

TEP Integrated Resource Plan

Public Workshop

WELCOME

JEFF YOCKEY
DIRECTOR, RESOURCE PLANNING



Tucson Electric Power



Meeting Logistics

- Connection

- Skype for Business (screen share)
- Materials at tep.com/resource-planning/
- Audio connection
 - Phone preferred
 - Disconnect device audio

- Public Engagement

- Chat
- Audio
 - All participants muted during presentations
 - Unmute for Q&A
 - Mute your device unless asking questions

- Safety Minute:

Embrace the “*New Normal*”

- Agenda

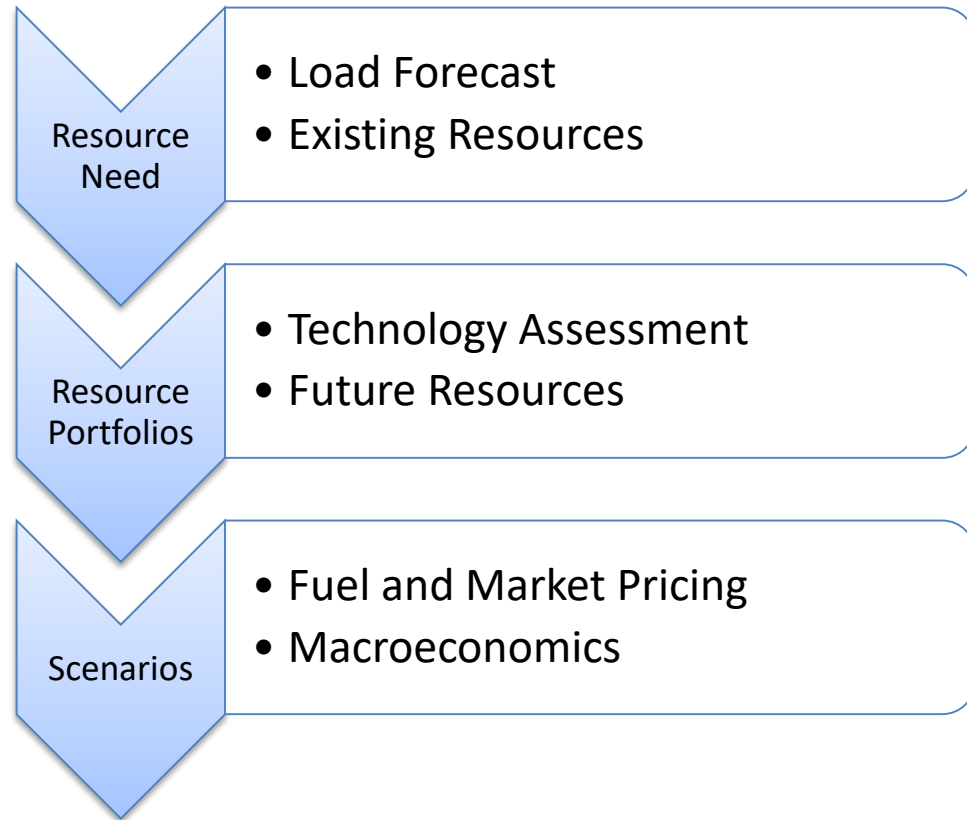
- IRP Overview
- Load Forecast
- Modeling Assumptions
- Resource Adequacy
- Portfolio Results

Lunch Break

- TEP CO₂ Reduction Goal
- Advisory Council Feedback
- Public Comment
- Wrap-up



Integrated Resource Plan (IRP) Overview



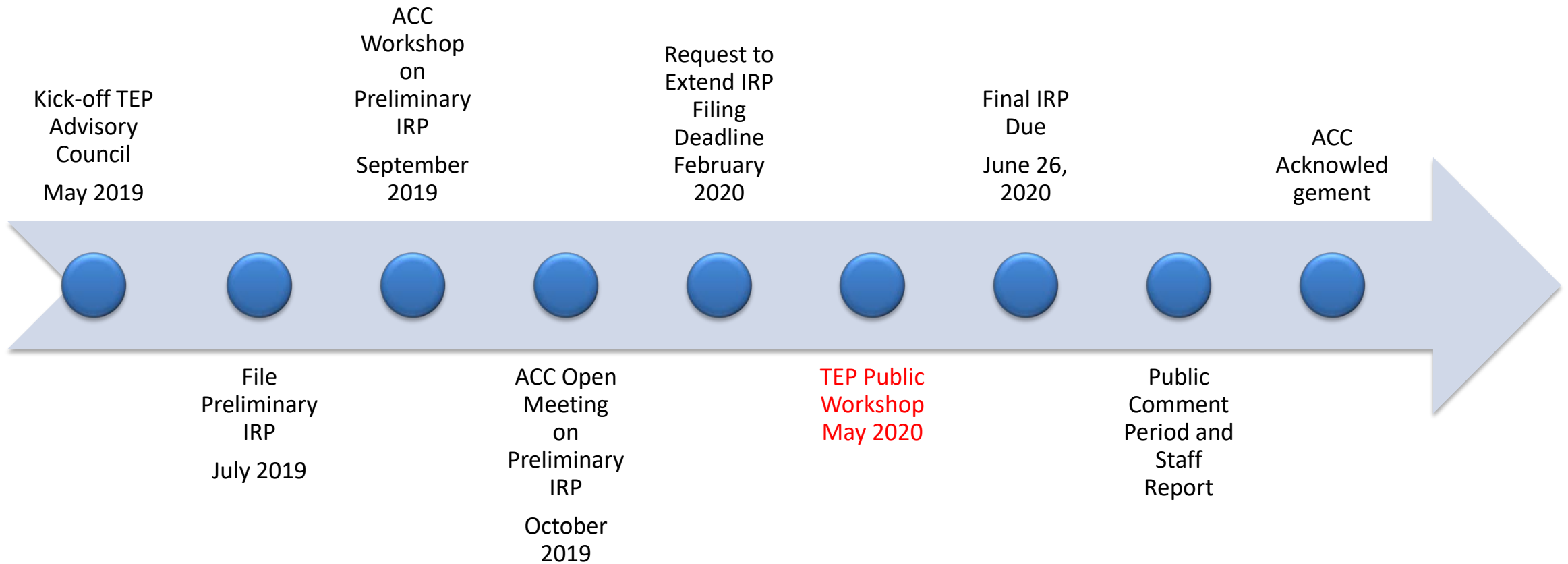
Timing

- 3-year planning cycle
- 15-year outlook
 - 2021 - 2035
- 5-year Action Plan

Portfolio Analysis



IRP Schedule





Advisory Council

	Category	Organization
Customers	Large/Industrial	Port of Tucson
	Commercial	GLHN, Architects and Engineers
	Residential	RUCO
	Low Income	Wildfire AZ
	Senior	Pima Council on Aging / AARP
Government	City	City of Tucson
	County	Pima County
	State	University of Arizona
	Federal	Davis Monthan AFB
Advocacy	Environment	Sierra Club / Western Resource Advocates
	Energy Efficiency	SWEEP
	Economic Development	Sun Corridor
	Distributed Generation	Technicians for Sustainability



Advisory Council Structure and Topics

- Monthly Meetings
 - May through December 2019
- Subject Matter Experts
 - Including guests
- Meeting Materials Posted Online
 - Presentations
 - Meeting Summary
 - <https://www.tep.com/resource-planning/>

Meeting Topics	
Planning for Uncertainty	Modeling Assumptions
Load Forecast	Grid Enhancements
Existing Resource Attributes	Customer Resources
Proposed Resource Additions	Coal Plant Economics
Future Resource Costs	CO ₂ Emission Reductions
Resource Adequacy	Electric Vehicles
Revenue Requirement	Demand Side Management

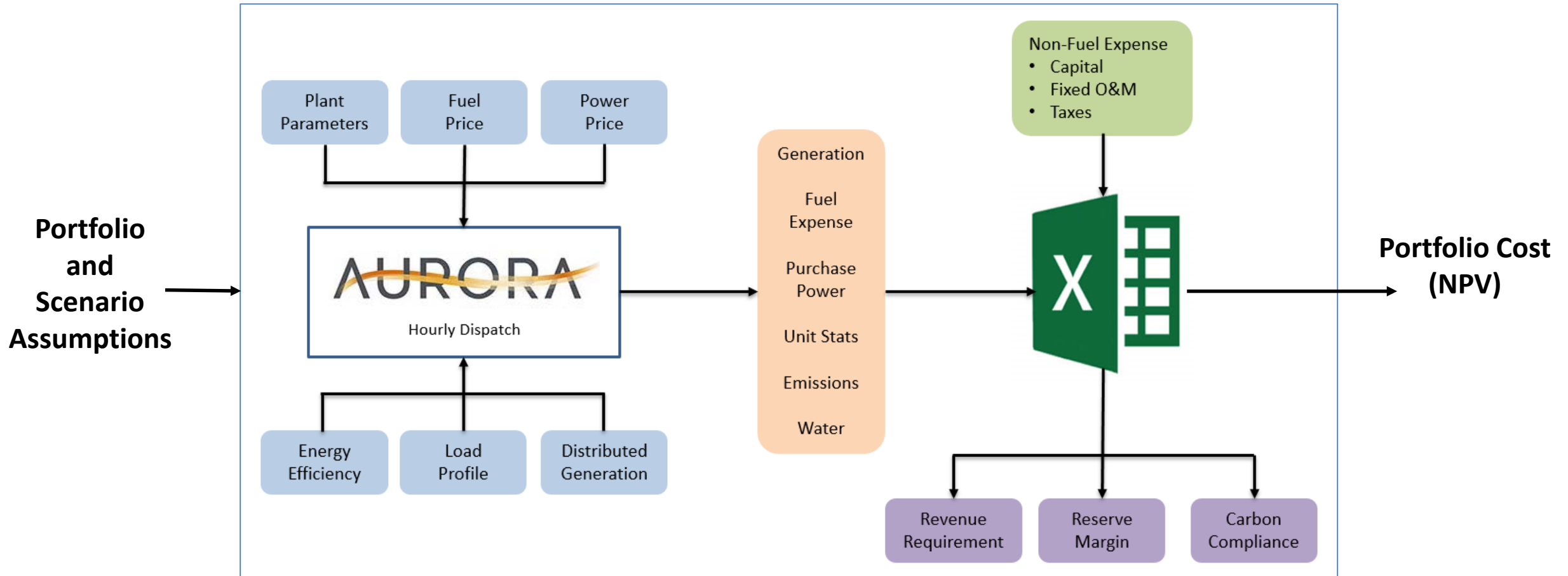
Modeling and Assumptions

KEVIN BATTAGLIA
LEAD SUPPLY-SIDE PLANNER



Tucson Electric Power

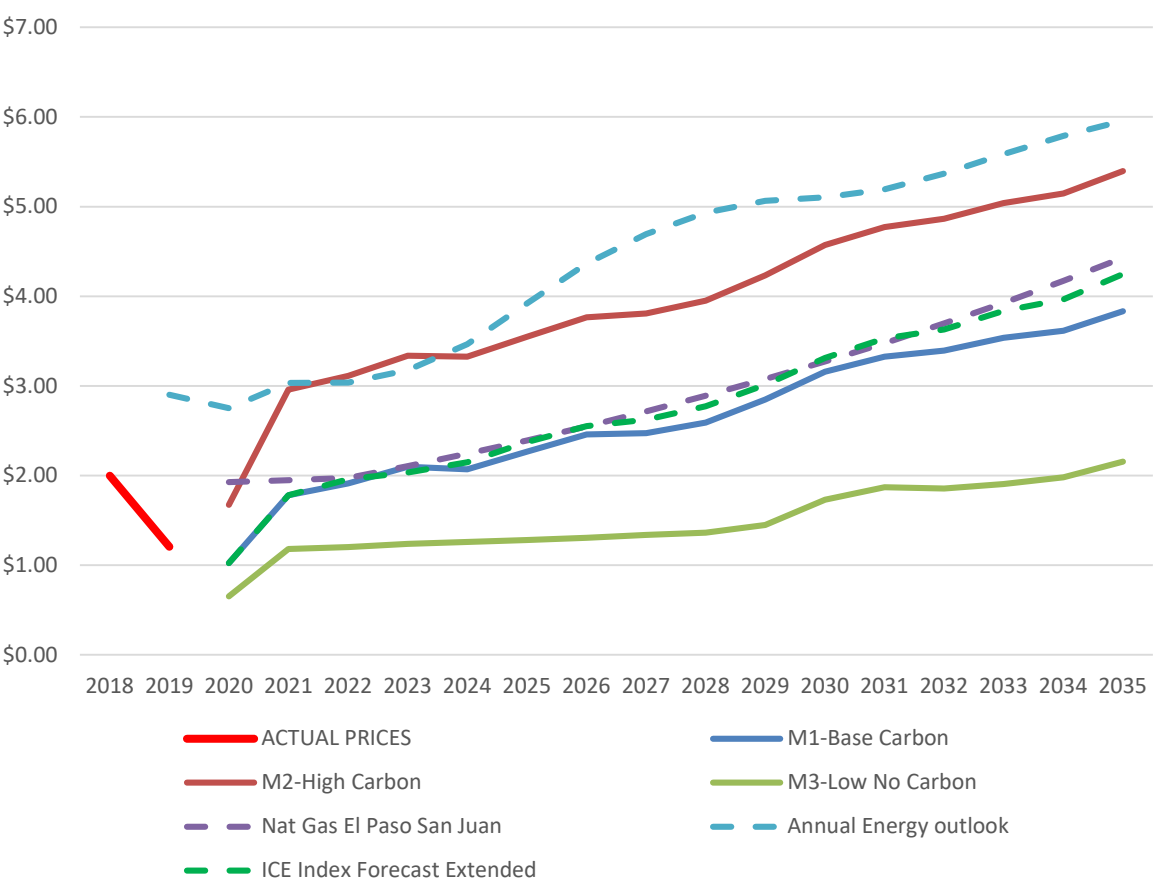
Overview of Portfolio Cost Assessment



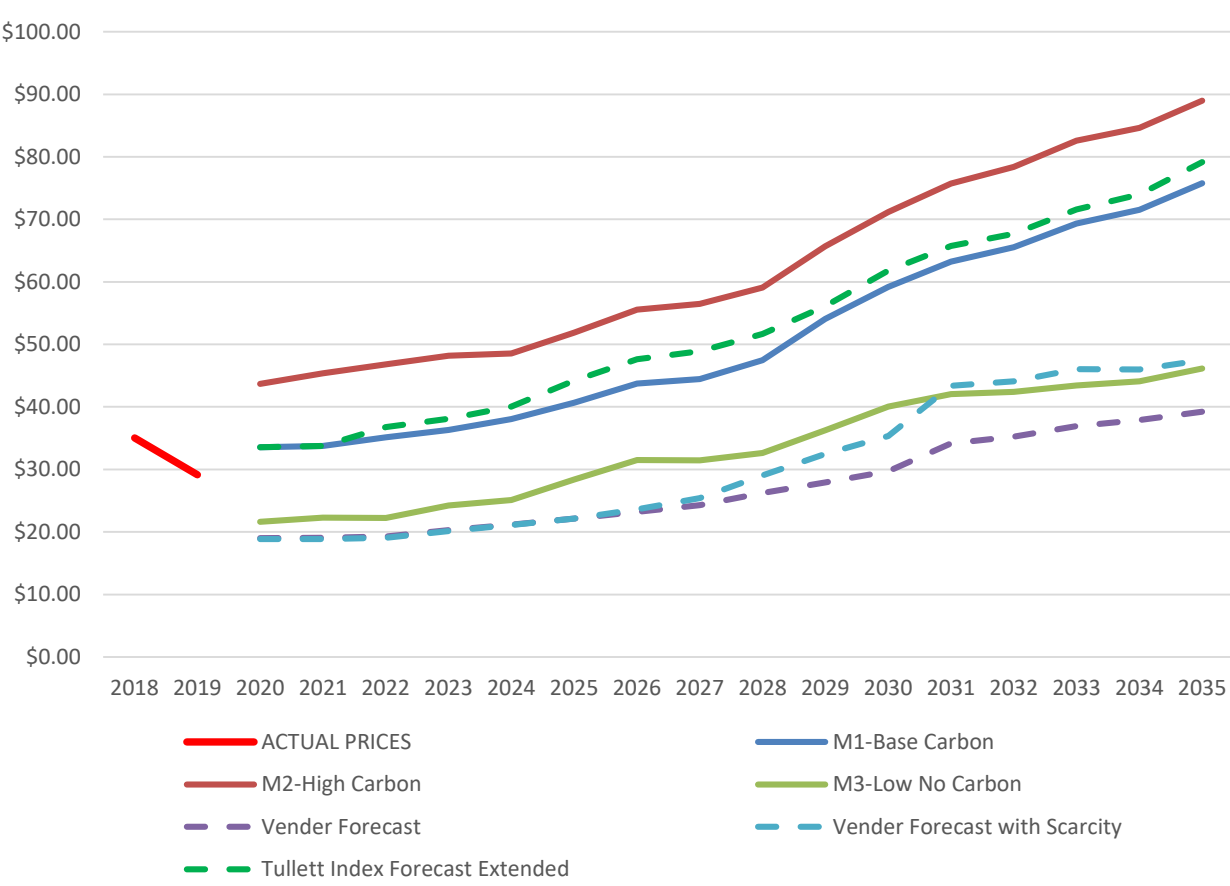


Market Assumptions

Permian Natural Gas (\$/MMBtu)



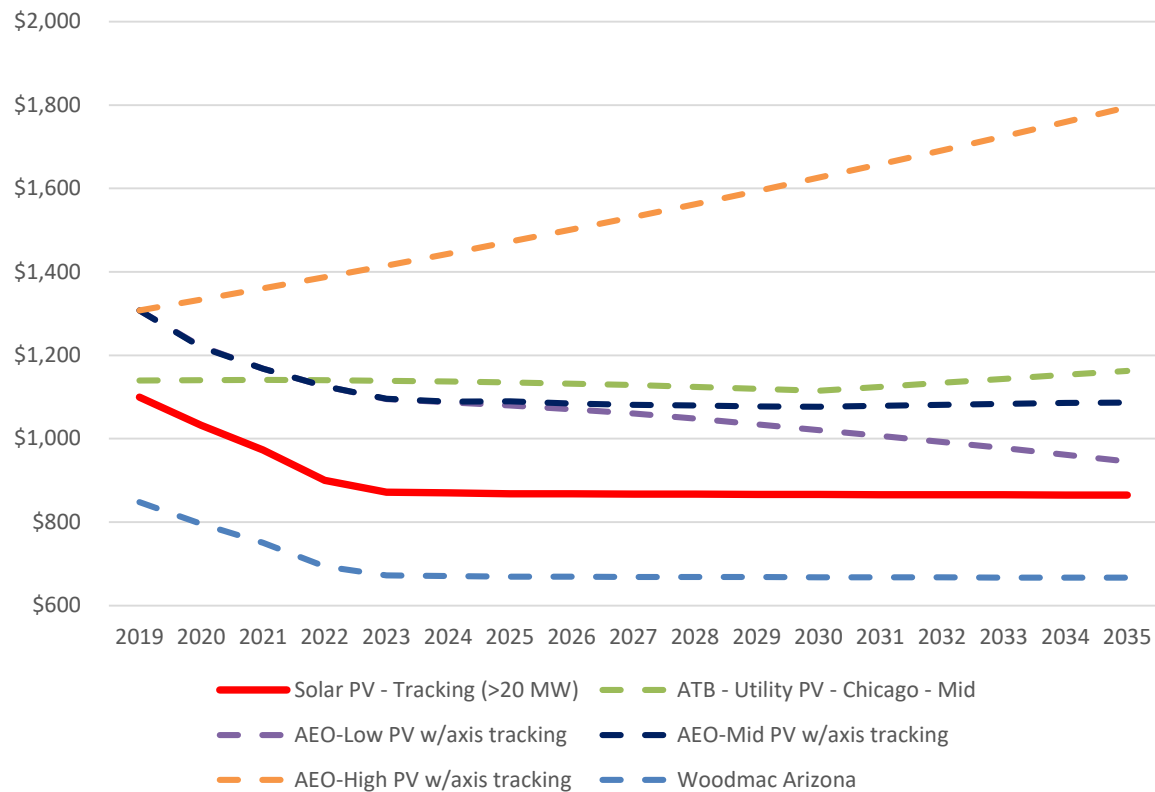
Palo Verde Market (\$/MWh)



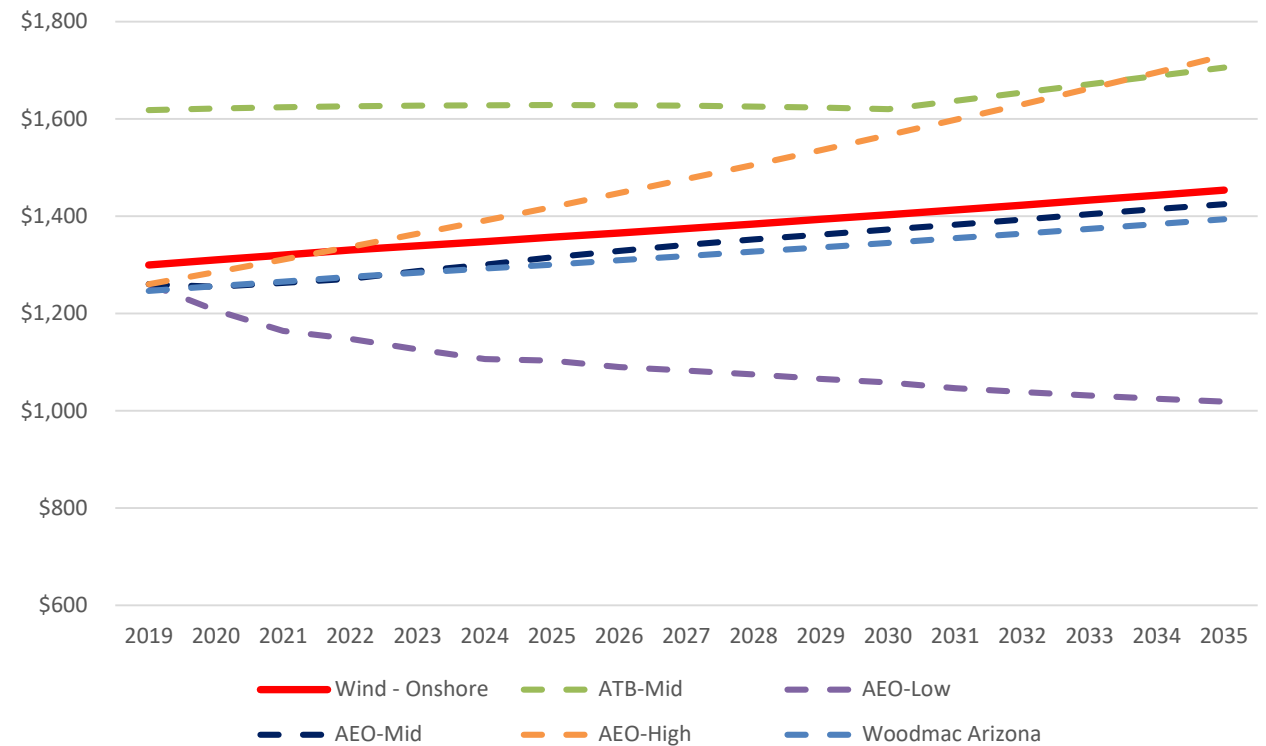


CapEx Forecast

Solar PV Single Axis Tracking (\$/kW)



Onshore Wind (\$/kW)

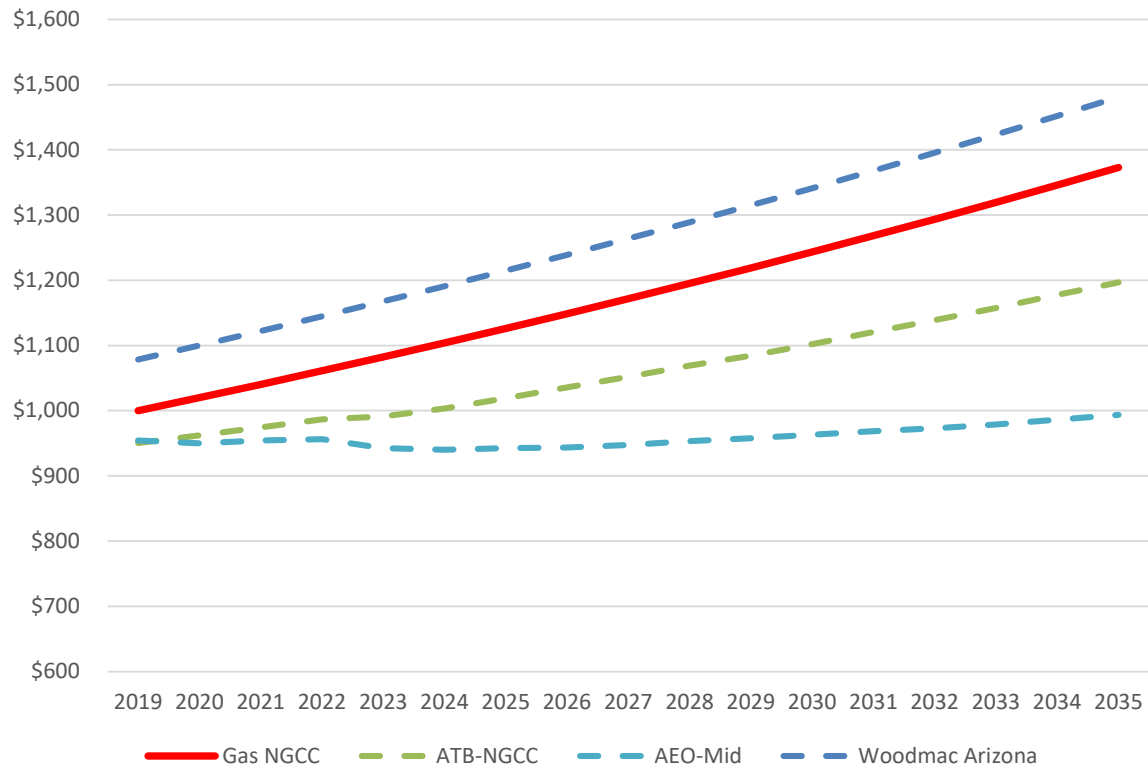


On a Levelized cost basis, the near term decrease in capital cost is offset by a reduction in the Investment Tax Credit.

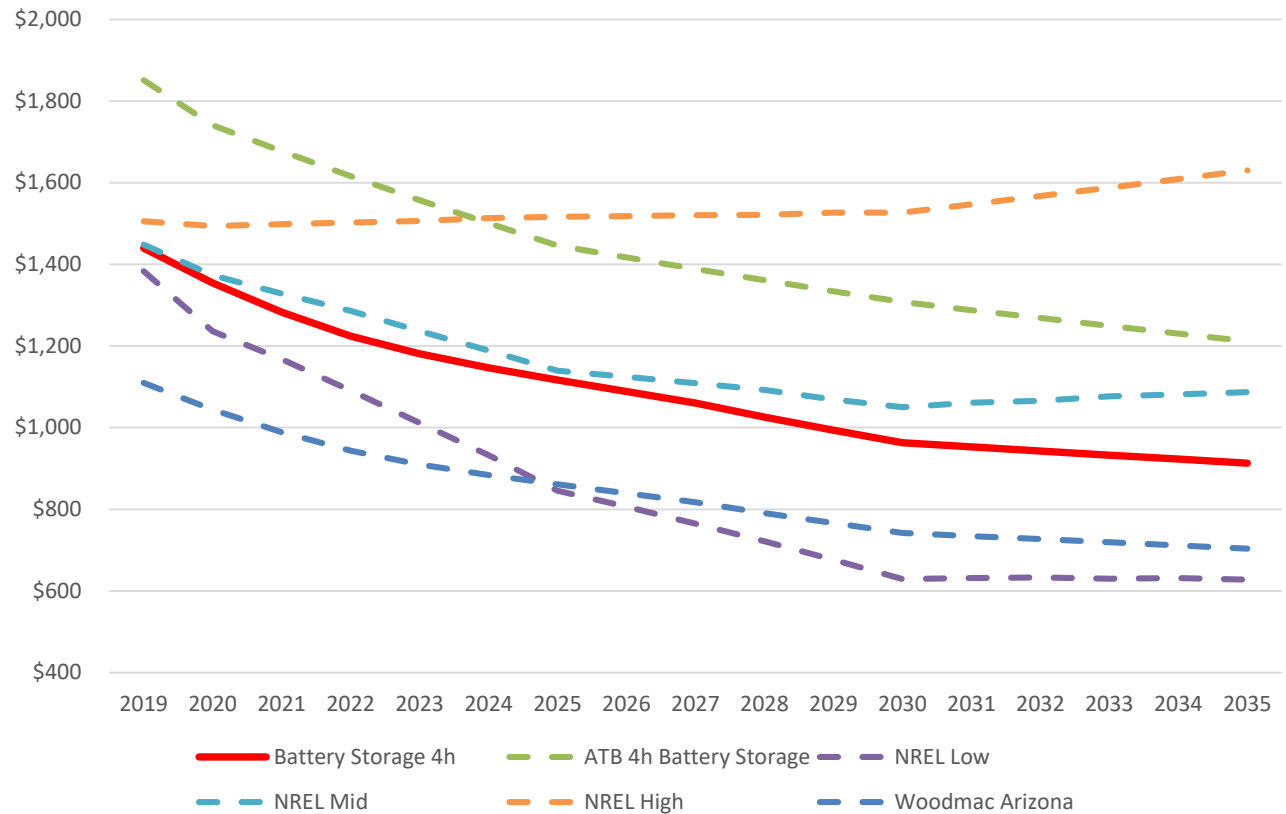


CapEx Forecast

Natural Gas Combined Cycle (NGCC) (\$/kW)



Battery Storage - 4 hour (\$/kW)





CO₂ Pricing

Carbon Prices

	Carbon Price (\$/short ton)
	Federal Carbon Tax
	nominal
2028	2.40
2029	4.89
2030	7.48
2031	10.17
2032	12.97
2033	15.87
2034	18.89
2035	22.02

RESOURCE ADEQUACY

LEE ALTER
LEAD SUPPLY-SIDE PLANNER



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PORTFOLIO REVIEW



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Portfolio Identification

P01aL1M1E1

P01	Portfolio Name (i.e. 80% renewable energy by 2050)
a	Portfolio variation (i.e. majority solar vs. majority wind)
L1	Load Scenario (electric vehicles, mining)
M1	Market Scenario (Low gas price vs. High gas price)
E1	Emission Scenario (Carbon price vs. No carbon price)



Alternative Scenarios

Load Scenario ID	Description
L1	December 2019 – Expected EV Sales
L2	No load growth
L3	Low load growth (<1%); Low EV Sales; Exclude Rosemont
L4	Exclude Rosemont
L5	Low EV sales
L6	High EV sales

Market Scenario ID	Description
M1	2019 Base Case
M2	2019 High Case
M3	2019 Low Case

Emission Scenario ID	Description
E1	Federal Carbon Case
E2	No Federal Carbon Case



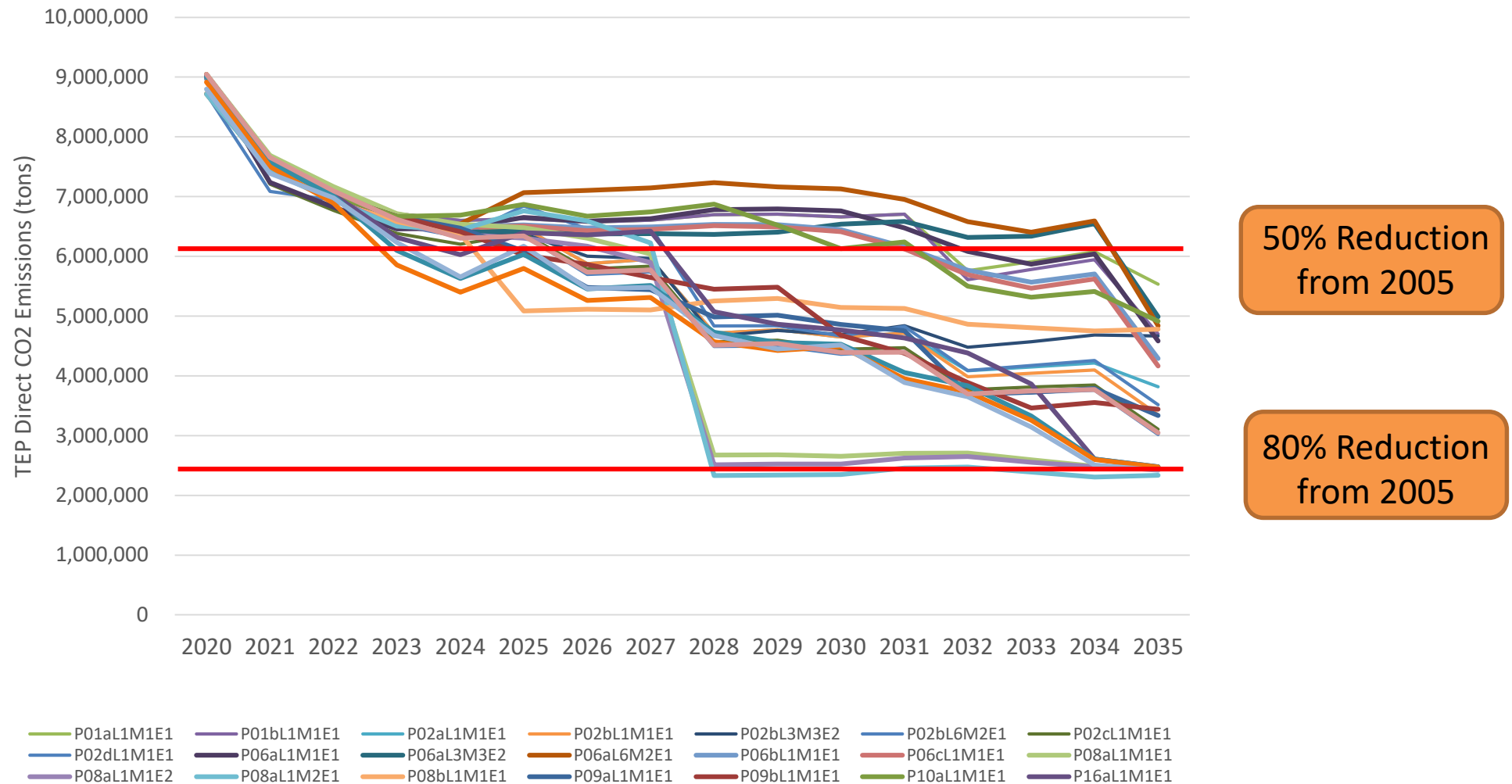
Portfolio List

Portfolio Identifier	Source	Design Element
P01	Arizona Corporation Commission	Portfolio standard: 80% - 100% clean energy by 2050
P02	Arizona Corporation Commission	Portfolio standard: 80% - 100% clean energy by 2050; 50% renewable energy by 2028 -2030
P05*	2017 IRP Order	Portfolio standard: Specified levels of clean energy, energy storage, energy efficiency and biomass
P06	Arizona Corporation Commission Draft Energy Rules	Portfolio standard: 45% renewable energy by 2035; 30% clean during peak by 2035
P08	Sierra Club	Coal retirements: all coal by 2028; Springerville 1 by 2025
P09	Western Resource Advocates	CO2 reduction (from 2005): 50% by 2025; 60% by 2030; 70% by 2035
P10	Western Resource Advocates	CO2 reduction (from 2005): 40% by 2025; 50% by 2030; 60% by 2035
P11*	Merchant Generators	Buy-through option
P13*	Residential Utility Consumer Office (RUCO)	Portfolio standard: Demand response 40% of peak
P16	TEP	Coal Supply Limits

*Portfolio development in process



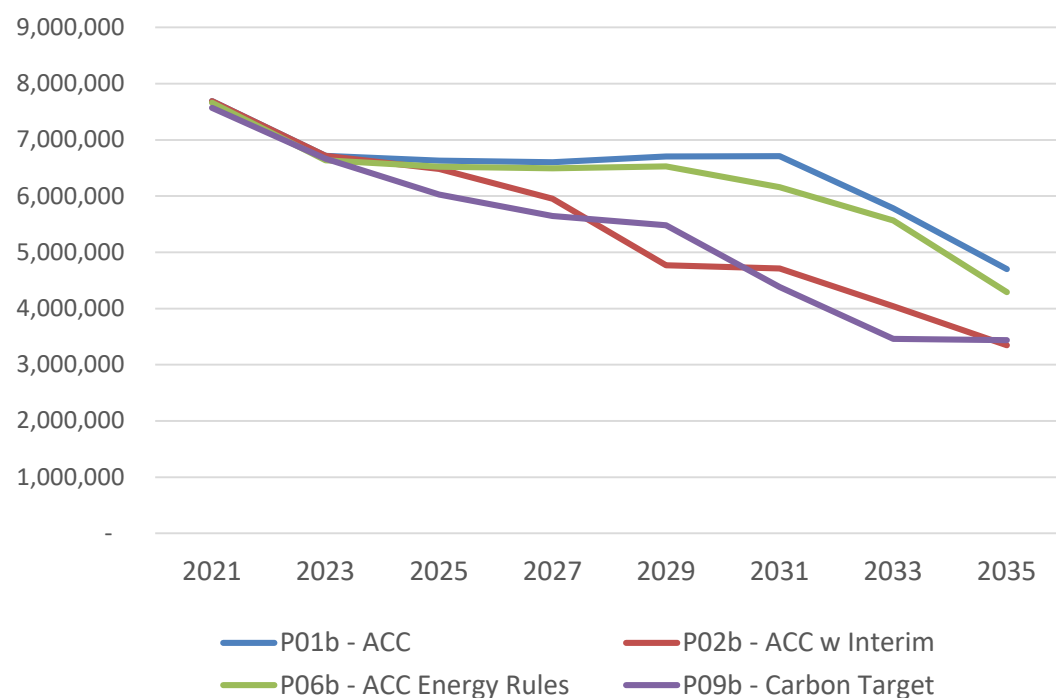
Emission Reductions



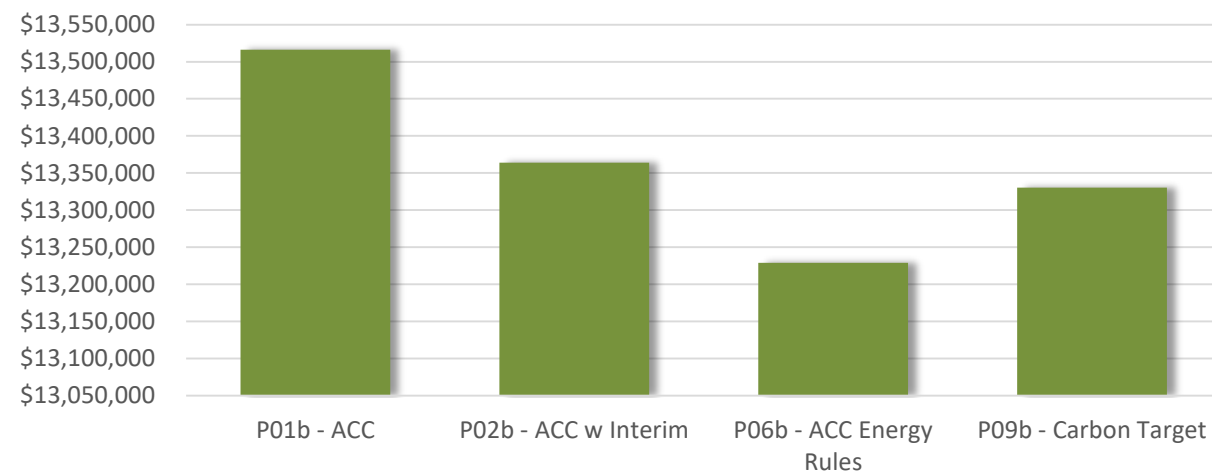


Comparing Policy Options

CO₂ Emissions
(tons)



NPV Rev. Req.
(\$000)



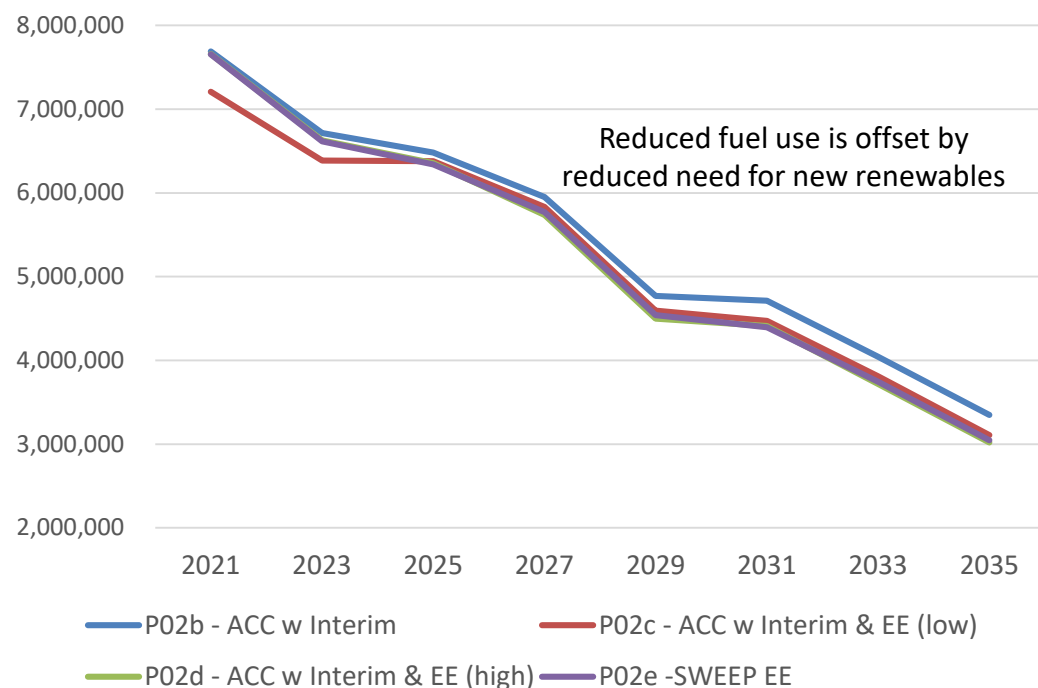
A carbon target can achieve emission reductions at lower cost than a portfolio standard

Renewable % of Retail Sales	2025	2030	2035
P01b - ACC	32%	31%	73%
P02b - ACC w Interim	37%	50%	80%
P06b - ACC Energy Rules	31%	29%	45%
P09b - Carbon Target	41%	38%	62%

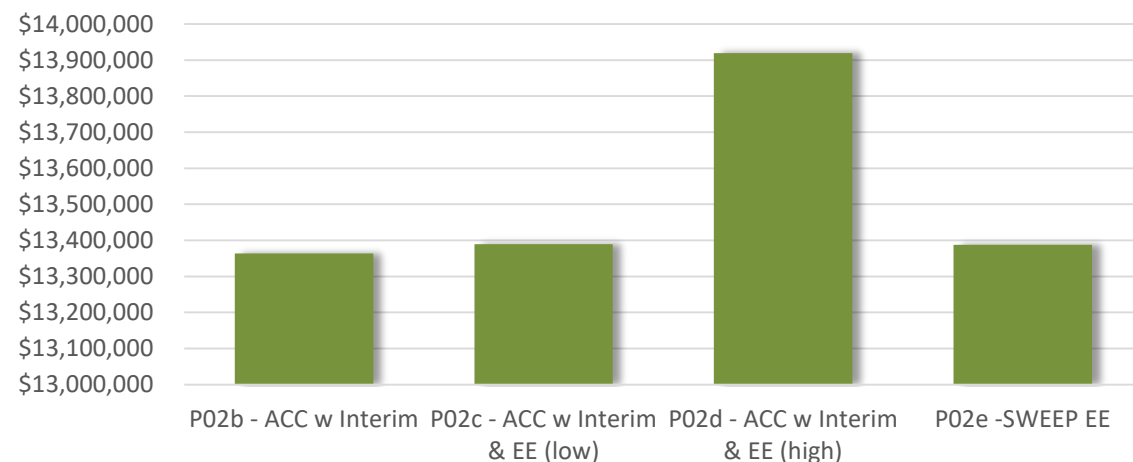


Energy Efficiency

CO₂ Emissions
(tons)



NPV Rev. Req.
(\$'000)



The cost of achieving energy efficiency targets depends on the availability of low cost measures

Energy Efficiency (GWh)	2025	2030	2035
P02b - ACC w Interim	997	1,193	1,441
P02c - ACC w Interim & EE (low)	1,349	2,031	2,625
P02d - ACC w Interim & EE (high)	1,348	2,030	2,623
P02e -SWEEP EE	1,454	2,183	2,858



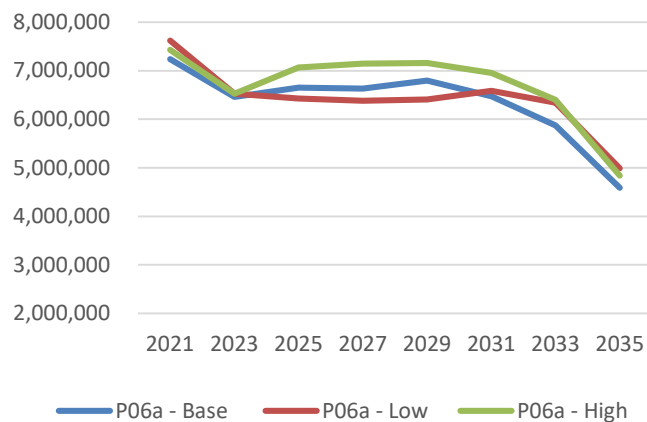
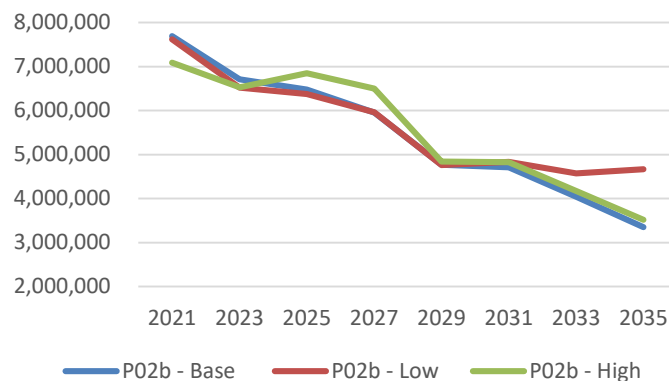
Scenario Analysis

Comparison of two portfolios under varying economic conditions.

High load growth and high prices consistent with a strong economy.

Low load growth and low market prices consistent with a weak economy.

CO₂ Emissions (tons)

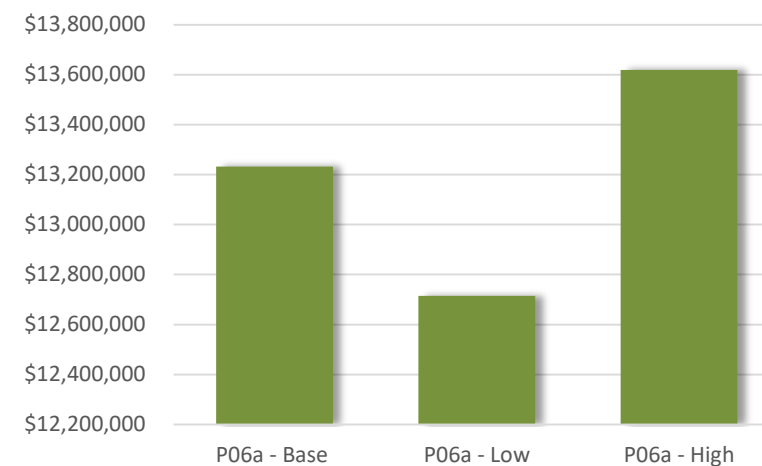


NPV Rev. Req. (\$000)

P02
50% renewables by 2030



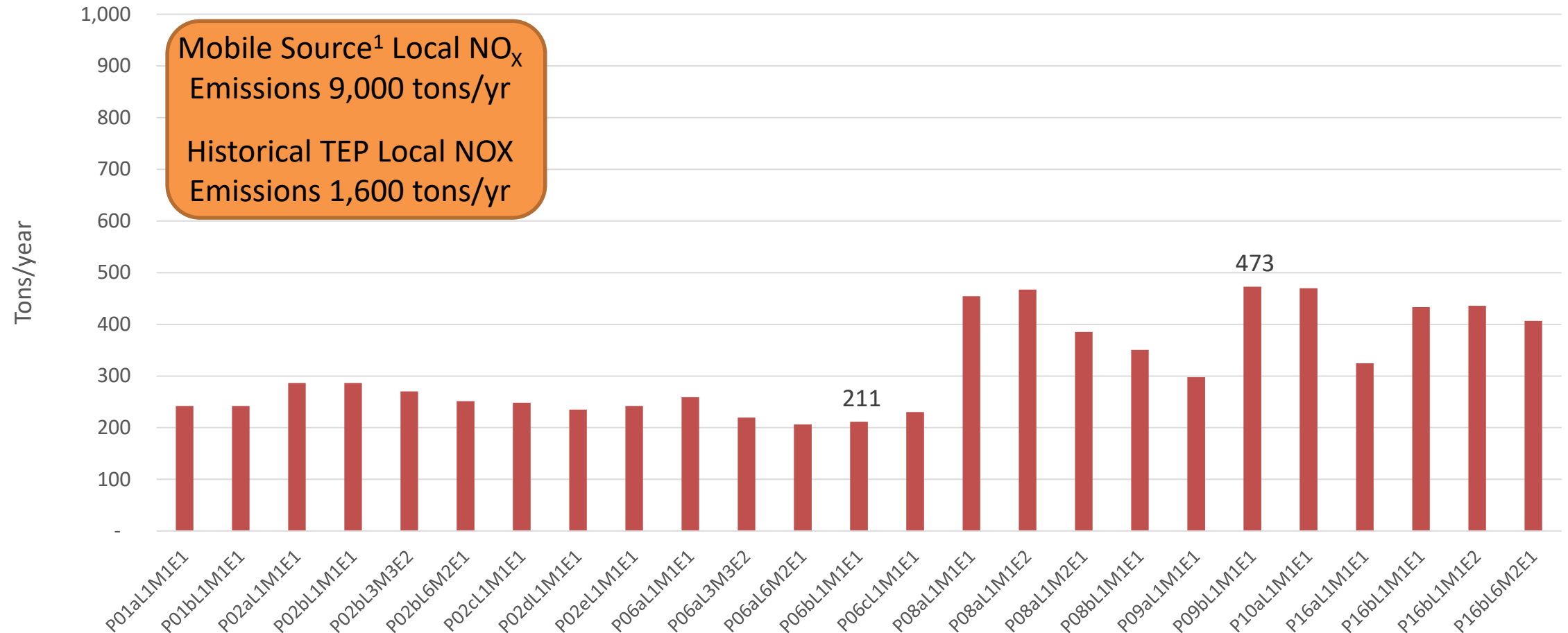
P06
45% renewables by 2035





TEP Local NO_x Emissions

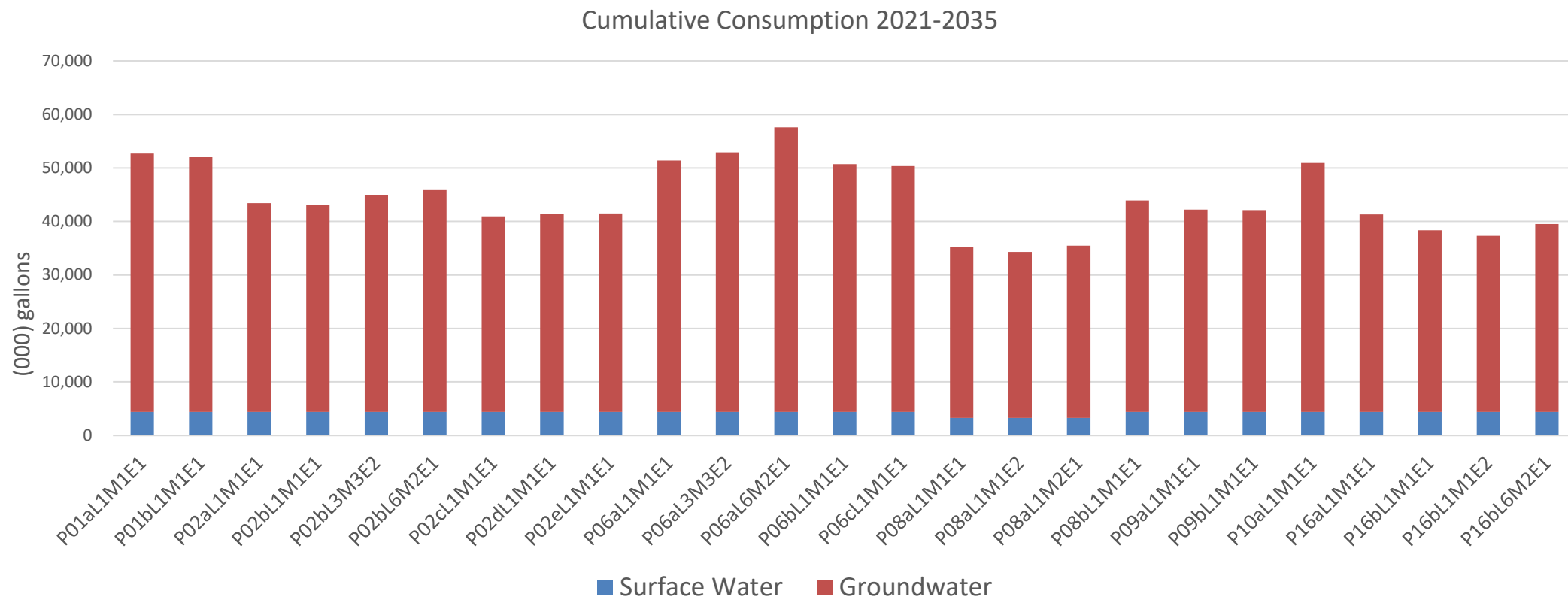
(Sundt, DeMoss Petrie, and North Loop Generating Stations)



1. On-road mobile source vehicle emissions; Pima County Department of Environmental Quality Emissions Inventory, https://www.webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Environmental%20Quality/Air/EmissionsInventory/pima_final_ei_report_erg_072817.pdf



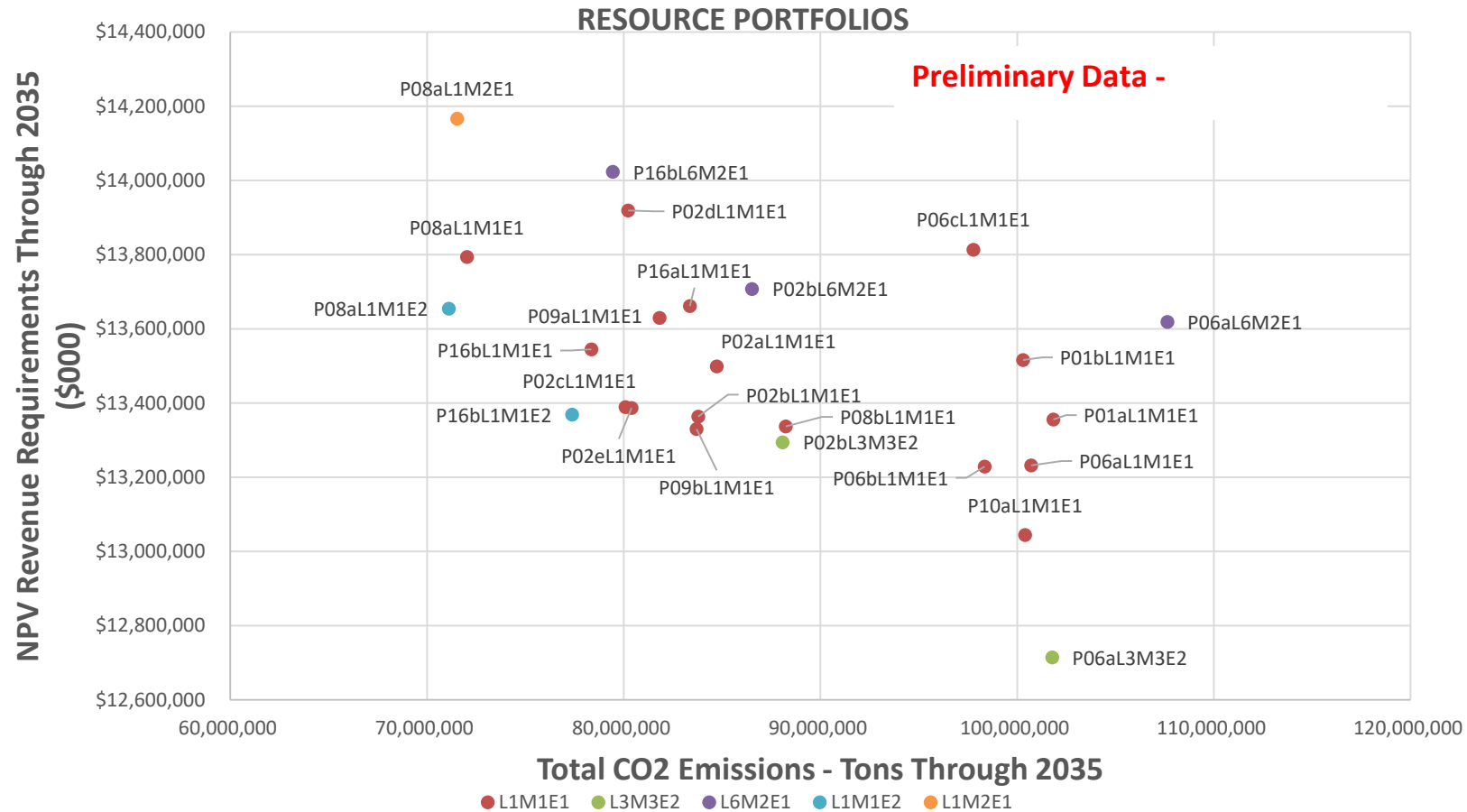
Water Consumption



Surface water use is eliminated in all Portfolios with the retirement of Four Corners



Portfolio Comparisons



CO₂ EMISSION TARGET

BEN MCMAHAN, PHD
WILL HOLMGREN, PHD
UNIVERSITY OF ARIZONA



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ADVISORY COUNCIL COMMENT



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PUBLIC COMMENT



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