



Creating a Low-Carbon Future

Association of State Energy Research and
Technology Transfer Institutions
(ASERTTI)

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Senior Vice President
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Presentation Overview

- **The Technology Challenge**

De-carbonize the electricity infrastructure and meet binding economy-wide CO₂ reduction targets

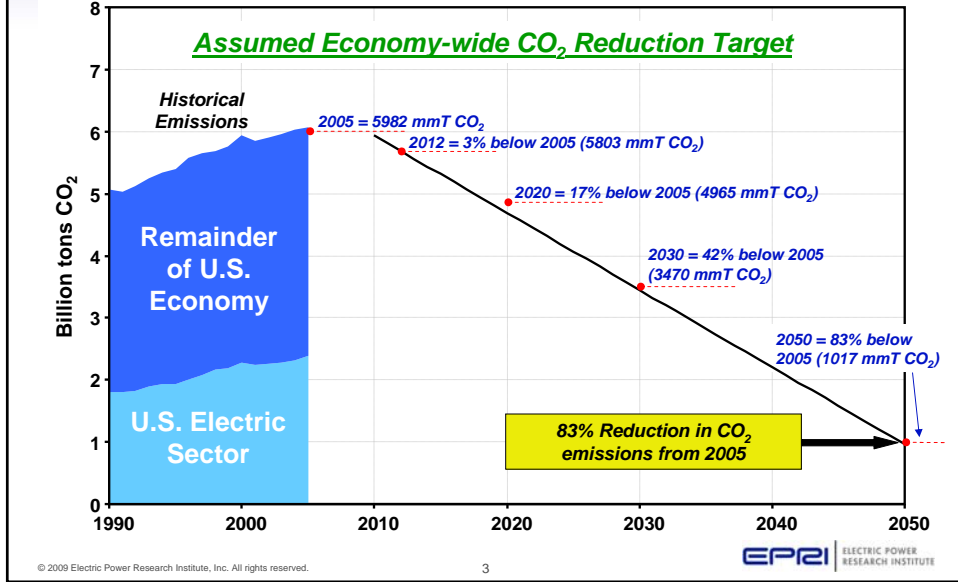
Provide reliable, affordable, and environmentally responsible electricity

- **Meeting The Challenge**

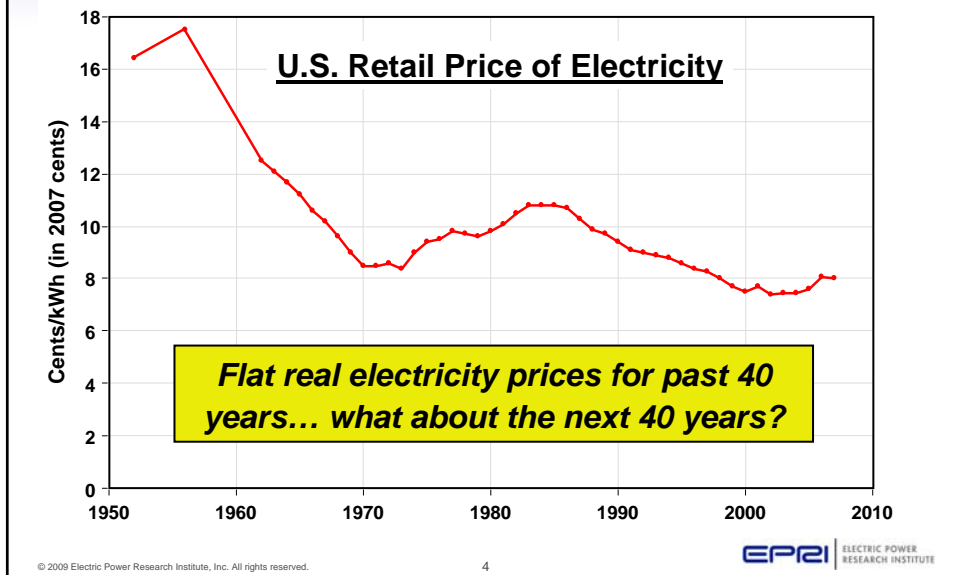
Technically feasible with a full portfolio of generation options

***Decisions Over the Next Decade will
Shape the Electricity Future of 2050***

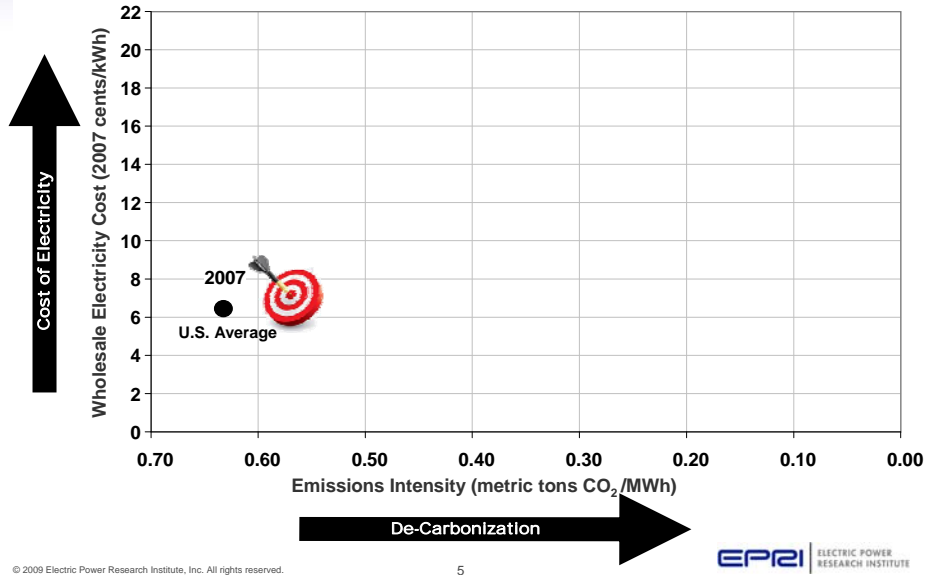
The CO₂ Challenge



The Cost Challenge



The Technology Challenge

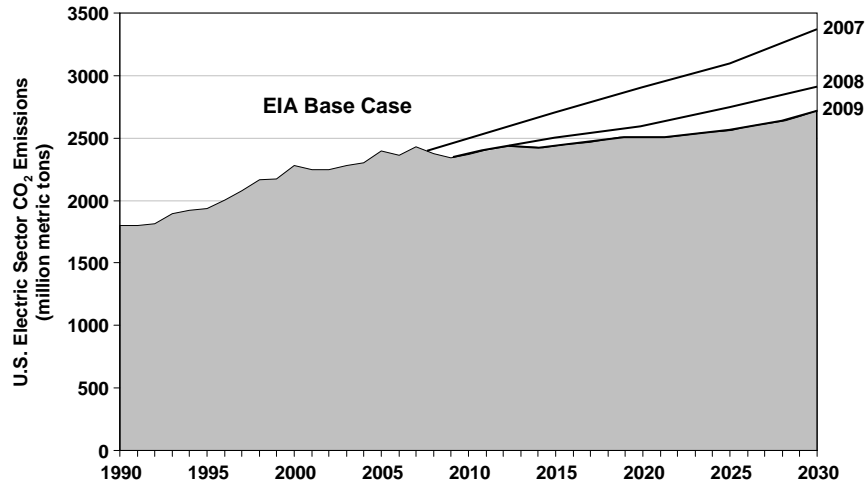


Understanding the Technology Challenge

Insights Provided by Two Different Analytical Models

- **Bottoms-up “Prism” Technology Analysis**
 - Uses Energy Information Administration’s (EIA) Annual Energy Outlook as the base case
 - Estimates CO₂ reduction impacts relative to the base case if more aggressive technology targets could be met
- **Tops-down “MERGE” Economic Analysis**
 - Optimization model of economic activity and energy use
 - Inputs: Energy supply technologies and costs for electric generation and non-electric energy
 - Constraints: Carbon policy and energy resource availability
 - Output: Economy-wide impacts of carbon policy

U. S. Electric Sector CO₂ Emissions

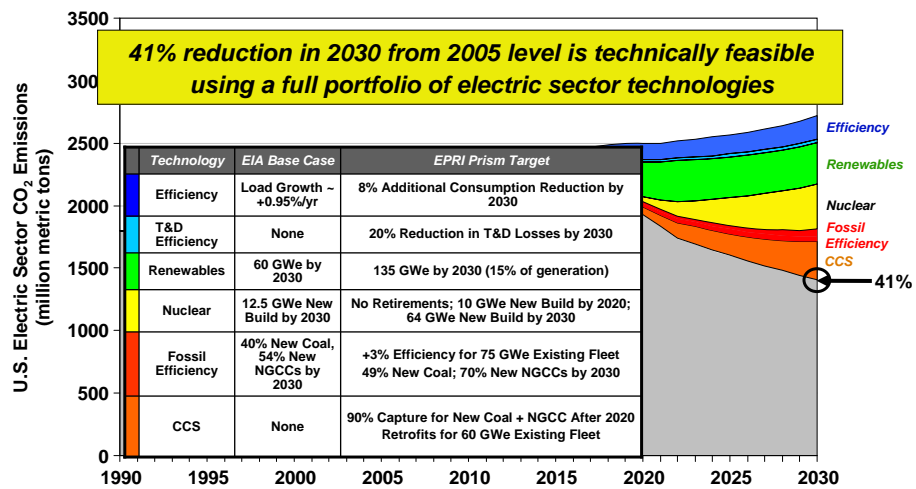


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2009 Prism

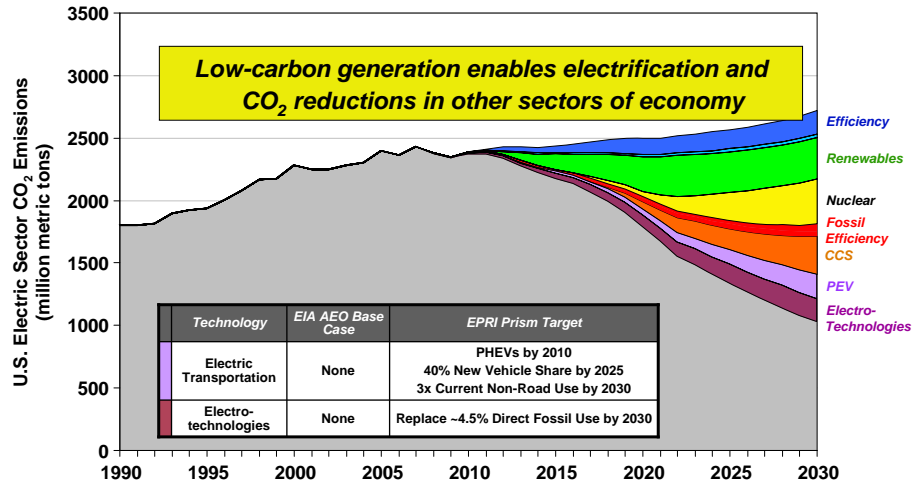


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2009 Prism – PEV and Electro-Technologies

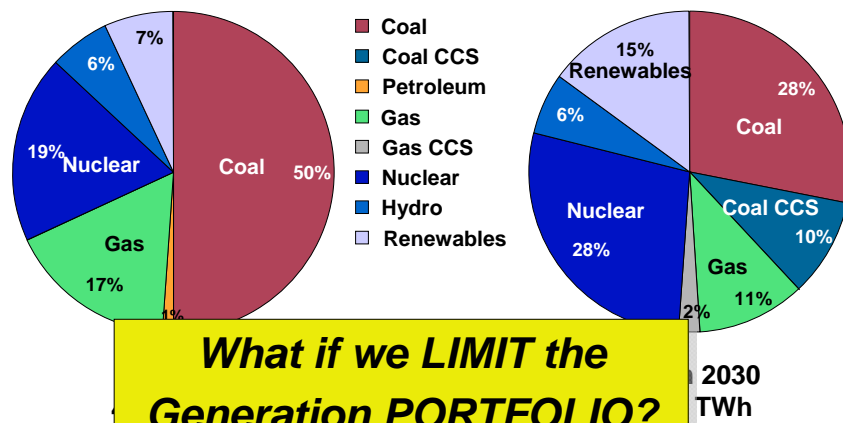


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Generation by Fuel Source in 2030



Prism → 60% no- or low-carbon electricity by 2030

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Technology Portfolios

• Full Portfolio

- Coal and Gas CCS available
- Accelerated end-use efficiency
- PEV's can expand
- Nuclear production can expand

• Limited Portfolio

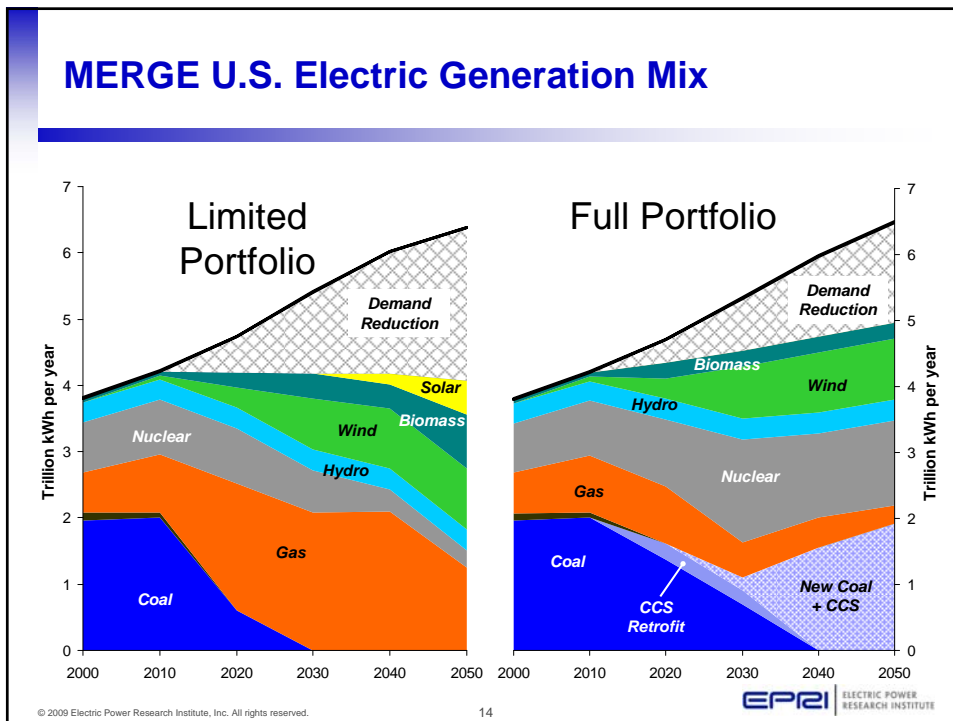
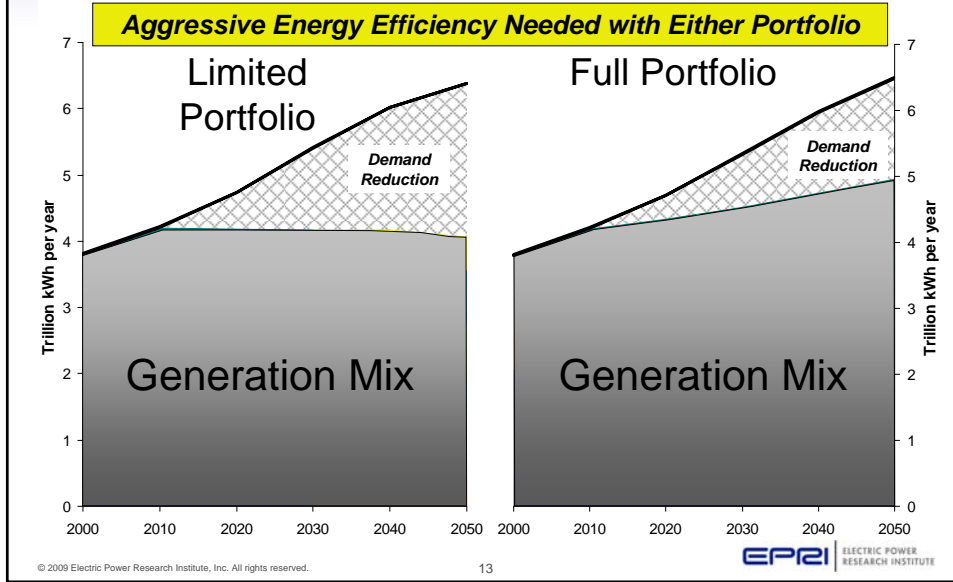
- No CO₂ capture and storage (CCS)
- Nuclear generation does not expand
- No plug-in electric vehicles (PEV's)

MERGE Economic Model

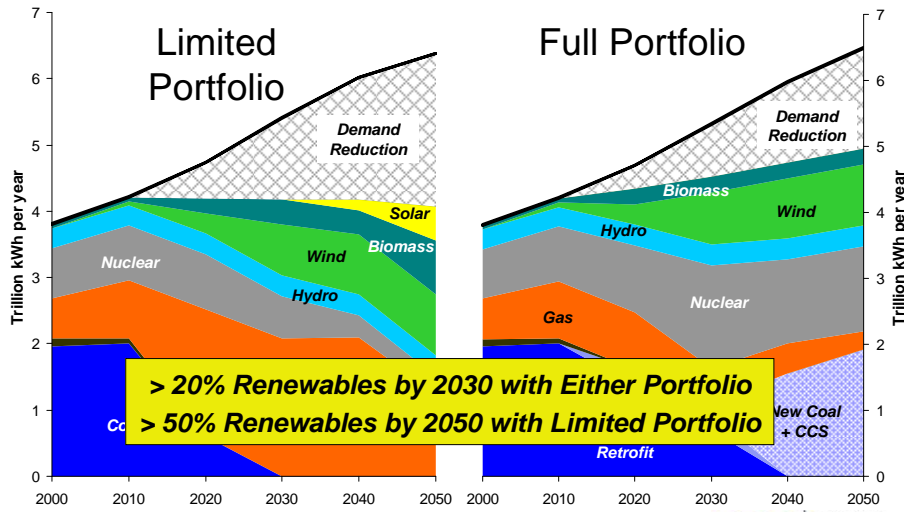
- Optimization Model of Economic Activity and Energy Use through 2050
 - Maximize Economic Wealth
- Inputs
 - Energy Supply Technologies and Costs for Electric Generation and Non-Electric Energy
- Constraints
 - Greenhouse Gas Control Scenarios
 - Energy Resources
- Outputs
 - Economy-wide Impact of Carbon Policy



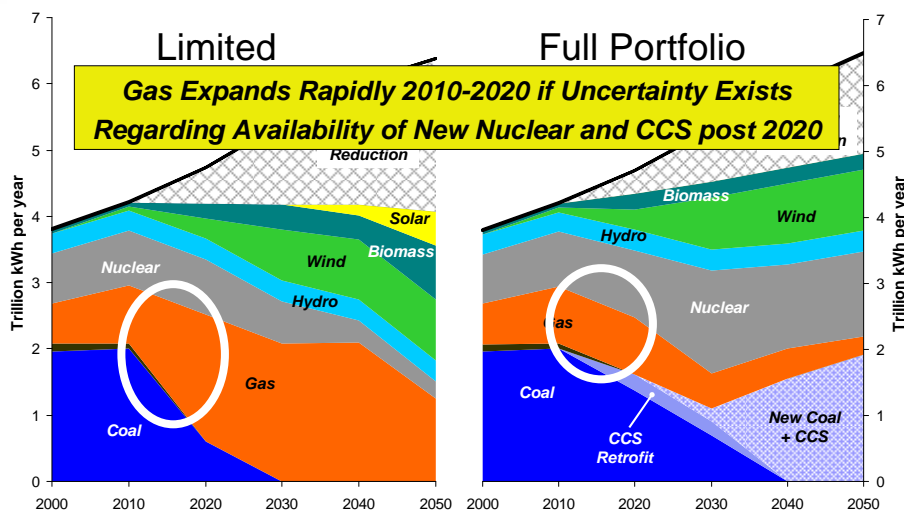
MERGE U.S. Electric Generation Mix



Insights – Renewables

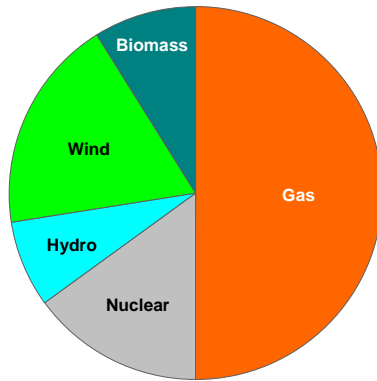


Insights – Nuclear and CCS

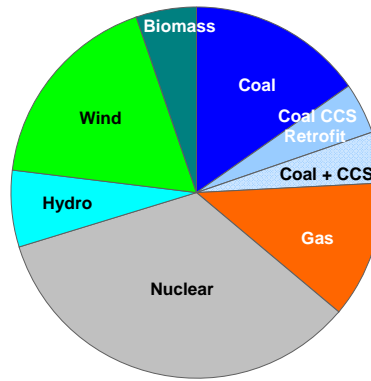


2030 Generation Mix

Remarkably different futures...and only 20 years away!



Limited Portfolio



Full Portfolio

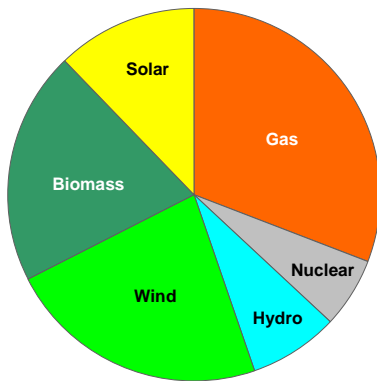
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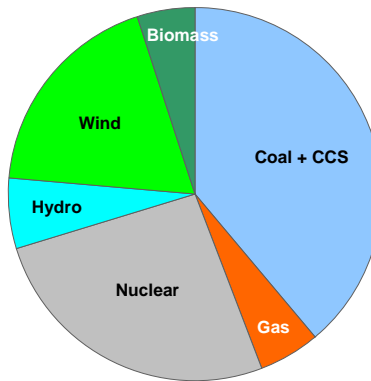
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2050 Generation Mix

Totally different futures in 2050



Limited Portfolio



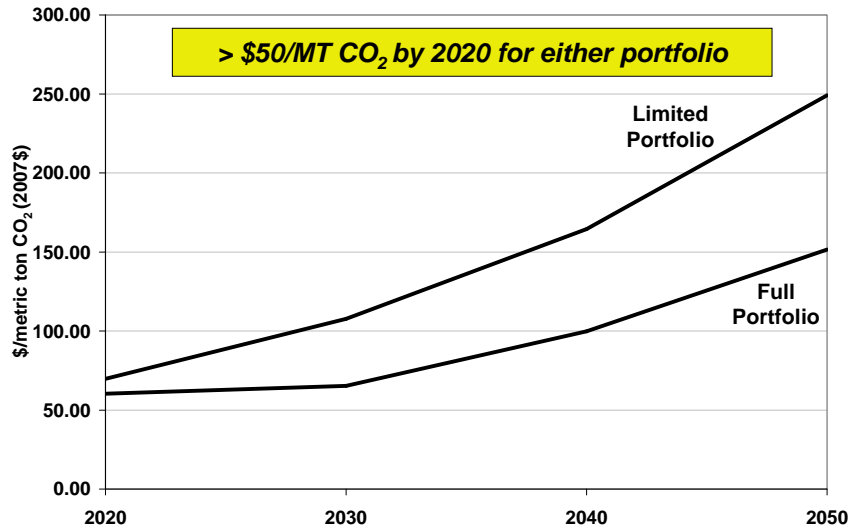
Full Portfolio

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MERGE CO₂ Price Results

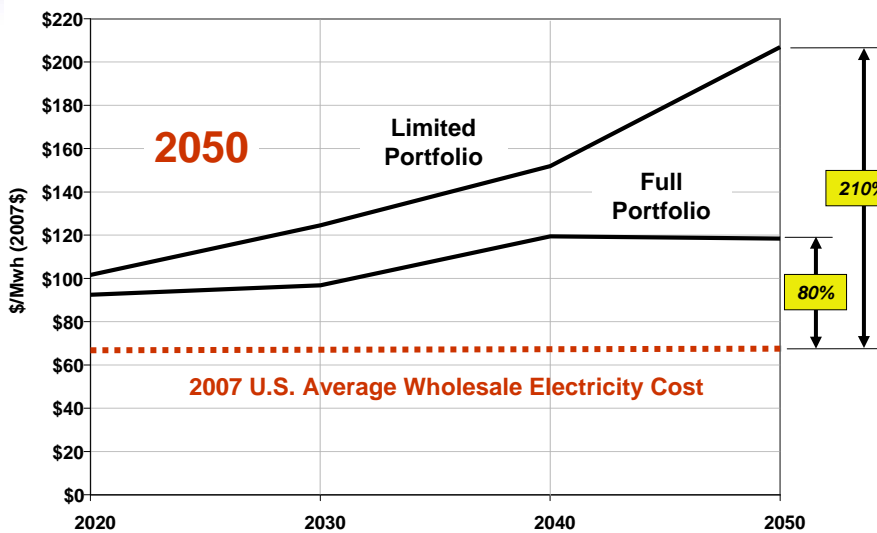


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MERGE Wholesale Electricity Cost Results

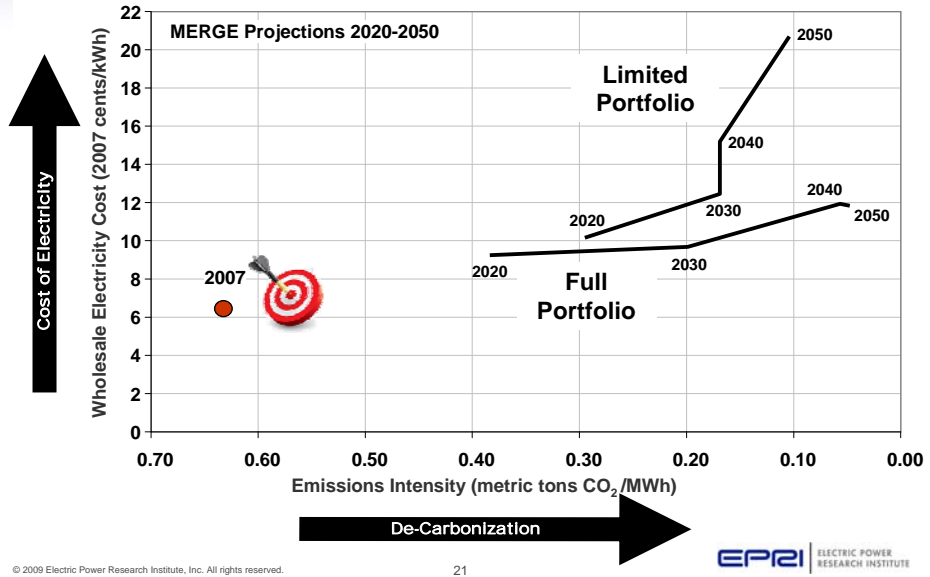


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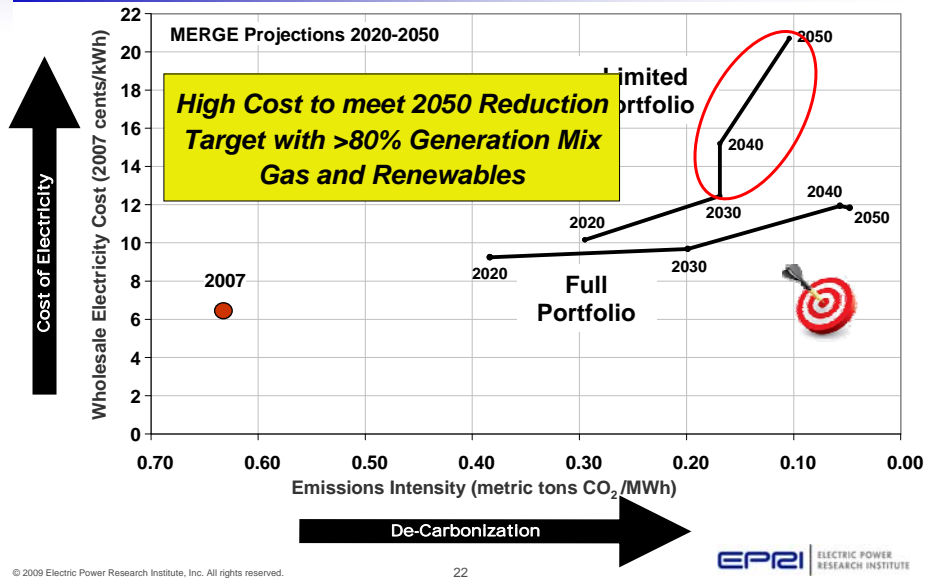
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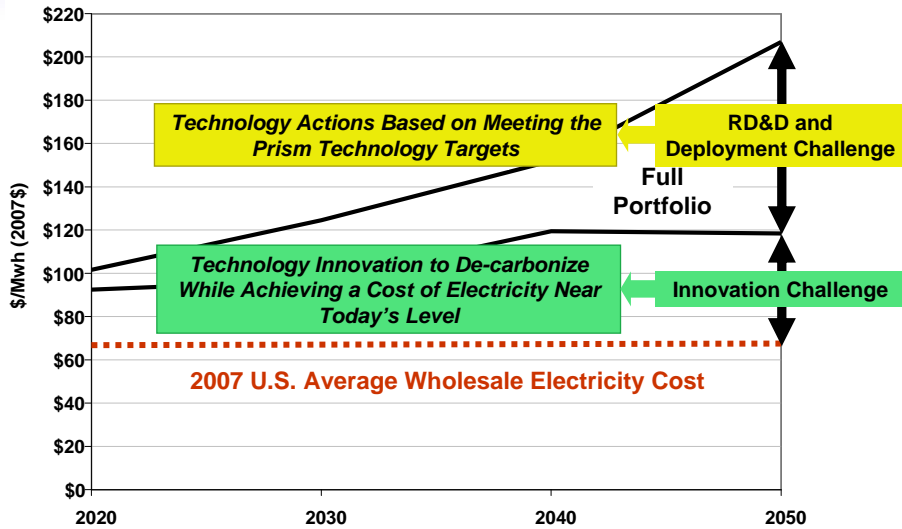
MERGE De-carbonization Results



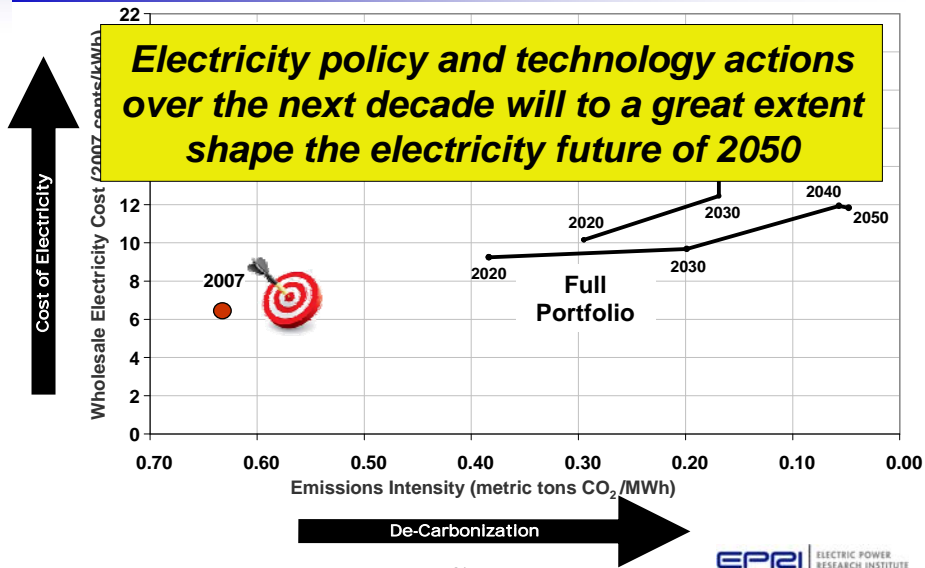
MERGE De-carbonization Results



Meeting the Challenge



Conclusion



Together...Shaping the Future of Electricity



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Image from NASA Visible Earth