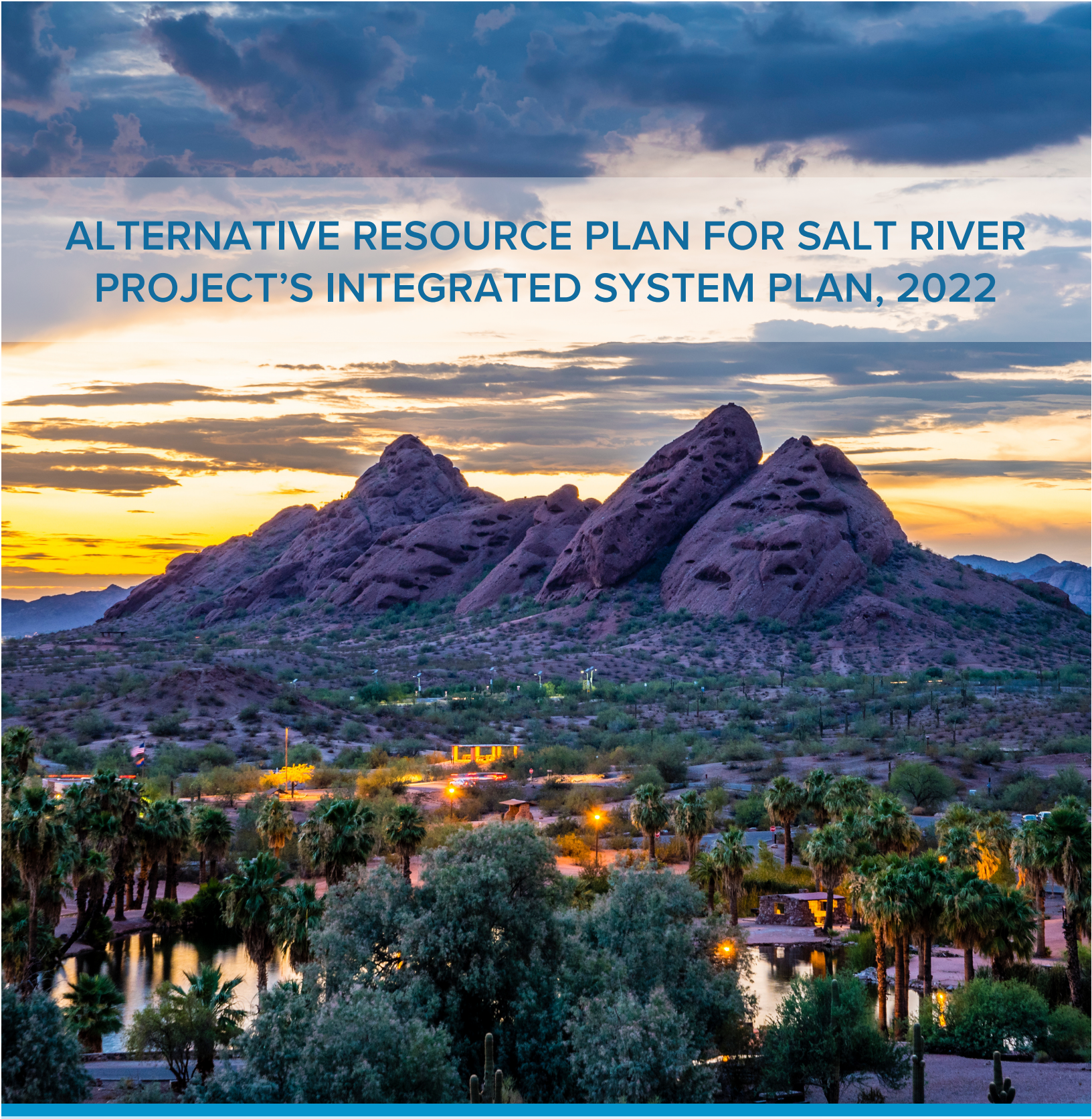
ALTERNATIVE RESOURCE PLAN FOR SALT RIVER PROJECT'S INTEGRATED SYSTEM PLAN, 2022



STRATEGEN

PREPARED FOR SIERRA CLUB
SEPTEMBER, 2022

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Alternative Resource Plan for Salt River Project's Integrated System Plan, 2022

Prepared by Strategen Consulting

This report is provided by Strategen Consulting on behalf of Sierra Club.

Strategen is a professional services company that specializes in power sector modeling and utility regulatory analysis. The firm has extensive experience working with global Fortune 500 corporations, utilities, governments, project developers, non-governmental organizations, and associations seeking to evaluate next generation grid and clean energy technologies.[1]

[1] For more information visit www.www.strategen.com

1. Executive Summary

Salt River Project ("SRP") has long been reliant on fossil fuels to generate electricity and is continuing to pursue new natural gas generation. Most recently, SRP proposed the Coolidge Expansion Project, which would include installation of 16 new gas turbines, a project with a budget of nearly $1 billion. The Coolidge Expansion Project would result in significant -- and avoidable -- costs and risks for customers, while also imposing a disproportional environmental burden on the Randolph community.

Despite the Arizona Corporation Commission's ("ACC") vote rejecting the Certificate of Environmental Compatibility for the Coolidge Expansion Project, SRP is still exploring options to move forward with the project or install at least some of these gas turbines at other sites, citing a near-term energy and capacity need. However, it is not clear that SRP has considered the full range of alternatives. The timing of this Integrated System Plan ("ISP") provides a unique opportunity for SRP to reconsider its commitment to new gas resources while transitioning away from coal resources in accordance with its 2035 Sustainability Goals. With the recent passage of the federal Inflation Reduction Act, new tax credit provisions are available that can help the utility meet its near-term energy and capacity needs with resources that are both clean and affordable. By seizing this opportunity, SRP can accelerate its transition from coal, avoid investing in new natural gas generation, and build a clean energy portfolio that will save its customers money and reduce emissions for decades to come.

For this report, Strategen used the EnCompass modeling platform in capacity expansion mode to identify the least cost of resources that meet SRP's projected load. The performance, cost, and emissions of the portfolios were then assessed through an hourly production cost simulation.

We find that:

- The Coolidge Expansion Project is not part of a least cost portfolio. Even prior to considering the Inflation Reduction Act ("IRA") tax credits, the Coolidge gas expansion was not selected as part of the optimal portfolio selected by the EnCompass model. After including tax credit extensions enabled by the IRA, the least cost portfolio for SRP includes no new gas generating capacity.

- Retiring and replacing SRP's coal units with clean energy resources could save SRP customers $390 million (net present value, 2023-2035) and 45 million tons of cumulative CO_2 emissions in the same period even prior to the extension of tax credits under the IRA. Re-optimizing the Clean Replacement Portfolio to find the optimal timing of retirements given the new federal support for clean energy results in a significantly accelerated transition and saves an additional $740 million while reducing CO_2 emissions by a total of 59 million tons.

- A more ambitious target that reduces CO_2 by 85% (from 2005 levels) by 2035 is feasible and can generate additional emission savings. The "Lower Carbon Scenario" portfolio results in cost savings of $110 million and 49 million tons of CO_2 over the study period. Re-optimizing the portfolio to include the extended tax credits, the portfolio saves $590 million and 63 million tons of CO_2. This clean energy portfolio further protects customers from fossil fuel price spikes like those experienced in early 2022 by reducing reliance on gas generation from existing units as well.

Based on this analysis, our recommendations are that SRP:

- Avoid or cease expenditures on gas units.
- Move up dates for retirement of or exit from coal-fired generating facilities:
    - Exit Four Corners Units 4&5 by 2025.
    - Retire Coronado Units by the end of 2025, avoiding the need to build the infrastructure to share the selective catalytic reduction equipment between the two units and freeing up transmission for wind resources.
- Continue investing in and supporting demand side resources.
- Set meaningful carbon reduction targets.
- Explore all options and incentives available through the Inflation Reduction Act.

2. Background

Salt River Project is Arizona's second-largest electric utility. SRP has long been reliant on fossil fuels to generate electricity and is continuing to pursue new fossil fuel generation. Most recently, the Company proposed the Coolidge Expansion Project, which includes installation of 16 new gas turbines, a project of 820 MW with a budget of nearly $1 billion resulting in significant – and potentially avoidable -- costs and risks for customers. SRP claims that the proposed Coolidge Expansion Project is needed to meet the significant near-term increase in energy demand in the service territory. However, this report shows that this demand can be more economically met by carbon free resources. The Coolidge Expansion Project's proposed location is near the community of Randolph, a historic Black community south of Coolidge, which has raised concerns over environmental justice.

While the Arizona Corporation Commission ("ACC") does not regulate SRP's rates, the Coolidge Expansion Project was required to obtain a Certificate of Environmental Compatibility ("CEC") from the Commission for the siting of the project. In April 2022, the ACC voted to deny the CEC for the Coolidge Expansion, finding that the project would have significant adverse environmental impacts on the already-burdened Randolph community and that SRP had not adequately evaluated alternatives to the project. The Commission reaffirmed that decision in June 2022.[2] SRP has filed a lawsuit to overturn the Commission's rejection of the Coolidge Expansion Project and is also proposing the installation of gas turbines at other sites, including at the site of SRP's Copper Crossing solar facility.

SRP is currently transitioning from Integrated Resource Planning to Integrated System Planning. The ISP process is intended to be a more comprehensive systemwide plan. The process began in November 2021, and in April 2022 SRP concluded its meetings with stakeholders to develop a study plan and began the modeling phase of the ISP process. This process is ongoing through November 2022. SRP plans on releasing the completed ISP report in April 2023. According to SRP, the key goal of transitioning to an ISP process is to support SRP's decarbonization goals. SRP currently has set a goal of reducing its emissions rate from 1,576 lbs. of CO_2 per MWh in 2005 to 550 lbs. in 2035, or about 65%.[3]

Given SRP's imminent energy needs, this ISP will guide significant resource investment decisions, the impacts of which will be experienced by customers in the next decades. If SRP continues to pursue new gas generation, customers will be left exposed to significant risks for decades, paying for higher cost, polluting electricity generation. Considering the provisions of the Inflation Reduction Act ("IRA"), and the recent significant increase in natural gas prices, it is increasingly sensible for SRP to create a path to reliable, clean, and affordable energy, while also being considerate of environmental justice concerns and providing a just and equitable transition for coal communities. The portfolios presented here demonstrate that all those goals can be met, while also protecting consumers from price volatility and risks of stranded assets. This report outlines a path for SRP to reduce both costs, greenhouse gas emissions, and local air pollution for customers.

The timing of this ISP presents SRP a unique opportunity to reconsider its new gas proposal, examine the current costs of its coal fleet, and assess the current market opportunities for cost effective, clean options, especially in light of the IRA. The IRA not only provides significant cost reductions for new renewable generation and energy storage assets in the form of extended tax credits, but also increases those credits if those carbon free resources replace retired coal units. Thus, IRA provisions further increase the cost differential between clean portfolios and the portfolio SRP seems to be considering.

SRP projects that it will meet 70% of its 2022 load with fossil fuel resources, including coal, gas, and oil. SRP has announced a plan to start to decommission certain coal-fired plants. The plan includes Hayden in 2027, Craig Unit 1 in 2025 and Unit 2 in 2028, Four Corners in 2031, and Coronado no later than 2032. Recently,

[2] Arizona regulators again reject SRP's proposed 820-MW gas plant expansion, Utility Dive, published 05/17/2022, updated 06/07/2022.

[3] https://www.srpnet.com/grid-water-management/sustainability-environment/sustainability-overview

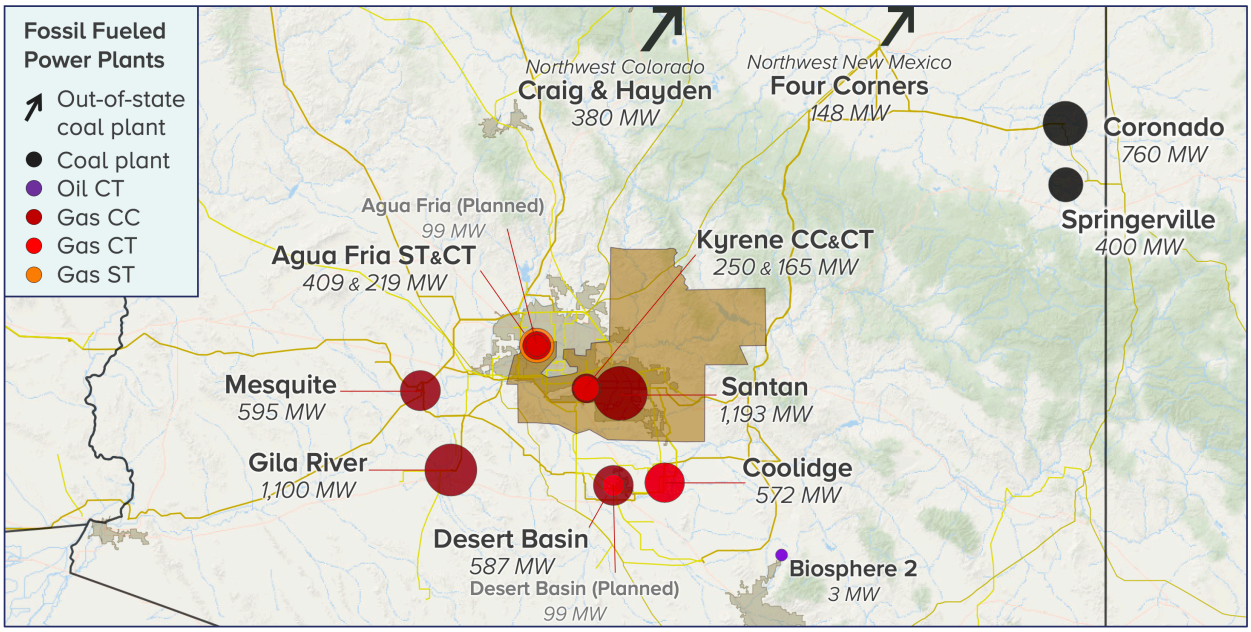
SRP indicated its intention to exit coal by May 2034.[4] Keeping the coal units in the system results in fuel, fixed and variable operations and maintenance costs, and also requires incremental capital expenses.

Multiple stakeholders, including Sierra Club, have pointed out that SRP's existing sustainability goals, including its carbon reduction target, are not ambitious enough, and have called for SRP to pursue an accelerated transition to clean energy resources.

To investigate this possibility, Strategen conducted a comprehensive analysis of SRP's resource portfolio and operations, which are detailed in this report. Strategen's analysis included a "baseline" scenario as well as two "clean replacement" portfolios. Under the baseline scenario, SRP's coal units retire according to the schedule outlined above. The clean replacement portfolios allow for the earlier retirement with a latest retirement date of 12/31/2029.

This report summarizes Strategen's findings and includes discussions around coal retirement decisions, gas plant expansions, and investment in renewable energy and storage technologies. The appendix details the methodology, inputs, and assumptions used in this analysis.

Figure 1. Fossil fueled power plants serving SRP



[4] SRP Integrated System Plan Study Plan Appendix – Assumptions Used in Scenarios, Sensitivities and Strategic Approaches, August 2022

3. Modeled Scenarios

Strategen conducted an analysis to evaluate different resource portfolios for SRP that minimize costs, maintain reliability, and further SRP's clean energy goals. This portfolio evaluation included SRP's existing power plants along with potential new resource investment options such as solar and storage.

Inputs and assumptions for the analysis were compiled from publicly available data on SRP's website, data from the S&P Market Intelligence Platform, and Strategen's expertise.[5]

Strategen considered three key scenarios to evaluate SRP's resource portfolio options:

1. Baseline: The Baseline scenario is not an exact replication of SRP's resource portfolio, as the ISP was not filed at the time this study was conducted. This portfolio serves as an approximation of the resource portfolio SRP will release once the IRP is complete and is meant to capture basic elements of SRP's baseline resource portfolio. It assumes that currently planned coal retirements will proceed as planned and the Coolidge Expansion Project or equivalent capacity will be built in 2025. Although the gas turbines might not be installed at the Coolidge Station, there is indication that SRP will install some of these turbines at other existing sites. The portfolio assumes least cost replacement and is aligned with the utility's "Current Trends" scenario: energy efficiency ("EE") reaches 3,800 GWh by 2035, Demand Response ("DR") goes up to 300 MW by 2035, and distributed solar levels reach 1,300 MW by 2035. No carbon constraint is explicitly modeled, but the portfolio readily achieves the 550 lbs/MWh target included in SRP's 2035 Sustainability Goals.

2. Clean Replacement with Distributed Generation: The Clean Replacement with distributed generation ("DG") scenario serves as the base case of a clean portfolio. Under the Clean Replacement with DG scenario, the coal fleet is retired by 2030. The Craig and Hayden units retire on the announced dates, while Four Corners, Coronado, and Springerville are allowed to retire economically, with a latest retirement date of Dec 31st, 2029. This scenario also assumes that the Coolidge Expansion Project or other new gas units will not be built. Planned gas unit upgrades are included in the scenario. EE and DR follow SRP's high EE and DR sensitivities, reaching 4,500 GWh and 400 MW by 2035, respectively. Distributed solar follows SRP's "Strong Climate Policy" assumption and reaches 2,300 MW by 2035. No carbon constraint is explicitly modeled, but the portfolio readily achieves the 550 lbs/MWh target included in SRP's 2035 Sustainability Goals.

3. Lower Carbon with Distributed Generation: The Lower Carbon with distributed generation scenario ramps up clean energy resources more significantly than the other scenarios. This scenario, like the Clean Replacement with DG scenario, retires the coal fleet by 2030, assumes the Coolidge Expansion Project is not built, and does not include any new gas. Energy Efficiency includes additional savings going up to 5,100 GWh by 2035 (reflecting approximately twice the incremental savings of SRP's high EE sensitivity). A carbon constraint is implemented limiting emissions to 85% of 2005 levels by 2035.

   A summary of the key inputs for each scenario is provided in the following table.

[5] In 2021 and 2022, Sierra Club made requests to SRP to provide detailed data and information on SRP's existing resource portfolio and other key planning assumptions used by the utility. One purpose of these requests was to ensure the accuracy of inputs used in this analysis. Since SRP did not provide much of this data to Sierra Club, Strategen relied on public data sources for its analysis.

Table 1. Summary of scenario assumptions

	Baseline / BAU	Clean Replacement	Lower Carbon
Fossil Resources	- Announced coal unit retirements[6] - Coolidge expansion (or equivalent) built	- Economic coal replacement by 2030 - Coolidge expansion not included	- Economic coal replacement by 2030 - Coolidge expansion not included
Replacement Resources	- 2022 ISP constraints	- Least cost clean replacement - No new gas allowed[7]	- Least cost clean replacement - No new gas allowed
Energy Efficiency & Demand Response	- Base EE (current trends)	- High EE sensitivity	- 2x High EE sensitivity
Distributed Solar	- Base DS (current trends)	- High distributed solar	- High distributed solar
Carbon Constraint	- None	- None	- 85% mass reduction by 2035 in capacity expansion model

Furthermore, while this analysis was under way, the Inflation Reduction Act was passed and signed into law on August 16, 2022. The IRA will have a significant impact on renewable resource deployment, further reducing the costs of renewable energy generation and making the transition to a cleaner portfolio an increasingly "no regrets" course of action for utilities.

To ensure the important effects of the IRA are included, Strategen re-optimized the Clean Replacement with DG, and the Lower Carbon with DG portfolios including the tax credit extensions of the Inflation Reduction Act. Strategen's understanding is that SRP as of the date that this report is written does not plan to include the extended credits in their 2021 ISP modeling. Consequently, the Baseline Portfolio was not re-optimized in order to better mimic SRP's own planning assumptions.

3.1 Findings

We find that:

- The Coolidge Expansion Project is not part of a least cost portfolio. Even prior to considering the Inflation Reduction Act tax credits, the Coolidge gas expansion was not selected as part of the optimal portfolio selected by the EnCompass model. After including tax credit extensions enabled by the IRA, the least cost portfolio for SRP includes no new gas generating capacity.

- The clean replacement of SRP's coal units could save SRP customers $390 million (net present value, 2023-2035) and 45 million tons of cumulative CO_2 emissions in the same period even prior to the extension of tax credits under the IRA. Re-optimizing the Clean Replacement Portfolio to find the optimal timing of retirements given the new federal support for clean energy results in a significantly accelerated transition and saves an additional $740 million while reducing CO_2 emissions by a total of 59 million tons.

[6] Currently planned coal retirements include Craig Unit 1 in 2025, Craig Unit 2 in 2028, Hayden 2 by 2027, Four Corners 4 & 5 by 2031, Coronado 1 & 2 by 2032, and Springerville 4 on 04/30/2034.

[7] Approved natural gas upgrades are included in the model.

- A lower carbon emissions target that reduces CO_2 by 85% (from 2005 levels) by 2035 is feasible and can generate additional savings. The Lower Carbon portfolio results in cost savings of $110 million and 49 million tons of CO_2 over the study period. Re-optimizing the portfolio to include the extended tax credits, the portfolio saves $590 million and 63 million tons of CO_2. This clean energy portfolio further protects customers from fossil fuel price spikes like those experienced in early 2022 by reducing reliance on gas generation from existing units as well.

3.2 Detailed Results

3.2.1 Generation Portfolio

In the Clean Replacement Portfolio, allowing for SRP's coal units to retire economically in the initial runs results in the retirement of the Four Corners units in the end of 2024 (as early as allowed in the model). When including the extended tax credits, retirement of the entire coal fleet becomes economic in earlier years, as renewable generation and energy storage are more economic than the continued operation of the coal units. Coronado retires by the end of 2026 avoiding the additional cost of splitting the existing selective catalytic reduction equipment between the units and freeing up transmission for wind resources (that receive the production credit, with the bonus of the energy community siting). Springerville Unit 4 also retires early and is replaced by solar plus storage resources.

In the Lower Carbon Portfolio, in which we have assumed a more ambitious carbon reduction limit than SRP's 2035 sustainability goals, the emissions limit becomes binding at the end of the period despite the retirement of all the coal units and drives higher investment in wind resources which displace generation from existing combined cycle units.

Figure 2. Nameplate capacity for modeled portfolios in years 2022, 2029, 2035

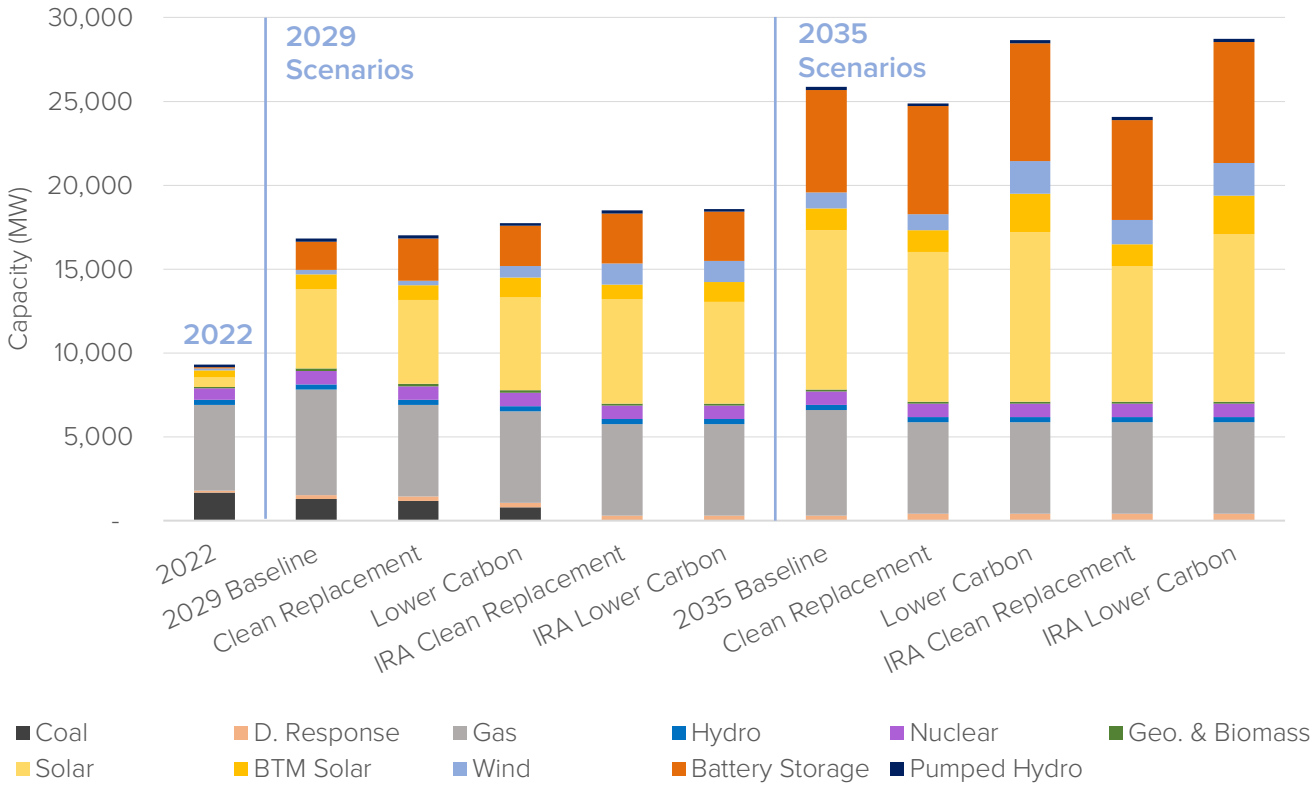
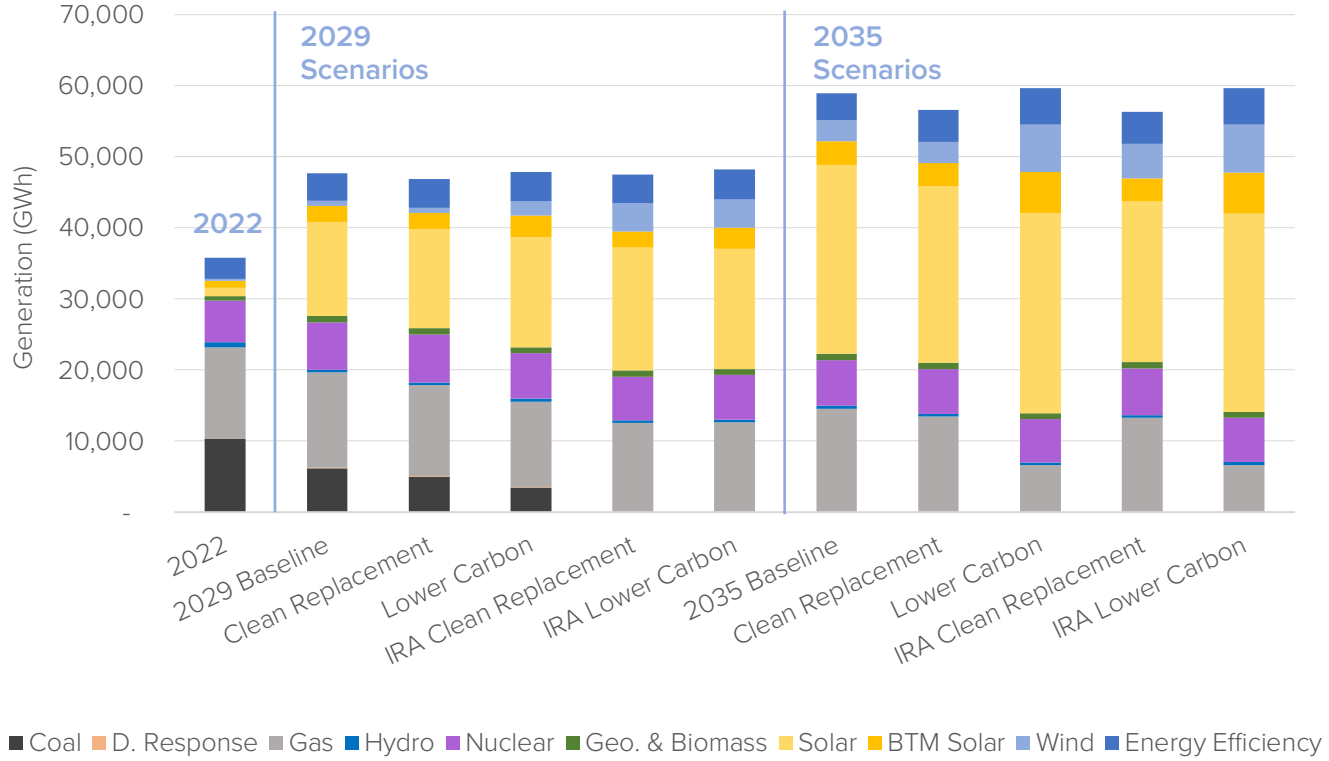


Figure 3. Annual generation for modeled portfolios in years 2022, 2029, 2035



3.2.2 Revenue Requirement

The model found the least cost portfolio for each scenario modeled and calculated the net present value of the revenue requirement ("NPVRR") for the period 2023-2035. The table below shows the cost differential of the different portfolios.

Table 2: Revenue requirement of modeled portfolios (2023-2035)

NPVRR[8] (Delta from Baseline In $Billion)		
	Initial Runs	IRA runs
Baseline	13.35	12.65[9]
Clean Replacement	12.96	11.91
Lower Carbon	13.24	12.07

The revenue requirement for the Baseline scenario is $390 million more than the Clean Replacement portfolio and $110 million more than the Lower Carbon portfolio, indicating that SRP's plan to add new gas resources in the near term and keep operating its coal units results in significantly higher costs for its customers.

[8] Note that the revenue requirement totals displayed represent the going-forward generation capital and operating costs only and exclude certain items such as depreciation on existing plants, distribution costs, etc., that are not expected to vary across between scenarios. As such, these absolute values are not comparable to revenue requirement values used in the SRP ISP.

[9] SRP indicated that their ISP modeling will be based on existing credits. Consequently, the Baseline was not re-optimized based on the IRA credits, but simply re-priced.

The Lower Carbon scenario requires additional emissions reductions from SRP's existing gas fleet in order to meet the 85% reduction target and consequently results in slightly elevated costs compared to the Clean Replacement portfolio. However, its NPVRR remains significantly lower than the cost of the Baseline portfolio.

When the assumptions are adjusted to reflect the IRA, the potential savings achieved by the clean energy portfolios are even further increased, relative to the baseline. Strategen estimates that the clean energy portfolios (inclusive of the IRA credits) will achieve savings of $590-$740 million when compared to the baseline portfolio (also inclusive of the IRA credits).

In conducting this comparative analysis, the Baseline portfolio was repriced to include the IRA tax credits, ensuring an "apples to apples" comparison. However, the underlying baseline resource portfolio was not re-optimized. This repricing resulted in a $700 million reduction in the baseline portfolio (with IRA), relative to the initial baseline portfolio (without IRA). The $590-$740 million in savings estimated for the clean energy portfolios are in addition to this initial $700 million reduction.

Sensitivity Analyses

An additional sensitivity run that did not include the incremental distributed solar was conducted and indicated that the Clean Replacement portfolio remains a more economic option than the Baseline. The inclusion of distributed solar displaces some of the utility scale solar but it results in significant NPVRR reduction, showing that rate design incentivizing distributed generation can reduce the NPVRR while also alleviating transmission constraints.

At the timing of this analysis, SRP had not announced a preferred portfolio. However, the baseline captures some core elements of what we expect the utility's proposed portfolio to be. However, since resource planning economics have dramatically shifted with the Inflation Reduction Act, we conducted one additional run that simulates an "alternative baseline" portfolio that includes no investment in new gas (neither the Coolidge Expansion Project, nor other new gas). It is Strategen's understanding that absent the Coolidge expansion, SRP presently intends to install several gas turbines at other existing sites that in total will achieve a similar capacity expansion.[10] This "alternative baseline" portfolio captures a scenario in which that the utility does not invest in any new gas. The NPVRR of the alternative baseline is close to the main Baseline Portfolio presented: specifically, the alternative baseline results in NPVRR that is approximately $30 million higher in cost than the one that includes the Coolidge expansion or equivalent gas capacity without including the IRA tax credits and $163 million lower in cost when including the IRA tax credits. This indicates that the Coolidge Expansion Project is not part of a least cost portfolio. Furthermore, this sensitivity analysis further confirms Strategen's overall findings. That is, significant savings are achieved from the clean energy portfolios. Those savings are a result of minimizing investment in new gas, but even in the case that SRP's preferred portfolio were to include no new gas resources, additional savings could be achieved by transitioning away from coal resources and investing in demand side resources.

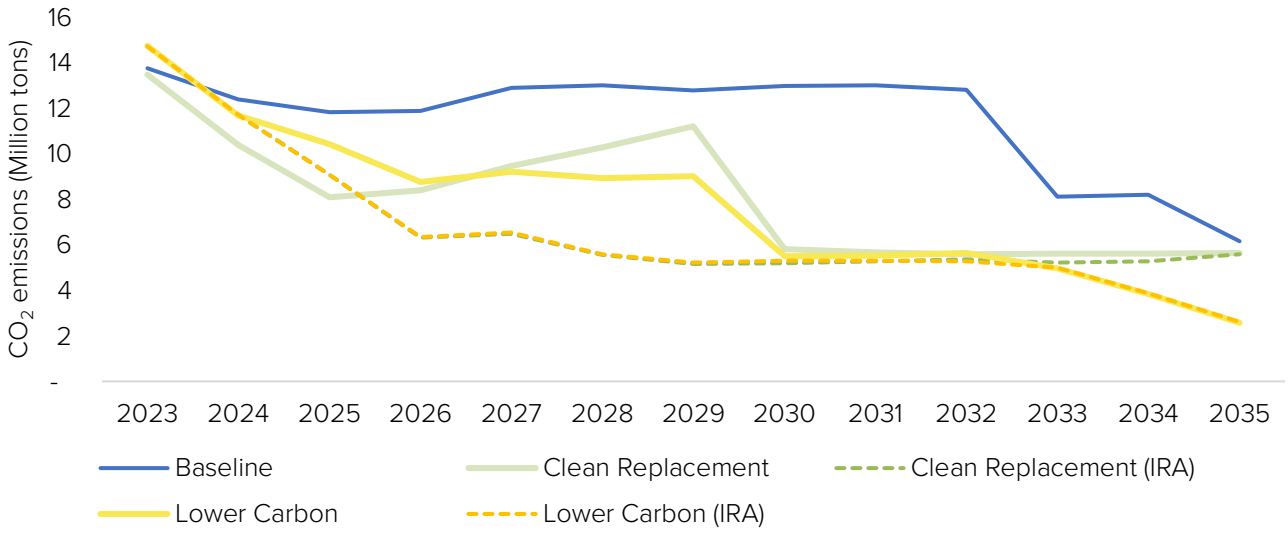
3.2.3 CO_2 Emissions Trajectory

The model also calculated the annual emissions from the operations of the portfolios, which are depicted in the graph below. Installing solar plus storage resources in early years for all the clean portfolios results in significant emissions savings compared to the baseline case. Additional emissions savings are achieved in 2030 for the clean energy portfolios when the Coronado and Springerville units retire.

When federal support from the IRA is included in the optimization of the portfolio, the coal units retire as early as allowed, resulting in significantly lower cumulative emissions over the study period.

[10] On 09/12/2022, the SRP Board of Directors voted to approve the first phase of a multi-phase continued development project at SRP's Copper Crossing facility to create the "Copper Crossing Energy and Research Center" which will include the installation of two natural gas turbines (out of the 16 of the Coolidge Expansion Project). SRP Board Approves Continued Resource Development at Copper Crossing, 09/12/2022

Figure 4: CO_2 emissions trajectory



Measuring emissions reduction at a single point in time, as usually done with emission reduction targets, is not informative enough. For example, focusing on 2035 the emissions of the Baseline portfolio are very close to the ones reported for the Clean Replacement portfolio. Despite the two portfolios having similar emissions levels in 2035, their cumulative emissions are very different. As SRP announced the Springerville retirement by the summer of 2034, the two portfolios look similar in that single year. However, the impact of keeping SRP's Springerville, Four Corners, and Coronado units online until then cannot be ignored.

With respect to emission reduction targets, it is important to note that a rate emissions reduction target for a utility with a high growing load like SRP is less meaningful that the same reduction in mass emissions.[11] The rate target does not necessarily reduce the tons of CO_2 emitted as generation keeps growing. In the case of SRP, the 2035 sustainability goal is achieved just based on its projected load growth and announced coal retirements.

A more ambitious mass emissions reduction target as the one included in the Lower Carbon case eliminates new fossil fuel generation as a viable resource option, results in the retirement of coal units, but also further reduces the generation of existing gas units. To achieve the additional emissions reduction, the model selects wind to diversify the portfolio and reduce the generation of existing combined cycle units in the later years of the study.

Table 3: Cumulative CO_2 emissions (2023-2035)

(Delta from Baseline In million tons)		
	Initial Runs	IRA runs
Baseline	-	-
Clean Replacement	(45)	(59)
Lower Carbon	(49)	(63)

[11] One of the primary reasons for pursuing the carbon reduction policy is to mitigate catastrophic climate change. However, the climate impacts of carbon emissions are the result of cumulative emissions, not annual emissions or an emissions rate. Thus, even if the baseline portfolio ultimately reaches annual emissions similar to the clean replacement portfolio, the overall trajectory of these reductions is what matters from a climate perspective. A faster pace of reduction such as the Clean Replacement or Lower Carbon portfolios will lead to fewer cumulative emissions, and thus have a more beneficial impact.

4. Recommendations

SRP currently has a unique opportunity to set the right path for its transition to a cleaner generation fleet. The utility faces a significant near-term energy and capacity need, and the IRA provides the tools and credits to help meet that need with a clean, lower-cost portfolio. SRP's resource planning decisions should account for costs, emissions, fuel price volatility and policy risks associated with new fossil fuel generation, as well as the impacts on local communities. Building a clean portfolio, similar to the ones presented in this analysis, is not only a no-regrets course of action, but the least-cost and least-risk option.

This analysis yields several key recommendations:

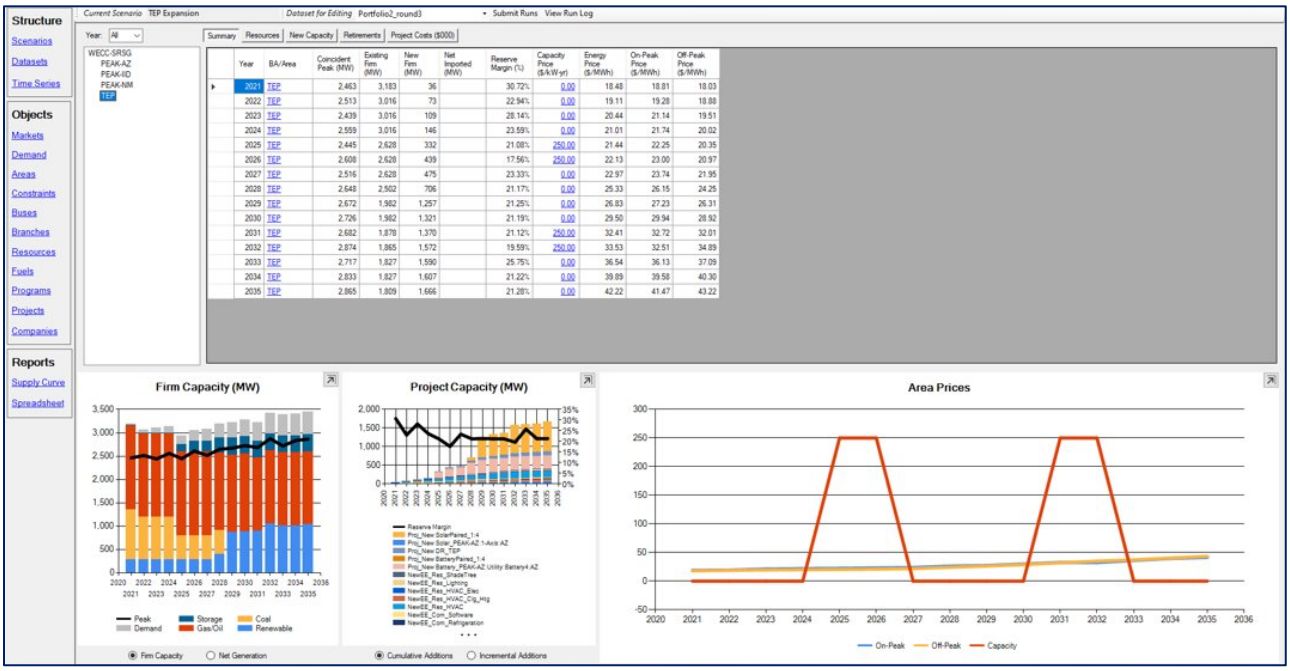
- Avoid expenditures on gas units. SRP should avoid or cease expenditures on gas generation, including the proposed Coolidge Expansion Project as well as the installation of gas turbines at other existing sites. Especially now, with the IRA provisions in place, new gas generation not only poses significant risks, but is no longer part of a least cost portfolio.
- Retire uneconomic coal units as soon as possible while ensuring a just and equitable transition plan. Strategen's initial modeling indicated that retiring coal units before 2030 can result in significant emission savings without raising costs for SRP customers. The IRA not only supports this finding, but dramatically accelerates the optimal timeline by providing bonus credits to eligible resources that are sited in communities where a coal plant retired. Strategen's capacity expansion modeling indicated that earlier retirement dates of 2025, and 2026 for the Four Corners, Springerville, and Coronado units are optimal. The model did not allow the earlier retirement of coal units with an announced retirement date before 2030 (Craig and Hayden). Strategen recognizes the need for careful planning prior to a unit retirement especially as the local community might be affected. Respecting the need for just transition planning, we recommend that SRP explores the retirement of its entire coal fleet prior to 2030 and as soon as possible.
- Continue investing in and supporting demand side resources. SRP should adopt more ambitious energy efficiency targets and programs, and incorporate these targets into the resource planning process. SRP can also offer flexible demand response programs for large customers and expand residential DR program offerings. SRP can further explore rate options that will incentivize distributed generation, especially as federal support will significantly reduce costs through extended credits.
- Set *meaningful* carbon reduction targets. SRP's current 2035 sustainability goals do not appear to drive any incremental emissions reductions and are readily achieved via SRP's previously announced coal retirements. Setting a more ambitious mass-based target could be helpful in focusing the utility's resource planning efforts towards both cleaner and cheaper portfolios.
- Explore all options and incentives available through the Inflation Reduction Act. SRP should explore available IRA provisions, including solar, storage, wind, and other clean electricity tax credits, transmission planning provisions, demand side resource incentives (tax credits and rebates for EE and distributed generation), credits for interconnection of smaller projects, as well as many other provisions that can support SRP in pursuing a cleaner, cheaper portfolio for its customers. It is important that SRP considers the impact of the IRA in this ISP cycle and does not lock itself and its customers into a sub-optimal portfolio.

5. Appendix

5.1 Methodology

In conducting this analysis, Strategen used the EnCompass power planning software tool, developed by Anchor Power Solutions. EnCompass is commercially available and can be configured either as a capacity expansion model or a production cost model.

Figure 5: Snapshot of the EnCompass user interface

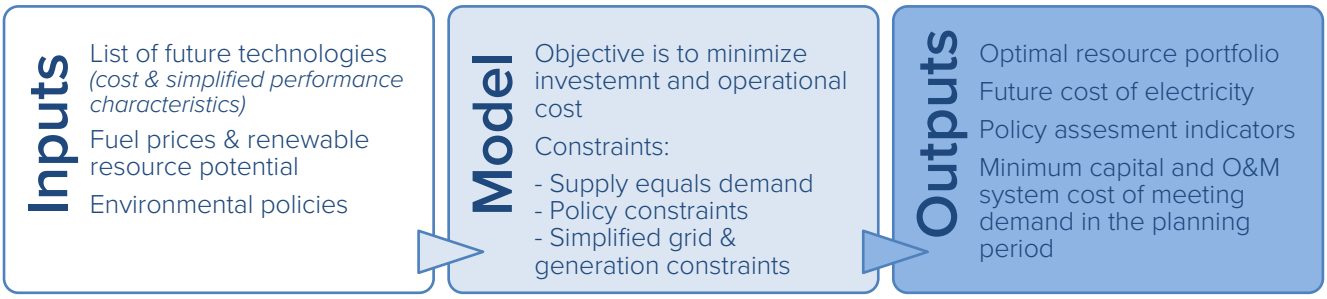


A capacity expansion model finds the least cost resource portfolio that meets the projected electricity demand over a period of several years. A production cost model finds the least cost dispatch of a given or pre-determined system of generators. Capacity expansion models have been traditionally used to provide investment guidance, while production cost models have been employed to provide answers to short-term operational questions or to perform comparisons of pre-selected or pre-determined portfolios. A capacity expansion model selects the resources that can serve the forecasted load over a period of several years at minimum cost. It is, therefore, suitable for developing utility resource plans and assessing the costs and benefits of longer looking utility regulatory policies.

Accordingly, for this study, EnCompass was run as a capacity expansion model with a planning horizon of 2035. In this mode, the model determines not only the most economical way to utilize existing resources, but also which technologies should be added in the future, and which existing resources should be retired, while meeting the forecasted load and any policy goals outlined in each simulation.

The figure below shows the inputs and outputs of a capacity expansion model.

Figure 6: Capacity expansion model: inputs & outputs



After selecting the resources that comprise the least cost portfolio under a set of assumptions, the operations, costs, and emissions of the portfolio were modeled through a detailed hourly production cost simulation.

Figure 7: Production cost model: inputs & outputs

The model simulates the SRP balancing area; import/export capability to the Palo Verde hub as a representation of the utilities' interconnection to other utilities in the state and the broader region and includes out of state wind resources for selection.

5.2 Inputs & Assumptions

The analysis uses public data from diverse sources including goals and resources from SRP's Integrated System Planning process, cost values from the National Renewable Energy Laboratory (NREL), operational data from the Energy Information Administration (EIA) and the S&P Market Intelligence Platform, and emissions records from the Environmental Protection Agency (EPA), as well as adjustments based on recent policy developments, and the Strategen team's expert judgement.

5.2.1 Load Forecast

Forecasting load is a foundational component of a resource plan, fundamental to analyzing the number, timing, and type of resources a utility need. The forecast is long-term in nature, with more emphasis placed on the near-term, as the near-term outlook guides short-term decision-making in a utility's three-to-five year "Action Plan" window, while the long-term forecast is important to develop a long-term strategy, directional resource targets, and assess policy impacts.

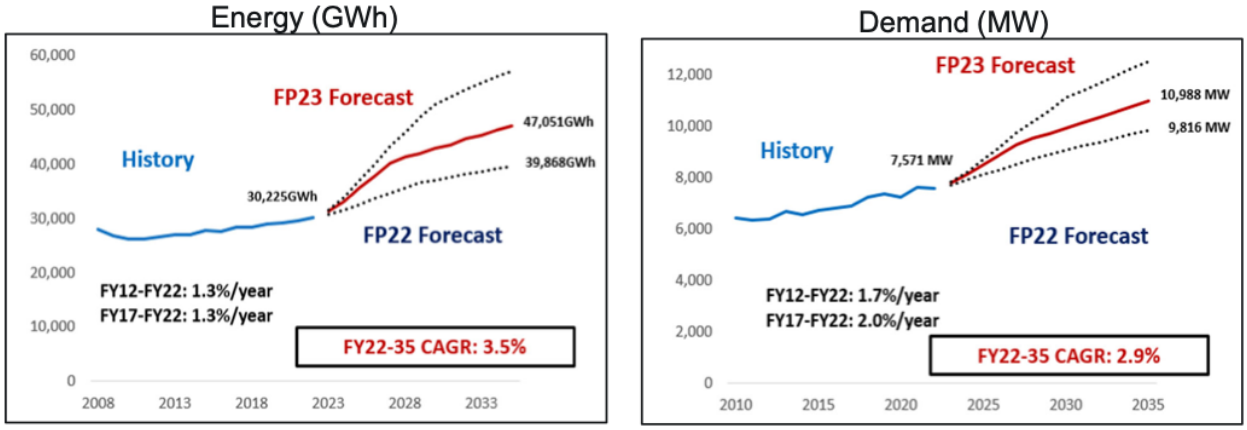
The present analysis projects energy needs up to 2035 based on SRP's forecasted annual energy consumption and system peak.[12] The hourly profile is derived from SRP's historical load from 2021, as reported by EIA,[13] Specifically, SRP's forecast assumed an average 3.5% annual growth rate of energy and a 2.9% annual growth rate of peak demand. SRP's forecast is assumed to include the effects of energy

[12] Itron the forecast, published in SRP's Power Committee meeting of April 21, 2022

[13] EIA's Hourly Electric Grid Monitor. Using data collected in form EIA-930, the agency collects data about the high-voltage bulk electric power grid from each balancing authority in the 48 lower states.

efficiency and distributed generation as those included in the utility's "Current Trends" portfolio. SRP's load forecast was then adjusted to reflect higher energy savings from Energy Efficiency in the Lower Carbon Scenario portfolio.

Figure 8. SRP's load forecast, Itron review



5.2.2 Planning Reserve Margin and Market Reliance

All modeled portfolios assume 525 MW of market availability and a 16% planning reserve margin. This is based on the utility's base assumption in the "Current Trends" scenario.

5.2.3 Capacity Value of Intermittent Resources

The capacity contribution of generation resources was based on E3's "Resource Adequacy in the Southwest" study published in February 2022.

5.2.4 Demand Side Resources

Future EE, DR, and distributed solar levels were included in the model based on SRP's projections. The graphs below summarize the forecasts showing how each of those are included in the SRP developed scenarios and the scenarios examined in this report:

Figure 9. SRP's demand response projections

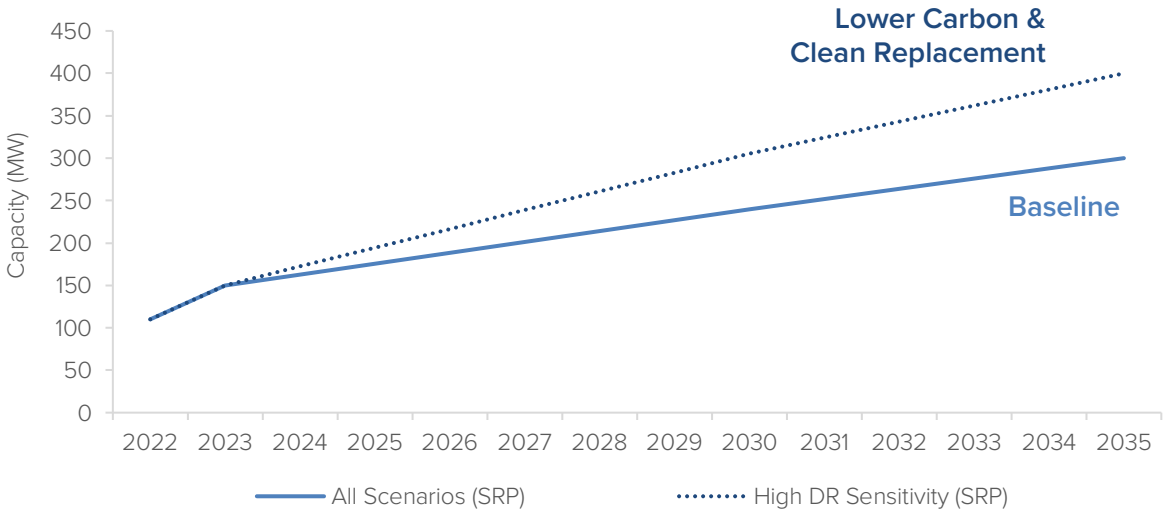


Figure 10. SRP's energy efficiency projections

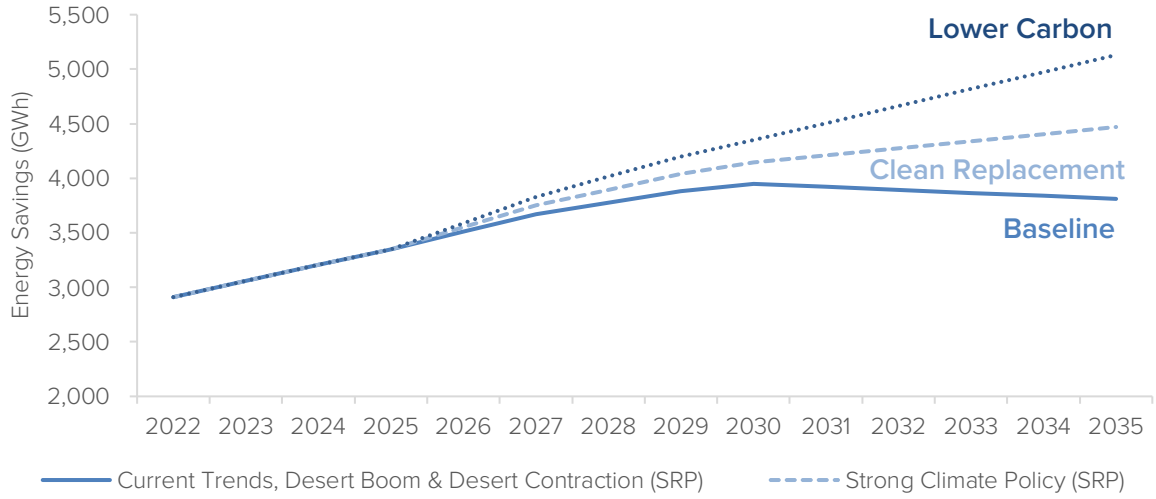
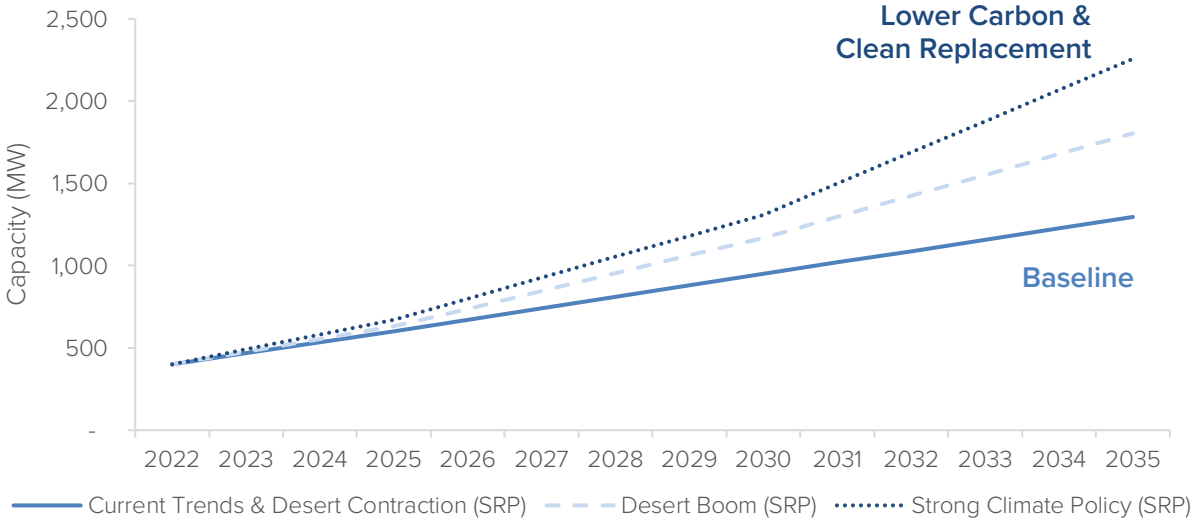


Figure 11. SRP's rooftop solar projections



The incremental EE cost has been estimated based on estimates provided in a recent study performed by Lawrence Berkeley National Laboratory, extrapolated to the relevant time periods.[14] Distributed solar costs were not included in the revenue requirement estimates.

5.2.5 Supply Side Resources

SRP's supply resources include generators of a variety of technologies, both owned and contracted by the utility. Strategen complied data on these resources and the ones SRP has committed to acquire in the near term.

[14] Based on LBL's "The Future of U.S. Electricity Efficiency Programs Funded by Utility Customers" study which presents costs by state for EE in 2020, 2025, and 2030. The analysis uses the "High EE" scenario for costs.

5.2.6 Existing Resources

Natural Gas Generation

Generating Station	Fuel	Capacity
Agua Fria	Natural gas	626 MW
Coolidge	Natural gas	575 MW
Gila River	Natural gas	1,100 MW
Desert Basin	Natural gas and steam	577 MW
Kyrene	Natural gas and oil	521 MW
Mesquite	Natural gas	625 MW
Santan	Natural gas	1,193 MW

The model also includes planned gas upgrades in the Agua Fria and Desert Basin Stations. Operational and cost characteristics of the gas resources including heat rates, forced outage rates, emission rates, and variable operations and maintenance costs are based on data from the S&P market intelligence platform or information about generic units of the same technology. No gas unit was allowed to retire economically for the study period.

Coal Resources

Operational and characteristics of the coal resources including heat rates, forced outage rates, emission rates, fixed and variable operations and maintenance costs are based on data from the S&P market intelligence platform or information about generic units of the same technology. Incremental capital expenses were calculated based on Energy Information Administration's (EIA) "Generating Unit Annual Capital and Life Extension Costs Analysis".

For Coronado, an additional cost of $50 million was modeled at the beginning of 2026 that would allow Unit 2 to share the existing selective catalytic reduction equipment with Unit 1 (CGS Split SCR project). In the Clean Replacement and Lower Carbon Portfolios the Coronado, Four Corners, and Springerville units were allowed to retire economically.

Salt River Power resources were assumed to operate at capacity factors similar to those of 2018, while Colorado river resources were reduced to half of that starting in 2025. The model results indicate hydro generation of approximately 0.7 TWh for 2022, which is consistent with SRP's projections for the year.[15]

Table 4: SRP's coal units

	Nameplate Capacity SRP share (MW)	Announced Retirement Date	Earliest Retirement Date Modeled	Seasonal Operations
Coronado Unit 1	382	12/31/2023	1/1/2026	Yes
Coronado Unit 2	380	12/31/2032	1/1/2026	Yes
Craig Unit 1	124	12/31/2025	-	
Craig Unit 2	124	12/31/2028	-	
Four Corners Unit 4	74	12/31/2031	1/1/2025	Yes
Four Corners Unit 5	74	12/31/2031	1/1/2025	
Hayden Unit 2	131	12/31/2027	-	
Springerville Unit 4	400	4/30/2034	1/1/2025	Yes

[15] SRP website, Today's energy mix (2022)

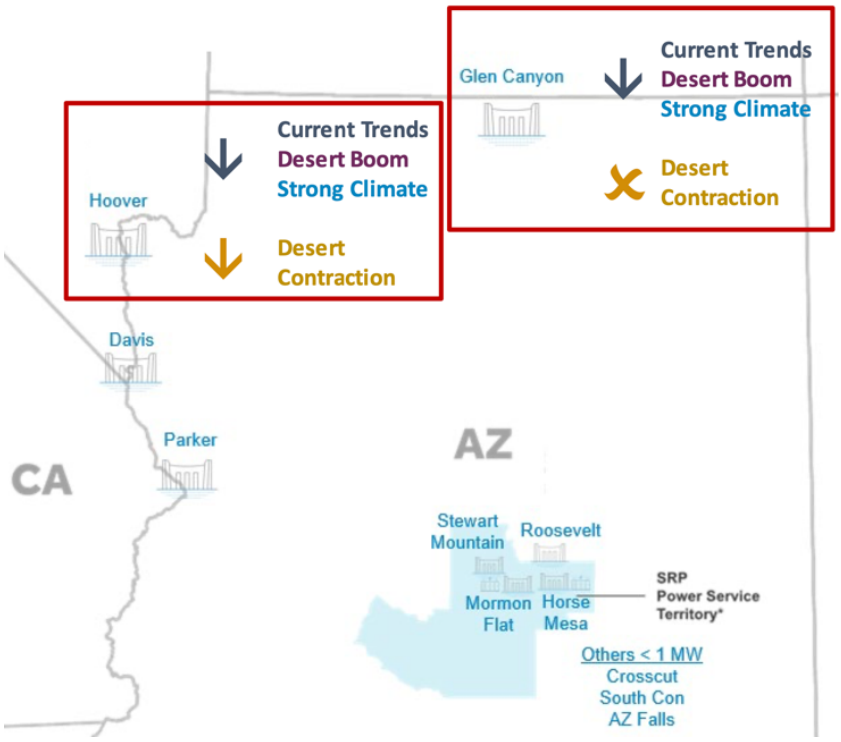
Nuclear Resources

SRP receives 689 MW from the Palo Verde Generating Station (17.49% share). SRP will acquire 104MW of Unit 1 on 1/1/2023 and 10MW on 1/1/2024 from Public Service Company of New Mexico. In one of the

Hydro Resources

SRP receives energy from several hydro resources, depicted below:

Figure 12. SRP's hydro resources[16]



Solar and Storage Resources

SRP owns or has contracts for wind, solar, and energy storage assets. Information around the utility's existing assets and power purchase agreements were compiled from SRP's website and are summarized below. All existing and planned additions were included in the model.

Table 5: SRP's solar and energy storage resources

Project	Nameplate Capacity	Commercial Operation Date
Copper Crossing Solar Ranch, Florence	20 megawatts (MW)	2011
Queen Creek Solar, Queen Creek	19 MW	2012
Sandstone Solar Facility, Florence	45 MW	2015
Kayenta 1, Navajo Nation	27 MW	2017
Pinal Central Energy Center, Casa Grande	20 MW + 10 MW 4-hour battery	2018
Dorman Energy Center, Chandler	10 MW, 4-hour battery	2019

[16] SRP's Integrated System Plan Technical Working Sessions:
Advisory Modeling Subgroup Meeting 2: Inputs for the ISP Study Plan

Project	Nameplate Capacity	Commercial Operation Date
Kayenta 2, Navajo Nation	28 MW	2019
Saint Solar	100 MW + 100 MW, 4-hour battery (in 2025)	2020
East Line Solar	200 MW	2020
Bolster Battery	25 MW, 4-hour battery	2021
Central Line Solar	100 MW	3/18/2022
West Line Solar	100 MW	10/31/2022
Sonoran Solar + Battery	260 MW Solar + 260 MW, 4-hour battery	By 2025
Storey Solar + Battery	88 MW Solar + 88 MW, 3-hour battery	By 2025
Saint Battery	100 MW, 4-hour battery	By 2025
Valley Farms Solar	200 MW	By 2025
Randolph Solar	200 MW	By 2025
Co Bar Solar	400 MW	By 2025

Wind Resources

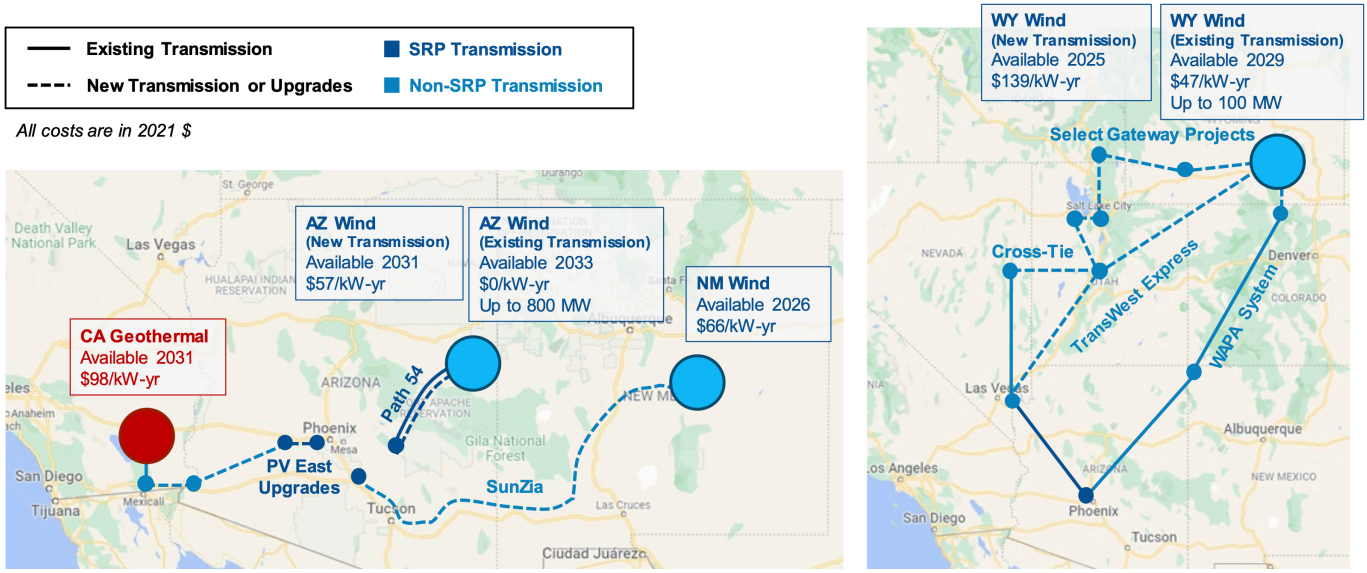
SRP has an agreement to purchase electricity from the Dry Lake Wind Power Project, located near Heber, Arizona (127 MW).

5.2.7 New Resources

Resource Options

The model was allowed to select combustion turbines, solar, wind, and energy storage assets. The initial modeling of the clean portfolios allowed no combustion turbines, while no such restriction was necessary in the IRA scenarios. A hybrid configuration of solar plus storage (50% of solar, 4hrs) was also included. Storage options included 4hour batteries for the duration of the study, and 8hour batteries post 2030. Wind resources included options from Arizona, New Mexico, and Wyoming and included transmission costs per SRP's assumptions:

Figure 13. Transmission cost adders for remote resources[17]



[17] SRP's Integrated System Plan Technical Working Sessions:
Advisory Modeling Subgroup Meeting 3: Inputs for the ISP Study Plan – Part 2

Wind from Arizona using existing transmission was made available in the model upon retirement of the Coronado units. In addition to the AZ wind utilizing existing transmission, the model was limited to select up to 1,000 MW of additional wind for the study period.

Resource Costs

The capital costs, fixed costs and variable operating costs of all resources were based on the 2022 National Renewable Energy Laboratory's Annual Technology Baseline (NREL ATB). Wind and solar costs, as well as gas turbine costs were based on the moderate cost projection, while energy storage costs were based on the advanced cost projection.

5.2.8 Commodity Prices

Gas prices were based on the EIA Annual Energy Outlook ("AEO") 2022 for delivered energy prices in the Mountain region (reference case). Monthly variation of gas prices was included in the forecast based on Strategen's expertise.

Coal prices were based on EIA's historical coal price database for Arizona units (ranging from $1.9/MMBtu for the Craig units to $3.1/MMBtu for the Four Corner units in 2021). Coal prices are assumed to escalate at the inflation rate.

5.2.9 Federal Tax Credits

Initial portfolios included investment tax credits ("ITC") for solar and solar plus storage assuming that though "commence-construction" or "safe-harboring" provisions by 2023, solar ITC projects can secure the 26% and 22% credits in 2022 through 2025. Post 2025, the modeled ITC dropped to 10%. No Production Tax Credit ("PTC") for wind resources was modeled.

For the IRA portfolios, extended ITC and PTC provisions are modeled. The ITC and PTC provisions in the model assume both the base credits and the adders for projects that meet labor requirements, resulting in ITC of 30%. The credits are assumed to phase down after 2033.[18] Solar plus storage projects that replace coal generation (whether planned or endogenously retired in the model) receive an additional 10% ITC based on the "energy community" siting provision. When Coronado retires, 800 MW of AZ wind with no additional transmission charge are eligible for the PTC with the bonus for siting in "energy community". The additional available bonus for meeting domestic content minimums was not included.

[18] Inflation Reduction Act: Solar Energy and Energy Storage Provisions Summary, Solar Energy Industries Association

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