
2024 IRP Working Group

Meeting 12: August 5, 2024
Chattanooga, TN

Welcome and Safety Moment

Jo Anne Lavender; IRP Facilitator

Safety Moment

EMERGENCY ACTIONS

In case of Building Emergency

Exit out of the conference room doors, go down the stairs to the lobby, exit right out of the building and gather in the parking lot across the street.

In case of Severe Weather

You will be directed to an interior room.



Agenda – August 5, 2024

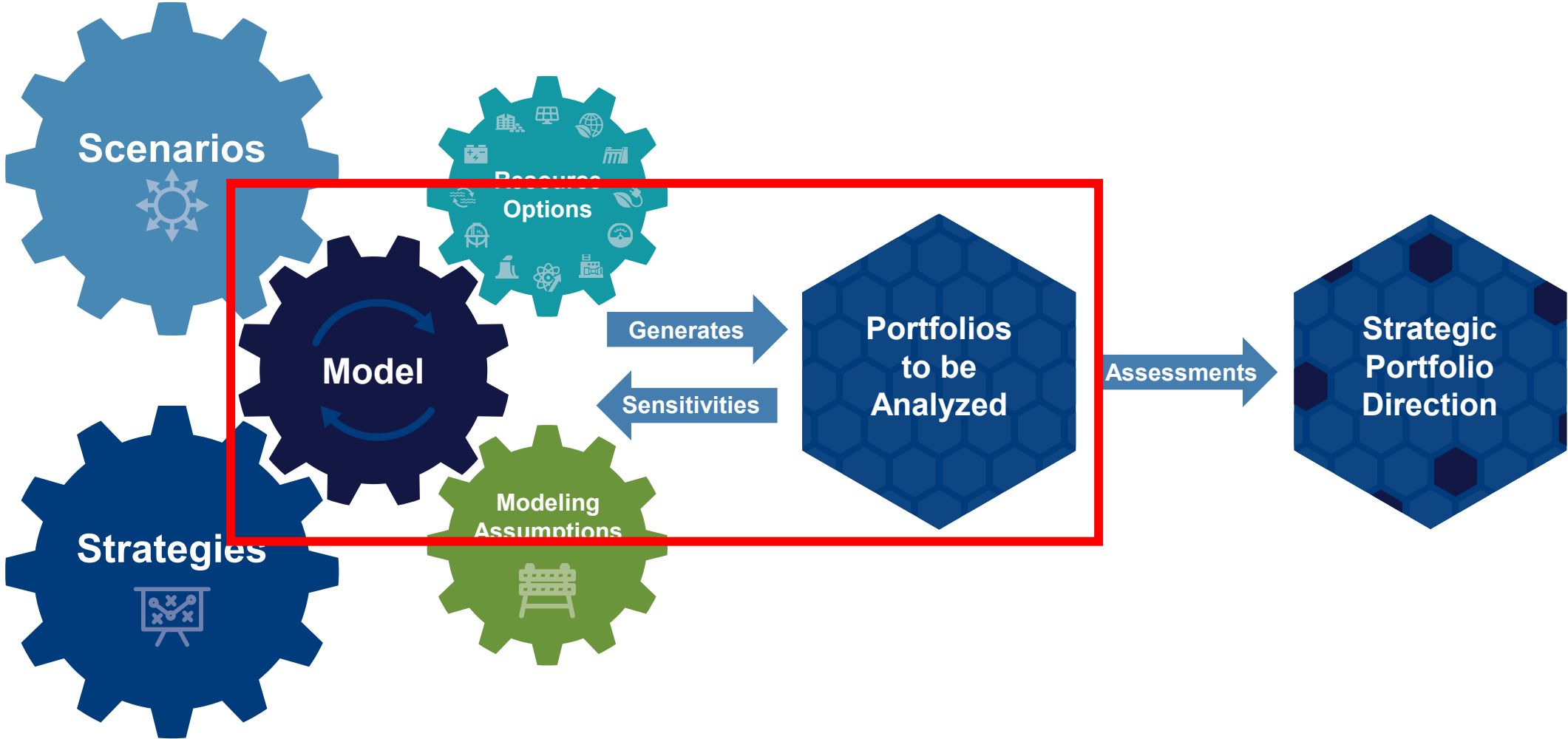
Topic	Time (ET)	Presenter(s)	Notes
Breakfast	8:00-9:00		
Welcome	9:00-9:15	Jo Anne Lavender	
Opening Remarks	9:15-9:45		Project updates, recent meeting recaps, etc.
IRP Draft Modeling Updates	9:45-10:30	Preeth Srinivasaraghavan	Updated Draft full case results, updated Draft IRP graphics
Break	10:30-10:45		
IRP Draft Modeling Updates (cont.)	10:45-11:45	Hunter Reed	
Lunch	11:45-1:00		
IRP Stakeholder Education and Engagement	1:00-2:00	Jane Elliott; Amy Reagan; Amy Edge	IRP website updates, new fact sheets, etc.
Recent IRP Feedback	2:00-2:30	Candy Kelly	Summary feedback from RERC and public engagement
Break	2:30-2:45		
Technology and Adoption Readiness Framework	2:45-3:45	Brad Chadwell; Scott Key; Daniel Sipe	Incorporation of DOE's technology readiness level and adoption readiness level in IRP study
Wrap-up	3:45-4:45	Jo Anne Lavender	

Opening Remarks

IRP Draft Modeling Updates

Preeth Srinivasaraghavan; Specialist III, Resource Strategy

How the Integrated Resource Planning Process Works



Stakeholder feedback is a key component in the development of all model inputs.

IRP Scenarios and Strategies

SCENARIOS



Reference (without Greenhouse Gas Rule)

Represents TVA's current forecast that reflects moderate population, employment, and industrial growth, weather-normal trends, growing electric vehicle use, and increasing efficiencies



Higher Growth Economy

Reflects a technology-driven increase in U.S. productivity growth that stimulates the national and regional economies, resulting in substantially higher demand for electricity



Stagnant Economy

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Carbon Regulation

Reflects the impact of May 2023 proposed greenhouse gas rules that target significant reductions in electric utility CO2 emissions beginning in 2030 and potential future regulations striving for net zero by 2050



Carbon Regulation Plus Growth

Reflects impact of proposed and potential future regulations along with substantial advancements in clean energy technologies, spurring economic growth and extensive electrification



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Reflects TVA's current forecast and incorporates the impact of greenhouse gas rules finalized in May 2024 that target significant reductions in electric utility CO2 emissions beginning in 2030

STRATEGIES



Baseline Utility Planning

Represents TVA's current outlook based on least-cost planning, incorporating existing programs and a planning reserve margin target. This reserve margin target applies in all strategies



Carbon-free Innovation Focus

Emphasizes and promotes emerging, firm and dispatchable carbon-free technologies through innovation, continued research and development, and strategic partnerships



Carbon-free Commercial Ready Focus

Emphasizes proven carbon-free technologies like wind, solar, and storage, at both utility-scale and through customer partnerships, along with strategic transmission investment



Distributed and Demand-side Focus

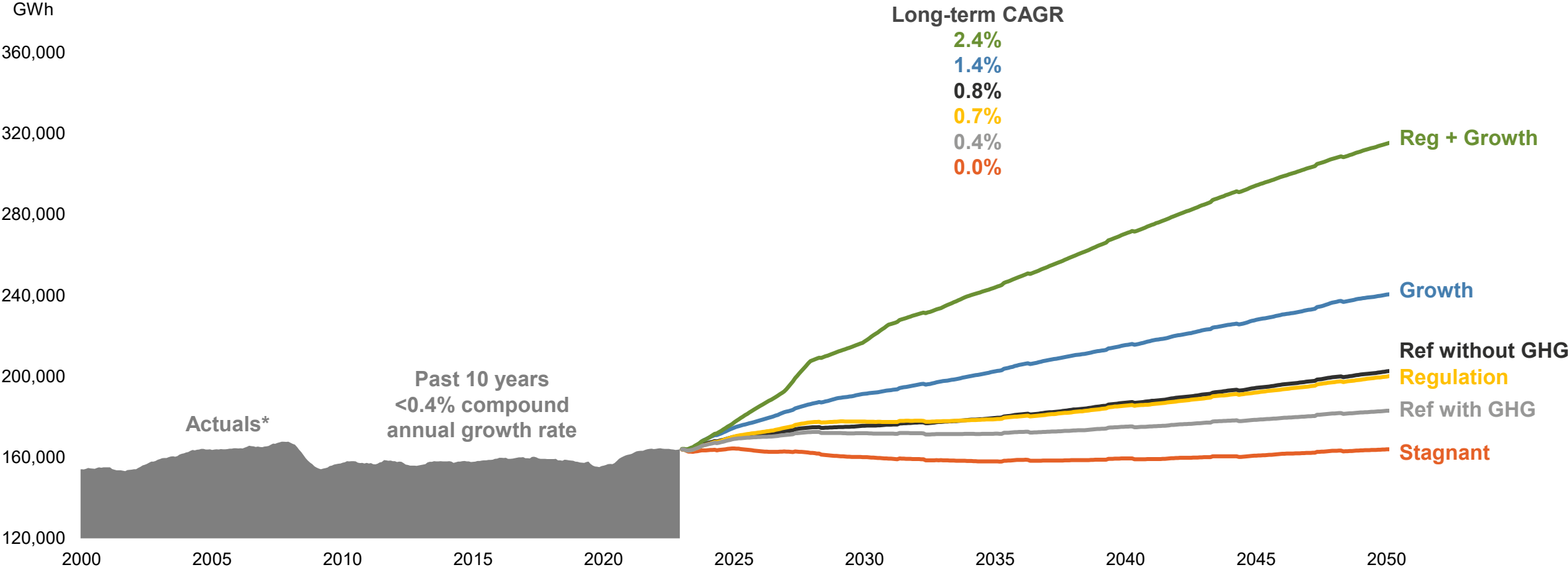
Emphasizes existing and potentially expanded customer partnerships and programmatic solutions to reduce reliance on central station generation and promote virtual power plants



Resiliency Focus

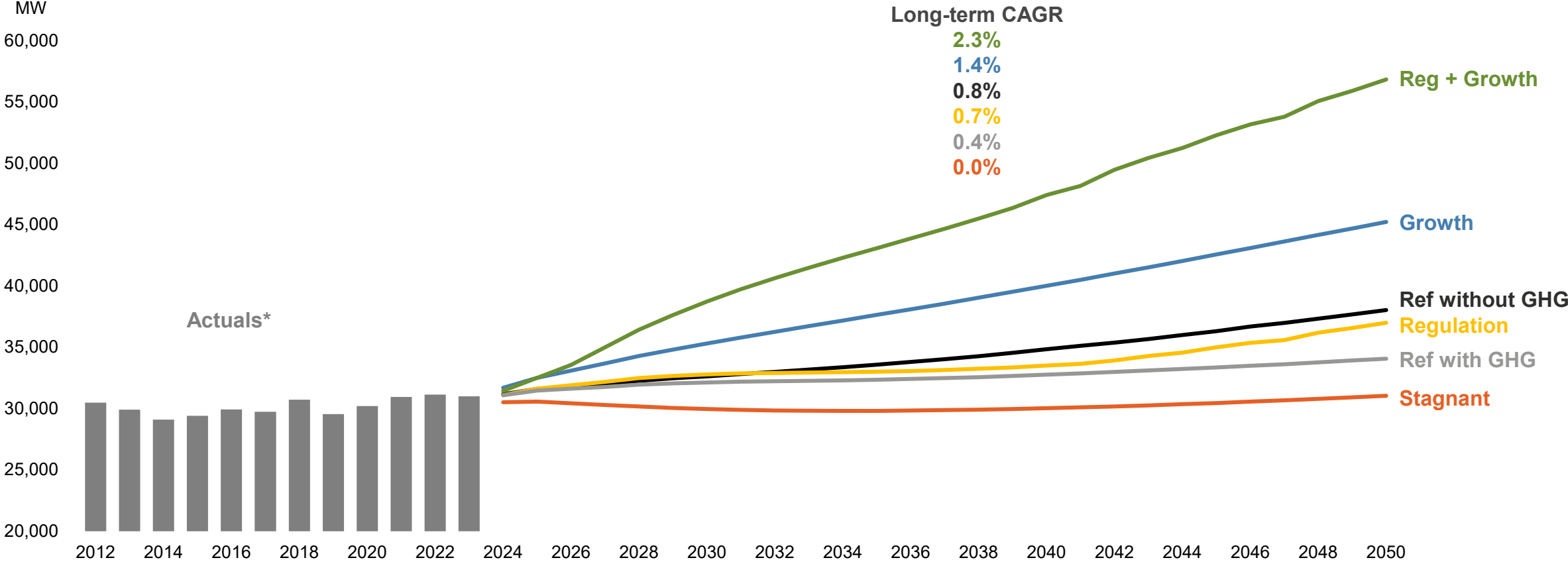
Emphasizes smaller units and the promotion of storage, along with strategic transmission investment, to drive wider geographic resource distribution and additional resiliency across the system

IRP Energy Demand Forecasts



* Weather normalized actuals. Excludes USEC

IRP Peak Demand Forecasts



* Weather normalized actuals. Excludes USEC

2024 IRP Core Cases

2024 IRP Core Case Matrix	A. Baseline Utility Planning	B. Carbon-Free Innovation Focus	C. Carbon-Free Commercial Ready Focus	D. Distributed and Demand Side Focus	E. Resiliency Focus
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Portfolio Results: 1 – Reference (without GHG Rule)



IRP Scenarios (Future Conditions)



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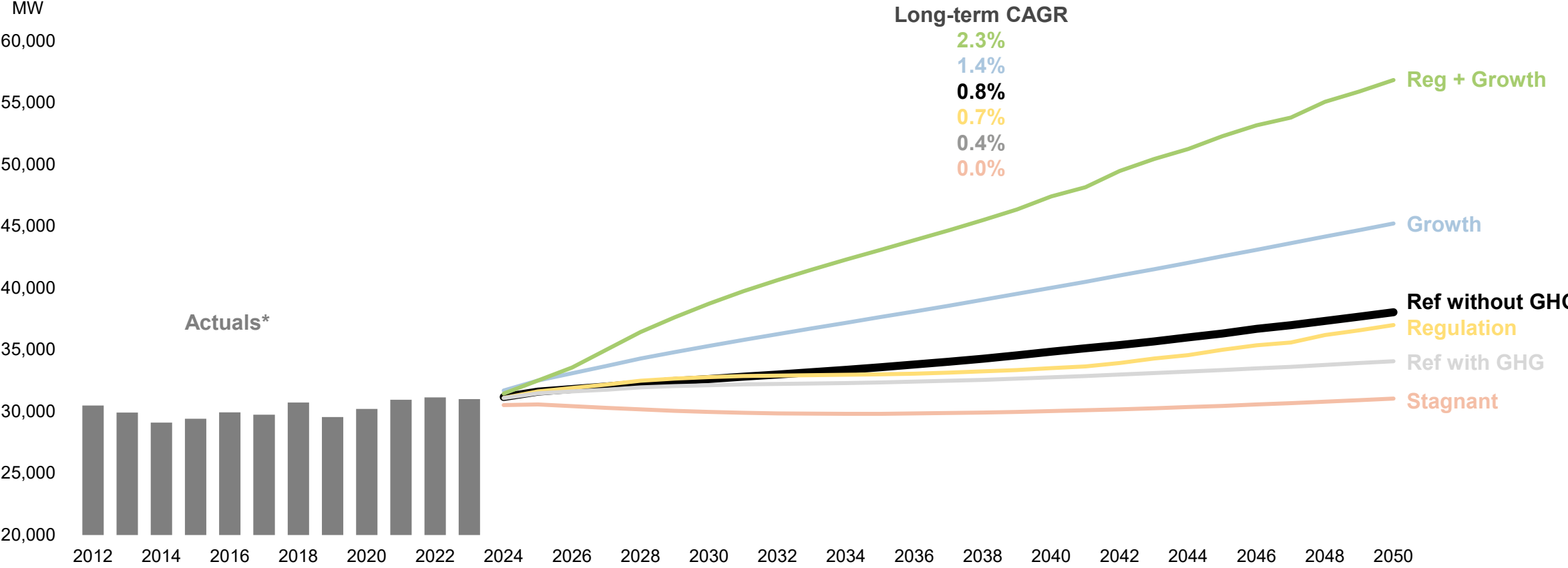
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IRP Peak Demand Forecasts



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Portfolio Results: 2 – Higher Growth Economy



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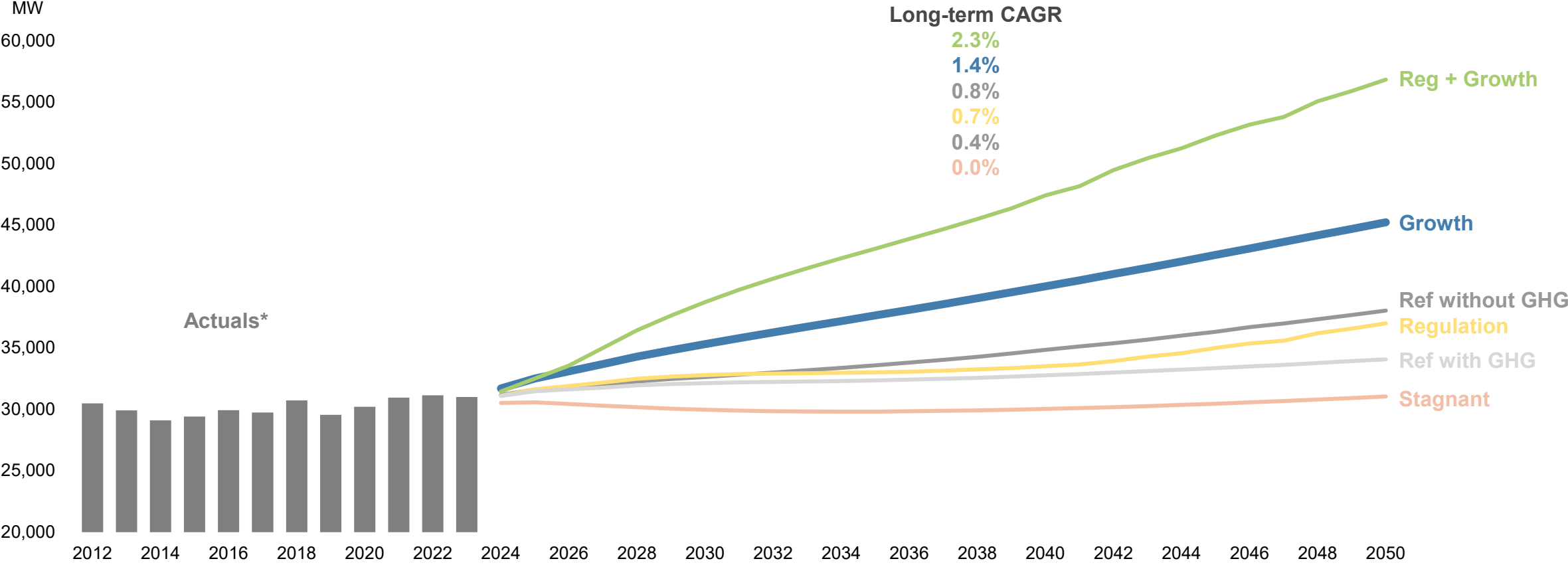
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IRP Peak Demand Forecasts



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Portfolio Results: 3 – Stagnant Economy



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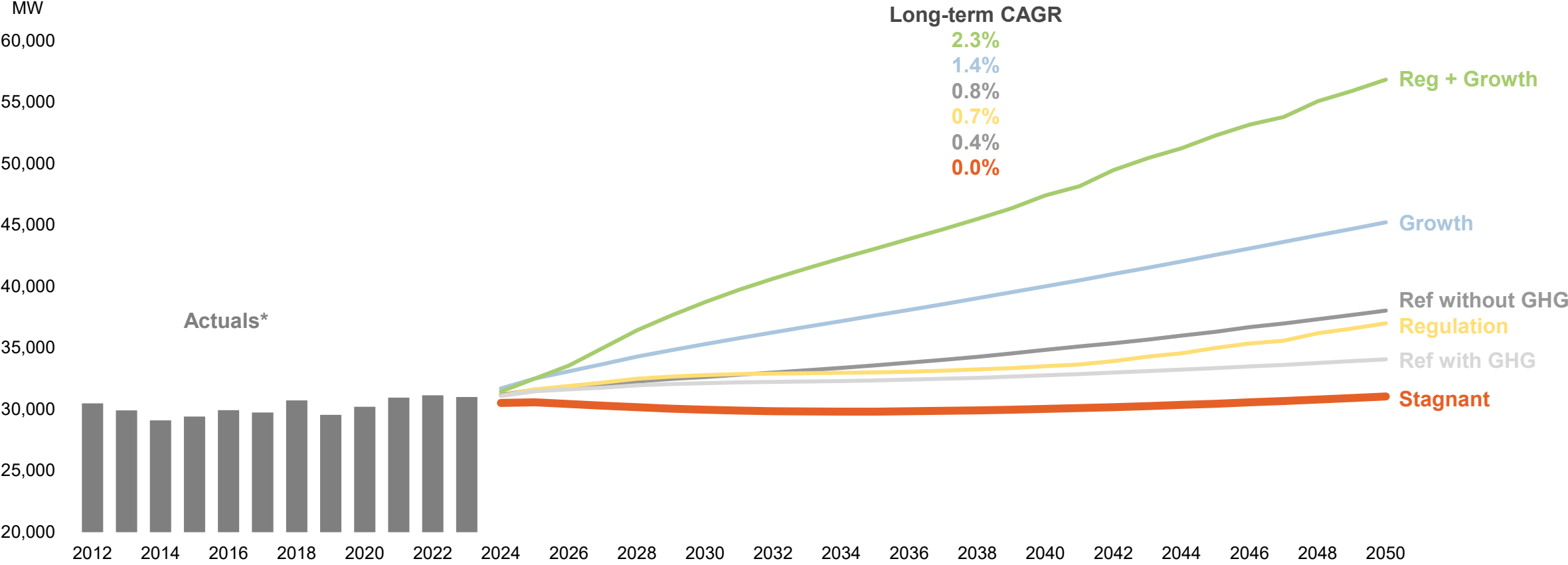
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IRP Peak Demand Forecasts



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Portfolio Results: 4 – Carbon Regulation



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2024 IRP Core Cases

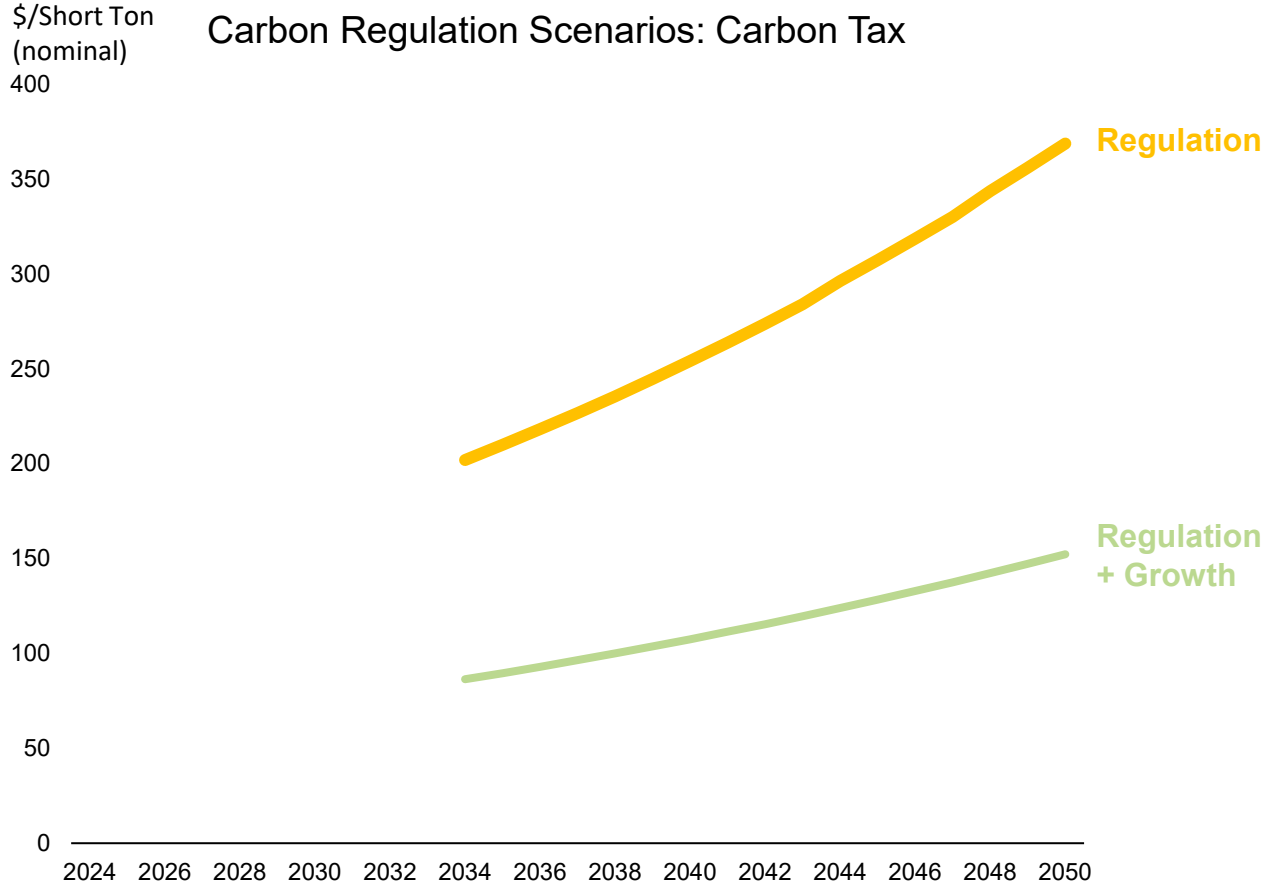
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Carbon Regulation Scenario: Major Assumptions

Resource cost forecasts remain the same as the Reference Case

Proposed EPA Greenhouse Gas Rules are implemented, requiring major changes to the operation of fossil fuel-based resources (phased impacts between 2030 and 2040)

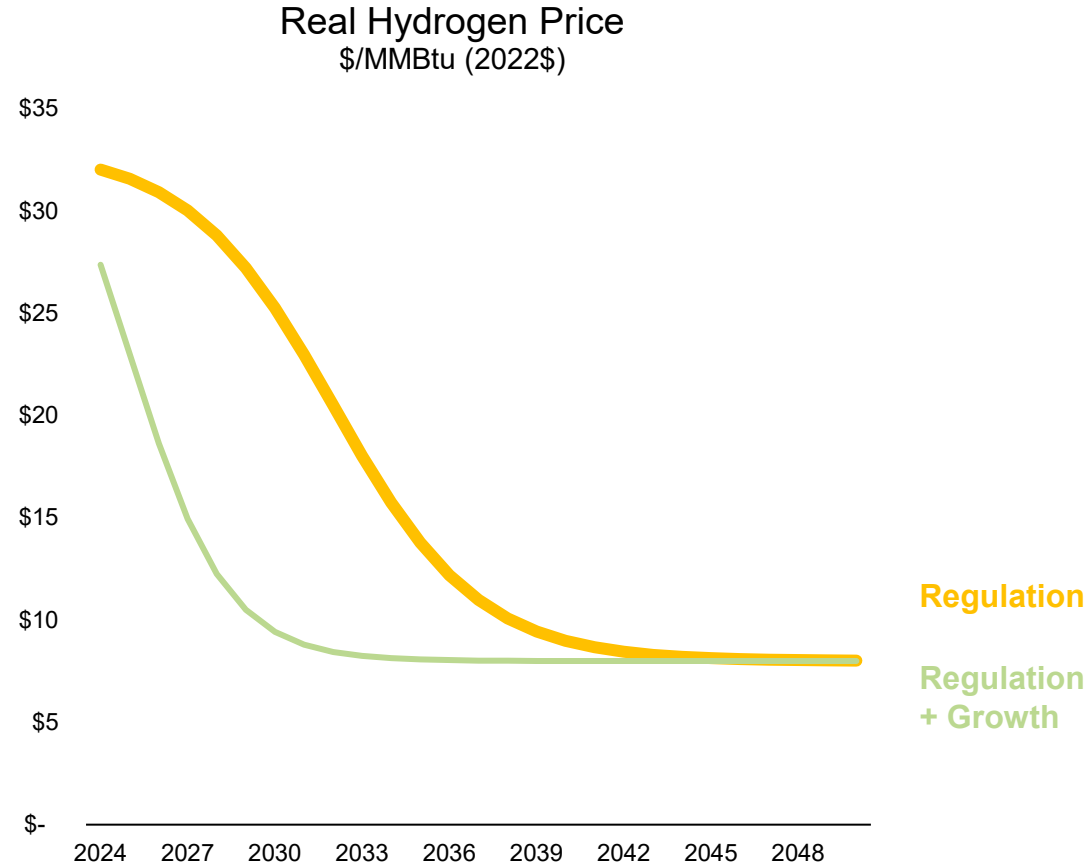
Starting in 2034, a Carbon Tax is applied using the draft EPA social cost of carbon at a 2.5% discount rate as a proxy (\$202/short ton in 2034)



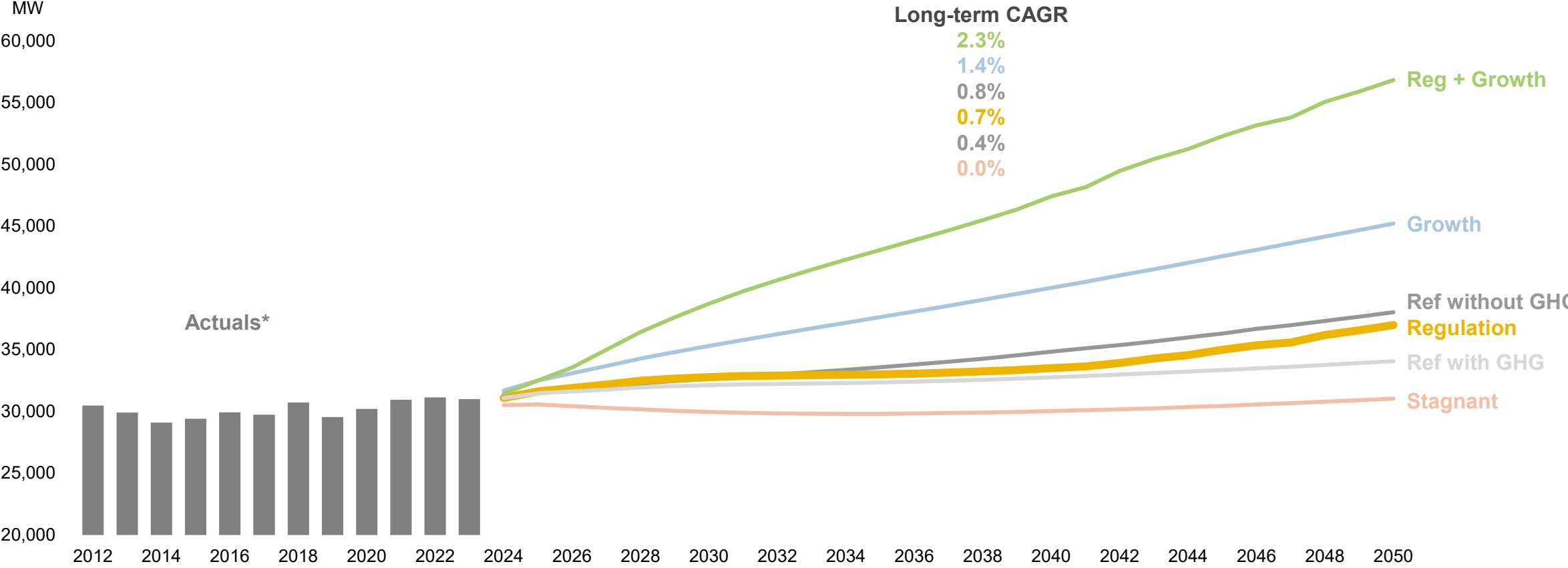
Hydrogen Price Assumptions

Market-delivered hydrogen reaches \$1/kg (\$8.70/MMBtu) by 2050

Prices are forecasted to fall slightly from current levels before a period of innovation results in dramatic price decreases until the \$1/kg target is ultimately achieved.



IRP Peak Demand Forecasts



* Weather normalized actuals. Excludes USEC



Portfolio Results: 5

5 – Carbon Regulation plus Growth



IRP Scenarios (Future Conditions)



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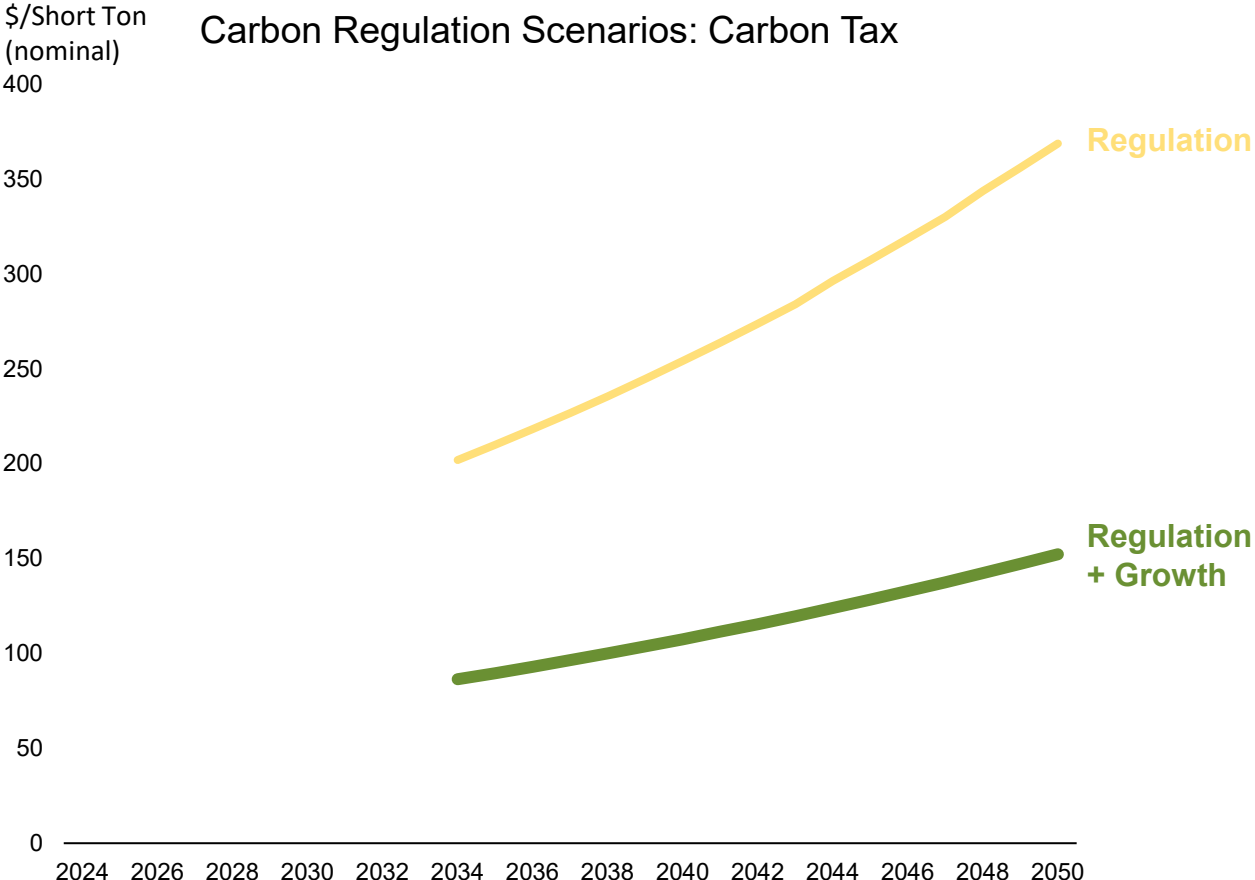
Carbon Regulation plus Growth Scenario: Major Assumptions

Resource cost forecasts are reduced to NREL advanced case

IRA tax credits increase to maximum value and do not expire

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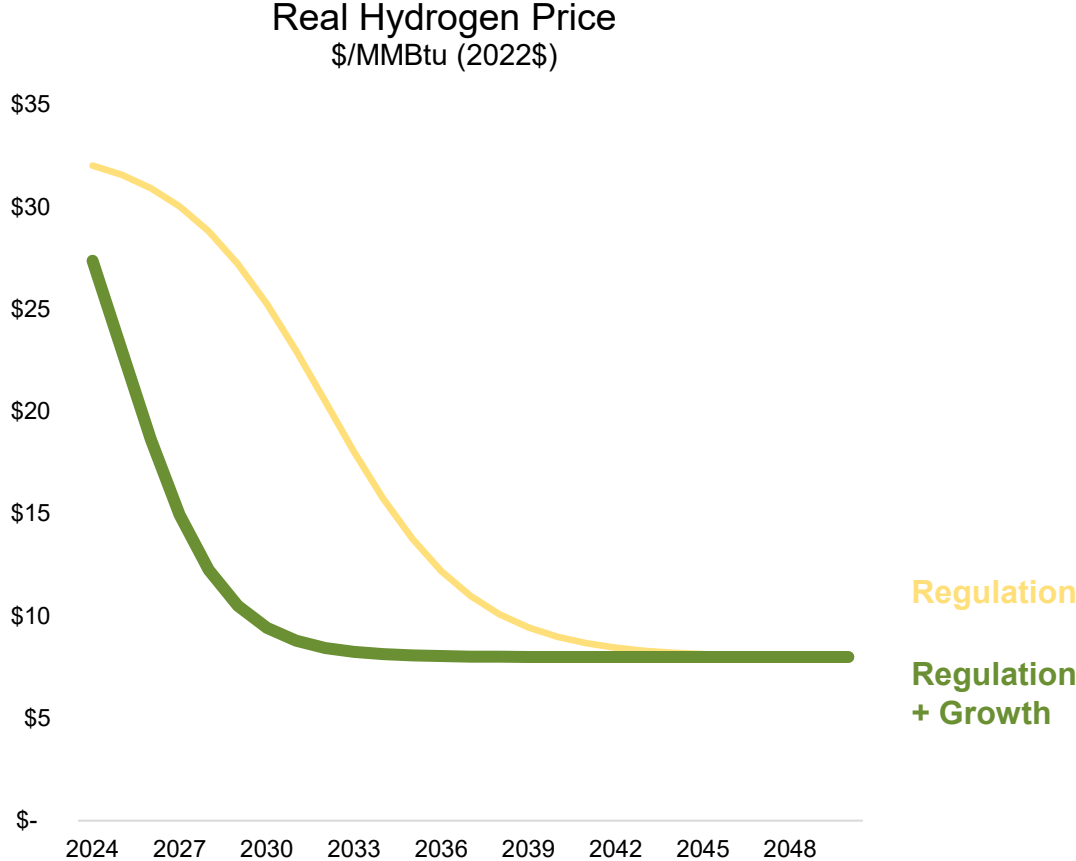
Starting in 2034, a Carbon Tax is applied using the 2021 White House interim social cost of carbon at a 3.0% discount rate as a proxy (\$86/short ton in 2034)



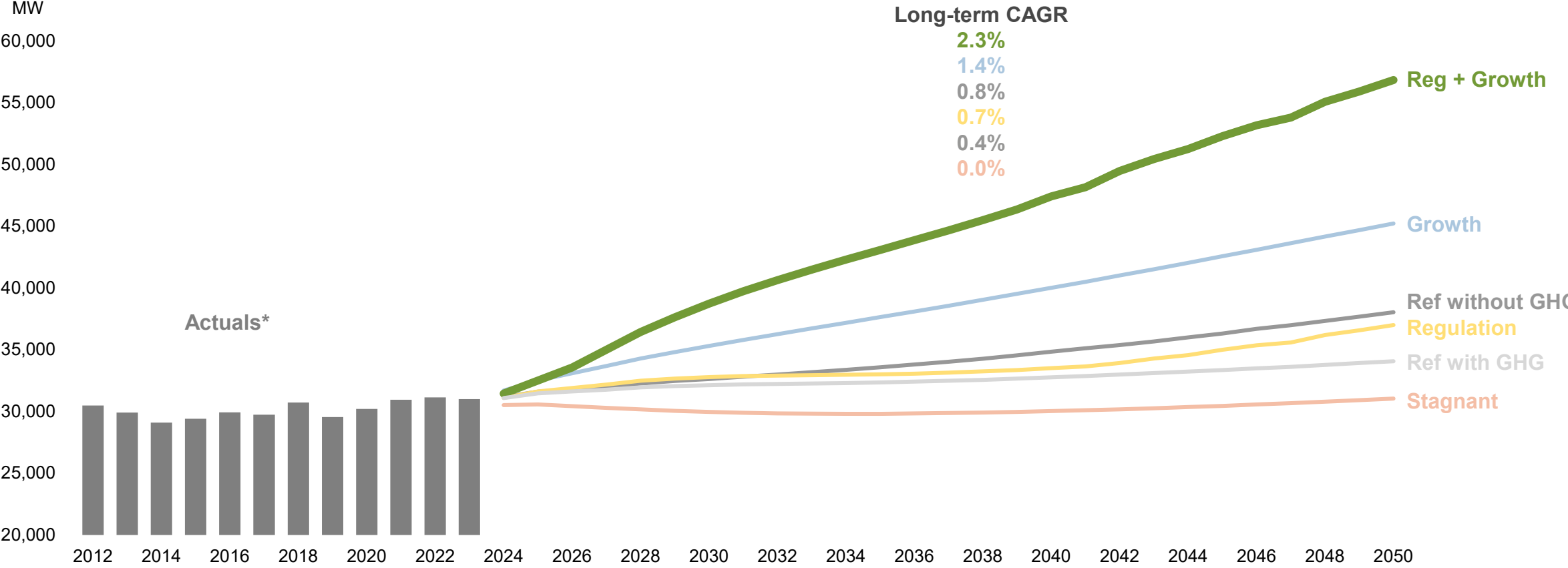
Hydrogen Price Assumptions

Both cases reflect an assumption of market-delivered hydrogen costs from \$3.60/kg in 2023 to \$1.00/kg by 2032 (\$31.57/MMBtu to \$8.70/MMBtu)

Driven by the increases in productivity and innovation in the Regulation and Growth scenario this reduction occurs quicker in 2032



IRP Peak Demand Forecasts



* Weather normalized actuals. Excludes USEC



Portfolio Results: 6 – Reference (with GHG Rule)



IRP Scenarios (Future Conditions)



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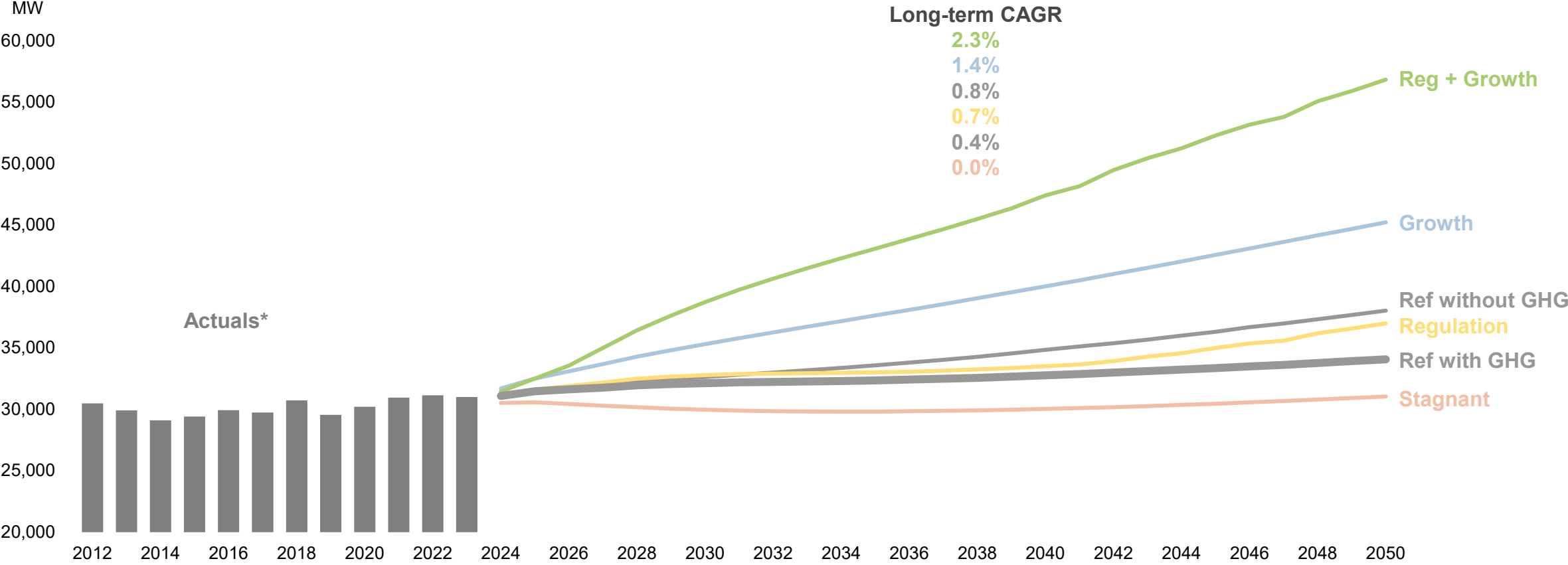
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IRP Peak Demand Forecasts



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TVA TENNESSEE
VALLEY
AUTHORITY

Break



All Scenario Incremental Charts

Hunter Reed; IRP Project Manager



Overall Draft IRP Results



TVA TENNESSEE
VALLEY
AUTHORITY

Lunch



IRP Stakeholder Education and Engagement

Jane Elliott; IRP Sr. Consultant

Amy Edge; Director, External Relations

Amy Reagan; Sr. Manager, Operations Communications

IRP Website – Making Information Easy to Find and Consume



YOU ARE HERE: HOME / ENVIRONMENT / INTEGRATED RESOURCE PLAN

www.tva.gov/irp

General Information

- Brief IRP introduction and important dates
- Key summaries and reports
- Contact information and how to stay informed

Engagement in the IRP

- Public meetings and how to get involved
- About the 2025 IRP Working Group
- Quotes from IRP-WG members

2025 Integrated Resource Plan Process

- Planning
- Engagement
- Analysis

Additional Information

- Summaries and reports
- Supporting documents
- Past Integrated Resource Plans

Key Summaries and Reports

Frequently Asked Questions (FAQs)

- Address common questions covering all key aspects of the IRP process
- Now references all six scenarios
- Address questions raised in public webinars and other avenues
- Update periodically throughout the IRP process

Links to key reports supporting the IRP

- Utility of the Future Information Exchange Report
- Scoping Report

Link to Additional Information section of the website

2025 Integrated Resource Plan Frequently Asked Questions July 2024

Background: Below are frequently asked questions related to the draft Integrated Resource Plan (IRP) and draft Environmental Impact Statement (EIS). This document will be updated and expanded throughout the IRP process.

Sections:

- General IRP information
- Stakeholder and public involvement
- Details related to long-term planning
- The IRP process
- IRP considerations
- IRP enhancements
- What happens next?

Engagement in the 2025 IRP



Public Meetings and How to Get Involved

The IRP evaluates options for how TVA will meet future power demand, and we want to hear from you. TVA invites public engagement in the IRP process through multiple venues, including in-person public meetings, virtual meetings and public comment periods. TVA has received comments during quarterly TVA Board listening sessions, at RERC meetings and during informational IRP webinars.

[View info from public meetings](#)



About the 2025 IRP Working Group

The IRP Working Group is a diverse group of stakeholders that meets regularly to provide comprehensive feedback on the IRP. The members represent the broad perspectives of those who live and work in the Valley. The 2025 IRP Working Group includes both customer and stakeholder representatives.

- Local Power Companies & Customer Associations (8)
- Associations / Special Interest Groups (3)
- Academia / Research (3)
- Government/Elected Officials (4)
- Energy and Environmental Non-Government Organizations (3)
- Community Stakeholders (3)

[View IRP working group schedule](#)

Engagement in the 2025 IRP



As a researcher at ORNL, the IRP process helps us evaluate the practical considerations for successful decarbonization and drives us to have a strong action plan toward a resilient, secure, clean grid for the Valley.

Teja Kuruganti
***Section Head, Advanced Computing
Methods for Engineered Systems
Oak Ridge National Laboratory (ORNL)***



The Nature Conservancy is committed to accelerating a clean and equitable energy transition. We're pleased to offer our expertise and help utilities like TVA identify opportunities to quickly build a nature-positive renewable energy infrastructure.

Lindsay Hanna
***Director of Government Relations
& Climate Policy
The Nature Conservancy in Tennessee***



The Valley faces important decisions as we tackle challenges such as shifting environmental policies and conflicting political priorities to new and expensive generation technologies. The stakes are high, so we need to get this right.

Wes Kelley
***President and CEO
Huntsville Utilities***

2025 Integrated Resource Plan Process



Planning

TVA's integrated resource planning is grounded in fundamental least-cost principles: low cost, risk informed, environmentally responsible, reliable and resilient, diverse and flexible.

Long-term planning entails considering future energy demand, evolving regulations, current power generation resources and new resource options, then determining what new power resources would work best to fill future capacity needs.

The IRP helps identify the optimal mix of resources for the region's future energy system.

Learn more about IRP planning in the fact sheet below.

[Fact sheet - IRP process](#)



Engagement

Gathering diverse opinions from key stakeholders and the public strengthens the IRP and EIS process. In addition to the IRP Working Group, the Regional Energy Resource Council (RERC), a federal advisory committee that provides formal advice to the TVA Board of Directors, is engaged in the process.

The public has provided comments during the public scoping comment period, quarterly TVA Board listening sessions, RERC meetings and public IRP webinars. The public's continued insights and opinions will help shape TVA's energy system of the future.

Learn more about engagement in the fact sheet below.

[Fact sheet - IRP public involvement](#)



Analysis

TVA and the IRP Working Group identified possible futures TVA could find itself operating in between now and 2050 and the alternative approaches to help meet electricity demand in these futures. They developed a list of power generation resource options for the IRP, including existing resources and emerging technologies.

TVA modeled the five strategies in the six scenarios. The modeling generated 30 unique potential resource "portfolios" – the power supply mix that results from assessing a particular strategy in a particular scenario. Additional analysis will be performed to evaluate evolving conditions and public input on the draft IRP.

Learn more about IRP analysis in the fact sheet below.

[Fact Sheet - Scenarios and Strategies](#)

IRP Fact Sheets

-  IRP Process
-  Public Involvement
-  National Environmental Policy Act (NEPA)
-  Scenarios and Strategies
-  Resource Options
-  Modeling Process

Supporting Documents

Supporting Documents

- The Valley Pathways Study
- Aging Coal Fleet Evaluation
- Energy Programs Potential Study

Supporting Data Files (available when the draft IRP and EIS are published):

Recent IRP Feedback

Avenues for Direct IRP Questions and Feedback

Regional Energy Resource Council (RERC)

- Most recent meeting held on July 16th
- Council provided a written advice statement to TVA and the TVA Board
- Nine members of the public also provided comments during a listening session

IRP Public Webinars

- Most recent webinar was held on July 25th (reschedule from July 18th)
- More than 40 questions were submitted

RERC Public Listening Session – IRP Related Themes

Comments for and against certain resource types, such as the desire to see TVA eliminate use of fossil fuels, phase-out nuclear energy, and/or increase renewable energy.

Comments expressing a desire to see TVA release IRP as quickly as possible.

Comments encouraging increased transparency in decision-making process (IRP and capital projects).

Comment encouraging the use of all forms of energy, including nuclear, natural gas, and renewables.

Comments urging TVA to continue to focus on affordability and reliability.

Comment on incorporation of EJ metrics in planning.

Comment urging net-zero emissions sooner than 2050.

IRP Public Webinar – Key Question Themes

Theme	Example(s)
IRP Process	Estimated Draft IRP release date Impact of IRP on proposed gas plants
Scenarios and Forecasts	Incorporation of the IRA Impacts of climate change
Resource Assumptions	Details on solar and LPC flexibility Cost assumption sourcing Incorporation of hydrogen
Evaluation and Metrics	How low rates are factored into modeling
Public and Stakeholder Engagement	How feedback from the public is incorporated Examples of incorporated feedback LPC involvement in the IRP
Environmental Justice (EJ)	How EJ is incorporated into the IRP How EJ community concerns are addressed
Environmental Impact Statement	How water demands are accounted for If methane leakage is considered

IRP-WG Thoughts

Does the IRP-WG generally feel that the comments and questions from recent feedback have been addressed, as appropriate, in the analysis to date?

Is additional sensitivity analysis in the Final IRP warranted in any of the areas mentioned?

Break



Technology and Adoption Readiness

Brad Chadwell: Director, Enterprise Research and Innovation

Scott Key: Project Manager, Integrated System Planning

Daniel Sipe: Manager, Generation Research

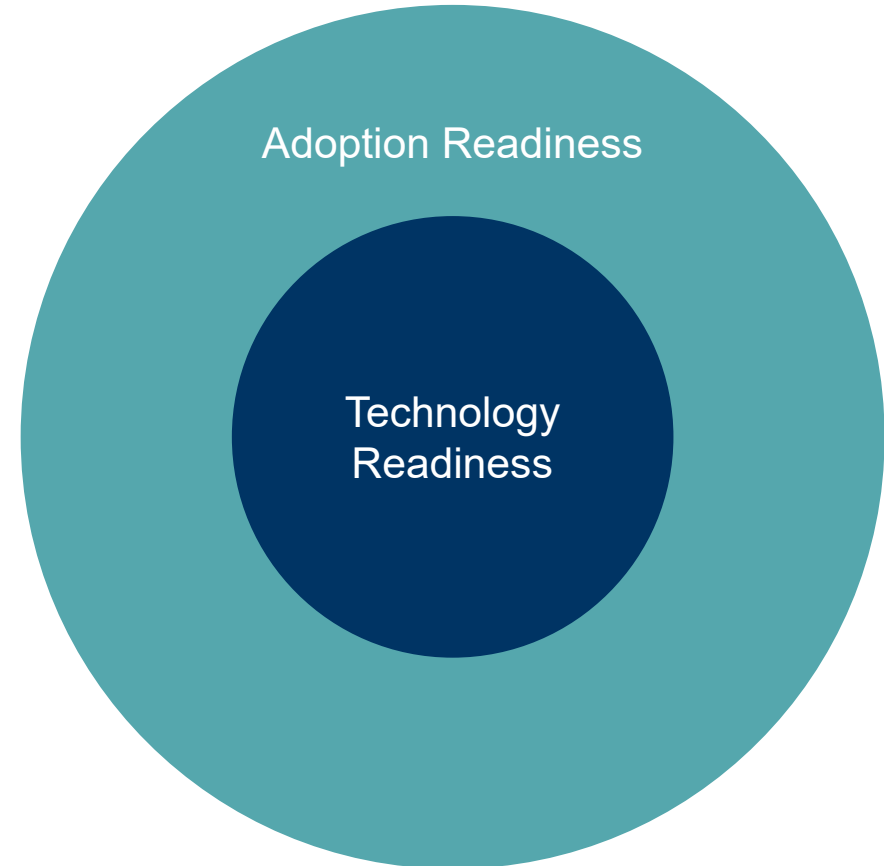
Technology and Adoption Readiness

The ability to successfully deploy a technology is dependent on:

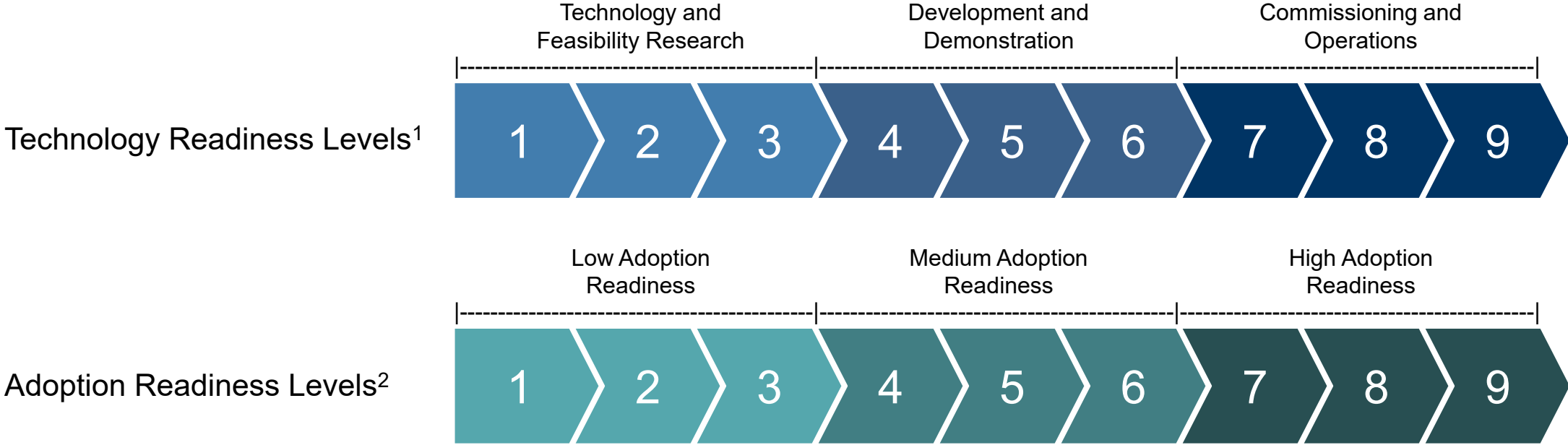
- Technology readiness, or the maturity of a technology from a fundamental perspective
- Adoption readiness, or the ability to adopt that technology throughout its entire value chain

DOE has developed frameworks to help assess these aspects of readiness.

Technology and adoption readiness are both needed to successfully deploy a technology in the energy marketplace.



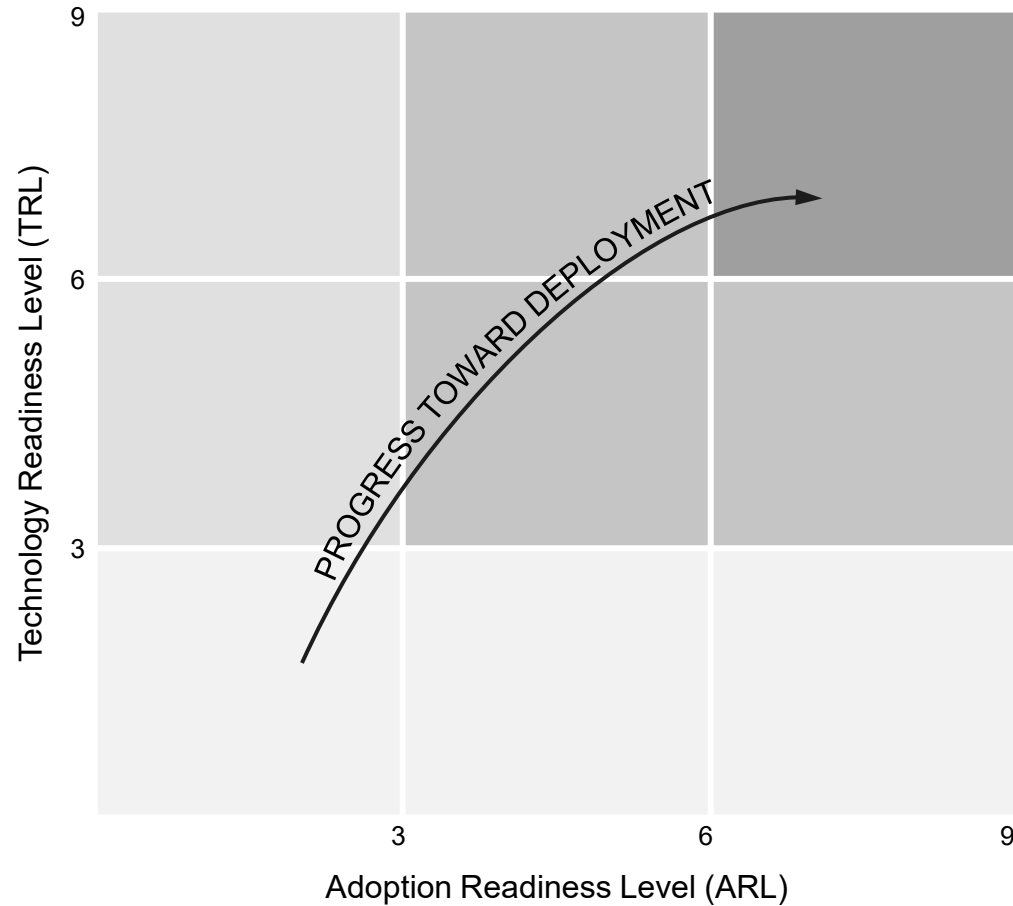
Technology and Adoption Readiness



¹ [Technology Readiness Assessment Guide \(doe.gov\)](#)

² [U.S. DOE, Commercial Adoption Readiness Assessment Tool \(CARAT\), March 2023](#)

Assessment of Overall Readiness



DOE assessment framework considers TRL and ARL and categorizes technologies based on both scores, indicating the following stages of overall readiness:

- Research
- Development
- Demonstration
- Deployment

DOE Technology Readiness Levels

Relative Level of Technology Development	Technology Readiness Level	TRL Definition
System Operations	TRL 9	Actual system operated over the full range of expected conditions
System Commissioning	TRL 8	Actual system completed and qualified through test and demonstration
	TRL 7	Full-scale, similar (prototypical) system demonstrated in a relevant environment
Technology Demonstration	TRL 6	Engineering/pilot-scale, similar (prototypical) system validation in a relevant environment
Technology Development	TRL 5	Laboratory scale, similar system validation in a relevant environment
	TRL 4	Component and/or system validation in laboratory environment
Research to Prove Feasibility	TRL 3	Analytical and experimental critical function and/or characteristic proof of concept
	TRL 2	Technology concept and/or application formulated
Basic Technology Research	TRL 1	Basic principles observed and reported

DOE Adoption Readiness – Core Risk Areas

VALUE PROPOSITION

Assesses a new technology's ability to meet the functionality required by the market at a price point that customers are willing to pay, to meet market demand (broadened definition of "product-market fit").

- Delivered Cost
- Functional Performance
- Ease of Use / Complexity

MARKET ACCEPTANCE

Captures the target market(s) demand characteristics and risks posed by existing players – including competitors, customers, and other value chain players.

- Demand Maturity / Market Openness
- Market Size
- Downstream Value Chain

RESOURCE MATURITY

Determines risks standing in the way of inputs that are needed to produce the technology solution.

- Capital Flow
- Project Development, Integration, and Management
- Infrastructure
- Manufacturing and Supply Chain
- Materials Sourcing
- Workforce

LICENSE TO OPERATE

Identifies the societal (national, state, and local), non-economic risks that can hinder the deployment of a technology.

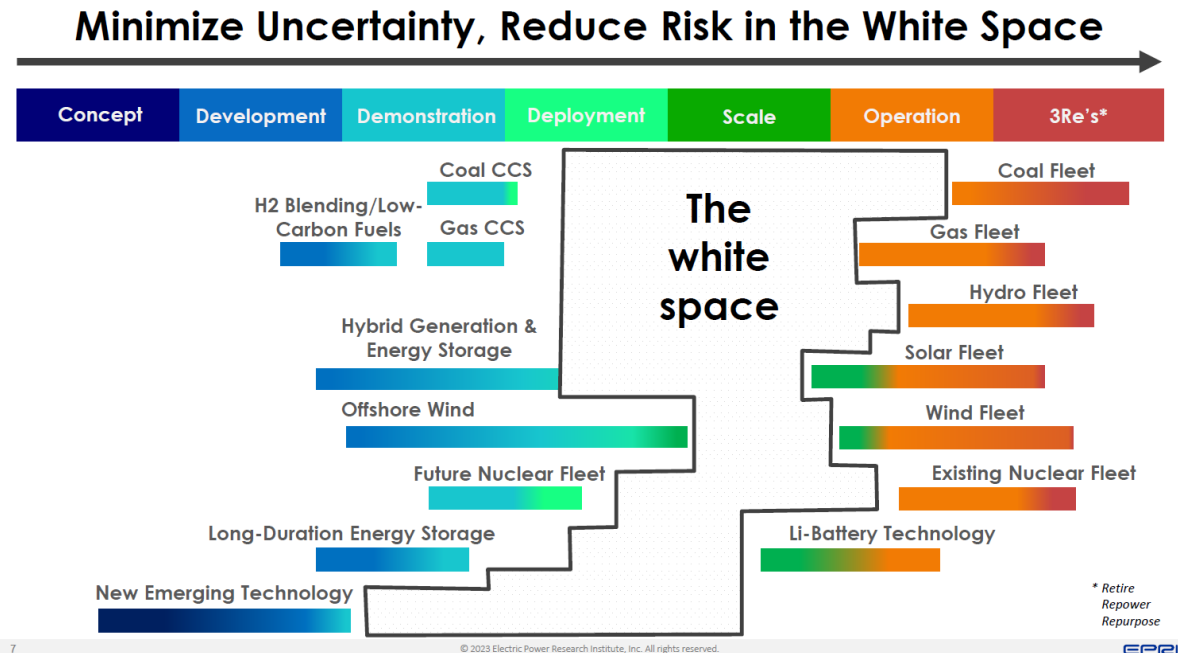
- Regulatory Environment
- Policy Environment
- Permitting and Siting
- Environmental and Safety
- Community Perception

Assessment Informed by Industry-led Efforts

Leading R&D provides robust assessment for technology readiness, risks, and adoption factors

"White space" represents the readiness or gap for industry deployment

"Risk registers" provide technology specific insight into what is contributing to the white space



Risk type: cost, execution, technology, regulatory, operational, reputational

Risk level: low, medium, high

Consequence: ability to operate, reduced generation capacity or energy

DOE Adoption Readiness Scoring

Using low, medium, and high scores for each of the 17 risk dimensions, an overall ARL score is developed for each technology based on the criteria summarized in the table below.

Overall Adoption Readiness Score		Number of High Risk Dimensions								
		0	1	2	3	4	5	6	7	8+
Number of Medium Risk Dimensions	0	9	8	7	5	3	1	1	1	1
	1	8	7	6	4	2	1	1	1	1
	2	8	7	6	4	2	1	1	1	1
	3	7	6	5	3	1	1	1	1	1
	4	7	6	5	3	1	1	1	1	1
	5	6	5	4	2	1	1	1	1	1
	6	5	4	3	1	1	1	1	1	1
	7	3	2	1	1	1	1	1	1	1
	8+	1	1	1	1	1	1	1	1	1

Wrap-up

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