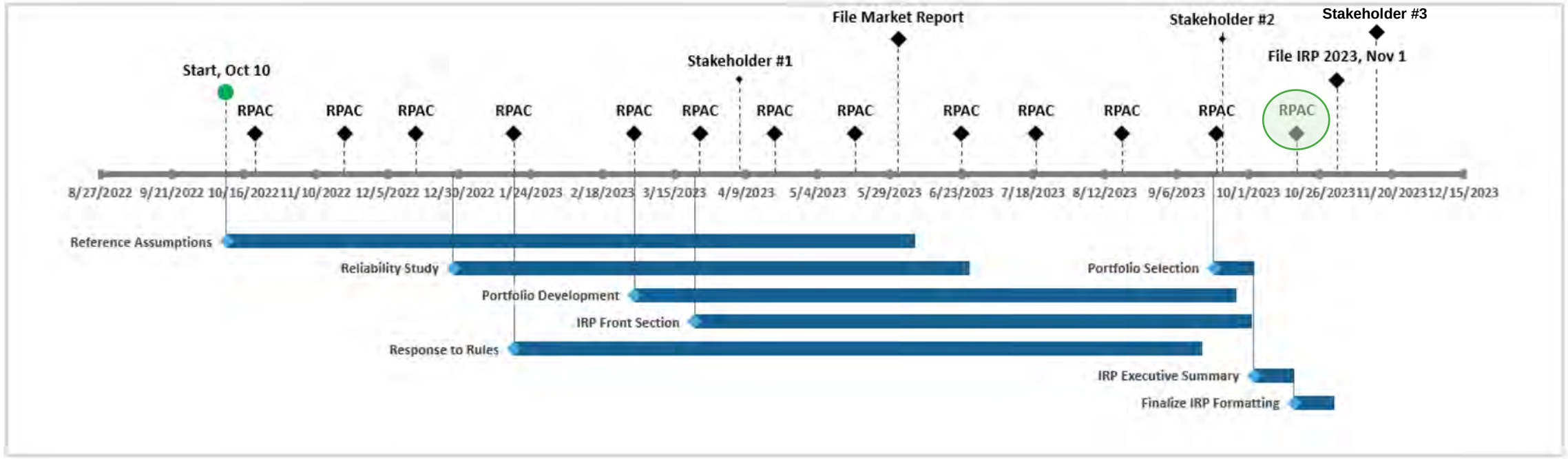
Thank You

APS wants to thank the RPAC for the involvement in the IRP process. Participation and feedback continue to be instrumental in the planning process.

Next Steps & Closing Remarks

Matt Lind, 1898 & Co.

IRP Timeline



Key Milestones

APS plans to host one more RPAC meeting before the end of the year: 12/12/2023

IRP Filing: 11/01/2023
Public Stakeholder Meeting #3: 11/07/2023