aes Indiana

2022 Integrated Resource Plan

(IRP)

Volume II

December 1, 2022

aes Indiana

2022 IRP

Attachment 1-1

(AES Indiana’s Non-Technical Summary)

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2022 Integrated Resource Plan
(IRP)

Non-Technical Summary

Background

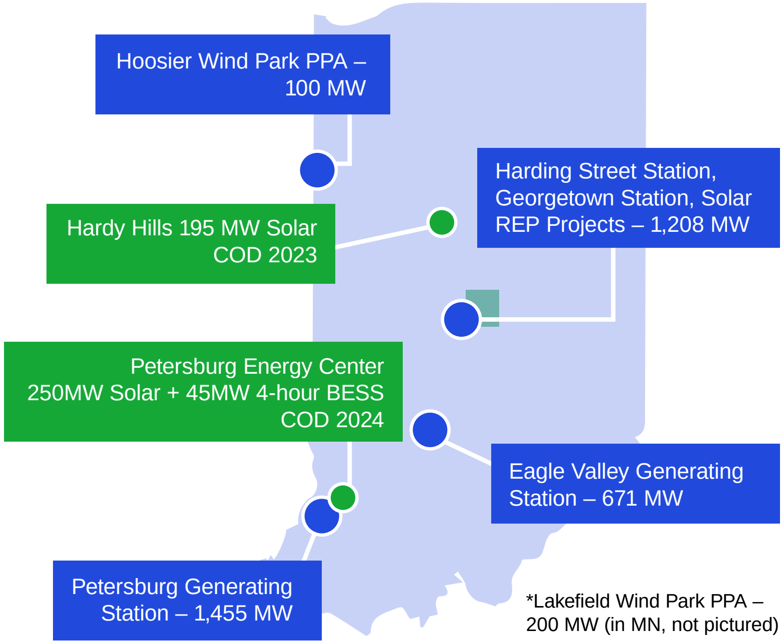
AES Indiana generates, transmits, distributes and sells electricity to approximately 517,000 retail customers in Indianapolis and neighboring areas, the most distant point being about 40 miles from Indianapolis. In total, AES Indiana's service area covers about 528 square miles.

AES Indiana is subject to the regulatory authority of the Indiana Utility Regulatory Commission ("IURC") and the Federal Energy Regulatory Commission ("FERC"). AES Indiana fully participates in the electricity markets managed by the Midcontinent Independent System Operating ("MISO"). AES Indiana is a transmission company member of Reliability First ("RF"). RF is one of eight Regional Reliability Councils under the North American Reliability Corporation ("NERC"), which has been designated as the Electric Reliability Organization under the EPAct.

AES Indiana is part of the AES Corporation, a Fortune 500 global power company, with a mission to improve lives by accelerating the future of energy, together.

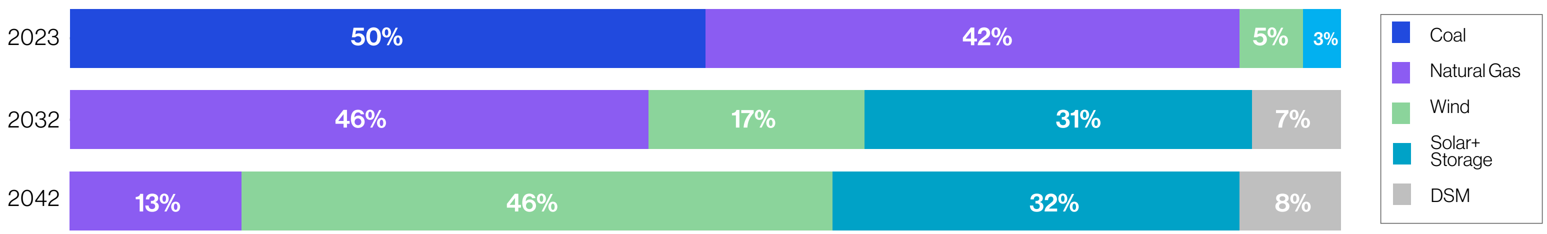
The Integrated Resource Plan ("IRP") is viewed as a guide for future resource decisions made at a snapshot in time. Resource decisions, particularly those beyond the five-year horizon, are subject to change based on future analyses and regulatory filings. Any new resource additions, including supply-side and demand-side resources, will be submitted for regulatory approval as necessary or appropriate.

3,634 Total MW of Generation



*Lakefield Wind Park PPA – 200 MW (in MN, not pictured)

Energy mix values



Meeting Our Customers' Needs Today and Tomorrow

AES Indiana is leading the inclusive, clean energy transition.

Reliability

Affordability

Sustainability

Preferred Resource Portfolio and Short Term Action Plan

AES Indiana's 2022 Integrated Resource Plan was developed in an environment with unprecedented market changes that created new challenges for long-range planning. Specifically, the approval of MISO's Seasonal Resource Adequacy Construct, the passage of the Inflation Reduction Act, volatile commodity prices for power and fuels, inflated costs for replacements resources, and scarcity within the NOx allowance market have all influenced AES Indiana's strategy and process for this IRP.

Through a transparent planning and stakeholder engagement process that addressed the noted challenges and a comprehensive evaluation of seventeen (17) Scorecard metrics, AES Indiana selected a Preferred Resource Portfolio and Short Term Action Plan that provides affordable, reliable, and sustainable energy for its customers.

AES Indiana's Preferred Resource Portfolio and Short Term Action Plan will:

1) Add Renewables

Add up to 1,300 MW of wind, solar and storage by 2027

After refueling Petersburg Units 3 and 4 to natural gas, AES Indiana still has a 240 MW winter capacity need starting in 2025 due to MISO's new Seasonal Resource Adequacy Construct. Modeling results indicate that, after including the ITC benefits for standalone storage that were included in the Inflation Reduction Act provisions, battery energy storage is the most cost-effective capacity resource to fill this need. Additionally, the model indicated that an additional 500 to 1,065 MW of wind and solar resources are needed to cost effectively replace some of the energy value provided by Petersburg as a coal resource.

2) Convert

Convert Petersburg units 3 and 4 (1,052 MW) to natural gas in 2025 via existing pipeline on site

Based on extensive modeling, AES Indiana has determined that the conversion of the Company's remaining coal units from coal to natural gas provides customers with a strategy that can reliably meet capacity obligations in MISO Seasonal Resource Adequacy Construct. Additionally, converting these units provides customers economic savings.

3) Monitor

Monitor emerging technologies for inclusion in future planning

Beyond the three to five-year Short Term Action Plan which includes the items mentioned above, AES Indiana intends to closely monitor new and emerging technologies that could serve as viable clean energy options for future IRP planning. More specifically, the Company is closely following progress made in new technologies like longer duration storage coupled with solar, clean hydrogen and small modular reactors that could serve as reliable capacity in future years. If these technologies are deemed cost effective and viable, the Company will include them as replacement options in future Integrated Resource Plans.

Note: Additionally, the plan includes a three-year DSM action plan that targets an annual average of 130,000 to 134,000 MWh of energy efficiency (approximately 1.1% of 2021 sales) and three-year total of 53 MW summer peak impacts of demand response.

Short Term Action Plan Best Serves Our Customers' Objectives

1

Reliability

Highest composite reliability score

2

Affordability

Saves AES Indiana customers more than $200M

3

Sustainability

Provides 68% reduction in carbon intensity in 2030 compared to 2018

IRP Objective

The objective of AES Indiana's IRP is to identify a preferred resource portfolio that provides safe, reliable, sustainable, and reasonable least cost energy service to AES Indiana customers, giving due consideration to potential risks and stakeholder input. The study period for this IRP is 2023 through 2042.

IRP Process

Every three years, AES Indiana submits an Integrated Resource Plan to the IURC in accordance with Indiana Administrative Code (IAC 170 4-7). The IRP describes expected electrical load requirements, discusses potential risks, possible future scenarios and defines a preferred resource portfolio to meet those requirements over a forward-looking 20-year study period based upon analysis of all factors. This process includes extensive collaboration with stakeholders known as a "Public Advisory" process.

Public Advisory Process

AES Indiana hosted five (5) public advisory meetings and five (5) technical meetings to discuss the IRP process with interested parties and solicit feedback from stakeholders. The meeting agendas from each meeting are highlighted here.

For all meeting notes, presentations and other materials, see AES Indiana's IRP webpage at aesindiana.com/irp. AES Indiana incorporated feedback from stakeholders to shape the scenarios, develop metrics, and clarify the data presented.

Stakeholder and public input process

Public advisory meetings were held virtually via Microsoft Teams and attended by stakeholders, AES Indiana employees and members of the public.

Public Advisory Meeting #1

January 24, 2021

Topics covered: 2019 IRP recap, 2022 IRP planning and model overview, overview of existing resources, baseline energy and load forecast, electric vehicle and solar PV forecasts, introduction to demand-side management market potential study.

Public Advisory Meeting #2

April 12, 2021

Topics covered: load scenarios, market potential study results and demand-side management resources, replacement resource assumptions, scenario framework and portfolio matrix.

Public Advisory Meeting #3

June 27, 2021

Topics covered: stakeholder presentations, 2022 All-Source RFP and replacement resource cost update, commodity forecasts, RTO reliability planning, modeling reliability assumptions, reliability analysis, portfolio metrics and scorecard, distribution system planning.

Public Advisory Meeting #4

September 19, 2021

Topics covered: preliminary model results, risk analysis, preliminary scorecard results.

Public Advisory Meeting #5

October 31, 2021

Topics covered: Summary of 2022 short term action plan, analysis of preferred resource portfolio and alternatives.

2022 IRP Framework

AES Indiana utilized a portfolio matrix scenario framework that evaluated five predefined strategies and one optimization (allowed the planning model to economically select a portfolio without a strategy predefined).

The five predefined strategies included:

1 Operating the remaining Petersburg Generating Station (Petersburg) coal units 3 and 4 on coal through the remainder of its useful life

2 Converting Petersburg units 3 and 4 to natural gas in 2025

3 Retiring Petersburg Unit 3 in 2026 and leaving Petersburg Unit 4 on coal through the remainder of its useful life

4 Retiring both Petersburg Units 3 and 4 in 2026 and 2028

5 Retiring both Petersburg units 3 and 4 in 2026 and 2028 and replacing them with wind solar and storage

These five strategies and sixth optimization were optimized across four different scenarios that included a range of environmental policy assumptions:

1 No Environmental Action – included relaxed environmental regulation and no subsidies for renewables

2 Current Trends/Reference Case – included the most likely future environmental regulations including renewable subsidies contained in the Inflation Reduction Act

3 Aggressive Environmental – included a carbon tax starting in 2028 at $19.47/ton

4 Decarbonized Economy – included a Renewable Portfolio Standard that requires utilities to transition supplying most of the energy from clean energy sources by 2042

Portfolio matrix

Results from the scenario analysis show that converting Petersburg to natural gas in 2025 is the reasonable least cost strategy for customers – particularly in the Current Trends/Reference Case scenario which provides the most likely representation of the future.

	Scenarios			
Strategies	No Environmental Action	Current Trends (Reference Case)	Aggressive Environmental	Decarbonized Economy
1: No Early Retirement	$7,111	$9,572	$11,349	$9,917
2: Petersburg Conversion (est. 2025)	$6,621	$9,330	$11,181	$9,546
3: One Petersburg Unit Retires (2026)	$7,462	$9,773	$11,470	$9,955
4: Both Petersburg Units Retire (2026 & 2028)	$7,425	$9,618	$11,145	$9,923
5: Clean Energy Strategy	$9,211	$9,711	$11,184	$9,690
6: Encompass Optimization	$6,610	$9,262	$10,994	$9,572

LEAST COST

HIGHEST COST

20-Year PVRR (2023$MM, 2023-2042)

Note: Candidate Portfolios evaluated on the IRP Scorecard

Scorecard Evaluation & Results Summary

AES Indiana conducted a robust Scorecard Evaluation of the Current Trends/Reference Case strategies (Candidate Portfolios) to select the Preferred Resource Portfolio and Short Term Action Plan.

In the Scorecard Evaluation, the Company evaluated the Candidate Portfolios using five categories that address critical utility planning considerations. These include the Five Pillars of Electric Service as defined by the 21st Century Energy Policy Development Task Force of Affordability, Sustainability, Reliability, Resiliency and Stability. Additionally, the Company included metric categories for Risks & Opportunities and Economic Impacts.

Strategies	Affordability	Environmental Sustainability						Reliability, Stability & Resiliency	Risk & Opportunity							Economic Impact	
	20-yr PVRR	CO2 Emissions	SO2 Emissions	NOX Emissions	Water Use	Coal Combustion Products (CCP)	Clean Energy Progress	Reliability Score	Environmental Policy Opportunity	Environmental Policy Risk	General Cost: Opportunity **Stochastic Analysis**	General Cost: Risk **Stochastic Analysis**	Market Exposure	Renewable Capital Cost Opportunity (Low Cost)	Renewable Capital Cost Risk (High Cost)	Employees (+/-)	Property Taxes
	Present Value of Revenue Requirements ($000,000)	Total portfolio CO2 Emissions (mmtons)	Total portfolio SO2 Emissions (tons)	Total portfolio NOx Emissions (tons)	Water Use (mmgal)	CCP (tons)	% Renewable Energy in 2032	Composite score from Reliability Analysis	Lowest PVRR across policy scenarios ($000,000)	Highest PVRR across policy scenarios ($000,000)	P5 [Mean - P5]	P95 [P95 - Mean]	20-year avg sales + purchases (GWh)	Portfolio PVRR w/ low renewable cost ($000,000)	Portfolio PVRR w/ high renewable cost ($000,000)	Total FTEs associated with generation	Total amount of property tax paid from AES IN assets ($000,000)
1	$9,572	101.9	64,991	45,605	36.7	6,611	45%	7.95	$8,860	$11,259	$9,271 [-$264]	$9,840 [$305]	5,291	$9,080	$10,157	222	$154
2	$9,330	72.5	13,513	22,146	7.9	1,417	55%	7.95	$8,564	$11,329	$9,030 [-$334]	$9,746 [$382]	5,222	$8,763	$9,999	99	$193
3	$9,773	88.1	45,544	42,042	26.7	4,813	52%	7.86	$9,288	$11,462	$9,608 [-$294]	$10,237 [$336]	5,737	$9,244	$10,406	195	$204
4	$9,618	79.5	25,649	24,932	15.0	2,700	48%	7.90	$9,135	$11,392	$9,295 [-$287]	$9,903 [$321]	5,512	$9,104	$10,249	74	$242
5	$9,711	69.8	25,383	24,881	14.8	2,676	64%	7.57	$9,590	$11,275	$9,447 [-$280]	$10,039 [$312]	6,088	$9,017	$10,442	55	$256
6	$9,262	76.1	18,622	25,645	10.9	1,970	54%	7.95	$8,517	$11,226	$8,952 [-$280]	$9,629 [$352]	5,136	$8,730	$9,909	88	$185

1: No Early Retirement	2: Pete Refuel to 100% Gas (est. 2025)	3: One Pete Unit Retires (2026)	4: Both Pete Units Retire (2026 & 2028)	5: Clean Energy Strategy	6: Encompass Optimization

HIGHEST COST ▨ LEAST COST

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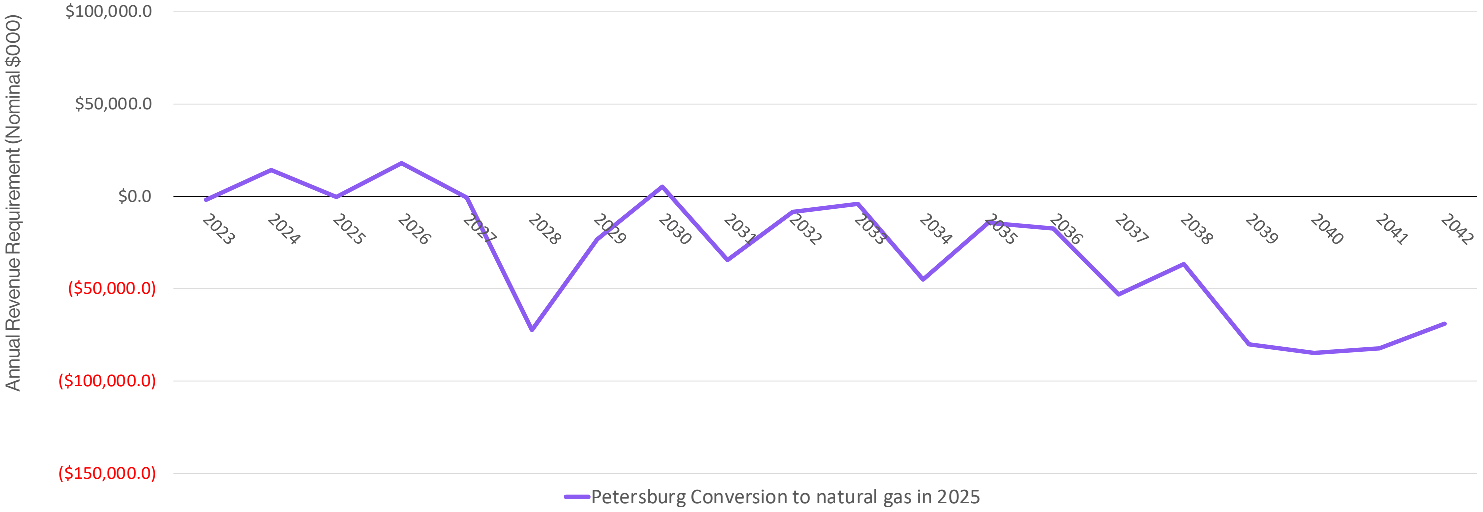
Affordability

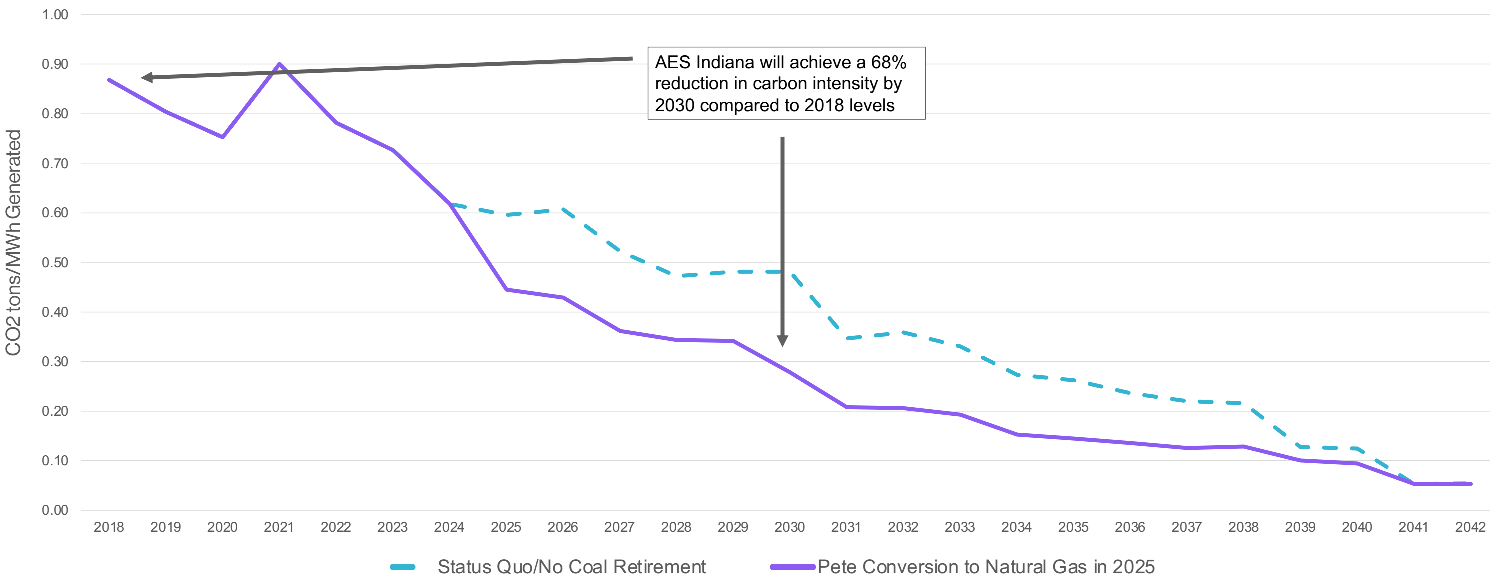
The Scorecard Evaluation demonstrated that the Petersburg conversion provides the most affordable strategy for AES Indiana customers by exhibiting the lowest 20-year Present Value of Revenue Requirements (PVRR) and lowest annual revenue requirement volatility over the 20-year planning period.



Annual revenue requirement of the Petersburg Conversion compared to the operation of Petersburg on coal from 2023-2042

Sustainability

Additionally, the Scorecard Evaluation demonstrated that the Petersburg conversion provides the lowest SO2, NOX, water use and coal production product emissions and the second lowest CO2 emissions over the 20-year planning period making it the best performing strategy in the Sustainability category. The chart at right shows that the Petersburg conversion will provide a 69% reduction in CO2 emission by 2030 compared to 2018 levels.



Carbon Intensity of the Petersburg Conversion strategy over the Planning Period (CO2/MWh)

AES Indiana will achieve a 68% reduction in carbon intensity by 2030 compared to 2018 levels

Reliability, Resiliency and Stability

To measure Reliability in the Scorecard Evaluation, AES Indiana consulted with Quanta Technology to perform a reliability analysis of the Candidate Portfolios.

Quanta evaluated nine different reliability categories including Energy Adequacy, Operational Flexibility and Frequency Support, Short Circuit Strength Requirement, Power Quality (Flicker), Blackstart, Dynamic VAR Support, Dispatchability and Automatic Generation Control, Predictability and Firmness of Supply, and Geographic Location Relative to Load (resilience). Quanta created a Composite reliability score from these nine categories to evaluate the Candidate Portfolios.

Their analysis demonstrated that the Petersburg conversion performed the best among the Candidate Portfolios by maintaining Petersburg as a dispatchable resource.

Risk & Opportunities

The Scorecard also evaluated the Candidate Portfolios for the Risk & Opportunity associated with changing environmental policies, volatile commodities, market interaction & exposure, and fluctuating renewable resource costs. This evaluation included a stochastic analysis that ran 100 simulations of power prices, gas prices, coal prices, load, and renewable generation.

The Petersburg conversion performed the best overall across the Risk & Opportunity metrics that were considered.

Economic Impacts

Finally, the Scorecard considered the Economic Impacts from the Candidate Portfolios.

The evaluation determined that the Petersburg conversion will continue to contribute economically to the Petersburg community by leveraging existing infrastructure and maintaining operation of the Petersburg Generating Station as a gas resource and hub for renewable resources.

Scorecard Evaluation & Results Summary

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2022 Integrated Resource Plan (IRP):
Non-Technical Summary

AES Indiana
One Monument Circle, Indianapolis, Indiana 46204

aesindiana.com

2022 IRP

Attachment 1-2

(AES Indiana’s Public Advisory Meeting Presentations)

2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #1

1/24/2022

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Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates

Agenda

Time	Topic	Speakers
Morning **Starting at 10:00 AM**	Safety and Virtual Meeting Schedule and Protocols	Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana Brandi Davis-Handy, Chief Public Relations Officer, AES US Utilities
	Welcome and Overview of AES Indiana	Kristina Lund, President & CEO, AES US Utilities
	IRP Planning and Model Overview	Erik Miller, Manager, Resource Planning, AES Indiana Will Vance, Senior Analyst, AES Indiana
	2019 IRP Recap	Aaron Cooper, Chief Commercial Officer, AES US Utilities Erik Miller, Manager, Resource Planning, AES Indiana
	Overview of Existing Resources, Replacement Resource Options and Future IRPs	Aaron Cooper, Chief Commercial Officer, AES US Utilities Erik Miller, Manager, Resource Planning, AES Indiana
Break **11:45 AM – 12:15 PM**	Lunch	
Afternoon **Starting at 12:15 PM**	Baseline Energy and Load Forecast	Eric Fox, Director, Forecasting Solutions, Itron Mike Russo, Forecast Consultant, Itron
	Electric Vehicle (EV) and Solar PV Forecasts	Jordan Janflone, EV Modeling Forecasting, GDS Associates Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
	DSM Market Potential Study Introduction	Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates Melissa Young, Demand Response Lead, GDS Associates
	Final Q&A and Next Steps	

Virtual Meeting Protocols and Safety

Brandi Davis-Handy, Chief Public Relations Officer, AES US Utilities

Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana

IRP Team Introductions

AES Indiana Leadership Team

Aaron Cooper, Chief Commercial Officer, AES US Utilities
Brandi Davis-Handy, Chief Public Relations Officer, AES US Utilities
Kristina Lund, President & CEO, AES US Utilities
Wendy Mehringer, Chief Customer Officer, AES US Utilities
Judi Sobecki, General Counsel and Chief Regulatory Officer, AES US Utilities

AES Indiana IRP Planning Team

Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana

AES Indiana IRP Partners

Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

AES Indiana Legal Team

Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP

Virtual Meeting Best Practices

Questions

→ Your candid feedback and input is an integral part to the IRP process.

→ Questions or feedback will be taken at the end of each section.

→ Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

→ All lines are muted upon entry.

→ For those using audio via Teams, you can unmute by selecting the microphone icon.

→ If you are dialed in from a phone, press *6 to unmute.

Video

→ Video is not required, however, if you have a camera on, please refrain from distractions.

Public Advisory Meeting

Public Advisory Meeting #1	Public Advisory Meeting #2	Public Advisory Meeting #3	Public Advisory Meeting #4	Public Advisory Meeting #5
January 24, 2022	**March/April**	**May/June**	**July/August**	**September/October**

→ All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

→ A Technical Meeting will be held the week preceding each Public Stakeholder Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Stakeholder Meeting.

→ Meeting materials can be accessed at ***www.aesindiana.com/integrated-resource-plan.***

AES Purpose & Values

Accelerating the future of energy, together.

Safety first

Highest standards

All together

Make your virtual environment safer

1.

Secure Your Accounts Use unique, complex passphrases and enable two-factor authentication wherever possible.

2.

Think before you click on a link, file, or attachment on your laptop and mobile.

3.

Know Your Network Protect your home network by changing default passwords; use a VPN when conducting sensitive transactions or on public WiFi.

4.

Protect your Device Patch your devices regularly and be mindful of connecting unauthorized hardware like USB drives.

5.

Share Data Responsibly Control your social media settings and be mindful when posting publicly.

6.

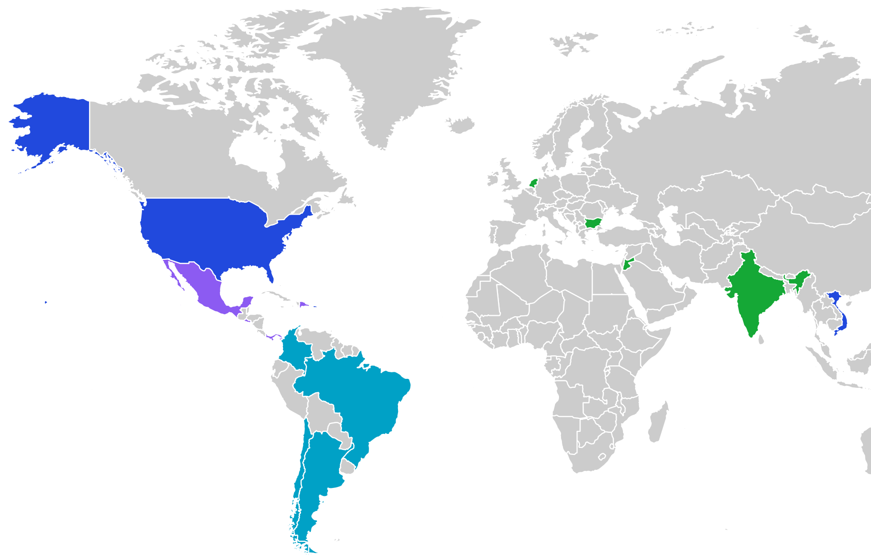
Be Safe by Being Prepared Know the cyberattack types and report anything suspicious.

Welcome & Overview of AES Indiana

Kristina Lund, President & CEO, AES US Utilities

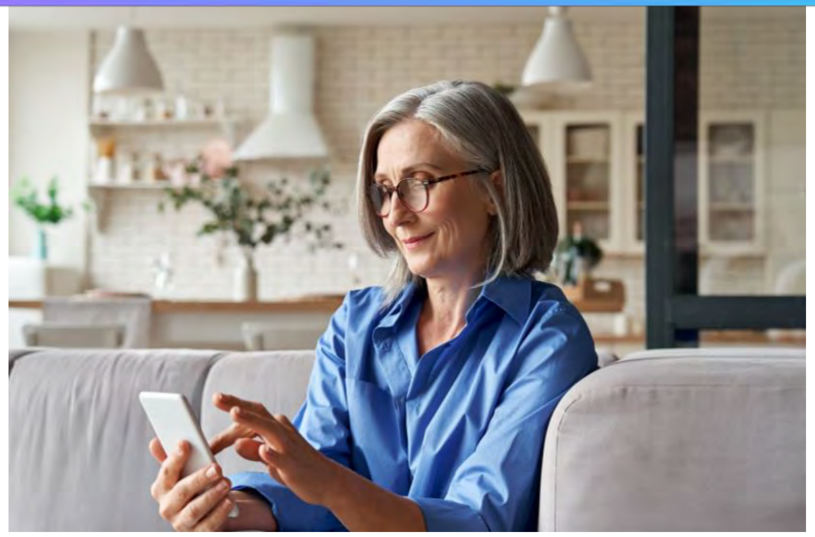
A Once in a Lifetime Transformation in the Energy Sector

AES: a unique culture of excellence, innovation and customer-centric product development.

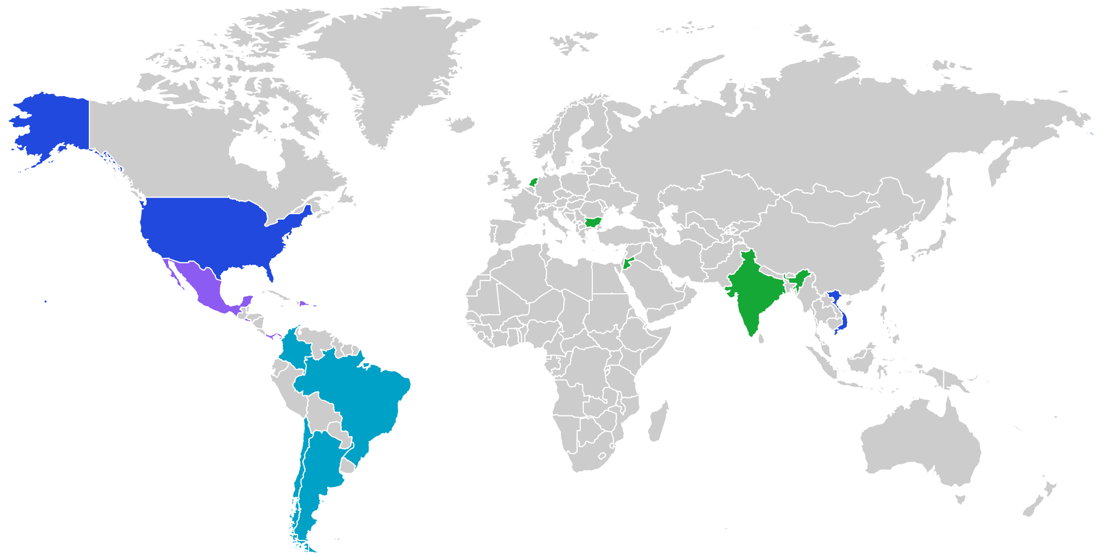


7x

Edison Award Winner



Company Overview



30,308

Gross MW in operation*

$9.78 billion

Total 2020 revenues

6,909 MW

Renewable generation under construction or with signed PPAs

$34.6 billion

Total assets owned & managed

4 Continents

14 Countries

4 Market-oriented strategic business units

6 Utility companies

2.5 million

Customers served

8,200 people

Our global workforce

Recognized for our commitment to sustainability

Great Place To Work

2021 WORLD'S MOST ETHICAL COMPANIES WWW.ETHISPHERE.COM 8-TIME HONOREE

FTSE4Good

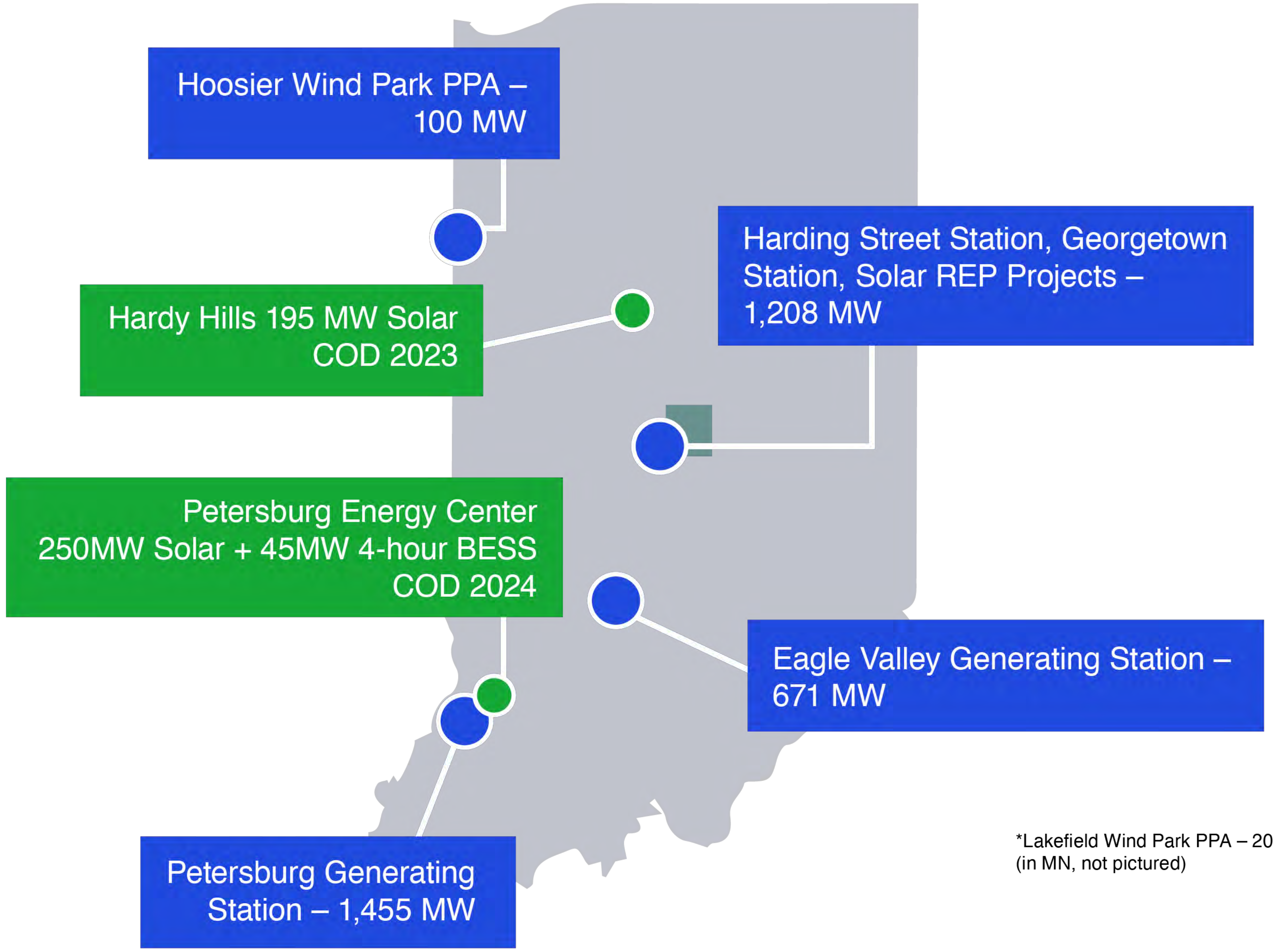
FAST COMPANY

Indiana

- MISO Member
- 528 square miles
- Serves downtown Indianapolis and 8 counties in Indiana
- Serves > 500,000 regulated customers
- 3,643 MW of Generation
  - 1,464 MW Coal*
  - 38 MW Oil
  - 1,745 MW Gas
  - 300 MW Wind
  - 96 MW Solar
- Retiring Pete 1 & 2 – 630 MW of coal – and replacing with solar and storage in 2023/2024

*Includes Pete 1 retirement of 220 MW

3,634 Total MW of Generation



Hoosier Wind Park PPA – 100 MW

Hardy Hills 195 MW Solar COD 2023

Harding Street Station, Georgetown Station, Solar REP Projects – 1,208 MW

Petersburg Energy Center 250MW Solar + 45MW 4-hour BESS COD 2024

Eagle Valley Generating Station – 671 MW

Petersburg Generating Station – 1,455 MW

*Lakefield Wind Park PPA – 200 MW (in MN, not pictured)

Leading the inclusive, clean energy transition

Customer

Reliability. Affordability. Diverse needs.

Create value in how we serve customers today to become their energy partner in the future.

Smart Grid

Use new technologies across our value chain to create the resilient grid of the future.

Sustainability

Maintain reliability and affordability while driving lower carbon emissions.

Workforce of the Future

Work differently, using new technologies and skills. Strengthen our culture of safety, innovation and belonging.

Facilitate economic and community development

IRP & Planning Model Overview

Erik Miller, Manager, Resource Planning, AES Indiana
Will Vance, Senior Analyst, AES Indiana

What is an Integrated Resource Plan?

Integrated Resource Plan (IRP) in Indiana –> 170 IAC 4-7-2

- → 20-year look at how AES Indiana will serve load
- → Submitted every three years
- → Plan created with stakeholder input
- → Modeling and analysis culminates in a preferred resource portfolio and a short-term action plan

What is a preferred resource portfolio?

"'Preferred resource portfolio' means the utility's selected long term supply-side and demand-side resource mix that safely, reliably, efficiently, and cost-effectively meets the electric system demand, taking cost, risk, and uncertainty into consideration." IAC 4-7-1-1-cc

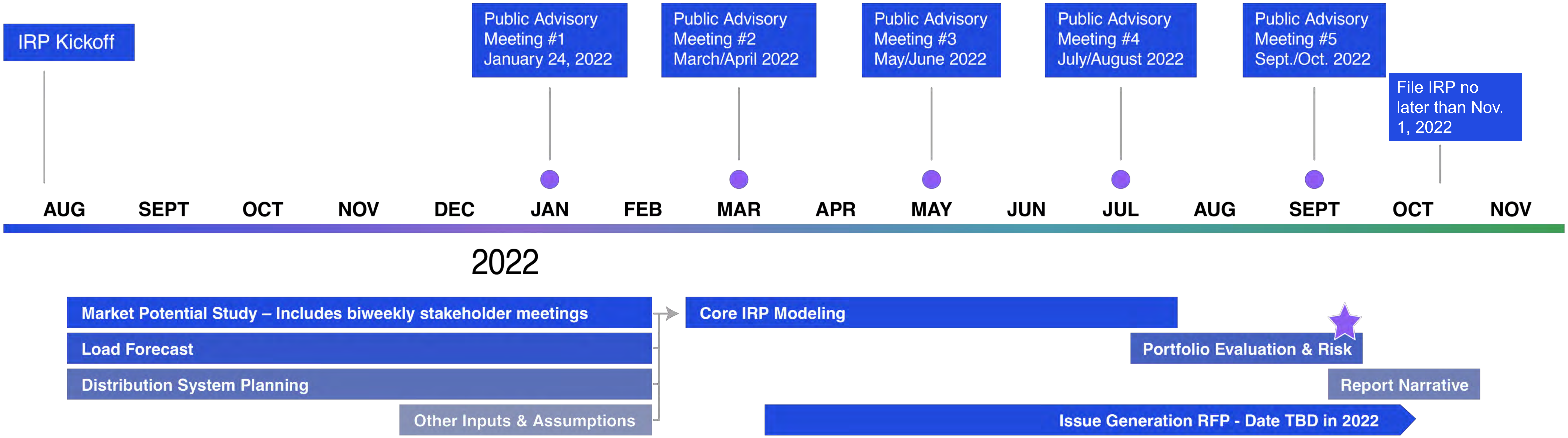
Stakeholders are critical to the process

AES Indiana is committed to providing an engaging and collaborative IRP process for its stakeholders:

- → Five Public Advisory Meetings for stakeholders to engage throughout the process
- → Five Technical Meetings available to stakeholders with nondisclosure agreements (NDA) for deeper analytics discussion
- → Planning documents and modeling materials will be shared with stakeholders with NDAs upon request
- → After full consideration of stakeholder input, the Preferred Resource Portfolio will be announced in the fall of 2022

IRP rules link: http://iac.iga.in.gov/iac/iac_title?iact=170&iaca=&submit=+Go Article 4. 170 IAC 4-7-2

Updated 2022 IRP Timeline



IRP Kickoff

Public Advisory Meeting #1 January 24, 2022

Public Advisory Meeting #2 March/April 2022

Public Advisory Meeting #3 May/June 2022

Public Advisory Meeting #4 July/August 2022

Public Advisory Meeting #5 Sept./Oct. 2022

File IRP no later than Nov. 1, 2022

AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEPT OCT NOV

2022

Market Potential Study – Includes biweekly stakeholder meetings

Load Forecast

Distribution System Planning

Other Inputs & Assumptions

Core IRP Modeling

Portfolio Evaluation & Risk

Report Narrative

Issue Generation RFP - Date TBD in 2022

● = Stakeholder Technical Meeting for stakeholders with executed NDAs held the week before each public stakeholder meeting

★ = Preferred Resource Portfolio selected

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.

Public Advisory Schedule

Public Advisory Meeting #1 - January 24, 2022

- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 - March/April

- DSM Modeling & Inputs
- Replacement Resource Inputs
- Commodity Inputs

Public Advisory Meeting #3- May/June

- Portfolio Matrix Framework
- Portfolio Metrics & Scorecard Framework
- Reliability Analysis

Public Advisory Meeting #4 - July/August

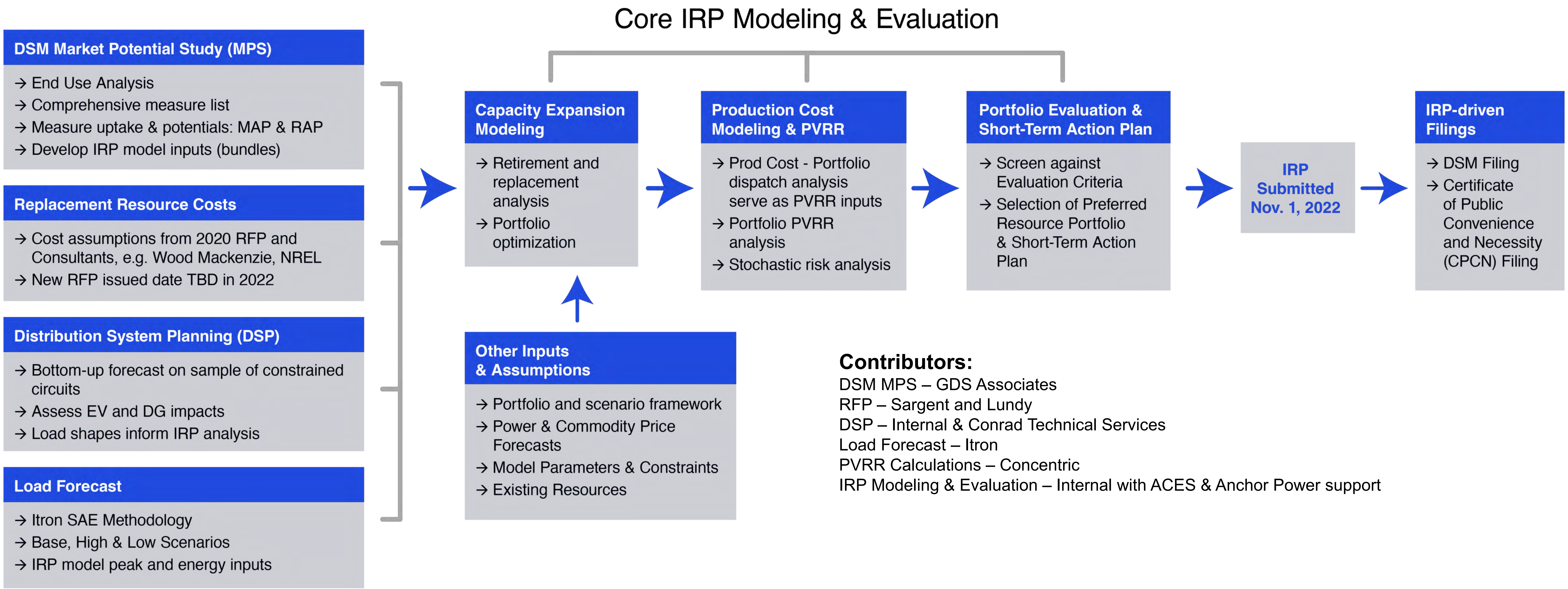
- Preliminary Modeling
- Risk Analysis
- Portfolio Metrics & Scorecard Review

Public Advisory Meeting #5 - September/October

- 2022 Modeling Insights
- Preferred Resource Portfolio & Short-Term Action Plan

Topics for meetings 2-5 are subject to change depending on modeling progress.

IRP Process Overview



Core IRP Modeling & Evaluation

DSM Market Potential Study (MPS)

- → End Use Analysis
- → Comprehensive measure list
- → Measure uptake & potentials: MAP & RAP
- → Develop IRP model inputs (bundles)

Replacement Resource Costs

- → Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
- → New RFP issued date TBD in 2022

Distribution System Planning (DSP)

- → Bottom-up forecast on sample of constrained circuits
- → Assess EV and DG impacts
- → Load shapes inform IRP analysis

Load Forecast

- → Itron SAE Methodology
- → Base, High & Low Scenarios
- → IRP model peak and energy inputs

Capacity Expansion Modeling

- → Retirement and replacement analysis
- → Portfolio optimization

Production Cost Modeling & PVRR

- → Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
- → Portfolio PVRR analysis
- → Stochastic risk analysis

Portfolio Evaluation & Short-Term Action Plan

- → Screen against Evaluation Criteria
- → Selection of Preferred Resource Portfolio & Short-Term Action Plan

IRP Submitted Nov. 1, 2022

IRP-driven Filings

- → DSM Filing
- → Certificate of Public Convenience and Necessity (CPCN) Filing

Other Inputs & Assumptions

- → Portfolio and scenario framework
- → Power & Commodity Price Forecasts
- → Model Parameters & Constraints
- → Existing Resources

Contributors:
DSM MPS – GDS Associates
RFP – Sargent and Lundy
DSP – Internal & Conrad Technical Services
Load Forecast – Itron
PVRR Calculations – Concentric
IRP Modeling & Evaluation – Internal with ACES & Anchor Power support

Portfolio Metrics & Scorecard

Scorecard Framework in the 2019 IRP

Customer Centricity
Focus on customer needs and wants

Least Cost
Considers current and forecasted market economics

Flexibility & Balance
Maintains generation optionality

Greener Energy Future
Moves the company to more renewables

→ Portfolio Metrics in the 2019 IRP included three key overarching categories: Cost, Environmental and Risk

→ In 2022, AES Indiana will consider additions to the scorecard, such as reliability metrics

Planning Model Overview

EnCompass

→ Long-term Production Cost and Capacity Expansion model created by Anchor Power Solutions.

ANCHOR
POWER SOLUTIONS

→ EnCompass is used by utilities, co-ops, municipalities, and consultants. It has been used to support regulatory filings in 17 states.

ACES excellence in energy

DUKE ENERGY

Xcel Energy RESPONSIBLE BY NATURE™

DAIRYLAND POWER COOPERATIVE

DTE Energy

Electric Cooperatives of Arkansas

PNM

GREAT RIVER ENERGY

minnesota power AN ALLETE COMPANY

Arizona G&T Cooperatives Touchstone Energy Cooperatives

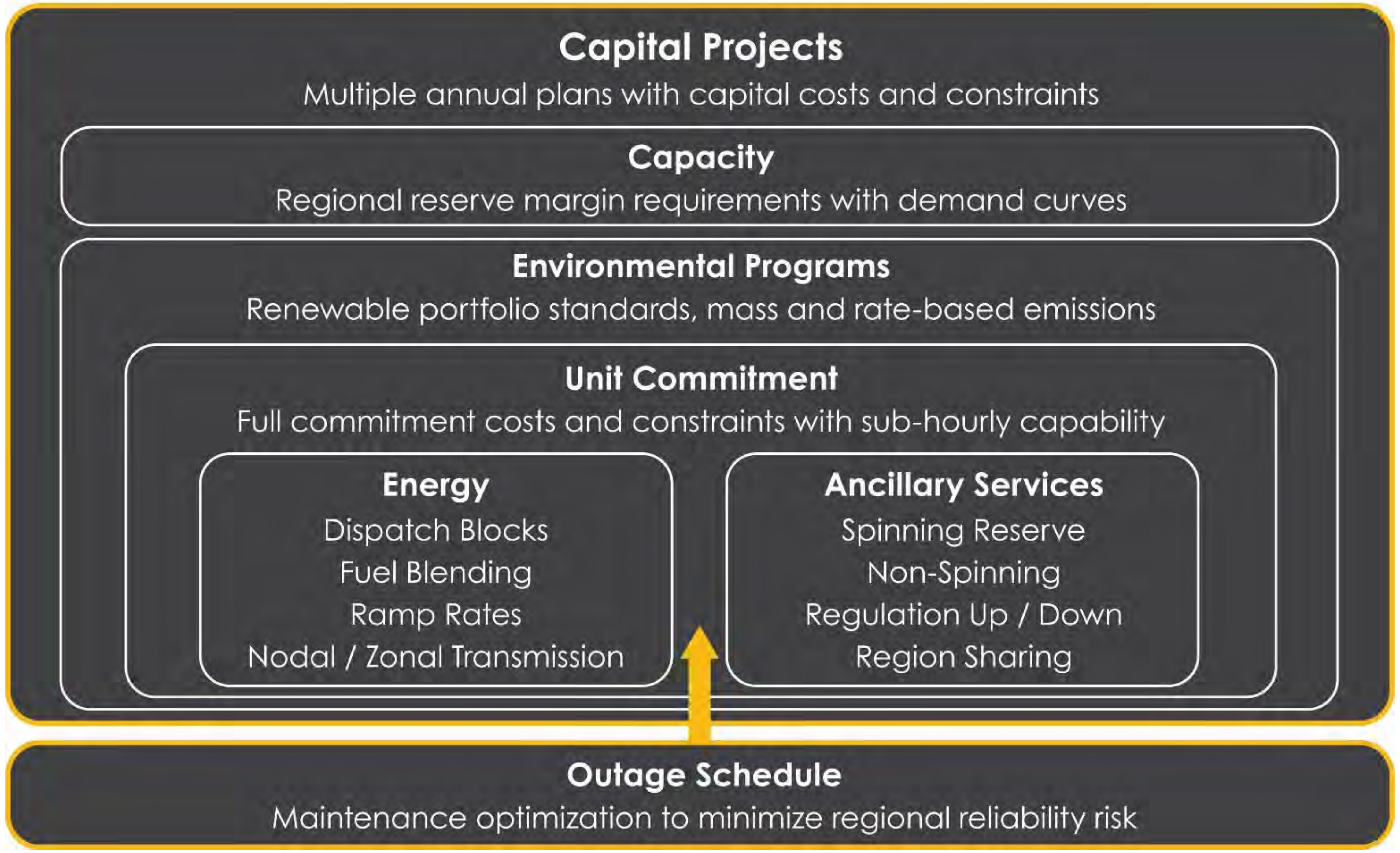
TVA

ODEC

EnCompass

- →EnCompass models thermal, renewable, storage, and load resources with hourly granularity.
- →It will be used for capacity expansion analysis to make long-term resource decisions based on scenario input assumptions.
- →Based on resource selections, EnCompass will calculate the present value revenue requirement of each portfolio.
- →Through the use of stochastic analysis, EnCompass will be used to understand the risk associated with portfolios.

ENCOMPASS POWER PLANNING SOFTWARE



Capital Projects
Multiple annual plans with capital costs and constraints

Capacity
Regional reserve margin requirements with demand curves

Environmental Programs
Renewable portfolio standards, mass and rate-based emissions

Unit Commitment
Full commitment costs and constraints with sub-hourly capability

Energy
Dispatch Blocks
Fuel Blending
Ramp Rates
Nodal / Zonal Transmission

Ancillary Services
Spinning Reserve
Non-Spinning
Regulation Up / Down
Region Sharing

Outage Schedule
Maintenance optimization to minimize regional reliability risk

EnCompass

Key Advantages of Utilizing EnCompass

- →Quick run times
  - → Allows for additional scenario analysis
  - → Provides expedient model feedback
- →Straightforward capacity expansion
  - → Deterministic capacity expansion allows for more intuitive cause and effect results
- →User control of modeling parameters
  - → MIP Stop Basis is a user input for capacity expansion
  - → Stochastic draws can be specified by user
- →Model Transparency
  - → Transparent hourly renewable and load profiles

2019 IRP Recap

Aaron Cooper, Chief Commercial Officer, AES US Utilities
Erik Miller, Manager, Resource Planning, AES Indiana

2019 IRP – Short-Term Action Plan

Retire

Retire 630 MW of coal generation by 2023:

→ Pete 1: 2021

→ Pete 2: 2023

Replace

Competitively bid for approximately 200 MW of firm capacity with all-source RFP.

Save

Target – 130,000 MWh per year of new DSM as part of the 2021-2023 DSM Plan.

Monitor

Maintain cost-effective units at Petersburg to retain flexibility and continue to monitor market conditions leading to our 2022 IRP.

Source: IPL's 2019 Integrated Resource Plan Non-Technical Summary, page 6.

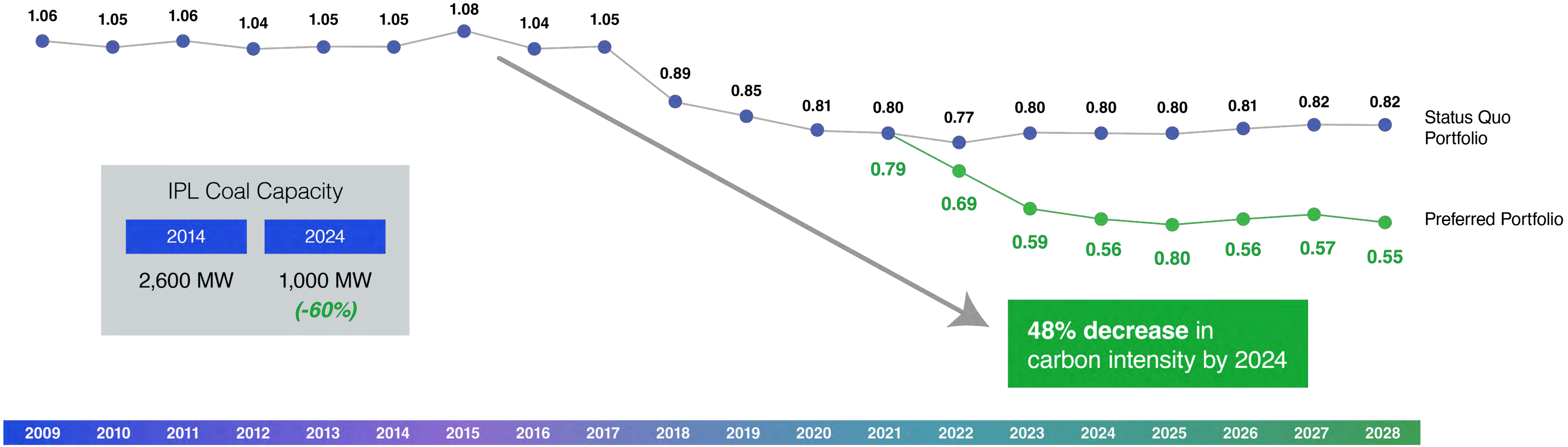
Short-Term Action Plan Progress

- → **December 2019 - July 2021** – AES Indiana issues & evaluates all-source RFP for approximately 200 MW of firm capacity in 2023 that will result from the anticipated retirements of Pete Units 1 & 2.
- → **November 2020** – AES Indiana receives IURC Order for the implementation of DSM programs in 2021-2023. DSM portfolio will target approximately 130,000 MWh per year.
- → **May 2021** – AES Indiana retires Petersburg Unit 1 (220 MW).
- → **June 2021** – AES Indiana receives IURC Order approving the CPCN for Hardy Hills Solar (195 MW) identified through the RFP process. Project estimated COD May 2023.
- → **November 2021** – AES Indiana receives IURC Order approving the CPCN for the Petersburg Energy Center Solar + Storage project (250 MW solar; 45 MW 4-hr battery) identified through the RFP process. Project estimated COD June 2024.
- → **May 31, 2023** – Plans for retirement of Petersburg Unit 2 (410 MW).

Portfolio changes have reduced carbon intensity by 48% since 2015

Petersburg Unit 1 retired May 31, 2021
Petersburg Unit 2 anticipated retirement May 31, 2023

Short-tons/MWh



IPL Coal Capacity

2014	2024
2,600 MW	1,000 MW *(-60%)*

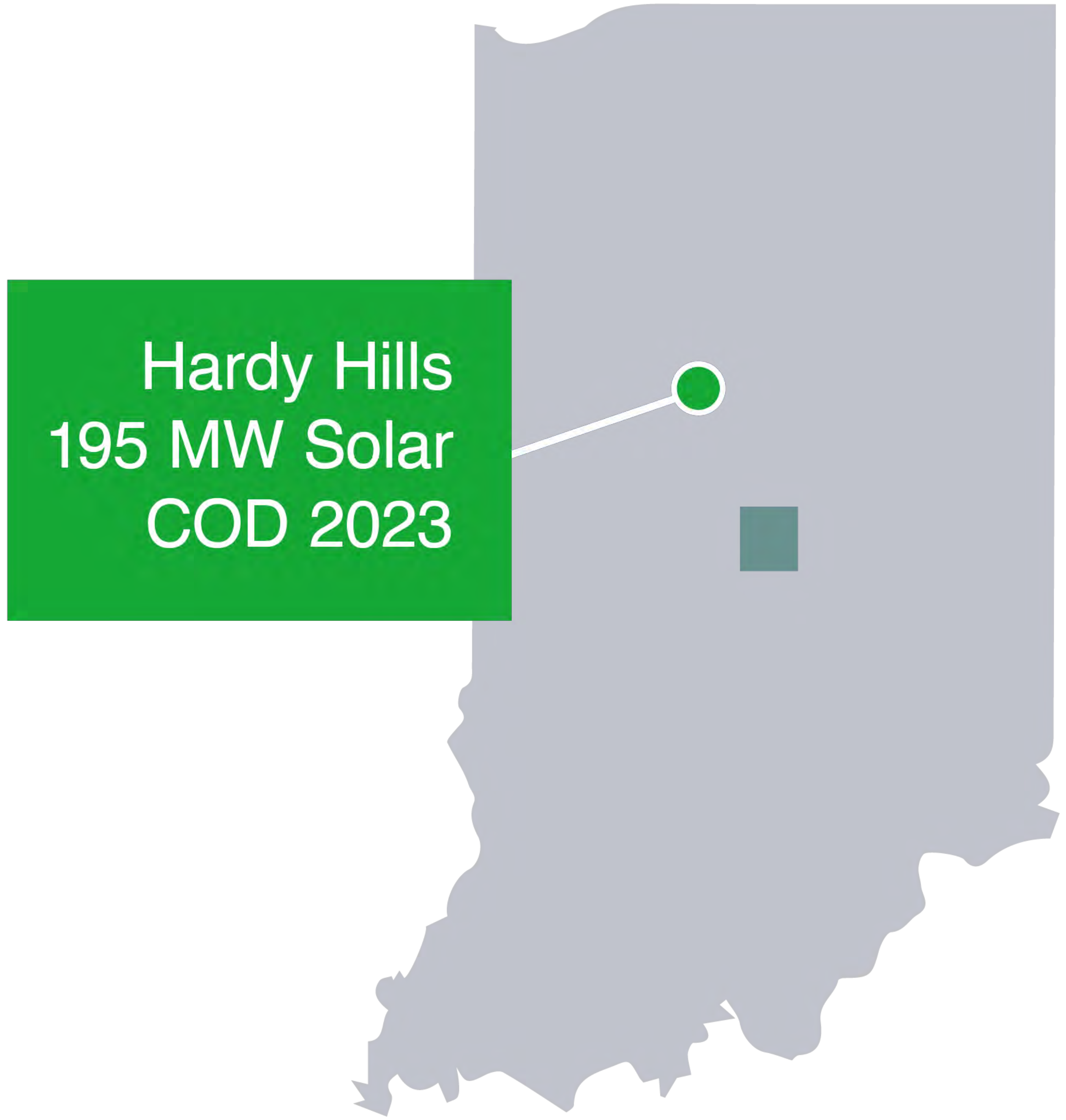
48% decrease in
carbon intensity by 2024

Hardy Hills Solar

Project Information

- → **Type:** Solar facility
- → **Size:** 195 MWac ICAP
- → **COD:** 2023
- → **Location:** Clinton County, IN
- → **Developer:** Invenergy Solar Development North America, LLC

Hardy Hills will contribute 98 MW to AES Indiana's 2023 UCAP need resulting from the retirement of Petersburg Units 1 & 2.

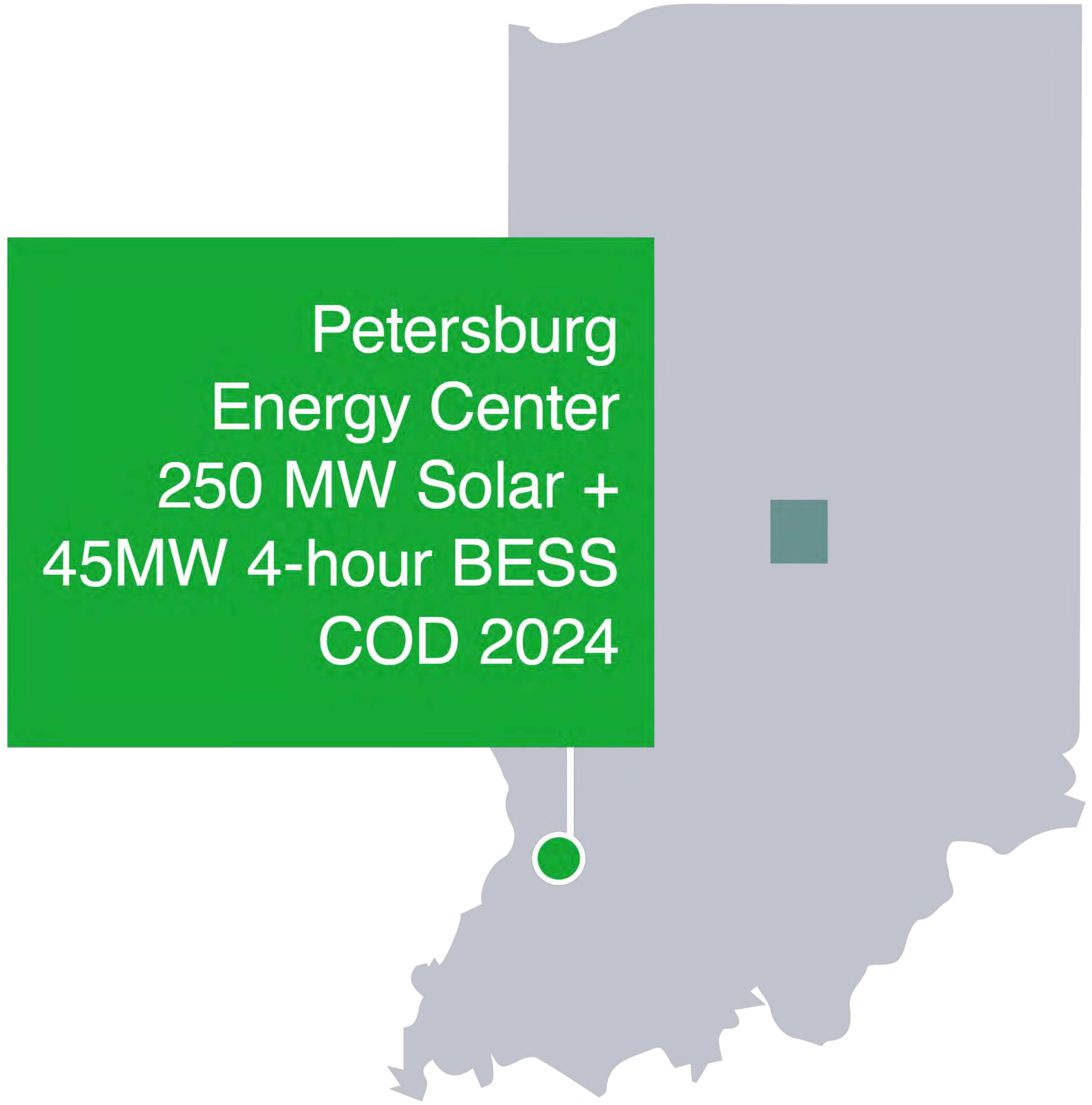


Petersburg Energy Center

Project Information

- → **Type:** Solar and battery energy storage facility
- → **Size:** 250 MWac ICAP coupled with a 180 MWh DC battery energy storage system (45 MW, 4-hour discharge power capacity)
- → **COD:** 2024
- → **Location:** Pike County, IN
- → **Developer:** NextEra Energy Resources, LLC

Petersburg Energy Center will contribute 168 MW to AES Indiana's 2023 UCAP need resulting from the retirement of Petersburg Units 1 & 2.



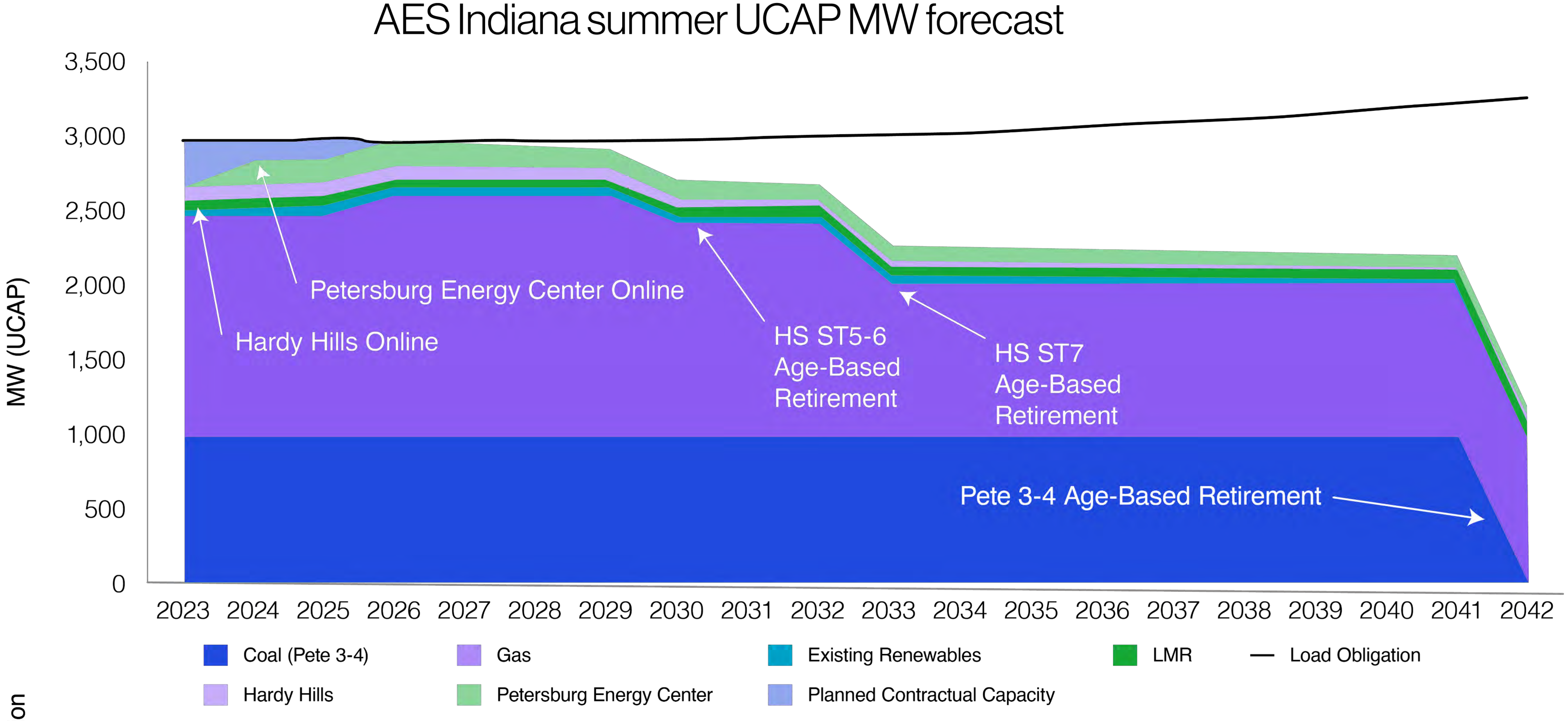
IURC Director's Comments to 2019 IRP

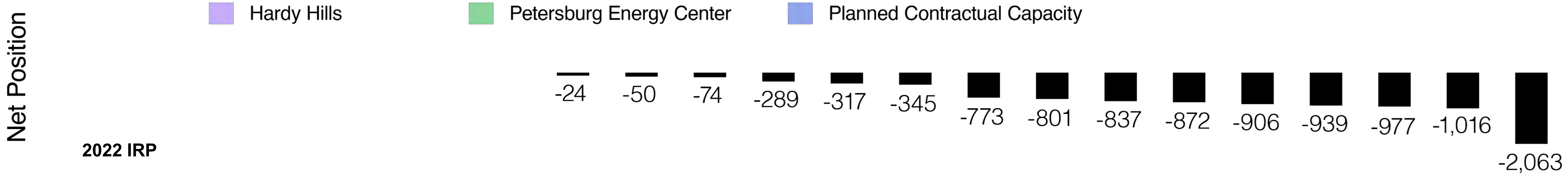
Topic	Comments Summary *(not exhaustive)*	2022 IRP Improvements
Resource Optimization & Risk	→ General **lack of clarity** around the model and methodology → PowerSimm's **stochastic capacity expansion methodology caused confusion** and lacked explanation → "Future IRPs would **benefit from industry experts' judgments** to evaluate whether there is a rationale for hardwiring certain resource." – *p.26, Director's Report for Indianapolis Power and Light's 2019 IRP*	→ AES IN will provide **better explanation of the model and methodology** used at stakeholder meetings and in the report. → AES IN is transitioning to **deterministic capacity expansion using Encompass** which should provide a more straightforward methodology. → An outside third-party consultant will provide **industry expert guidance** regarding resource options and modeling approaches.
DSM Modeling	→ DSM **bundles span the entire planning period** which is too long → Combining unrelated measures across residential and C&I measures makes a **questionable load shape** → Important that **hourly impact of DSM measures** be given particular attention	→ Encompass will allow for optimization using **shorter duration bundles**; AES IN will collaborate with stakeholders to determine more appropriate bundle durations. → AES IN will collaborate with our consultants and stakeholders to **consider alternative approaches** for measure bundling → AES IN will work with LBNL and NREL to **capture the hourly shapes** associated with DSM measures for inclusion in the portfolio modeling
Load Forecasting	→ IRP excluded **detailed Itron report** in the appendix → IRP excluded analysis on the **appropriateness of base temperature** for weather normalization → IRP excluded discussion of **street lighting usage** and how it is modeled in the load forecast → IRP excluded discussion of risk and uncertainty associated with the **load forecasting scenarios**	→ AES IN has contracted Itron to **perform the load forecast and provide a detailed report** that describes the methodology including all items noted to by the Director

Overview of Existing Resources

Aaron Cooper, Chief Commercial Officer, AES US Utilities
Erik Miller, Manager, Resource Planning, AES Indiana

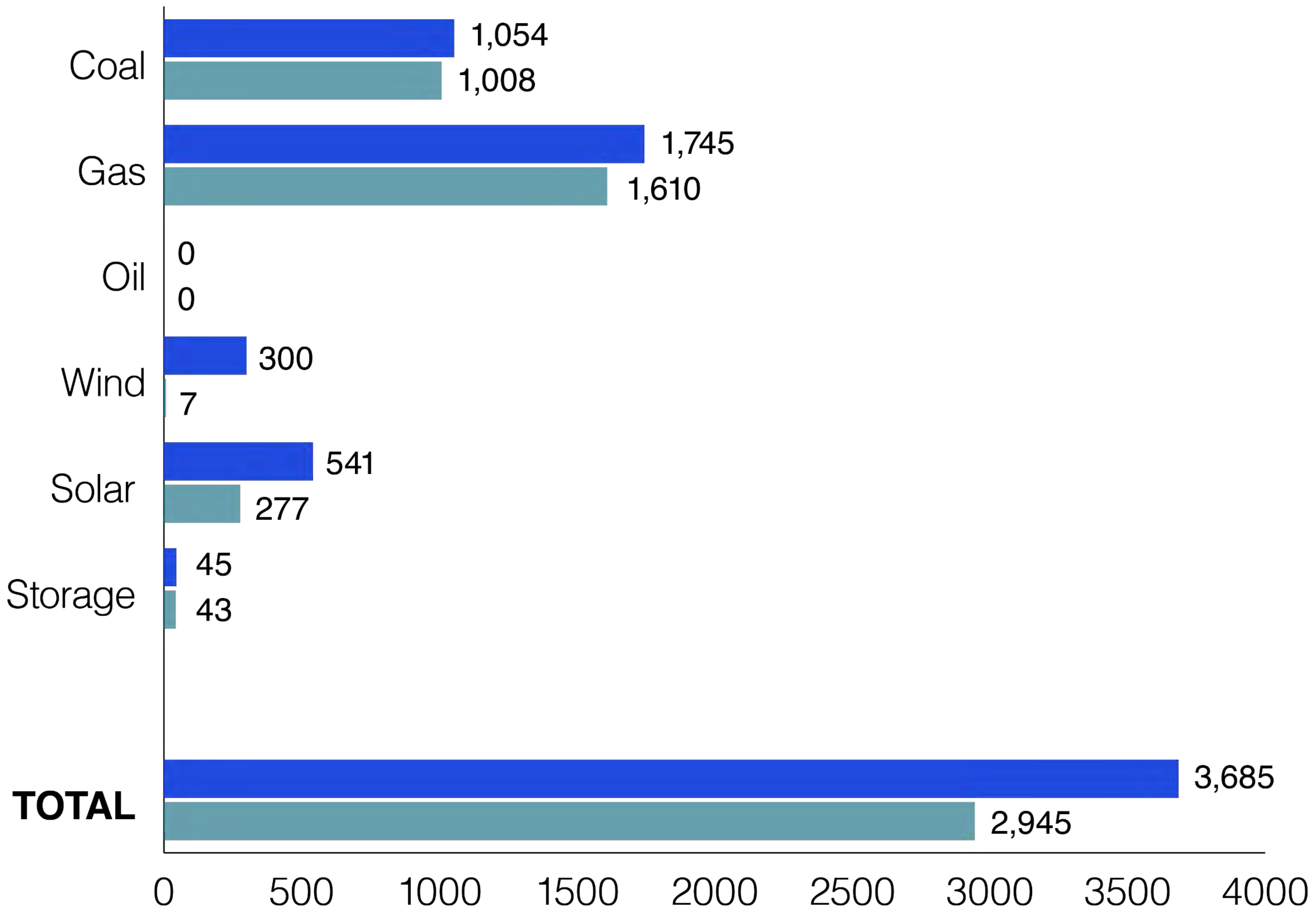
Starting Point Portfolio


AES Indiana summer UCAP MW forecast

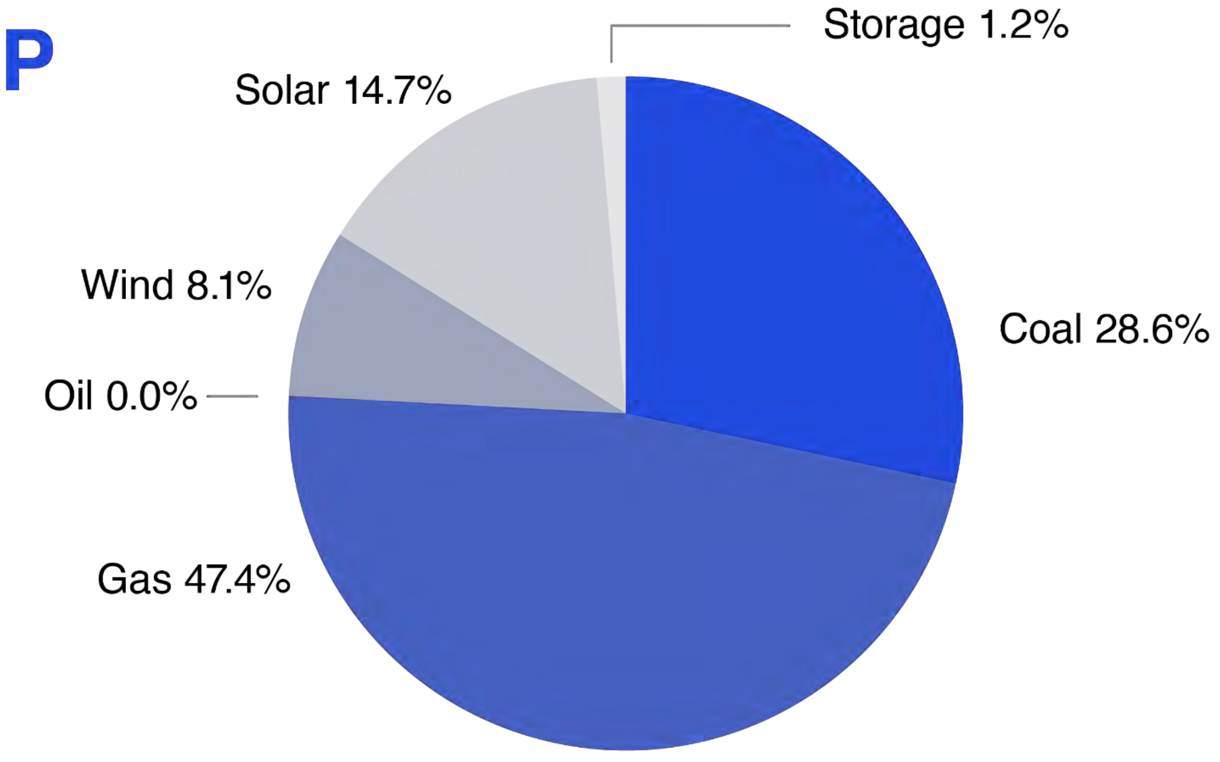


AES Indiana: Current Generation Mix

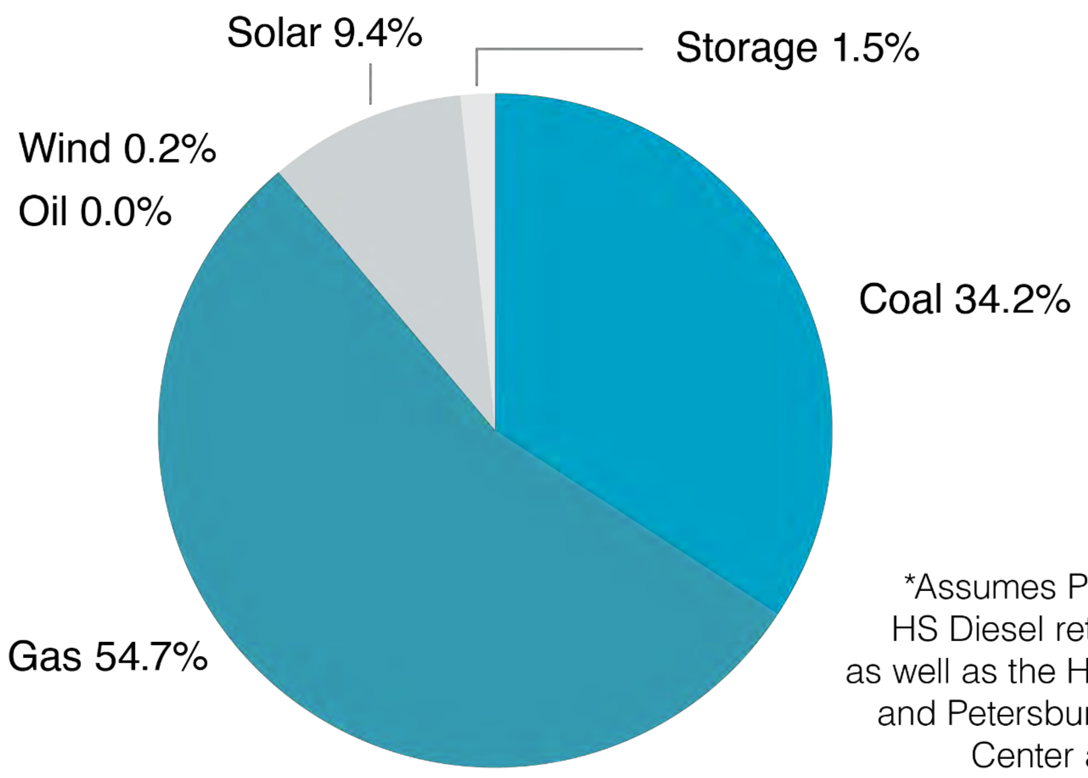
TECHNOLOGY – ICAP MW / UCAP MW



ICAP



UCAP



*Assumes Pete 2 and HS Diesel retirements, as well as the Hardy Hills and Petersburg Energy Center additions.

Existing Coal Resources

Coal Units	Reference Name	Technology	ICAP (MW)	UCAP (MW)	In-Service Year	Estimated Last Year In-Service
Petersburg						
PETE ST 2	Pete 2	Coal ST	410	368	1969	2023
PETE ST 3	Pete 3	Coal ST	518	488	1977	2042
PETE ST 4	Pete 4	Coal ST	536	520	1986	2042
		Total Coal:	1,464	1,376		

Notes on units:

→ Petersburg Unit 1 retired on May 31, 2021 consistent with the 2019 IRP Short Term Action Plan

→ Petersburg Unit 2 scheduled to retire on May 31, 2023 is consistent with the 2019 IRP Short Term Action Plan

Existing Gas Resources

Gas Units	Reference Name	Technology	ICAP (MW)	UCAP (MW)	In-Service Year	Estimated Last Year In-Service
Eagle Valley						
EV CCGT	Eagle Valley	CCGT	671	601	2018	2055
Harding Street						
HS 5G	Harding Street 5	Gas ST	100	93	1958	2030
HS 6G	Harding Street 6	Gas ST	99	94	1961	2030
HS 7G	Harding Street 7	Gas ST	415	399	1973	2033
HS GT4	Harding Street GT4	Gas CT	74	67	1994	2044
HS GT5	Harding Street GT5	Gas CT	74	69	1995	2045
HS GT6	Harding Street GT6	Gas CT	154	140	2002	2052
HS GT1 & GT2	Harding Street GT1 & 2	Oil	38	36	1973	2023/2024
Georgetown						
GTOWN GT1	Georgetown 1	Gas CT	79	72	2000	2050
GTOWN GT4	Georgetown 4	Gas CT	79	75	2001	2052
		Total Gas:	1,745	1,610		
		Total Oil:	38	36		

	ICAP (MW)	UCAP (MW)
CCGT	**671**	**601**
CT	**460**	**423**
ST	**614**	**586**

Existing Renewable Resources

Renewables	Technology	ICAP (MW)	UCAP (MW)	In-Service Year/ PPA Start	Estimated Last Year In-Service/PPA End
Hardy Hills					
Hardy Hills	Solar Only	195	98	2023	TBD
Petersburg Energy Center					
PEC Solar	Solar + BESS	250	125	2024	TBD
PEC BESS	Solar + BESS	180 MWh	45 MW, 4-hour	2024	TBD
PPAs					
Hoosier Wind Park (IN)	PPA	100	7	2009	2029
Lakefield Wind (MN)	PPA	200	0	2011	2031
Solar (Rate REP)	PPA	96	54	varies	varies
	Total Renewable:	841	328		

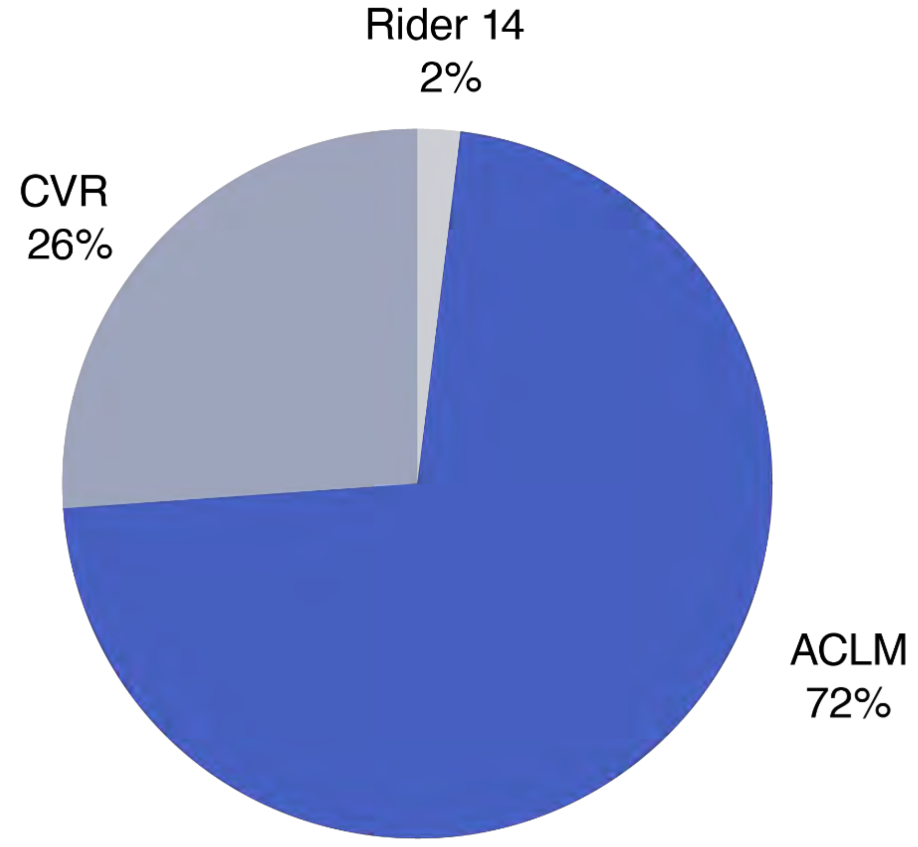
- → Lakefield Wind has no firm transmission and therefore receives no capacity credit from MISO to AES
- → Rate REP solar receives no capacity credit from MISO; rather it serves as a reduction to load in the PRA
- → UCAP values are based on current MISO capacity credit levels for renewable resources. These values will likely fall over time as renewable penetration increases within MISO.

	ICAP (MW)	UCAP (MW)
Solar	**541**	**277**
Wind	**300**	**7**
Storage	**45**	**43**

Existing DSM Resources

DEMAND RESPONSE

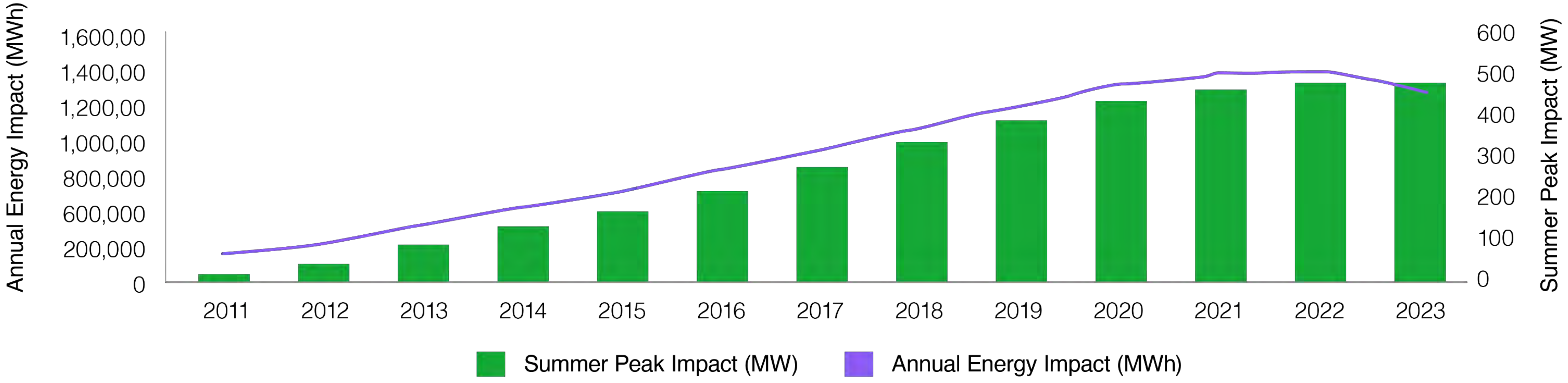
Load Modifying Resources	Summer Capacity Value (MW)
Air Conditioner Load Management	46.3
Conservation Voltage Reduction	16.8
Rider 14	1.1



ENERGY EFFICIENCY

→ Avg annual incremental program savings of 1% per year of 2021 sales

→ Savings of approximately 10% of 2021 sales from measures installed to date



Replacement Resource Options

Erik Miller, Manager, Resource Planning, AES Indiana

Commercially Available Replacement Resources

DSM/EE

- → EE & DR Measures bundled into traunches for planning model selection

Wind

- → Land-Based Wind

Solar

- → Utility-Scale
- → C&I
- → Residential

Storage

- → Standalone Front-of-meter
- → Solar + Storage
- → Wind + Storage

Natural Gas

- → CCGT
- → CT
- → Reciprocating Engine/ICE

Optionality for Emerging Technologies

The energy sector is transforming, and many new generation technologies are under development that can be utilized to support AES Indiana's commitment to achieve our customers' goals of reliability, affordability and sustainability.

These technologies include but may not be limited to:

→Green Hydrogen

→Small Modular Reactors (SMRs)

→Gravity Energy Storage

→Pumped-hydro Storage

→Carbon Capture and Sequestration (CCS)

As a company, we see these technologies as providing optionality in a path towards reducing carbon and we plan to consider them in future IRPs as they become commercially available.

AES Indiana welcomes stakeholder input regarding new & emerging technologies.

2022 Integrated Resource Plan (IRP)

Baseline Energy & Load Forecast

Presented by Itron

Itron
aes Indiana

Introduction to the Itron Team

→ Itron has over 30 years of experience developing forecast models for customers worldwide. Itron's energy forecasting group is nationally recognized for its expertise in short-term forecasting (hour-ahead and day-ahead), financial forecasting (1-3 years-ahead), and long-term forecasting (10-20 years-ahead).
We are a leading provider of forecasting solutions to independent system operators (ISO), regional transmission organizations, energy retailers, public utilities, municipalities, and cooperatives.

→ Itron specializes in long-term load modeling, regulatory support, statistical analysis, and forecasting system implementation. The forecasting staff includes economists, statisticians, programmers, and consultants that have extensive experience in these areas, as well as database design and software development.

Eric Fox

Director, Forecasting Solutions

Michael Russo

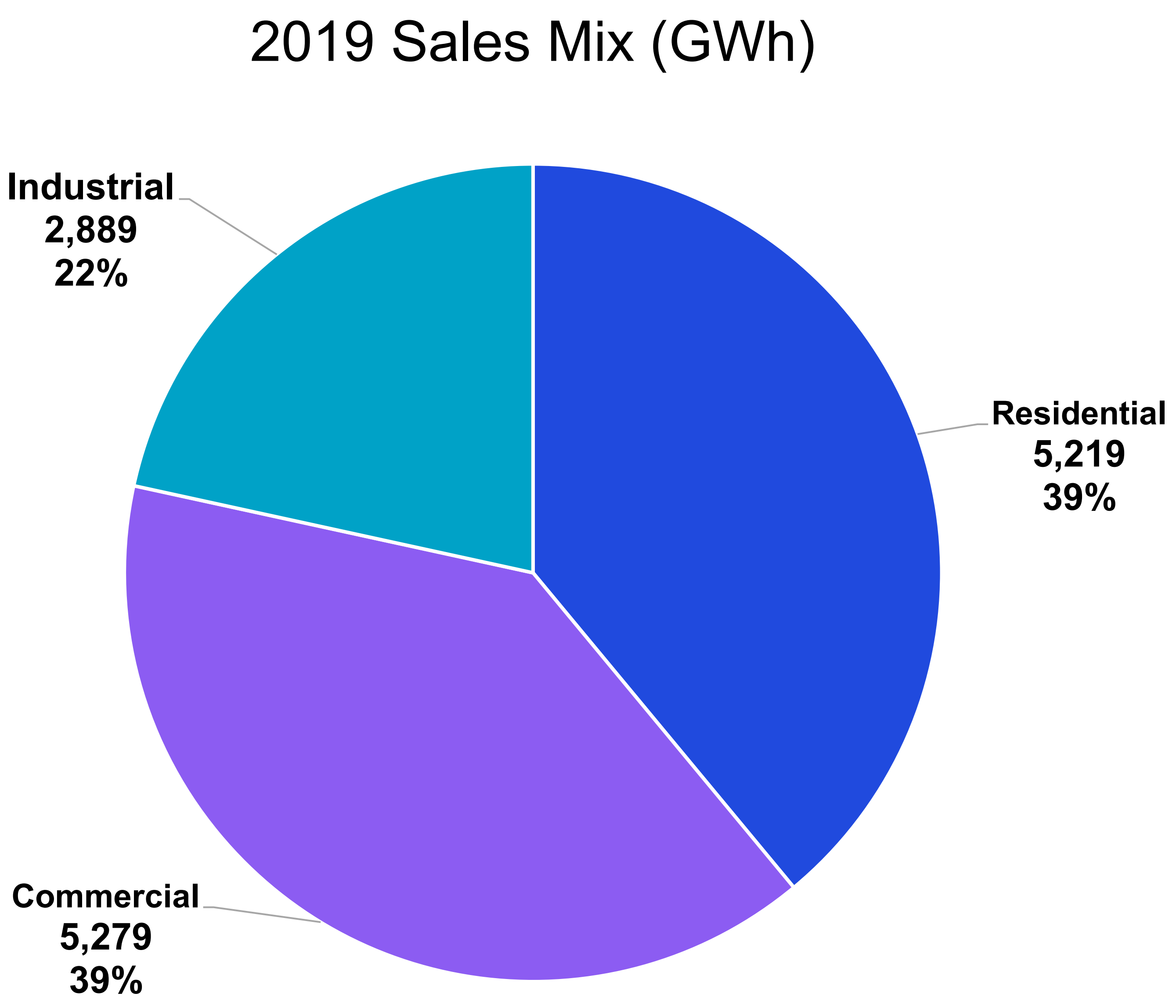
Forecast Consultant

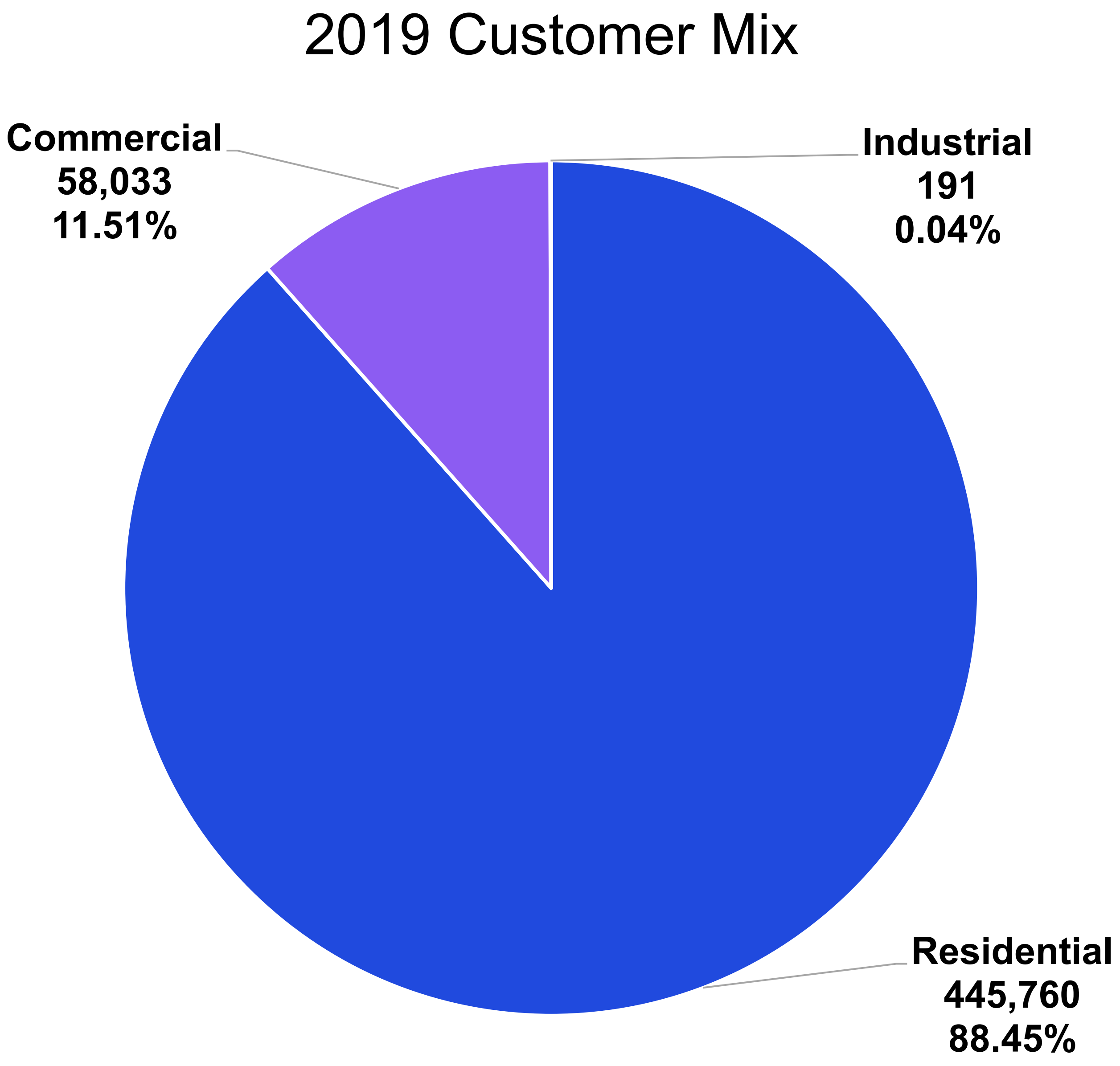
Agenda

- → Sales, Energy, and Demand Trends
- → Modeling Approach
- → Baseline Forecast

Sales, Energy and Demand Trends

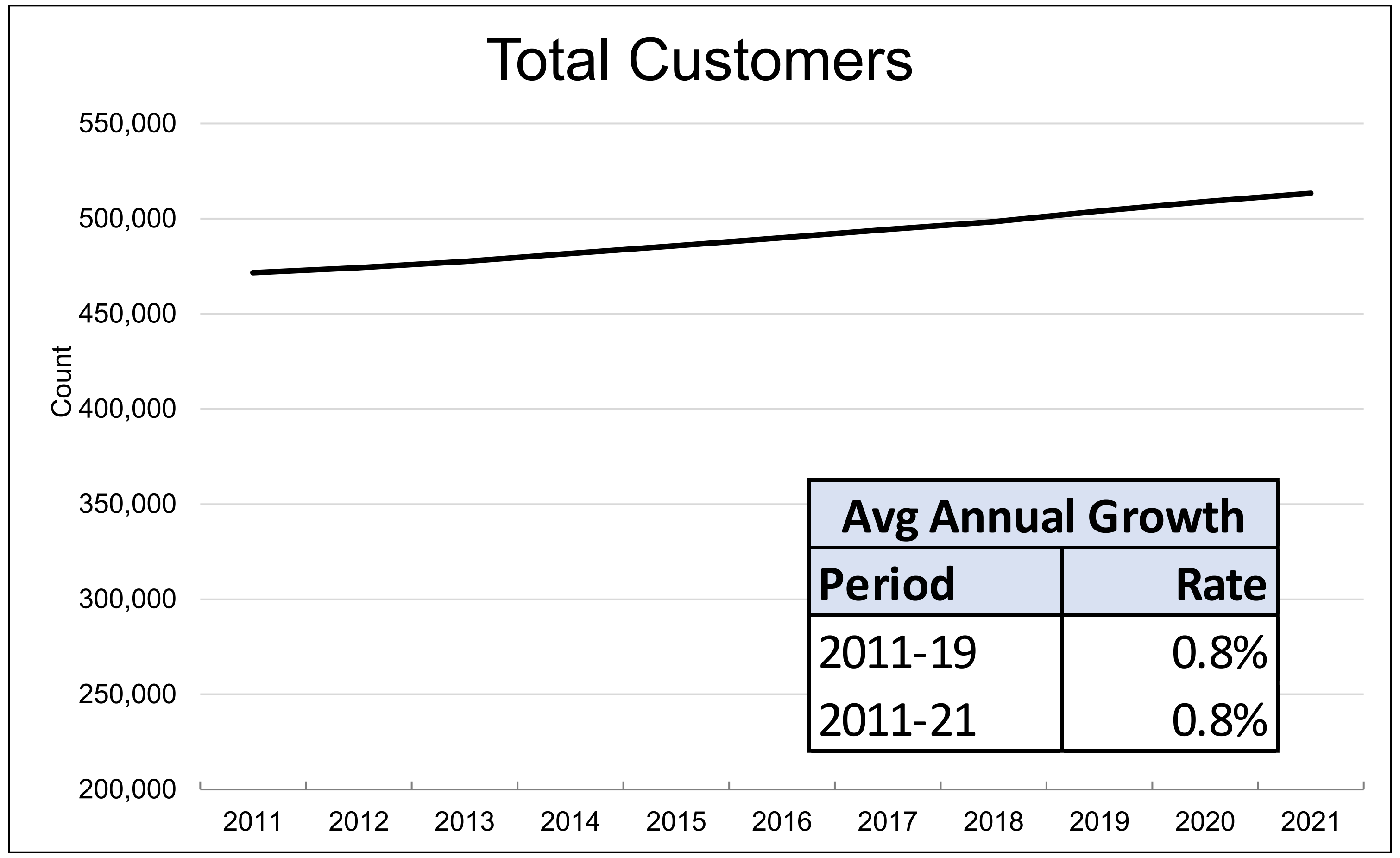
AES Indiana Customer Class Mix



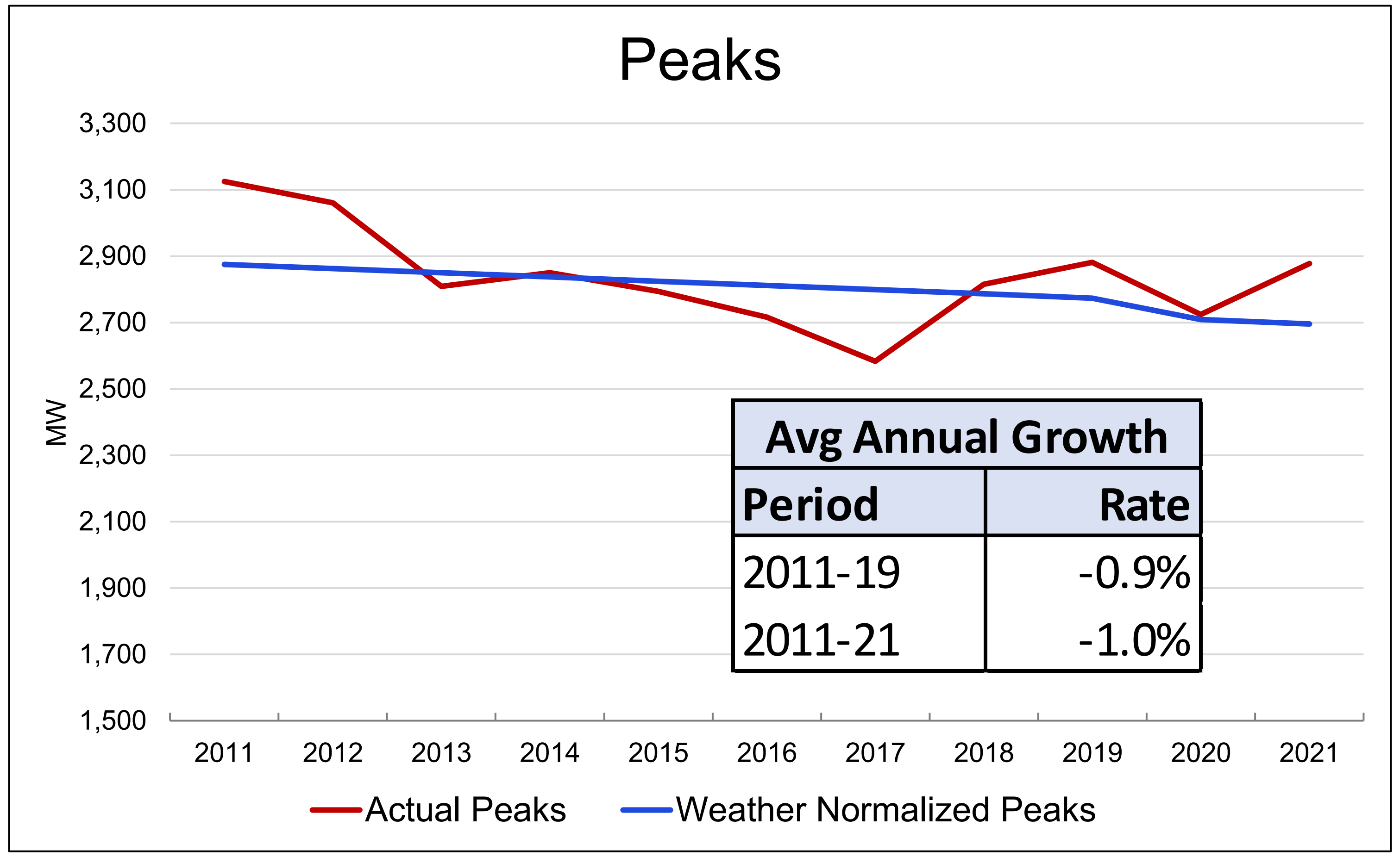


AES Indiana serves over 500,000 customers across residential, commercial, and industrial customer class. The residential class accounts for nearly 90% of the customers and 40% of system sales. Commercial sales 40%. Industrial sales 20%.

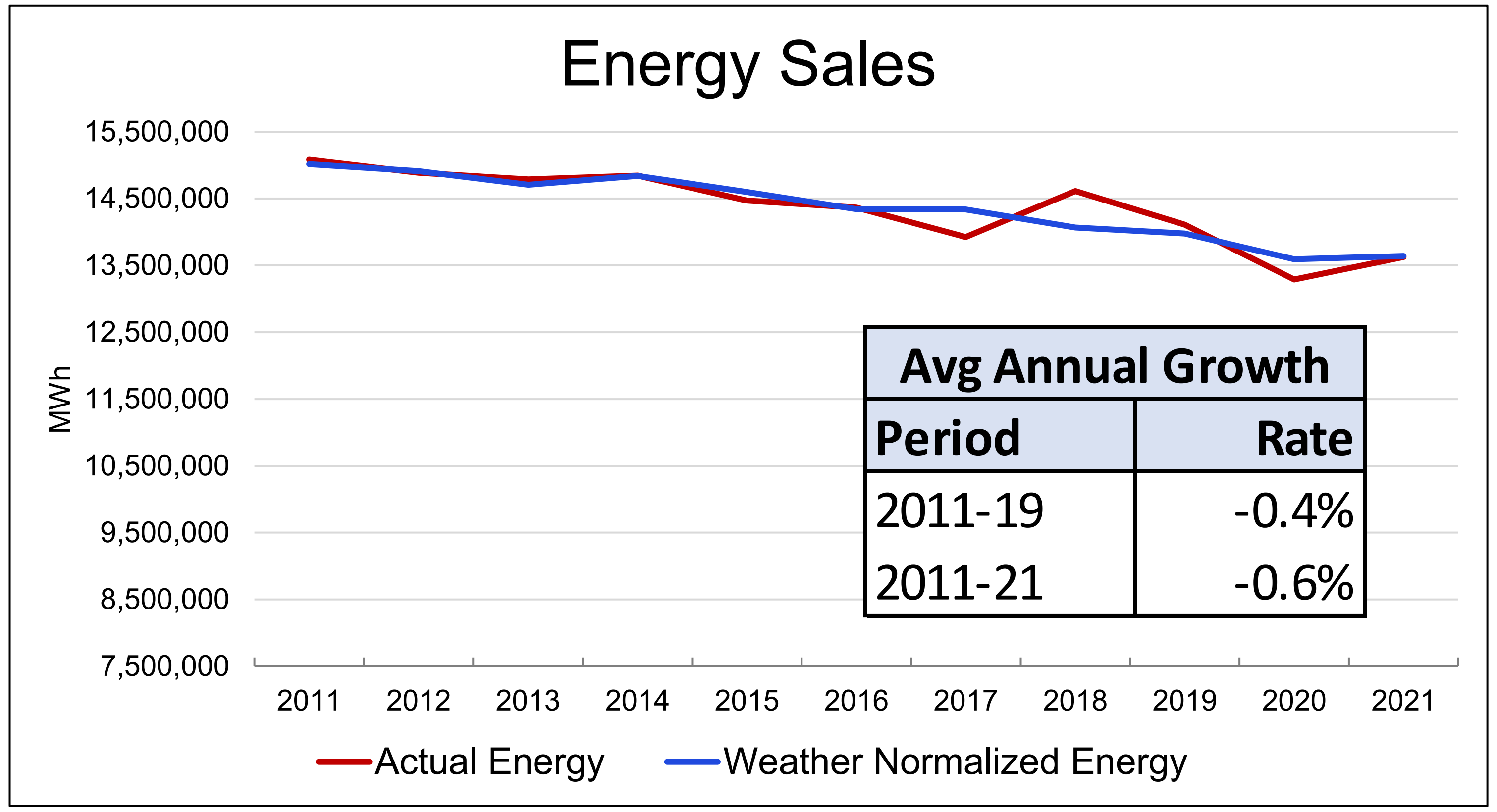
Historical Energy, Peak, and Customer Trends


Total Customers

Avg Annual Growth	
Period	**Rate**
2011-19	0.8%
2011-21	0.8%


Peaks

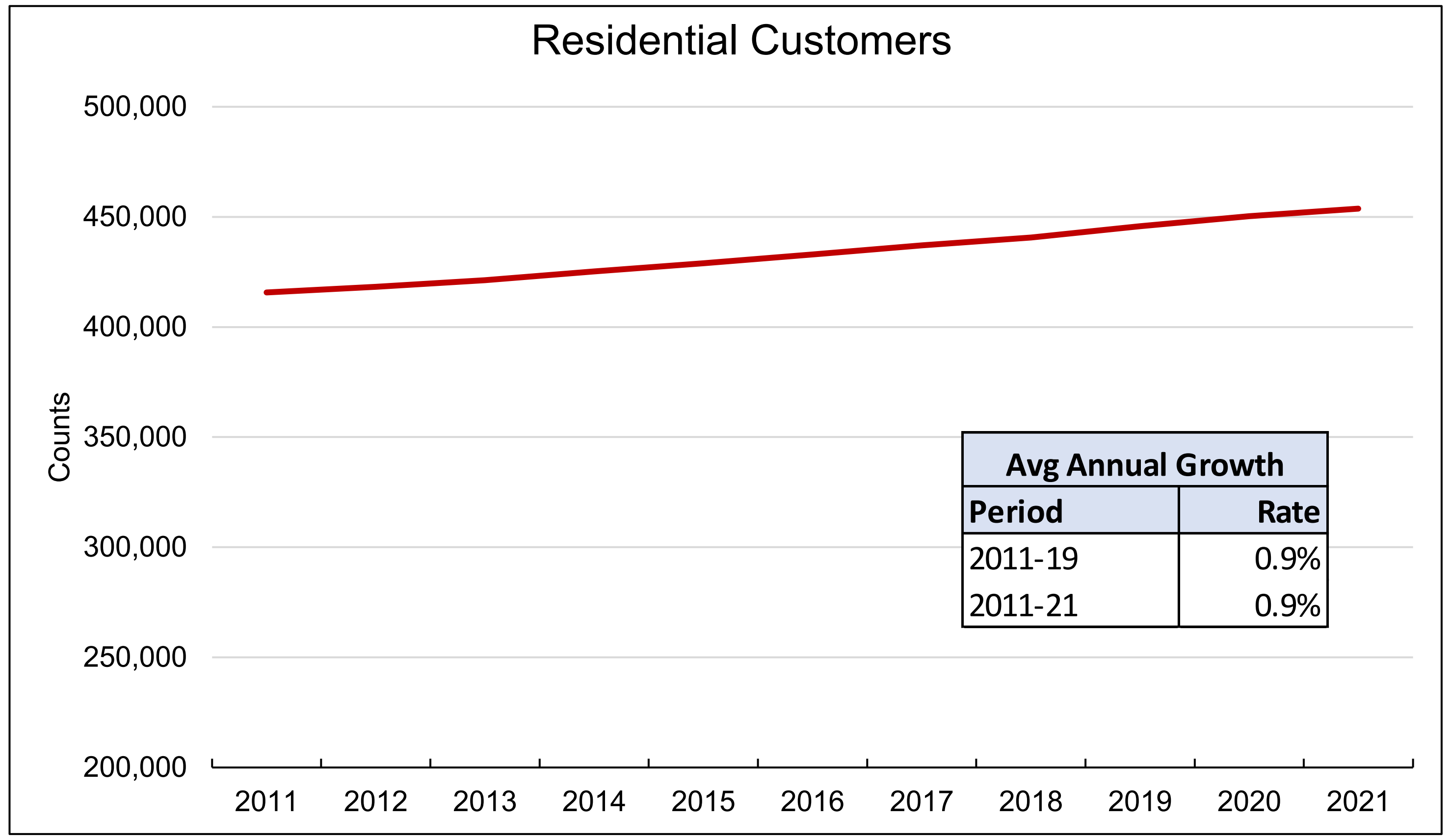
Avg Annual Growth	
Period	**Rate**
2011-19	-0.9%
2011-21	-1.0%


Energy Sales

Avg Annual Growth	
Period	**Rate**
2011-19	-0.4%
2011-21	-0.6%

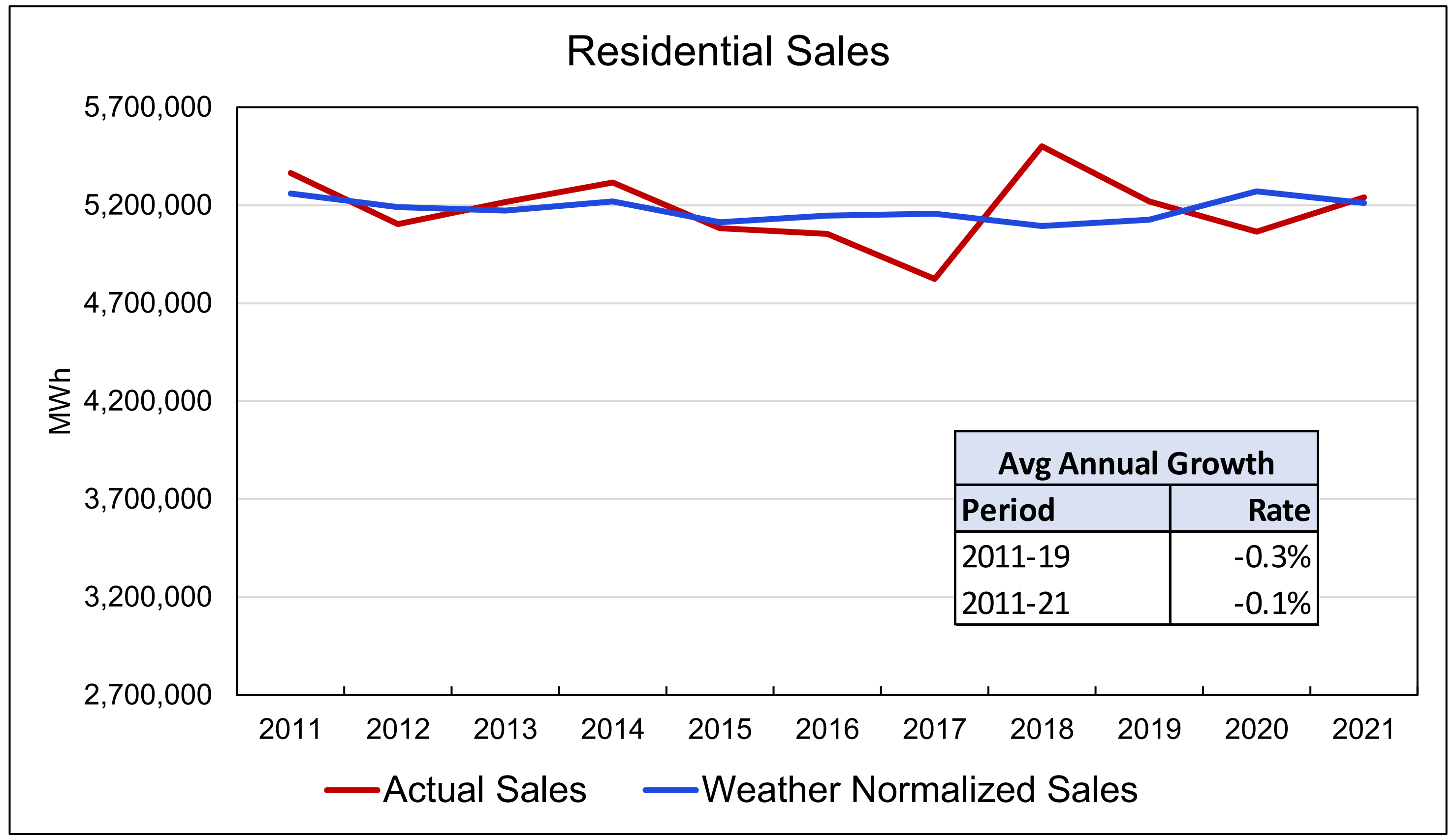
Despite relatively strong customer growth, system energy and peak demand has been declining as efficiency gains have outweighed customer growth

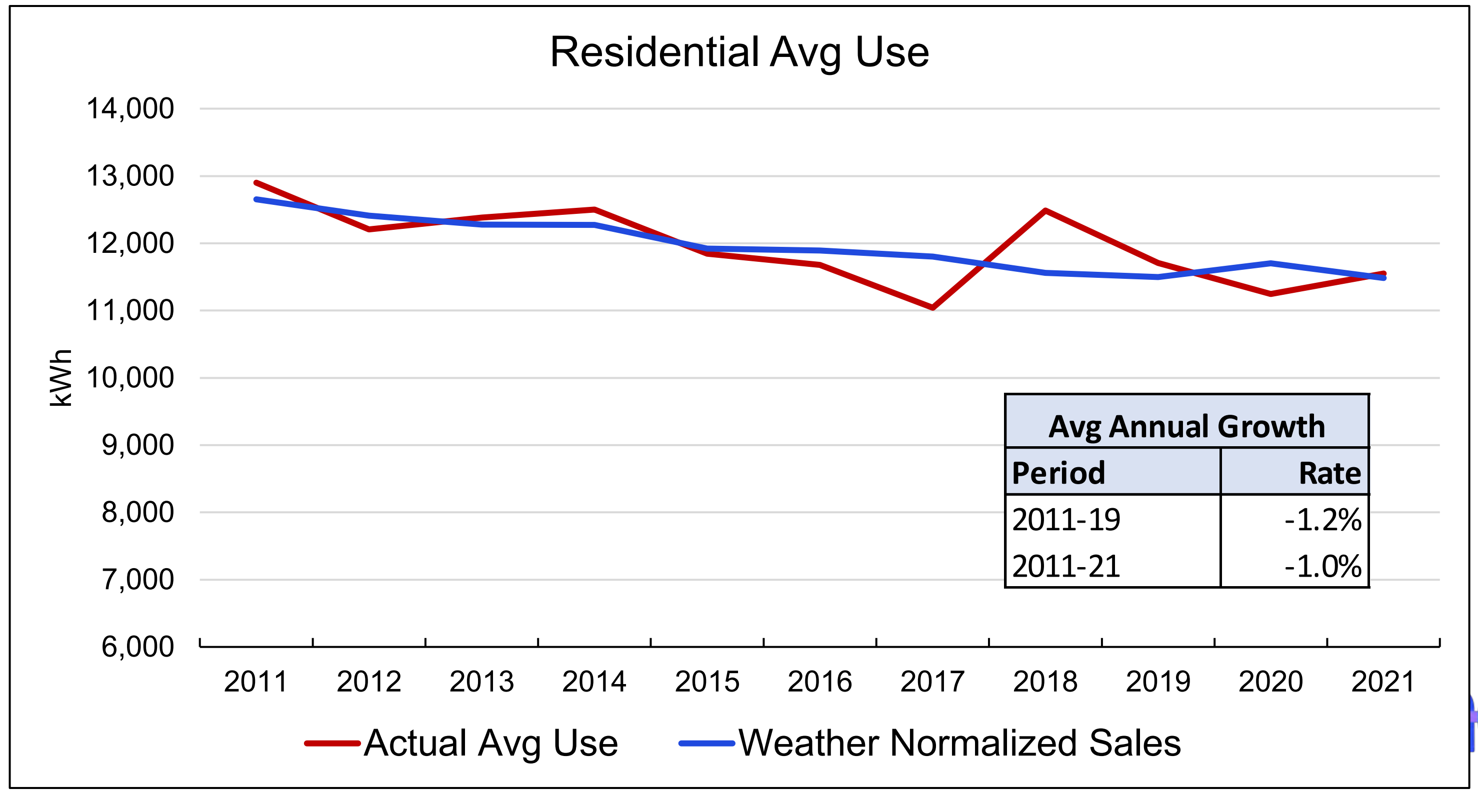
Residential Customer and Sales Trends



The number of customers has increased from 417,000 in 2010 to 455,500 by year-end 2021. Adding approximately 3,500 new customers per year.

But despite strong customer growth, sales have been flat with average use declining at roughly the same rate as customer growth.





What’s Driving Customer Growth

Strong population and household growth

→ Home to over 876,000 people and more than 2 million residents in the metropolitan area. Third most populous city in the Midwest behind Chicago and Columbus. Population projected to grow 26% over the next 30 years

Strong regional economy

→ Regional GDP over $126 billion (Fed Reserve Bank of St. Louis)

→ Employment growth 1.7% year over year, over 1 million employed in the metro area

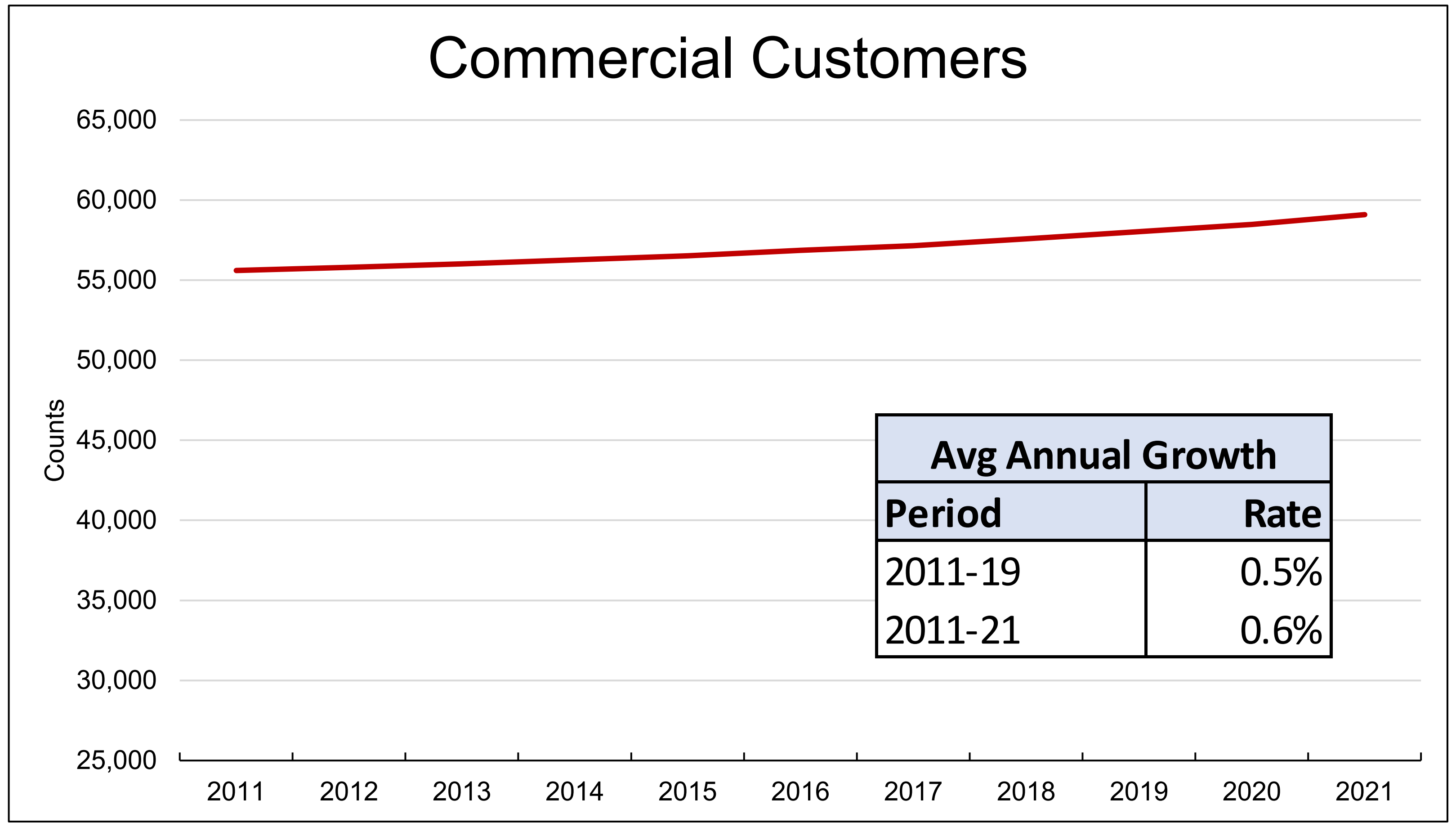
Affordable Housing

→ According to Kiplinger’s, Indianapolis has an affordability index of 1 out of 10, (based on percent of income needed to buy a median price home, $185,000)

The Indianapolis real estate market: stats & trends for 2021 (roofstock.com)

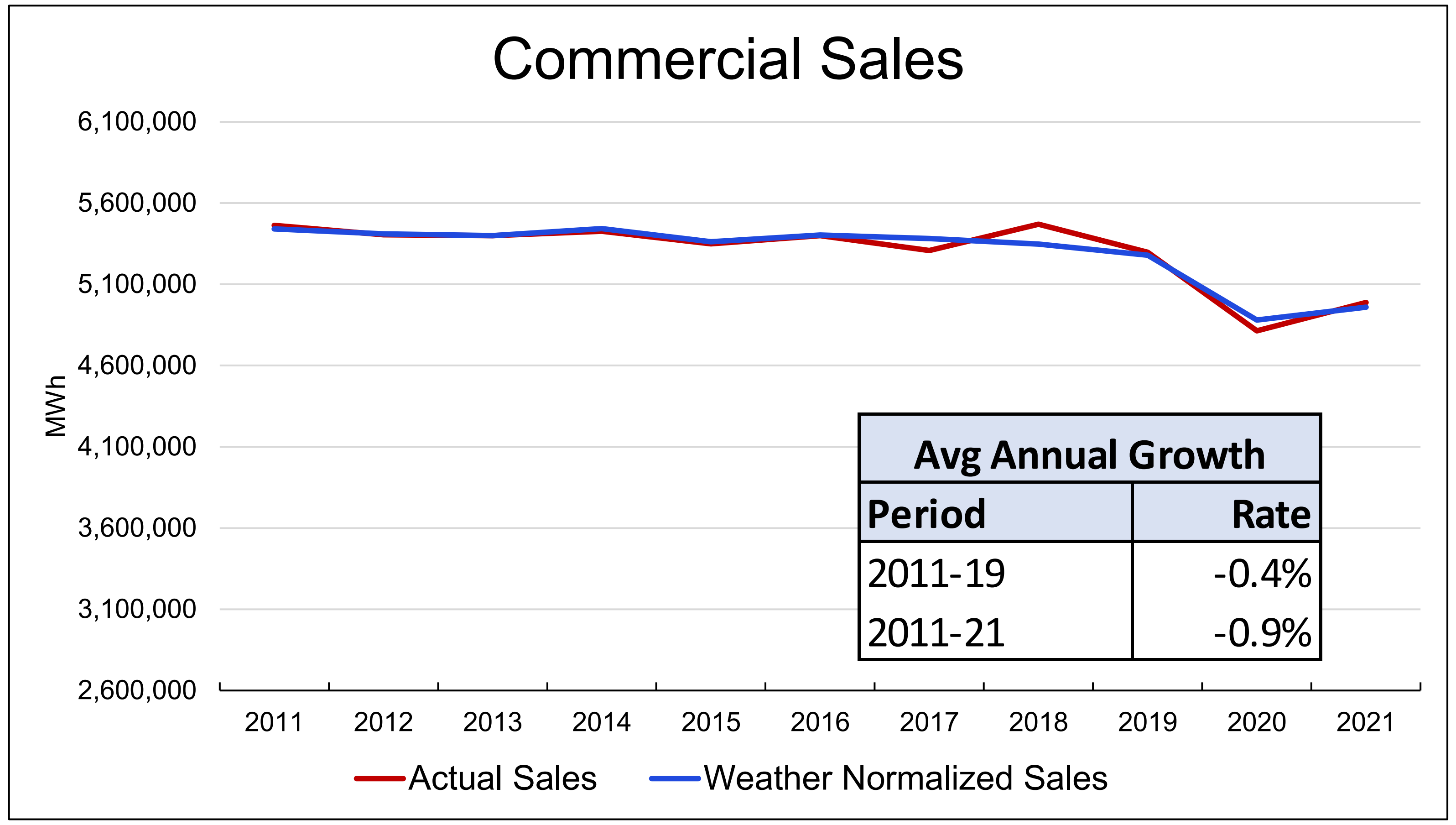
https://www.kiplinger.com/article/real-estate/t010-c000-s002-home-price-changes-in-the-100-largest-metro-areas.html

Commercial Sales and Customer Trends



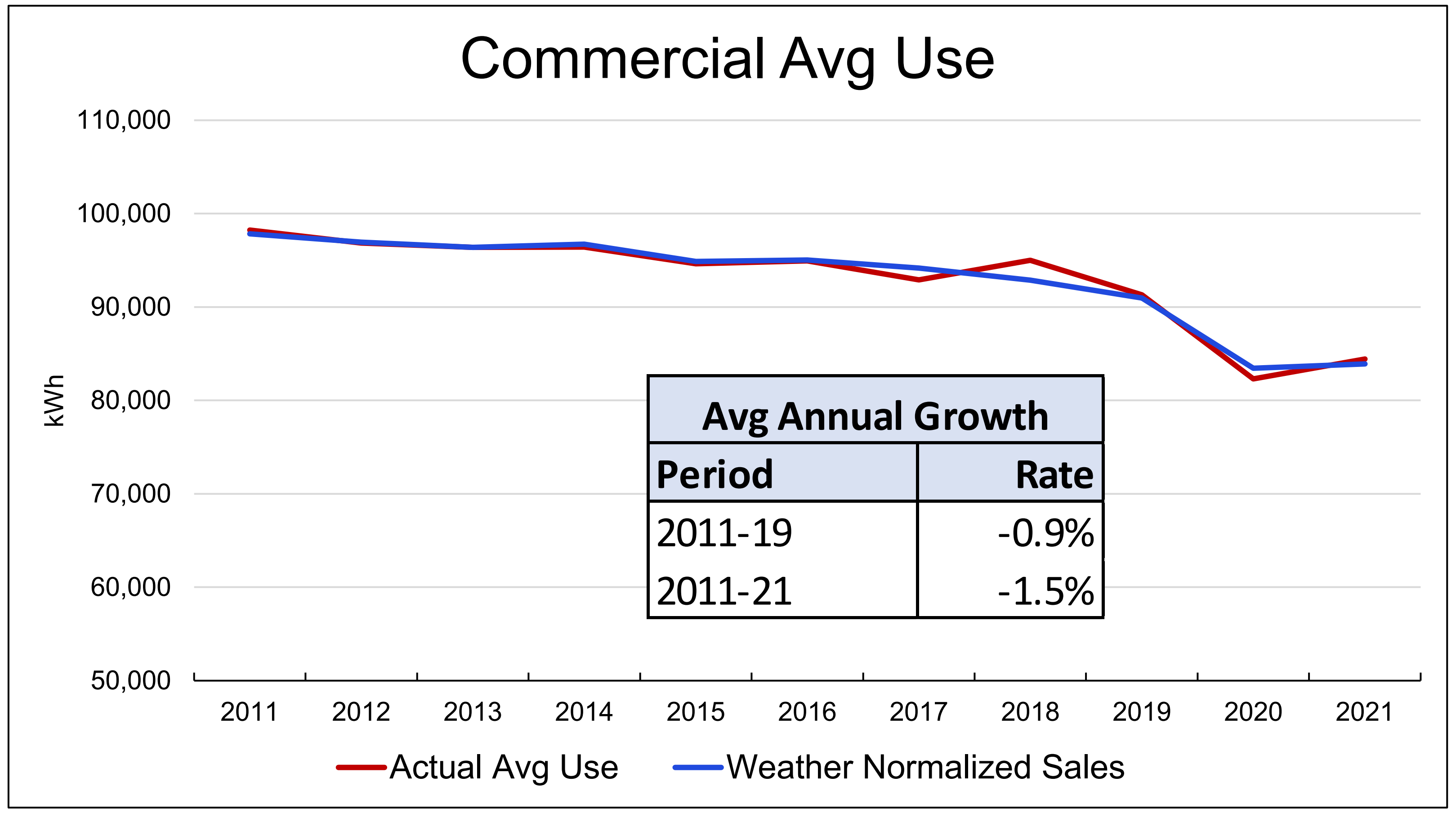
Avg Annual Growth

Period	Rate
2011-19	0.5%
2011-21	0.6%



Avg Annual Growth

Period	Rate
2011-19	-0.4%
2011-21	-0.9%



Avg Annual Growth

Period	Rate
2011-19	-0.9%
2011-21	-1.5%

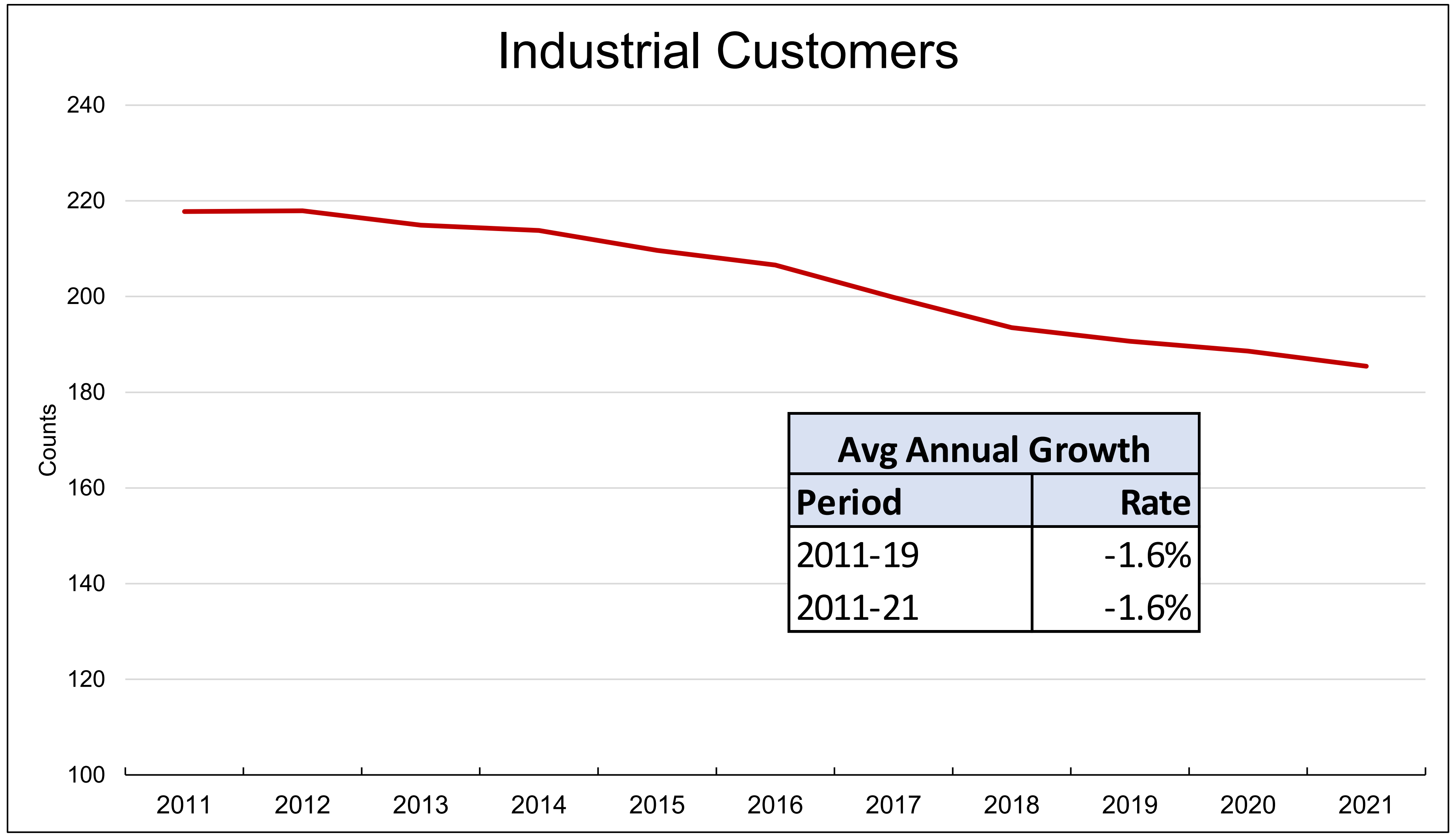
→ Strong efficiency improvements in the commercial sector

→ AES Energy Efficiency Program Activity

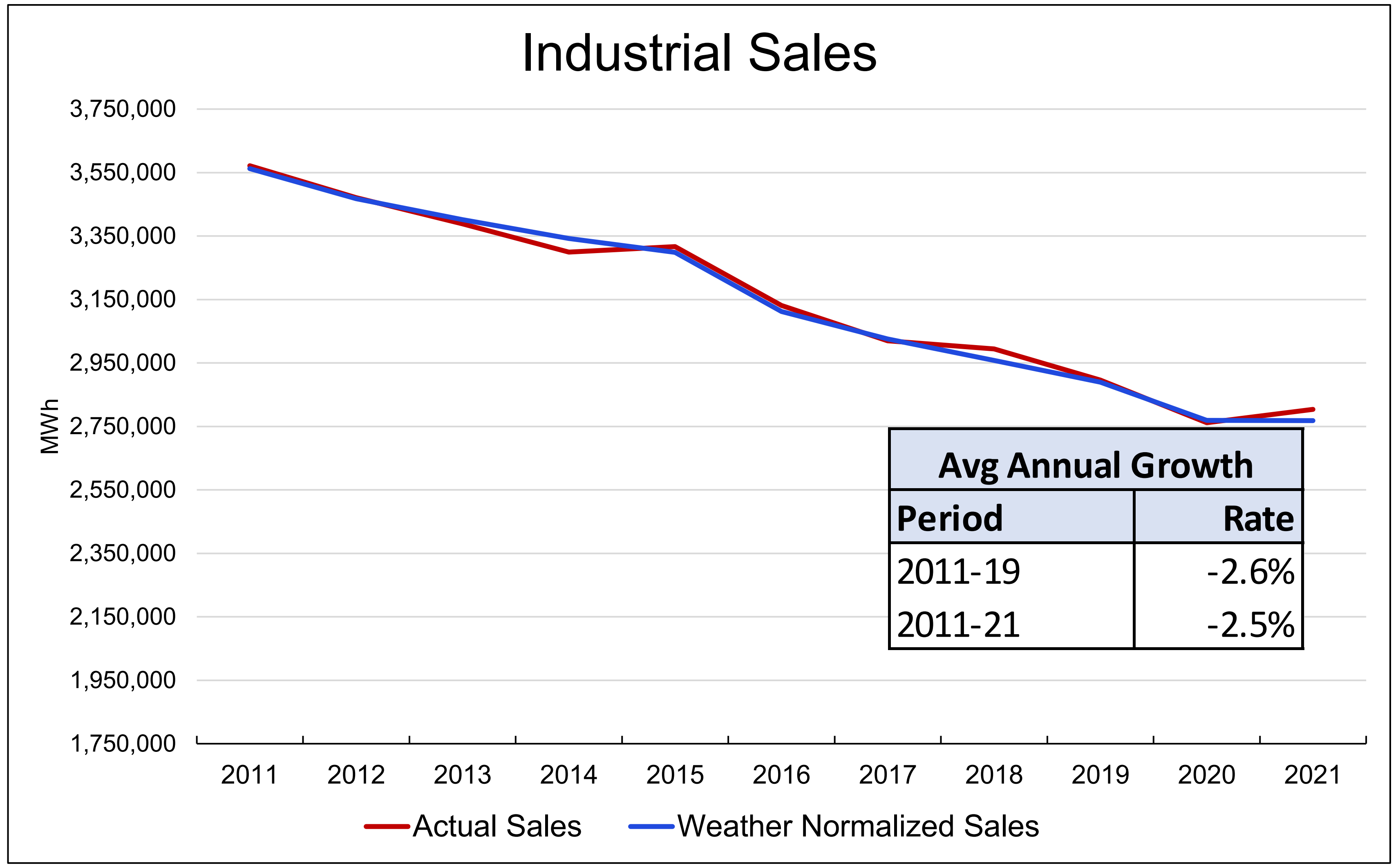
→ LED Adoption

→ Sharp drop in 2020 sales due to COVID-19

Industrial Trends – AES's Largest Customers



Avg Annual Growth	
Period	**Rate**
2011-19	-1.6%
2011-21	-1.6%



Avg Annual Growth	
Period	**Rate**
2011-19	-2.6%
2011-21	-2.5%

→Industrial customers and sales have been trending down since 2010, but appears to be leveling off

→Manufacturing transitioning to less energy intensive industry mix and end-use processes, and strong efficiency gains.

Who are AES’s largest customers

INDIANAPOLIS MSA TOP EMPLOYERS

	# EMPLOYEES
ST. VINCENT HEALTH	± 30,000
IU HEALTH	± 30,000
COMMUNITY HEALTH	± 14,000
ELI LILLY AND CO	± 10,000
KROGER	± 9,000
IUPUI	± 7,000
SIMON PROPERTY GROUP	± 5,000
ANTHEM BLUE CROSS BLUE SHIELD	± 5,000
ROCHE DIAGNOSTICS	± 4,000
FEDEX HUB	± 4,000
ROLLS ROYCE	± 4,000
ALLISON TRANSMISSION	± 3,000
ONE AMERICA	± 2,000
IU SCHOOL OF MEDICINE	± 2,000

- → What is classified as industrial, includes significant commercial activity
- → Health care
- → Education
- → Office - Management/Administrative
- → Distribution
- → The distinction between commercial and industrial activity is blurring
- → AES’s 10 largest customers account for approximately 14% of sales

CBRE
[indianapolis-multifamily-market-overview-2020-e.pdf (cbre.us)](indianapolis-multifamily-market-overview-2020-e.pdf)

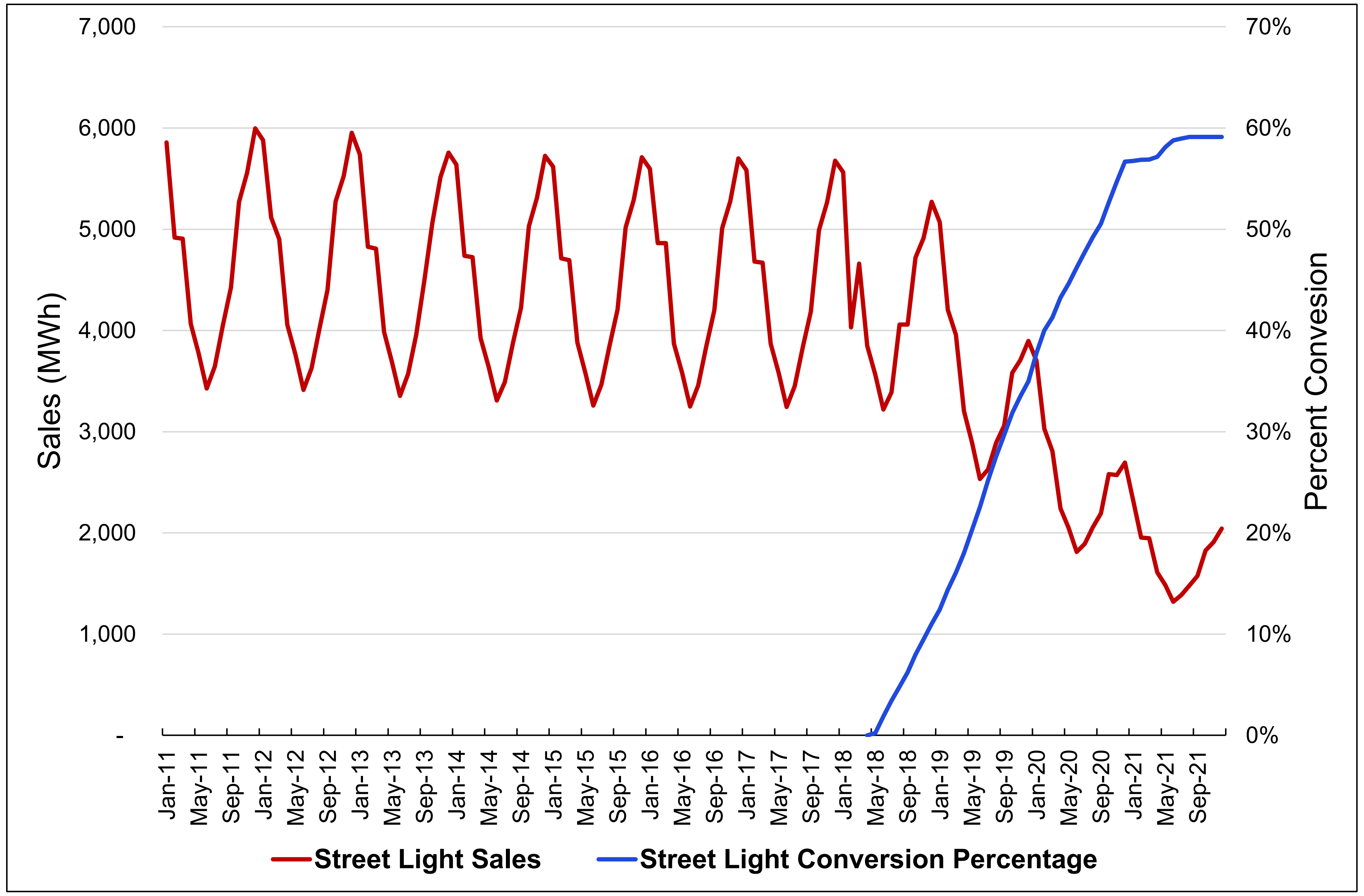
Street Lighting: LED Conversion Program

Operation Night Light is a public-private sector partnership that began in 2016 between the City of Indianapolis and AES Indiana. By converting to high-efficiency LED technology, the city would see savings generated due to lower maintenance costs and energy usage.

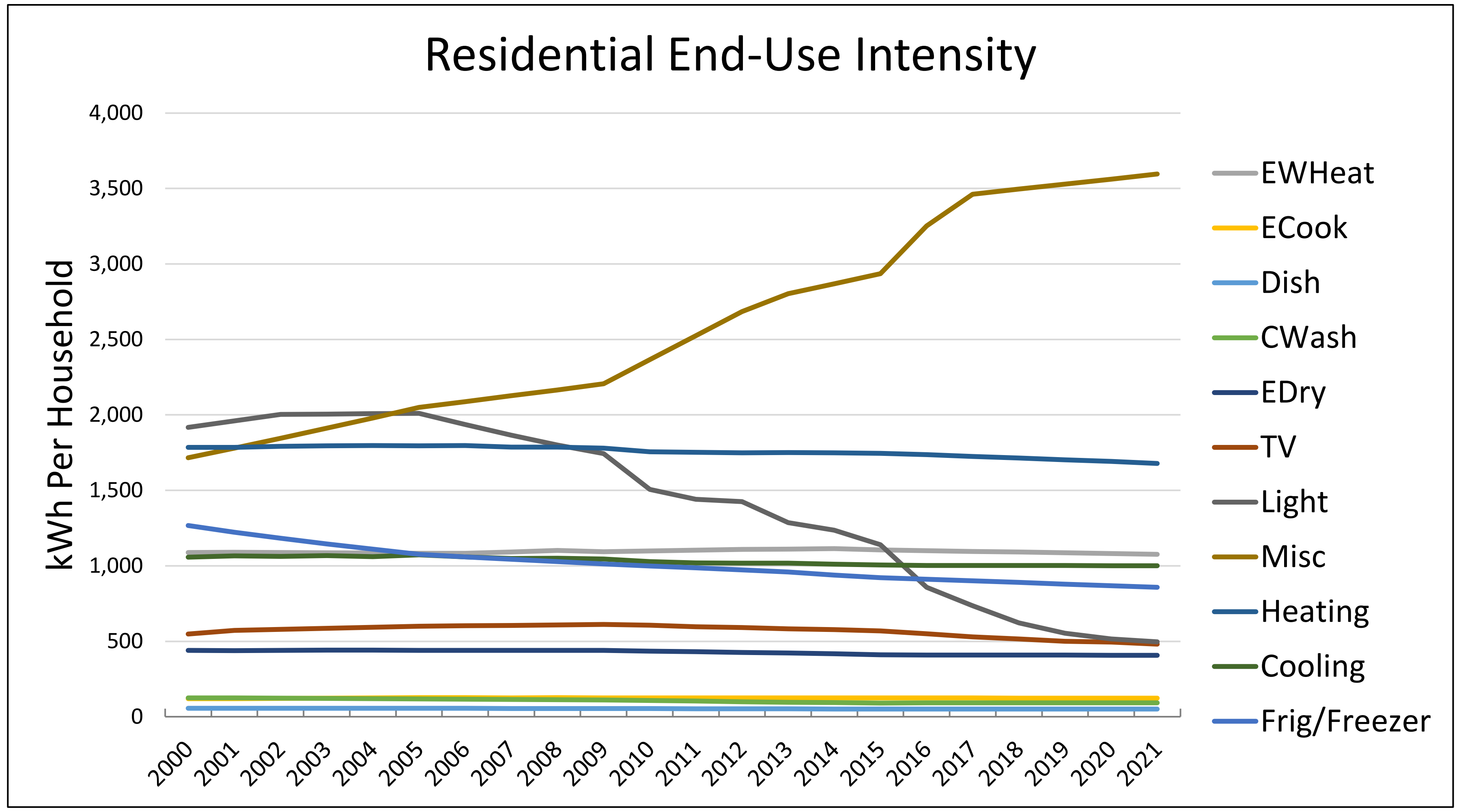
→27,000 streetlights across Marion County have been converted to high-efficiency LED fixtures

→Since the LED program began, electricity usage is down over 67%

→New lights will continue to be installed through 2025



Why is Average Use Declining ?

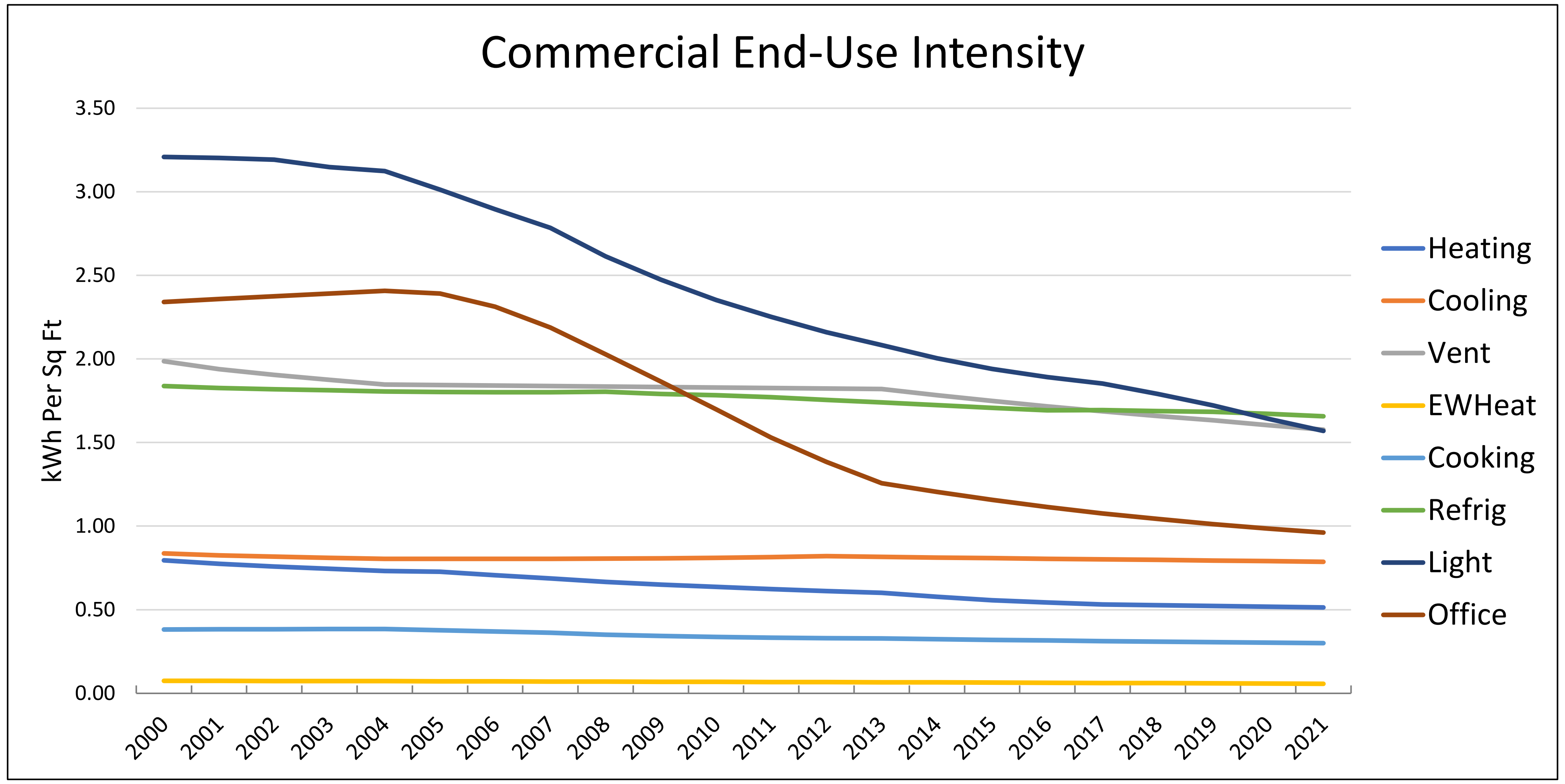


→ Residential. End-use intensities have been declining across nearly all end-uses except miscellaneous. Over the last 10 years:

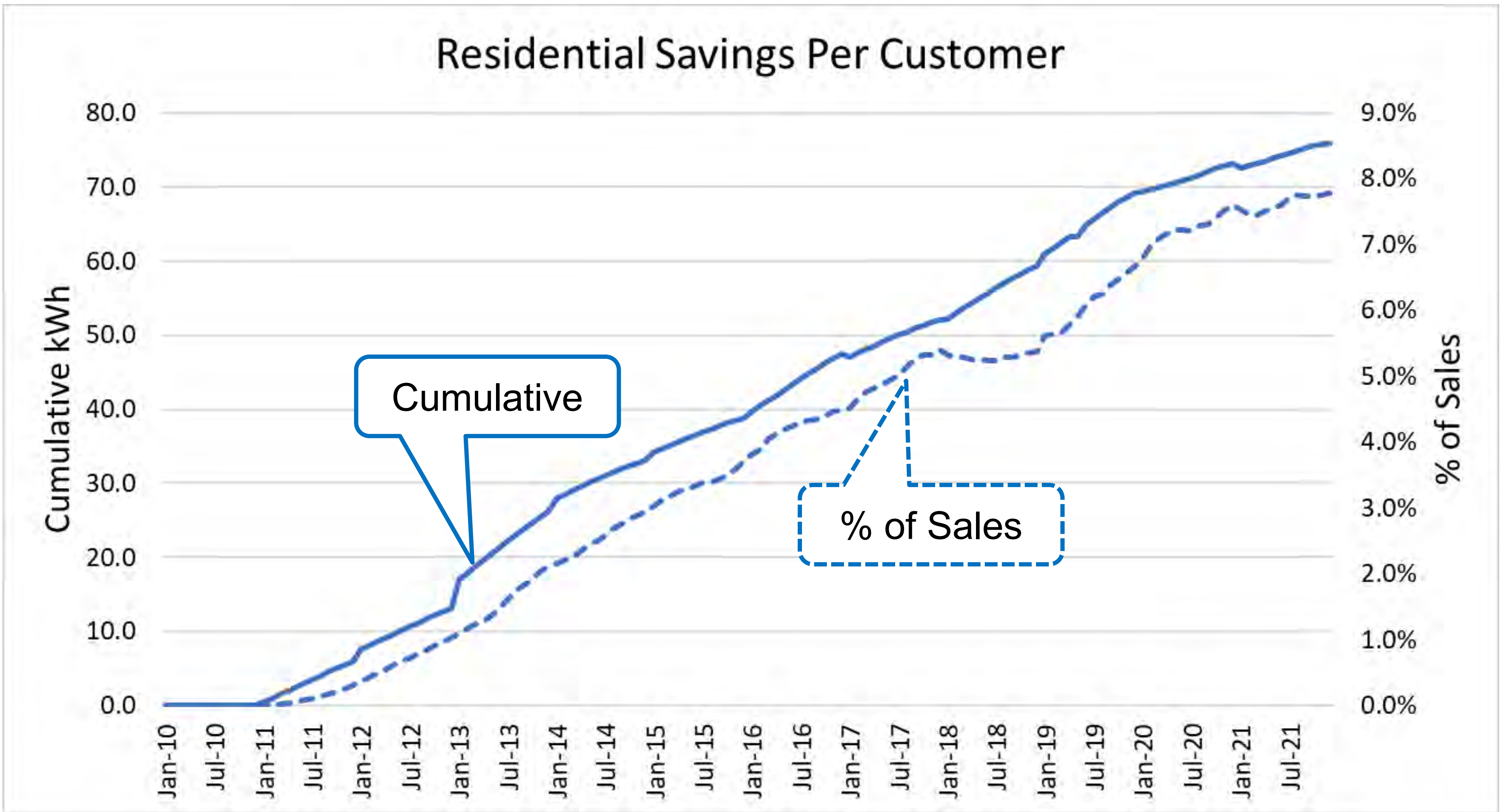
- → Heating down 0.5%
- → Cooling down 0.4%
- → Base down 0.2%

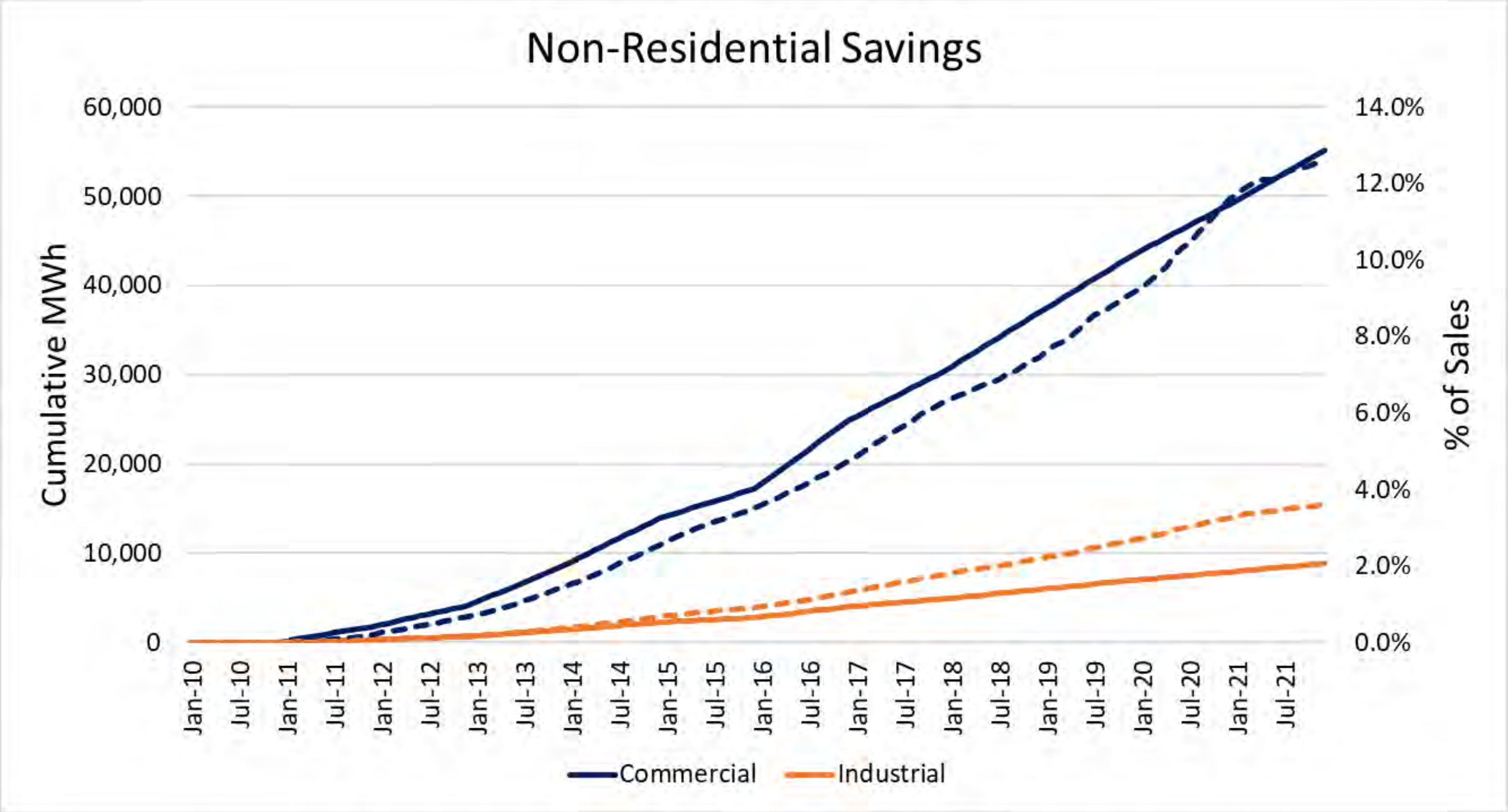
→ Similar trends in the commercial sector with the strongest decline in lighting and computer related loads. Over the last 10 years:

- → Heating down 1.9% (minimal commercial heating)
- → Cooling down 0.2%
- → Base down 1.2%



Significant Energy Efficiency Program Activity


Residential Savings Per Customer


Non-Residential Savings

- → Energy Efficiency Programs have had a significant impact on sales
  - → Reduce residential average use by 8% over the last ten years
  - → And reduce commercial sales by 13%

Annual Cumulative Saving (MWh)

Year	Res	Com	Ind
2011	30,123	21,547	3,456
2012	66,290	49,406	7,923
2013	133,328	103,074	16,530
2014	170,356	166,836	26,756
2015	201,208	206,761	33,158
2016	247,829	299,311	48,001
2017	274,827	365,279	58,580
2018	315,502	444,192	71,235
2019	372,124	522,340	83,768
2020	396,524	589,484	94,536

Modeling Approach

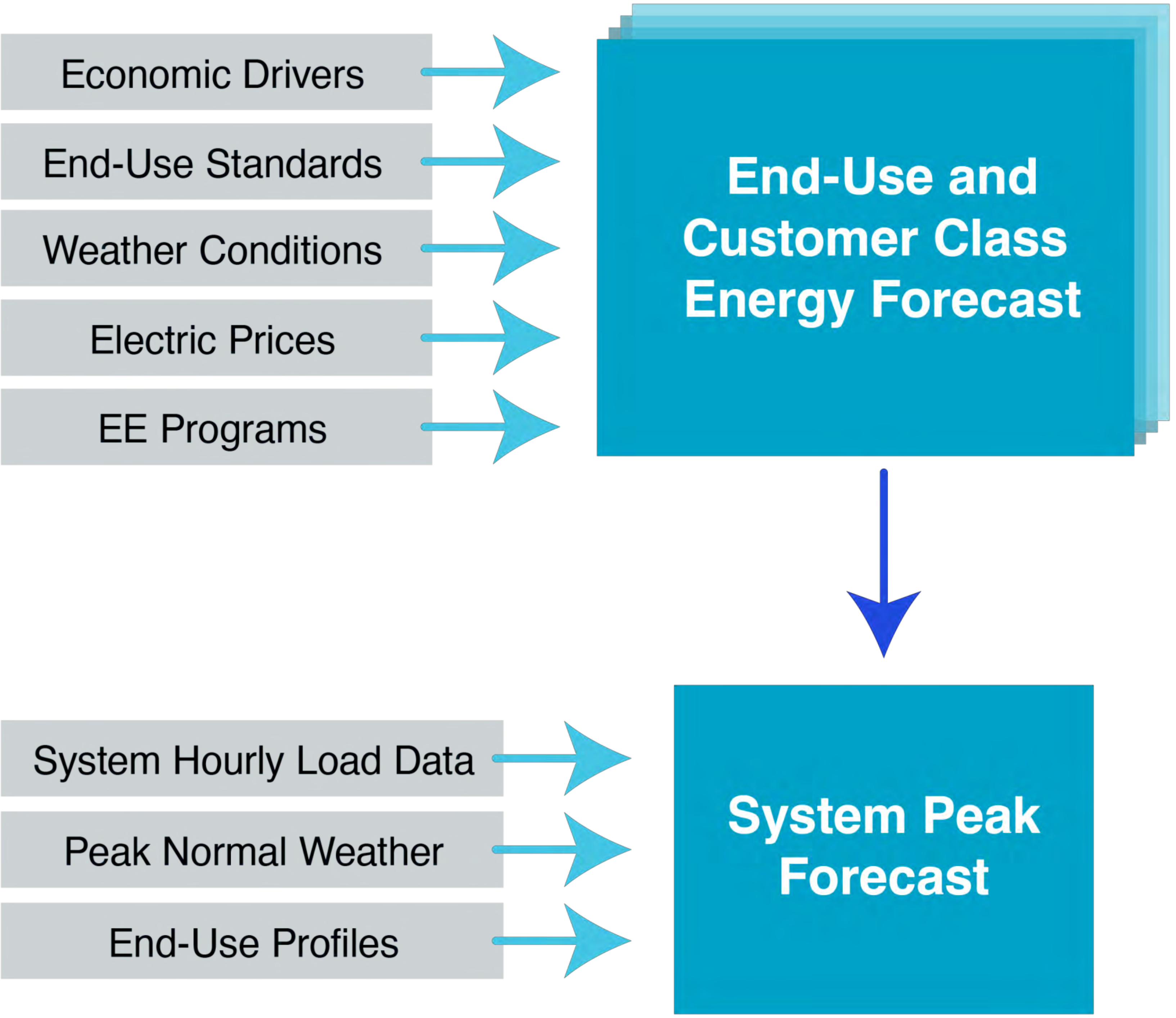
Baseline Modeling Approach

- → Bottom-up Modeling Approach
- → Estimate rate-class level sales and customer models from historical billed sales data
- → Sales/energy driven by households, economic forecasts, expected weather conditions, price, and end-use efficiency improvements. End-use demand drives system peak demand

Monthly sales and customer models are estimated for:

- → Residential
- → Commercial
- → Industrial
- → Other (Lighting)

Monthly peak model driven by end-use energy forecasts



Economic Drivers

End-Use Standards

Weather Conditions

Electric Prices

EE Programs

End-Use and Customer Class Energy Forecast

System Hourly Load Data

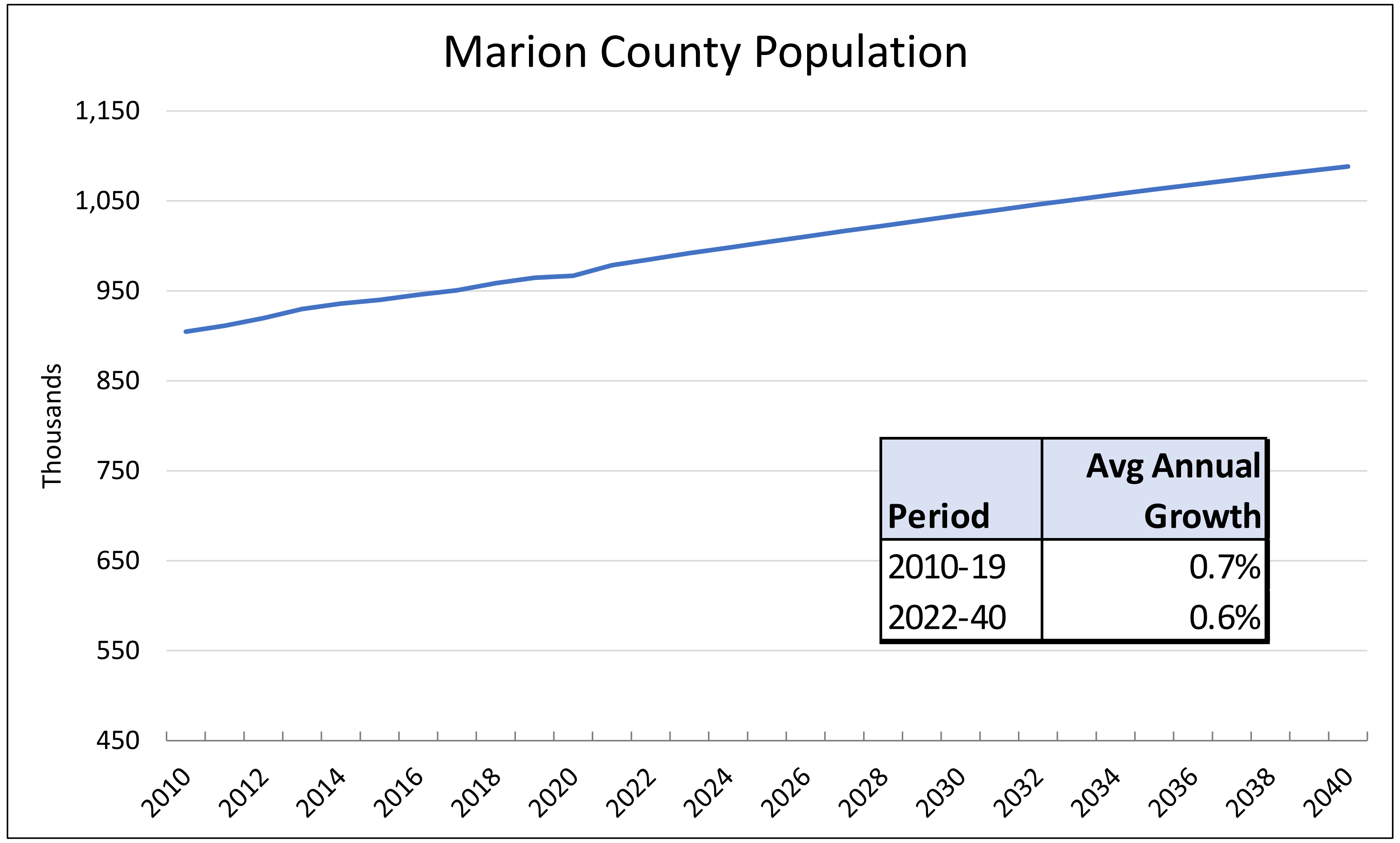
Peak Normal Weather

End-Use Profiles

System Peak Forecast

THE BASELINE FORECAST EXCLUDES BEHIND THE METER SOLAR, ELECTRIC VEHICLE LOADS, AND FUTURE EE PROGRAM SAVINGS

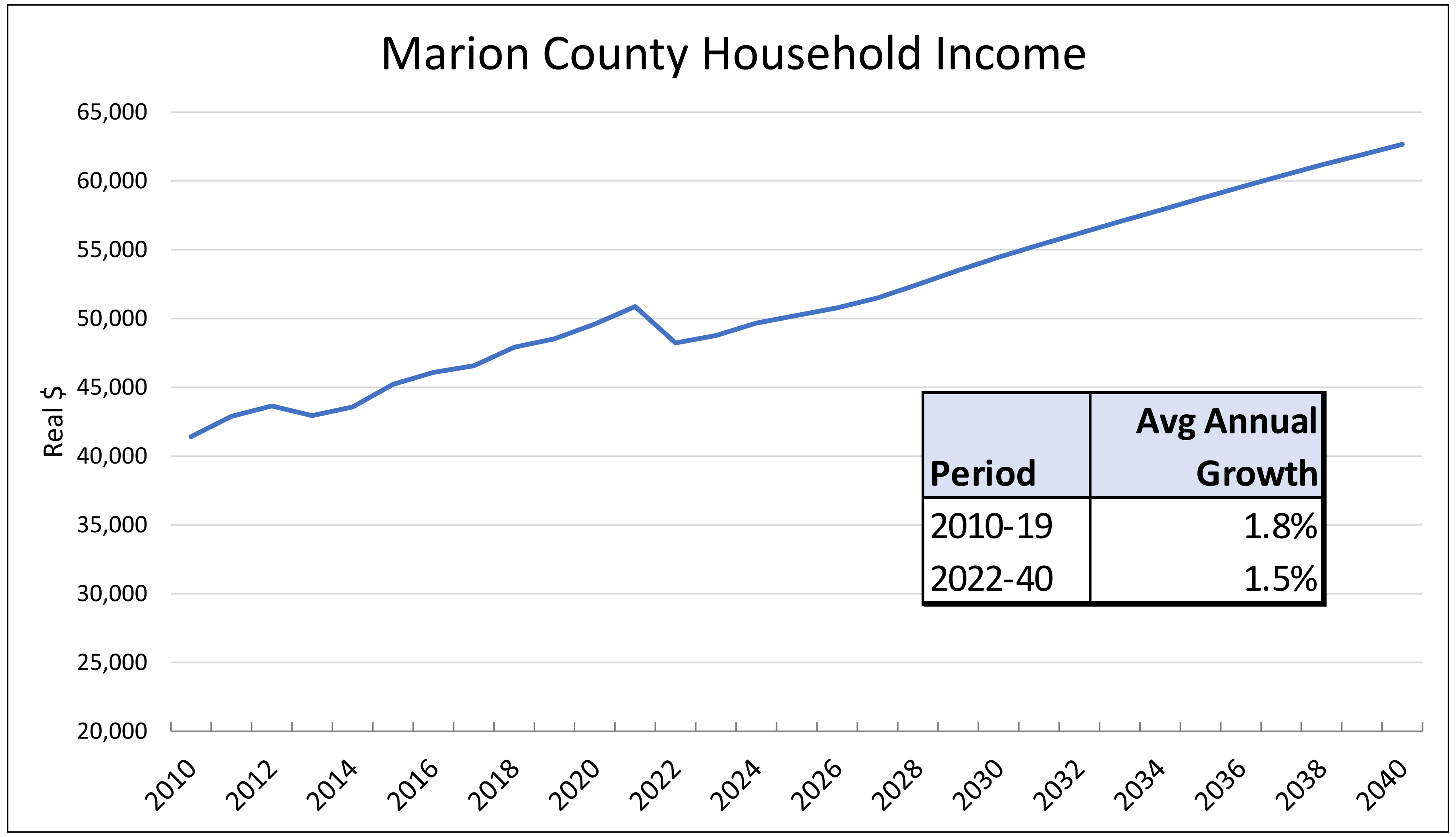
Residential Economic Drivers



Period	**Avg Annual Growth**
2010-19	0.7%
2022-40	0.6%

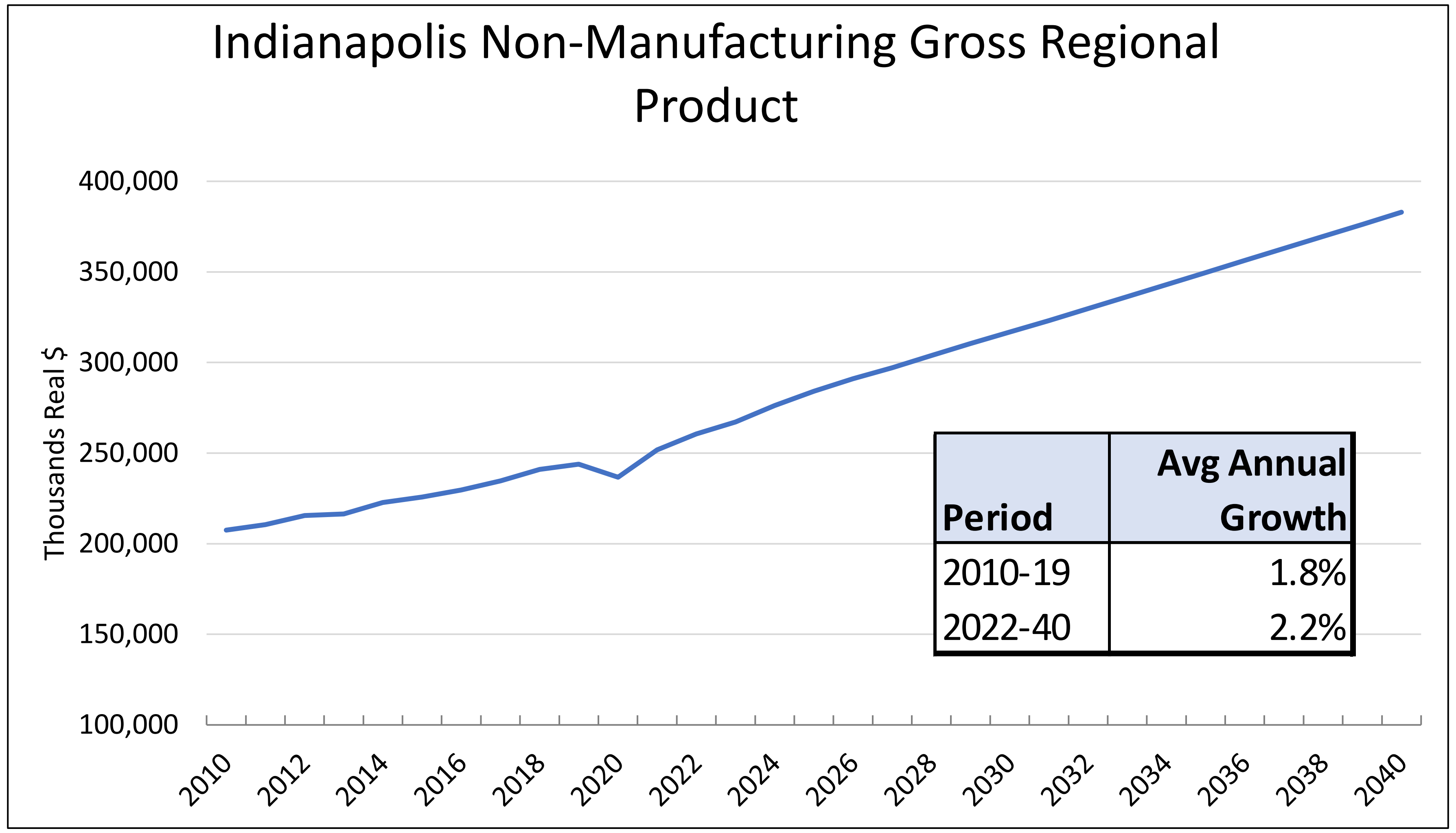
- → Moody Analytics (August 2021), economic forecast for Marion County.
- → Population projections drive the residential customer forecast. Expected population growth slightly slower than the last ten years.

- → Household income influences customer use.
- → Real income growth slightly lower than prior ten-years.

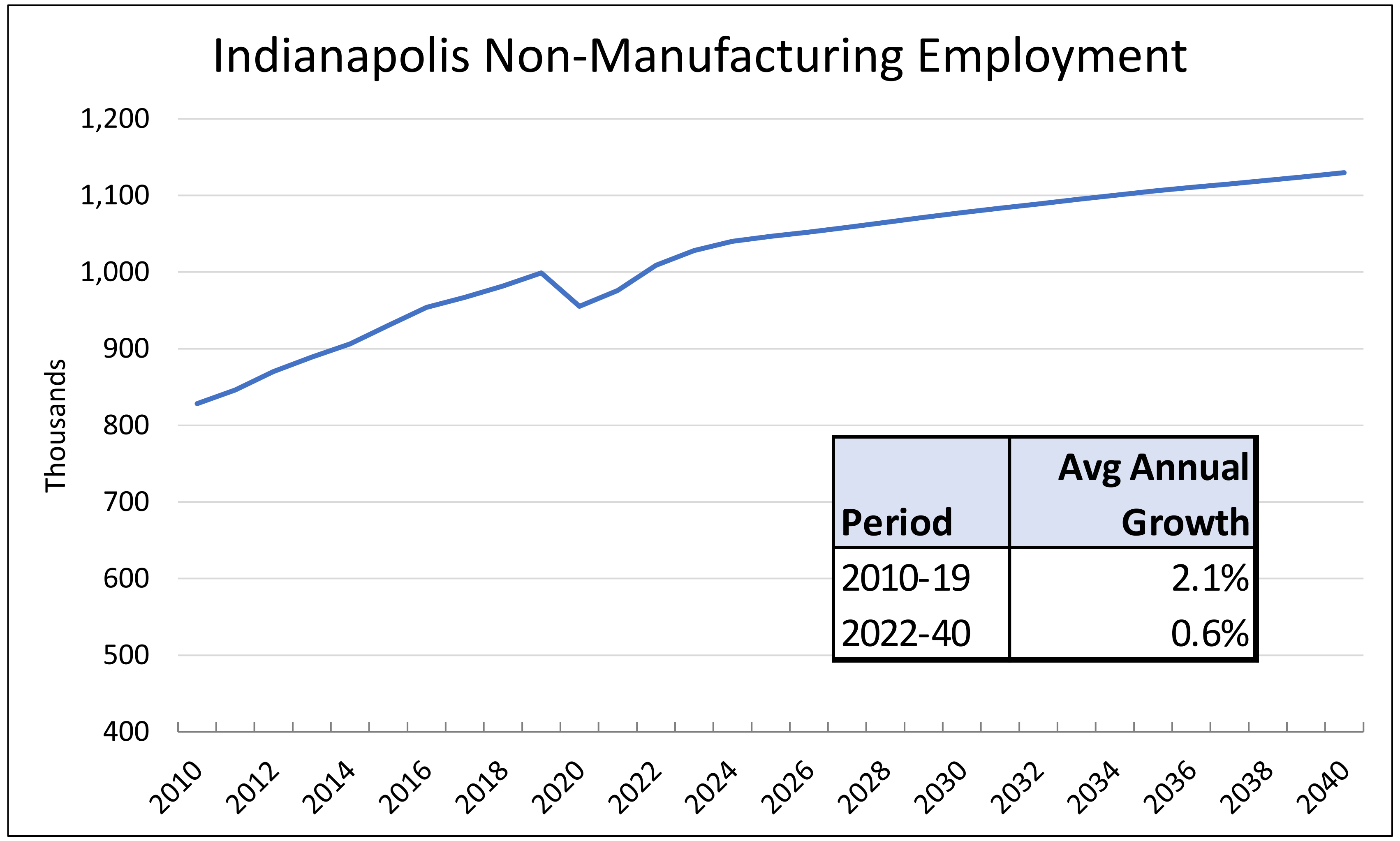


Period	**Avg Annual Growth**
2010-19	1.8%
2022-40	1.5%

C&I Economic Drivers



Period	Avg Annual Growth
2010-19	1.8%
2022-40	2.2%



Period	Avg Annual Growth
2010-19	2.1%
2022-40	0.6%

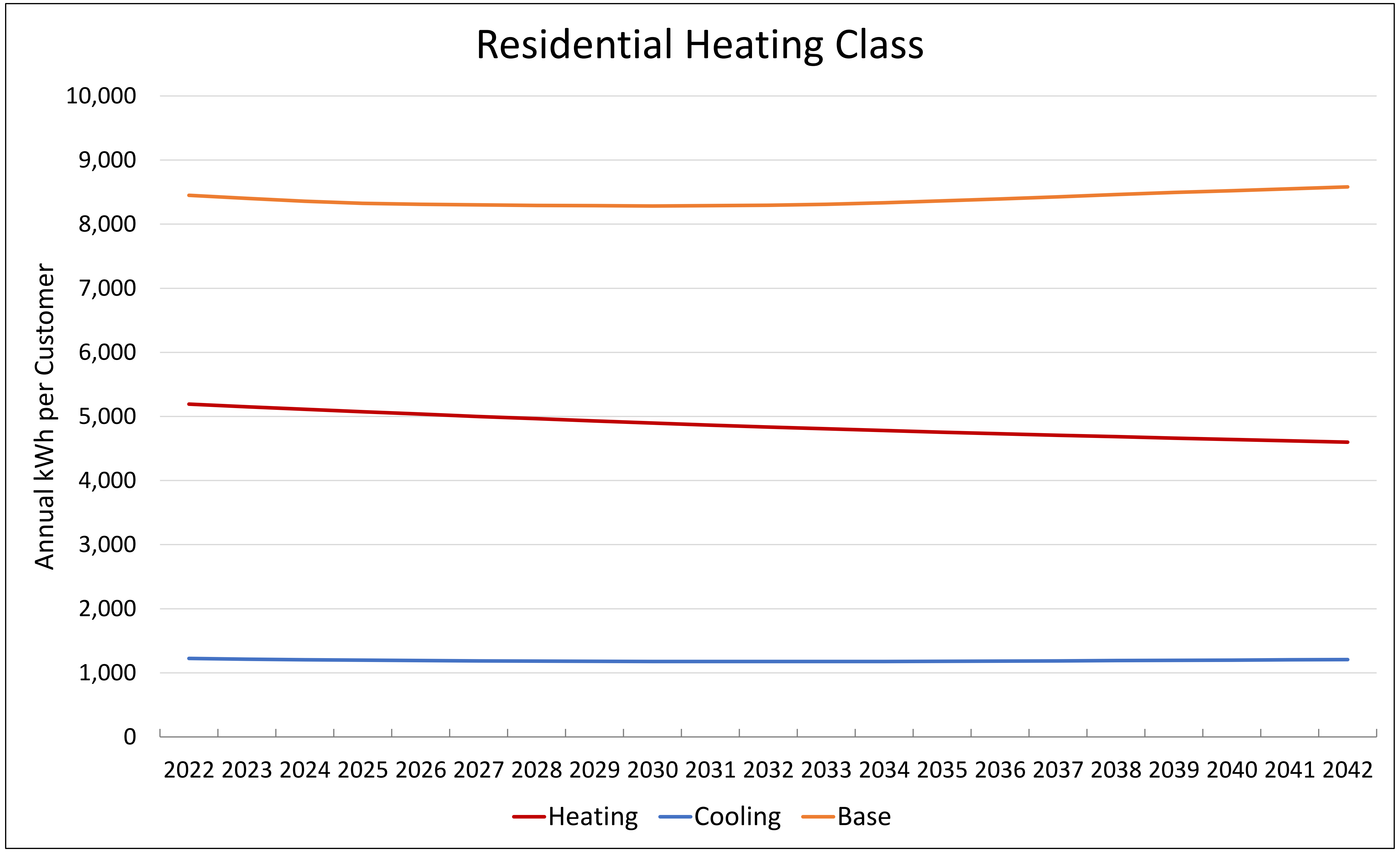
→Non-manufacturing output tracks U.S. growth

→Slower employment growth in the out years. Implies higher long-term productivity.

Residential End-Use Intensity Projections

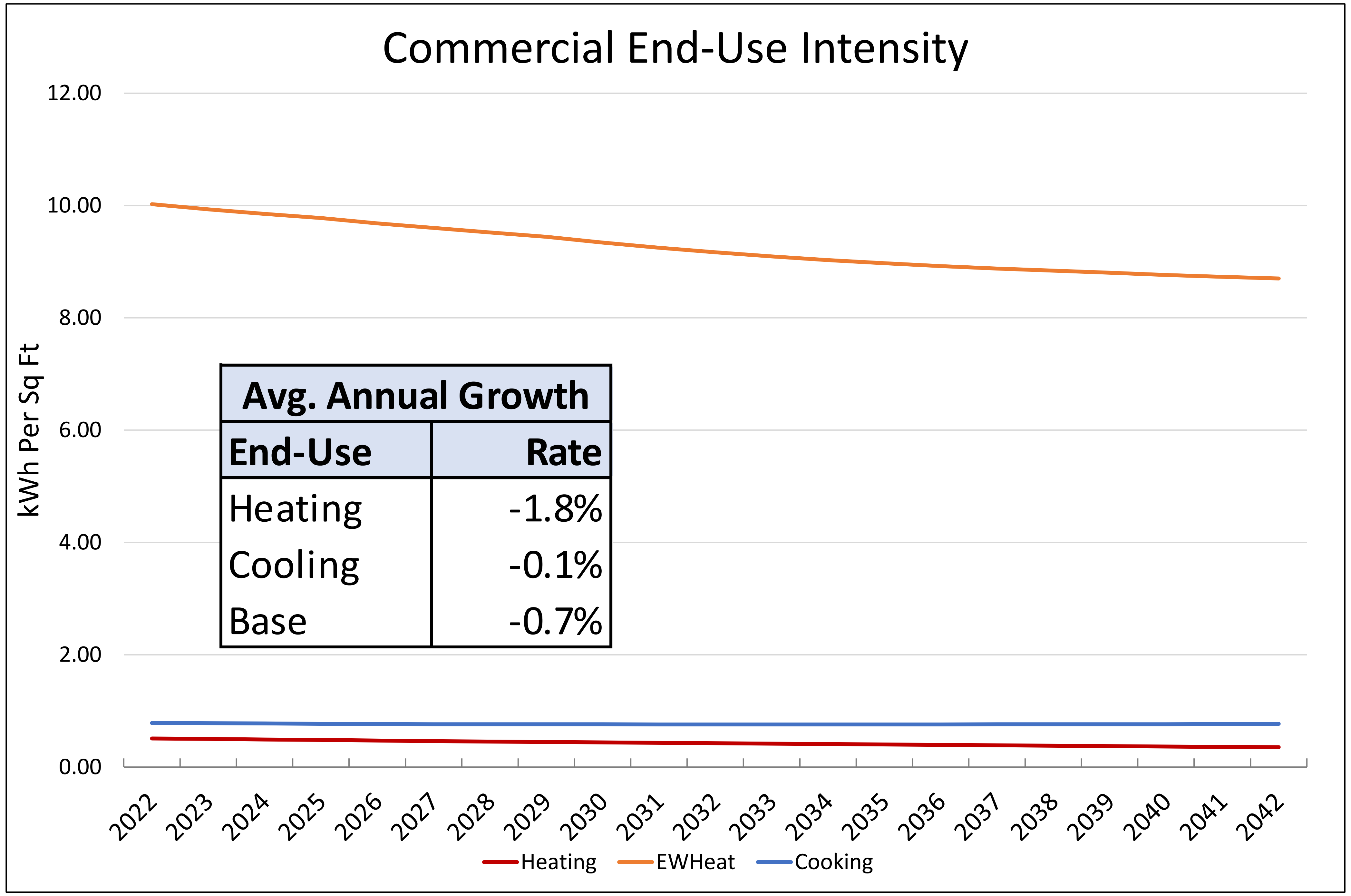
- →End-Use intensities based on end-use saturation and average stock efficiency derived from EIA' Annual Energy Outlook (AEO) for East North Central Census Division.
- →Residential calibrated to AES service area based on historical appliance saturation surveys and DSM potential study.

Avg. Annual Growth	
End-Use	**Rate**
Heating	-0.6%
Cooling	-0.1%
Base	0.1%



Commercial End-Use Intensity Projections

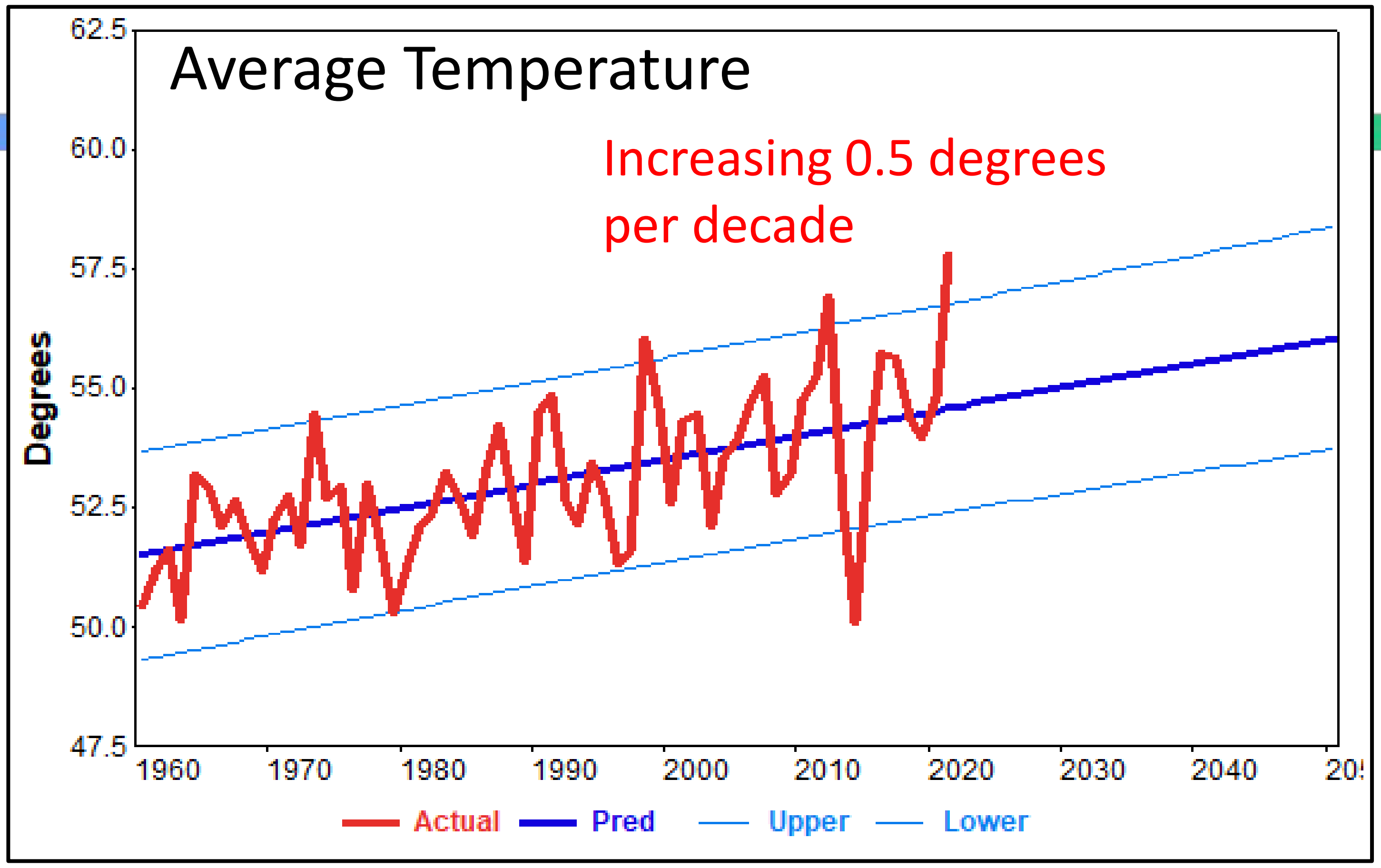
- →End-Use intensities (kWh per square ft) projected for 9 end-uses and 11 building types
- →Derived from EIA' Annual Energy Outlook (AEO) for East North Central Census Division.
- →Building-type intensities weighted to the AES service area based on AES commercial sales
- →Projected efficiency gains in lighting and ventilation have the largest impact on base use



Avg. Annual Growth	
End-Use	**Rate**
Heating	-1.8%
Cooling	-0.1%
Base	-0.7%

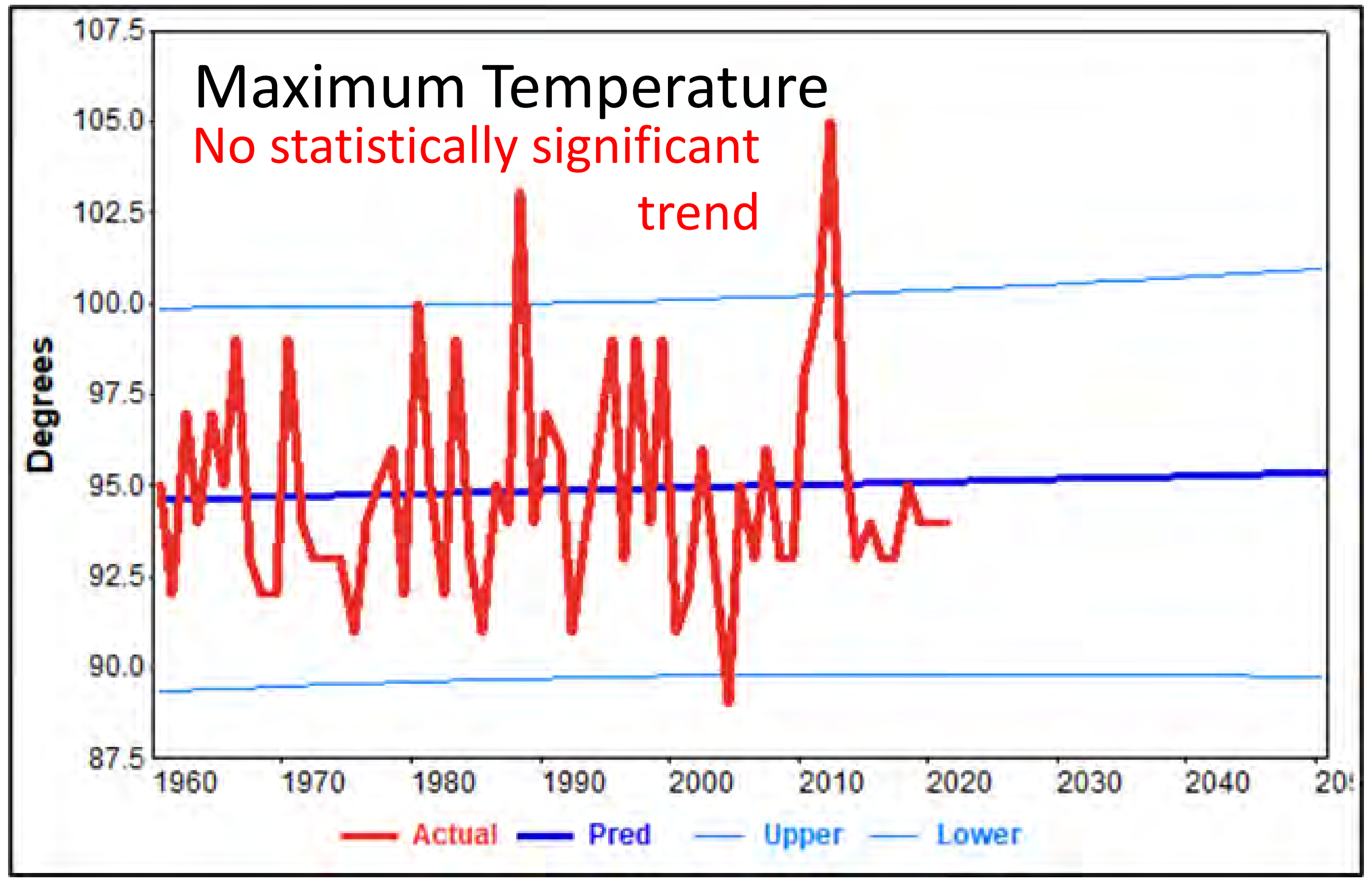
Temperature Trends

- → Average annual temperature is increasing .05 degrees per year or 0.5 degrees per decade.
- → Consistent with temperature trends across the country 0.4 degrees to 1.0 degrees per decade.
- → Minimum temperature increasing twice as fast as the average temperature. No increase in the maximum temperature.



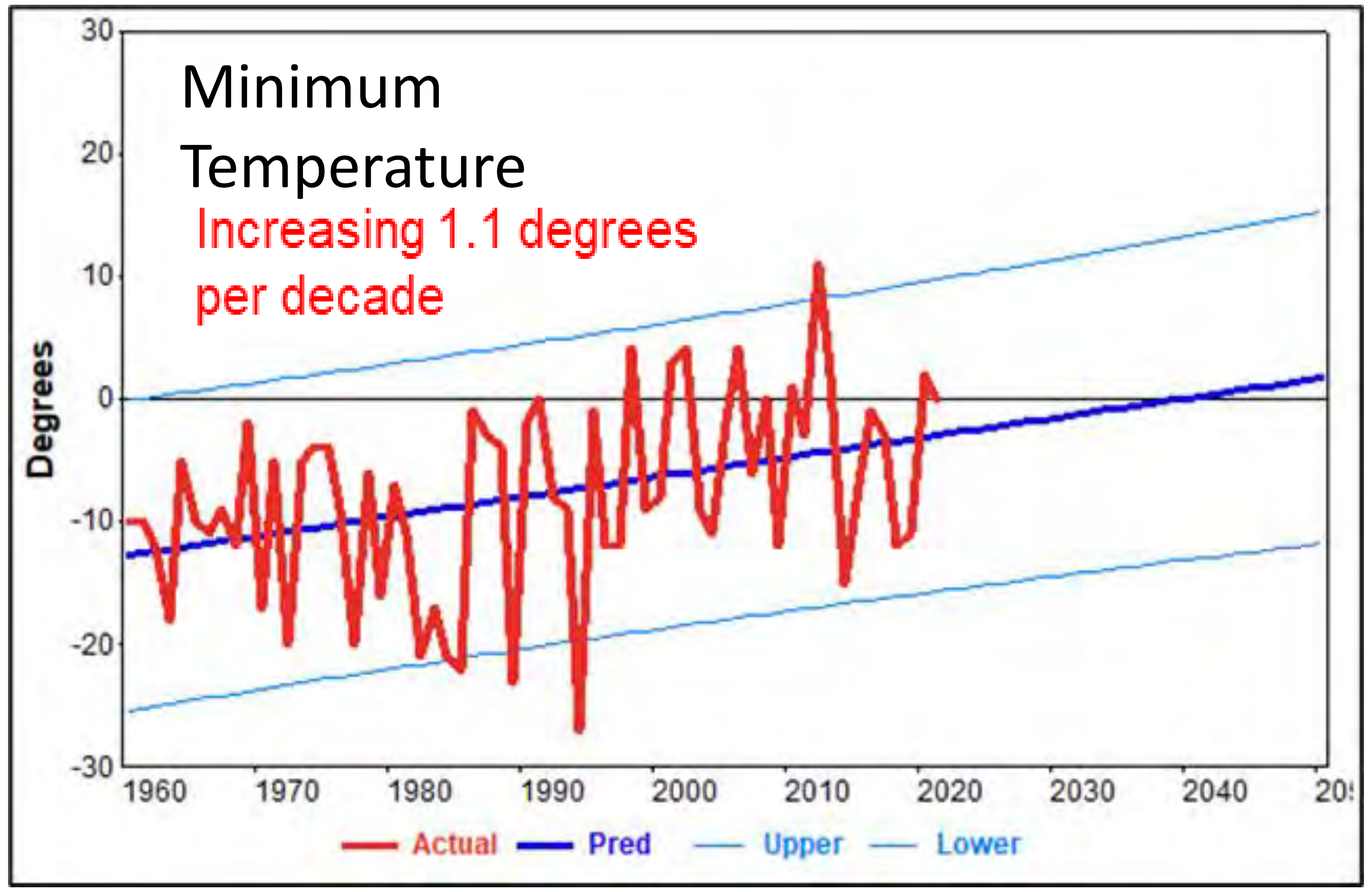
Average Temperature

Increasing 0.5 degrees per decade



Maximum Temperature

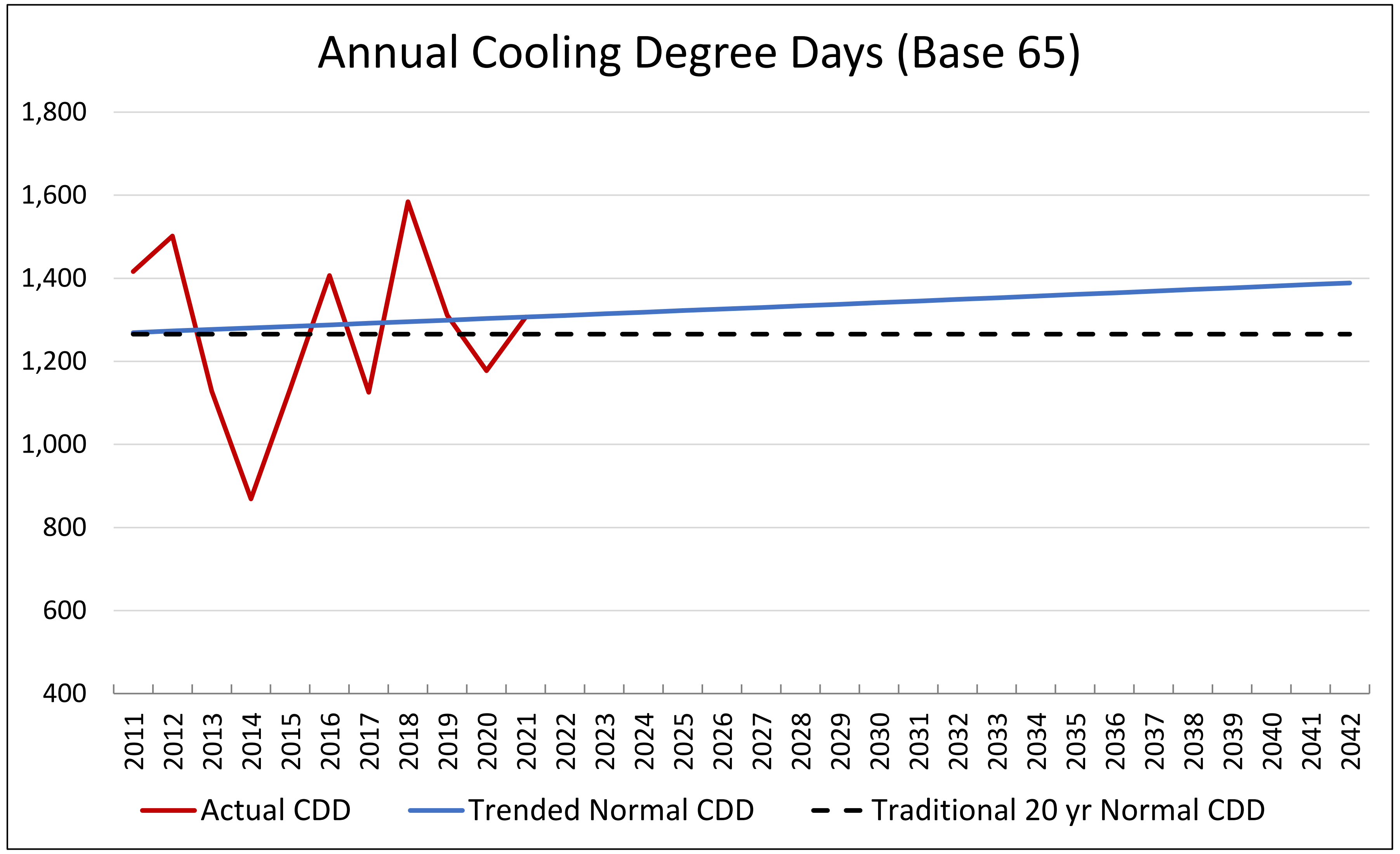
No statistically significant trend



Minimum Temperature

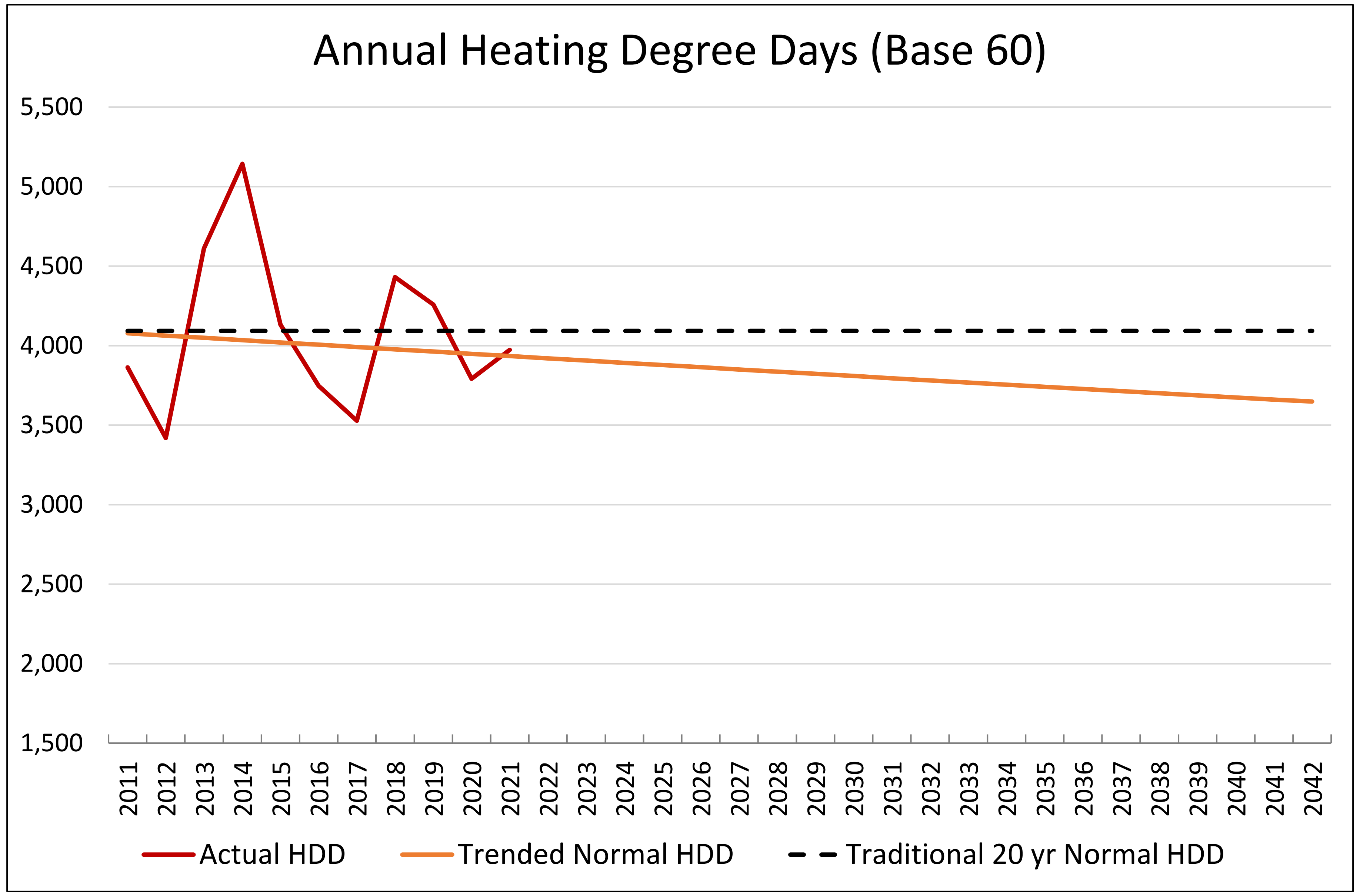
Increasing 1.1 degrees per decade

Trending Degree Days

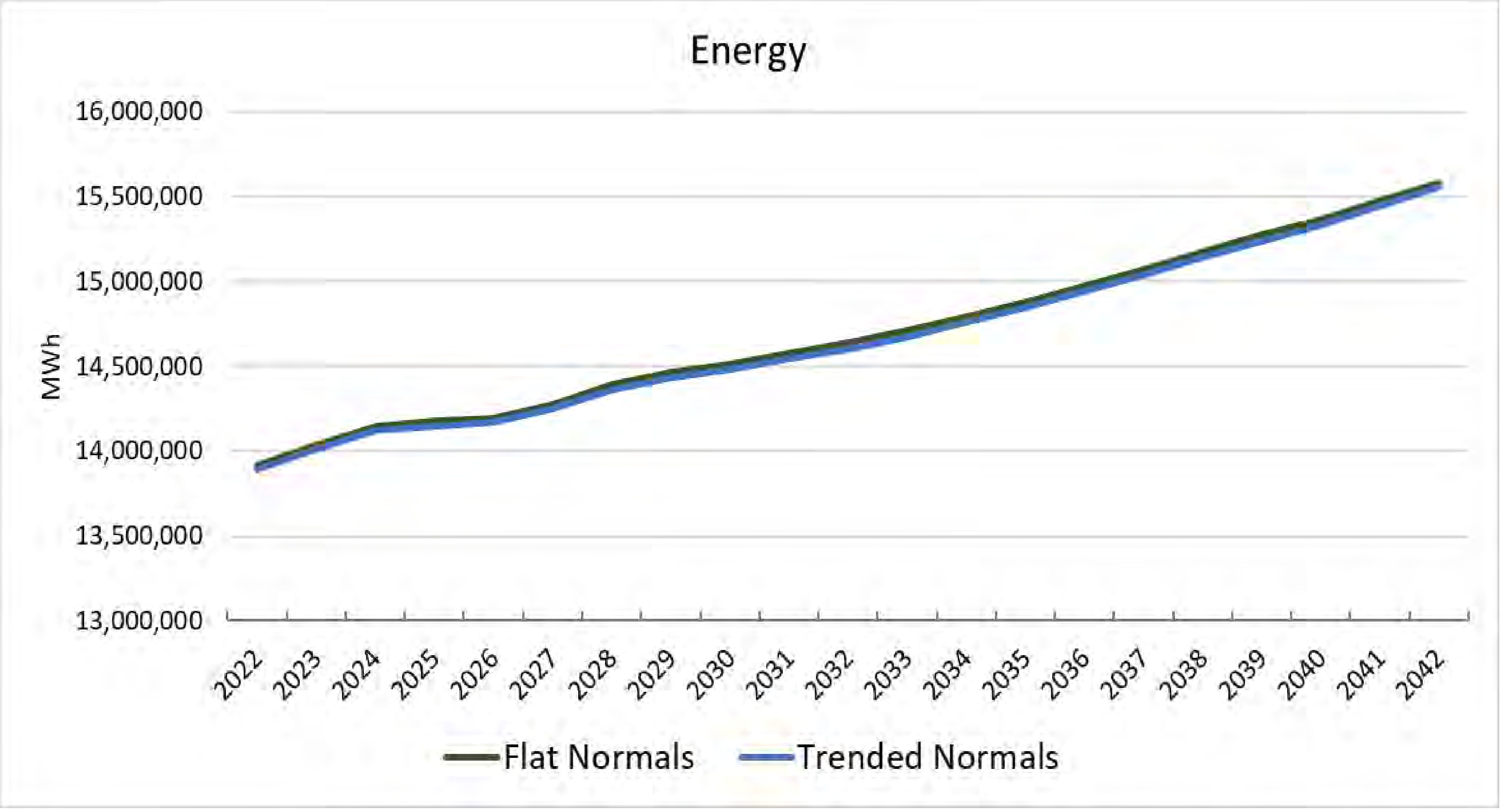


Increasing average temperature translates into 0.3% annual growth in cooling degree days.

And 0.4% annual decline in heating degree days.



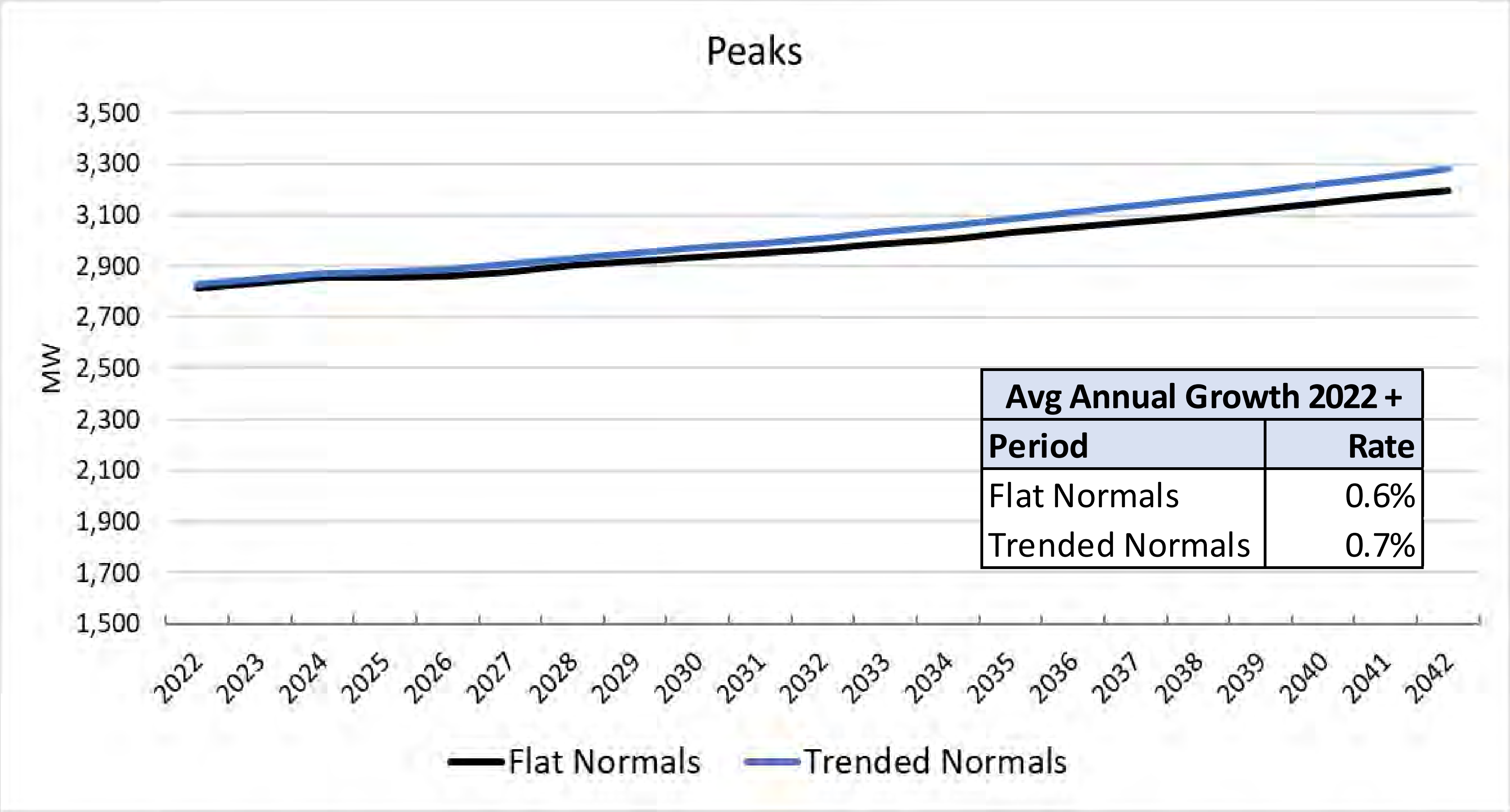
Impact of Increasing Temperatures



→Little change in energy requirements as increase in cooling loads is offset by decrease in heating loads.

→Increasing temperatures contribute to cooling load growth in turn driving system peak demand.

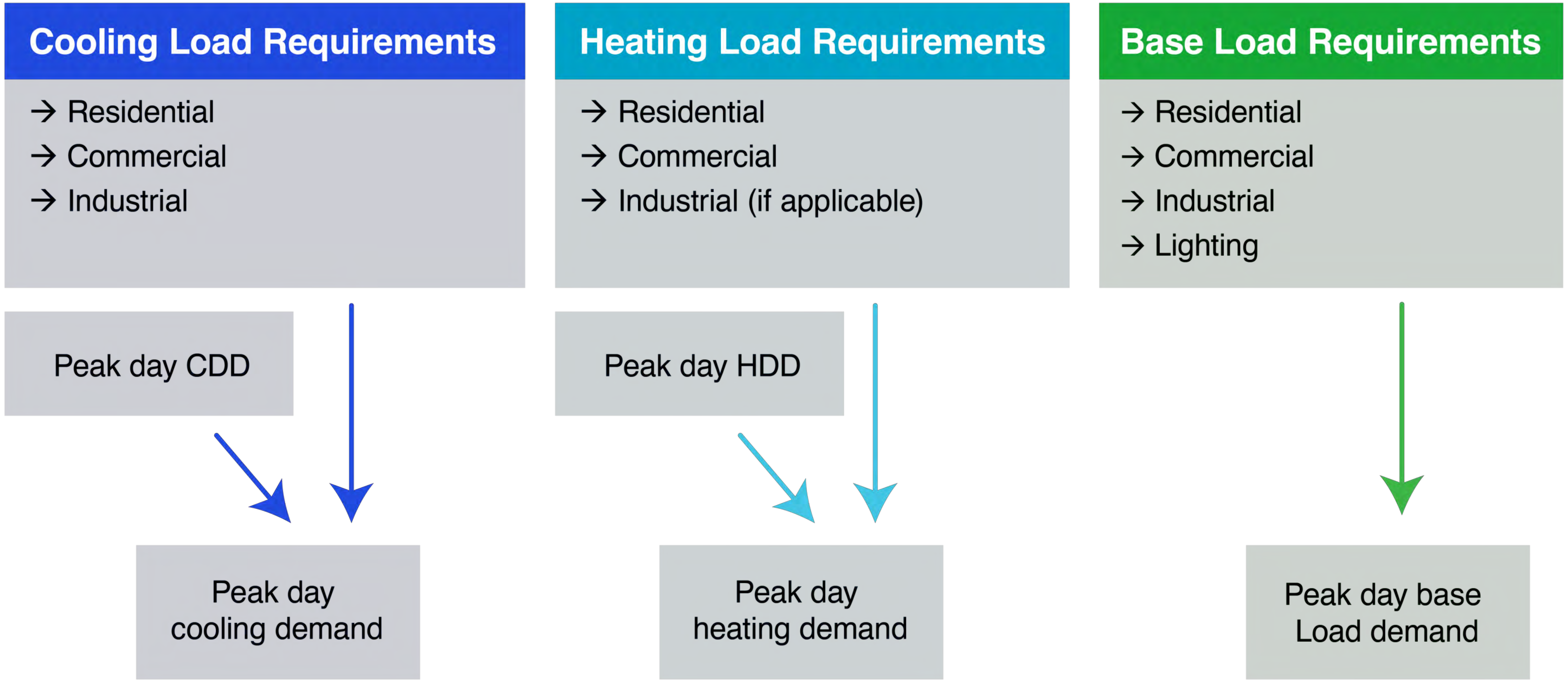
→0.05% annual temperature change contributes to 0.1% annual increase in baseline peak demand adding 82 MW by 2042.



Avg Annual Growth 2022 +	
Period	**Rate**
Flat Normals	0.6%
Trended Normals	0.7%

Peak Model

Peak demand is driven by heating, cooling, and base load requirements derived from the rate class sales forecast models.



Cooling Load Requirements

- → Residential
- → Commercial
- → Industrial

Peak day CDD

Peak day cooling demand

Heating Load Requirements

- → Residential
- → Commercial
- → Industrial (if applicable)

Peak day HDD

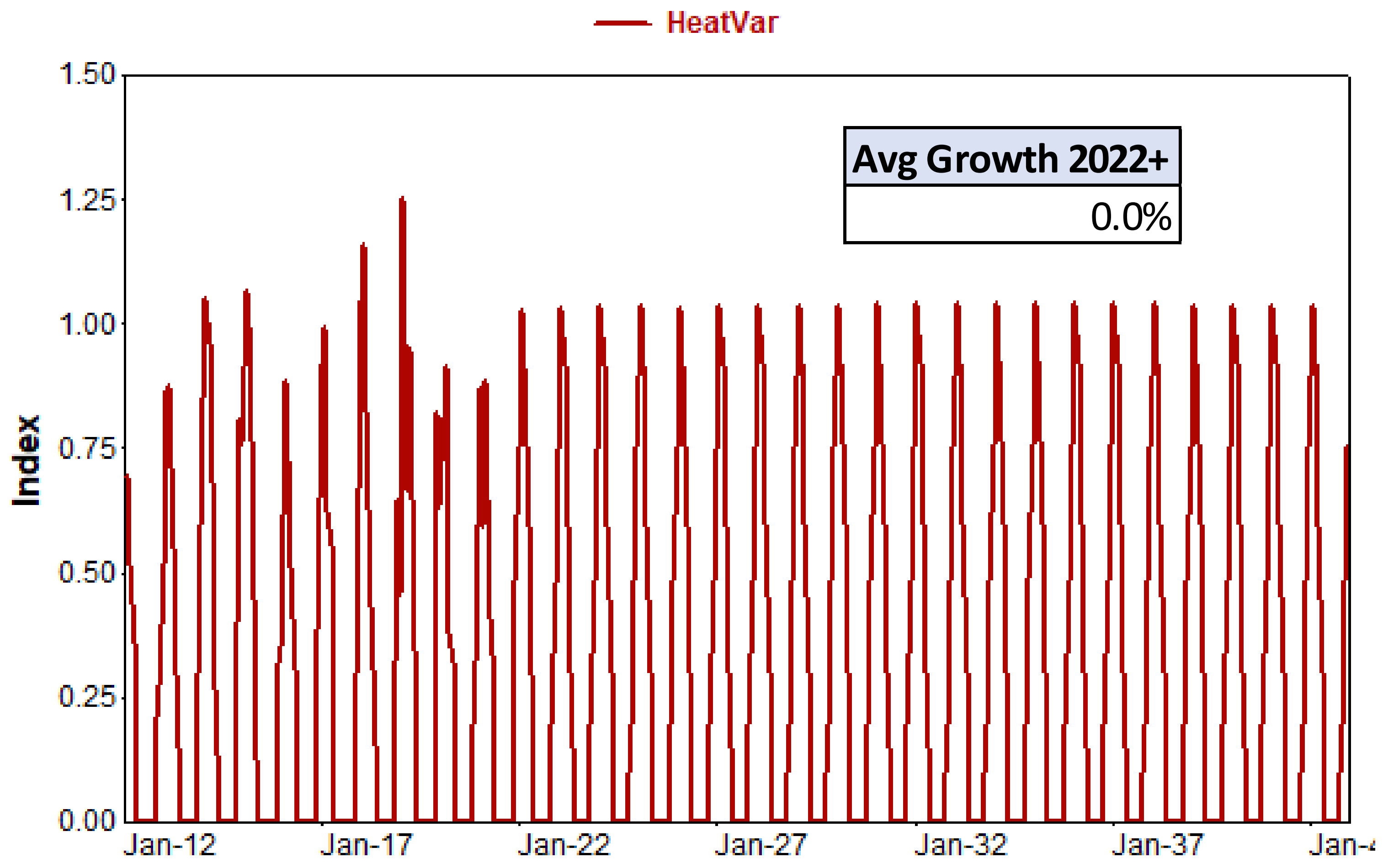
Peak day heating demand

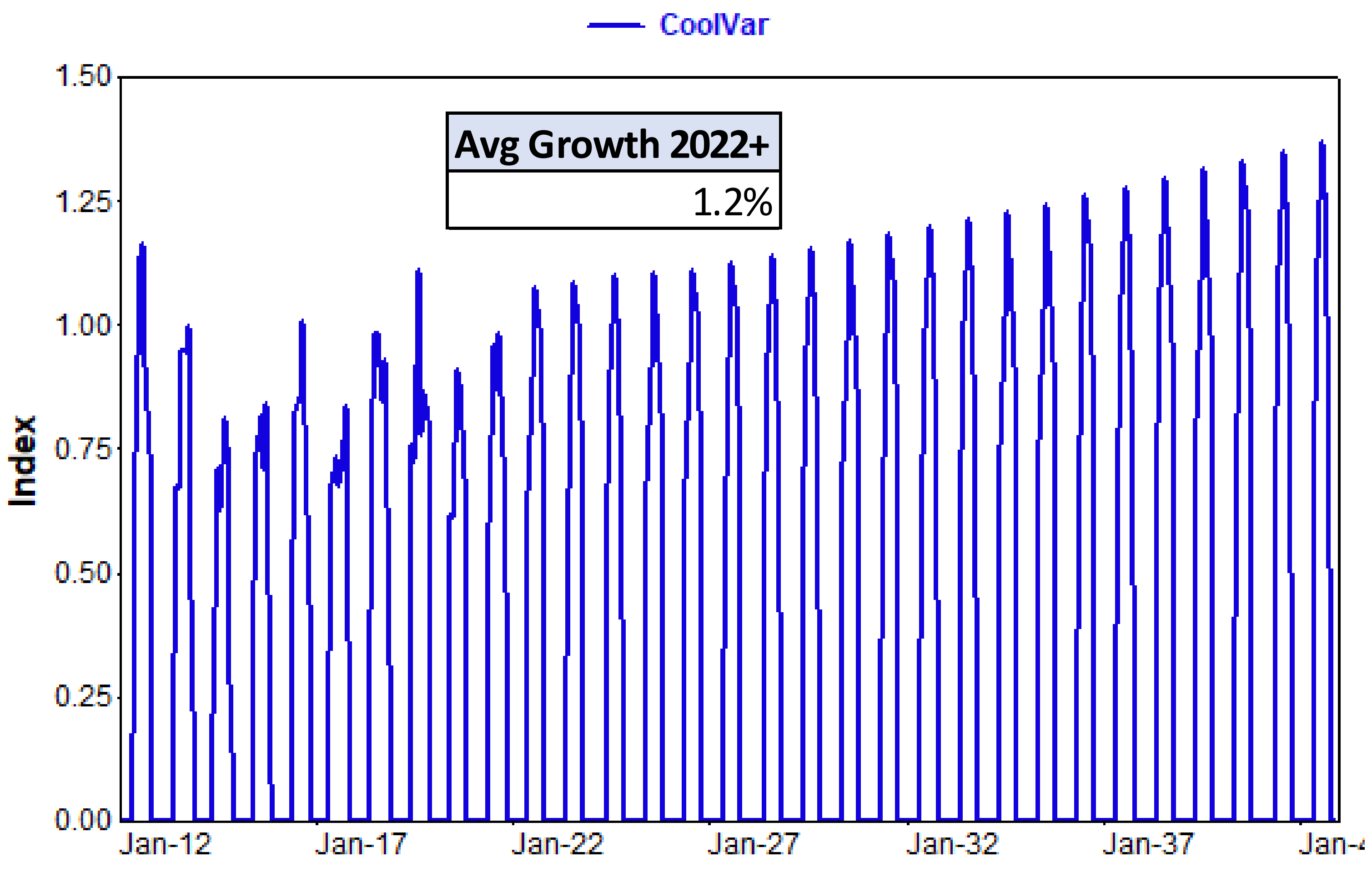
Base Load Requirements

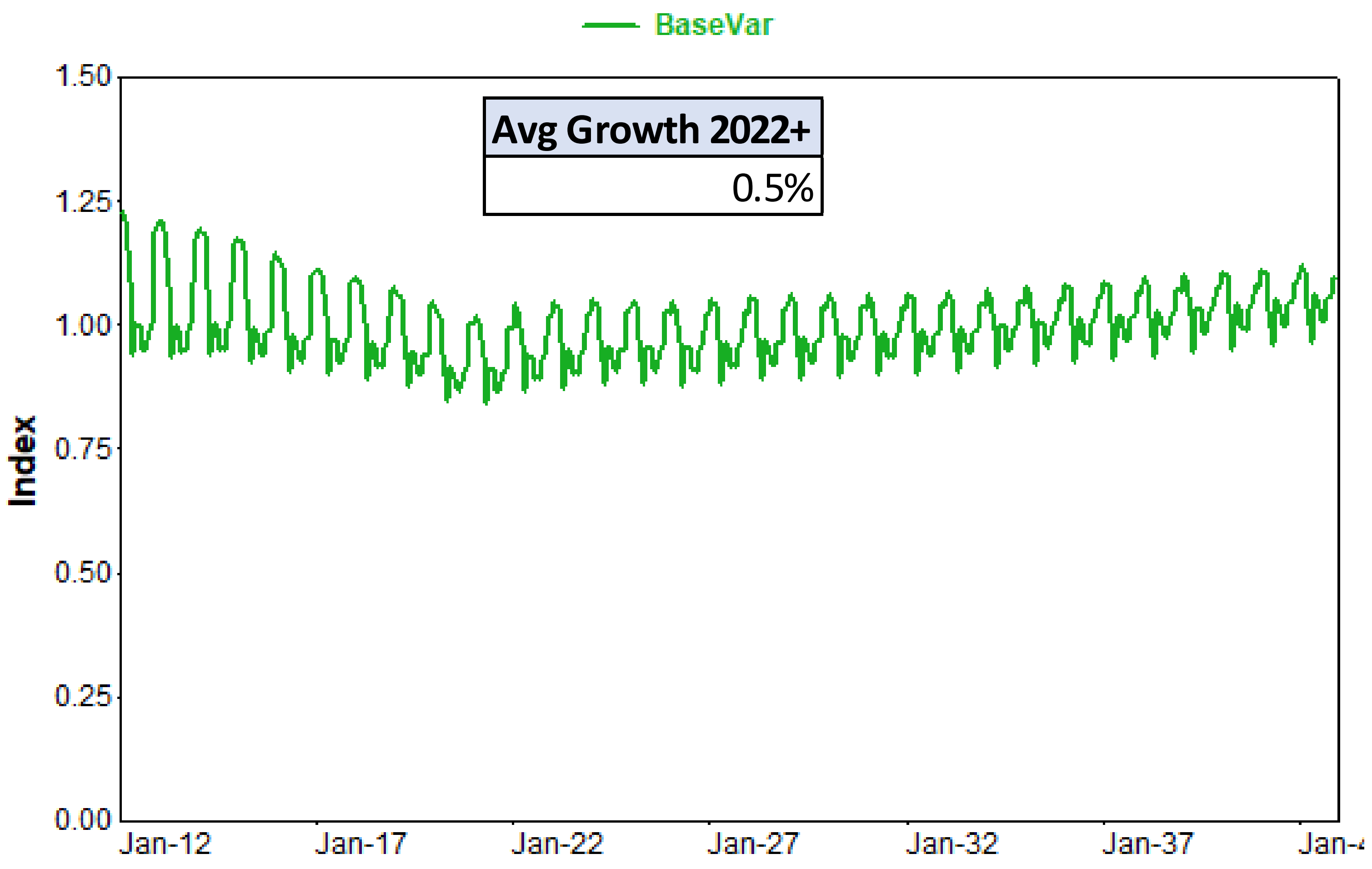
- → Residential
- → Commercial
- → Industrial
- → Lighting

Peak day base Load demand

Peak Model Drivers





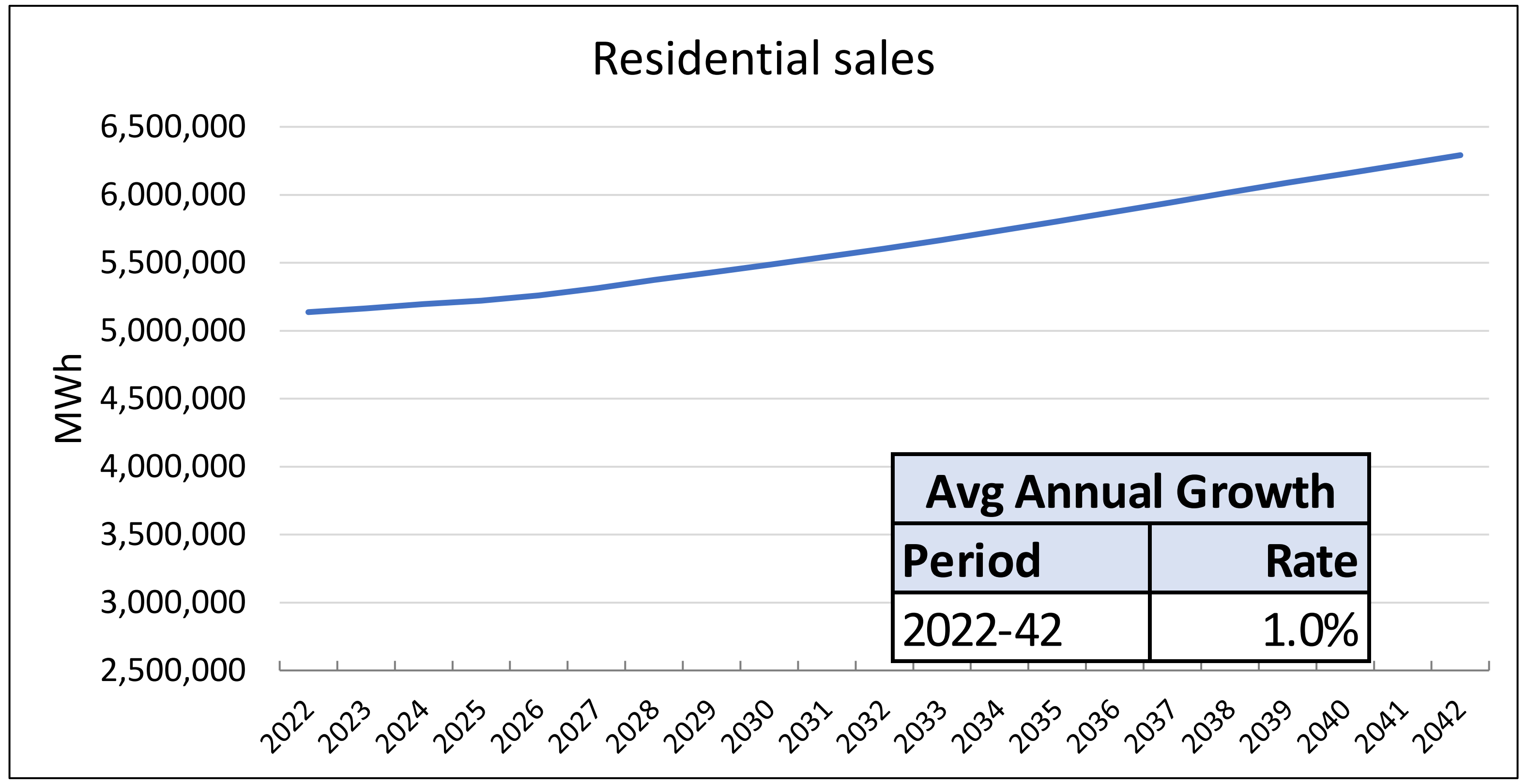


→Heating, cooling, and base-use energy requirements derived from sales forecast models.

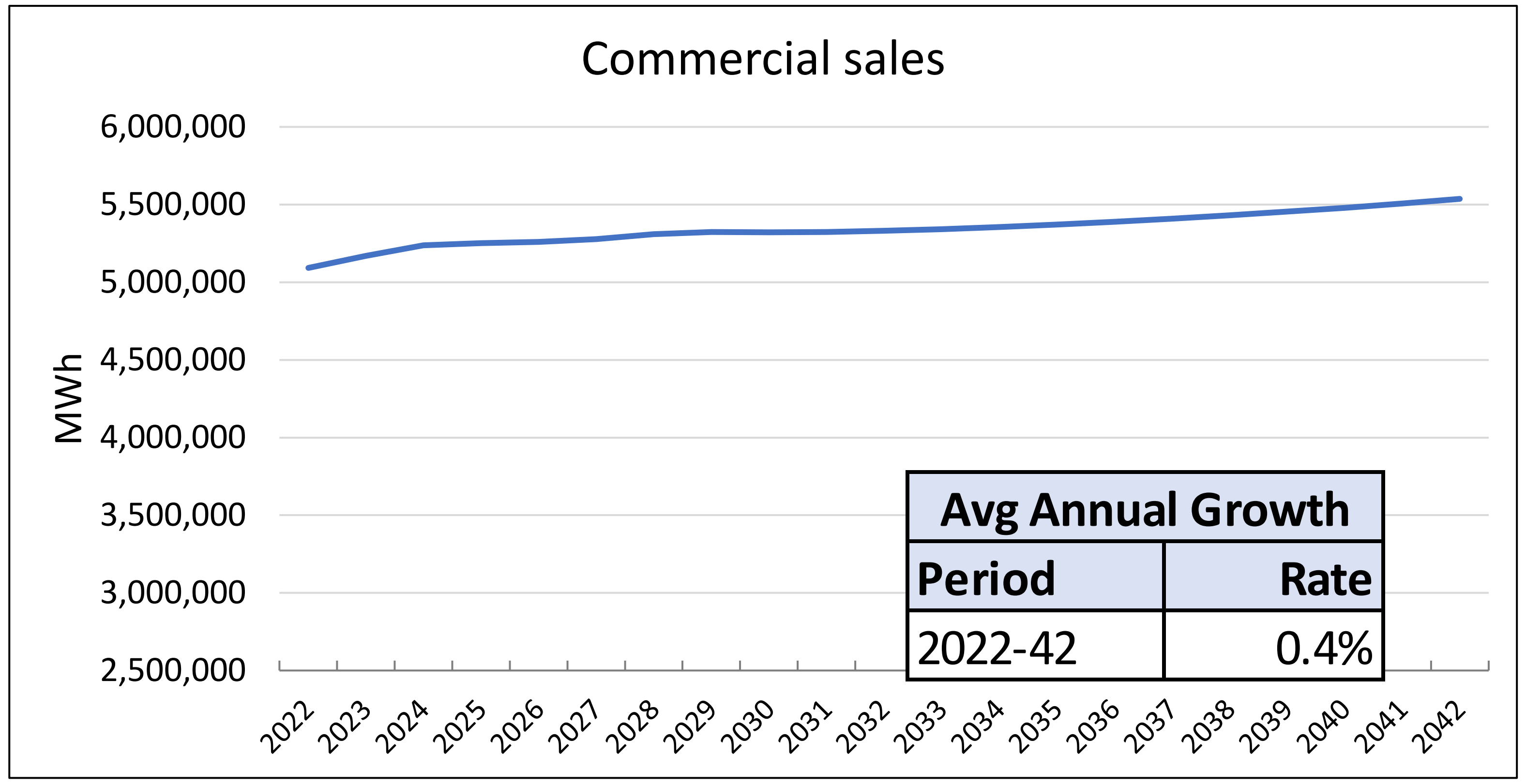
→Base-use energy allocated to end-use coincident peak loads. Highest load in winter – lighting load.

Baseline Forecast

Baseline Class Sales Forecast



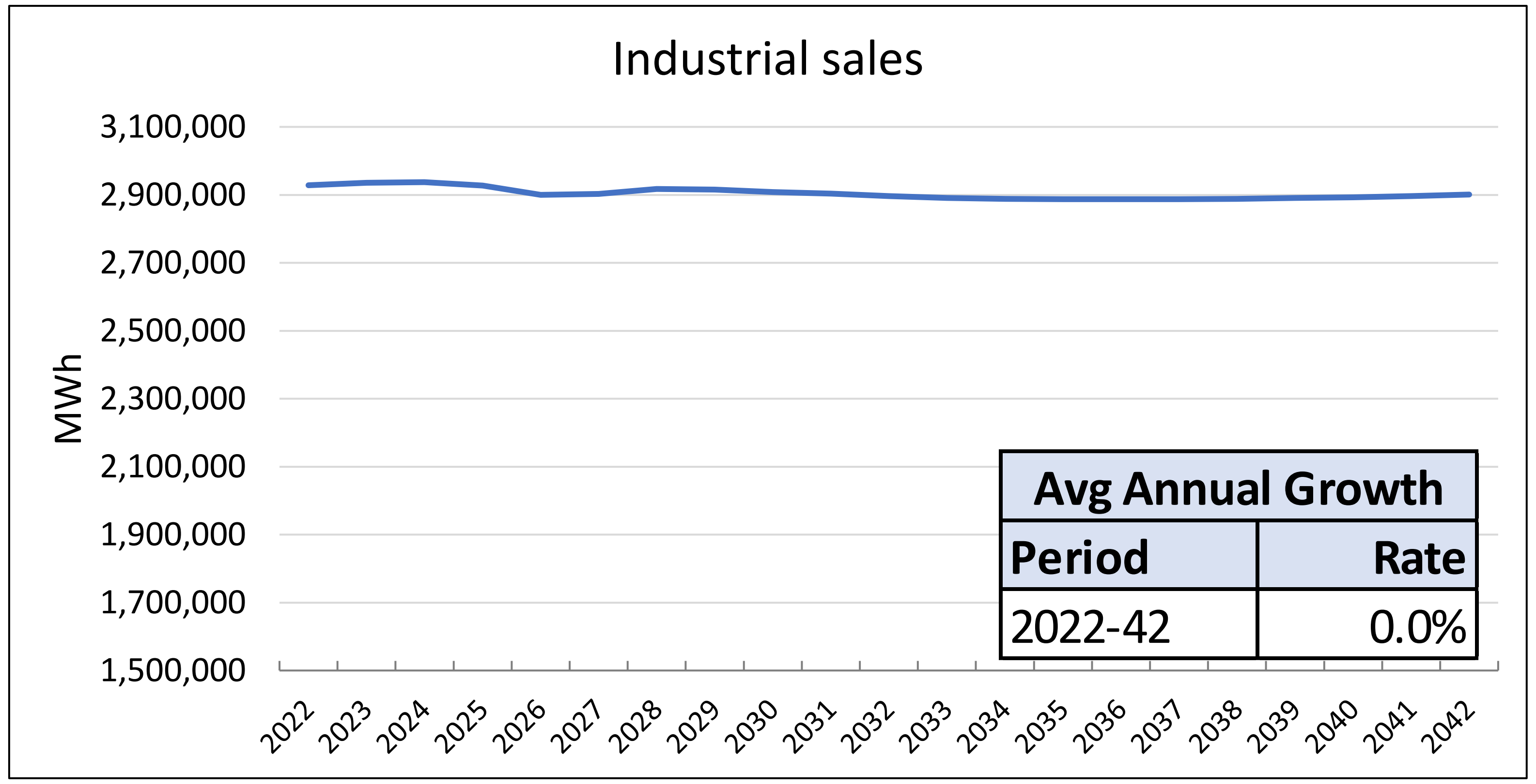
Avg Annual Growth	
Period	**Rate**
2022-42	1.0%



Avg Annual Growth	
Period	**Rate**
2022-42	0.4%

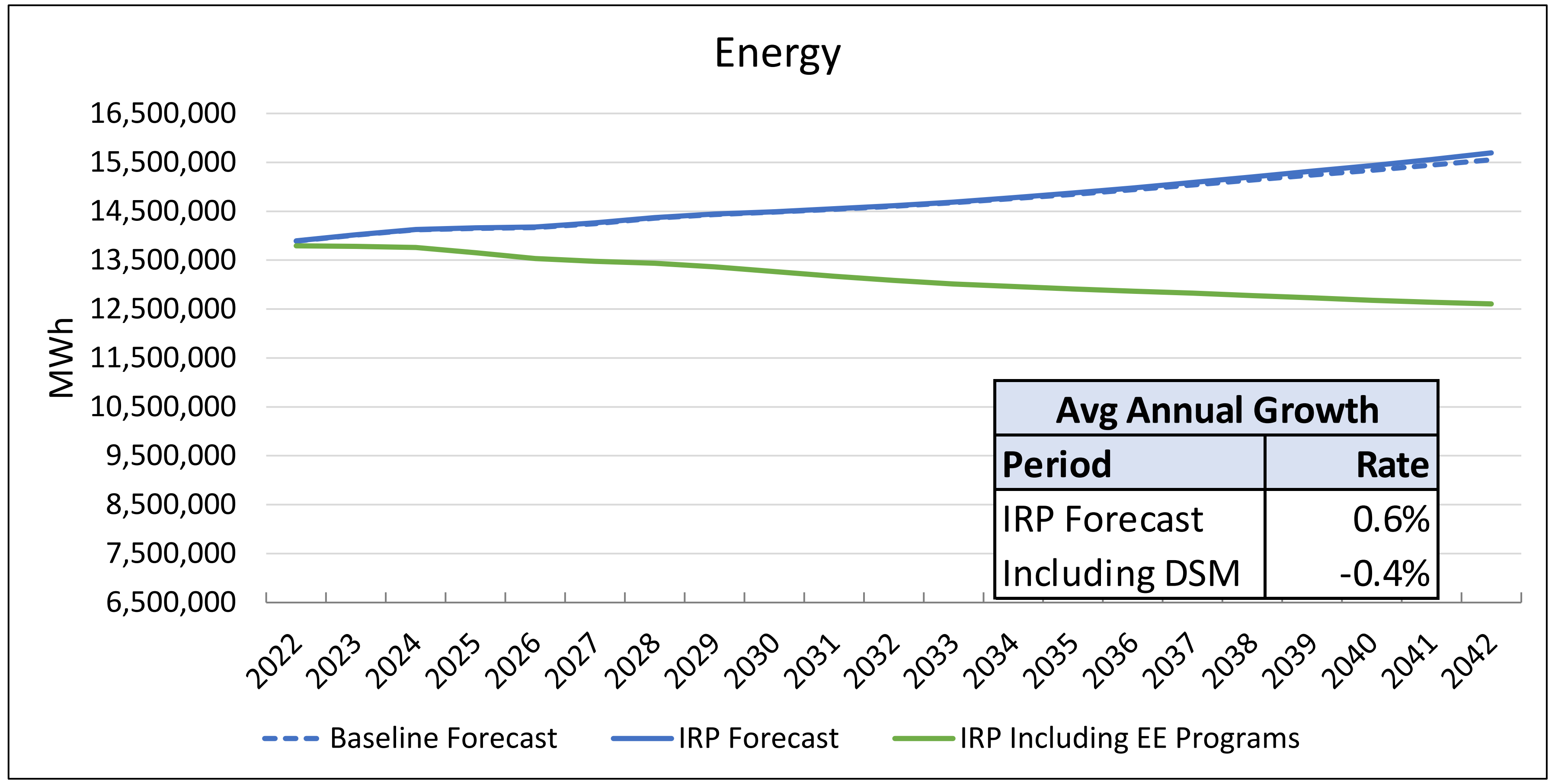
→Excludes

- Future Energy Efficiency Program savings
- Electric vehicle charging loads
- Future Behind-the-Meter solar adoption

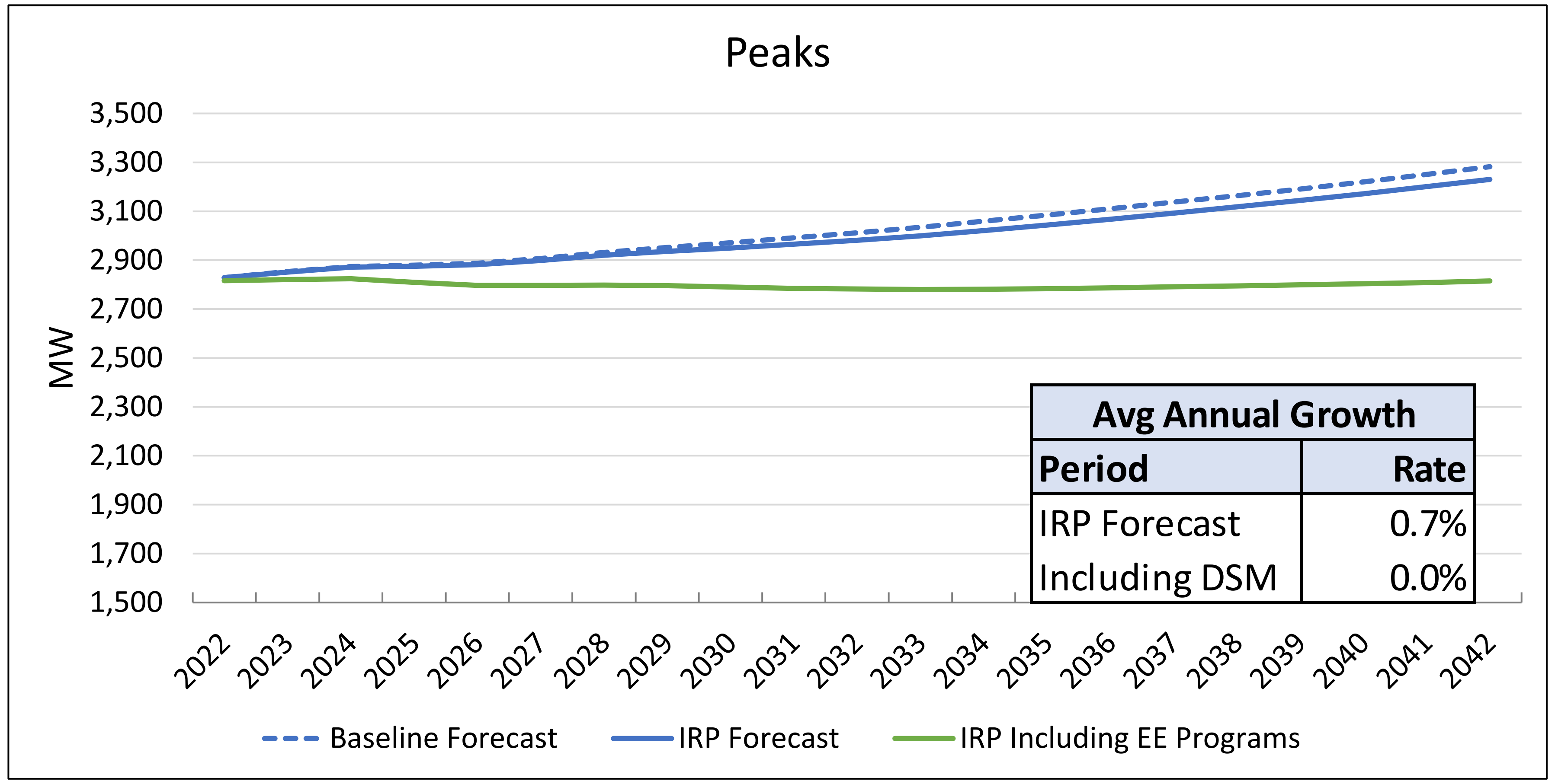


Avg Annual Growth	
Period	**Rate**
2022-42	0.0%

Energy & Peak Forecast



Avg Annual Growth	
Period	**Rate**
IRP Forecast	0.6%
Including DSM	-0.4%



Avg Annual Growth	
Period	**Rate**
IRP Forecast	0.7%
Including DSM	0.0%

- Baseline Forecast excludes energy efficiency programs (EE), electric vehicles, and solar impact
- IRP Forecast includes the impact of electric vehicles and solar but excludes EE
- Green line shows energy and peak demand with future EE continuing at current levels
  - With EE, energy and peak trend is consistent with the last ten-years

2022 Integrated Resource Plan (IRP)

Electric Vehicle (EV) and Solar PV Forecasts

Presented by IRP Partners

GDS Associates, Inc.
ENGINEERS & CONSULTANTS

brightline GROUP

aes Indiana

Introduction to the GDS team

GDS will serve as the prime contractor for these studies. GDS is a privately-held multi-service engineering and consulting firm, with more than 175 employees. Our broad range of expertise focuses on clients associated with, or affected by electric, natural gas, water and wastewater utilities. GDS has completed over 75 energy efficiency and demand response potential studies over the last two decades. GDS also has significant experience in: Statistical & Market Research Services, Integrated Resource Planning, Load Forecasting Services, and Regulatory Support Services.

Woman-owned collective of industry experts in DSM program planning and evaluation, with over 60 years of combined experience in the energy efficiency and engineering industry. Members of the Brightline Group has previously worked for GDS on I&M, Ameren Missouri, California POU, and Pennsylvania PUC evaluation and market research projects.

JEFFREY HUBER
Overall Project Manager & MPS Lead
GDS Associates

JACOB THOMAS
Market Research & End-Use Analysis Lead
GDS Associates

PATRICK BURNS
PV Modeling Lead & Regulatory/IRP Support
Brightline Group

MELISSA YOUNG
Demand Response Lead
GDS Associates

JORDAN JANFLONE
EV Modeling/Forecasting
GDS Associates

DSM Market Potential Study Introduction

Electric Vehicle (EV) / Solar PV Forecasts

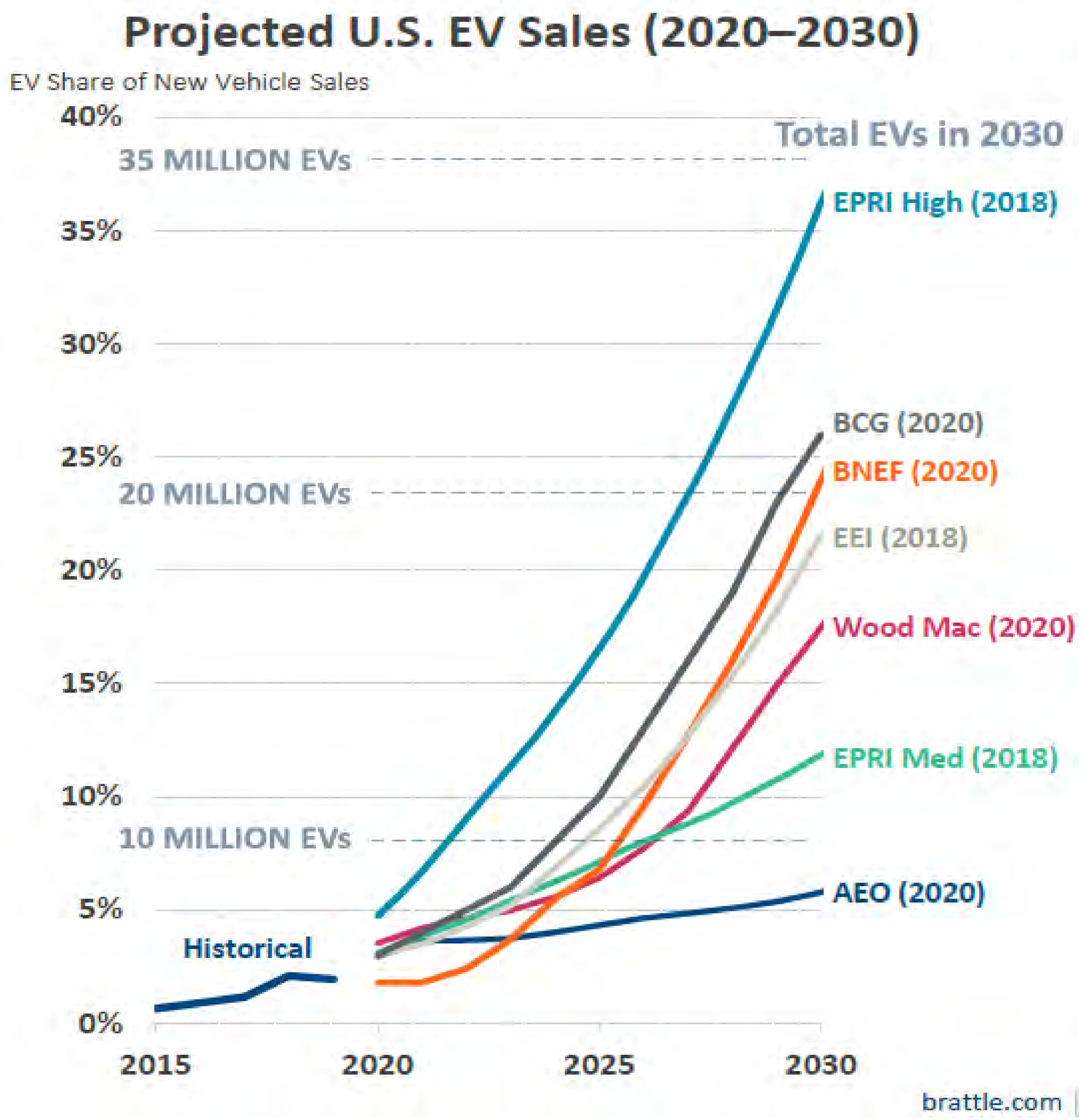
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Jordan Janflone, EV Modeling Forecasting, GDS Associates

Residential Electric Vehicle Forecast

→Goal is to forecast total number of EVs and resulting energy use in AES-IN service territory

→Various assumptions are needed as inputs

→Very broad ranges for EV penetration in the market, various sources have differing opinions and projections



Residential Electric Vehicle Forecast

- →EV Unit forecast informs EV Total Energy Forecast
- →Similar process to a typical customer class forecast

Total number of EVs

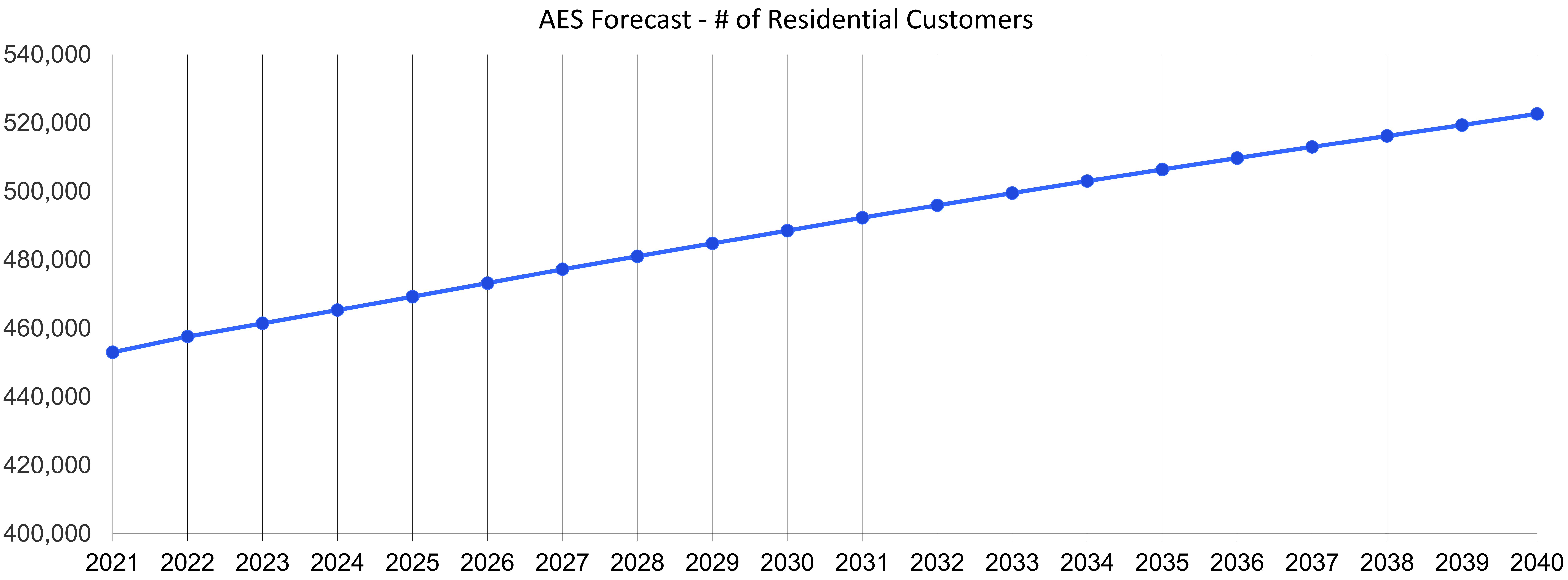
→

Total energy consumed by EVs

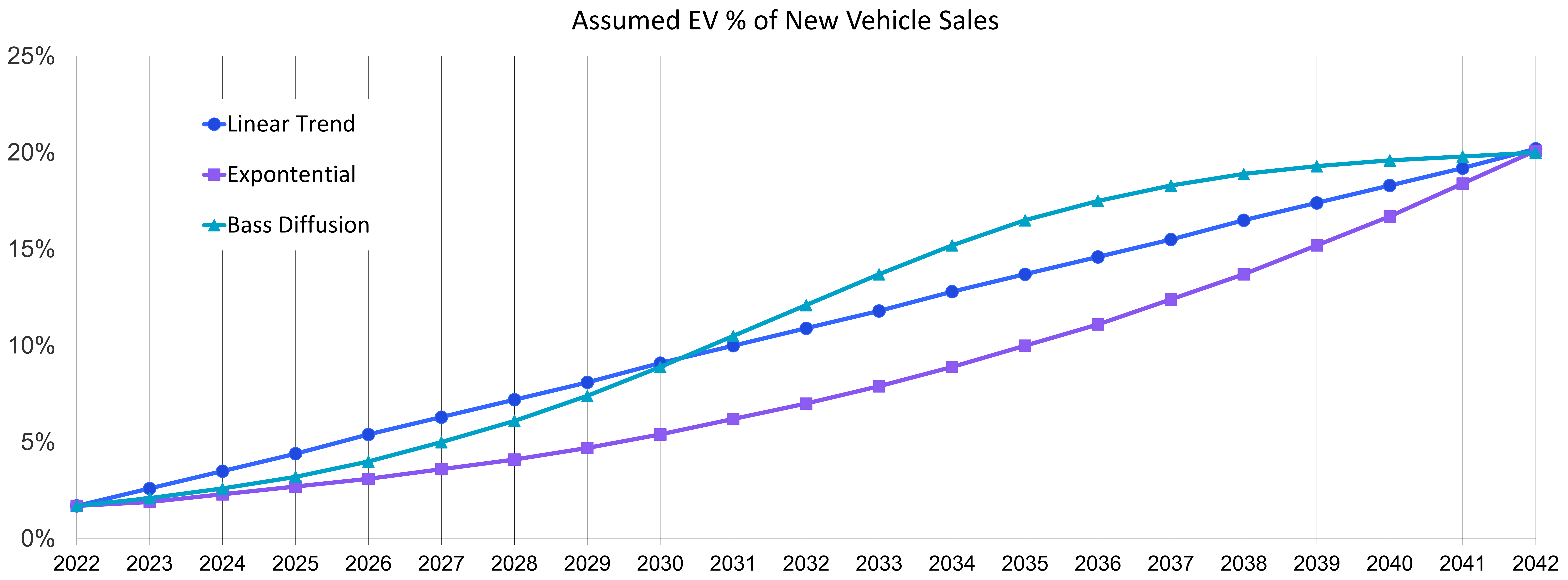
Residential Electric Vehicle Forecast

Input	Source
Number of residential customers	AES-IN Load Forecast
Average number of vehicles per household	U.S. Census – Indianapolis Metropolitan Area
Average vehicle life	U.S. Department of Transportation
Initial number of EVs	EV Registration data from AES-IN
Passenger car to light truck ratio	Energy Information Administration (EIA)
EV sales as percentage of total vehicle sales	Multiple scenarios and studies considered
Average kWh per mile	U.S. Department of Energy
Average miles per year driven by EV	Car & Driver EV Owner Study

Residential Customer Forecast

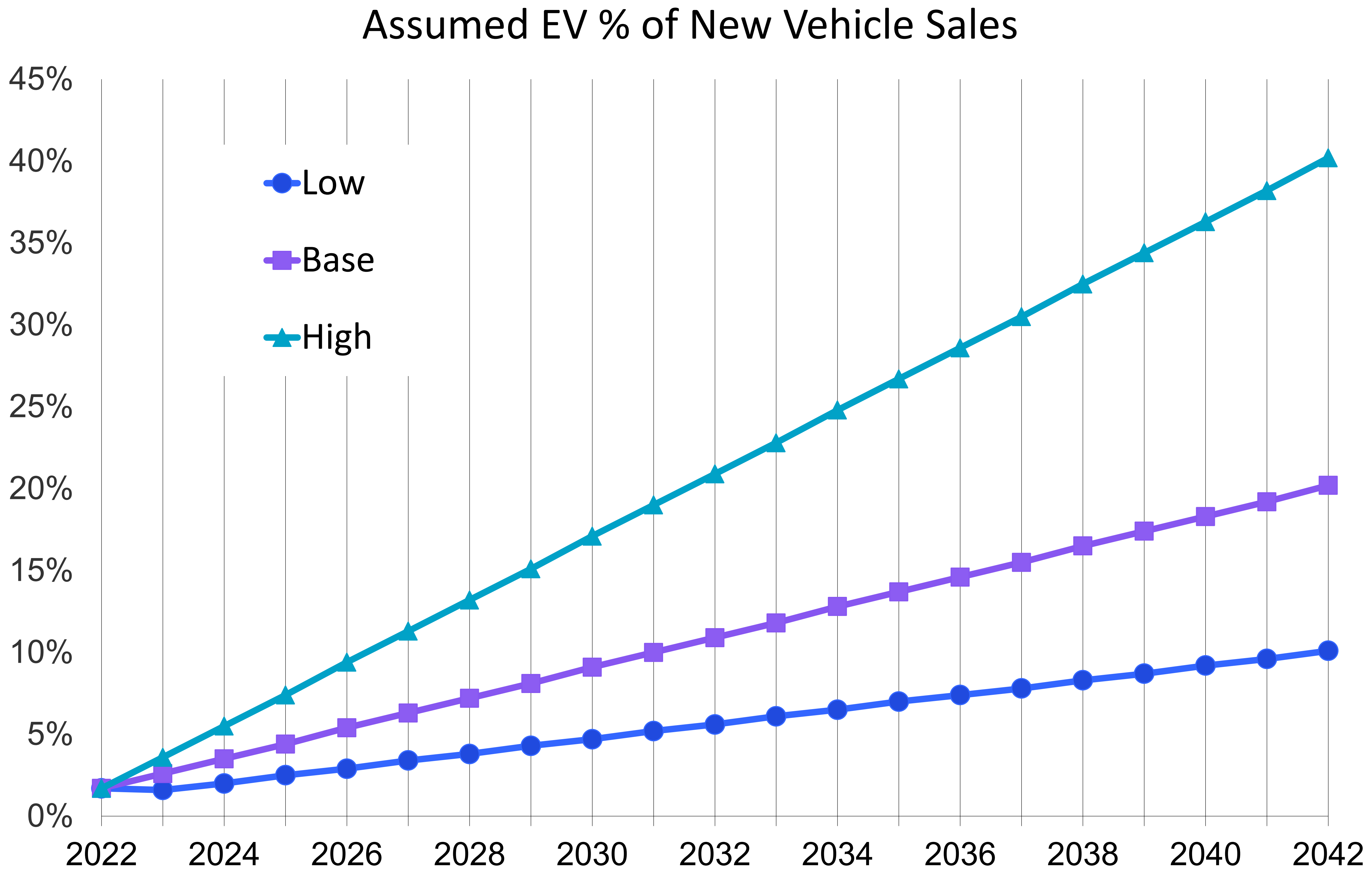


EV Sales Trend Forecast

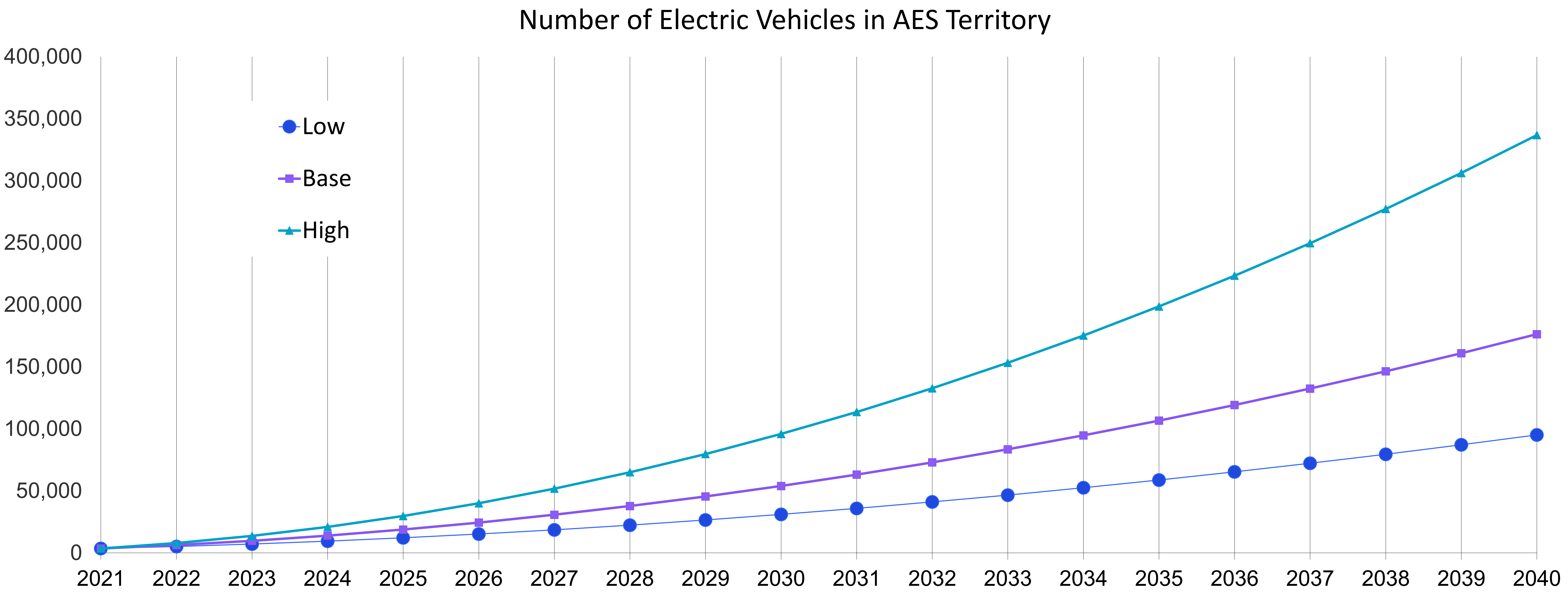


EV Sales Scenarios

- →Linear trend was selected for scenario modeling
- →EIA uses a linear trend sales trend
- →3 trend scenarios were modeled
  - → Low projections are similar to current EIA forecast
  - → Medium aligns with a blend of the BCG and EPRI medium projections
  - → High projections are similar to EPRI High.



EV Sales Scenarios



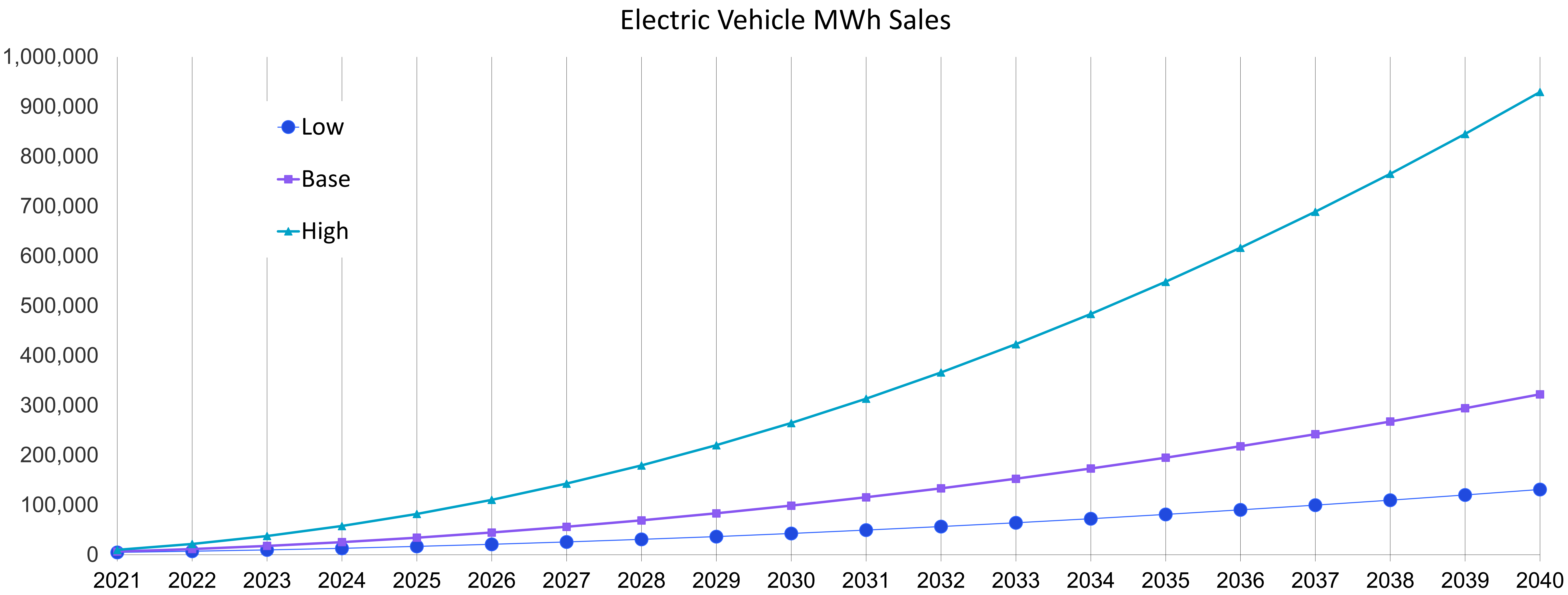
Electric Vehicle Energy (MWh) Forecast

- Energy is a function of total EV units, average kWh/mile, and total number of miles/year/EV

- 3 trend scenarios were modeled
    - Low, Base, High

Input	Base	High	Low
Number of Vehicles in 2021	3,575	3,575	3,575
% of EV Sales in 2030	11%	21%	6%
% of EV Sales in 2040	20%	40%	10%
Miles/year/vehicle	5,300	8,000	4,000
Average kWh/mile	0.345	0.345	0.345

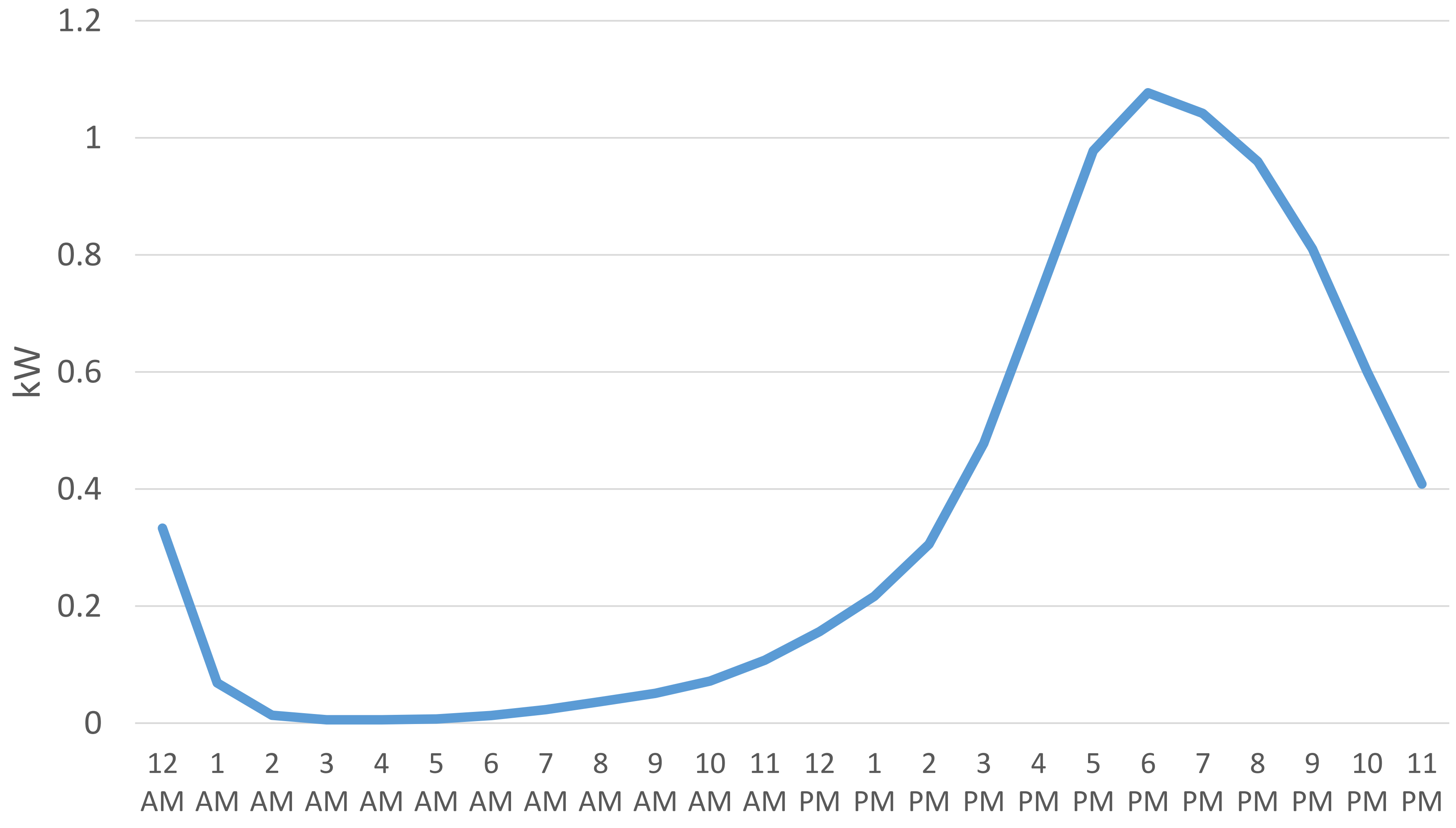
EV Energy (MWh) Forecast



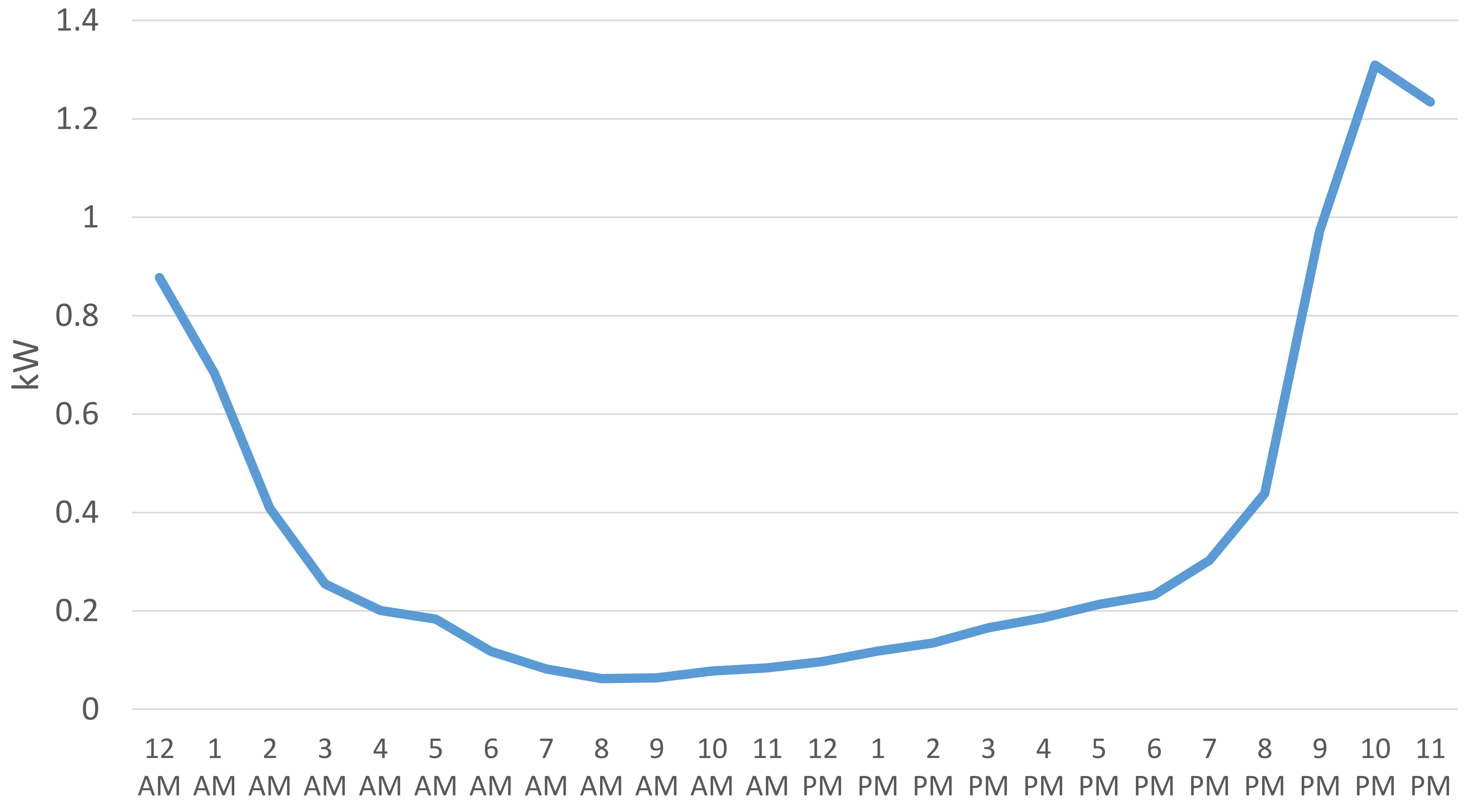
Residential Electric Vehicle Load Shape

- → Load shapes for electric vehicles come from:
  - → Non-managed Charging – Guidehouse which uses a blend of utility EV metering programs and synthetic datasets from US National Labs
  - → Managed Charging – AES Indiana AMI data from EVX customers

Weekday: Non-managed Customer Profile



Weekday: Managed Customer Profile

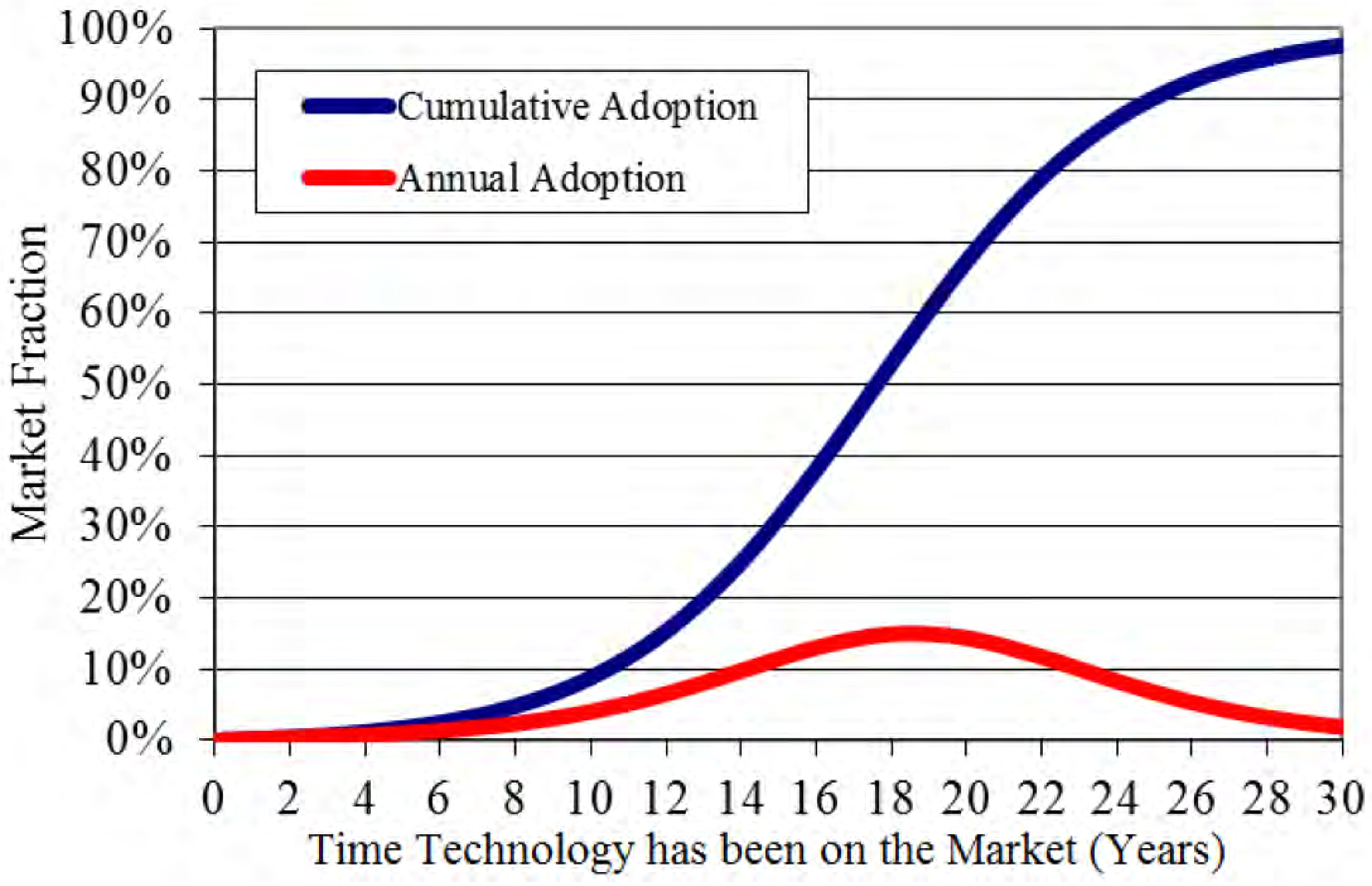


PV Preliminary Forecast

Forecast Framework – Bass diffusion model

→Key parameters:

- → Existing market share
- → Maximum market share
- → Coefficients of innovation (p) and imitation (q)



PV Preliminary Forecast – Bass model parameters

- →Existing market share:
  - → AES IN 2021 Q3 cumulative net metering data
    - 625 existing residential systems
    - 46 existing non-residential systems
- → Maximum market share:
  - → AES IN customer forecast
  - → PV technical constraint factor
    - 48% residential; 79% non-residential
    - Based on NREL NSRDB data which accounts for constraints such as shading, contiguous roof area, panel orientation, etc.
- → Coefficients of innovation (p) and imitation (q):
  - → NREL dGen model (based on state-level EIA DGPV interconnection and Census data)

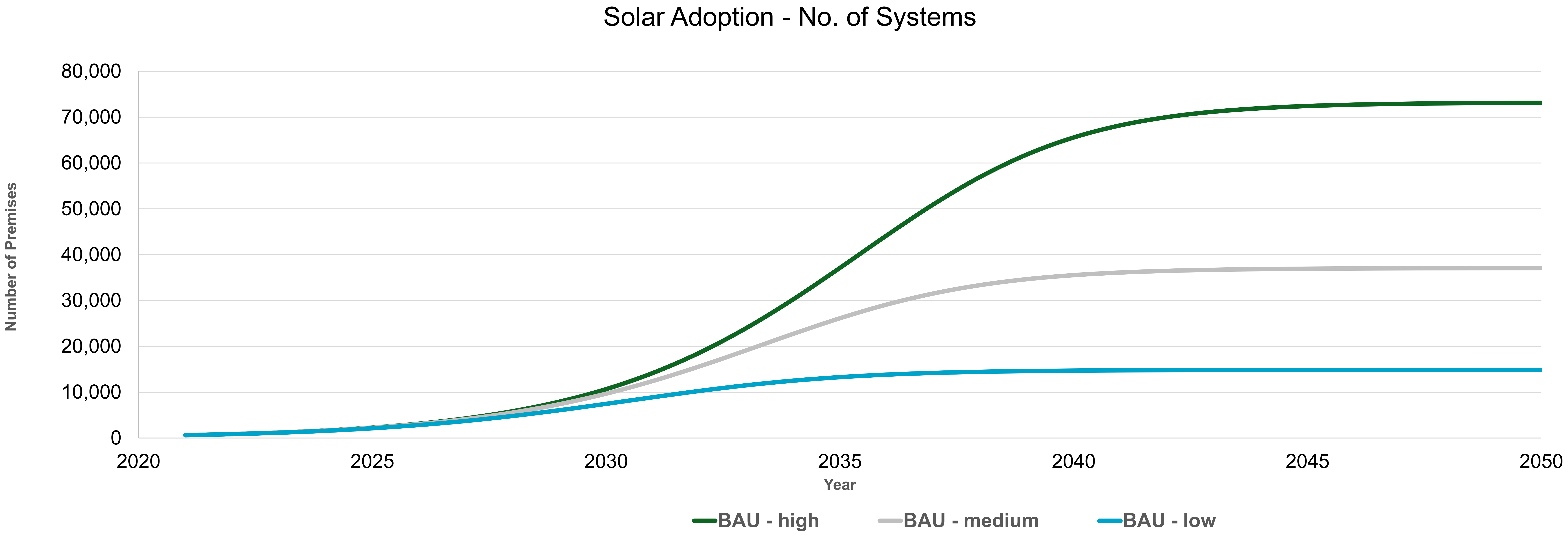
PV Preliminary Forecast – Scenario Analysis

3 Business-As-Usual (BAU) Scenarios Considered

- →Scenarios based on adoption probability:
  - → Currently estimated based on CAGR of historically installed systems within AES IN territory and regional customer WTP survey data
  - → Will be updated based on findings from AES IN market research
- →Residential:
  - →High: 29% market adoption
  - →Medium: 15% market adoption
  - →Low: 6% market adoption
- →Non-Residential:
  - →High: 35% market adoption
  - →Medium: 19% market adoption
  - →Low: 7% market adoption

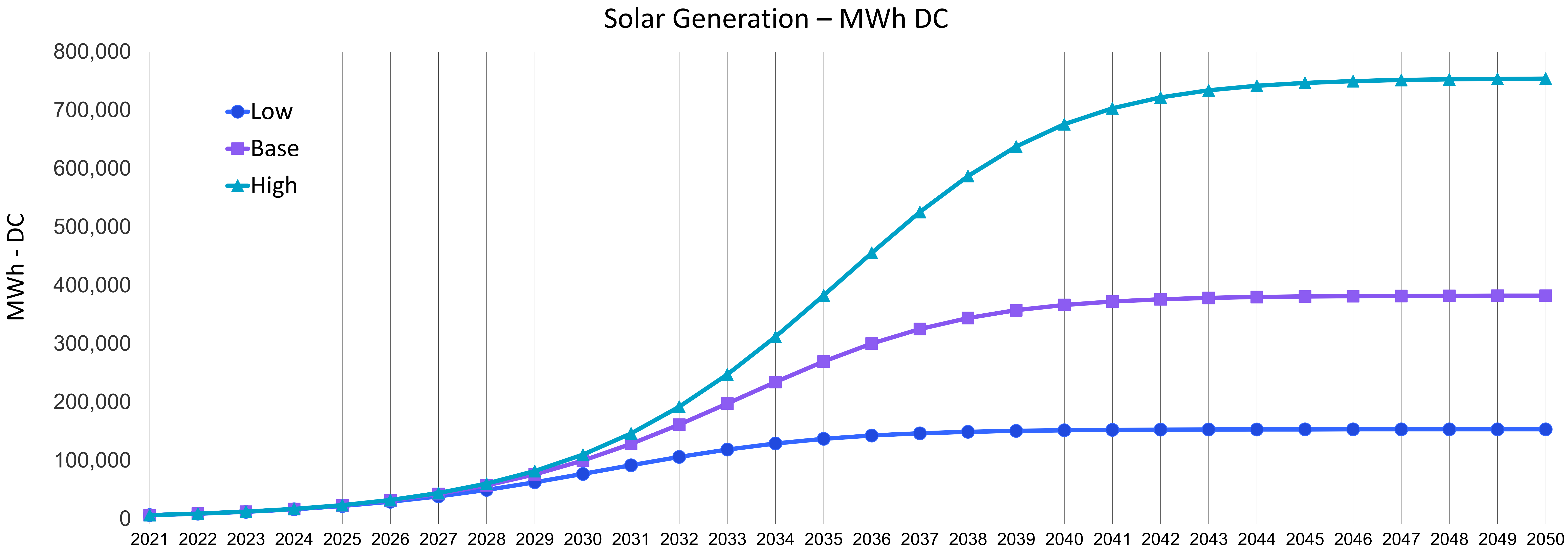
PV Preliminary Forecast

Model forecast results – Residential



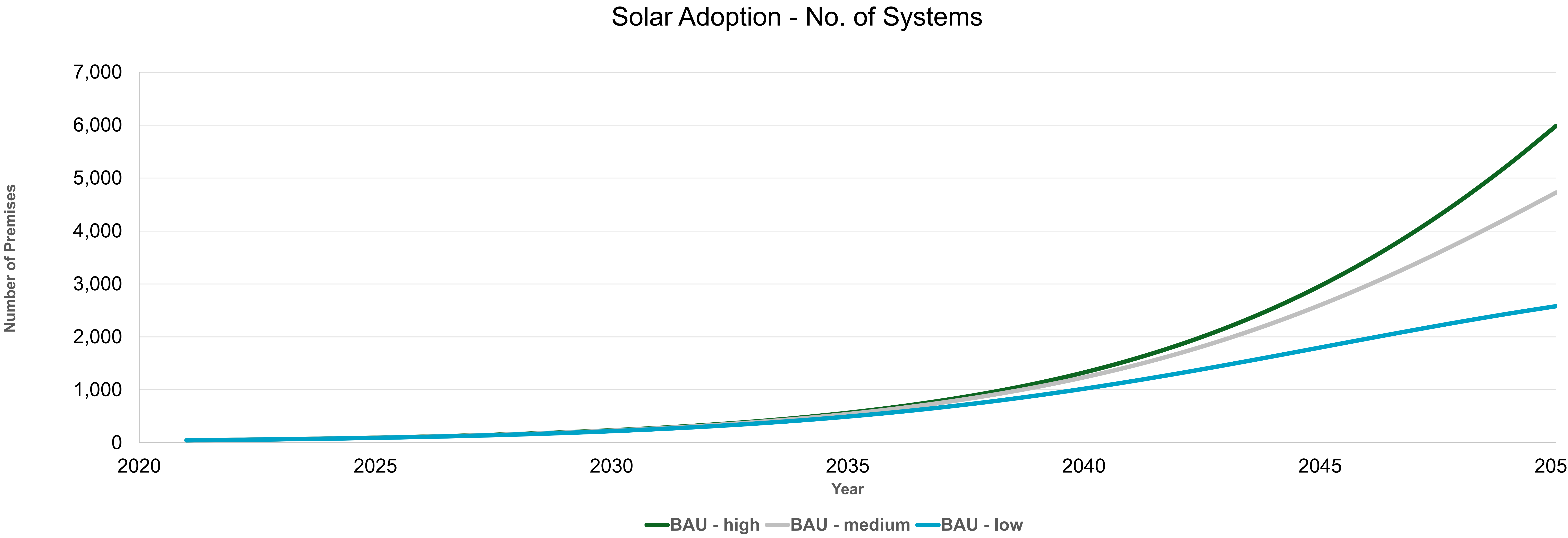
PV Preliminary Forecast

Model forecast results – Residential



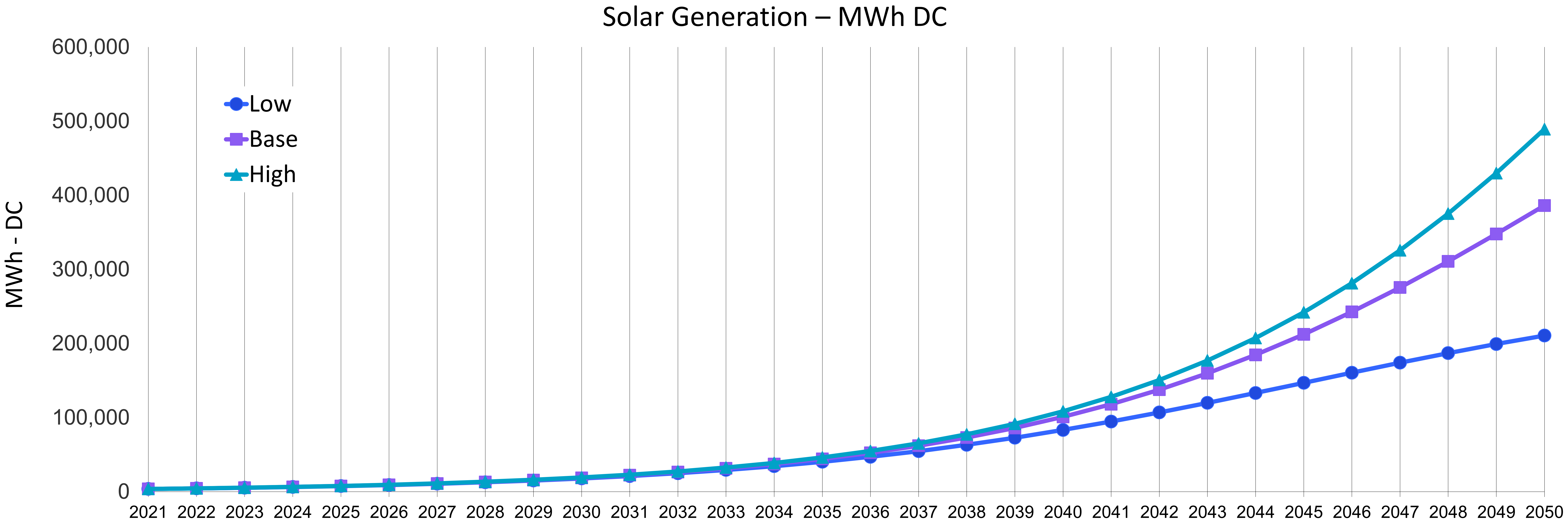
PV Preliminary Forecast

Model forecast results – Non-Residential



PV Preliminary Forecast

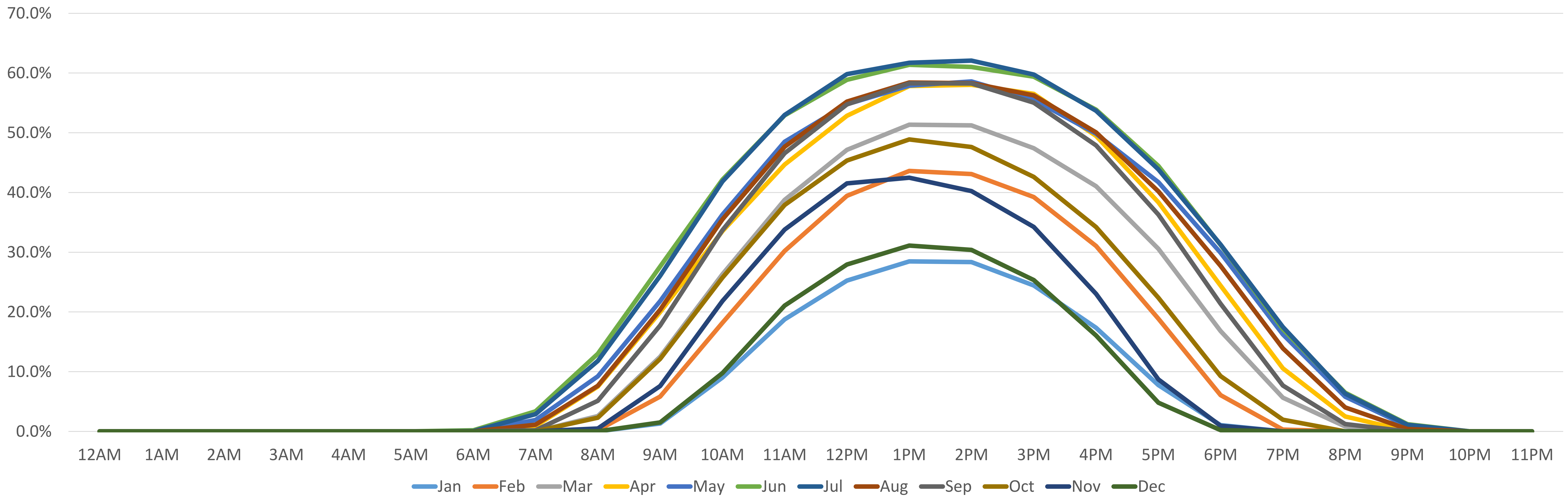
Model forecast results – Non-Residential



PV Load Shape

→Load shapes for solar come from:

- → Residential customer AMI data for ground (50%) and roof (50%) solar installations



2022 Integrated Resource Plan (IRP)

DSM Market Potential Study Introduction

Presented by IRP Partners

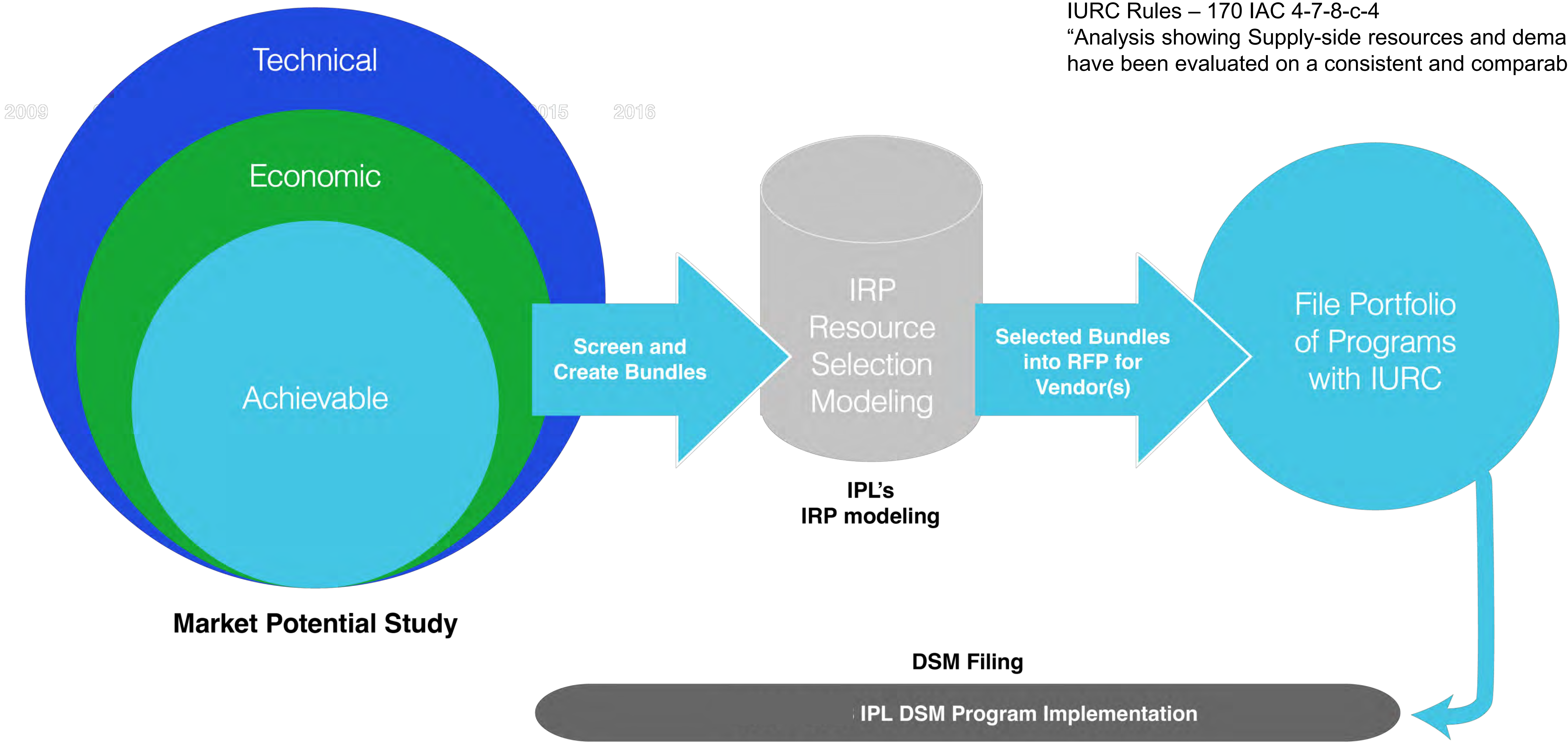
GDS Associates, Inc.
ENGINEERS & CONSULTANTS

brightline
GROUP

aes Indiana

Introduction to the DSM Process in the IRP

IURC Rules – 170 IAC 4-7-8-c-4
“Analysis showing Supply-side resources and demand-side resources have been evaluated on a consistent and comparable basis.”



2009
015
2016

Technical

Economic

Achievable

Market Potential Study

Screen and Create Bundles

IRP Resource Selection Modeling

IPL’s
IRP modeling

Selected Bundles into RFP for Vendor(s)

File Portfolio of Programs with IURC

DSM Filing

IPL DSM Program Implementation

Agenda

→ Overview

- Team Introduction
- Purpose of a Market Potential Study (MPS)
- MPS/IRP Related Work

→ Market Research

- End-Use Analysis
- Willingness to Participate in DSM Programs

→ Energy Efficiency (EE) Potential

→ Demand Response (DR) Potential

→ Initial EV/PV Forecasts

Introduction to the GDS team

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ENGINEERS & CONSULTANTS

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brightline
GROUP

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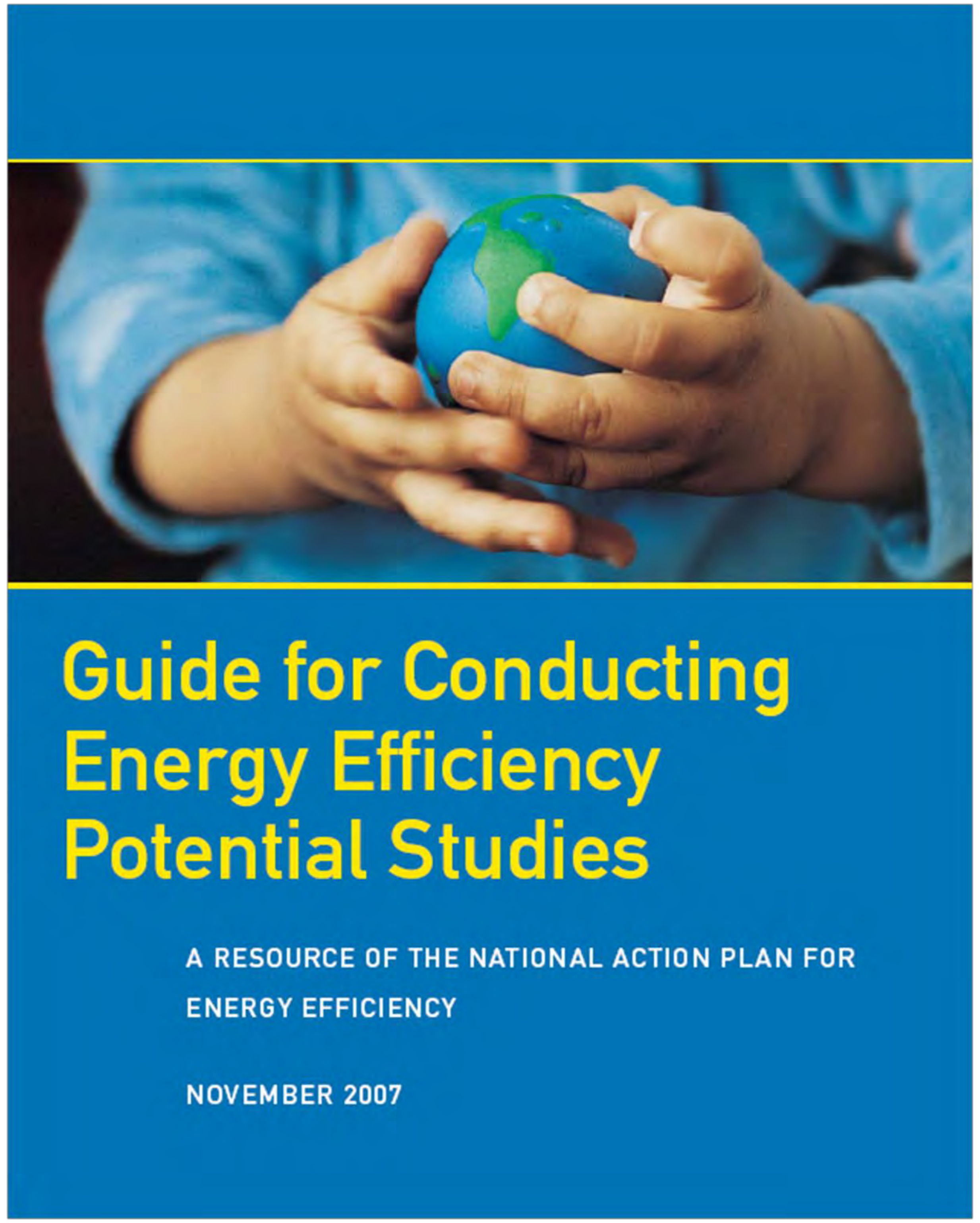
Demand Response Lead
GDS Associates

JORDAN JANFLONE
EV Modeling/Forecasting
GDS Associates

What is a Market Potential Study?

Simply put, a potential study is a quantitative analysis of the amount of energy savings that either exists, is cost-effective, or could be realized through the implementation of energy efficiency programs and policies.



Guide for Conducting Energy Efficiency Potential Studies

A RESOURCE OF THE NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY

NOVEMBER 2007

Purpose of a Market Potential Study

- **Market Potential Study identifies the remaining amount of EE/DR potential in the AES-IN service territory**
- **The savings potential from this analysis will be used to create EE/DR resources to be modeled in the IRP.**
- **EE/DR selections from the IRP will be used to inform AES-IN DSM plan for 2024-2026.**

DSM Market Potential Study Introduction

Market Research

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

Market Research Activities

RESEARCH TO IMPROVE UPON INPUTS TYPICALLY USED IN BOTH LOAD FORECAST & MPS

- ***Primary & Secondary Research***
  - Surveys & onsite visits
  - Building energy simulation models
  - CBECS
- ***Residential***
  - End Use Market Share
  - Unit Energy Consumption
- ***Small Commercial & Industrial***
  - End-use intensity
  - Distribution of customers by building type
  - End-use saturation

RESEARCH TO HELP UNDERSTAND MOTIVATIONS AND BARRIERS TO ADOPTION

- ***Willingness to Participate (WTP) at varying incentive levels***
  - Residential /Commercial
  - Asked for EE / DR / DER
- ***Importance of financial/non-financial motivations and barriers toward adoption***
  - Motivations: *Energy/bill savings, personal sustainability goals, improved comfort, increased reliability, quieter operation, etc.*
  - Barriers: *Upfront cost, access to financing, uncertainty about savings, lack of knowledge, limitations of building characteristics, unwanted features or negative impacts on aesthetics/comfort, etc.*
- ***Awareness of current AES-IN Programs***

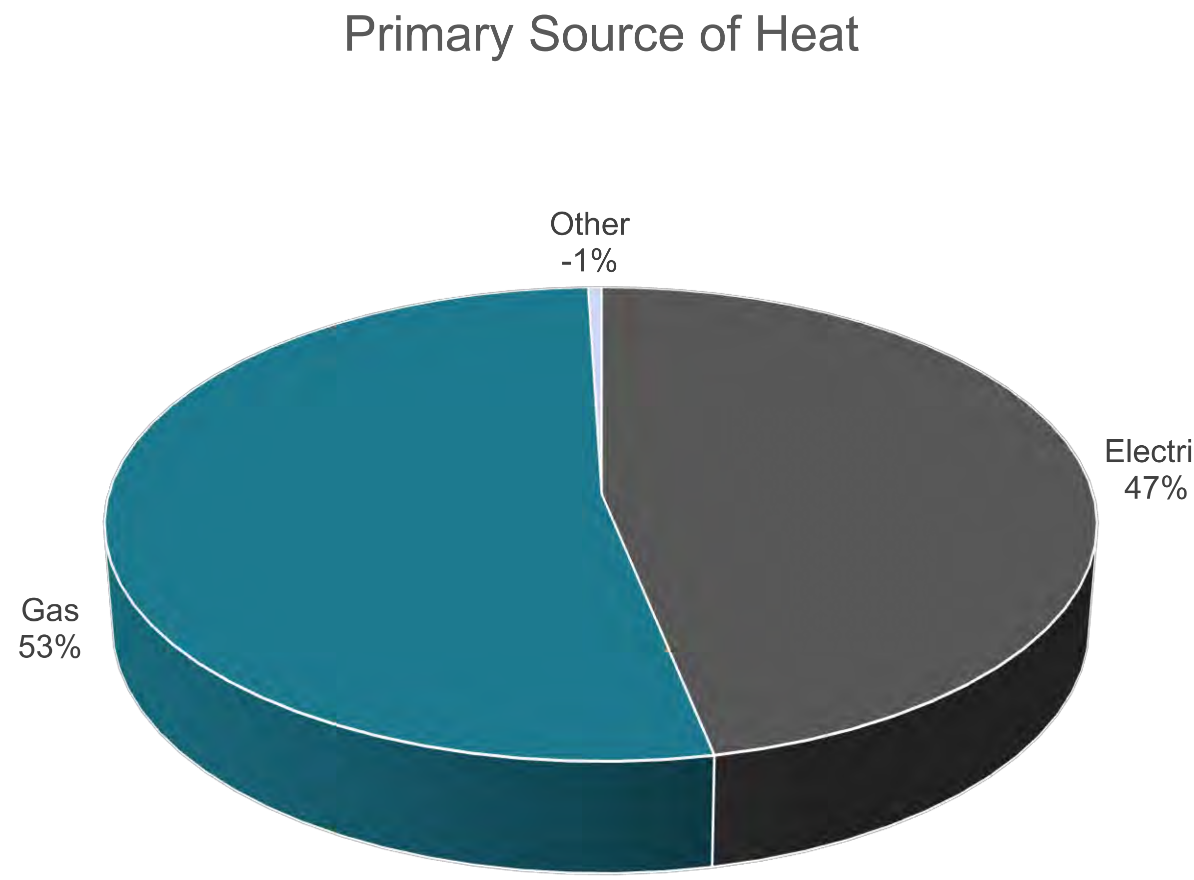
Residential Baseline Survey Statistics

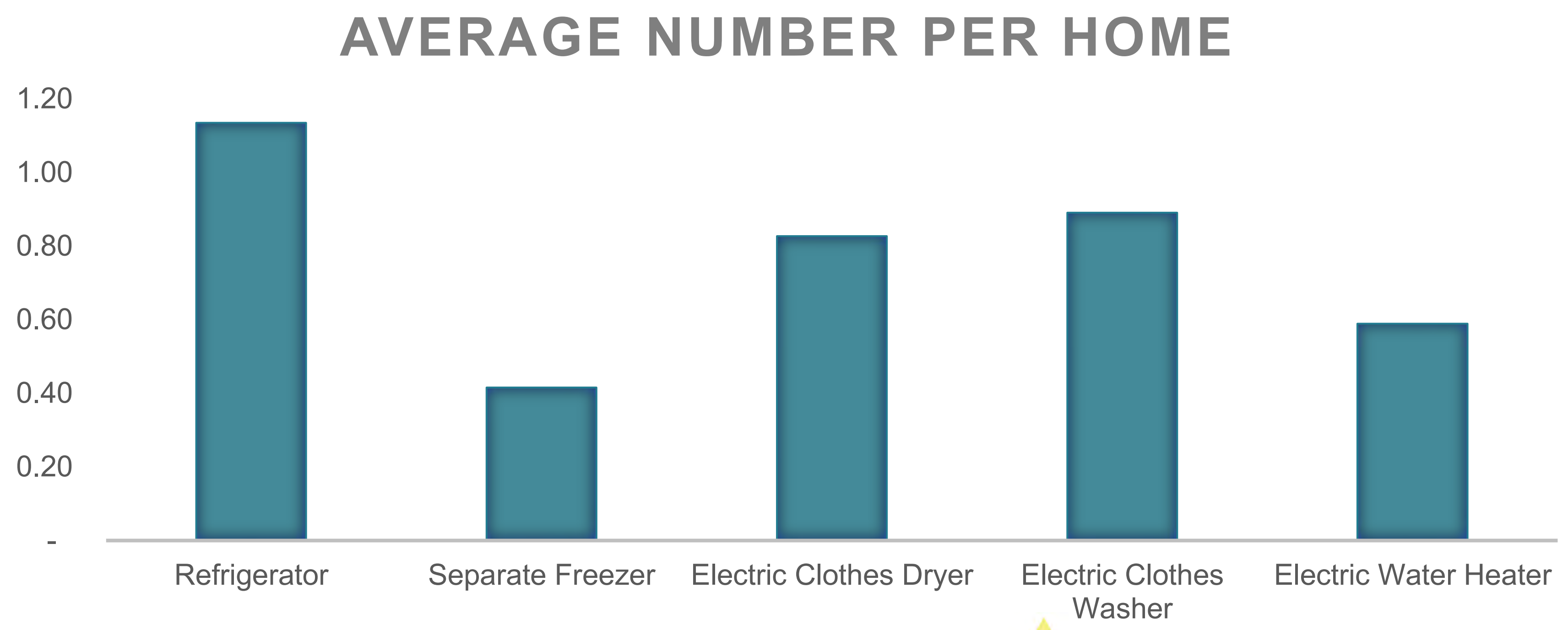
Market Segment	**Sample Design**	**Sample Frame**	**# of Responses**	**Response Rate**	**Achieved Precision**
Total Residential Population	95/5 Design = 384 Responses	15,000 (100%)	972	6.5%	3.1% @ 95% Conf.
Multifamily Homes	90/10 Design = 68 Responses	2,720 (18%)	231	8.5%	5.4% @ 90% Conf.
Single Family Homes	316 Responses	12,280 (82%)	741	6.0%	3.0% @ 90% Conf.

* *Commercial survey underway. Roughly 9,000 accounts in sample frame.*

Equipment Characteristics

- *Data collection elements limited to items that may be answered accurately*
- Residential survey collected
  - Ownership, age, and count of electric end-use appliances
  - Information on smart appliances and electric vehicles
- Nonresidential survey focused on key electric end-uses
  - Ex: Lighting, Cooling, Heating, Ventilation, Water Heating, Refrigeration
  - Key Equipment Penetration
  - Limited Efficiency Saturation Characteristics





Willingness to Participate (WTP) Sample Sizes

Residential Modules	Est # of Completions	Actual # of Completions	Achieved Precision @ 90% Confidence
Water Heater Efficiency	180	349	4.4%
Clothes Dryer Efficiency	146	264	5.1%
Insulation Efficiency	230	279	4.9%
HVAC Efficiency	195	283	4.9%
DER – Solar PV	180	269	5.0%
DER – Electric Vehicles	195	236	5.4%
Water Heater Control DR	146	229	5.4%
Smart Thermostat DR	158	157	6.6%
Time of Use Rate DR	72	88	8.8%

* *Commercial WTP survey underway. Similarly targets several commercial EE end-uses (HVAC, Water Heating, Refrigeration, Lighting), DER (Solar Purchase/Leased) and DR (AC Control, Critical Peak Pricing) options.*

WTP Survey Research

- → Represents the proportion of customers who can be reasonably expected to perform energy efficiency upgrades through DSM programs
- → Used to estimate likely long-term adoption rates for achievable potential scenarios

→Long-term adoption rates will be estimated at the end-use or measures level for key end uses:

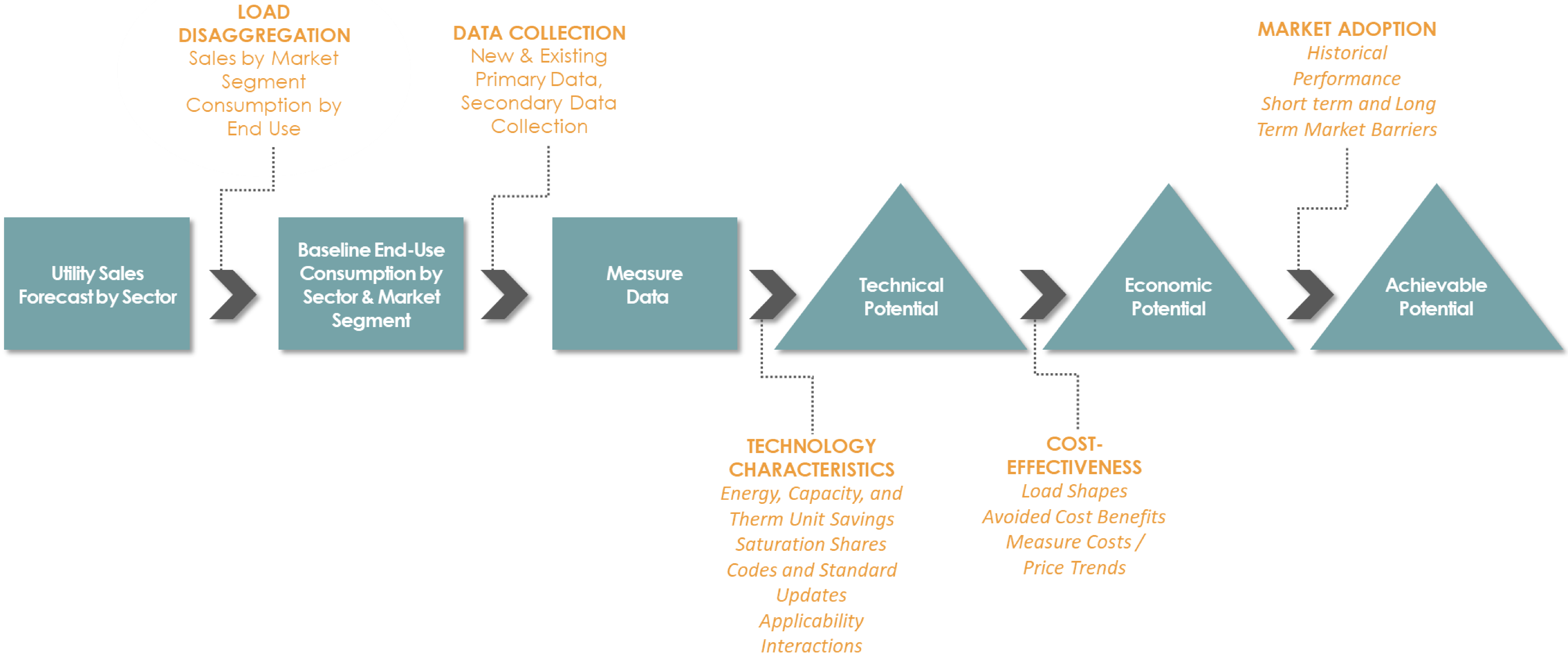
HVAC	Appliances
Water Heating	Building Shell
Lighting	Distributed Energy Resources
Refrigeration	Demand Response

DSM Market Potential Study Introduction

Energy Efficiency (EE) Potential

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

Overall Market Potential Study Process



LOAD DISAGGREGATION
Sales by Market Segment
Consumption by End Use

DATA COLLECTION
New & Existing Primary Data, Secondary Data Collection

MARKET ADOPTION
Historical Performance
Short term and Long Term Market Barriers

Utility Sales Forecast by Sector

Baseline End-Use Consumption by Sector & Market Segment

Measure Data

Technical Potential

Economic Potential

Achievable Potential

TECHNOLOGY CHARACTERISTICS
Energy, Capacity, and Therm Unit Savings
Saturation Shares
Codes and Standard Updates
Applicability
Interactions

COST-EFFECTIVENESS
Load Shapes
Avoided Cost Benefits
Measure Costs / Price Trends

MPS Segmentation

Residential		Commercial		Industrial	
Home Types	**End-Uses**	**Building Types**	**End-Uses**	**Industry Types**	**End-Uses**
Single Family – Market Rate	Whole Building	Education	Whole Building	Chemicals	HVAC
Multifamily – Market Rate	Heat	Food/Liquor	Heat	Electronics	Lighting
Single Family – Income Qualified	Cool	Health Care	Cool	Fabricated Metals	Machine Drive
Multifamily – Income Qualified	WH	Hotel	Vent.	Food	Process Heat
	Int. Lighting	Miscellaneous	Refrigeration	Lumber & Furniture	Process Refrigeration
	Ext. Lighting	Office	WH	Average	Other Process
	Refrigeration	Restaurant	Cook	Nonmetallic Mineral	Other Facility
	Other Appliances	Retail Store	Interior Lighting	Paper	
	Electronics	Warehouse	Exterior Lighting	Chemicals	
	Pools		Office Equip.	Plastics	
	Misc.		Misc.	Primary Metals	
			Air Comp.	Transportation	
			Motors		
			Proc.		

Measure Characterization

☐ Several hundred energy efficiency measures will be considered

☐ Draft list of measures to be considered were shared with AES-IN Staff and members of the AES-IN Oversight Board (OSB)

☐ Key data source: AES-IN planning and evaluation databases and Illinois TRM

☐ Measure assumptions include:
- Savings
- Incremental/full costs
- Measure interaction
- Measure life
- Measure Applicability

Emerging Technologies

- →Emerging technologies and practices are defined as those that are either: (1) not yet commercialized but are likely to be commercialized and cost-effective for a significant proportion of end-users (on a life-cycle cost basis) over the next few years; or (2) commercialized, but currently have penetrated no more than 2% of the appropriate market (ACEEE)
  - →Reviewed latest TRMs, DOE databases, and the Northwest Energy Efficiency Alliance Emerging Tech Advisory Committee.
- →Require some documented estimate of savings and/or costs for inclusion.
- →**MPS does not include a placeholder for "future unknown technologies"**

Energy Efficiency Potential Types

TECHNICAL POTENTIAL

All technically feasible measures are incorporated to provide a theoretical maximum potential.

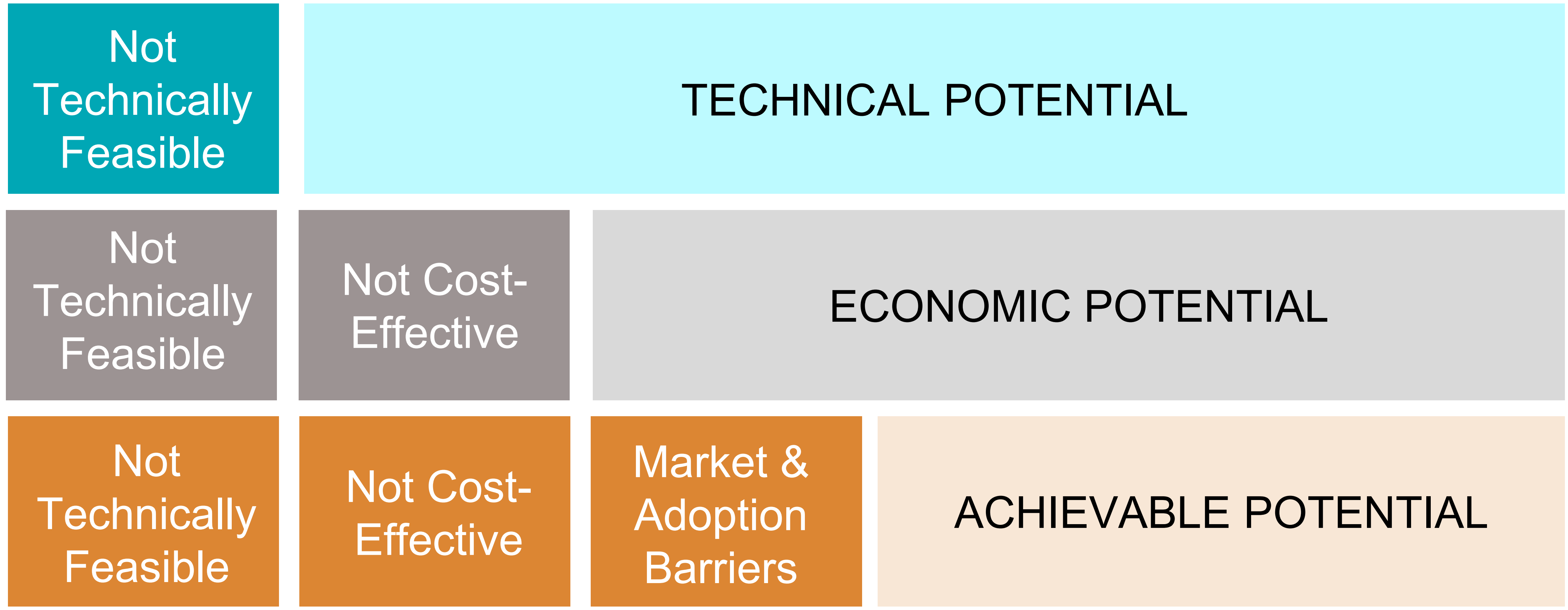
ECONOMIC POTENTIAL

All measures are screened for cost-effectiveness using the UCT Test. Only cost-effective measures are included.

ACHIEVABLE POTENTIAL

Cost-effective energy efficiency potential that can practically be attained in a real-world program delivery case, assuming that a certain level of market penetration can be attained.

Types of Energy Efficiency Potential



Not Technically Feasible | TECHNICAL POTENTIAL

Not Technically Feasible | Not Cost-Effective | ECONOMIC POTENTIAL

Not Technically Feasible | Not Cost-Effective | Market & Adoption Barriers | ACHIEVABLE POTENTIAL

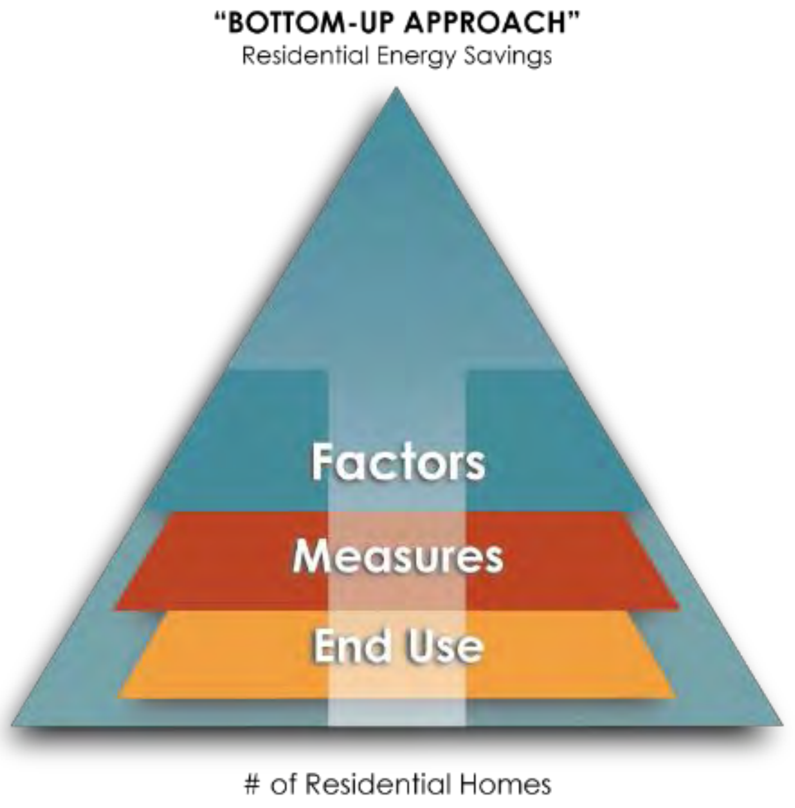
Technical Potential Calculation

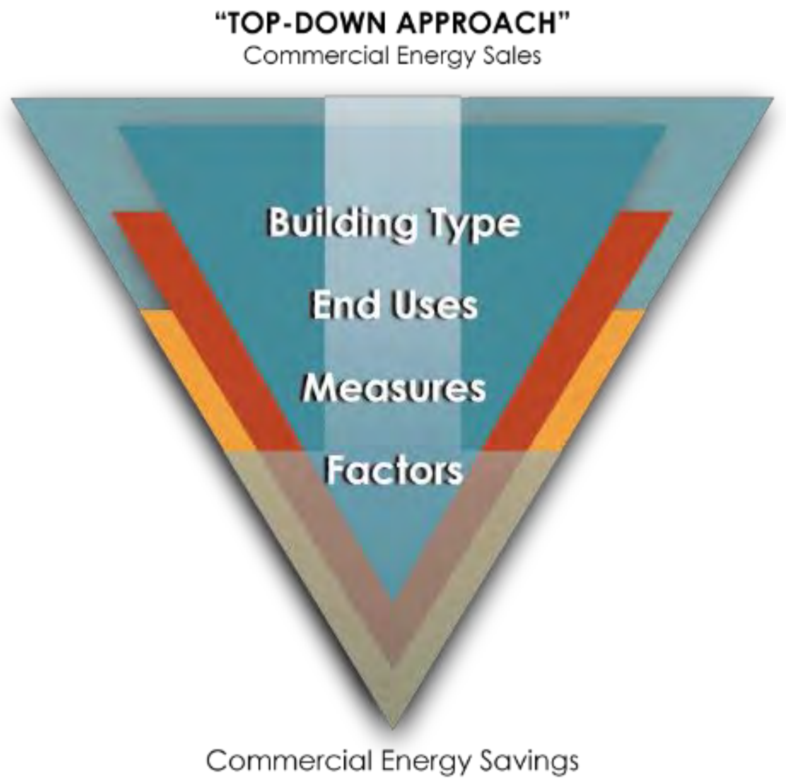
RESIDENTIAL EQUATION

TECHNICAL POTENTIAL OF EFFICIENT MEASURES = *Total Number of Households* X *Base Case Equipment End Use Intensity* X *Saturation Share* X *Applicability Factor* X *Savings Factor*

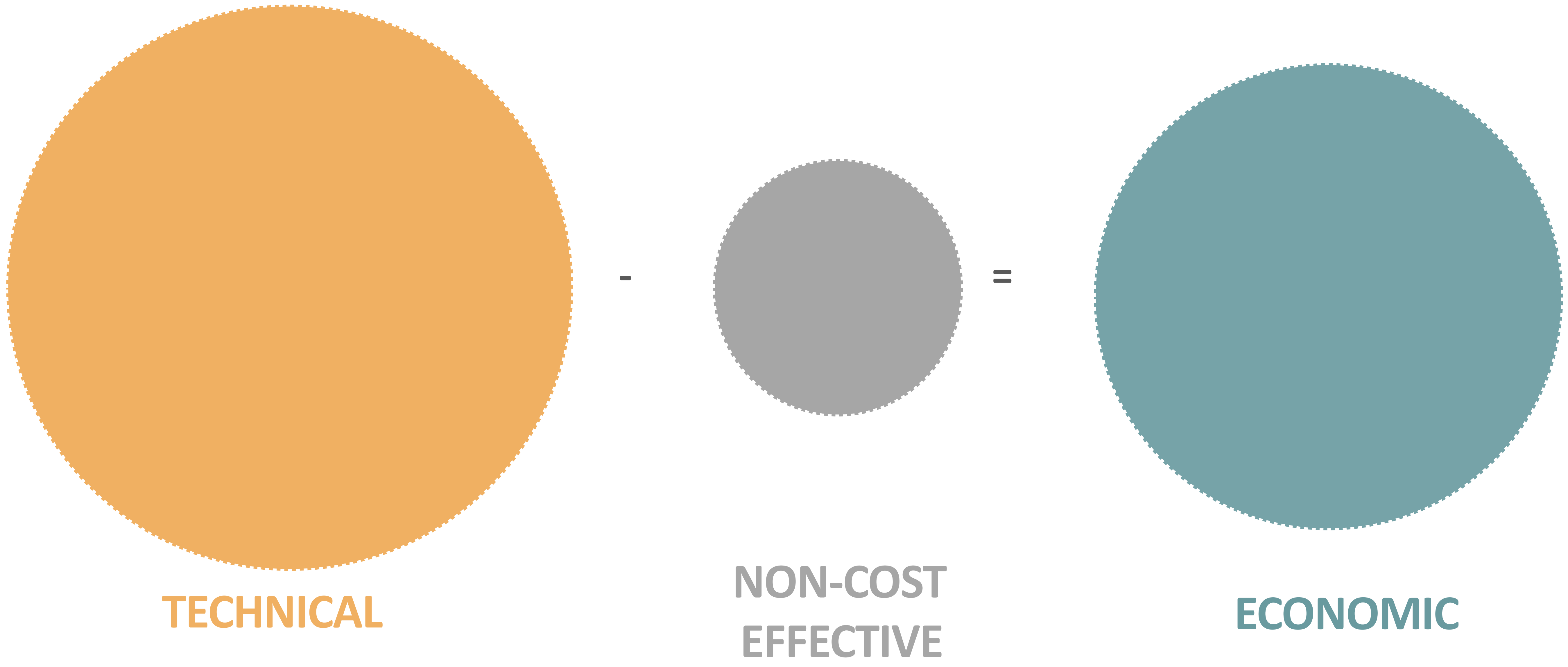
NON-RESIDENTIAL EQUATION

TECHNICAL POTENTIAL OF EFFICIENT MEASURES = *Total End Use Sales By Industry Type* X *Base Case Factor* X *Remaining Factor* X *Convertible Factor* X *Savings Factor*





Economic Potential

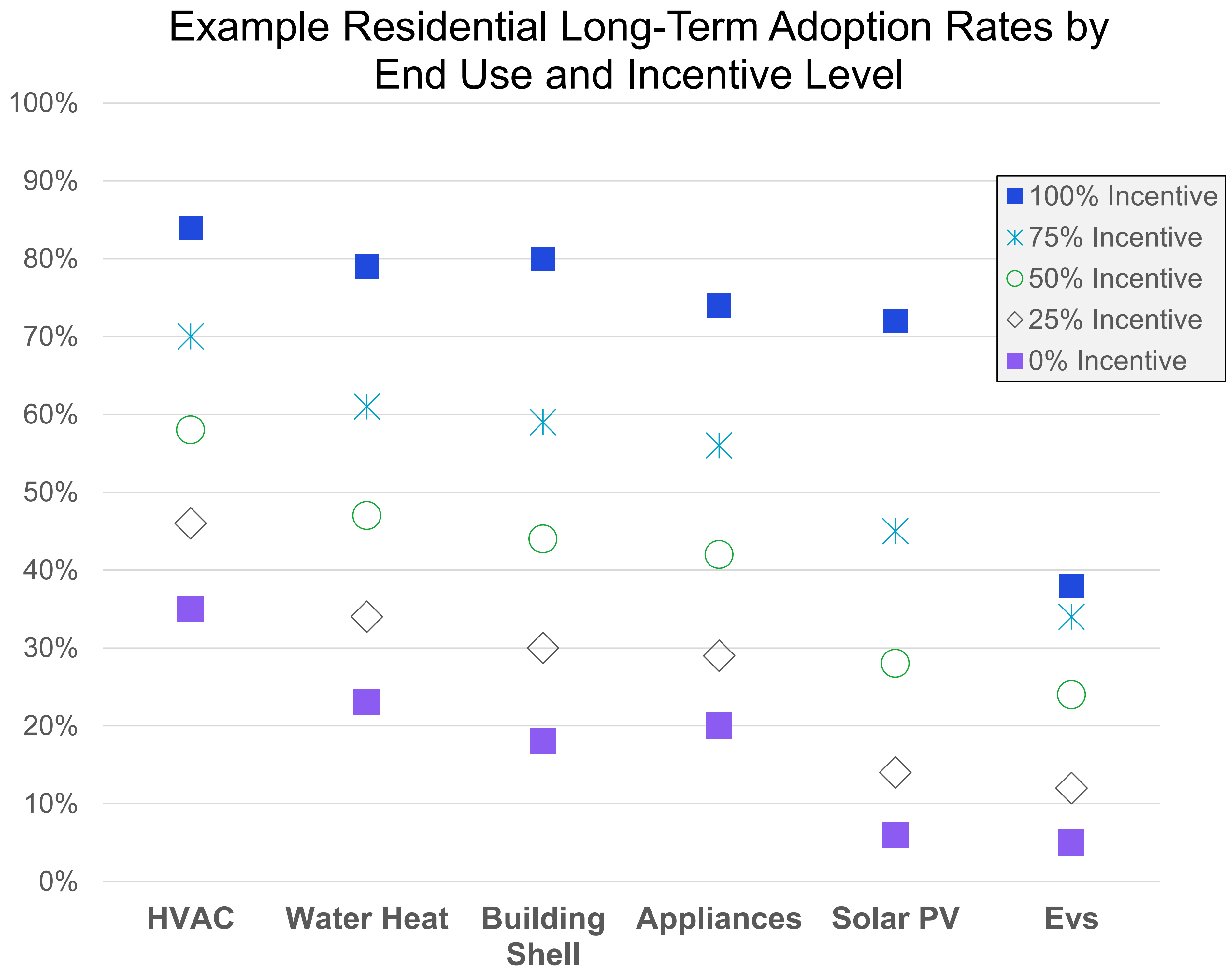


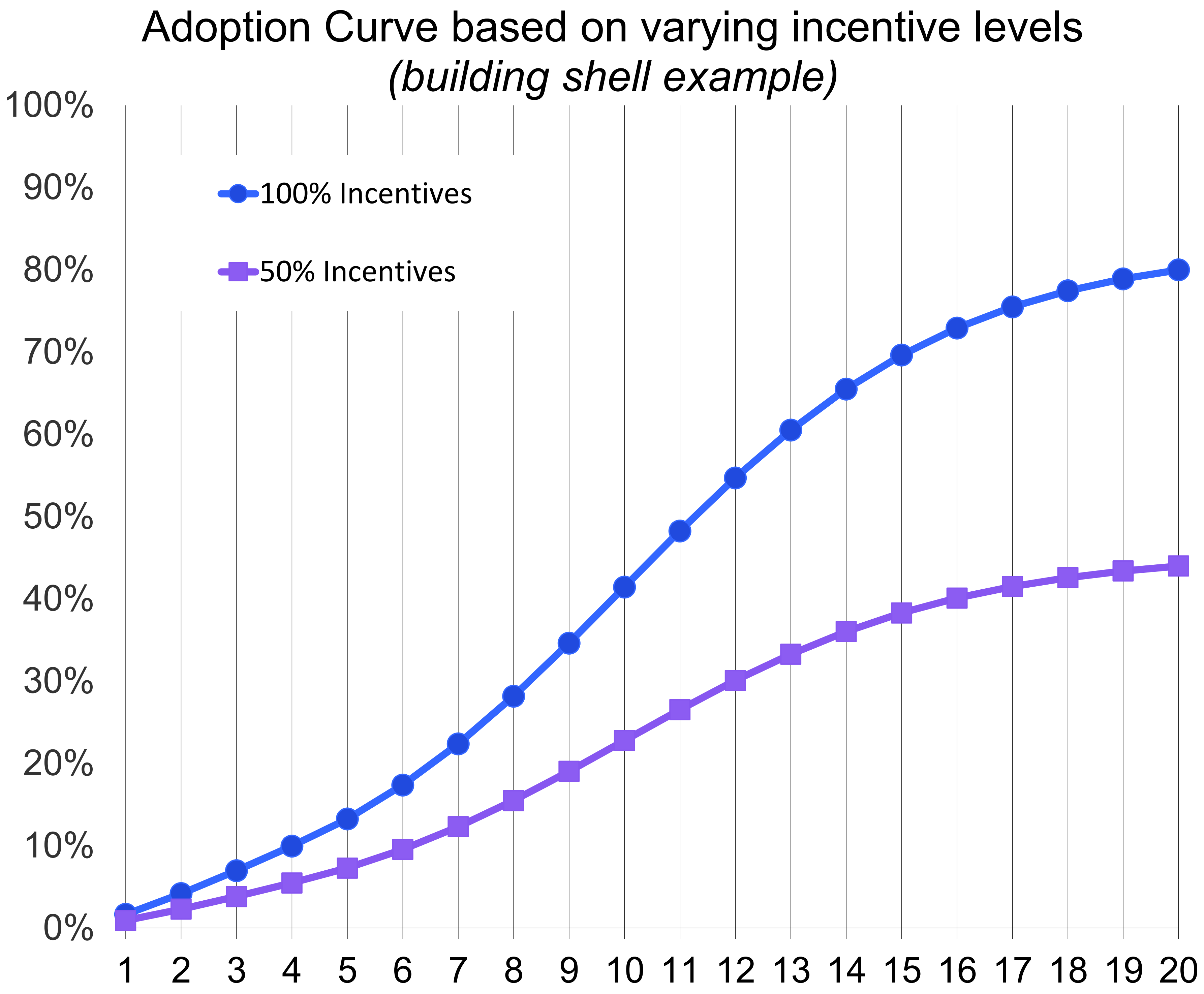
ECONOMIC POTENTIAL

Subset of the Technical Potential that is economically cost effective (based on screening with the Utility Cost Test)

Screen measures for cost-effectiveness over the 20-year forecast horizon

Achievable / Program Potential





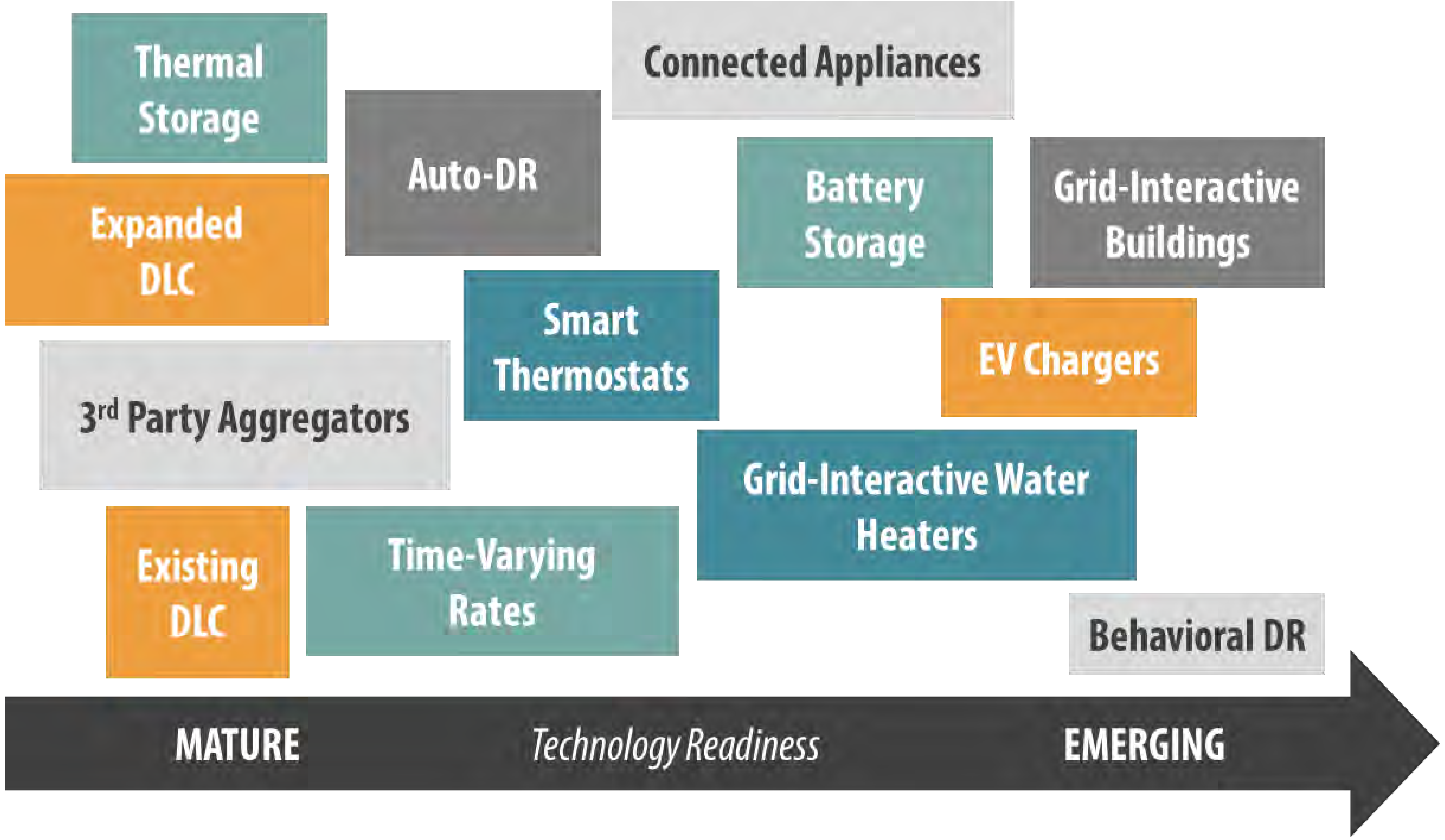
DSM Market Potential Study Introduction

Demand Response (DR) Potential

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

Demand Response Programs Considered

- →DLC – Central ACs
- →DLC –Room ACs
- →DLC – Smart Appliances
- →DLC – Water Heaters
- →DLC – Electric Space Heat
- →DLC – Lighting
- →Battery Energy Storage
- →Electric Vehicle Charing
- →Curtailment Agreements
- →Demand Bidding
- →Capacity Bidding
- →Time of Use Rates
- →Behavior DR



Demand Response Methodology

- → Analysis will be conducted using GDS Demand Response Model (DR Model)
- → Utility-specific data on avoided costs, line losses, and discount rates will be incorporated
- → Participation rates will be developed to simulate the rate at which load reductions can be attained over time
- → Current data on the estimated coincident peak (CP) load reduction per participant will be used to calculate the achievable potential

Demand Response Equations

Achievable Potential Calculation:

☐ If the model user chooses to base estimated potential demand reduction on percent of total per participant CP load, then:

Achievable Demand Response Potential = **Potentially Eligible Customers** X **Eligible Customer Participation Rate** X **Per Customer CP Load for Eligible Customer Segment (kW)** X **Percent CP Load Reduction per Participant**

☐ If the model user chooses to base estimated potential demand reduction on a per customer CP load reduction value, then:

Achievable Demand Response Potential = **Potentially Eligible Customers** X **Eligible Customer Participation Rate** X **Per Customer CP Load Reduction for Eligible Customer Segment (kW)**

Final Q&A and Next Steps

Thank You

APPENDIX

IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.

IRP Acronyms

- ACEE: The American Council for an Energy-Efficient Economy
- AMI: Advanced Metering Infrastructure
- BESS: Battery Energy Storage System
- BNEF: Bloomberg New Energy Finance
- BTA: Build-Transfer Agreement
- C&I: Commercial and Industrial
- CAA: Clean Air Act
- CAGR: Compound Annual Growth Rate
- CCGT: Combined Cycle Gas Turbines
- CCS: Carbon Dioxide Capture and Storage
- CDD: Cooling Degree Day
- COD: Commercial Operation Date
- CONE: Cost of New Entry
- CP: Coincident Peak
- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- EV: Electric Vehicle
- GDP: Gross Domestic Product
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IC: Indiana Code
- ICAP: Installed Capacity
- ICE: Internal Combustion Engine
- IRP: Integrated Resource Plan
- ITC: Investment Tax Credit
- IURC: Indiana Regulatory Commission
- kW: Kilowatt
- kWh: Kilowatt-Hour
- LED: Light Emitting Diode
- LMR: Load Modifying Resource
- LNBL: Lawrence Berkeley National Laboratory
- Max Gen: Maximum Generation Emergency Warning
- MIP: Mixed Integer Programming
- MISO: Midcontinent Independent System Operator
- MPS: Market Potential Study
- MW: Megawatt
- NDA: Nondisclosure Agreement
- NOX: Nitrogen Oxides
- NREL: National Renewable Energy Laboratory
- PPA: Power Purchase Agreement
- PRA: Planning Resource Auction
- PTC: Renewable Electricity Production Tax Credit
- PRMR: Planning Reserve Margin Requirement
- PV: Photovoltaic
- PVRR: Present Value Revenue Requirement
- PY: Planning Year
- RA: Resource Adequacy
- RAN: Resource Availability and Need
- REC: Renewable Energy Credit
- REP: Renewable Energy Production
- RFP: Request for Proposals
- RIIA: MISO's Renewable Integration Impact Assessment
- SAC: MISO's Seasonal Accredited Capacity
- SCR: Selective Catalytic Reduction System
- SMR: Small Modular Reactors
- ST: Steam Turbine
- SUFG: State Utility Forecasting Group
- TRM: Technical Resource Manual
- UCT: Utility Cost Test
- UCAP: Unforced Capacity
- WTP: Willingness to Participate
- XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control

2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #2

4/12/2022

aes Indiana

Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates

Agenda

Time	Topic	Speakers
Morning **Starting at 10:00 AM**	Virtual Meeting Protocols and Safety, Schedule	Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
	Meeting #1 Recap	Erik Miller, Manager, Resource Planning, AES Indiana
	Load Scenarios	Mike Russo, Forecast Consultant, Itron Eric Fox, Director, Forecasting Solutions, Itron
	MPS Results & DSM Resources	Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Break **12:00 PM – 12:30 PM**	Lunch	
Afternoon **Starting at 12:30 PM**	Current Generation Portfolio Overview	Kristina Lund, President & CEO, AES Indiana
	Replacement Resource Assumptions	Erik Miller, Manager, Resource Planning, AES Indiana
	IRP Portfolio Matrix & Scenario Framework	Erik Miller, Manager, Resource Planning, AES Indiana
	Final Q&A and Next Steps	

**Distribution System Planning was included on a prior distributed agenda. This topic will be covered in Public Advisory Meeting #3.*

Virtual Meeting Protocols and Safety

Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana

IRP Team Introductions

AES Indiana Leadership Team

Kristina Lund, President & CEO, AES Indiana
Aaron Cooper, Chief Commercial Officer, AES Indiana
Brandi Davis-Handy, Chief Public Relations Officer, AES Indiana
Ahmed Pasha, Chief Financial Officer, AES Indiana
Tom Raga, Vice President Government Affairs, AES Indiana
Judi Sobecki, General Counsel and Chief Regulatory Officer, AES Indiana

AES Indiana IRP Planning Team

Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana

AES Indiana IRP Partners

Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates

AES Indiana Legal Team

Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP

Welcome to Today’s Participants

- ACES
- Advanced Energy Economy
- Barnes & Thornburg LLP
- Boardwalk Pipelines
- Butler University
- CCR
- CenterPoint Energy
- Citizens Action Coalition
- City of Indianapolis
- Clean Grid Alliance
- Develop Indy | Indy Chamber
- Duke Energy
- E&C
- EDP Renewables NA
- Energy Futures Group
- Faith in Place
- Fluence Energy
- GDS Associates
- Hallador Energy
- Hoosier Energy
- IBEW LOCAL UNION 1395
- Indiana Chamber
- Indiana Energy Association
- Indiana Utility Regulatory Commission
- IUPUI
- NuScale Power
- Office of Utility Consumer Counselor
- Purdue - State Utility Forecasting Group
- Rolls-Royce/ISS
- Sierra Club
- Wartsila

… and members of the AES Indiana team and the public!

Virtual Meeting Best Practices

Questions

→Your candid feedback and input is an integral part to the IRP process.

→Questions or feedback will be taken at the end of each section.

→Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

→All lines are muted upon entry.

→For those using audio via Teams, you can unmute by selecting the microphone icon.

→If you are dialed in from a phone, press *6 to unmute.

Video

→Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.

AES Purpose & Values

Accelerating the future of energy, together.

Safety first

Highest standards

All together

Make your virtual environment safer

1\.

Secure Your Accounts Use unique, complex passphrases and enable two-factor authentication wherever possible.

2\.

Think before you click on a link, file, or attachment on your laptop and mobile.

3\.

Know Your Network Protect your home network by changing default passwords; use a VPN when conducting sensitive transactions or on public WiFi.

4\.

Protect your Device Patch your devices regularly and be mindful of connecting unauthorized hardware like USB drives.

5\.

Share Data Responsibly Control your social media settings and be mindful when posting publicly.

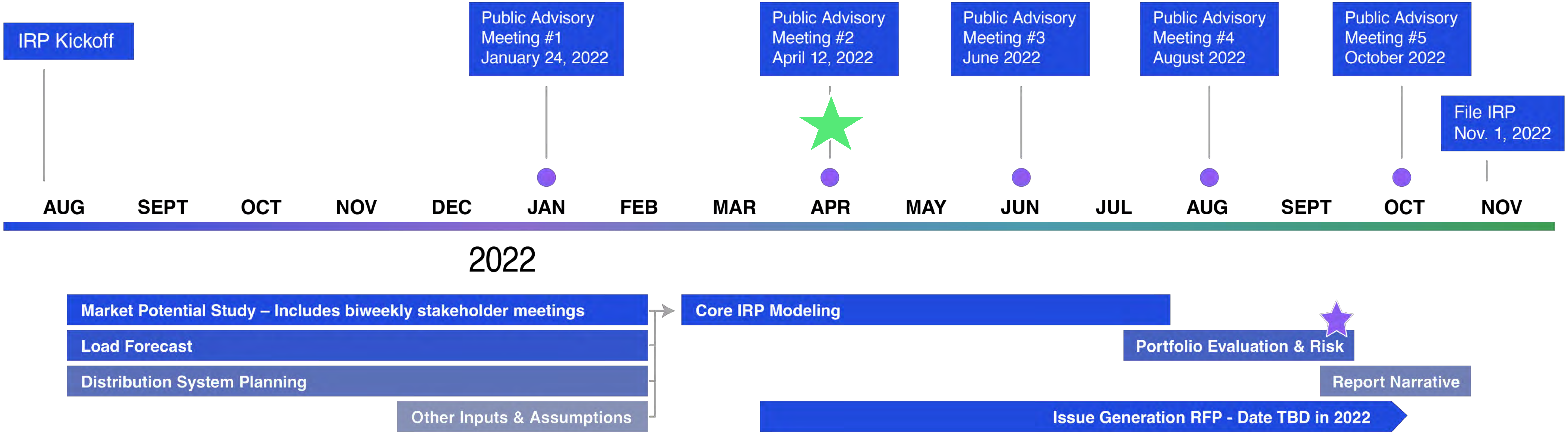
6\.

Be Safe by Being Prepared Know the cyberattack types and report anything suspicious.

Meeting #1 Recap

Erik Miller, Manager, Resource Planning, AES Indiana

Updated 2022 IRP Timeline



IRP Kickoff

Public Advisory Meeting #1
January 24, 2022

Public Advisory Meeting #2
April 12, 2022

Public Advisory Meeting #3
June 2022

Public Advisory Meeting #4
August 2022

Public Advisory Meeting #5
October 2022

File IRP
Nov. 1, 2022

Market Potential Study – Includes biweekly stakeholder meetings

Load Forecast

Distribution System Planning

Other Inputs & Assumptions

Core IRP Modeling

Portfolio Evaluation & Risk

Report Narrative

Issue Generation RFP - Date TBD in 2022

● = Stakeholder Technical Meeting for stakeholders with executed NDAs held the week before each public stakeholder meeting

★ = Preferred Resource Portfolio selected

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.

Public Advisory Schedule

Public Advisory Meeting #1 – January 24, 2022

- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 – April 12, 2022

- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

Public Advisory Meeting #3- June

- Portfolio Metrics & Scorecard Framework
- Overview of Reliability in Indiana
- Reliability Analysis
- Distribution System Plan

Public Advisory Meeting #4 - August

- Preliminary Modeling Results
- Risk Analysis
- Portfolio Metrics & Scorecard Review

Public Advisory Meeting #5 - October

- 2022 Modeling Insights
- Preferred Resource Portfolio & Short-Term Action Plan

Topics for meetings 3-5 are subject to change depending on modeling progress.

2022 Integrated Resource Plan (IRP)

Load Scenarios

Presented by Itron

Itron aes Indiana

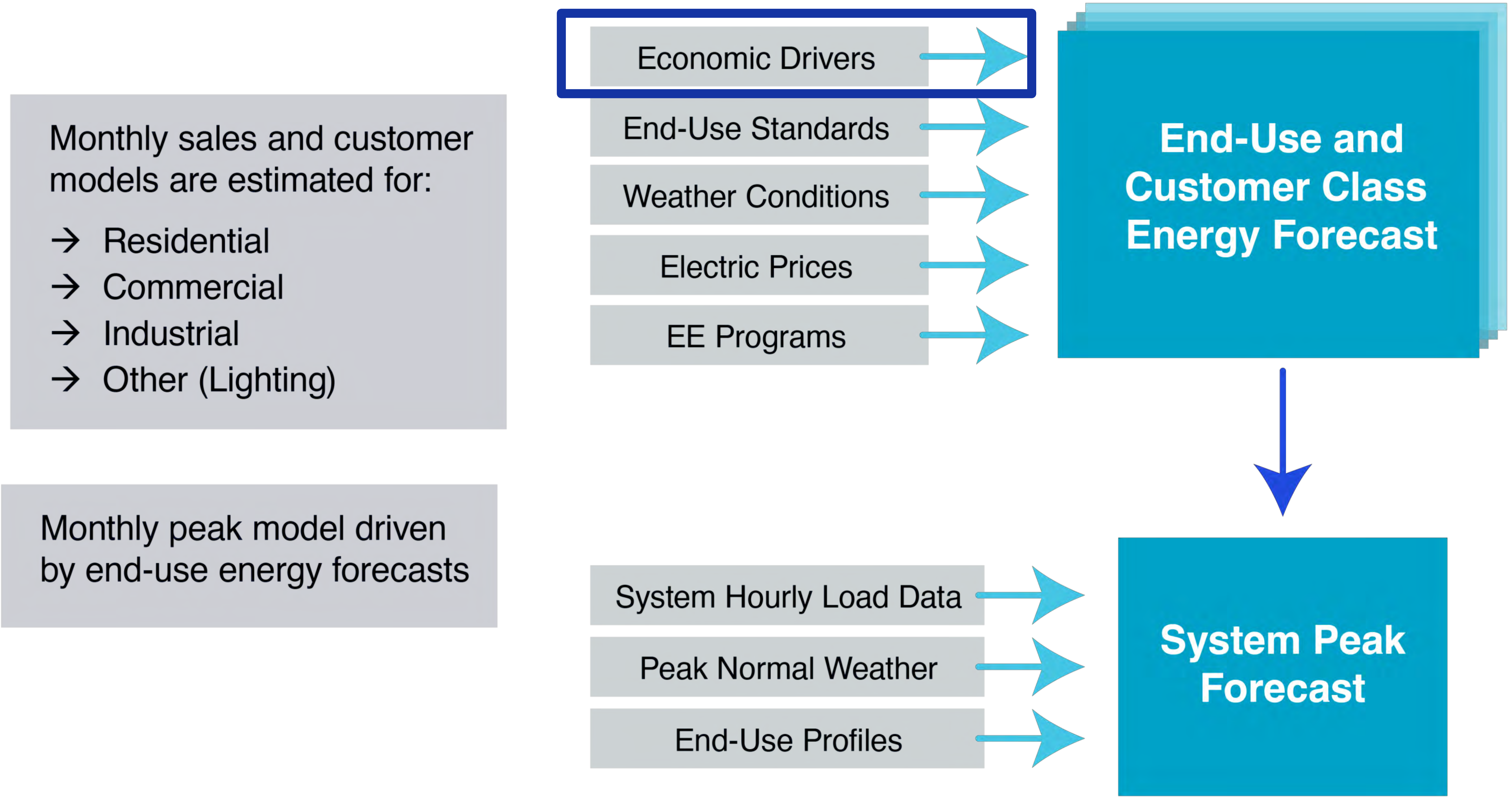
Load Scenarios

High/Low Load Model Drivers

Mike Russo, Forecast Consultant, Itron

Modeling Approach

- → Bottom-up Modeling Approach
- → Estimate rate-class level sales and customer models from historical billed sales data
- → Sales/energy driven by households, economic forecasts, expected weather conditions, price, and end-use efficiency improvements. End-use demand drives system peak demand



Monthly sales and customer models are estimated for:

- → Residential
- → Commercial
- → Industrial
- → Other (Lighting)

Monthly peak model driven by end-use energy forecasts

Economic Drivers

End-Use Standards

Weather Conditions

Electric Prices

EE Programs

End-Use and Customer Class Energy Forecast

System Hourly Load Data

Peak Normal Weather

End-Use Profiles

System Peak Forecast

The baseline forecast excludes behind the meter solar, electric vehicle loads, and future EE program savings

Economic Based Scenarios

Baseline Forecast

- Baseline forecast models use economic concepts from Moody's Analytics Baseline Forecast, Aug 2021. Moody's defines their baseline forecast as "the probability that the economy will perform better than this projection is equal to 50%, the same as the probability that it will perform worse".

Low Forecast Scenario

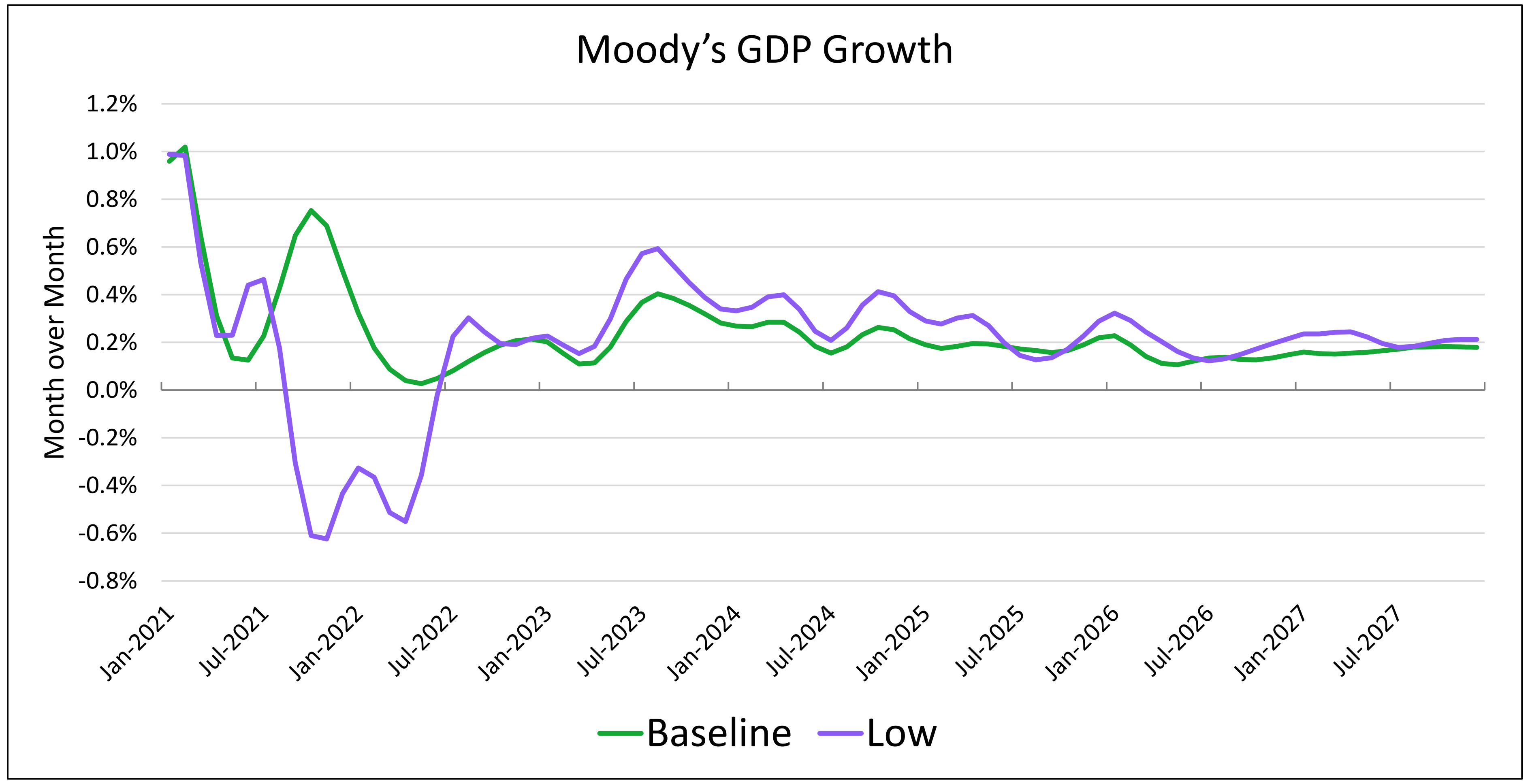
- Based on Moody's S3: Alternative Scenario 3 – Downside – 90th Percentile: In this scenario, there is a 90% probability that the economy will perform better, broadly speaking, and a 10% probability that it will perform worse.

High Forecast

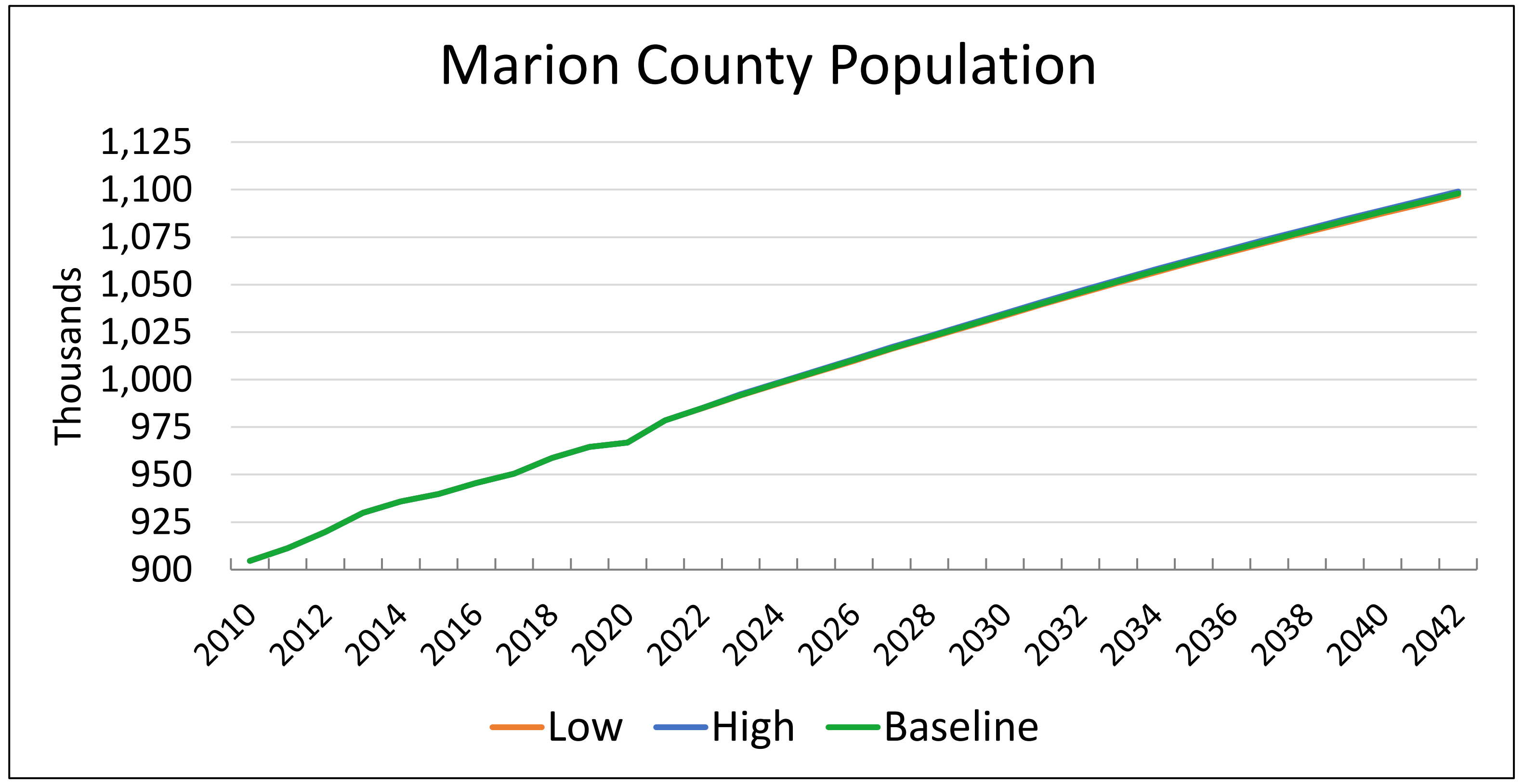
- Based on Moody's S1: Alternative Scenario 1 – Upside – 10th Percentile: In this scenario, there is a 10% probability that the economy will perform better, broadly speaking, and a 90% probability that it will perform worse.

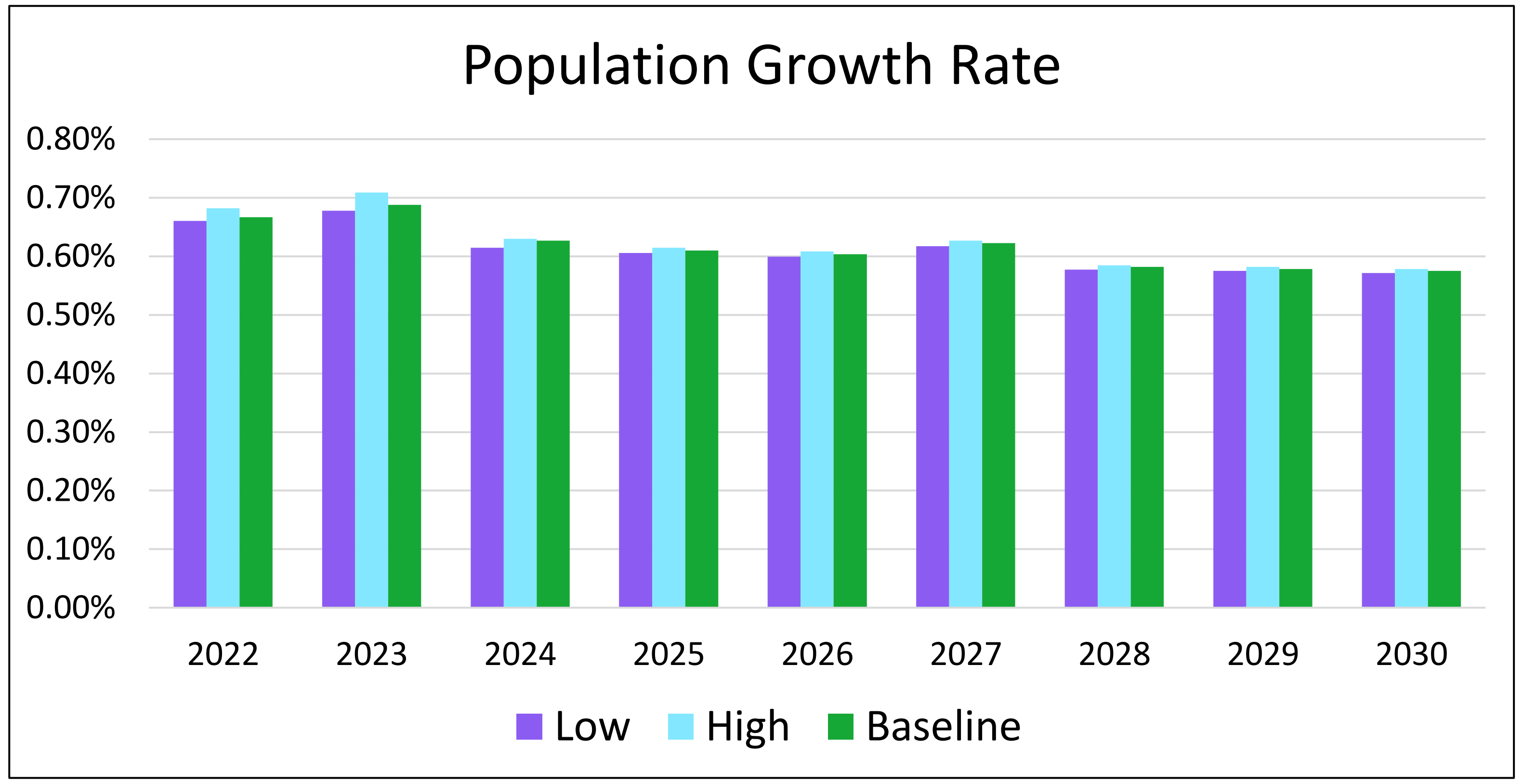
Construction of Scenario Economic Drivers

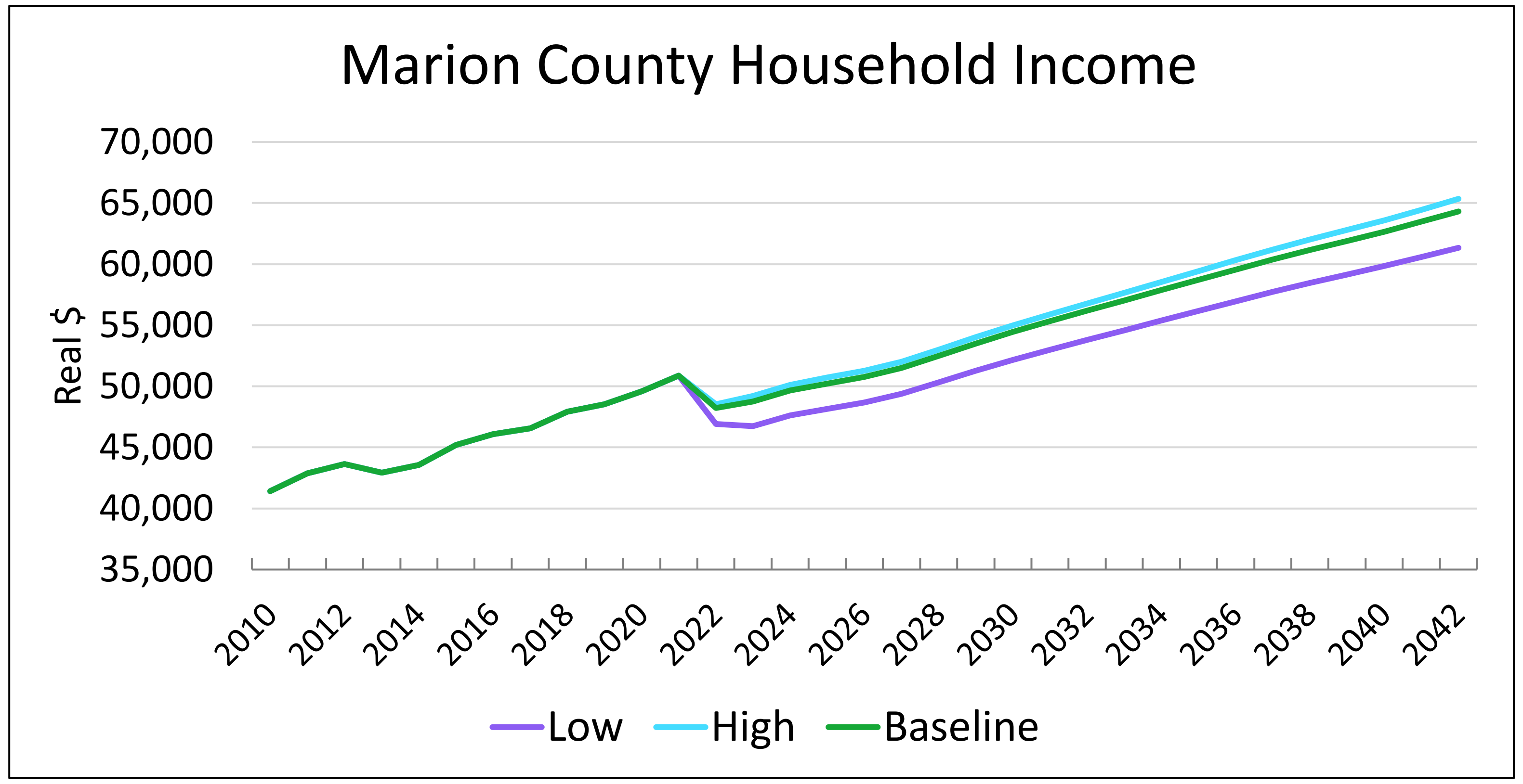
- → Growth rates from the Moody's Low/High scenarios are applied to the Baseline economic variables beginning in January 2022
- → The chosen methodology ensures the growth rates used are less than or equal to the Baseline growth rates in the Low case and greater than or equal to the Baseline growth rates in the High case.
  - ● If this adjustment were not made Low case growth rates would be greater than the baseline in certain years, as seen below. This could result in the Low load forecast exceeding the Baseline load forecast.

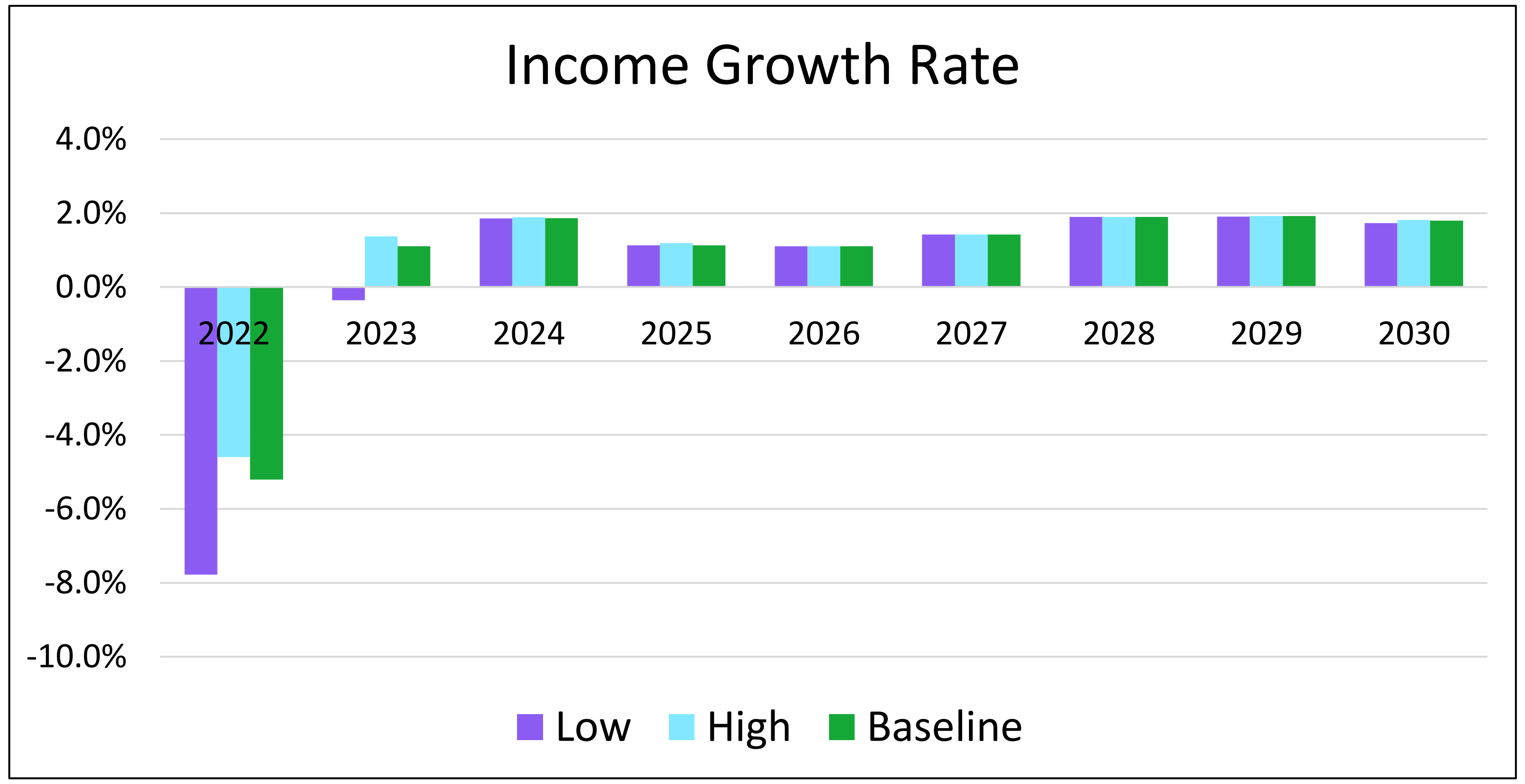


Residential Economic Drivers



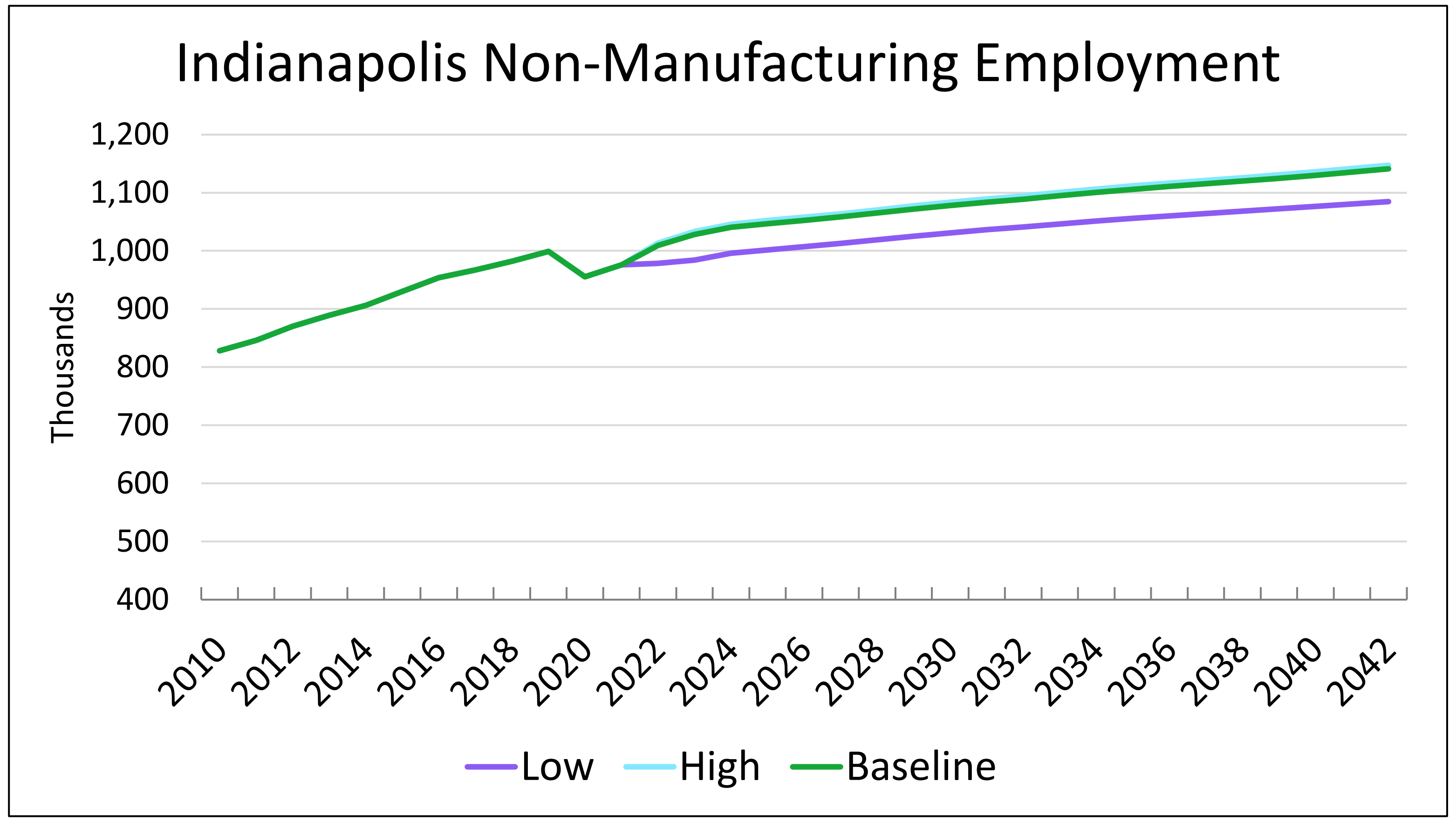


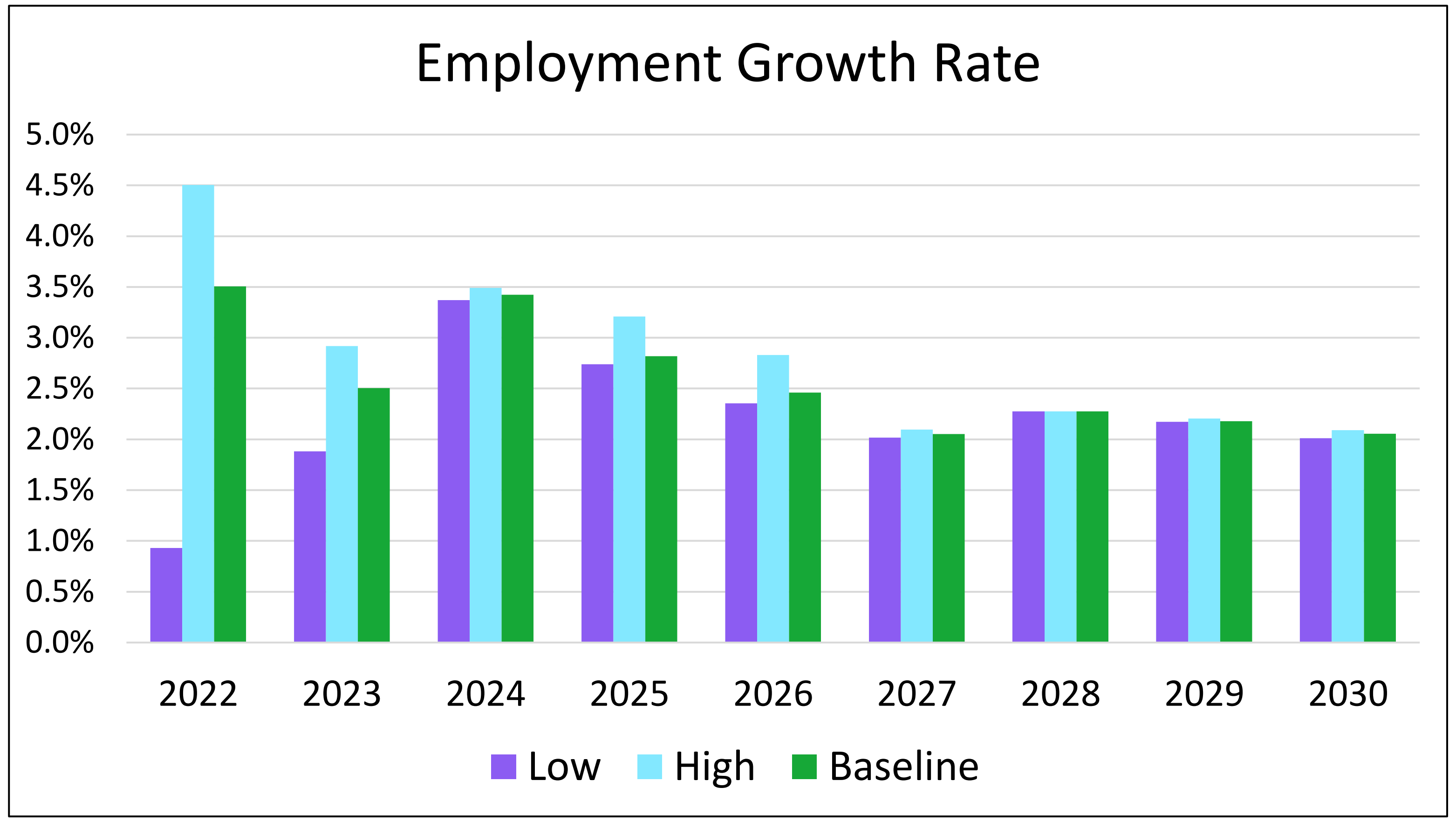


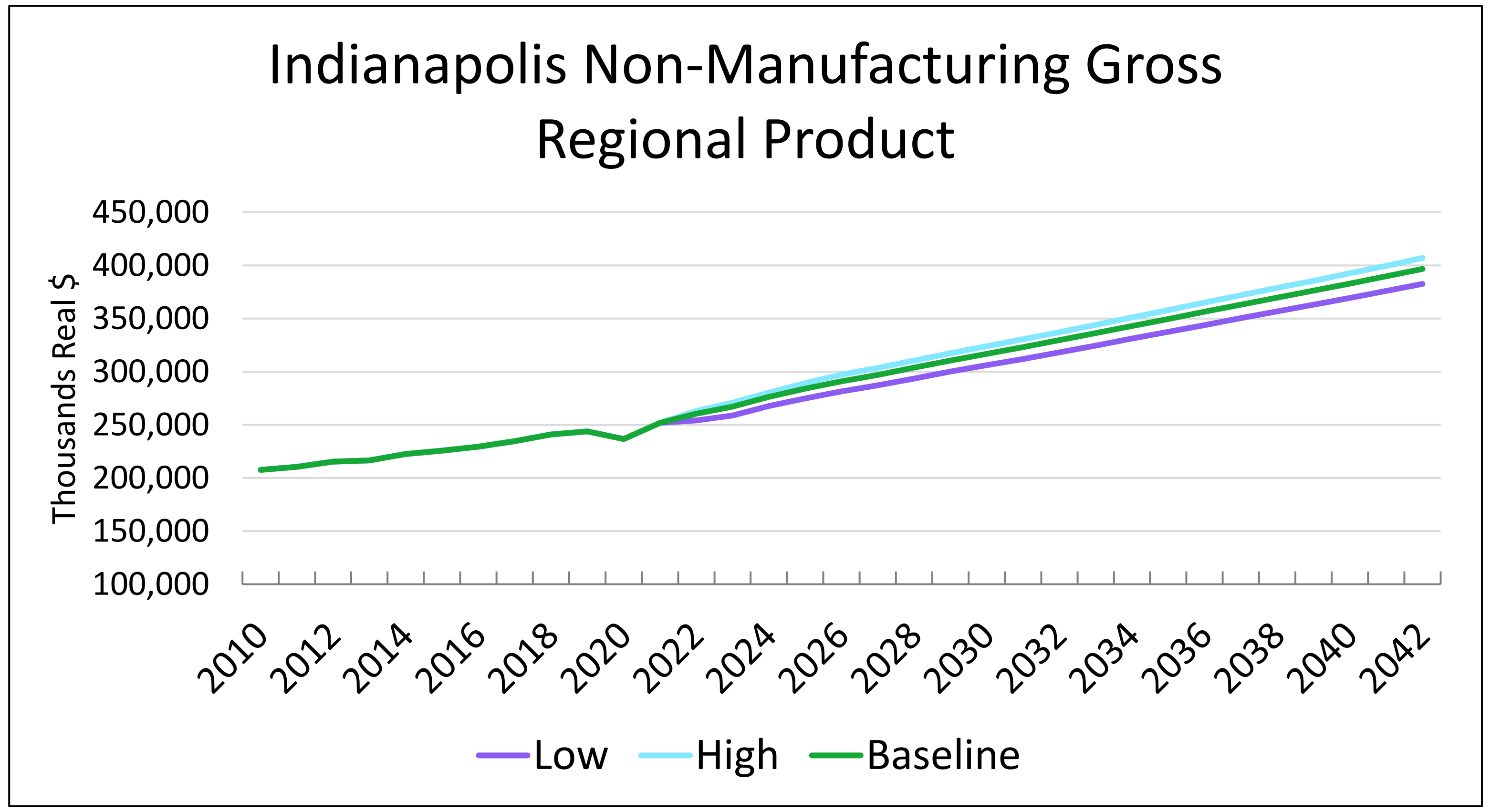


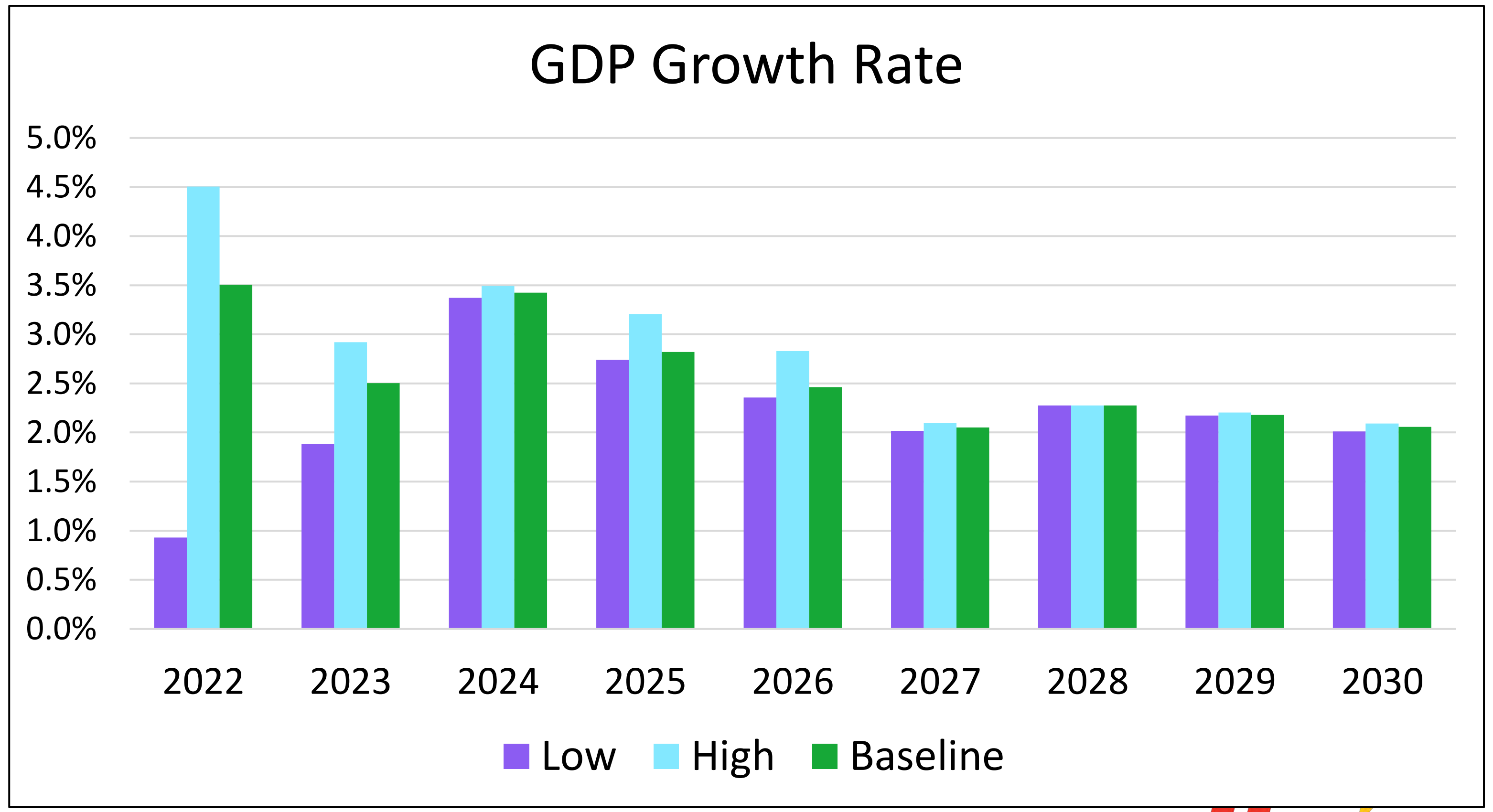
→ Moody Analytics scenarios growth rates are noticeably different in the near-term but revert back to long-term growth rates.

C&I Economic Drivers



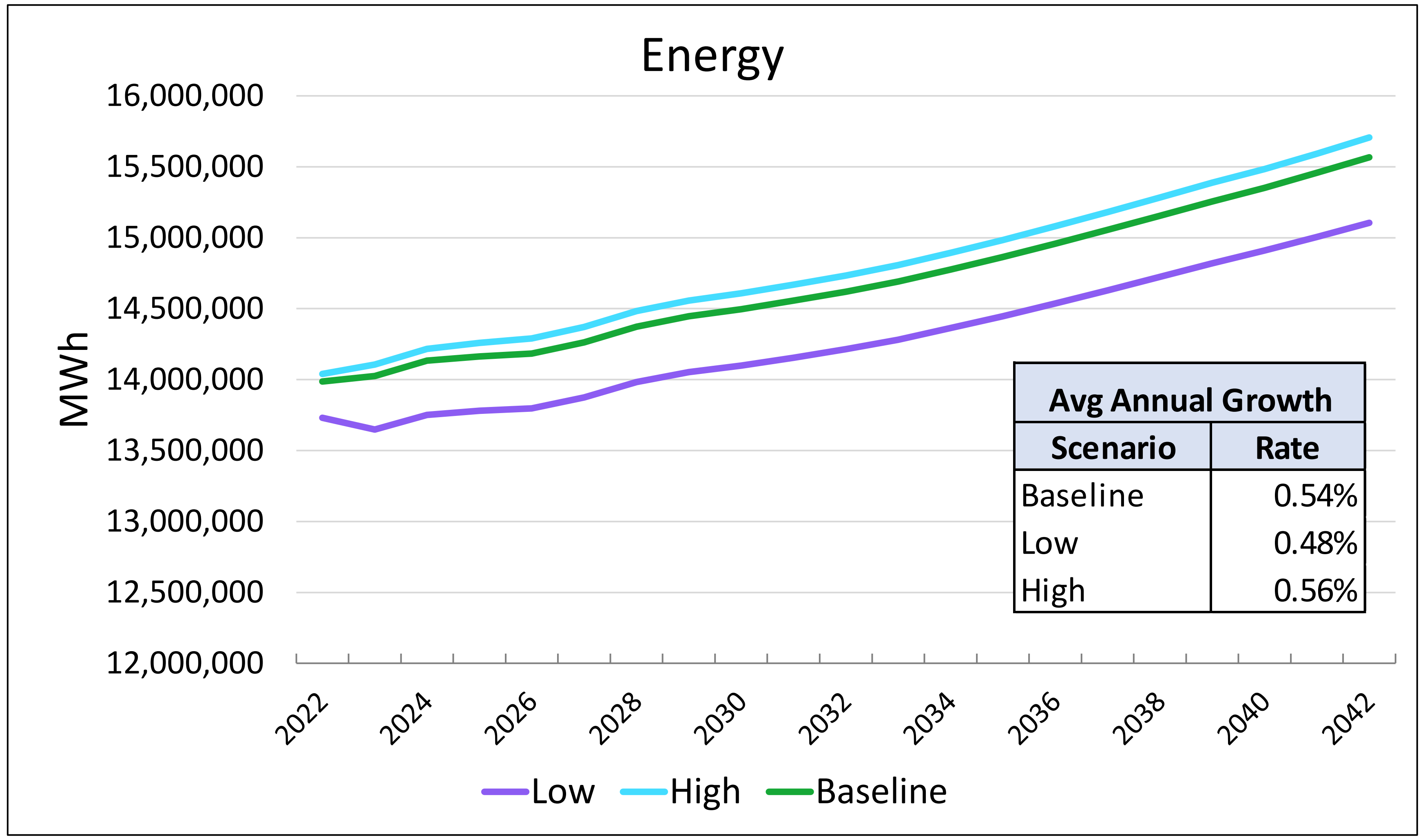




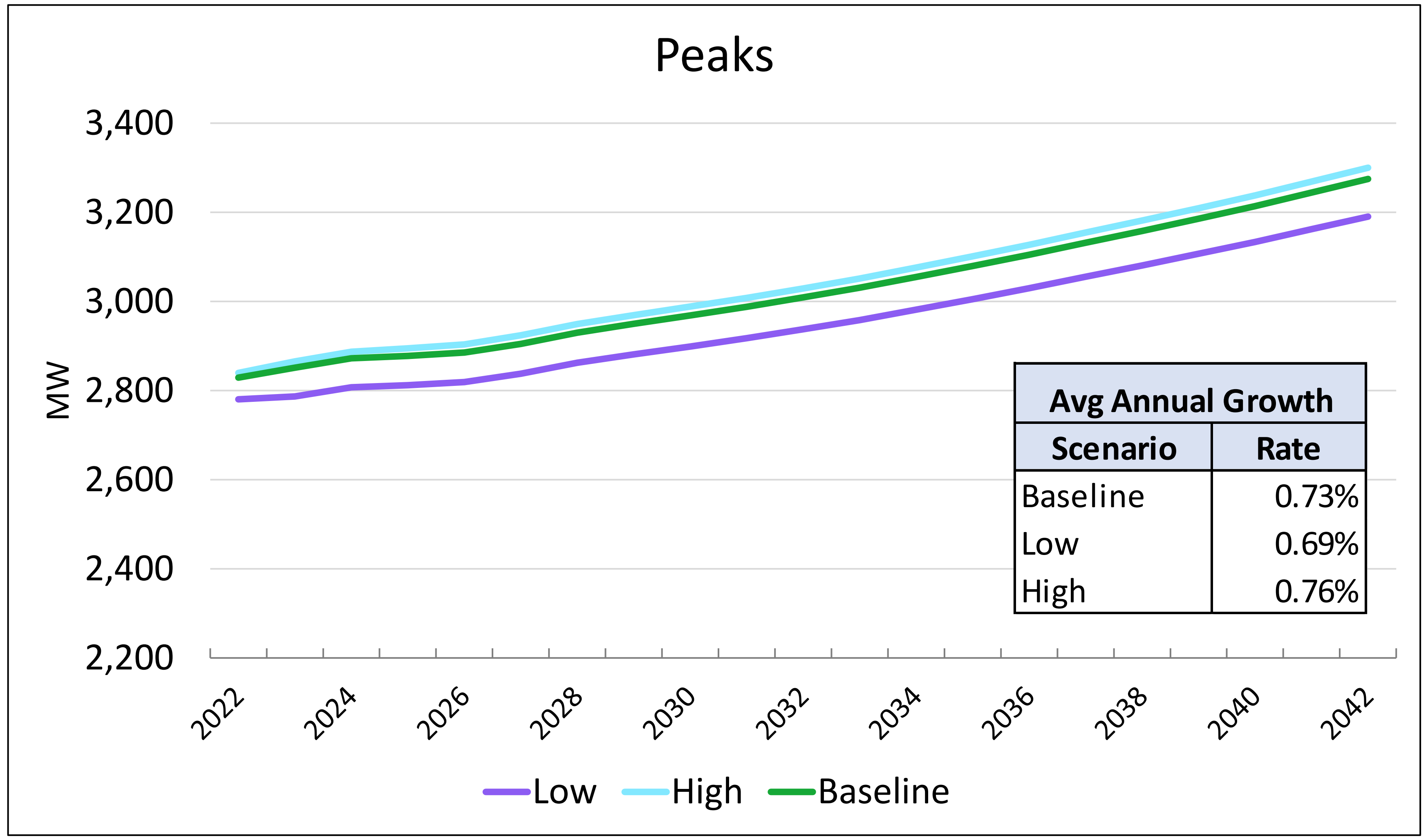


Forecast Scenarios

Energy & Peak Forecast



Avg Annual Growth	
Scenario	Rate
Baseline	0.54%
Low	0.48%
High	0.56%



Avg Annual Growth	
Scenario	Rate
Baseline	0.73%
Low	0.69%
High	0.76%

- Models updated to include actuals through Dec 2021
- Forecasts excludes energy efficiency programs (EE), electric vehicles, and solar impact
- Low forecast results in a reduction of 461,928 MWh and 84 MW by 2042
- High forecast results in an increase of 139,270 MWh and 26 MW by 2042

2022 Integrated Resource Plan (IRP)

DSM Market Potential Study Introduction

Presented by IRP Partners

GDS Associates, Inc.
ENGINEERS & CONSULTANTS

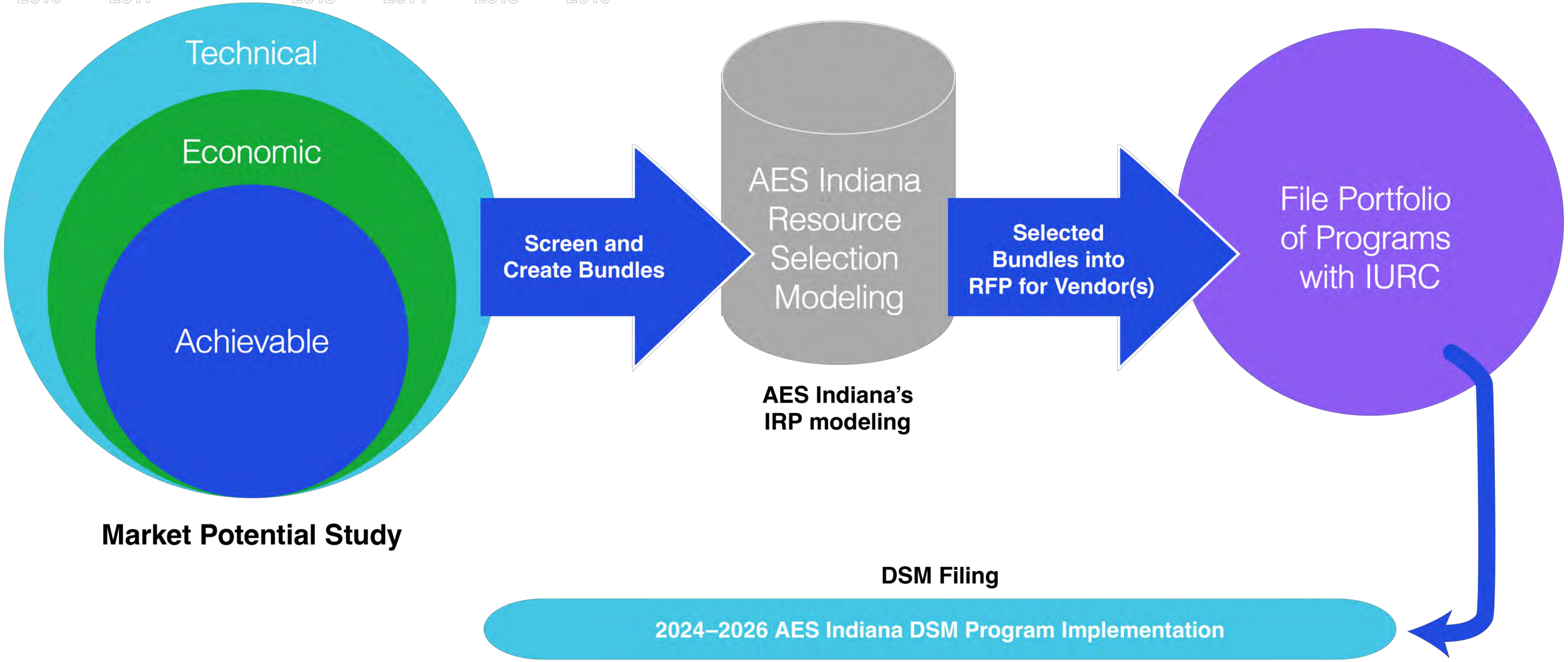
brightline GROUP

aes Indiana

MPS Results & DSM Resources

Introduction to the DSM Process in the IRP

IURC Rules – 170 IAC 4-7-8-c-4
“Analysis showing Supply-side resources and demand-side resources have been evaluated on a consistent and comparable basis.”



Technical

Economic

Achievable

Market Potential Study

Screen and Create Bundles

AES Indiana Resource Selection Modeling

AES Indiana’s IRP modeling

Selected Bundles into RFP for Vendor(s)

File Portfolio of Programs with IURC

DSM Filing

2024–2026 AES Indiana DSM Program Implementation

Agenda

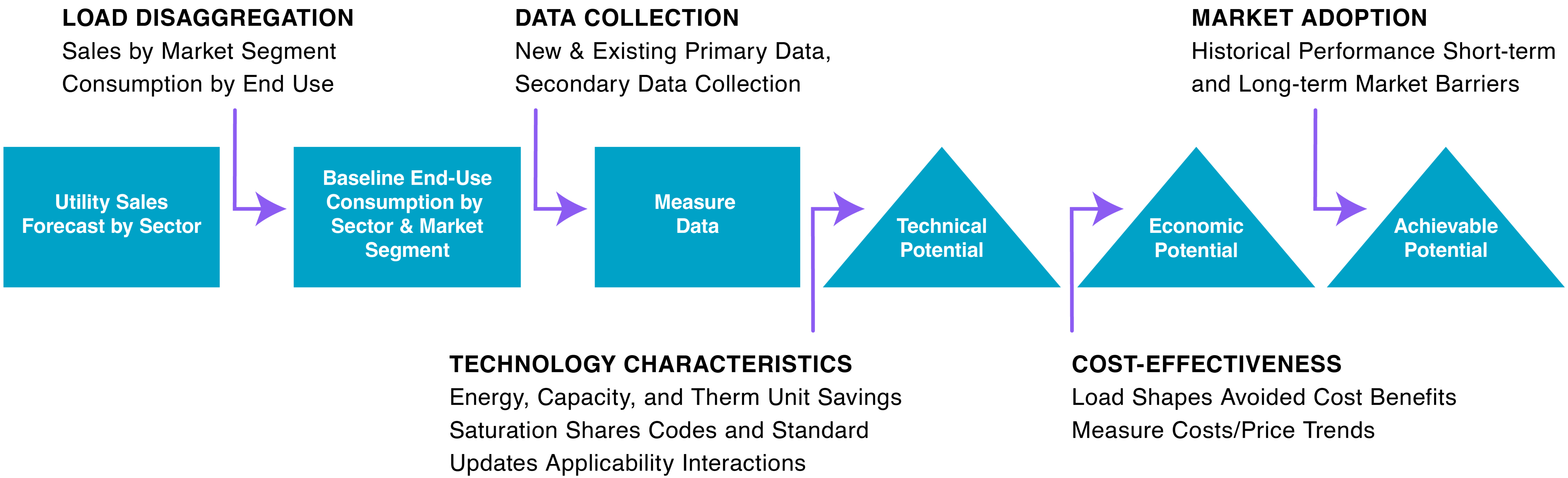
- → MPS Recap
- → Energy Efficiency Potential
  - Overview of results
  - Sector-level results
  - Program potential
- → Demand Response Potential
  - Overview of results
  - Sector-level results
- → Developing DSM IRP Inputs

DSM Market Potential Study

MPS Recap

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates

Overall Market Potential Study Process



LOAD DISAGGREGATION
Sales by Market Segment
Consumption by End Use

DATA COLLECTION
New & Existing Primary Data,
Secondary Data Collection

MARKET ADOPTION
Historical Performance Short-term
and Long-term Market Barriers

TECHNOLOGY CHARACTERISTICS
Energy, Capacity, and Therm Unit Savings
Saturation Shares Codes and Standard
Updates Applicability Interactions

COST-EFFECTIVENESS
Load Shapes Avoided Cost Benefits
Measure Costs/Price Trends

Energy Efficiency Potential Types

TECHNICAL POTENTIAL

All technically feasible measures are incorporated to provide a theoretical maximum potential.

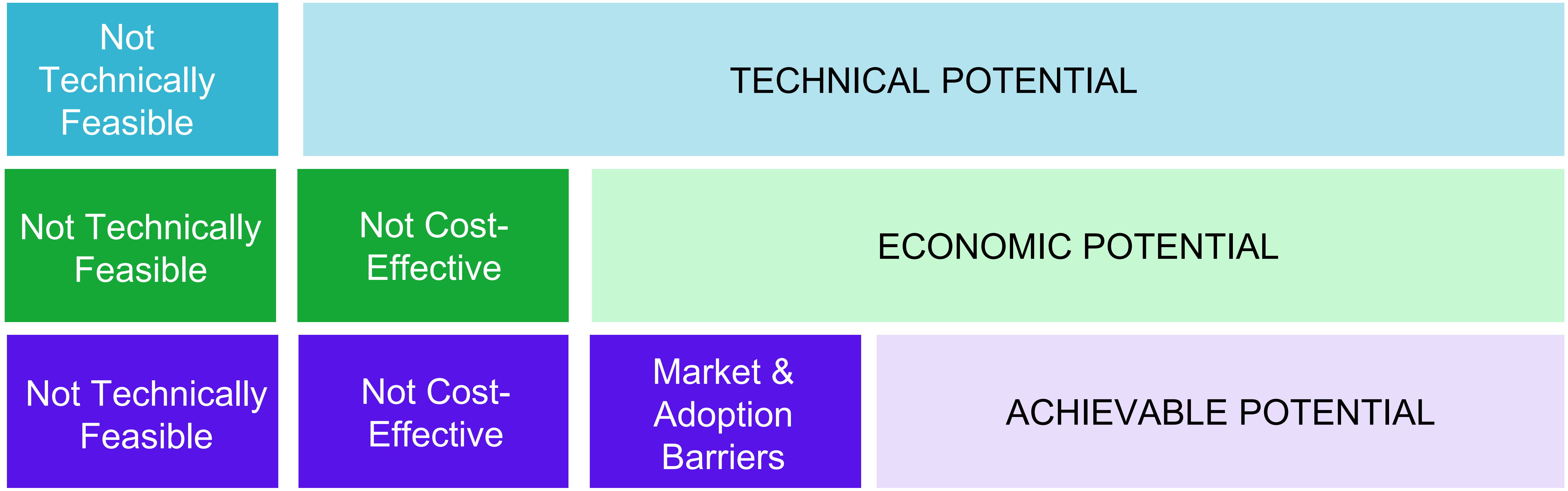
ECONOMIC POTENTIAL

All measures are screened for cost-effectiveness using the UCT Test. Only cost-effective measures are included.

ACHIEVABLE POTENTIAL

Cost-effective energy efficiency potential that can practically be attained in a real-world program delivery case, assuming that a certain level of market penetration can be attained.

Types of Energy Efficiency Potential


Not Technically Feasible
TECHNICAL POTENTIAL
Not Technically Feasible
Not Cost-Effective
ECONOMIC POTENTIAL
Not Technically Feasible
Not Cost-Effective
Market & Adoption Barriers
ACHIEVABLE POTENTIAL

MAXIMUM ACHIEVABLE POTENTIAL (MAP)

Incentives set up to 100% of incremental cost

REALISTIC ACHIEVABLE POTENTIAL (RAP)

Incentives based on historical levels

Key Methodological Assumptions for MAP/RAP

01

Adoption Rates

Method for determining both the short-term and long-term adoption levels by key market segments

02

Incentives

Historical incentives are a key driver of the Realistic Achievable Potential (RAP) scenario

03

Non-Incentive Costs

Non-Incentive costs are included at both the MAP/RAP level

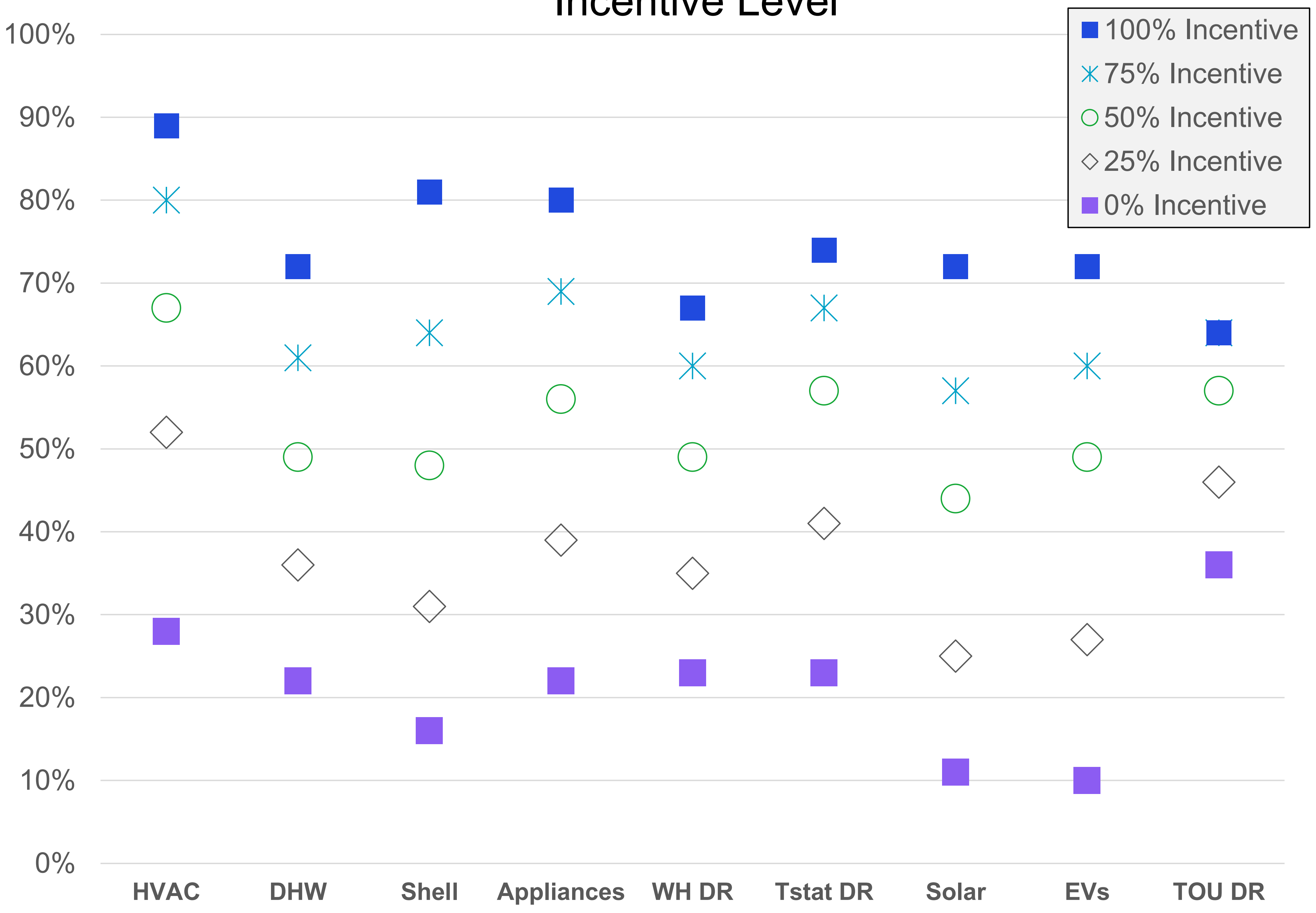
04

Program Mapping & NTG

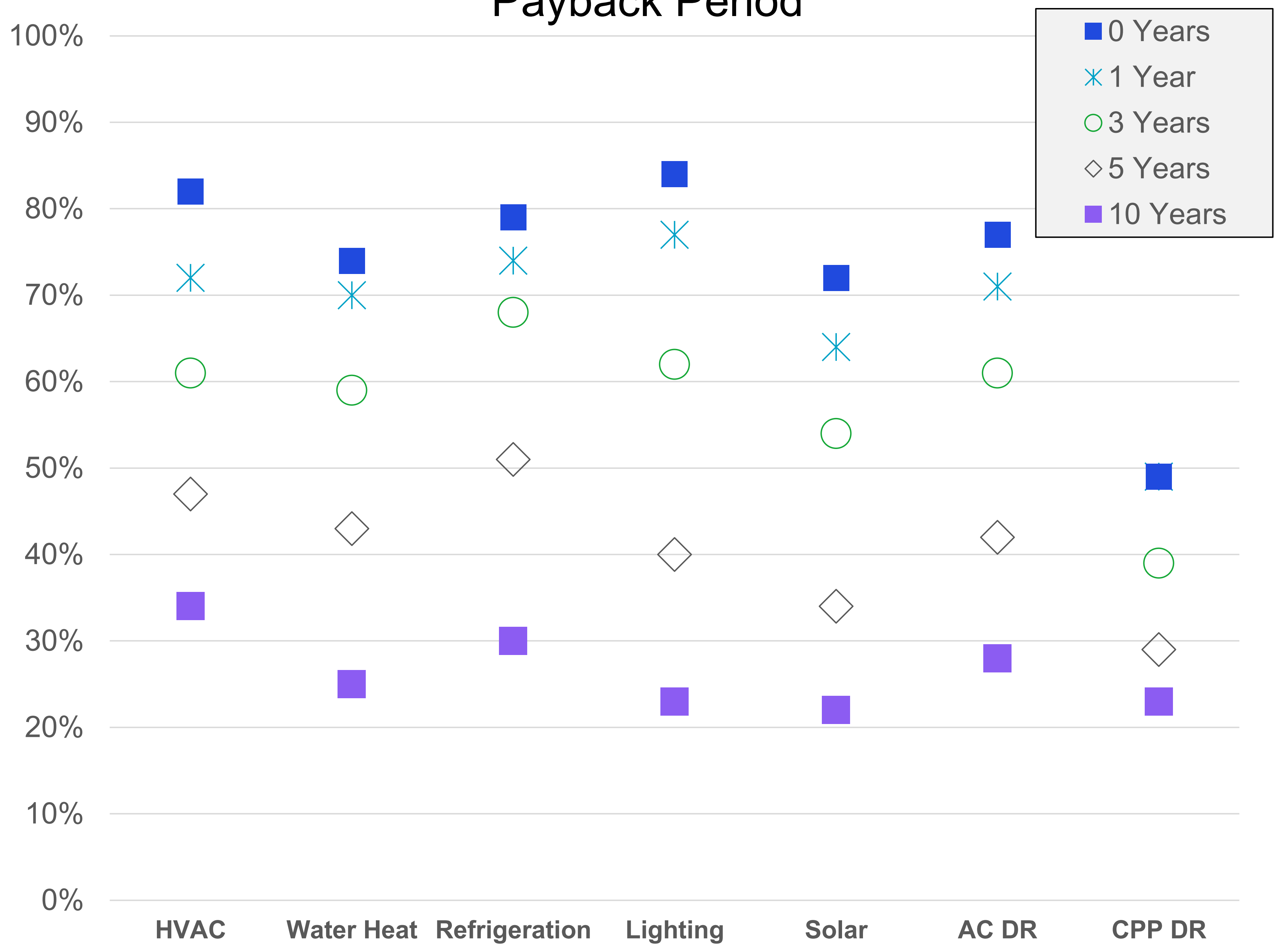
Evaluated NTG results were incorporated to assess Program RAP

Willingness to Participate (WTP) Results

Residential Long-Term Adoption Rates by End Use and Incentive Level



C&I Long-Term Adoption Rates by End Use and Payback Period



*** WTP data gives an indication of the relationship between utility intervention and customer acceptance/adoption of EE technologies*

DSM Market Potential Study Results

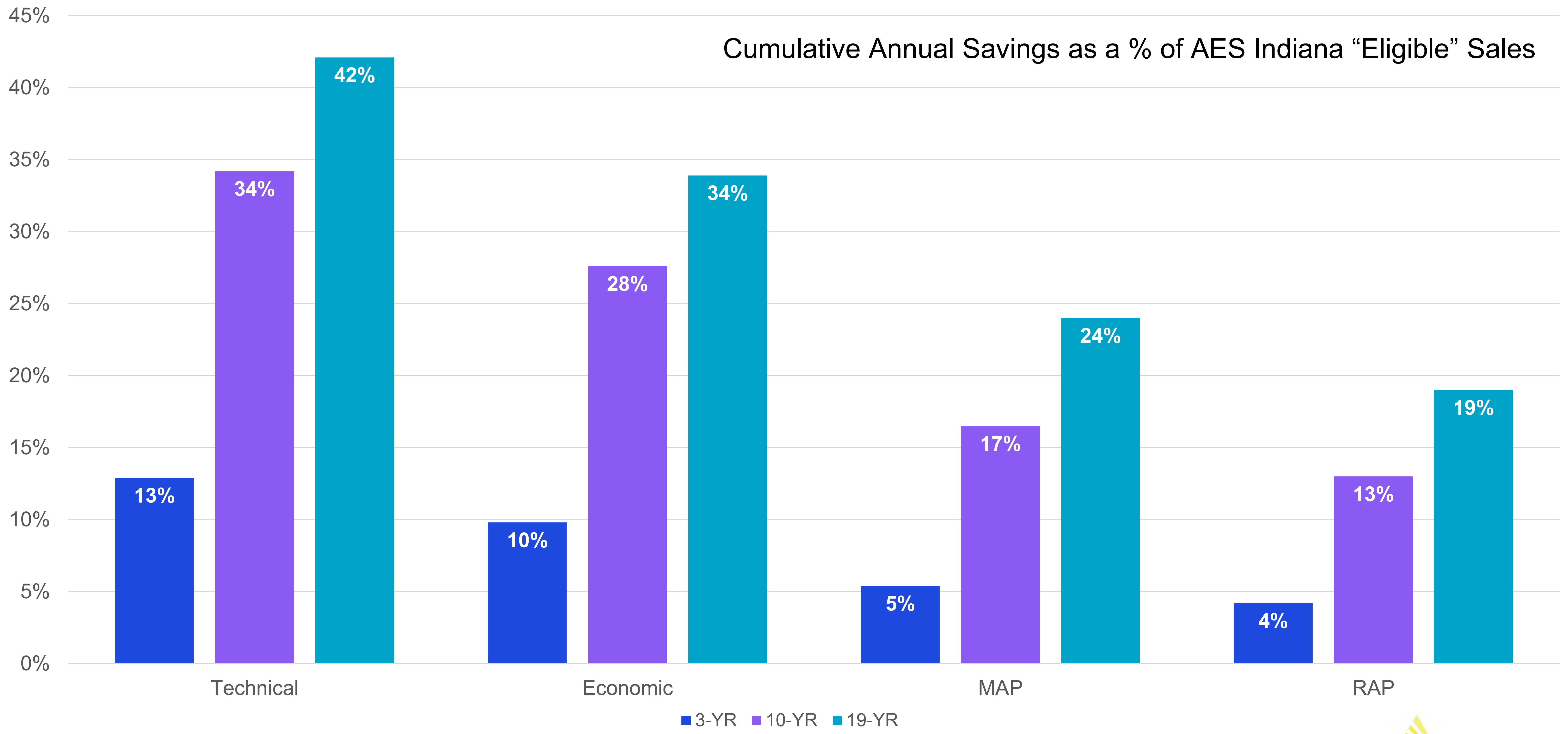
Energy Efficiency (EE) Potential

Initial Comments

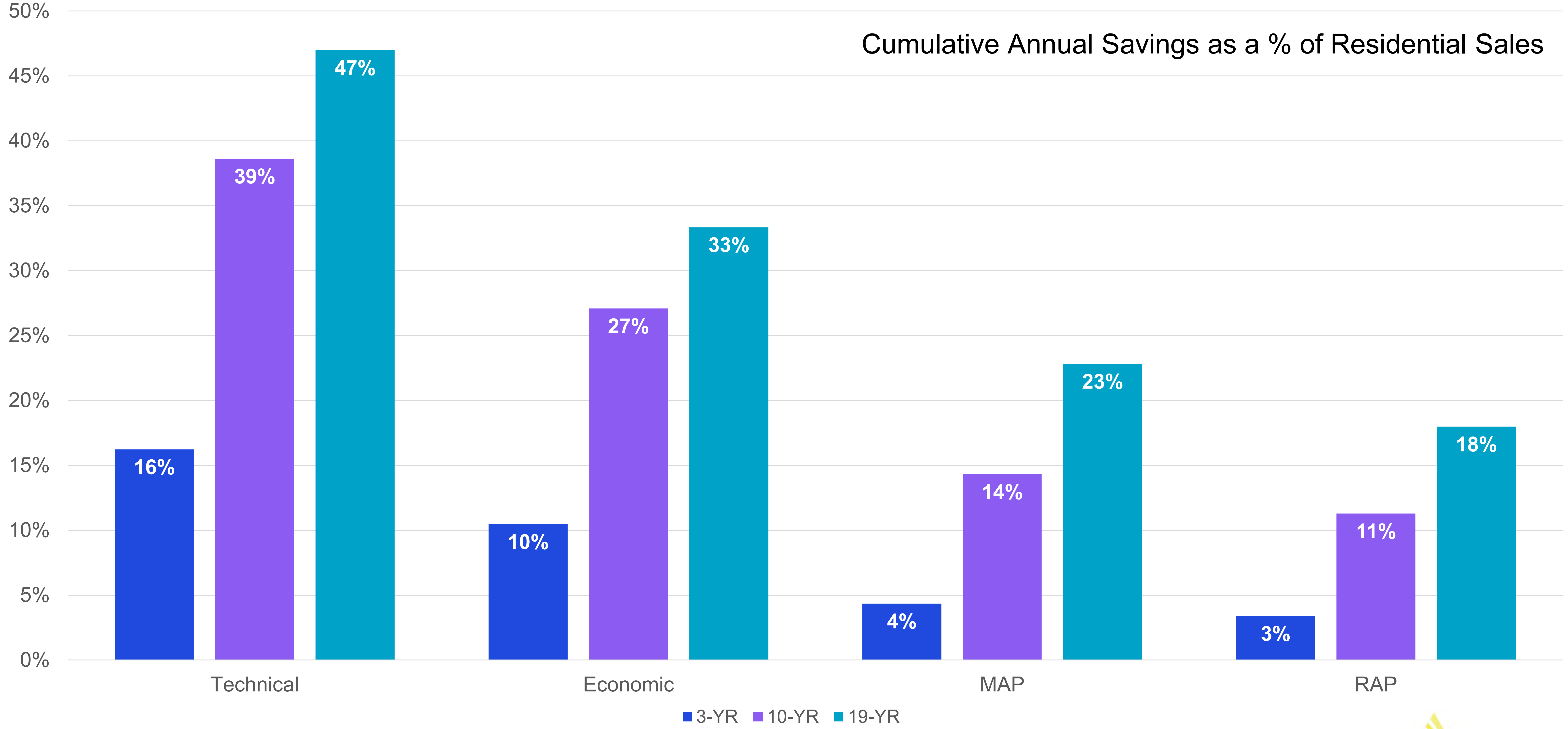
Overall Comments (all sectors):

- All savings are gross
- Economic Screening is the UCT Test using current incentive levels and no administrative costs
- Measure assumptions (savings / costs) are based on a review of current evaluated savings as well as savings from approved sources (i.e., EM&V results, Illinois TRM, MEMD, etc.)
- Technical & Economic potential is a phased-in potential; *i.e. opportunities are dependent on stock turnover*
- RAP scenario is based on current incentive levels and associated long-term adoption rates (informed by primary market research)
- MAP scenario examines ability to move incentive levels higher than historical; *does not examine lowering incentives for measures that do not currently screen as cost-effective.*

Overview of Results – Cumulative Annual

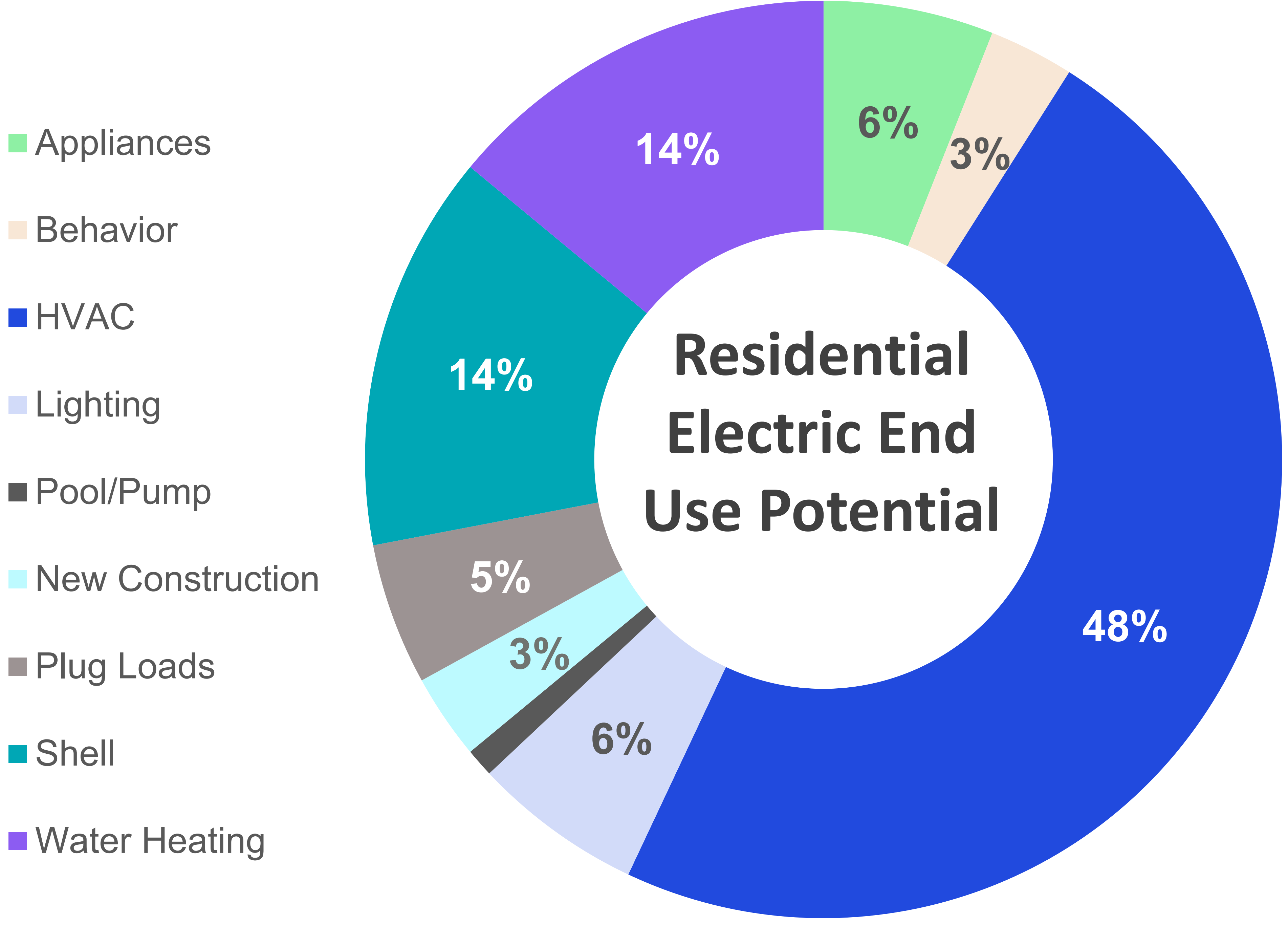


Residential Sector Results



Residential Maximum Achievable Potential (MAP)

2042 Cumulative Annual



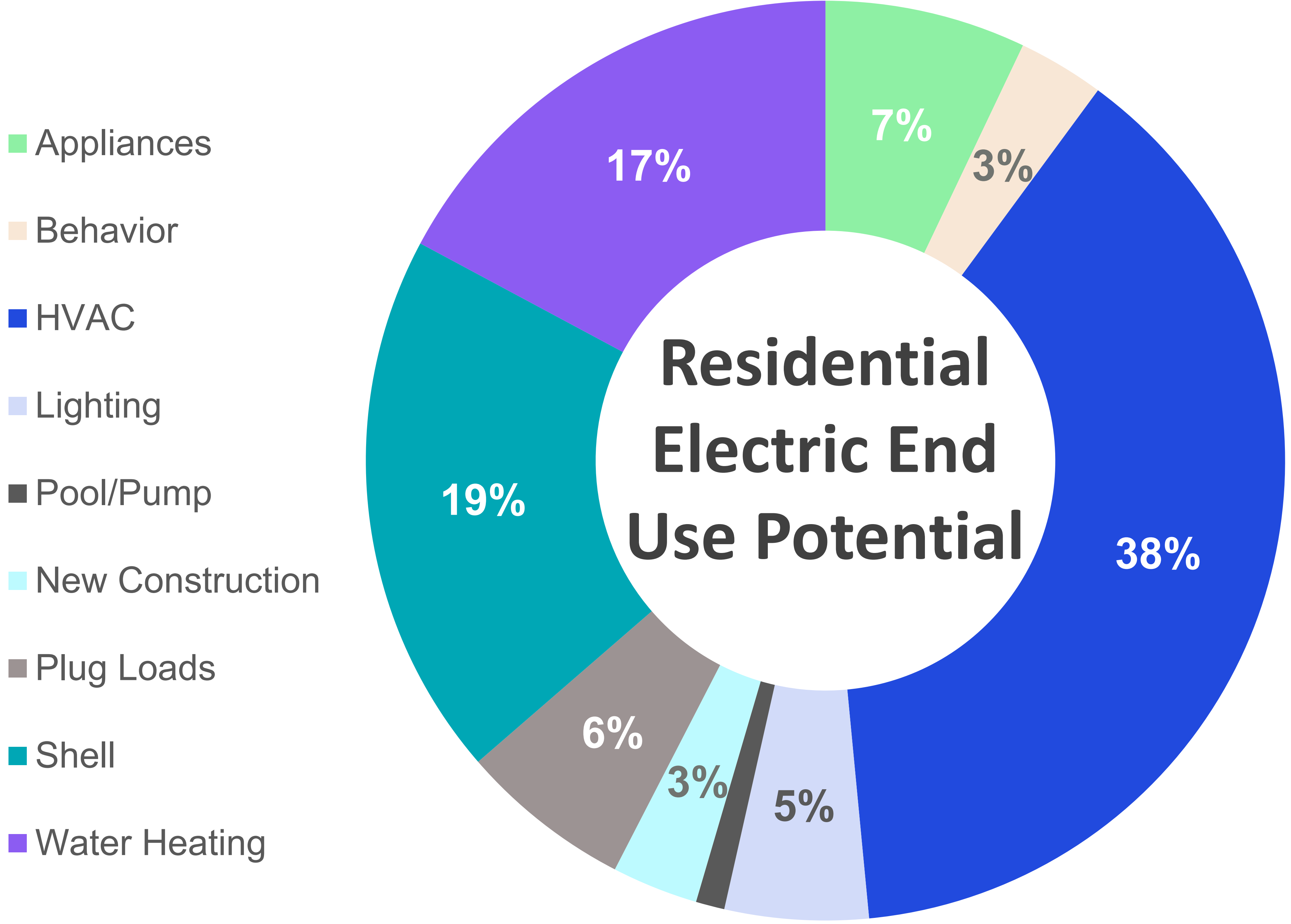
23%

Residential cumulative annual maximum achievable potential as a percentage of forecasted sales in 2042

(compared to 35% by 2039 in 2019 MPS; difference attributable to lower economic potential, updated saturation data and adoption rates)

Residential Realistic Achievable Potential (RAP)

2042 Cumulative Annual

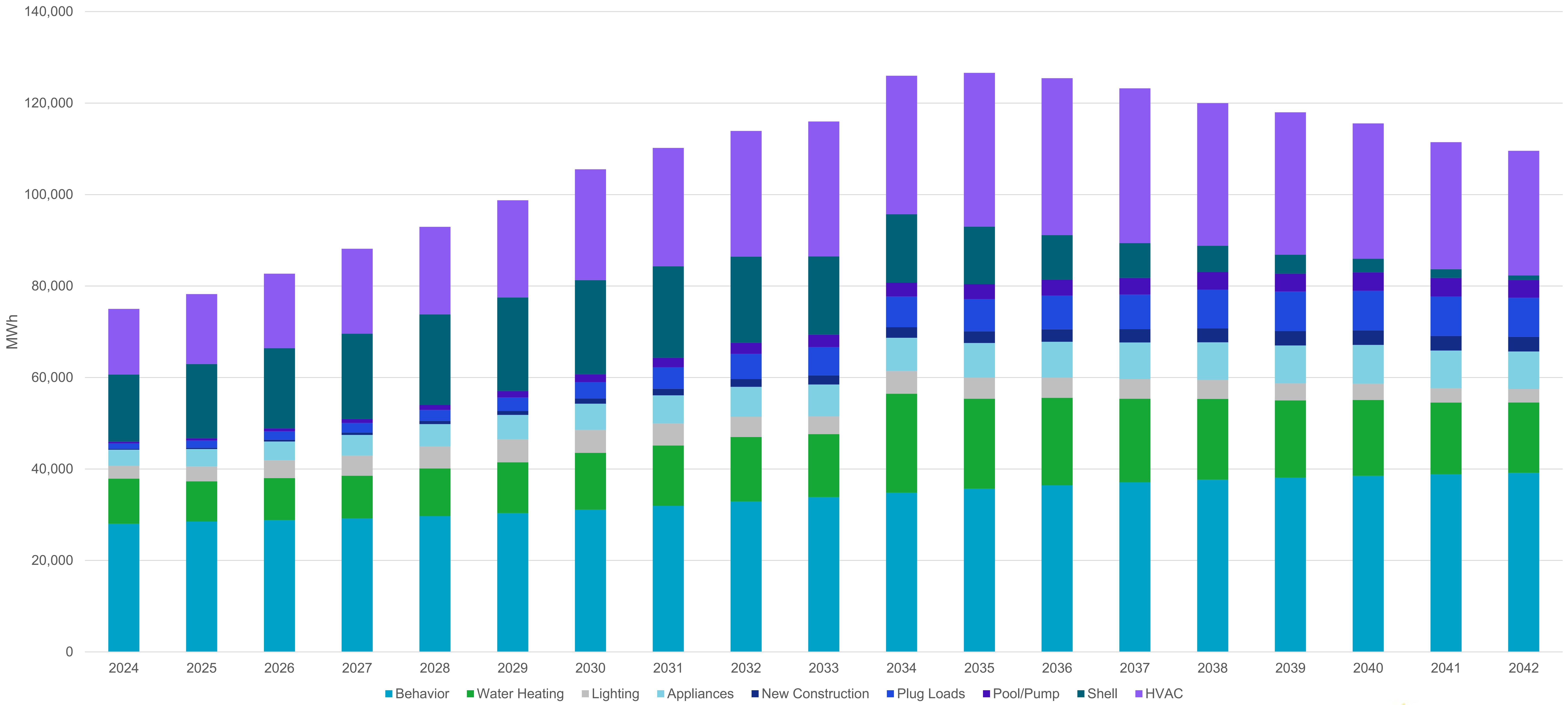


18%

Residential cumulative annual realistic achievable potential as a percentage of forecasted sales in 2042

(compared to 24% by 2039 in 2019 MPS; difference attributable to lower economic potential, updated saturation data and adoption rates)

Residential Incremental Annual Savings by End Use



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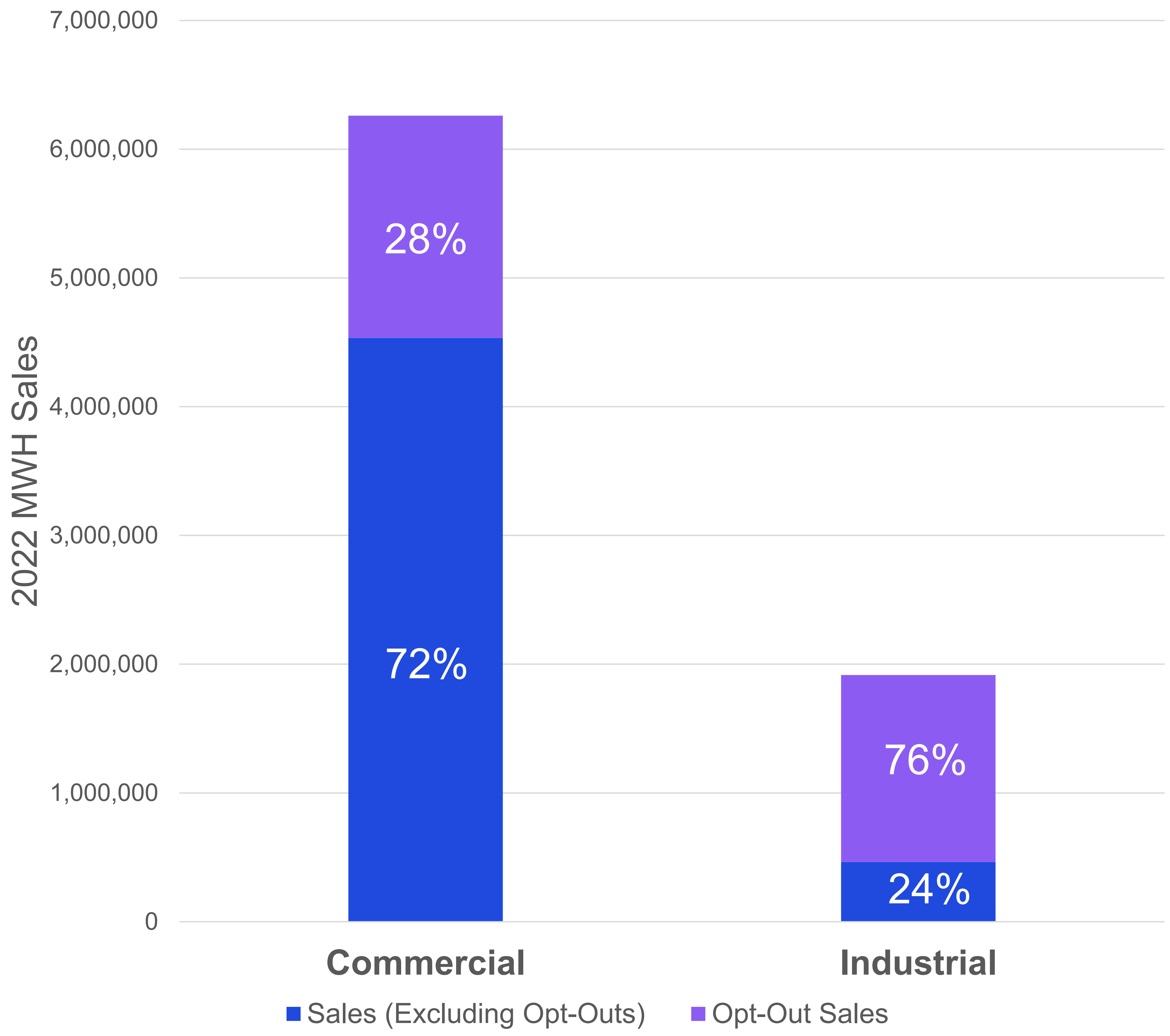
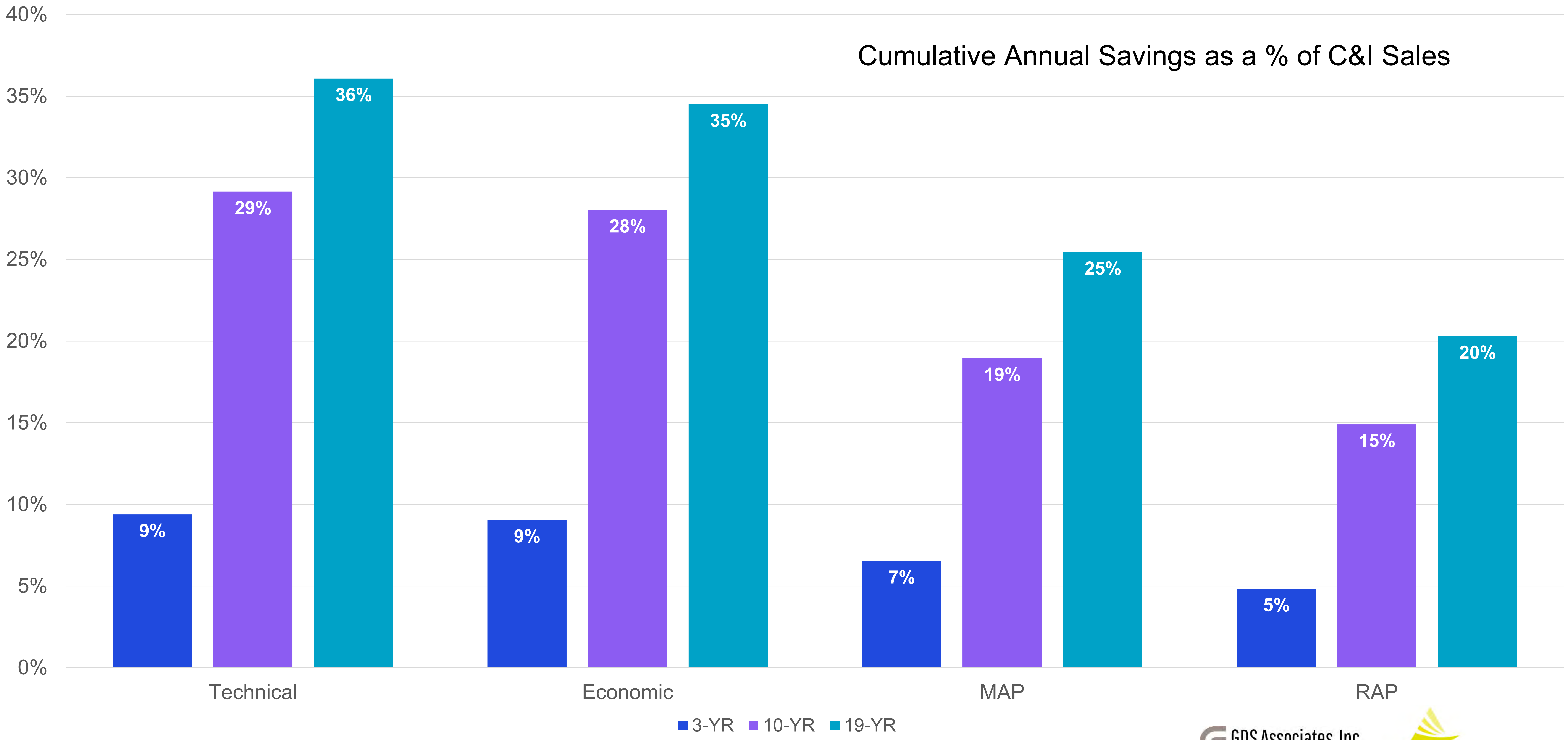
C&I Opt-Outs



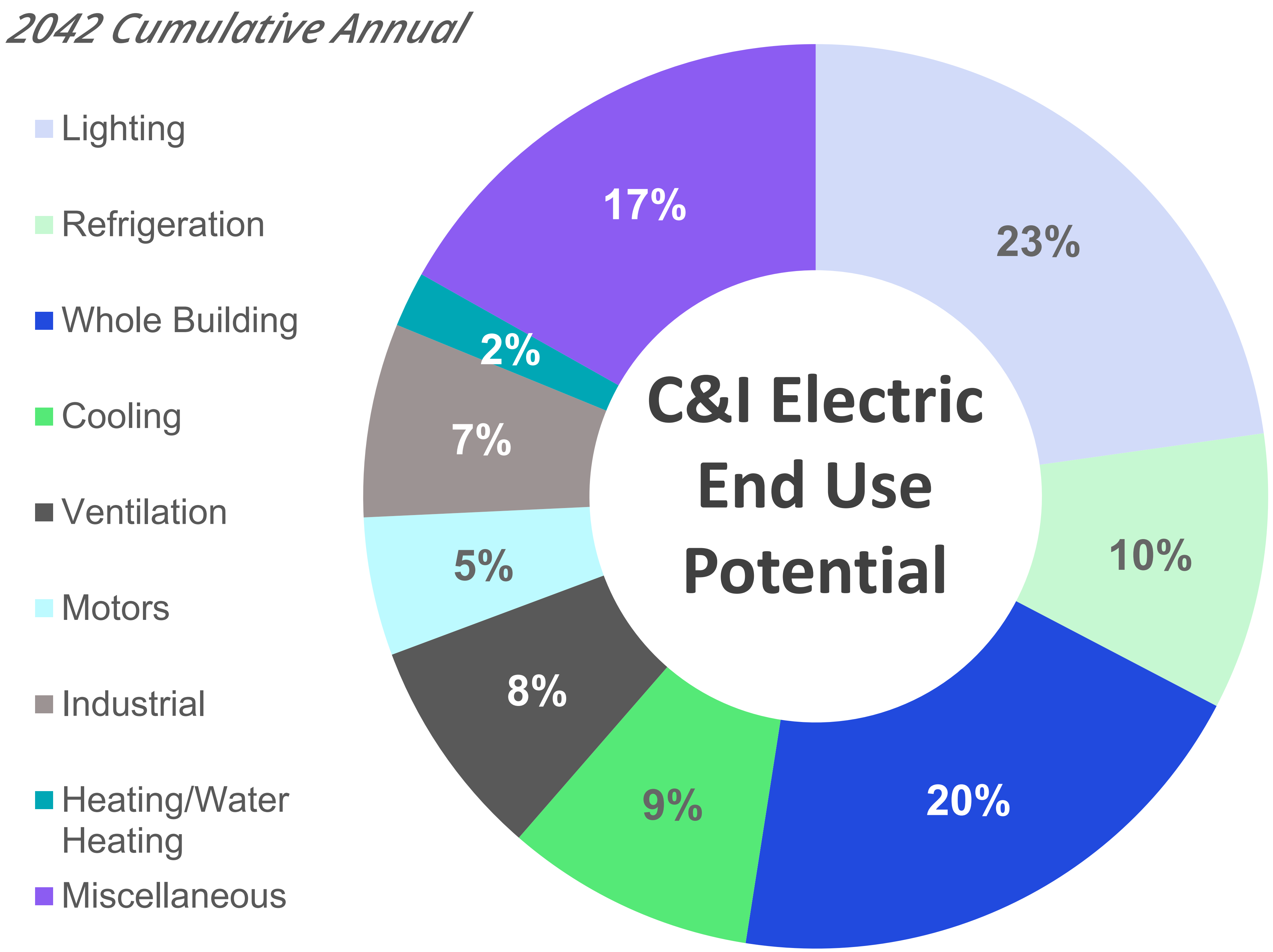
C&I "Opt-Out Sales" Adjustment

- → MPS uses only "eligible" sales for electric energy efficiency potential, removing sales from C&I customers who opt-out of the energy efficiency rider.
- → 28% of Commercial Sales were from opt-out customers in 2022
- → 76% of Industrial Sales were from opt-out customers in 2022
- → Savings (as a % of sales) are relative to "eligible" sales in subsequent slides

C&I Sector Results



C&I Maximum Achievable Potential (MAP)



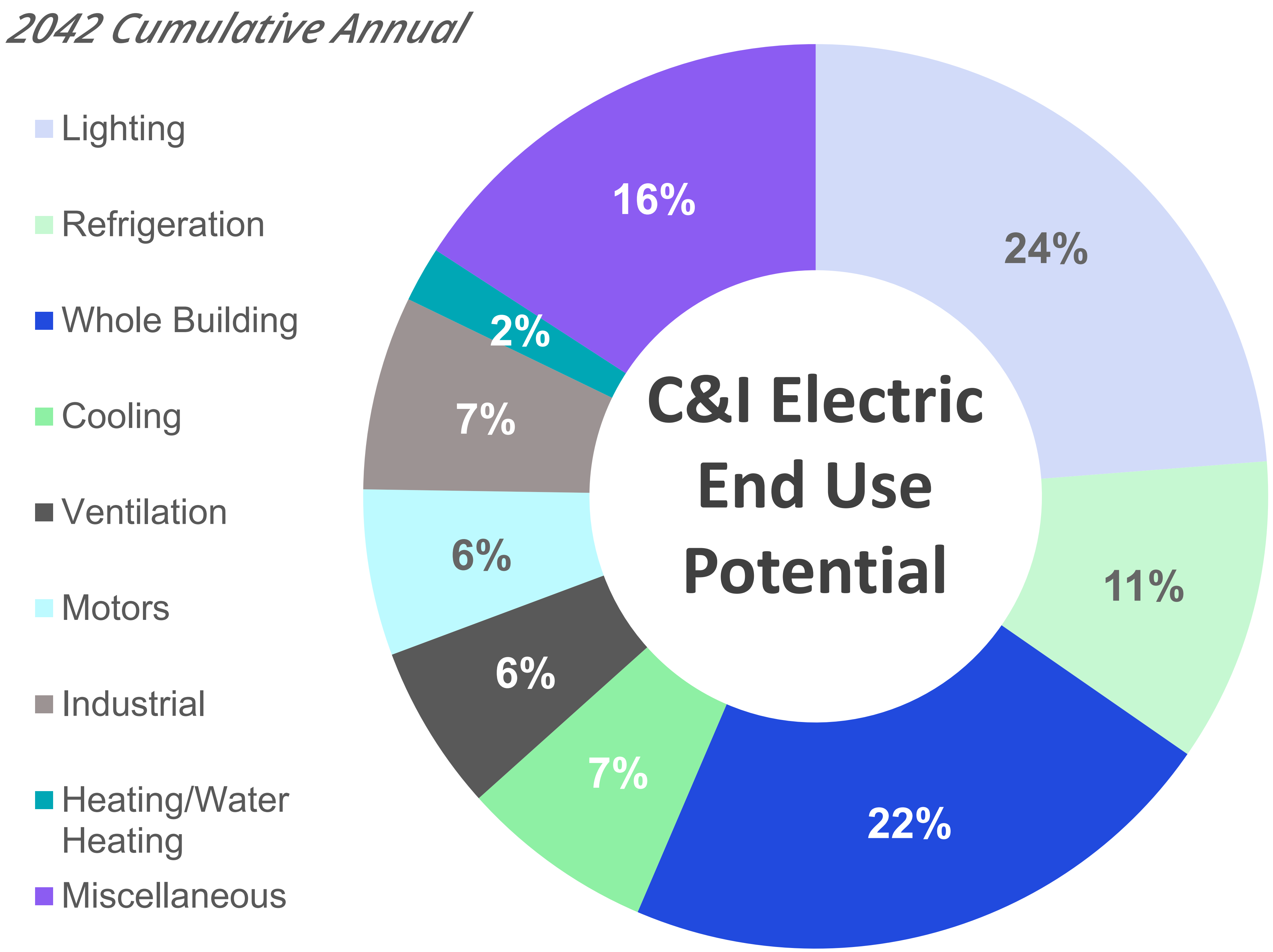
25%

C&I cumulative annual maximum achievable potential as a percentage of forecasted sales in 2042

(compared to 36% by 2039 in 2019 MPS ; primary difference in assumed MAP incentive assumptions and associated adoption levels)

***Other includes potential associated with cooking, compressed air, behavioral and other miscellaneous loads (elevators, vending machines, etc.)*

C&I Realistic Achievable Potential (RAP)



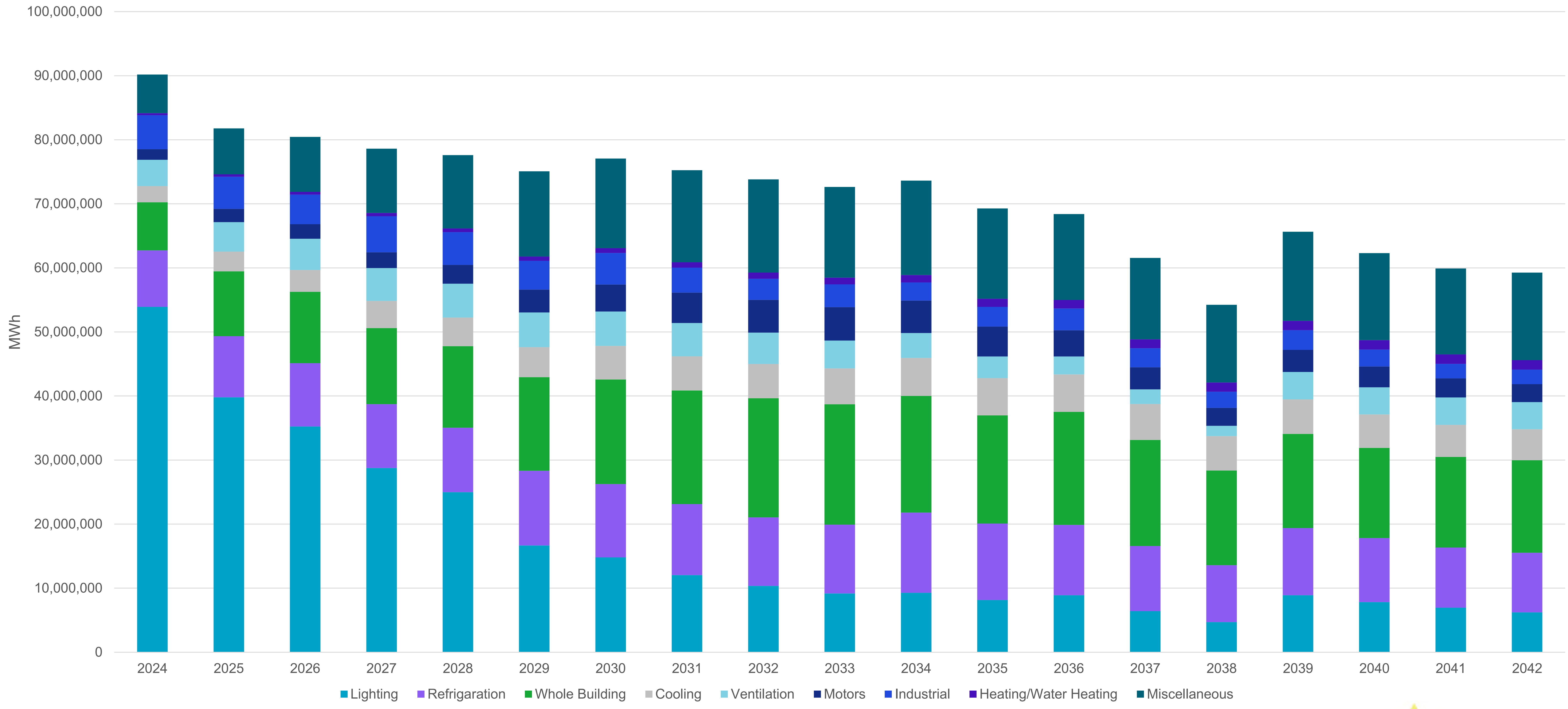
20%

C&I cumulative annual maximum achievable potential as a percentage of forecasted sales in 2042

(compared to 19% by 2039 in 2019 MPS)

***Other includes potential associated with cooking, compressed air, behavioral and other miscellaneous loads (elevators, vending machines, etc.)*

C&I Incremental Annual Savings by End Use



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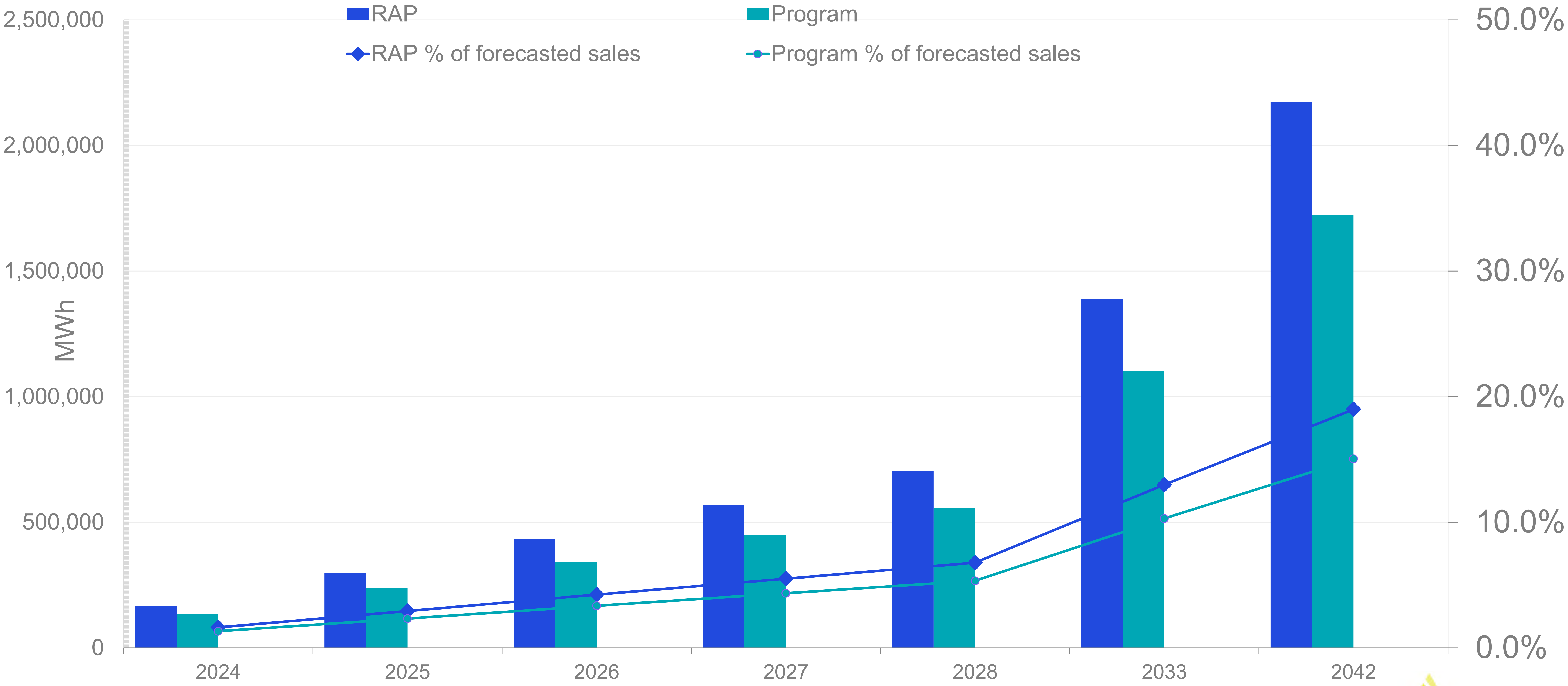
Developing Program Potential from RAP

Key differences between RAP and Program Potential:

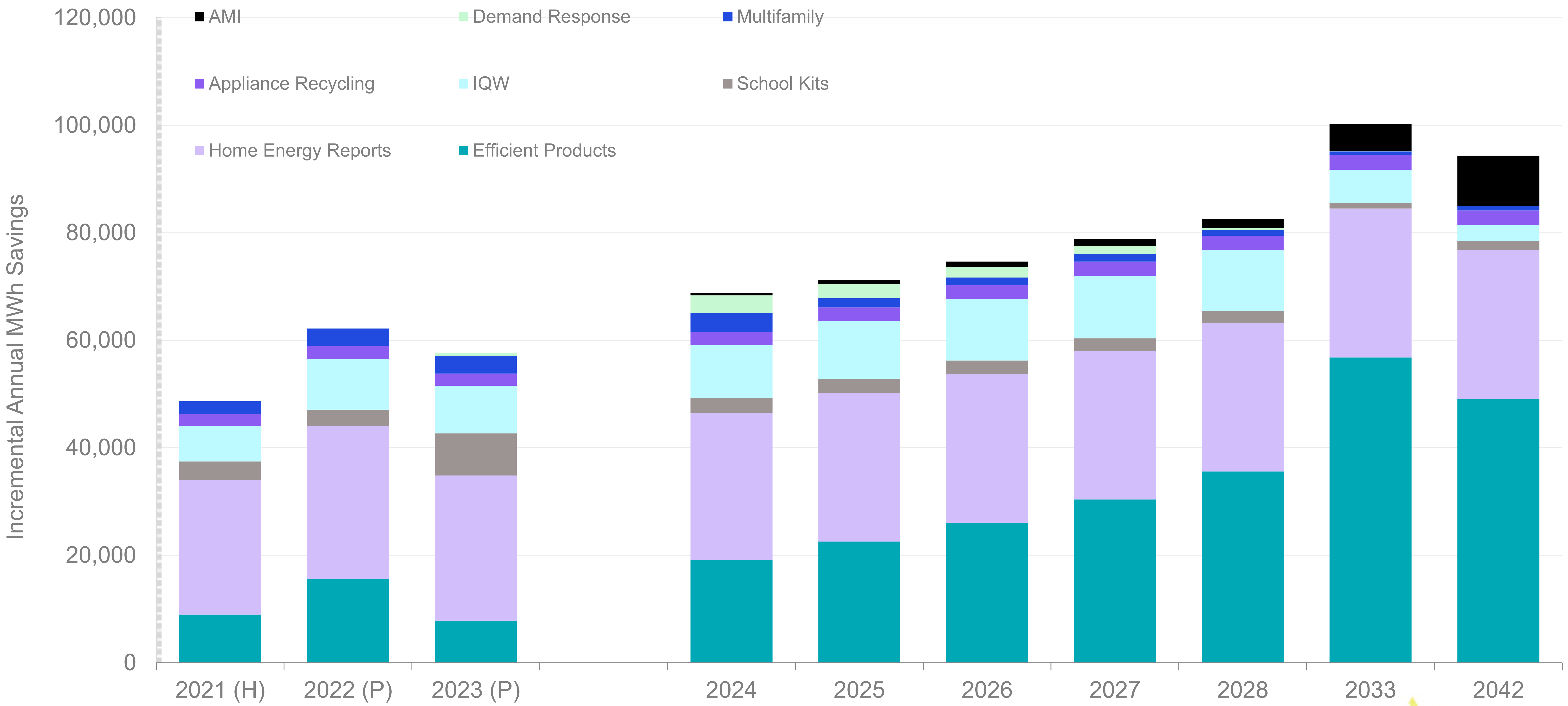
Program Potential applies the most recent evaluated net-to-gross (“NTG”) ratios to the RAP (overall reduction due to NTG <1.0).

Residential Program	NTG Ratio
Efficient Products	80%
Home Energy Reports	100%
School Kits	63%
Income-Qualified Weatherization	89%
Appliance Recycling	70%
Multifamily	98%
Demand Response	100%
C&I Programs	**NTG Ratio**
Prescriptive	74%
Custom	80%
Strategic Energy Management	100%

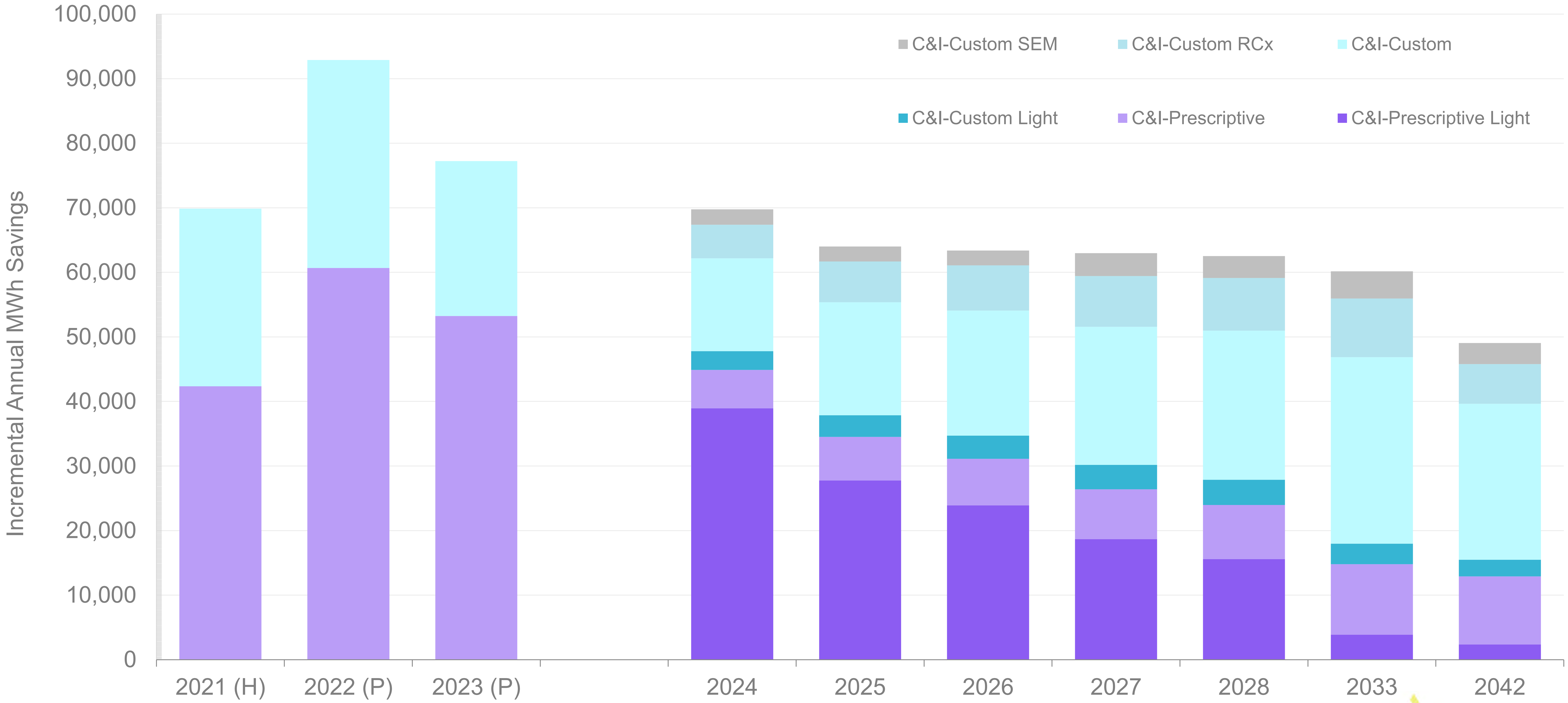
Comparison of RAP and Program Potential



Annual Residential Program Potential



Annual C&I Program Potential

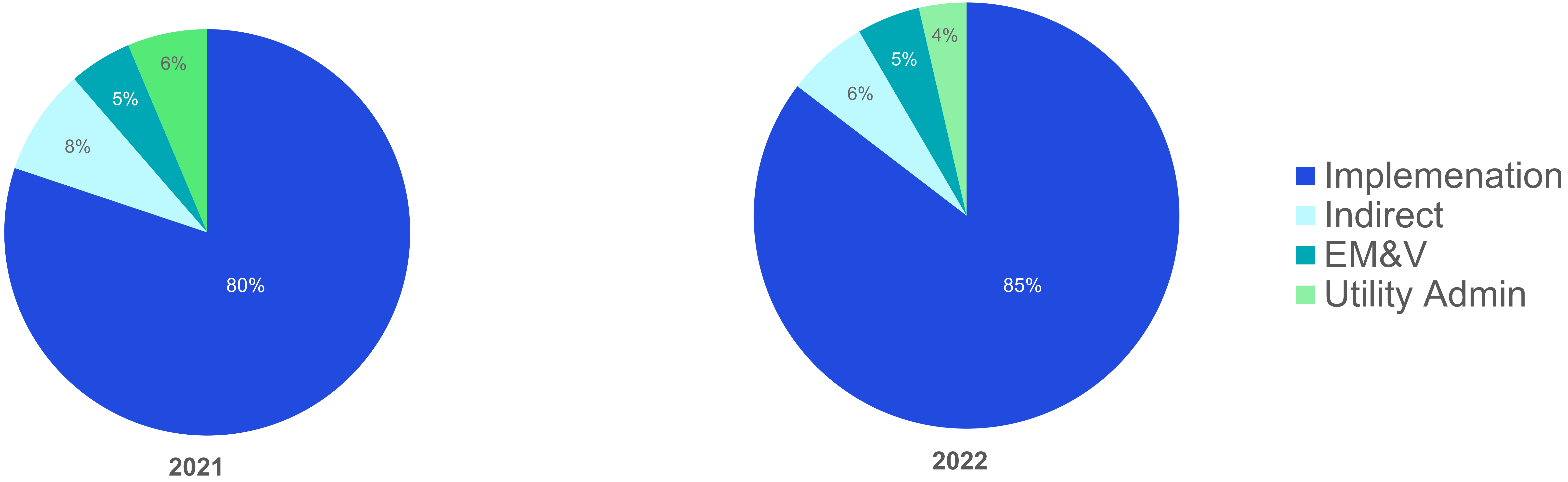


Program Potential Non-Incentive Costs

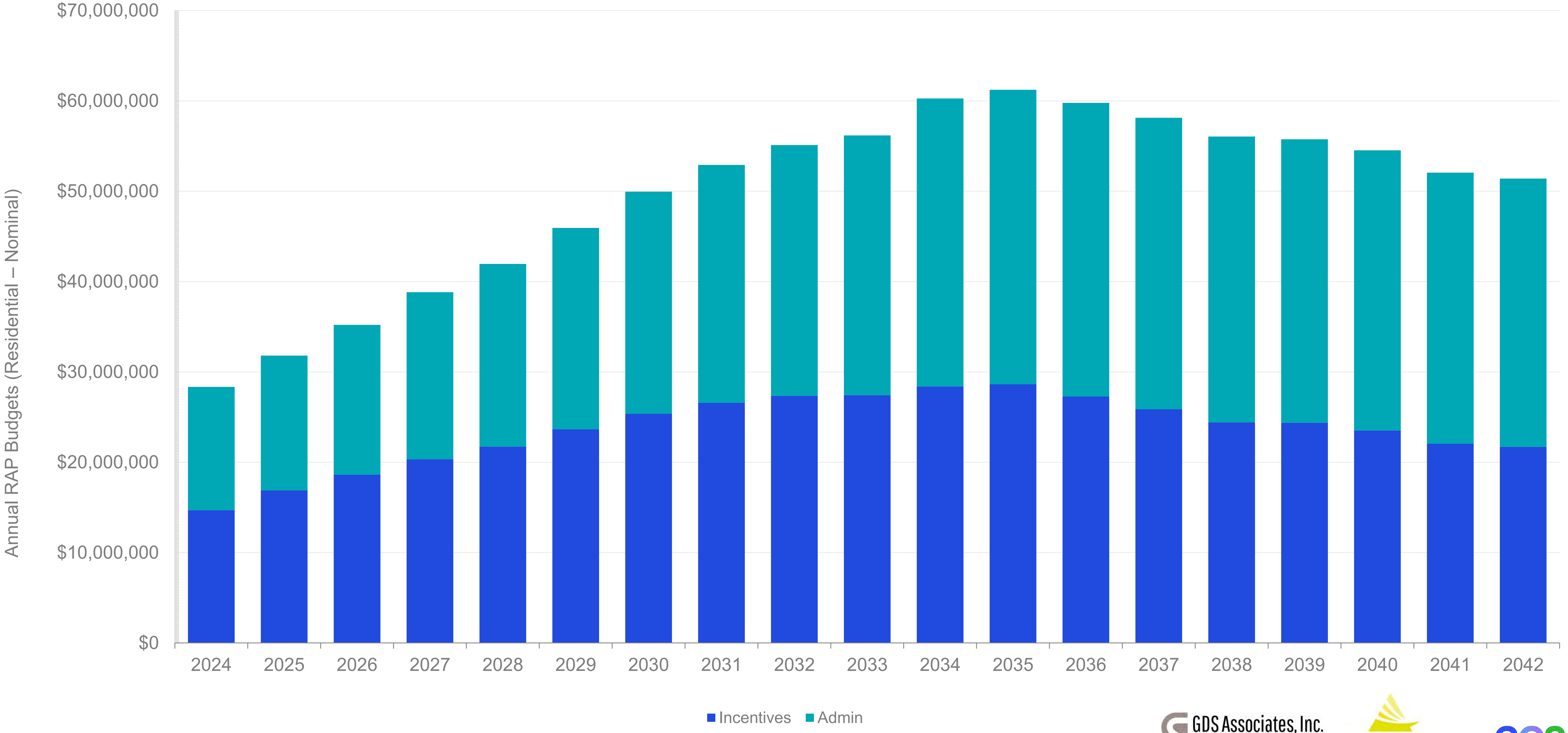
Non-Incentive costs were developed using recent 2021-2022 actual program cost data. Program non-incentive costs were calculated on a gross $ per first-year kWh saved. Non-incentive costs were developed for each sector, and by program when possible.

Historical non-incentive cost categories include:

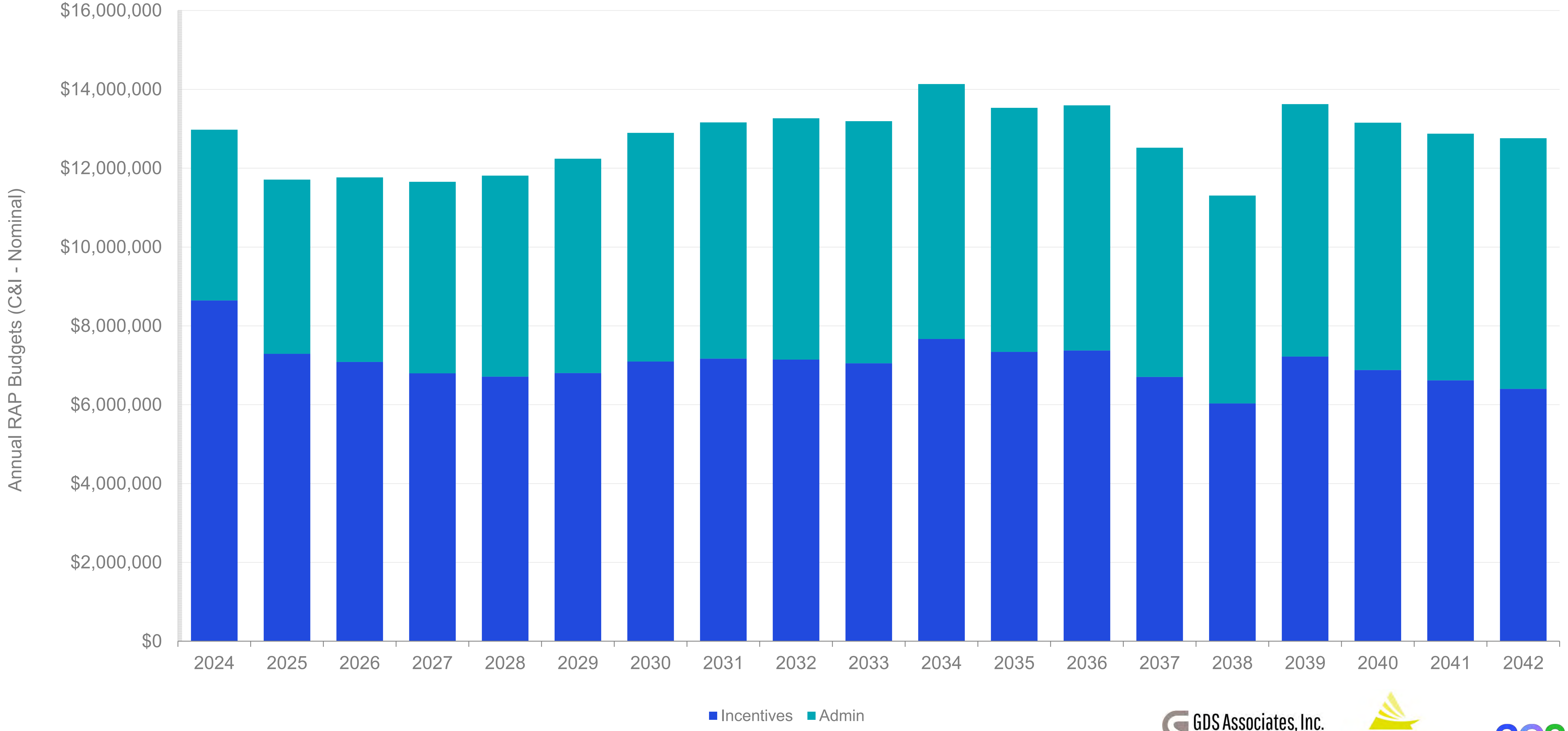
- Implementation
- Utility admin
- Indirect
- EM&V



Residential Program Potential Annual Costs



C&I Program Potential Annual Costs



DSM Market Potential Study Results

Demand Response (DR) Potential

Demand Response Overview

Measures Considered

Demand Response includes Direct Load Control (DLC), Behavior DR, Time of Use (TOU) Rates, Capacity Bidding, Demand Bidding and Interruptible Agreements.

- → In the residential sector, DLC includes central air conditioning, room air conditioning, electric space heating, water heating, smart appliances, and pool pumps
- → In the nonresidential sector, DLC includes air conditioning, electric space heating, lighting, and water heating

DR Hierarchies

DR analysis will account for interactive effects as additional types of demand response programs are added to the mix. The hierarchy for demand response programs in the base case for the four market sectors is as follows:

Residential

1. Direct Load Control
2. Behavior DR
3. TOU

Small C&I

1. Direct Load Control
2. Capacity Bidding
3. TOU

Large C&I

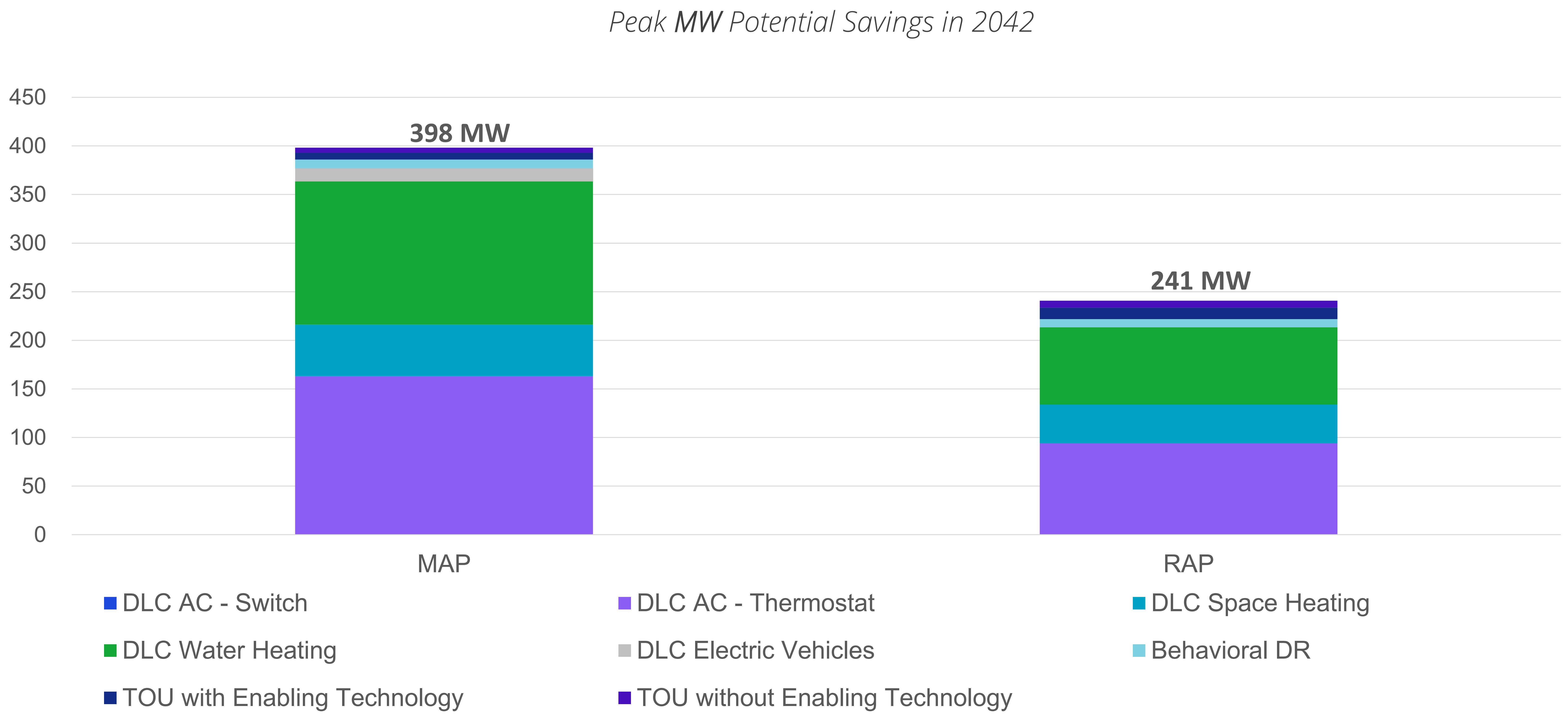
1. Interruptible Agreements
2. Capacity Bidding
3. TOU

Demand Response Programs Considered

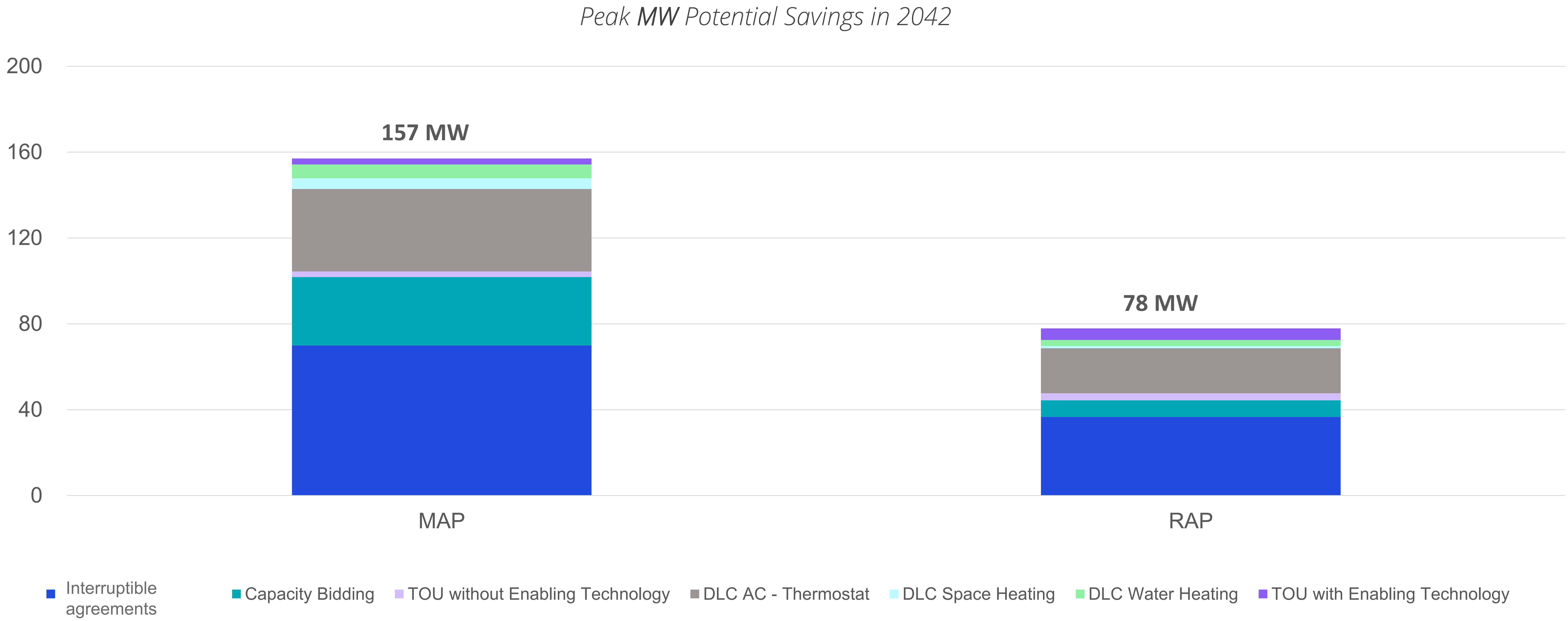
- →Direct Load Control (“DLC”) – Central ACs
- →DLC – Room ACs
- →DLC – Smart Appliances
- →DLC – Water Heaters
- →DLC – Electric Space Heat
- →DLC – Lighting

- →Battery Energy Storage
- →Electric Vehicle Charging
- →Interruptible Agreements
- →Demand Bidding
- →Capacity Bidding
- →Time of Use Rates
- →Behavior DR

Residential Demand Response MAP/RAP Results

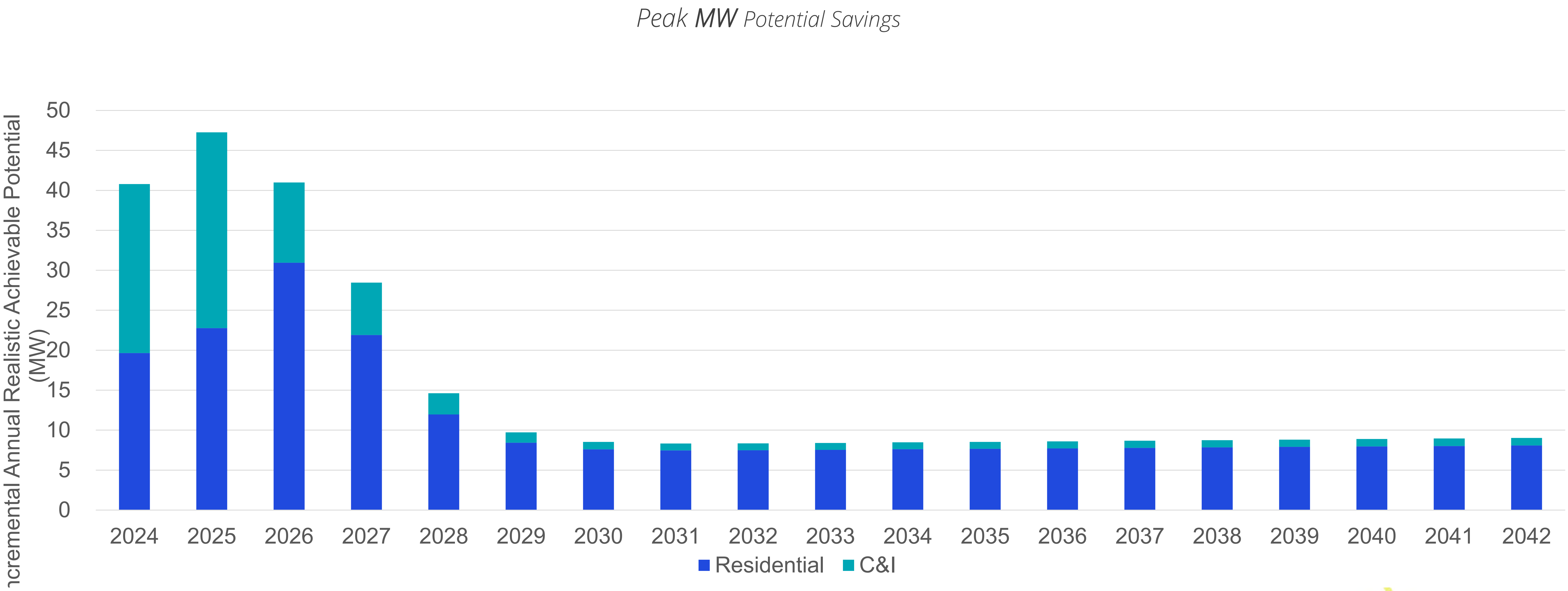


C&I Demand Response MAP/RAP Results

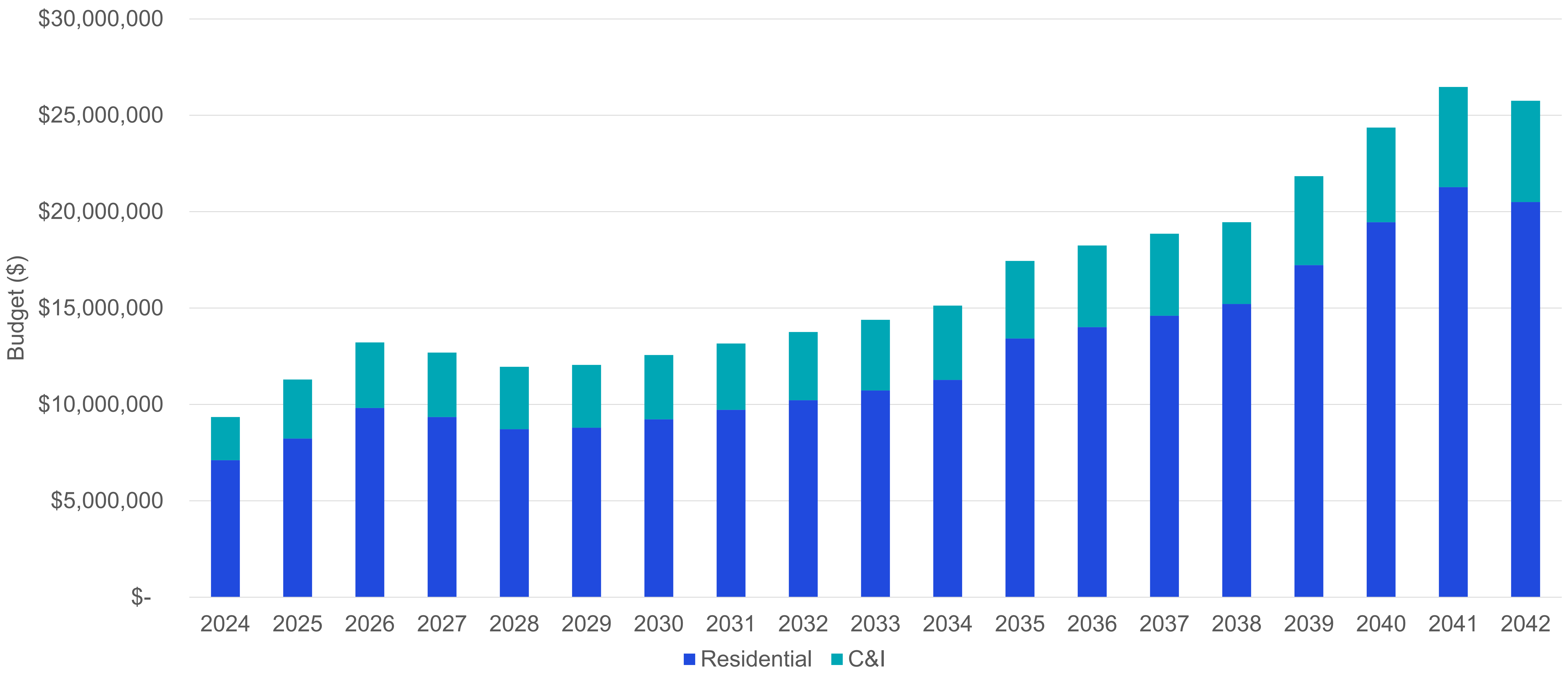


Annual Demand Response (RAP – by Sector)

INCREMENTAL ANNUAL



Annual Demand Response Budgets (by Sector)



DSM Market Potential Study

Developing DSM IRP Inputs

IRP Inputs – Energy Efficiency

Reference Case

→EE Inputs for reference case will align with the Program RAP Potential

→EE Inputs will be provided over three different vintages

- 2024-2026 (3 years)
- 2026-2028 (3 years)
- 2029-2042 (13 years)

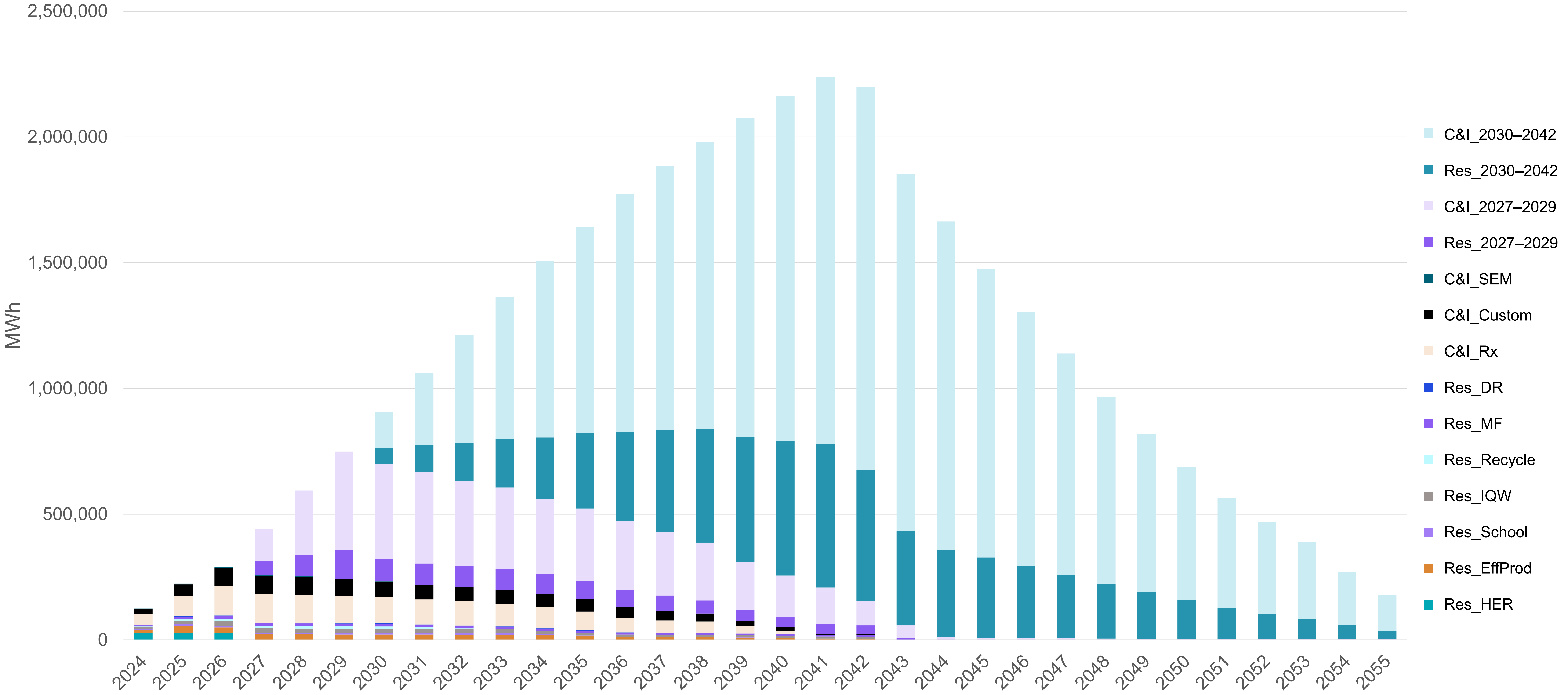
→For 2024-2026 Vintage, EE Inputs will be bundled to closely resemble program offerings

- For remaining vintages, EE Inputs will be aggregated at the sector level

→EE Costs will include utility costs (incentives and non-incentive costs) and will be adjusted to reflect the NPV impacts of T&D benefits.

→*2023 will be "hard coded" to align with current approved DSM Plan savings and costs*

IRP Inputs – Energy Efficiency



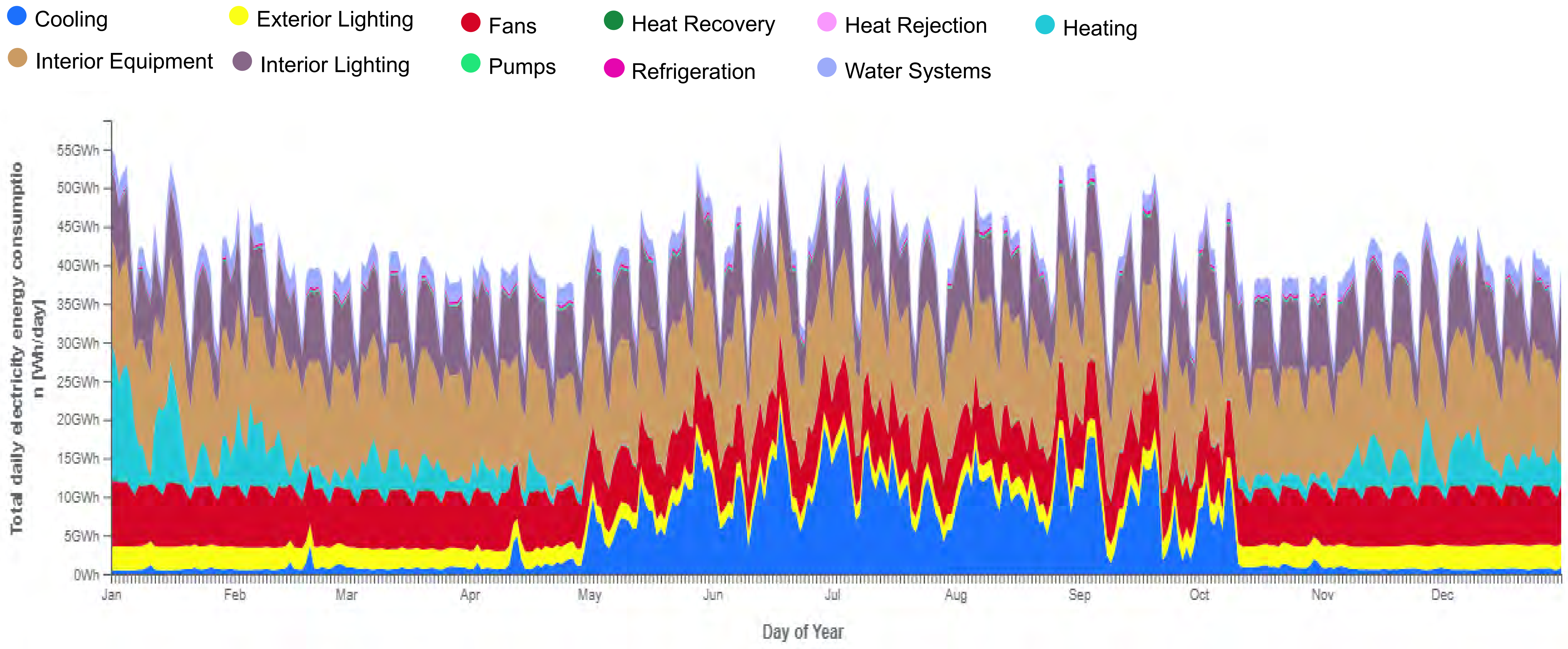
IRP Inputs – Energy Efficiency

Time Differentiated Savings

- →Within a bundle/vintage, the EE Savings are broken out by end-use
- →Saving by end-use are mapped to 8,760 end-use load shape data, developed by National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Lab (LBL).
  - Residential sector includes 33 end-uses
  - Nonresidential sector includes 11 end-uses
- →Hourly savings shapes are provided so that the model captures the timing of savings relative to the AES Indiana system and peak periods.

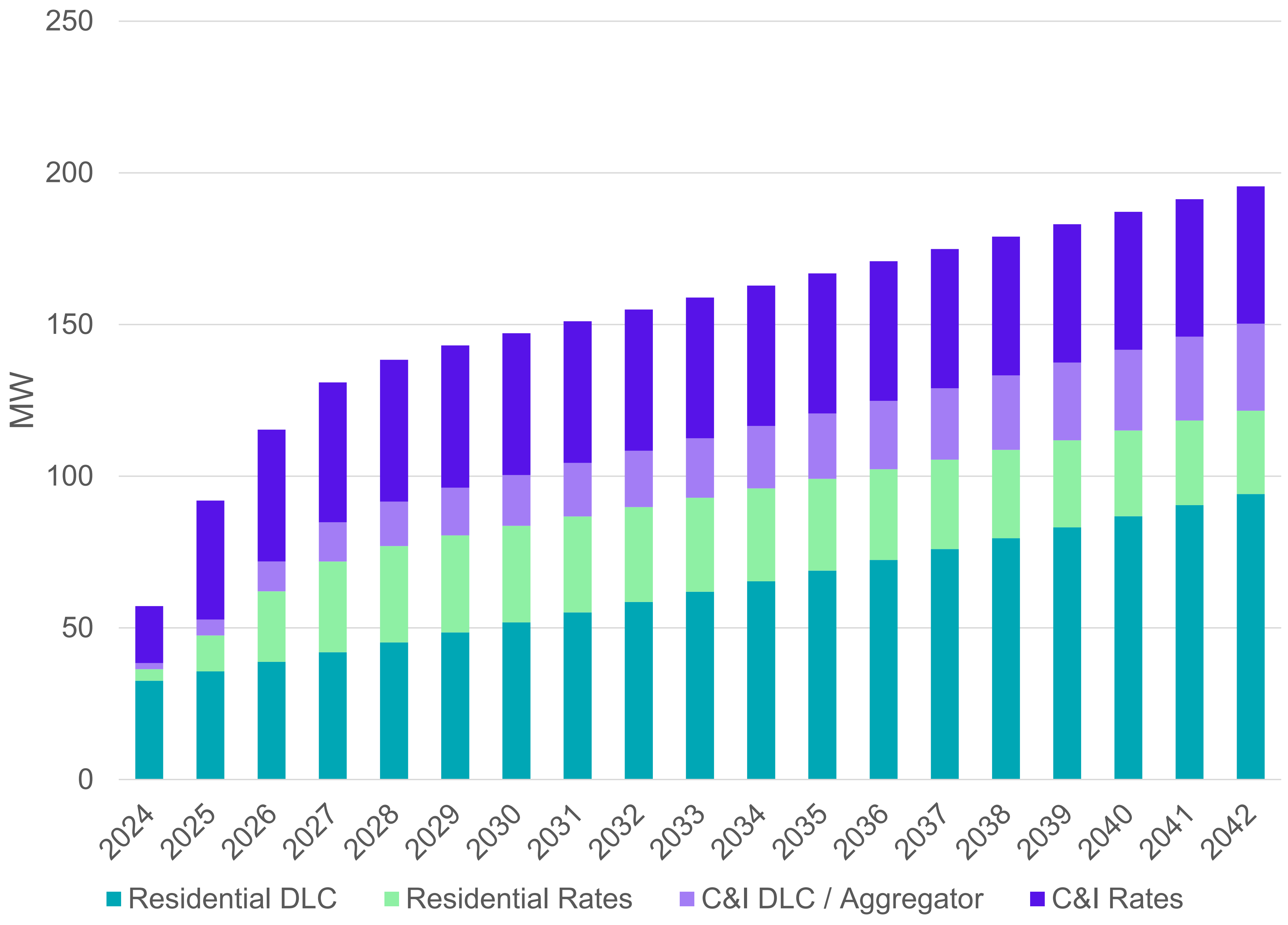
IRP Inputs – Energy Efficiency

Example Commercial Loadshape Data



IRP Inputs – Demand Response

- Bundles for demand response follow the same vintages as Energy Efficiency
- Demand response bundles created for four categories
  - Residential DLC
  - Residential Rates
  - C&I DLC/Aggregator
  - C&I Rates
- DR bundles will include savings for both summer and winter peak, with summer peak savings potentially generally more significant



Break for Lunch

Current Generation Portfolio Overview

Kristina Lund, President & CEO, AES Indiana

Current Portfolio


Petersburg


Harding Street


Eagle Valley


Wind/Solar/Batteries

Gradual change to the AES Indiana portfolio over time

2009-2015

Signed 100 MW PPA at Hoosier Wind Park in NW Indiana, 200 MW PPA at Lakefield Wind Farm in Minnesota and 96 MW PPA for solar in Indianapolis through Rate REP

2016

Retired 260 MW of coal at Eagle Valley

2016

Finalized refuel of 630 MW of coal-fired generation at Harding Street to natural gas

2018

Eagle Valley 671 MW Gas-Fired Combined Cycle Plant Completed

2021-2023

Retired (Unit 1) 220 MW of coal at Petersburg; Plans to retire (Unit 2) 401 MW of coal at Petersburg in 2023

2023 – 2024

Plans to complete 195 MW Hardy Hills Solar project and 250 MW + 180 MWh Petersburg Energy Center solar + storage project

Capabilities and Infrastructure

Largest sites have valuable capabilities and infrastructure for the energy transition

Petersburg

Experienced, skilled labor force, land, interconnection, water rights, water treatment, natural gas pipelines already present on site

Harding Street

Experienced, skilled labor force, land, interconnection, location near load center, rail, water rights

Eagle Valley

New plant, highly efficient, flexible for future grid changes

AES Indiana seeks to partner with Pike County and City of Indianapolis to drive customer value and community impact of Petersburg and Harding Street Sites.

Replacement Resource Assumptions

Erik Miller, Manager, Resource Planning, AES Indiana

Commercially Available Replacement Resources

DSM/EE

- → EE & DR Measures bundled into traunches for planning model selection

Wind

- → Land-Based Wind

Solar

- → Utility-Scale
- → C&I
- → Residential

Storage

- → Utility-Scale standalone
- → Solar + Storage

Natural Gas

- → CCGT
- → CT
- → Reciprocating Engine/ICE
- → Pete Refuel

Key Replacement Resource Assumptions for IRP Modeling

Replacement Resource Assumptions are the key inputs that the planning model uses for selecting replacement resources when energy or capacity is needed.

Replacement Resource Assumptions include:

- → Overnight Capital Cost to construct ($/kW) – Costs associated with development and construction of resource
- → Operating Cost:
  - Fixed Operation & Maintenance (FOM) – Costs incurred whether plant is operating or not, e.g. staff cost, regular maintenance, administrative costs
  - Variable Operation & Maintenance (VOM) – Costs associated with electricity production, e.g. repair and replacement of parts
- → Operating Characteristics:

Operating Characteristics		
Solar & Wind	**Storage**	**CT or CCGT (Natural Gas)**
Generation Profiles	Ramp Rates	Heat Rates
Effective Load Carrying Capability (ELCC)	Capacity Accreditation	Ramp Rates
MW Limits	MW and MWh Limits	Capacity Accreditation
Asset Useful Life	Asset Useful Life	MW Limits
		Asset Useful Life

Methodology for Replacement Resource Cost Assumptions

Overview

- AES Indiana used a combination of Sargent & Lundy's (S&L) RFP review, Bloomberg New Energy Finance (BNEF), National Renewable Energy Labs (NREL) and Wood Mackenzie data to benchmark the starting year assumptions for replacement resources in this IRP.
- Replacement Resource capital cost forecasts were calculated by averaging forecasts from NREL, BNEF and Wood Mackenzie or from S&L.

Sargent & Lundy's (S&L) review of AES Indiana's 2019 RFP

- AES Indiana contracted S&L to administer the Company's 2019 All-source RFP for generation.
- As follow up to this work, S&L summarized the cost and operating components for the resources included in the 2019 All-source RFP to inform the 2022 IRP.
- To supplement this review, S&L also reviewed and sourced their internal databases and a comprehensive list of public data sources.
- Resources reviewed:
  - Solar
  - Wind
  - Solar + Storage
  - Standalone 4-hr Storage
  - Combustion Turbine (Frame and Aeroderivative)
  - Combined Cycle Gas Turbine
  - Reciprocating Engine
- Cost components reviewed:
  - Capital Cost ($/kWac)
  - Interconnection Cost ($/kWac)
  - Cost of Tax Equity ($/kWac)
  - FOM ($/kWac)
  - VOM ($/MWh)
  - Capacity Factor (%)
  - Curtailment (%)
  - Property Tax ($/kWac)
  - Max Capacity per year (MW)

2022 All-Source Generation RFP

AES Indiana is conducting an all-source RFP

- Positions AES Indiana to efficiently procure generation consistent with final IRP Preferred Resource Portfolio
- Informs IRP process in considering Replacement Resource Costs sensitivities
- RFP offers requested for Commercial Operation Date (COD) of 2025-2027
- Incorporate invitation for projects leveraging remaining uncommitted Petersburg Unit 2 injection rights
- Issue RFP mid-April

Department of Commerce Anti-Dumping/Countervailing Duties (AD/CVD) investigation

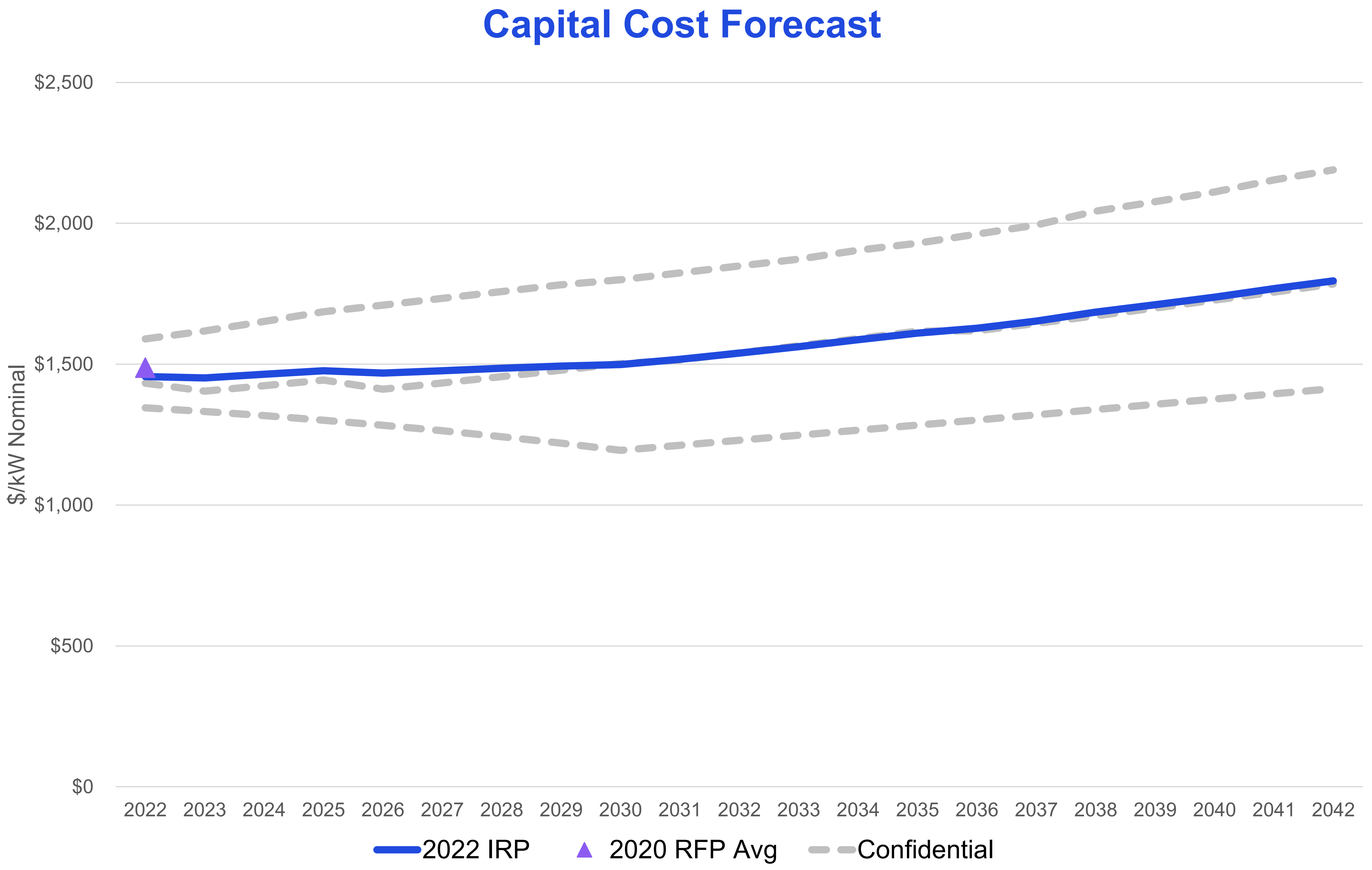
- Preliminary decision 150 days
- Repercussions for solar industry
- Creates uncertainty for developers – particularly in near-term
- Issue resolution for 2025-2027 COD projects – address uncertainty around solar in RFP

Sources for Replacement Resource Cost Assumptions

Primary Assumption	**Wind**	**Solar**	**Storage**	**Solar + Storage**	**CCGT**	**Frame CT**	**Aero CT**	**Reciprocating Engine**
Capital Cost	BNEF, NREL, Wood Mack & 2020 RFP	BNEF, NREL, Wood Mack & 2020 RFP	BNEF, Wood Mack & 2020 RFP	BNEF, NREL, Wood Mack & 2020 RFP	BNEF, NREL, Wood Mack & 2020 RFP	BNEF, NREL, Wood Mack & 2020 RFP	Sargent & Lundy	Sargent & Lundy
Fixed O&M	Company Assets	Company Assets	Company Assets	Company Assets	Company Assets	Company Assets	Sargent & Lundy	Sargent & Lundy
Variable O&M	N/A	N/A	N/A	N/A	Company Assets	Company Assets	Sargent & Lundy	Sargent & Lundy
Operating Characteristic	NREL System Advisory Model (SAM)	NREL System Advisory Model (SAM)	NREL 2021 ATB	NREL 2021 ATB	Company Assets	Company Assets	Sargent & Lundy	Sargent & Lundy
Other Key Assumption								
ELCC / Capacity Credit	Horizons Energy / MISO	Horizons Energy / MISO	Horizons Energy / MISO	Horizons Energy / MISO	MISO	MISO	MISO	MISO
Grid Connection Cost	Sargent & Lundy	Sargent & Lundy	Sargent & Lundy	Sargent & Lundy	Sargent & Lundy	Sargent & Lundy	Sargent & Lundy	Sargent & Lundy
Tax Equity Cost	Sargent & Lundy	Sargent & Lundy	N/A	Sargent & Lundy	N/A	N/A	N/A	N/A

Wind Capital and Operating Costs

Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
$ 1,451	$ 30	$ -

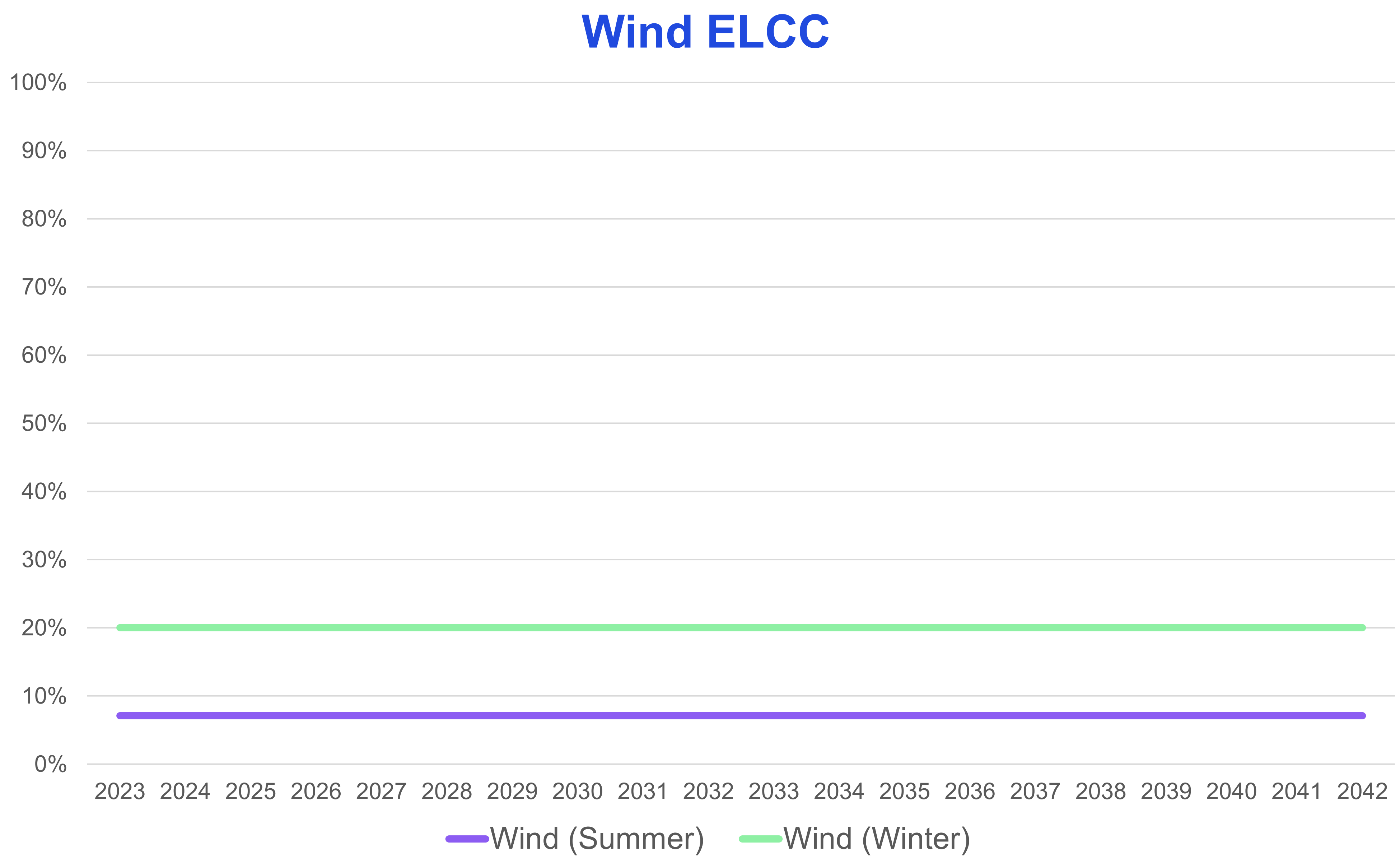


Note: **Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.**

Note: Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF

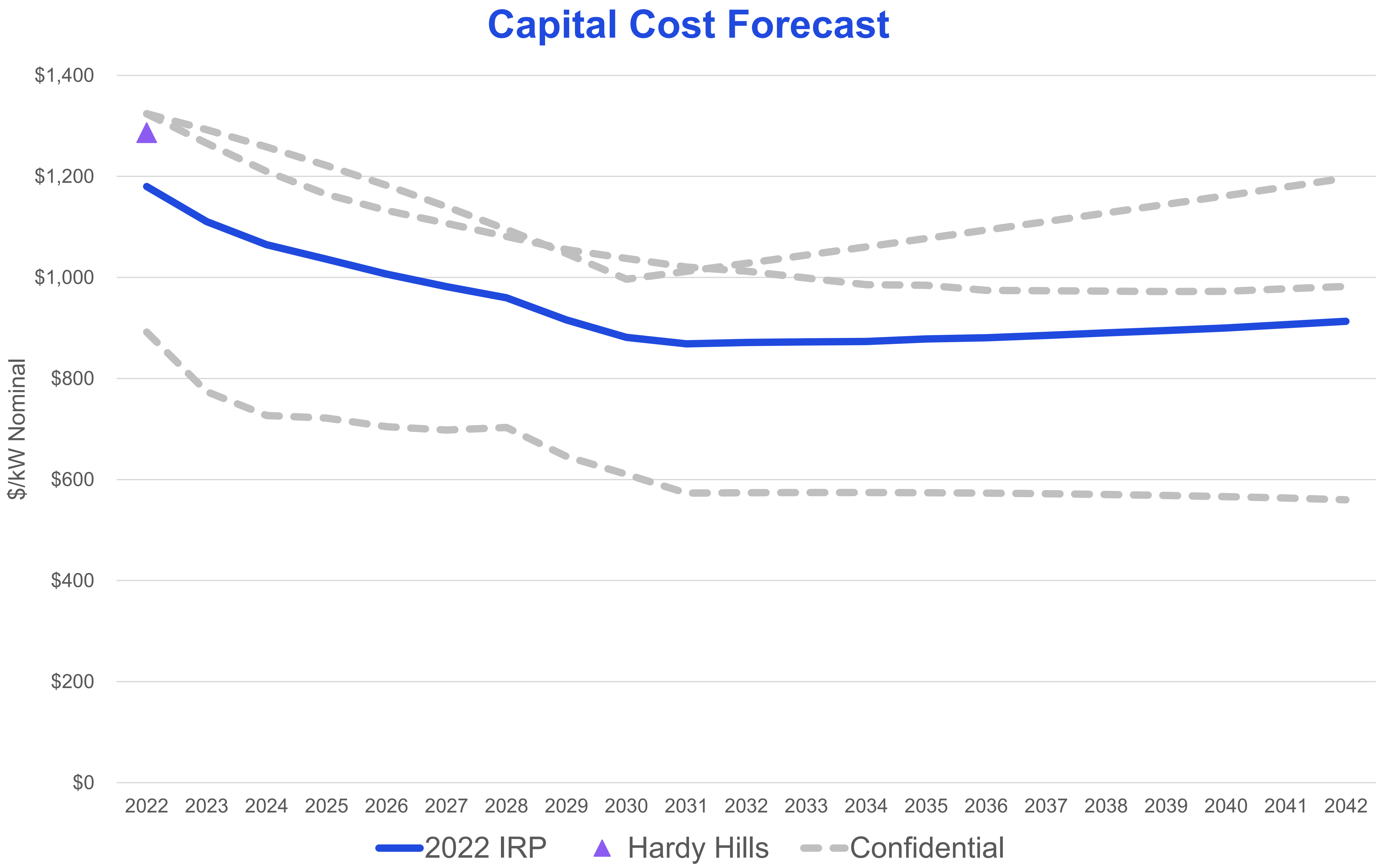
Wind Parameters

- **Location:** Indiana
- **Annual Capacity Factor:** 33.6 – 40.4%
- **Source Profile:** NREL System Advisory Model (SAM)
- **Project Size:** 50 MW ICAP
- **Useful Life:** 30 years
- **Summer ELCC (2025):** 7.1%; *Source: Horizons Energy*
- **Winter ELCC:** 20%; *Source: MISO RAN*



Solar Capital and Operating Costs

Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
$1,111	$12	$0

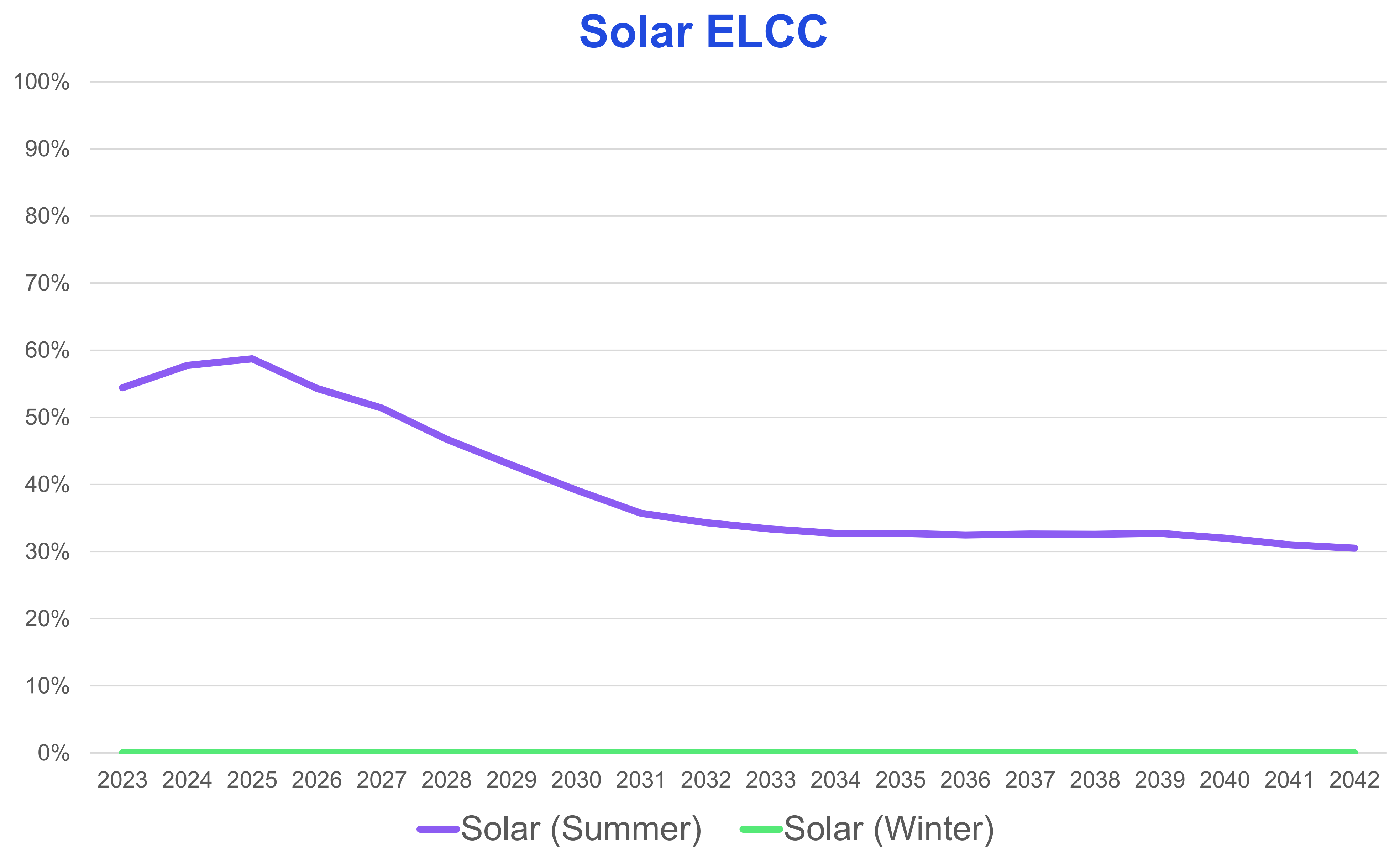


Note: **Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.**

Note: Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF

Solar Parameters

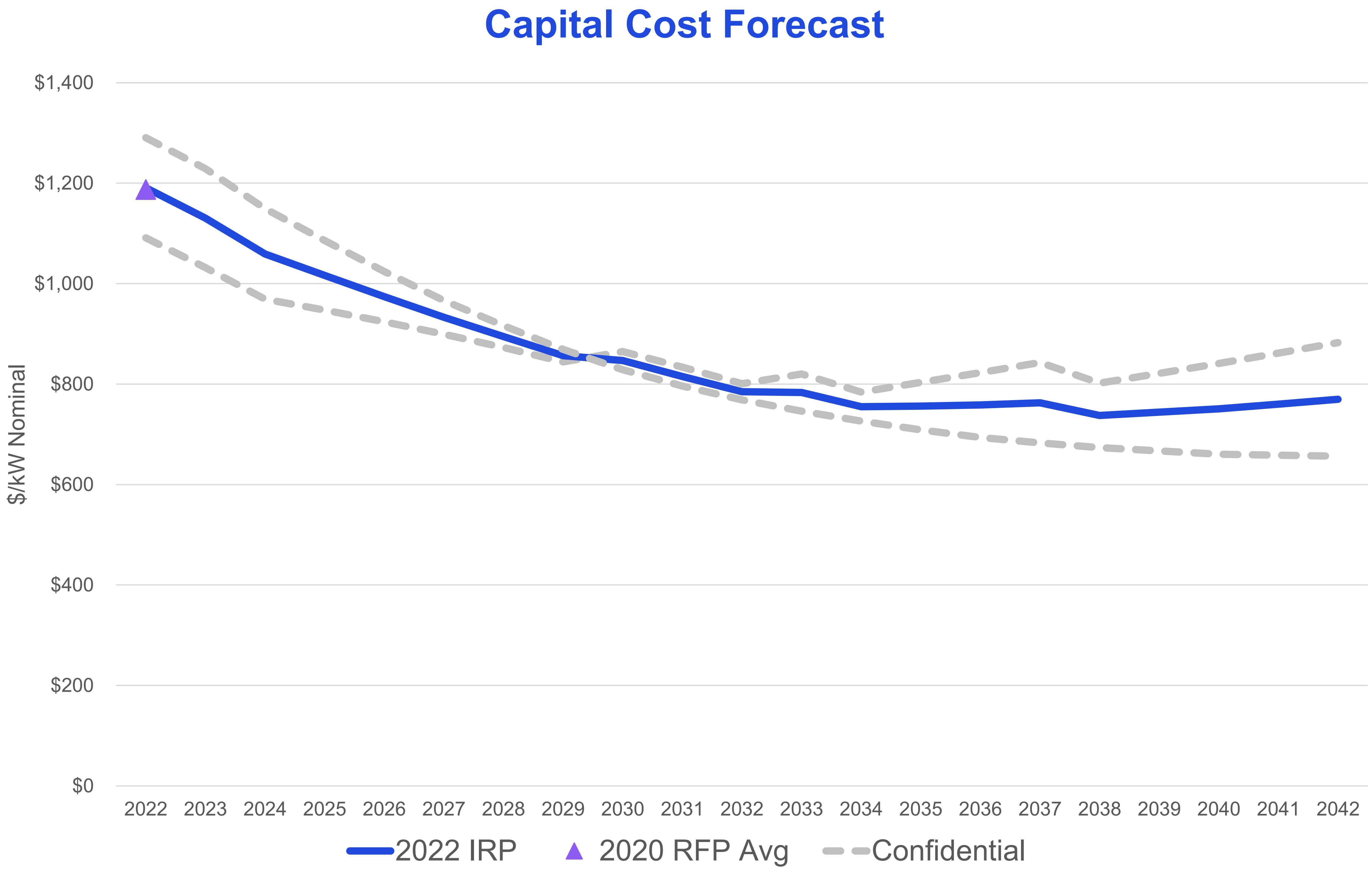
- **Location:** Petersburg, Indiana
- **Annual Capacity Factor:** 24.5%
- **Source Profile:** NREL System Advisory Model (SAM)
- **Project Size:** 25 MW ICAP
- **Useful Life:** 35 years
- **Summer ELCC (2025):** 58.7%; *Source: Horizon Energy*
- **Winter ELCC:** 0%; *Source: MISO RAN*



*Summer ELCC forecast presented in chart is from the Horizon Custom Reference Case – ELCC forecast will vary by custom scenario

Storage Capital and Operating Costs

Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
$ 1,130	$ 27	$ -

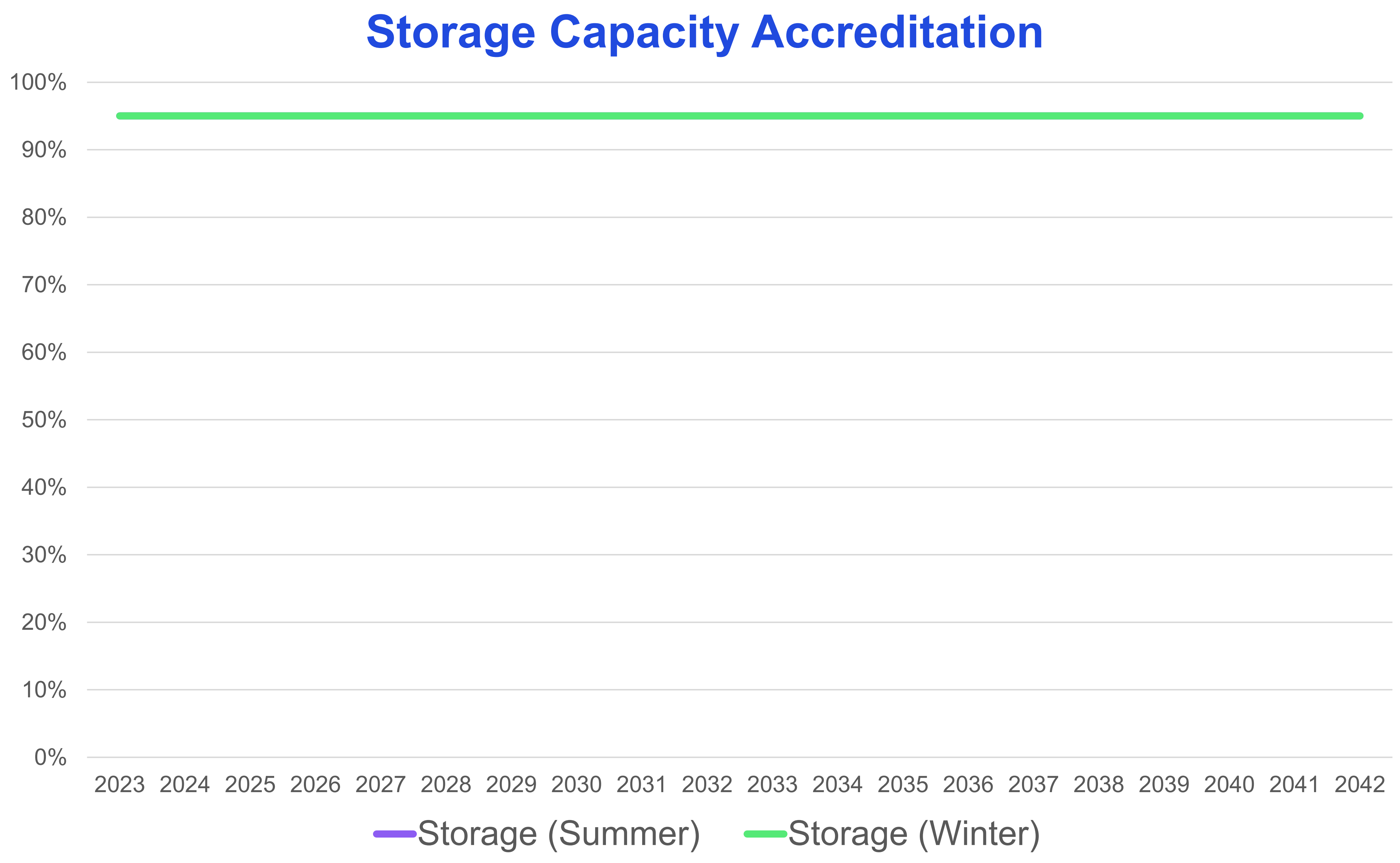


Note: Confidential cost forecasts in chart include forecasts from Wood Mackenzie and BNEF

Note: Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.

Storage Parameters

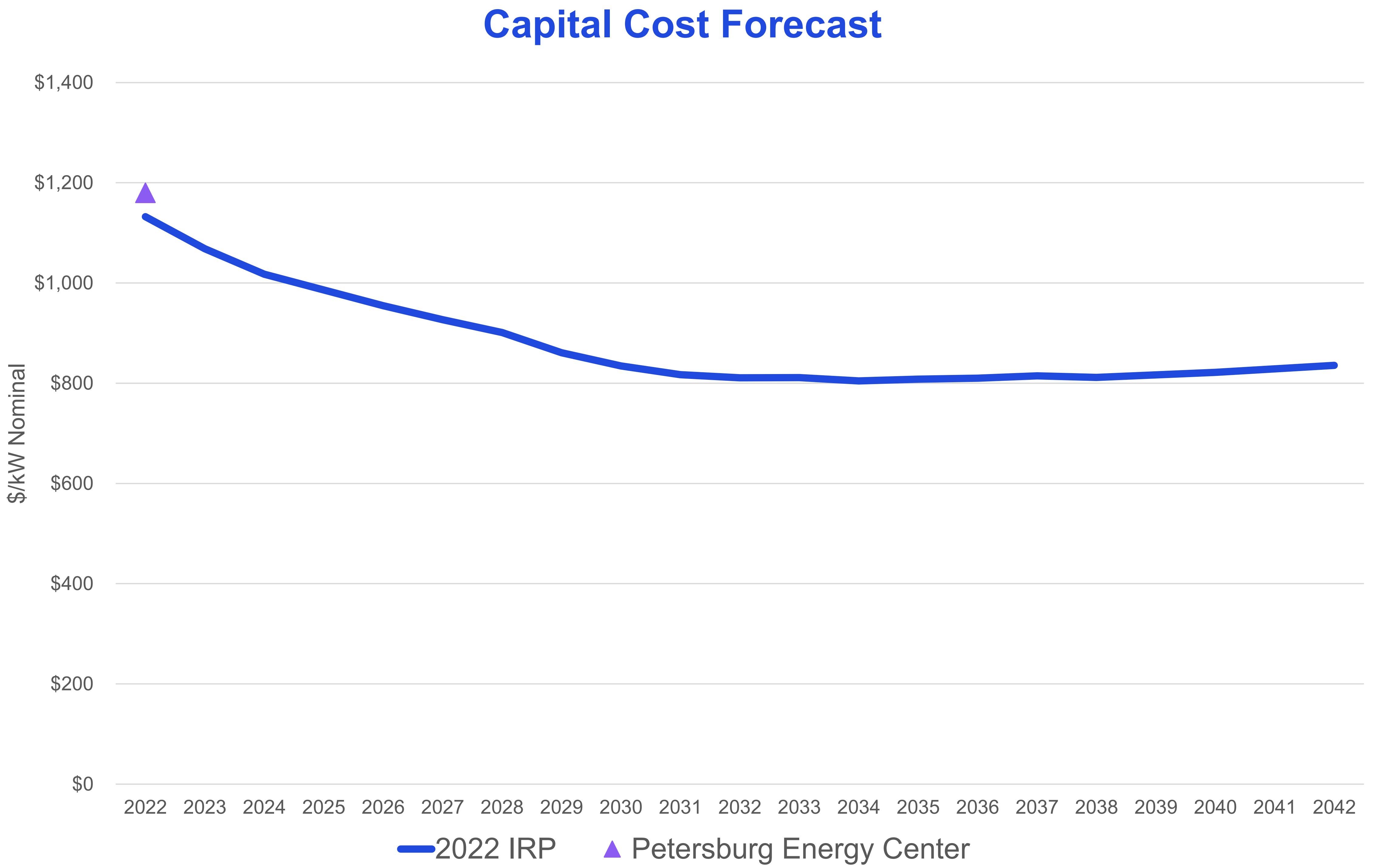
- **Location:** Indianapolis, Indiana
- **Project Size:** 20 MW ICAP | 80 MWh (4-hour)
- **Round Trip Efficiency (RTE):** 85%
- **Useful Life:** 20 years
- **Summer/Winter Capacity Accreditation:** 95% (19 MW)



Note: 6-hour Storage also be modeled and scaled off of the 4-hour Storage assumptions

Solar + Storage Capital and Operating Costs

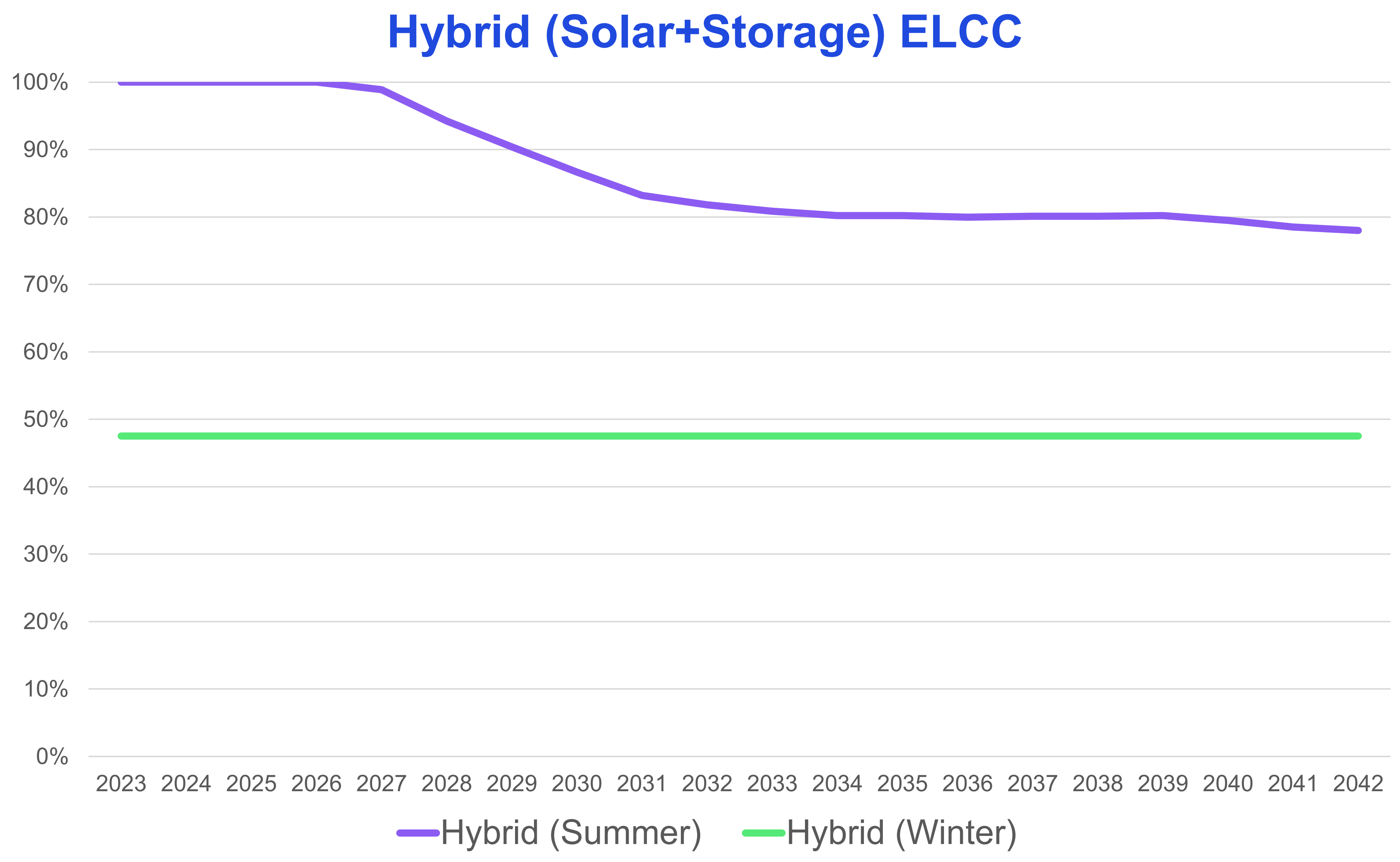
Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
$1,069	$17	$0



Note: Capital Cost estimates presented here are without federal tax credits. Federal tax credits will be included in modeling based on the IRP scenario assumptions.

Solar + Storage Parameters

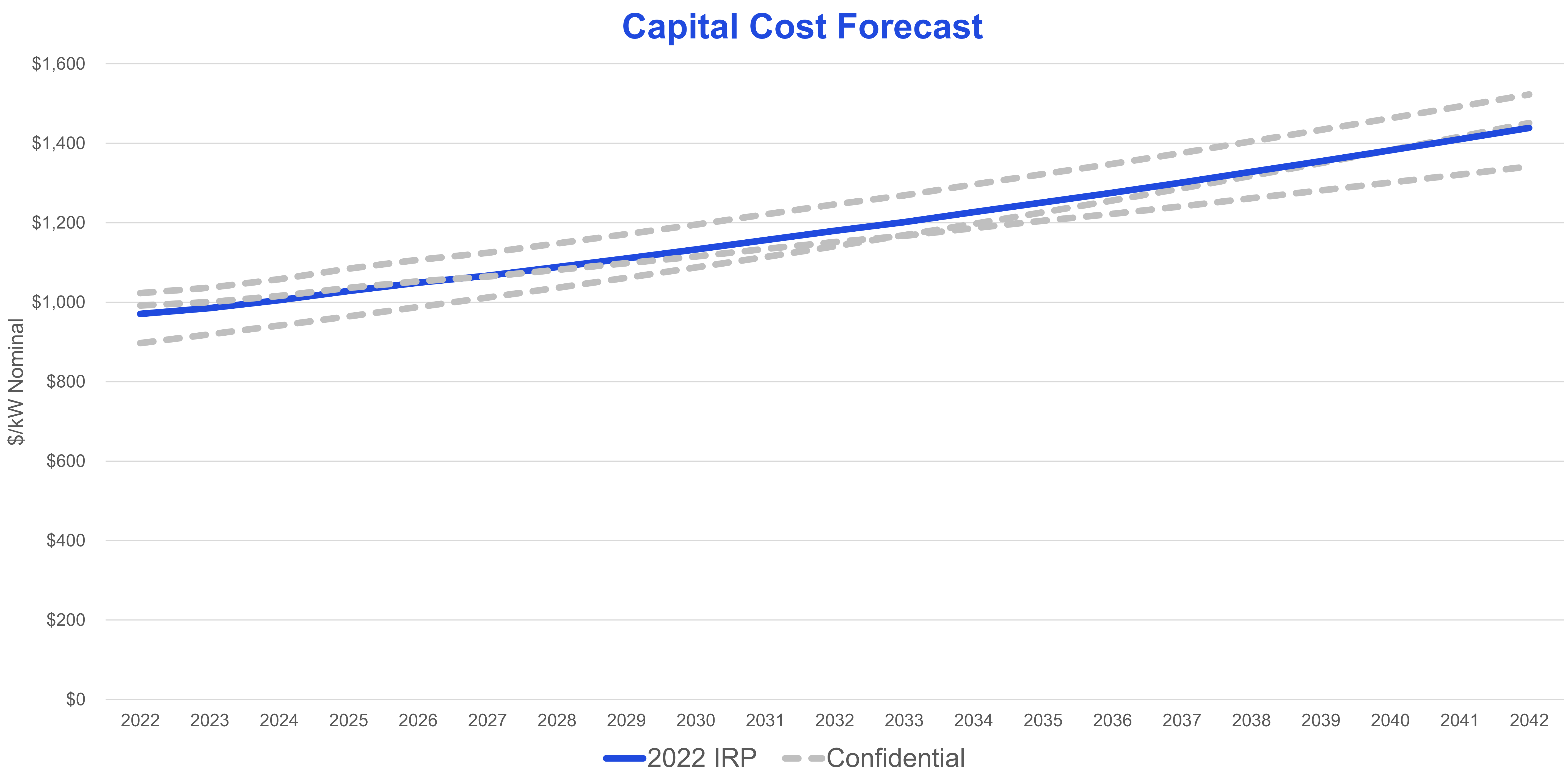
- **Location:** Petersburg, Indiana
- **System:** DC Coupled Solar + Storage System, Storage charges exclusively from the solar array
- **Solar Component:** Identical to stand-alone solar (25 MW ICAP)
- **Storage Component:** 12.5 MW ICAP | 50 MWh
- **Synergies:** 4.3% reduction in capital costs, 2% improvement of RTE
- **Summer ELCC (2025):** 100%
- **Winter ELCC:** 48%



*Summer forecast presented in chart above is from the Horizon Custom Reference Case – forecast will vary by custom scenario

CCGT Capital and Operating Costs

Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
$1,026	$32	$2



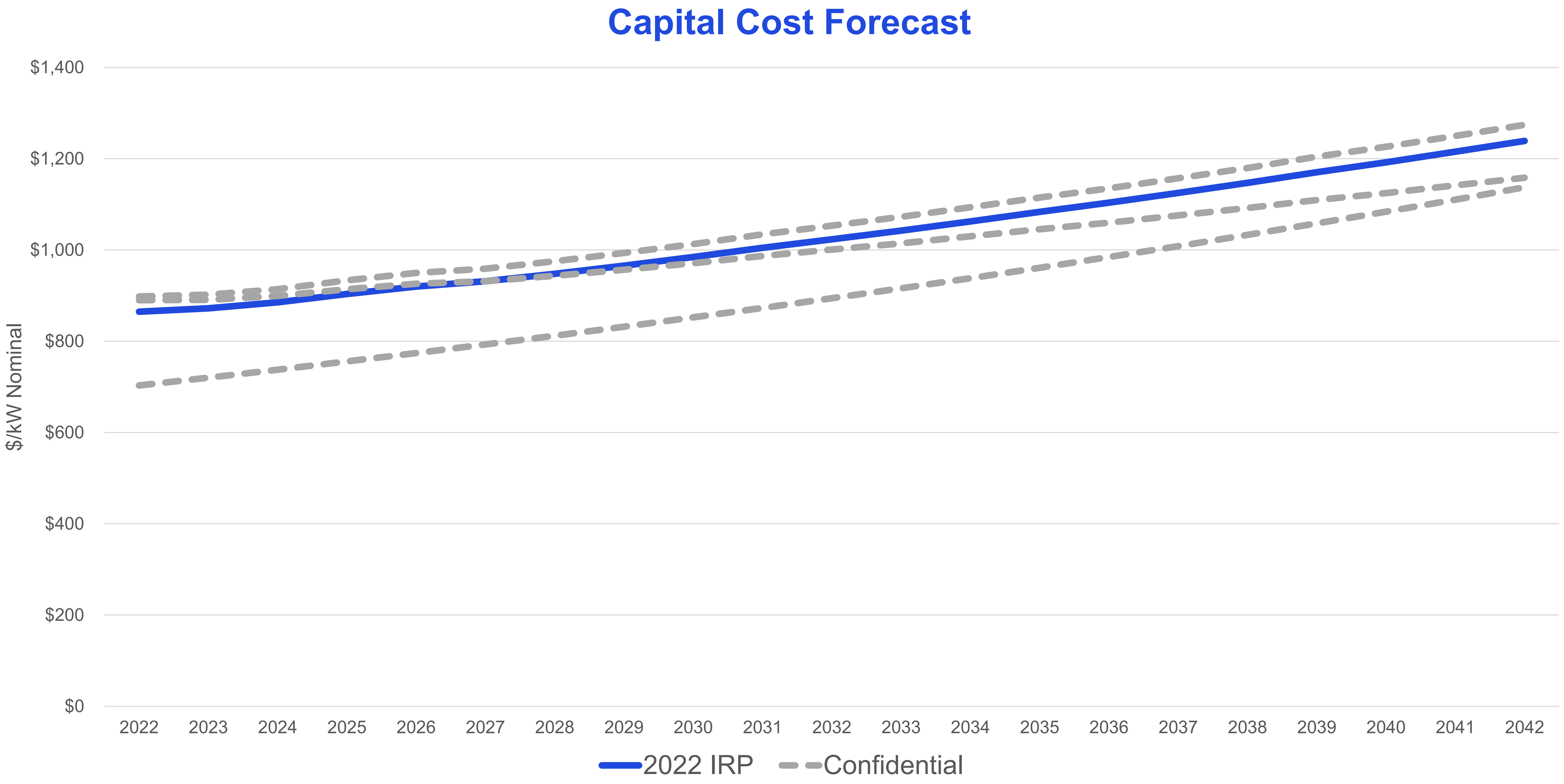
Note: Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF

CCGT Parameters

- **Project Size:** 325 MW ICAP
- **Heat Rate at Max Economic Load:** 6,700 Btu/kWh
- **Useful Life:** 30 years
- **Summer/Winter Capacity Credit:** 94.2% static

Frame Combustion Turbine Capital and Operating Costs

Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
$872	$30	$1



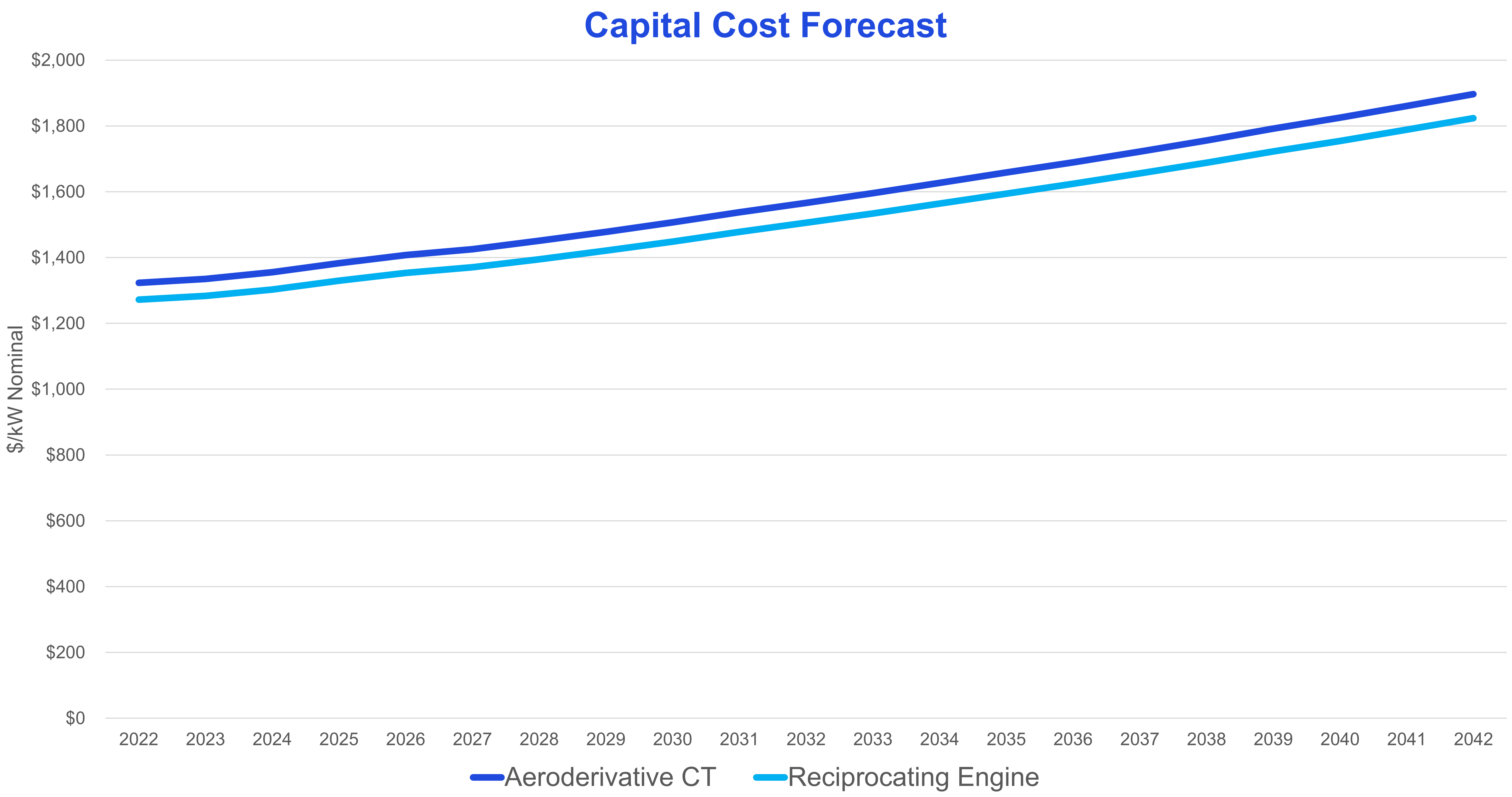
Note: Confidential cost forecasts in chart include forecasts from NREL, Wood Mackenzie and BNEF

Frame Combustion Turbine Parameters

- **Project Size:** 100 MW ICAP
- **Heat Rate at Max Economic Load:** 10,000 Btu/kWh
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 95.6% static

Aero CT and Recip Engine Capital and Operating Costs

	Capital Cost ($/kW)	Fixed O&M ($/kW)	Variable O&M ($/MWh)
Aero CT	$1,335	$36	$5
Recip	$1,283	$46	$6



Aero CT and Reciprocating Engine Parameters

Aero Combustion Turbine

- **Project Size:** 90 MW ICAP
- **Heat Rate at Max Economic Load:** 8,200 Btu/kWh
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 95.6% static

Reciprocating Engine

- **Project Size:** 54 MW ICAP
- **Heat Rate at Max Economic Load:** 7,400 Btu/kWh
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 95.6% static

Petersburg Refuel Capital and Operating Costs

Petersburg Units 3 & 4 Refuel to Natural Gas

→Low capital cost (~$100/kW)

→Refueling will require gas infrastructure upgrade not included in capital cost above

Modeling Assumptions

Costs:

→Capital expenditure estimated based on cost to refuel Harding Street 5, 6, 7

→Engineering analysis performed to understand the cost for gas infrastructure upgrade

Potential Refueling Benefits

→Reduces carbon intensity (lower capacity factor and emission rate for ST gas – similar to Harding St)

→Dispatchable resource that positions AES Indiana well with new MISO seasonal capacity construct

Refuel of Petersburg Units 3 & 4 Parameters

→ Petersburg Unit 3

- **Project Size:** 526 MW ICAP
- **Heat Rate at Max Economic Load:** 10,800 Btu/kWh
- **Variable O&M:** < $0.50/MWh
- **Fixed O&M:** 65% reduction from coal Fixed O&M
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 90.9% static

→ Petersburg Unit 4

- **Project Size:** 526 MW ICAP
- **Heat Rate at Max Economic Load:** 10,800 Btu/kWh
- **Variable O&M:** < $0.50/MWh
- **Fixed O&M:** 65% reduction from coal Fixed O&M
- **Useful Life:** 20 years
- **Summer/Winter Capacity Credit:** 94.1% static

IRP Portfolio Matrix Introduction

Erik Miller, Manager, Resource Planning, AES Indiana

Portfolio Matrix: Strategies vs. Scenarios

AES Indiana’s Portfolio Matrix considers four generation portfolio Strategies across four Scenarios

Strategies

- AES Indiana’s potential future strategies for the generation portfolio.
- Retirement dates, capital expenditures & cost treatments are anticipated and defined for each strategy and included in the planning model.

Scenarios

- Scenarios are views of the future defined by external influences like political outcomes, economics, regulations, etc.
- In the planning model, each scenario will have a unique set of input assumptions that correspond to the external influences defining the scenario.

***Note that AES Indiana will also use stochastics & sensitivities to assess risk around particular variables, e.g. replacement resource costs.**

IRP Strategies

Generation Portfolio Strategies

No Changes to Existing Portfolio	→ Status quo → Units remain in service through useful life of 2042
Petersburg Refuel	→ Petersburg Unit 3 & 4 refueled to Natural Gas in 2025 → Natural gas pipeline already present on site
One Petersburg unit retires early (2026)	→ One unit retired early in 2026 → The other unit remains in service through useful life of 2042 → Replacement capacity starting in 2026
Both Petersburg units retire early (2026 & 2028)	→ One unit retires early in 2026 → The other unit retires early in 2028

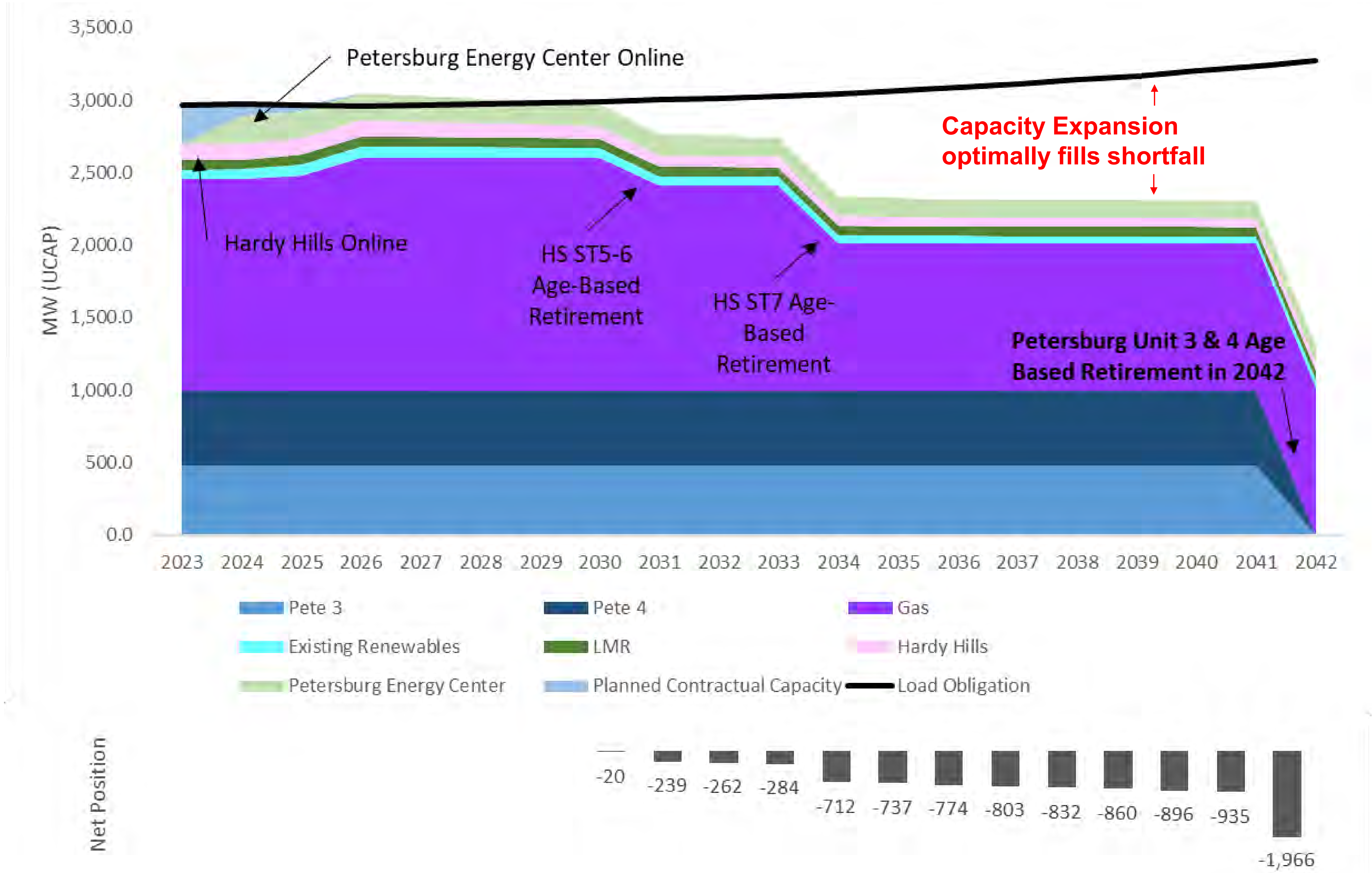
Rationale for Predefined Portfolio Strategies

Generation Portfoilo Strategy	Rationale
No Changes to Existing Portfolio	Provides portfolios with coal through 2042 for Scorecard metric comparison & evaluation
Petersburg Refuel	Earliest possible refuel date that provides sufficent lead time to execute the natural gas conversion
One Petersburg Unit Retires Early (2026)	Earliest possible retirement date that provides sufficient lead time to procure capacity
Both Petersburg Units Retire Early (2026 & 2028)	Staggering specific unit retirement dates provides sufficient lead time to procure capacity

Predefined strategies provide for comparison and evaluation of portfolios with the earliest possible exit from coal vs portfolios with coal through the entire planning period.

Note: To support decision making, AES Indiana will perform capacity expansion analysis without specified dates that allows the Encompass model to fully optimize retirements and replacements; however, outcomes from this analysis may not be viable and/or reasonable.

Strategy: No Changes to Existing Portfolio



Petersburg Energy Center Online

Hardy Hills Online

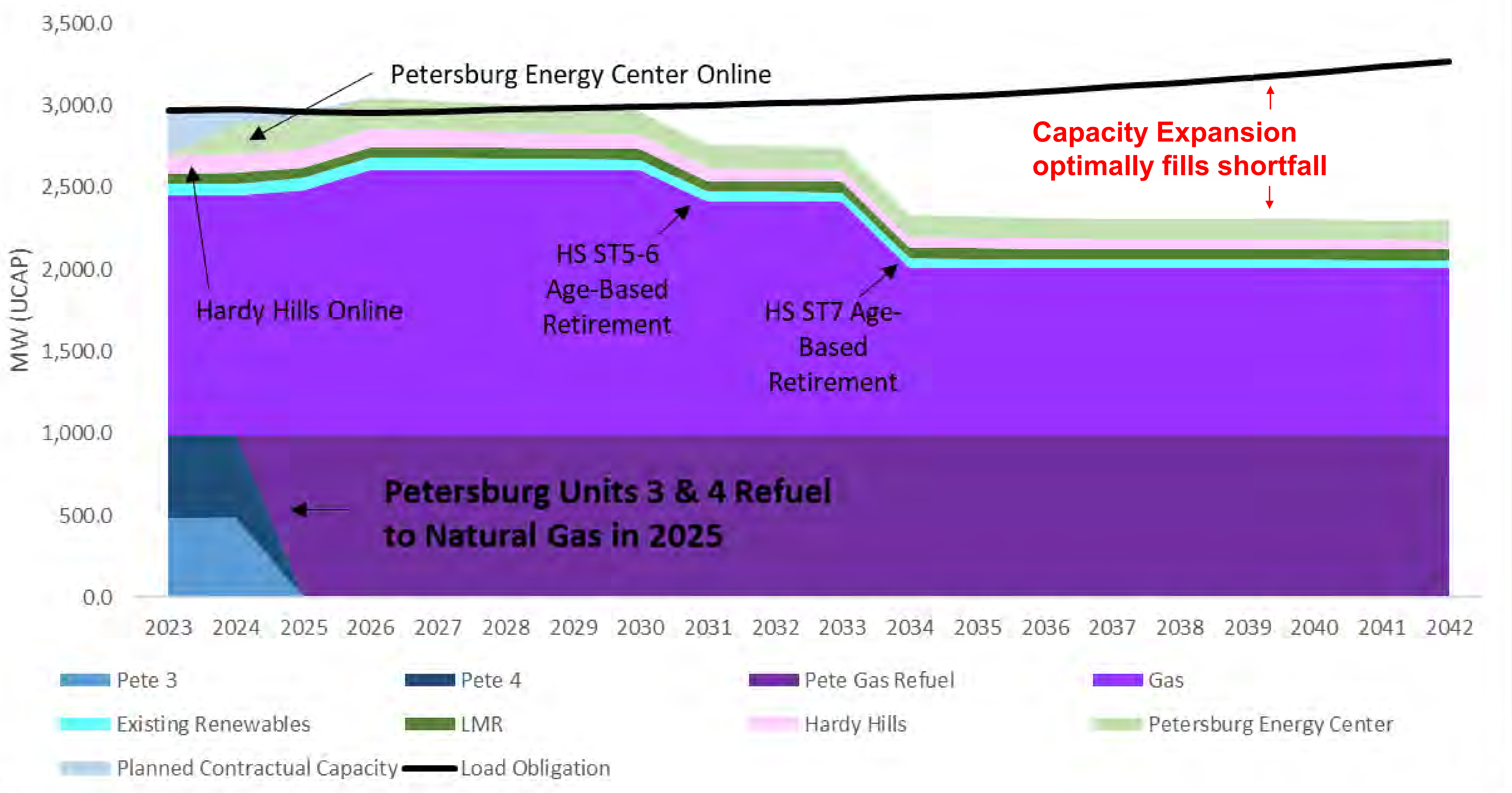
HS ST5-6 Age-Based Retirement

HS ST7 Age-Based Retirement

Capacity Expansion optimally fills shortfall

Petersburg Unit 3 & 4 Age Based Retirement in 2042

Strategy: Petersburg Refuel in 2025



Petersburg Energy Center Online

Hardy Hills Online

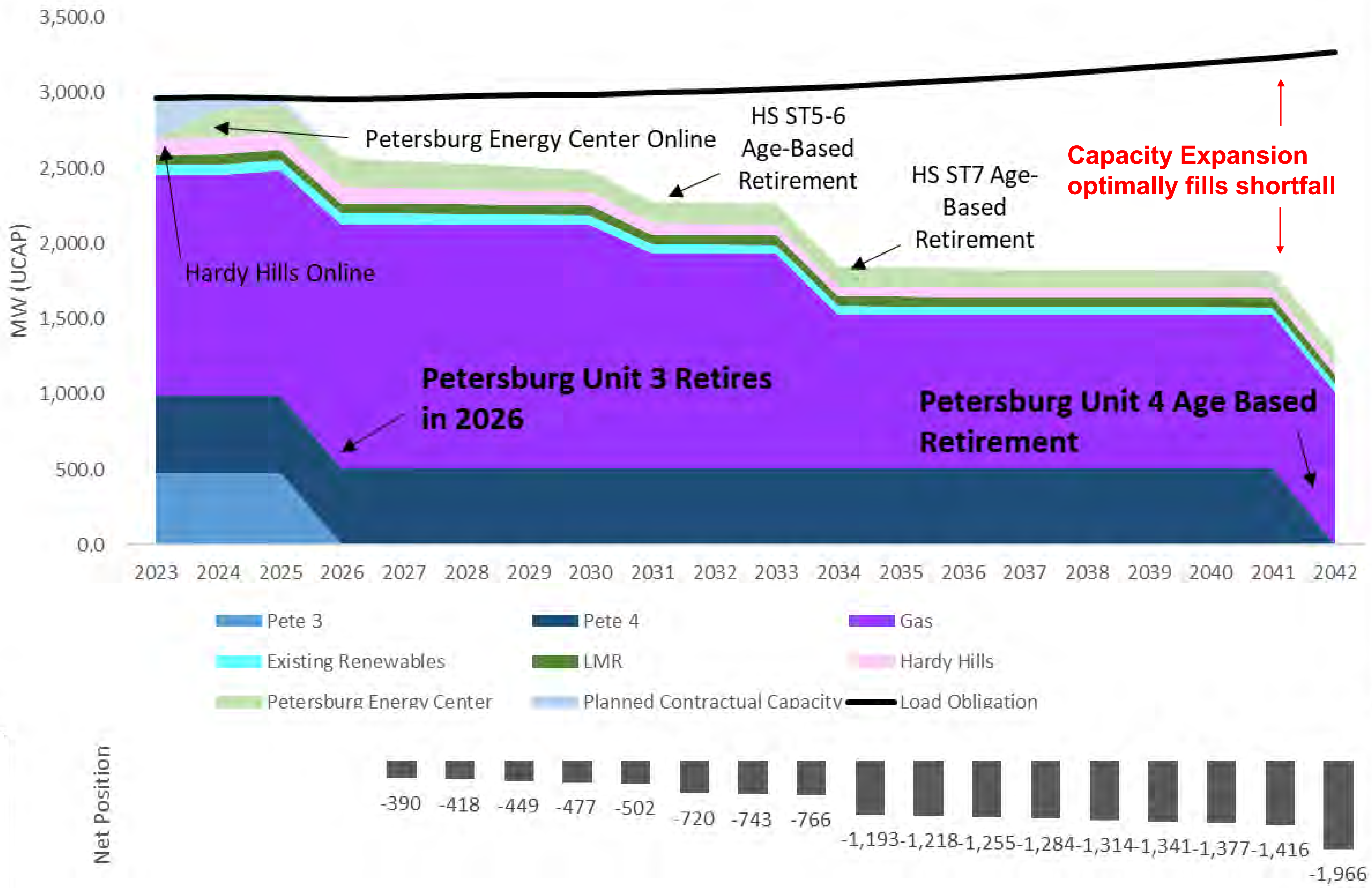
HS ST5-6 Age-Based Retirement

HS ST7 Age-Based Retirement

Petersburg Units 3 & 4 Refuel to Natural Gas in 2025

Capacity Expansion optimally fills shortfall

Strategy: One Petersburg Unit Retires



Petersburg Energy Center Online

HS ST5-6 Age-Based Retirement

HS ST7 Age-Based Retirement

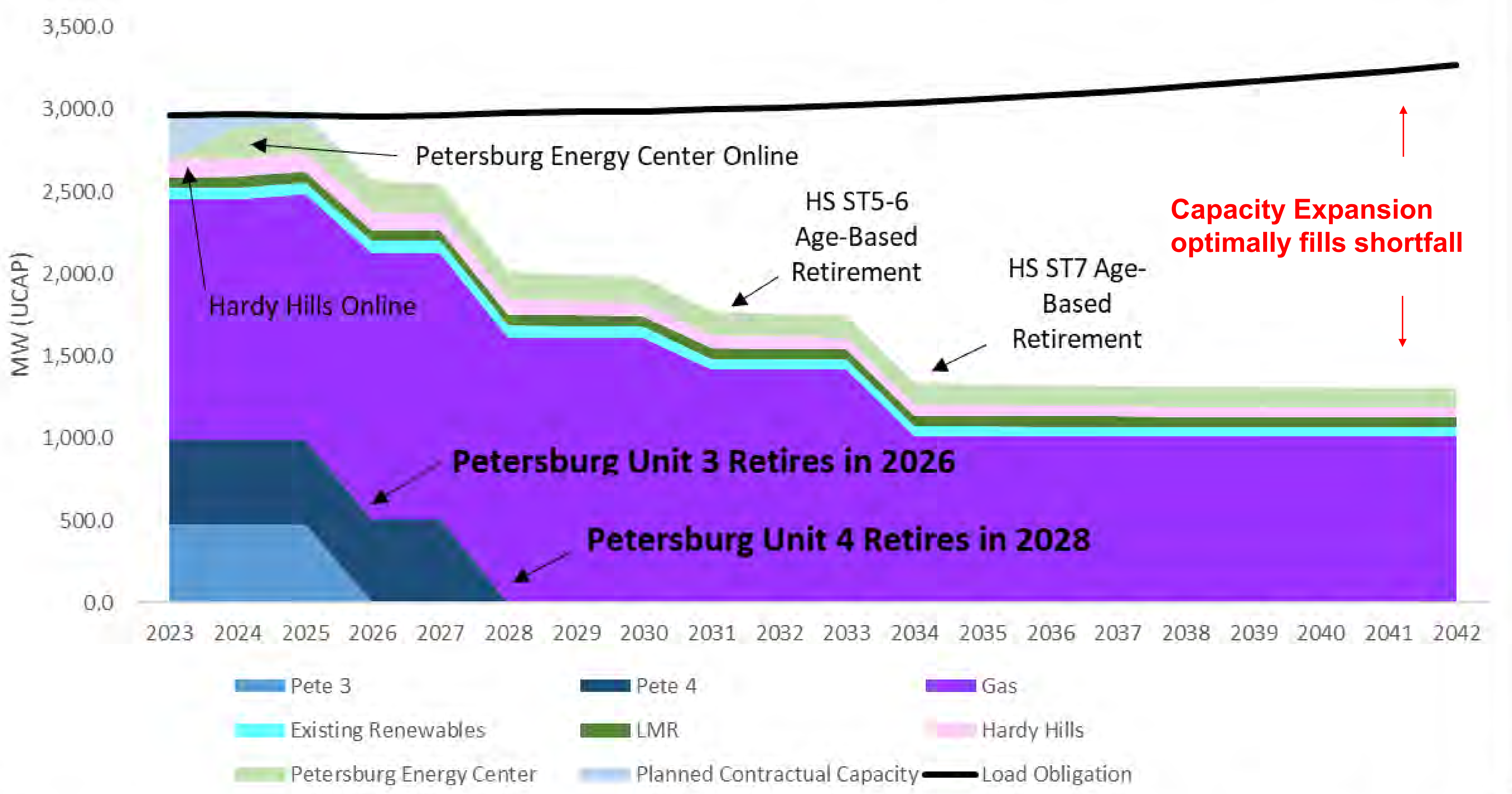
Capacity Expansion optimally fills shortfall

Hardy Hills Online

Petersburg Unit 3 Retires in 2026

Petersburg Unit 4 Age Based Retirement

Strategy: Both Petersburg Units Retire



Petersburg Energy Center Online

Hardy Hills Online

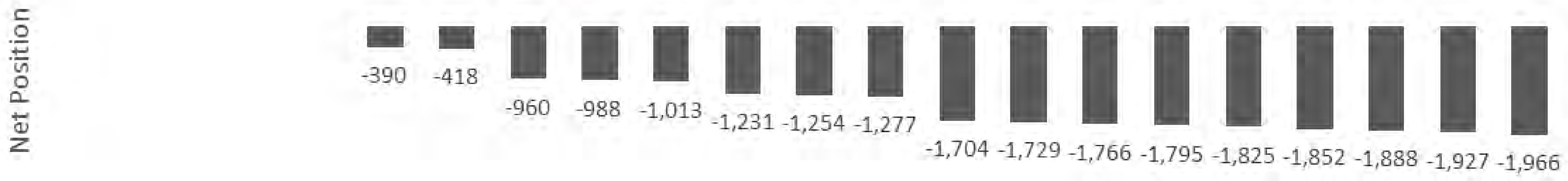
HS ST5-6 Age-Based Retirement

HS ST7 Age-Based Retirement

Capacity Expansion optimally fills shortfall

Petersburg Unit 3 Retires in 2026

Petersburg Unit 4 Retires in 2028



IRP Scenario Framework & Driving Assumptions

IRP Scenarios

AES Indiana will model the four strategies for the generation portfolio across four scenarios:

A. No Environmental Action – “NoEnv”

B. Current Trends (Reference Case) – “Ref”

C. Aggressive Environmental – “AE”

D. Decarbonized Economy – “Decarb”

IRP Commodity Assumptions for the Scenarios

AES Indiana has contracted Horizons Energy to produce custom fundamental commodity forecasts for the four IRP Scenarios – No Environmental Action, Current Trends (Reference Case), Aggressive Environmental and Decarbonized Economy.

- Horizons Energy is modeling AES Indiana’s environmental policy and fuel price assumptions associated with each scenario to produce scenario-specific fundamental forecasts for the MISO system.
- Horizons Energy uses the EnCompass model for capacity expansion of the MISO System in producing the custom fundamental forecasts.
- Fundamental Curve modeling results include:
  - ATC, On-Peak and Off-Peak Power Prices
  - Capacity Prices
- **The No Environmental Action, Current Trends (Reference Case), Aggressive Environmental and Decarbonized Economy custom fundamental forecasts are currently in production with Horizons Energy.**

Scenario "NoEnv": No Environmental Action

Driving Assumptions							
Scenario	Load	EV	PV	Power	Gas	Coal	CO2
No Environmental Action	Low	Low	Low	TBD	Low	Base	None

Scenario Narrative

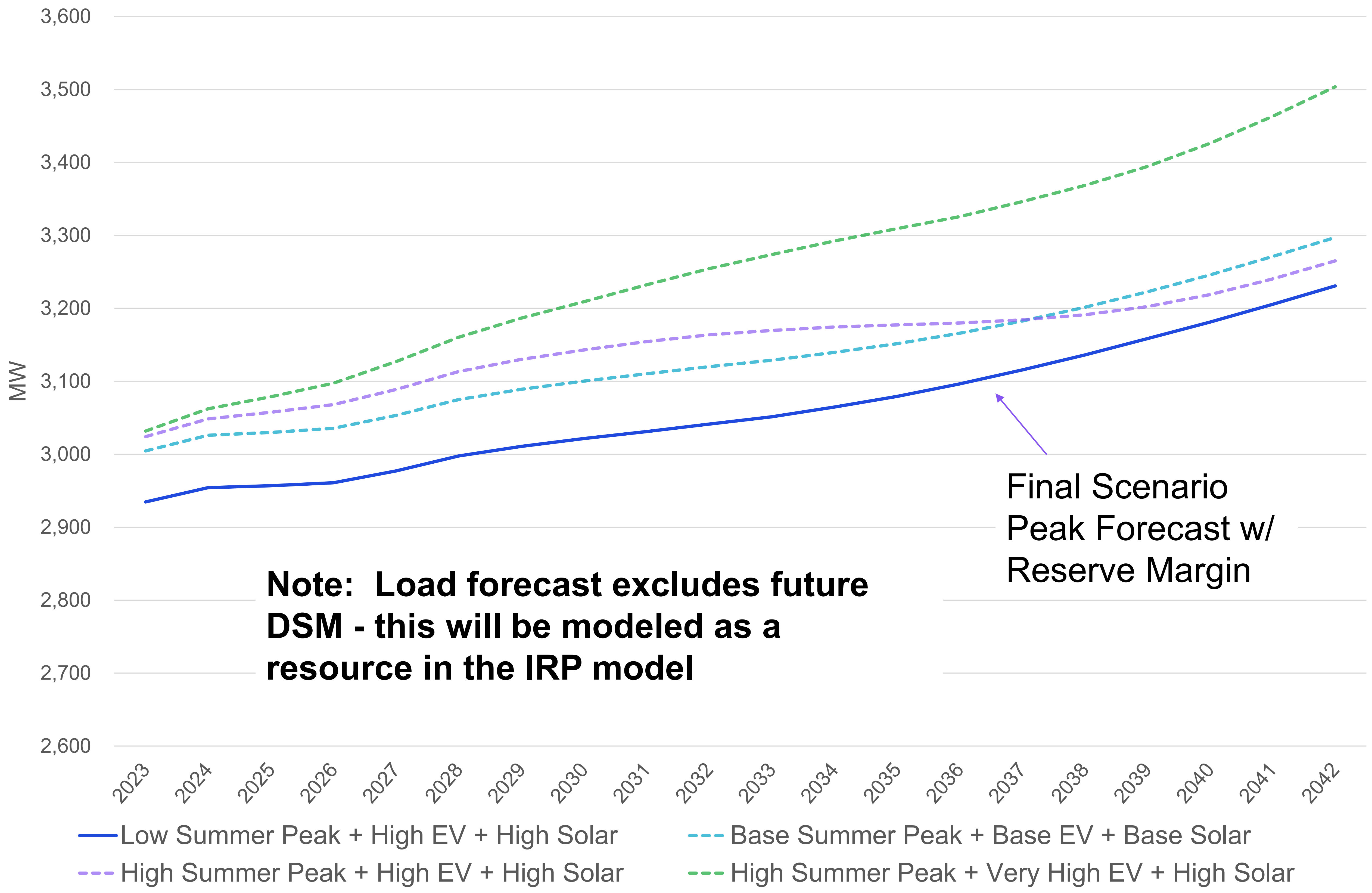
- Future defined by relaxed environmental regulations, expanded fracking and low demand with low electrification.
- Inflation persists driving low GDP & customer growth.
- Continued coal operation combined with expanded gas production result in low gas prices.

Scenario “NoEnv”: No Environmental Action – Load Assumptions

Load Forecast:
Low Case
Driven by Moody’s Economics S3:
Alternative Scenario 3 – Downside – 90th Percentile

Electric Vehicle Forecast:
Low Case
EV market share of 12% in 2042

Distributed Solar Forecast:
Low Case
Market adoption of 6% in 2042



Note: Load forecast excludes future DSM - this will be modeled as a resource in the IRP model

Final Scenario Peak Forecast w/ Reserve Margin

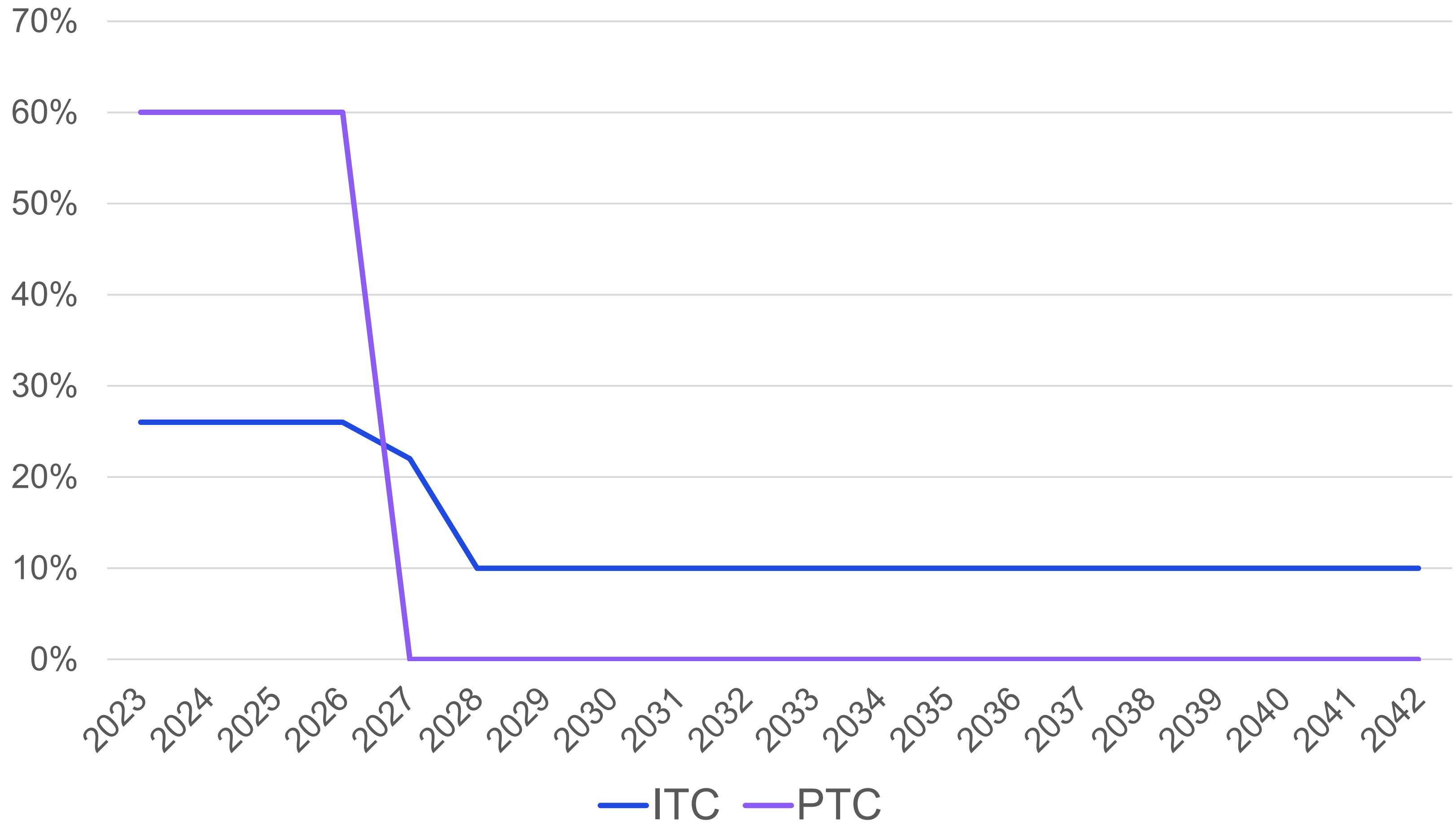
Scenario “NoEnv”: No Environmental Action – Environmental Policy Assumptions

ITC: No subsidy extension; Current tax subsidy schedule – declines to 10% by 2028 and remains at 10% through analysis period

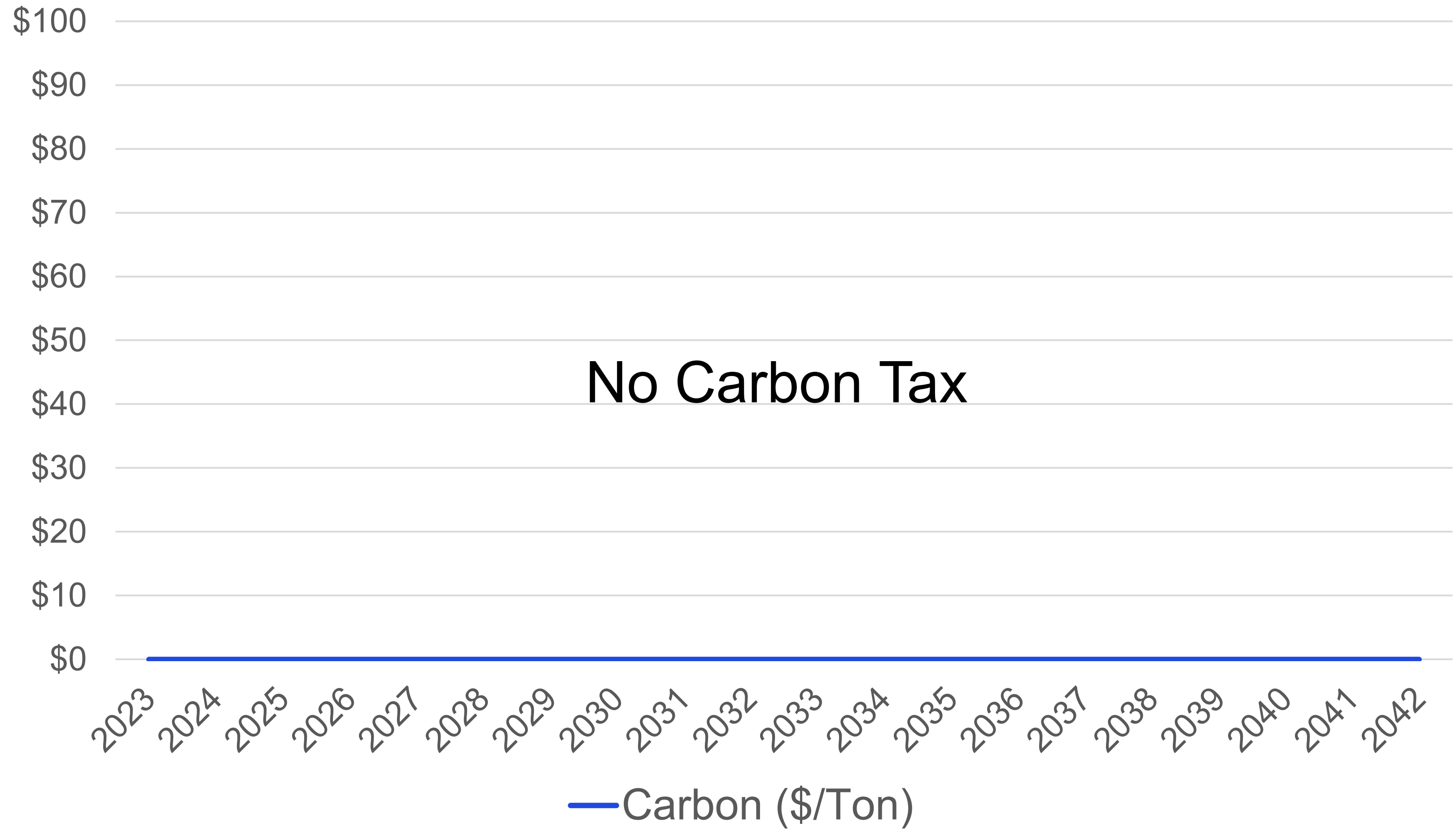
PTC: No subsidy extension; Current tax subsidy schedule – safe harbor period expires in 2027

Carbon: None

Additional Coal-fired Production Costs: None



*Years correspond to years projects first produce energy



Scenario “Ref”: Current Trends (Reference Case)

Driving Assumptions							
Scenario	Load	EV	PV	Power	Gas	Coal	CO2
Current Trends	Base	Base	Base	TBD	Base	Base	Low

Scenario Narrative

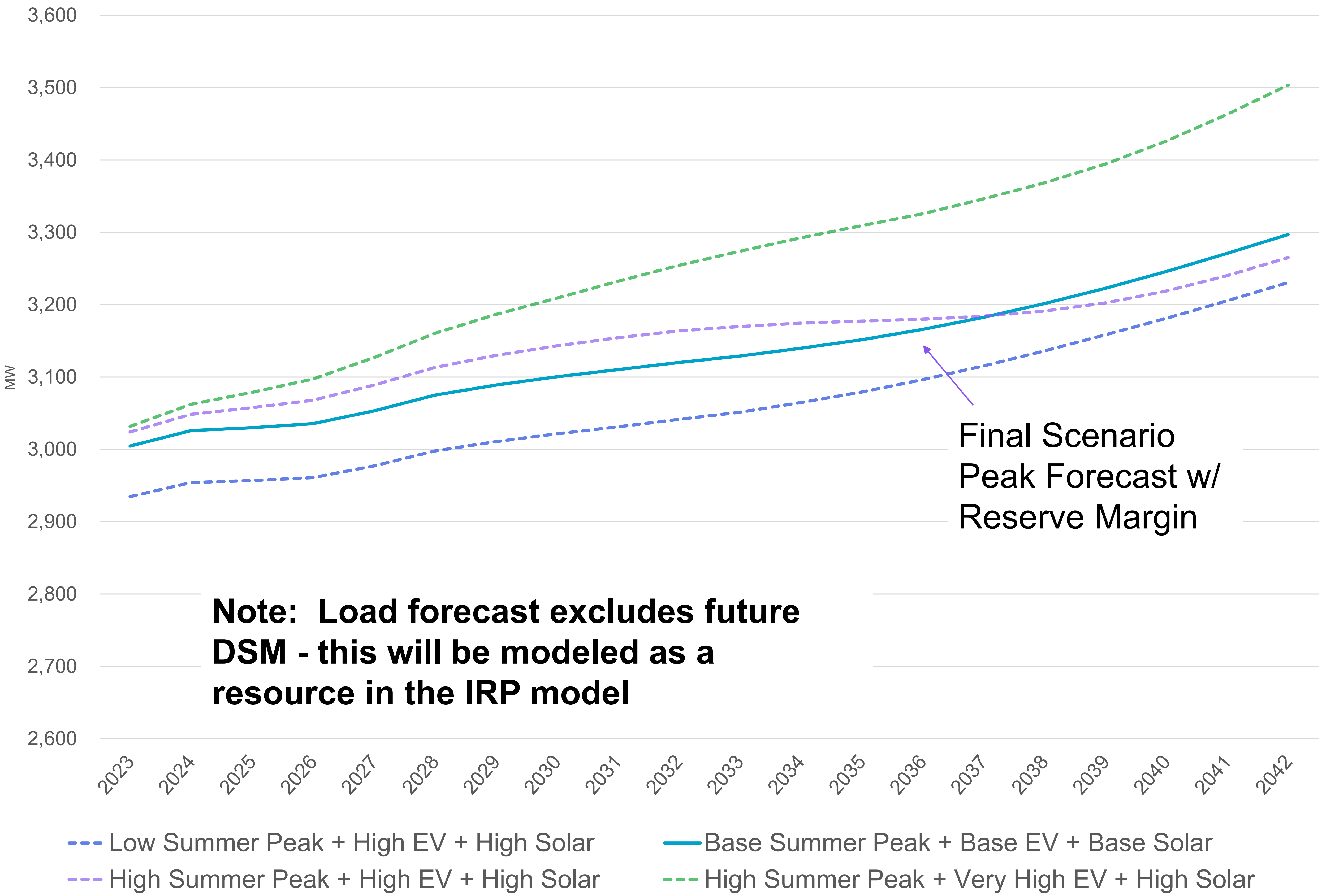
- Congressional gridlock persists with stalled progress on passing sweeping environmental legislation.
- The ITC and PTC given single year extensions for the next five years.
- Assumes modest price for carbon starting at $6.49/ton in the late 2020s.

Scenario “Ref”: Current Trends – Load Assumptions

Load Forecast:
Base Case with base Moody’s economic assumptions

Electric Vehicle Forecast:
Base Case
EV market share of 22% in 2042

Distributed Solar Forecast:
Base Case
Market adoption of 15% in 2042



Final Scenario Peak Forecast w/ Reserve Margin

Note: Load forecast excludes future DSM - this will be modeled as a resource in the IRP model

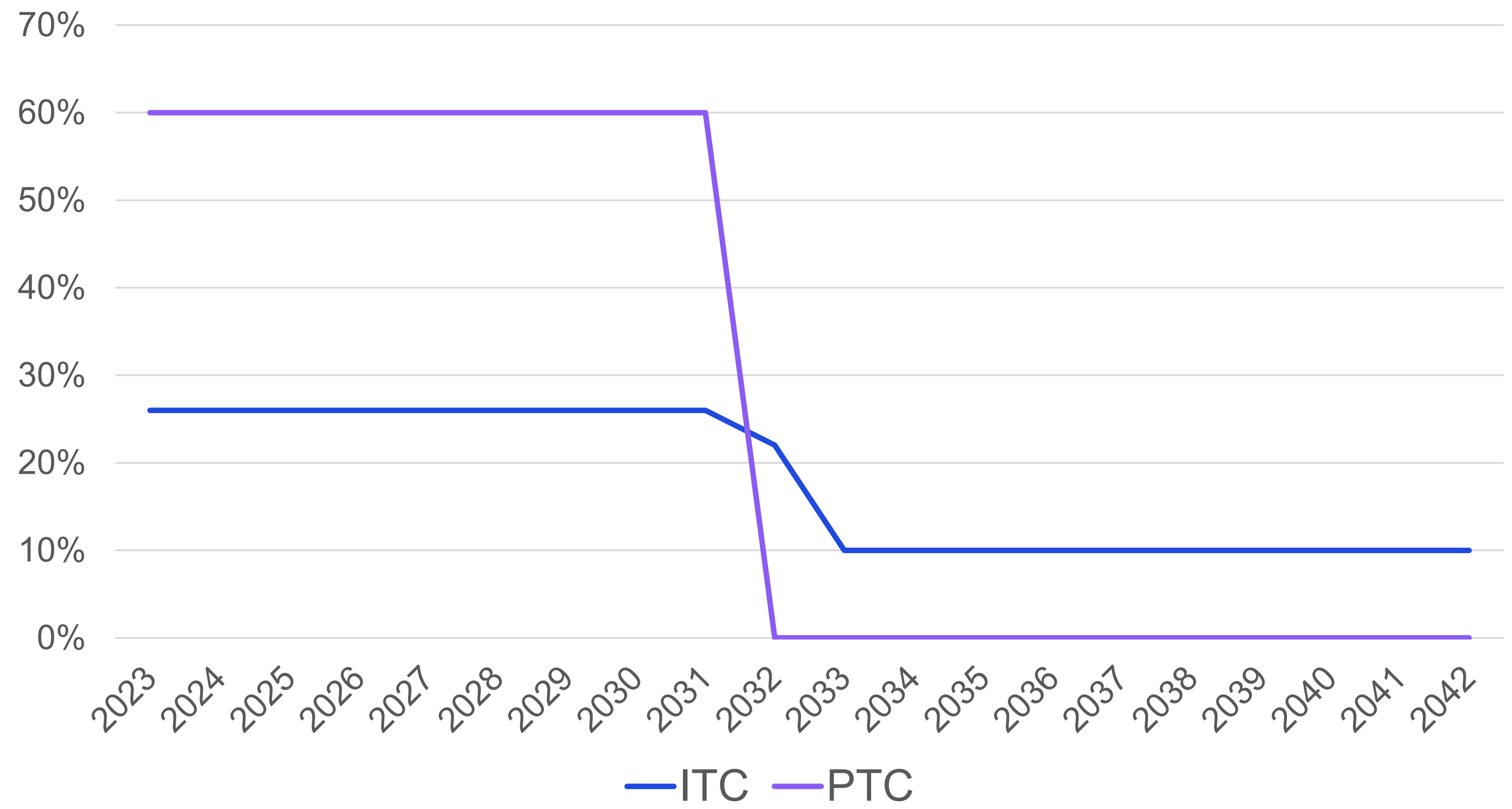
Scenario “Ref”: Current Trends – Environmental Policy Assumptions

ITC: Five-year extension – declines to 10% by 2032 and remains at 10% through analysis period

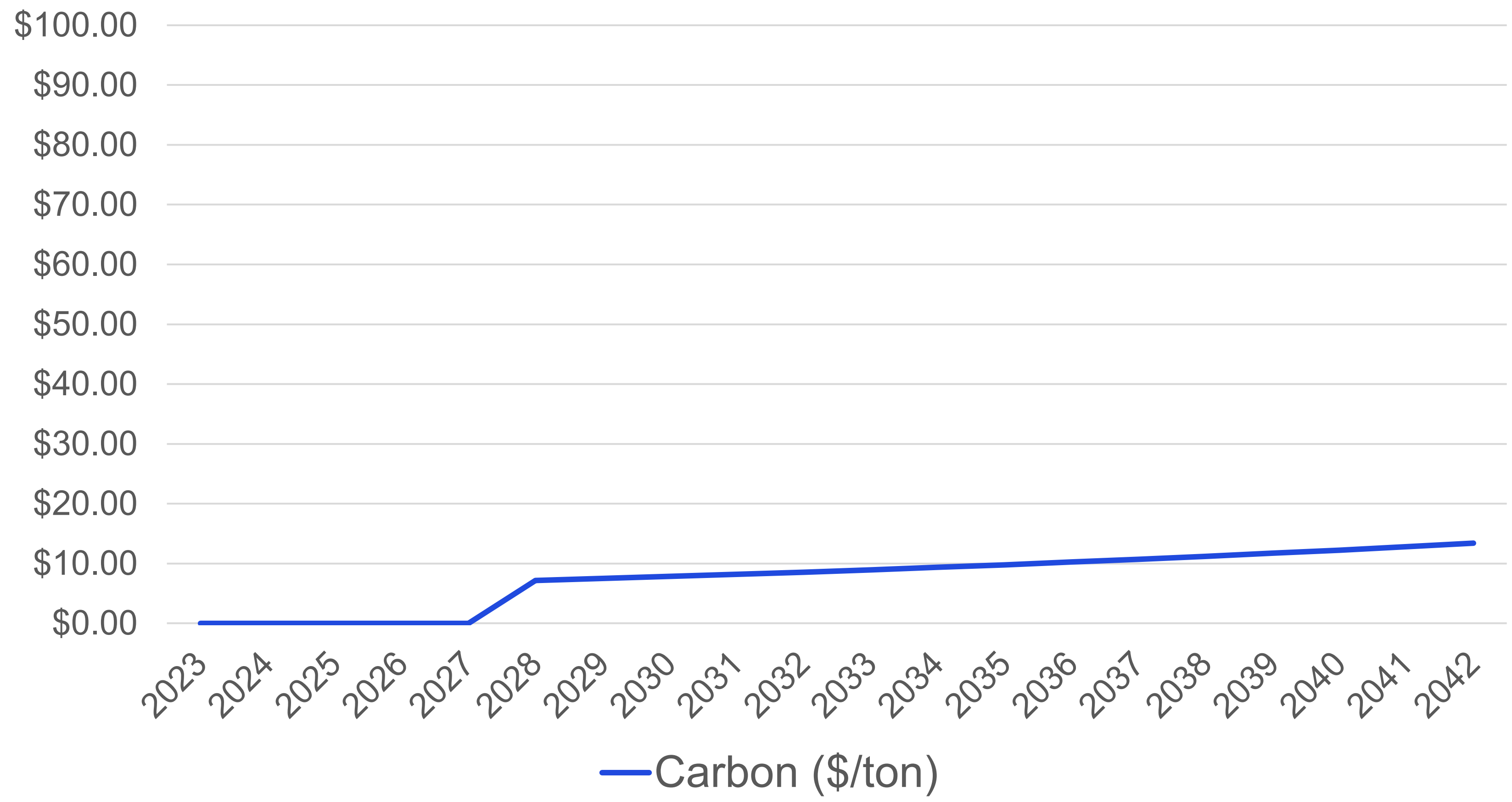
PTC: Five-year extension – safe harbor period expires in 2032

Carbon: Carbon set at $6.49/ton starting in 2028 and escalating at 2.5% through planning period; Carbon price consistent with 1/3 the value of the Social Cost of Carbon as calculated by the U.S. Govt Interagency Working Group on Social Cost of Greenhouse Gases

Additional Coal-fired Production Costs: None



*Years correspond to years projects first produce energy



https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Scenario “AE”: Aggressive Environmental

Driving Assumptions							
Scenario	Load	EV	PV	Power	Gas	Coal	CO2
Aggressive Environmental	High	High	High	TBD	High	Base	High

Scenario Narrative

- → Congress passes environmental legislation that includes carbon tax starting in 2035.
- → ITC and PTC extensions are consistent with Build Back Better.
- → Includes high demand scenario with high electric vehicle and solar forecasts
- → Near term transition from coal to natural gas results in high gas prices.

Scenario “AE”: Aggressive Environmental – Load Assumptions

Load Forecast:

High Case driven by Moody’s S1: Alternative Scenario 1 – Upside – 10th Percentile

Electric Vehicle Forecast:

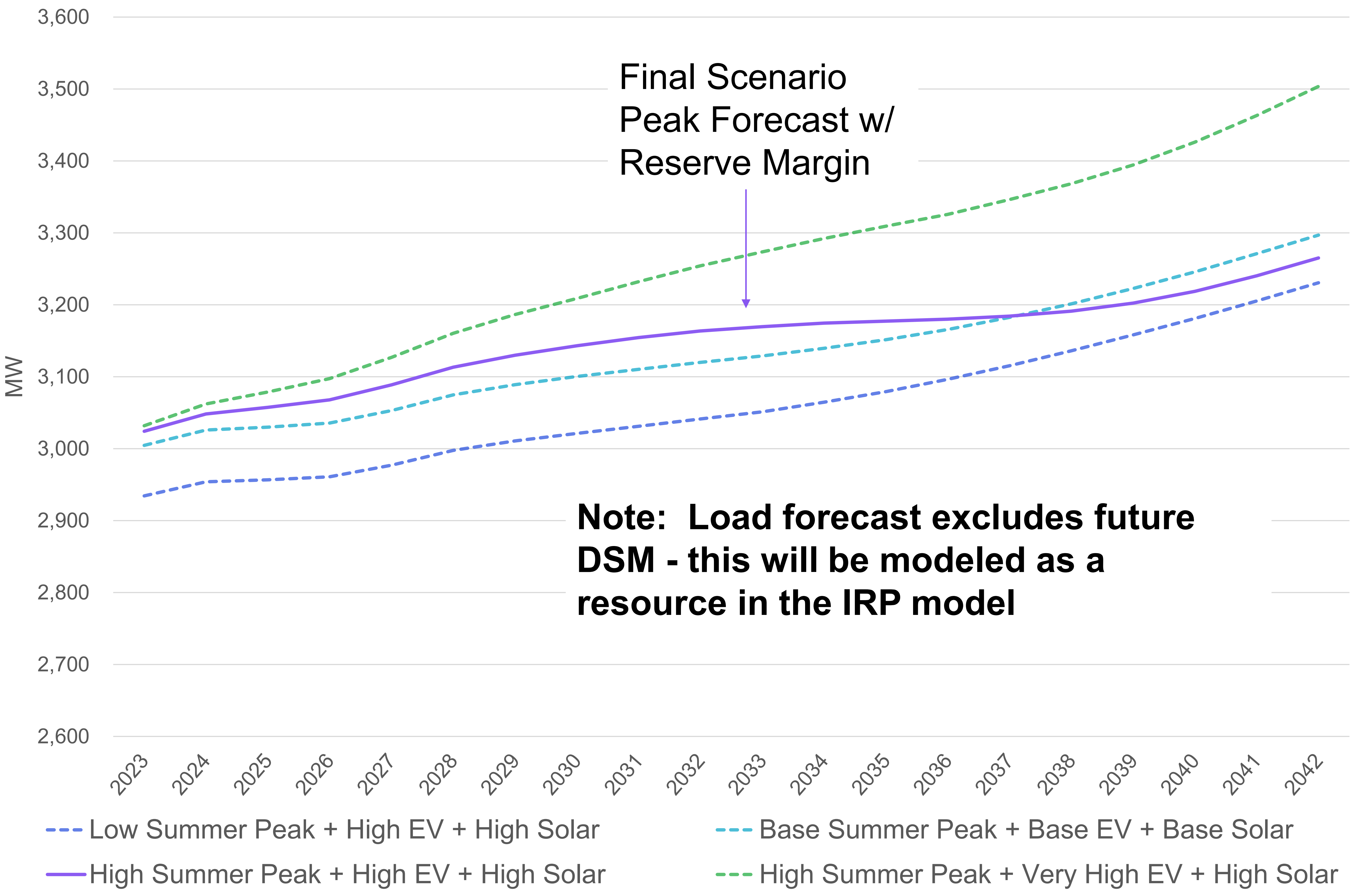
High Case

EV market share of 44% in 2042

Distributed Solar Forecast:

High Case

Market adoption of 29% in 2042



Final Scenario Peak Forecast w/ Reserve Margin

Note: Load forecast excludes future DSM - this will be modeled as a resource in the IRP model

Scenario “AE”: Aggressive Environmental – Environmental Policy Assumptions

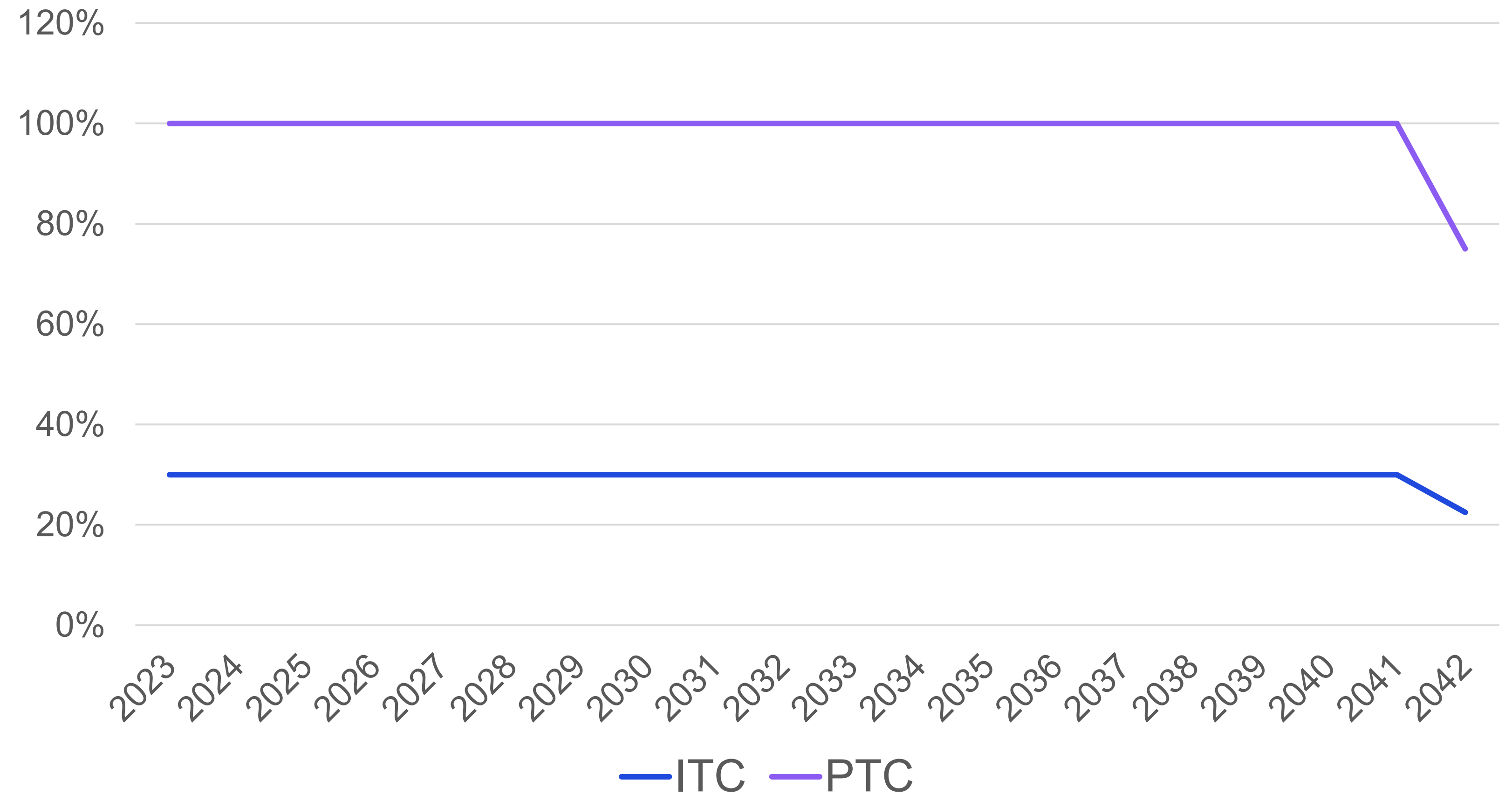
ITC: Ten-year extension – declines to 10% by 2042 and remains at 10% through analysis period

PTC: Ten-year extension – safe harbor period expires in 2042

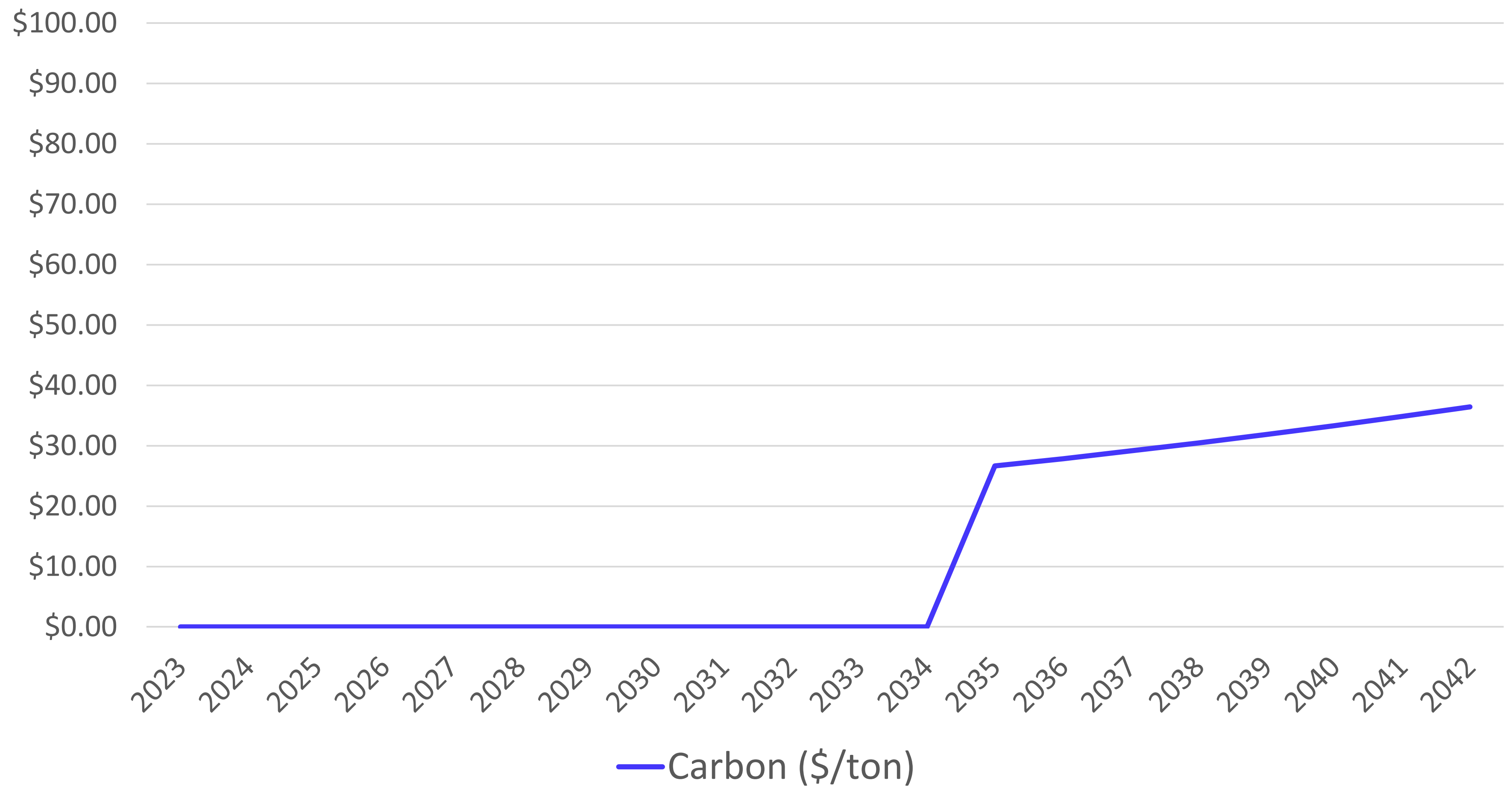
Carbon: Carbon set at $26.64/ton starting in 2035 and escalating at 5% through planning period; Carbon price consistent with the whole value of the Social Cost of Carbon as calculated by the U.S. Govt Interagency Working Group on Social Cost of Greenhouse Gases.

Additional Coal-fired Production Costs:

1 Additional cost for coal ash disposal 2 High Ozone Season NOx price forecast



*Years correspond to years projects first produce energy



https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Scenario “Decarb”: Decarbonized Economy

Driving Assumptions							
Scenario	Load	EV	PV	Power	Gas	Coal	CO2
Decarbonized Economy	High	Very High	High	TBD	Base	Base	None*

*Carbon targets will be modeled through a National Renewable Portfolio Standard

Scenario Narrative

- → Congress passes aggressive decarbonization mandate on power sector with explicit renewable energy targets.
- → High ITC/PTC runs through planning horizon.
- → Carbon targets achieved through a Renewable Portfolio Standard that targets Net Zero; not a market mechanism like a carbon tax or cap and trade.
- → High load driven by electrification
- → Base gas prices driven by low demand due to reduced gas generation.

Scenario “Decarb”: Decarbonized Economy – Load Assumptions

Load Forecast:

High Case driven by Moody’s S1: Alternative Scenario 1 – Upside – 10th Percentile

Electric Vehicle Forecast:

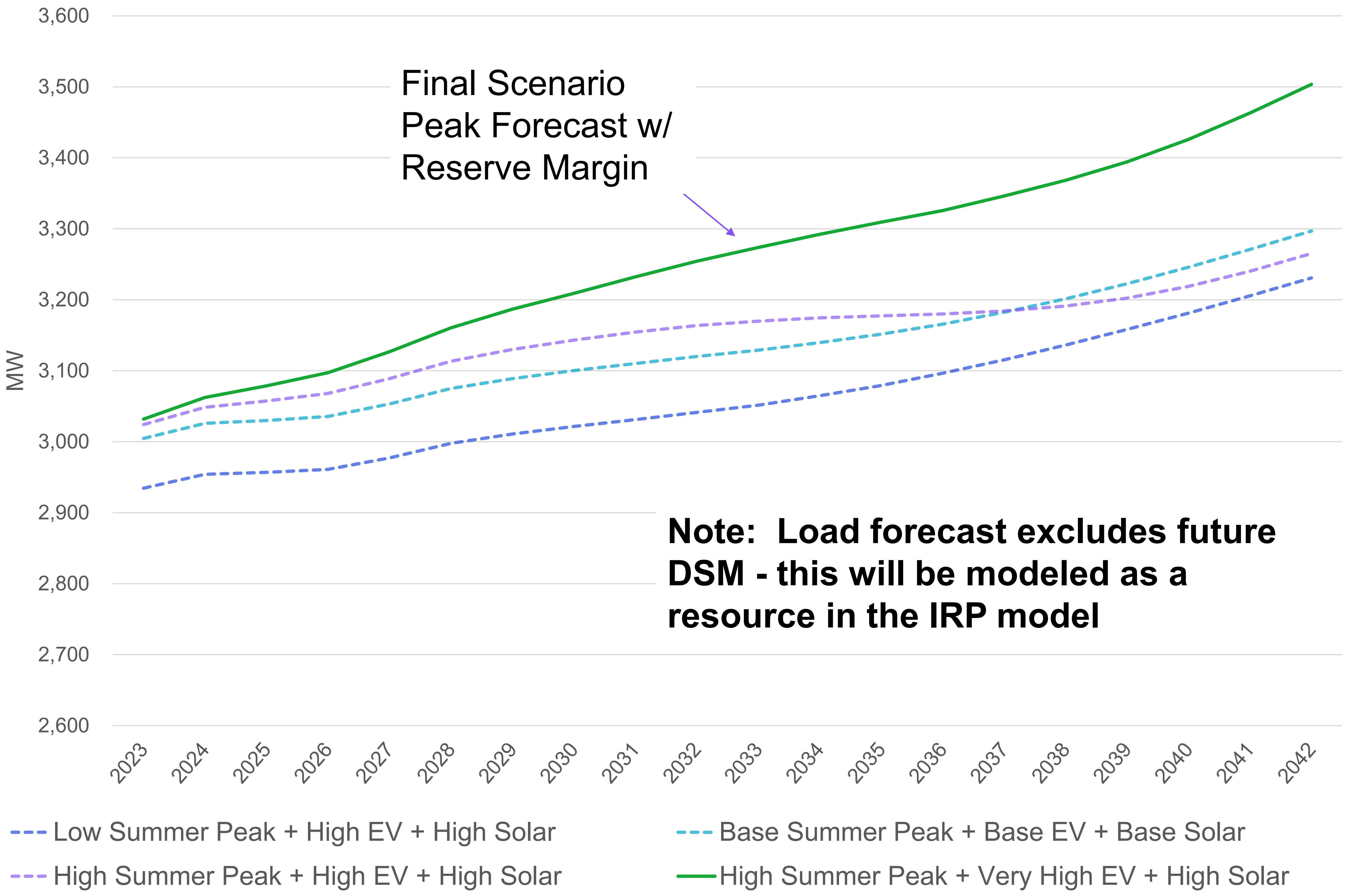
Very High Case

EV market share of 85% in 2042

Distributed Solar Forecast:

High Case

Market adoption of 29% in 2042



Note: Load forecast excludes future DSM - this will be modeled as a resource in the IRP model

Scenario "Decarb": Decarbonized Economy – Environmental Policy Assumptions

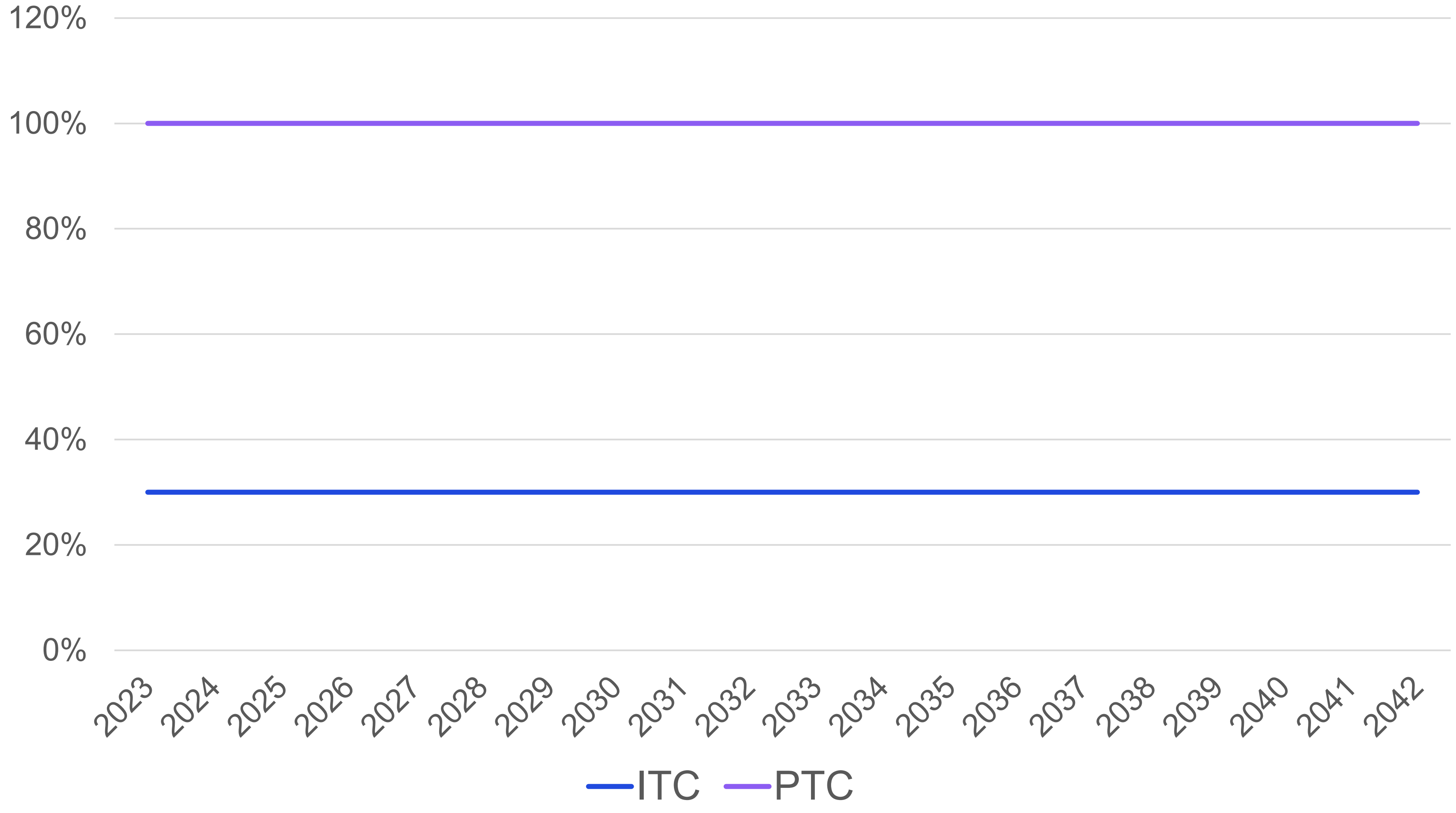
ITC: 30% throughout the planning period

PTC: 100% through entire period

Carbon: No price on Carbon; Renewable Portfolio Standard similar to Clean Energy Performance Program (CEPP)

Additional Coal-fired Production Costs:

1. Additional cost for coal ash disposal
2. High Ozone Season NOx price forecast



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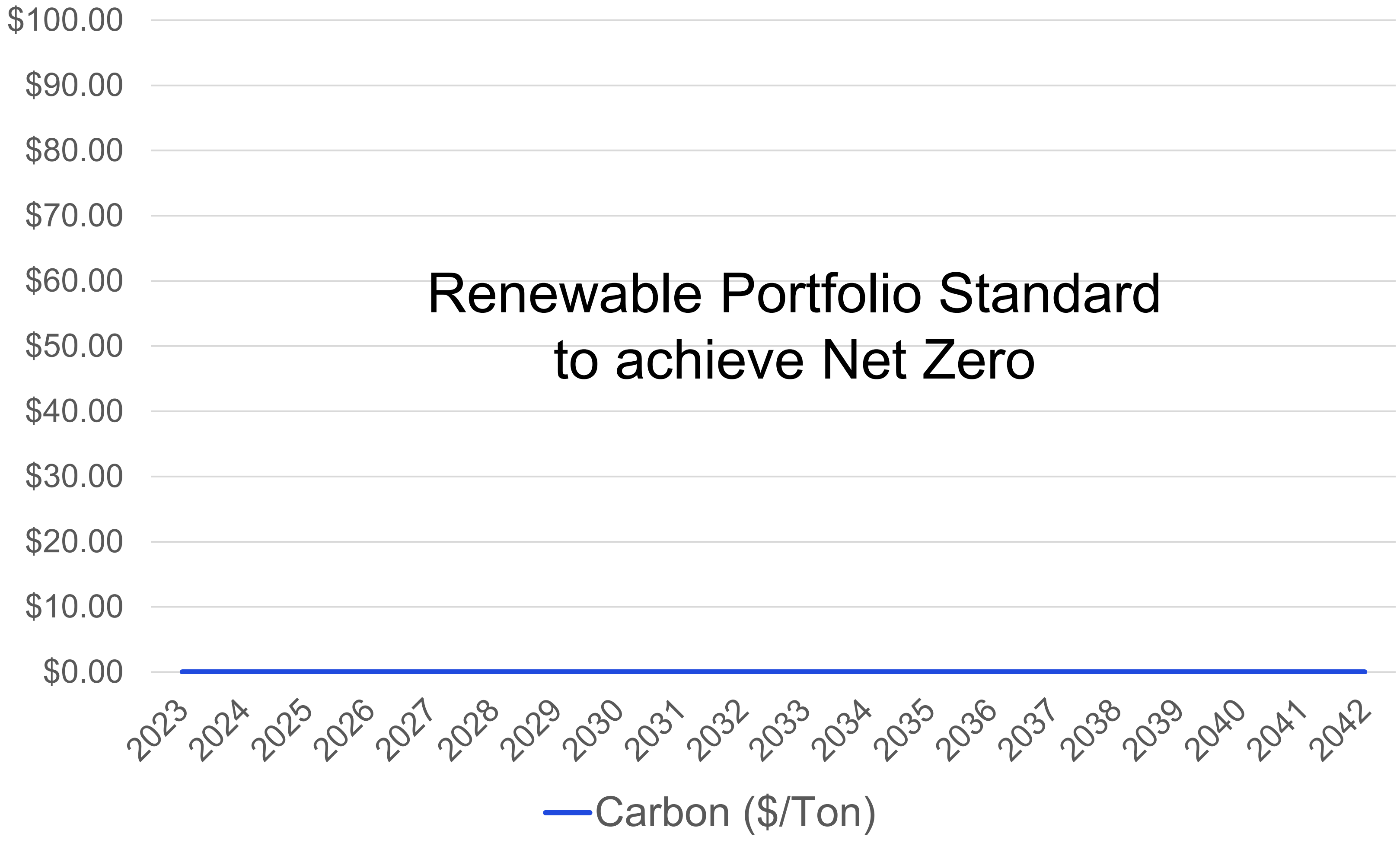


Renewable Portfolio Standard to achieve Net Zero

Summary of Scenario Driving Assumptions

Scenario	Load	EV	Dist Solar	Power	Gas	Coal	CO2
No Environmental Action – “No Env”	Low	Low	Low	TBD	Low	Base	None
Current Trends (Reference Case) – “Ref”	Base	Base	Base	TBD	Base	Base	Low
Aggressive Environmental – “AE”	High	High	High	TBD	High	Base	High
Decarbonized Economy – “Decarb”	High	Very High	High	TBD	Base	Base	None*

*Carbon targets will be modeled through a National Renewable Portfolio Standard

Final IRP Portfolio Matrix

Final Portfolio Matrix

Combining Strategies and Scenarios results in the Portfolio Matrix or framework for IRP evaluation:

		Scenarios			
		No Environmental Action	**Current Trends (Reference Case)**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**	No Retire/NoEnv	No Retire/Ref	No Retire/AE	No Retire/Decarb
	Pete Refuel to 100% Gas (est. 2025)	Refuel/NoEnv	Refuel/Ref	Refuel/AE	Refuel/Decarb
	One Pete Unit Retires (2026)	One Unit/NoEnv	One Unit/Ref	One Unit/AE	One Unit/Decarb
	Both Pete Units Retire (2026 & 2028)	Both Units/NoEnv	Both Units/Ref	Both Units/AE	Both Units/Decarb

→ The 16 portfolios defined above will be evaluated using a Scorecard that includes cost, environmental, reliability & risk metrics.

→ A Preferred Resource Portfolio will be selected using this rigorous Scorecard evaluation process.

Risk Analysis: Sensitivities & Stochastic

Risk Analysis

→ Key variable sensitivities

- AES Indiana will model sensitivities for key variables to understand how the PVRR may change in a future where the variable looks very different from the IRP assumption, e.g. renewable capital cost sensitivity.

→ Portfolio sensitivities

- AES Indiana will model environmental policy sensitivities on the optimized capacity expansion results from the Current Trends (Reference Case) to understand how the PVRR may change in a very different policy future.
- The results will help to answer the question – "How would the optimized Reference Case perform in a very different policy future, e.g. Reference Case in a Decarbonized Economy future?"

→ Stochastic Analysis

- AES Indiana will run a stochastic analysis on fuel prices, energy prices and load in order to understand the risk to PVRR in the Reference Case from these key IRP variables.

Further detail regarding the Risk Analysis will be presented in Public Advisory Meeting #3.

Final Q&A and Next Steps

Public Advisory Meeting

Public Advisory Meeting #1	Jan. 24, 2022
Public Advisory Meeting #2	April 12, 2022
Public Advisory Meeting #3	June 2022
Public Advisory Meeting #4	August 2022
Public Advisory Meeting #5	October 2022

→ All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

→ A Technical Meeting will be held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Advisory Meeting.

→ Meeting materials can be accessed at ***www.aesindiana.com/integrated-resource-plan.***

Thank You

APPENDIX

IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.

IRP Acronyms

- ACEE: The American Council for an Energy-Efficient Economy
- AMI: Advanced Metering Infrastructure
- BESS: Battery Energy Storage System
- BNEF: Bloomberg New Energy Finance
- BTA: Build-Transfer Agreement
- BTU: British Thermal Unit
- C&I: Commercial and Industrial
- CAA: Clean Air Act
- CAGR: Compound Annual Growth Rate
- CCGT: Combined Cycle Gas Turbines
- CCS: Carbon Dioxide Capture and Storage
- CDD: Cooling Degree Day
- COD: Commercial Operation Date
- CONE: Cost of New Entry
- CP: Coincident Peak
- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- EV: Electric Vehicle
- GDP: Gross Domestic Product
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IC: Indiana Code
- ICAP: Installed Capacity
- ICE: Internal Combustion Engine
- IRP: Integrated Resource Plan
- ITC: Investment Tax Credit
- IURC: Indiana Regulatory Commission
- kW: Kilowatt
- kWh: Kilowatt-Hour
- LED: Light Emitting Diode
- LMR: Load Modifying Resource
- LNBL: Lawrence Berkeley National Laboratory
- Max Gen: Maximum Generation Emergency Warning
- MAP: Maximum Achievable Potential
- MIP: Mixed Integer Programming
- MISO: Midcontinent Independent System Operator
- MPS: Market Potential Study
- MW: Megawatt
- NDA: Nondisclosure Agreement
- NOX: Nitrogen Oxides
- NPV: Net Present Value
- NREL: National Renewable Energy Laboratory
- NTG: Net to Gross
- PPA: Power Purchase Agreement
- PRA: Planning Resource Auction
- PTC: Renewable Electricity Production Tax Credit
- PRMR: Planning Reserve Margin Requirement
- PV: Photovoltaic
- PVRR: Present Value Revenue Requirement
- PY: Planning Year
- RA: Resource Adequacy
- RAN: Resource Availability and Need
- RAP: Realistic Achievable Potential
- REC: Renewable Energy Credit
- REP: Renewable Energy Production
- RFP: Request for Proposals
- RIIA: MISO’s Renewable Integration Impact Assessment
- SAC: MISO’s Seasonal Accredited Capacity
- SCR: Selective Catalytic Reduction System
- SMR: Small Modular Reactors
- ST: Steam Turbine
- SUFG: State Utility Forecasting Group
- TRM: Technical Resource Manual
- UCT: Utility Cost Test
- UCAP: Unforced Capacity
- WTP: Willingness to Participate
- XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control

Replacement Resource Cost Assumptions Summary Table (of all parameters by tech type)

	Wind	Solar	Storage	Solar + Storage	CCGT	Frame CT	Aero CT	Reciprocating Engine
Fuel type:	Wind	Solar	Battery	Solar + Battery	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Unsubsidized Capital Cost ($/kWac):	$1,451	$1,111	$1,310	$1,126	$1,026	$872	$1,335	$1,283
*Subsidized Capital Cost ($/kWac):	$1,002	$803	N/A	$882	N/A	N/A	N/A	N/A
Fixed O&M ($/kW-yr):	$37	$21	$36	$25	$32	$30	$36	$46
Variable O&M ($/MWh):	$0	$0	$0	$0	$2	$1	$5	$6
Grid Connection Cost ($/kWac):	$26	$54	$59	$54	$30	$30	$30	$30
**Tax Equity Cost ($/kWac):	$59	$59	N/A	$59	N/A	N/A	N/A	N/A
Size (POI MW):	50	25	20 MW | 80 MWh	25 MW POI, 32.5 MWdc Solar, 12.5 MW | 50 MWh Battery	325	100	90	54
Asset Useful Life (years):	30	35	20	31	30	20	20	20
Capacity Factor:	33.6-40.4%	24.5%	N/A	20.0%	Varies	Varies	Varies	Varies
Summer ELCC (2025):	7%	59%	96%	100%	94%	96%	96%	96%
Summer Capacity Credit (2025):	4	15	19	25	306	96	86	52
Heat Rate at Max Econ Load (Btu/kWh):	N/A	N/A	N/A	N/A	6,700	10,000	8,200	7,400
Ramp Rate (MW/min):	N/A	N/A	N/A	N/A	20	12	43	37
WACC:	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%
Estimated LCOE (2022$/MWh):	$30	$38	$113	$53	$44	$120	$69	$61

*Includes 26% ITC for solar and $15/MWh PTC for wind consistent with the Current Trends Scenario
**Cost only considered when resource is subsidized
***Storage LCOS assumes one full discharge per day; Dispatchable resources LCOE calculations highly dependent on capacity factor

DSM Market Potential Study

APPENDIX SLIDES

Demand Response Assumptions – Residential Load Reduction

Program	Residential Load Reduction Per Participant
DLC Central AC Switch	0.972 kW
DLC Central AC Thermostat	0.846 kW
DLC Smart Appliances	0.072 kW
DLC Water Heaters	0.4 kW Summer, 0.8 kW Winter
DLC Electric Space Heaters	1 kW
DLC Electric Vehicle Chargers	0.63 kW
Battery Energy Storage	3 kW
Time of Use Rate with Enabling Technology	8% of CP billing demand
Time of Use Rate without Enabling Technology	5.2% of CP billing demand
Behavior DR	12.9% of CP billing demand

Demand Response Assumptions – Non-Residential Load Reduction

Program	Non-Residential Load Reduction Per Participant
DLC Central AC Switch	1.103 kW
DLC Central AC Thermostat	0.96 kW
DLC Water Heaters	0.6 kW Summer, 1.2 kW Winter
DLC Electric Space Heaters	1.5 kW
DLC Lighting	8.9% of CP billing demand
Curtail Agreements	5% of CP billing demand for day ahead, 3% day of
Demand Bidding	7% of CP billing demand
Capacity Bidding	19.5% of CP billing demand
Time of Use Rate with Enabling Technology	3.8% of CP billing demand
Time of Use Rate without Enabling Technology	2% of CP billing demand

Demand Response Assumptions – Residential Costs

Program	Equipment & Installation Cost	Incentive Cost
DLC Central AC One-Way Communicating Switch	$220	$20/participant/year
DLC Central AC Two-Way Communicating Switch	$245	$20/participant/year
DLC Central AC Thermostat	$300	$20/participant/year
DLC Smart Appliances	$245	$20/participant/year
DLC Water Heaters	$300	$20/participant/year
DLC Electric Space Heaters	$0; assumed must be participating in DLC AC program	$20/participant/year
DLC Electric Vehicle Chargers	$0; assumed must have Level 2 charger	$50/participant/year
Battery Energy Storage	$12,385	$0
Time of Use Rate with Enabling Technology	$300	$0
Time of Use Rate without Enabling Technology	$0	$0
Behavior DR	$0	$0.75/kWh

Demand Response Assumptions – Non-Residential Costs

Program	Equipment & Installation Cost	Incentive Cost
DLC Central AC One-Way Communicating Switch	$220	$30/participant/year
DLC Central AC Two-Way Communicating Switch	$245	$30/participant/year
DLC Central AC Thermostat	$300	$30/participant/year
DLC Water Heaters	$300	$30/participant/year
DLC Electric Space Heaters	$0; assumed must be participating in DLC AC program	$30/participant/year
DLC Lighting	$1,900	
Curtail Agreements	$0	Starts at $87/kW-yr for MAP and $47/kW-yr for RAP; increases by 2% per year
Demand Bidding	$0	$0.5/kWh-yr
Capacity Bidding	$0	$8.50/kW-yr
Time of Use Rate with Enabling Technology	$300	$0
Time of Use Rate without Enabling Technology	$0	$0
Ice Energy Storage Rate	$55,000	$0

Demand Response Assumptions – Adoption Rates

Residential Adoption Rates

Program	MAP	RAP
DLC Central AC (Switch and Thermostat Total)	71%	41%
DLC Smart Appliances	31%	20%
DLC Water Heaters	65%	35%
DLC Electric Space Heaters	20%	15%
DLC Electric Vehicle Chargers	72%	27%
Battery Energy Storage	10%	5%
Time of Use Rate (with and without Enabling Technology total)	64%	46%
Behavior DR	93%	21%

Non-Residential Adoption Rates

Program	MAP	RAP
DLC Central AC (Switch and Thermostat Total)	14%	3%
DLC Water Heaters	16%	7%
DLC Electric Space Heaters	14%	3%
DLC Lighting	14%	3%
Demand Bidding	8%	1%
Capacity Bidding	21%	3%
Time of Use Rate (with and without Enabling Technology total)	74%	13%
Ice Energy Storage Rate	81%	16%

2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #3

6/27/2022

aes Indiana

Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates

Agenda

Time	Topic	Speakers
Morning **Starting at 10:00 AM**	Virtual Meeting Protocols and Safety, Schedule	Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana
	IRP Midway Touchpoint	Kristina Lund, President & CEO, AES Indiana
	Stakeholder Presentations	Wendy Bredhold, Senior Campaign Representative, Sierra Club Ray Wilson, Faith in Place
	IRP Schedule & Meeting #2 Recap	Erik Miller, Manager, Resource Planning, AES Indiana
	2022 All-Source RFP & Replacement Resource Cost Update	Erik Miller, Manager, Resource Planning, AES Indiana
	Commodity Forecasts	Erik Miller, Manager, Resource Planning, AES Indiana
	RTO Reliability Planning: Resource Adequacy & Seasonal Construct	Lynn Hecker, Senior Manager, Resource Adequacy Policy and Analytics, MISO
Break **12:00 PM – 12:30 PM**	Lunch	
Afternoon **Starting at 12:30 PM**	Modeling Reliability Assumptions	Erik Miller, Manager, Resource Planning, AES Indiana
	Reliability Analysis	Hisham Othman, VP Transmission and Regulatory Consulting, Quanta
	Portfolio Metrics & Scorecard	Erik Miller, Manager, Resource Planning, AES Indiana
	AES Indiana Distribution System Planning	Kathy Storm, Vice President, US Smart Grid, AES Indiana Mike Russ, Senior Manager, T&D Forecasting, AES Indiana
	Final Q&A and Next Steps	

Virtual Meeting Protocols and Safety

Chad Rogers, Senior Manager, Regulatory Affairs, AES Indiana

IRP Team Introductions

AES Indiana IRP Partners

Annette Brocks, Senior Resource Planning Analyst, ACES

Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group

Eric Fox, Director, Forecasting Solutions, Itron

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates

Jordan Janflone, EV Modeling Forecasting, GDS Associates

Patrick Maguire, Executive Director of Resource Planning, ACES

Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology

Stewart Ramsey, Managing Executive, Vanry & Associates

Mike Russo, Forecast Consultant, Itron

Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates

Melissa Young, Demand Response Lead, GDS Associates

AES Indiana Legal Team

Nick Grimmer, Indiana Regulatory Counsel, AES Indiana

Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP

Welcome to Today’s Participants

IBEW Local Union 1395
Indiana Chamber

Indiana DG
Indiana Distributed Energy Alliance
Indiana Energy Association
Indiana Utility Regulatory Commission

Indiana State Conference of the NAACP

IUPUI
NIPSCO
NuScale Power
Office of Utility Consumer Counselor

Power Takeoff
Purdue - State Utility Forecasting Group

Ranger Power

Reliable Energy
Rolls-Royce/ISS
Sierra Club

Solar United Neighbors

Synapse Energy Economics
Wartsila

… and members of the AES Indiana team and the public!

Virtual Meeting Best Practices

- Your candid feedback and input is an integral part to the IRP process.
- Questions or feedback will be taken at the end of each section.
- Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

- All lines are muted upon entry.
- For those using audio via Teams, you can unmute by selecting the microphone icon.
- If you are dialed in from a phone, press *6 to unmute.

Video

- Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.

AES Purpose & Values

Safety first

Highest standards

All together

Our safety beliefs

1. Safety comes first for our people, our contractors and our communities.

2. All occupational incidents can be prevented.

3. Working safely is a condition of employment.

4. All AES people and contractors have the right and obligation to stop work when they identify a situation they believe to be unsafe

We can all be safety leaders.

AES

- → Fortune 200 company with operations in 14 countries across 4 continents.
- → Track record of innovation in the technologies that are transforming the energy sector.
- → AES is a global energy company and with the addition of 5 GW of new renewables in 2021, is now positioned as the fastest growing US renewables developer and the largest supplier of corporate renewables contracts in the world.
- → AES announced a target to exit coal by year-end 2025 at the global portfolio level, subject to meeting regulatory obligations. The exit may be achieved through asset sales, fuel conversions or retirements.

AES Indiana

- → 20-year IRP plan created with stakeholder input.
- → Modeling and analysis culminates in a preferred resource portfolio and a short-term action plan.
- → The need for a utility to engage in a rigorous stakeholder process and describe how the utility plans to deliver safe, reliable and efficient electricity at just and reasonable rates is a legal requirement in Indiana and is an obligation AES Indiana will meet.

Leading the inclusive, clean energy transition

1. AES Indiana has a diverse power generation portfolio that serves our customers' needs today and well into the future.

2. Our 2019 IRP projected that AES Indiana would achieve a reduction in carbon intensity of more than 40% from 2015 to 2025.

3. AES Indiana has been incorporating new technologies and fuels into its generation fleet for more than a decade.
   - Signed power purchase agreements with wind farms back beginning in 2009
   - Converted Harding Street from coal to natural gas
   - Retired Eagle Valley coal and started operations of a new CCGT in 2018
   - Announced plans to retire Petersburg Unit 1 in 2021 and Unit 2 in 2023 and signed the acquisitions of Hardy Hills (195 MW solar project) and the Petersburg Energy Center (250 MW solar and 180 MWh energy storage project)

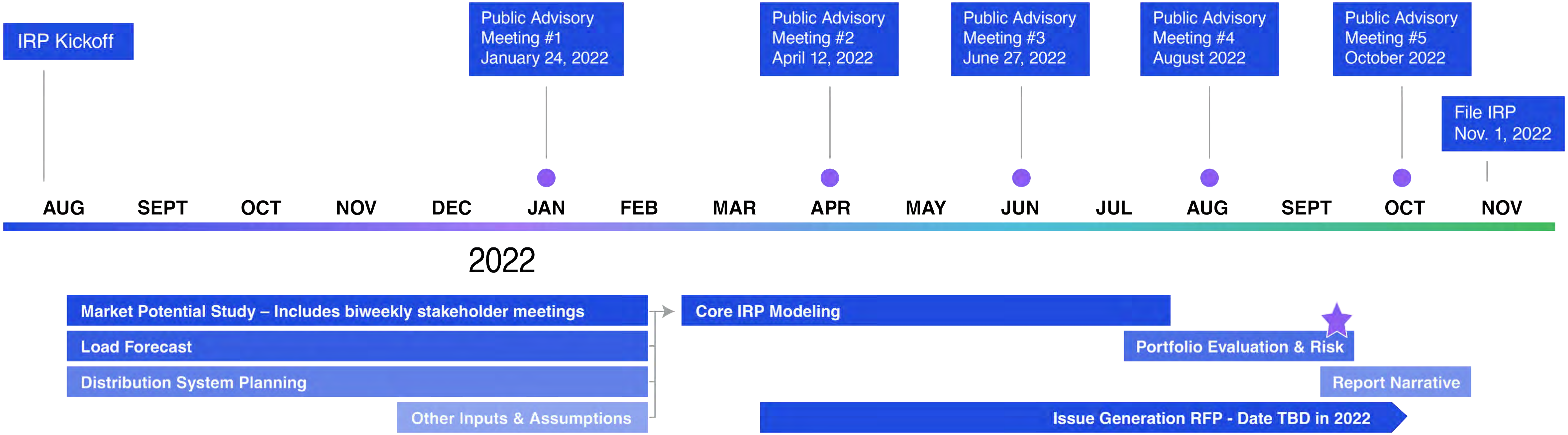
4. AES Indiana is committed to safety and compliance of all environmental regulations and will responsibly close ash ponds in the manner required by Indiana state law.

Stakeholder Presentations

Stakeholder Presentations

IRP Schedule & Meeting #2 Recap

Updated 2022 IRP Timeline



IRP Kickoff

Public Advisory Meeting #1
January 24, 2022

Public Advisory Meeting #2
April 12, 2022

Public Advisory Meeting #3
June 27, 2022

Public Advisory Meeting #4
August 2022

Public Advisory Meeting #5
October 2022

File IRP
Nov. 1, 2022

AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEPT OCT NOV

2022

Market Potential Study – Includes biweekly stakeholder meetings

Load Forecast

Distribution System Planning

Other Inputs & Assumptions

Core IRP Modeling

Portfolio Evaluation & Risk

Report Narrative

Issue Generation RFP - Date TBD in 2022

● = Stakeholder Technical Meeting for stakeholders with executed NDAs held the week before each public stakeholder meeting

★ = Preferred Resource Portfolio selected

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.

Public Advisory Schedule

Public Advisory Meeting #1 – January 24, 2022

- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 – April 12, 2022

- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

Public Advisory Meeting #3- June 27, 2022

- Stakeholder Presentations
- Portfolio Metrics & Scorecard Framework
- MISO Reliability Planning
- IRP Reliability Analysis
- Distribution System Plan

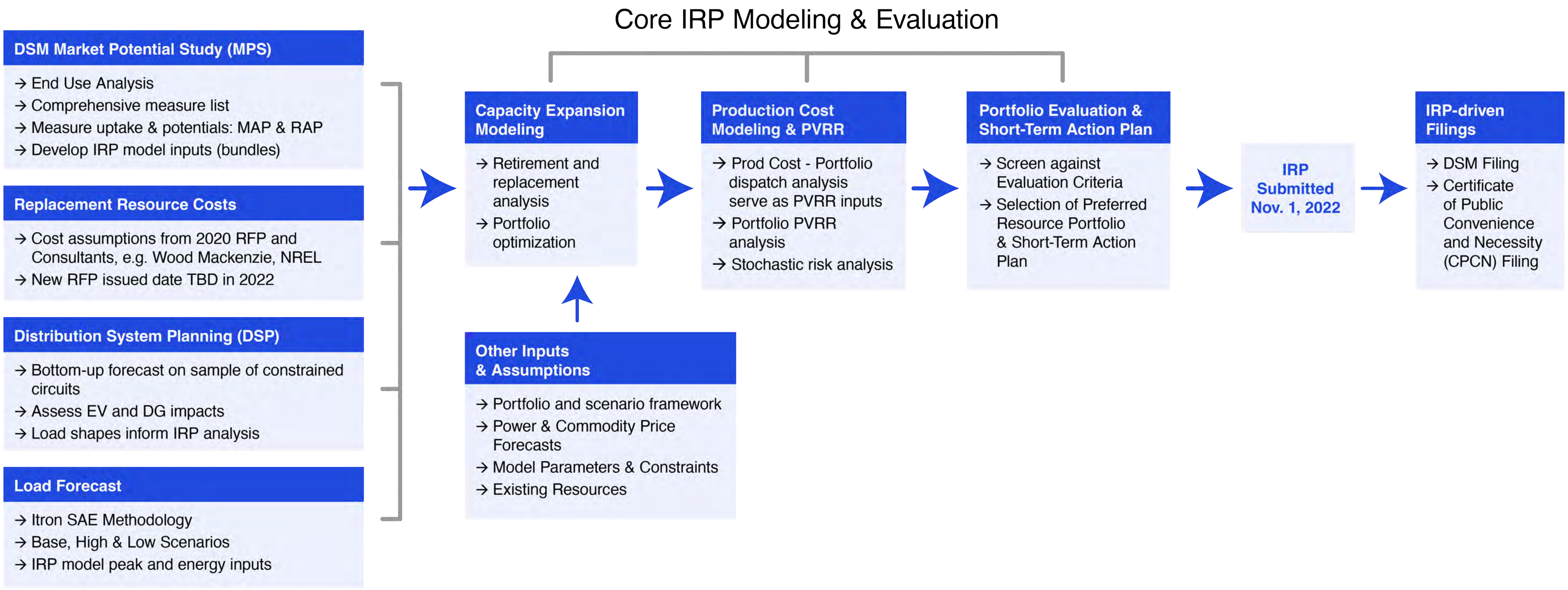
Public Advisory Meeting #4 - August

- Preliminary Modeling Results
- Risk Analysis
- Preliminary Scorecard Results

Public Advisory Meeting #5 - October

- 2022 Modeling Insights
- Preferred Resource Portfolio & Short-Term Action Plan

IRP Process Overview



Core IRP Modeling & Evaluation

DSM Market Potential Study (MPS)

- → End Use Analysis
- → Comprehensive measure list
- → Measure uptake & potentials: MAP & RAP
- → Develop IRP model inputs (bundles)

Replacement Resource Costs

- → Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
- → New RFP issued date TBD in 2022

Distribution System Planning (DSP)

- → Bottom-up forecast on sample of constrained circuits
- → Assess EV and DG impacts
- → Load shapes inform IRP analysis

Load Forecast

- → Itron SAE Methodology
- → Base, High & Low Scenarios
- → IRP model peak and energy inputs

Capacity Expansion Modeling

- → Retirement and replacement analysis
- → Portfolio optimization

Other Inputs & Assumptions

- → Portfolio and scenario framework
- → Power & Commodity Price Forecasts
- → Model Parameters & Constraints
- → Existing Resources

Production Cost Modeling & PVRR

- → Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
- → Portfolio PVRR analysis
- → Stochastic risk analysis

Portfolio Evaluation & Short-Term Action Plan

- → Screen against Evaluation Criteria
- → Selection of Preferred Resource Portfolio & Short-Term Action Plan

IRP Submitted Nov. 1, 2022

IRP-driven Filings

- → DSM Filing
- → Certificate of Public Convenience and Necessity (CPCN) Filing

Meeting #2 Recap: Portfolio Matrix Update

Combining Strategies and Scenarios results in the Portfolio Matrix or framework for IRP evaluation:

		Scenarios			
		No Environmental Action	**Current Trends (Reference Case)**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**				
	Pete Refuel to 100% Gas (est. 2025)				
	One Pete Unit Retires (2026)				
	Both Pete Units Retire (2026 & 2028)				
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)				
	Encompass Optimization without predefined Strategy				

Portfolio cost (PVRR) will be calculated for each portfolio to complete Portfolio Matrix

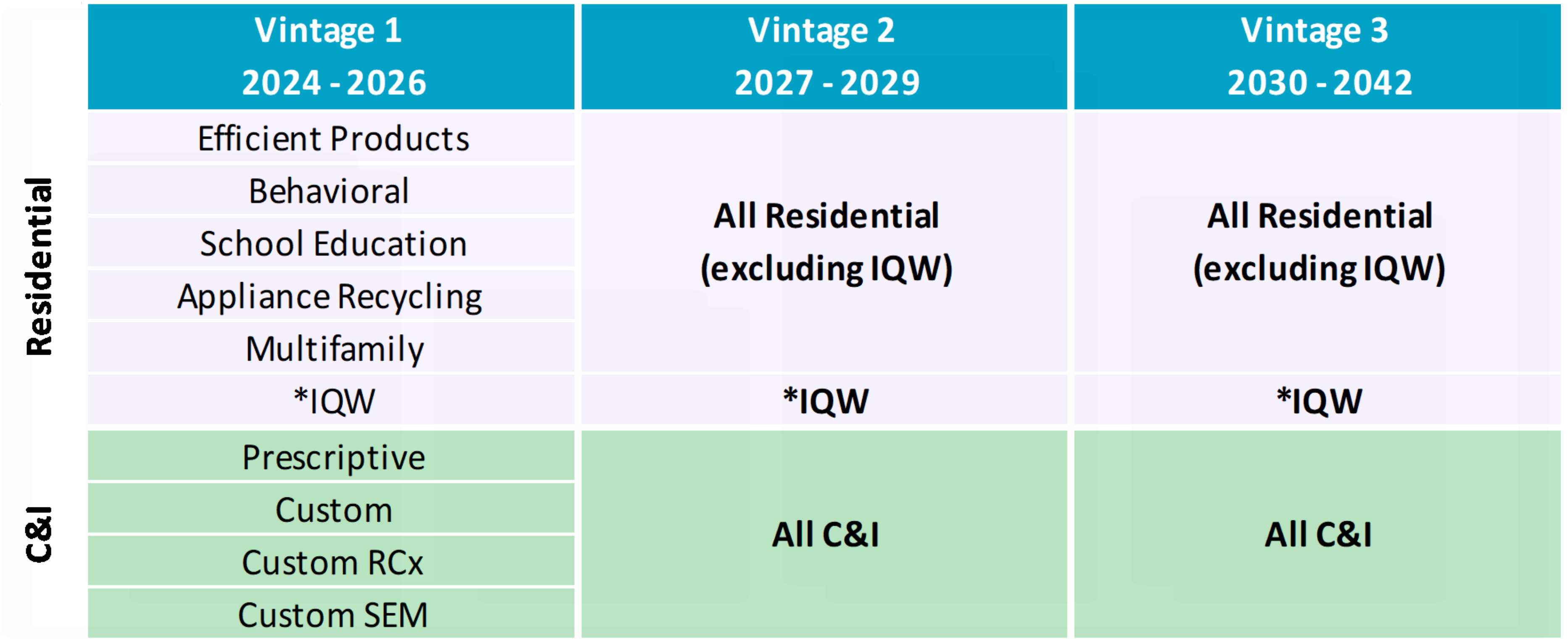
- → The Current Trends portfolios defined above will be evaluated using a Scorecard that includes cost, environmental, reliability & risk metrics.
- → A Preferred Resource Portfolio will be selected using this rigorous Scorecard evaluation process.

Other Updates from Meeting #2

1) Energy Efficiency Bundles

- After stakeholder collaboration AES Indiana decided to split Efficient Products and Residential Vintage 2 & 3 into higher and lower cost bundles to provide the opportunity for additional cost-effective energy efficiency to get selected.

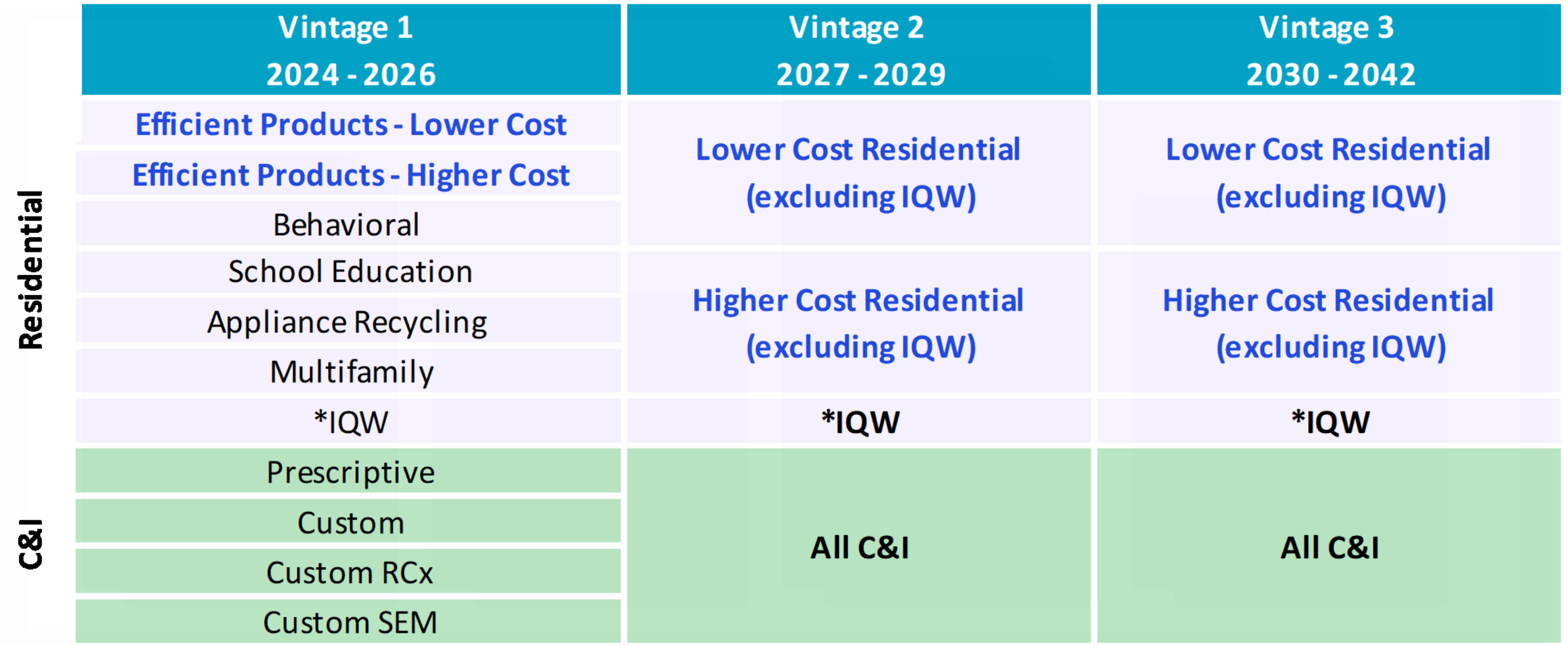
BEFORE



	Vintage 1 2024 - 2026	Vintage 2 2027 - 2029	Vintage 3 2030 - 2042
Residential	Efficient Products	**All Residential (excluding IQW)**	**All Residential (excluding IQW)**
	Behavioral		
	School Education		
	Appliance Recycling		
	Multifamily		
	*IQW	***IQW**	***IQW**
C&I	Prescriptive	**All C&I**	**All C&I**
	Custom		
	Custom RCx		
	Custom SEM		

*IQW Program will be predefined in the IRP modeling

AFTER



	Vintage 1 2024 - 2026	Vintage 2 2027 - 2029	Vintage 3 2030 - 2042
Residential	Efficient Products - Lower Cost	Lower Cost Residential (excluding IQW)	Lower Cost Residential (excluding IQW)
	Efficient Products - Higher Cost		
	Behavioral		
	School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
	Appliance Recycling		
	Multifamily		
	*IQW	***IQW**	***IQW**
C&I	Prescriptive	**All C&I**	**All C&I**
	Custom		
	Custom RCx		
	Custom SEM		

*IQW Program will be predefined in the IRP modeling

2022 All-Source RFP & Replacement Resource Costs Update

2022 All-Source Generation RFP

Summary of All-Source RFP Responses

Technology	# of Projects
Solar	14
Wind	[redacted]
Thermal-Aero CT	[redacted]
Solar + Storage	[redacted]
Storage	[redacted]
TOTAL	24

****Confidential****
Competitively Sensitive Information

A project is defined as a unique site and each site may have multiple proposal offerings (PPA, Asset Transfer, etc.).

All-Source RFP Capacity Summary

- Low volume of wind capacity possibly due to limited siting availability in Indiana and uncertainty around PTC
- Capacity volumes help to inform resource build constraints included in the IRP planning model (EnCompass)

Commodity Forecasts

IRP Commodity Price Updates

- In response to stakeholder comment and in order to ensure reasonable forecasts are included in this IRP – AES Indiana has had Horizon Energy update the custom fundamental power price studies using the Spring gas and coal price outlook. Thus, this IRP reflects the recent upward trend in gas, coal and power prices. The following commodity review slides reflect this update.

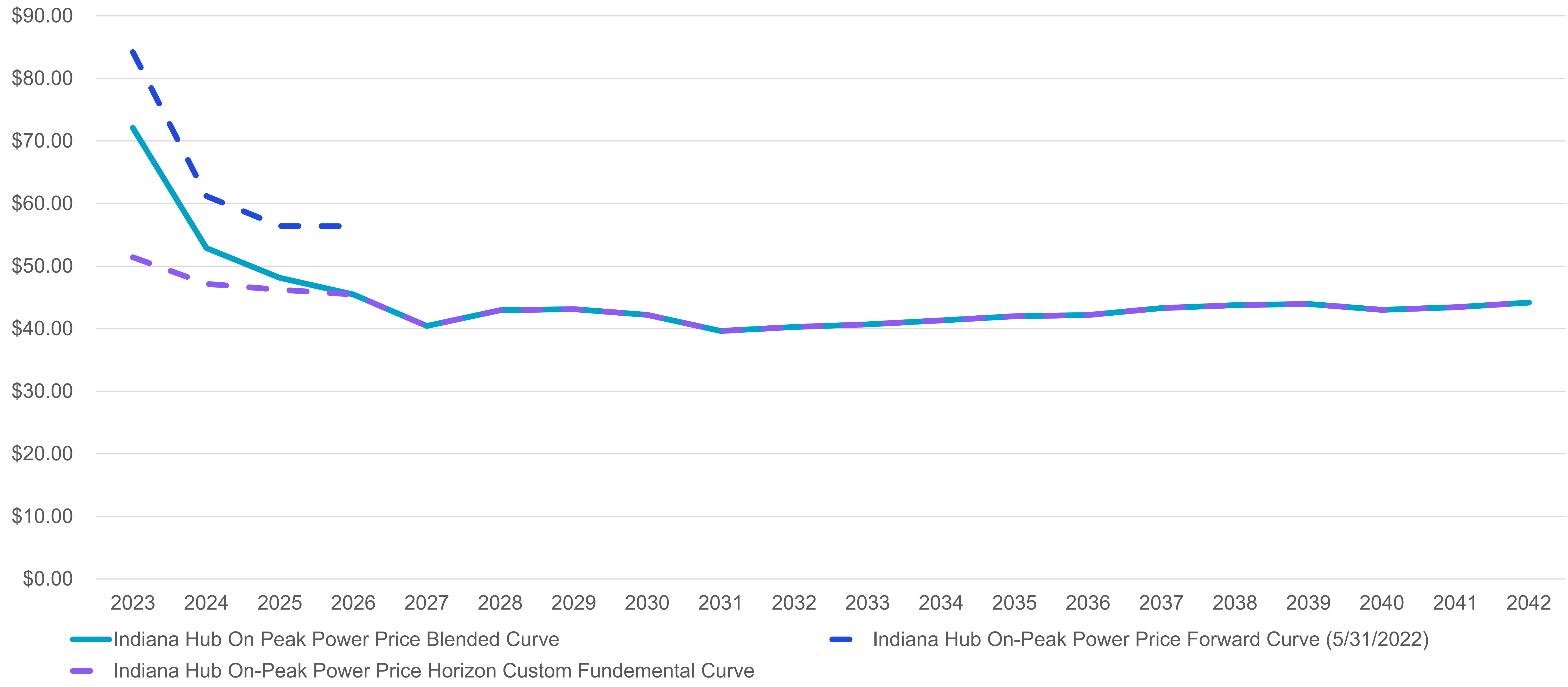
Summary of Scenario Commodity Assumptions

Scenario	Gas	Coal	Power	Capacity	NOx	CO_2
No Environmental Action – “No Env”	Low	Base	Custom	Base	Base	None
Current Trends (Reference Case) – “Ref”	Base	Base	Custom	Base	Base	Base
Aggressive Environmental – “AE”	High	Base	Custom	Base	High	High
Decarbonized Economy – “Decarb”	Base	Base	Custom	Base	High	None – Clean Energy Mandate

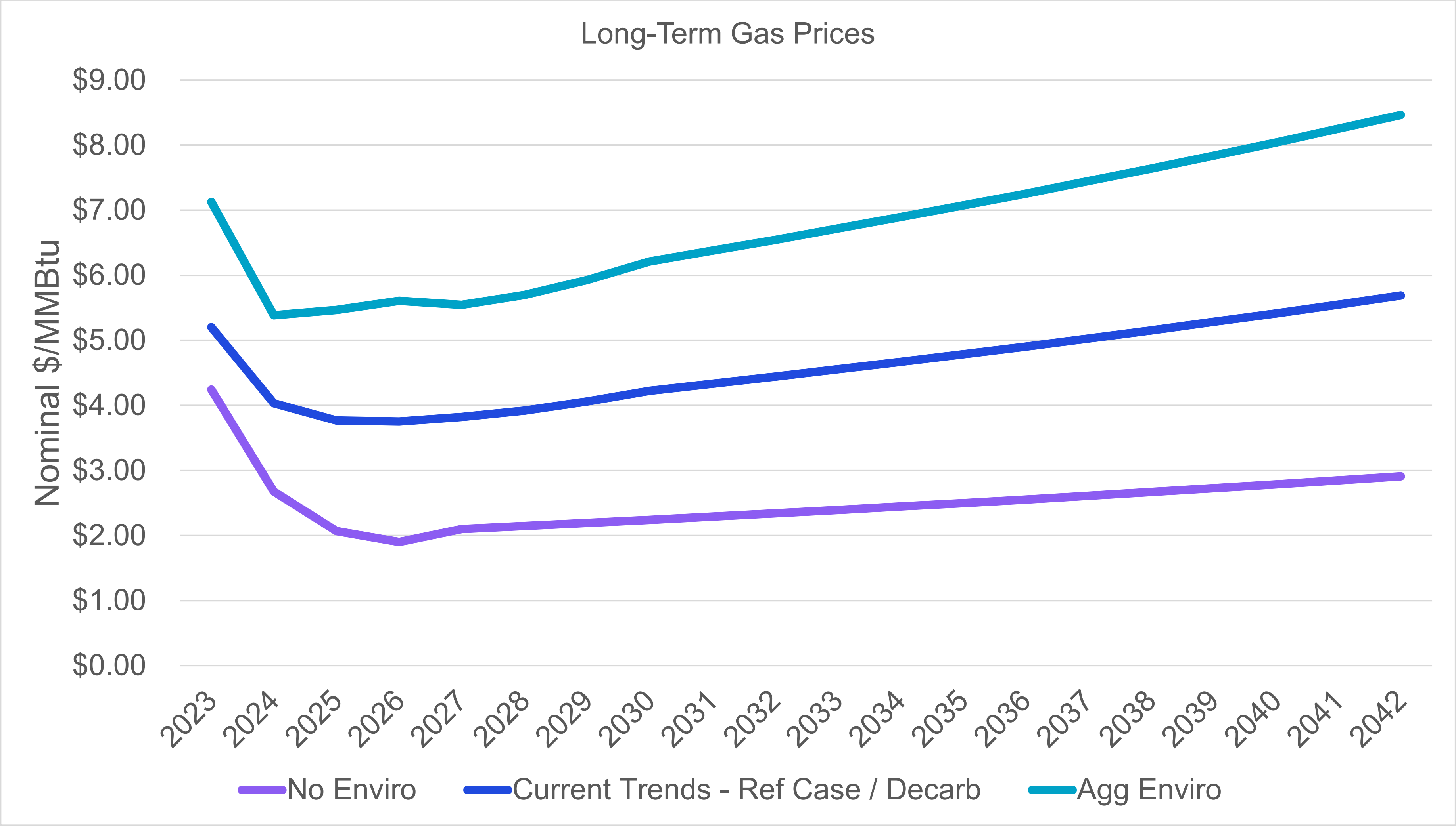
Methodology: Blending Curves

Power prices, gas prices and coal prices are a blend of forward market curves and Fundamental Curves from Horizon Energy.

Blending prices in near-term captures near-term market impacts.

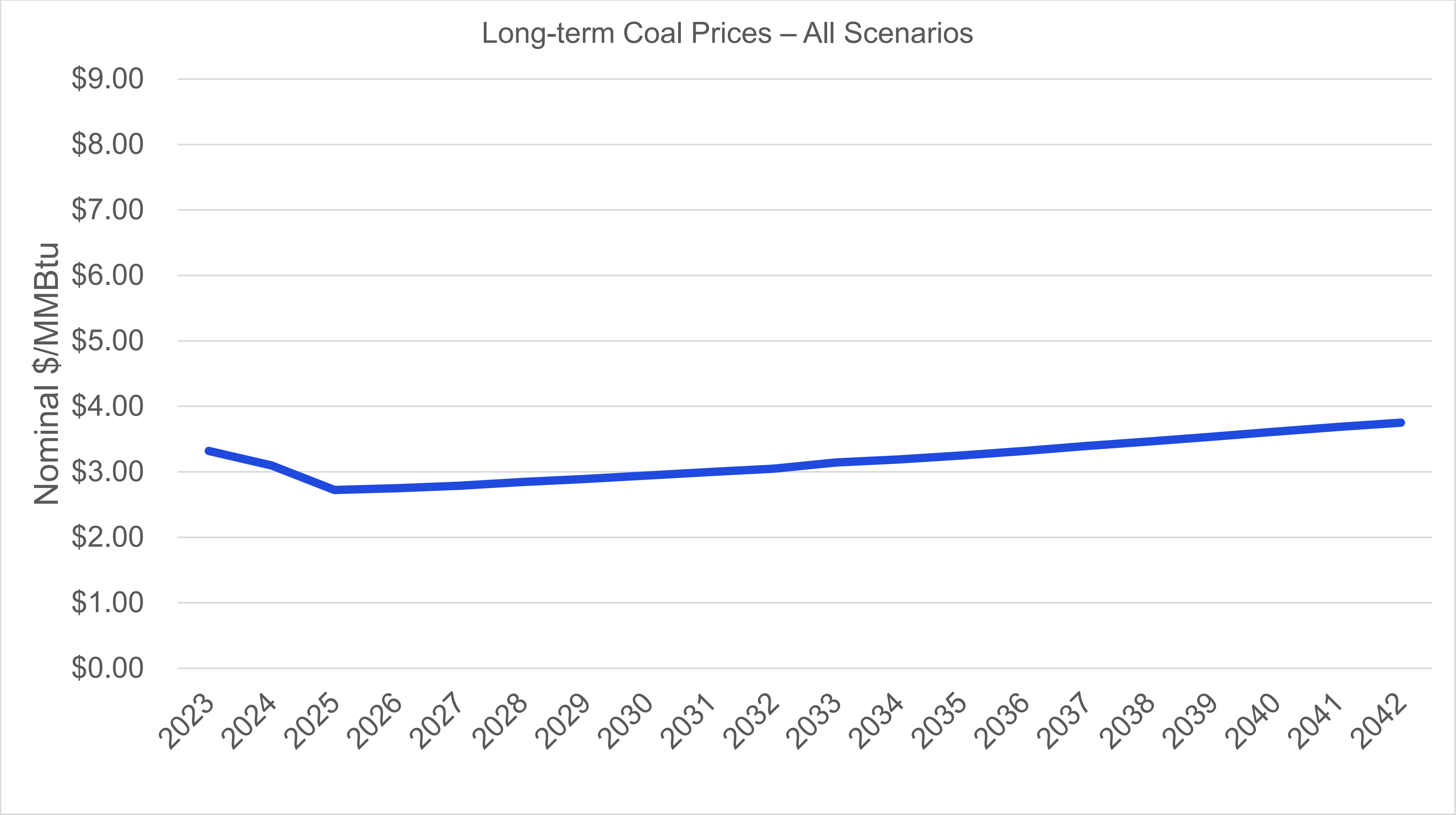


Fuel Price Forecasts

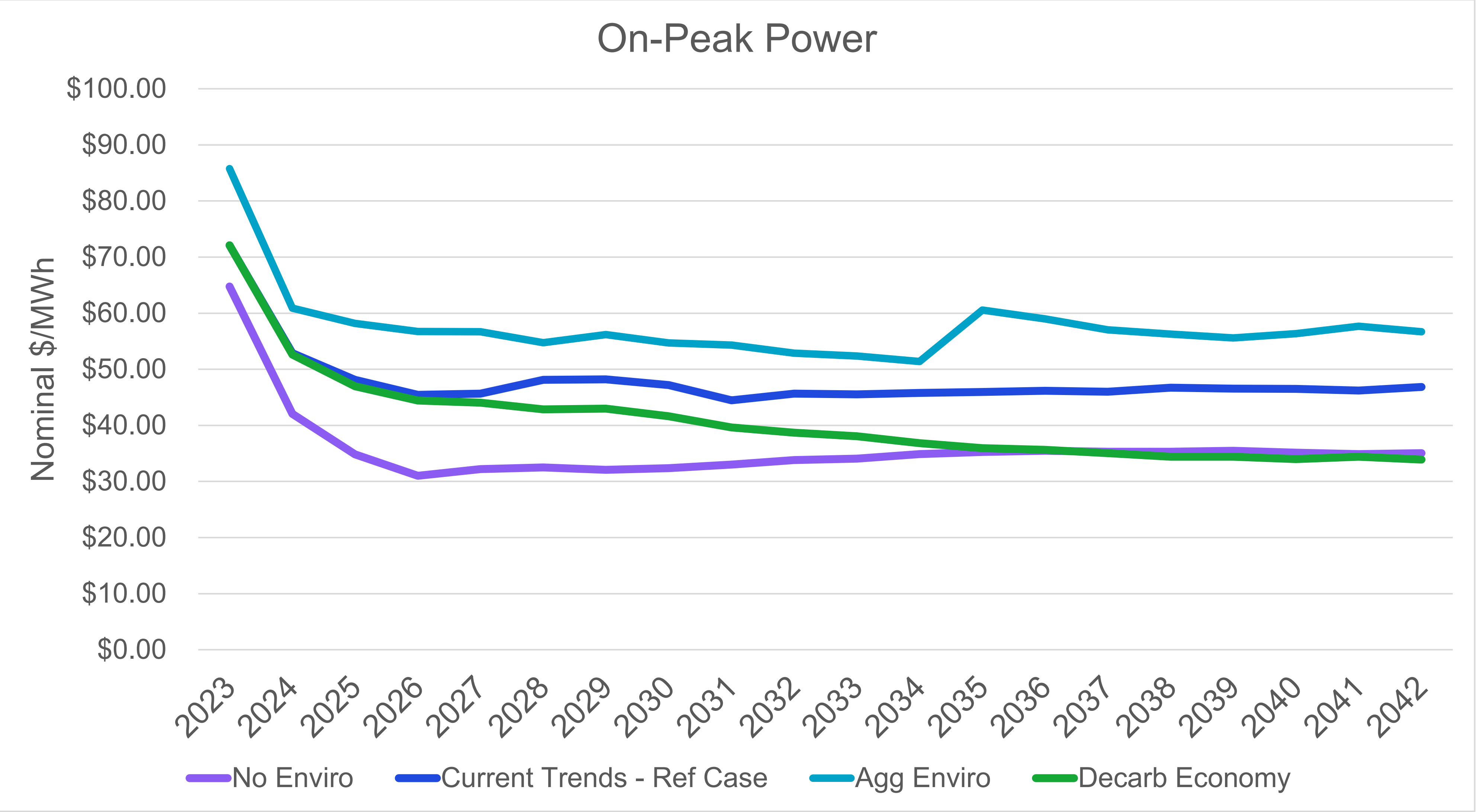


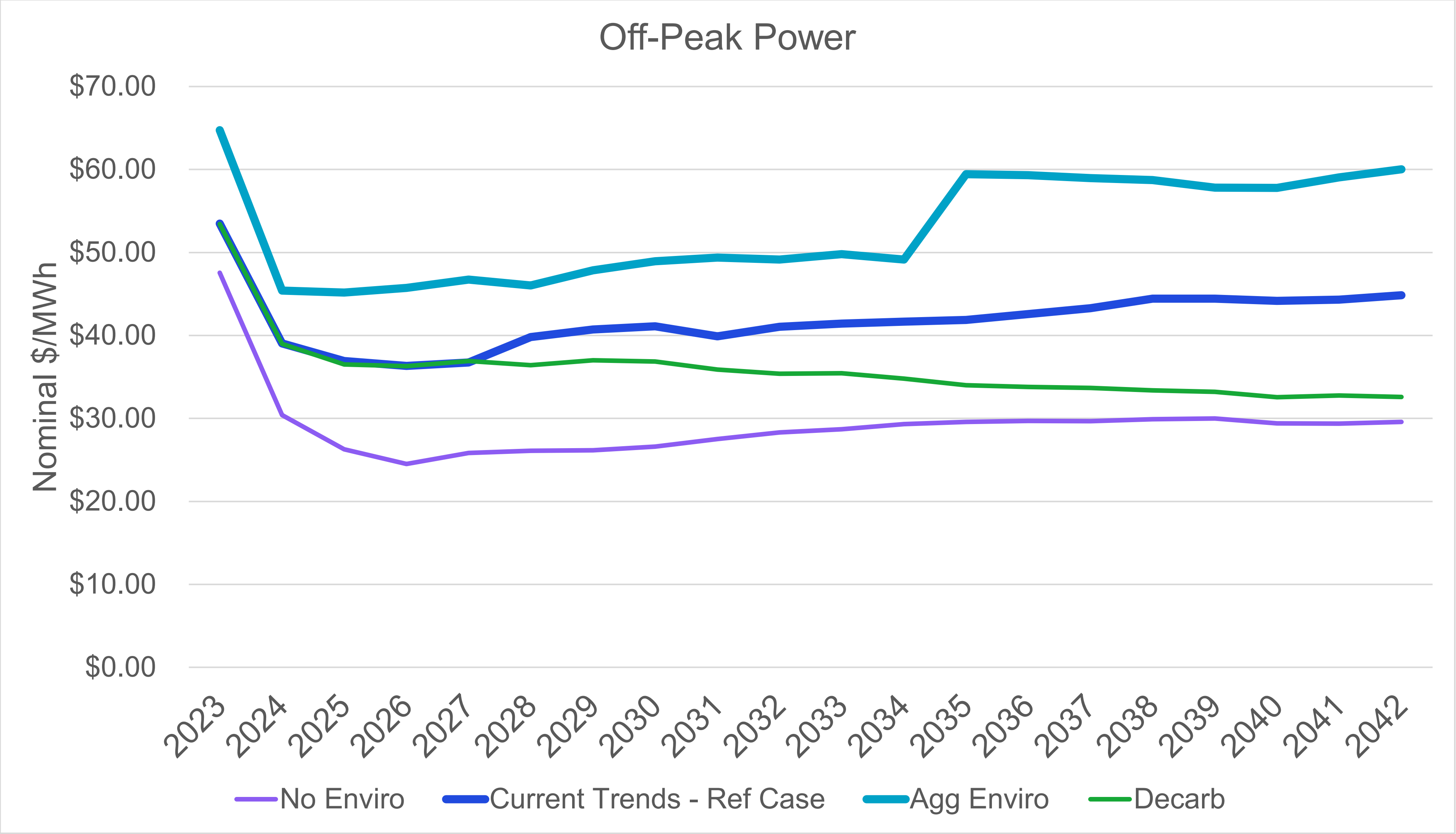
Blended Long-term Coal Prices –

- 2023 – 2025 Blended: Internal Mkt Intelligence,
- 2026 – 2042: Internal Mkt Intelligence with Horizon Energy Spring Case growth rate for Illinois Basin

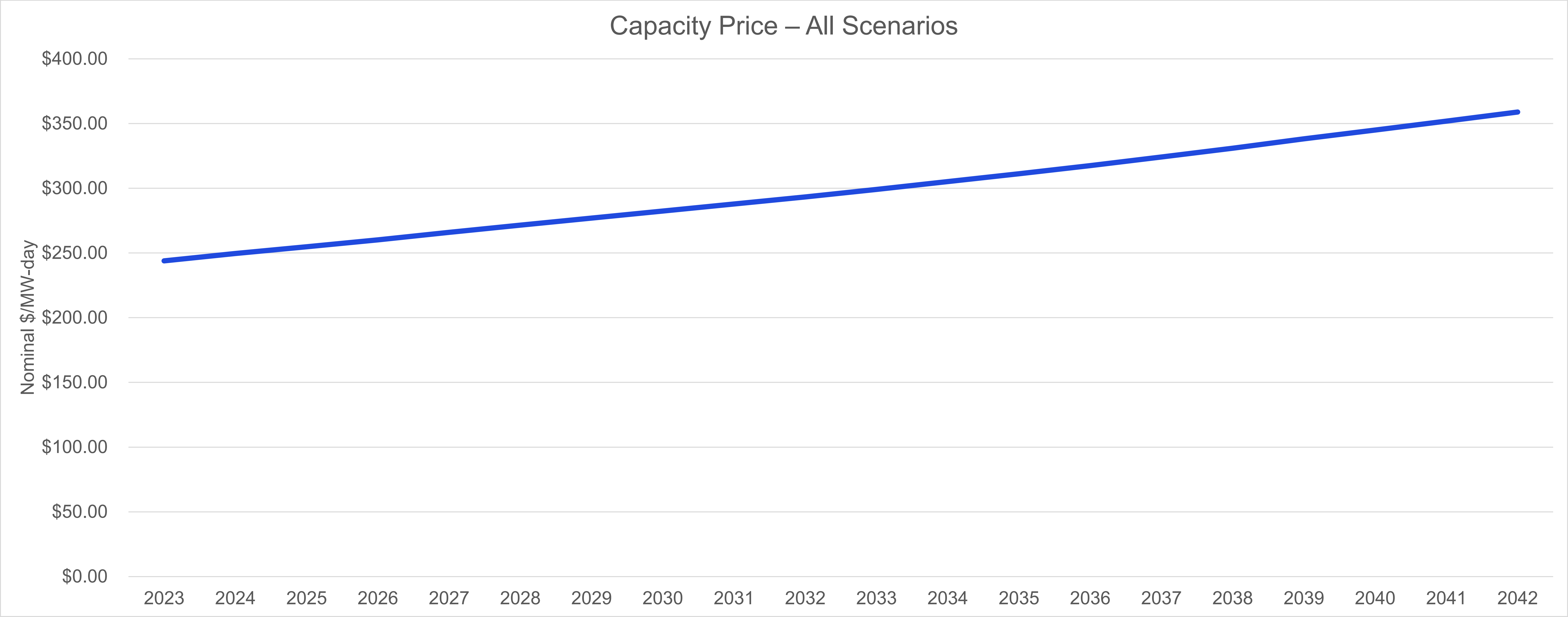


Power Price Forecast

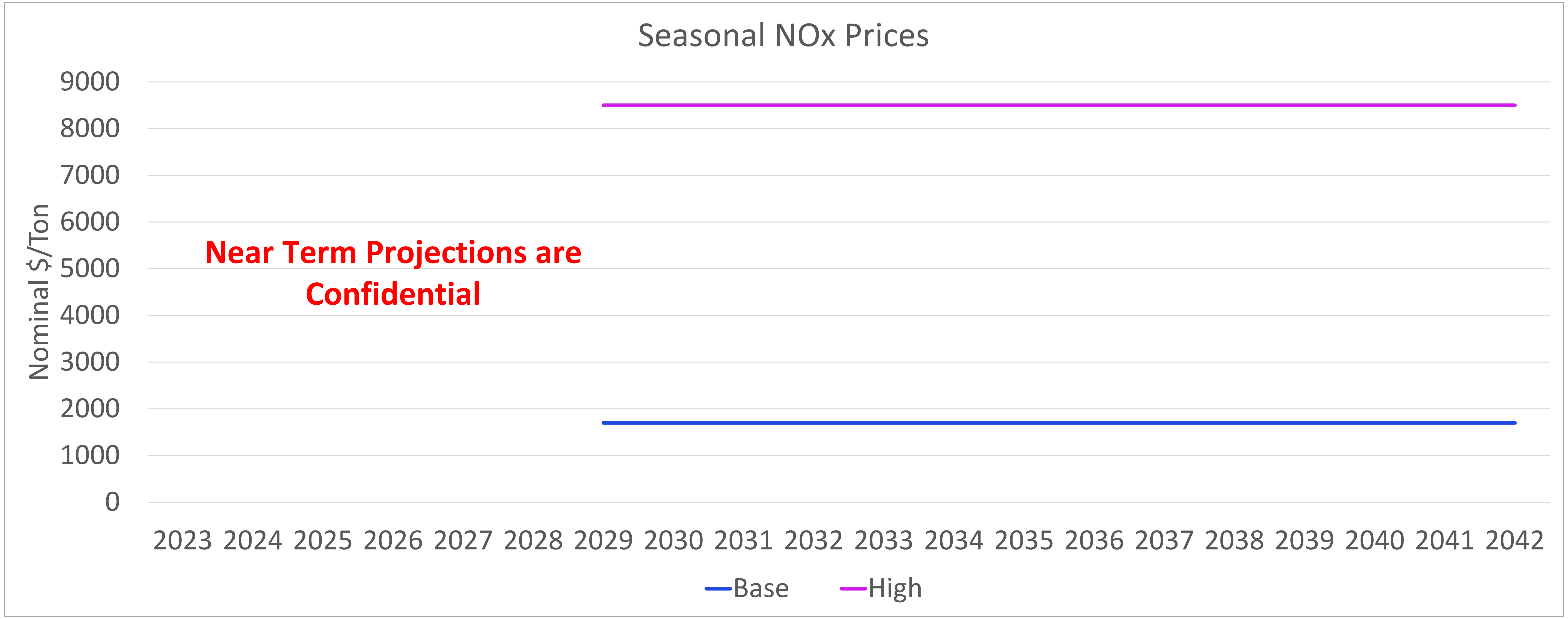




Capacity Price Forecast



NOx Price Forecast



Near Term Projections are Confidential

RTO Reliability Planning: Resource Adequacy & Seasonal Construct

Lynn Hecker, Senior Manager, Resource Adequacy Policy and Analytics, MISO

Break for Lunch

Time	Topic	Speakers
Afternoon Starting at 12:30 PM	Modeling Reliability Assumptions	Erik Miller, Manager, Resource Planning, AES Indiana
	Reliability Analysis & Reliability Metric	Hisham Othman, VP Transmission and Regulatory Consulting, Quanta
	Portfolio Metrics & Scorecard	Erik Miller, Manager, Resource Planning, AES Indiana
	AES Indiana Distribution System Planning	Kathy Storm, Vice President, US Smart Grid, AES Indiana Mike Russ, Senior Manager, T&D Forecasting, AES Indiana
	Final Q&A and Next Steps	

Modeling Reliability Assumptions

Erik Miller, Manager, Resource Planning, AES Indiana

Reliability Overview

The Importance of Measuring Reliability

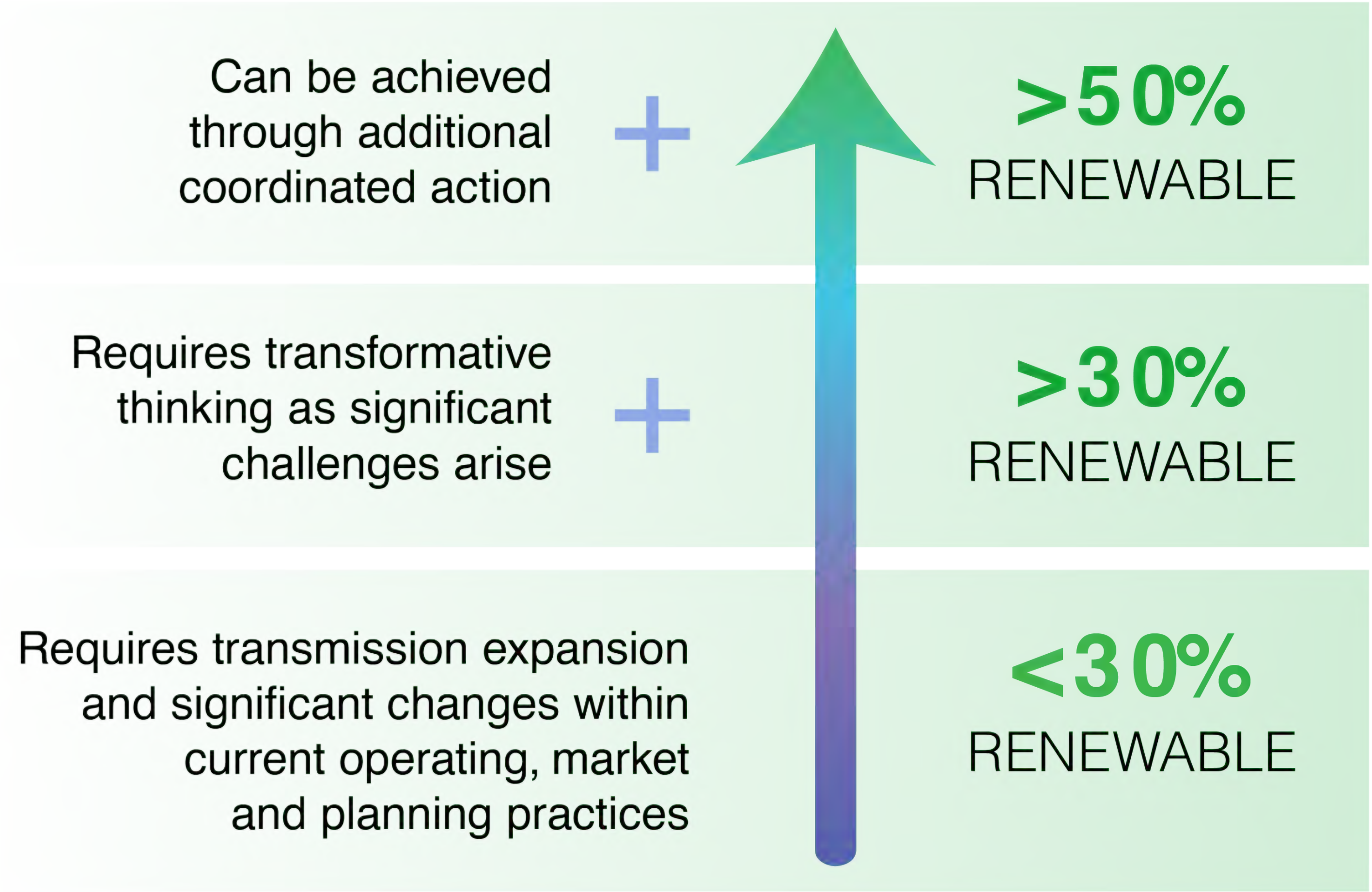
→ Guiding research on reliability

→ **MISO's Renewable Integration Impact Assessment (RIIA) – completed Feb 2021**

- MISO analysis to understand the bulk electric system needs and risks as intermittent renewable resources increasingly replace baseload resources.
- Analysis finds increasing risk and need for coordinated action as renewables increase to 30% and 50% of the MISO system portfolio.

→ **RIIA's three key areas of focus**

- The RIIA analysis suggests three key focus areas for MISO and stakeholders.
- **Utilities can consider two of the three within the context of the IRP.**



Can be achieved through additional coordinated action	+	**>50%** RENEWABLE
Requires transformative thinking as significant challenges arise	+	**>30%** RENEWABLE
Requires transmission expansion and significant changes within current operating, market and planning practices		**<30%** RENEWABLE

Topic	Definition	Planning Responsibility
Resource Adequacy	Having sufficient resources to reliably serve peak demand	AES Indiana will address in this IRP
2 **Energy Adequacy**	Ability to provide energy in all operating hours continuously throughout the year	AES Indiana will address in this IRP
3 **Operating Reliability**	Ability to withstand unanticipated component losses or disturbances	Joint coordination between AES Indiana and MISO

https://www.misoenergy.org/planning/policy-studies/Renewable-integration-impact-assessment/

Reliability in the IRP

①

MISO Seasonal Resource Adequacy Construct

- → On November 30, 2021 – MISO filed with FERC to include seasonal and accreditation requirements for the MISO Resource Adequacy Construct.
- → Reason: Ensure resource adequacy across all seasons after significant increase in MaxGen events resulting from the retirement of baseload generation, increased intermittent resources and extreme weather events.
- → MISO's proposed filing would require MISO member utilities to meet an unforced capacity requirement in each season as opposed to only Summer (current requirement).
- → MISO has proposed these changes begin in the 2023/2024 planning year.

Planning Implications

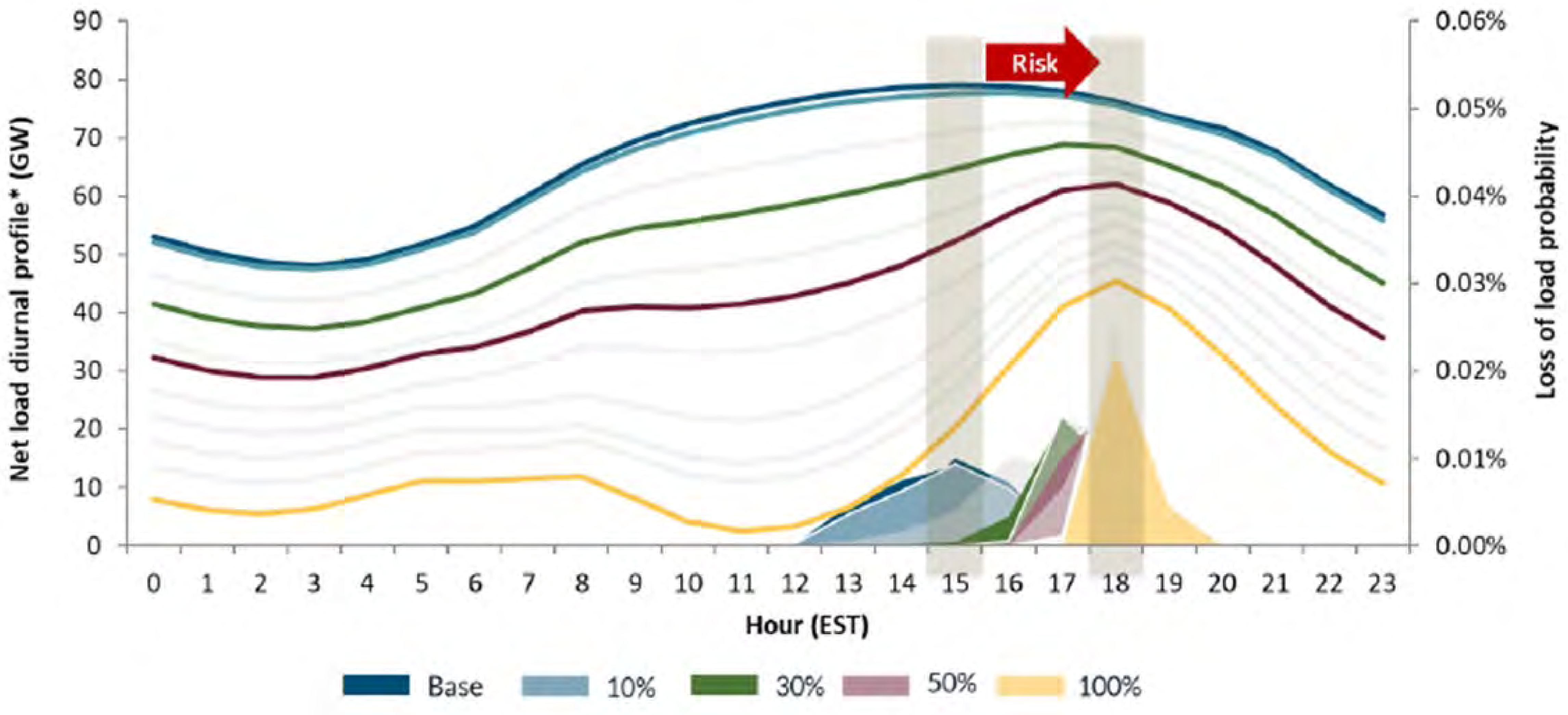
- → AES Indiana will model a four-season Resource Adequacy Construct starting in 2023/2024 to align with MISO's FERC filing.
- → Per MISO guidance, AES Indiana will include these reserve margin targets in the IRP analysis:

Target Seasonal Planning Reserve Margin:

PRM% Summer	**7.51%**
PRM% Fall	**11.82%**
PRM% Winter	**21.35%**
PRM% Spring	**26.27%**

Reliability in the IRP

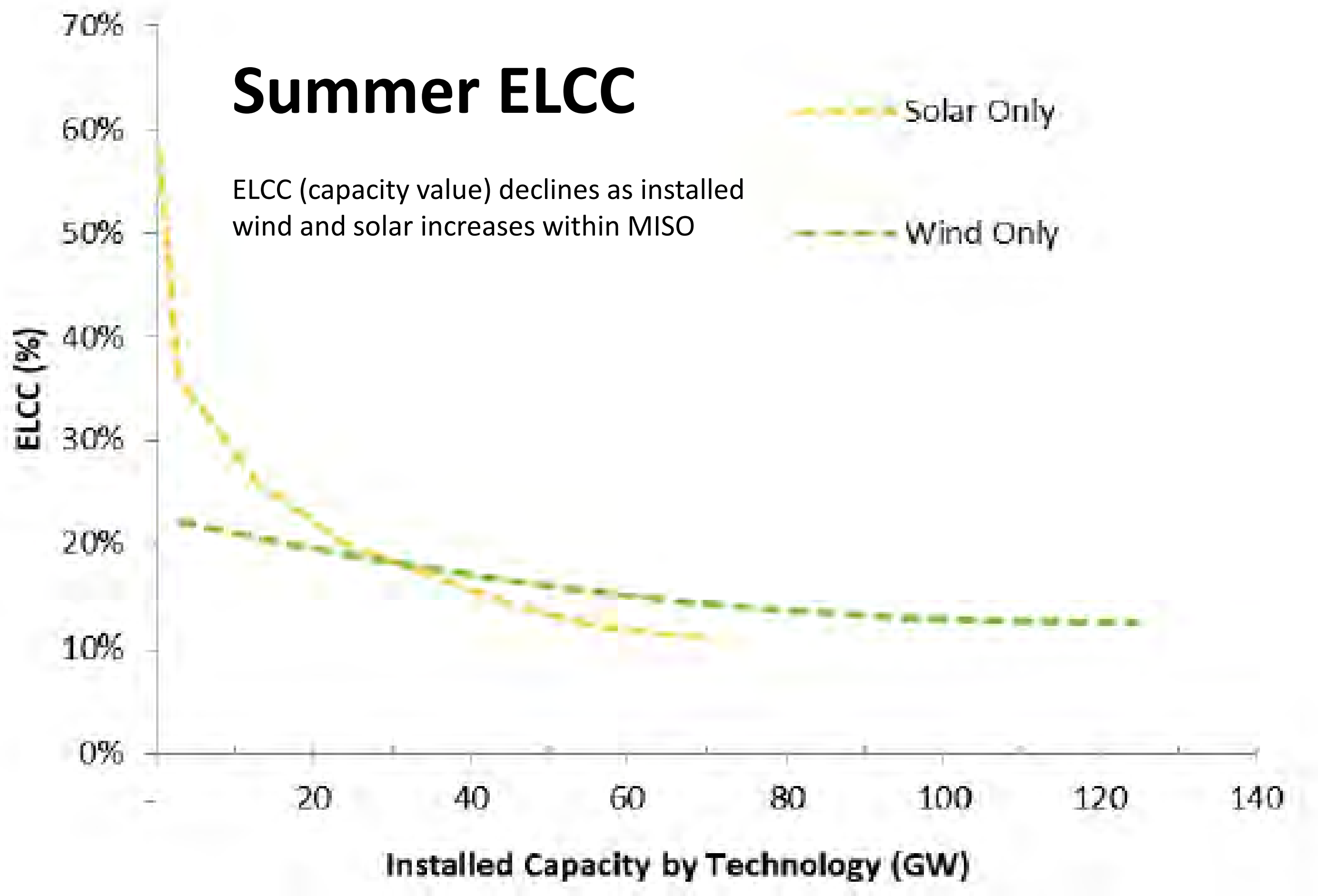
① **Resource Adequacy:** Having sufficient resources to reliably serve load



*Charts from MISO RIIA Report pp.27 & 29

Planning Implications:

- The planning model will capture the changing availability of wind and solar through the ELCC, i.e. capacity value for wind and solar
- AES Indiana has consulted with MISO to understand the ELCC value for seasonal planning – Summer, Winter, Spring & Fall


Summer ELCC

ELCC (capacity value) declines as installed wind and solar increases within MISO

****AES Indiana presented ELCC of wind, solar and storage resources in Public Stakeholder Meeting #2 – also provided in slide appendix of this deck****

Reliability in the IRP

②

Production Cost Modeling (8,760)

→ As part of the core IRP modeling, AES Indiana will perform a production cost analysis on each candidate portfolio.

→ The analysis provides an understanding of economic energy adequacy or how much AES Indiana will rely on the market for sales and purchases.

System Reliability Analysis

→ AES Indiana contracted Quanta Energy to perform a System Reliability Analysis as part of the IRP Scorecard evaluation.

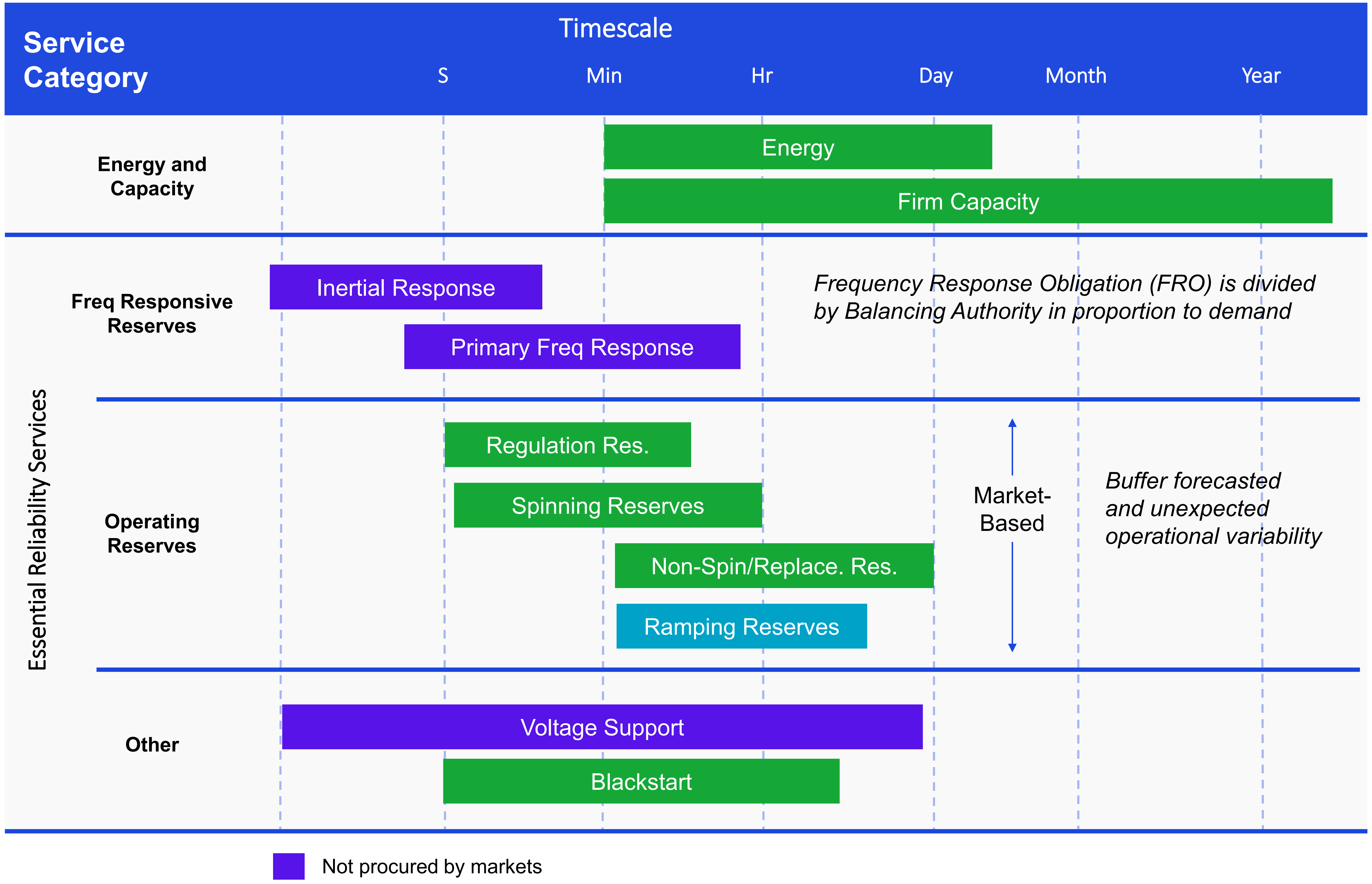
→ The analysis looks at eight system metrics with the objective of evaluating how well the candidate portfolios deliver sufficient energy and system stability in every hour.

→ **Quanta Energy will review the methodology for the System Reliability Analysis in the slides that follow.**

Reliability Analysis

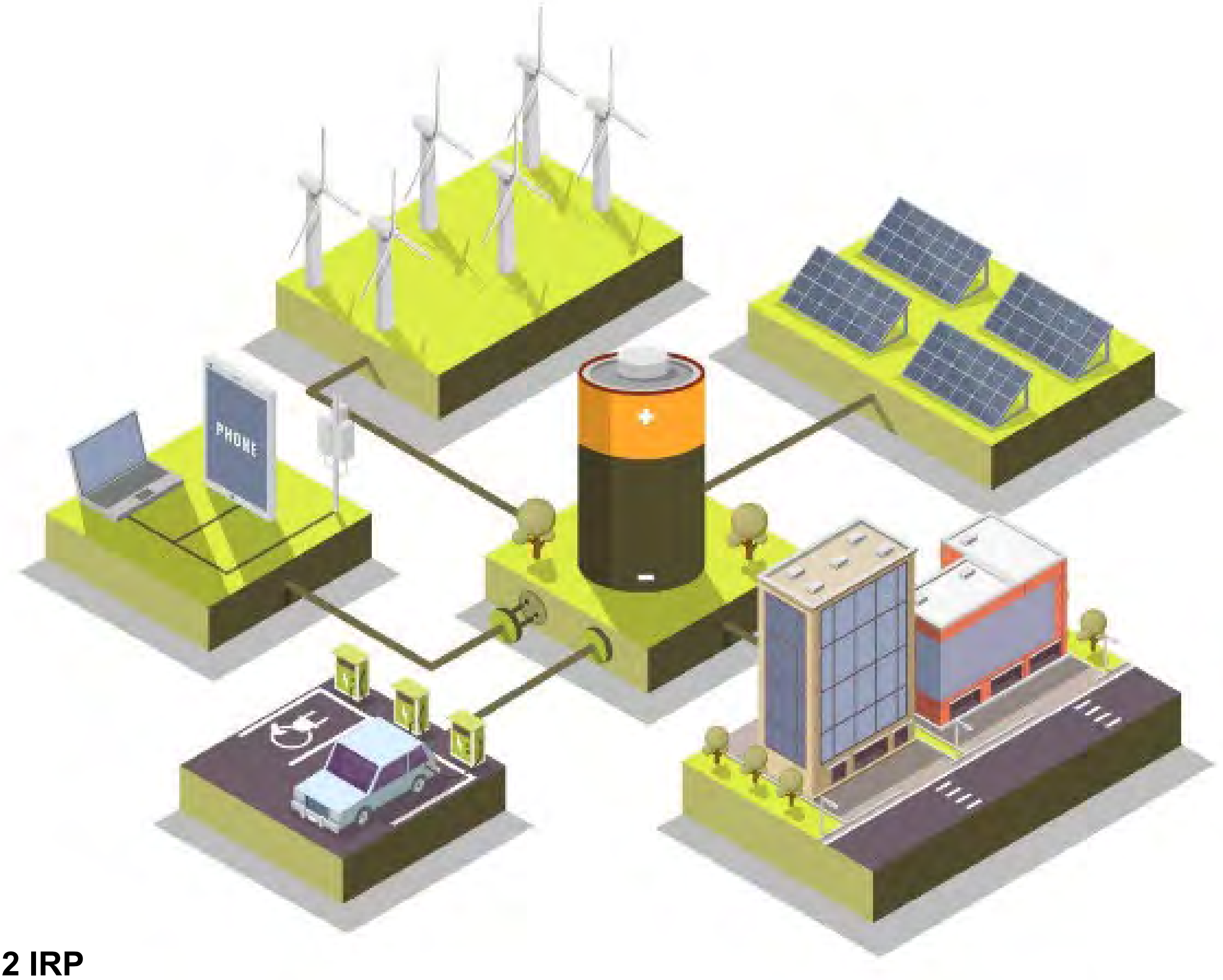
Hisham Othman, VP Transmission and Regulatory Consulting, Quanta

Essential Reliability Services



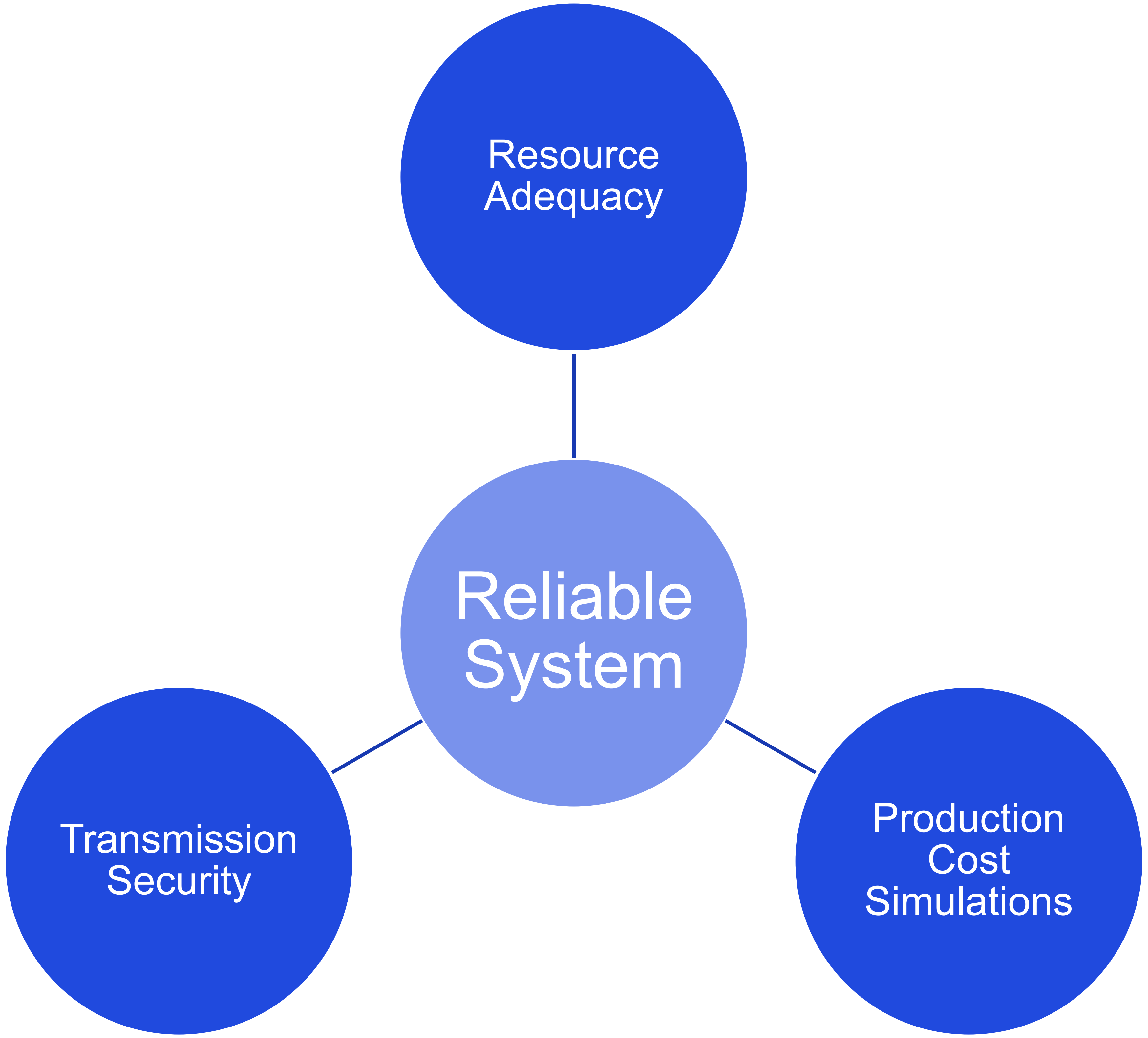
- Power systems rely on several reliability services to operate and deliver expected services. Some have traditionally been assumed to be provided by the supply resources, while others are procured by the market. As the resource portfolio changes, the associated essential reliability services should be assessed and secured.
- **NERC (2022 Summer Reliability Assessment – MISO):**
  - Midcontinent ISO (MISO) faces a capacity shortfall in its North and Central areas, resulting in high risk of energy emergencies during peak summer conditions.
  - More extreme temperatures, higher generation outages, or low wind conditions expose the MISO North and Central areas to higher risk of temporary operator-initiated load shedding to maintain system reliability.
- **PJM (Grid of the Future - May 2022):**
  - A proliferation of IBRs can significantly impact reactive control, stability, short-circuit current, inertia and frequency control – all critical dimensions of future grid planning.

Resource Reliability Attributes



- **Reliability and Resilience Attributes/Metrics:**
  - Dispatchability
  - Predictability
  - Dependability (e.g., Supply Resilience, firmness)
  - Performance Duration Limits
  - Flexibility (e.g., ramping speed, operating range)
  - Intermittency (e.g., intra-hour and multi-hour ramping)
  - Dynamic VAR support
  - Energy Profile (e.g., capacity value / ELCC)
  - Inertial Response
  - Primary Frequency Response
  - Minimum Short Circuit Ratio
  - Locational Characteristics (e.g., deliverability, resilience to grid outages)
  - Blackstart and system restoration support
  - Harmonics

Assuring System Reliability – Traditional Approach



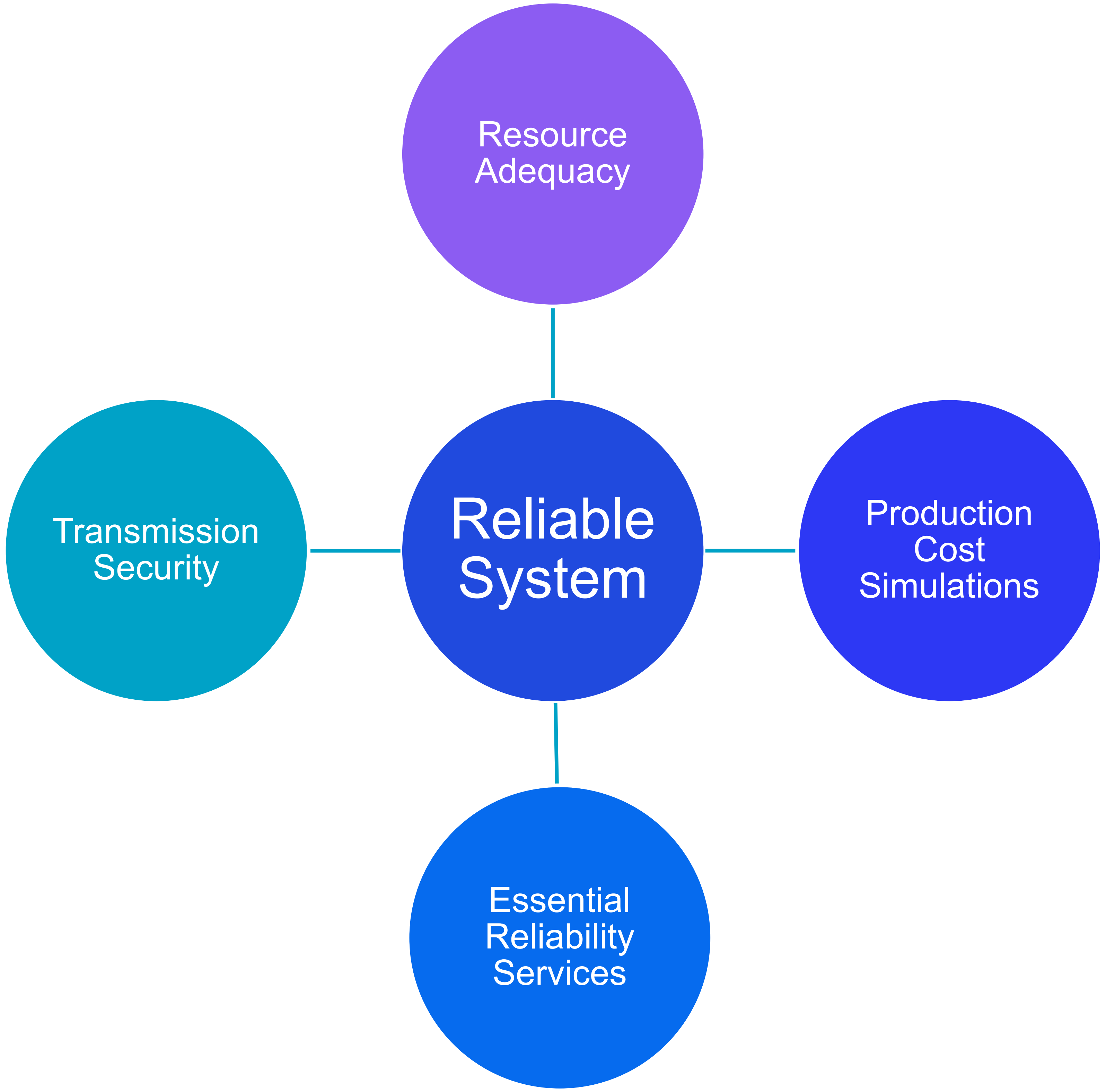
Resource Adequacy

Reliable System

Transmission Security

Production Cost Simulations

Assuring System Reliability – Evolving Approaches



Resource Adequacy

Transmission Security

Reliable System

Production Cost Simulations

Essential Reliability Services

Reliability Assessment & Portfolio Eval. Methodology

Review & Update Reliability Metrics

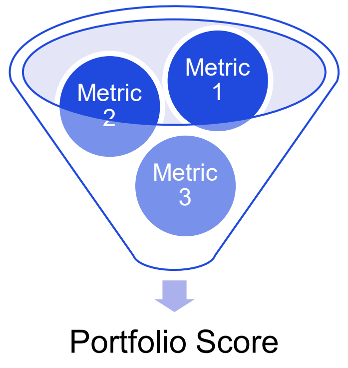
Assemble Data and Configure Analysis Tools

- Existing Resources
- IRP Portfolios
- Grid Models
- Solar & Wind Profiles
- Load Profile
- Transfer Capability with Outside

Apply a Series of Reliability Filters to IRP Portfolios

Design Scoring Criteria

Evaluate Portfolios



Indicative Scope of Reliability Studies

	Reliability Study Area	Normal (50/50, Connected)	Max-Gen (90/10, Import Limited)	Islanded (Critical Load)
-	Resource Adequacy	X (also 90/10)		
-	Energy Adequacy	X (8760)		
-	Transmission Reliability / Deliverability / Interconnections	X		
1	Energy Adequacy		X	X
2	Operational Flexibility and Frequency Support	X		X
3	Short Circuit Strength Requirement	X		X
4	Power Quality (Flicker)	X		
5	Blackstart			X
6	Dynamic VAR Deliverability	X		
7	Dispatchability and Automatic Generation Control	X		
8	Predictability and Firmness of Supply	X		
9	Geographic Location Relative to Load	X		

→ Additional Reliability Analysis

Reliability Metrics (1/2)

	Metric	Description	Rationale
1	**Energy Adequacy**	Resources are able to meet the energy and capacity duration requirements. Portfolio resources are able to supply the energy demand of customers during normal and emergency max gen events, and also to supply the energy needs of critical loads during islanded operation events.	Utility must have long duration resources to serve the needs of its customers during emergency and islanded operation events.
2	**Operational Flexibility and Frequency Support**	Ability to provide inertial energy reservoir or a sink to stabilize the system. Additionally, resources can adjust their output to provide frequency support or stabilization in response to frequency deviations with a droop of 5% or better.	Regional markets and/or control centers balance supply and demand under different time frames according to prevailing market construct under normal conditions, but preferable that local control centers possess the ability to maintain operation during under-frequency conditions in emergencies.
3	**Short Circuit Strength Requirement**	Ensure the strength of the system to enable the stable integration of all inverter-based resources (IBRs) within a portfolio.	The retirement of synchronous generators within utility footprint and replacements with increasing levels of inverter-based resources will lower the short circuit strength of the system. Resources that can operate at lower levels of short circuit ratio (SCR) and those that provide higher short circuit current provide a better future proofing without the need for expensive mitigation measures.
4	**Power Quality (Flicker)**	The “stiffness of the grid” affect the sensitivity of grid voltages to the intermittency of renewable resources. Ensuring the grid can deliver power quality in accordance with IEEE standards is essential.	Retirement of large thermal generation plants lower the strength of the grid and increases its susceptibility to voltage flicker due to intermittency of renewable resources, unless properly assessed and mitigated.
5	**Blackstart**	Ensure that resources have the ability to be started without support from the wider system or are designed to remain energized without connection to the remainder of the system, with the ability to energize a bus, supply real and reactive power, frequency and voltage control	In the event of a black out condition, utility must have a blackstart plan to restore its local electric system. The plan should demonstrate the ability to energize a cranking path to start large flexible resources with sufficient energy reservoir.
6	**Dynamic VAR Support**	Customer equipment driven by induction motors (e.g., air conditioning or factories) requires dynamic reactive power after a grid fault to avoid stalling. The ability of portfolio resources to provide this service depends on their closeness to the load centers.	Utility must retain resources electrically close to load centers to provide this attribute in accordance with NERC and IEEE Standards

Reliability Metrics (2/2)

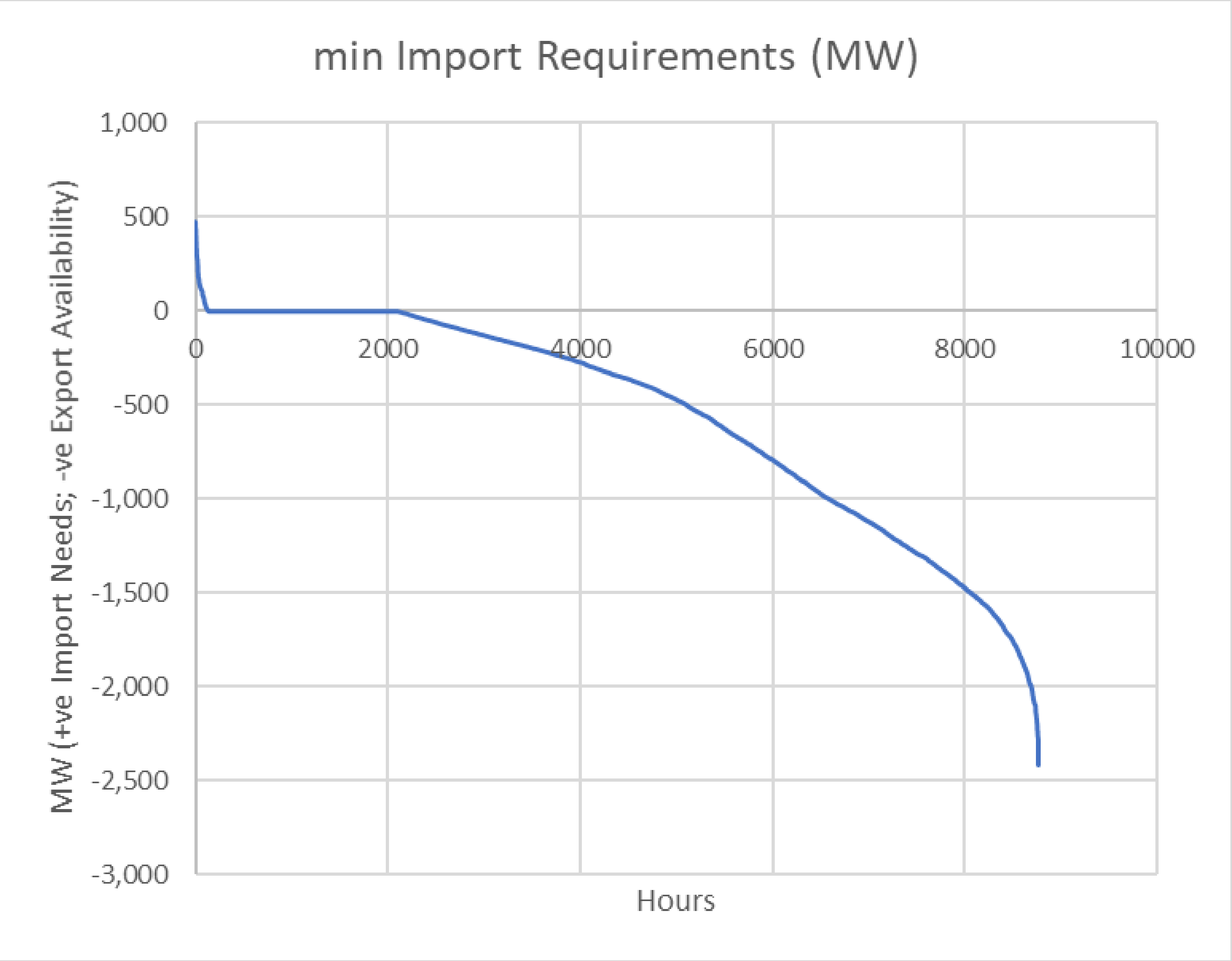
	Metric	Description	Rationale
7	**Dispatchability and Automatic Generation Control**	Resources should respond to directives from system operators regarding their status, output, and timing. Resources that can be ramped up and down automatically to respond immediately to changes in the system contribute more to reliability than resources which can be ramped only up or only down, and those in turn are better than ones that cannot be ramped.	Ability to control frequency is paramount to stability of the electric system and the quality of power delivered to customers. Control centers (regional or local) provide dispatch signals under normal conditions, and under emergency restoration procedures or other operational considerations.
8	**Predictability and Firmness of Supply**	Ability to predict/forecast the output of resources and to counteract forecast errors.	The ability to predict resource output from a day-ahead to real-time is advantageous to minimize the need for spinning reserves. In places with an active energy market, energy is scheduled with the market in the day-ahead hourly market and in the real-time 5-minute market. Deviations from these schedules have financial consequences and thus the ability to accurately forecast the output of a resource up to 38 hours ahead of time for the day-ahead market and 30 minutes for the real time market is advantageous.
9	**Geographic Location Relative to Load (Resilience)**	Ensure the ability to have redundant power evacuation or deliverability paths from resources. Preferrable to locate resources at substations with easy access to multiple high voltage paths, unrestricted fuel supply infrastructure, and close to major load centers.	Location provides economic value in the form of reduced losses, congestion, curtailment risk, and address local capacity requirements. Additionally, from a reliability perspective, resources that are interconnected to buses with multiple power evacuation paths and those close to load centers are more resilient to transmission system outages and provide better assistance in the blackstart restoration process.

Sample Analysis

The following are illustrative sample analyses, not related to AES-Indiana system or portfolios.

(1) Energy Adequacy during Market Emergency Events

Illustrative sample analyses, not related to AES-Indiana system or portfolios

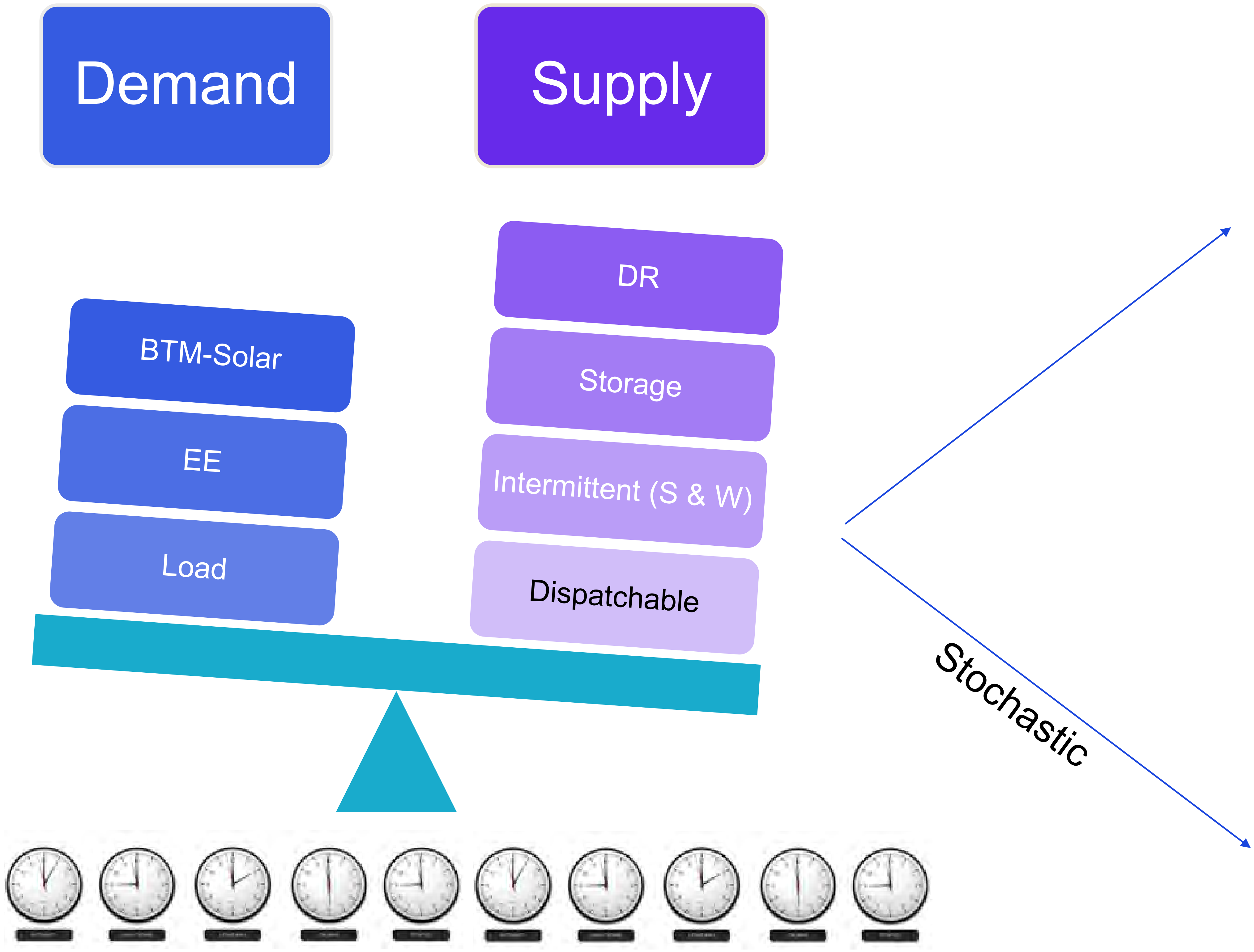


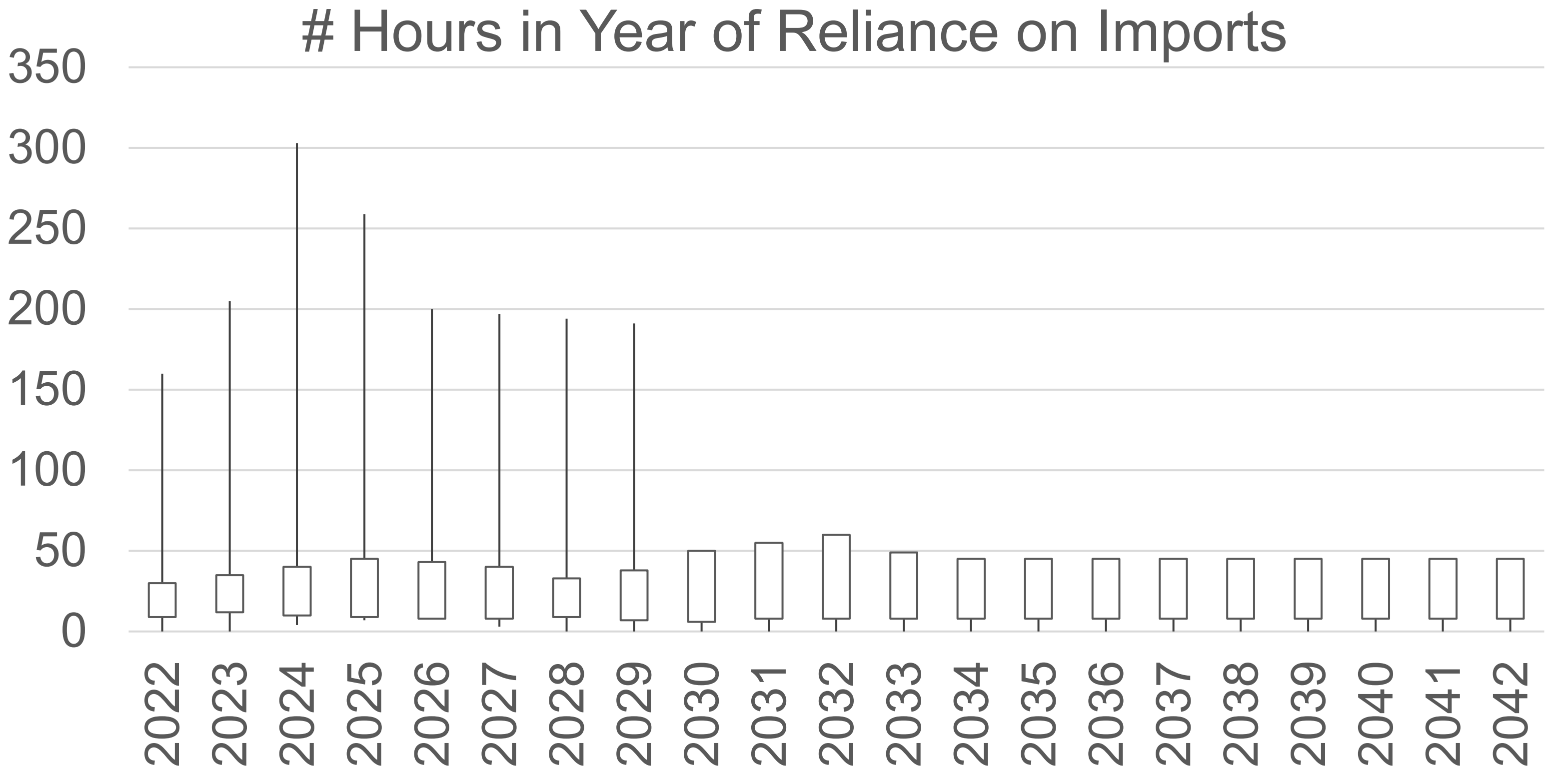
	# Import Hrs																							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	2	0	0
7	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15	17	10	6	2
8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	17	17	6	2	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7	3	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

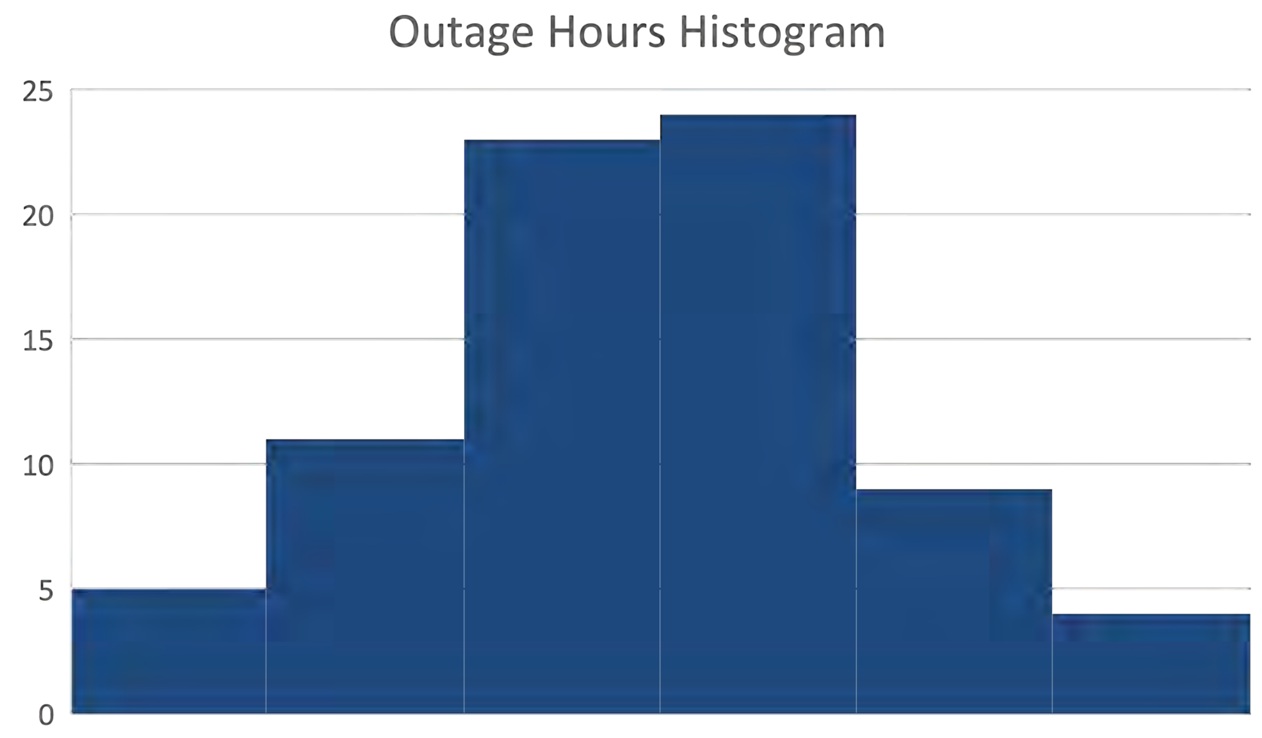
→ The analysis shows that a sample Portfolio P1 is energy long and relies on energy purchases only 136 hours in a year (i.e., 2% of time) to meet its energy needs with a maximum purchase of 475MW, while it has excess energy to potentially sell 6,658 hours in a year (i.e., 76% of time).

(1) Energy Adequacy – Scenario & Stochastic Study Approaches

Illustrative sample analyses, not related to AES-Indiana system or portfolios







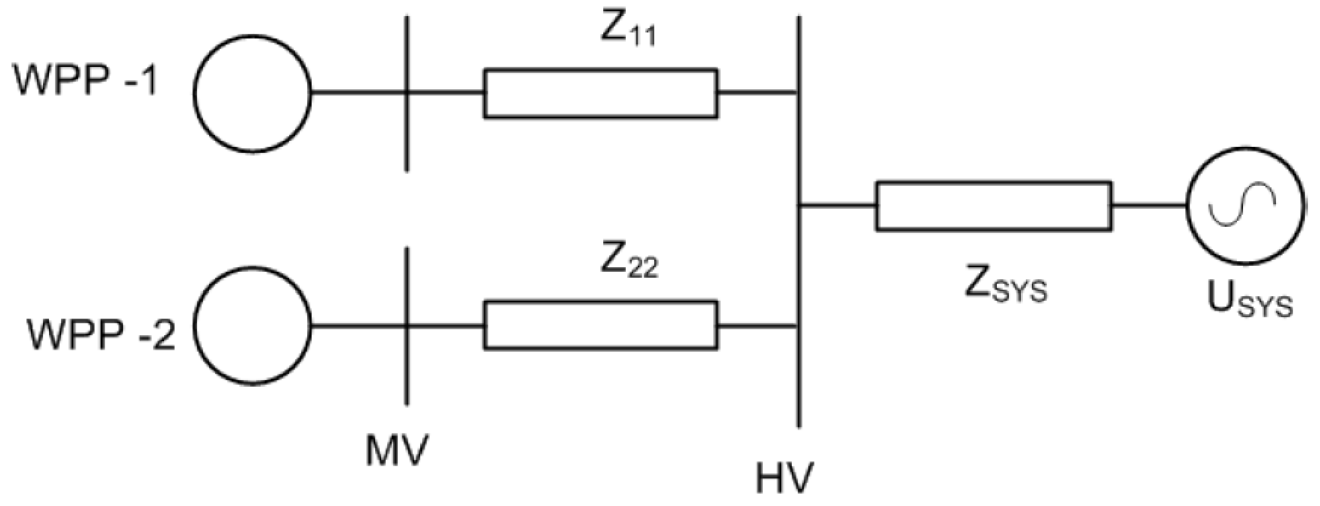
(3) Importance and Impacts of Short Circuit Strength

Illustrative sample analyses, not related to AES-Indiana system or portfolios

- **Impact:**
  - When conventional power plants with synchronous generators are retired and/or the system tie-lines are severed, the short circuit currents will dramatically decline. IBRs are not a substitute because their short circuit contribution is limited, and also the phase of their current (real) is not aligned with typical short circuit currents (reactive).
  - Declining SCMVA and increasing IBRs will eventually violate the ESCR limits, requiring either a prohibition on additional IBR interconnections, or provisioning additional mitigation measures.
  - Mitigations can come in the form of optimal placement of IBRs to avoid clustering them in a manner that violates the ESCR limits, provisioning synchronous condensers, or requiring inverters to have grid-forming (GFM) capability.

(3) Short Circuit Strength: Equivalent Short Circuit Ratio

Illustrative sample analyses, not related to AES-Indiana system or portfolios



Bus #	IBR* (MW)	SCMVA	SCR	ESCR	ESCR with SC
237	30	343	11.5	2.1	3.2
59200	32	369	11.5	2.3	3.7
59100	32	600	18.7	2.5	4.0
238	23	206	8.9	2.2	4.2
1813	10	605	60.0	2.6	4.2
99000	20	481	24.0	2.6	4.2
119	29	311	10.8	3.0	4.2
56	29	343	12.0	2.2	4.3
94	28	1092	39.0	2.7	4.6
59400	23	736	32.0	3.1	4.8
2803	28	548	19.8	3.0	4.9

SCR is not a good indicator under high IBR penetration
Synchronous Condensers (SC) can increase short circuit strength

Optimal Placement of IBRs* from Short Circuit perspective to avoid ESCR limitation:

$$MAXIMIZE \ \sum_{j \in buses} P_j$$

$$\text{Subject to} \quad \sum_j IF_{ji} * P_j \leq \frac{S_i}{ESCR\ Threshold}$$

$$P_j \geq 0$$

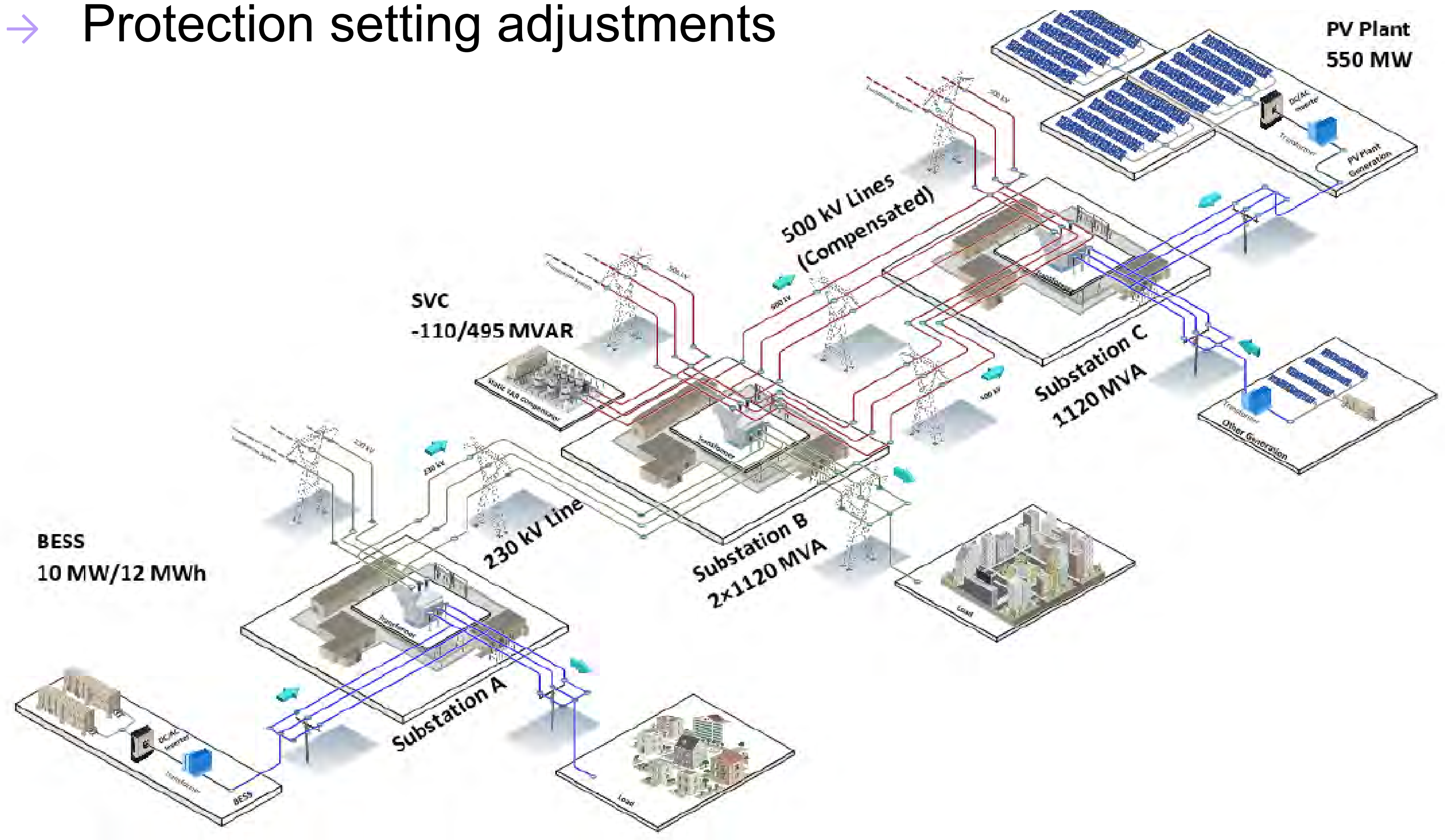
*Inverter Based Resource (IBR)

(5) Black Start Studies – Key Considerations

Illustrative sample analyses, not related to AES-Indiana system or portfolios

Results:

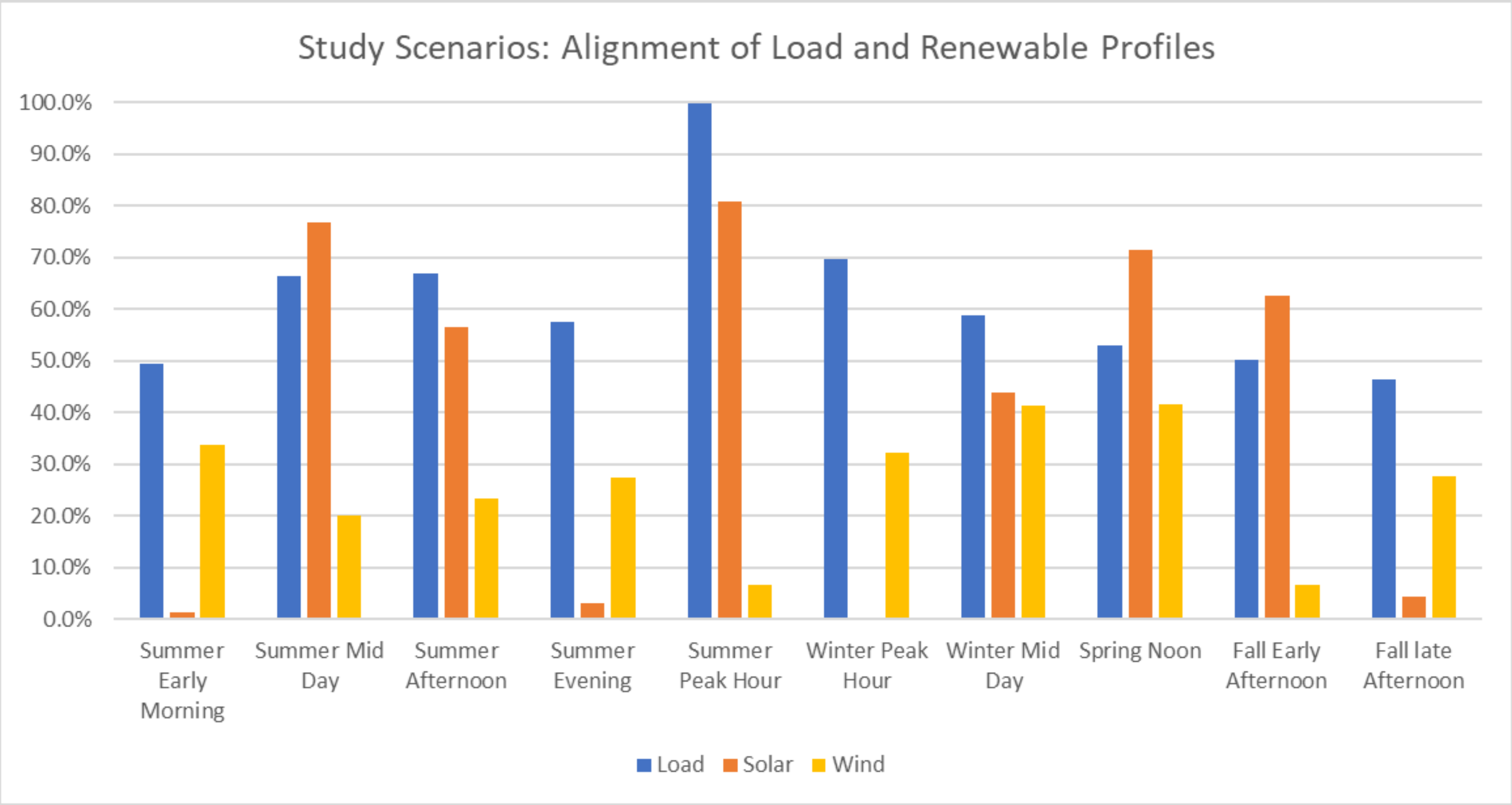
- Inverter Size (MVA, PF)
- BESS Size (MW, MWh)
- BESS control and protection settings
- Transformer tap settings
- Protection setting adjustments

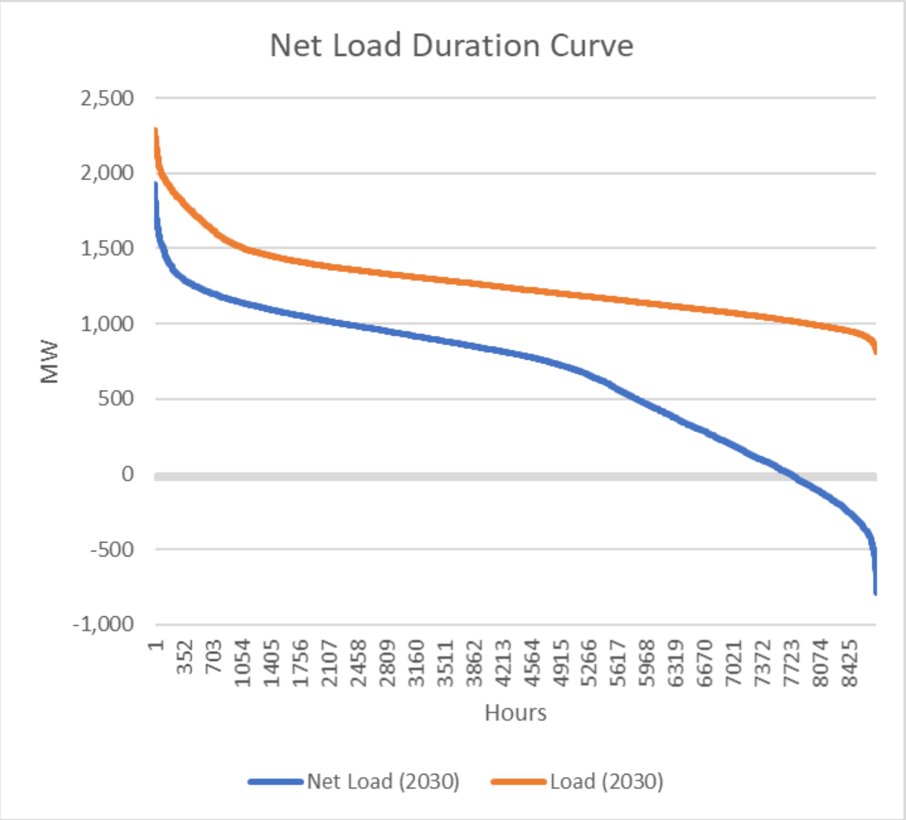


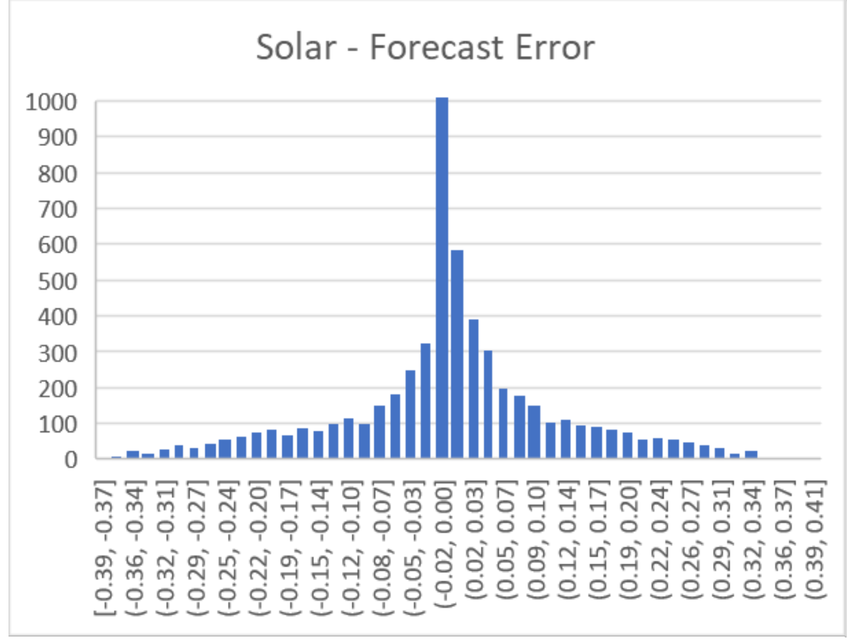
(8) Resource Predictability & Firmness: Variability Analysis

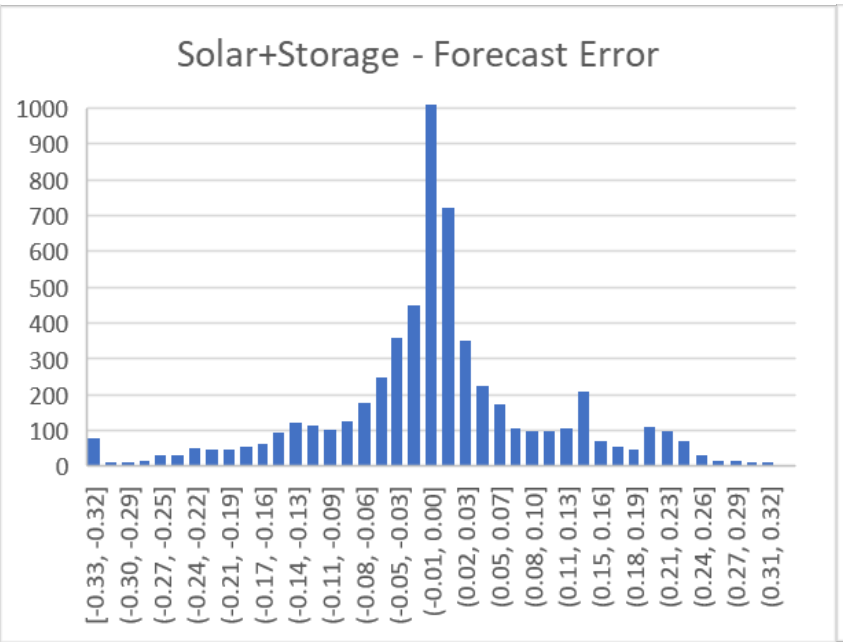
Illustrative sample analyses, not related to AES-Indiana system or portfolios

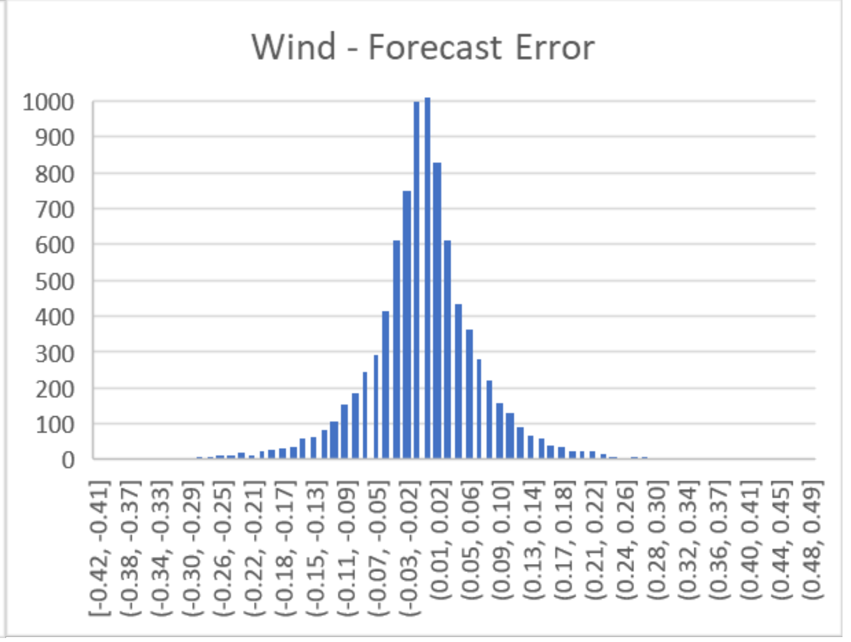
Forecast Error%	Solar	Wind	S+S
Standard Deviation	9.9%	7.5%	9.2%
min Error	-39%	-42%	-33%
max Error	39%	48%	33%
90% Percentile	19%	8%	12%


Study Scenarios: Alignment of Load and Renewable Profiles


Net Load Duration Curve


Solar - Forecast Error

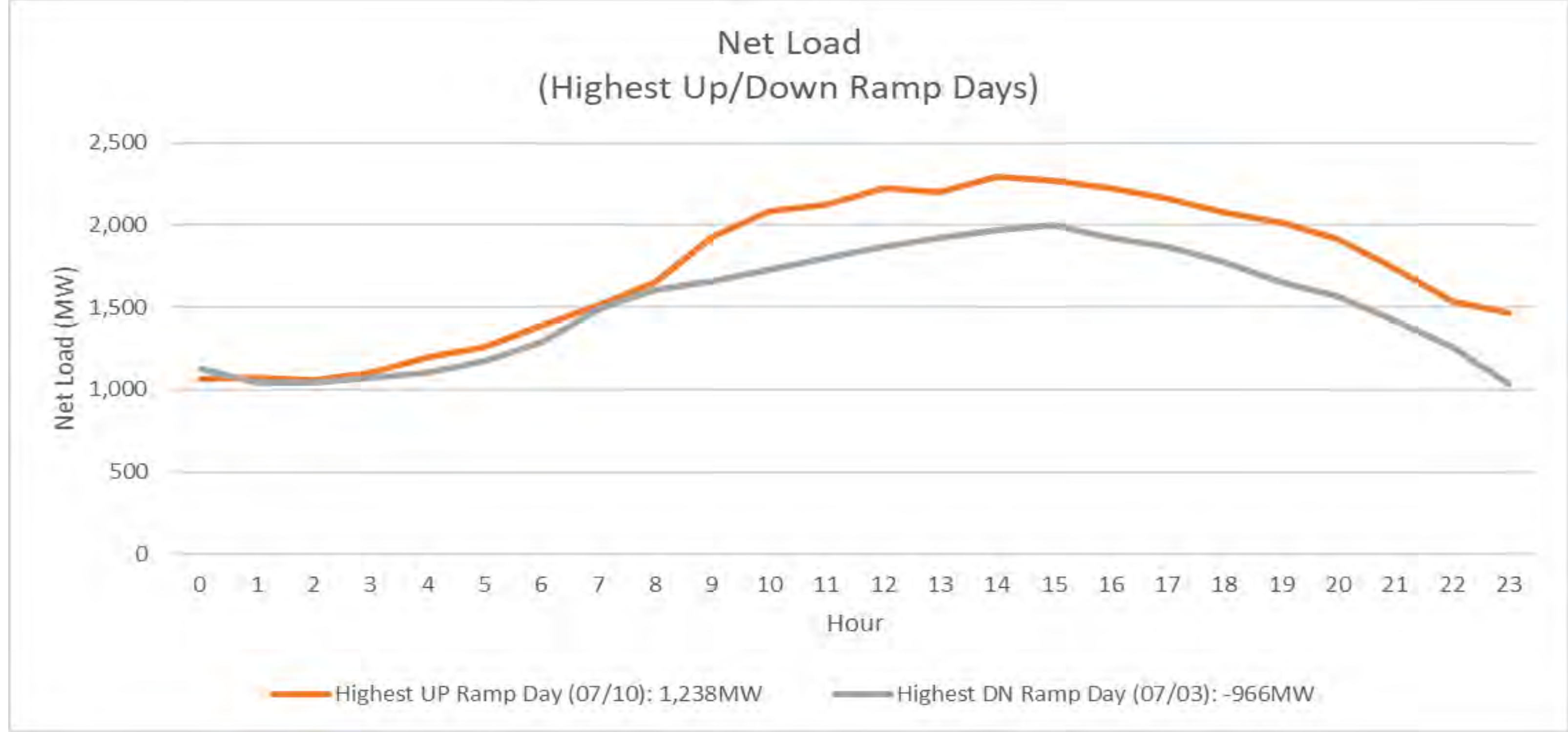

Solar+Storage - Forecast Error

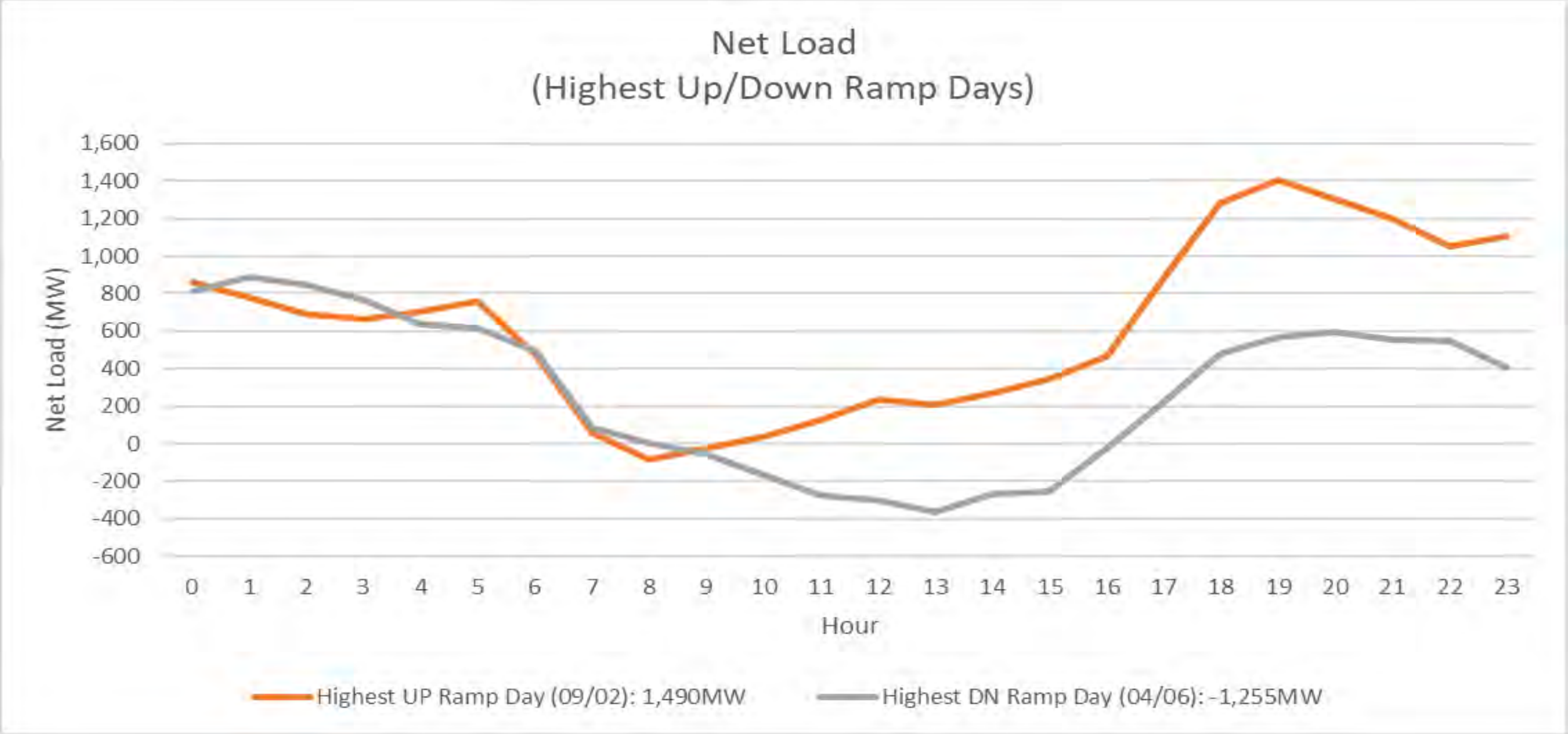

Wind - Forecast Error

(8) Resource Predictability & Firmness: Net Load Power Ramps

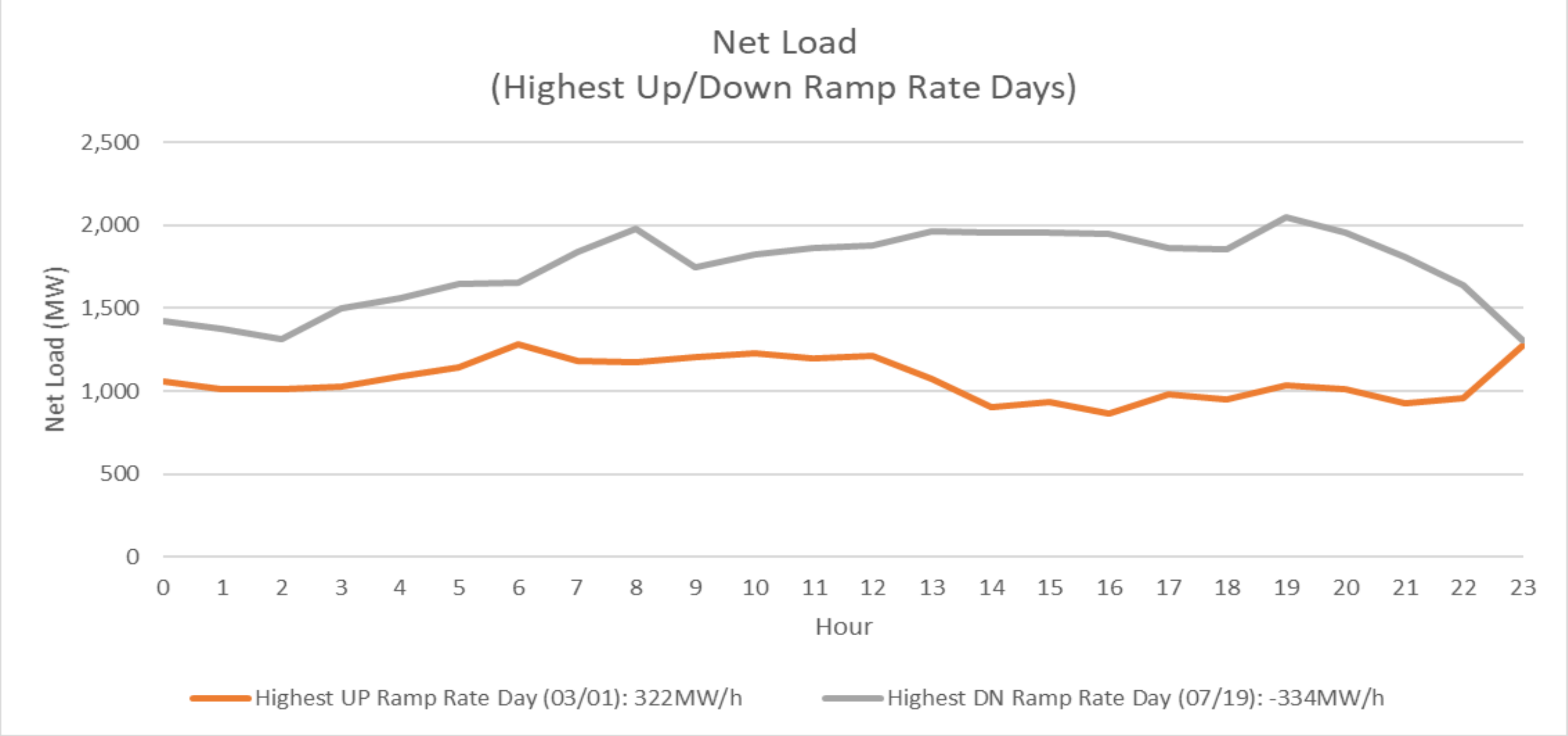
Illustrative sample analyses, not related to AES-Indiana system or portfolios

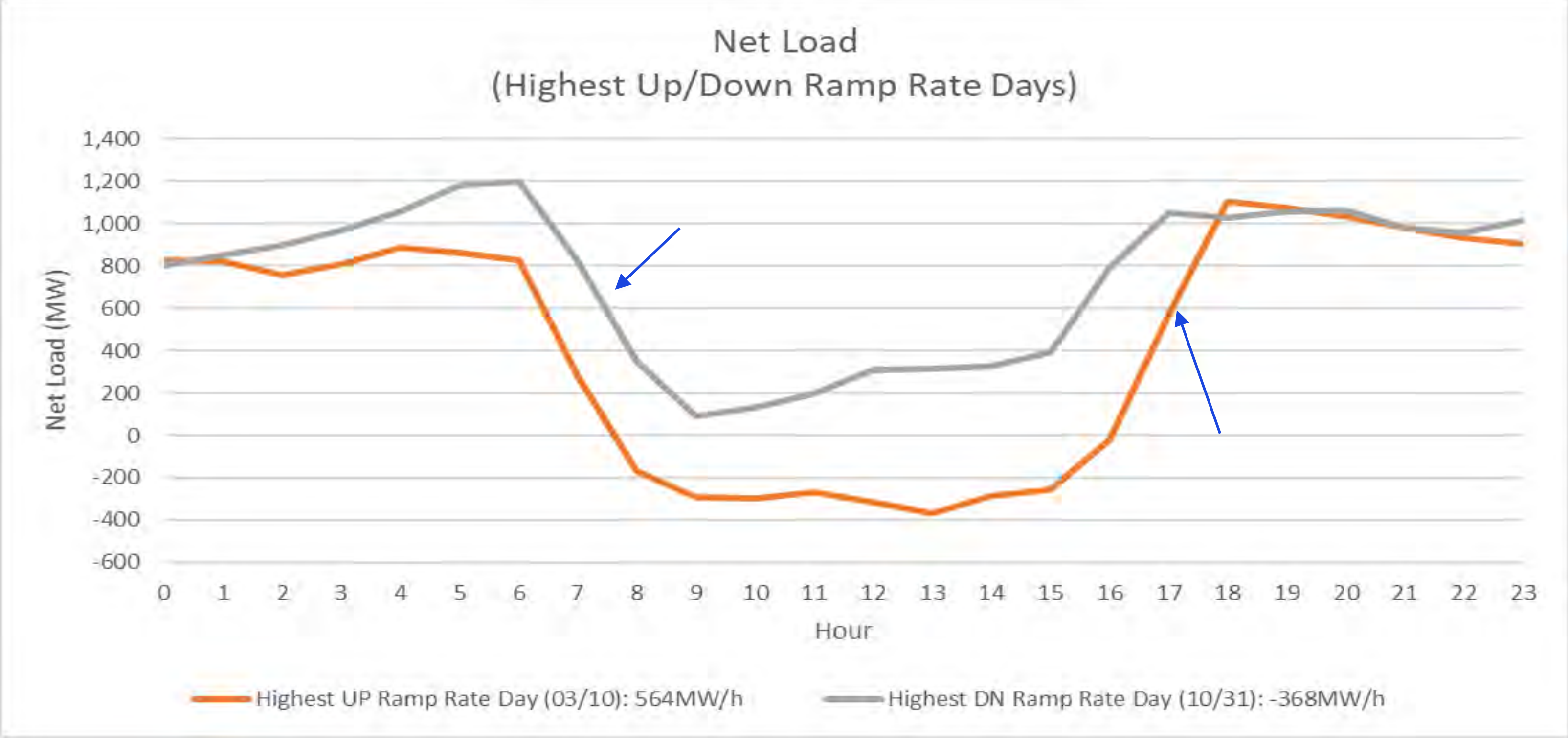
→ Highest Up/Down Ramp Days





→ Highest Up/Down Ramp Rate Hours



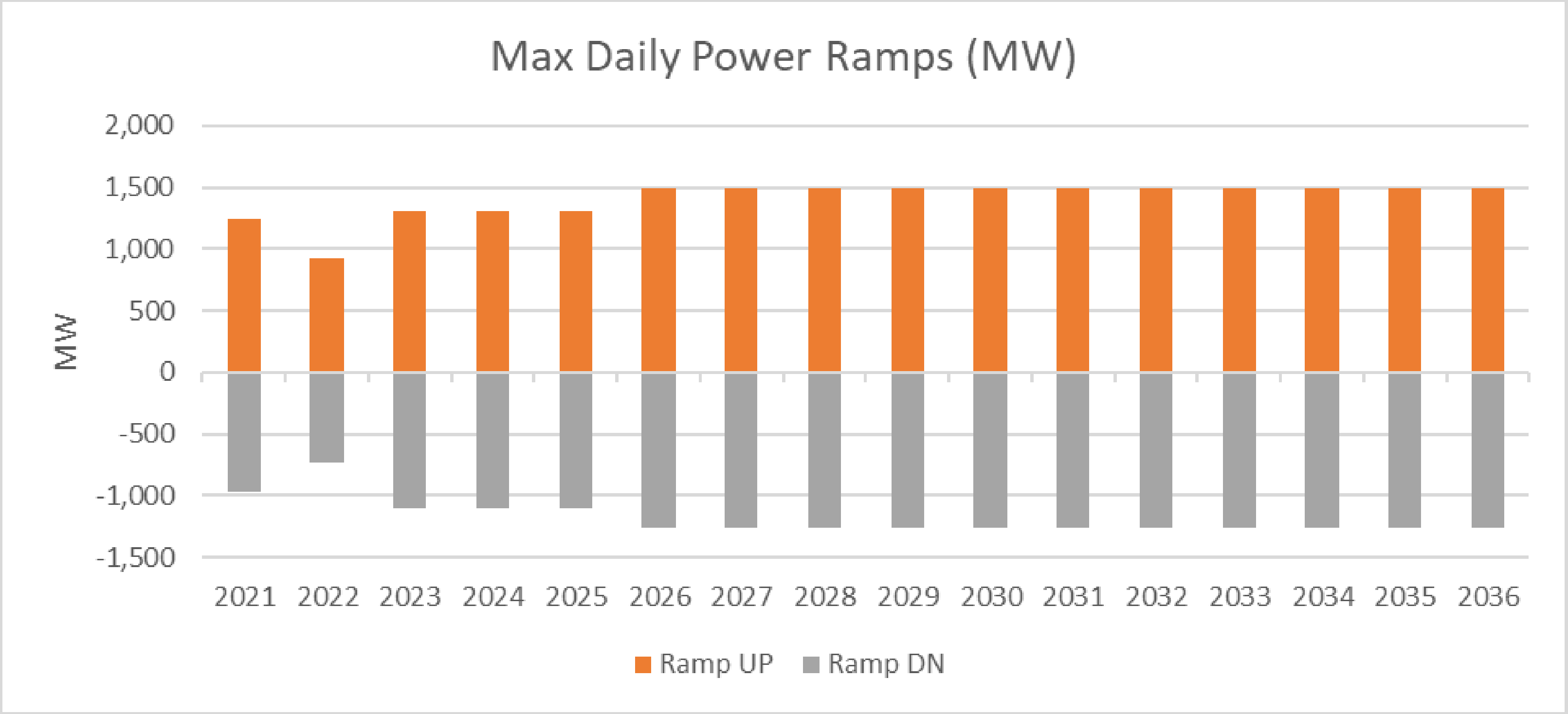


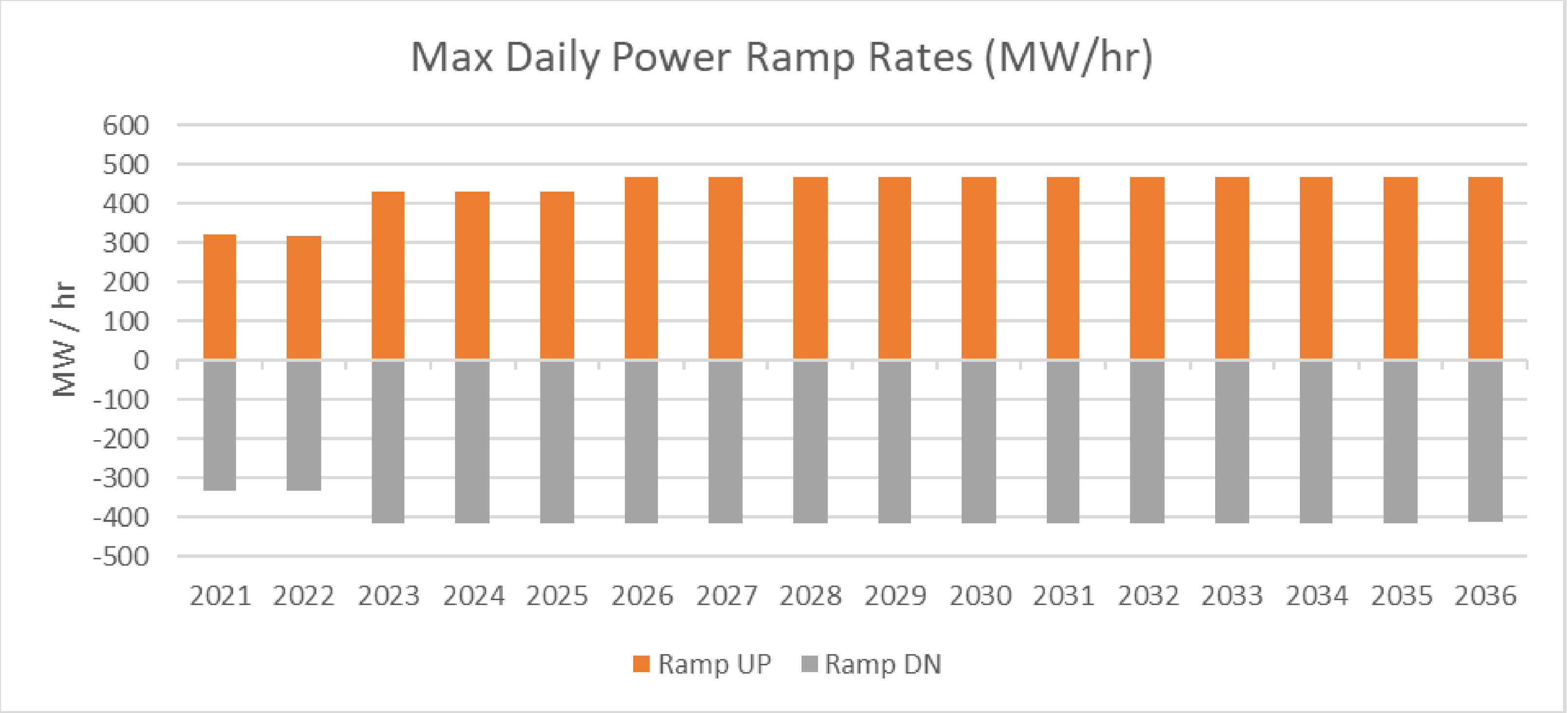
→ Significant change in Net Load profile from a conventional shape in 2020 to a “Duck Curve” in 2030

(8) Resource Predictability & Firmness: Net Load Power Ramps

Illustrative sample analyses, not related to AES-Indiana system or portfolios

Year	Ramp UP	Ramp DN	Ramp Rate UP	Ramp Rate DN
2021	1,238	-966	322	-334
2022	929	-733	319	-332
2023	1,309	-1,101	431	-415
2024	1,308	-1,101	430	-414
2025	1,307	-1,101	430	-414
2026	1,490	-1,255	468	-414
2027	1,490	-1,255	468	-414
2028	1,490	-1,255	468	-414
2029	1,490	-1,255	468	-414
2030	1,490	-1,255	468	-413
2031	1,489	-1,255	467	-413
2032	1,489	-1,255	467	-413
2033	1,489	-1,255	467	-413
2034	1,489	-1,255	467	-413
2035	1,489	-1,255	467	-413
2036	1,489	-1,255	467	-413


Max Daily Power Ramps (MW)


Max Daily Power Ramp Rates (MW/hr)

Ramping Category	2020 MW	%Peak	2030 MW	%Peak	Increased MW 2030 vs. 2020
1-hr Up	306	13.1%	468	20.5%	162
1-hr Down	-222	9.5%	-413	18.1%	191
Day Up	1,044	44.6%	1,489	65.2%	445
Day Down	-852	36.4%	-1,255	54.9%	403

(8) Resource Predictability & Firmness: Net Load Power Ramps (Y2030 vs Y2020)

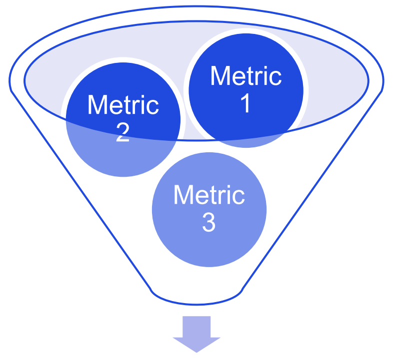
Illustrative sample analyses, not related to AES-Indiana system or portfolios

Portfolio	Solar	BTM Solar	Wind	Solar + Storage	Day Ramping Up (MW)	Day Ramping Down (MW)	1hr Ramping Up (MW)	1hr Ramping Down (MW)	Peaker/ Storage (MW)	Forecast Error 90th Percentile	Excess Ramping Capability (MW)
2020	**22**	**270**	**103**	**87**	**1,013**	**-860**	**243**	**-299**	**465**	**89**	**375**
P1	1,225	359	103	224	1,851	-1,557	506	-446	605	342	262
P2	1,725	359	103	224	1,988	-1,557	591	-455	605	434	171
P3	2,225	359	103	224	1,988	-1,557	676	-682	605	526	79
P4	2,725	359	103	224	2,258	-1,827	801	-817	1,225	618	607
P5	3,225	359	103	224	2,258	-1,827	872	-817	1,225	710	515
P6	3,975	359	103	224	2,258	-1,827	936	-817	1,225	848	377
P7	4,225	359	103	224	2,438	-2,007	1,026	-907	2,365	894	1,471
P8	4,225	359	103	224	2,438	-2,007	1,026	-907	2,365	894	1,471
P9	4,225	359	103	224	2,438	-2,007	1,026	-907	2,365	894	1,471

	Reliability Study Area	Normal (50/50, Connected)	Max-Gen (90/10, Import Limited)	Islanded (Critical Load)
1	Energy Adequacy		X	X
2	Operational Flexibility and Frequency Support	X		X
3	Short Circuit Strength Requirement	X		X
4	Power Quality (Flicker)	X		
5	Blackstart			X
6	Dynamic VAR Deliverability	X		
7	Dispatchability and Automatic Generation Control	X		
8	Predictability and Firmness of Supply	X		
9	Geographic Location Relative to Load	X		

Scoring Criteria

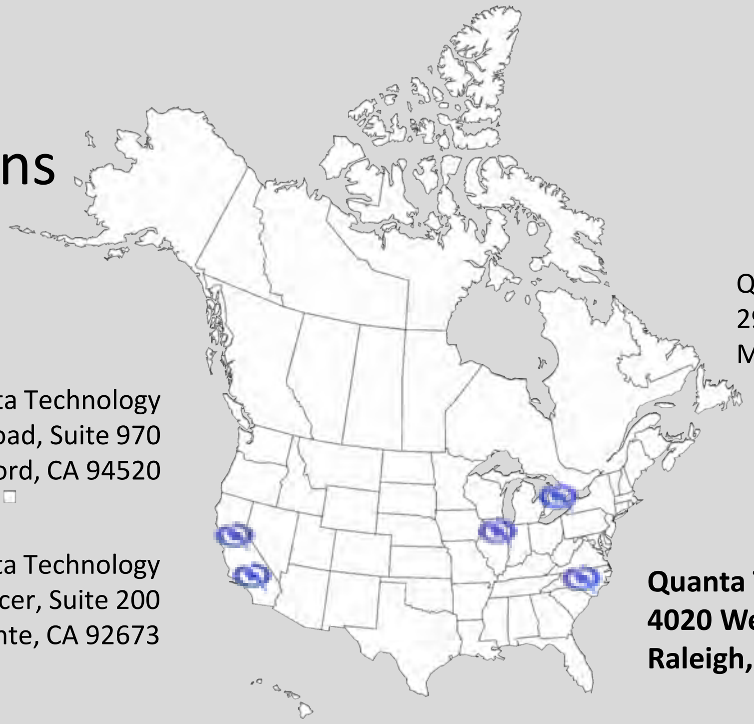
Evaluate Portfolios



Portfolio Score

Thank you

Office Locations



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Portfolio Metrics & Scorecard

Erik Miller, Manager, Resource Planning, AES Indiana

Guidance for the IRP Scorecard Framework

Categorical Framework for AES Indiana’s IRP Scorecard

Each category has one or more metrics that quantitively measure portfolio performance.

IRP Scorecard for Portfolio Evaluation

	Affordability	**Environmental Sustainability**				**Reliability, Stability & Resiliency**	**Risk & Opportunity**						**Economic Impact**	
	20-yr PVRR	***CO_2 Emissions***	***SO_2 Emissions***	***NO_x Emissions***	***Other Emissions***	***Reliability Score***	***Environmental Policy Opportunity***	***Environmental Policy Risk***	***Cost Opportunity***	***Cost Risk***	***Market Exposure***	***Renewable Capital Cost Risk***	***Employees (+/-)***	***Property Taxes***
	Present Value of Revenue Requirements	Total portfolio CO2 Emissions	Total portfolio SO2 Emissions	Total portfolio NOx Emissions	Water Use & Coal Ash	Composite score from Reliability Analysis	Lowest PVRR across policy scenarios	Highest PVRR across policy scenarios	Mean - P5	P95 - Mean	20-year avg sales + purchases	**TBD**	Total # of AES IN generation employees	Total amount of property tax paid from AES IN assets
1)														
2)														
3)														
4)														
5)														
6)														

Calculations for each scoring metric will be included to complete the Scorecard

- **Strategies**
  - 1. No Early Retirement
  - 2. Pete Refuel to 100% Natural Gas (est. 2025)
  - 3. One Pete Unit Retires in 2026
  - 4. Both Pete Units Retire in 2026 & 2028
  - 5. “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
  - 6. Encompass Optimization without Predefined Strategy

A Preferred Resource Portfolio will be selected after evaluation of the Scorecard results

Affordability Metric

PVRR =

Operating Expenses

- → Energy Purchases
- → Fuel
- → Variable O&M
- → Fixed O&M
- → Emissions

\+

Recovery of and Return on New Capital

- → Book Depreciation
- → Return on Rate Base
- → Property Taxes

−

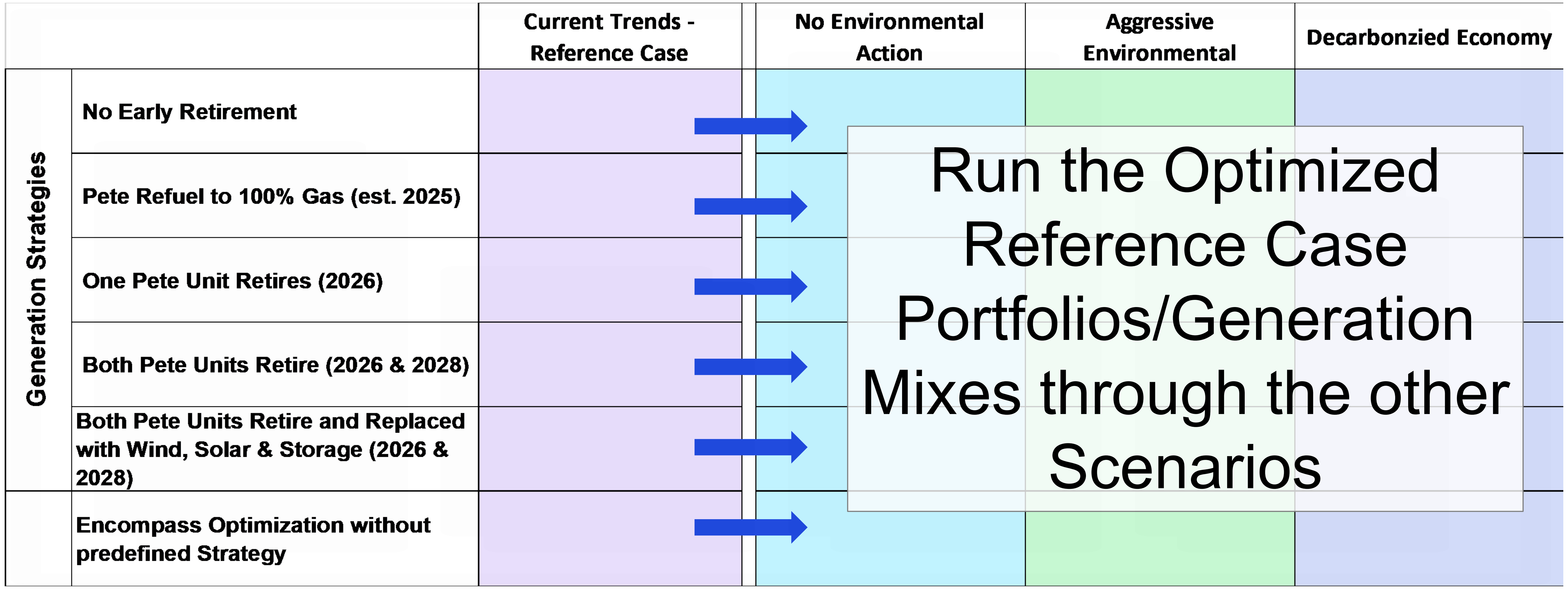
Market Revenues

- → MISO Energy Revenue
- → Net Capacity Revenue

Environmental Sustainability Metrics

Reliability, Resilience and Stability Metric

Risk & Opportunity Metrics



		Current Trends - Reference Case	No Environmental Action	Aggressive Environmental	Decarbonzied Economy
Generation Strategies	No Early Retirement	→			
	Pete Refuel to 100% Gas (est. 2025)	→			
	One Pete Unit Retires (2026)	→			
	Both Pete Units Retire (2026 & 2028)	→			
	Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	→			
	Encompass Optimization without predefined Strategy	→			

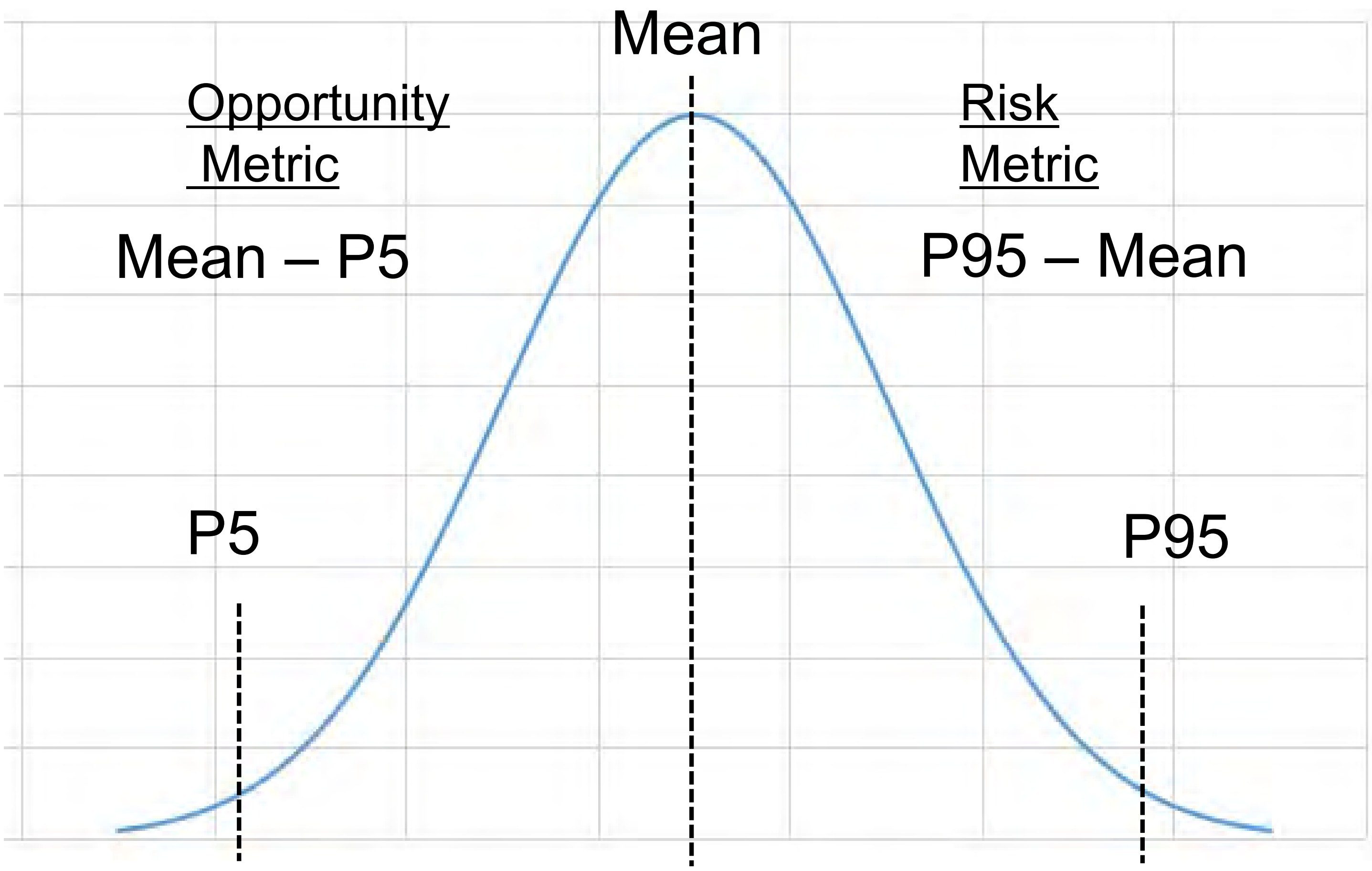
Run the Optimized Reference Case Portfolios/Generation Mixes through the other Scenarios

Metrics

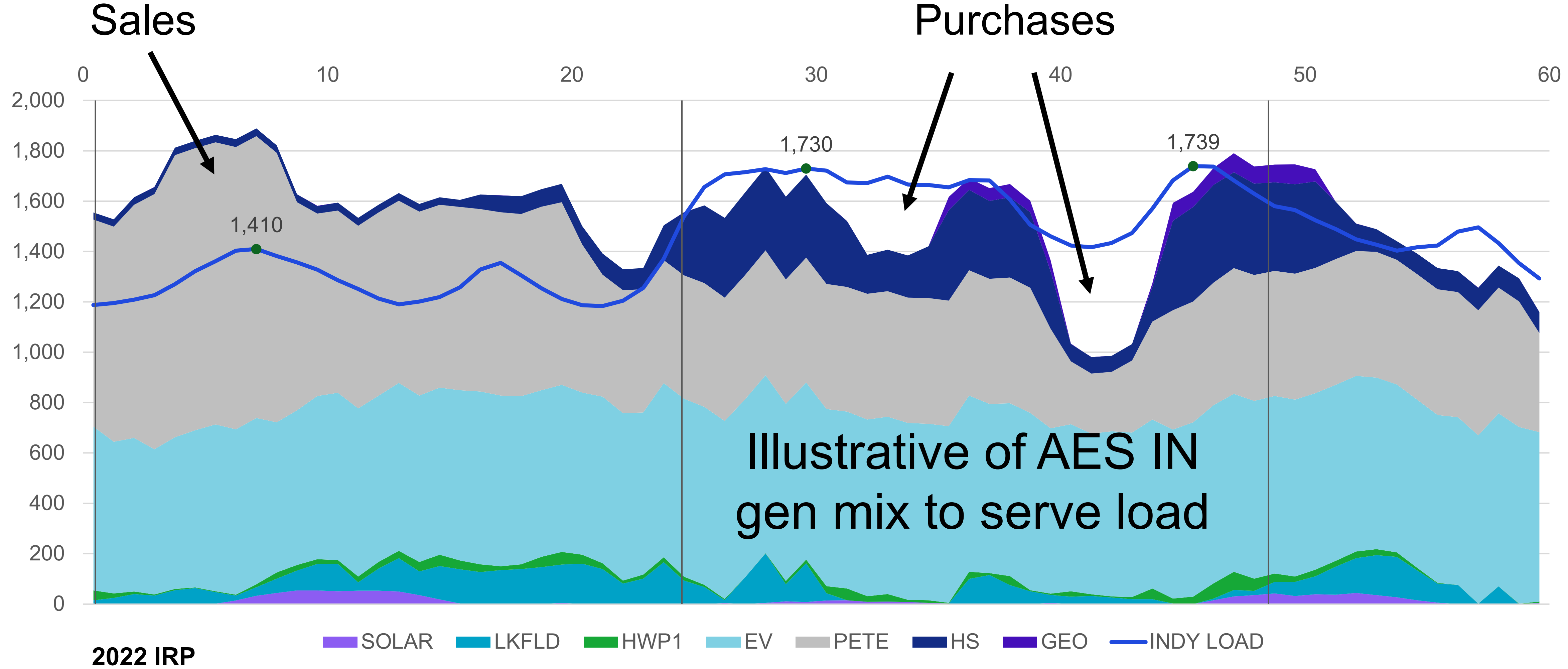
For each strategy, the analysis will capture:

- Risk potential using the **highest scenario PVRR for each strategy**
- Opportunity potential using the **lowest scenario PVRR for each strategy**

Risk & Opportunity Metrics



Risk & Opportunity Metrics



Sales

Purchases

Illustrative of AES IN gen mix to serve load

Day 1

Day 2

Day 3

Market Exposure Metric

To estimate the risk for each strategy, AES Indiana will calculate the average of the absolute value of the annual sales and purchases and sum those over the 20-yr period.

| 20-year Average Sales | + | 20-year Average Purchases |

Economic Impact Metrics

IRP Scorecard for Portfolio Evaluation

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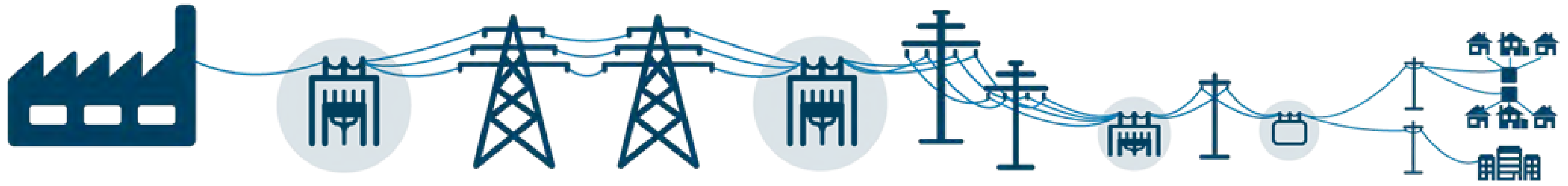
AES Indiana Distribution System Planning

Agenda

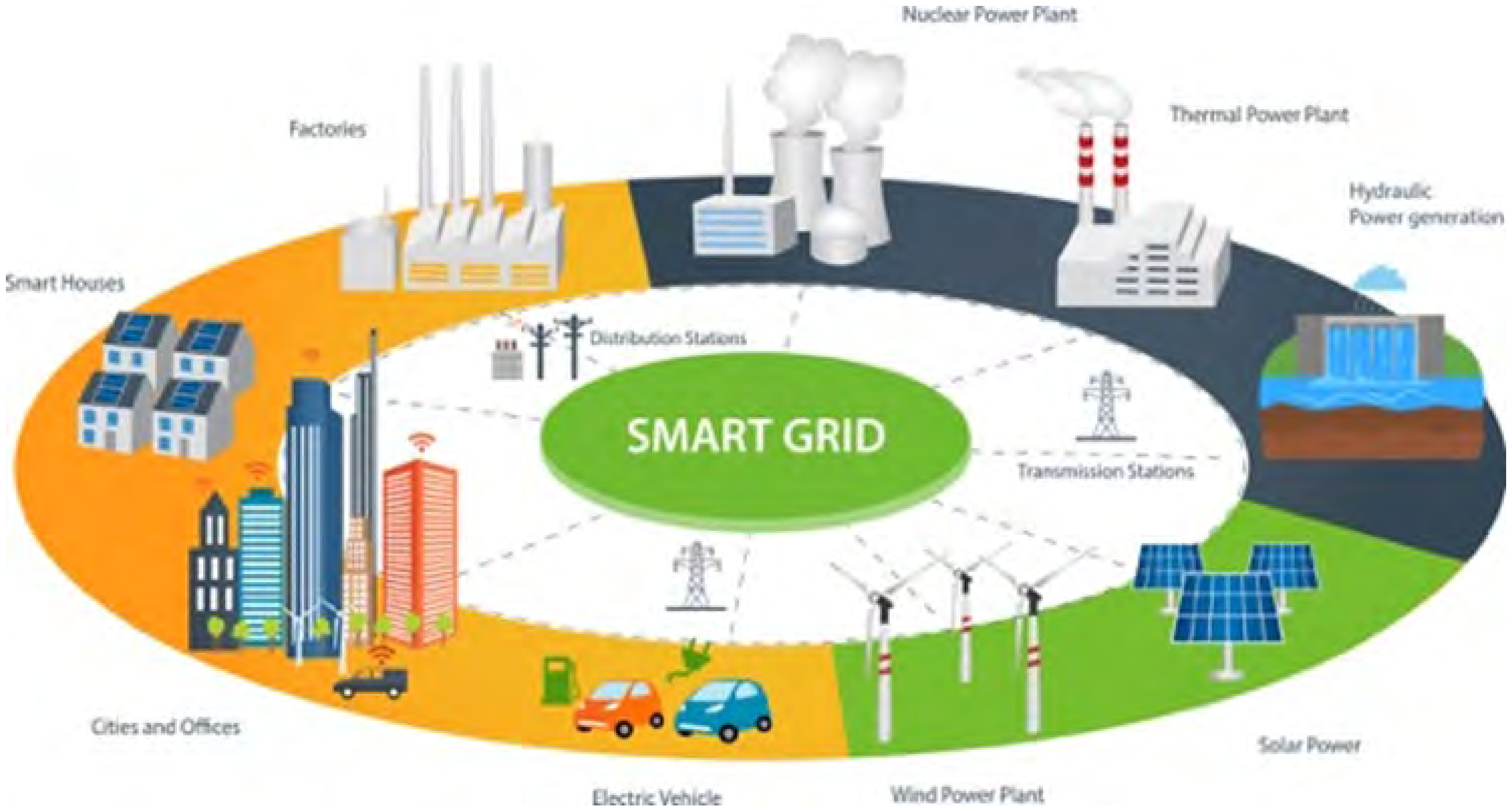
Building the AES of the Future

Transforming the traditional one-way grid into…

An interactive two-way intelligent platform



AES Indiana



Smart Grid Vision

CUSTOMER	Engage with our customers through a more personalized experience and build a trusted customer relationship.
SMART GROWTH	Build a distribution system that attracts new customers through innovative clean energy products and services.
INNOVATION	Transform to a customer-focused, data-driven culture that empowers our people to reimaging the energy ecosystem and be leaders in the clean energy transition.
RESILIENCY	Transform our energy system and services to improve resiliency and seamlessly integrate renewables, distributed generation, energy storage and electrification technologies.

Operations Future State Vision

DMS – Distribution Management System
OMS – Outage Management System
DERMS – Distributed Energy Resources Management System
AMI – Advance Metering Infrastructure

Enterprise Integration

- GIS
- CIS
- Work Management
- AMI/MDMS
- Weather Service
- Outage Data Warehouse

DER Dispatch
DER Forecast
DER Monitoring and Control
DER Market Interface
DER Scheduling
DER Estimation

Storm Management
Outage Analysis
Call Management
Planned Outage Management
Outage Reporting
Crew Management

Switch Order Management
Volt/Var Optimization
Distribution Power Flow
Feeder Reconfiguration
Fault Location Restoration
Short Circuit Analysis

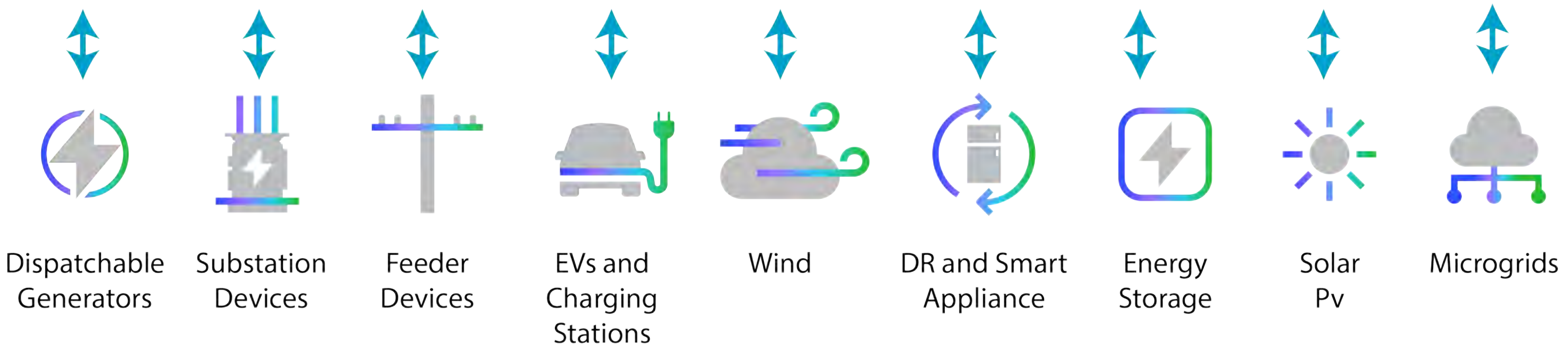
Distribution Network Operating Model

Network Model | Topology Processing | Graphical User Interface | DER Modeling | DER Aggregation

Operations Technology Platform

SCADA, Alarming, Trending, Visualization, Historian, Load Shed, Study Mode

Real-Time/DER Communication



Mobile Application

- Real Time Map View
- Job Management
- Damage Assessment
- Field Switching
- Off-Line Operation
- GPS Integration

Connected Planning & Operations

DERs

EVs and Charging Stations

DR and Smart Appliance

Energy Storage

Interconnection Portal

Collect all technical specifications needed for detailed modeling

Demand Forecasting Tool

In alignment with resource planning develop bottom-up geo-referenced forecasts, with forecast updates as a result of resource changes and information from smart grid devices

Network Model Building & Analysis

Develop short, mid, long term power flow study models for T&D systems

Grid Upgrades

Develop solutions for grid interconnection, capacity, and reliability needs

DER Dispatch
DER Forecast
DER Monitoring and Control
DER Market Interface
DER Scheduling
DER Estimation

Storm Management
Outage Analysis
Call Management
Planned Outage Management
Outage Reporting
Crew Management

Switch Order Management
Volt/Var Optimization
Distribution Power Flow
Feeder Reconfiguration
Fault Location Restoration
Short Circuit Analysis

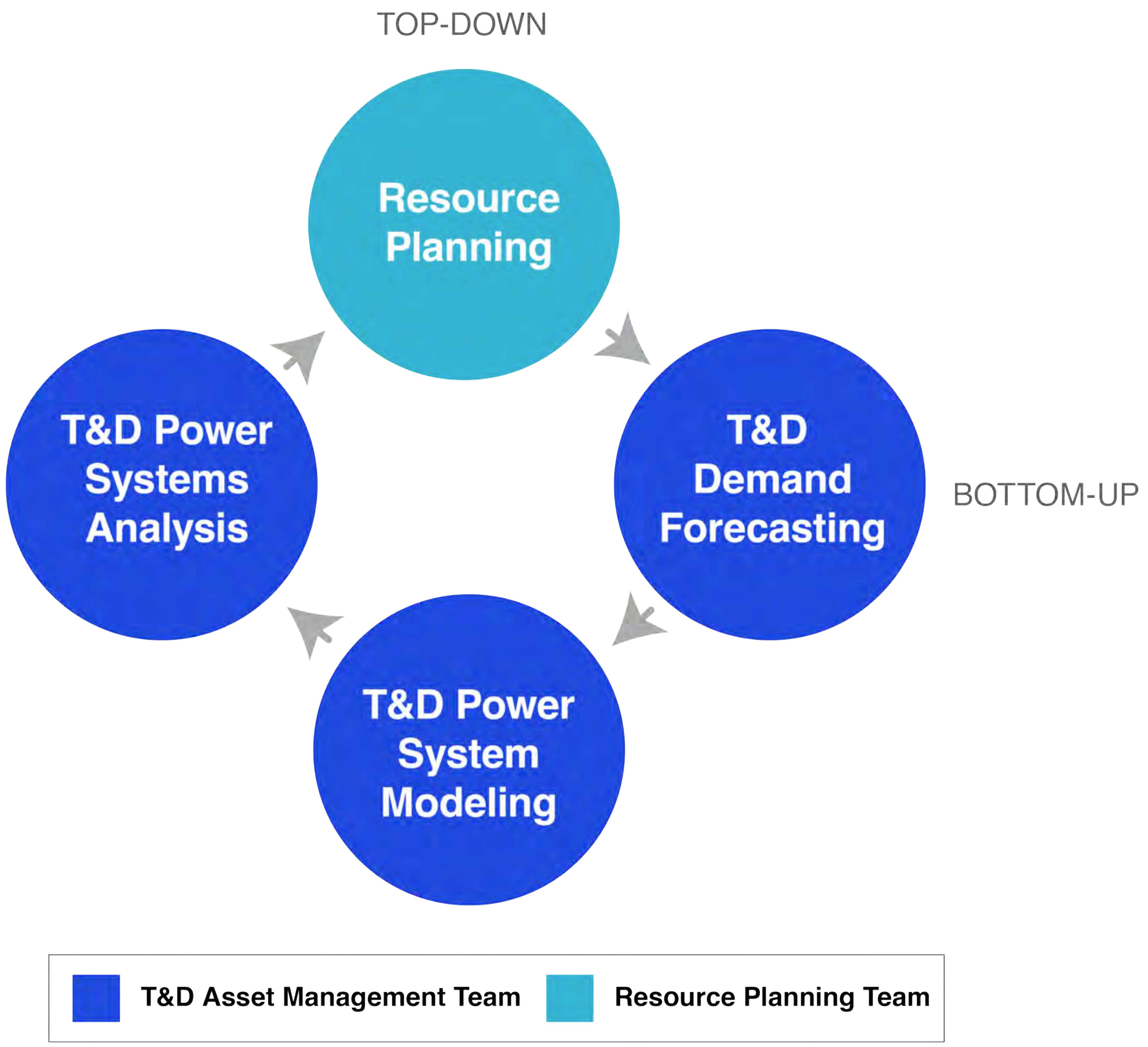
- Collecting all technical data at the front of the interconnection process and translating it directly to standardized forecasting and modeling tools in planning & operations.
- Leveraging Smart Grid investments for better forecasting and model inputs.
- Devices are utilized for better operational visibility & orchestration leading to better customer outcomes.

Smart Grid Devices

AMI, Smart Reclosers, Sensors, SCADA/Pi, Weather data utilized to build better modes and provide an operations technology platform that enhances planning and operations

DMS – Distribution Management System
OMS – Outage Management System
DERMS – Distributed Energy Resources Management System
AMI – Advance Metering Infrastructure

Aligned Planning at AES Indiana



TOP-DOWN

Resource Planning

T&D Demand Forecasting

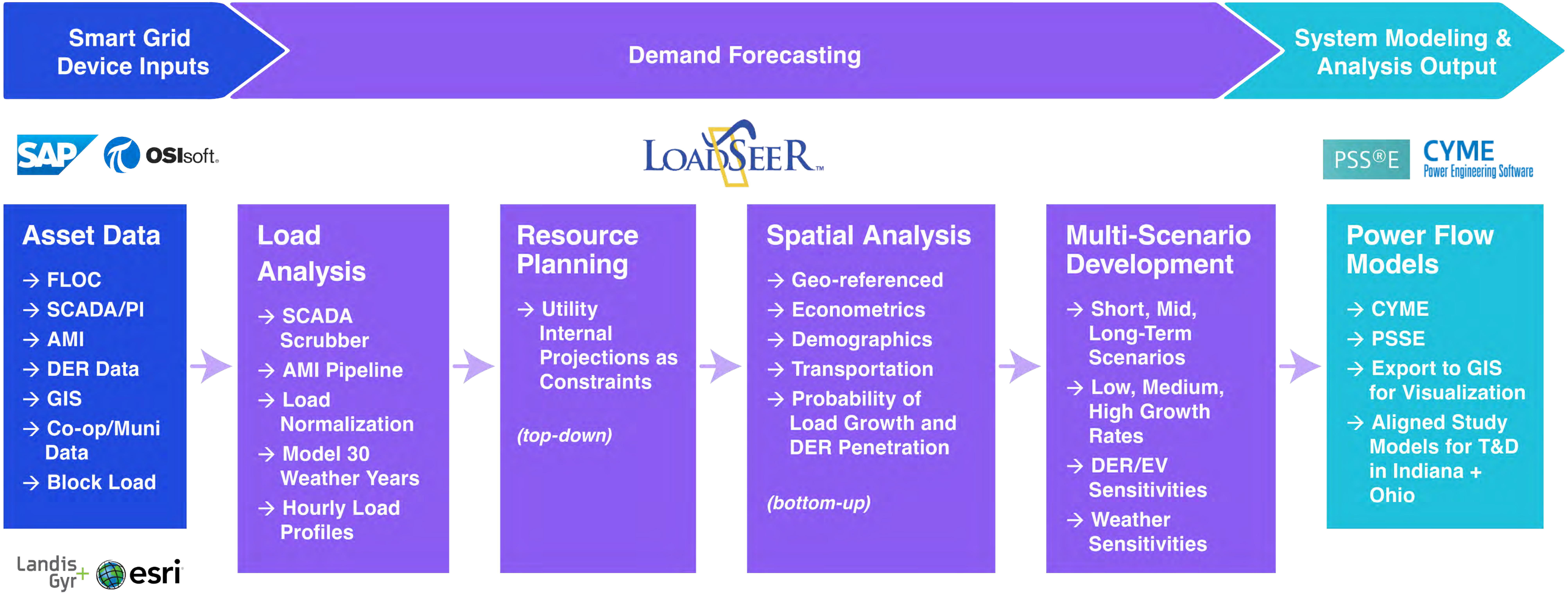
BOTTOM-UP

T&D Power System Modeling

T&D Power Systems Analysis

🟦 T&D Asset Management Team 🟦 Resource Planning Team

T&D Demand Forecasting Future State Process



Smart Grid Device Inputs → **Demand Forecasting** → **System Modeling & Analysis Output**

SAP OSIsoft

LOADSEER

PSS®E CYME Power Engineering Software

Asset Data

- → FLOC
- → SCADA/PI
- → AMI
- → DER Data
- → GIS
- → Co-op/Muni Data
- → Block Load

Landis+Gyr esri

Load Analysis

- → SCADA Scrubber
- → AMI Pipeline
- → Load Normalization
- → Model 30 Weather Years
- → Hourly Load Profiles

Resource Planning

- → Utility Internal Projections as Constraints

(top-down)

Spatial Analysis

- → Geo-referenced
- → Econometrics
- → Demographics
- → Transportation
- → Probability of Load Growth and DER Penetration

(bottom-up)

Multi-Scenario Development

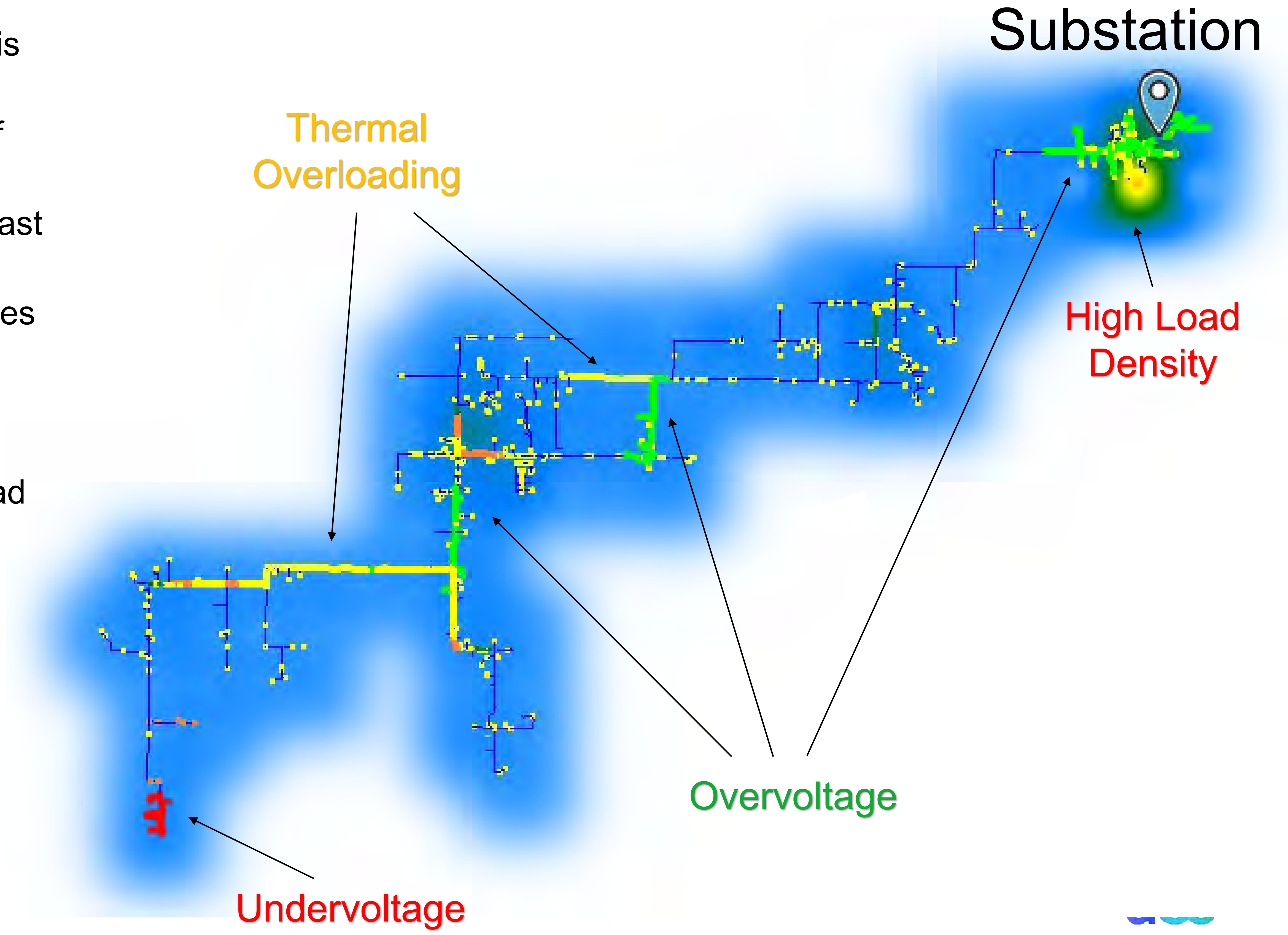
- → Short, Mid, Long-Term Scenarios
- → Low, Medium, High Growth Rates
- → DER/EV Sensitivities
- → Weather Sensitivities

Power Flow Models

- → CYME
- → PSSE
- → Export to GIS for Visualization
- → Aligned Study Models for T&D in Indiana + Ohio

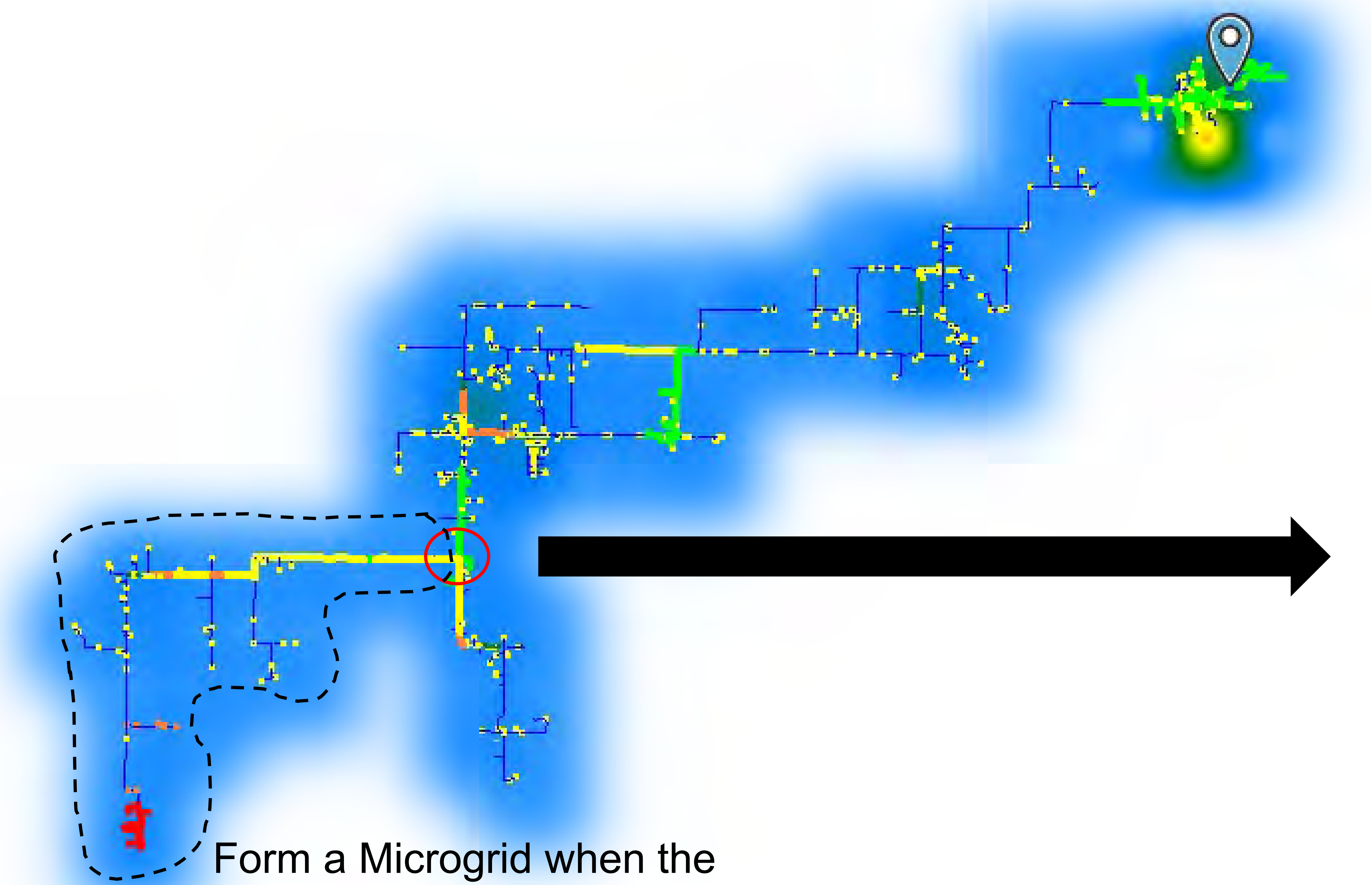
Load Flow Analysis for Distribution Systems

- AES uses CYME for distribution system modeling and analysis
- CYME takes advanced forecasts/scenarios from our demand forecasting tool (LoadSEER) to develop power flow models of the system
  - These forecasts and scenarios will be analyzed to forecast future system capacity, redundancy, and voltage needs
  - Contingency & Scenario Planning present new challenges for distribution since multiple circuit configurations are possible with smart grid devices
- Time series for load profiles
  - Will become more important over time with changing load profiles due to DER, EV charging, etc. being major load modifiers
- Advanced Capabilities Under Development
  - Reliability Assessment
  - Recloser Placement Module
  - Time Series
  - Hosting Capacity

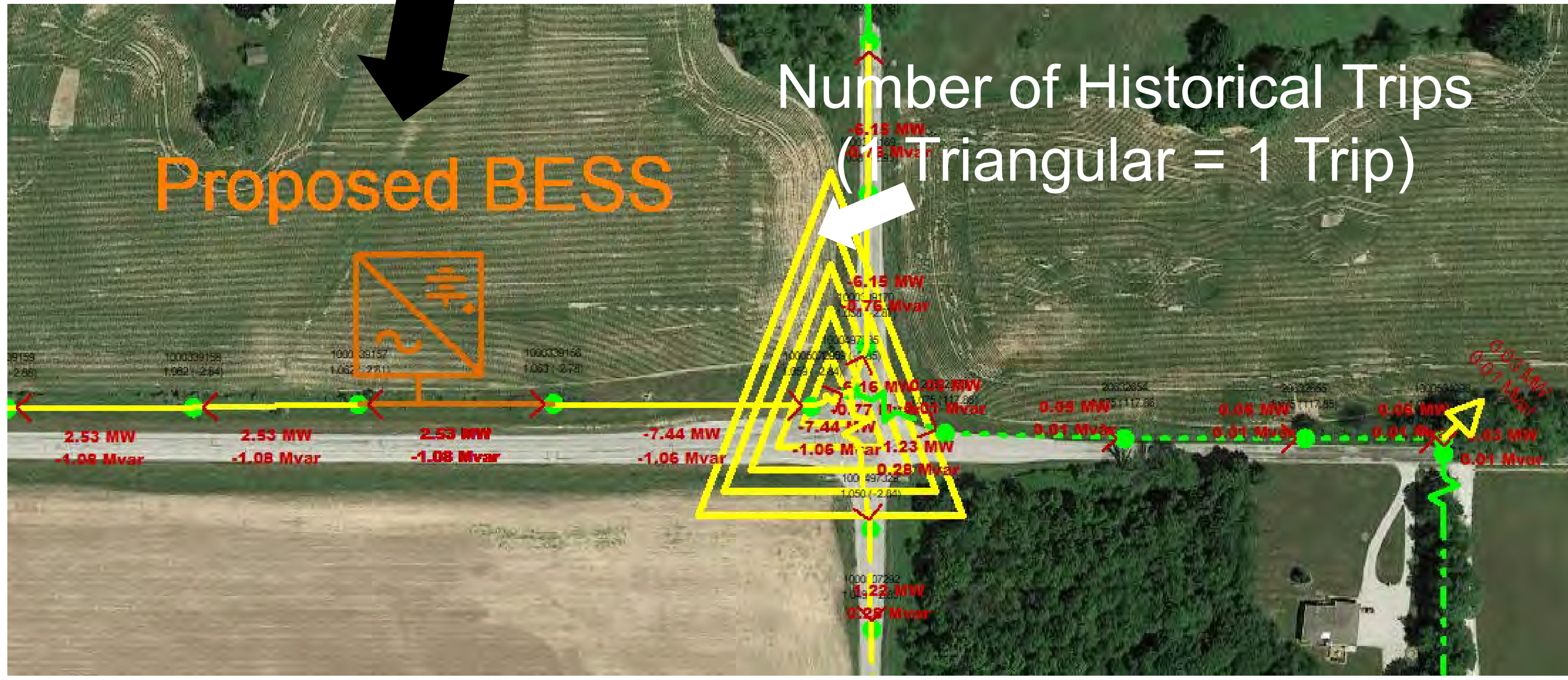


Example of a Battery Energy Storage System (BESS) (a Non-Wire Alternative)

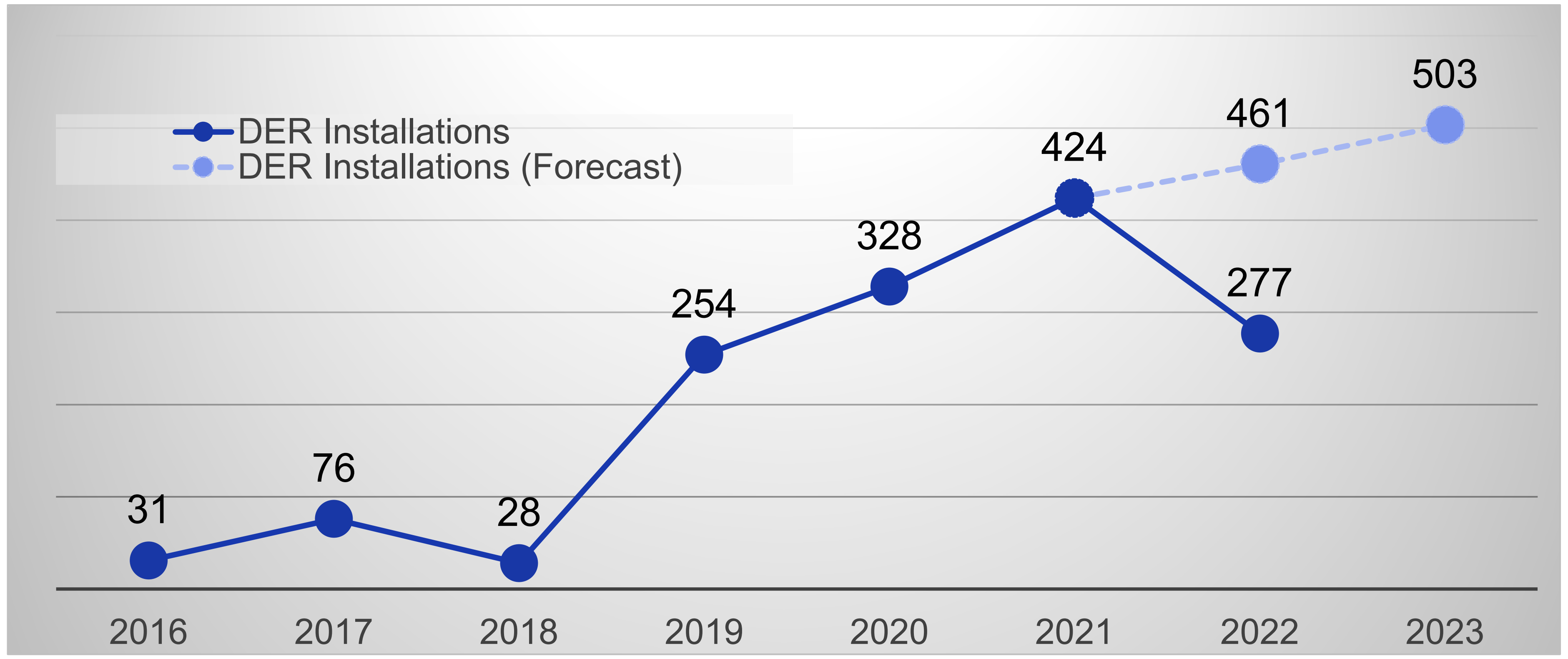
Substation

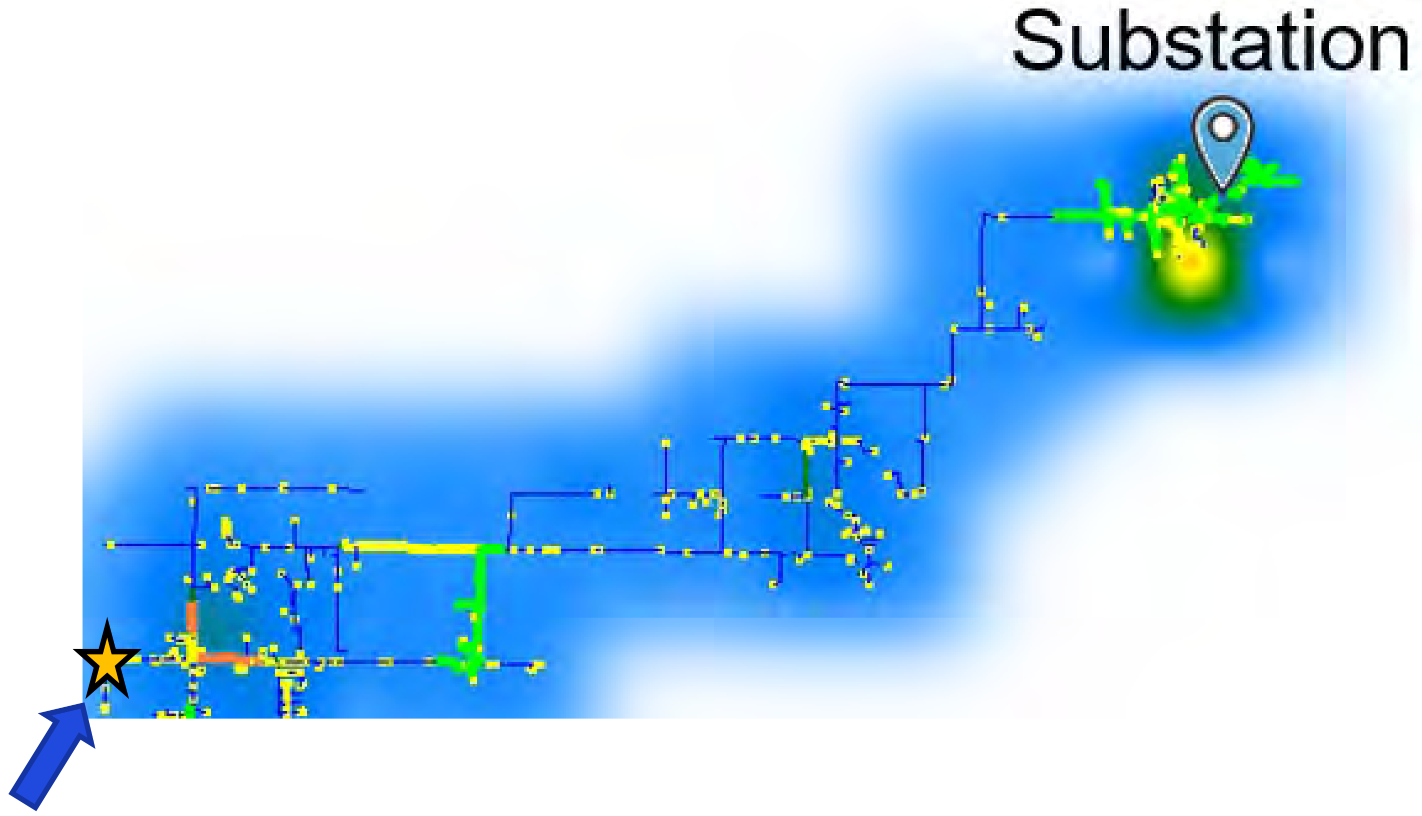


Form a Microgrid when the highlighted isolation device trips



Distributed Energy Resources





Targeted solar to solve thermal issue, part of planning toolbox

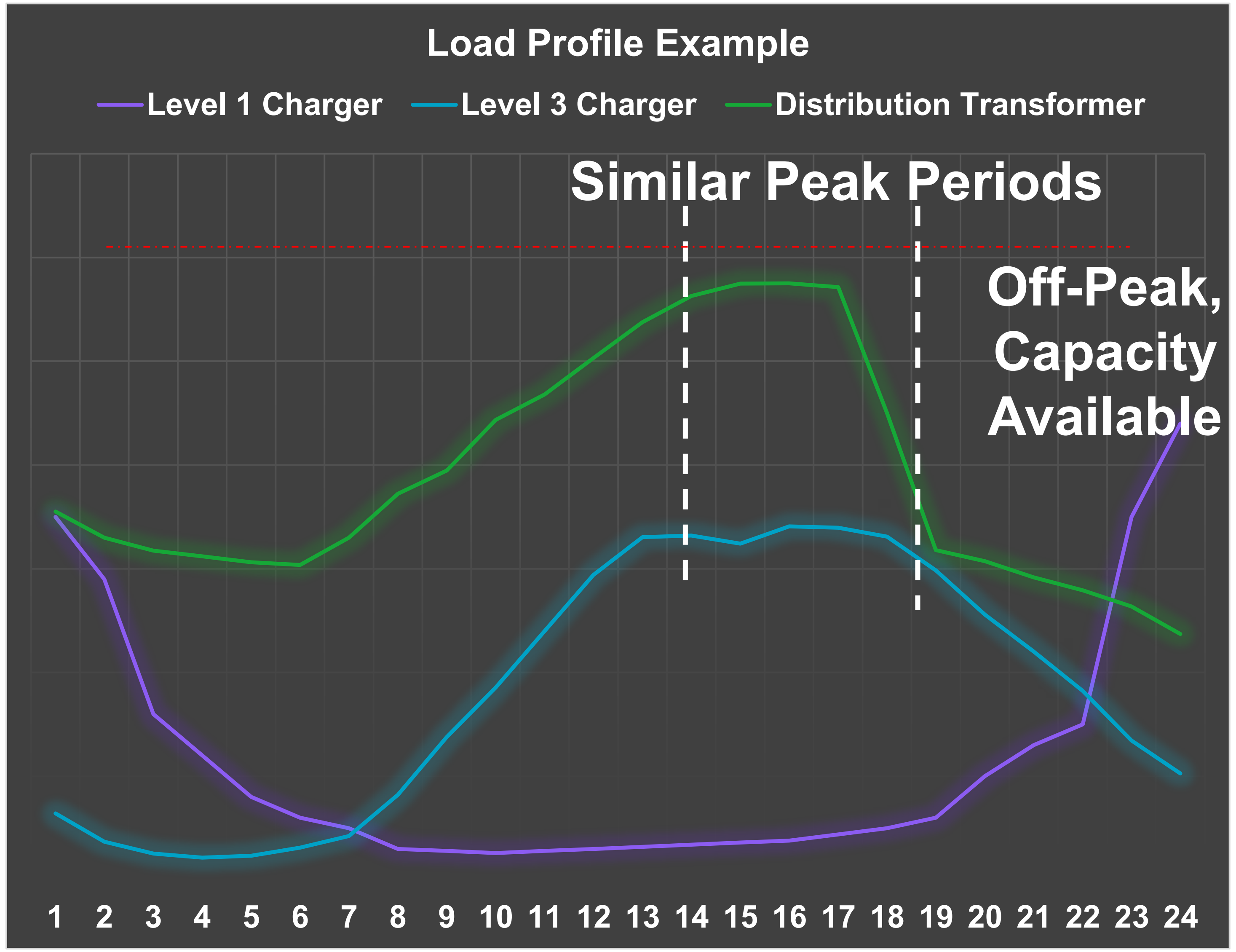
Electric Vehicles

Distribution planning considerations for electric vehicles (ev's)

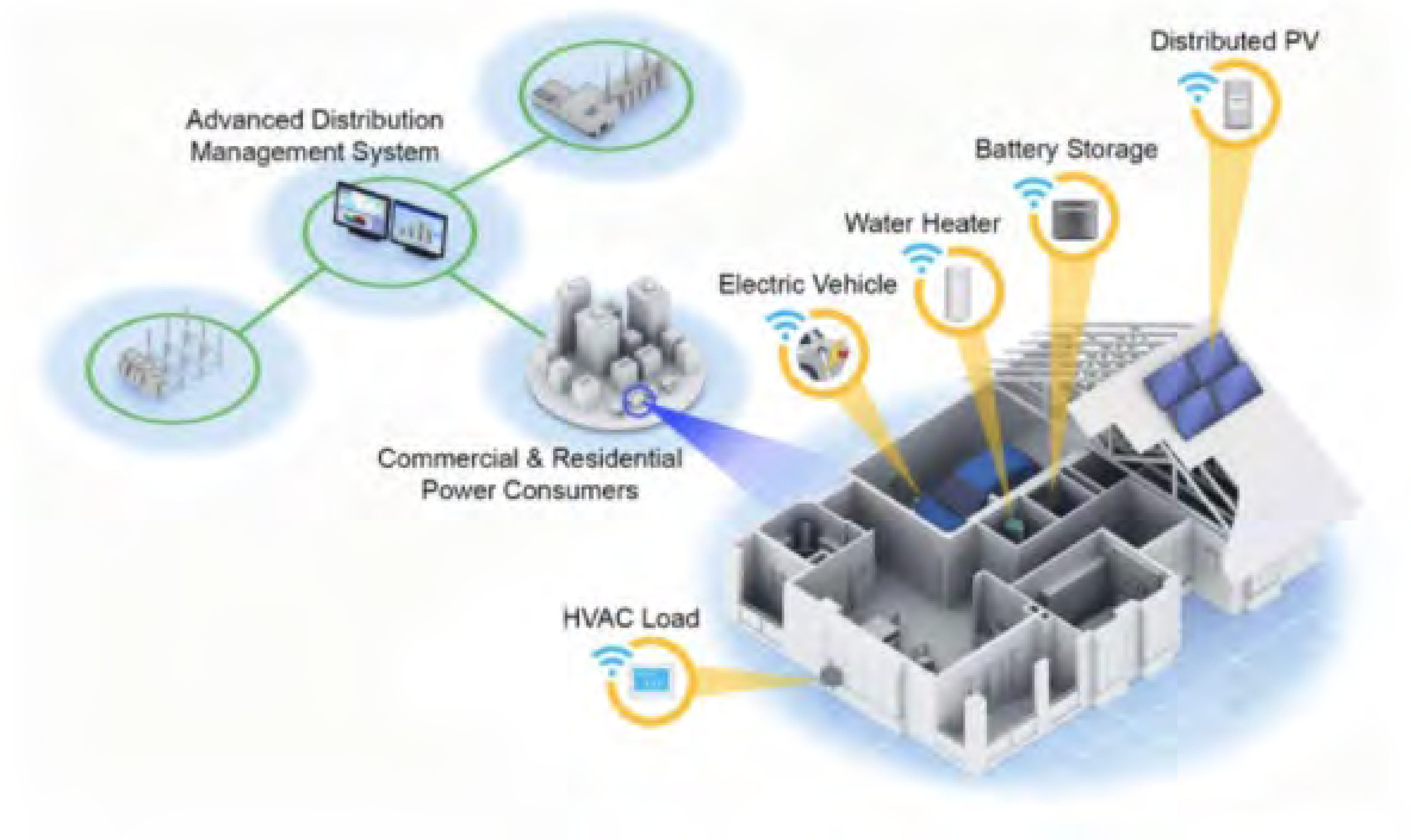
- Level 1 and 2 charging are generally manageable for capacity planning assuming effective time of use (TOU) charging rates are in place.
- Level 3 charging is more problematic due to the peak load occurring simultaneously with the grid peak and at much higher magnitudes.
- Fleet charging requests have been limited but we see the potential for very large loads in this space that may have a major impact on system planning.

Demand forecasting & network modeling

- AES will account for EV growth by taking the resource planning top-down forecast and utilizing our demand forecasting parcel level EV propensity model to allocate it down to the circuits and feeders.
- AES will study the multiple scenarios developed around EV charging in our network models to determine if capacity upgrades will be required. In combination with other system needs on a particular circuit, there could be multiple ways to plan for solutions such as traditional asset upgrades, strategic battery placements, optimally placed circuit ties, optimal DER placements, etc.



FERC Order 2222



Importance of FERC Order 2222

- FERC Order No. 2222 enables distributed energy resources (DERs) aggregators to compete in wholesale electric markets such as MISO

- DERs can range from solar to battery storage, demand response, energy efficiency, thermal storage, electric vehicles and their charging equipment. DERs can locate on the distribution system and/or behind a customer meter

Distribution Planning Considerations:

- Distribution Aggregation studies will need to be completed.
- Furthers the need for connected T&D systems, processes, and interconnection portals as DER is integrated into MISO markets.
- Modernization of interconnection databases for tracking all DERs and their technical specifications.
- Potential for significant increases to DER interconnection study volumes, complexity, and size expected.
- Long-term forecasting of DERs, DERAs, and their performance impacts
- Potential need for distribution energy storage locally to manage the variability on each circuit.

Expedites and further justifies the need to expand smart grid operations & programs (AMI, ADMS, GIS, etc.).

- Basic levels of visibility and monitoring will be required for the continued safe operation of the system.
- Need to perform RTO day ahead and real time market studies with adequate visibility and monitoring.
- Enhancement of distribution system operator and market roles.

Conclusion

Strategic Organizational Alignment between Resource & T&D planning

Advanced Demand Forecasting, Connected top-down & bottom-up load forecasting

Advanced Modeling & Analysis, utilization of advanced power flow tools

Cutting-Edge Grid Operations, Utilization of ADMS to be Grid of the Future

Final Q&A and Next Steps

Public Advisory Meeting

Public Advisory Meeting #1	Public Advisory Meeting #2	Public Advisory Meeting #3	Public Advisory Meeting #4	Public Advisory Meeting #5
Jan. 24, 2022	**April 12, 2022**	**June 27, 2022**	**August 2022**	**October 2022**

→ All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.

→ A Technical Meeting will be held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Advisory Meeting.

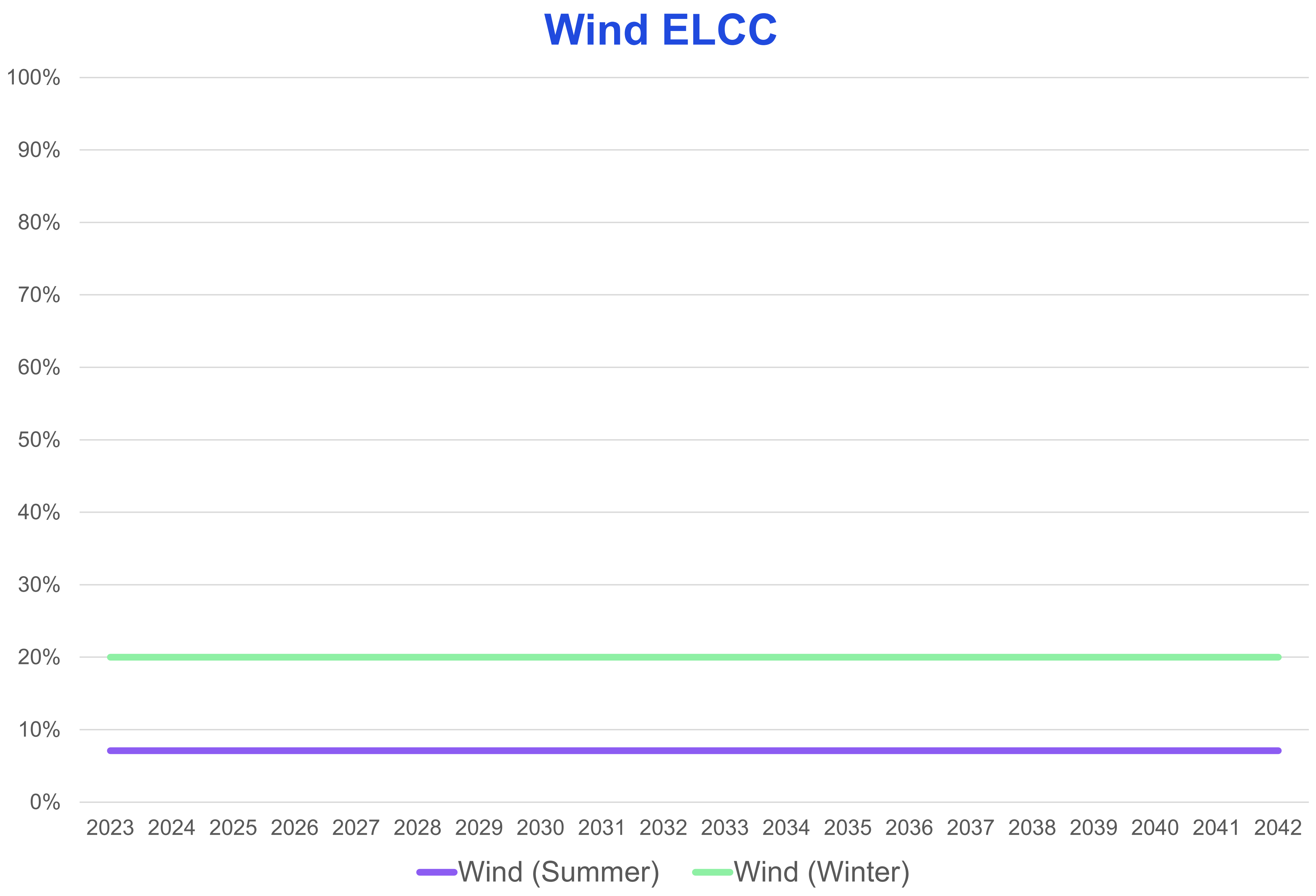
→ Meeting materials can be accessed at ***www.aesindiana.com/integrated-resource-plan.***

Thank You

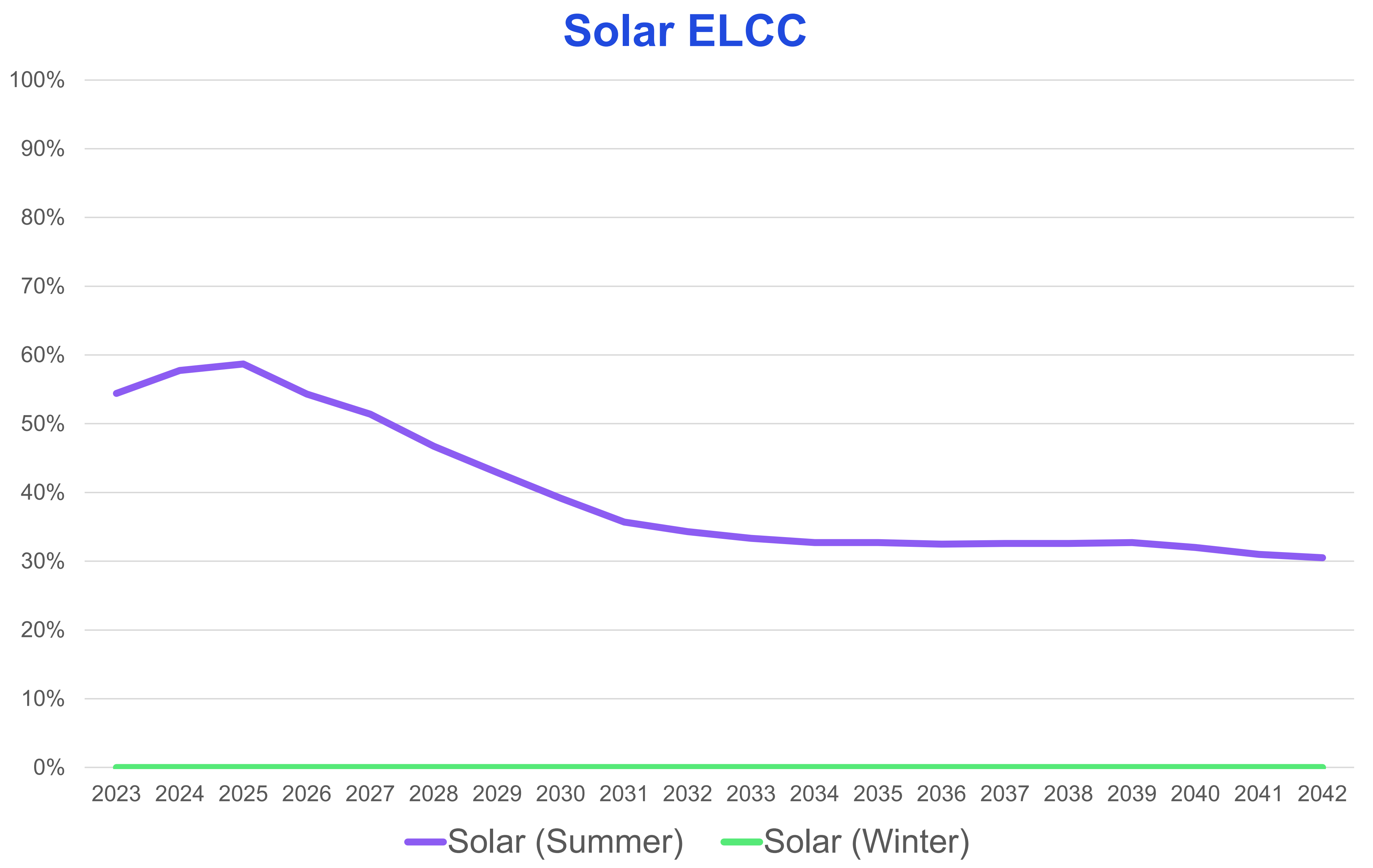
Appendix

Wind Parameters

- **Location:** Indiana
- **Annual Capacity Factor:** 33.6 – 40.4%
- **Source Profile:** NREL System Advisory Model (SAM)
- **Project Size:** 50 MW ICAP
- **Useful Life:** 30 years
- **Summer ELCC (2025):** 7.1%; *Source: Horizons Energy*
- **Winter ELCC:** 20%; *Source: MISO RAN*



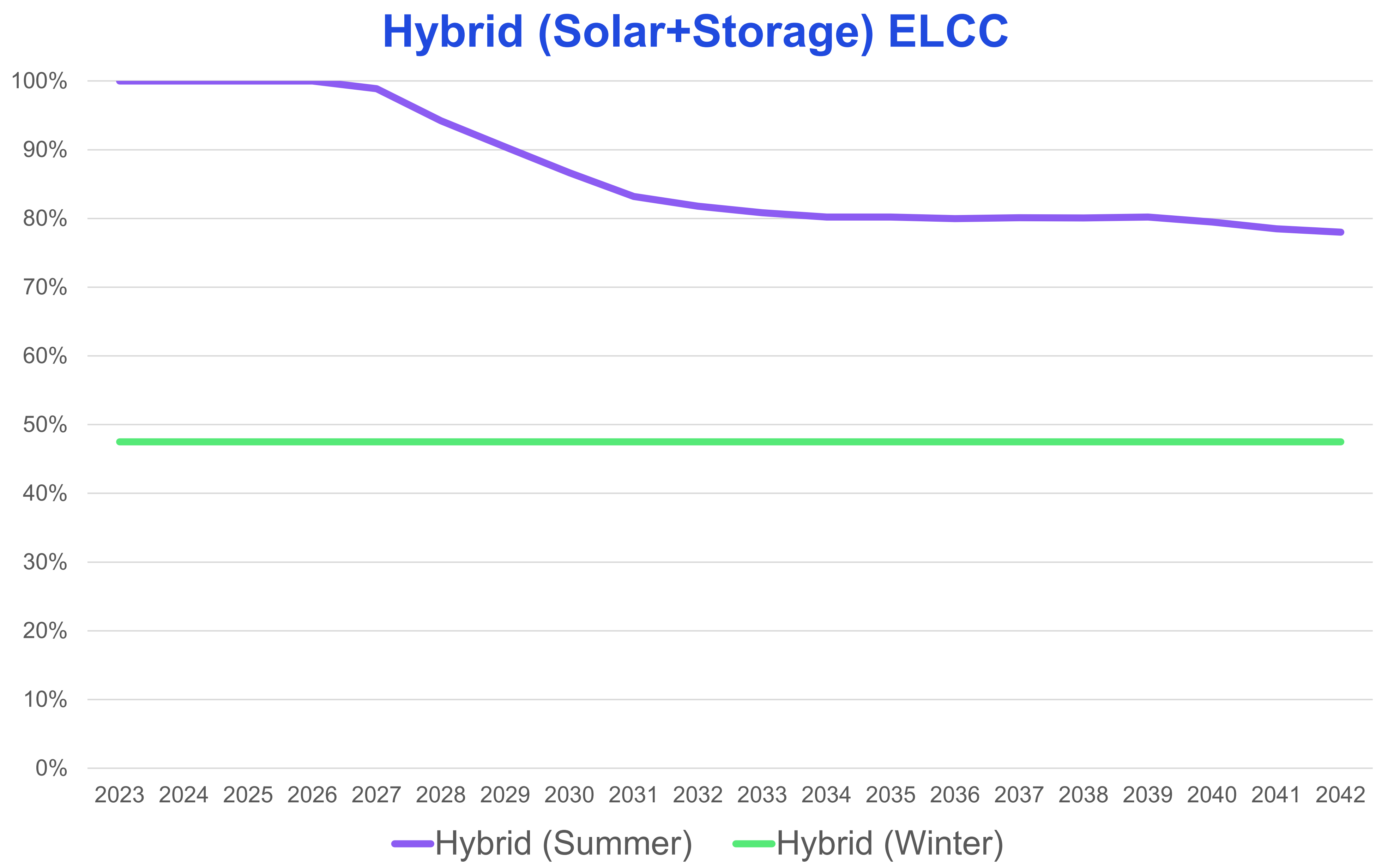
Solar Parameters



*Summer ELCC forecast presented in chart is from the Horizon Custom Reference Case – ELCC forecast will vary by custom scenario

Solar + Storage Parameters

- **Location:** Petersburg, Indiana
- **System:** DC Coupled Solar + Storage System, Storage charges exclusively from the solar array
- **Solar Component:** Identical to stand-alone solar (25 MW ICAP)
- **Storage Component:** 12.5 MW ICAP | 50 MWh
- **Synergies:** 4.3% reduction in capital costs, 2% improvement of RTE
- **Summer ELCC (2025):** 100%
- **Winter ELCC:** 48%



IRP Acronyms

https://www.aesindiana.com/integrated-resource-plan.

IRP Acronyms

- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVD: Countervailing Duties
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DERA: Distributed Energy Resource Aggregation
- DERMS: Distributed Energy Resource Management System
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOC: U.S. Department of Commerce
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DMS: Distribution Management System
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- ESCR: Effective Selective Catalytic Reduction System
- EV: Electric Vehicle
- FLOC: Federated Learning of Cohorts
- GDP: Gross Domestic Product
- GFL: Grid-Following System
- GIS: Geographic Information System
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IBR: Inverter-Based Resource
- IC: Indiana Code
- ICE: Intercontinental Exchange
- ICAP: Installed Capacity
- IEEE: Institute of Electrical and Electronics Engineers
- IRP: Integrated Resource Plan

IRP Acronyms

- PRA: Planning Resource Auction
- PSSE: Power System Simulator for Engineering
- PTC: Renewable Electricity Production Tax Credit
- PRMR: Planning Reserve Margin Requirement
- PV: Photovoltaic
- PVRR: Present Value Revenue Requirement
- PY: Planning Year
- RA: Resource Adequacy
- RAN: Resource Availability and Need
- RAP: Realistic Achievable Potential
- RCx: Retrocommissioning
- REC: Renewable Energy Credit
- REP: Renewable Energy Production
- RFP: Request for Proposals
- RIIA: MISO’s Renewable Integration Impact Assessment
- RTO: Regional Transmission Organization
- SAC: MISO’s Seasonal Accredited Capacity
- SAE: Small Area Estimation
- SCADA: Supervisory Control and Data Acquisition
- SCR: Selective Catalytic Reduction System
- SEM: Strategic Energy Management
- SO2: Sulfur Dioxide
- SMR: Small Modular Reactors
- ST: Steam Turbine
- SUFG: State Utility Forecasting Group
- T&D: Transmission and Distribution
- TOU: Time-of-Use
- TRM: Technical Resource Manual
- UCT: Utility Cost Test
- UCAP: Unforced Capacity
- VAR: Volt-Amp Reactive
- VPN: Virtual Private Network
- WTP: Willingness to Participate
- XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control

2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #4

9/19/2022

aes Indiana

Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates

Agenda

Time	Topic	Speakers
Morning Starting at 10:00 AM	Virtual Meeting Protocols and Safety	Chad Rogers, Director, Regulatory Affairs, AES Indiana
	Welcome and Opening Remarks	Kristina Lund, President & CEO, AES Indiana
	Stakeholder Presentations	Bhawramaett Broehm, Market Development Analyst, Wartsila Marcus Nichol, Senior Director, Nuclear Energy Institute
	IRP Schedule & Timeline	Erik Miller, Manager, Resource Planning, AES Indiana
	IRP Framework Review & Modeling Updates	Erik Miller, Manager, Resource Planning, AES Indiana
	Retirement & Replacement Analysis Results	Erik Miller, Manager, Resource Planning, AES Indiana
Break 12:00 PM – 12:30 PM	Lunch	
Afternoon Starting at 12:30 PM	Replacement Resource Cost Sensitivity Analysis Results	Erik Miller, Manager, Resource Planning, AES Indiana
	Preliminary IRP Scorecard Results	Erik Miller, Manager, Resource Planning, AES Indiana
	Final Q&A and Next Steps	

Virtual Meeting Protocols and Safety

Chad Rogers, Director, Regulatory Affairs, AES Indiana

IRP Team Introductions

AES Indiana Leadership Team

Kristina Lund, President & CEO, AES Indiana
Aaron Cooper, Chief Commercial Officer, AES Indiana
Brandi Davis-Handy, Chief Customer Officer, AES Indiana
Tanya Sovinski, Senior Director, Public Relations, AES Indiana
Ahmed Pasha, Chief Financial Officer, AES Indiana
Tom Raga, Vice President Government Affairs, AES Indiana
Sharon Schroder, Senior Director, Regulatory Affairs, AES Indiana
Kathy Storm, Vice President, US Smart Grid, AES Indiana

AES Indiana IRP Planning Team

Joe Bocanegra, Load Forecasting Analyst, AES Indiana
Erik Miller, Manager, Resource Planning, AES Indiana
Scott Perry, Manager, Regulatory Affairs, AES Indiana
Chad Rogers, Director, Regulatory Affairs, AES Indiana
Mike Russ, Senior Manager, T&D Planning & Forecasting, AES Asset Management
Brent Selvidge, Engineer, AES Indiana
Will Vance, Senior Analyst, AES Indiana
Kelly Young, Director, Public Relations, AES Indiana

AES Indiana IRP Partners

Annette Brocks, Senior Resource Planning Analyst, ACES
Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group
Eric Fox, Director, Forecasting Solutions, Itron
Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates
Jordan Janflone, EV Modeling Forecasting, GDS Associates
Patrick Maguire, Executive Director of Resource Planning, ACES
Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology
Stewart Ramsey, Managing Executive, Vanry & Associates
Mike Russo, Forecast Consultant, Itron
Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates
Melissa Young, Demand Response Lead, GDS Associates
Danielle Powers, Executive Vice President, Concentric Energy Advisors
Meredith Stone, Senior Project Manager, Concentric Energy Advisors

AES Indiana Legal Team

Nick Grimmer, Indiana Regulatory Counsel, AES Indiana
Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP

Welcome to Today’s Participants

Advanced Energy Economy
Alliance Coal
Barnes & Thornburg LLP
Bose, McKinney & Evans LLP
CenterPoint Energy
Citizens Action Coalition
City of Indianapolis
Clean Grid Alliance
Demand Side Analytics
Develop Indy | Indy Chamber
Energy Futures Group
Faith in Place
Hallador Energy
Hoosier Energy
Hoosier Environmental Council
IBEW Local Union 1395
Indiana Chamber
Indiana DG
Indiana Distributed Energy Alliance
Indiana Energy Association
Indiana Office of Energy Development
Indiana Utility Regulatory Commission
Indiana State Conference of the NAACP

IUPUI
M&G
Midwest Energy Efficiency Alliance
Midcontinent Independent System Operator (MISO)
NIPSCO
Nuclear Energy Institute
NuScale Power
Office of Utility Consumer Counselor
Power Takeoff
Purdue - State Utility Forecasting Group
Ranger Power
Rolls-Royce/ISS
Sierra Club
Solar United Neighbors
UUI Green Team
Wartsila

… and members of the AES Indiana team and the public!

Virtual Meeting Best Practices

Questions

- Your candid feedback and input is an integral part to the IRP process.
- Questions or feedback will be taken at the end of each section.
- Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

- All lines are muted upon entry.
- For those using audio via Teams, you can unmute by selecting the microphone icon.
- If you are dialed in from a phone, press *6 to unmute.

Video

- Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.

AES Purpose & Values

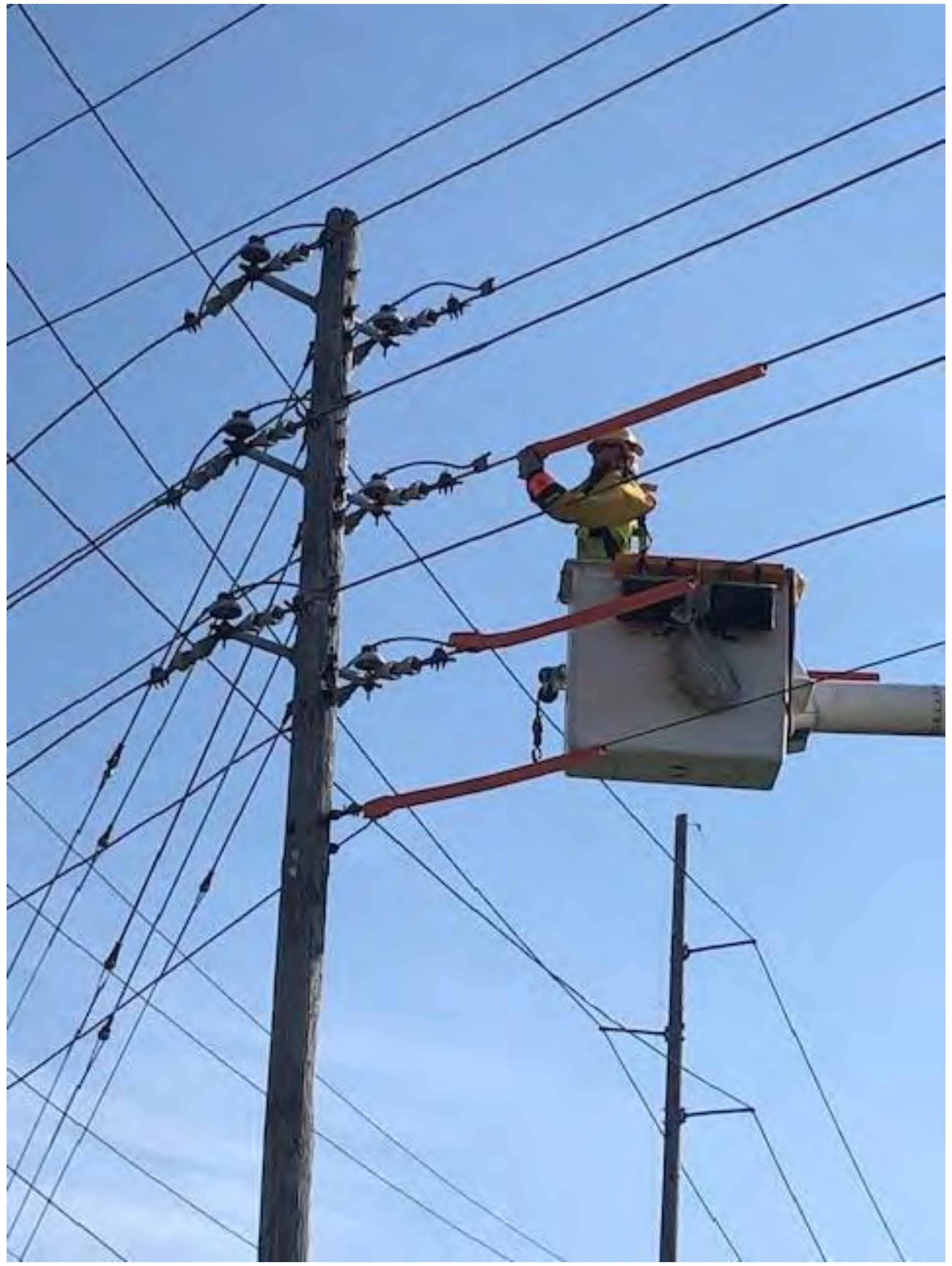
Accelerating the future of energy, **together**.

Safety first

Highest standards

All together

Safety First



1. AES Indiana strives to provide a place of employment that is free from recognized hazards and one that meets or exceeds governmental regulations regarding occupational health and safety.

2. AES Indiana considers occupational health and safety a fundamental value of the organization and is a key performance indicator of the overall success of the company.

3. AES Indiana's ultimate objective is that each day all AES Indiana people, contractors, and the public we serve return home to their family, friends, and community free from harm.

IRP Overview

Advisory Meeting #1 (January 24): AES Indiana Resource Planning team recapped the 2019 IRP Short-Term Action Plan, introduced the IRP resource planning process and model overview, and highlighted existing resources, replacement resource options and future IRPs.

Advisory Meeting #2 (April 12): AES Indiana Resource Planning team presented load scenarios, results of the market potential study, commodity forecasts and distribution system planning items, and shared additional analysis of reliability that will give insight into how AES Indiana is working to ensure any changes to its portfolio maintain reliable service 24/7/365 for its customers.

IRP Overview

Advisory Meeting #3 (June 27): AES Indiana's Resource Planning team discussed system planning and RTO reliability planning, presented content on modeling reliability, and provided an overview of Portfolio metrics and scorecard. We welcomed presentations from MISO, Sierra Club and Faith in Place.

Today, the AES Indiana Resource Planning team will cover results from preliminary core IRP modeling and the scorecard, which evaluates multiple strategies and scenarios using defined cost, environmental, reliability and risk metrics.

We thank you for your input into this important process!

AES Indiana and the IRP

- → The IRP is a unique opportunity for AES Indiana to engage with our customers, communities and stakeholders to analyze our energy future, together.
- → The in-depth analysis and stakeholder input will position AES Indiana to best serve our customers' needs today and well into the future.

AES Indiana and Our Stakeholders

- The IRP process has allowed us to engage with many stakeholders through our Advisory Meetings and Technical Meetings and through their participation, questions, input and stakeholder presentations.
- We are listening and taking feedback seriously. Through our collaboration, the IRP team has:
  - Evaluated all feedback
  - Added the Clean Energy Strategy
  - Worked collaboratively with stakeholders on key inputs

Meeting our customers’ needs today and tomorrow

AES Indiana
is leading the
inclusive,
clean energy
transition.

Reliability

Affordability

Sustainability

Stakeholder Presentations

Bhawramaett Broehm, Market Development Analyst, Wartsila

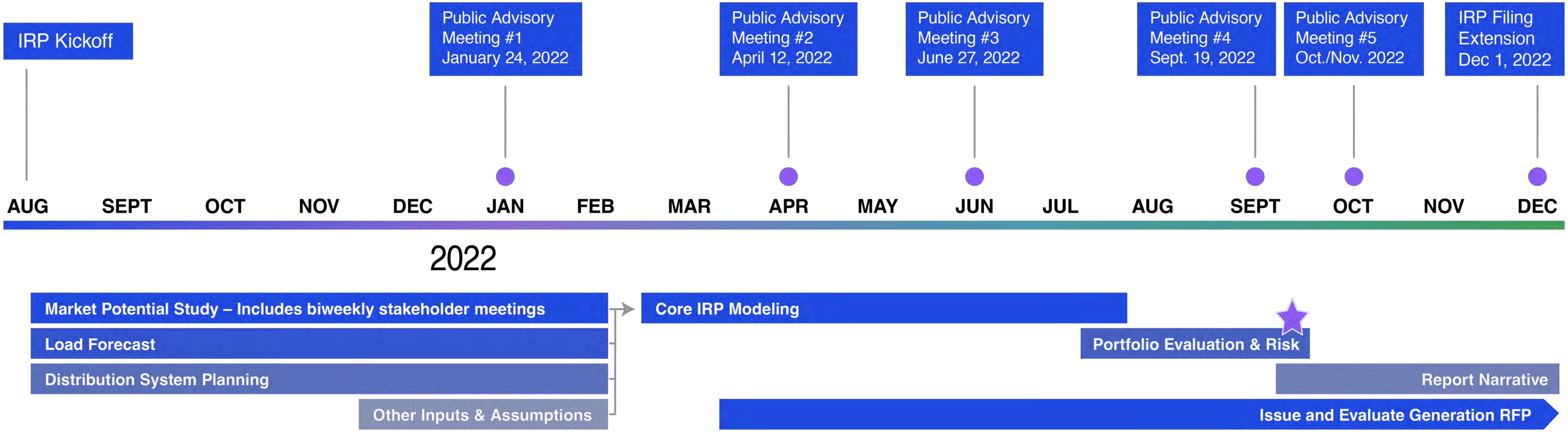
Stakeholder Presentations

Marcus Nichol, Senior Director, Nuclear Energy Institute

IRP Schedule & Timeline

Erik Miller, Manager, Resource Planning, AES Indiana

Updated 2022 IRP Timeline



IRP Kickoff

Public Advisory Meeting #1 January 24, 2022

Public Advisory Meeting #2 April 12, 2022

Public Advisory Meeting #3 June 27, 2022

Public Advisory Meeting #4 Sept. 19, 2022

Public Advisory Meeting #5 Oct./Nov. 2022

IRP Filing Extension Dec 1, 2022

Market Potential Study – Includes biweekly stakeholder meetings

Load Forecast

Distribution System Planning

Other Inputs & Assumptions

Core IRP Modeling

Portfolio Evaluation & Risk

Report Narrative

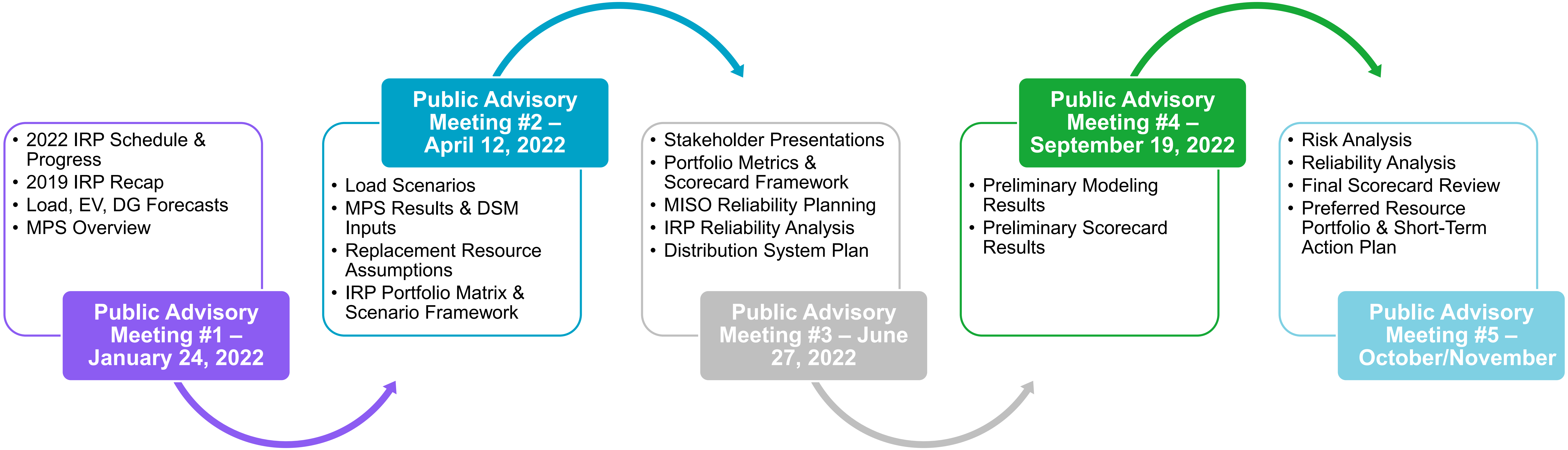
Issue and Evaluate Generation RFP

● = Stakeholder Technical Meeting for stakeholders with executed NDAs held the week before each public stakeholder meeting

★ = Preferred Resource Portfolio selected

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.

Public Advisory Schedule



- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #1 – January 24, 2022

Public Advisory Meeting #2 – April 12, 2022

- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

- Stakeholder Presentations
- Portfolio Metrics & Scorecard Framework
- MISO Reliability Planning
- IRP Reliability Analysis
- Distribution System Plan

Public Advisory Meeting #3 – June 27, 2022

Public Advisory Meeting #4 – September 19, 2022

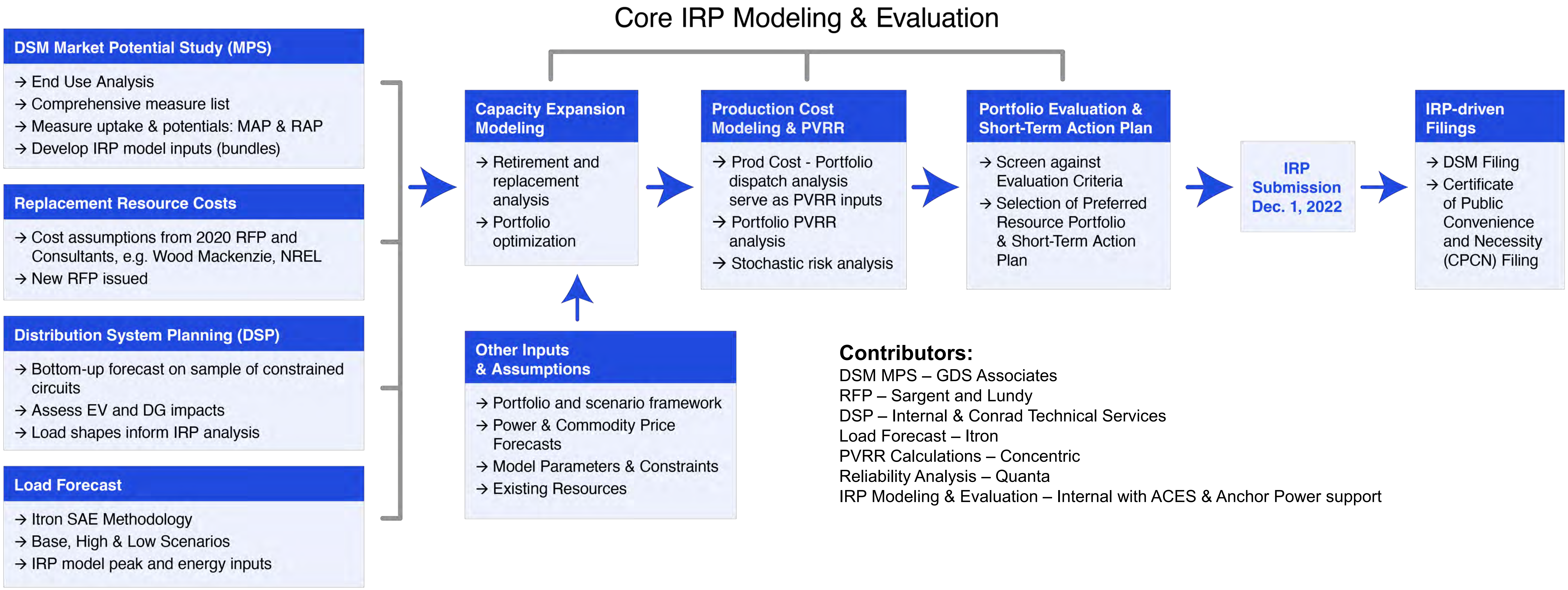
- Preliminary Modeling Results
- Preliminary Scorecard Results

- Risk Analysis
- Reliability Analysis
- Final Scorecard Review
- Preferred Resource Portfolio & Short-Term Action Plan

Public Advisory Meeting #5 – October/November

Topics for meeting 5 are subject to change.

IRP Process Overview



DSM Market Potential Study (MPS)
- → End Use Analysis
- → Comprehensive measure list
- → Measure uptake & potentials: MAP & RAP
- → Develop IRP model inputs (bundles)

Replacement Resource Costs
- → Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
- → New RFP issued

Distribution System Planning (DSP)
- → Bottom-up forecast on sample of constrained circuits
- → Assess EV and DG impacts
- → Load shapes inform IRP analysis

Load Forecast
- → Itron SAE Methodology
- → Base, High & Low Scenarios
- → IRP model peak and energy inputs

Core IRP Modeling & Evaluation

Capacity Expansion Modeling
- → Retirement and replacement analysis
- → Portfolio optimization

Production Cost Modeling & PVRR
- → Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
- → Portfolio PVRR analysis
- → Stochastic risk analysis

Portfolio Evaluation & Short-Term Action Plan
- → Screen against Evaluation Criteria
- → Selection of Preferred Resource Portfolio & Short-Term Action Plan

IRP Submission Dec. 1, 2022

IRP-driven Filings
- → DSM Filing
- → Certificate of Public Convenience and Necessity (CPCN) Filing

Other Inputs & Assumptions
- → Portfolio and scenario framework
- → Power & Commodity Price Forecasts
- → Model Parameters & Constraints
- → Existing Resources

Contributors:

DSM MPS – GDS Associates
RFP – Sargent and Lundy
DSP – Internal & Conrad Technical Services
Load Forecast – Itron
PVRR Calculations – Concentric
Reliability Analysis – Quanta
IRP Modeling & Evaluation – Internal with ACES & Anchor Power support

Modeling Updates & IRP Framework Review

Erik Miller, Manager, Resource Planning, AES Indiana

Model Constraints

Capacity Expansion models require constraints to provide meaningful results. There are three main constraints AES Indiana utilized:

Limiting Capacity Purchases and Sales

→ Prevents the selection of a portfolio that relies excessively on market purchases for capacity or on uncertain revenues associated with selling capacity. The constraint is ~50 MW.

Limiting Energy Purchases and Sales

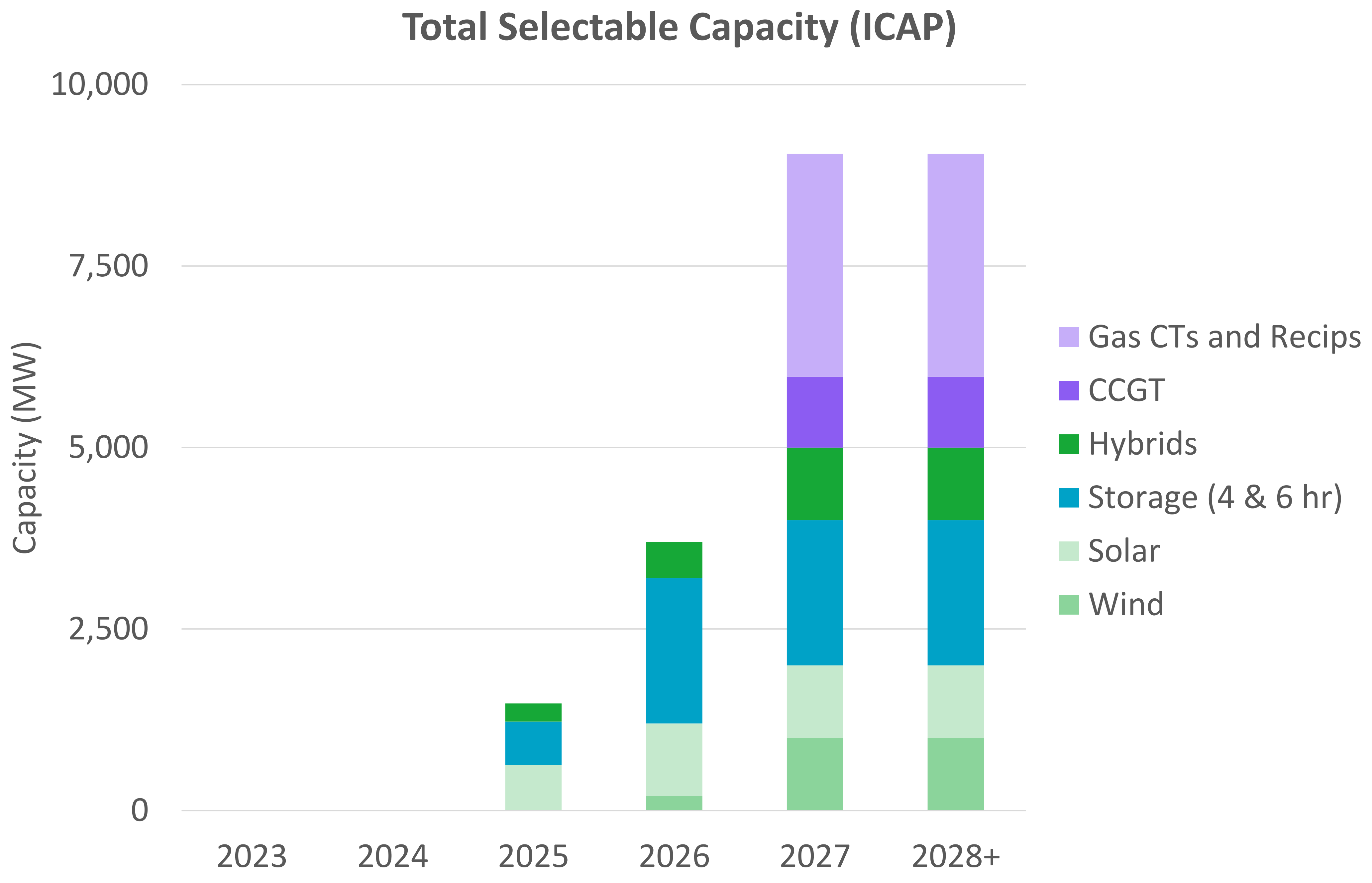
→ Selects a portfolio that covers at least 90% of AES Indiana’s energy sales on an annual basis, limiting reliance on the market.

→ Also prevents a portfolio that sells more than 10% above AES Indiana's expected energy sales on an annual basis, limiting reliance on uncertain energy revenue. Excess generation is assumed to be curtailed.

Model Constraints *(continued)*

Limiting the Build of New Resources

- Prevents the model from selecting resources in the near term that cannot practically be executed and are not supported by recent RFP responses.
  - Earliest build is ~1,500 MW (ICAP) of Solar, Storage, and Hybrids in 2025
  - By 2027, can build ~1,000 MW (ICAP) of any technology per year
  - Over the 20-year time span, can build a max of ~2,000 MW of any one technology

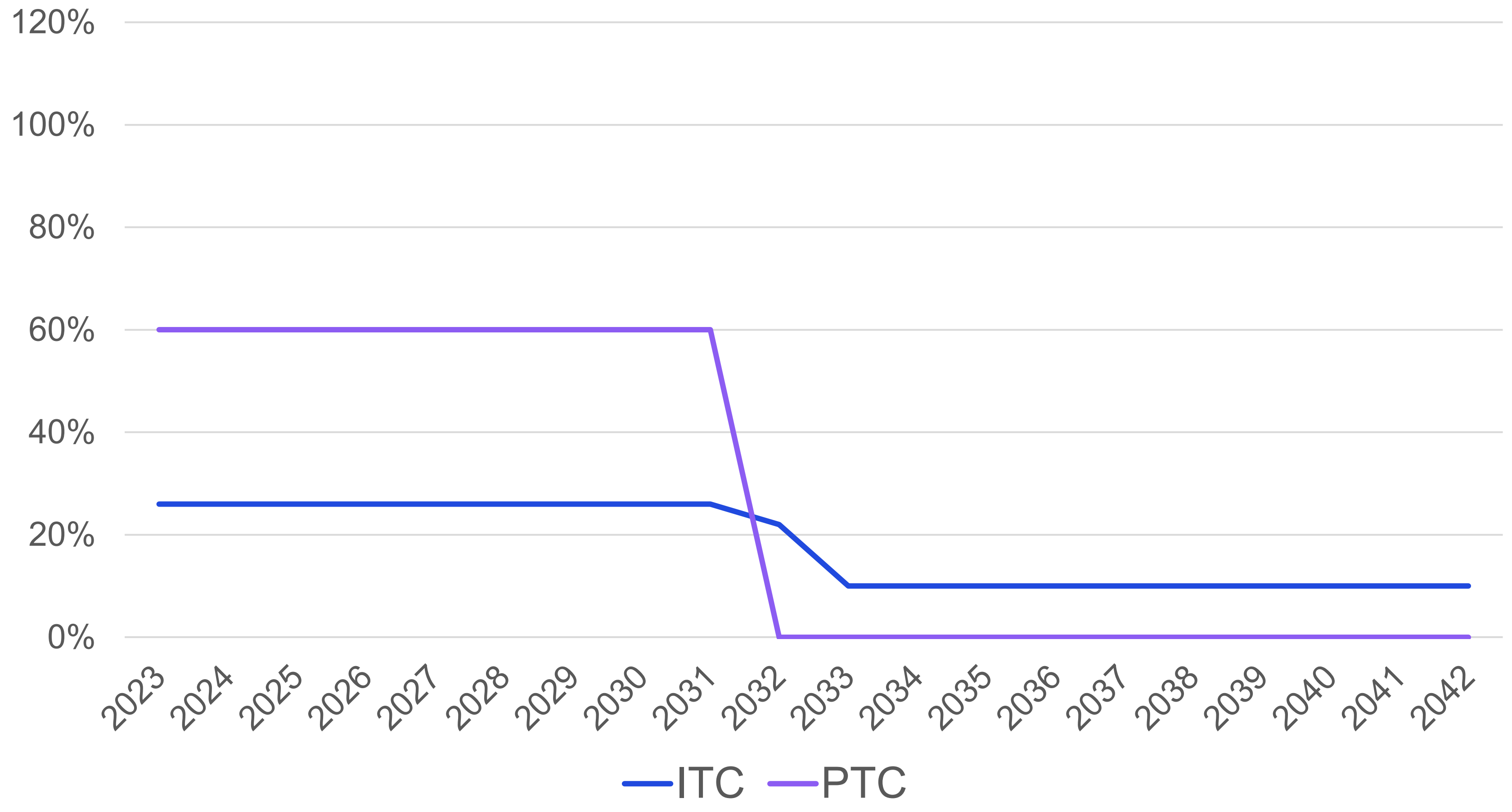


Modeling Updates

Inflation Reduction Act of 2022 (IRA) included in Current Trends

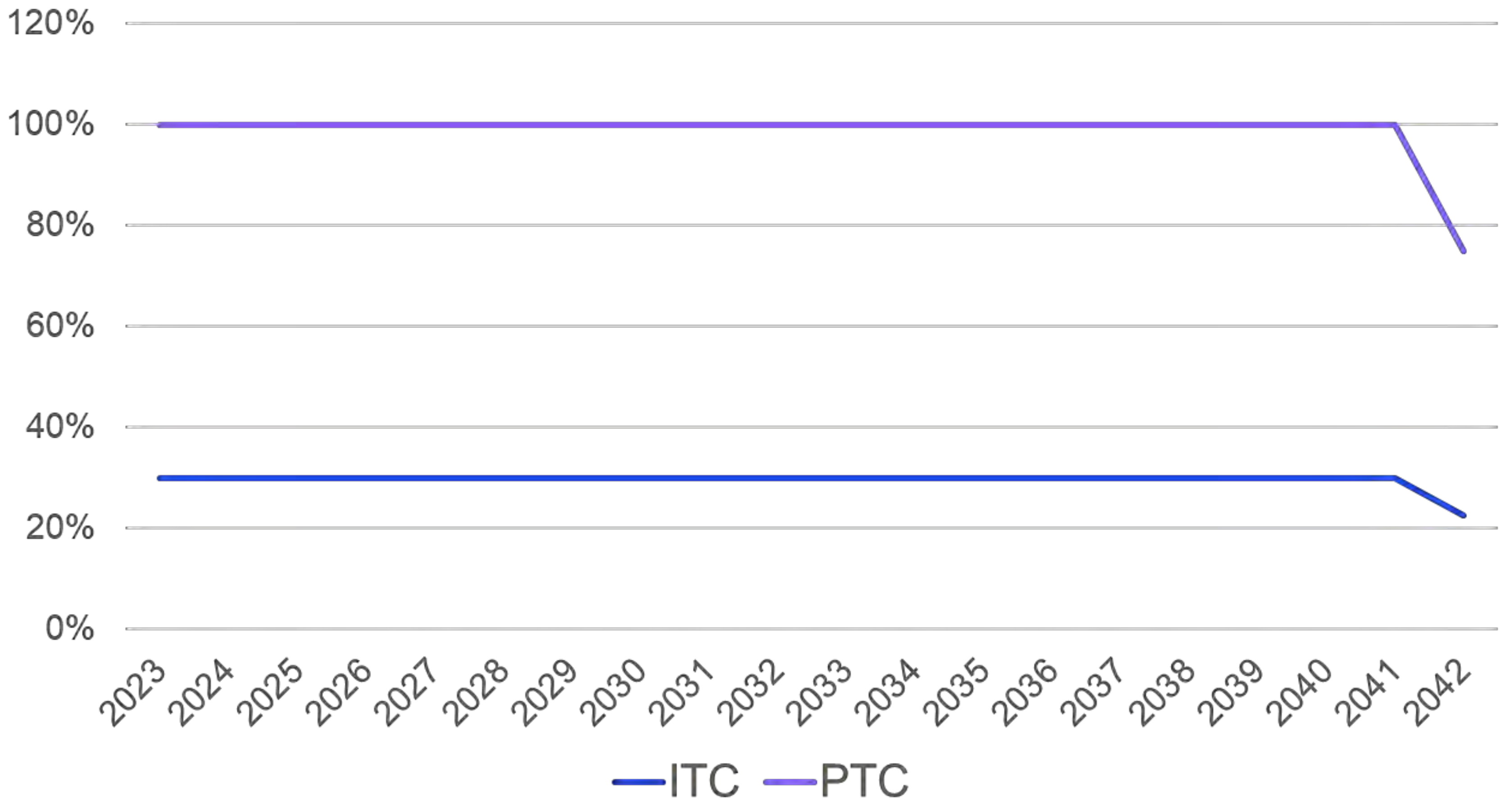
- IRA passed House and Senate and signed into law in August
- Legislation changes the Current Trends (Reference Case) assumptions for the ITC and PTC

Original – as presented in Public Advisory Meeting #2, April 12, 2022



Original Current Trends – Five one-year tax credit extensions

Updated – aligns with the IRA tax provisions



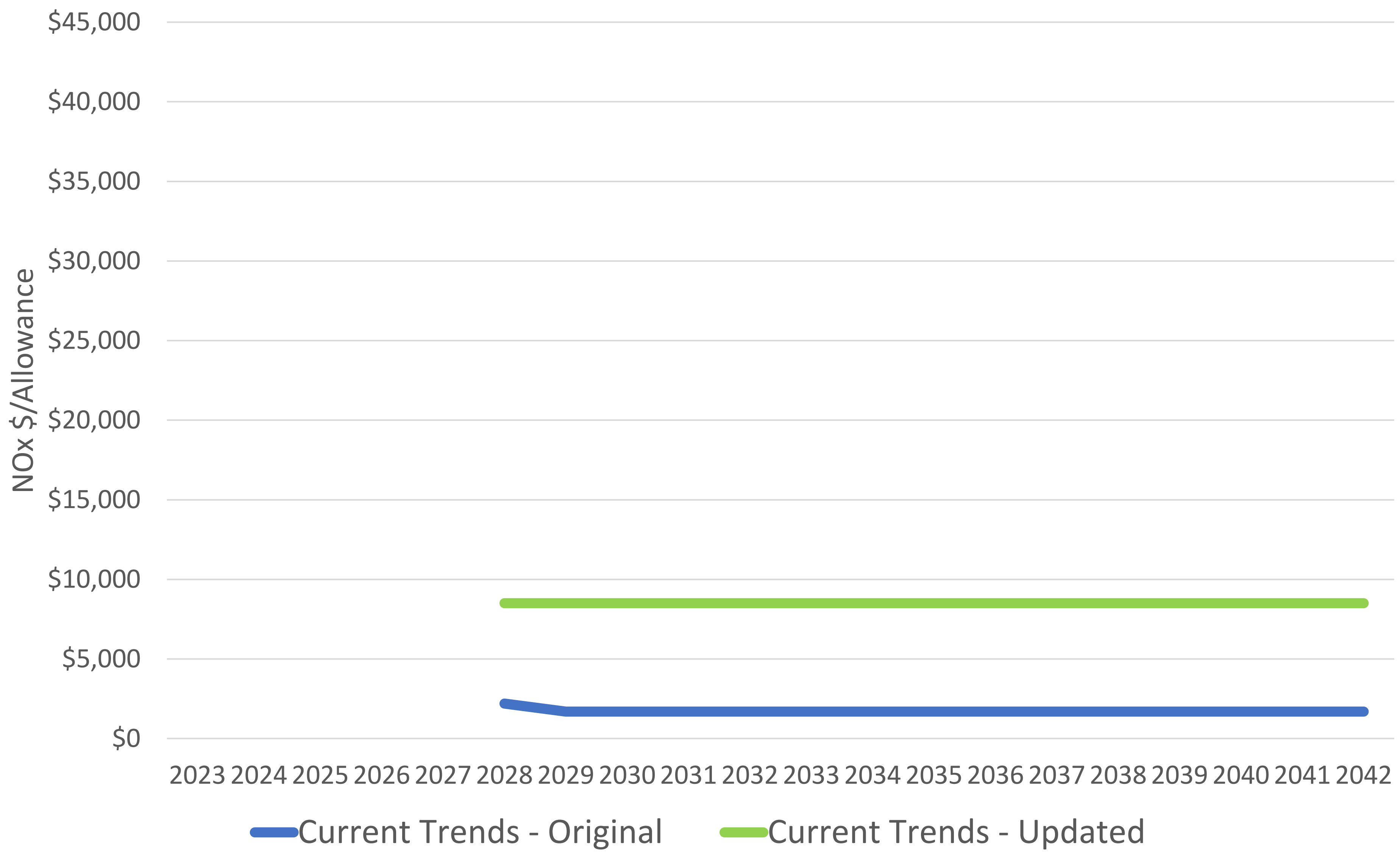
Revised Current Trends – Ten-year tax credit extension

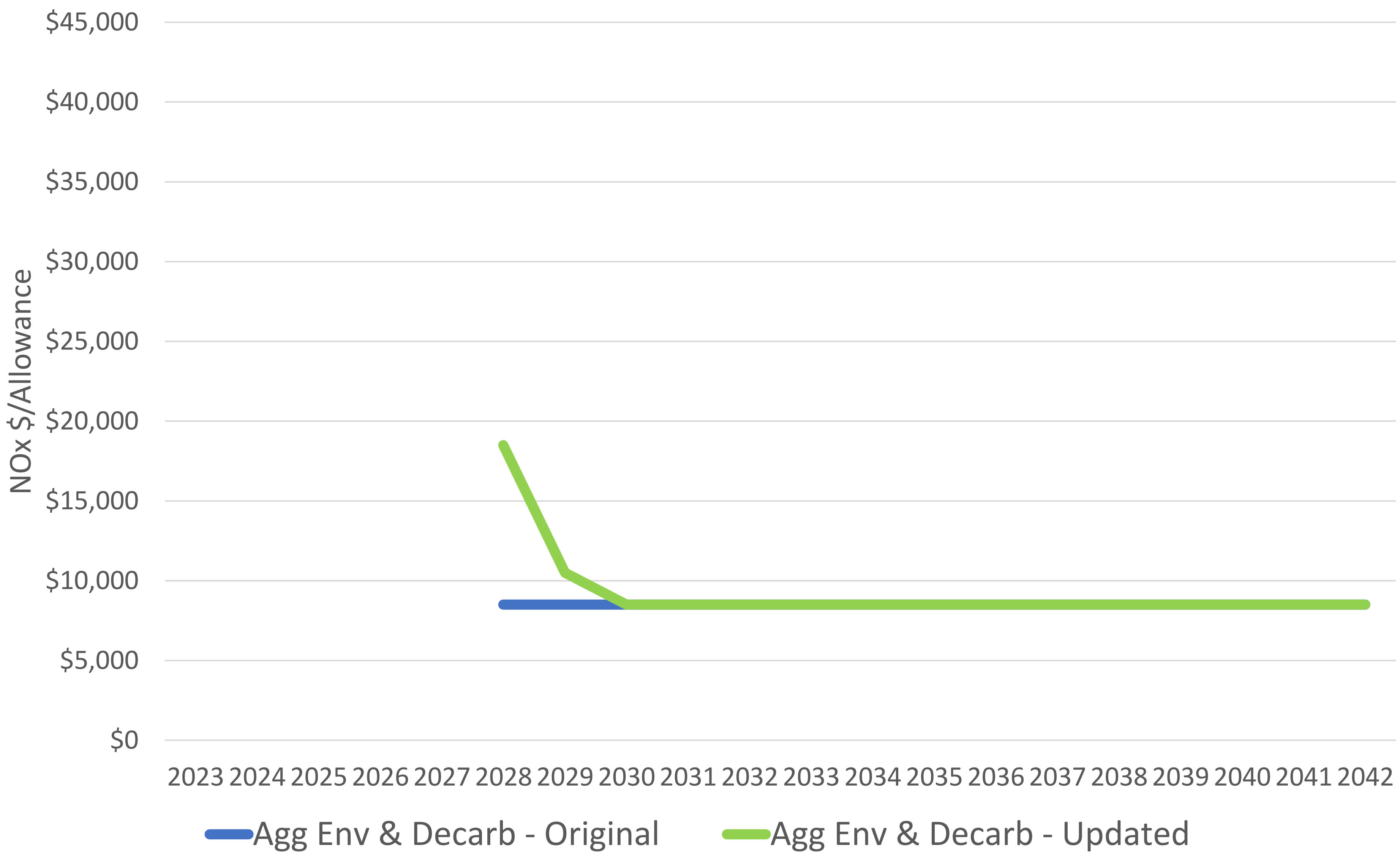
*Years correspond to years projects first produce energy

Modeling Updates

Forecast for NOx allowance prices updated based on current market trends

- Scarcity within the NOx allowance market has driven prices to historic highs
- Updated prices included in the Current Trends (Reference Case), Aggressive Environmental and Decarbonized Economy Scenarios

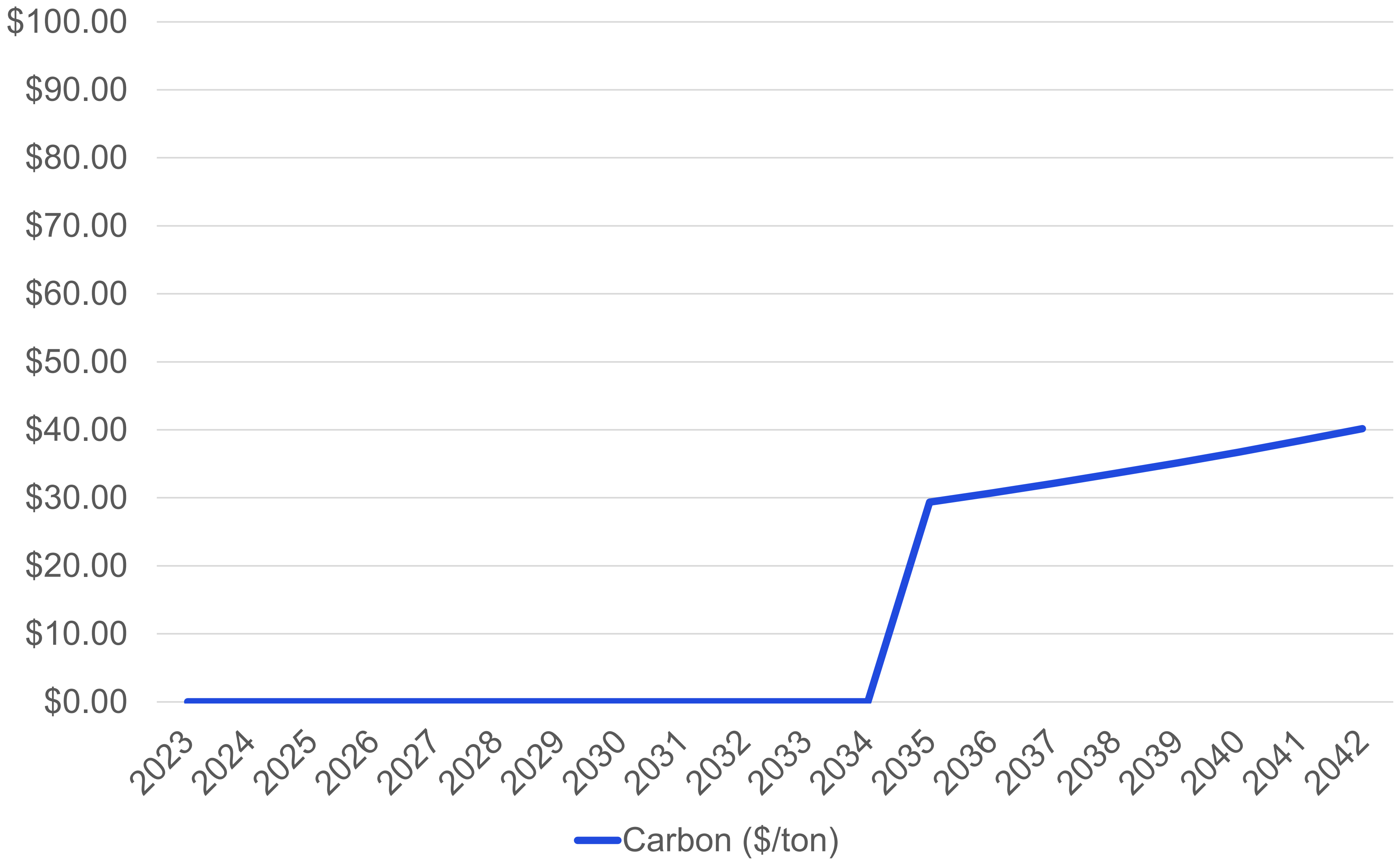


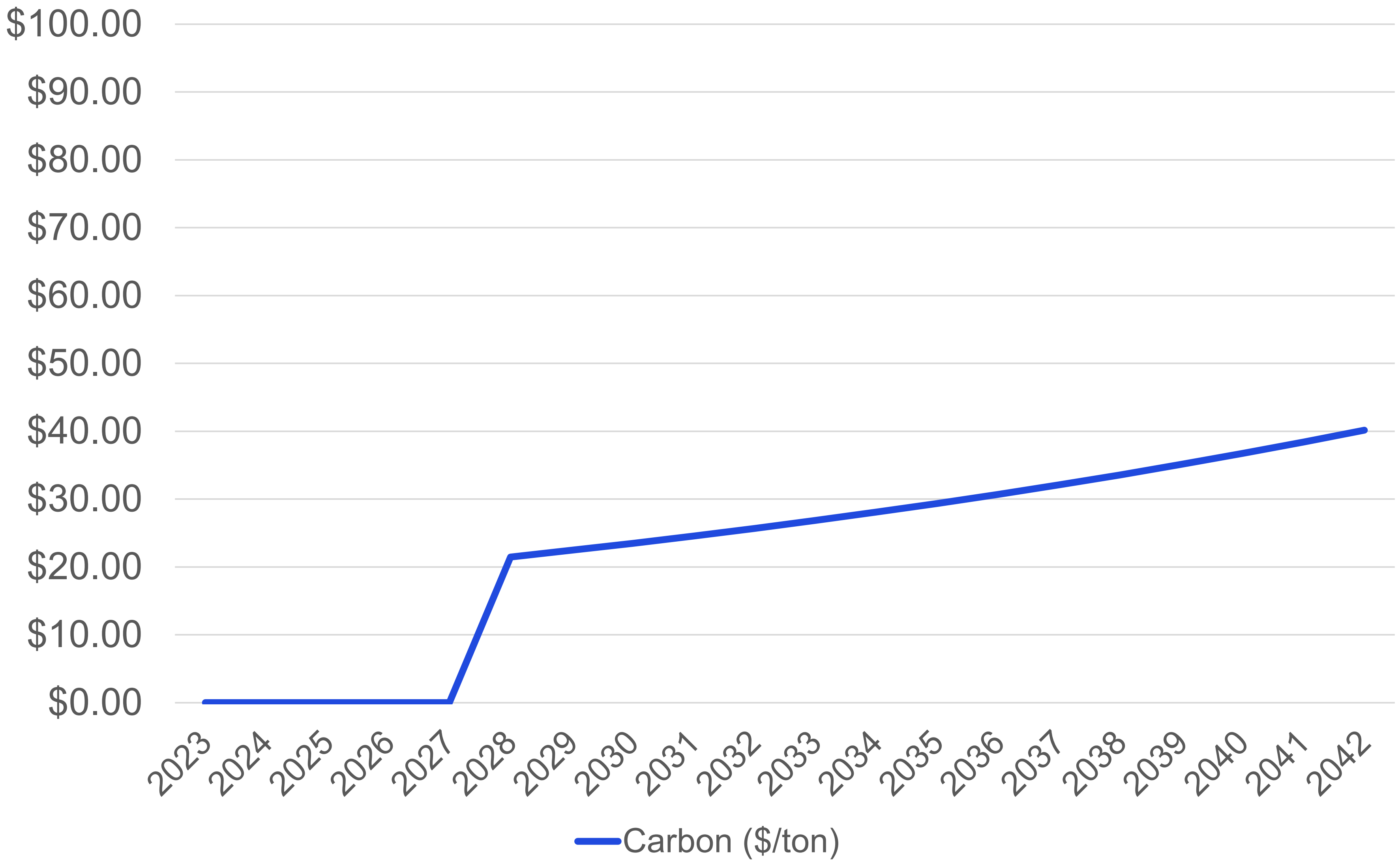


Modeling Updates

Carbon Tax moved from starting in 2035 to starting in 2028 in the Aggressive Environmental Scenario

- Change made to provide a reasonably aggressive environmental scenario
- Aligns with the Interagency Working Group Social Cost of Carbon Forecast (5% Discount Rate)

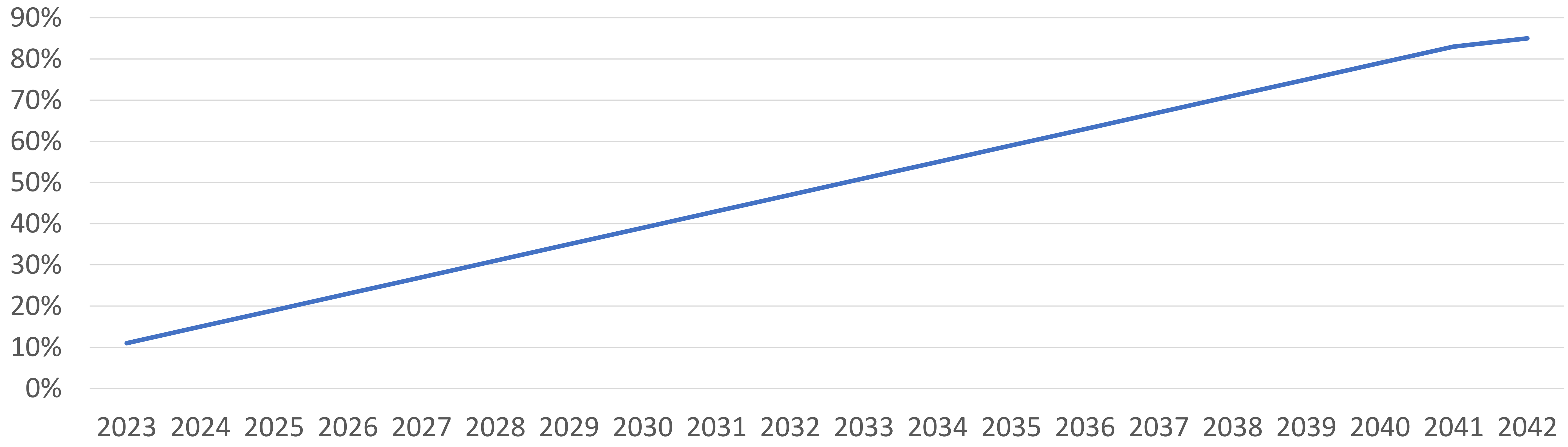




https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Modeling the Decarbonized Economy Scenario

The Decarbonization Scenario captures a bookend with an aggressive grid transition to renewable energy generation. This is accomplished through a progressive Renewable Portfolio Standard (RPS):


Percent of Load to be Served with Renewable Generation

RPS target, penalties, and grants are based on the theoretical Clean Energy Performance Program:

- → Failure to hit the RPS results in a $40/MWh penalty, per MWh of shortfall
- → Exceeding the RPS results in a $150/MWh grant, per MWh of exceedance

Structure for Today's Review

① **Retirement & Replacement Analysis Review:** Review the optimized portfolios and complete the Portfolio Matrix

		Scenarios			
		No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**				
	Pete Refuel to 100% Gas (est. 2025)				
	One Pete Unit Retires (2026)				
	Both Pete Units Retire (2026 & 2028)				
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)				
	Encompass Optimization without predefined Strategy				

Portfolio cost (PVRR) will be calculated for each portfolio to complete Portfolio Matrix

- → Review generation mixes and PVRR in the Current Trends (Reference Case)
- → Complete the Portfolio Matrix and compare PVRR
- → Review the Replacement Resource Cost Sensitivity Analysis

Structure for Today's Review

②

Review key IRP Scorecard Metrics for the Current Trends (Reference Case)

	Affordability	**Environmental Sustainability**						**Reliability, Stability & Resiliency**	**Risk & Opportunity**						**Economic Impact**	
	20-yr PVRR	***CO_2 Emissions***	***SO_2 Emissions***	***NO_X Emissions***	***Water Use***	***Coal Combustion Products (CCP)***	***Clean Energy Progress***	***Reliability Score***	***Environmental Policy Opportunity***	***Environmental Policy Risk***	***Cost Opportunity***	***Cost Risk***	***Market Exposure***	***Renewable Capital Cost Risk (+50%)***	***Employees (+/-)***	***Property Taxes***
	Present Value of Revenue Requirements	Total portfolio CO2 Emissions (mmtons)	Total portfolio SO2 Emissions (tons)	Total portfolio NOx Emissions (tons)	Water Use (mmgal)	CCP (tons)	% Renewable Energy in 2032	Composite score from Reliability Analysis	Lowest PVRR across policy scenarios	Highest PVRR across policy scenarios	Mean - P95	P95 - Mean	20-year avg sales + purchases	Portfolio PVRR w/ renewable costs +50%	Total FTEs associated with generation	Total amount of property tax paid from AES IN assets
1																
2																
3																
4																
5																
6																

Calculations for each scoring metric will be included to complete the Scorecard

Strategies

- 1. No Early Retirement
- 2. Pete Refuel to 100% Natural Gas (est. 2025)
- 3. One Pete Unit Retires in 2026
- 4. Both Pete Units Retire in 2026 & 2028
- 5. "Clean Energy Strategy" – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- 6. Encompass Optimization without Predefined Strategy

- Review PVRR, emissions and economic metrics
- **Reliability and risk analysis still in-progress and will be presented in Meeting #5**

I. Retirement and Replacement Analysis Results

Erik Miller, Manager, Resource Planning, AES Indiana

Capacity vs. Energy in Resource Planning

These are two very different planning/market concepts.

1) Capacity Planning

- MISO requires utilities to have enough generation resources to meet their peak hour plus a reserve margin (buffer). This is called a Planning Reserve Margin Requirement (PRMR).
- Historically, MISO planning has been based on only the summer peak hour + buffer/PRMR.
- This changed earlier in the month when FERC approved MISO's seasonal construct – **Utilities now are required to have enough generation to serve their peak hour + buffer/PRMR in all four seasons – summer, fall, winter and spring.**
- With the seasonal construct, AES Indiana now has a higher winter peak hour + buffer/PRMR than summer.
- There's a market for capacity – thus, AES Indiana assigns a monetary value to capacity for modeling purposes - $89/kW-yr.

Capacity vs. Energy in Resource Planning cont'd

2) Energy Planning

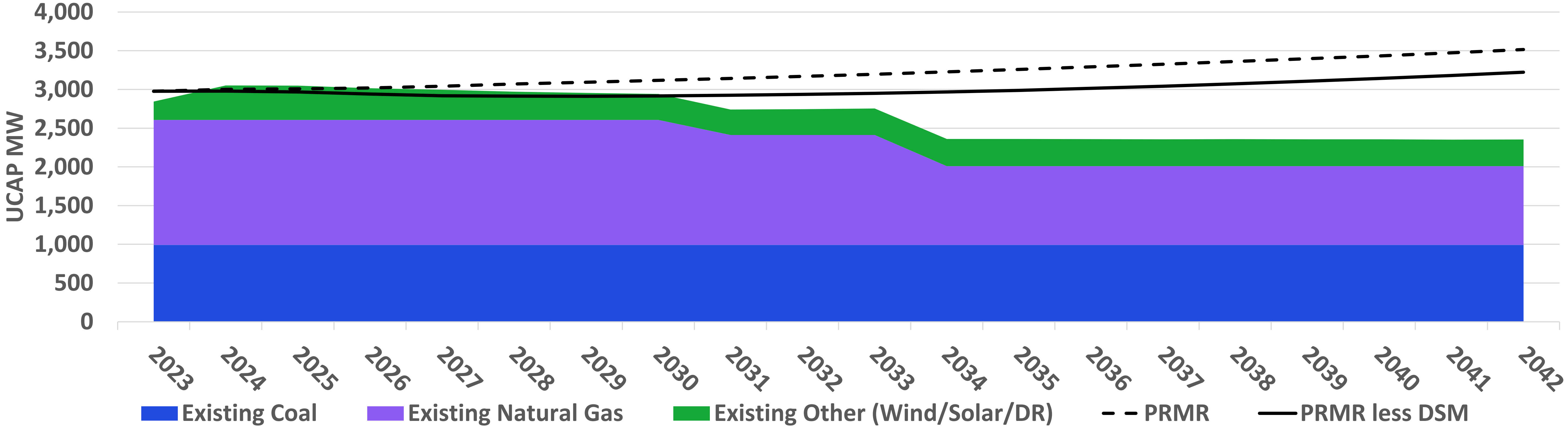
- Most people are familiar with energy – this is a MWh that is produced or purchased to supply customers.
- For planning purposes, AES Indiana can build generation to supply energy for its customers or rely on the market. Relying on the market for energy comes with both price and reliability risks to customers.
- **Energy planning is where we can really make an impact on emissions.**

Differences in Resource Types

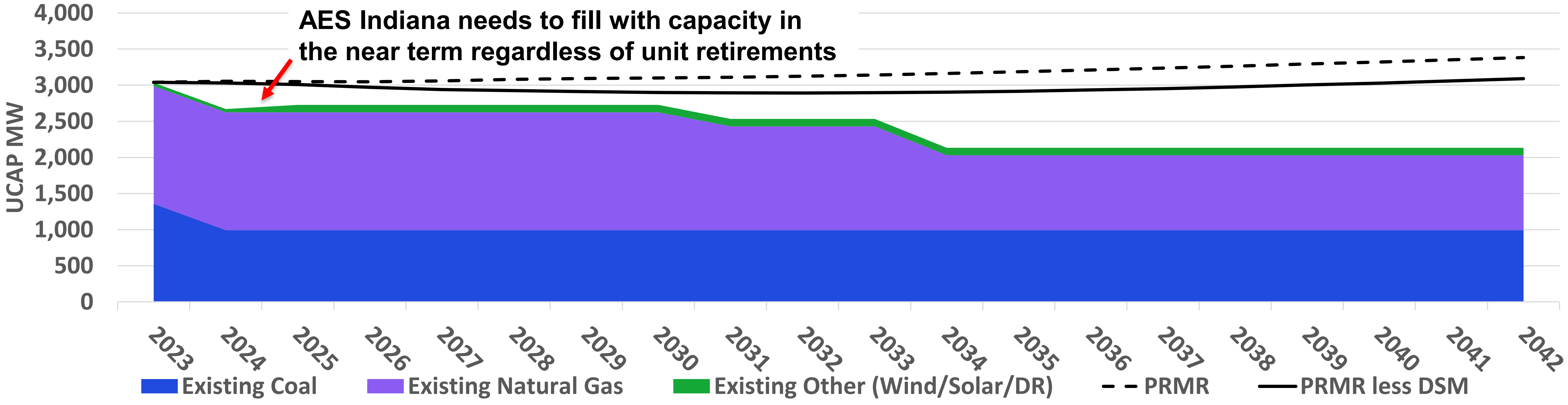
- Certain resources are better suited for supplying <u>capacity</u> –
  - Thermal and battery energy storage resources are dispatchable – therefore, MISO gives them almost full credit as a capacity resource in all seasons.
  - Wind and solar are not dispatchable (utilities can't control when they are on) – therefore, MISO correspondingly adjusts down their capacity value, e.g. a 200 MW solar resource receives zero capacity value (ELCC) in the winter.
  - A resource can be built for its <u>capacity</u> value and run very little to supply <u>energy</u>. **It's there when the system really needs it!**

Summer vs. Winter Capacity Position

Summer Capacity Position – "Status Quo"



Winter Capacity Position – "Status Quo"



AES Indiana needs to fill with capacity in the near term regardless of unit retirements

Historically, AES Indiana has only had to plan for its summer peak + buffer/PRMR.

This changed in early September when FERC approved MISO's four-season capacity construct.

AES has a winter capacity shortage in the near-term regardless of unit retirements.

Unfortunately, based on MISO's accreditation, solar receives no value in the winter and wind receives only 18% of it's full value.

The planning model can only select thermal or battery energy storage resources to fill this winter capacity need. Solar can be combined with battery energy storage if economic.

Summary of Scenario Driving Assumptions

Scenario	Load	EV	Dist Solar	Power	Gas	Coal	CO2
No Environmental Action – “No Env”	Low	Low	Low	Horizon Fundamental Forecast	Low	Base	None
Current Trends (Reference Case) – “Ref”	Base	Base	Base	Horizon Fundamental Forecast	Base	Base	Low
Aggressive Environmental – “AE”	High	High	High	Horizon Fundamental Forecast	High	Base	High
Decarbonized Economy – “Decarb”	High	Very High	High	Horizon Fundamental Forecast	Base	Base	None*

*Carbon targets will be modeled through a National Renewable Portfolio Standard

Current Trends Assumptions Review

The following slides provide the **Portfolio Summaries for the Current Trends Scenario – these are the candidate portfolios**. Portfolio Summaries will include the following:

- Generation mix and Unforced Capacity position
- Installed capacity over the planning period
- % energy mix to serve load
- DSM Selections
- PVRR

As a review, the **Current Trends Scenario** includes the **following driving assumptions**:

- Base Power, Gas, and Coal Prices
- Base NOx Prices
- ITC & PTC assumptions aligned with the Inflation Reduction Act
- Low Carbon Price at $6.49/ton starting in 2028 and escalating annually at 4.6%
- Base load, EV and customer solar forecasts

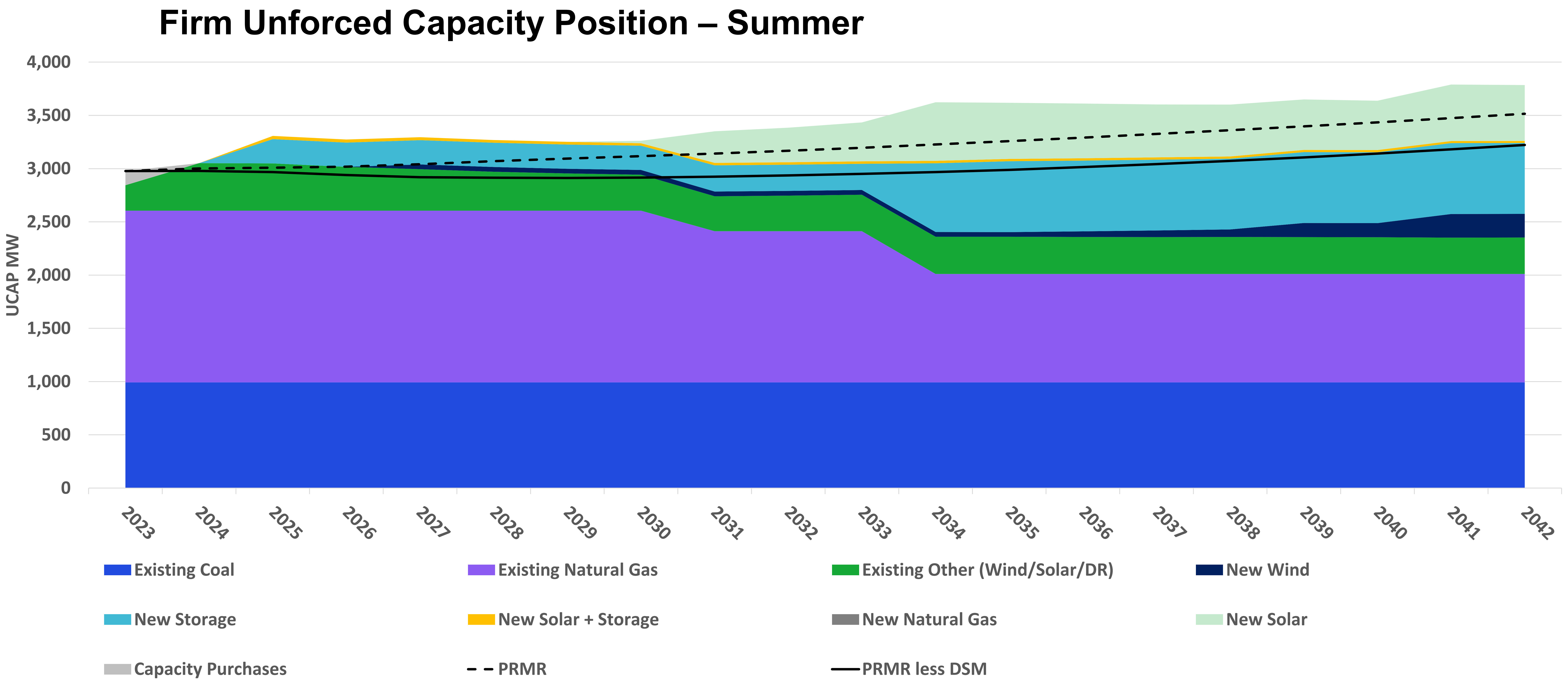
This section will conclude with a comparison of the PVRRs for the Strategies and Scenarios in the Portfolio Matrix.

Note: The Portfolio Summaries for the No Environmental Action, Aggressive Environmental and Decarbonized Economy scenarios are included in the appendix of this presentation.

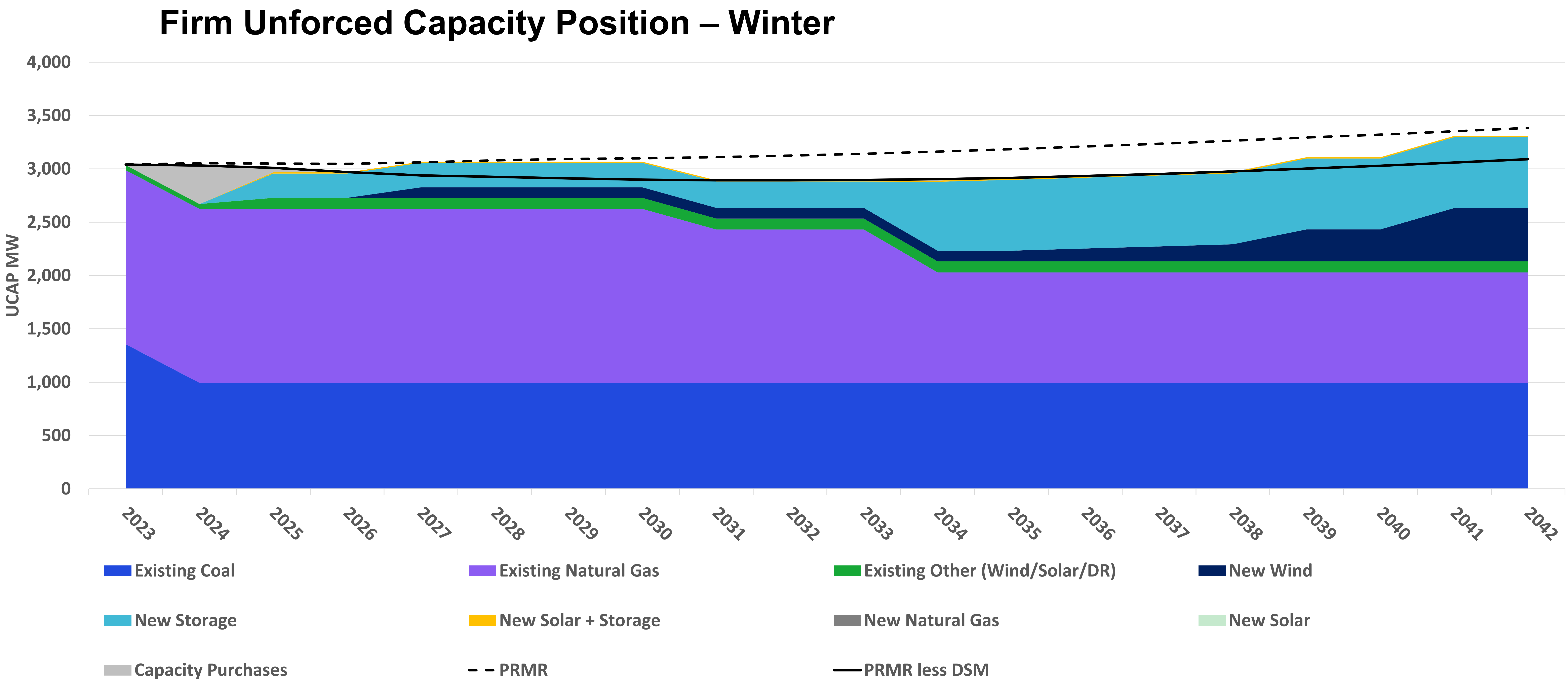
A. No Early Retirement

Scenarios			
No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
	$9,572		

No Early Retirement: Current Trends *(Reference Case)*

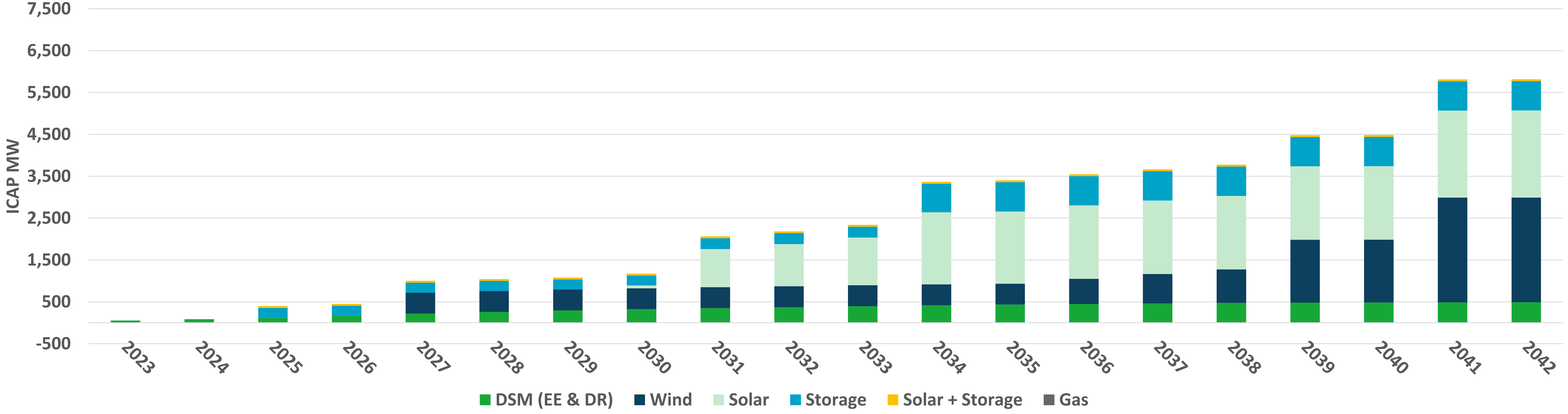


No Early Retirement: Current Trends *(Reference Case)*



No Early Retirement: Current Trends *(Reference Case)*

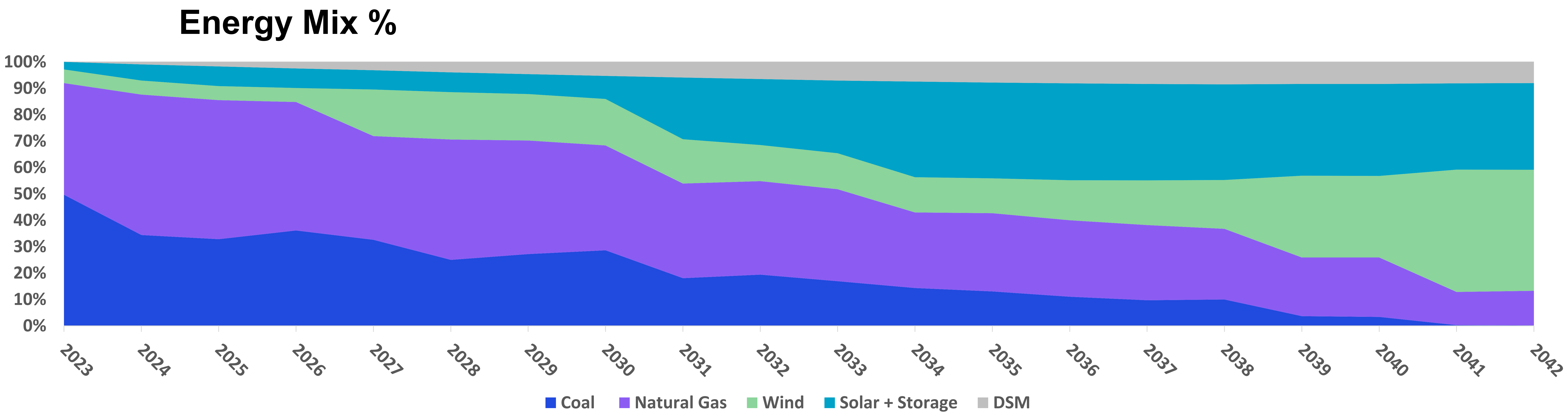
Installed Capacity Cumulative Additions (MW)

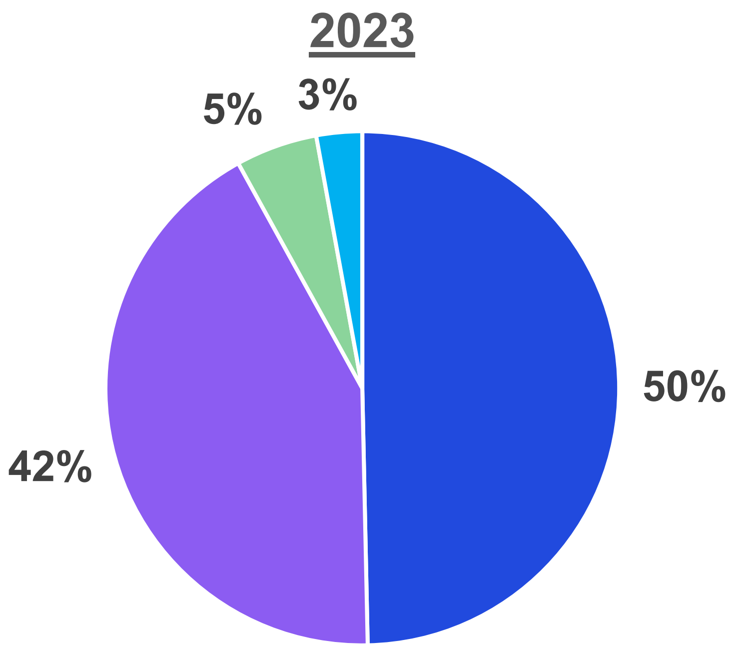


Installed Capacity Incremental Additions (MW): 2023 - 2028

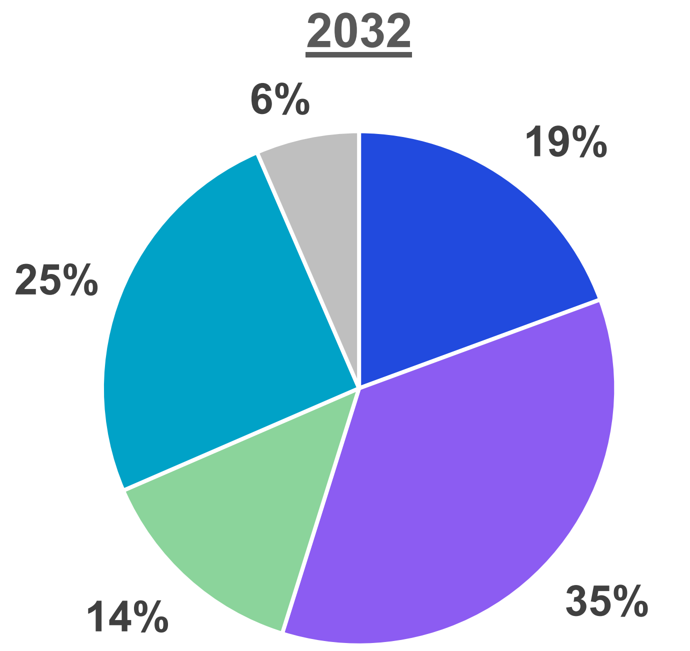
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	0	500	0
Solar	0	0	0	0	0	0
Storage	0	0	240	0	0	0
Solar + Storage	0	0	45	0	0	0
Natural Gas	0	0	0	0	0	0

No Early Retirement: Current Trends *(Reference Case)*

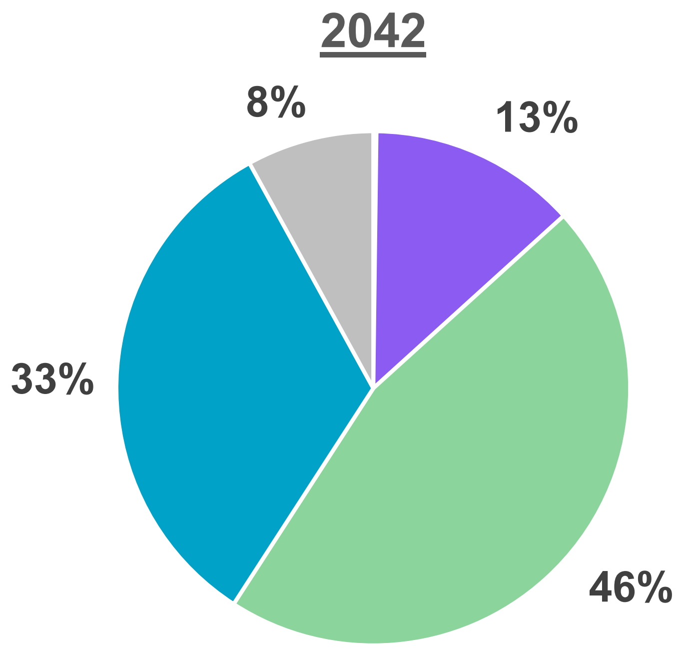




Thermal MWh %	92%
Renewable/DSM MWh %	8%



Thermal MWh %	55%
Renewable/DSM MWh %	45%



Thermal MWh %	13%
Renewable/DSM MWh %	87%

No Early Retirement: Current Trends *(Reference Case)*

DSM Results

Energy Efficiency:

		Vintage 1	Vintage 2	Vintage 3
		2024 - 2026	2027 - 2029	2030 - 2042
Residential		Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
		Efficient Products - Higher Cost		
		Behavioral		
		School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
		Appliance Recycling		
		Multifamily		
		IQW	IQW	IQW
C&I		Prescriptive	C&I	C&I
		Custom		
		Custom RCx		
		Custom SEM		
Impacts		Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
		134,263	141,526	146,428
		% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
		1.1%	1.1%	1.2%
		Cummulative Summer MW	Cummulative Summer MW	Cummulative Summer MW
		89 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	75 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

No Early Retirement: Current Trends *(Reference Case)*

Portfolio Overview

Retirements

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,080 MW
- Storage: 700 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

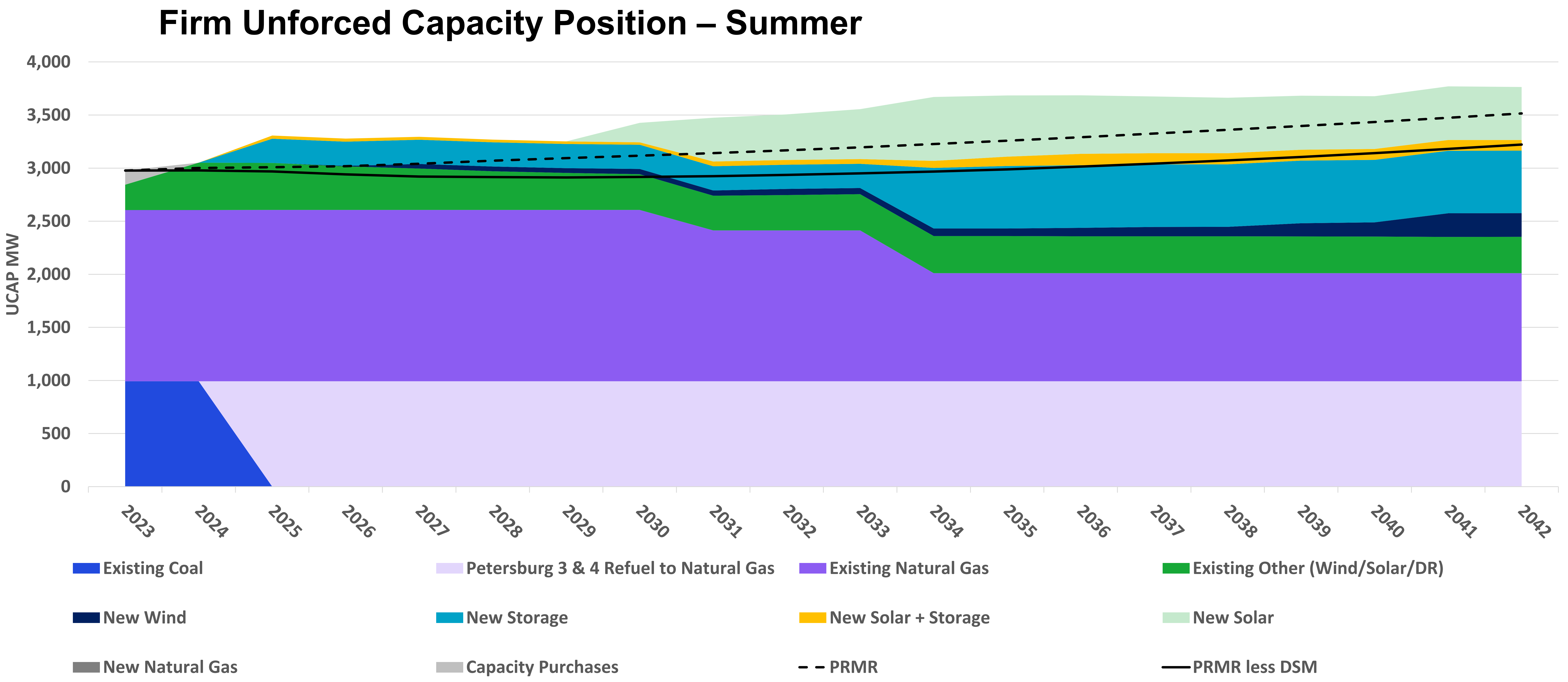
20-Year PVRR (2023$MM, 2023-2042)

Strategy	PVRR
No Early Retirement	$9,572
Pete Refuel to 100% Gas (est. 2025)	$9,330
One Pete Unit Retires (2026)	$9,773
Both Pete Units Retire (2026 & 2028)	$9,618
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711
Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,262

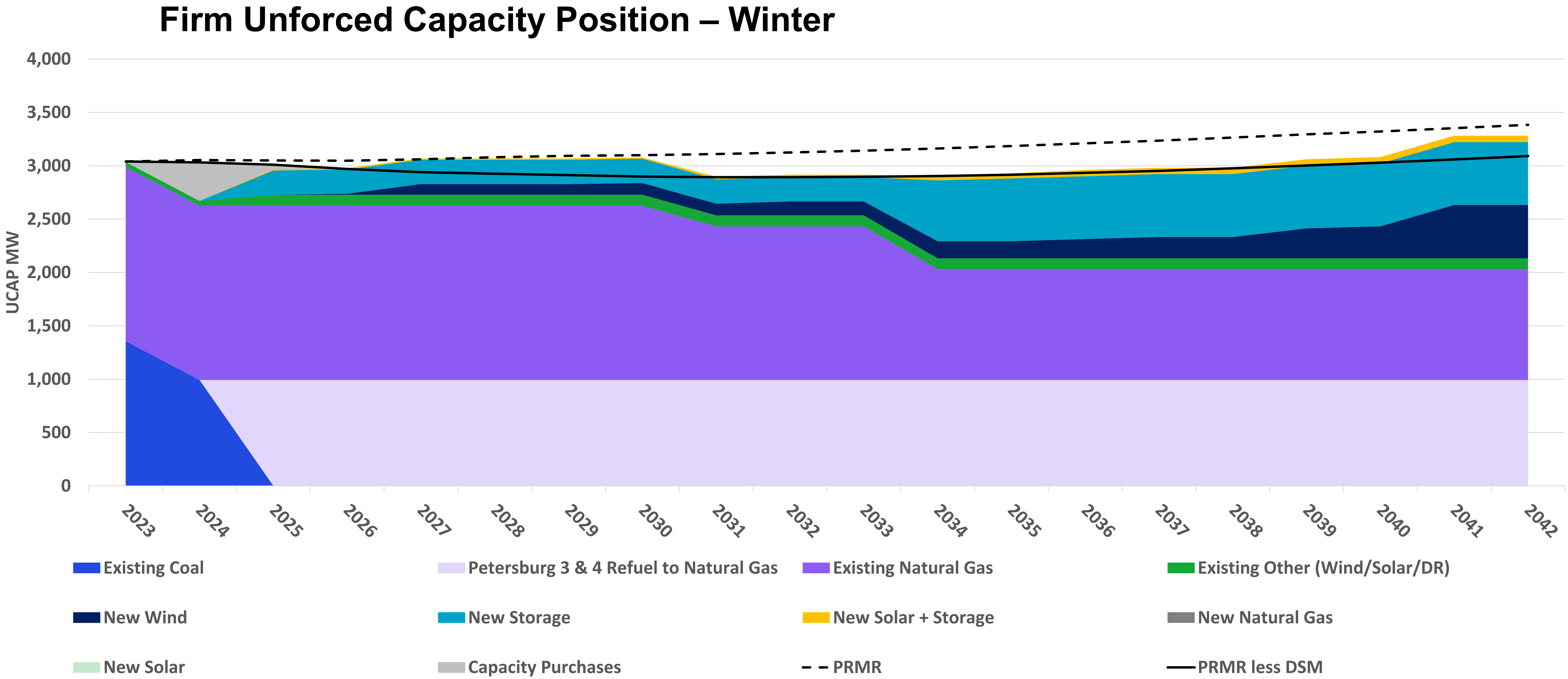
B. Pete Refuel by 2025

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
	$9,330		

Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*

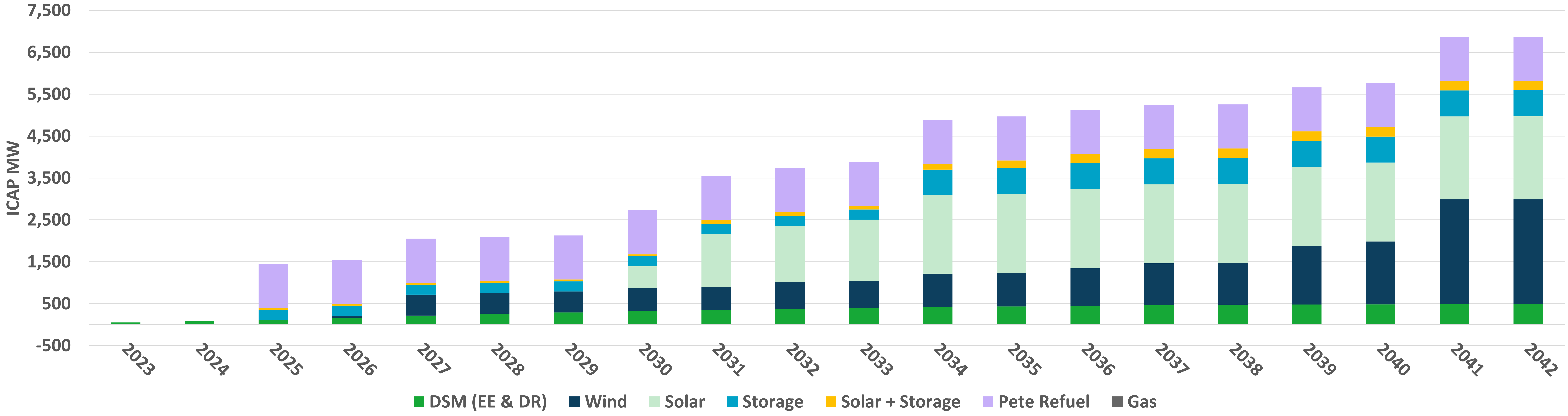


Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*



Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*

Installed Capacity Cumulative Additions (MW)

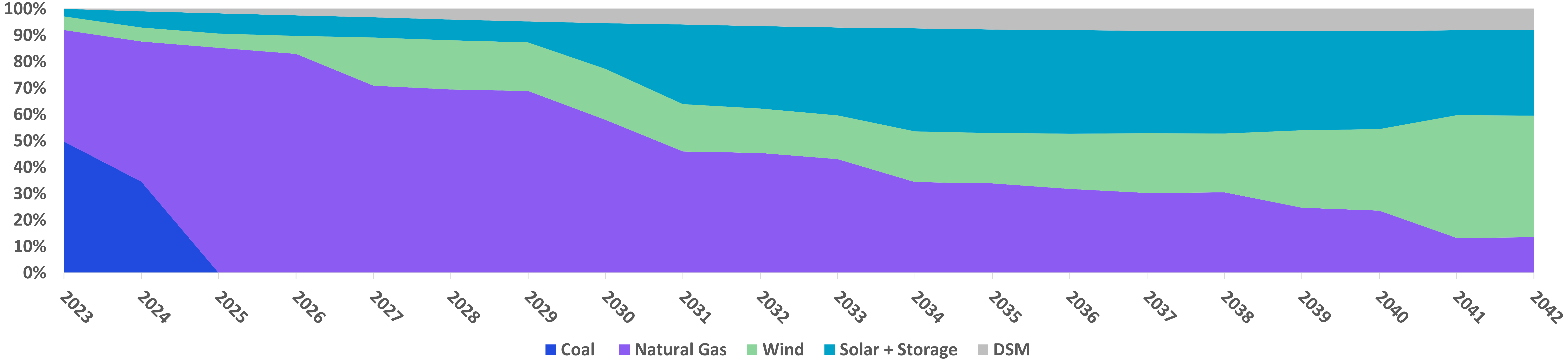


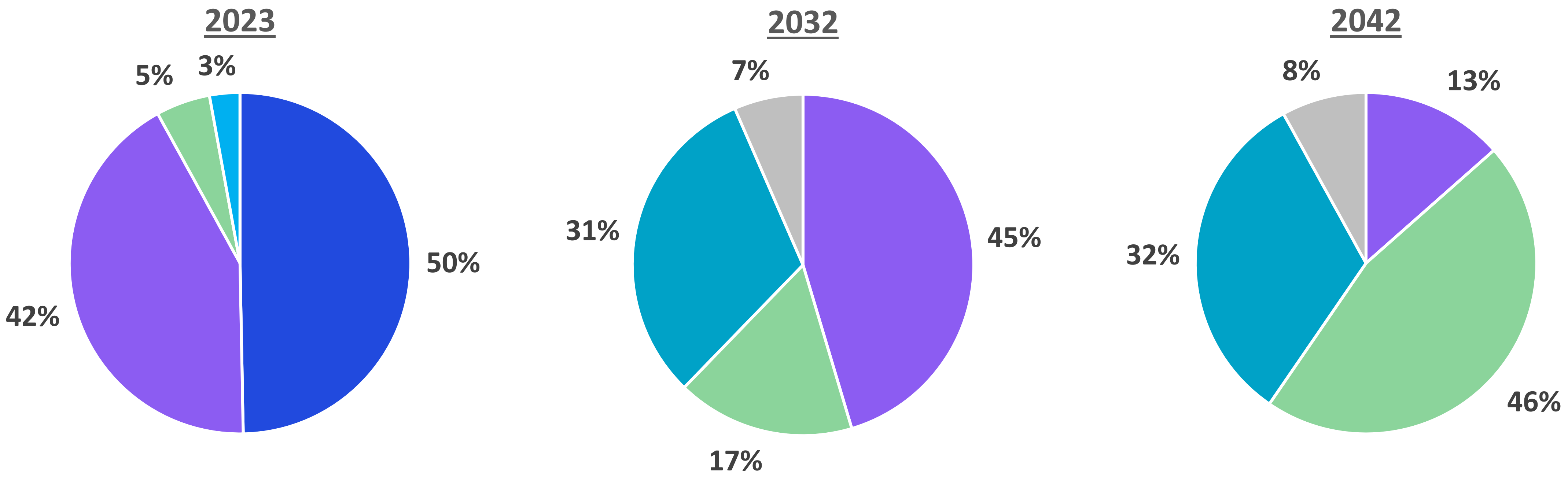
Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Pete Refuel	0	0	1,052	0	0	0
Wind	0	0	0	50	450	0
Solar	0	0	0	0	0	0
Storage	0	0	240	0	0	0
Solar + Storage	0	0	45	0	0	0
Natural Gas	0	0	0	0	0	0

Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*

Energy Mix %





Thermal MWh %	92%
Renewable/DSM MWh %	8%

Thermal MWh %	45%
Renewable/DSM MWh %	55%

Thermal MWh %	13%
Renewable/DSM MWh %	87%

Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*

DSM Results

Energy Efficiency:

	Vintage 1	Vintage 2	Vintage 3
	2024 - 2026	**2027 - 2029**	**2030 - 2042**
Residential	Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
	Efficient Products - Higher Cost		
	Behavioral		
	School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
	Appliance Recycling		
	Multifamily		
	IQW	IQW	IQW
C&I	Prescriptive	C&I	C&I
	Custom		
	Custom RCx		
	Custom SEM		
Impacts	Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
	131,578	141,526	146,428
	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
	1.0%	1.1%	1.2%
	Cumulative Summer MW	Cumulative Summer MW	Cumulative Summer MW
	87 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	75 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*

Portfolio Overview

Retirements

Petersburg:
- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
  - **Total Refueled MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 1,983 MW
- Storage: 620 MW
- Solar + Storage: 225 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,000 MW

Current Trends PVRR Summary

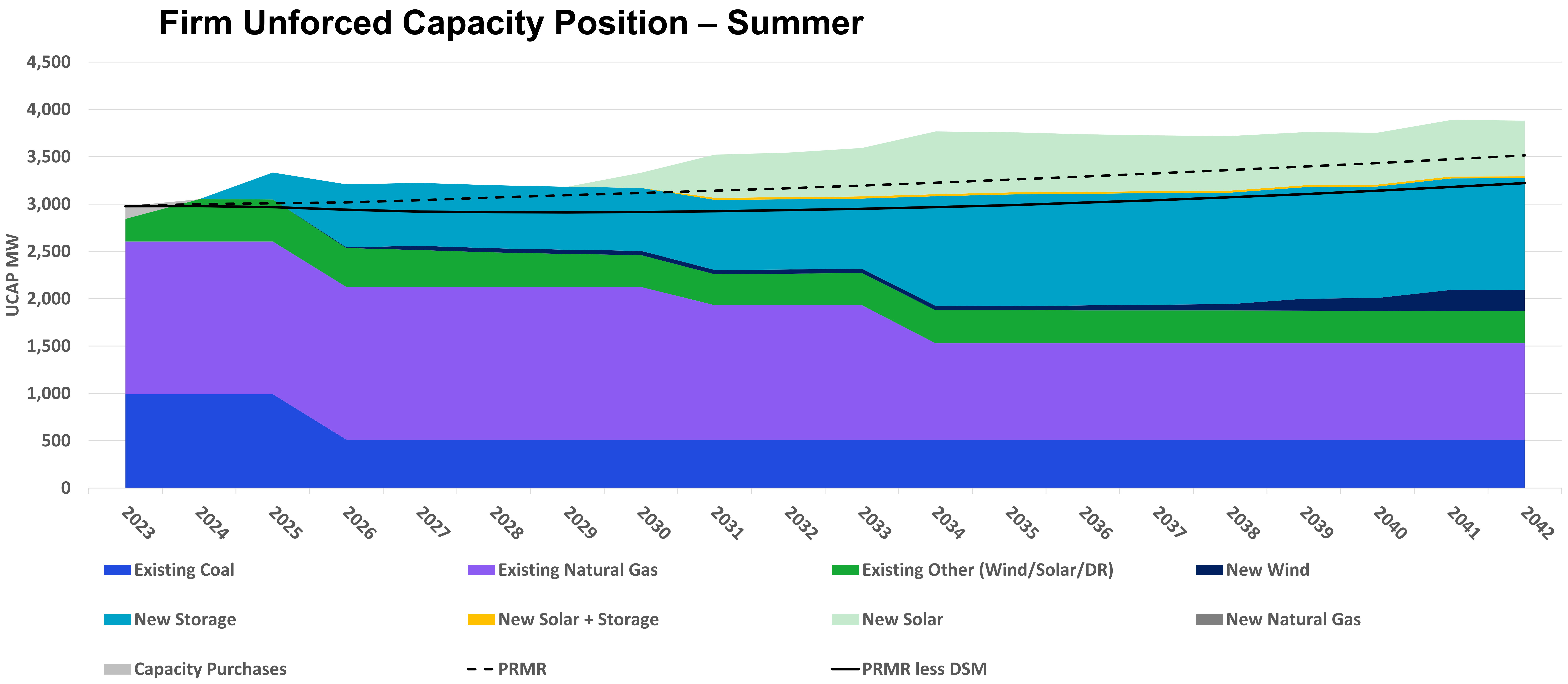
20-Year PVRR (2023$MM, 2023-2042)

Strategy	PVRR
No Early Retirement	$9,572
Pete Refuel to 100% Gas (est. 2025)	$9,330
One Pete Unit Retires (2026)	$9,773
Both Pete Units Retire (2026 & 2028)	$9,618
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711
Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,262

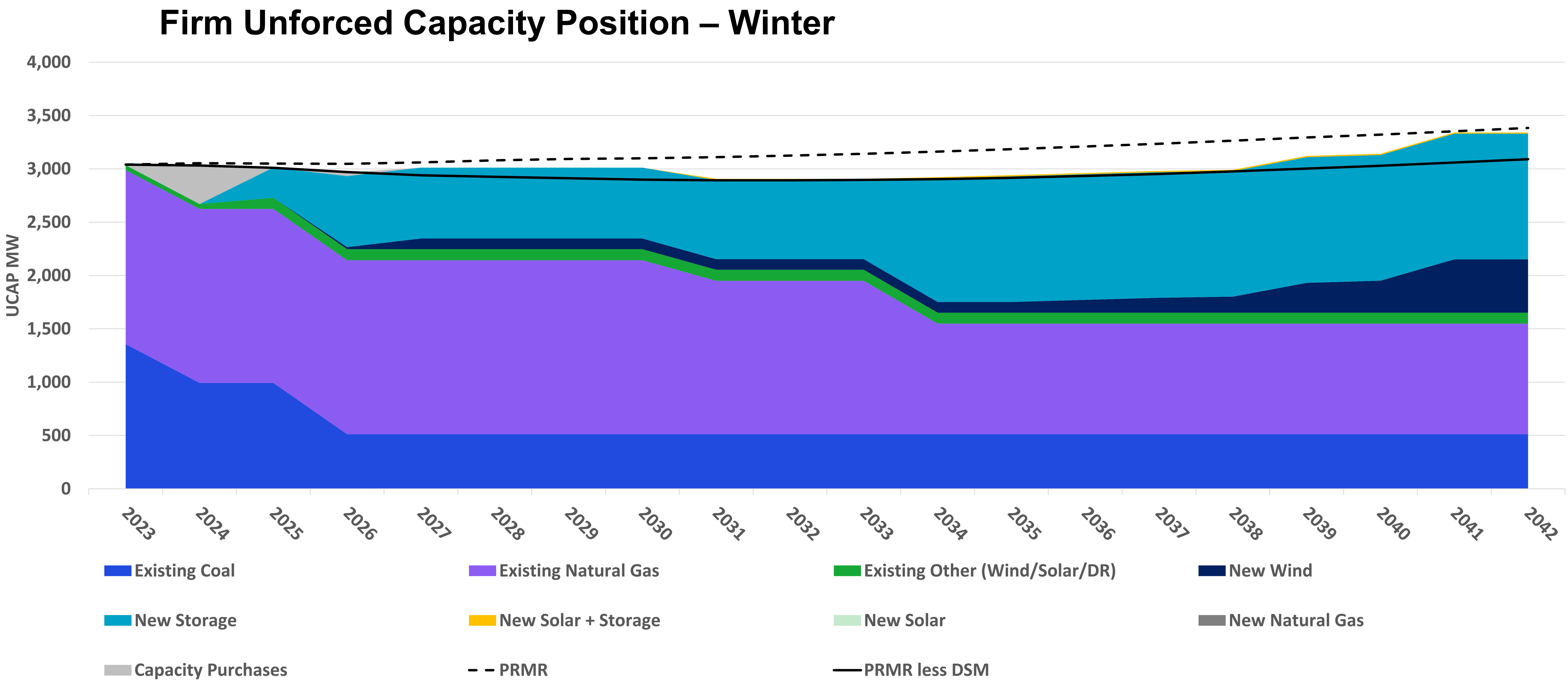
C. One Pete Unit Retires (2026)

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
	$9,773		

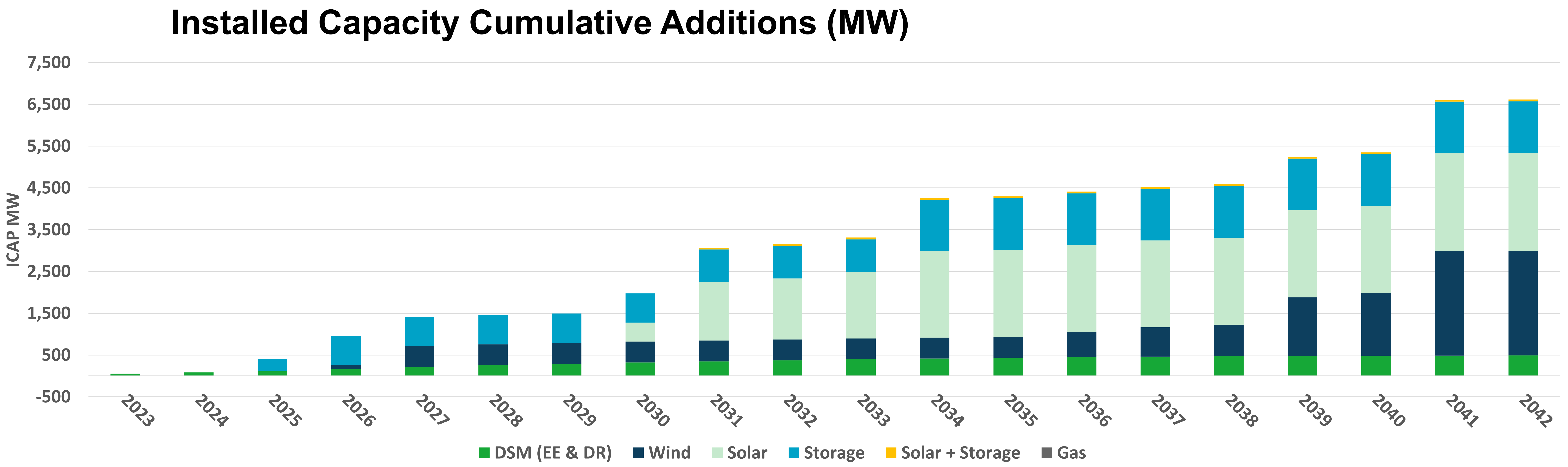
One Pete Unit Retires (2026): Current Trends *(Reference Case)*



One Pete Unit Retires (2026): Current Trends *(Reference Case)*



One Pete Unit Retires (2026): Current Trends *(Reference Case)*



Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	0
Solar	0	0	0	0	0	0
Storage	0	0	300	400	0	0
Solar + Storage	0	0	0	0	0	0
Natural Gas	0	0	0	0	0	0

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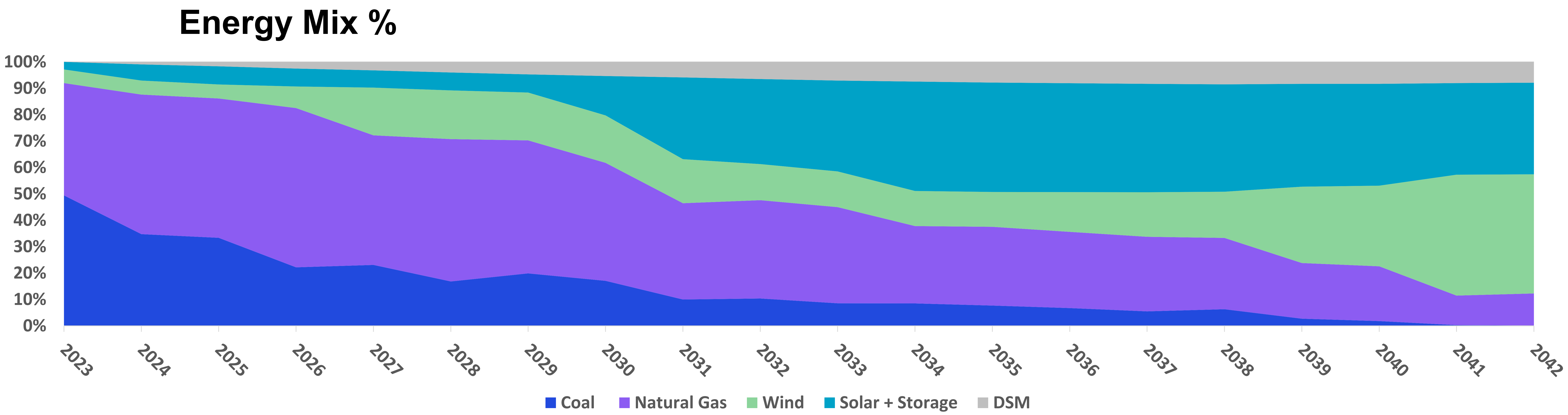
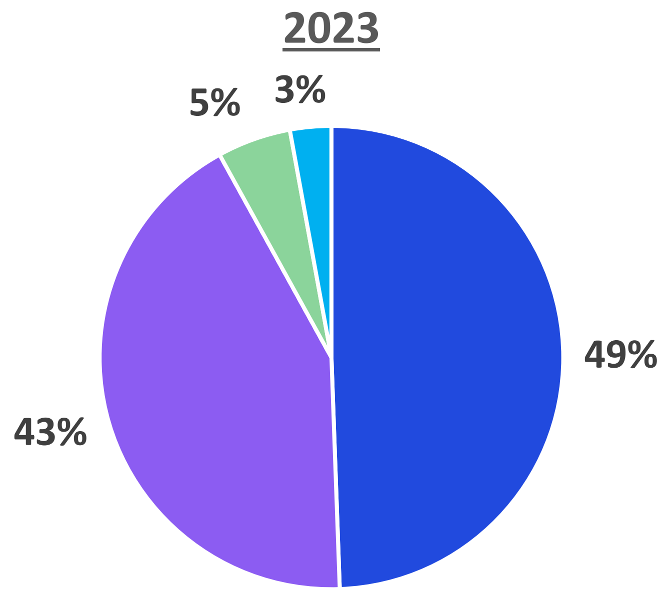
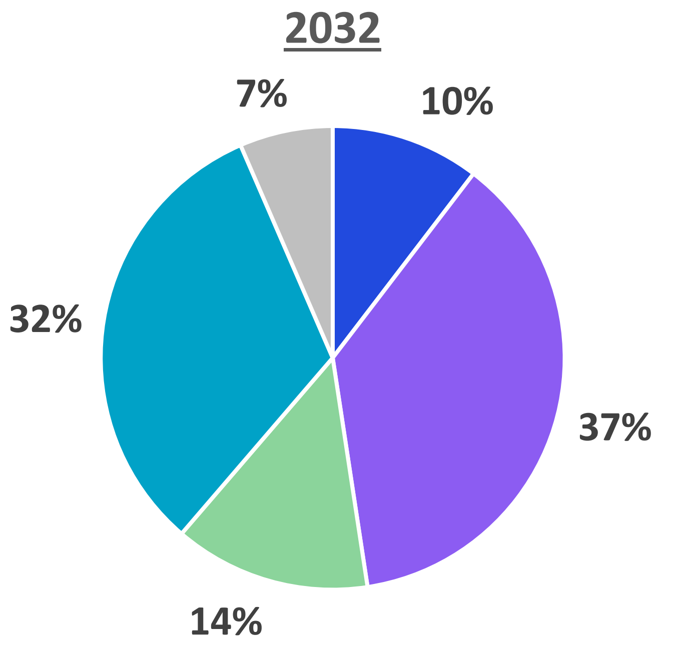
One Pete Unit Retires (2026): Current Trends *(Reference Case)*

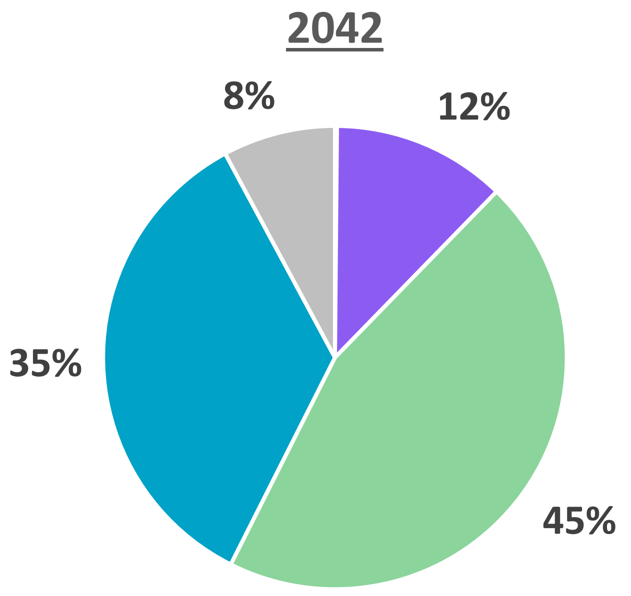




Thermal MWh %	92%
Renewable/DSM MWh %	8%



Thermal MWh %	48%
Renewable/DSM MWh %	52%



Thermal MWh %	12%
Renewable/DSM MWh %	88%

One Pete Unit Retires (2026): Current Trends *(Reference Case)*

DSM Results

Energy Efficiency:

	Vintage 1	Vintage 2	Vintage 3
	2024 - 2026	**2027 - 2029**	**2030 - 2042**
Residential	Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
	Efficient Products - Higher Cost		
	Behavioral		
	School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
	Appliance Recycling		
	Multifamily		
	IQW	IQW	IQW
C&I	Prescriptive	C&I	C&I
	Custom		
	Custom RCx		
	Custom SEM		
Impacts	Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
	131,578	141,526	146,428
	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
	1.0%	1.1%	1.2%
	Cummulative Summer MW	Cummulative Summer MW	Cummulative Summer MW
	87 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	75 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

One Pete Unit Retires (2026): Current Trends *(Reference Case)*

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
  - **Total Coal Retired MW: 520 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,340 MW
- Storage: 1,240 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

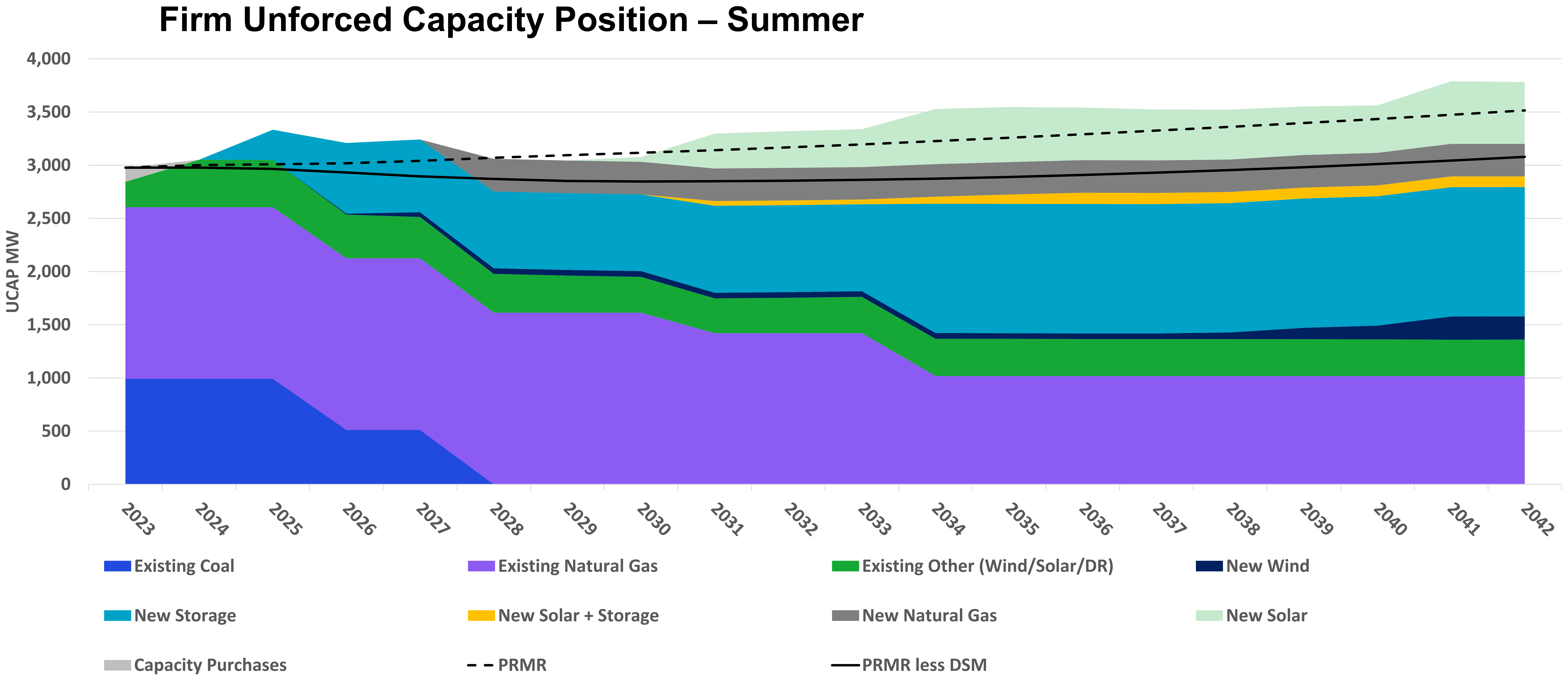
Strategy	PVRR
No Early Retirement	$9,572
Pete Refuel to 100% Gas (est. 2025)	$9,330
One Pete Unit Retires (2026)	$9,773
Both Pete Units Retire (2026 & 2028)	$9,618
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711
Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,262

D. Both Pete Units Retire (2026 & 2028)

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
	$9,618		

Both Pete Units Retire: Current Trends *(Reference Case)*

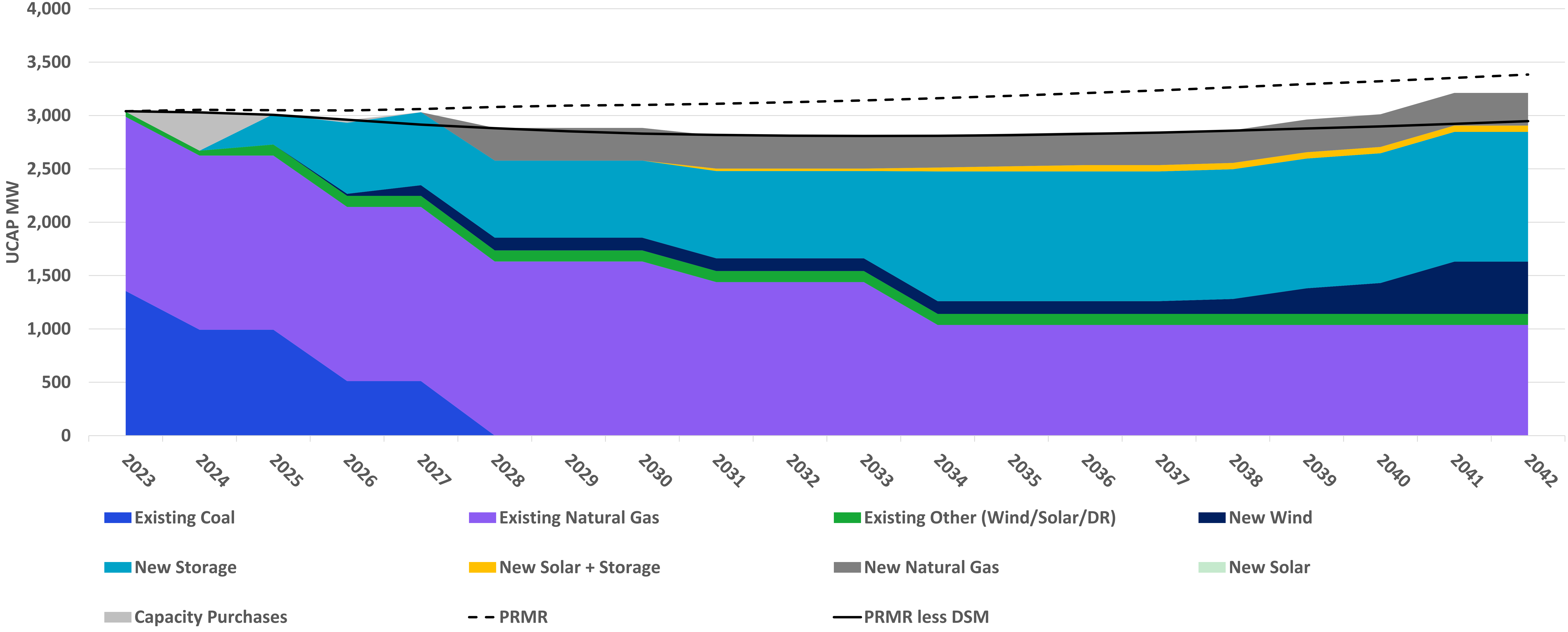
2026 & 2028



Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028

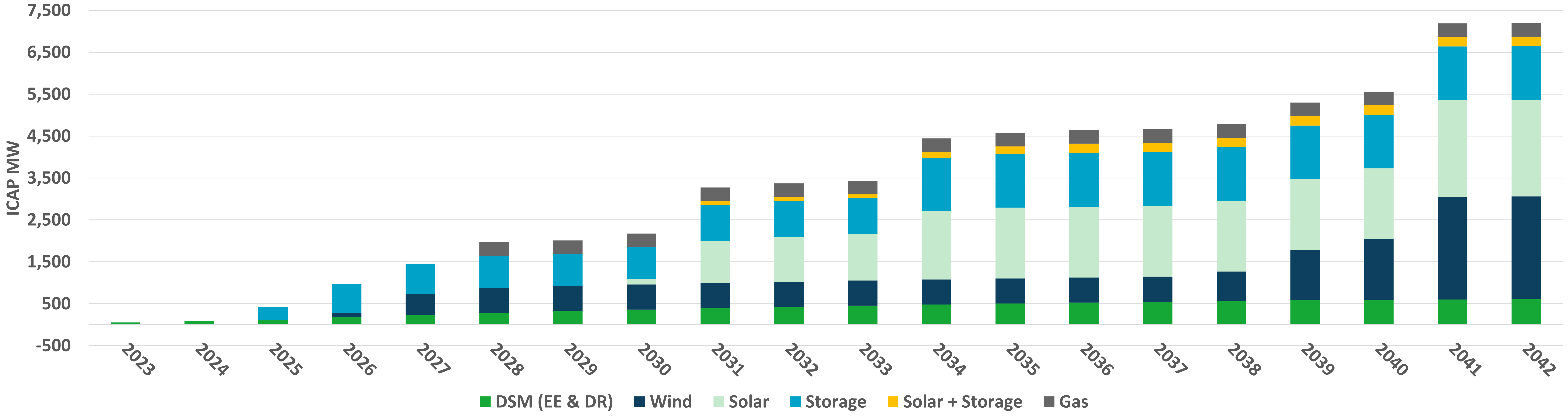
Firm Unforced Capacity Position – Winter



Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028

Installed Capacity Cumulative Additions (MW)



Installed Capacity Incremental Additions (MW): 2023 – 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	100
Solar	0	0	0	0	0	0
Storage	0	0	300	400	20	40
Solar + Storage	0	0	0	0	0	0
Natural Gas	0	0	0	0	0	325

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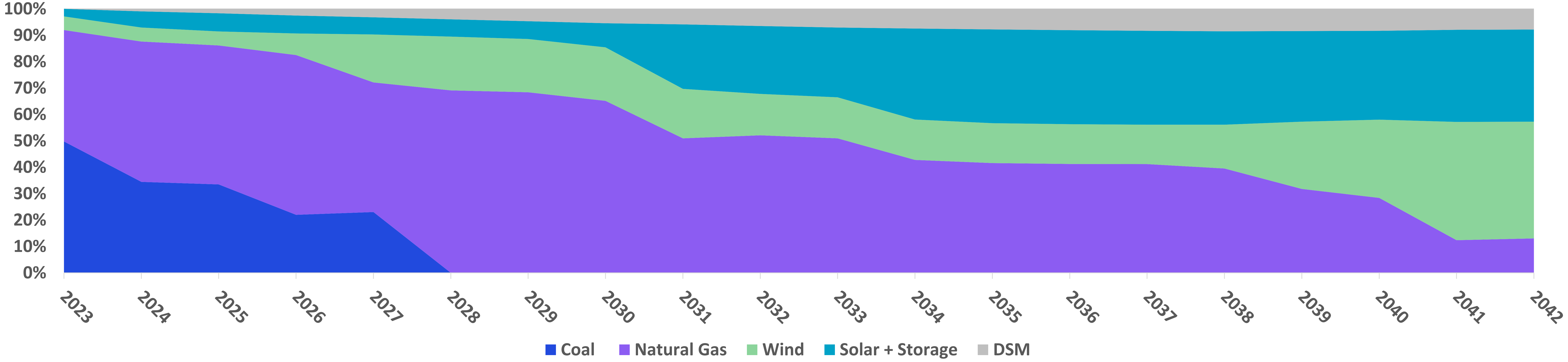
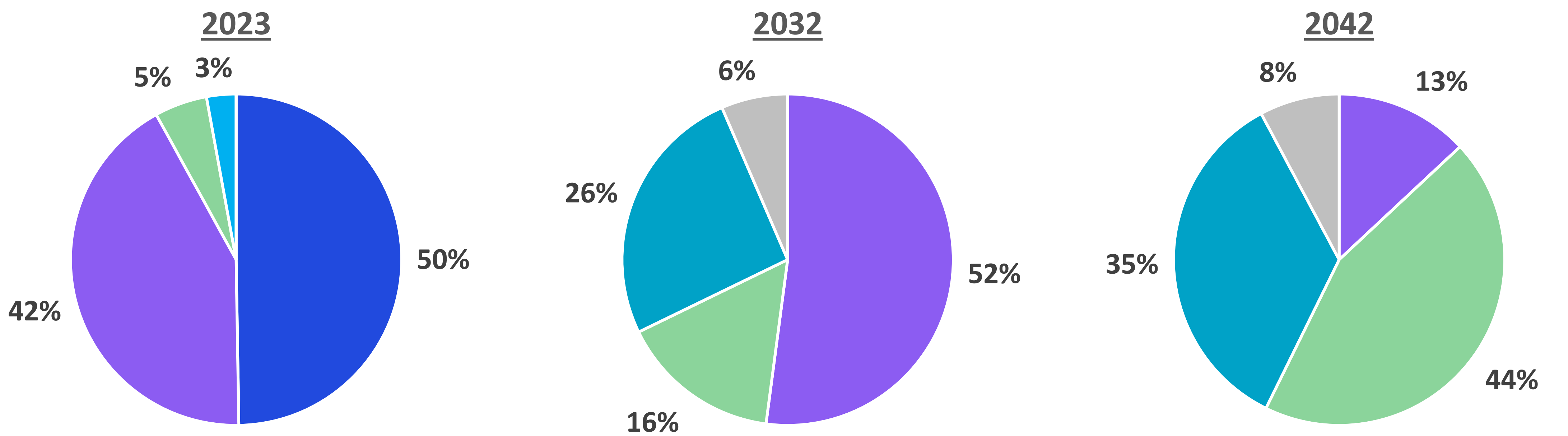
Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028

Energy Mix %





Thermal MWh %	92%
Renewable/DSM MWh %	8%

Thermal MWh %	52%
Renewable/DSM MWh %	48%

Thermal MWh %	13%
Renewable/DSM MWh %	87%

Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028

DSM Results

Energy Efficiency:

	Vintage 1	Vintage 2	Vintage 3
	2024 - 2026	**2027 - 2029**	**2030 - 2042**
Residential	Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
	Efficient Products - Higher Cost		
	Behavioral		
	School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
	Appliance Recycling		
	Multifamily		
	IQW	IQW	IQW
C&I	Prescriptive	C&I	C&I
	Custom		
	Custom RCx		
	Custom SEM		
Impacts	Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
	131,578	141,526	146,428
	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
	1.0%	1.1%	1.2%
	Cummulative Summer MW	Cummulative Summer MW	Cummulative Summer MW
	87 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	195 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 610 MW
- Wind: 2,450 MW
- Solar: 2,308 MW
- Storage: 1,280 MW
- Solar + Storage: 225 MW
- Thermal: 325 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

Strategy	PVRR
No Early Retirement	$9,572
Pete Refuel to 100% Gas (est. 2025)	$9,330
One Pete Unit Retires (2026)	$9,773
Both Pete Units Retire (2026 & 2028)	$9,618
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711
Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,262

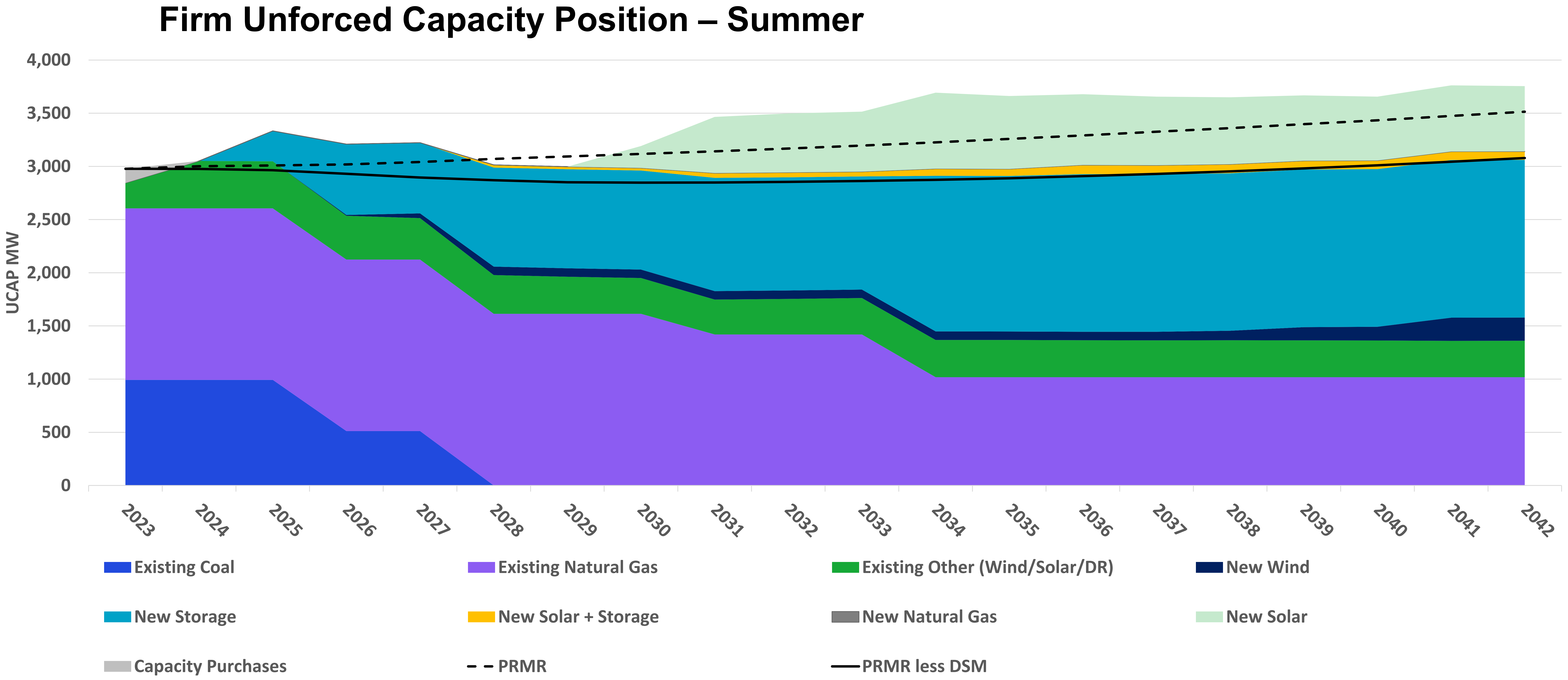
E. Clean Energy Strategy

Retire & Replace Pete with Clean Energy

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
	$9,711		

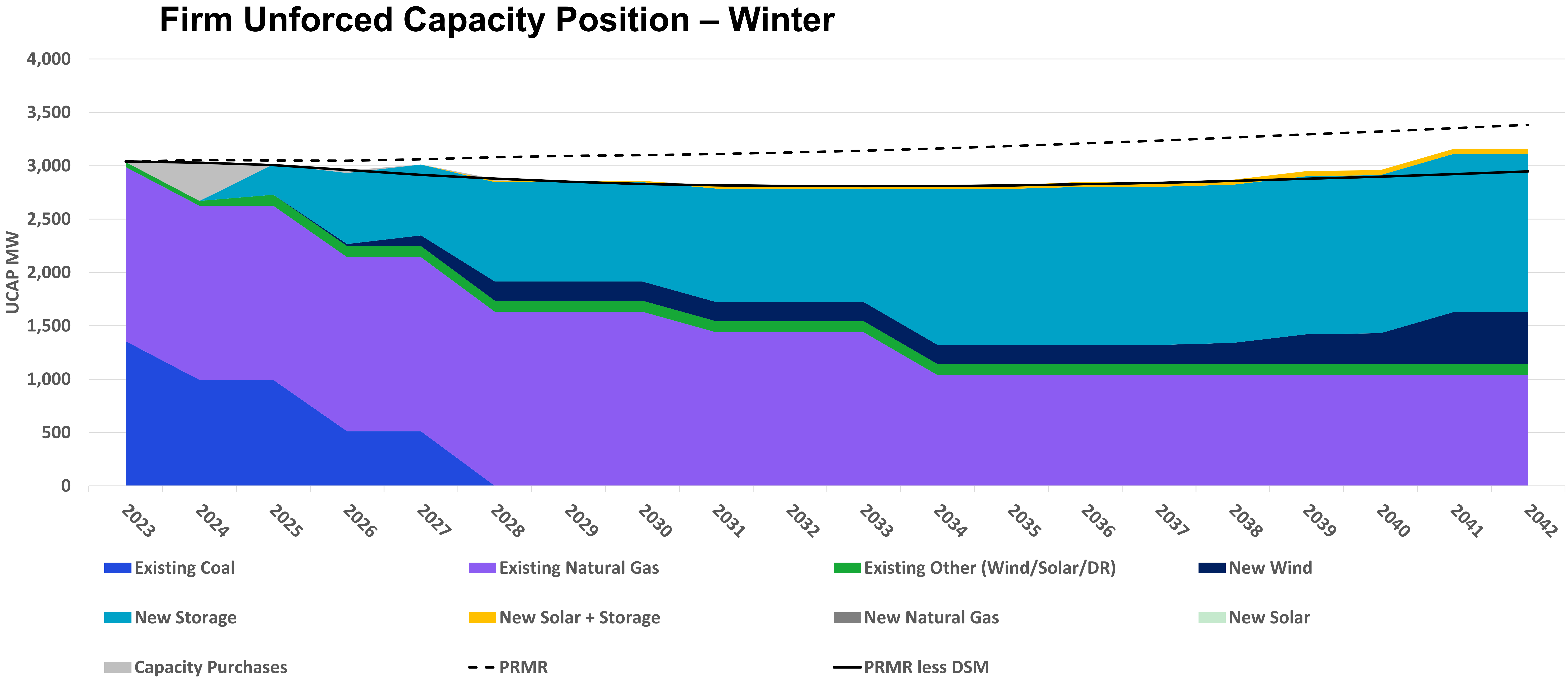
Clean Energy Strategy: Current Trends *(Reference Case)*

Retire & Replace Pete with Clean Energy



Clean Energy Strategy: Current Trends *(Reference Case)*

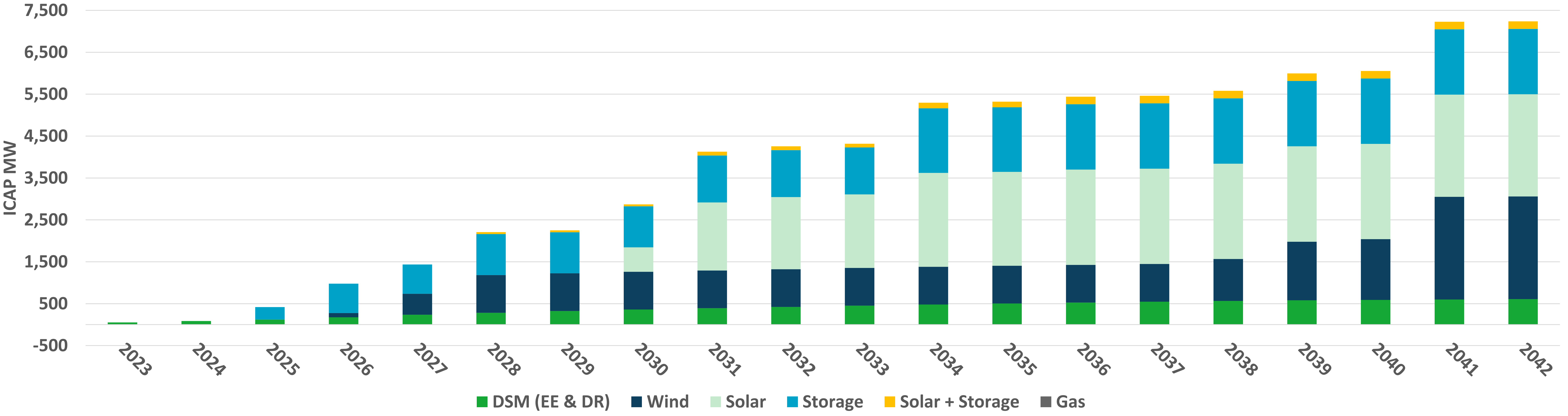
Retire & Replace Pete with Clean Energy



Clean Energy Strategy: Current Trends *(Reference Case)*

Retire & Replace Pete with Clean Energy

Installed Capacity Cumulative Additions (MW)



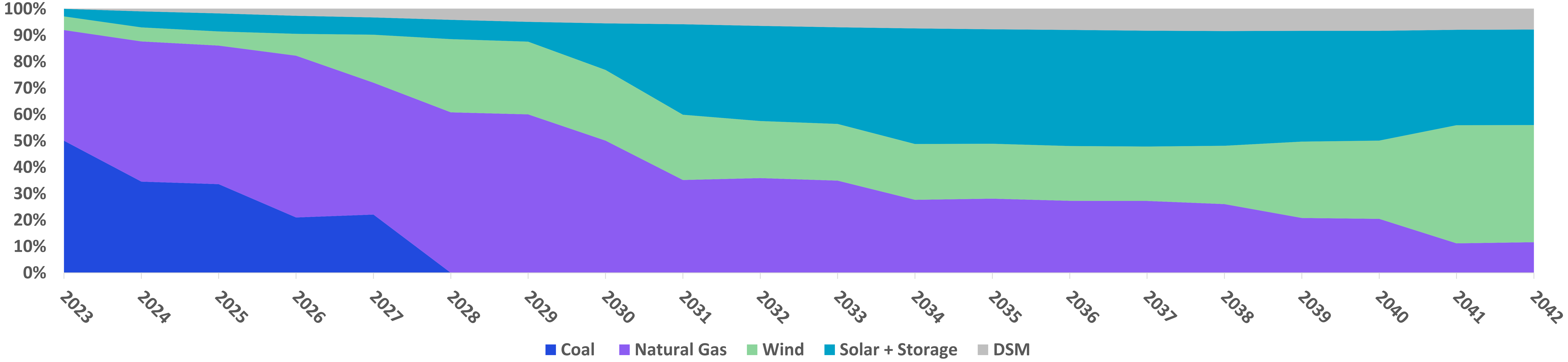
Installed Capacity Incremental Additions (MW): 2023 – 2028

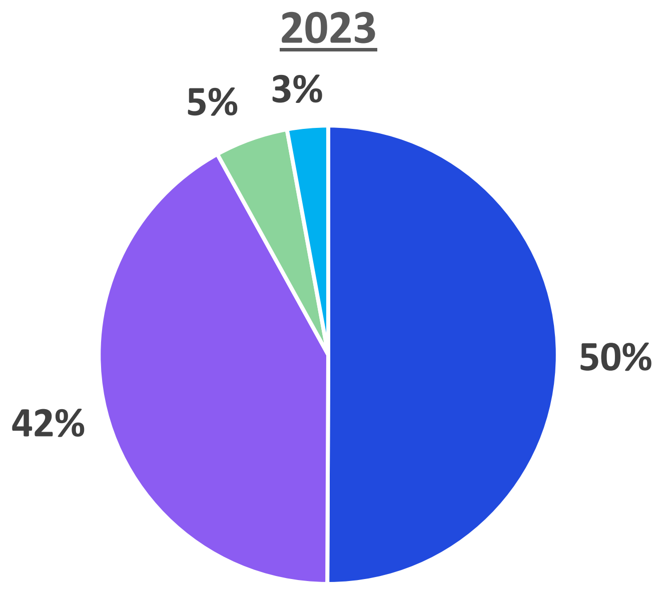
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	400
Solar	0	0	0	0	0	0
Storage	0	0	300	400	0	280
Solar + Storage	0	0	0	0	0	45
Natural Gas	0	0	0	0	0	0

Clean Energy Strategy: Current Trends *(Reference Case)*

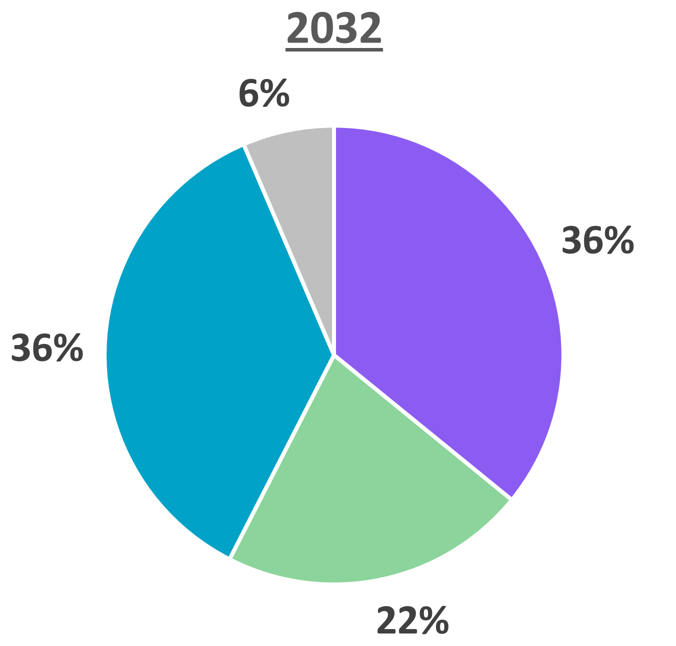
Retire & Replace Pete with Clean Energy

Energy Mix %

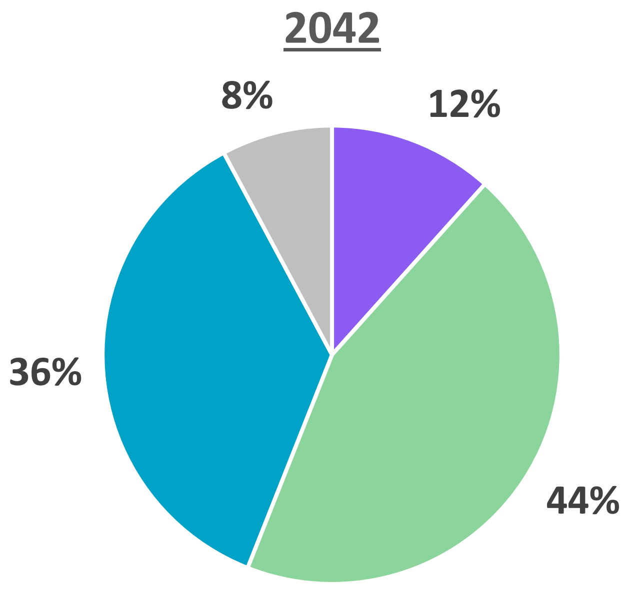




Thermal MWh %	92%
Renewable/DSM MWh %	8%



Thermal MWh %	36%
Renewable/DSM MWh %	64%



Thermal MWh %	12%
Renewable/DSM MWh %	88%

Clean Energy Strategy: Current Trends *(Reference Case)*

Retire & Replace Pete with Clean Energy

DSM Results

Energy Efficiency:

	Vintage 1	Vintage 2	Vintage 3
	2024 - 2026	2027 - 2029	2030 - 2042
Residential	Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
	Efficient Products - Higher Cost		
	Behavioral		
	School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
	Appliance Recycling		
	Multifamily		
	IQW	IQW	IQW
C&I	Prescriptive	C&I	C&I
	Custom		
	Custom RCx		
	Custom SEM		
Impacts	Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
	134,263	141,526	146,428
	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
	1.1%	1.1%	1.2%
	Cummulative Summer MW	Cummulative Summer MW	Cummulative Summer MW
	89 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	195 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

Clean Energy Strategy: Current Trends *(Reference Case)*

Retire & Replace Pete with Clean Energy

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Retired Nat Gas MW: 618 MW**

Replacements by 2042

- DSM: 610 MW
- Wind: 2,450 MW
- Solar: 2,438 MW
- Storage: 1,560 MW
- Solar + Storage: 180 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

Strategy	PVRR
No Early Retirement	$9,572
Pete Refuel to 100% Gas (est. 2025)	$9,330
One Pete Unit Retires (2026)	$9,773
Both Pete Units Retire (2026 & 2028)	$9,618
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711
Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,262

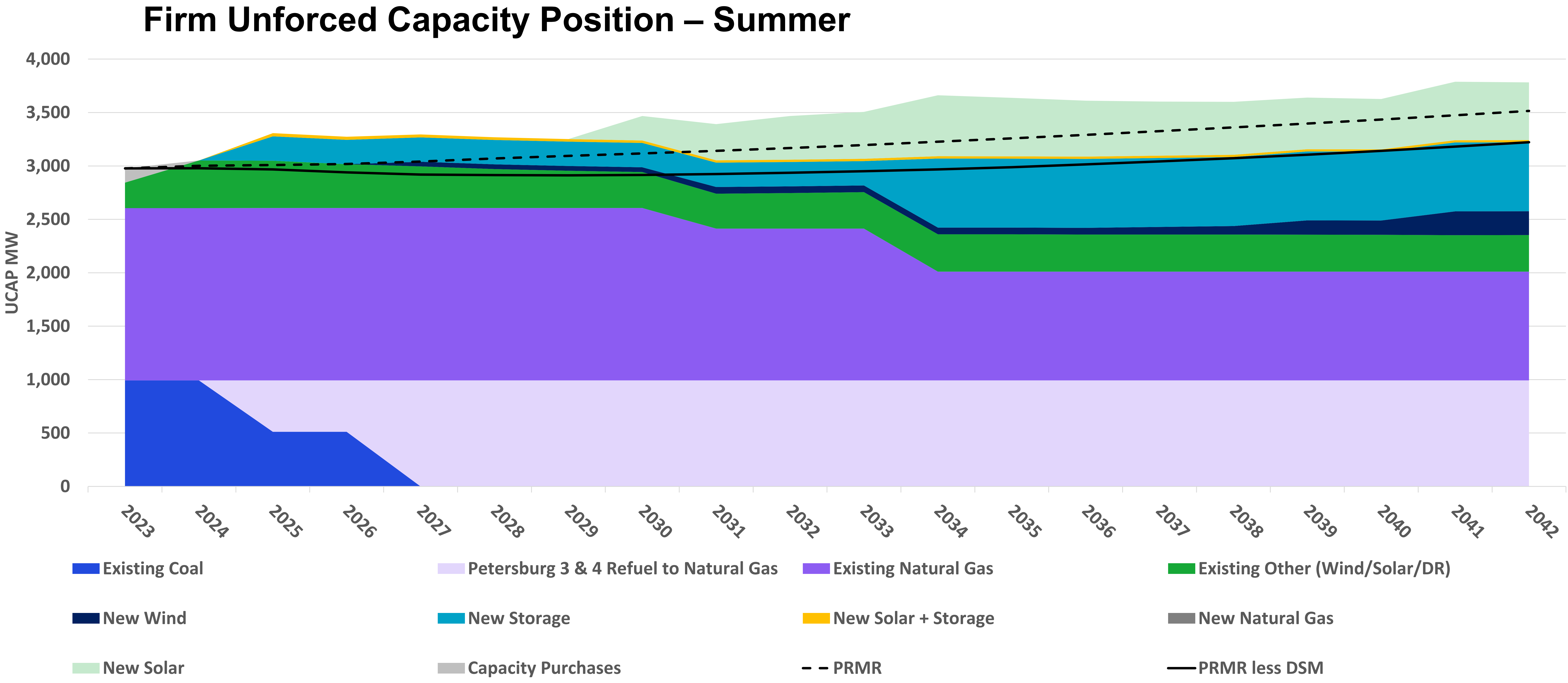
F. Encompass Optimization

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
	$9,262		

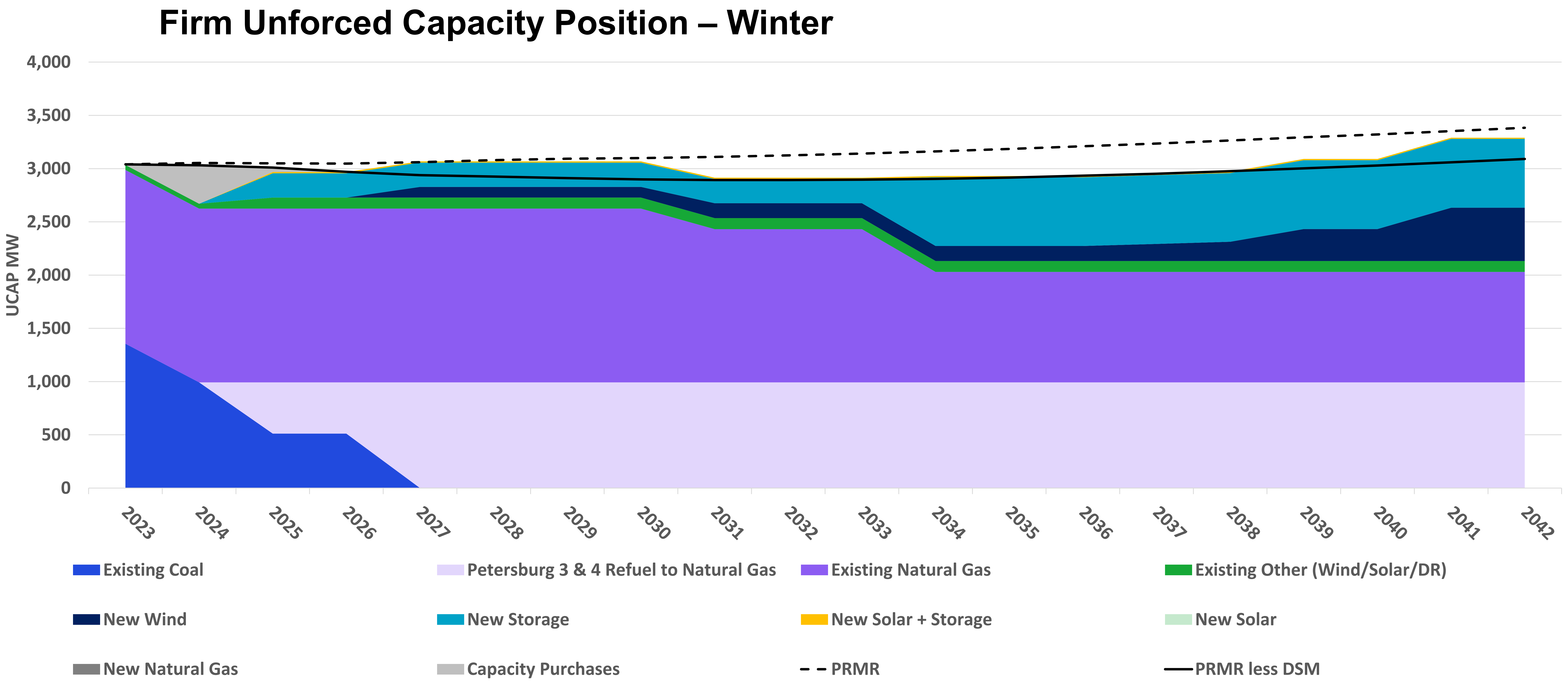
Encompass Optimization: Current Trends *(Reference Case)*

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027



Encompass Optimization: Current Trends *(Reference Case)*

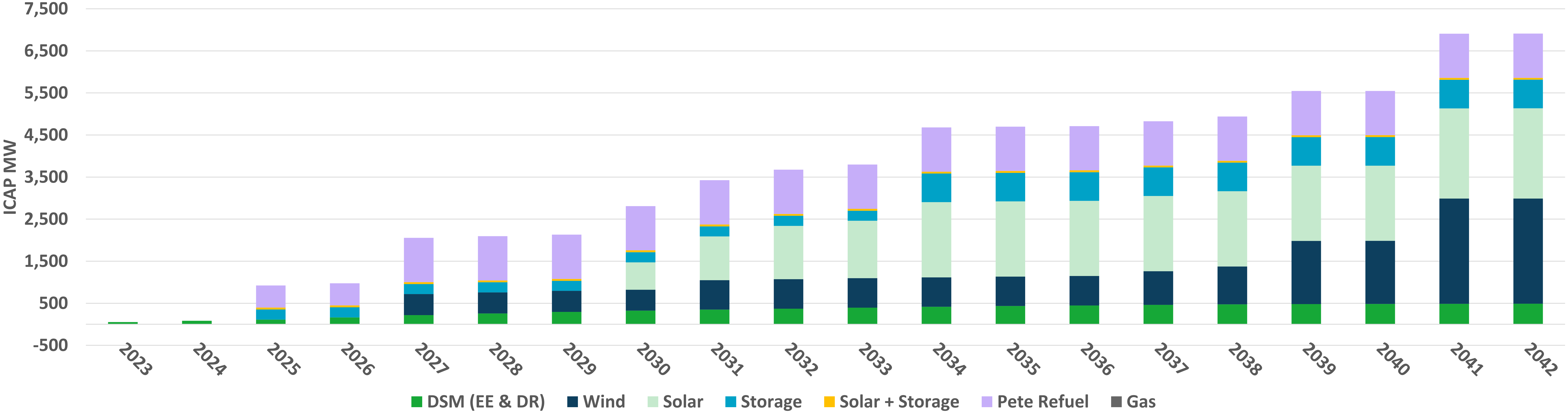
Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027



Encompass Optimization: Current Trends *(Reference Case)*

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Installed Capacity Cumulative Additions (MW)



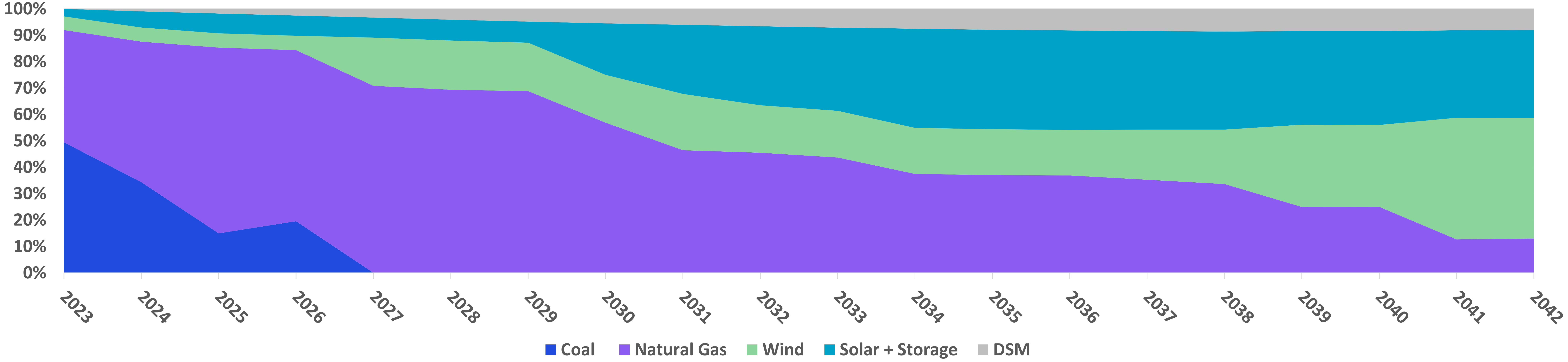
Installed Capacity Incremental Additions (MW): 2023 - 2028

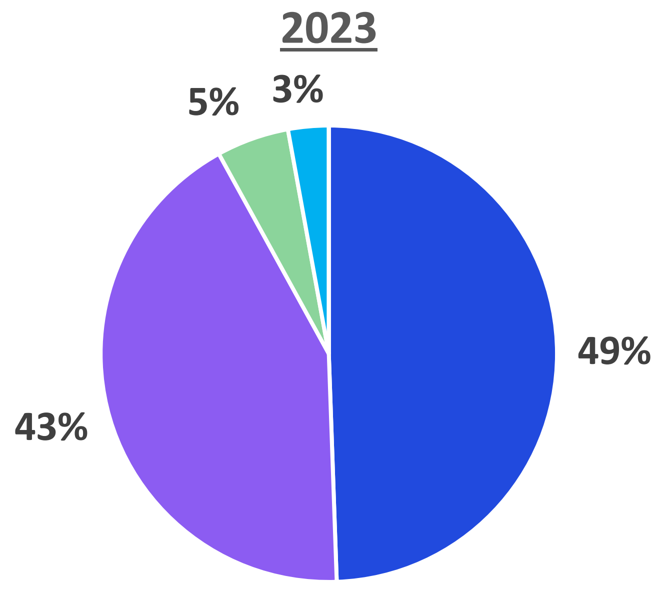
	2023	2024	2025	2026	2027	2028
Pete Refuel	0	0	526	0	526	0
Wind	0	0	0	0	500	0
Solar	0	0	0	0	0	0
Storage	0	0	240	0	0	0
Solar + Storage	0	0	45	0	0	0

Encompass Optimization: Current Trends *(Reference Case)*

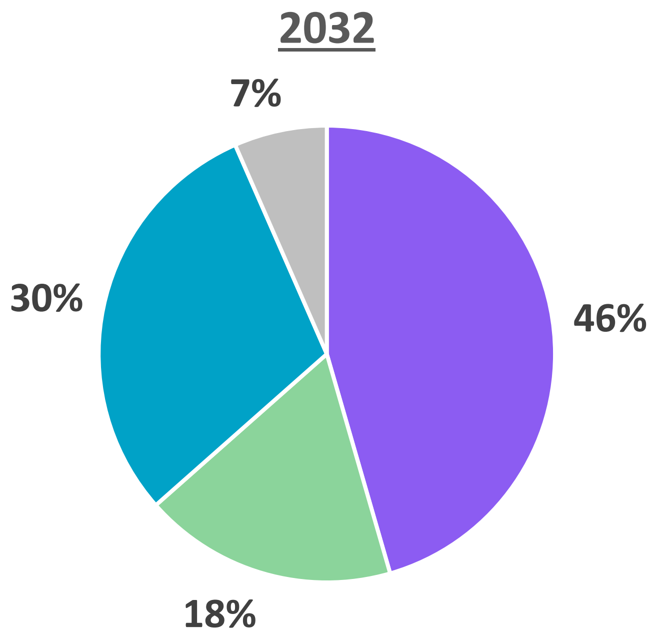
Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Energy Mix %

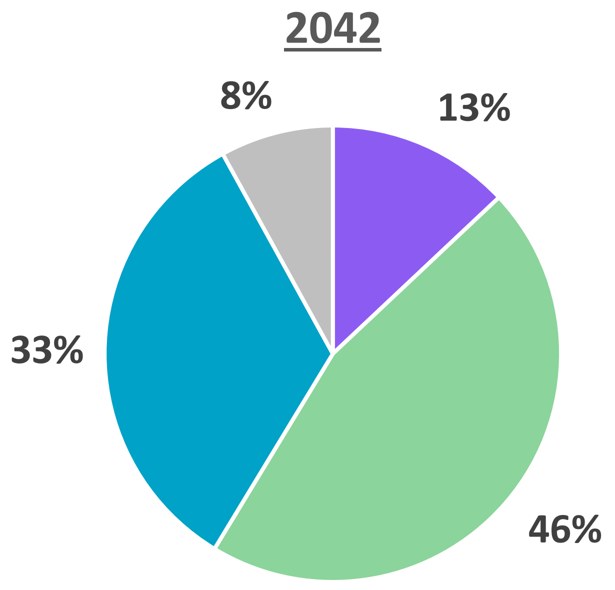




Thermal MWh %	92%
Renewable/DSM MWh %	8%



Thermal MWh %	46%
Renewable/DSM MWh %	54%



Thermal MWh %	13%
Renewable/DSM MWh %	87%

Encompass Optimization: Current Trends *(Reference Case)*

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

DSM Results

Energy Efficiency:

		Vintage 1	Vintage 2	Vintage 3
		2024 - 2026	2027 - 2029	2030 - 2042
Residential		Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
		Efficient Products - Higher Cost		
		Behavioral		
		School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
		Appliance Recycling		
		Multifamily		
		IQW	IQW	IQW
C&I		Prescriptive	C&I	C&I
		Custom		
		Custom RCx		
		Custom SEM		
Impacts		Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
		134,263	141,526	146,428
		% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
		1.1%	1.1%	1.2%
		Cummulative Summer MW	Cummulative Summer MW	Cummulative Summer MW
		89 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	75 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

Encompass Optimization: Current Trends *(Reference Case)*

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Refueled MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,145 MW
- Storage: 680 MW
- Solar + Storage: 45 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

Strategy	PVRR
No Early Retirement	$9,572
Pete Refuel to 100% Gas (est. 2025)	$9,330
One Pete Unit Retires (2026)	$9,773
Both Pete Units Retire (2026 & 2028)	$9,618
Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711
Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,262

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Portfolio Matrix

	20-Year PVRR (2023$MM, 2023-2042)	**Scenarios**			
		No Environmental Action	**Current Trends (Reference Case)**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**	$7,111	$9,572	$11,349	$9,917
	Pete Refuel to 100% Gas (est. 2025)	$6,621	$9,330	$11,181	$9,546
	One Pete Unit Retires (2026)	$7,462	$9,773	$11,470	$9,955
	Both Pete Units Retire (2026 & 2028)	$7,425	$9,618	$11,145	$9,923
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211	$9,711	$11,184	$9,690
	Encompass Optimization without predefined Strategy	$6,610	$9,262	$10,994*	$9,572

Encompass Optimization Results by Scenario:

Refuels Petersburg Units 3 & 4 in 2025	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 4 in 2027*	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

*Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.

Break for Lunch

Time	Topic	Speakers
Afternoon Starting at 12:30 PM	Replacement Resource Cost Sensitivity Analysis	Erik Miller, Manager, Resource Planning, AES Indiana
	Preliminary IRP Scorecard Results	Erik Miller, Manager, Resource Planning, AES Indiana

Replacement Resource Cost Sensitivity Analysis

Erik Miller, Manager, Resource Planning, AES Indiana

Replacement Resource Cost Sensitivity Analysis Overview

As part of this IRP, AES Indiana conducted a sensitivity analysis on the capital costs for replacement resources. The analysis was conducted in response to the current volatility of replacement resource capital cost caused by supply constraints and potential solar tariffs.

How the analysis was performed

- Using secondary data sources and the responses from AES Indiana's past two RFPs that were issued in 2020 and the spring of 2022, the IRP team created low, base and high levels of replacement resource costs.
  - Low – low costs were based on the avg of the contemporary replacement resource capital cost forecasts from Wood Mackenzie, NREL and BNEF and benchmarked against the responses from AES Indiana's 2020 RFP.
  - Base – base costs were based on the lower half of the 2022 RFP responses.
  - High – high costs were based on the upper half of the 2022 RFP responses.
  - Capacity Expansion (Retirement & Replacement) analysis was performed for each

Current Trends strategies at the three different replacement resource cost levels.

The following slides present the range of generation additions for each strategy that result from running capacity expansion with the different cost levels.

Low, Base and High replacement resource costs (nominal $/kW unsubsidized) in 2025

	Low	Base	High
Wind	$1,477	$1,909	$2,340
Solar	$1,036	$1,364	$1,925
4-hr Storage	$1,016	$1,253	$1,447
6-hr Storage	$1,525	$1,880	$2,170
Hybrid	$985	$1,270	$1,689
CCGT	$1,028	$1,120	$1,212
Frame CT	$868	$945	$1,023
Aero CT	$1,328	$1,447	$1,566
Recip	$1,277	$1,391	$1,505

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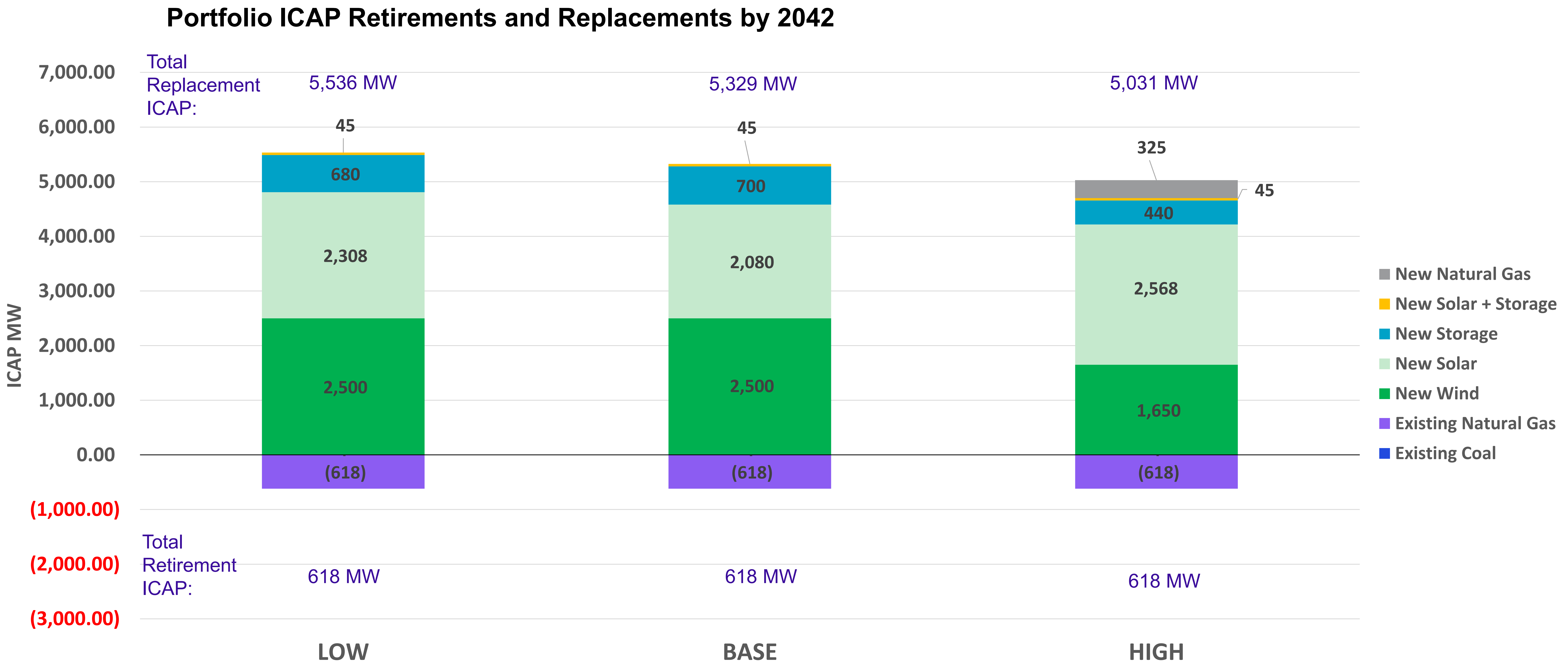
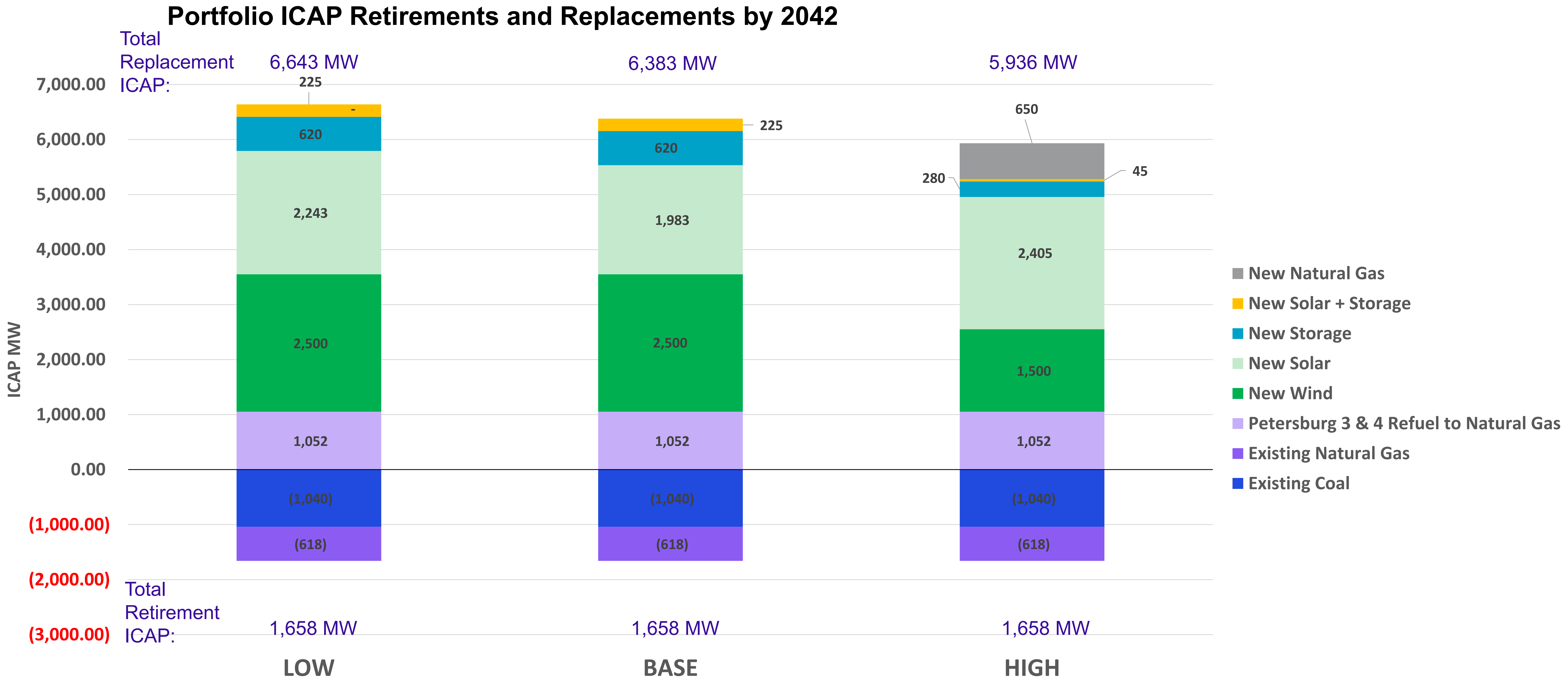
Replacement Resource Cost Sensitivity

No Early Retirement



Replacement Resource Cost Sensitivity

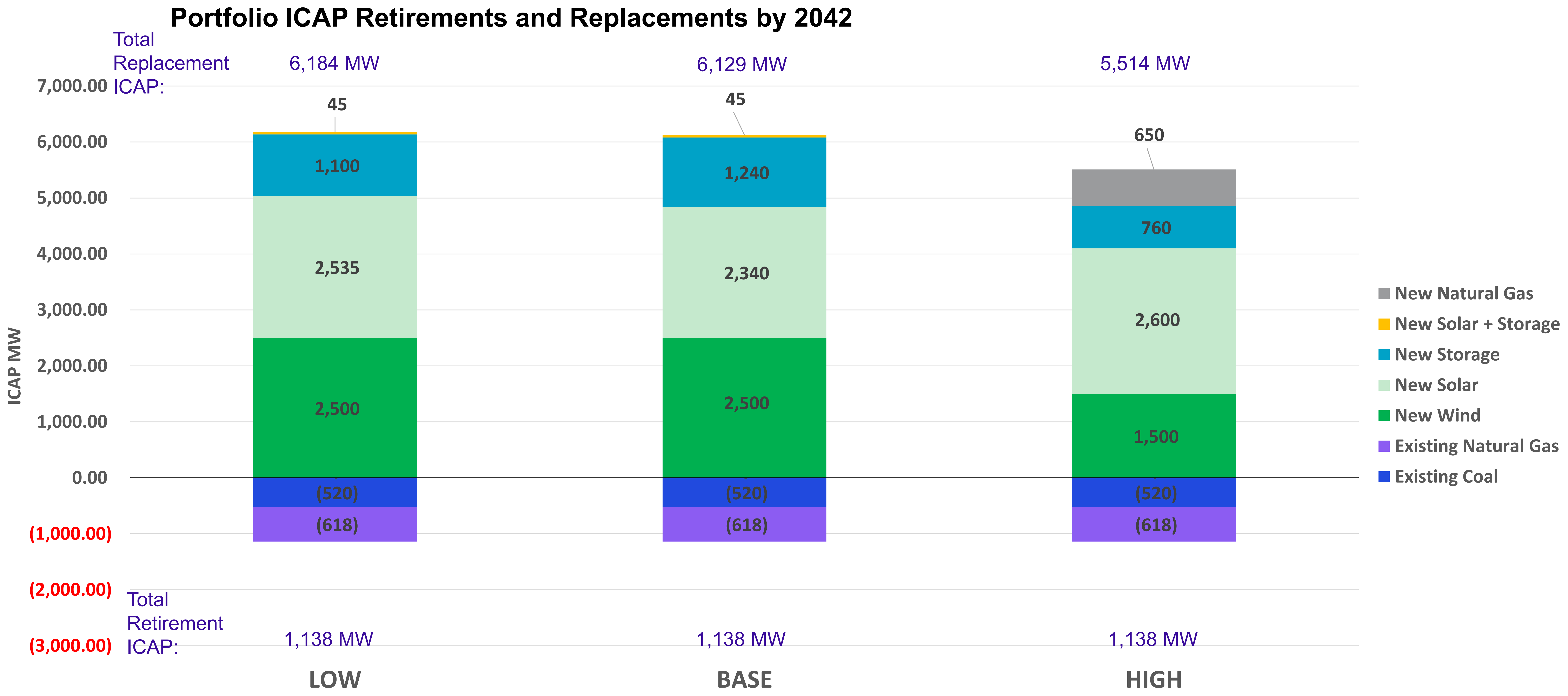
Pete Refuel by 2025



Portfolio ICAP Retirements and Replacements by 2042

Replacement Resource Cost Sensitivity

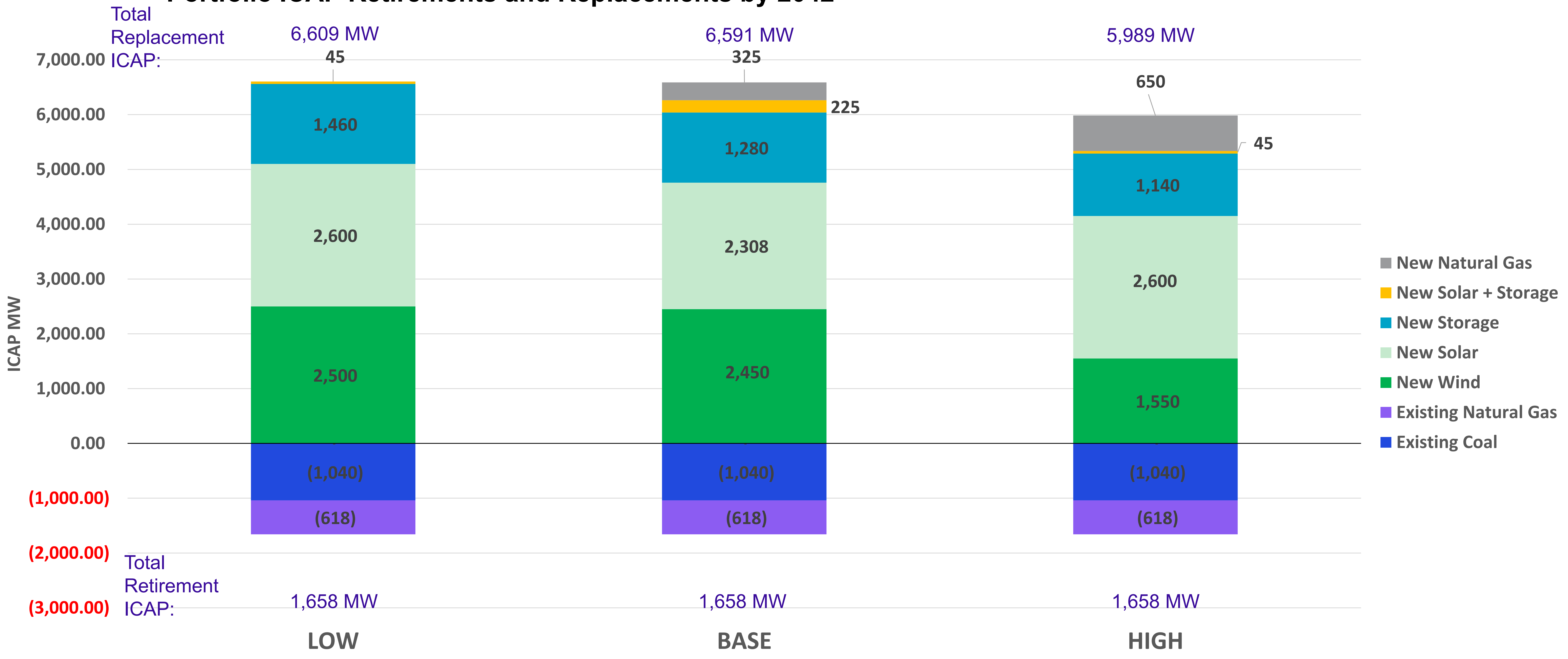
One Pete Unit Retires



Replacement Resource Cost Sensitivity

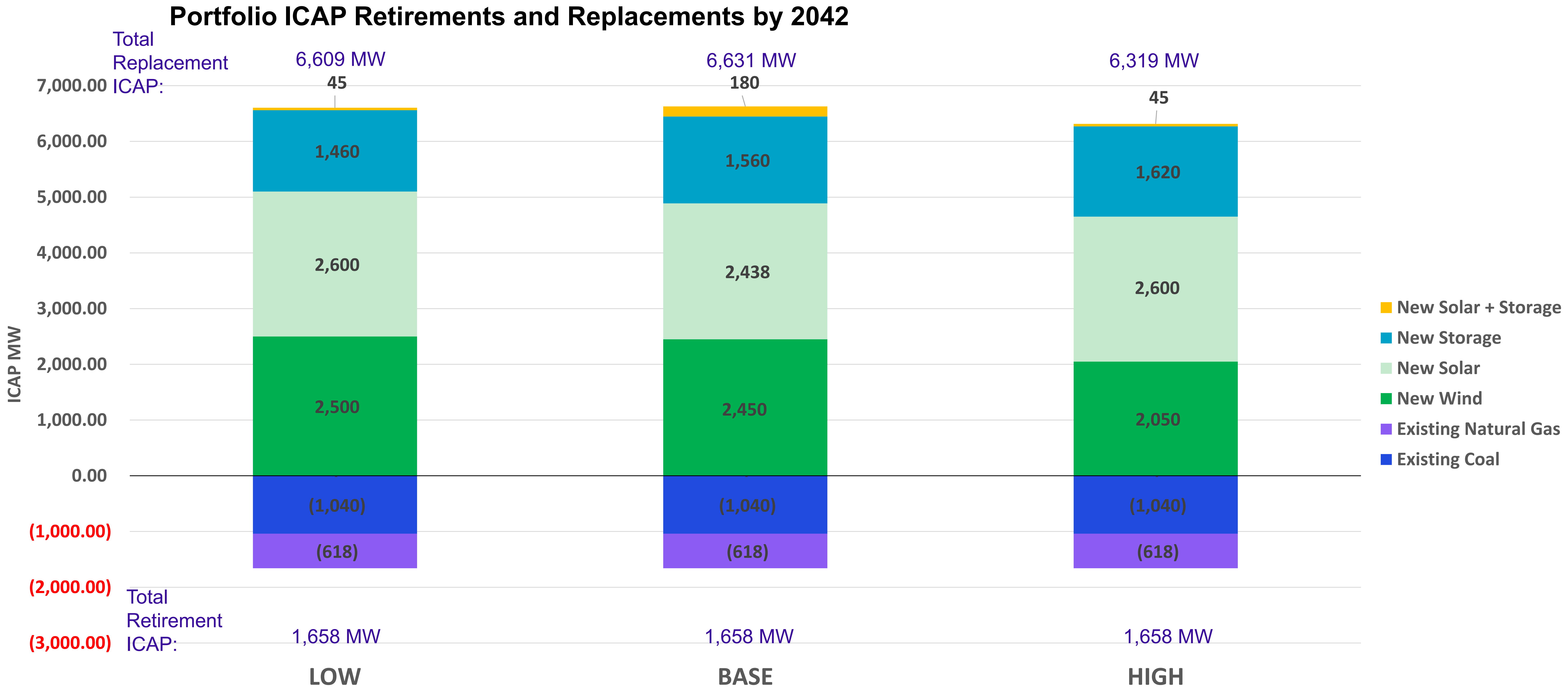
Both Pete Unite Retire

Portfolio ICAP Retirements and Replacements by 2042



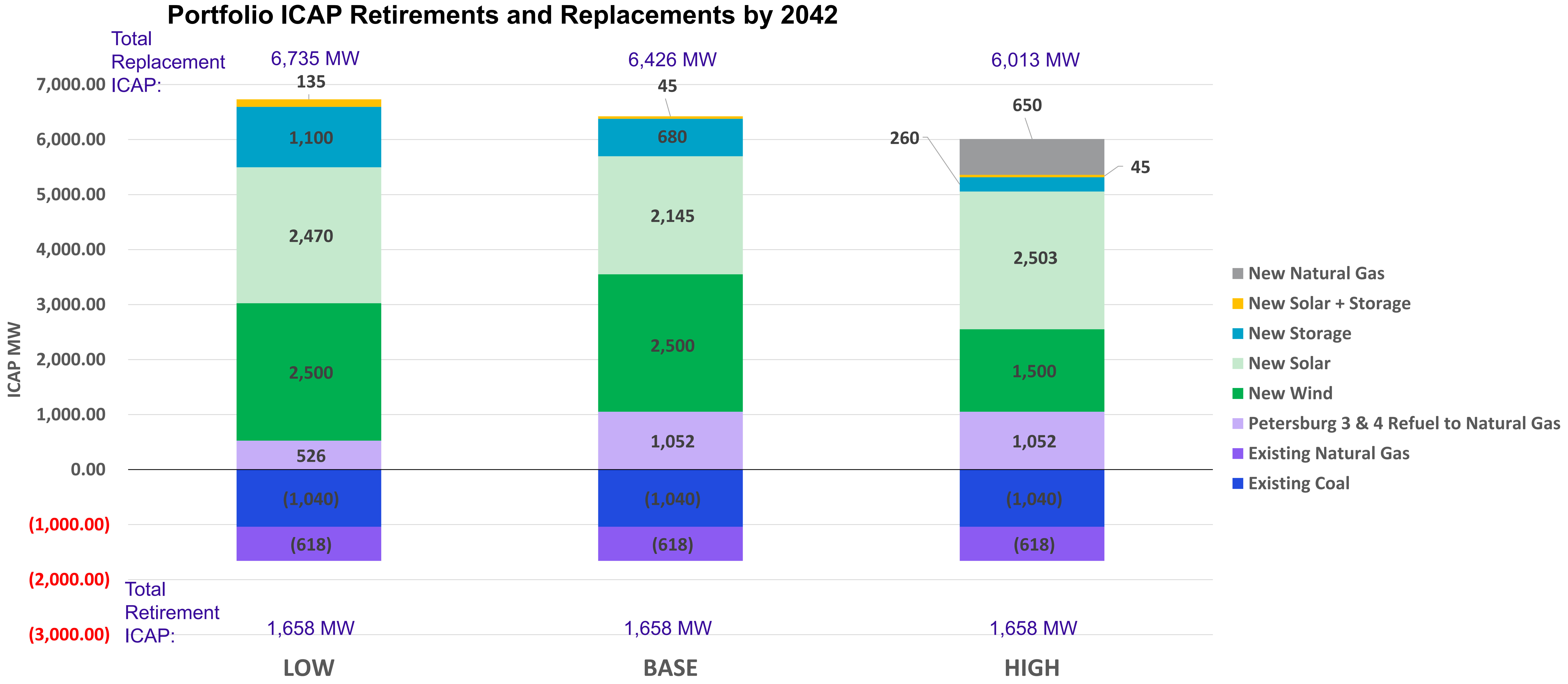
Replacement Resource Cost Sensitivity

Clean Energy Strategy



Replacement Resource Cost Sensitivity

Encompass Optimization



Replacement Resource Cost Sensitivity

Key Takeaways & PVRR Results

- → As capital costs increase, fewer renewables are built for their energy value to the portfolio.
- → As capital costs increase, newly constructed natural gas becomes more cost effective – less high price volatility with the cost to construct natural gas.
- → Across the range of Replacement Resource Costs, refueling Petersburg provides a low PVRR.

20-Year PVRR (2023$MM, 2023-2042)		**Current Trends (Reference Case)**		
		Low	**Base**	**High**
Generation Strategies	**No Early Retirement**	$9,054	$9,572	$9,876
	Pete Refuel to 100% Gas (est. 2025)	$8,698	$9,330	$9,661
	One Pete Unit Retires (2026)	$9,081	$9,773	$10,181
	Both Pete Units Retire (2026 & 2028)	$8,790	$9,618	$10,178
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$8,787	$9,711	$10,586
	Encompass Optimization without predefined Strategy	$8,670*	$9,262	$9,624

Encompass Optimization Portfolios		
Low	**Base**	**High**
Refuels Petersburg Unit 3 in 2025*	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

*Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.

Preliminary IRP Scorecard Results

Erik Miller, Manager, Resource Planning, AES Indiana

Preliminary Scorecard Results

Affordability, Environmental Sustainability and Risk & Opportunity metrics for the Current Trends portfolios

	Affordability	Environmental Sustainability						Reliability, Stability & Resiliency	Risk & Opportunity						Economic Impact	
	20-yr PVRR	*CO_2 Emissions*	*SO_2 Emissions*	*NO_X Emissions*	*Water Use*	*Coal Combustion Products (CCP)*	*Clean Energy Progress*	*Reliability Score*	*Environmental Policy Opportunity*	*Environmental Policy Risk*	*Cost Opportunity*	*Cost Risk*	*Market Exposure*	*Renewable Capital Cost Risk (+50%)*	*Employees (+/-)*	*Property Taxes*
	Present Value of Revenue Requirements (2023 $000,000)	CO2 Emissions (mmtons) 2023 - 2032	SO2 Emissions (tons) 2023 - 2032	NOx Emissions (tons) 2023 - 2032	Water Use (mmgal) 2023 - 2032	CCP (tons) 2023 - 2032	% Renewable Energy in 2032	Composite score from Reliability Analysis	Lowest PVRR across policy scenarios	Highest PVRR across policy scenarios	Mean - P95	P95 - Mean	20-year avg sales + purchases	Portfolio PVRR w/ renewable costs +50%	Total FTEs associated with generation	Total amount of property tax paid from AES IN assets (2023 $000,000)
1	$ 9,572	73.2	49,944	34,755	28.4	5,126	45%									$ 173
2	$ 9,330	54.5	13,402	19,501	7.9	1,417	55%									$ 211
3	$ 9,773	65.2	37,102	33,243	26.7	4,813	52%									$ 215
4	$ 9,618	58.6	25,506	23,102	15.0	2,700	48%									$ 248
5	$ 9,711	55.3	25,254	23,303	14.8	2,676	64%									$ 262
6	$ 9,262	56.6	18,503	22,559	10.9	1,970	54%									$ 203

Metrics Still in Progress

Strategies

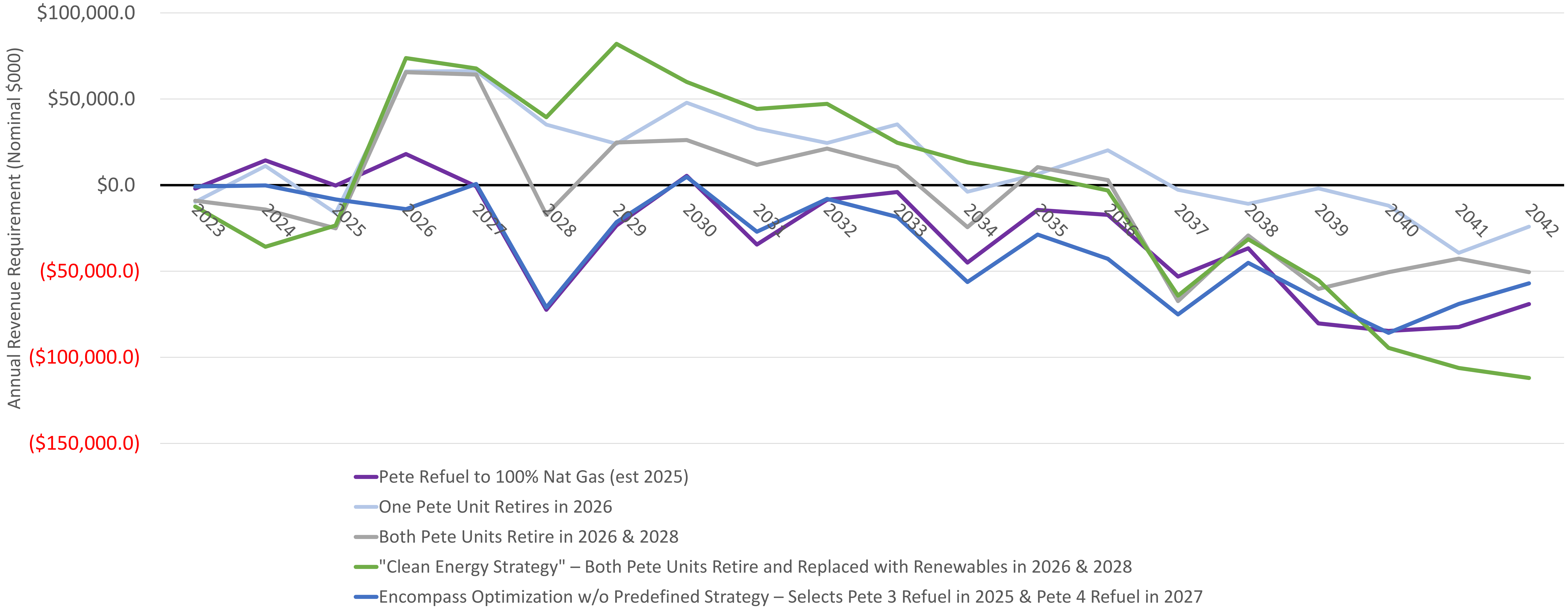
- **1.** No Early Retirement
- **2.** Pete Refuel to 100% Natural Gas (est. 2025)
- **3.** One Pete Unit Retires in 2026
- **4.** Both Pete Units Retire in 2026 & 2028
- **5.** "Clean Energy Strategy" – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- **6.** Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Complete Scorecard review and selection of the Preferred Resource Portfolio will be topics for Public Advisory Meeting # 5.

IRP Annual Revenue Requirement

Compared to the No Retirement ("Status Quo") Scenario

Presented revenue requirement is only for incremental generation capital expenditures



Final Q&A and Next Steps

Public Advisory Meeting

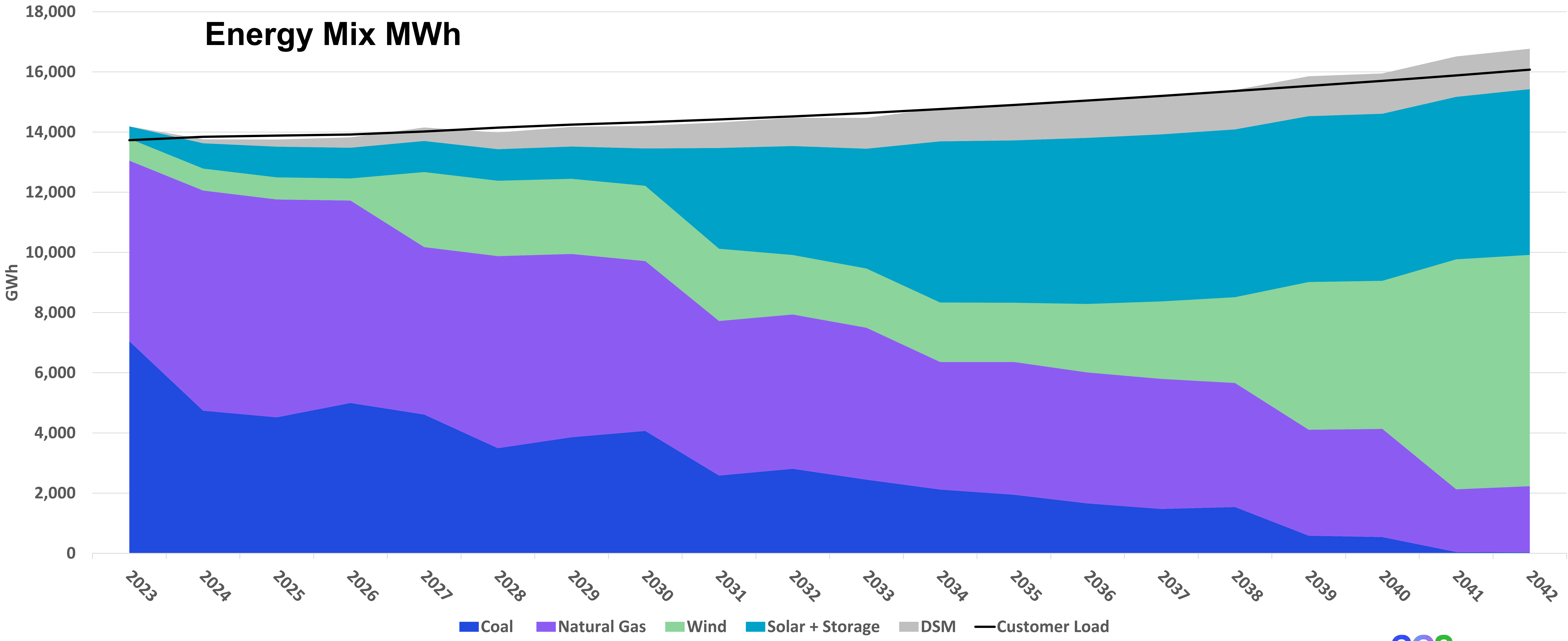
Public Advisory Meeting #1	Public Advisory Meeting #2	Public Advisory Meeting #3	Public Advisory Meeting #4	Public Advisory Meeting #5
Jan. 24, 2022	**April 12, 2022**	**June 27, 2022**	**Sept. 19, 2022**	**Oct./Nov. 2022**

- → All meetings will be available for attendance via Teams. Meetings in 2022 may also occur in-person.
- → A Technical Meeting will be held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics will focus on those anticipated at the next Public Advisory Meeting.
- → Meeting materials can be accessed at ***www.aesindiana.com/integrated-resource-plan.***

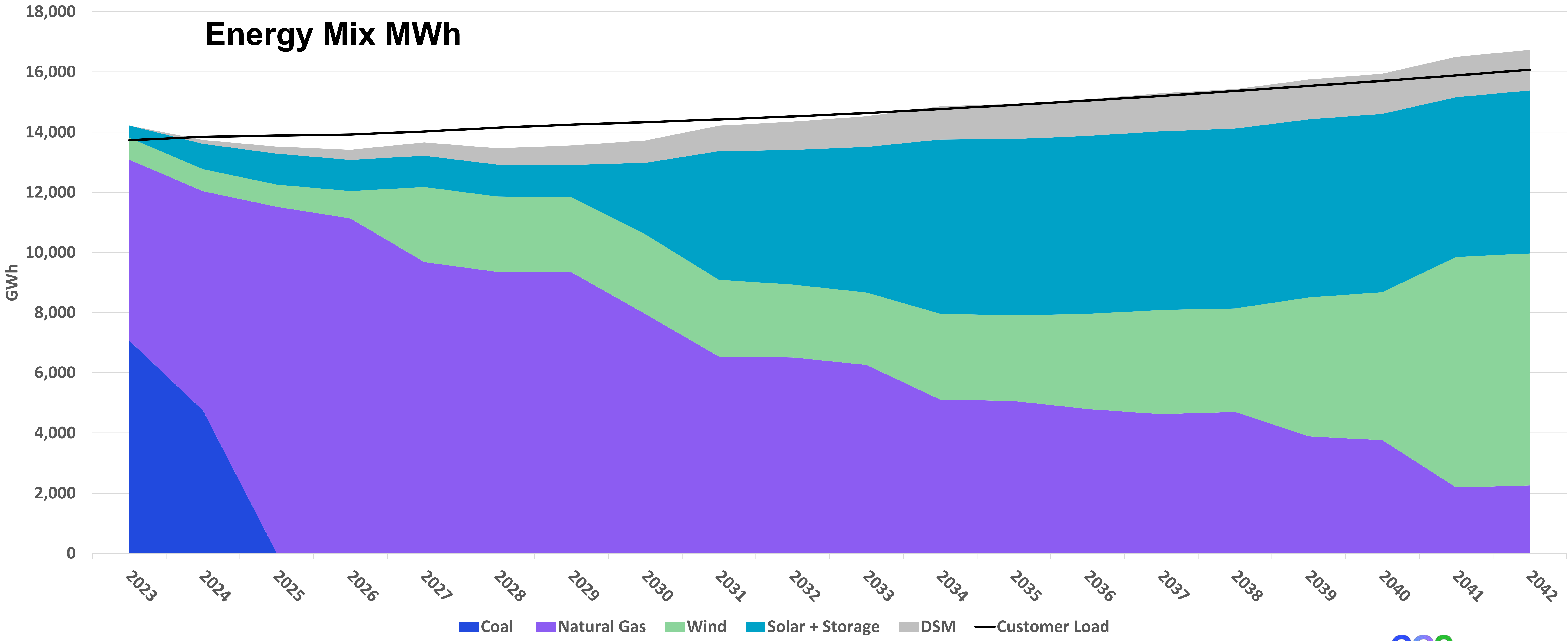
Thank You

Appendix

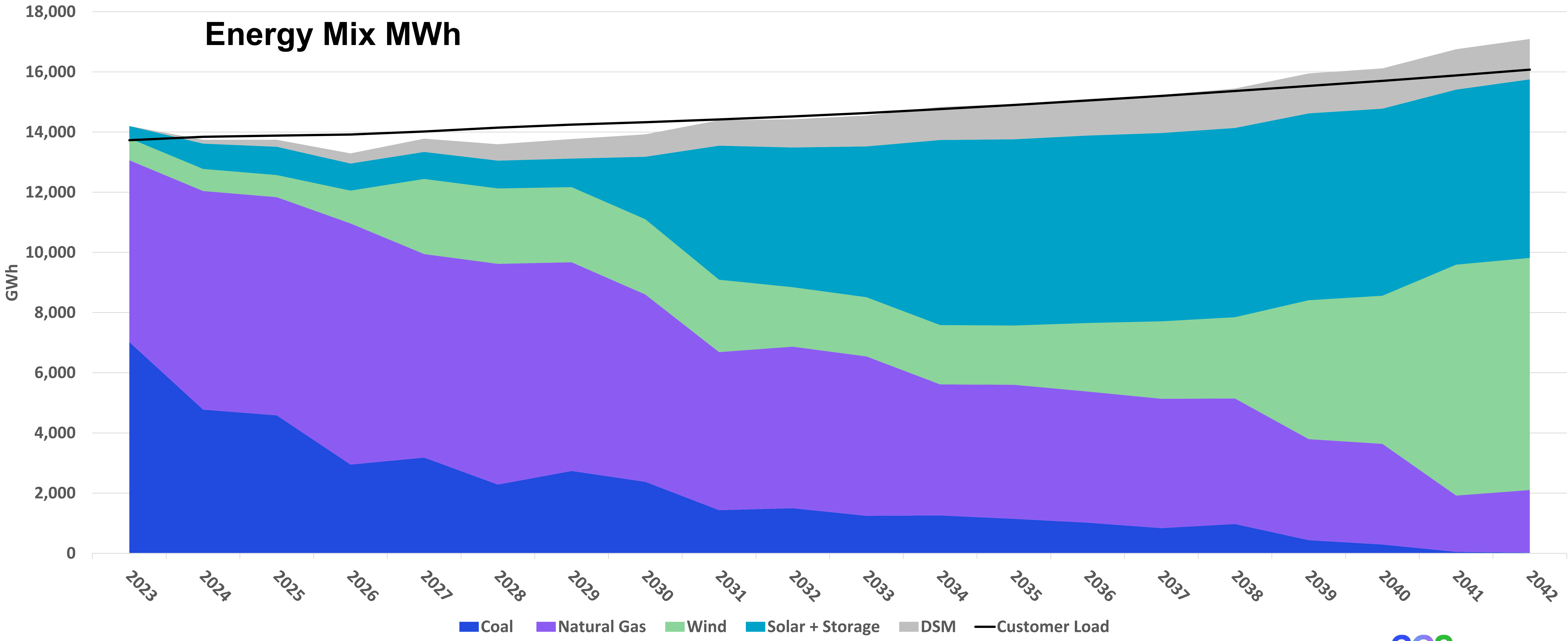
No Early Retirement: Current Trends *(Reference Case)*



Pete 3 & 4 Refuel in 2025: Current Trends *(Reference Case)*

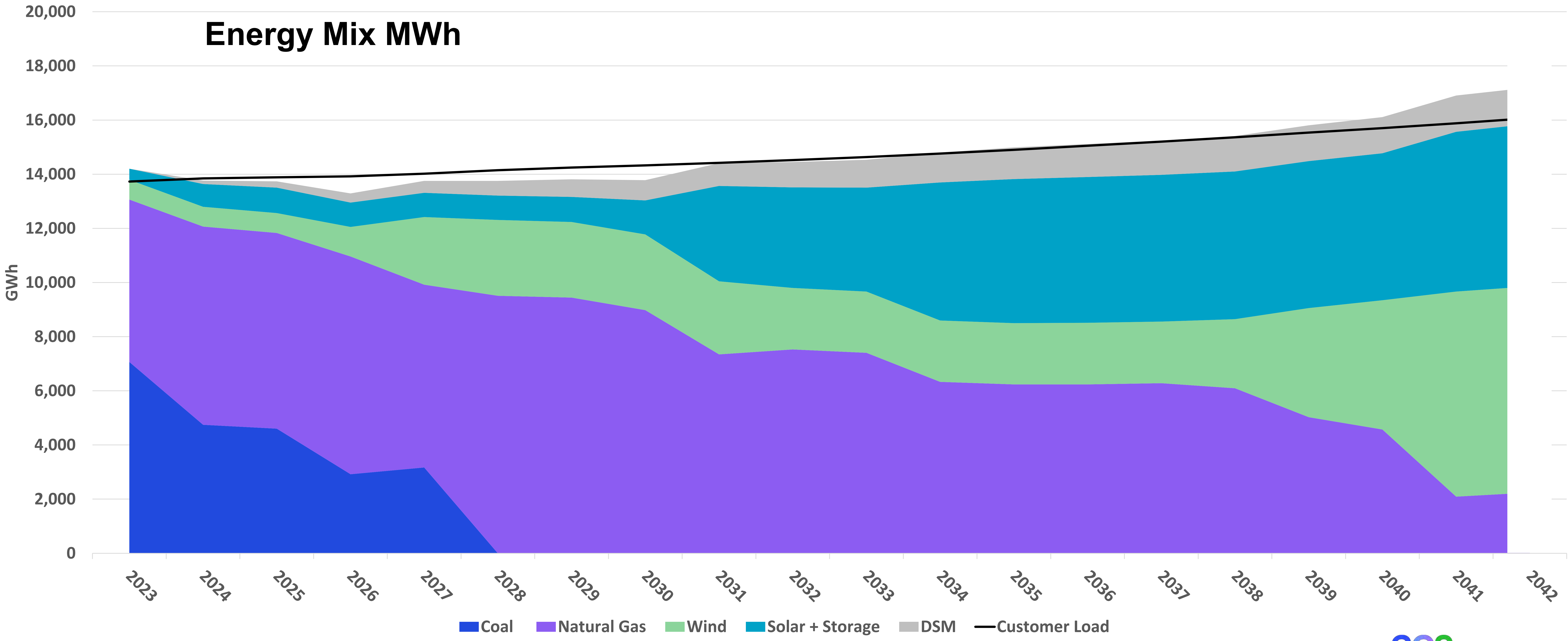


One Pete Unit Retires (2026): Current Trends *(Reference Case)*



Both Pete Units Retire: Current Trends *(Reference Case)*

2026 & 2028



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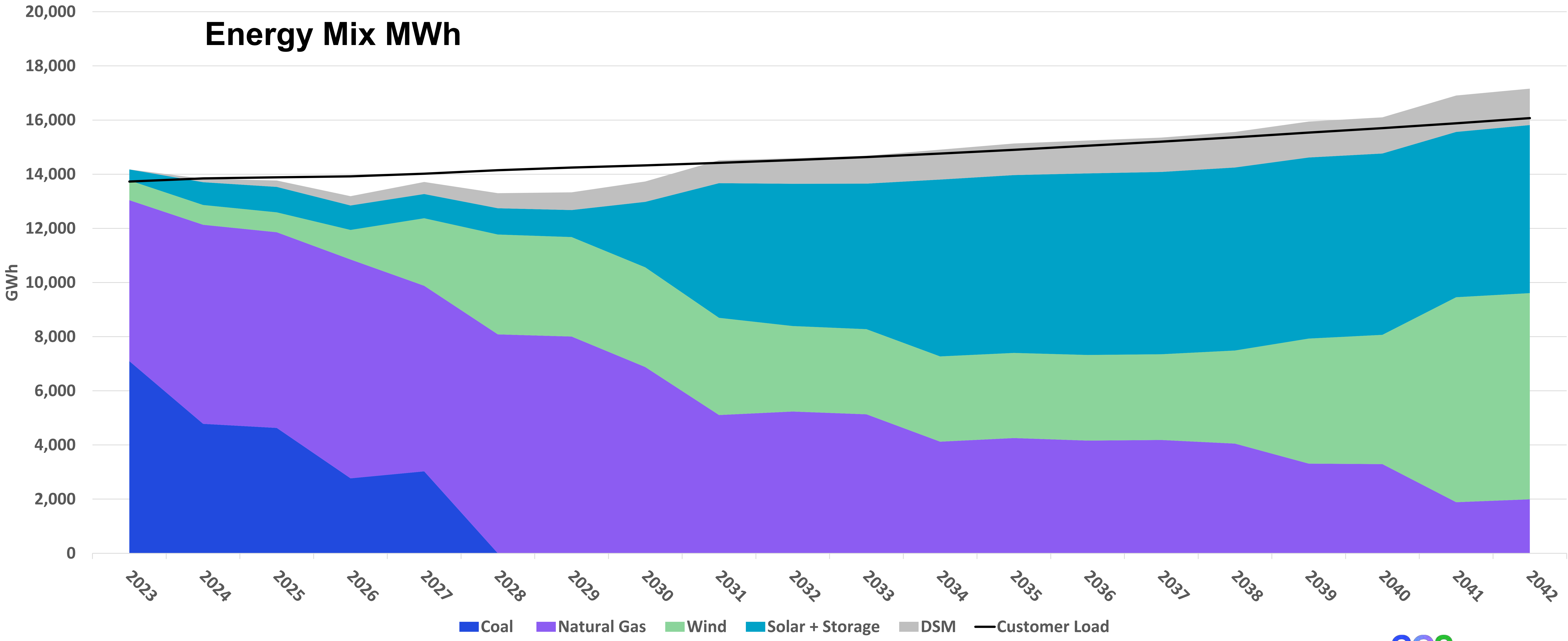
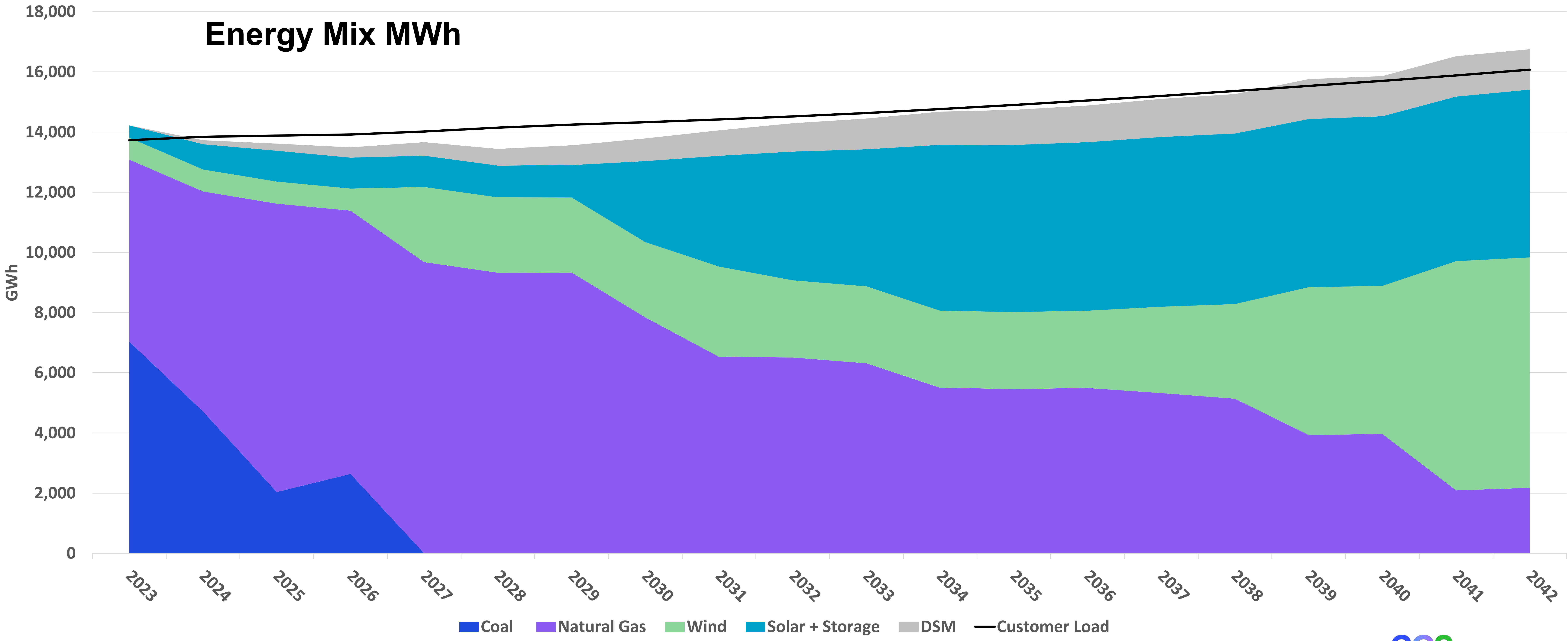
Clean Energy Strategy: Current Trends *(Reference Case)*

Retire & Replace Pete with Clean Energy



Encompass Optimization: Current Trends *(Reference Case)*

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027



Environmental Sustainability Metrics

Environmental Sustainability					
***CO_2* Emissions**	***SO_2* Emissions**	***NO_X* Emissions**	***Water Use***	***Coal Combustion Products (CCP)***	***Clean Energy Progress***
Total portfolio CO2 Emissions (mmtons) 2023 - 2042	Total portfolio SO2 Emissions (tons) 2023 - 2042	Total portfolio NOx Emissions (tons) 2023 - 2042	Water Use (mmgal) 2023 - 2042	CCP (tons) 2023 - 2042	% Renewable Energy in 2032
101.9	64,991	45,605	36.7	6,611	45%
72.5	13,513	22,146	7.9	1,417	55%
88.1	45,544	42,042	26.7	4,813	52%
79.5	25,649	24,932	15.0	2,700	48%
69.8	25,383	24,881	14.8	2,676	64%
76.1	18,622	25,645	10.9	1,970	54%

Strategies

- **1.** No Early Retirement
- **2.** Pete Refuel to 100% Natural Gas (est. 2025)
- **3.** One Pete Unit Retires in 2026
- **4.** Both Pete Units Retire in 2026 & 2028
- **5.** “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- **6.** Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.

IRP Acronyms

- ACEE: The American Council for an Energy-Efficient Economy
- AMI: Advanced Metering Infrastructure
- AD: Ad Valorem
- AD/CVD: Antidumping and Countervailing Duties
- ADMS: Advanced Distribution Management System
- BESS: Battery Energy Storage System
- BNEF: Bloomberg New Energy Finance
- BTA: Build-Transfer Agreement
- BTU: British Thermal Unit
- C&I: Commercial and Industrial
- CAA: Clean Air Act
- CAGR: Compound Annual Growth Rate
- CCGT: Combined Cycle Gas Turbines
- CCP: Coal Combustion Products
- CCS: Carbon Dioxide Capture and Storage
- CDD: Cooling Degree Day
- CIS: Customer Integrated System
- COD: Commercial Operation Date
- CONE: Cost of New Entry
- CP: Coincident Peak
- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVD: Countervailing Duties
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DERA: Distributed Energy Resource Aggregation
- DERMS: Distributed Energy Resource Management System
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOC: U.S. Department of Commerce
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DMS: Distribution Management System
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- ESCR: Effective Selective Catalytic Reduction System
- EV: Electric Vehicle
- FLOC: Federated Learning of Cohorts
- FTE: Full-Time Employee
- GDP: Gross Domestic Product
- GFL: Grid-Following System
- GIS: Geographic Information System
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IBR: Inverter-Based Resource
- IC: Indiana Code
- ICE: Intercontinental Exchange
- ICAP: Installed Capacity
- IEEE: Institute of Electrical and Electronics Engineers

IRP Acronyms

- IRA: Inflation Reduction Act
- IRP: Integrated Resource Plan
- ICE: Internal Combustion Engine
- IQW: Income Qualified Weatherization
- ITC: Investment Tax Credit
- IURC: Indiana Regulatory Commission
- kW: Kilowatt
- kWh: Kilowatt-Hour
- MATS: Mercury and Air Toxics Standards
- MaxGen: Maximum Generation
- MDMS: Meter Data Management System
- MISO: Midcontinent Independent System Operator
- MMGAL: One Million Gallons
- MMTons: One Million Metric Tons
- MPS: Market Potential Study
- MW: Megawatt
- Nat Gas: Natural Gas
- NDA: Nondisclosure Agreement
- NOX: Nitrogen Oxides
- NPV: Net Present Value
- NREL: National Renewable Energy Laboratory
- NTG: Net to Gross
- OMS: Outage Management System
- PLL: Phase-Locked Loop
- PPA: Power Purchase Agreement
- PRA: Planning Resource Auction
- PSSE: Power System Simulator for Engineering
- PTC: Renewable Electricity Production Tax Credit
- PRMR: Planning Reserve Margin Requirement
- PV: Photovoltaic
- PVRR: Present Value Revenue Requirement
- PY: Planning Year
- RA: Resource Adequacy
- RAN: Resource Availability and Need
- RAP: Realistic Achievable Potential
- RCx: Retrocommissioning
- REC: Renewable Energy Credit
- REP: Renewable Energy Production
- RFP: Request for Proposals
- RIIA: MISO’s Renewable Integration Impact Assessment
- RPS: Renewable Portfolio Standard
- SCADA: Supervisory Control and Data Acquisition
- RTO: Regional Transmission Organization
- SAC: MISO’s Seasonal Accredited Capacity
- SAE: Small Area Estimation
- SCR: Selective Catalytic Reduction System
- SEM: Strategic Energy Management
- SO2: Sulfur Dioxide
- SMR: Small Modular Reactors
- ST: Steam Turbine
- SUFG: State Utility Forecasting Group
- T&D: Transmission and Distribution
- TOU: Time-of-Use
- TRM: Technical Resource Manual
- UCT: Utility Cost Test
- UCAP: Unforced Capacity
- VAR: Volt-Amp Reactive
- VPN: Virtual Private Network
- WTP: Willingness to Participate
- XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control

No Environmental Action

20-Year PVRR (2023$MM, 2023-2042)

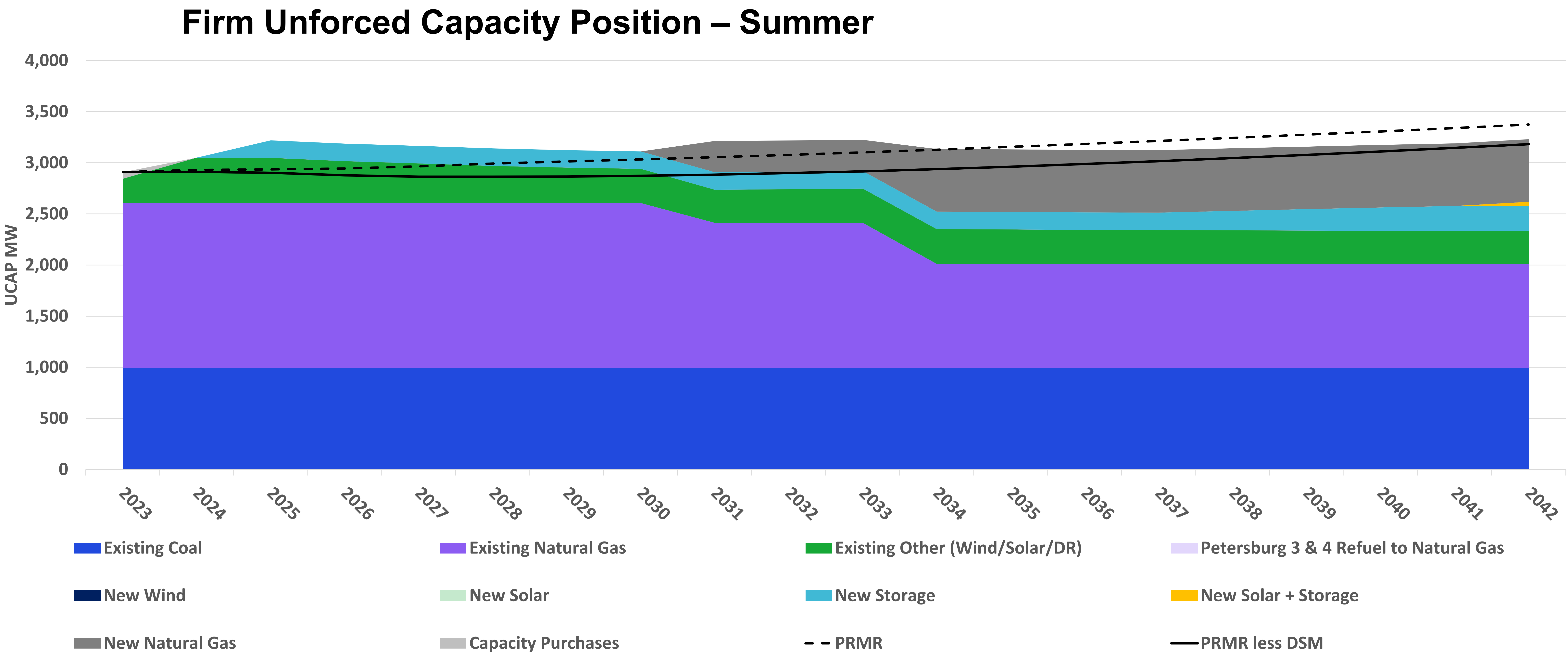
		Scenarios
		No Environmental Action
Generation Strategies	**No Early Retirement**	**$7,111**
	Pete Refuel to 100% Gas (est. 2025)	**$6,621**
	One Pete Unit Retires (2026)	**$7,462**
	Both Pete Units Retire (2026 & 2028)	**$7,425**
	“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	**$9,211**
	Encompass Optimization without predefined Strategy – Selects Pete 3 & 4 Refuel in 2025	**$6,610**

A. No Early Retirement

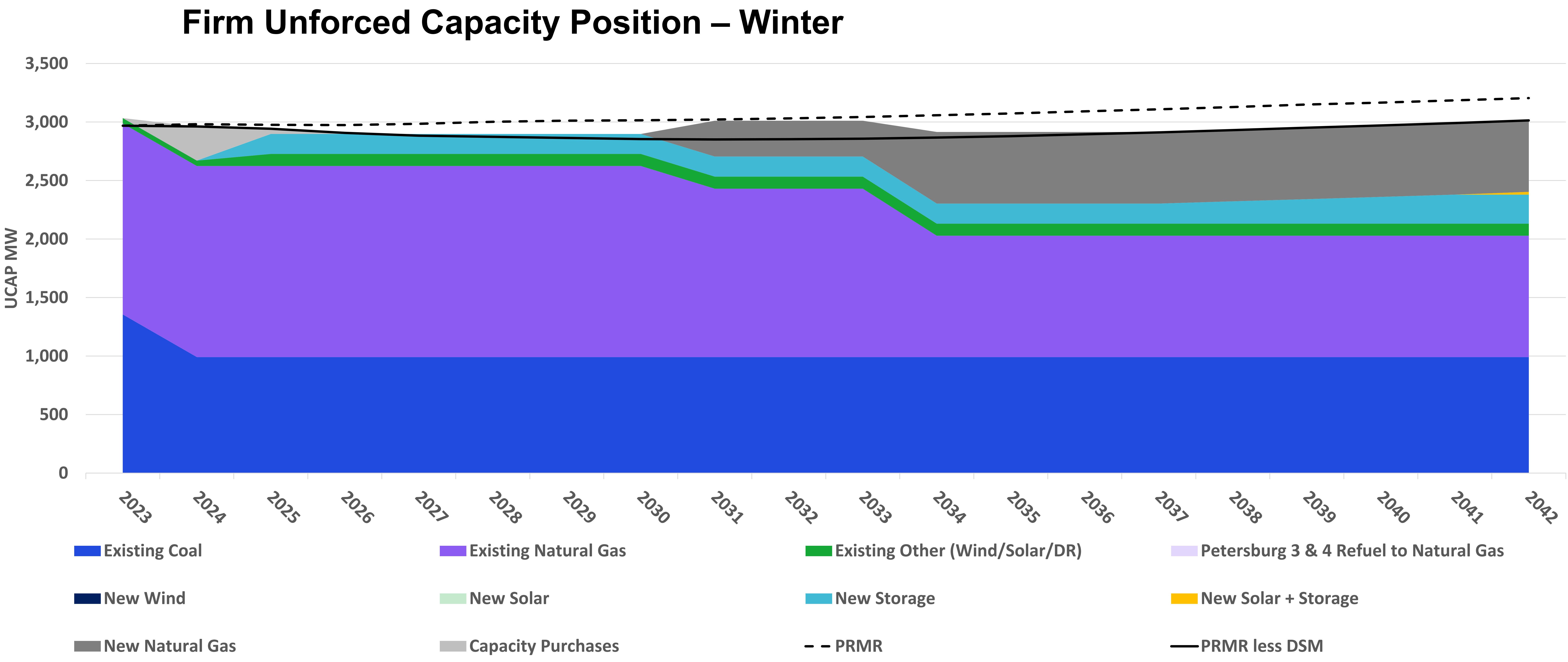
Generation Strategy:
No Early Retirement

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
$7,111			

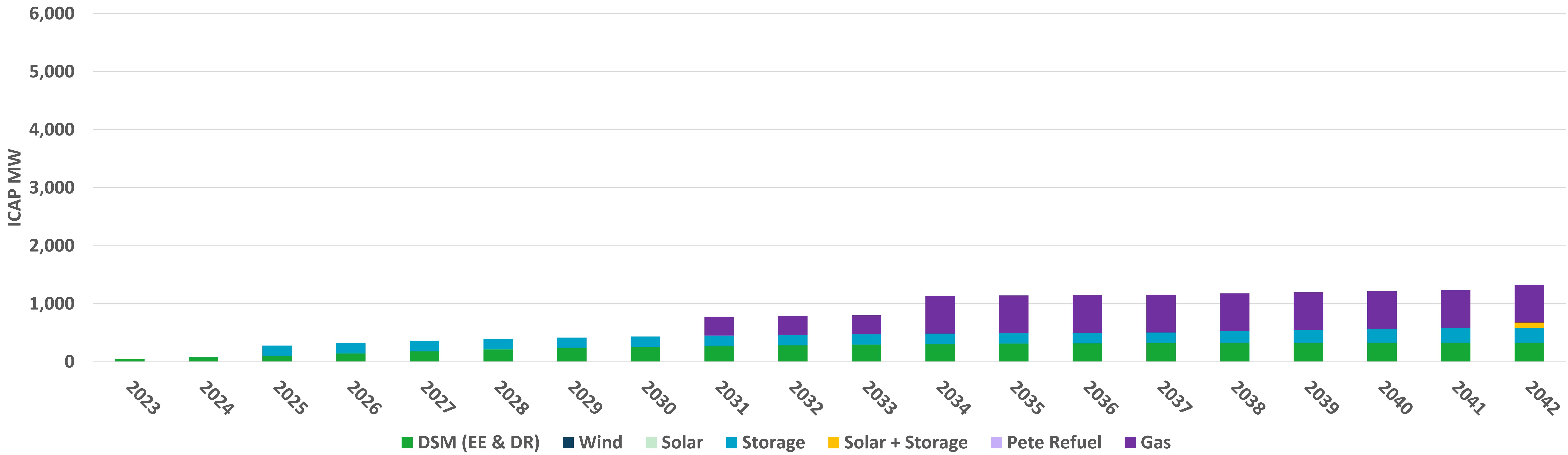
No Early Retirement: No Environmental Action



No Early Retirement: No Environmental Action



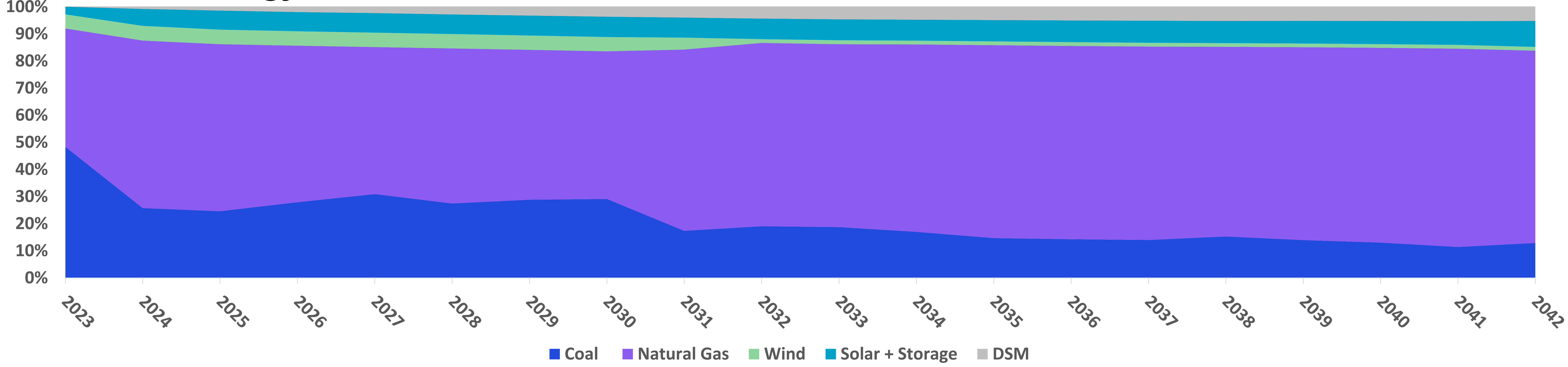
No Early Retirement: No Environmental Action

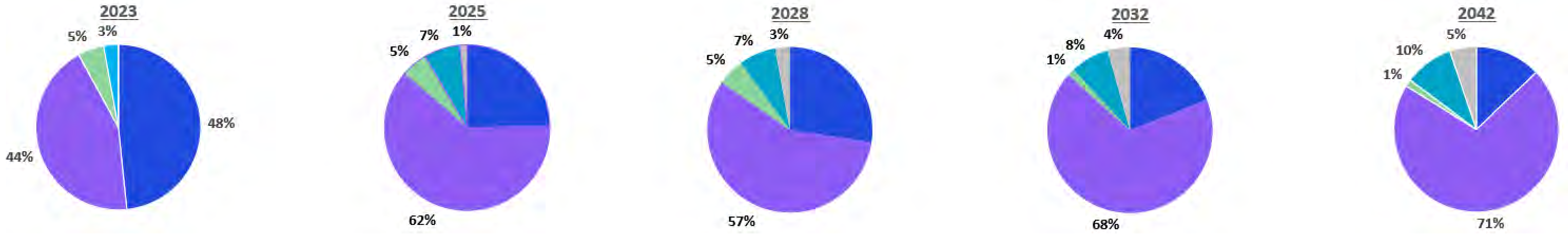


Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	0	0	0
Solar	0	0	0	0	0	0
Storage	0	0	180	0	0	0
Solar + Storage	0	0	0	0	0	0
Pete Refuel	0	0	0	0	0	0
Gas	0	0	0	0	0	0

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	85%	Thermal MWh %	87%	Thermal MWh %	84%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	13%	Renewable/DSM MWh %	16%

No Early Retirement: No Environmental Action

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	No Environmental Action
No Early Retirement	**$7,111**
Pete Refuel to 100% Gas (est. 2025)	$6,621
One Pete Unit Retires (2026)	$7,462
Both Pete Units Retire (2026 & 2028)	$7,425
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211
Encompass Optimization without predefined Strategy	$6,610

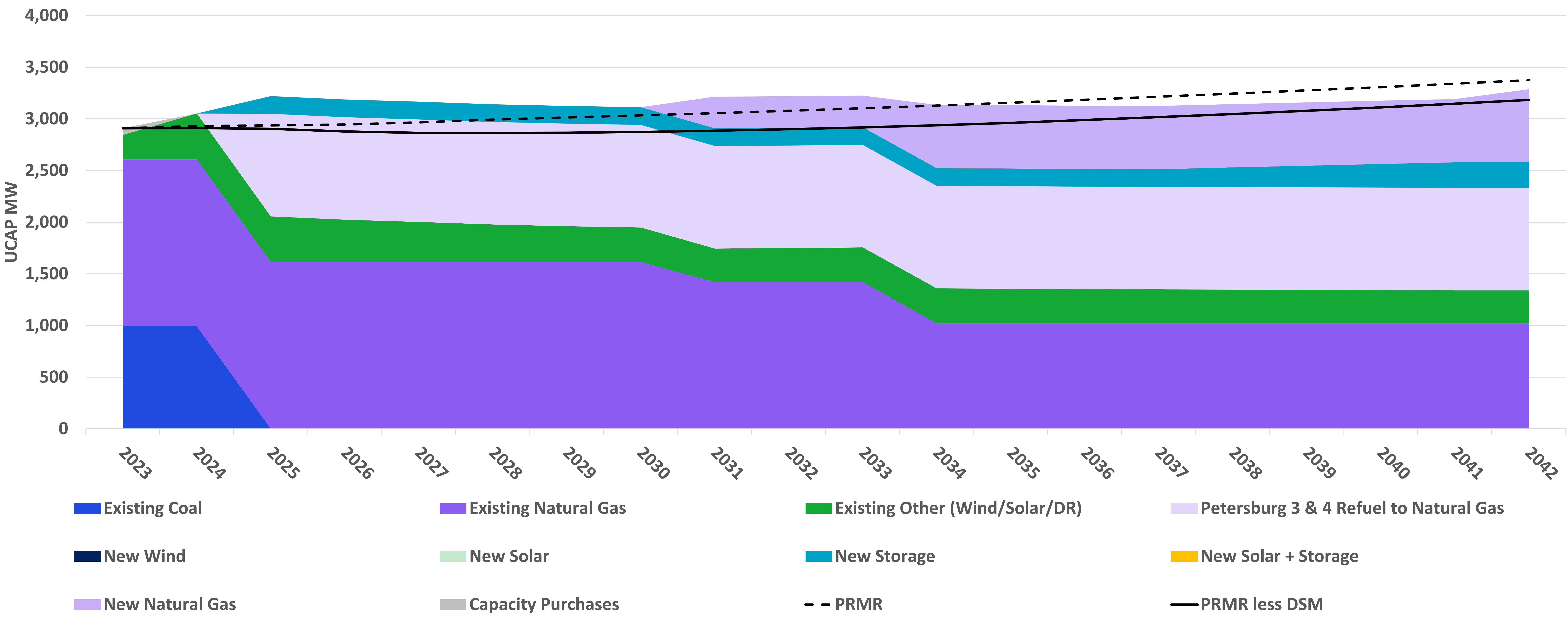
B. Pete Refuel by 2025

20-Year PVRR
(2023$MM, 2023-2042)

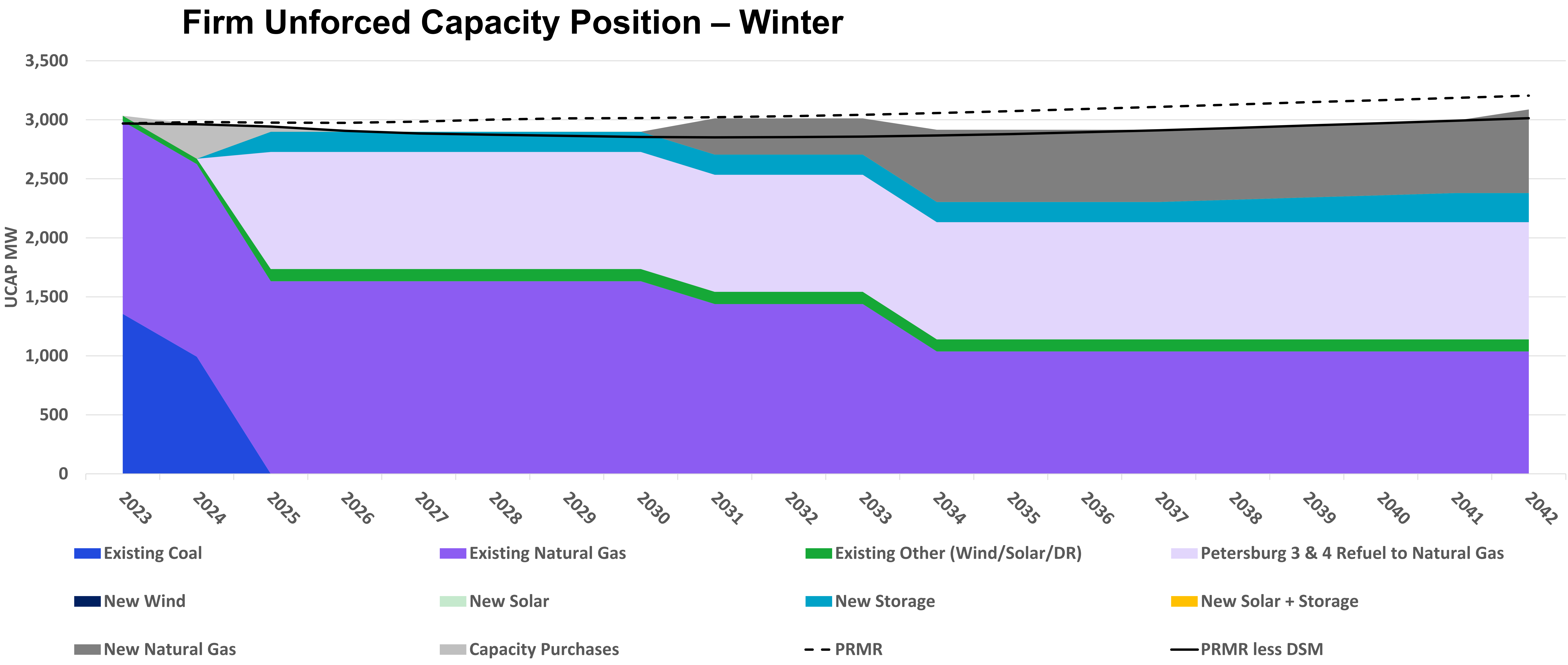
Generation Strategy:
Pete Refuel to 100% Gas (est. 2025)

Scenarios			
No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
$6,621			

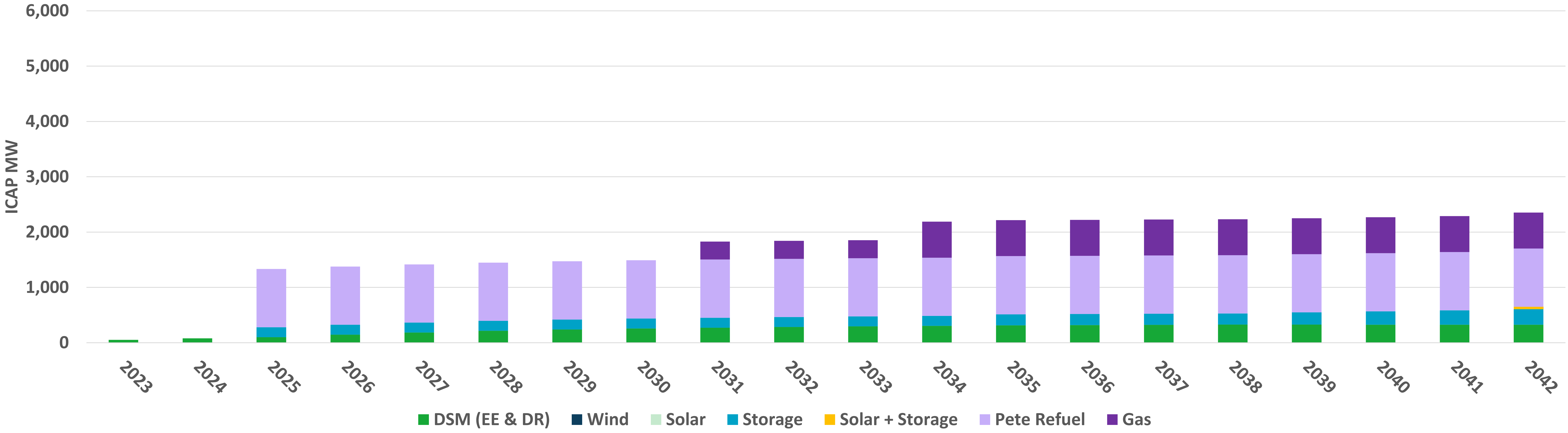
Pete 3 & 4 Refuel in 2025: No Environmental Action



Pete 3 & 4 Refuel in 2025: No Environmental Action



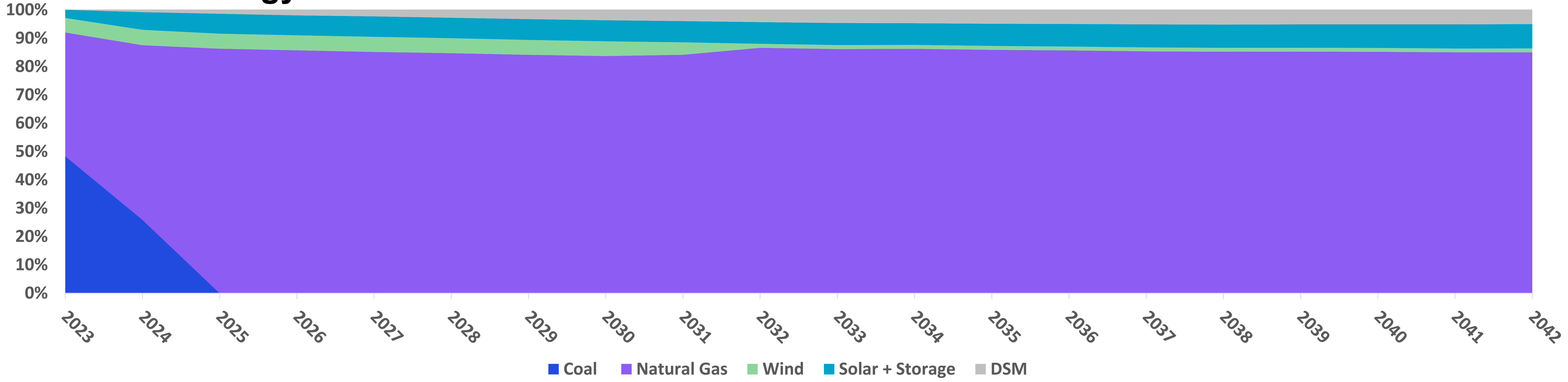
Pete 3 & 4 Refuel in 2025: No Environmental Action

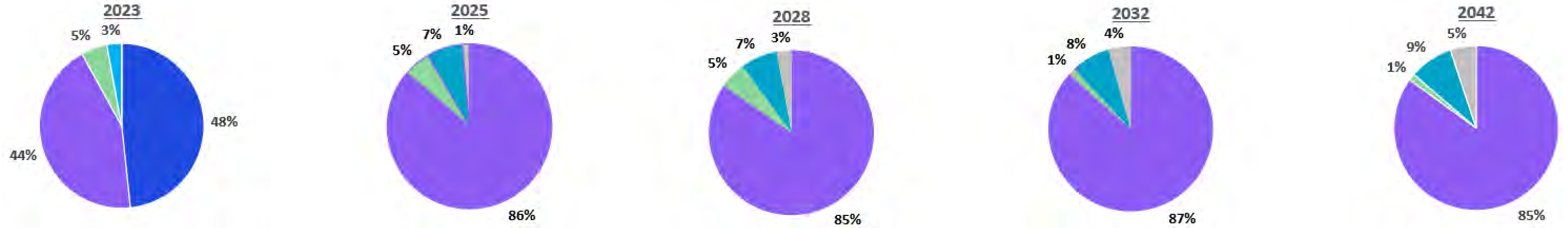


Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	0	0	0
Solar	0	0	0	0	0	0
Storage	0	0	180	0	0	0
Solar + Storage	0	0	0	0	0	0
Pete Refuel	0	0	1,052	0	0	0
Gas	0	0	0	0	0	0

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	85%	Thermal MWh %	87%	Thermal MWh %	85%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	13%	Renewable/DSM MWh %	15%

Pete 3 & 4 Refuel in 2025: No Environmental Action

Portfolio Overview

Retirements

Petersburg:

- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
  - **Total Refueled MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 326 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 260 MW
- Solar + Storage: 0 MW
- Thermal: 750 MW
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios **No Environmental Action**
No Early Retirement	$7,111
Pete Refuel to 100% Gas (est. 2025)	**$6,621**
One Pete Unit Retires (2026)	$7,462
Both Pete Units Retire (2026 & 2028)	$7,425
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211
Encompass Optimization without predefined Strategy	$6,610

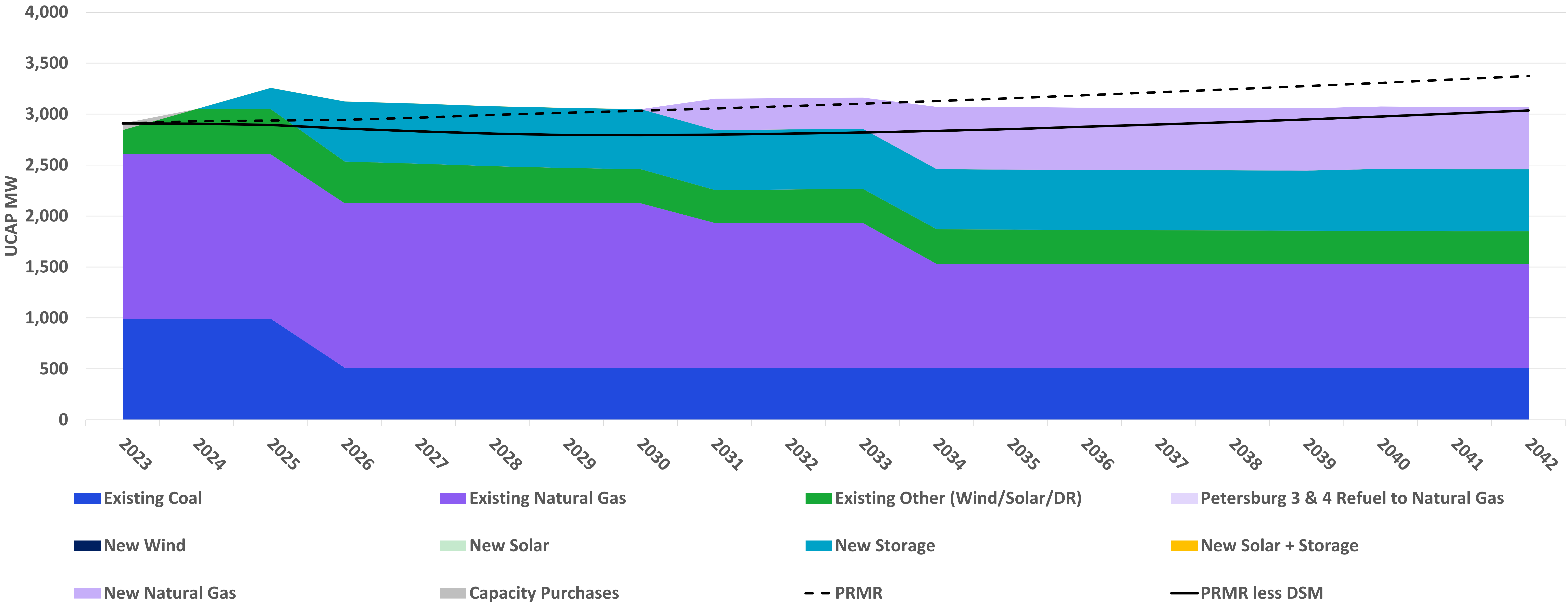
C. One Pete Unit Retires (2026)

20-Year PVRR (2023$MM, 2023-2042)

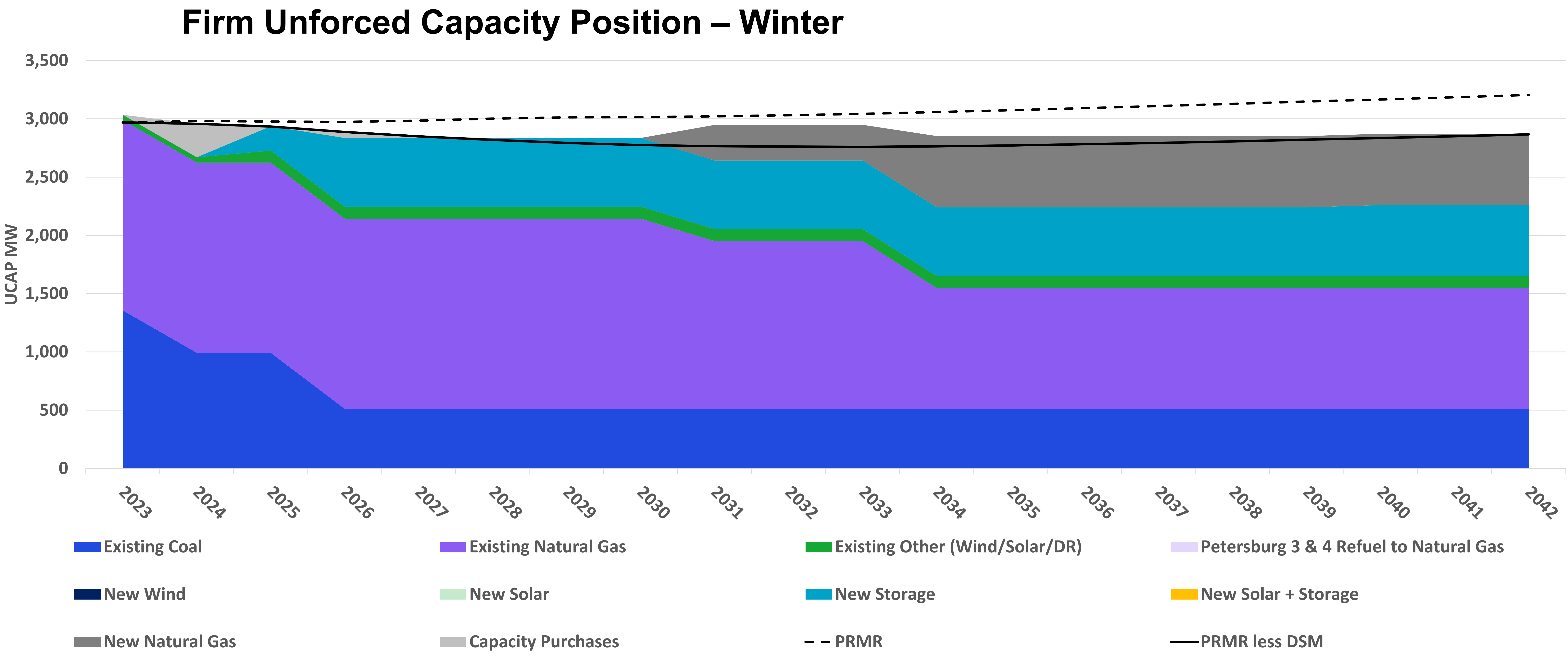
Generation Strategy: *One Pete Unit Retires (2026)*	Scenarios			
	No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
	$7,462			

One Pete Unit Retires (2026): No Environmental Action

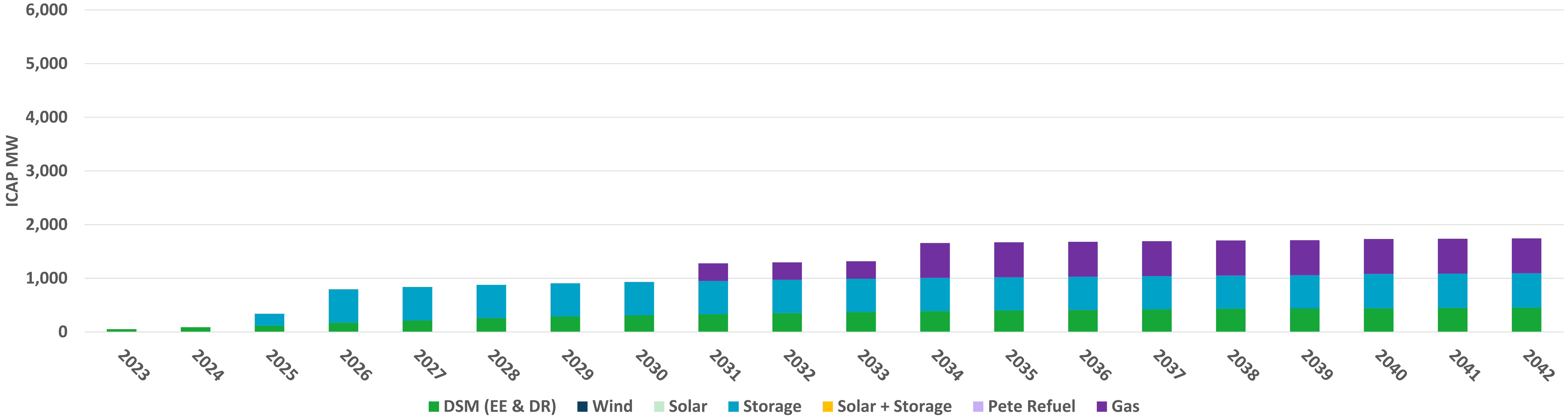
Firm Unforced Capacity Position – Summer



One Pete Unit Retires (2026): No Environmental Action



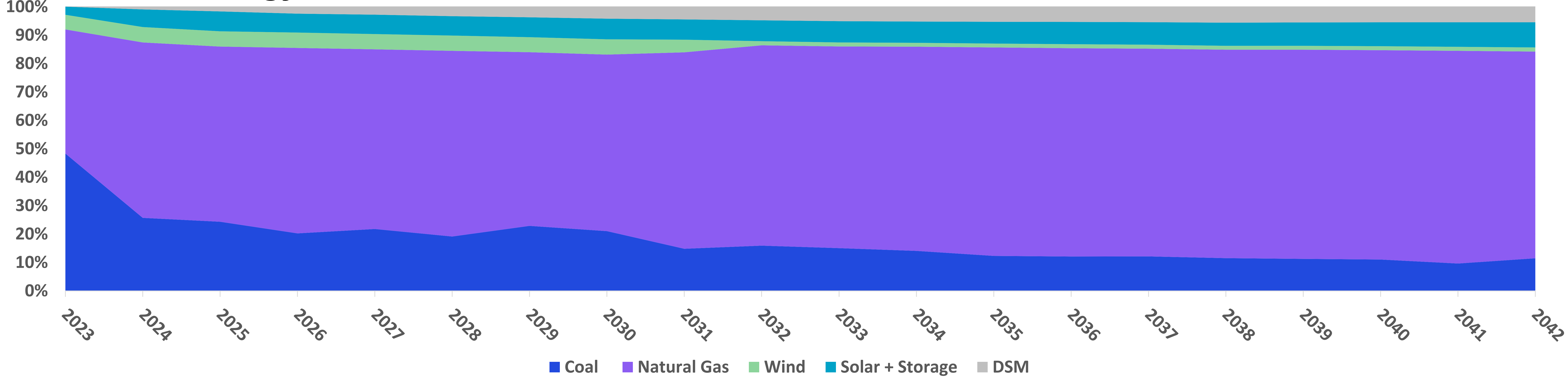
One Pete Unit Retires (2026): No Environmental Action

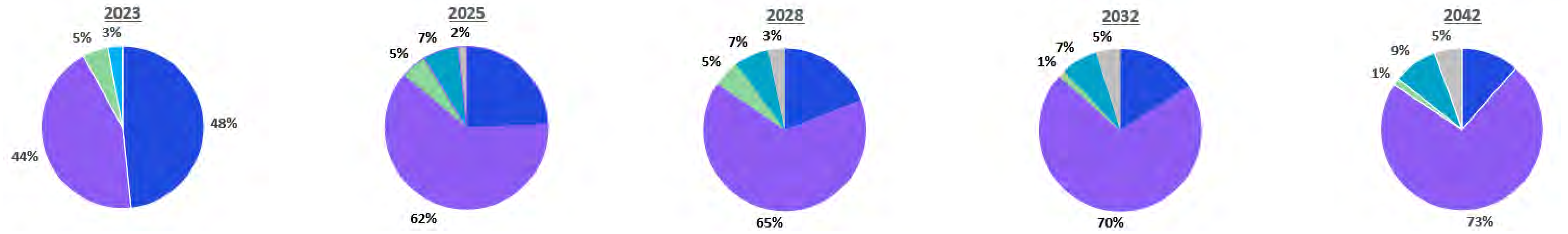


Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	0	0	0
Solar	0	0	0	0	0	0
Storage	0	0	220	400	0	0
Solar + Storage	0	0	0	0	0	0
Pete Refuel	0	0	0	0	0	0
Gas	0	0	0	0	0	0

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	84%	Thermal MWh %	86%	Thermal MWh %	84%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	16%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	16%

One Pete Unit Retires (2026): No Environmental Action

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
  - **Total Coal Retired MW: 520 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 453 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 640 MW
- Solar + Storage: 0 MW
- Thermal: 650 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

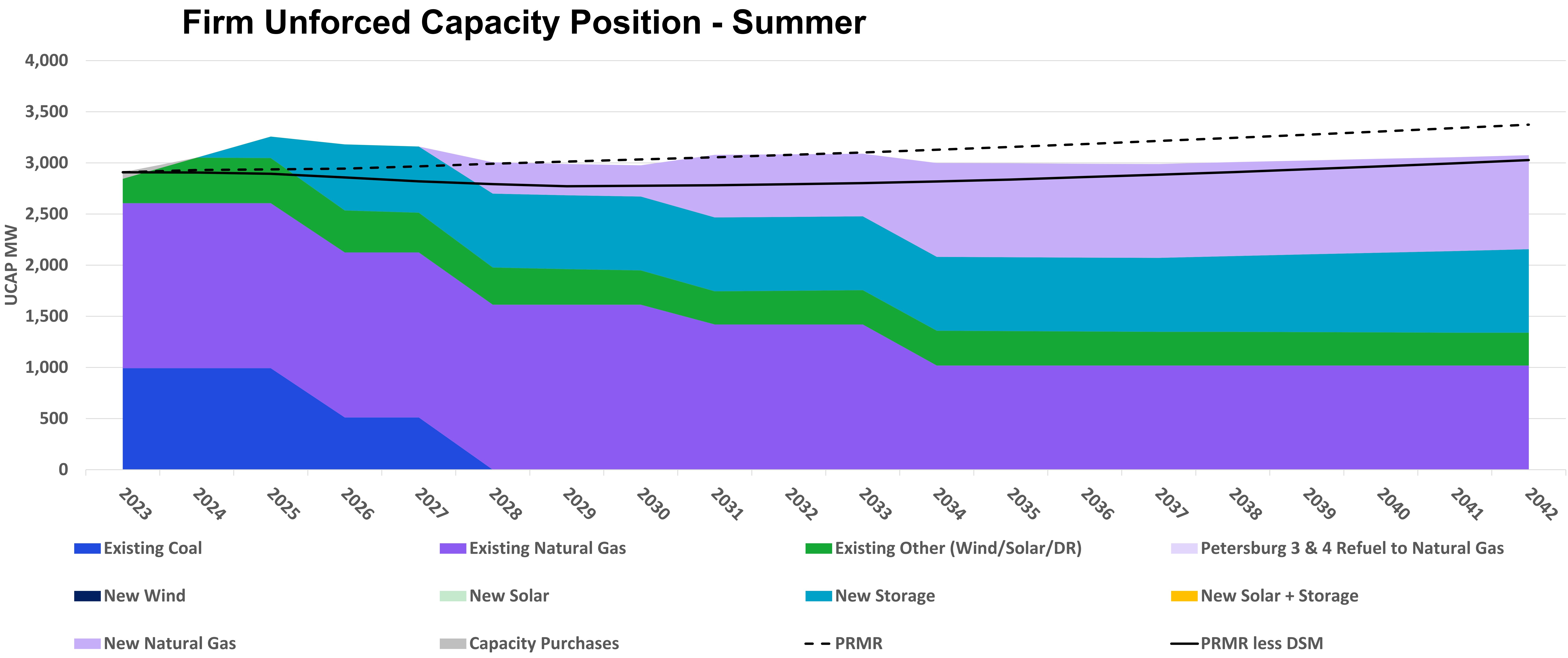
	Scenarios
	No Environmental Action
No Early Retirement	$7,111
Pete Refuel to 100% Gas (est. 2025)	$6,621
One Pete Unit Retires (2026)	**$7,462**
Both Pete Units Retire (2026 & 2028)	$7,425
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211
Encompass Optimization without predefined Strategy	$6,610

D. Both Pete Units Retire (2026 & 2028)

20-Year PVRR (2023$MM, 2023-2042)	Scenarios			
	No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
Generation Strategy: *Both Pete Units Retire (2026 & 2028)*	**$7,425**			

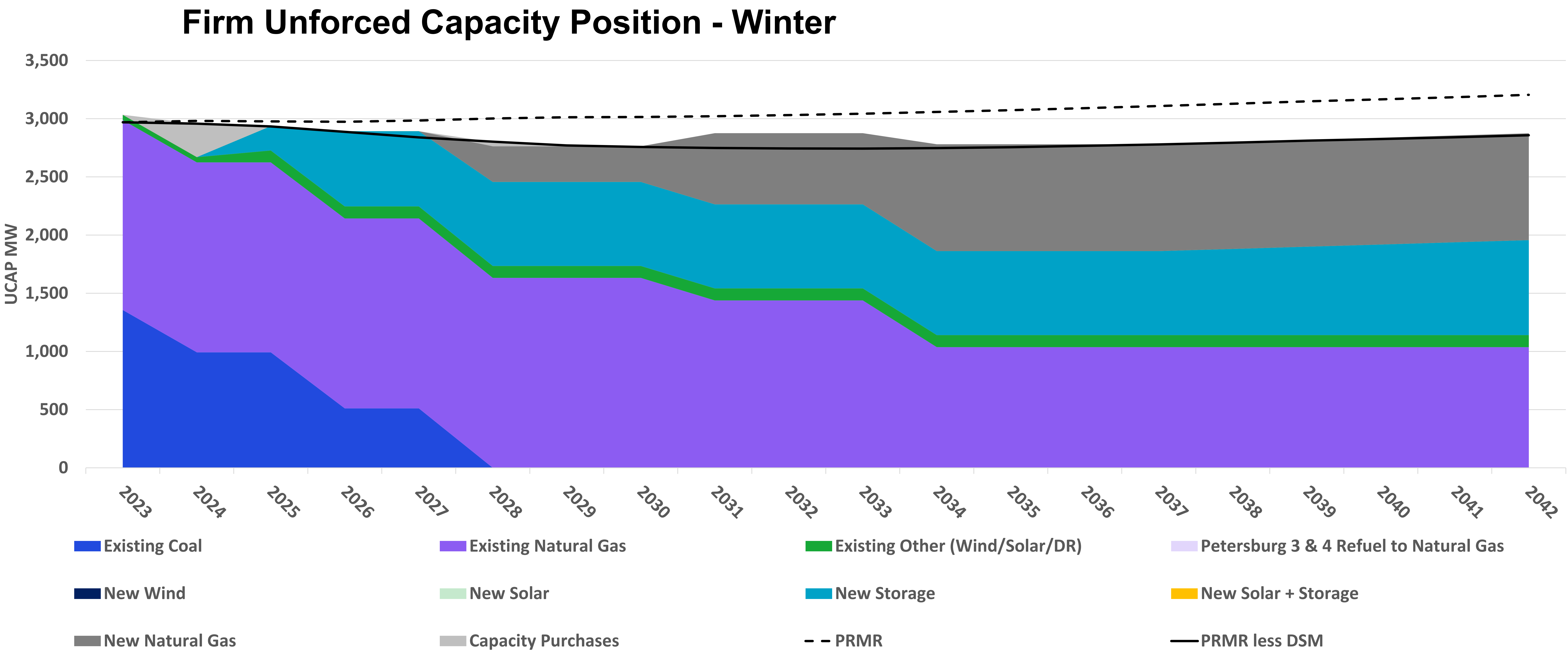
Both Pete Units Retire: No Environmental Action

2026 & 2028



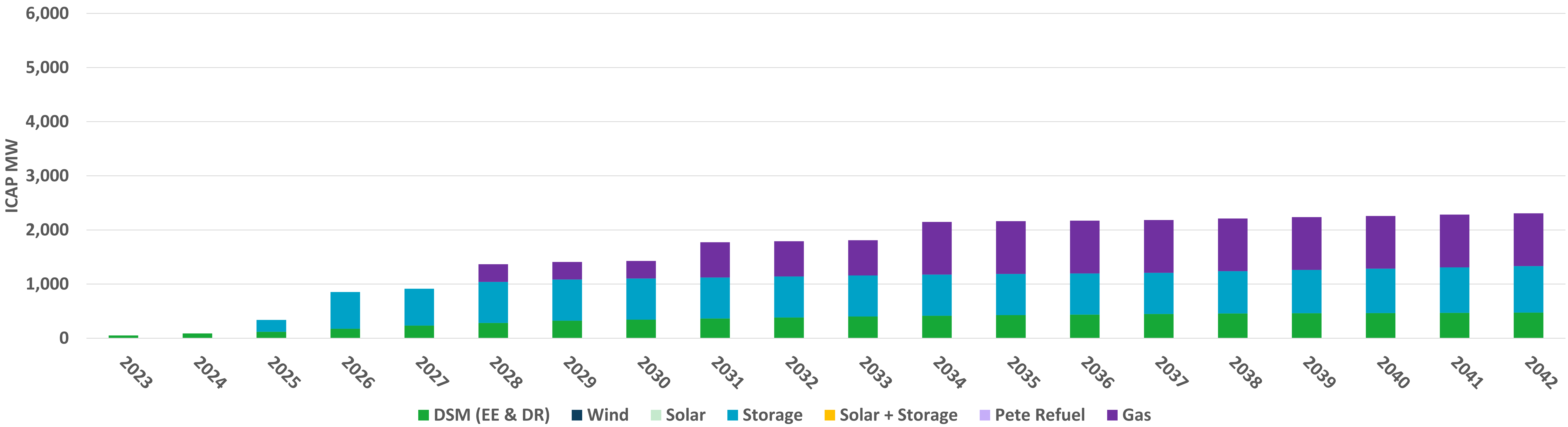
Both Pete Units Retire: No Environmental Action

2026 & 2028



Both Pete Units Retire: No Environmental Action

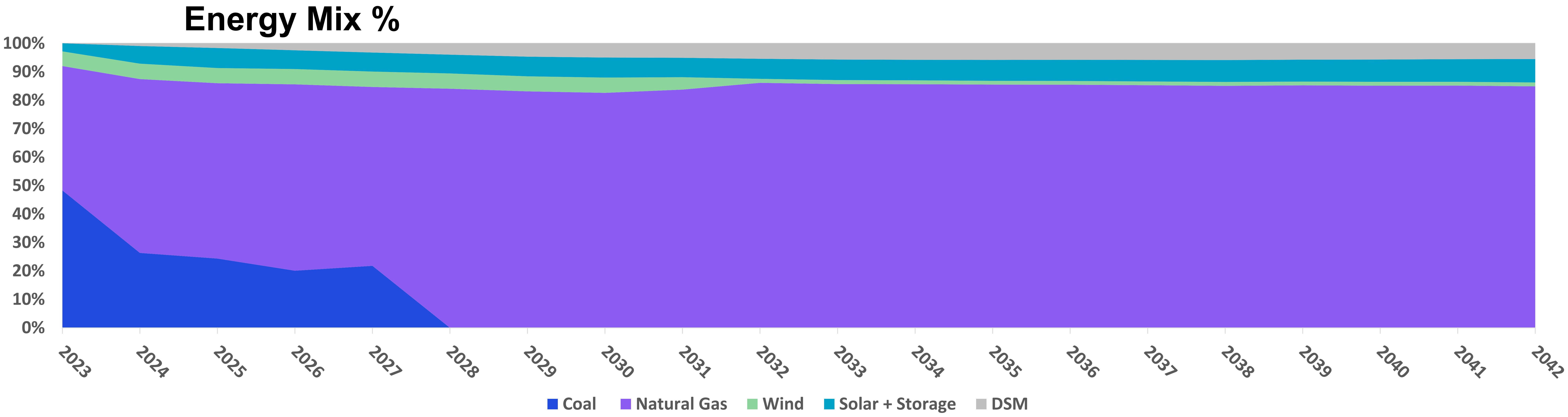
2026 & 2028

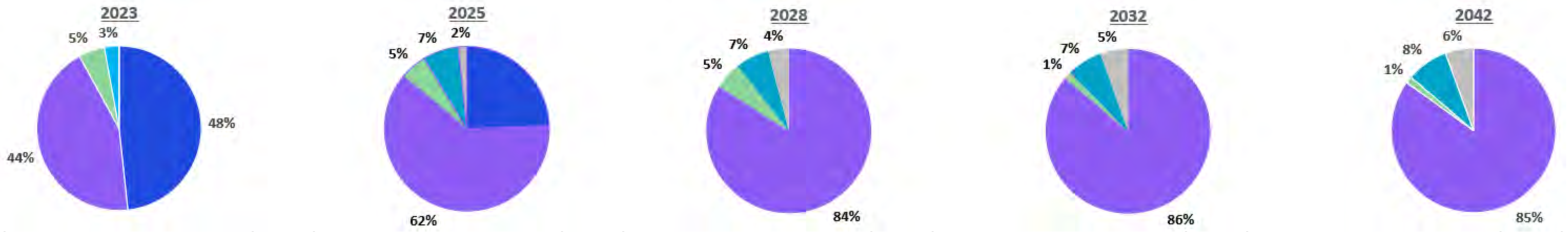


Installed Capacity Incremental Additions (MW): 2023 – 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	0	0	0
Solar	0	0	0	0	0	0
Storage	0	0	220	460	0	80
Solar + Storage	0	0	0	0	0	0
Pete Refuel	0	0	0	0	0	0
Gas	0	0	0	0	0	325

2026 & 2028





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	84%	Thermal MWh %	86%	Thermal MWh %	85%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	16%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	15%

Both Pete Units Retire: No Environmental Action

2026 & 2028

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 472 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 860 MW
- Solar + Storage: MW
- Thermal: 975 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	No Environmental Action
No Early Retirement	$7,111
Pete Refuel to 100% Gas (est. 2025)	$6,621
One Pete Unit Retires (2026)	$7,462
Both Pete Units Retire (2026 & 2028)	**$7,425**
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211
Encompass Optimization without predefined Strategy	$6,610

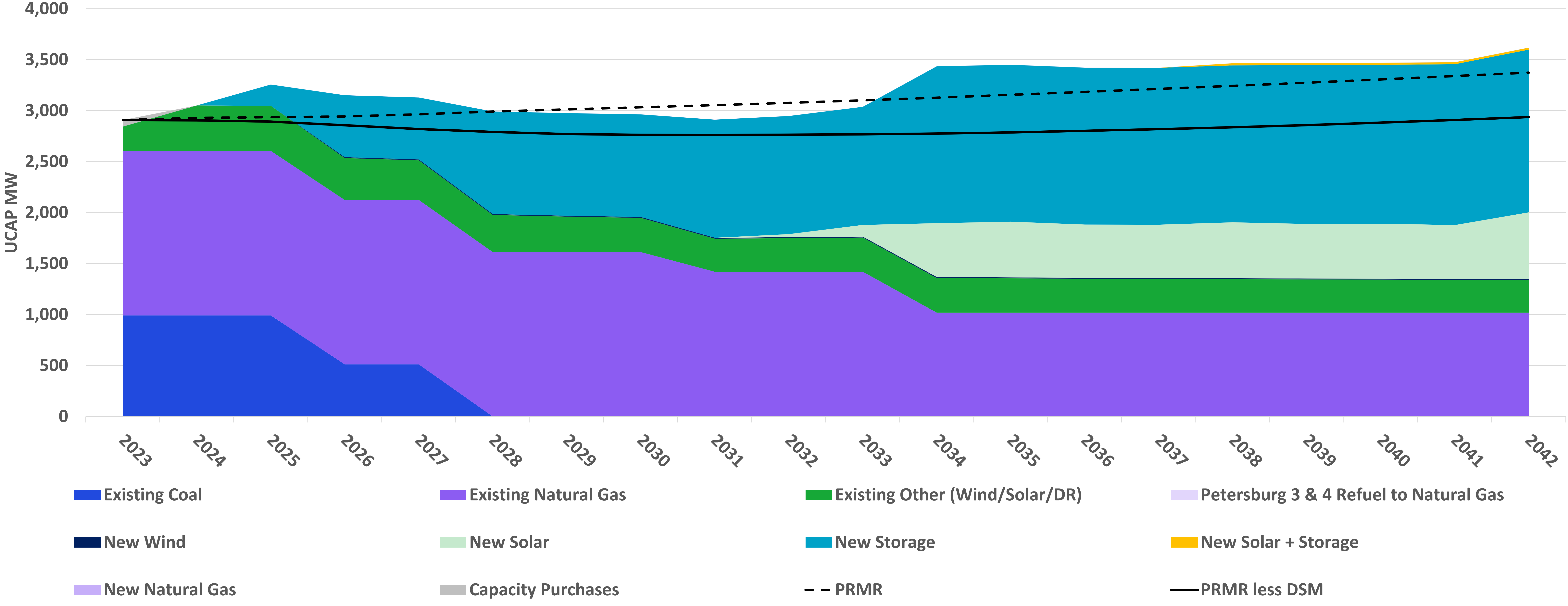
Retire & Replace Pete with Clean Energy

20-Year PVRR (2023$MM, 2023-2042)	**Scenarios**			
Generation Strategy:	**No Environmental Action**	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	**$9,211**			

Clean Energy Strategy: No Environmental Action

Retire & Replace Pete with Clean Energy

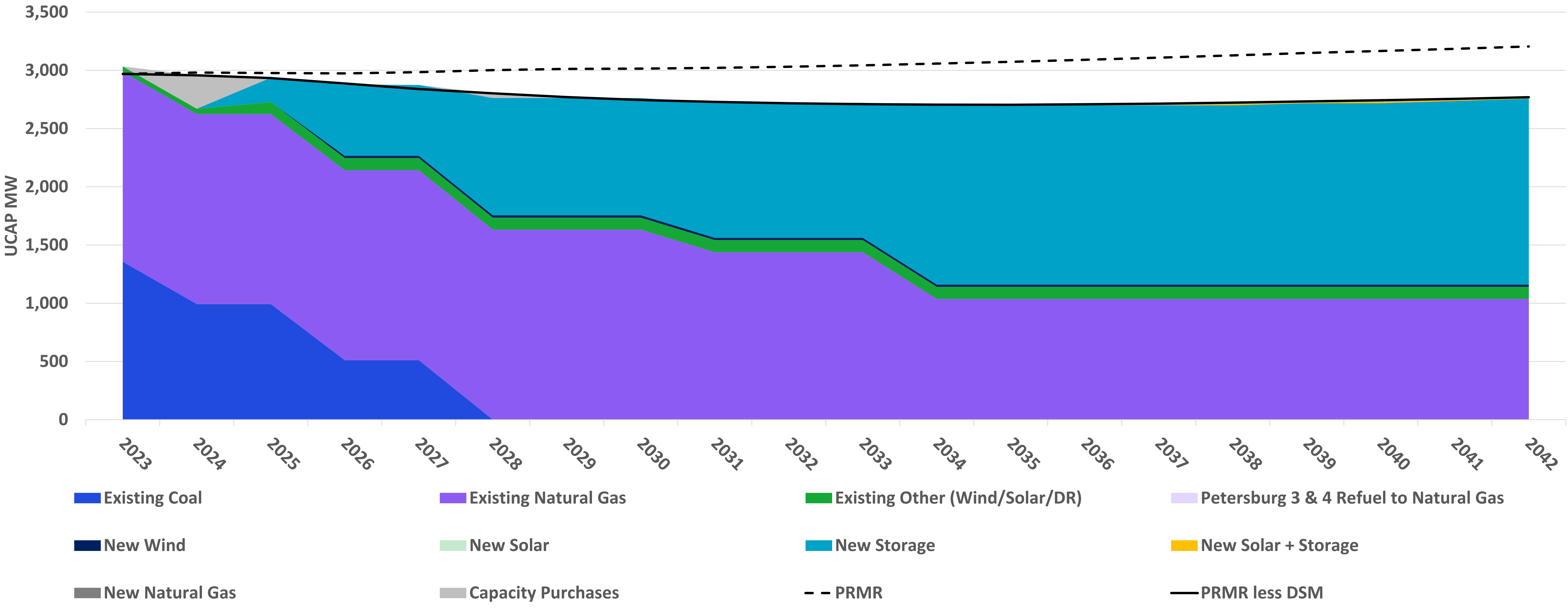
Firm Unforced Capacity Position – Summer



Clean Energy Strategy: Decarbonized Economy

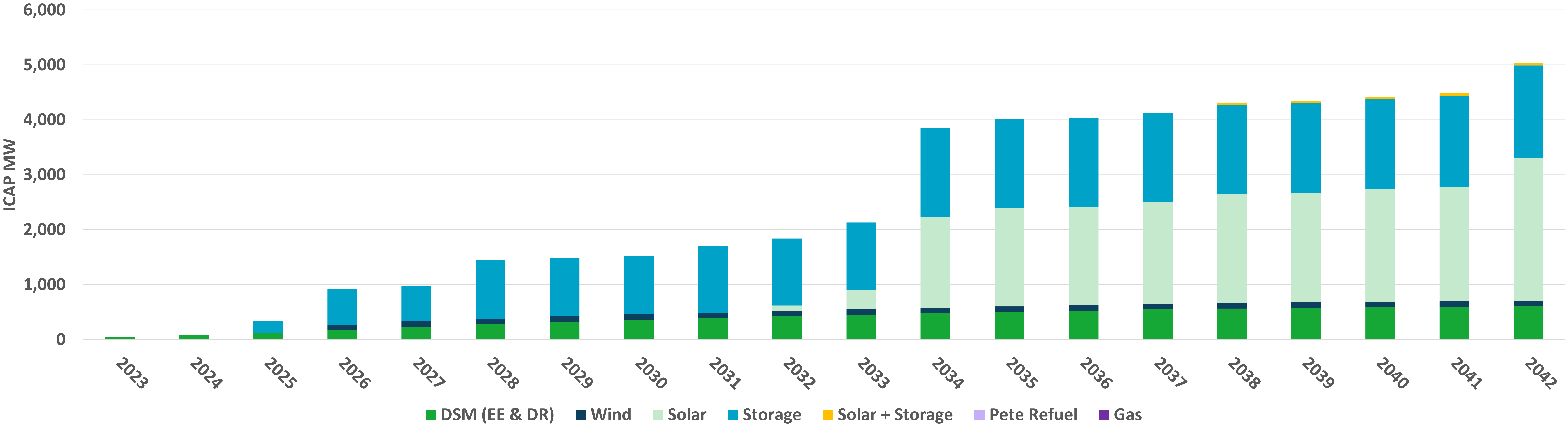
Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Winter



Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

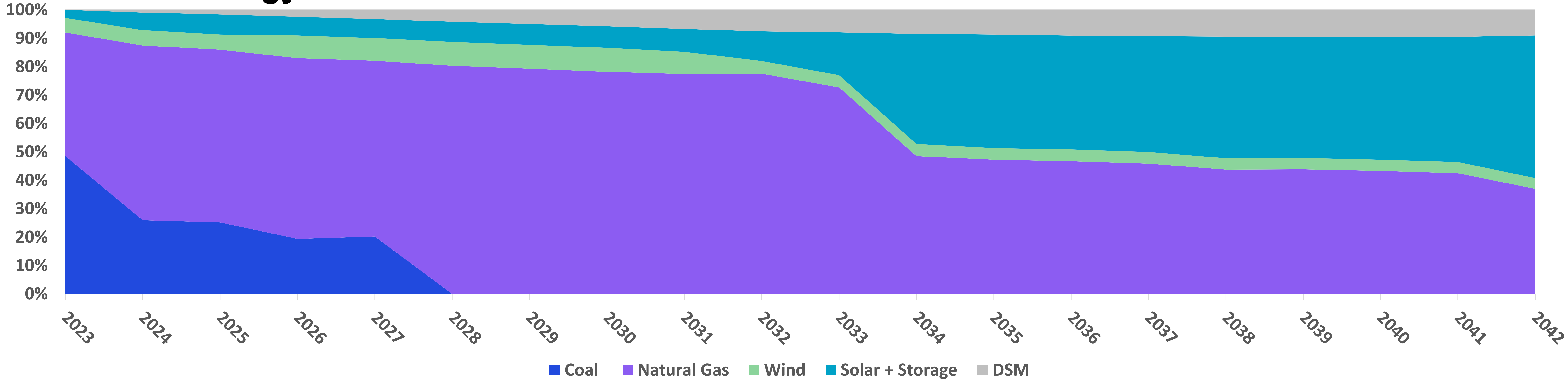


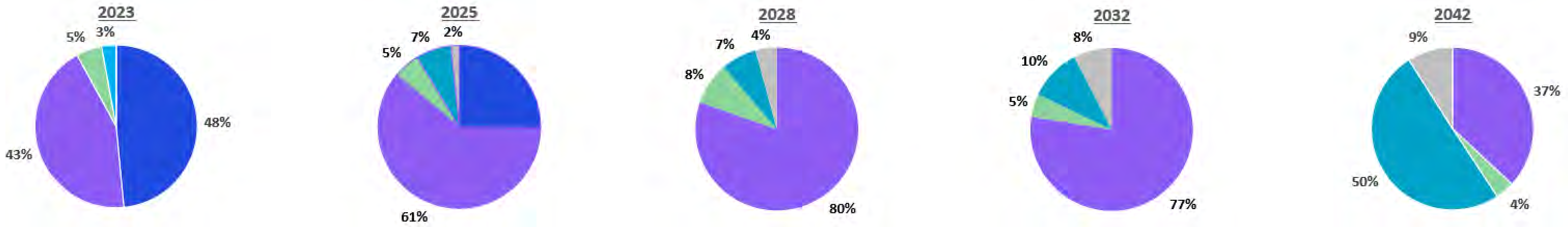
Installed Capacity Incremental Additions (MW): 2023 – 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	0	0
Solar	0	0	0	0	0	0
Storage	0	0	220	420	0	420
Solar + Storage	0	0	0	0	0	0
Pete Refuel	0	0	0	0	0	0
Gas	0	0	0	0	0	0

Clean Energy Strategy: Decarbonized Economy

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	80%	Thermal MWh %	77%	Thermal MWh %	37%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	20%	Renewable/DSM MWh %	23%	Renewable/DSM MWh %	63%

Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Retired Nat Gas MW: 618 MW**

Replacements by 2042

- DSM: 610 MW
- Wind: 100 MW
- Solar: 2,600 MW
- Storage: 1,680 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	No Environmental Action
No Early Retirement	$7,111
Pete Refuel to 100% Gas (est. 2025)	$6,621
One Pete Unit Retires (2026)	$7,462
Both Pete Units Retire (2026 & 2028)	$7,425
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	**$9,211**
Encompass Optimization without predefined Strategy	$6,610

F. Encompass Optimization

Refuels Petersburg Units 3 & 4 in 2025

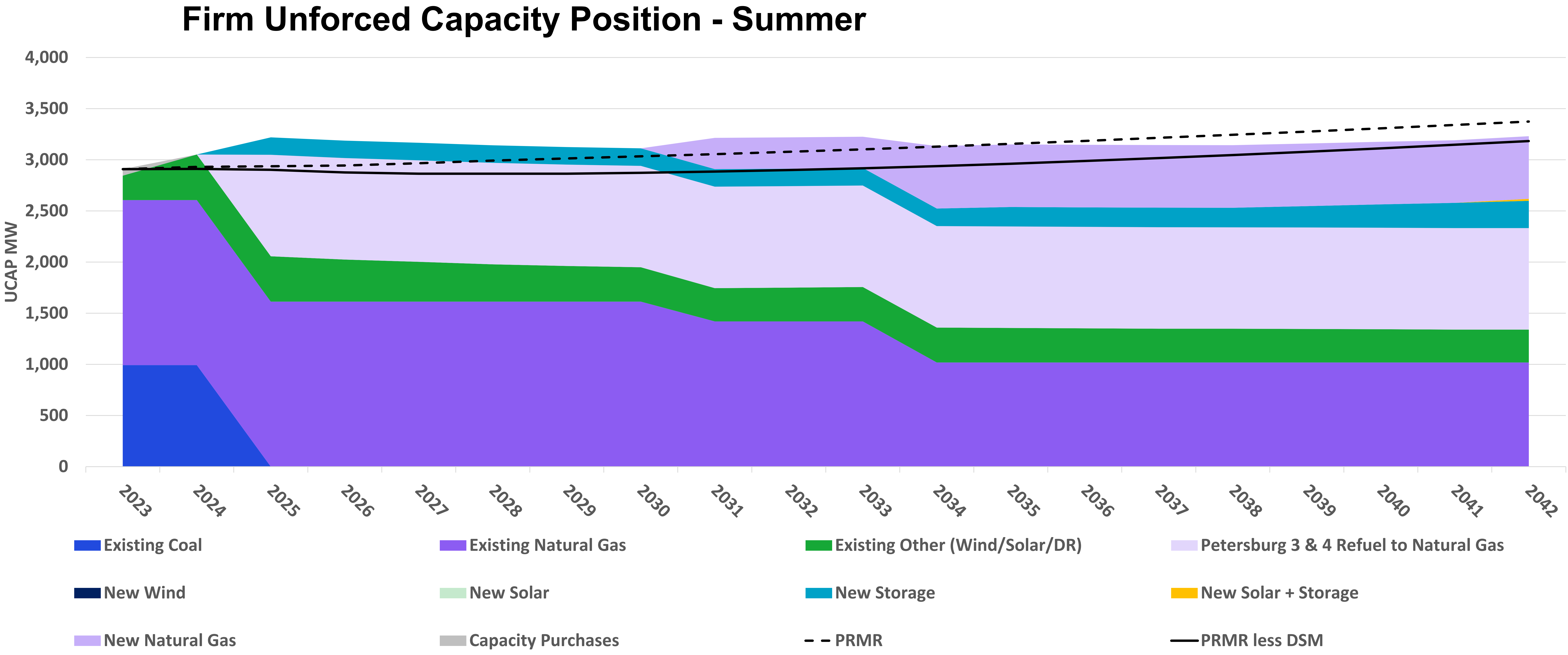
20-Year PVRR (2023$MM, 2023-2042)

Generation Strategy: ***Encompass Optimization without predefined Strategy – Selects Pete 3 & 4 Refuel in 2025***

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
$6,610			

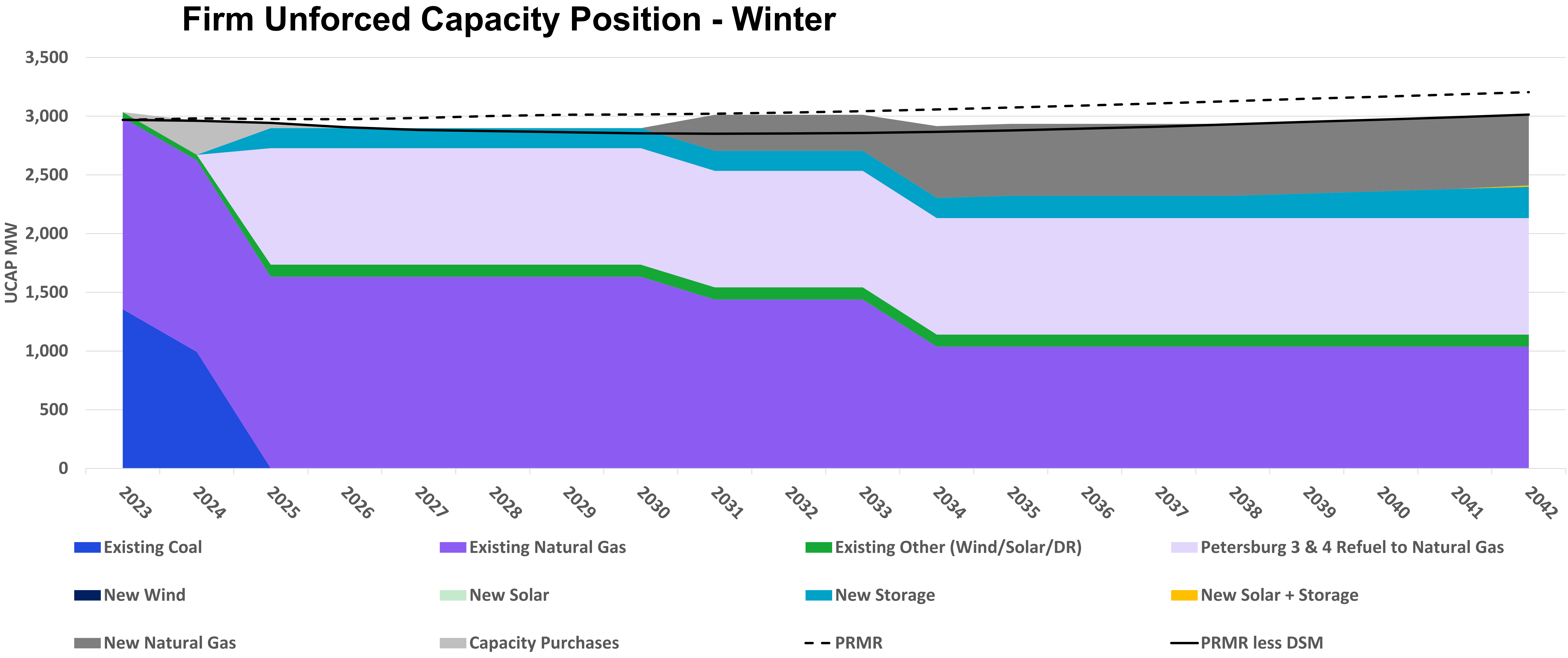
Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025



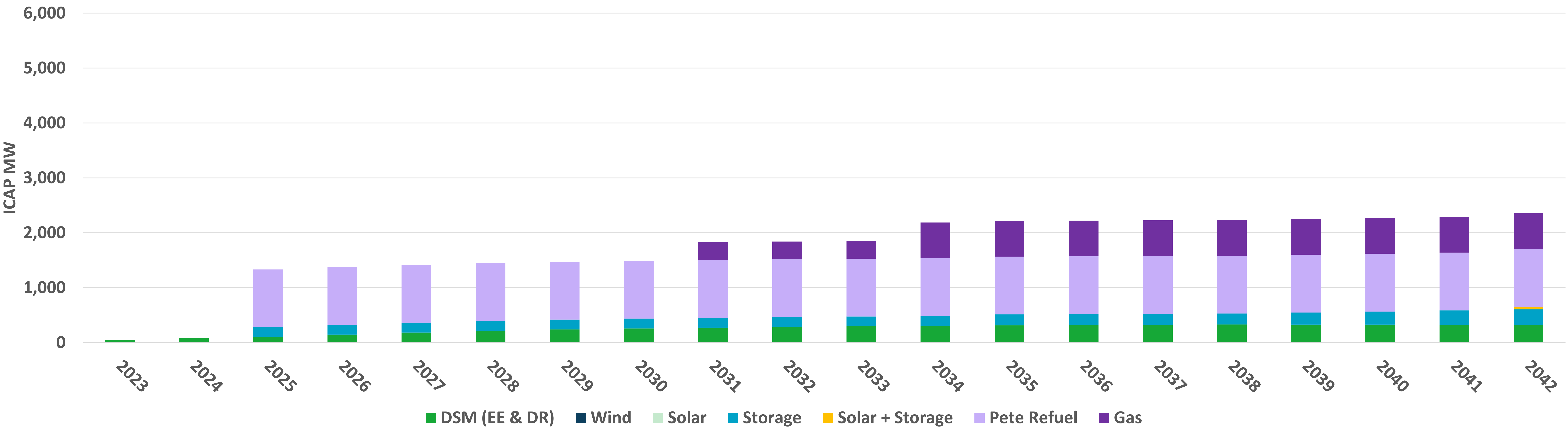
Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025



Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025

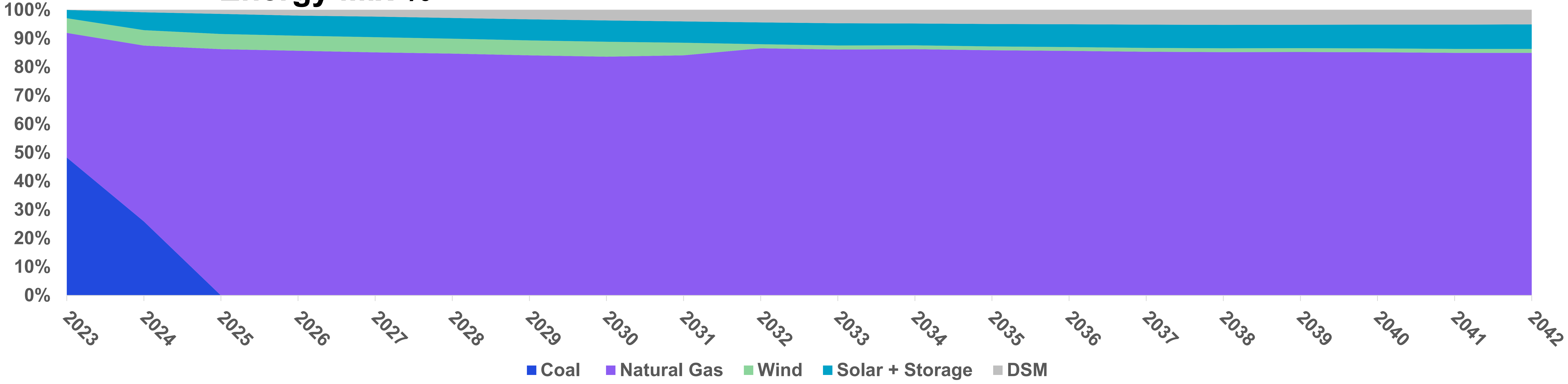


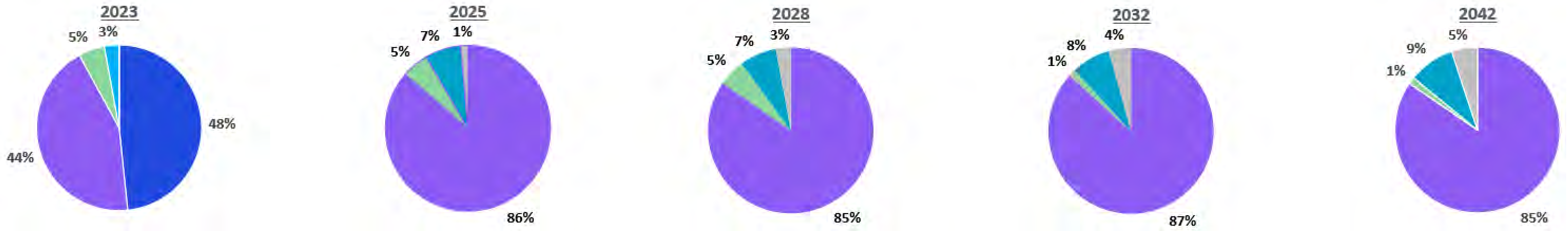
Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	0	0	0
Solar	0	0	0	0	0	0
Storage	0	0	180	0	0	0
Solar + Storage	0	0	0	0	0	0
Pete Refuel	0	0	1,052	0	0	0
Gas	0	0	0	0	0	0

Refuels Petersburg Units 3 & 4 in 2025

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	85%	Thermal MWh %	87%	Thermal MWh %	85%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	13%	Renewable/DSM MWh %	15%

Encompass Optimization: No Environmental Action

Refuels Petersburg Units 3 & 4 in 2025

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2025
- Pete 4 Coal: 2025
  - **Total Refueled MW: 1,040 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 326 MW
- Wind: 0 MW
- Solar: 0 MW
- Storage: 280 MW
- Solar + Storage: 45 MW
- Thermal: 650 MW
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	No Environmental Action
No Early Retirement	$7,111
Pete Refuel to 100% Gas (est. 2025)	$6,621
One Pete Unit Retires (2026)	$7,462
Both Pete Units Retire (2026 & 2028)	$7,425
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211
Encompass Optimization without predefined Strategy	**$6,610**

Portfolio Matrix

		Scenarios			
	20-Year PVRR (2023$MM, 2023-2042)	**No Environmental Action**	**Current Trends (Reference Case)**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**	$7,111	$9,572	$11,349	$9,917
	Pete Refuel to 100% Gas (est. 2025)	$6,621	$9,330	$11,181	$9,546
	One Pete Unit Retires (2026)	$7,462	$9,773	$11,470	$9,955
	Both Pete Units Retire (2026 & 2028)	$7,425	$9,618	$11,145	$9,923
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211	$9,711	$11,184	$9,690
	Encompass Optimization without predefined Strategy	$6,610	$9,262	$10,994	$9,572

Encompass Optimization Results by Scenario:

	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

Decarbonized Economy

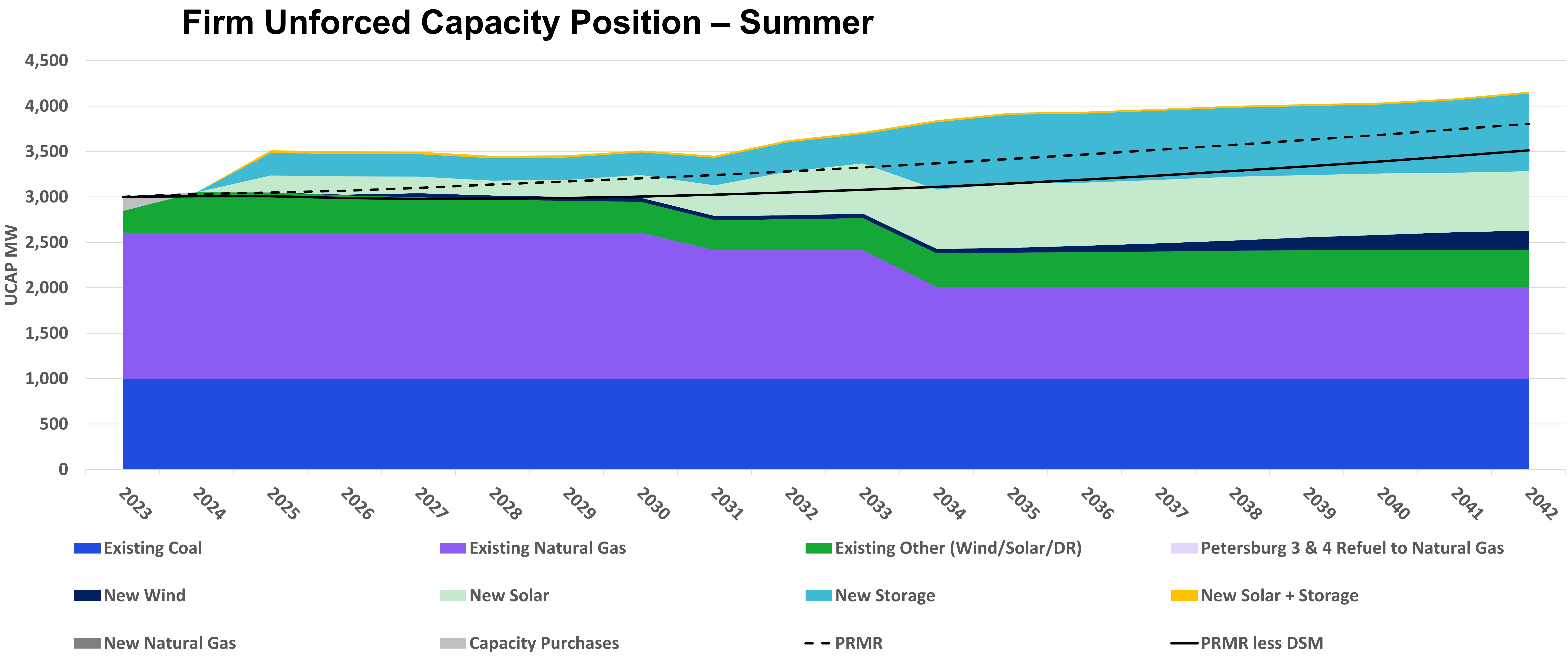
		Scenarios
	20-Year PVRR (2023$MM, 2023-2042)	Decarbonized Economy
Generation Strategies	No Early Retirement	$9,917
	Pete Refuel to 100% Gas (est. 2025)	$9,546
	One Pete Unit Retires (2026)	$9,955
	Both Pete Units Retire (2026 & 2028)	$9,923
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,690
	Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027	$9,572

A. No Early Retirement

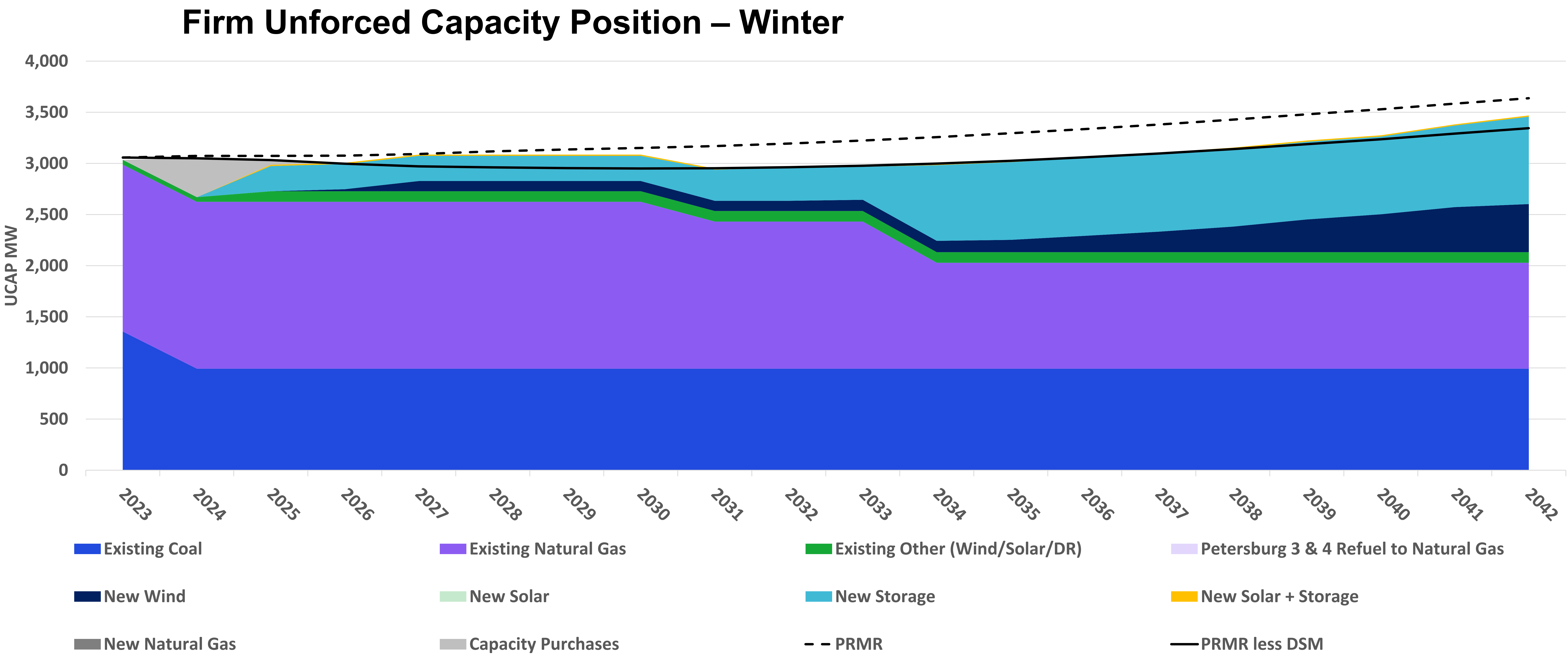
Generation Strategy:
No Early Retirement

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
			$9,917

No Early Retirement: Decarbonized Economy

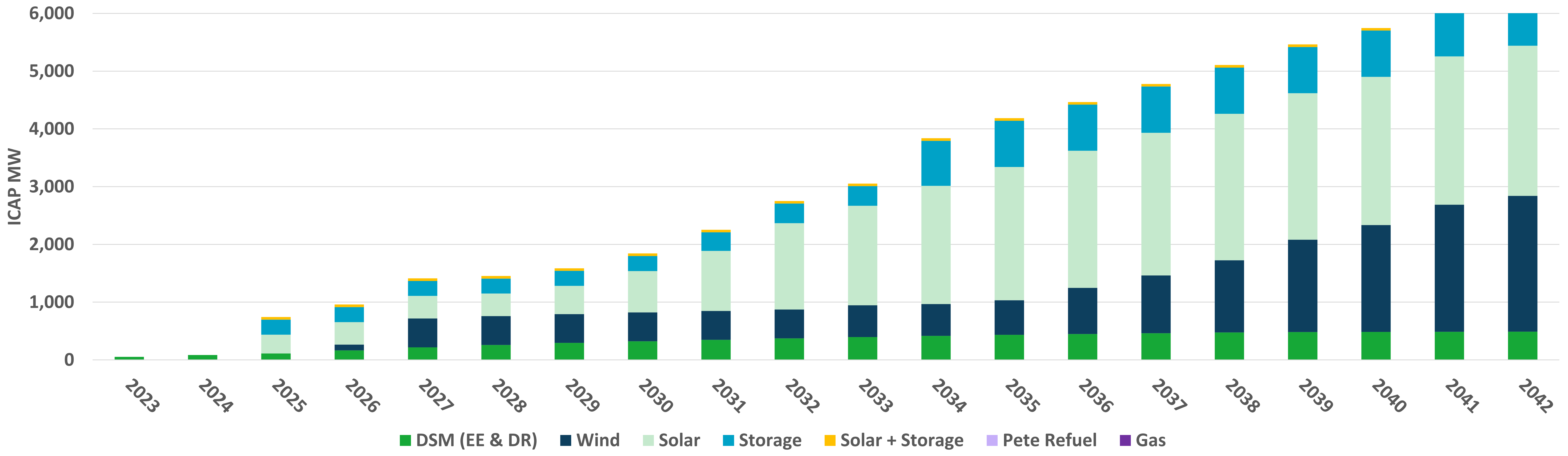


No Early Retirement: Decarbonized Economy



No Early Retirement: Decarbonized Economy

Installed Capacity Cumulative Additions (MW)

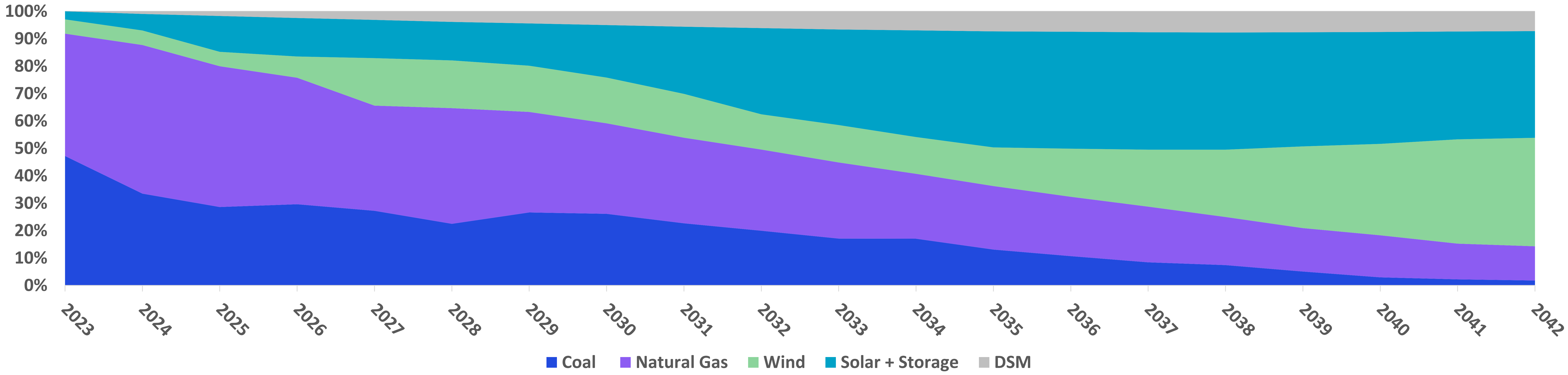


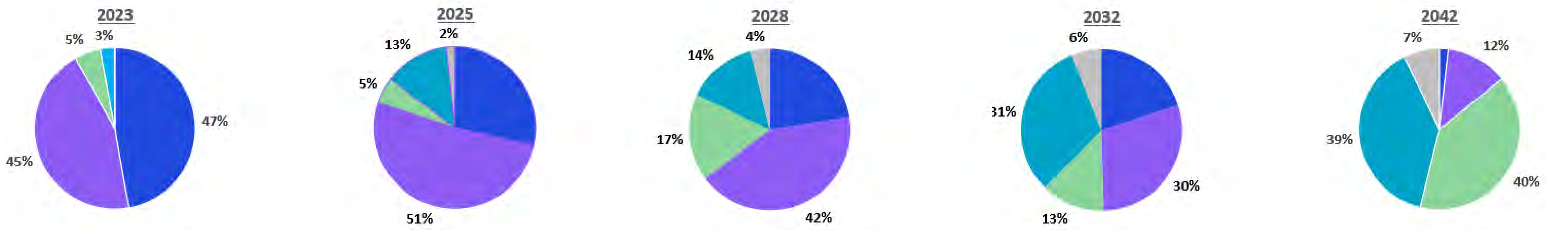
Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	0
Solar	0	0	325	65	0	0
Storage	0	0	260	0	0	0
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

No Early Retirement: Decarbonized Economy

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	80%	Thermal MWh %	65%	Thermal MWh %	50%	Thermal MWh %	14%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	20%	Renewable/DSM MWh %	35%	Renewable/DSM MWh %	50%	Renewable/DSM MWh %	86%

No Early Retirement: Decarbonized Economy

Portfolio Overview

Retirements

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,350 MW
- Solar: 2,600 MW
- Storage: 900 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Decarbonized Economy
No Early Retirement	$9,917
Pete Refuel to 100% Gas (est. 2025)	$9,546
One Pete Unit Retires (2026)	$9,955
Both Pete Units Retire (2026 & 2028)	$9,923
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,690
Encompass Optimization without predefined Strategy	$9,572

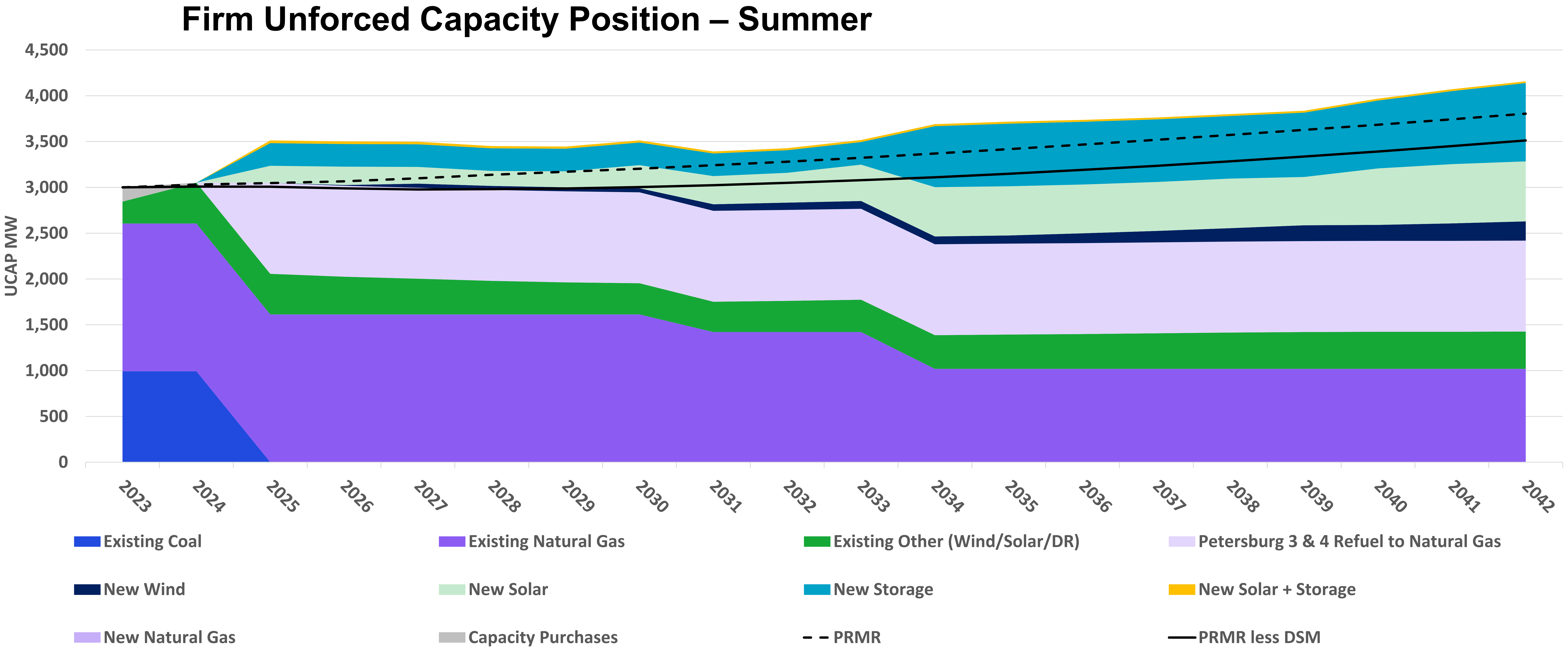
B. Pete Refuel by 2025

20-Year PVRR (2023$MM, 2023-2042)

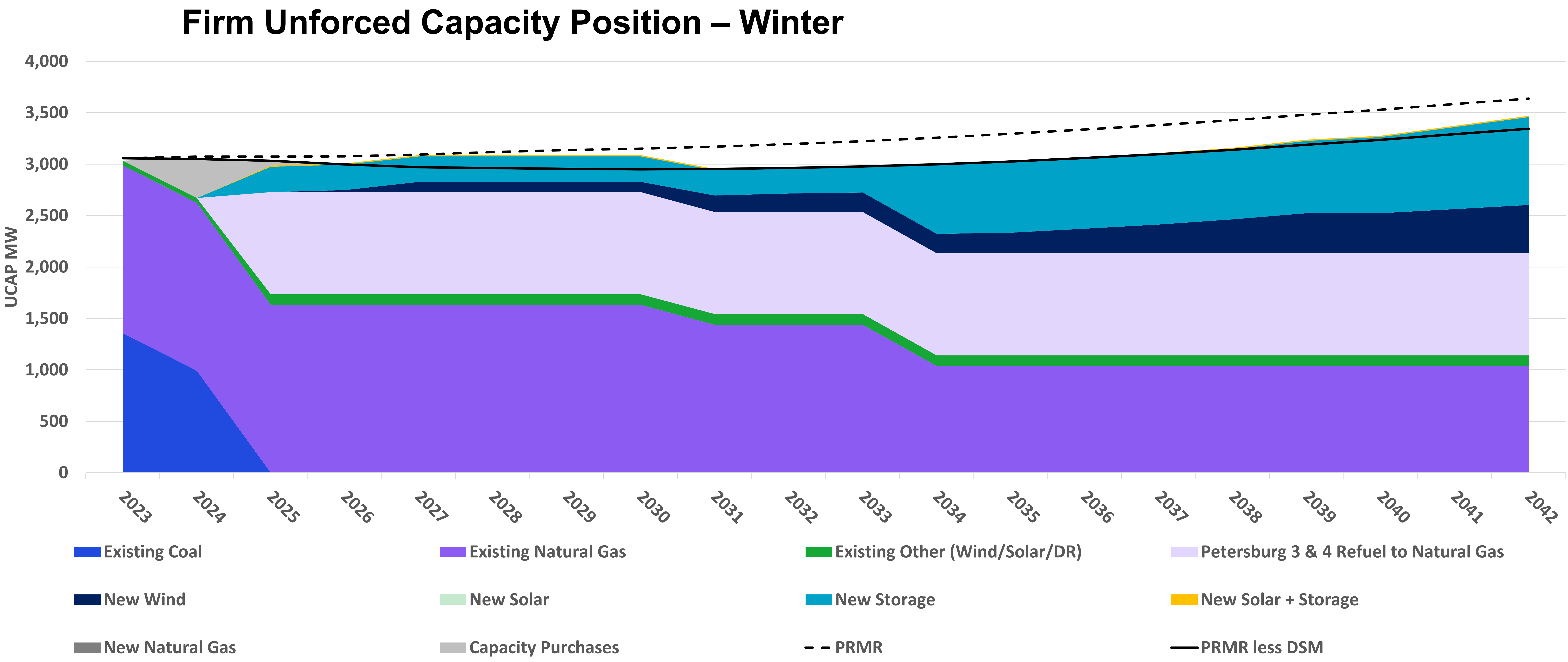
Generation Strategy: *Pete Refuel to 100% Gas (est. 2025)*

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
			$9,546

Pete 3 & 4 Refuel in 2025: Decarbonized Economy

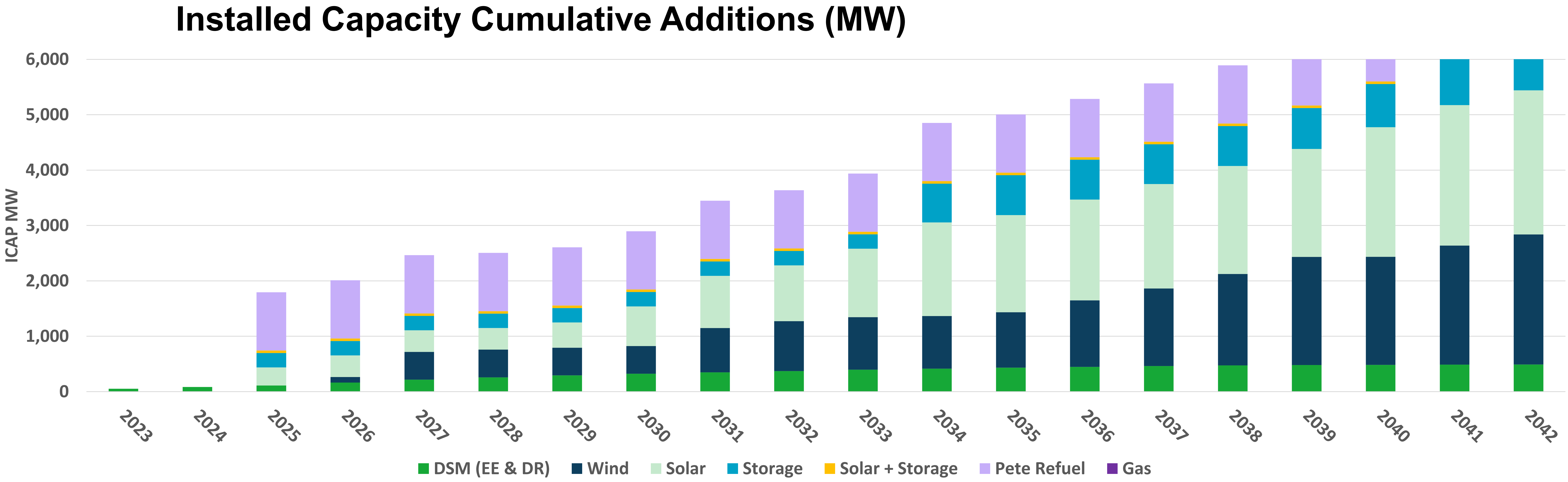


Pete 3 & 4 Refuel in 2025: Decarbonized Economy



aes Indiana

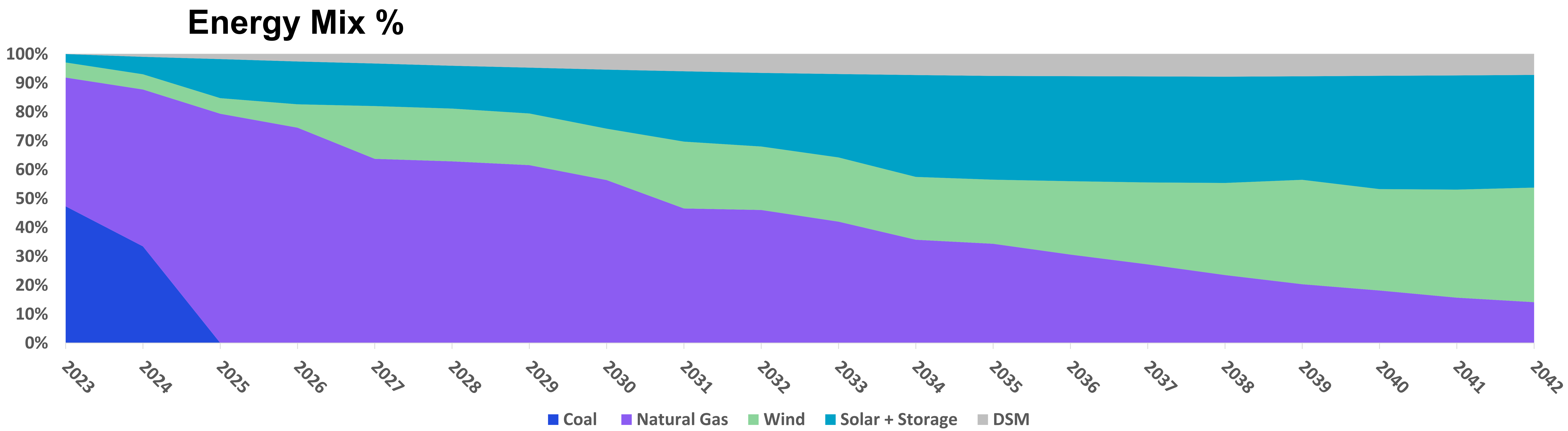
Pete 3 & 4 Refuel in 2025: Decarbonized Economy

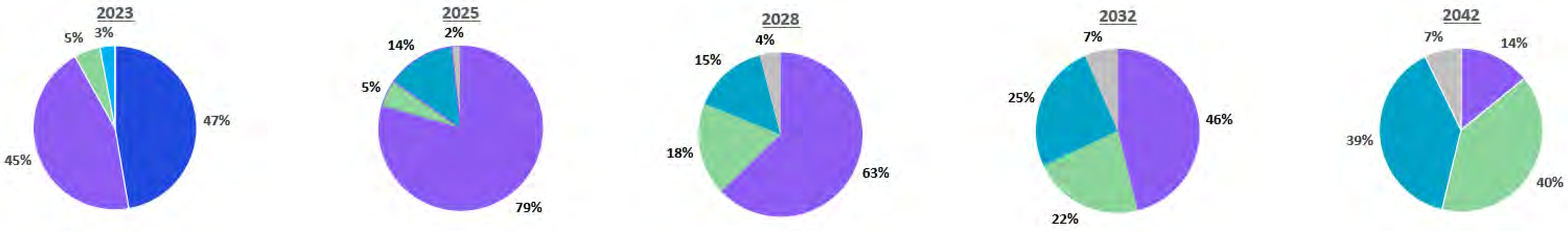


Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	0
Solar	0	0	325	65	0	0
Storage	0	0	260	0	0	0
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

Pete 3 & 4 Refuel in 2025: Decarbonized Economy





Thermal MWh %	92%	Thermal MWh %	79%	Thermal MWh %	63%	Thermal MWh %	46%	Thermal MWh %	14%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	21%	Renewable/DSM MWh %	37%	Renewable/DSM MWh %	54%	Renewable/DSM MWh %	86%

Pete 3 & 4 Refuel in 2025: Decarbonized Economy

Portfolio Overview

Retirements

Petersburg:

- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
  - **Total Refueled MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,350 MW
- Solar: 2,600 MW
- Storage: 900 MW
- Solar + Storage: 45 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

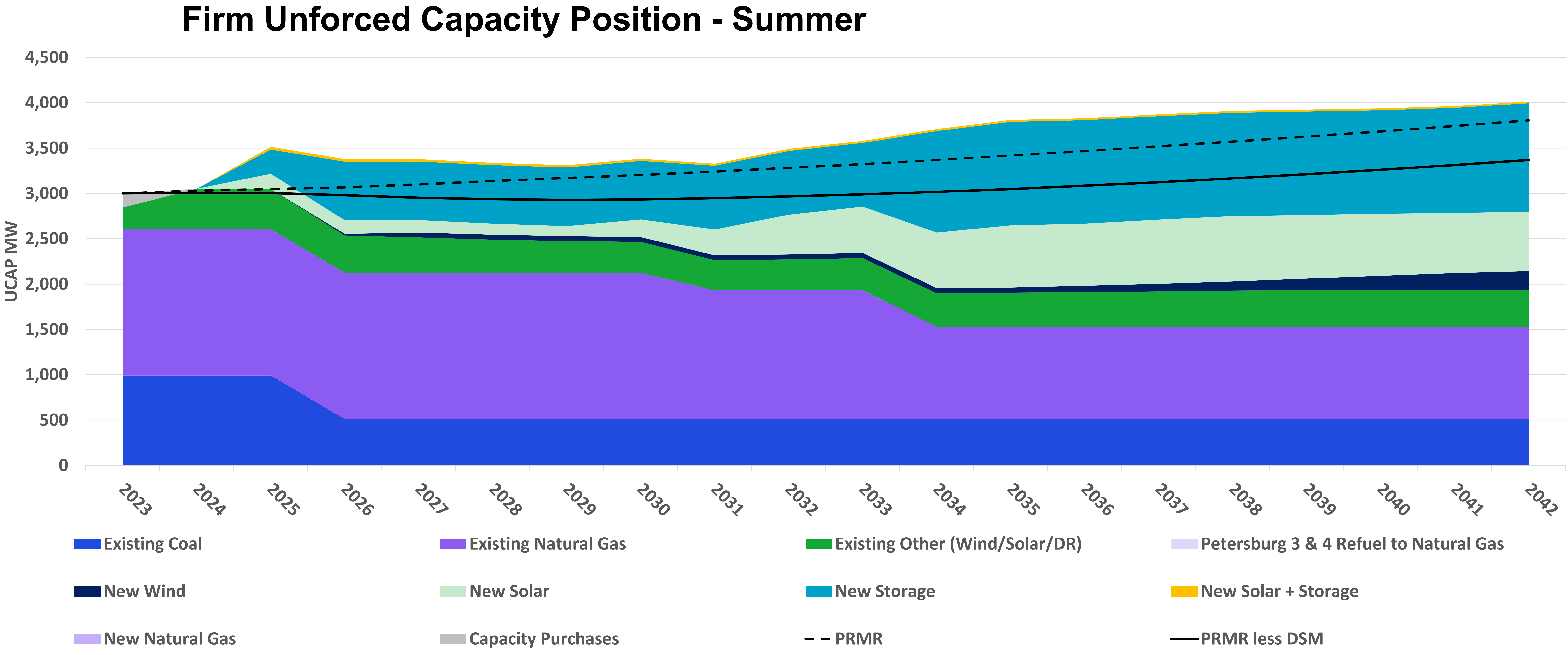
20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Decarbonized Economy
No Early Retirement	$9,917
Pete Refuel to 100% Gas (est. 2025)	**$9,546**
One Pete Unit Retires (2026)	$9,955
Both Pete Units Retire (2026 & 2028)	$9,923
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,690
Encompass Optimization without predefined Strategy	$9,572

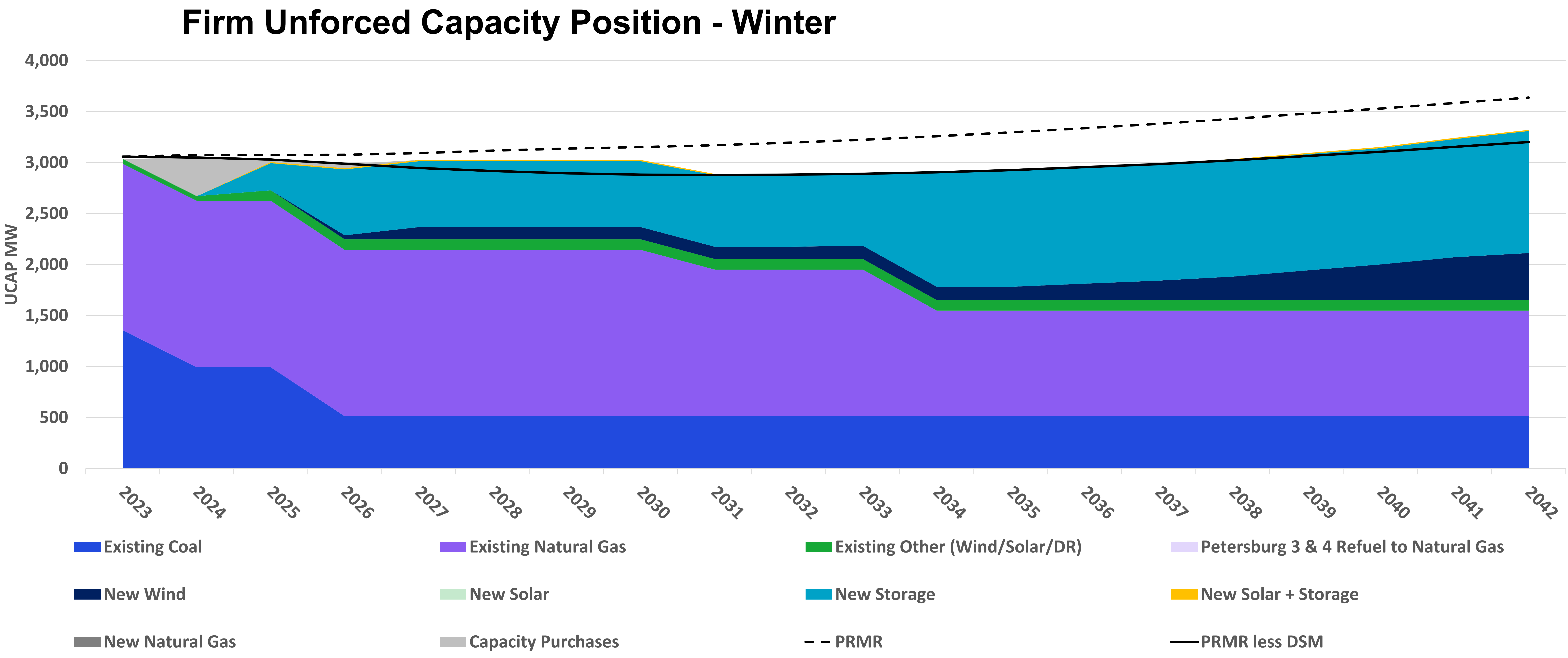
C. One Pete Unit Retires (2026)

20-Year PVRR (2023$MM, 2023-2042)	Scenarios			
	No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategy: *One Pete Unit Retires (2026)*				**$9,955**

One Pete Unit Retires (2026): Decarbonized Economy

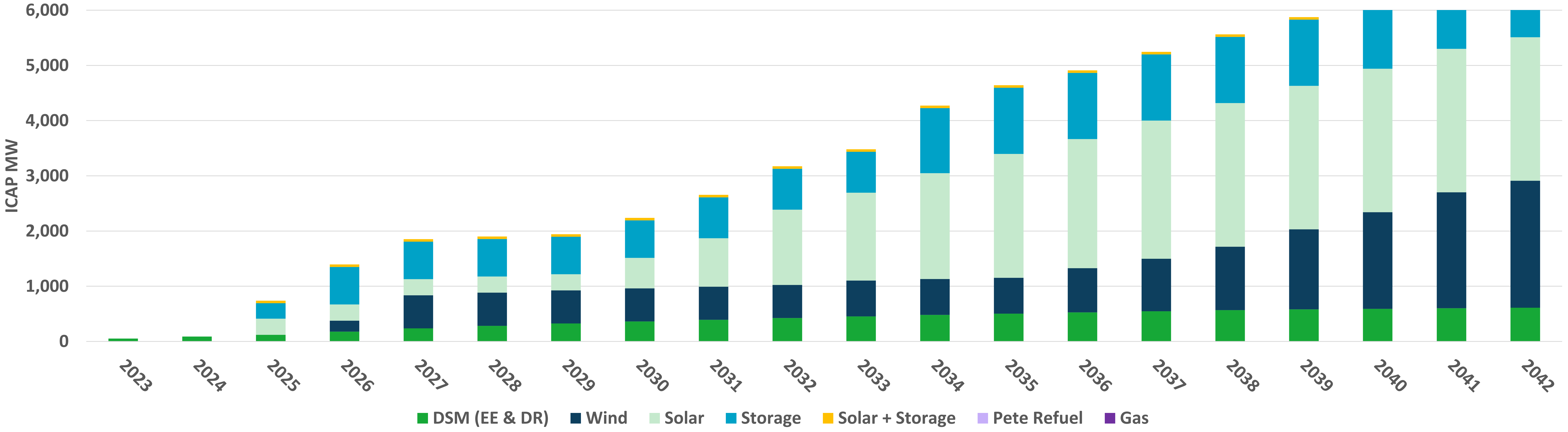


One Pete Unit Retires (2026): Decarbonized Economy



One Pete Unit Retires (2026): Decarbonized Economy

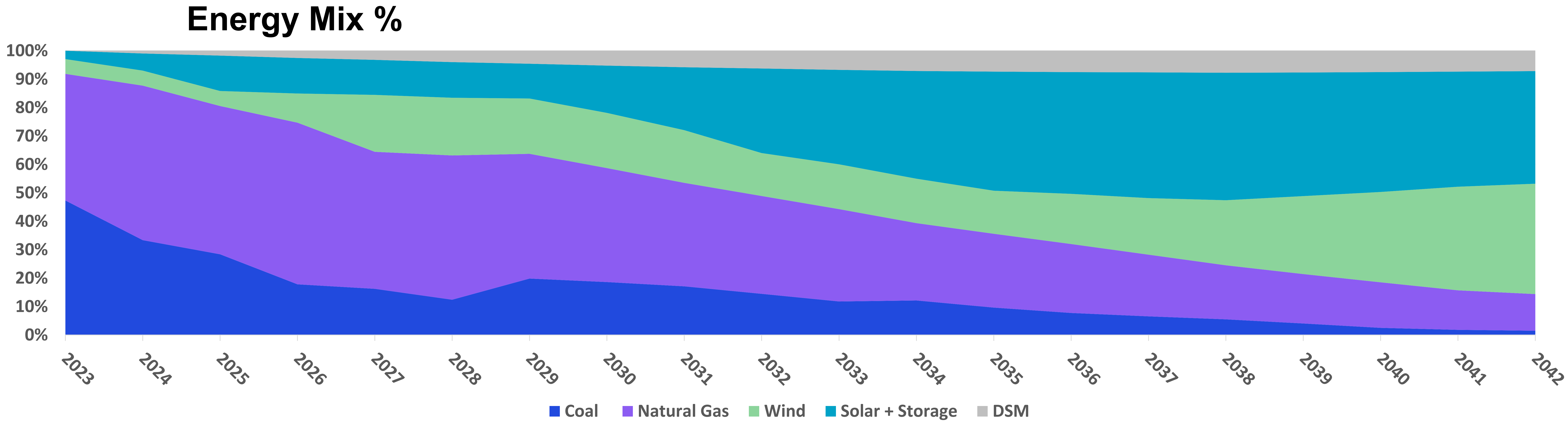
Installed Capacity Cumulative Additions (MW)

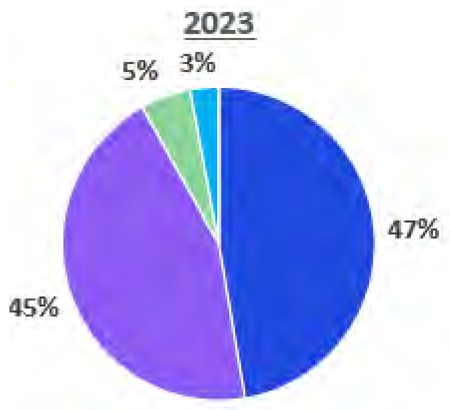


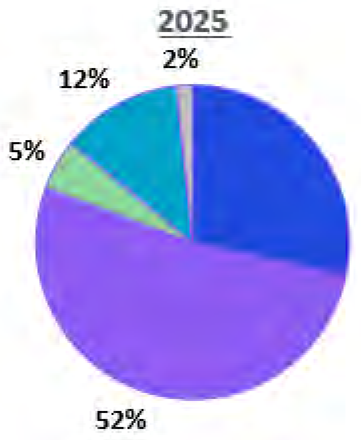
Installed Capacity Incremental Additions (MW): 2023 - 2028

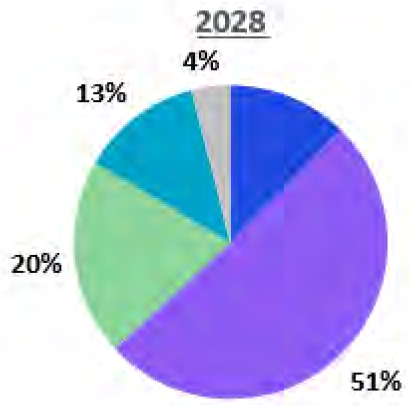
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	200	400	0
Solar	0	0	293	0	0	0
Storage	0	0	280	400	0	0
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

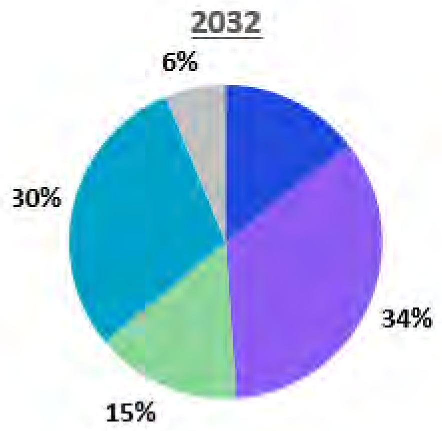
One Pete Unit Retires (2026): Decarbonized Economy

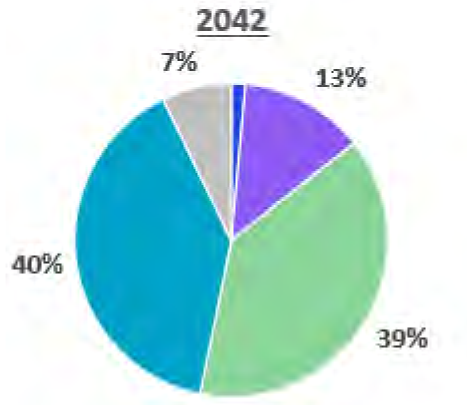












Thermal MWh %	92%	Thermal MWh %	81%	Thermal MWh %	63%	Thermal MWh %	49%	Thermal MWh %	14%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	19%	Renewable/DSM MWh %	37%	Renewable/DSM MWh %	51%	Renewable/DSM MWh %	86%

One Pete Unit Retires (2026): Decarbonized Economy

Portfolio Overview

Retirements

Petersburg:
- Pete 3 Coal: 2026
  - **Total Coal Retired MW: 520 MW**

Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 610 MW
- Wind: 2,300 MW
- Solar: 2,600 MW
- Storage: 1,260 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Decarbonized Economy
No Early Retirement	$9,917
Pete Refuel to 100% Gas (est. 2025)	$9,546
One Pete Unit Retires (2026)	**$9,955**
Both Pete Units Retire (2026 & 2028)	$9,923
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,690
Encompass Optimization without predefined Strategy	$9,572

D. Both Pete Units Retire (2026 & 2028)

20-Year PVRR
(2023$MM, 2023-2042)

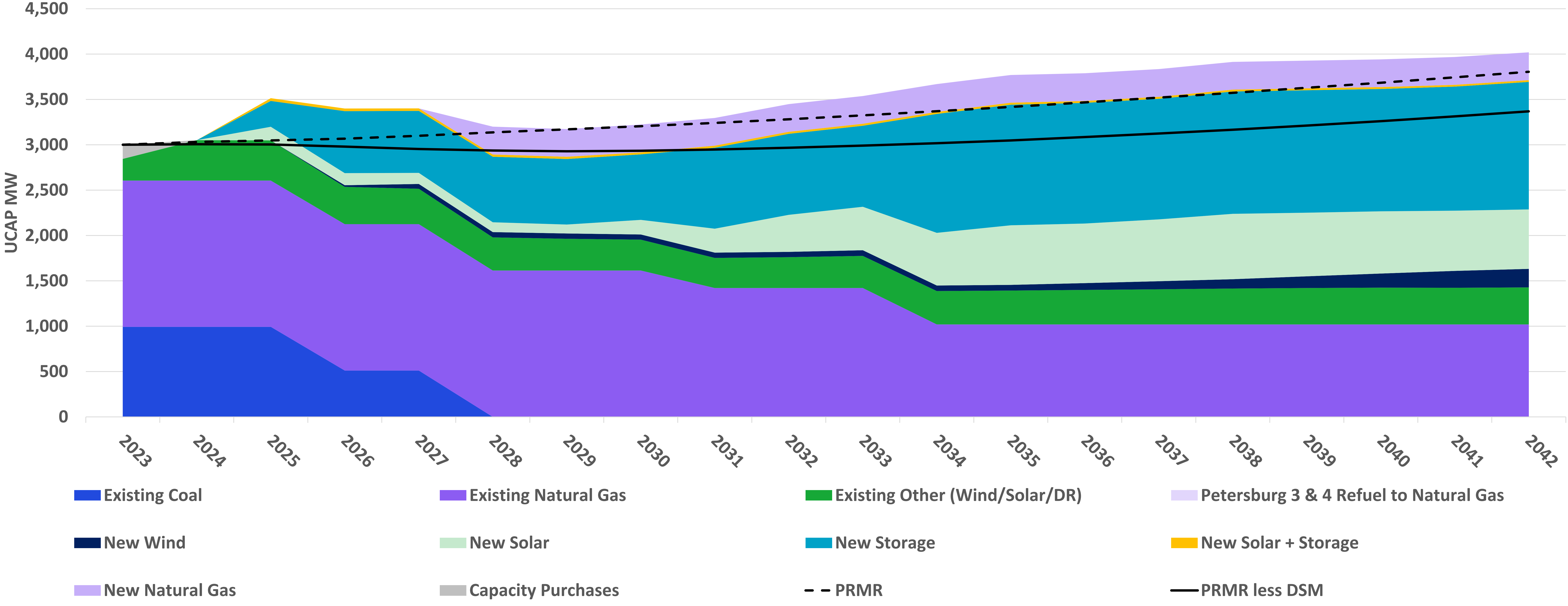
Generation Strategy:
Both Pete Units Retire
(2026 & 2028)

Scenarios			
No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
			$9,923

Both Pete Units Retire: Decarbonized Economy

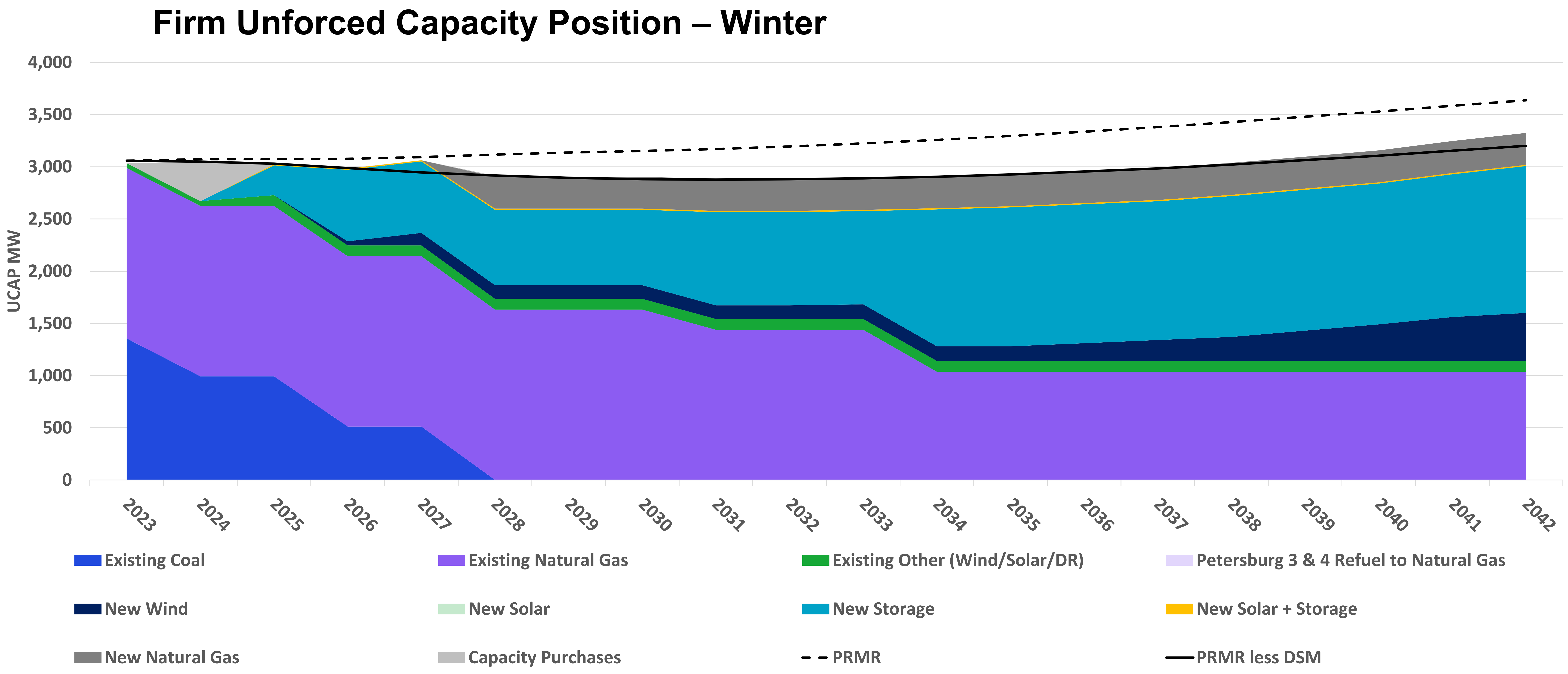
2026 & 2028

Firm Unforced Capacity Position – Summer



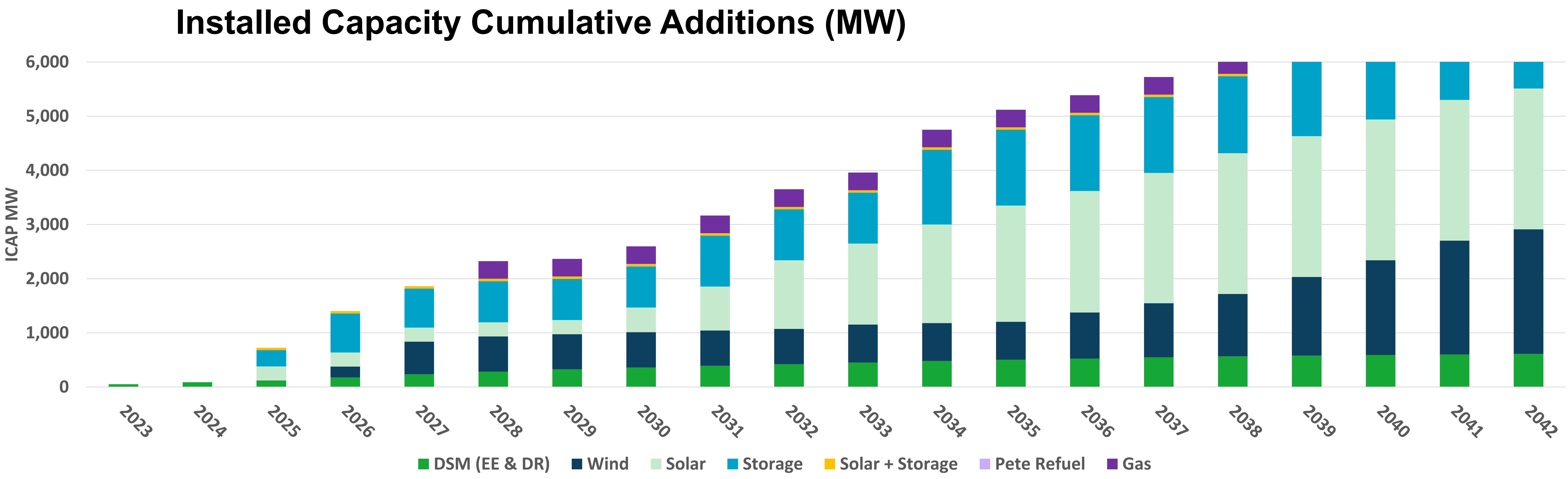
Both Pete Units Retire: Decarbonized Economy

2026 & 2028



Both Pete Units Retire: Decarbonized Economy

2026 & 2028

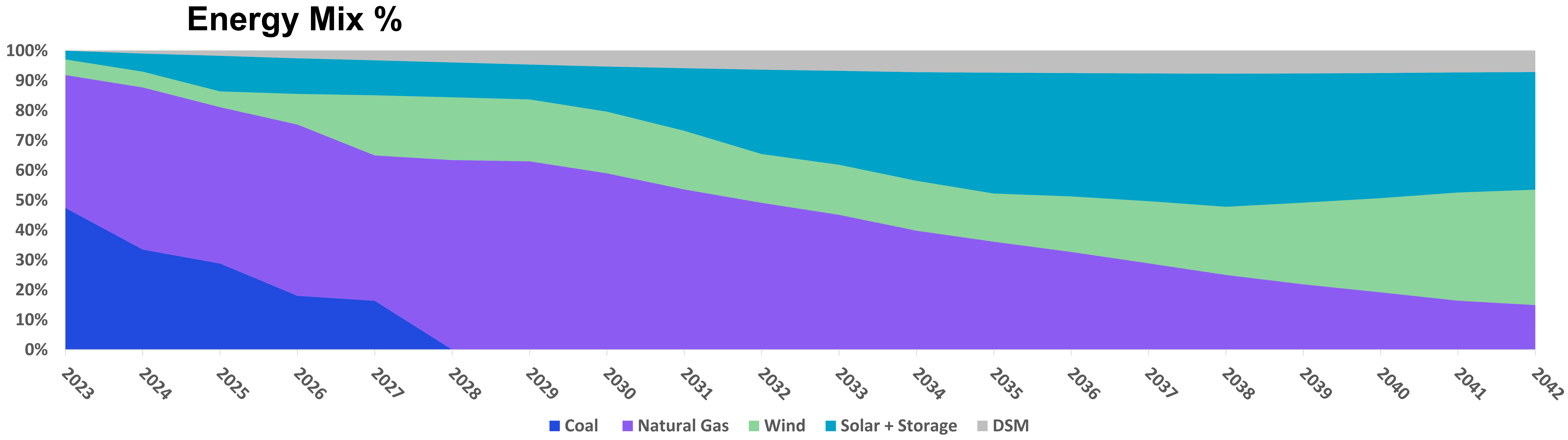


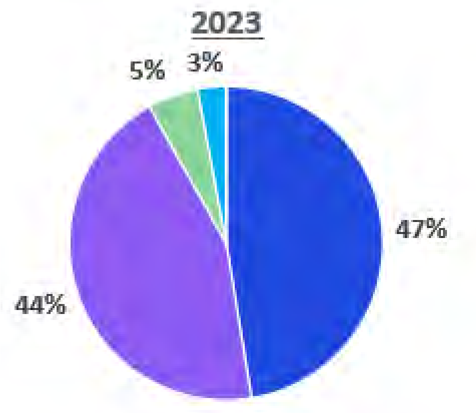
Installed Capacity Incremental Additions (MW): 2023 – 2028

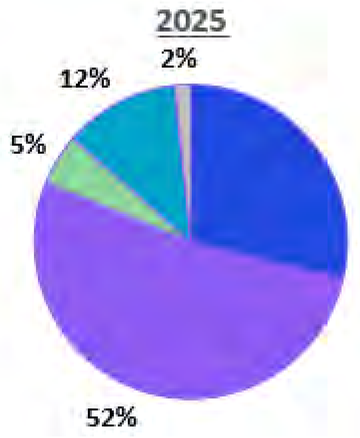
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	200	400	50
Solar	0	0	260	0	0	0
Storage	0	0	300	420	0	40
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	325

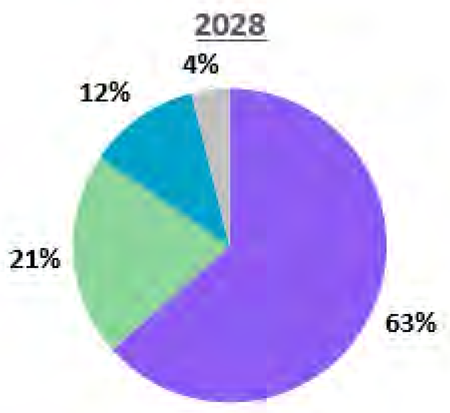
Both Pete Units Retire: Decarbonized Economy

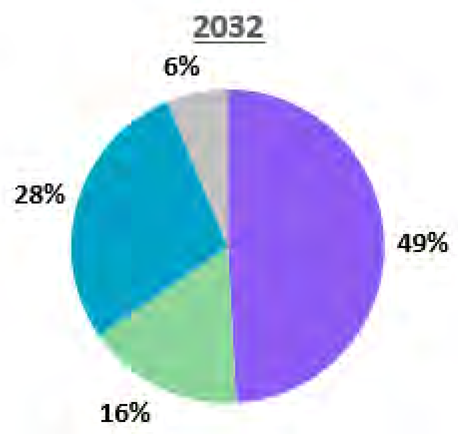
2026 & 2028

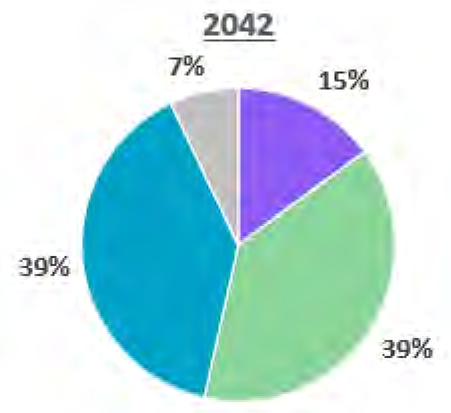












Thermal MWh %	92%	Thermal MWh %	81%	Thermal MWh %	63%	Thermal MWh %	49%	Thermal MWh %	15%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	19%	Renewable/DSM MWh %	37%	Renewable/DSM MWh %	51%	Renewable/DSM MWh %	85%

Both Pete Units Retire: Decarbonized Economy

2026 & 2028

Portfolio Overview

Retirements

- Petersburg:
- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

- Harding Street:
- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 610 MW
- Wind: 2,300 MW
- Solar: 2,600 MW
- Storage: 1,480 MW
- Solar + Storage: 45 MW
- Thermal: 325 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Decarbonized Economy
No Early Retirement	$9,917
Pete Refuel to 100% Gas (est. 2025)	$9,546
One Pete Unit Retires (2026)	$9,955
Both Pete Units Retire (2026 & 2028)	**$9,923**
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,690
Encompass Optimization without predefined Strategy	$9,572

E. Clean Energy Strategy

Retire & Replace Pete with Clean Energy

20-Year PVRR
(2023$MM, 2023-2042)

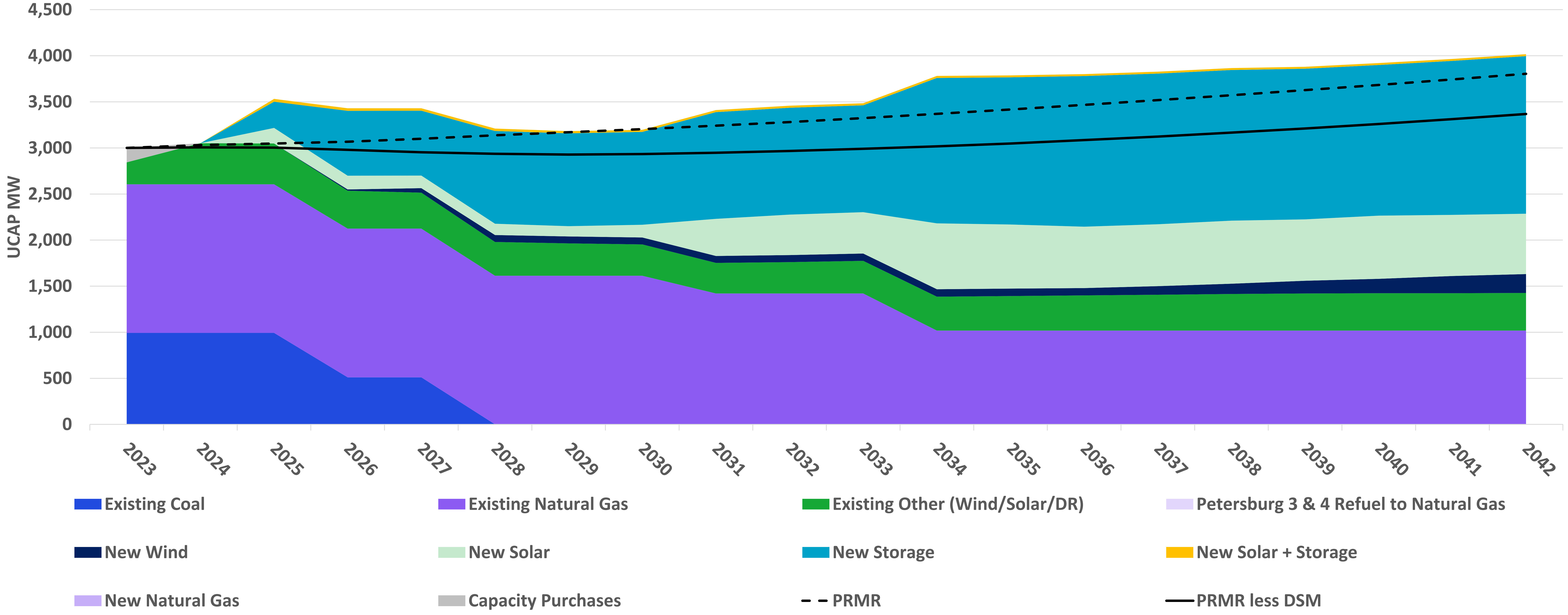
Generation Strategy:
"Clean Energy Strategy"
Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)

Scenarios			
No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
			$9,690

Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

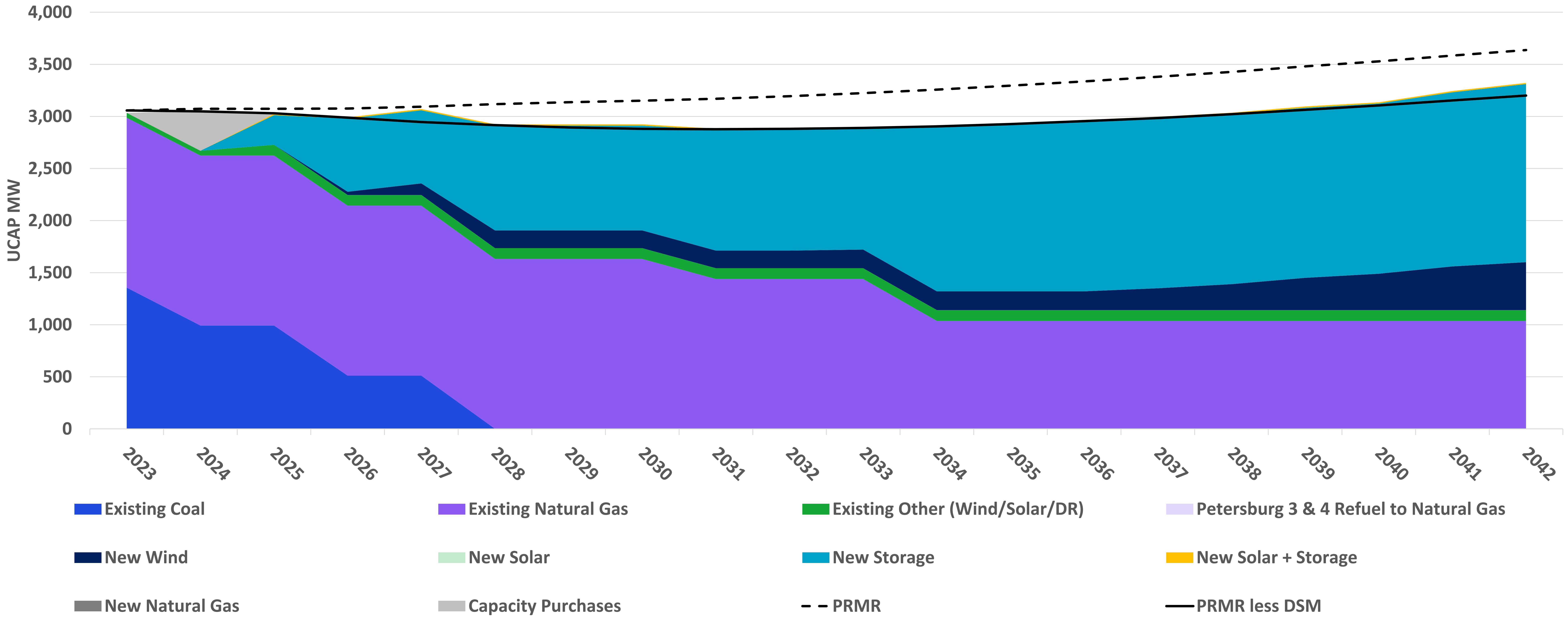
Firm Unforced Capacity Position – Summer



Clean Energy Strategy: Decarbonized Economy

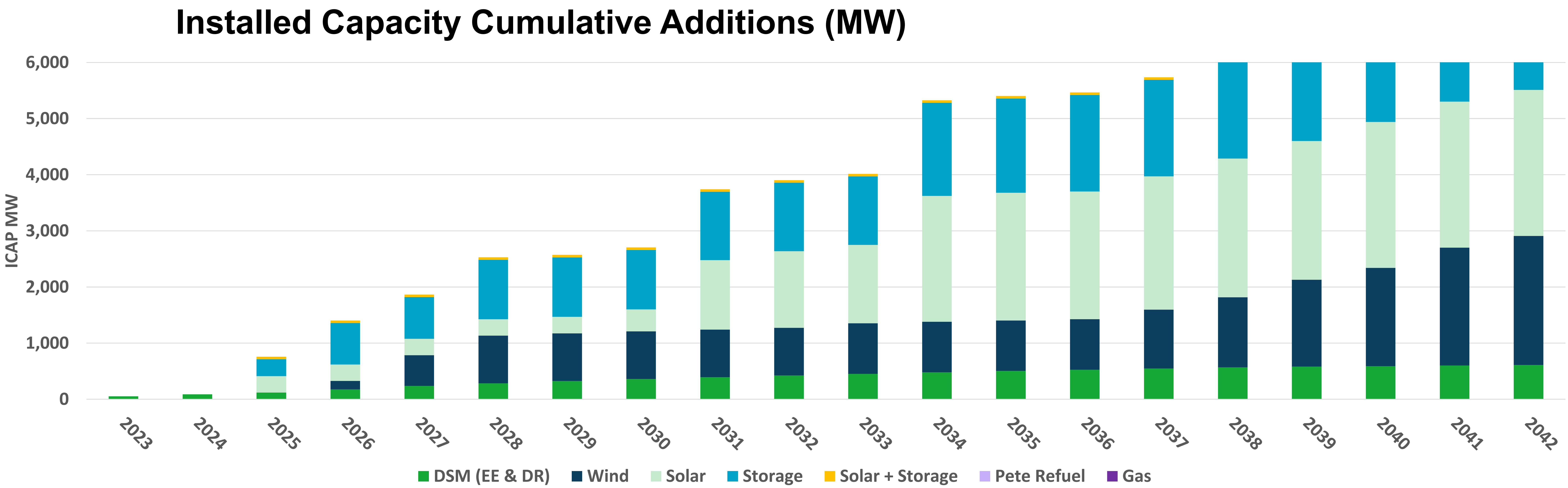
Retire & Replace Pete with Clean Energy

Firm Unforced Capacity Position – Winter



Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy



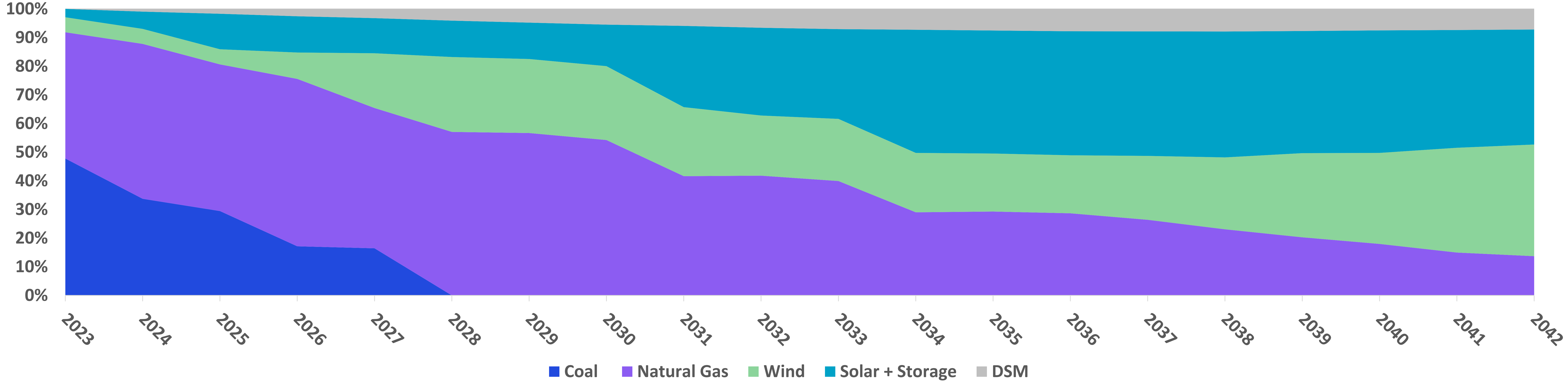
Installed Capacity Incremental Additions (MW): 2023 – 2028

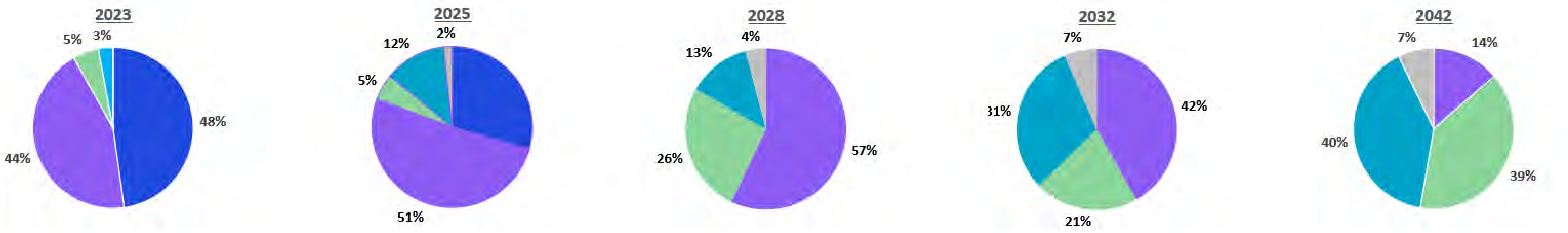
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	150	400	300
Solar	0	0	293	0	0	0
Storage	0	0	300	440	0	320
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	81%	Thermal MWh %	57%	Thermal MWh %	42%	Thermal MWh %	14%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	19%	Renewable/DSM MWh %	43%	Renewable/DSM MWh %	58%	Renewable/DSM MWh %	86%

Clean Energy Strategy: Decarbonized Economy

Retire & Replace Pete with Clean Energy

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
    - **Total Coal Retired MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
    - **Total Retired Nat Gas MW: 618 MW**

Replacements by 2042

- DSM: 610 MW
- Wind: 2,300 MW
- Solar: 2,600 MW
- Storage: 1,800 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Decarbonized Economy
No Early Retirement	$9,917
Pete Refuel to 100% Gas (est. 2025)	$9,546
One Pete Unit Retires (2026)	$9,955
Both Pete Units Retire (2026 & 2028)	$9,923
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	**$9,690**
Encompass Optimization without predefined Strategy	$9,572

F. Encompass Optimization

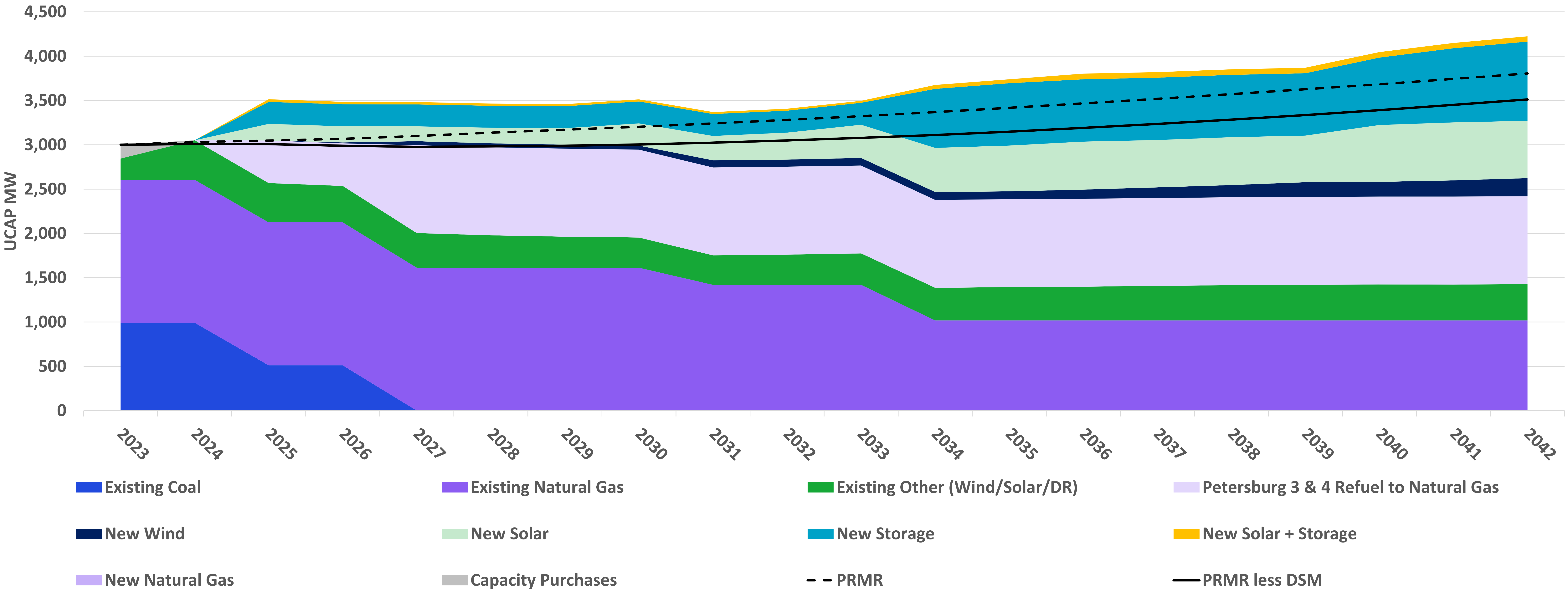
Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

20-Year PVRR (2023$MM, 2023-2042)	**Scenarios**			
	No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategy: ***Encompass Optimization without predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027***				**$9,572**

Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

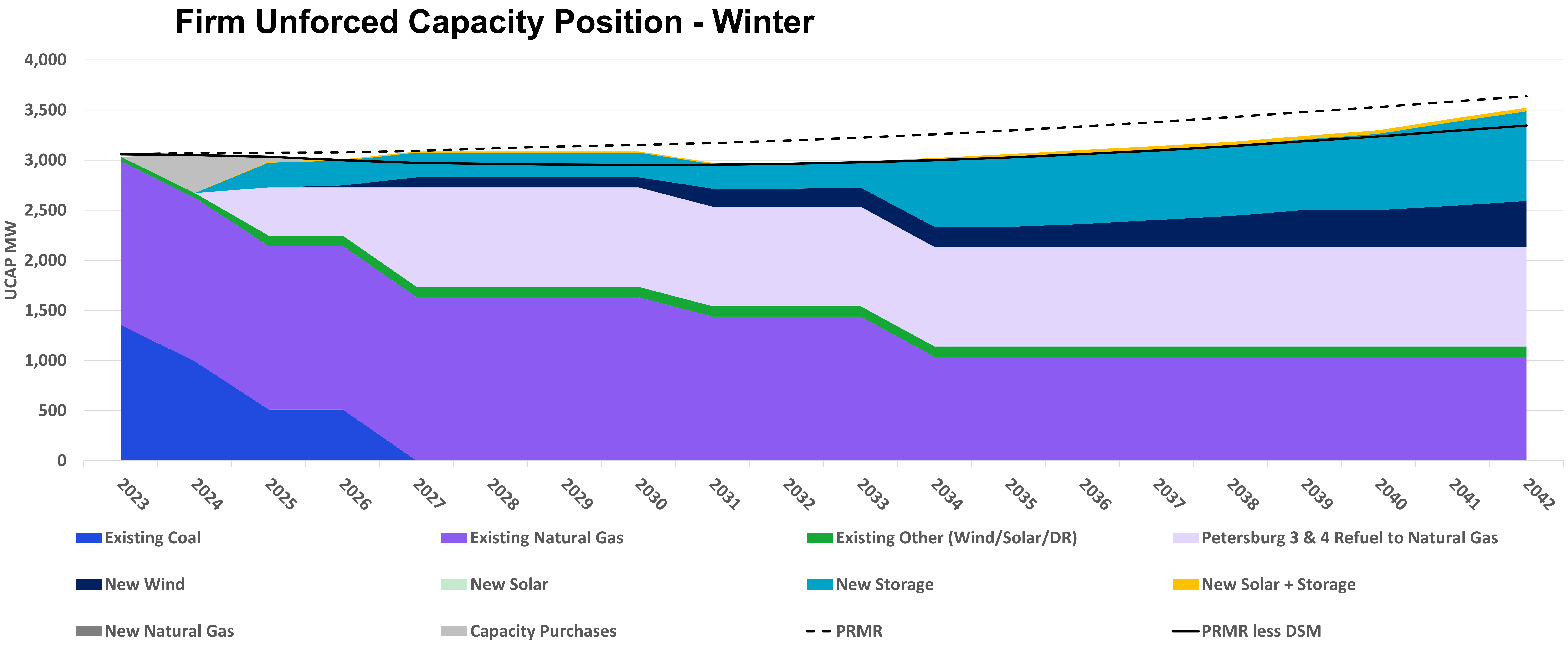
Firm Unforced Capacity Position - Summer



AES Indiana

Encompass Optimization: Decarbonized Economy

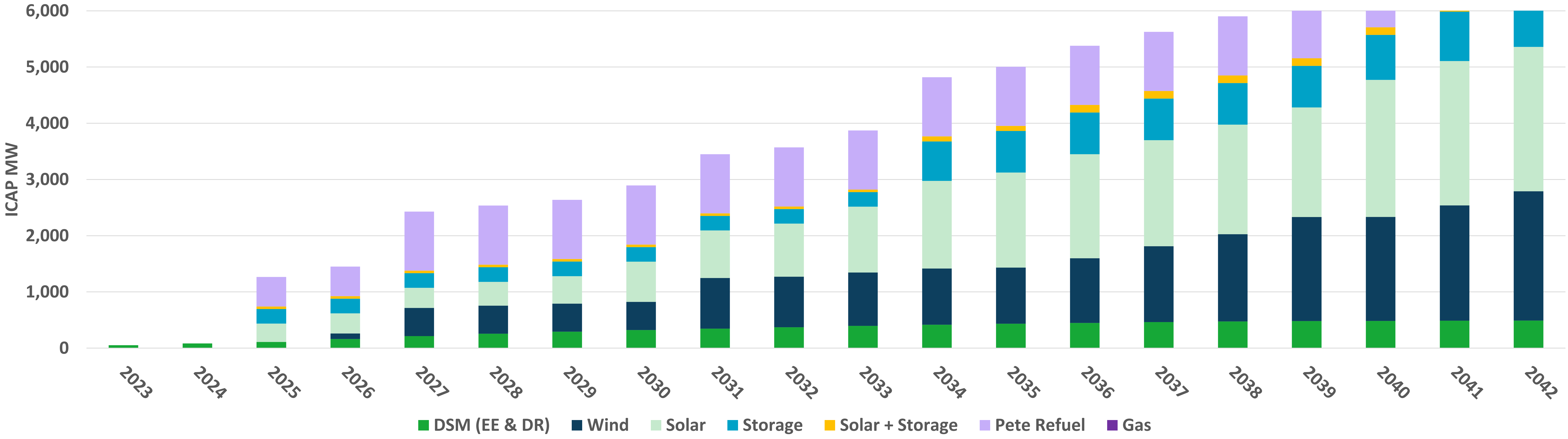
Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027



Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Installed Capacity Cumulative Additions (MW)

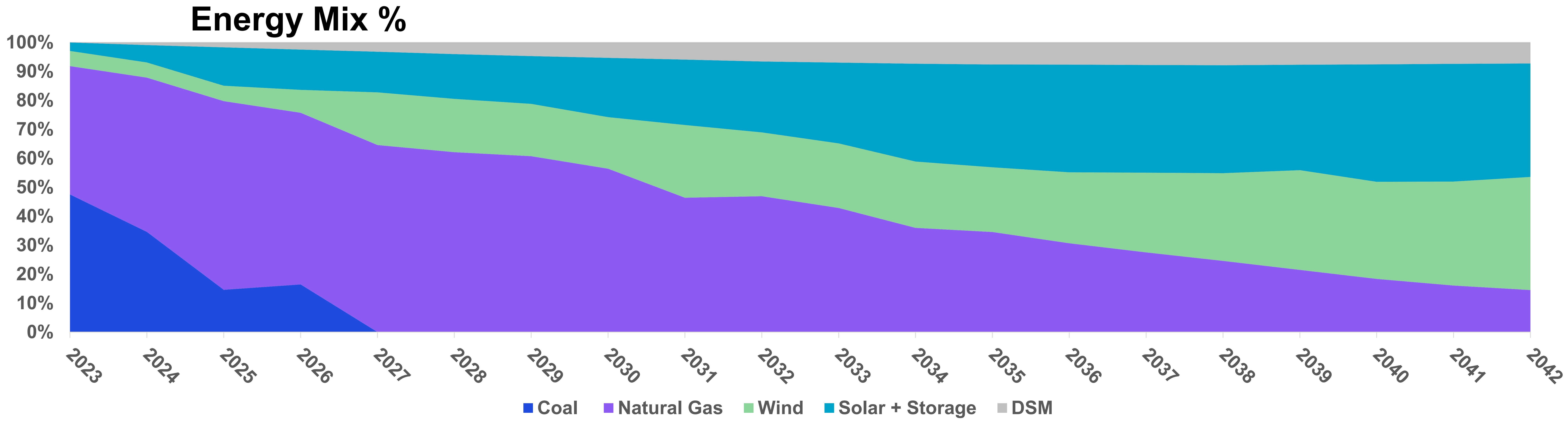


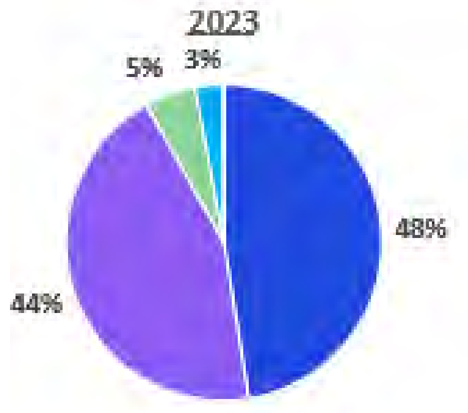
Installed Capacity Incremental Additions (MW): 2023 - 2028

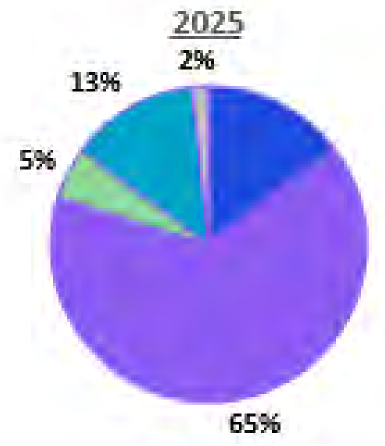
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	0
Solar	0	0	325	33	0	65
Storage	0	0	260	0	0	0
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

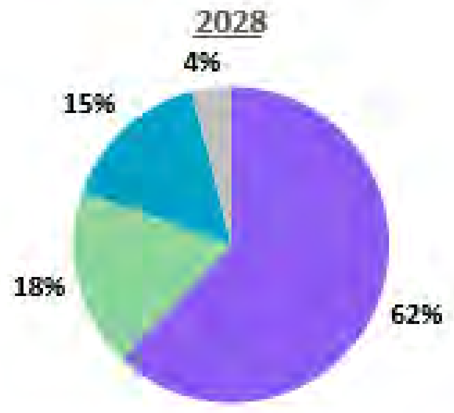
Encompass Optimization: Decarbonized Economy

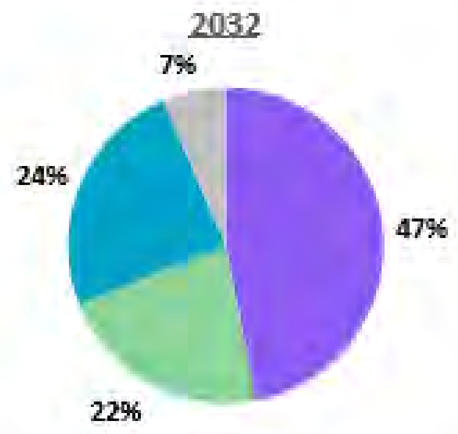
Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

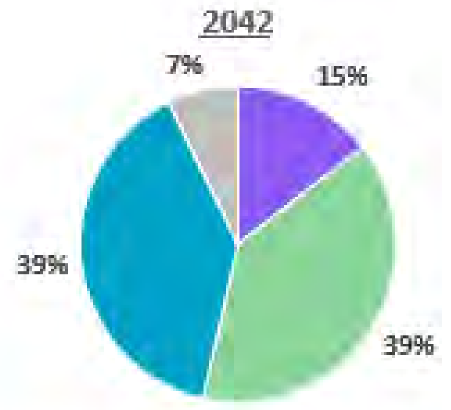












Thermal MWh %	92%	Thermal MWh %	80%	Thermal MWh %	62%	Thermal MWh %	47%	Thermal MWh %	15%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	20%	Renewable/DSM MWh %	38%	Renewable/DSM MWh %	53%	Renewable/DSM MWh %	85%

Encompass Optimization: Decarbonized Economy

Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2025
- Pete 4 Coal: 2027
  - **Total Refueled MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,300 MW
- Solar: 2,568 MW
- Storage: 940 MW
- Solar + Storage: 135 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Decarbonized Economy
No Early Retirement	$9,917
Pete Refuel to 100% Gas (est. 2025)	$9,546
One Pete Unit Retires (2026)	$9,955
Both Pete Units Retire (2026 & 2028)	$9,923
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,690
Encompass Optimization without predefined Strategy	**$9,572**

Portfolio Matrix

	20-Year PVRR (2023$MM, 2023-2042)	**Scenarios**			
		No Environmental Action	**Current Trends (Reference Case)**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**	$7,111	$9,572	$11,349	$9,917
	Pete Refuel to 100% Gas (est. 2025)	$6,621	$9,330	$11,181	$9,546
	One Pete Unit Retires (2026)	$7,462	$9,773	$11,470	$9,955
	Both Pete Units Retire (2026 & 2028)	$7,425	$9,618	$11,145	$9,923
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211	$9,711	$11,184	$9,690
	Encompass Optimization without predefined Strategy	$6,610	$9,262	$10,994	$9,572

Encompass Optimization Results by Scenario:

Refuels Petersburg Units 3 & 4 in 2025	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

Aggressive Environmental

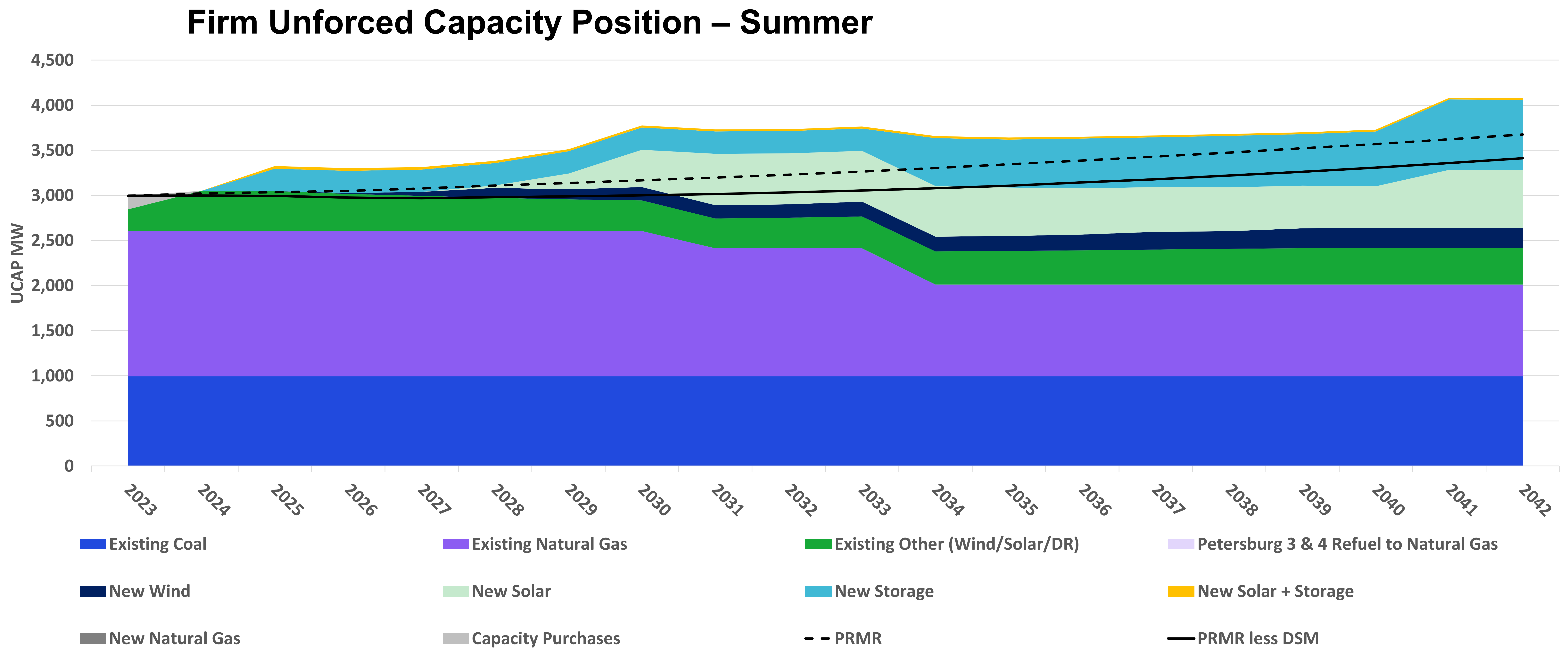
		Scenarios
	20-Year PVRR (2023$MM, 2023-2042)	**Aggressive Environmental**
Generation Strategies	**No Early Retirement**	**$11,349**
	Pete Refuel to 100% Gas (est. 2025)	**$11,181**
	One Pete Unit Retires (2026)	**$11,470**
	Both Pete Units Retire (2026 & 2028)	**$11,145**
	“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	**$11,184**
	Encompass Optimization without predefined Strategy – Selects Pete 4 Refuel in 2027	**$10,994**

A. No Early Retirement

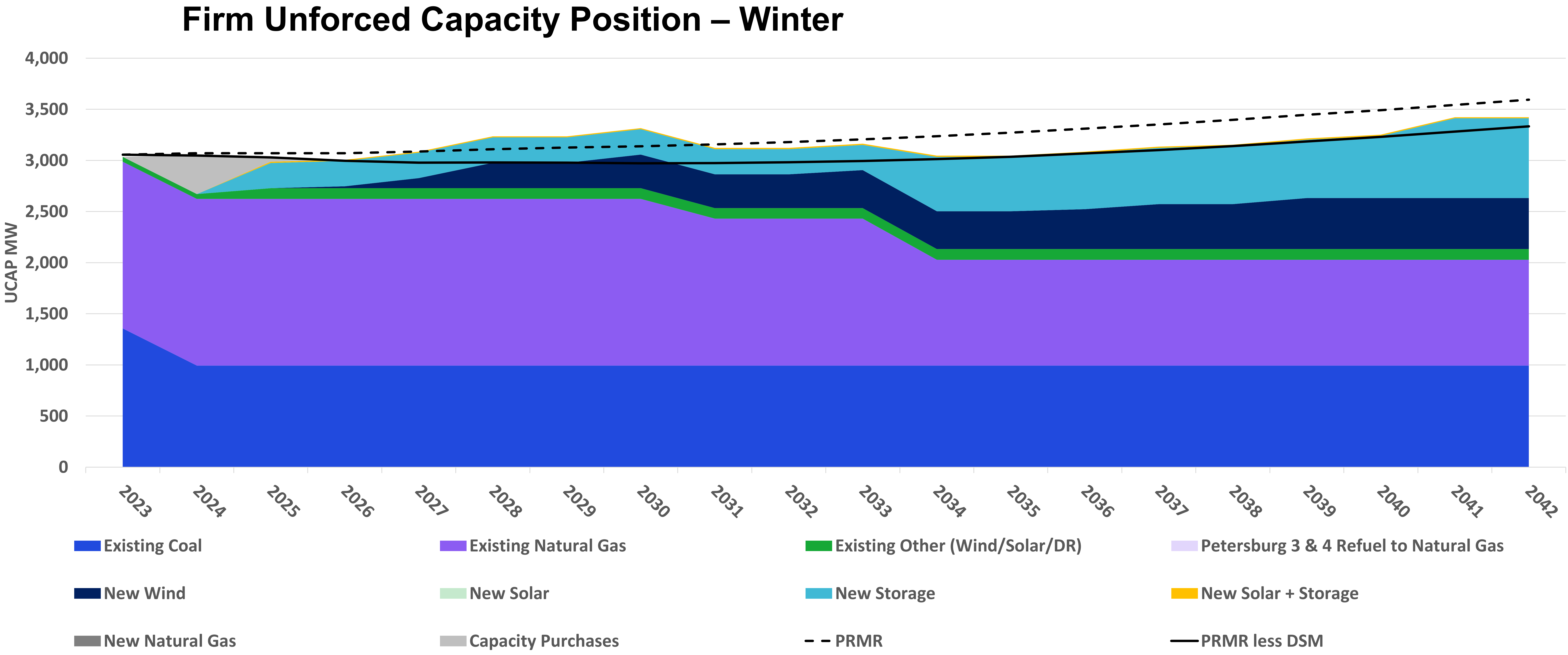
Generation Strategy:
No Early Retirement

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
		$11,349	

No Early Retirement: Aggressive Environmental

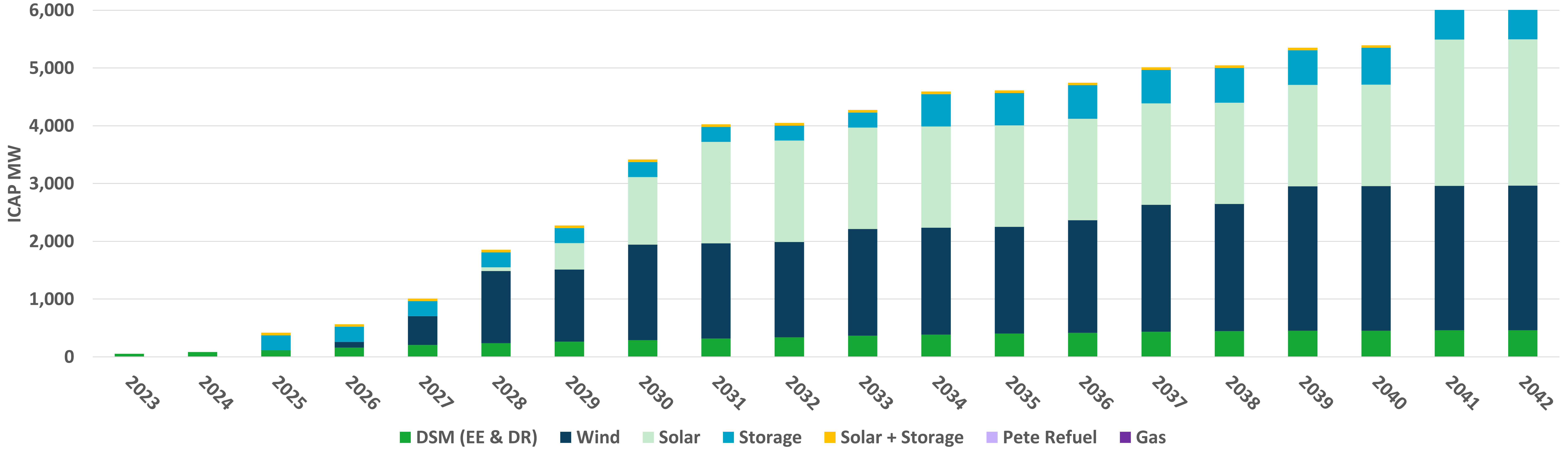


No Early Retirement: Aggressive Environmental



No Early Retirement: Aggressive Environmental

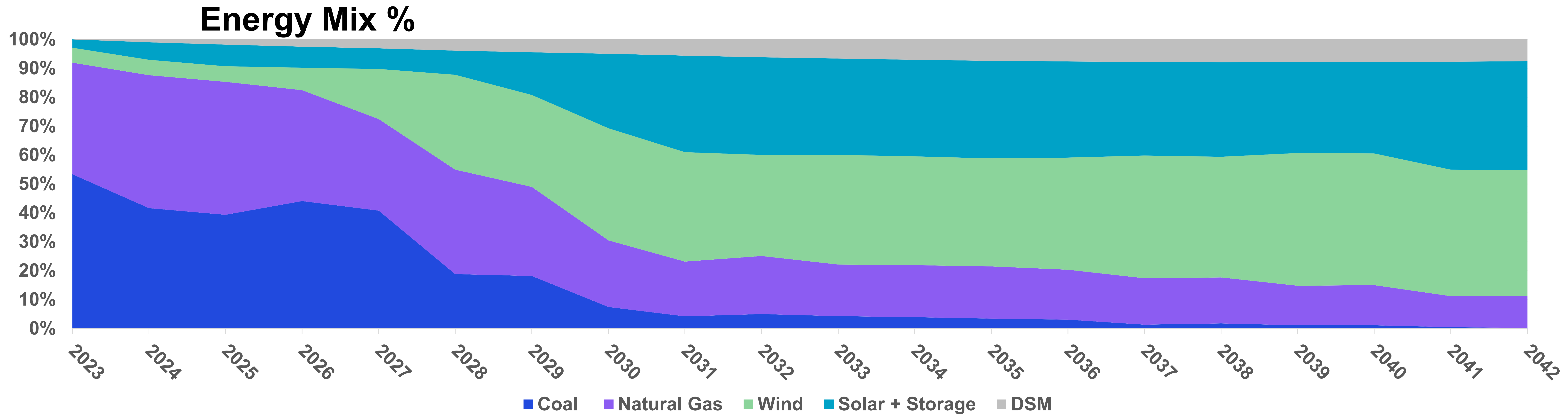
Installed Capacity Cumulative Additions (MW)

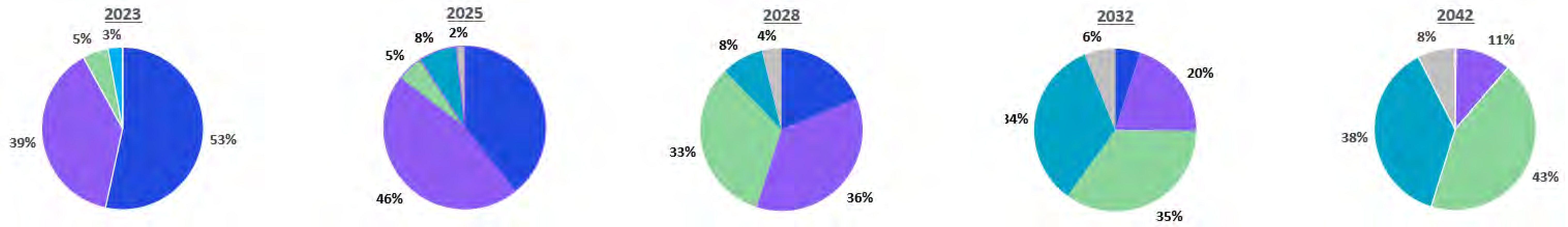


Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	100	400	750
Solar	0	0	0	0	0	65
Storage	0	0	260	0	0	0
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

No Early Retirement: Aggressive Environmental





Thermal MWh %	92%	Thermal MWh %	85%	Thermal MWh %	55%	Thermal MWh %	25%	Thermal MWh %	11%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	45%	Renewable/DSM MWh %	75%	Renewable/DSM MWh %	89%

No Early Retirement: Aggressive Environmental

Portfolio Overview

Retirements

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 462 MW
- Wind: 2,500 MW
- Solar: 2,535 MW
- Storage: 820 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

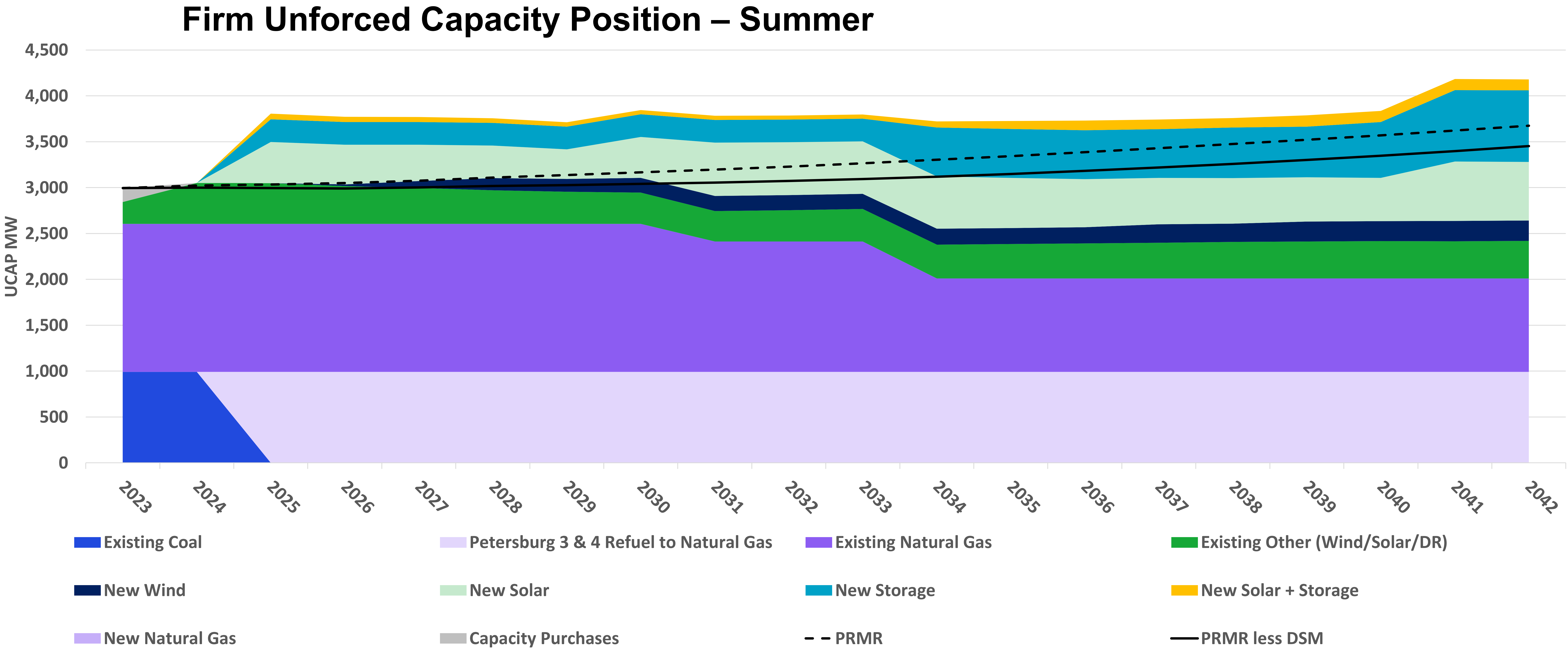
20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Aggressive Environmental
No Early Retirement	**$11,349**
Pete Refuel to 100% Gas (est. 2025)	$11,181
One Pete Unit Retires (2026)	$11,470
Both Pete Units Retire (2026 & 2028)	$11,145
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$11,184
Encompass Optimization without predefined Strategy	$10,994

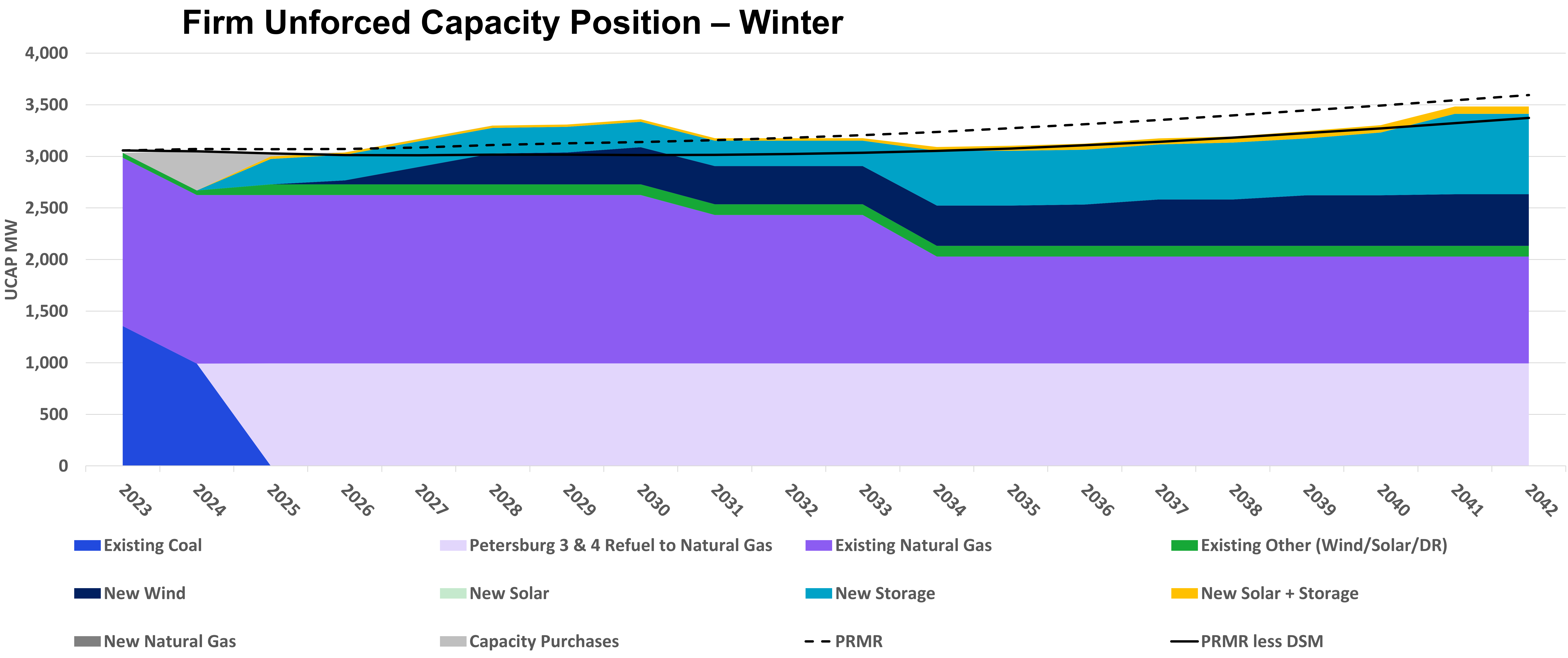
B. Pete Refuel by 2025

20-Year PVRR (2023$MM, 2023-2042)	Scenarios			
	No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
Generation Strategy: *Pete Refuel to 100% Gas (est. 2025)*			**$11,181**	

Pete 3 & 4 Refuel in 2025: Aggressive Environmental



Pete 3 & 4 Refuel in 2025: Aggressive Environmental


Firm Unforced Capacity Position – Winter

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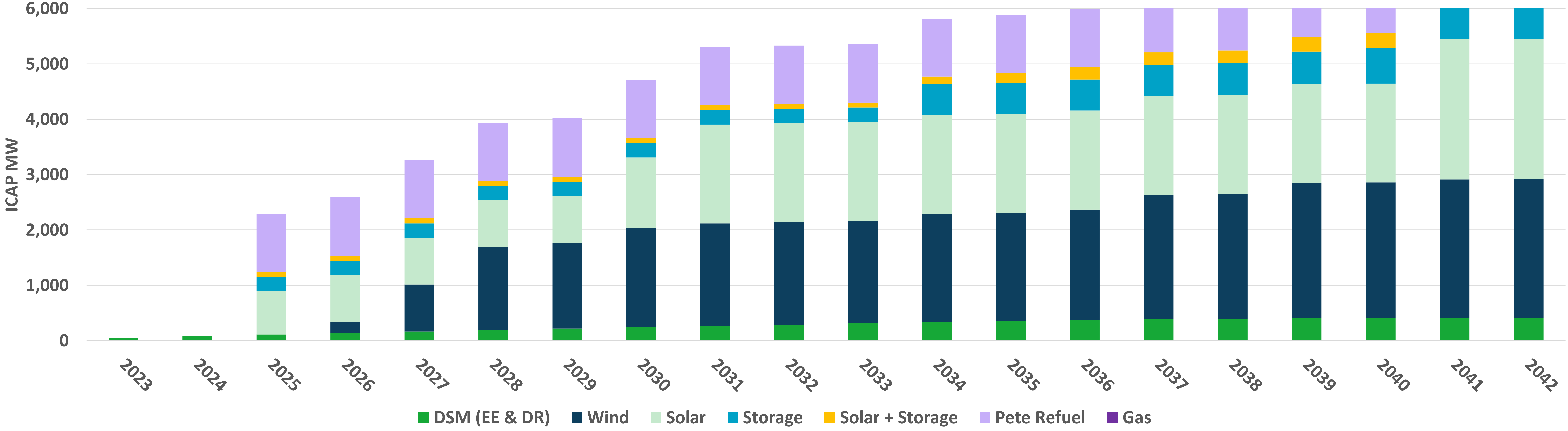
Pete 3 & 4 Refuel in 2025: Aggressive Environmental

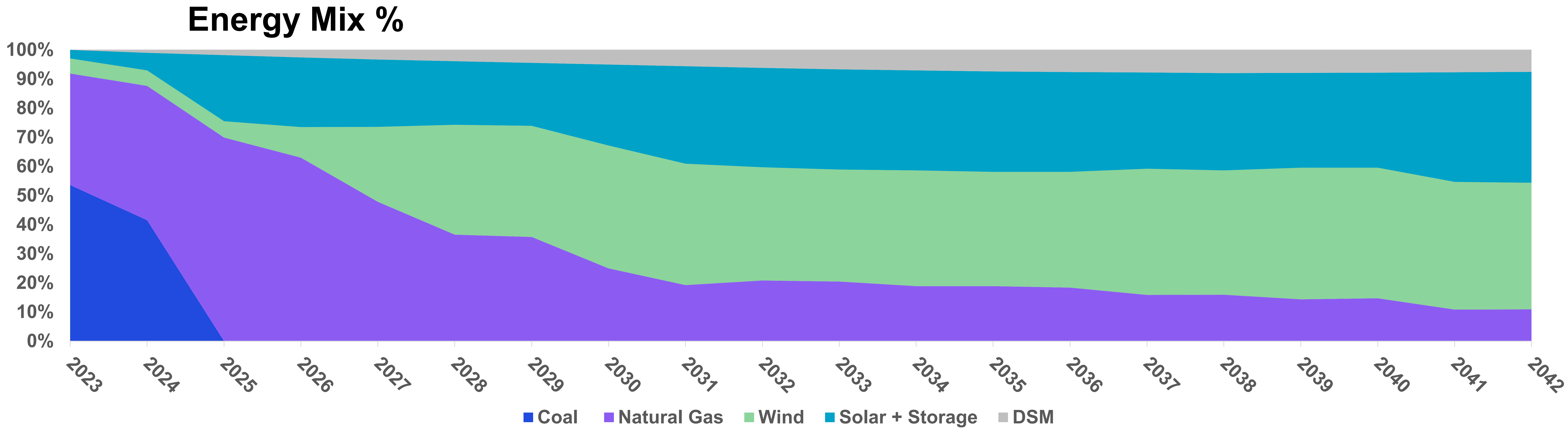
Installed Capacity Cumulative Additions (MW)

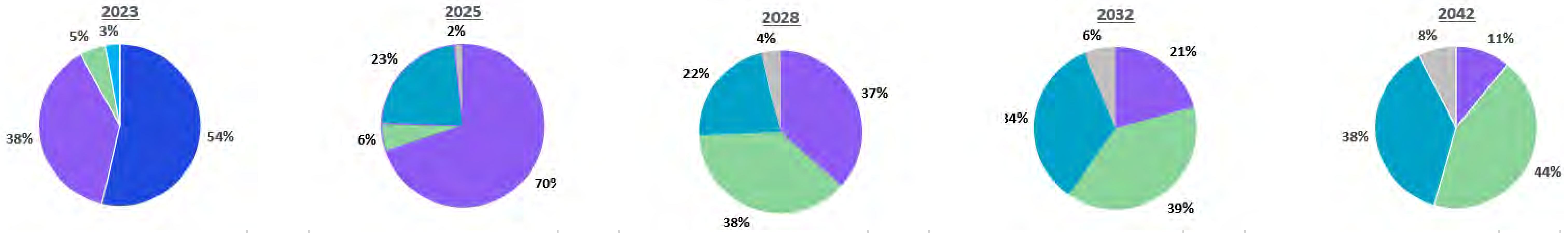


Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	200	650	650
Solar	0	0	780	65	0	0
Storage	0	0	260	0	0	0
Solar + Storage	0	0	90	0	0	0
Pete Refuel	0	0	1,052	0	0	0
Gas	0	0	0	0	0	0

Pete 3 & 4 Refuel in 2025: Aggressive Environmental





Thermal MWh %	92%	Thermal MWh %	70%	Thermal MWh %	37%	Thermal MWh %	21%	Thermal MWh %	11%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	30%	Renewable/DSM MWh %	63%	Renewable/DSM MWh %	79%	Renewable/DSM MWh %	89%

Pete 3 & 4 Refuel in 2025: Aggressive Environmental

Portfolio Overview

Retirements

Petersburg:

- Pete 3 & 4 Coal: 2025 Refuel with Nat Gas
  - **Total Refueled MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 415 MW
- Wind: 2,500 MW
- Solar: 2,535 MW
- Storage: 820 MW
- Solar + Storage: 270 MW
- Thermal: 0
- Pete 3 & 4 Refueled to Nat Gas: 1,052 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Aggressive Environmental
No Early Retirement	$11,349
Pete Refuel to 100% Gas (est. 2025)	**$11,181**
One Pete Unit Retires (2026)	$11,470
Both Pete Units Retire (2026 & 2028)	$11,145
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$11,184
Encompass Optimization without predefined Strategy	$10,994

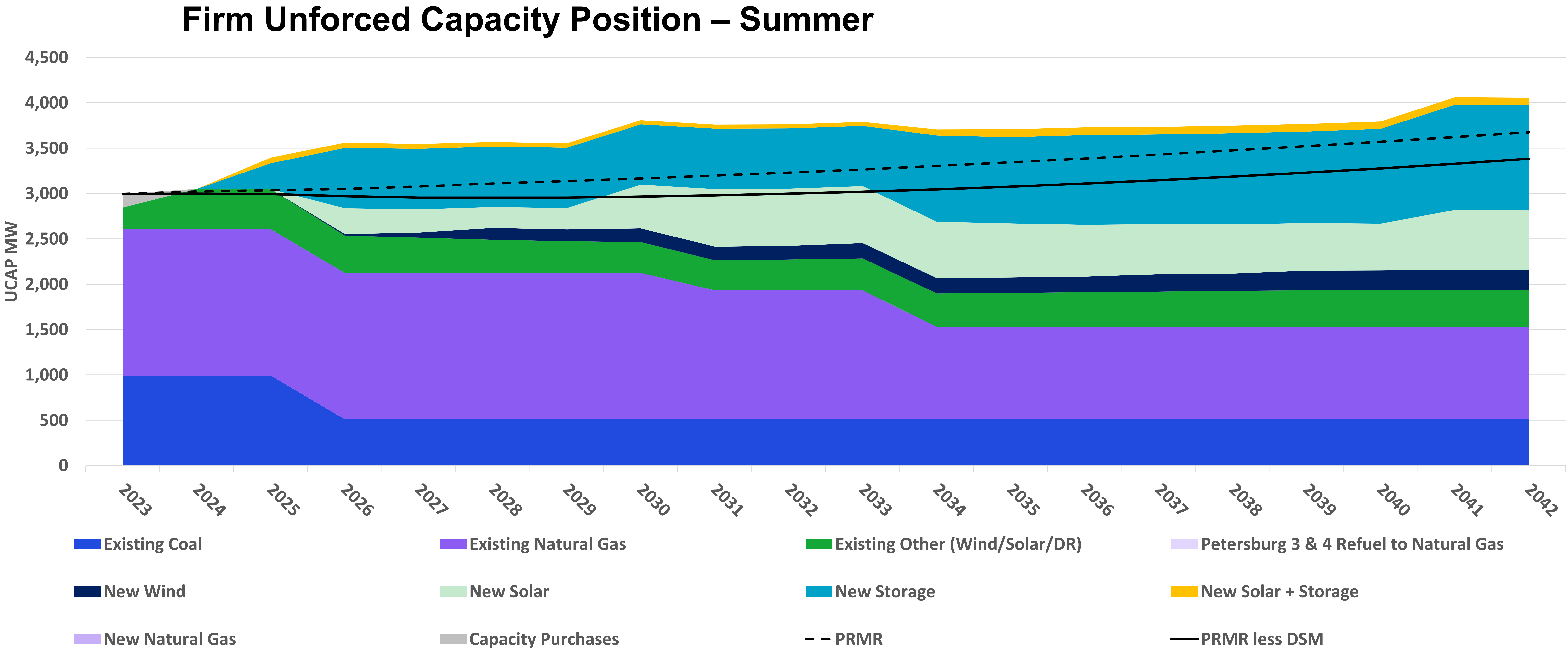
C. One Pete Unit Retires (2026)

20-Year PVRR (2023$MM, 2023-2042)

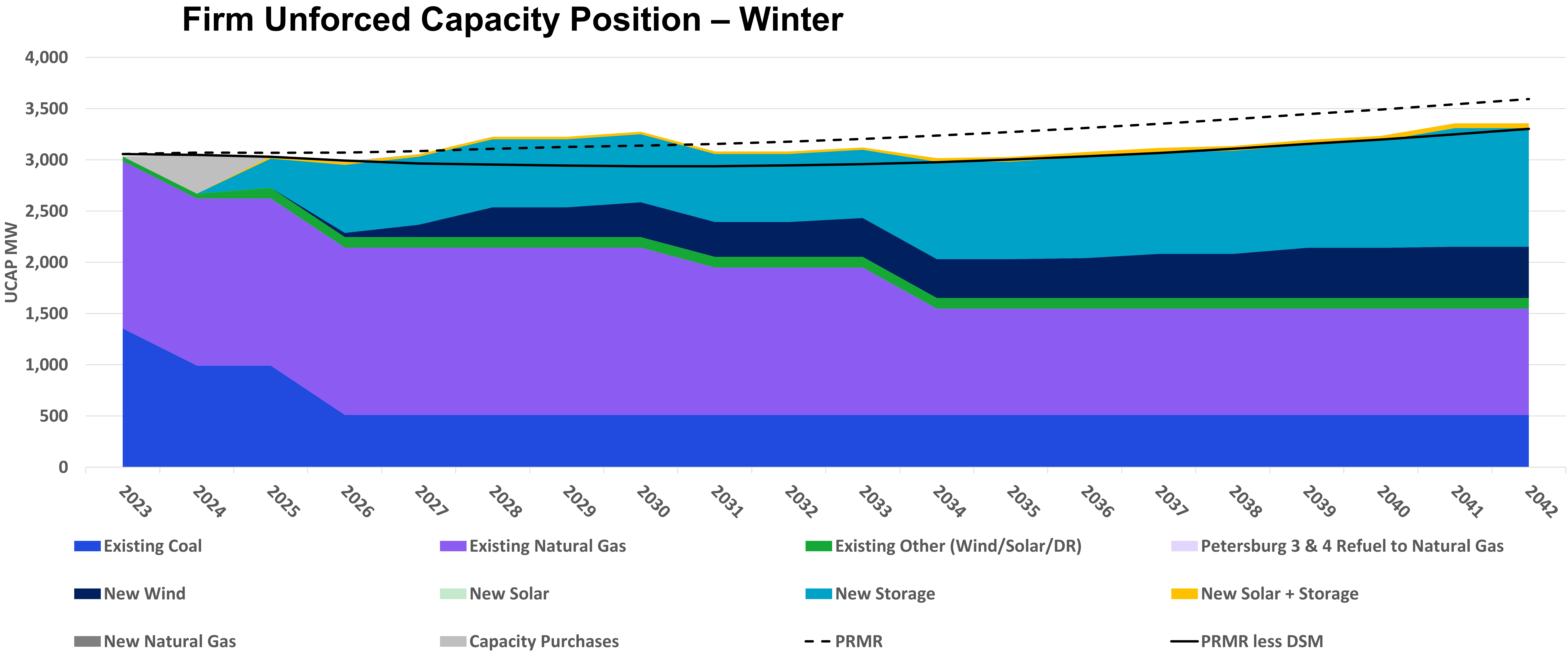
Generation Strategy: *One Pete Unit Retires (2026)*

Scenarios			
No Environmental Action	Current Trends	Aggressive Environmental	Decarbonized Economy
		$11,470	

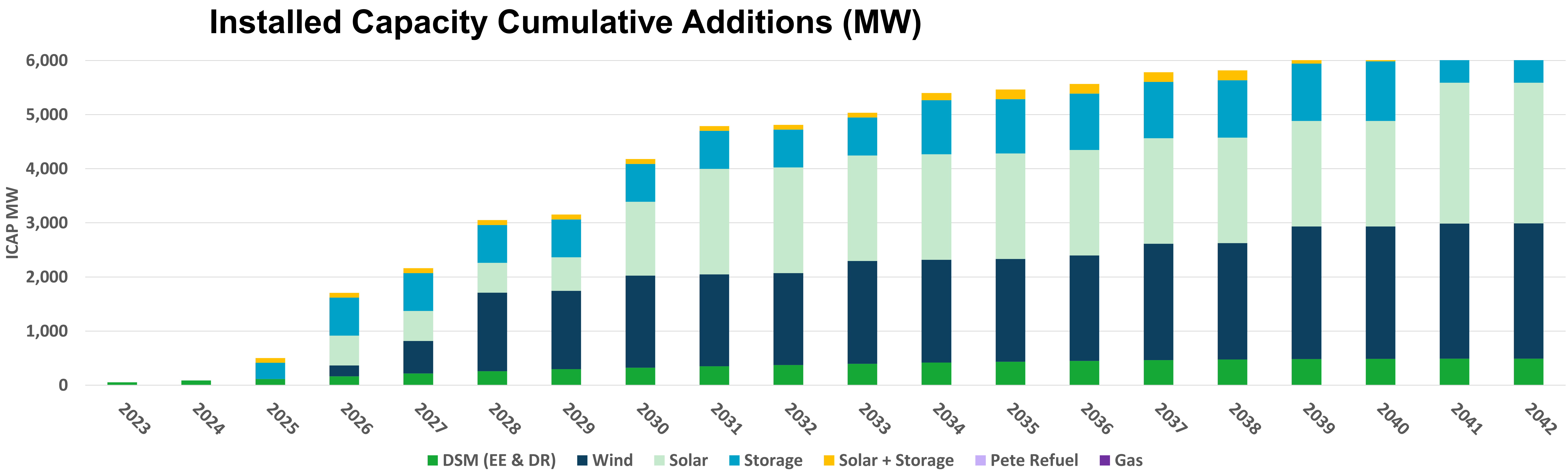
One Pete Unit Retires (2026): Aggressive Environmental



One Pete Unit Retires (2026): Aggressive Environmental



One Pete Unit Retires (2026): Aggressive Environmental



Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	200	400	850
Solar	0	0	0	553	0	0
Storage	0	0	300	400	0	0
Solar + Storage	0	0	90	0	0	0
Gas	0	0	0	0	0	0

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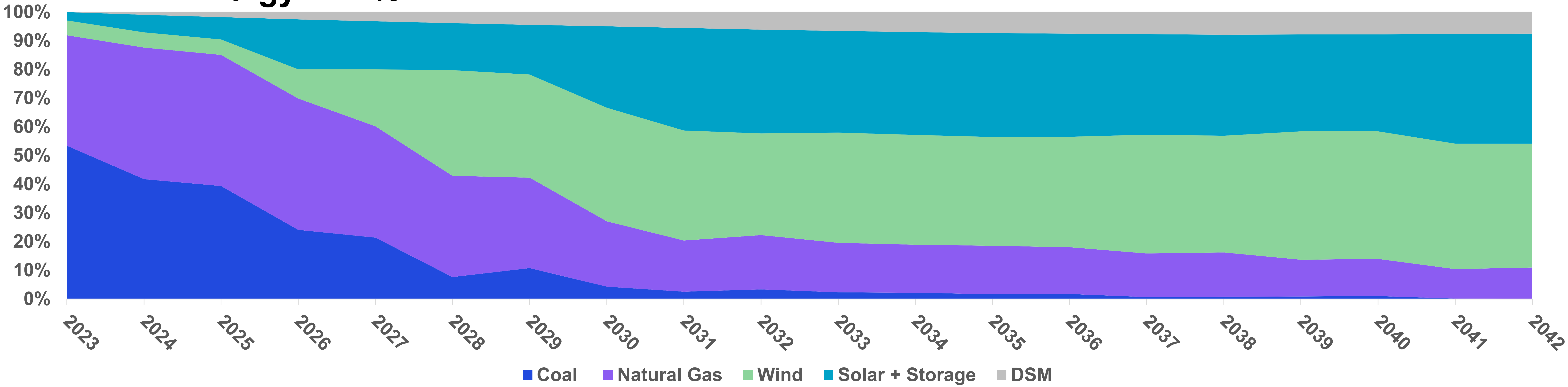
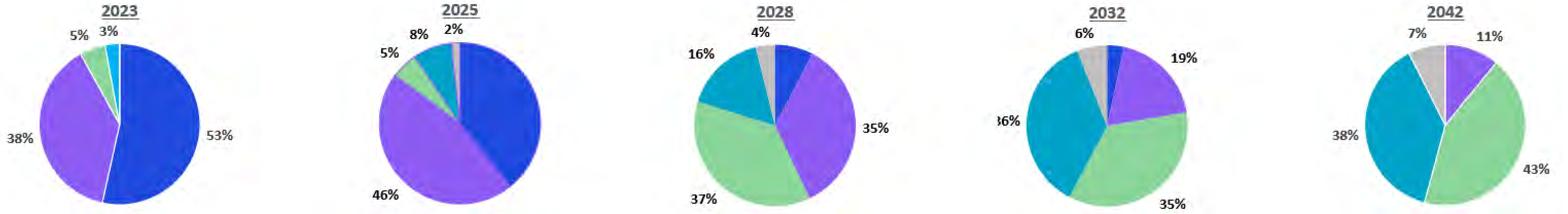
One Pete Unit Retires (2026): Aggressive Environmental

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	85%	Thermal MWh %	43%	Thermal MWh %	22%	Thermal MWh %	11%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	57%	Renewable/DSM MWh %	78%	Renewable/DSM MWh %	89%

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One Pete Unit Retires (2026): Aggressive Environmental

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
  - **Total Coal Retired MW: 520 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,600 MW
- Storage: 1,240 MW
- Solar + Storage: 180 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Aggressive Environmental
No Early Retirement	$11,349
Pete Refuel to 100% Gas (est. 2025)	$11,181
One Pete Unit Retires (2026)	**$11,470**
Both Pete Units Retire (2026 & 2028)	$11,145
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$11,184
Encompass Optimization without predefined Strategy	$10,994

D. Both Pete Units Retire (2026 & 2028)

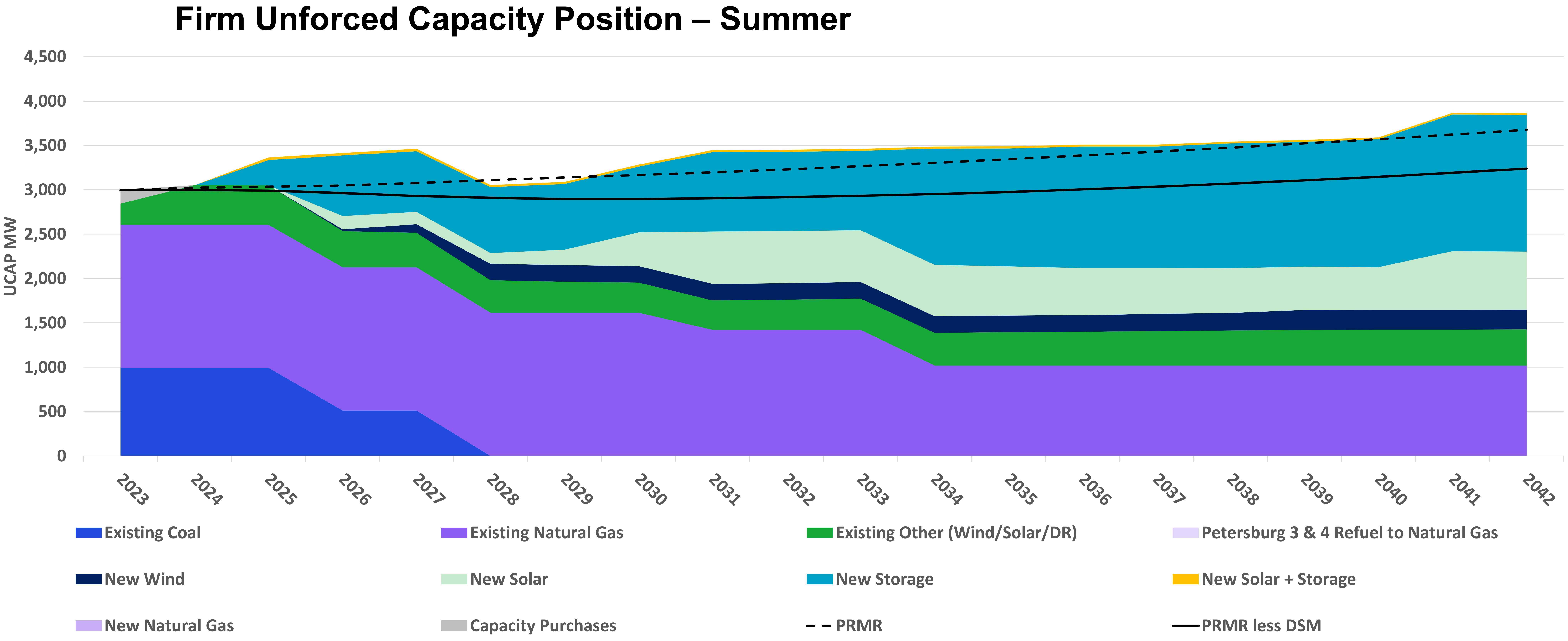
20-Year PVRR
(2023$MM, 2023-2042)

Generation Strategy:
Both Pete Units Retire (2026 & 2028)

Scenarios			
No Environmental Action	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
		$11,145	

Both Pete Units Retire: Aggressive Environmental

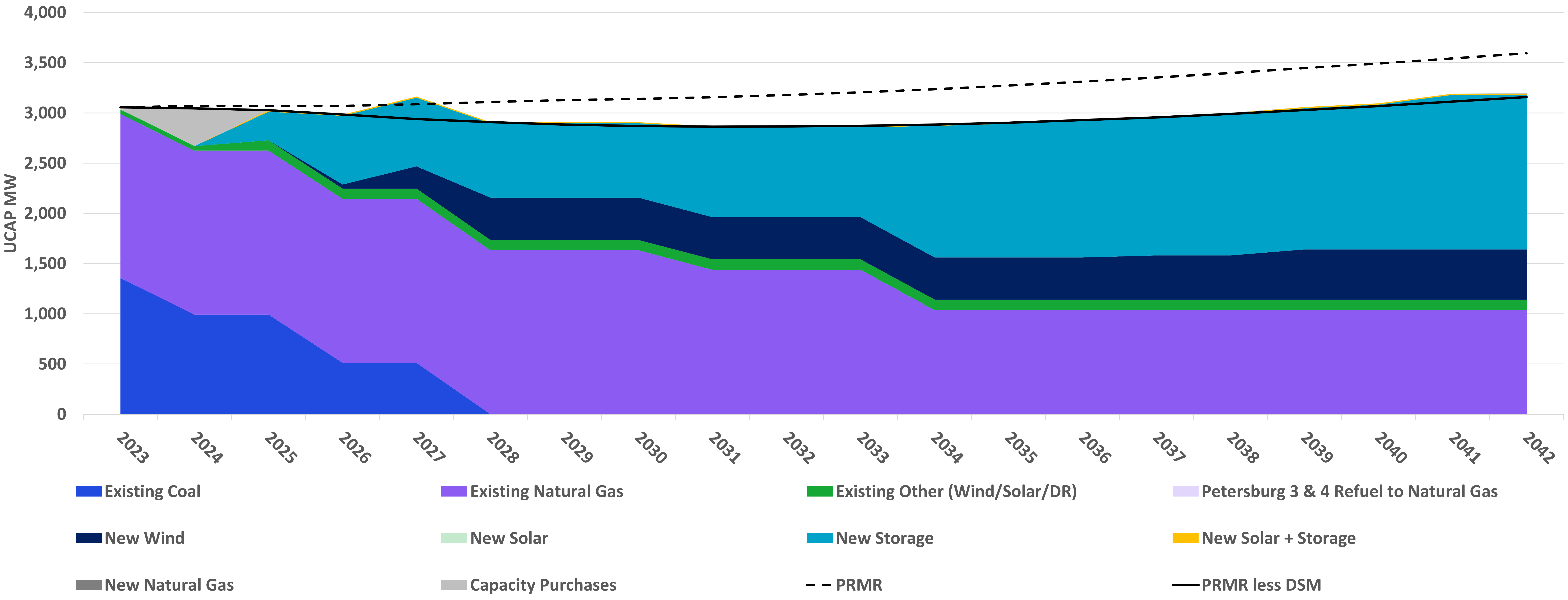
2026 & 2028



Both Pete Units Retire: Aggressive Environmental

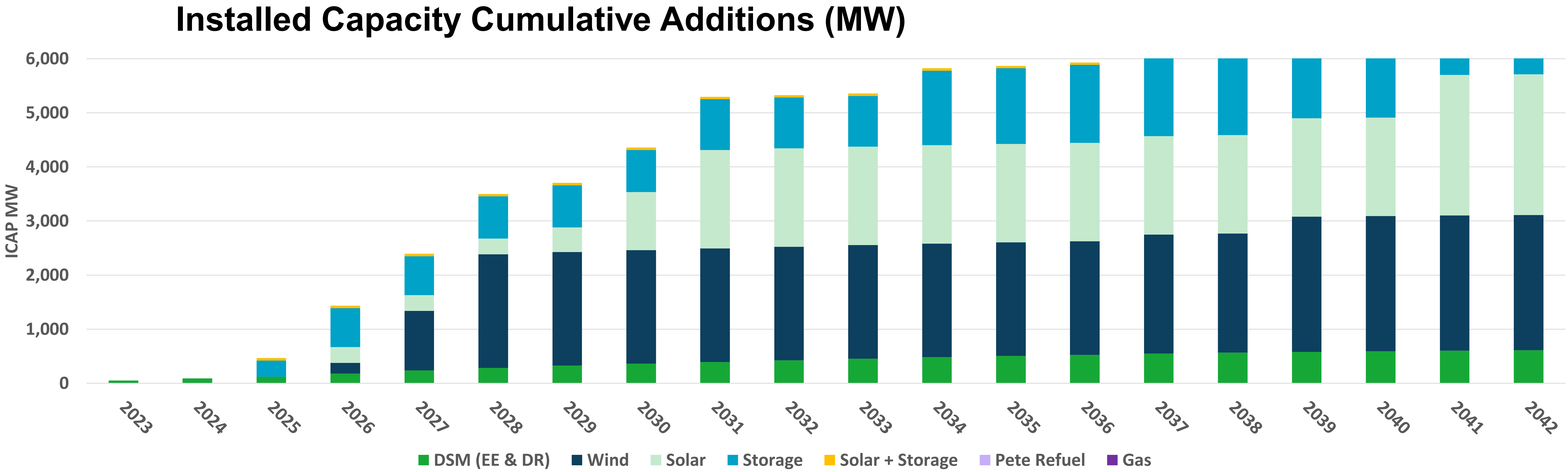
2026 & 2028

Firm Unforced Capacity Position – Winter



Both Pete Units Retire: Aggressive Environmental

2026 & 2028



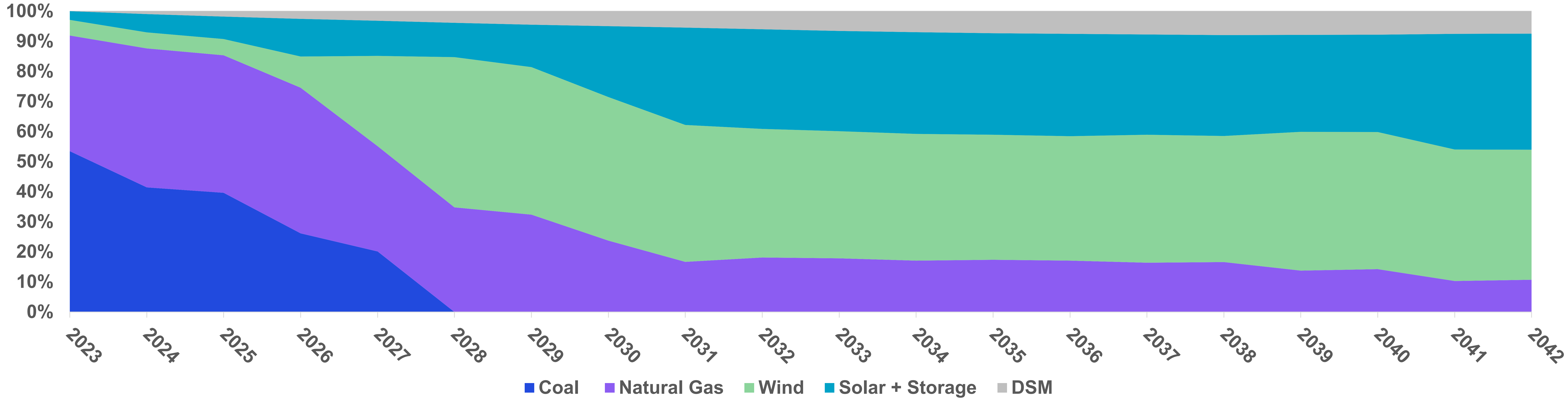
Installed Capacity Incremental Additions (MW): 2023 – 2028

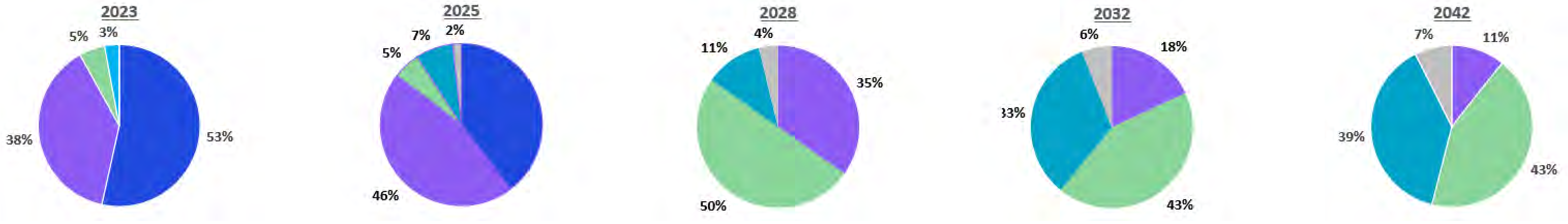
	2023	2024	2025	2026	2027	2028
Wind	0	0	0	200	900	1,000
Solar	0	0	0	293	0	0
Storage	0	0	300	420	0	60
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

Both Pete Units Retire: Aggressive Environmental

2026 & 2028

Energy Mix %





Thermal MWh %	92%	Thermal MWh %	85%	Thermal MWh %	35%	Thermal MWh %	18%	Thermal MWh %	11%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	65%	Renewable/DSM MWh %	82%	Renewable/DSM MWh %	89%

Both Pete Units Retire: Aggressive Environmental

2026 & 2028

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 610 MW
- Wind: 2,500 MW
- Solar: 2,600 MW
- Storage: 1,620 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Aggressive Environmental
No Early Retirement	$11,349
Pete Refuel to 100% Gas (est. 2025)	$11,181
One Pete Unit Retires (2026)	$11,470
Both Pete Units Retire (2026 & 2028)	**$11,145**
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$11,184
Encompass Optimization without predefined Strategy	$10,994

E. Clean Energy Strategy

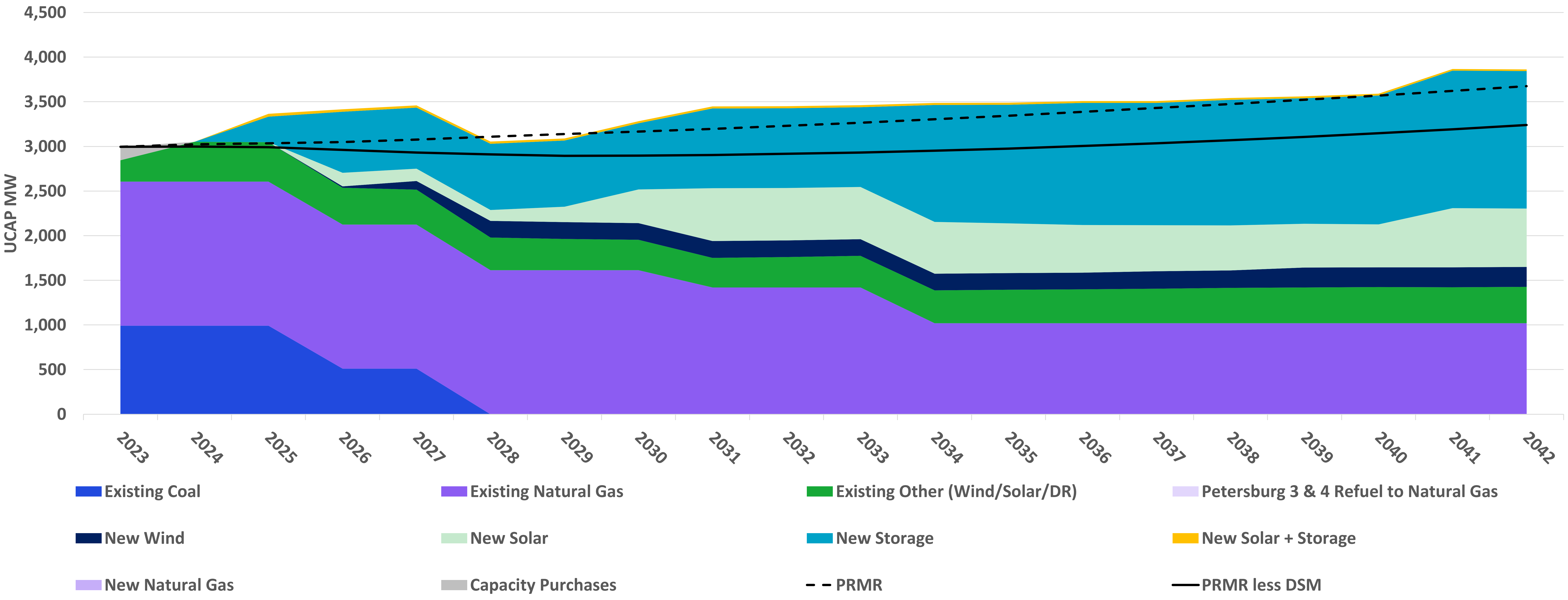
Retire & Replace Pete with Clean Energy

20-Year PVRR (2023$MM, 2023-2042)	**Scenarios**			
Generation Strategy: *“Clean Energy Strategy” Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)*	**No Environmental Action**	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
			$**11,184**	

Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy

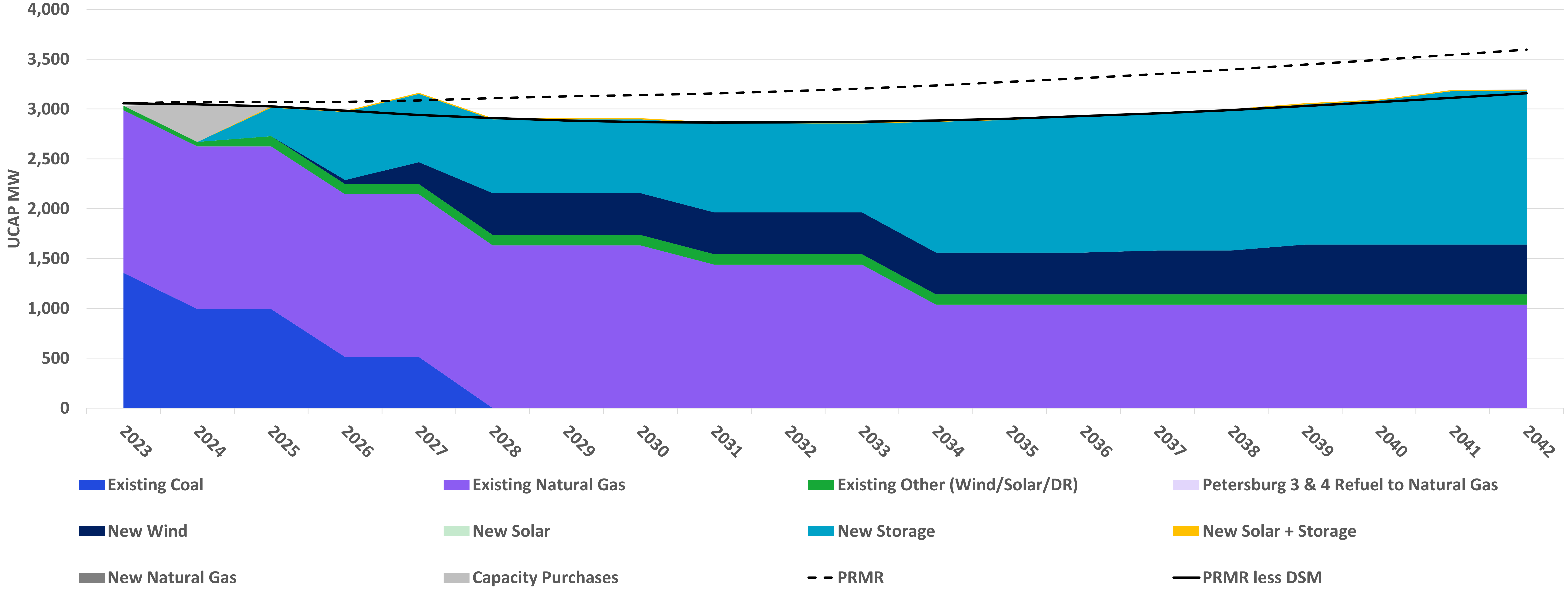
Firm Unforced Capacity Position – Summer



Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy

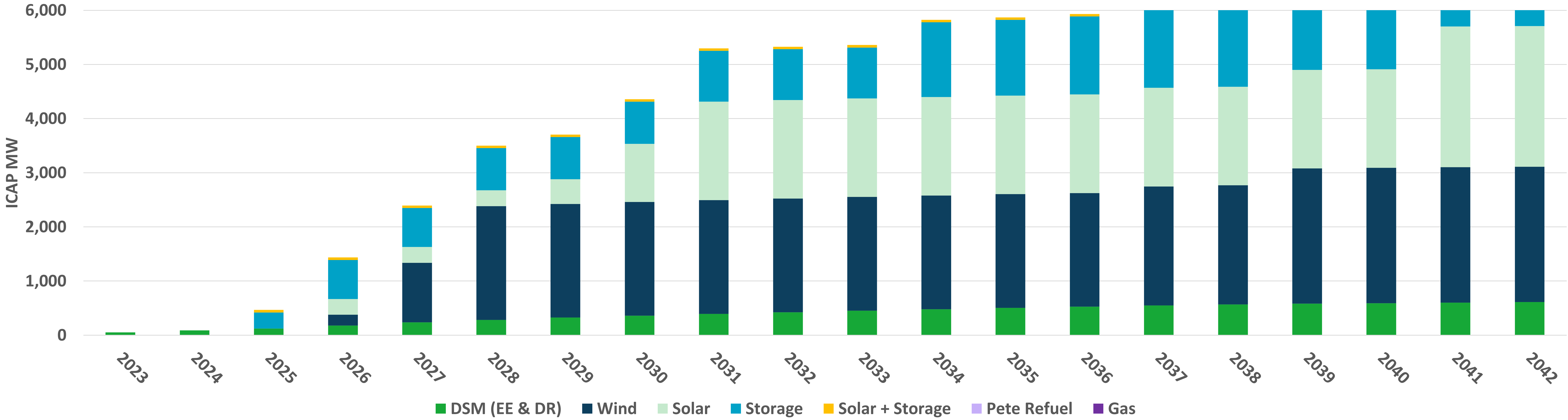
Firm Unforced Capacity Position – Winter



Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy

Installed Capacity Cumulative Additions (MW)



Installed Capacity Incremental Additions (MW): 2023 – 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	200	900	1,000
Solar	0	0	0	293	0	0
Storage	0	0	300	420	0	60
Solar + Storage	0	0	45	0	0	0
Gas	0	0	0	0	0	0

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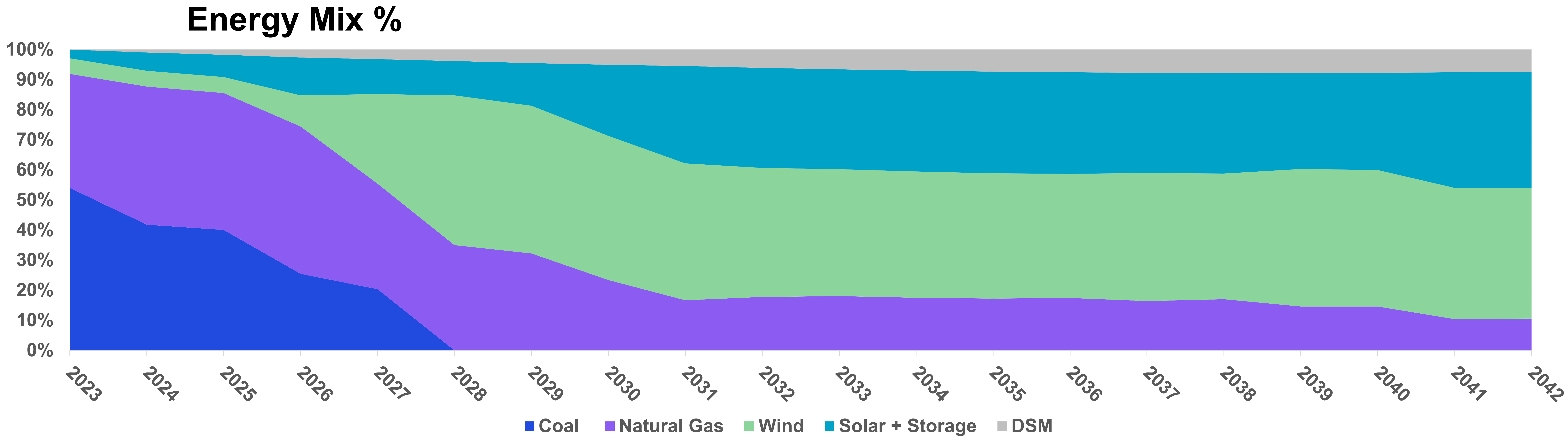
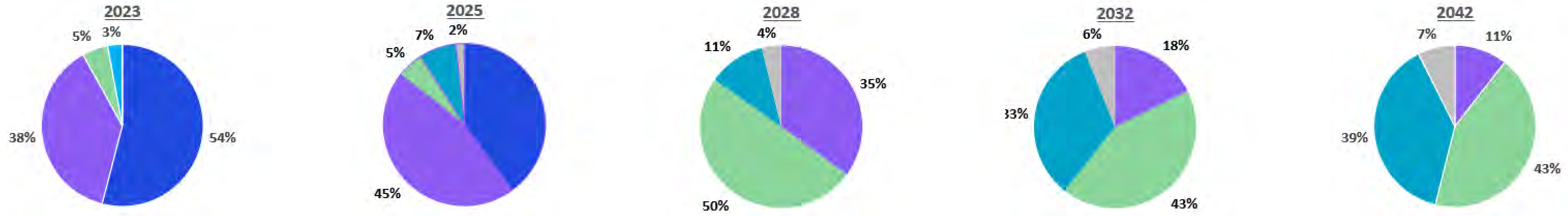
Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy





Thermal MWh %	92%	Thermal MWh %	86%	Thermal MWh %	35%	Thermal MWh %	18%	Thermal MWh %	11%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	14%	Renewable/DSM MWh %	65%	Renewable/DSM MWh %	82%	Renewable/DSM MWh %	89%

Clean Energy Strategy: Aggressive Environmental

Retire & Replace Pete with Clean Energy

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2026
- Pete 4 Coal: 2028
  - **Total Coal Retired MW: 1,040 MW**

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Retired Nat Gas MW: 618 MW**

Replacements by 2042

- DSM: 610 MW
- Wind: 2,500 MW
- Solar: 2,600 MW
- Storage: 1,620 MW
- Solar + Storage: 45 MW
- Thermal: 0 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios
	Aggressive Environmental
No Early Retirement	$11,349
Pete Refuel to 100% Gas (est. 2025)	$11,181
One Pete Unit Retires (2026)	$11,470
Both Pete Units Retire (2026 & 2028)	$11,145
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	**$11,184**
Encompass Optimization without predefined Strategy	$10,994

F. Encompass Optimization

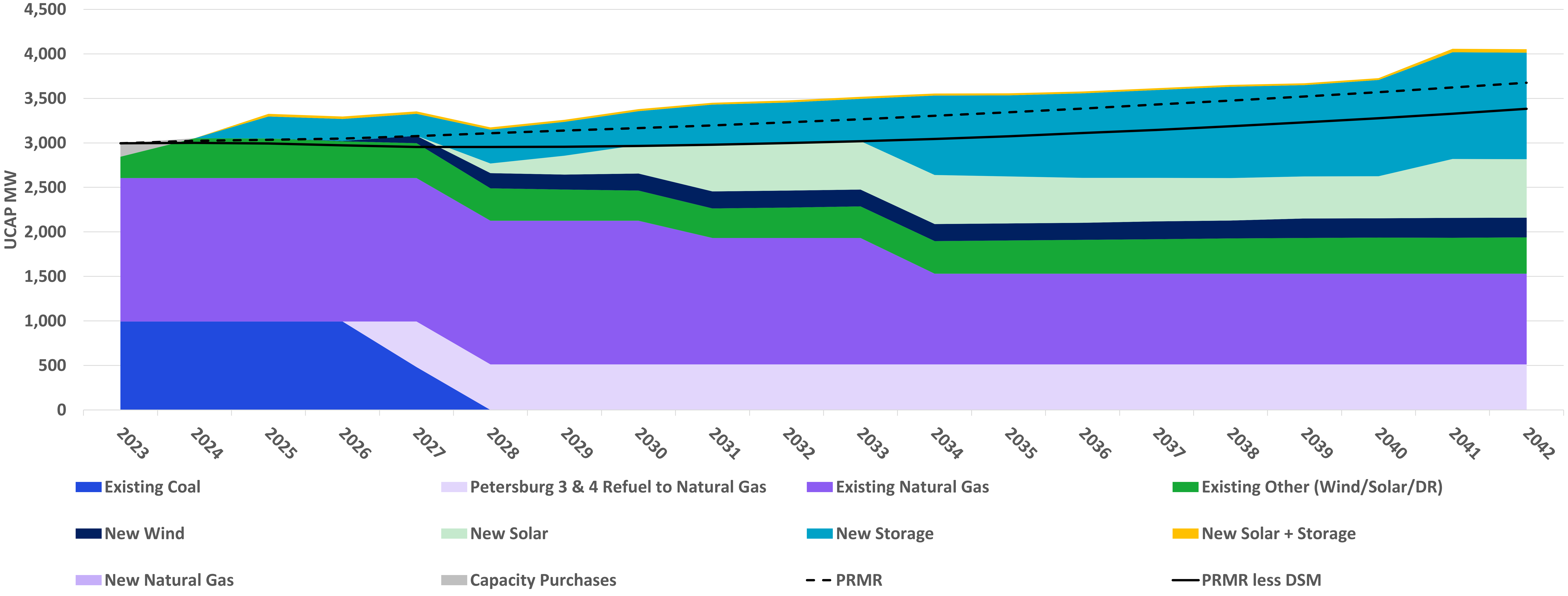
Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

20-Year PVRR (2023$MM, 2023-2042)	**Scenarios**			
Generation Strategy:	**No Environmental Action**	**Current Trends**	**Aggressive Environmental**	**Decarbonized Economy**
Encompass Optimization without predefined Strategy – Selects Pete 4 Refuel in 2027			**$10,994**	

Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

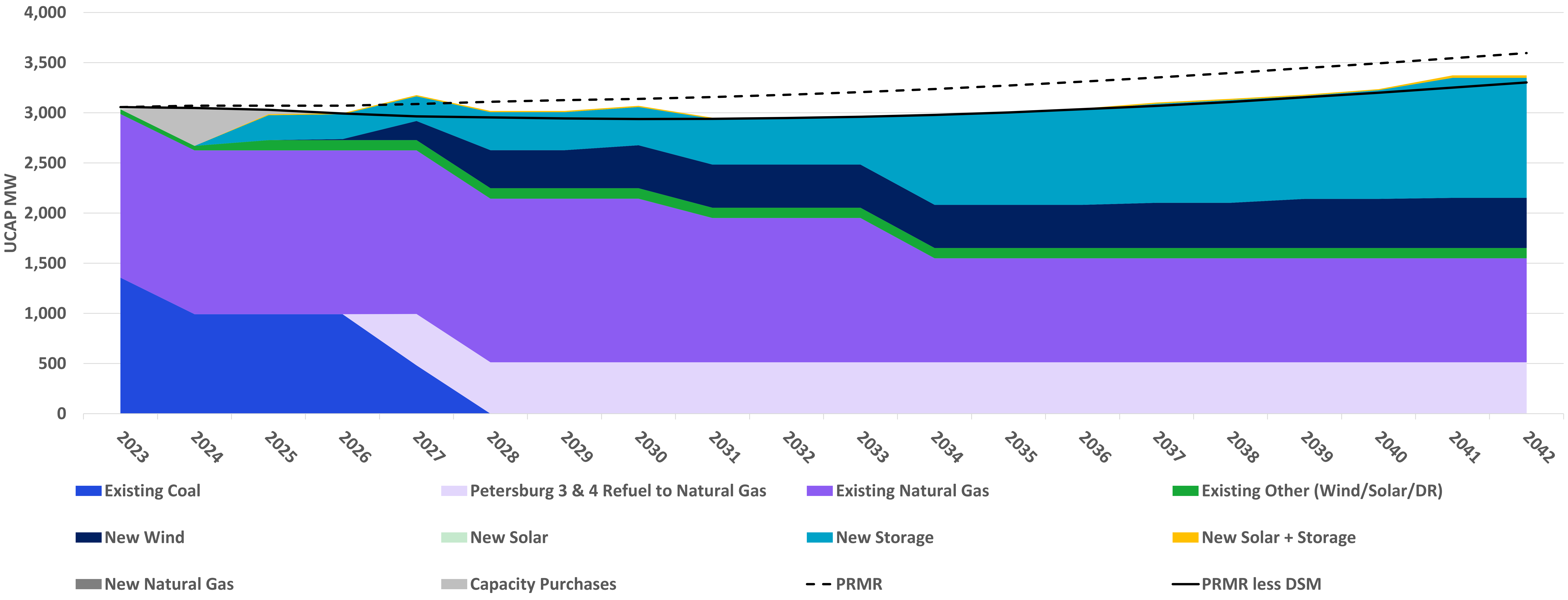
Firm Unforced Capacity Position – Summer



Encompass Optimization: Aggressive Environmental

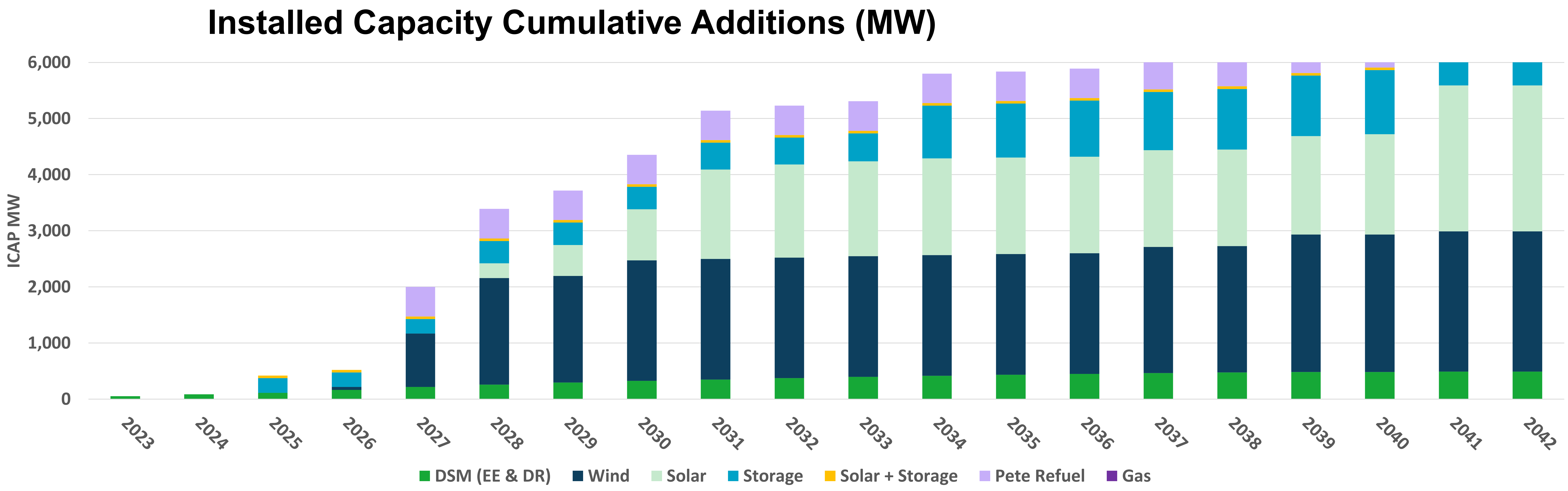
Selects Pete 4 Refuel in 2027

Firm Unforced Capacity Position – Winter



Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

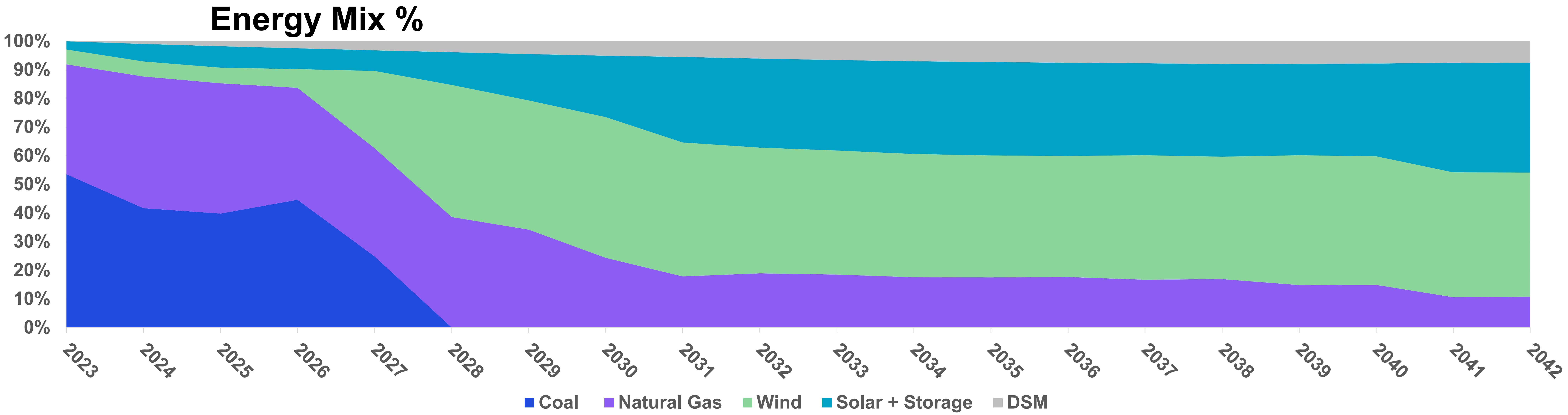


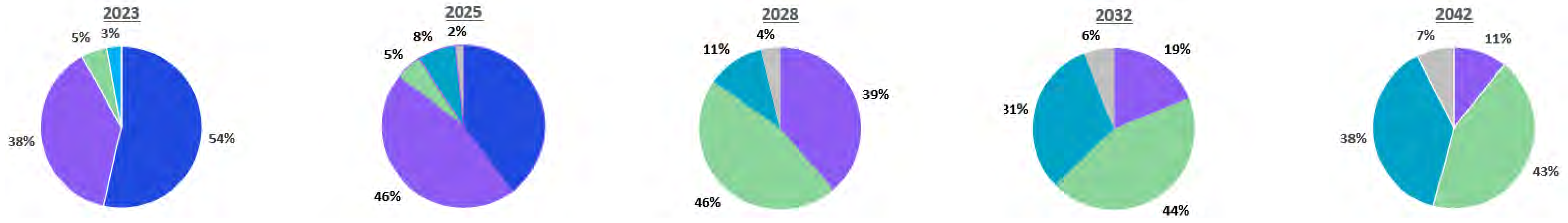
Installed Capacity Incremental Additions (MW): 2023 - 2028

	2023	2024	2025	2026	2027	2028
Wind	0	0	0	50	900	950
Solar	0	0	0	0	0	260
Storage	0	0	260	0	0	140
Solar + Storage	0	0	45	0	0	0
Pete Refuel	0	0	0	0	526	0
Gas	0	0	0	0	0	0

Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027





Thermal MWh %	92%	Thermal MWh %	85%	Thermal MWh %	39%	Thermal MWh %	19%	Thermal MWh %	11%
Renewable/DSM MWh %	8%	Renewable/DSM MWh %	15%	Renewable/DSM MWh %	61%	Renewable/DSM MWh %	81%	Renewable/DSM MWh %	89%

Encompass Optimization: Aggressive Environmental

Selects Pete 4 Refuel in 2027

Portfolio Overview

Retirements

Petersburg:

- Pete 3 Coal: 2028 – Retired 520 MW
- Pete 4 Coal: 2026 – Refueled 520 MW

Harding Street:

- HS ST5 Nat Gas: 2030
- HS ST6 Nat Gas: 2030
- HS ST7 Nat Gas: 2033
  - **Total Nat Gas Retired MW: 618 MW**

Replacement Additions by 2042

- DSM: 490 MW
- Wind: 2,500 MW
- Solar: 2,600 MW
- Storage: 1,260 MW
- Solar + Storage: 90 MW
- Thermal: 0
- Pete 4 Refueled to Nat Gas: 526 MW

Current Trends PVRR Summary

20-Year PVRR (2023$MM, 2023-2042)

	Scenarios **Aggressive Environmental**
No Early Retirement	$11,349
Pete Refuel to 100% Gas (est. 2025)	$11,181
One Pete Unit Retires (2026)	$11,470
Both Pete Units Retire (2026 & 2028)	$11,145
"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$11,184
Encompass Optimization without predefined Strategy	**$10,994**

Portfolio Matrix

		Scenarios			
	20-Year PVRR (2023$MM, 2023-2042)	**No Environmental Action**	**Current Trends (Reference Case)**	**Aggressive Environmental**	**Decarbonized Economy**
Generation Strategies	**No Early Retirement**	$7,111	$9,572	$11,349	$9,917
	Pete Refuel to 100% Gas (est. 2025)	$6,621	$9,330	$11,181	$9,546
	One Pete Unit Retires (2026)	$7,462	$9,773	$11,470	$9,955
	Both Pete Units Retire (2026 & 2028)	$7,425	$9,618	$11,145	$9,923
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211	$9,711	$11,184	$9,690
	Encompass Optimization without predefined Strategy	$6,610	$9,262	$10,994	$9,572

Encompass Optimization Results by Scenario:

Refuels Petersburg Units 3 & 4 in 2025	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

2022 Integrated Resource Plan (IRP)

Public Advisory Meeting #5

10/31/2022

aes Indiana

Agenda and Introductions

Stewart Ramsay, Managing Executive, Vanry & Associates

Agenda

Time	Topic	Speakers
Morning Starting at 10:00 AM	Virtual Meeting Protocols and Safety	Chad Rogers, Director, Regulatory Affairs, AES Indiana
	Welcome and Opening Remarks	Kristina Lund, President & CEO, AES Indiana
	IRP Schedule & Timeline	Erik Miller, Manager, Resource Planning, AES Indiana
	IRP Framework Review	Erik Miller, Manager, Resource Planning, AES Indiana
	Risk & Opportunity Metrics	Erik Miller, Manager, Resource Planning, AES Indiana
Break 12:00 PM – 12:30 PM	Lunch	
Afternoon Starting at 12:30 PM	Reliability, Stability & Resiliency Metric	Hisham Othman, Manager, Resource Planning, Quanta Technology
	IRP Scorecard Results	Erik Miller, Manager, Resource Planning, AES Indiana
	Preferred Resource Portfolio & Short-Term Action Plan	Erik Miller, Manager, Resource Planning, AES Indiana
	Final Q&A and Next Steps	

Virtual Meeting Protocols and Safety

Chad Rogers, Director, Regulatory Affairs, AES Indiana

IRP Team Introductions

AES Indiana Leadership Team

Kristina Lund, President & CEO, AES Indiana

Aaron Cooper, Chief Commercial Officer, AES Indiana

Brandi Davis-Handy, Chief Customer Officer, AES Indiana

Tanya Sovinski, Senior Director, Public Relations, AES Indiana

Ahmed Pasha, Chief Financial Officer, AES Indiana

Tom Raga, Vice President Government Affairs, AES Indiana

Sharon Schroder, Senior Director, Regulatory Affairs, AES Indiana

Kathy Storm, Vice President, US Smart Grid, AES Indiana

AES Indiana IRP Planning Team

Joe Bocanegra, Load Forecasting Analyst, AES Indiana

Erik Miller, Manager, Resource Planning, AES Indiana

Scott Perry, Manager, Regulatory Affairs, AES Indiana

Chad Rogers, Director, Regulatory Affairs, AES Indiana

Mike Russ, Senior Manager, T&D Planning & Forecasting, AES Asset Management

Brent Selvidge, Engineer, AES Indiana

Will Vance, Senior Analyst, AES Indiana

Kelly Young, Director, Public Relations, AES Indiana

AES Indiana IRP Partners

Annette Brocks, Senior Resource Planning Analyst, ACES

Patrick Burns, PV Modeling Lead and Regulatory/IRP Support, Brightline Group

Eric Fox, Director, Forecasting Solutions, Itron

Jeffrey Huber, Overall Project Manager and MPS Lead, GDS Associates

Jordan Janflone, EV Modeling Forecasting, GDS Associates

Patrick Maguire, Executive Director of Resource Planning, ACES

Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology

Stewart Ramsey, Managing Executive, Vanry & Associates

Mike Russo, Forecast Consultant, Itron

Jacob Thomas, Market Research and End-Use Analysis Lead, GDS Associates

Melissa Young, Demand Response Lead, GDS Associates

Danielle Powers, Executive Vice President, Concentric Energy Advisors

Meredith Stone, Senior Project Manager, Concentric Energy Advisors

AES Indiana Legal Team

Nick Grimmer, Indiana Regulatory Counsel, AES Indiana

Teresa Morton Nyhart, Counsel, Barnes & Thornburg LLP

Welcome to Today's Participants

- Advanced Energy Economy
- Barnes & Thornburg LLP
- Bose, McKinney & Evans LLP
- CenterPoint Energy
- Citizens Action Coalition
- City of Indianapolis
- Demand Side Analytics
- Develop Indy | Indy Chamber
- Earth Charter Indiana
- EDPR North America
- Energy Futures Group
- Faith in Place
- Hallador Energy
- Hoosier Energy
- IBEW Local Union 1395
- Indiana Farm Bureau, Inc.
- Indiana Friends Committee On Legislation
- Indiana Michigan Power
- Indiana Office of Energy Development
- Indiana Utility Regulatory Commission
- IUPUI
- Indiana Office of Utility Consumer Counselor
- Key Capture Energy
- NIPSCO
- NuScale Power
- Power Takeoff
- Purdue - State Utility Forecasting Group
- R3 Renewables
- Ranger Power
- Rolls-Royce/ISS
- Sierra Club
- Solar United Neighbors
- Synapse Energy Economics
- Wartsila

… and members of the AES Indiana team and the public!

Virtual Meeting Best Practices

Questions

- Your candid feedback and input is an integral part to the IRP process.
- Questions or feedback will be taken at the end of each section.
- Feel free to submit a question in the chat function at any time and we will ensure those questions are addressed.

Audio

- All lines are muted upon entry.
- For those using audio via Teams, you can unmute by selecting the microphone icon.
- If you are dialed in from a phone, press *6 to unmute.

Video

- Video is not required. To minimize bandwidth, please refrain from using video unless commenting during the meeting.

AES Purpose & Values

Accelerating the future of energy, **together**.

Safety first

Highest standards

All together

Safety First

1. AES Indiana strives to provide a place of employment that is free from recognized hazards and one that **meets or exceeds governmental regulations** regarding occupational health and safety.
2. AES Indiana considers occupational health and safety a **fundamental value** of the organization and is a **key performance indicator** of the overall success of the company.
3. AES Indiana's ultimate objective is that each day all AES Indiana people, contractors, and the public we serve return home to their family, friends, and community **free from harm**.

Meeting our customers' needs today and tomorrow

AES Indiana is leading the **inclusive, clean energy** transition.

- Reliability
- Affordability
- Sustainability

Gradual change to the AES Indiana portfolio over time

2009-2015

Signed 100 MW PPA at Hoosier Wind Park in NW Indiana, 200 MW PPA at Lakefield Wind Farm in Minnesota and 96 MW PPA for solar in Indianapolis through Rate REP

2016

Retired 260 MW of coal at Eagle Valley

2016

Finalized refuel of 630 MW of coal-fired generation at Harding Street to natural gas

2018

Eagle Valley 671 MW Gas-Fired Combined Cycle Plant Completed

2021-2023

Retired (Unit 1) 220 MW of coal at Petersburg; Plans to retire (Unit 2) 401 MW of coal at Petersburg in 2023

2023 – 2024

Plans to complete 195 MW Hardy Hills Solar project and 250 MW + 180 MWh Petersburg Energy Center solar + storage project

Capabilities and infrastructure of current fleet

Largest sites have valuable capabilities and infrastructure for the energy transition

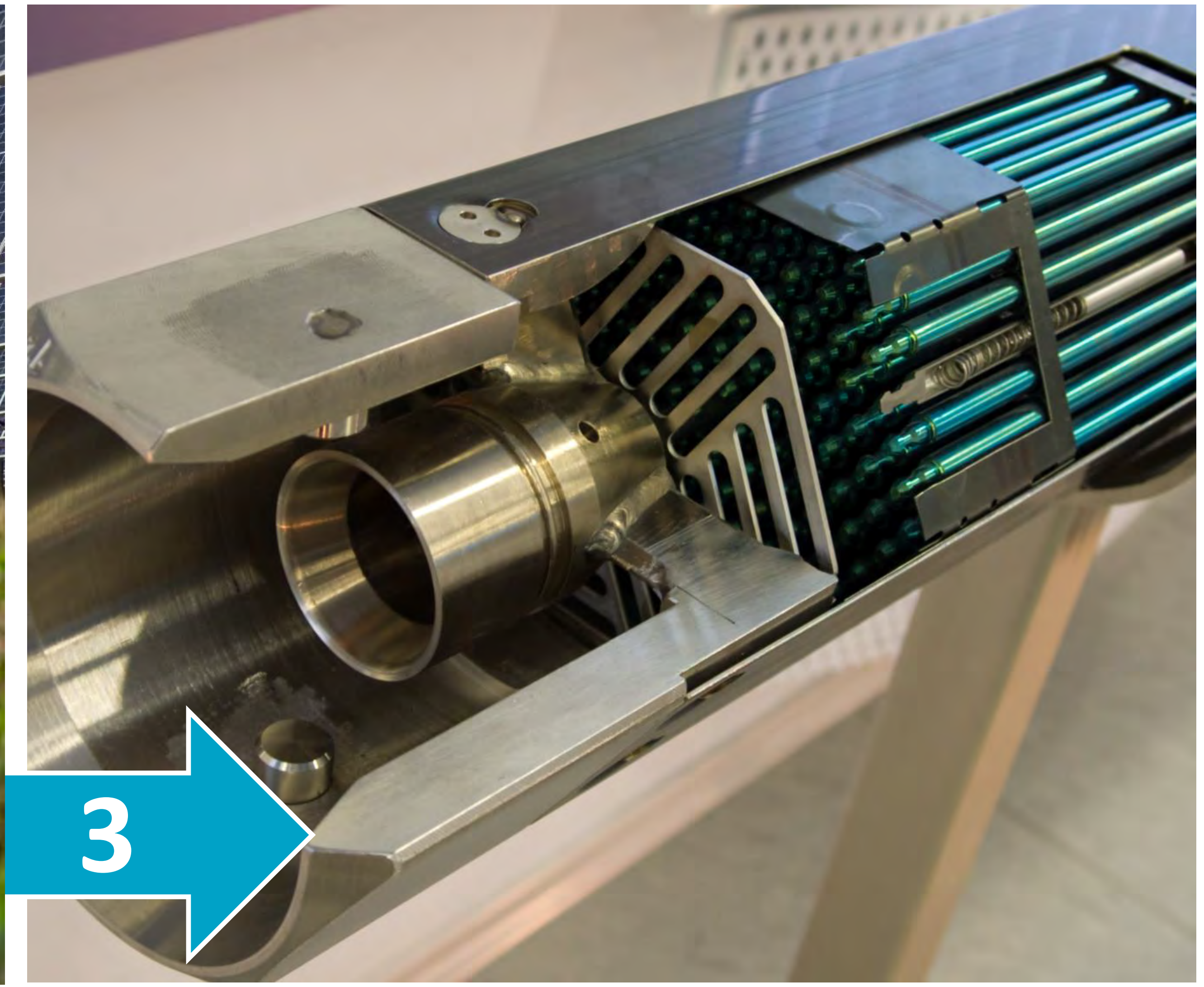
Petersburg
Experienced, skilled labor force, land, interconnection, water rights, water treatment, natural gas pipelines already present on site

Harding Street
Experienced, skilled labor force, land, interconnection, location near load center, rail, water rights

Eagle Valley
New plant, highly efficient, flexible for future grid changes

AES Indiana seeks to partner with Pike County and City of Indianapolis to drive customer value and community impact of Petersburg and Harding Street Sites.

Short-term Action Plan Uses Existing Capacity and Adds Significant Renewables



CONVERT

Convert Petersburg units 3 & 4 (1,052 MW) to natural gas in 2025 via existing pipeline on site

ADD RENEWABLES

Add up to 1300 MW of wind, solar, and storage as early as 2025

MONITOR

Monitor emerging technologies for inclusion in future planning

PREFERRED PORTFOLIO MAINTAINS OPTIONALITY FOR THE FUTURE

Short-term Action Plan Best Serves Our Customers' Objectives

1

RELIABILITY

→ Highest composite reliability score

2

AFFORDABILITY

→ Saves AES Indiana customers more than $200M

3

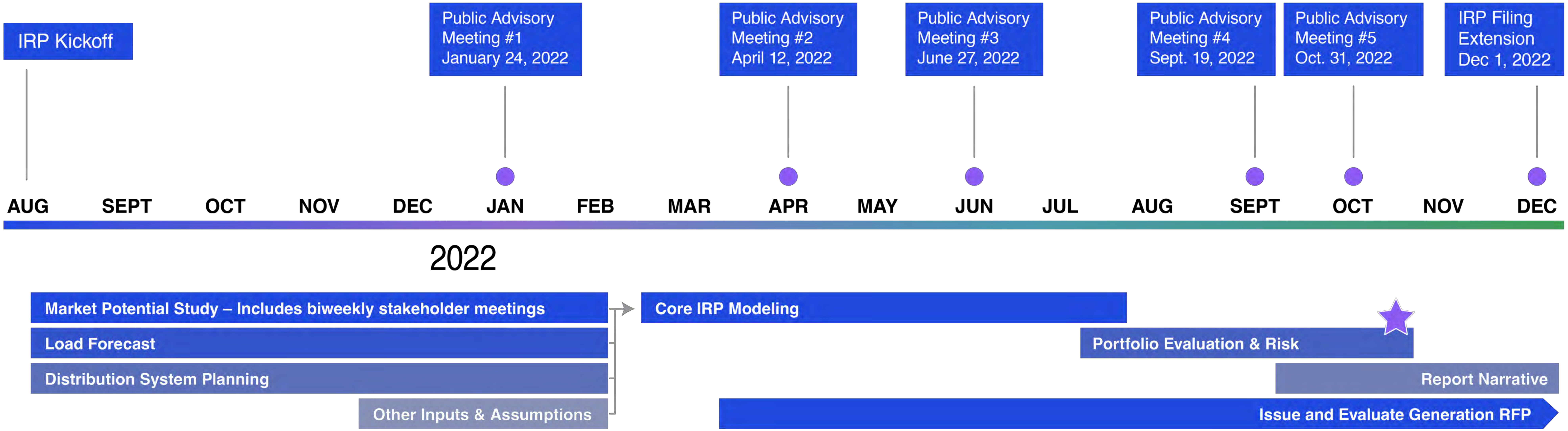
SUSTAINABILITY

→ Provides 68% reduction in carbon intensity in 2030 compared to 2018

IRP Schedule & Timeline

Erik Miller, Manager, Resource Planning, AES Indiana

Updated 2022 IRP Timeline



IRP Kickoff

Public Advisory Meeting #1
January 24, 2022

Public Advisory Meeting #2
April 12, 2022

Public Advisory Meeting #3
June 27, 2022

Public Advisory Meeting #4
Sept. 19, 2022

Public Advisory Meeting #5
Oct. 31, 2022

IRP Filing Extension
Dec 1, 2022

AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEPT OCT NOV DEC

2022

Market Potential Study – Includes biweekly stakeholder meetings

Load Forecast

Distribution System Planning

Other Inputs & Assumptions

Core IRP Modeling

Portfolio Evaluation & Risk

Report Narrative

Issue and Evaluate Generation RFP

● = Stakeholder Technical Meeting for stakeholders with executed NDAs held the week before each public stakeholder meeting

★ = Preferred Resource Portfolio selected

AES Indiana is available for additional touchpoints with stakeholders to discuss IRP-related topics.

Public Advisory Schedule

Public Advisory Meeting #1 – January 24, 2022

- 2022 IRP Schedule & Progress
- 2019 IRP Recap
- Load, EV, DG Forecasts
- MPS Overview

Public Advisory Meeting #2 – April 12, 2022

- Load Scenarios
- MPS Results & DSM Inputs
- Replacement Resource Assumptions
- IRP Portfolio Matrix & Scenario Framework

Public Advisory Meeting #3 – June 27, 2022

- Stakeholder Presentations
- Portfolio Metrics & Scorecard Framework
- MISO Reliability Planning
- IRP Reliability Analysis
- Distribution System Plan

Public Advisory Meeting #4 – September 19, 2022

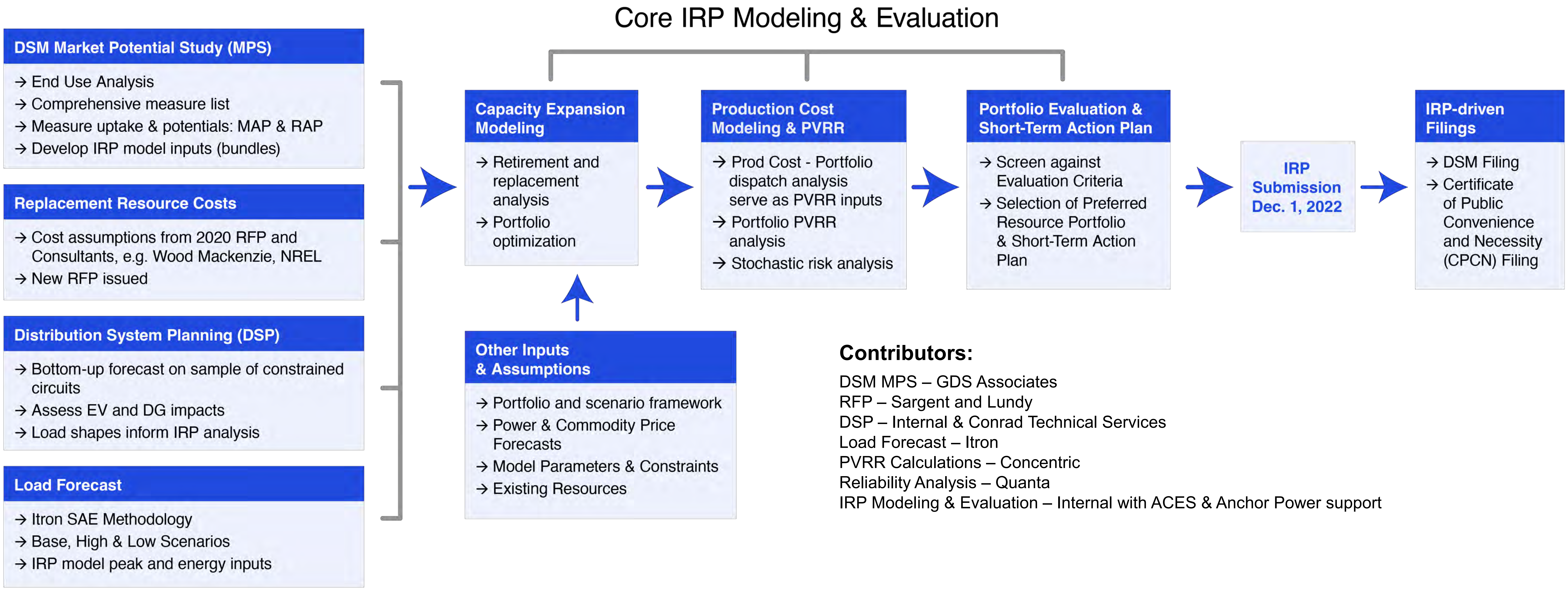
- Preliminary Modeling Results
- Preliminary Scorecard Results

Public Advisory Meeting #5 – October 31, 2022

- Risk & Opportunity Metrics
- Reliability Analysis
- Final Scorecard Review
- Preferred Resource Portfolio & Short-Term Action Plan

Topics for meeting 5 are subject to change.

IRP Process Overview



Core IRP Modeling & Evaluation

DSM Market Potential Study (MPS)

- → End Use Analysis
- → Comprehensive measure list
- → Measure uptake & potentials: MAP & RAP
- → Develop IRP model inputs (bundles)

Replacement Resource Costs

- → Cost assumptions from 2020 RFP and Consultants, e.g. Wood Mackenzie, NREL
- → New RFP issued

Distribution System Planning (DSP)

- → Bottom-up forecast on sample of constrained circuits
- → Assess EV and DG impacts
- → Load shapes inform IRP analysis

Load Forecast

- → Itron SAE Methodology
- → Base, High & Low Scenarios
- → IRP model peak and energy inputs

Capacity Expansion Modeling

- → Retirement and replacement analysis
- → Portfolio optimization

Other Inputs & Assumptions

- → Portfolio and scenario framework
- → Power & Commodity Price Forecasts
- → Model Parameters & Constraints
- → Existing Resources

Production Cost Modeling & PVRR

- → Prod Cost - Portfolio dispatch analysis serve as PVRR inputs
- → Portfolio PVRR analysis
- → Stochastic risk analysis

Portfolio Evaluation & Short-Term Action Plan

- → Screen against Evaluation Criteria
- → Selection of Preferred Resource Portfolio & Short-Term Action Plan

IRP Submission Dec. 1, 2022

IRP-driven Filings

- → DSM Filing
- → Certificate of Public Convenience and Necessity (CPCN) Filing

Contributors:

DSM MPS – GDS Associates
RFP – Sargent and Lundy
DSP – Internal & Conrad Technical Services
Load Forecast – Itron
PVRR Calculations – Concentric
Reliability Analysis – Quanta
IRP Modeling & Evaluation – Internal with ACES & Anchor Power support

IRP Framework Review

Erik Miller, Manager, Resource Planning, AES Indiana

Final Portfolio Matrix

Results from Capacity Expansion Scenario Analysis

Candidate Portfolios

20-Year PVRR (2023$MM, 2023-2042)		Scenarios			
		No Environmental Action	Current Trends (Reference Case)	Aggressive Environmental	Decarbonized Economy
Generation Strategies	**No Early Retirement**	$7,111	$9,572	$11,349	$9,917
	Pete Refuel to 100% Gas (est. 2025)	$6,621	$9,330	$11,181	$9,546
	One Pete Unit Retires (2026)	$7,462	$9,773	$11,470	$9,955
	Both Pete Units Retire (2026 & 2028)	$7,425	$9,618	$11,145	$9,923
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,211	$9,711	$11,184	$9,690
	Encompass Optimization without predefined Strategy	$6,610	$9,262	$10,994*	$9,572

Encompass Optimization Results by Scenario:

Refuels Petersburg Units 3 & 4 in 2025	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 4 in 2027 Retires Unit 3 in 2028*	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

**Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.*

Replacement Resource Cost Sensitivity Analysis

Key Takeaways & PVRR Results

- → As capital costs increase, fewer renewables are built for their energy value to the portfolio.
- → As capital costs increase, newly constructed natural gas becomes more cost effective – less high price volatility with the cost to construct natural gas.
- → Across the range of Replacement Resource Costs, refueling Petersburg provides a low PVRR.

20-Year PVRR (2023$MM, 2023-2042)		**Current Trends** *(Reference Case)*		
		Low	**Base**	**High**
Generation Strategies	**No Early Retirement**	$9,054	$9,572	$9,876
	Pete Refuel to 100% Gas (est. 2025)	$8,698	$9,330	$9,661
	One Pete Unit Retires (2026)	$9,081	$9,773	$10,181
	Both Pete Units Retire (2026 & 2028)	$8,790	$9,618	$10,178
	"Clean Energy Strategy" Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$8,787	$9,711	$10,586
	Encompass Optimization without predefined Strategy	$8,670*	$9,262	$9,624

Encompass Optimization Portfolios		
Low	**Base**	**High**
Refuels Petersburg Unit 3 in 2025 Retires Unit 4 in 2028*	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027	Refuels Petersburg Unit 3 in 2025 & Refuels Petersburg Unit 4 in 2027

**Refueling Pete 3 & 4 at the same time provides cost efficiencies. These efficiencies are not captured when only one unit refuels.*

Preliminary Scorecard Results

The IRP Scorecard evaluates the **Candidate Portfolios (Strategies in Current Trends/Reference Case)** using metrics that fit into five categories.

	Affordability	**Environmental Sustainability**						**Reliability, Stability & Resiliency**	**Risk & Opportunity**							**Economic**	**Impact**
	20-yr PVRR	***CO_2 Emissions***	***SO_2 Emissions***	***NO_X Emissions***	***Water Use***	***Coal Combustion Products (CCP)***	***Clean Energy Progress***	***Reliability Score***	***Environmental Policy Opportunity***	***Environmental Policy Risk***	***General Cost Opportunity **Stochastic Analysis*****	***General Cost Risk **Stochastic Analysis*****	***Market Exposure***	***Renewable Capital Cost Opportunity (Low Cost)***	***Renewable Capital Cost Risk (High Cost)***	***Employees (+/-)***	***Property Taxes***
	Present Value of Revenue Requirements ($000,000)	Total portfolio CO2 Emissions (mmtons)	Total portfolio SO2 Emissions (tons)	Total portfolio NOx Emissions (tons)	Water Use (mmgal)	CCP (tons)	% Renewable Energy in 2032	Composite score from Reliability Analysis	Lowest PVRR across policy scenarios ($000,000)	Highest PVRR across policy scenarios ($000,000)	P5 [Mean - P5]	P95 [P95 – Mean]	20-year avg sales + purchases (GWh)	Portfolio PVRR w/ low renewable cost ($000,000)	Portfolio PVRR w/ high renewable cost ($000,000)	Total change in FTEs associated with generation 2023 - 2042	Total amount of property tax paid from AES IN assets ($000,000)
1	$ 9,572	101.9	64,991	45,605	36.7	6,611	45%										$ 173
2	$ 9,330	72.5	13,513	22,146	7.9	1,417	55%										$ 211
3	$ 9,773	88.1	45,544	42,042	26.7	4,813	52%										$ 215
4	$ 9,618	79.5	25,649	24,932	15.0	2,700	48%										$ 248
5	$ 9,711	69.8	25,383	24,881	14.8	2,676	64%										$ 262
6	$ 9,262	76.1	18,622	25,645	10.9	1,970	54%										$ 203

Strategies

- **1.** No Early Retirement
- **2.** Pete Refuel to 100% Natural Gas (est. 2025)
- **3.** One Pete Unit Retires in 2026
- **4.** Both Pete Units Retire in 2026 & 2028
- **5.** "Clean Energy Strategy" – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- **6.** Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

- In Meeting #4 – we reviewed a partially completed Scorecard
- **Today, we will review the remaining metrics and completed Scorecard.**
- **The Meeting will conclude with review of the Preferred Resource Portfolio and Short-term Action Plan**

Risk and Opportunity Metrics

Erik Miller, Manager, Resource Planning, AES Indiana

Risk & Opportunity Metrics

AES Indiana included four **Risk & Opportunity Metrics** on the IRP Scorecard. Analyses were performed on the Candidate Portfolios to quantify these metrics – analyses include:

→ Environmental Policy Sensitivity Analysis
→ Cost Risk & Opportunity Metric **Stochastic Analysis**
→ Market Interaction/Exposure Analysis
→ Renewable Resource Capital Cost Sensitivity Analysis

The following slides will review the results from each analysis performed to quantify these metrics.

Risk & Opportunity Metrics:

Environmental Policy Sensitivity Analysis

- AES Indiana modeled environmental policy sensitivities on the optimized capacity expansion results from the Candidate Portfolios (Current Trends/Reference Case) to understand how the PVRR may change using different environmental policy and commodities.
- The results will help to answer the question – "How would the optimized Reference Case perform in a very different policy future, e.g. Reference Case in a Decarbonized Economy future?"

		Current Trends – Reference Case	No Environmental Action	Aggressive Environmental	Decarbonzied Economy
Generation Strategies	**No Early Retirement**				
	Pete Refuel to 100% Gas (est. 2025)				
	One Pete Unit Retires (2026)				
	Both Pete Units Retire (2026 & 2028)				
	Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)				
	Encompass Optimization without predefined Strategy				

Run the Optimized Reference Case Portfolios/Generation Mixes through the other Scenarios

Metrics

For each strategy, the analysis will capture:

- Risk potential using the **highest scenario PVRR for each strategy**
- Opportunity potential using the **lowest scenario PVRR for each strategy**

Risk & Opportunity Metrics:

Environmental Policy Sensitivity Analysis

- **Env Policy Opportunity Metric** – the environmental policy and commodity assumptions in the No Environmental Action Scenario results in the lowest PVRR in all strategies because this scenario has no carbon price and low gas prices.
- **Env Policy Risk Metric** – the environmental policy and commodity assumptions in the Aggressive Environmental Scenario results in the highest PVRR because this scenario has a high carbon price ($19.47/ton) starting in 2028 and high gas.

		Current Trends – Reference Case	No Environmental Action	Aggressive Environmental	Decarbonized Economy
Generation Strategies	**No Early Retirement**	$9,572	$8,860	$11,259	$9,953
	Pete Refuel to 100% Gas (est. 2025)	$9,330	$8,564	$11,329	$9,699
	One Pete Unit Retires (2026)	$9,773	$9,288	$11,462	$10,084
	Both Pete Units Retire (2026 & 2028)	$9,618	$9,135	$11,392	$10,334
	Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,711	$9,590	$11,275	$9,776
	Encompass Optimization (Refuel in 2025 & 2027)	$9,262	$8,517	$11,226	$9,721

Lowest PVRR Opportunity Potential

Highest PVRR Risk Potential

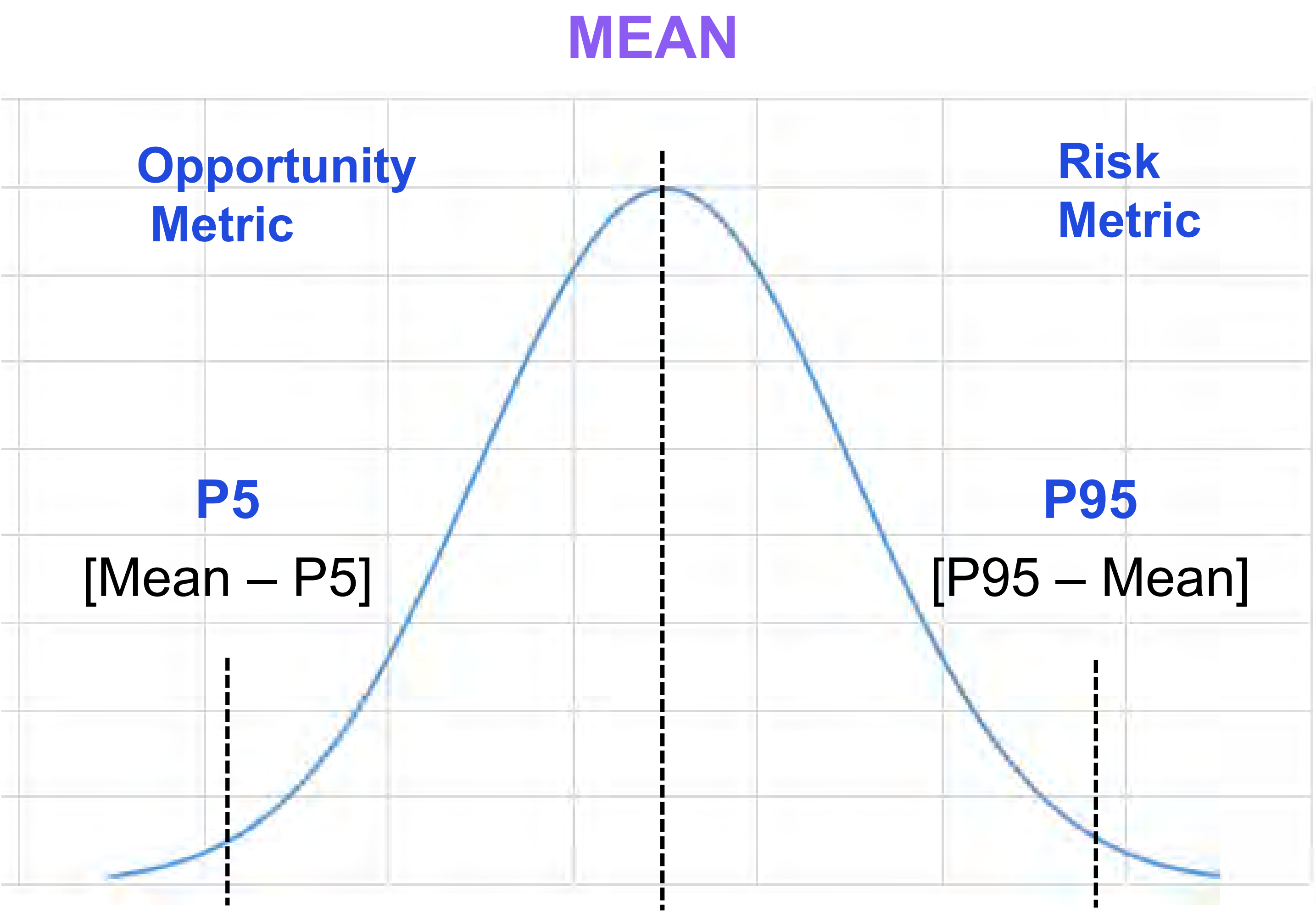
Key takeaways/explanations

- Low gas prices and no carbon price drive the Pete Refuel to be the least cost portfolio in the No Env Action scenario.
- Low-capacity factor due to negative spark spreads (power and gas) drives the Pete Refuel to be the least cost portfolio in the Decarb Econ scenario – *portfolio has low energy from gas units and high energy from renewables to meet RPS.*
- Base coal prices dampen the impact of higher carbon prices and higher NOx, which results in comparatively low PVRR for No Early Retirement in the Agg Env scenario.

Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

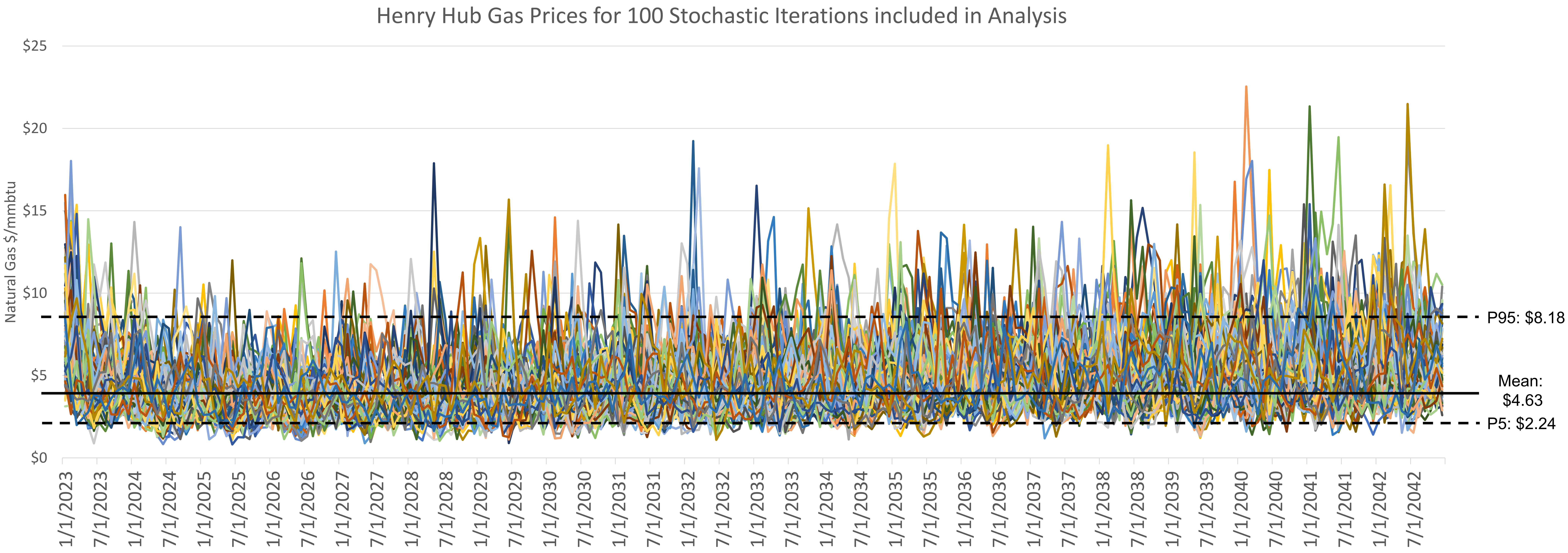
- Stochastic analysis was performed on the **Candidate Portfolios** to understand the risks and opportunities to each Strategy from:
    - Energy price volatility
    - Gas price volatility
    - Coal price volatility
    - Load volatility
    - Renewable generation volatility
- Each variable was varied across a full stochastic distribution using 100 iterations of potential outcomes.
- Metrics to measure cost risks and cost opportunities include:
    - Risk Metric = P95 and [P95 – Mean]
    - Opportunity Metric = P5 and [Mean – P5]



Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

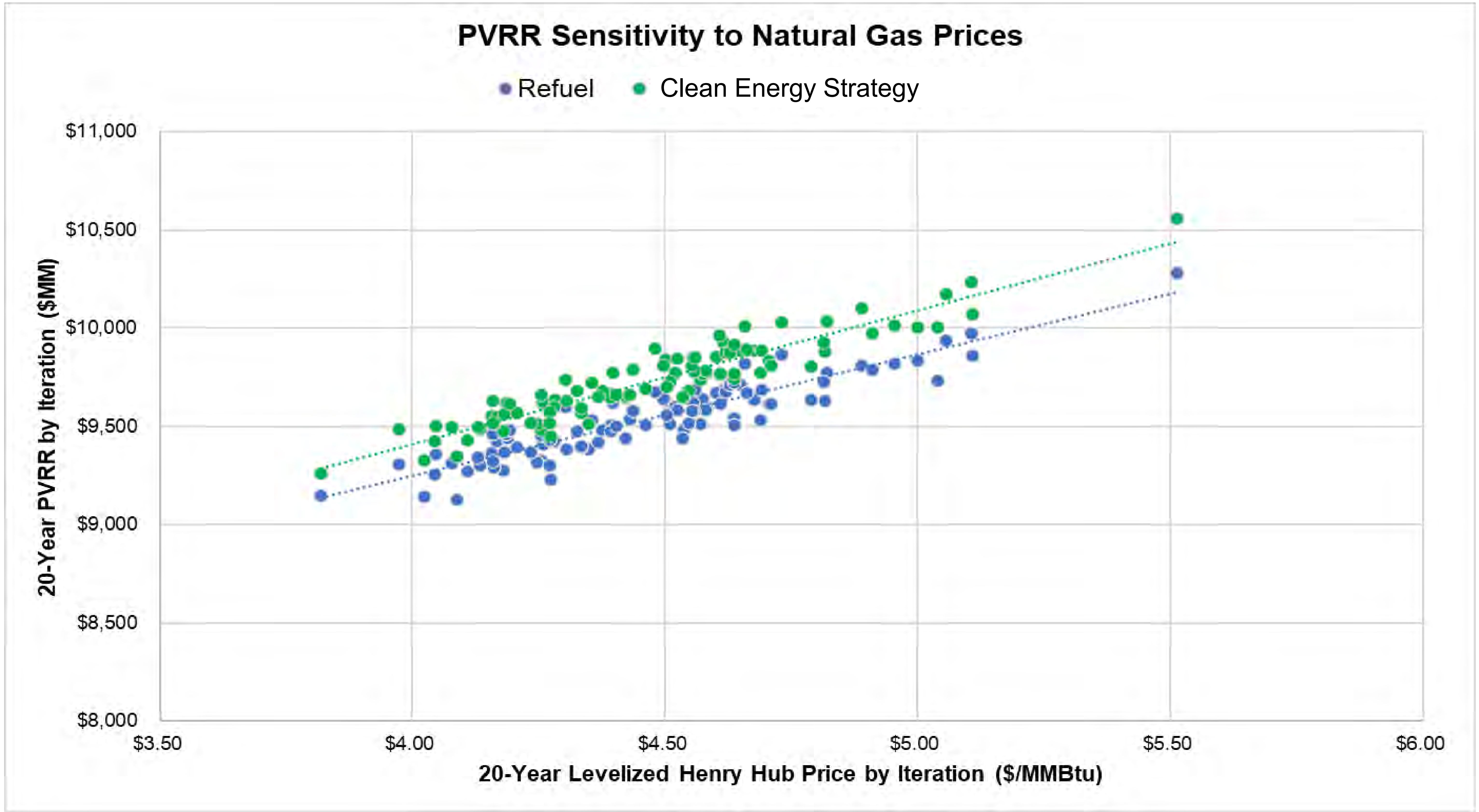
In order to fully evaluate commodity risk, the stochastic analysis captures recent volatility in commodity prices in forecasted distributions.



Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

All Candidate Portfolios rely partly on gas generation and therefore exhibit sensitivity to gas price volatility.



Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

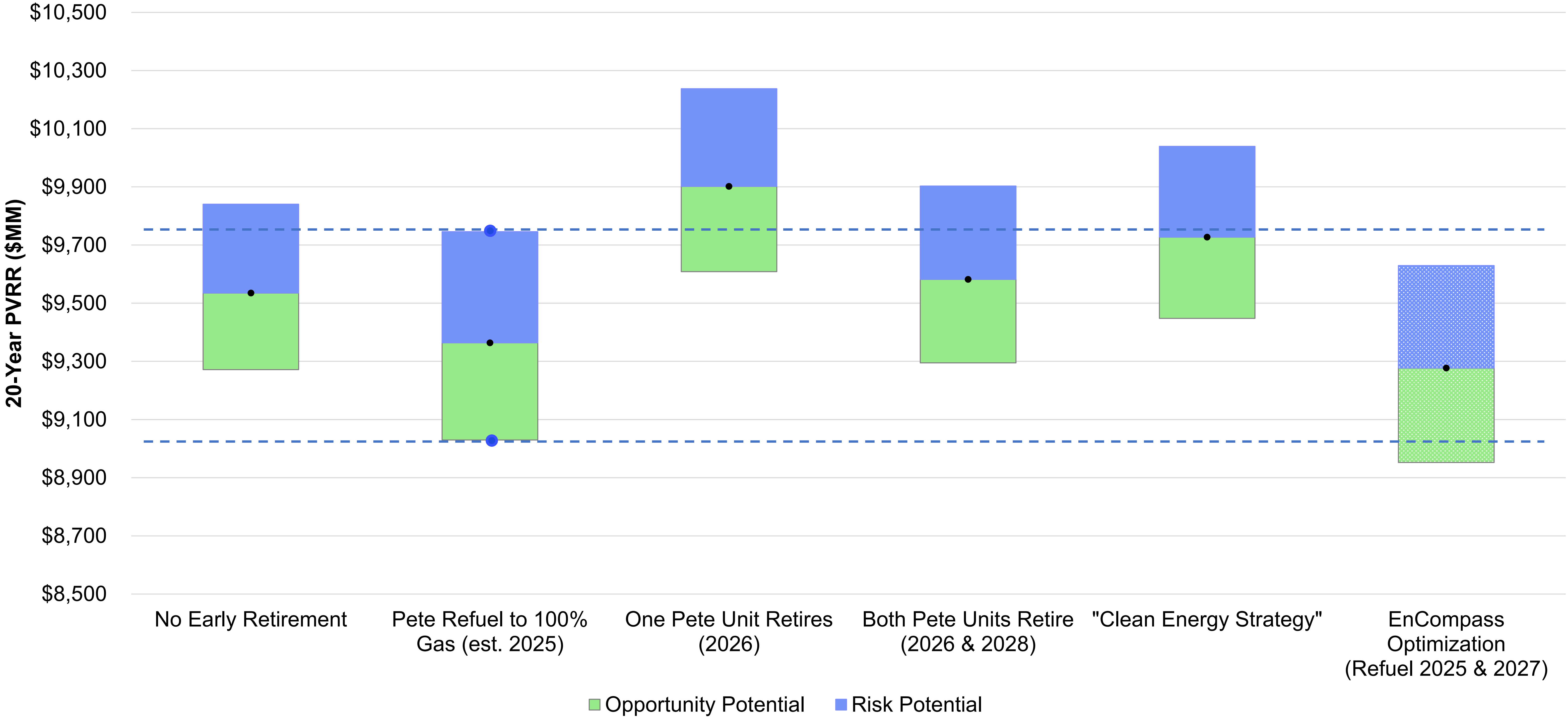
- For the stochastic analysis, AES Indiana lifted the energy constraints in Encompass to fully assess portfolio risk which results in a slightly different mean compared to the deterministic results.
- Risk: P95 – Indicates that 95% of potential PVRRs will fall below this value – there's a 5% chance PVRR will be higher.
- Opportunity: P5 – Indicates 95% of PVRRs will fall above this value – there's a 5% chance PVRR will be lower.

Stochastic results from varying power prices, gas prices, coal prices, load and renewable generation.

Portfolio	Scorecard PVRR Metric	Mean ↓	Opportunity: P5 [Mean - P5]	Risk: P95 [P95 - Mean]
No Early Retirement	$9,572	$9,535	$9,271 [-$264]	$9,840 [$305]
Pete Refuel to 100% Gas (est. 2025)	$9,330	$9,364	$9,030 [-$334]	$9,746 [$382]
One Pete Unit Retires (2026)	$9,773	$9,902	$9,608 [-$294]	$10,237 [$336]
Both Pete Units Retire (2026 & 2028)	$9,618	$9,582	$9,295 [-$287]	$9,903 [$321]
"Clean Energy Strategy"	$9,711	$9,727	$9,447 [-$280]	$10,039 [$312]
EnCompass Optimization (Refuel 2025 & 2027)	$9,262	$9,277	$8,952 [-$324]	$9,629 [$352]

Risk & Opportunity Metrics:

Cost Risk & Opportunity Metric **Stochastic Analysis**

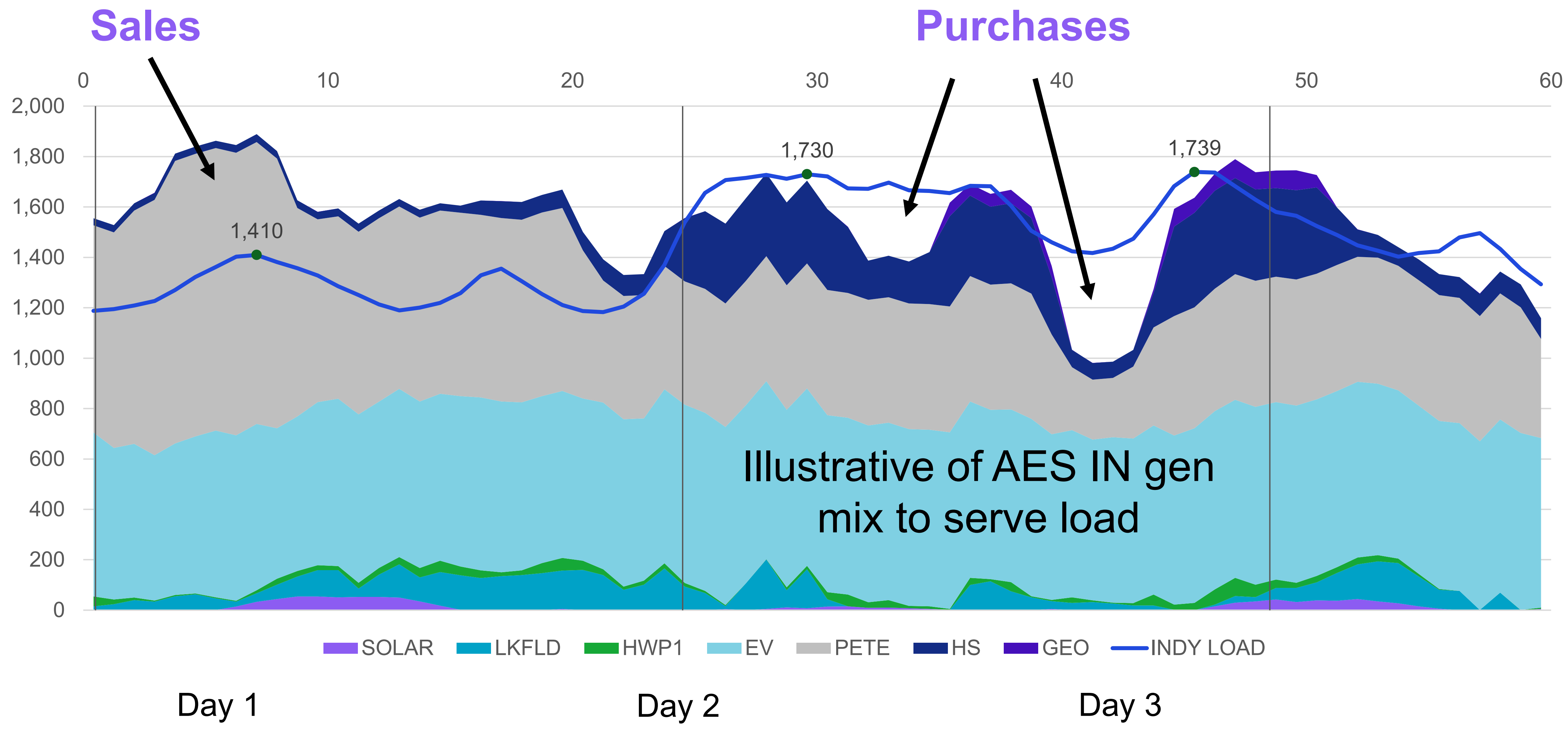


- Converting Petersburg to natural gas provides lowest PVRR at the P95 (risk) and the lowest PVRR at the P5 (opportunity) compared to the other strategies.
- Converting Petersburg to natural gas exhibits the widest distribution due to gas price volatility.
- Continuing to operate Petersburg on coal provides the tightest distribution because coal prices are subject to less volatility compared to other commodities.

Risk & Opportunity Metrics:

Market Interaction/Exposure

- When a utility generates energy in excess of load, the energy is sold into the market. Conversely, when a utility is short energy, the utility must purchase energy to supply load.
- Generally, the less sales and purchases in a portfolio, the less risky the portfolio or strategy is for the customer because the sales and purchases aren't exposed to price volatility in the market.
- For example – what if prices drop to zero when wind is available in excess of load or what if prices spike when energy purchases are needed to meet load?



Market Interaction/Exposure Metric

To estimate this risk for each strategy, AES Indiana calculated the average of the absolute value of the annual sales and purchases and summed those over the 20-yr period.

$$\left| \text{20-year Average Sales} \right| + \left| \text{20-year Average Purchases} \right|$$

Risk & Opportunity Metrics:

Market Interaction/Exposure Results

20-year Average Sales	+	20-year Average Purchases	=	Market Interaction/Exposure Metric

Candidate Portfolios (Strategies in Current Trends/Ref Case)	20-yr Annual Avg Market Sales (GWh)	20-yr Annual Avg Market Purchases (GWh)	Market Interaction/Exposure (GWh)
No Early Retirement	2,935	2,356	5,291
Pete Refuel to 100% Natural Gas (2025)	2,346	2,877	5,222
One Pete Unit Retires in 2026	2,916	2,821	5,737
Both Pete Units Retire in 2026 & 2028	2,921	2,591	5,512
"Clean Energy Strategy"*	3,146	2,942	6,088
Encompass Optimization**	2,285	2,851	5,136

*Both Pete Units Retire and replaced with Renewables in 2026 & 2028

**Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

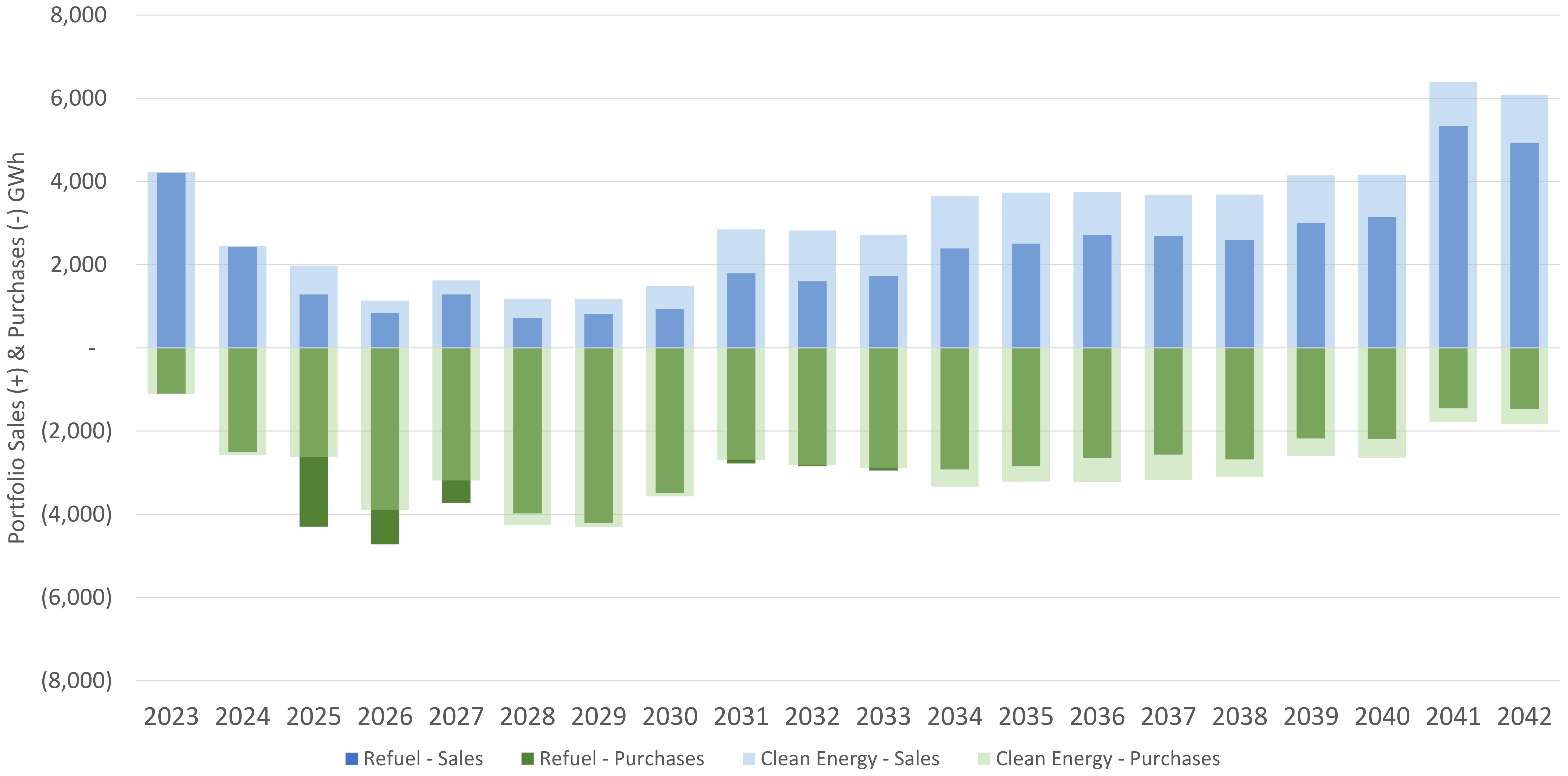
Comparing across strategies, we see portfolios with less dispatchable generation have higher market interaction in the form of energy sales.

Risk & Opportunity Metrics:

Market Interaction/Exposure Example and Comparison

- Strategies with less dispatchable generation typically have higher market interaction in the form of sales due to inability to control when energy is generated.
- In the near term, the Clean Energy Strategy adds more renewables to replace Petersburg, resulting in comparatively higher sales.
- Starting in 2031, both strategies add similar amounts of renewables, so we see sales grow somewhat proportionally.

Market Interaction Comparison – Pete Refuel Strategy vs Clean Energy Strategy



Risk & Opportunity Metrics:

Renewable Resource Capital Cost Sensitivity Analysis

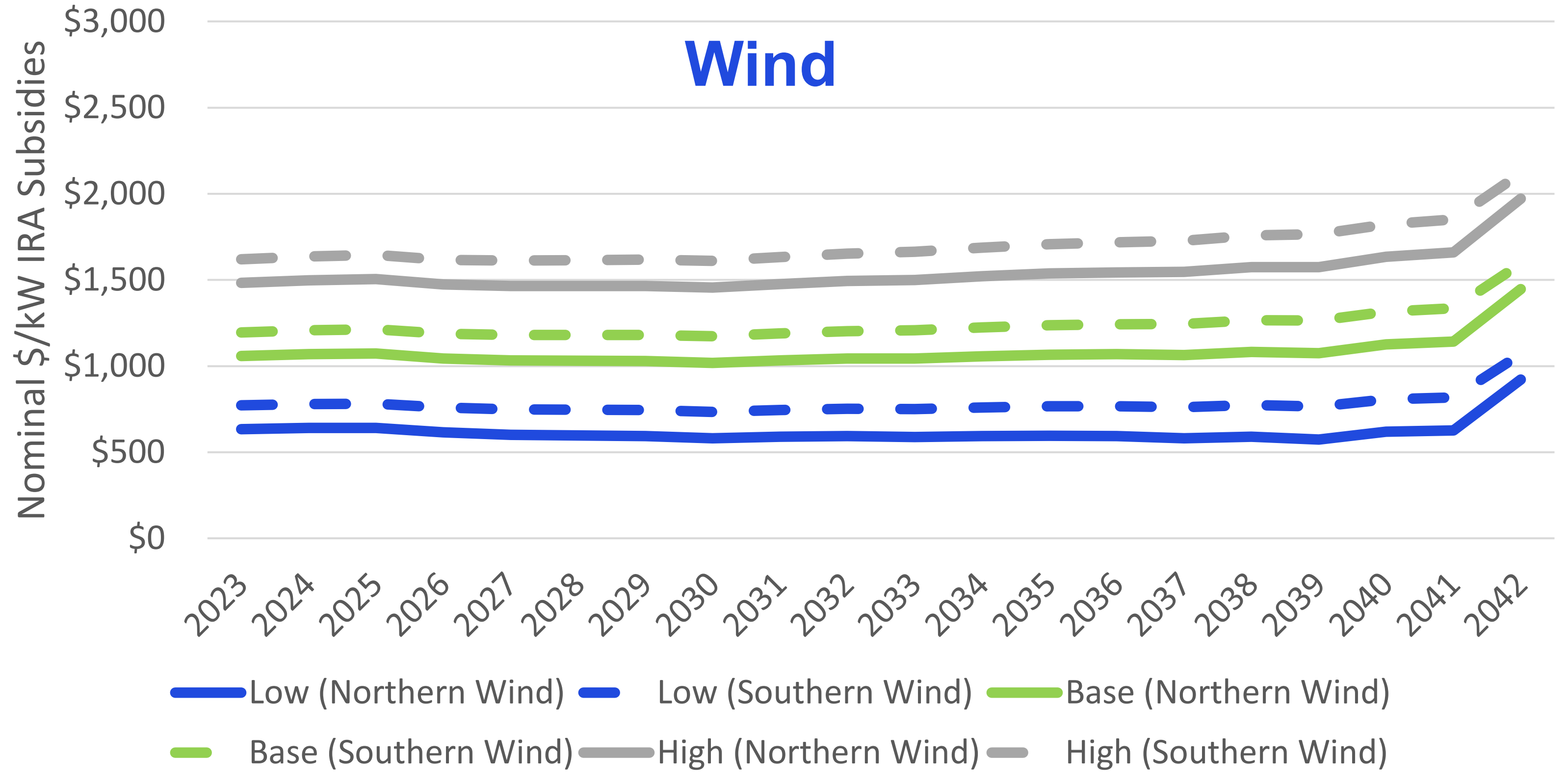
The Renewable Resource Capital Cost Sensitivity Analysis evaluates how much the Candidate Portfolio's PVRRs would change if renewable resource costs end up being higher or lower than the base assumptions.

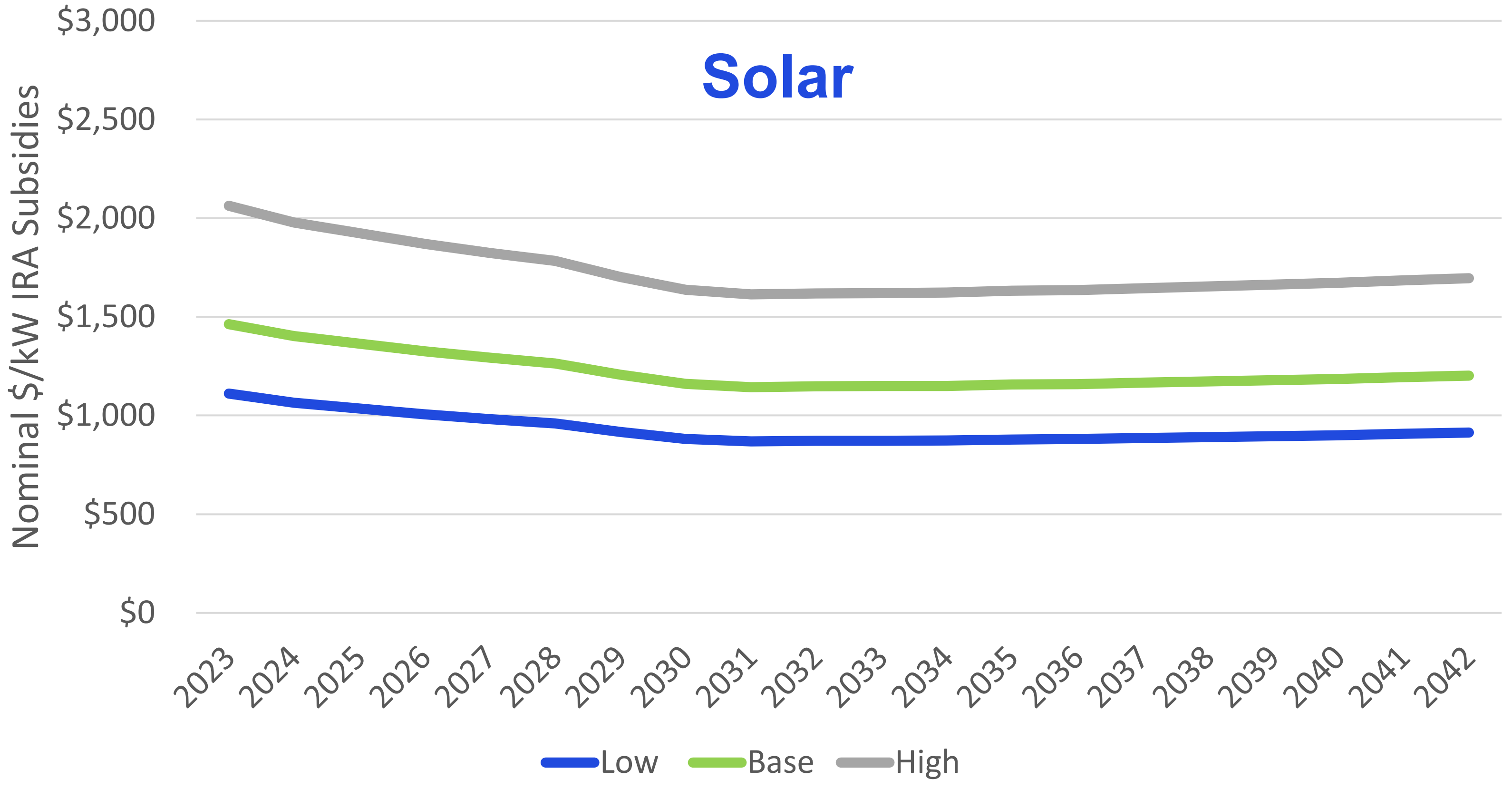
How the analysis was performed

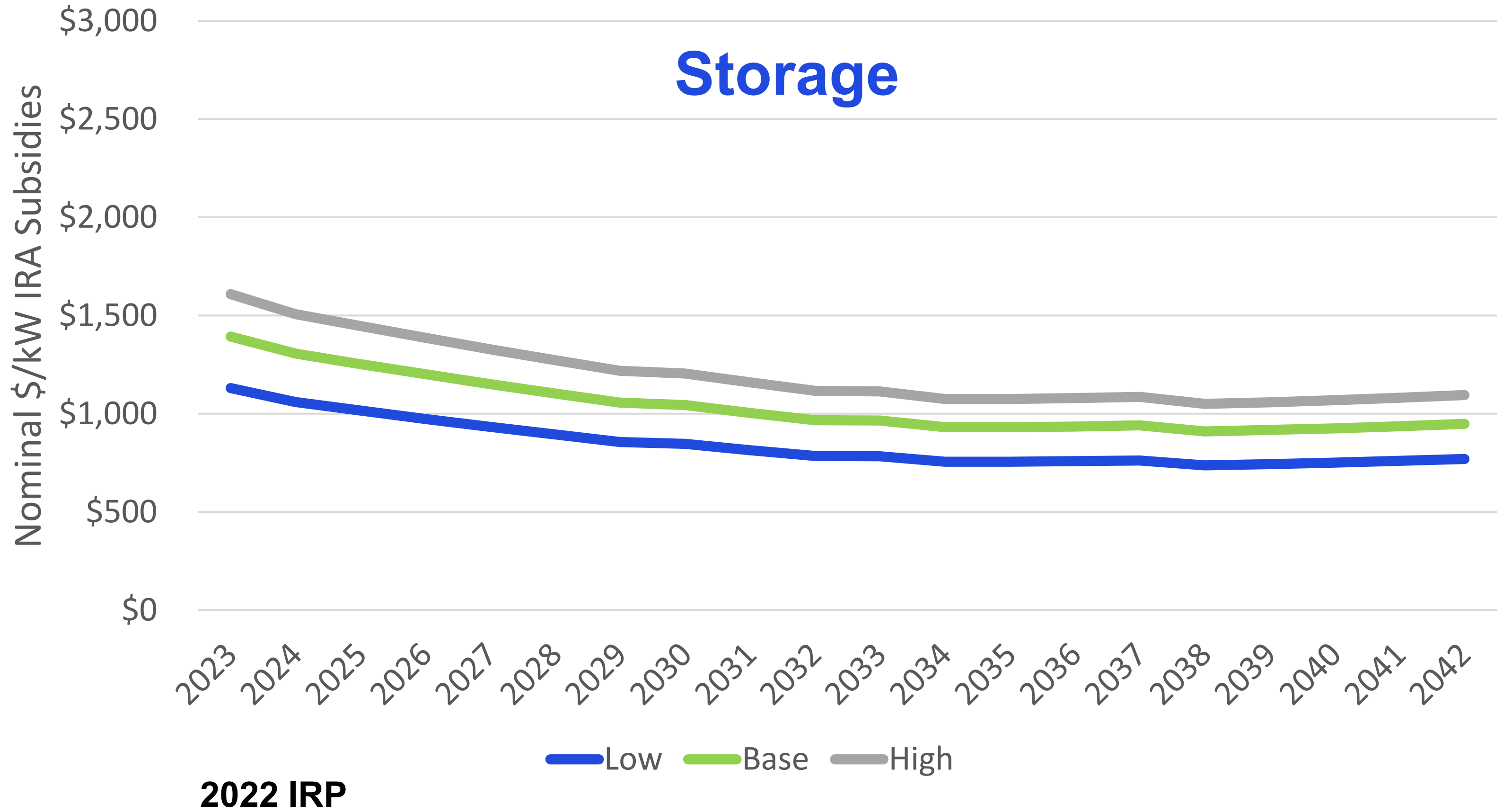
- Using secondary data sources and the responses from AES Indiana’s past two RFPs that were issued in 2020 and the spring of 2022, the IRP team created low, base and high levels of renewable resource capital costs.
    - Low – low costs were based on the avg of the 2021 replacement resource capital cost forecasts from Wood Mackenzie, NREL and BNEF and benchmarked against the responses from AES Indiana’s 2020 RFP.
    - Base – base costs were based on the lower half of the 2022 all-source RFP responses.
    - High – high costs were based on the upper half of the 2022 all-source RFP responses.
    - **The Renewable Resource Capital Cost Sensitivity analysis was performed by using the high and low cost calculations to increase and decrease the capital costs for the renewable additions in the Candidate Portfolios.**

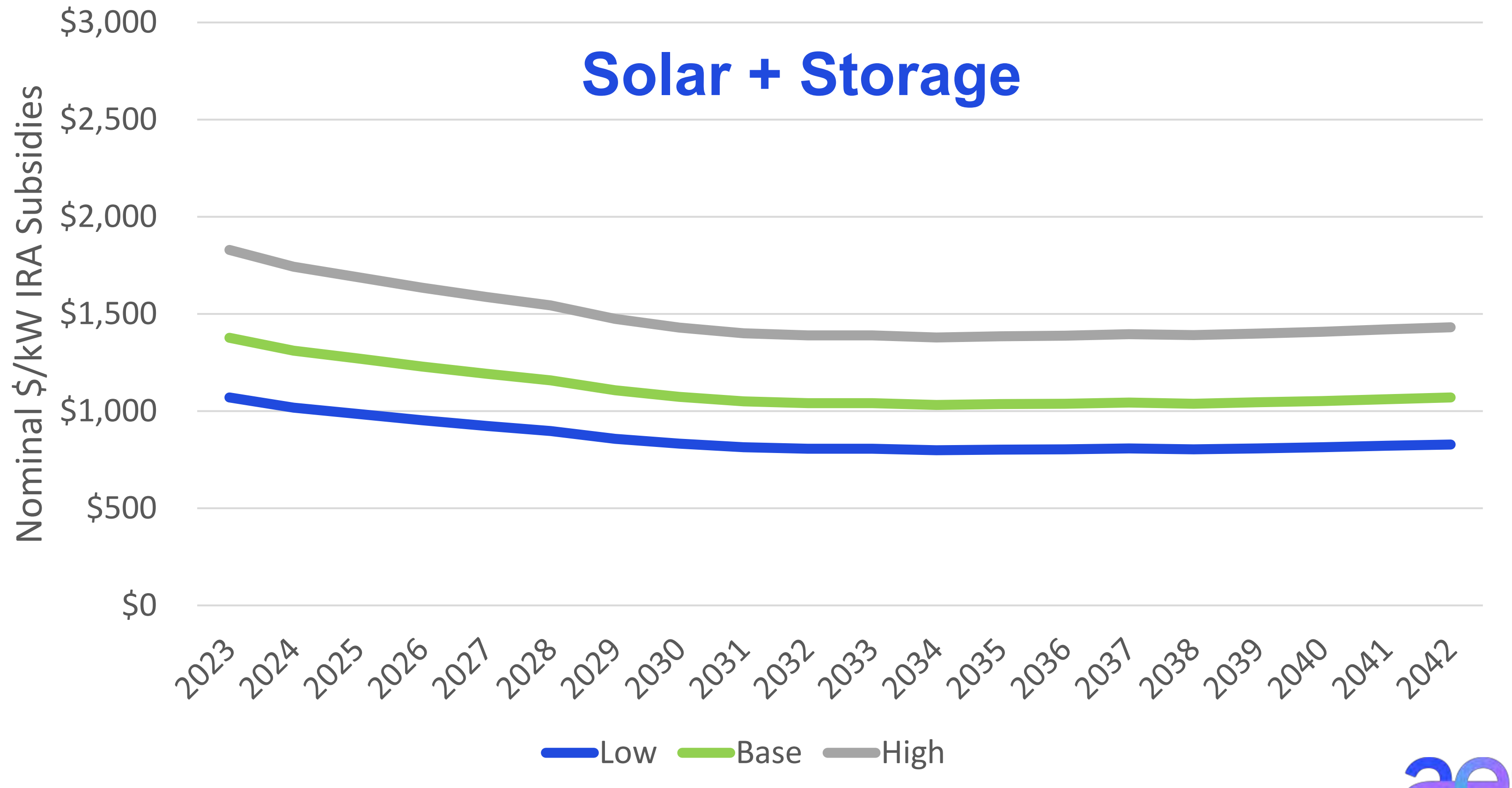
Risk & Opportunity Metrics:

Renewable Resource Capital Costs – Low, Base & High









Risk & Opportunity Metrics:

Renewable Resource Capital Cost Sensitivity Analysis Results

Portfolios with the highest renewable investment are most sensitive to price fluctuations.

****RESULTS****

	Current Trends *(Reference Case)*		
	Low	**Base**	**High**
No Early Retirement	$9,080	$9,572	$10,157
Pete Refuel to 100% Gas (est. 2025)	$8,763	$9,330	$9,999
One Pete Unit Retires (2026)	$9,244	$9,773	$10,406
Both Pete Units Retire (2026 & 2028)	$9,104	$9,618	$10,249
Both Pete Units Retire and Replaced with Wind, Solar & Storage (2026 & 2028)	$9,017	$9,711	$10,442
Encompass Optimization without predefined Strategy (Refuel 2025 & 2027)	$8,730	$9,262	$9,909

Opportunity Metric: Candidate Portfolios using low costs for renewables

Risk Metric: Candidate Portfolios using high costs for renewables

Break for Lunch

Time	Topic	Speakers
Break **12:00 PM – 12:30 PM**	Lunch	
Afternoon **Starting at 12:30 PM**	Reliability, Stability & Resiliency Metric	Hisham Othman, Manager, Resource Planning, Quanta Technology
	IRP Scorecard Results	Erik Miller, Manager, Resource Planning, AES Indiana
	Preferred Resource Portfolio & Short-Term Action Plan	Erik Miller, Manager, Resource Planning, AES Indiana
	Final Q&A and Next Steps	

Reliability, Resiliency & Stability Metric

Hisham Othman, VP Transmission & Regulatory Consulting, Quanta

Integrated Resource Plan (IRP) 2022

Reliability Analysis of IRP Portfolios: Final Report

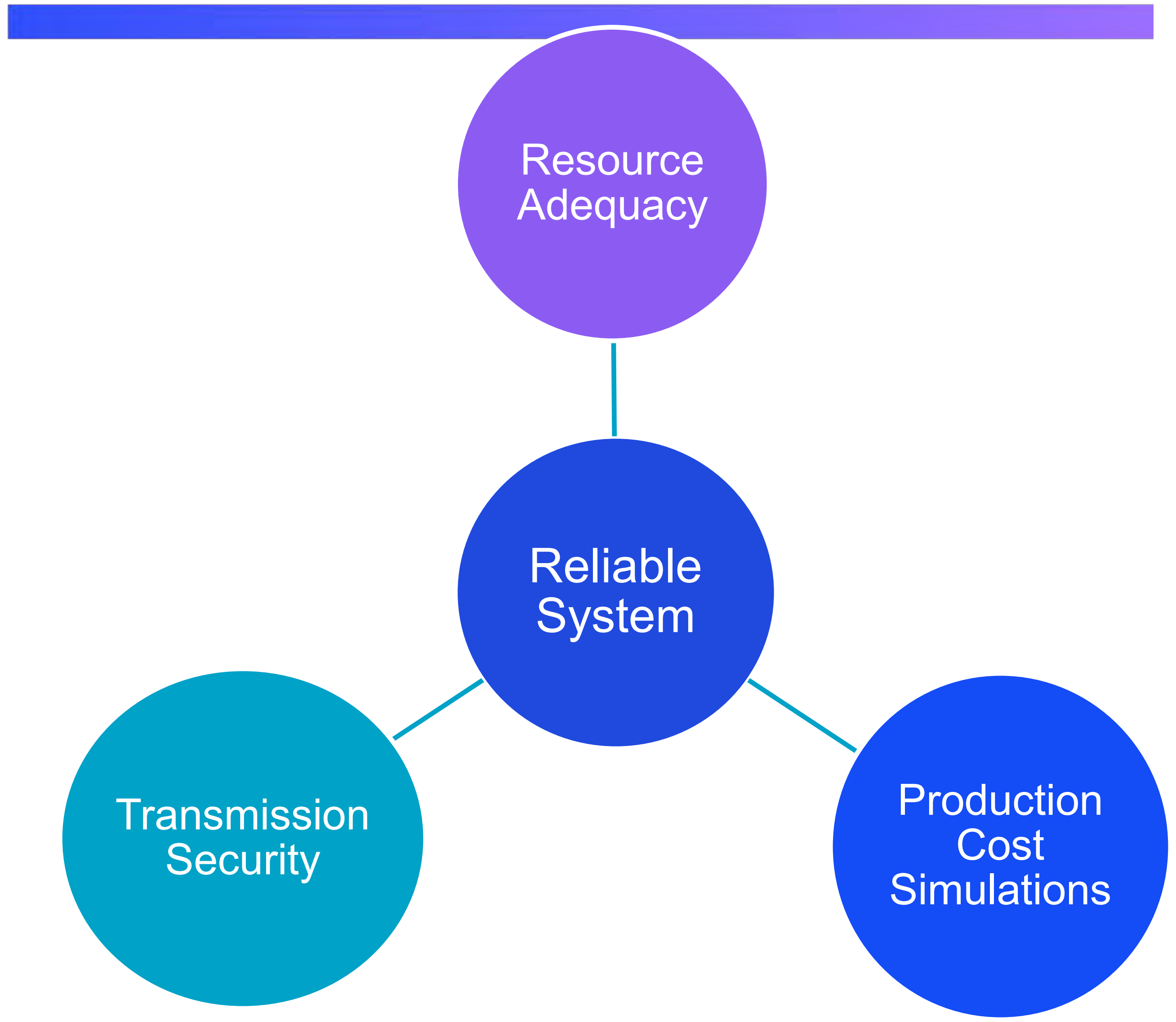
October 19, 2022

Presented by IRP Partner

QUANTA TECHNOLOGY

aes Indiana

Managing System Reliability – High IBR Portfolios



Resource Adequacy

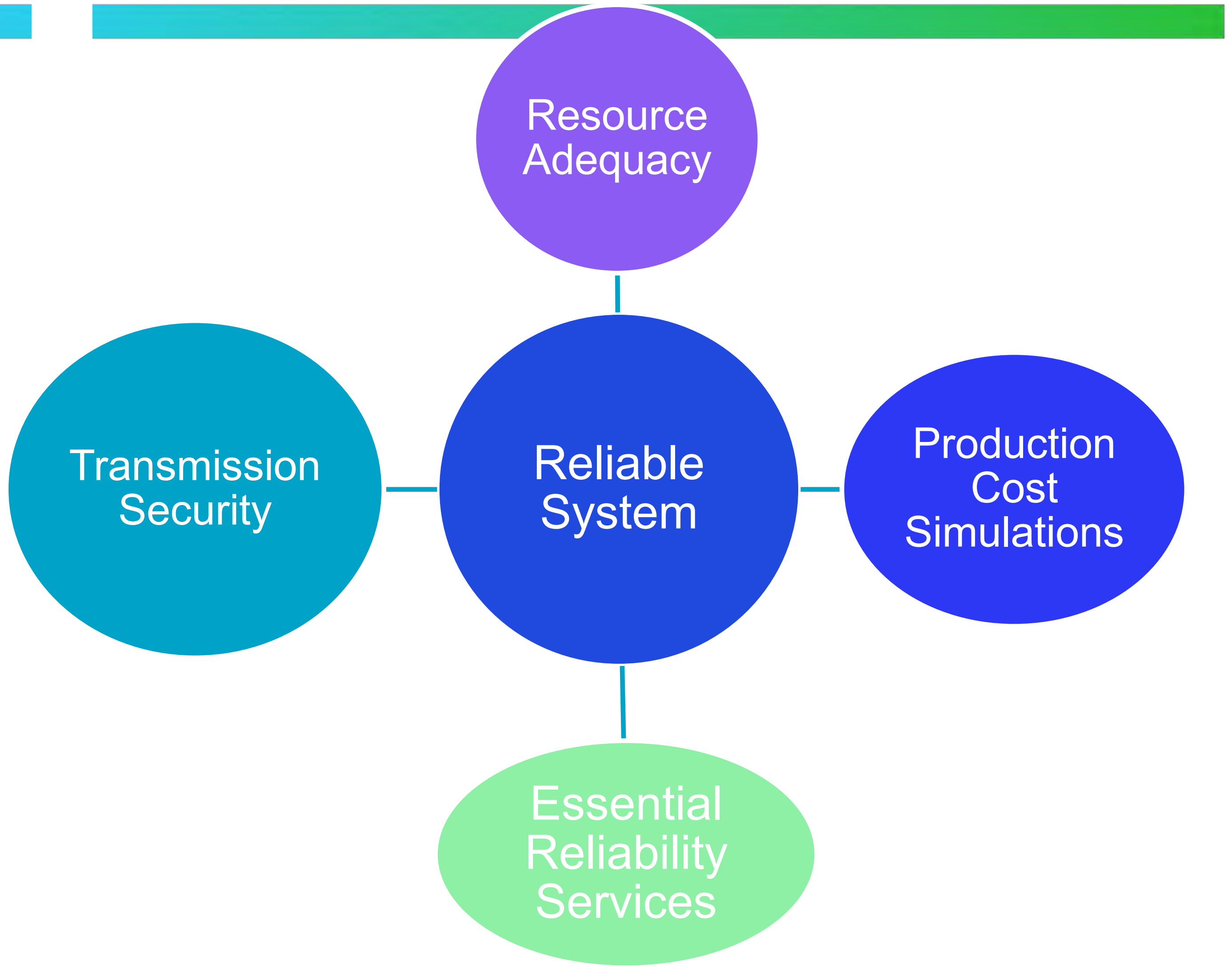
Reliable System

Transmission Security

Production Cost Simulations

- Traditional planning ensures the provision of sufficient generation and transmission capacity based on:
  - Centralized synchronous generation
  - Dispatchable resources
  - Predictable flow patterns
  - Excludes fuel constraints
  - Few operating snapshots (e.g., 2-4)
  - Separate T and D planning

With increasing retirements and dependence on solar/wind/storage resources, both distributed and utility-scale, planning paradigm is evolving to assure operational reliability.



Resource Adequacy

Transmission Security

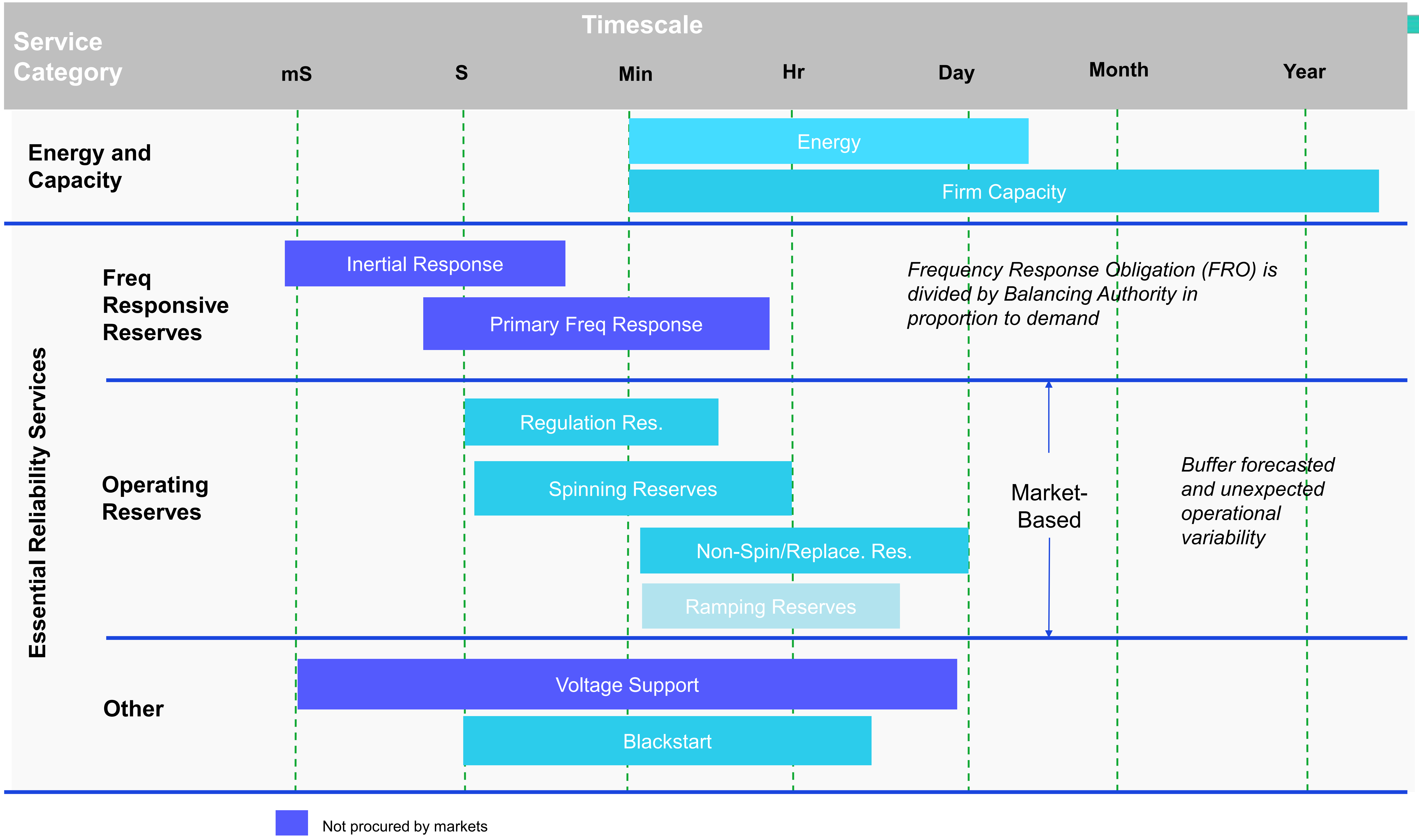
Reliable System

Production Cost Simulations

Essential Reliability Services

- Traditional planning methods are evolving:
  - Resource Adequacy: Effective Load Carrying Capability (ELCC)
  - Time-series transmission security (8760 hrs)
  - Probabilistic production cost simulations (renewable/load profiles)
  - Coordinated/Integrated T&D planning
  - Scenario planning approaches to address increased uncertainty
- More analysis is required - Essential Reliability Service

Essential Reliability Services



Frequency Response Obligation (FRO) is divided by Balancing Authority in proportion to demand

Buffer forecasted and unexpected operational variability

- Market-Procured Reliability Services
  - Some reliability services are typically procured competitively by the RTO or the ISO such as capacity, energy, and reserves.

- Portfolio-Supplied Reliability Services
  - Some reliability services are assumed to be innately supplied by the resource portfolio such as inertial and primary frequency response and voltage support

Essential Reliability Studies

	Reliability Study Area	Normal (50/50, Connected)	Max-Gen (90/10, Import Limited)	Islanded (Critical Load)
-	Resource Adequacy	X (also 90/10)		
-	Energy Adequacy	X (8760)		
-	Transmission Reliability / Deliverability / Interconnections	X		
1	Energy Adequacy	X	X	X
2	Operational Flexibility and Frequency Support	X		X
3	Short Circuit Strength Requirement	X		X
4	Power Quality (Flicker)	X		X
5	Blackstart			X
6	Dynamic VAR Deliverability	X		
7	Dispatchability and Automatic Generation Control	X		
8	Predictability and Firmness of Supply	X		
9	Geographic Location Relative to Load	X		

Typically, Part of IRP Portfolio Design

Additional Reliability Analysis

Reliability Metrics (1/2)

	Metric	Description	Rationale
1	**Energy Adequacy**	Resources are able to meet the energy and capacity duration requirements. Portfolio resources are able to supply the energy demand of customers during normal and emergency max gen events, and also to supply the energy needs of critical loads during islanded operation events.	Utility must have long duration resources to serve the needs of its customers during emergency and islanded operation events.
2	**Operational Flexibility and Frequency Support**	Ability to provide inertial energy reservoir or a sink to stabilize the system. Additionally, resources can adjust their output to provide frequency support or stabilization in response to frequency deviations with a droop of 5% or better.	Regional markets and/or control centers balance supply and demand under different time frames according to prevailing market construct under normal conditions, but preferable that local control centers possess the ability to maintain operation during under-frequency conditions in emergencies.
3	**Short Circuit Strength Requirement**	Ensure the strength of the system to enable the stable integration of all inverter-based resources (IBRs) within a portfolio.	The retirement of synchronous generators within utility footprint and replacements with increasing levels of inverter-based resources will lower the short circuit strength of the system. Resources than can operate at lower levels of short circuit ratio (SCR) and those that provide higher short circuit current provide a better future proofing without the need for expensive mitigation measures.
4	**Power Quality (Flicker)**	The “stiffness of the grid” affect the sensitivity of grid voltages to the intermittency of renewable resources. Ensuring the grid can deliver power quality in accordance with IEEE standards is essential.	Retirement of large thermal generation plants lower the strength of the grid and increases its susceptibility to voltage flicker due to intermittency of renewable resources, unless properly assessed and mitigated.
5	**Blackstart**	Ensure that resources have the ability to be started without support from the wider system or are designed to remain energized without connection to the remainder of the system, with the ability to energize a bus, supply real and reactive power, frequency and voltage control	In the event of a black out condition, utility must have a blackstart plan to restore its local electric system. The plan should demonstrate the ability to energize a cranking path to start large flexible resources with sufficient energy reservoir.
6	**Dynamic VAR Support**	Customer equipment driven by induction motors (e.g., air conditioning or factories) requires dynamic reactive power after a grid fault to avoid stalling. The ability of portfolio resources to provide this service depends on their closeness to the load centers.	Utility must retain resources electrically close to load centers to provide this attribute in accordance with NERC and IEEE Standards

Reliability Metrics (2/2)

	Metric	Description	Rationale
7	**Dispatchability and Automatic Generation Control**	Resources should respond to directives from system operators regarding their status, output, and timing. Resources that can be ramped up and down automatically to respond immediately to changes in the system contribute more to reliability than resources which can be ramped only up or only down, and those in turn are better than ones that cannot be ramped.	Ability to control frequency is paramount to stability of the electric system and the quality of power delivered to customers. Control centers (regional or local) provide dispatch signals under normal conditions, and under emergency restoration procedures or other operational considerations.
8	**Predictability and Firmness of Supply**	Ability to predict/forecast the output of resources and to counteract forecast errors.	The ability to predict resource output from a day-ahead to real-time is advantageous to minimize the need for spinning reserves. In places with an active energy market, energy is scheduled with the market in the day-ahead hourly market and in the real-time 5-minute market. Deviations from these schedules have financial consequences and thus the ability to accurately forecast the output of a resource up to 38 hours ahead of time for the day-ahead market and 30 minutes for the real time market is advantageous.
9	**Geographic Location Relative to Load (Resilience)**	Ensure the ability to have redundant power evacuation or deliverability paths from resources. Preferrable to locate resources at substations with easy access to multiple high voltage paths, unrestricted fuel supply infrastructure, and close to major load centers.	Location provides economic value in the form of reduced losses, congestion, curtailment risk, and address local capacity requirements. Additionally, from a reliability perspective, resources that are interconnected to buses with multiple power evacuation paths and those close to load centers are more resilient to transmission system outages and provide better assistance in the blackstart restoration process.

Scoring Criteria Thresholds (1/2)

	Year 2031		1 (Pass)	2 (Caution)	3 (Problem)	Rationale
1	Energy Adequacy	Loss of Load Hours (LOLH) - normal system, 50/50 forecast	<2.4 hrs	2.4-4.8 hrs	>4.8 hrs	Expected number of hours in a year the portfolio is energy short and relies on imports (2.4hrs = 1day in 10 years)
		Expected Energy not Served (GWh) - normal system 50/50 fcst	<2.4*Peak	2.4-4.8*Peak	>4.8*Peak	The energy consumption which is not supplied due to insufficient capacity resources within portfolio to meet the demand
		max MW Short (MW) - normal system 50/50 forecast	<90%	90-110%	>110%	The maximum hourly power shortage in the portfolio that has to be supplied by imports (% of Tie-line Import Limits)
		max MW Short - loss of 50% of tieline capacity, 50/50 fcst	<45%	45-55%	>55%	The energy consumption which is not supplied due to insufficient resources and imports to meet the demand, when tieline import capacity is halved
		max MW Short (islanded, 50/50 forecast)	<70%	70-85%	>85%	Ability of Resources to serve critical loads, estimated at 15% of total load. Adding other important loads brings the total to 30%
		max MW Short (normal system, 90/10 forecast)	<5%	5-20%	>20%	Ability of portfolio resources to serve unanticipated growth in load consumption during MISO emergency max-gen events
2	Operational Flexibility and Frequency Support	Inertia MVA-s	>4.2 *Peak	2.6-4.2 *Peak	<2.6 *Peak	Synchronous machine has inertia of 2-5xMVA rating. Conventional systems have inertia that exceeds 2-5x (Peak load x 1.3)
		Inertial Gap FFR MW (% CAP)	0	0-10% of CAP	>10% of CAP	System should have enough inertial response, so gap should be 0. Inertial response of synch machine ≈ 10% of CAP
		Primary Gap PFR MW (% CAP)	0	0-2% of CAP	>2% of CAP	System should have enough primary response, so gap should be 0. Primary response of synch machine ≈ 3.3%of CAP/0.1Hz (Droop 5%)
3	Short Circuit Strength	Inverter MWs passing ESCR limits (%) - Connected System	95%	80-95%	80%	Grid following inverters require short circuit strength at the point of connection to operate properly (ESCR threshold of 3.5)
		Inverter MWs passing ESCR limits (%) - Islanded System	80%	50-80%	>50%	Grid following inverters require short circuit strength at the point of connection to operate properly (ESCR threshold of 3.5)
		Required Additional Synch Condensers MVA (% peak load) - Connected	0	0-500	>500	Portfolio should not require additional synchronous condensers. 500MVArs is a threshold
		Required Additional Synch Condensers MVA (% peak load) - Islanded	0	0-500	>500	Portfolio should not require additional synchronous condensers. 500MVArs is a threshold

QUANTA TECHNOLOGY

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Scoring Criteria Thresholds (2/2)

	Year 2031		1	2	3	Rationale
			(Pass)	(Caution)	(Problem)	
4	Flicker	Compliance with Flicker limits when Connected (GE Flicker Curve or IEC Flicker Meter)	>95%	80-95%	<80%	% of system load buses that is likely to experience flicker (>100% of Border line of irritation or Pst>1)
		Compliance with Flicker limits when Islanded	>80%	50-80%	<50%	% of system load buses that is likely to experience flicker (>100% of Border line of irritation or Pst>1)
		Required Synchronous Condensers MVA to mitigate Flicker	0%	0-500	>500	Size of Synchronous condensers required to mitigate flicker (500MVArs is a threshold)
5	Blackstart	Qualitative Assessment of Ability to Blackstart the system	Excellent	Average	Poor	System requires real and reactive power sources with sufficient rating and duration to start other resources. Higher rated resources lower the risk
6	Dynamic VAR Support	Dynamic VAR to load Center Capability (% of Peak Load)	≥85%	55-85%	<55%	Dynamic reactive power (DRP) should exceed 55-85% of the peak load served by the load centers. DRP requirement to prevent induction motor stalling is 2.5x the steady state reactive consumption. Assuming a PF=0.9, and Induction motors account for 50-80% of the load. Assume that only 20% of the load can experience a common voltage event.
7	Dispatchability	Dispatchable (%CAP)	>60%	50-60%	<50%	Dispatchable resource are essential for system operation
		Unavoidable VER Penetration %	<60%	60-70%	>70%	Intermittent Power Penetration above 60% is problematic when islanded
		Increased Freq Regulation Requirements (% Peak Load)	<2% of peak load	2-3% of Peak Load	>3% of peak load	Regulation of Conventional Systems ≈1%
		1-min Ramp Capability (MW)	>15% of CAP	10-15% of CAP	<10% of CAP	10% per minute was the norm for conventional systems. Renewable portfolios require more ramping capability
		10-min Ramp Capability (MW)	>65% of CAP	50-65% of CAP	<50% of CAP	10% per minute was the norm for conventional systems. But with 50% min loading, that will be 50% in 10 min. Renewable portfolios require more ramping capability
8	Predictability and Firmness	Ramping Capability to Mitigate Forecast Errors (+Excess/-Deficit) (%VER MW)	≥ 0	-10% - 0% of CAP	<-10% of CAP	Excess ramping capability to offset higher levels of intermittent resource output variability is desired
9	Location	Average Number of Evacuation Paths	>3	2-3	<2	More power evacuation paths increase system resilience

Scorecard – Portfolio Scores

			Candidate Portfolios in 2031					
	Year 2031		Status Quo	Refuel	1 Retire	2 Retire	Clean	Optimize
1	Energy Adequacy	Loss of Load Hours (LOLH) - normal system, 50/50 forecast	1	1	0	0	0	1
		Expected Energy not Served (GWh) - normal system 50/50 fcst	1	1	1	1	1	1
		max MW Short (MW) - normal system 50/50 forecast	1	1	1	1	1	1
		max MW Short - loss of 50% of tieline capacity, 50/50 fcst	1	1	1	1/2	0	1
		max MW Short (islanded, 50/50 forecast)	1	1	1	1	1	1
		max MW Short (normal system, 90/10 forecast)	1/2	1/2	0	0	0	1/2
2	Operational Flexibility and Frequency Support	Inertia MVA-s	1/2	1/2	1/2	1/2	1/2	1/2
		Inertial Gap FFR MW (% CAP)	1/2	1/2	1/2	1/2	1/2	1/2
		Primary Gap PFR MW (% CAP)	0	0	1	1	1	0
3	Short Circuit Strength	Inverter MWs passing ESCR limits (%) - Connected System	1	1	1	1	1	1
		Inverter MWs passing ESCR limits (%) - Islanded System	1	1	0	1/2	0	1
		Required Additional Synch Condensers MVA (when Connected)	1	1	1	1	1	1
		Required Additional Synch Condensers MVA (when Islanded)	1	1	1/2	1/2	0	1
4	Power Quality	Compliance with Flicker limits when Connected (GE Flicker Curve or IEC Flicker Meter)	1	1	1	1	1	1
		Compliance with Flicker limits when Islanded	1	1	1	1	1	1
		Required Synchronous Condensers MVA to mitigate Flicker	1	1	1	1	1	1
5	Blackstart	Qualitative Assessment of Ability to Blackstart the system	1	1	1	1	1	1
6	Dynamic VAR Support	Dynamic VAR to load Center Capability (% of Peak Load)	1	1	1	1	1	1
7	Dispatchability and Automatic Generation Control	Dispatchable (%CAP)	1	1	1	1	1	1
		Unavoidable VER Penetration %	1	1	1	1	1	1
		Increased Freq Regulation Requirements (% Peak Load)	1	1	1	1	1	1
		1-min Ramp Capability (MW)	1/2	1/2	1	1	1	1/2
		10-min Ramp Capability (MW)	0	0	1/2	1/2	1/2	0
8	Predictability and Firmness	Ramping Capability to Mitigate Forecast Errors (+Excess/-Deficit) (%VER MW)	1	1	1	1	1	1
9	Location	Average Number of Evacuation Paths	1	1	1	1	1	1
		Cumulative score (out of possible 9)	7.95	7.95	7.86	7.90	7.57	7.95

Mitigations

	Current Trends					
	Status Quo	Refuel	1 Retire	2 Retire	Clean	Optimize
Equip Stand-alone ESS with GFM inverters (MW)	**129**	**99**	**183**	**49**	**128**	**98**
Additional Synchronous Condensers (MVA)	**0**	**0**	**350**	**300**	**1500**	**0**
Additional Power Mitigations (MW)	**298**	**326**	**183**	**49**	**128**	**325**
Increased Freq Regulation	39	48	49	45	66	47
Address Inertial Response Gaps	129	99	183	49	128	98
Address Primary Response Gaps	298	326	0	0	0	325
Firm up Intermittent Renewable Forecast	0	0	0	0	0	0

Thank you!

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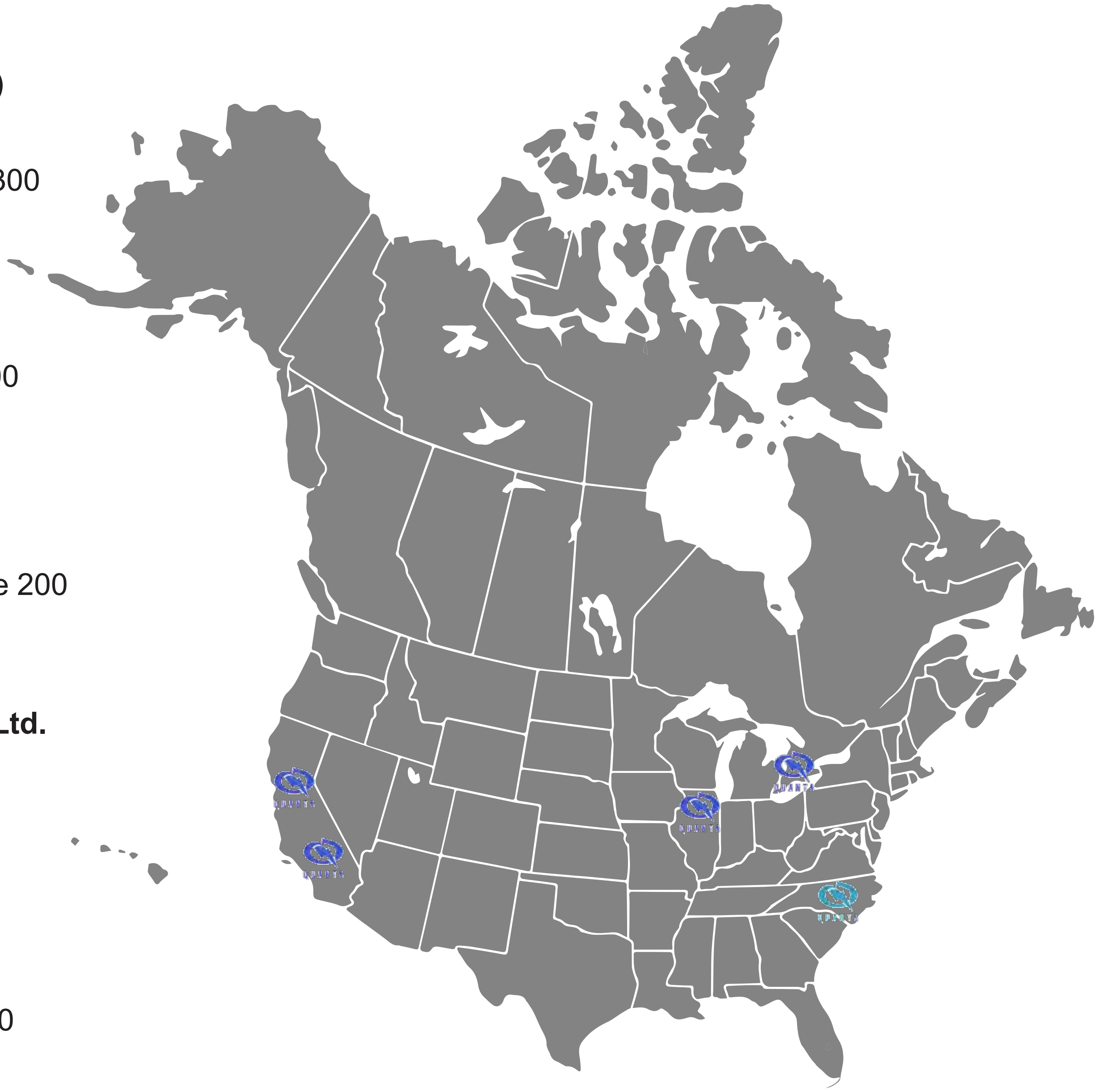

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IRP Scorecard Results

Erik Miller, Manager, Resource Planning, AES Indiana

What is a Preferred Resource Portfolio?

What is a preferred resource portfolio?

"'Preferred resource portfolio' means the utility's selected long term supply-side and demand-side resource mix that safely, reliably, efficiently, and cost-effectively meets the electric system demand, taking cost, risk, and uncertainty into consideration."
IAC 4-7-1-1-cc

Integrated Resource Plan (IRP) in Indiana –> 170 IAC 4-7-2

- 20-year look at how AES Indiana will serve load
- Submitted every three years
- Plan created with stakeholder input
- Modeling and analysis culminates in a preferred resource portfolio and a short-term action plan

Stakeholders are critical to the process

AES Indiana has been committed to providing an engaging and collaborative IRP process for its stakeholders:

- Five Public Advisory Meetings for stakeholders to engage throughout the process
- Five Technical Meetings available to stakeholders with nondisclosure agreements (NDA) for deeper analytics discussion
- Additional ad hoc meetings to review comments and questions from stakeholders with NDAs
- Planning documents and modeling materials were shared with stakeholders with NDAs including Encompass model database
- The Preferred Resource Portfolio was determined after full consideration of stakeholder input

IRP rules link: http://iac.iga.in.gov/iac/iac_title?iact=170&iaca=&submit=+Go Article 4. 170 IAC 4-7-2

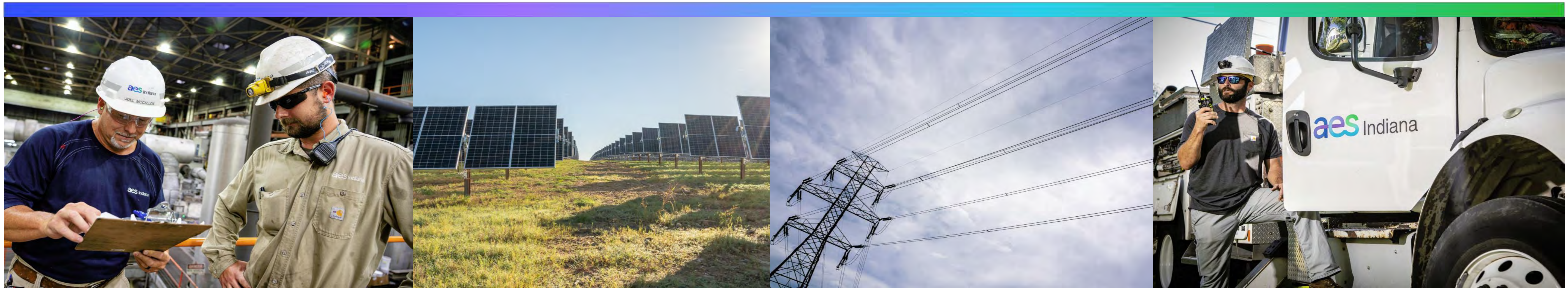
Final IRP Scorecard Results

	Affordability	Environmental Sustainability						Reliability, Stability & Resiliency	Risk & Opportunity							Economic Impact	
	20-yr PVRR	***CO_2 Emissions***	***SO_2 Emissions***	***NO_X Emissions***	***Water Use***	***Coal Combustion Products (CCP)***	***Clean Energy Progress***	***Reliability Score***	***Environmental Policy Opportunity***	***Environmental Policy Risk***	***General Cost Opportunity **Stochastic Analysis*****	***General Cost Risk **Stochastic Analysis*****	***Market Exposure***	***Renewable Capital Cost Opportunity (Low Cost)***	***Renewable Capital Cost Risk (High Cost)***	***Generation Employees (+/-)***	***Property Taxes***
	Present Value of Revenue Requirements ($000,000)	Total portfolio CO2 Emissions (mmtons)	Total portfolio SO2 Emissions (tons)	Total portfolio NOx Emissions (tons)	Water Use (mmgal)	CCP (tons)	% Renewable Energy in 2032	Composite score from Reliability Analysis	Lowest PVRR across policy scenarios ($000,000)	Highest PVRR across policy scenarios ($000,000)	P5 [Mean - P5]	P95 [P95 – Mean]	20-year avg sales + purchases (GWh)	Portfolio PVRR w/ low renewable cost ($000,000)	Portfolio PVRR w/ high renewable cost ($000,000)	Total change in FTEs associated with generation 2023 - 2042	Total amount of property tax paid from AES IN assets ($000,000)
1	$ 9,572	101.9	64,991	45,605	36.7	6,611	45%	7.95	$ 8,860	$ 11,259	$ 9,271 [-$264]	$ 9,840 [$305]	5,291	$ 9,080	$ 10,157	222	$ 154
2	$ 9,330	72.5	13,513	22,146	7.9	1,417	55%	7.95	$ 8,564	$ 11,329	$ 9,030 [-$334]	$ 9,746 [$382]	5,222	$ 8,763	$ 9,999	99	$ 193
3	$ 9,773	88.1	45,544	42,042	26.7	4,813	52%	7.86	$ 9,288	$ 11,462	$ 9,608 [-$294]	$ 10,237 [$336]	5,737	$ 9,244	$ 10,406	195	$ 204
4	$ 9,618	79.5	25,649	24,932	15.0	2,700	48%	7.90	$ 9,135	$ 11,392	$ 9,295 [-$287]	$ 9,903 [$321]	5,512	$ 9,104	$ 10,249	74	$ 242
5	$ 9,711	69.8	25,383	24,881	14.8	2,676	64%	7.57	$ 9,590	$ 11,275	$ 9,447 [-$280]	$ 10,039 [$312]	6,088	$ 9,017	$ 10,442	55	$ 256
6	$ 9,262	76.1	18,622	25,645	10.9	1,970	54%	7.95	$ 8,517	$ 11,226	$ 8,952 [-$324]	$ 9,629 [$352]	5,136	$ 8,730	$ 9,909	88	$ 185

Strategies

- **1.** No Early Retirement
- **2.** Pete Refuel to 100% Natural Gas (est. 2025)
- **3.** One Pete Unit Retires in 2026
- **4.** Both Pete Units Retire in 2026 & 2028
- **5.** “Clean Energy Strategy” – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- **6.** Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

Opportunities for our people



CONVERSION

→ Jobs to support the conversion from coal to natural gas

RENEWABLES

→ Jobs to support new renewables added on-site

TRANSMISSION AND DISTRIBUTION

→ Jobs to maintain transmission and distribution

CONSTRUCTION

→ Jobs to build and expand infrastructure

New opportunities and continued economic impact

Preferred Resource Portfolio & Short-Term Action Plan

Erik Miller, Manager, Resource Planning, AES Indiana

Preferred Resource Portfolio

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and add up to ~1,300 MW of wind, solar and storage by 2027

Affordability

- → Provides the least cost to customers over the 20-year planning horizon by lowering the fixed cost at Petersburg through the economic conversion of the remaining Petersburg units from coal to natural gas.
- → Demonstrates lowest annual PVRR relative to other portfolios over the 20-year planning horizon.

Environmental Sustainability

- → Delivers the quickest exit from coal-fired generation (in 2025) which provides the lowest 20-year AES Indiana generation portfolio emissions for SO2, NOx, water use and coal combustion products, and the second lowest emissions for CO2.

Reliability, Stability & Resiliency

- → Offers1-for-1 replacement dispatchable capacity (UCAP) for Petersburg that economically and effectively delivers in meeting MISO’s Seasonal Resource Adequacy Construct.
- → Provides firm unforced capacity when needed which will allow AES Indiana to responsibly and gradually transition to renewable energy resources over the planning horizon.
- → Demonstrates the highest composite reliability score while still delivering significant renewable generation investment.

Preferred Resource Portfolio *(continued)*

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and add up to ~1,300 MW of wind, solar and storage by 2027

Risk & Opportunity

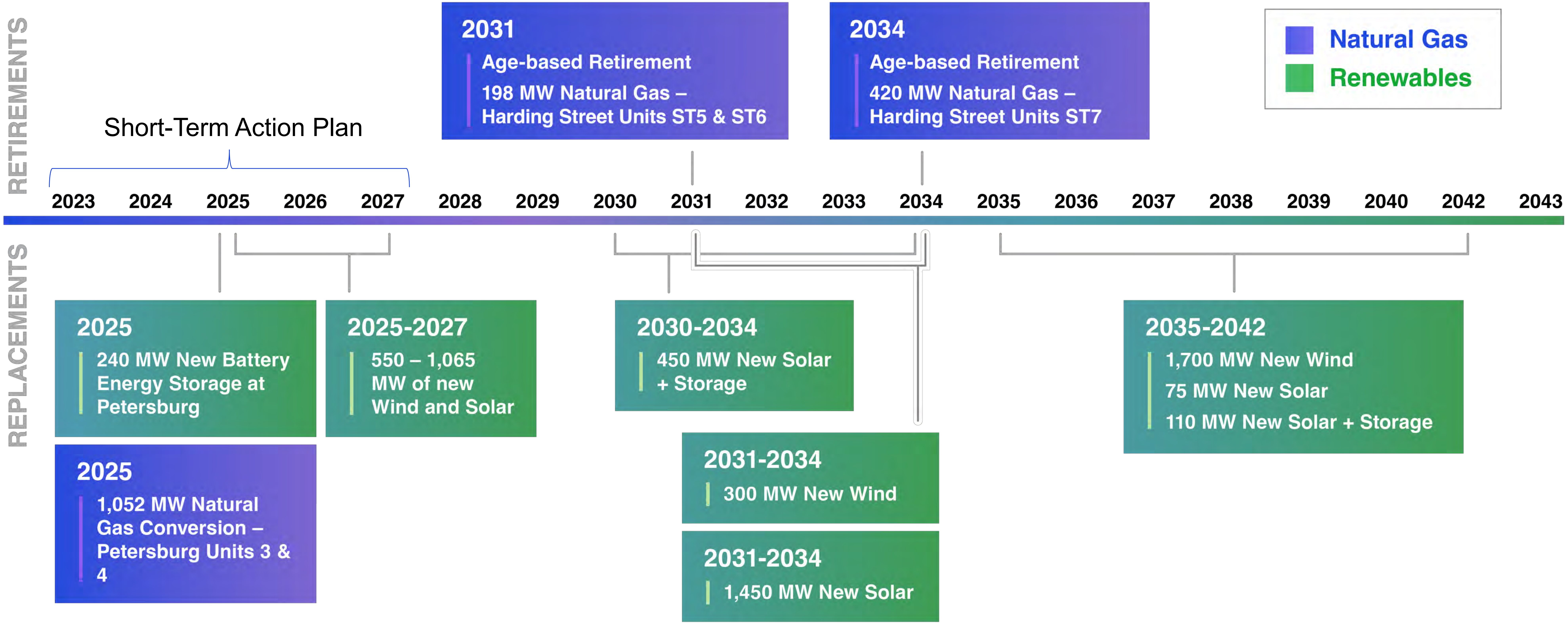
→ Provides best general performance across risk and opportunity metrics.

Economic Impact

→ Continues to contribute economically to the Petersburg community by leveraging existing infrastructure and maintaining operation of the Petersburg Generating Station as a gas resource and hub for renewable resources.

Preferred Resource Portfolio

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and build ~1,300 MW of renewables by 2027



🟪 Natural Gas
🟩 Renewables

RETIREMENTS

2031
Age-based Retirement
198 MW Natural Gas – Harding Street Units ST5 & ST6

2034
Age-based Retirement
420 MW Natural Gas – Harding Street Units ST7

Short-Term Action Plan

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2042 2043

REPLACEMENTS

2025
240 MW New Battery Energy Storage at Petersburg

2025
1,052 MW Natural Gas Conversion – Petersburg Units 3 & 4

2025-2027
550 – 1,065 MW of new Wind and Solar

2030-2034
450 MW New Solar + Storage

2031-2034
300 MW New Wind

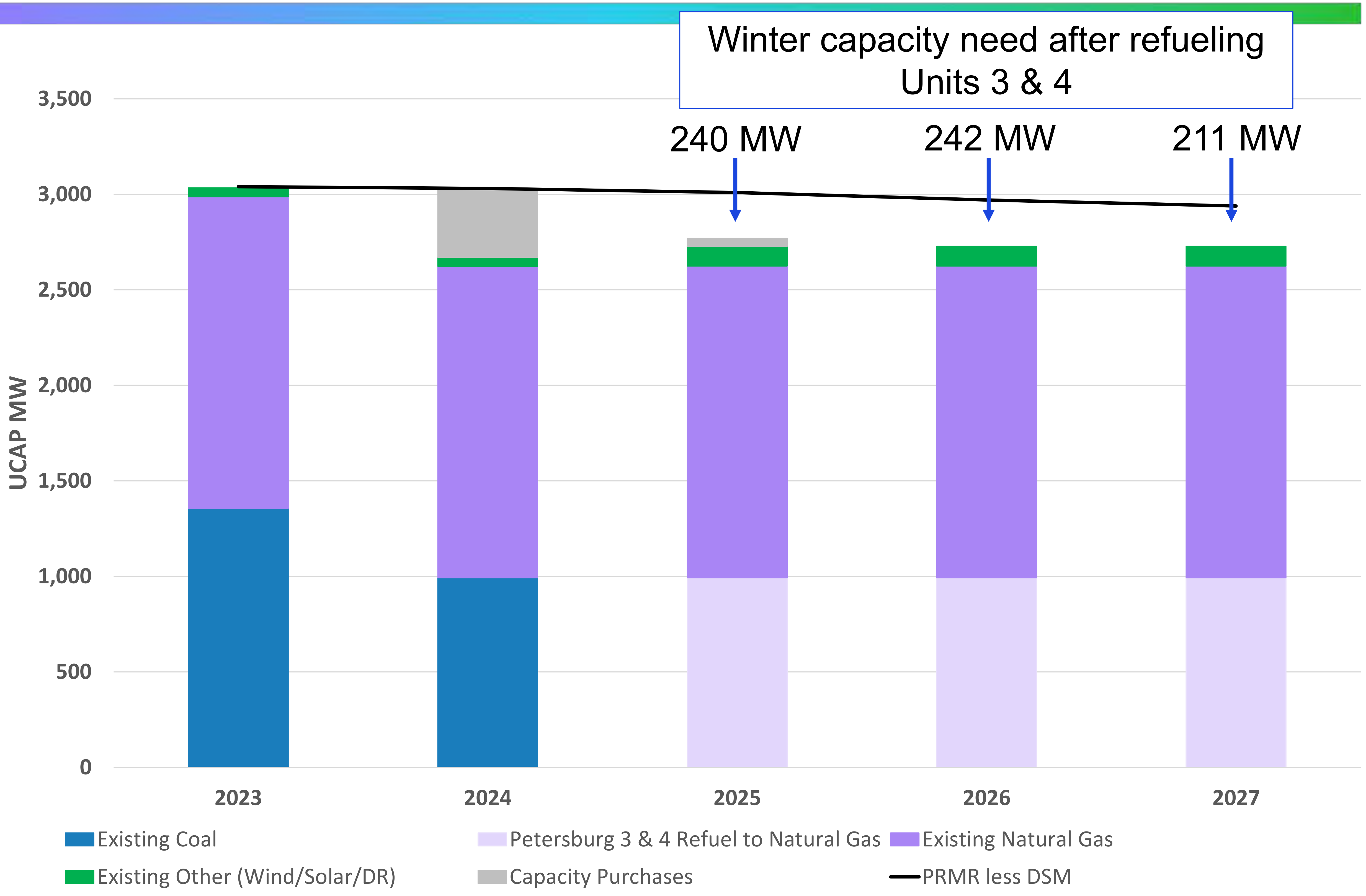
2031-2034
1,450 MW New Solar

2035-2042
1,700 MW New Wind
75 MW New Solar
110 MW New Solar + Storage

Winter capacity position after converting Petersburg to Natural Gas

Pete Conversion to 100% Natural Gas (est. 2025)

- → Refueling Units 3 & 4 provides 1-for-1 dispatchable replacement of the existing coal units.
- → AES Indiana still has a capacity need (~240 MW) in the winter under MISO's new seasonal construct with high winter reserve margin.
- → Company to fill the remaining capacity need with renewable generation based on model results.


Winter capacity need after refueling Units 3 & 4

240 MW

242 MW

211 MW

Short-Term Action Plan: 2023-2027

Convert Petersburg Coal Units 3 & 4 to Natural Gas in 2025 and add up to ~1,300 MW of wind, solar and storage by 2027

AES Indiana's short-term action plan balances reliability, affordability and sustainability by:

- Ceasing coal-fired generation in 2025 after converting Petersburg Units 3 and 4 to natural gas
- Adding up to 1,300 MW of renewable generation for capacity and energy, which includes:
  - 240 MW ICAP of battery energy storage at Petersburg to fill winter capacity position in 2025
  - 550 – 1,065 MW ICAP of wind and solar as energy replacement for Petersburg based on results from the base and low Replacement Resource Capital Cost Sensitivity Analysis
- Implementing three-year DSM action plan that targets an annual average of 130,000 – 134,000 MWh of energy efficiency (approximately 1.1% of 2021 sales) and three-year total of 75 MW summer peak impacts of demand response

Pete Conversion Strategy using **Base** Replacement Resource Costs
(presented in MW ICAP)

Replacements	*2023*	*2024*	*2025*	*2026*	*2027*
Pete Conversion to Natural Gas	0	0	1052	0	0
Wind	0	0	0	50	450
Solar	0	0	0	0	0
Storage	0	0	240	0	0
Solar + Storage	0	0	45	0	0

Pete Conversion Strategy using **Low** Replacement Resource Costs
(presented in MW ICAP)

Replacements	*2023*	*2024*	*2025*	*2026*	*2027*
Pete Conversion to Natural Gas	0	0	1052	0	0
Wind	0	0	0	200	700
Solar	0	0	75	0	0
Storage	0	0	240	0	0
Solar + Storage	0	0	90	0	0

AES Indiana plans to procure a range of renewables as energy replacement for Petersburg based on results from the Base and Low Replacement Resource Capital Cost Sensitivity Analysis. If renewables can be procured at a cost closer to the low-cost sensitivity, then AES Indiana will pursue a quantity consistent with the low sensitivity.

DSM Short Term Action Plan

DSM Results

Energy Efficiency:

	Vintage 1 2024 - 2026	Vintage 2 2027 – 2029	Vintage 3 2030 - 2042
Residential	Efficient Products - Lower Cost	Lower Cost Residential (excluding Income Qualified Weatherization (IQW))	Lower Cost Residential (excluding IQW)
	Efficient Products - Higher Cost		
	Behavioral		
	School Education	Higher Cost Residential (excluding IQW)	Higher Cost Residential (excluding IQW)
	Appliance Recycling		
	Multifamily		
	IQW	IQW	IQW
C&I	Prescriptive	C&I	C&I
	Custom		
	Custom RCx		
	Custom SEM		
Impacts	Avg Annual MWh	Avg Annual MWh	Avg Annual MWh
	131,578 - 134,263	141,526	146,428
	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out	% of 2021 Sales ex. Opt-Out
	1 - 1.1%	1.1%	1.2%
	Cumulative Summer MW	Cummulative Summer MW	Cummulative Summer MW
	87 - 89 MW	92 MW	303 MW

Demand Response:

	2026 - 2042
Residential	Direct Load Control
	Residential Rates
C&I	Direct Load Control
	C&I Rates
	Cumulative Summer MW
	75 MW

Note: Boxes highlighted in purple denote DSM bundles that were selected by Encompass

Affordability

Petersburg conversion to natural gas provides the lowest 20-yr PVRR and low PVRR volatility over the planning period

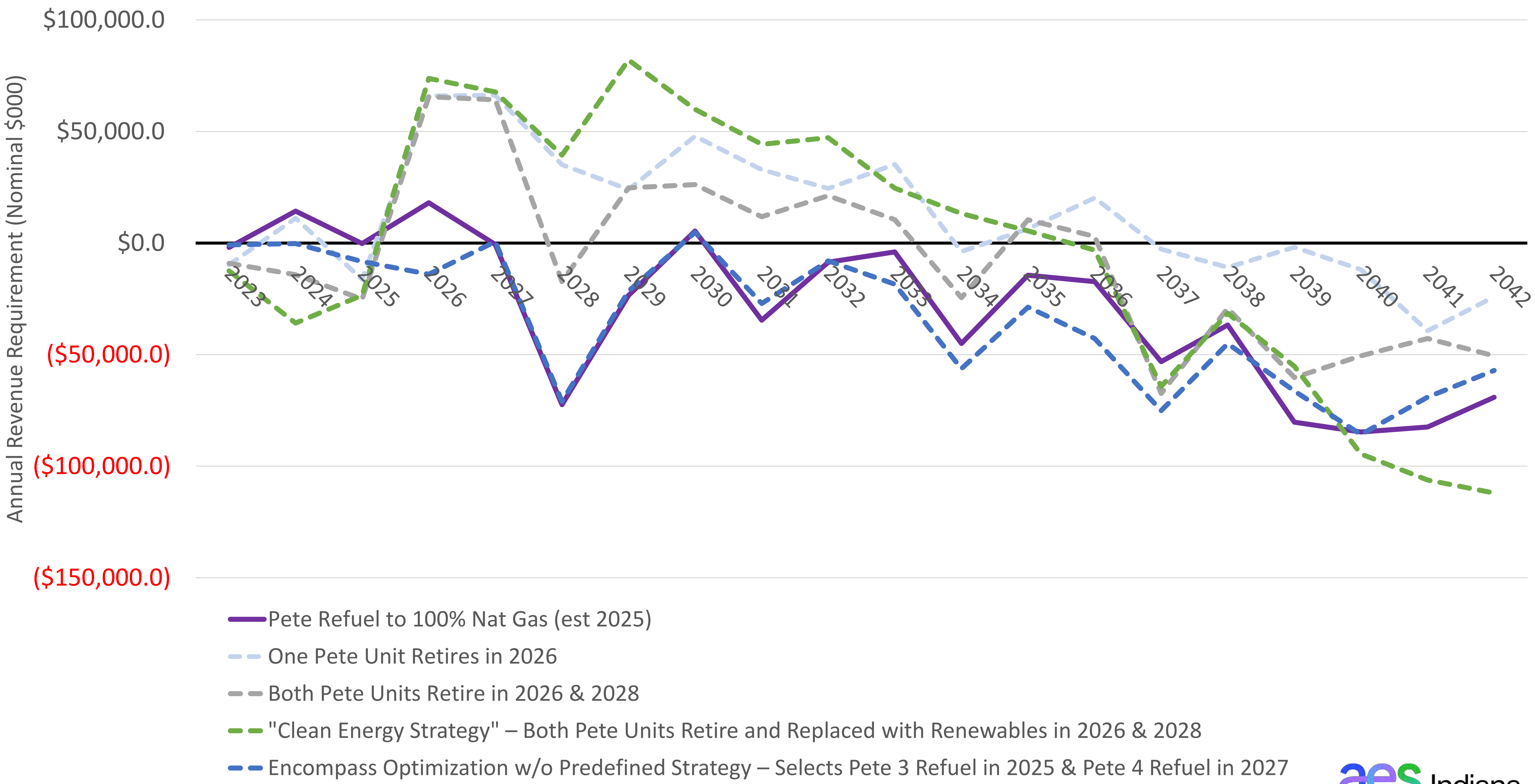
20-yr PVRR

	Present Value of Revenue Requirements (2023 $000,000)
1	$ 9,572
2	$ 9,330
3	$ 9,773
4	$ 9,618
5	$ 9,711
6	$ 9,262

Strategies

- **1.** No Early Retirement
- **2.** Pete Refuel to 100% Natural Gas (est. 2025)
- **3.** One Pete Unit Retires in 2026
- **4.** Both Pete Units Retire in 2026 & 2028
- **5.** "Clean Energy Strategy" – Both Pete Units Retire and replaced with Renewables in 2026 & 2028
- **6.** Encompass Optimization without Predefined Strategy – Selects Pete 3 Refuel in 2025 & Pete 4 Refuel in 2027

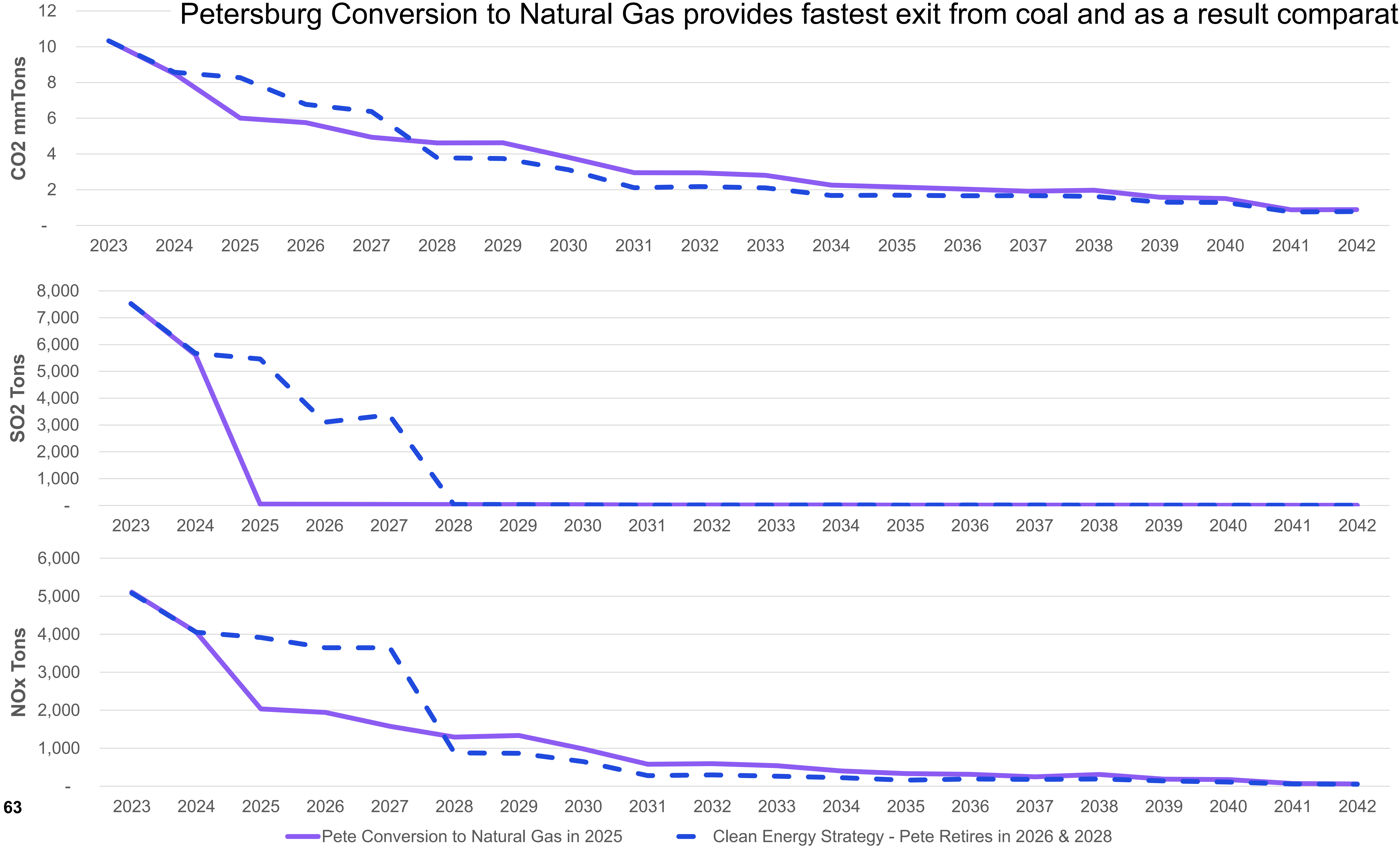
Compared to the No Retirement ("Status Quo") Scenario



Sustainability

Emissions Comparison – Petersburg Conversion vs Clean Energy Strategy

Petersburg Conversion to Natural Gas provides fastest exit from coal and as a result comparatively low emissions



CO2 mmTons	**2023 - 2032**	**2023 - 2042**
Pete Conversion	54	73
Clean Energy Strategy	55	70

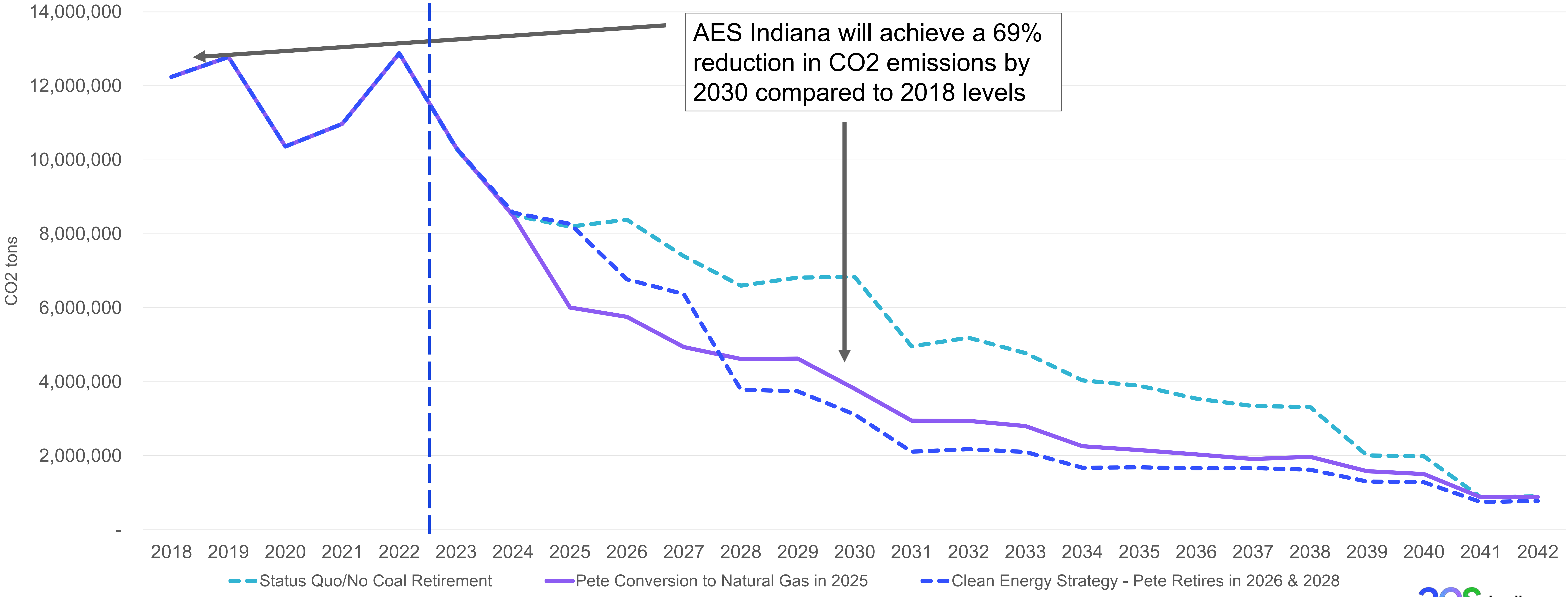
SO2 Tons	**2023 - 2032**	**2023 - 2042**
Pete Conversion	13,402	13,513
Clean Energy Strategy	25,254	25,383

NOx Tons	**2023 - 2032**	**2023 - 2042**
Pete Conversion	19,501	22,146
Clean Energy Strategy	23,303	24,881

Sustainability

AES Indiana Generation Portfolio CO2 Emissions Projections

Converting Petersburg Units 3 & 4 to natural gas effectively reduces CO2 emissions due to a low-capacity factor of Pete on natural gas combined with significant investment in renewables.



AES Indiana will achieve a 69% reduction in CO2 emissions by 2030 compared to 2018 levels

City of Indianapolis Recommendations for AES Indiana's 2022 IRP

City of Indianapolis Recommendations	AES Indiana Response
The City of Indianapolis seeks a resource mix with renewable generation capacity that aligns with the goals of the City and community. *City recommends AES Indiana develop a model with multiple scenarios that achieve a 62.8% reduction over 2018 emissions levels, in order to align with the City's Science Based Target's for 2030.*	AES Indiana's Preferred Resource Portfolio achieves a 69% reduction in CO2 emissions in 2030 compared to 2018 levels. The portfolio provides affordable, reliable and sustainable energy to Indianapolis residents.
The City of Indianapolis strongly supports AES Indiana's use of "all-source" procurement for future capacity additions to ensure cost-effective, market-driven innovation.	AES Indiana will fill it's need for replacement capacity identified in the Short-Term Action Plan through all-source RFPs. The Company will pursue the most cost effective and viable wind, and storage projects through this process.
The City of Indianapolis encourages AES Indiana to expand offerings of and access to energy efficiency programs targeting those with the highest energy burden.	AES Indiana has identified energy efficiency as a cost-effective energy resource and will work to develop a new energy efficiency program plan to start in 2024 - 2026. Based on current IRP modeling results we expect our new plan will continue to have an emphasis on programs that provide energy savings to all customers, with added emphasis on programs that benefit low- and moderate-income households.
The City of Indianapolis encourages AES Indiana to support a Just Transition for each Indiana community.	AES Indiana will continue to invest in new technologies and identify clean energy projects that deliver greener, smarter energy solutions. AES Indiana remains invested in our communities through commitments to the workforce, charitable organizations and economic development. Advanced modeling, additional economic impact metrics, greater transparency with stakeholders and increased accessibility to the IRP process allowed AES Indiana to paint a full picture of the potential impacts of each generation strategy and select a just and inclusive portfolio.
The City of Indianapolis requests that AES Indiana make energy performance and aggregated whole building data available to customers.	AES Indiana currently offers online tools that provide customers throughout our service territory with access to their energy usage data. These tools also provide recommendations to customers for managing their energy usage and costs through energy efficiency measures and programs. As AES Indiana expects the capabilities of our online tools will evolve to support additional customer friendly features that meet current and future data driven needs such as whole building data aggregation.

2022 IRP Key Modeling Solutions

There were several significant events in 2022 that created challenges for IRP modeling.

Market Changes	Modeling Solutions
In 2022, FERC approved MISO's Seasonal Capacity Construct and MISO's Capacity Market cleared at CONE (Planning Reserve Auction – PRA)	Modeled a MISO's Seasonal Capacity Construct and included CONE as the capacity price in all four seasons
Inflated replacement resource capital costs identified through AES Indiana's 2022 RFP	Conducted Replacement Resource Sensitivity Analysis with low, base and high capital costs for replacement resources. Analysis optimized portfolios assuming a range of capital costs. Provides for flexibility in executing the Short-Term Action Plan if resources can be procured at a lower cost
Inflation Reduction Act of 2022 passed into law in August of 2022 which changed the ITC and PTC provisions for renewable resources	Included IRA assumptions in the Current Trends (Reference Case) Scenarios for candidate portfolio evaluation
Scarcity within the NOx allowance market brought on by uncertainty around CSAPR resulted in historically high NOx prices	Increased NOx price forecast in near-term to reflect current NOx allowance market volatility
Volatile commodities starting in early 2022 marked by inflated gas and power prices starting Feb/Mar 2022	Updated commodity curves using ICE Forward Curves from May 31, 2022 and Spring 2022 Horizon Fundamental Curves

Future Modeling Enhancements

2022 IPL IRP

- Focused modeling on viable renewable technologies – wind, solar & storage
- Conducted hourly dispatch modeling to capture portfolio PVRR
- Distribution System Planning analysis that assessed system constraints from emerging technologies
- Captured appropriate resource accreditation for non-dispatchable generation based on MISO guidance

Consideration for Future IRPs

- Model alternative replacement resource options such as hydrogen or SMRs if commercially viable
- Sub hourly modeling to capture additional PVRR benefits including ancillary services value of battery energy storage and reciprocating engines
- Enhanced Distribution System Planning that captures circuit-level value of distributed generation and DSM
- Include refinements made to non-dispatchable resource seasonal capacity credit such as seasonal ELCC

IRP SURVEY

- AES Indiana invites the public and stakeholders to provide feedback on the IRP process.
- Your responses will help AES Indiana ensure the 2022 IRP reflects a meaningful, objective look at our shared energy future.
- Input from this survey will be reviewed by members of the IRP team in advance of the final IRP report filing on or before Dec. 1, 2022, and to improve future IRPs.
- Your participation in this survey is confidential and completely voluntary.
- Responses will be collected until Nov. 13, 2022.
- The survey link will be shared in the chat.

Final Q&A and Next Steps

Public Advisory Meeting

Public Advisory Meeting #1	Public Advisory Meeting #2	Public Advisory Meeting #3	Public Advisory Meeting #4	Public Advisory Meeting #5
Jan. 24, 2022	**April 12, 2022**	**June 27, 2022**	**Sept. 19, 2022**	**Oct. 31, 2022**

→ All meetings were made available for attendance via Teams.

→ A Technical Meeting was held the week preceding each Public Advisory Meeting for stakeholders with nondisclosure agreements. Tech Meeting topics focused on those anticipated at the proceeding Public Advisory Meeting.

→ Meeting materials can be accessed at ***www.aesindiana.com/integrated-resource-plan***.

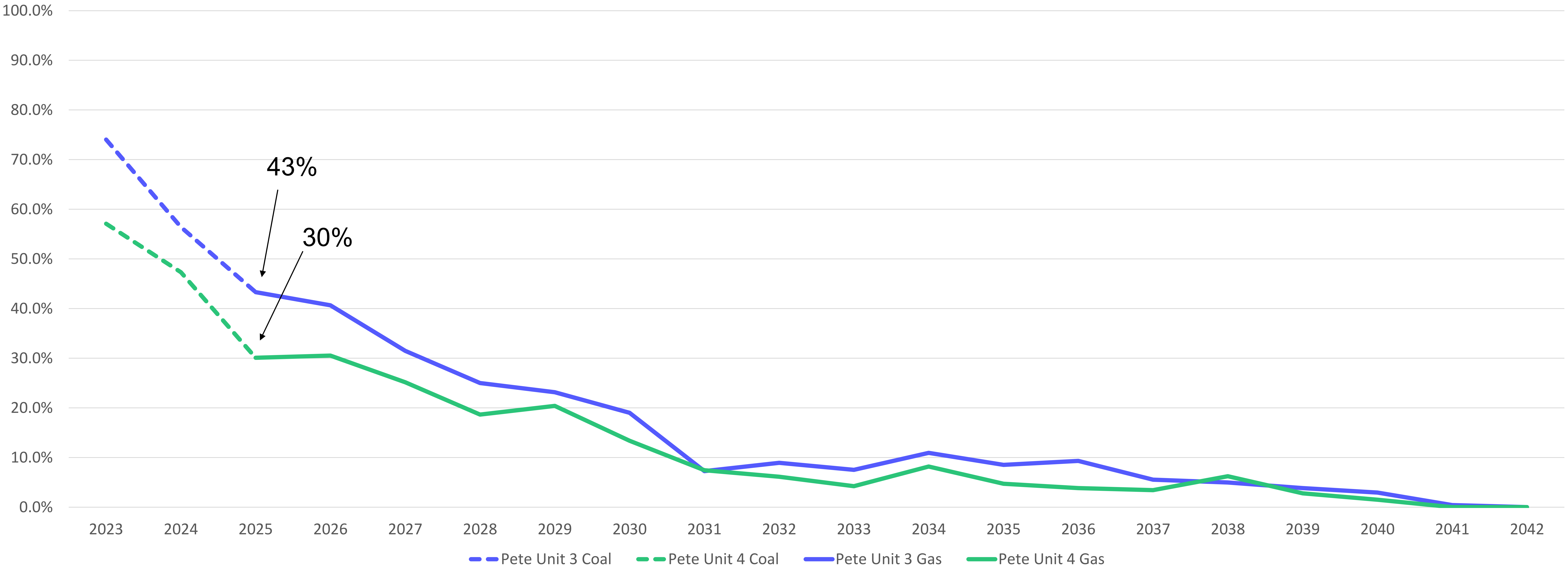
→ ***IRP Report will be filed with the IURC December 1, 2022***

Thank You

Appendix

Petersburg Capacity Factors Pre vs Post Gas Conversion

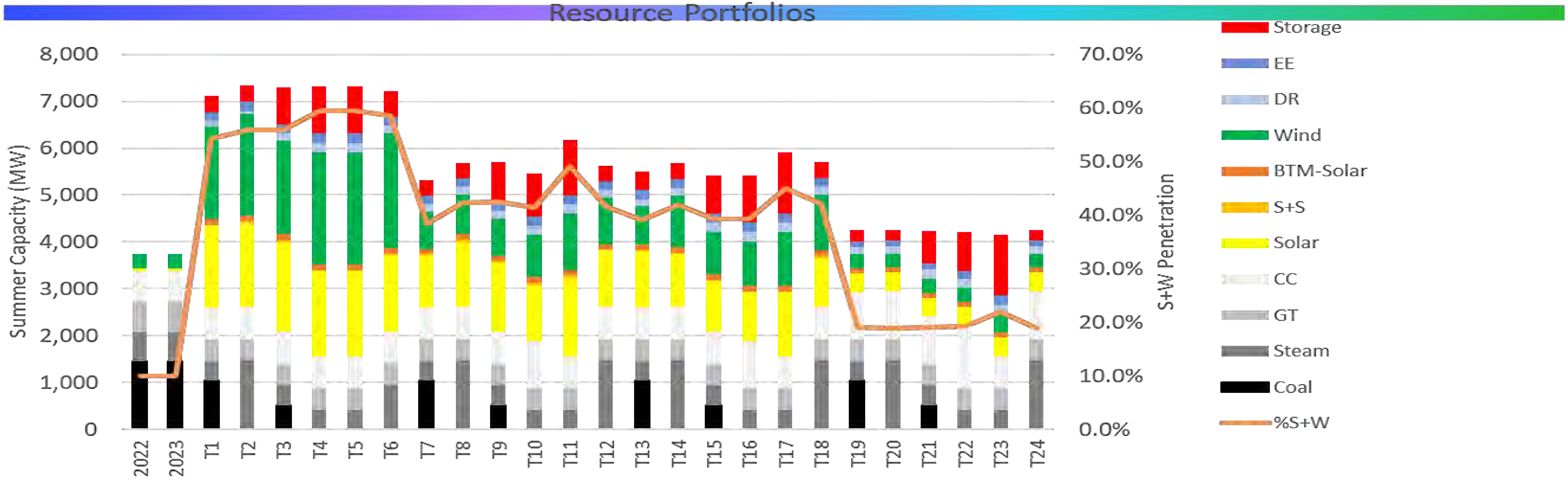
Converting Petersburg to natural gas results in significant drop in capacity factor that continues over the planning period.



Quanta Analysis - Appendix 1

All Portfolios

Portfolios (T1-T24)



	Aggressive Environmental						Current Trends						Decarbonization						No Environmental					
	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz
Disp %	43	42	42	38	38	39	58	55	54	55	48	55	57	55	57	57	52	55	78	78	78	77	73	78
S&W %	54	56	56	59	59	59	38	42	43	41	49	42	39	42	39	39	45	42	19	19	19	19	22	19

Portfolio Resources

	Aggressive Environmental						Current Trends						Decarbonization						No Environmental					
	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz
Y2031 - All Resources	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**	**T11**	**T12**	**T13**	**T14**	**T15**	**T16**	**T17**	**T18**	**T19**	**T20**	**T21**	**T22**	**T23**	**T24**
Solar	1,755	1,780	1,905	1,805	1,805	1,630	1,105	1,380	1,480	1,180	1,655	1,205	1,205	1,130	1,080	1,030	1,355	1,055	405	405	405	405	405	405
BTM-Solar	124	124	124	124	124	124	110	110	110	110	110	110	124	124	124	124	124	124	102	102	102	102	102	102
Wind	1,950	2,150	2,000	2,400	2,400	2,450	800	850	800	900	1,200	1,000	800	1,100	900	950	1,150	1,200	300	300	300	300	400	300
S+S	25	50	50	25	25	25	25	60	35	69	69	25	25	25	25	25	25	25	0	0	0	0	0	0
Storage	333	345	785	1,013	1,013	553	333	313	840	920	1,180	313	393	333	813	1,013	1,293	333	240	240	680	820	1,280	240
Steam	420	1,472	420	420	420	946	420	1,472	420	420	420	1,472	420	1,472	420	420	420	1,472	420	1,472	420	420	420	1,472
GT	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464
CC	680	680	680	680	680	680	680	680	680	1,005	680	680	680	680	680	1,005	680	680	1,005	1,005	1,005	1,330	680	1,005
Coal	1,040	0	520	0	0	0	1,040	0	520	0	0	0	1,040	0	520	0	0	0	1,040	0	520	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EE	195	195	195	195	195	195	195	194	194	194	195	195	195	195	195	195	195	194	118	118	136	165	194	119
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DR	121	73	154	198	198	154	154	154	154	198	198	154	154	154	198	198	198	154	154	154	198	198	198	154
ICAP (MW) - Total	**7,106**	**7,333**	**7,296**	**7,322**	**7,322**	**7,220**	**5,325**	**5,676**	**5,696**	**5,460**	**6,170**	**5,617**	**5,499**	**5,676**	**5,417**	**5,422**	**5,902**	**5,700**	**4,247**	**4,259**	**4,229**	**4,203**	**4,142**	**4,260**
Conventional (MW)	2,604	2,616	2,084	1,564	1,564	2,090	2,604	2,616	2,084	1,889	1,564	2,616	2,604	2,616	2,084	1,889	1,564	2,616	2,929	2,941	2,409	2,214	1,564	2,941
Intermittent (MW)	3,854	4,104	4,079	4,354	4,354	4,229	2,040	2,390	2,415	2,240	3,015	2,340	2,154	2,379	2,129	2,129	2,654	2,404	807	807	807	807	907	807
Storage (MW)	333	345	785	1,013	1,013	553	333	313	840	920	1,180	313	393	333	813	1,013	1,293	333	240	240	680	820	1,280	240
% Renewable Penetration	70%	76%	74%	81%	81%	80%	35%	40%	41%	39%	52%	41%	36%	42%	37%	37%	46%	43%	13%	13%	13%	13%	15%	13%
% Intermittent	54%	56%	56%	59%	59%	59%	38%	42%	43%	41%	49%	42%	39%	42%	39%	39%	45%	42%	19%	19%	19%	19%	22%	19%

Scorecard – Portfolio Scores

			Aggressive Environmental						Current Trends						Decarbonization						No Environmental					
			Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz
	Year 2031		**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**	**T11**	**T12**	**T13**	**T14**	**T15**	**T16**	**T17**	**T18**	**T19**	**T20**	**T21**	**T22**	**T23**	**T24**
1	Energy Adequacy	Loss of Load Hours (LOLH) - normal system, 50/50 forecast	1	1	1	0	0	1	1	1	0	0	0	1	1	1	0	1	0	1	1	1	1	0	0	1
		Expected Energy not Served (GWh) - normal system 50/50 fcst	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		max MW Short (MW) - normal system 50/50 forecast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		max MW Short - loss of 50% of tieline capacity, 50/50 fcst	1	1	1	0	0	1	1	1	1	1/2	0	1	1	1	1	1	0	1	1	1	1	1	0	1
		max MW Short (islanded, 50/50 forecast)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		max MW Short (normal system, 90/10 forecast)	1/2	1/2	0	0	0	0	1/2	1/2	0	0	0	1/2	1/2	1/2	0	1/2	0	1/2	1/2	1/2	0	0	0	1/2
2	Operational Flexibility and Frequency Support	Inertia MVA-s	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1	1	1/2	1	1/2	1
		Inertial Gap FFR MW (% CAP)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
		Primary Gap PFR MW (% CAP)	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0
3	Short Circuit Strength	Inverter MWs passing ESCR limits (%) - Connected System	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Inverter MWs passing ESCR limits (%) - Islanded System	0	0	0	0	0	0	1	1	0	1/2	0	1	1	1	1/2	1/2	0	1	1	1	1	1	1	1
		Required Additional Synch Condensers MVA (when Connected)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Required Additional Synch Condensers MVA (when Islanded)	0	0	0	0	0	0	1	1	1/2	1/2	0	1	1	1	1/2	1/2	0	1	1	1	1	1	1	1
4	Power Quality	Compliance with Flicker limits when Connected (GE Flicker Curve or IEC Flicker Meter)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Compliance with Flicker limits when Islanded	1	1	1	1/2	1/2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Required Synchronous Condensers MVA to mitigate Flicker	1	1	1	1/2	1/2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Blackstart	Qualitative Assessment of Ability to Blackstart the system	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Dynamic VAR Support	Dynamic VAR to load Center Capability (% of Peak Load)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	Dispatchability and Automatic Generation Control	Dispatchable (%CAP)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Unavoidable VER Penetration %	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Increased Freq Regulation Requirements (% Peak Load)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		1-min Ramp Capability (MW)	1/2	1/2	1	1	1	1	1/2	1/2	1	1	1	1/2	1/2	1/2	1	1	1	1/2	1/2	1/2	1	1	1	1/2
		10-min Ramp Capability (MW)	0	0	0	1/2	1/2	0	0	0	1/2	1/2	1/2	0	0	0	1/2	1/2	1	0	0	0	1/2	1/2	1	0
8	Predictability and Firmness	Ramping Capability to Mitigate Forecast Errors (+Excess/-Deficit) (%VER MW)	1/2	1/2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	Location	Average Number of Evacuation Paths	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Energy Adequacy		0.92	0.92	0.83	0.50	0.50	0.83	0.92	0.92	0.67	0.58	0.50	0.92	0.92	0.92	0.67	0.92	0.50	0.92	0.92	0.92	0.83	0.67	0.50	0.92
2	Dispatchability and Automatic Generation Control		0.70	0.70	0.80	0.90	0.90	0.80	0.70	0.70	0.90	0.90	0.90	0.70	0.70	0.70	0.90	0.90	1.00	0.70	0.70	0.70	0.90	0.90	1.00	0.70
3	Operational Flexibility and Frequency Support		0.33	0.33	0.67	0.67	0.67	0.33	0.33	0.33	0.67	0.67	0.67	0.33	0.33	0.33	0.67	0.67	0.67	0.33	0.50	0.50	0.67	0.83	0.67	0.50
4	Predictability and Firmness		0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Short Circuit Strength		0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	0.63	0.75	0.50	1.00	1.00	1.00	0.75	0.75	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Dynamic VAR Support		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	Location		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	Power Quality		1.00	1.00	1.00	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	Blackstart		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
		Cumulative Score (out of possible 9	6.95	6.95	7.80	7.23	7.23	7.47	7.95	7.95	7.86	7.90	7.57	7.95	7.95	7.95	7.98	8.23	7.67	7.95	8.12	8.12	8.40	8.40	8.17	8.12

QUANTA TECHNOLOGY

aes Indiana

Mitigations

	Aggressive Environmental						Current Trends						Decarbonization						No Environmental					
	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz	Quo	Refuel	1 Retire	2 Retire	Clean	Optimiz
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**	**T11**	**T12**	**T13**	**T14**	**T15**	**T16**	**T17**	**T18**	**T19**	**T20**	**T21**	**T22**	**T23**	**T24**
Equip Stand-alone ESS with GFM inverters (MW)	**124**	**93**	**178**	**123**	**123**	**164**	**129**	**99**	**183**	**49**	**128**	**98**	**129**	**98**	**183**	**49**	**128**	**98**	**53**	**23**	**107**	**221**	**133**	**23**
Additional Synchronous Condensers (MVA)	**1250**	**1500**	**1900**	**2700**	**2700**	**2050**	**0**	**0**	**350**	**300**	**1500**	**0**	**0**	**0**	**100**	**200**	**1100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Additional Power Mitigations (MW)	**323**	**322**	**178**	**123**	**123**	**164**	**298**	**326**	**183**	**49**	**128**	**325**	**239**	**310**	**183**	**49**	**128**	**310**	**370**	**378**	**107**	**221**	**133**	**378**
Increased Freq Regulation	90	97	97	105	105	101	39	48	49	45	66	47	42	48	41	41	56	49	9	9	9	9	11	9
Address Inertial Response Gaps	124	93	178	123	123	164	129	99	183	49	128	98	129	98	183	49	128	98	53	23	107	221	133	23
Address Primary Response Gaps	323	322	0	0	0	117	298	326	0	0	0	325	239	310	0	0	0	310	370	378	0	0	0	378
Firm up Intermittent Renewable Forecast	94	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

IRP Acronyms

Note: A glossary of acronyms with definitions is available at https://www.aesindiana.com/integrated-resource-plan.

IRP Acronyms

- ACEE: The American Council for an Energy-Efficient Economy
- AMI: Advanced Metering Infrastructure
- AD: Ad Valorem
- AD/CVD: Antidumping and Countervailing Duties
- ADMS: Advanced Distribution Management System
- BESS: Battery Energy Storage System
- BNEF: Bloomberg New Energy Finance
- BTA: Build-Transfer Agreement
- BTU: British Thermal Unit
- C&I: Commercial and Industrial
- CAA: Clean Air Act
- CAGR: Compound Annual Growth Rate
- CCGT: Combined Cycle Gas Turbines
- CCP: Coal Combustion Products
- CCS: Carbon Dioxide Capture and Storage
- CDD: Cooling Degree Day
- CIS: Customer Integrated System
- COD: Commercial Operation Date
- CONE: Cost of New Entry
- CP: Coincident Peak
- CPCN: Certificate of Public Convenience and Necessity
- CT: Combustion Turbine
- CVD: Countervailing Duties
- CVR: Conservation Voltage Reduction
- DER: Distributed Energy Resource
- DERA: Distributed Energy Resource Aggregation
- DERMS: Distributed Energy Resource Management System
- DG: Distributed Generation
- DGPV: Distributed Generation Photovoltaic System
- DLC: Direct Load Control
- DOC: U.S. Department of Commerce
- DOE: U.S. Department of Energy
- DR: Demand Response
- DRR: Demand Response Resource
- DSM: Demand-Side Management
- DMS: Distribution Management System
- DSP: Distribution System Planning
- EE: Energy Efficiency
- EFORd: Equivalent Forced Outage Rate Demand
- EIA: Energy Information Administration
- ELCC: Effective Load Carrying Capability
- EM&V: Evaluation Measurement and Verification
- ESCR: Effective Short Circuit Ratio
- ESPT: Energy Storage Planning Tool
- EV: Electric Vehicle
- FLOC: Functional Location
- FTE: Full-Time Employee
- GDP: Gross Domestic Product
- GFL: Grid-Following System
- GFM: Grid-Forming System
- GIS: Geographic Information System
- GT: Gas Turbine
- HDD: Heating Degree Day
- HVAC: Heating, Ventilation, and Air Conditioning
- IAC: Indiana Administrative Code
- IBR: Inverter-Based Resource
- IC: Indiana Code
- ICE: Intercontinental Exchange
- ICAP: Installed Capacity

IRP Acronyms

- IEEE: Institute of Electrical and Electronics Engineers
- IRA: Inflation Reduction Act
- IRP: Integrated Resource Plan
- ICE: Internal Combustion Engine
- IQW: Income Qualified Weatherization
- ITC: Investment Tax Credit
- IURC: Indiana Regulatory Commission
- kW: Kilowatt
- kWh: Kilowatt-Hour
- Li-ion: Lithium-ion
- MATS: Mercury and Air Toxics Standards
- MaxGen: Maximum Generation
- MDMS: Meter Data Management System
- MISO: Midcontinent Independent System Operator
- MMGAL: One Million Gallons
- MMTons: One Million Metric Tons
- MPS: Market Potential Study
- MS: Millisecond
- MVA: Mega Volt Ampere
- MW: Megawatt
- Nat Gas: Natural Gas
- NDA: Nondisclosure Agreement
- NOX: Nitrogen Oxides
- NPV: Net Present Value
- NREL: National Renewable Energy Laboratory
- NTG: Net to Gross
- OMS: Outage Management System
- PLL: Phase-Locked Loop
- PPA: Power Purchase Agreement
- PRA: Planning Resource Auction
- PSSE: Power System Simulator for Engineering
- PTC: Renewable Electricity Production Tax Credit
- PRMR: Planning Reserve Margin Requirement
- PV: Photovoltaic
- PVRR: Present Value Revenue Requirement
- PY: Planning Year
- RA: Resource Adequacy
- RAN: Resource Availability and Need
- RAP: Realistic Achievable Potential
- RCx: Retrocommissioning
- REC: Renewable Energy Credit
- REP: Renewable Energy Production
- RFP: Request for Proposals
- RIIA: MISO’s Renewable Integration Impact Assessment
- RPS: Renewable Portfolio Standard
- SCADA: Supervisory Control and Data Acquisition
- RTO: Regional Transmission Organization
- SAC: MISO’s Seasonal Accredited Capacity
- SAE: Small Area Estimation
- SCR: Selective Catalytic Reduction System
- SEM: Strategic Energy Management
- SO2: Sulfur Dioxide
- SMR: Small Modular Reactors
- ST: Steam Turbine
- SUFG: State Utility Forecasting Group
- T&D: Transmission and Distribution
- TOU: Time-of-Use
- TRM: Technical Resource Manual
- UCT: Utility Cost Test
- UCAP: Unforced Capacity
- VAR: Volt-Amp Reactive
- VPN: Virtual Private Network
- WTP: Willingness to Participate
- XEFORd: Equivalent Forced Outage Rate Demand excluding causes of outages that are outside management control