



## Creating a Secure, Low-Carbon Future

**Steven Specker**  
President and CEO

AESIEAP 2009 CEO Conference  
Kaohsiung, Taiwan  
October 15, 2009

## The Electric Power Research Institute

### RD&D for the Electricity Industry

- Independent, unbiased, tax-exempt collaborative research organization
- Full spectrum industry coverage
  - Nuclear
  - Generation
  - Environment
  - Power Delivery & Utilization
- 460 participants in over 40 countries
- Major offices in Palo Alto, CA; Charlotte, NC and Knoxville, TN

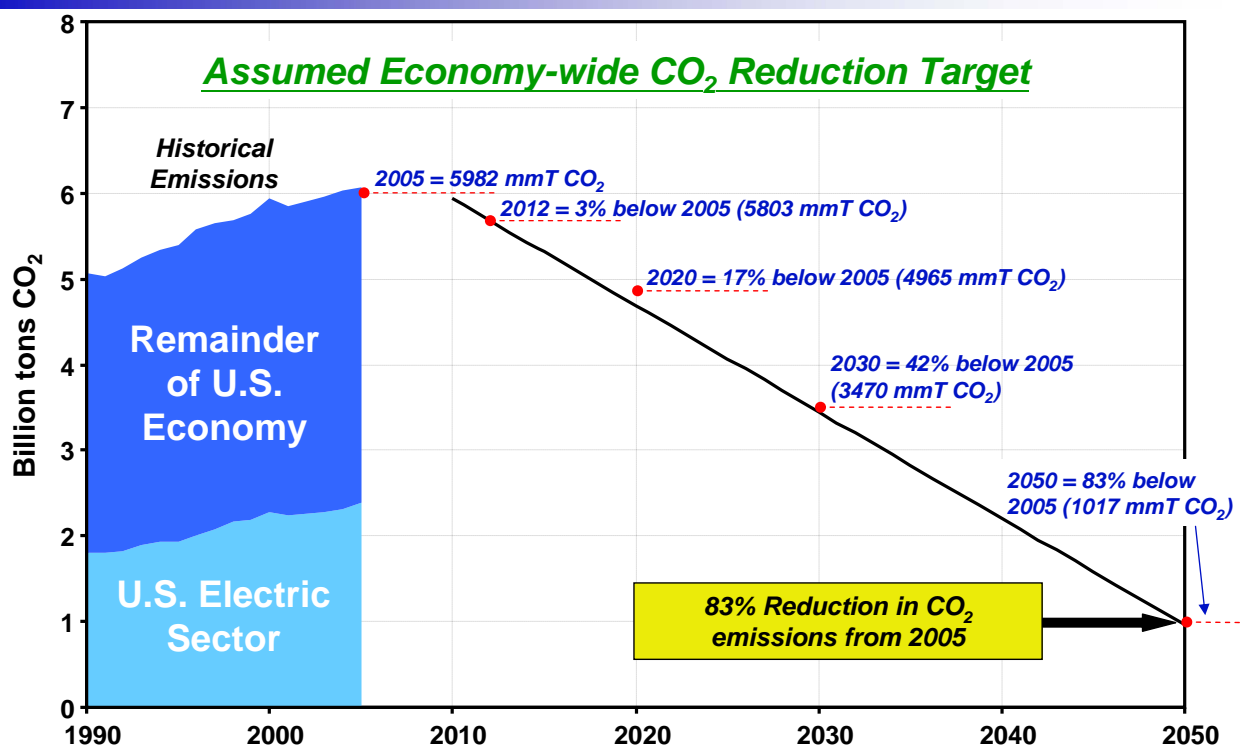


# Defining the Electricity Technology Challenge

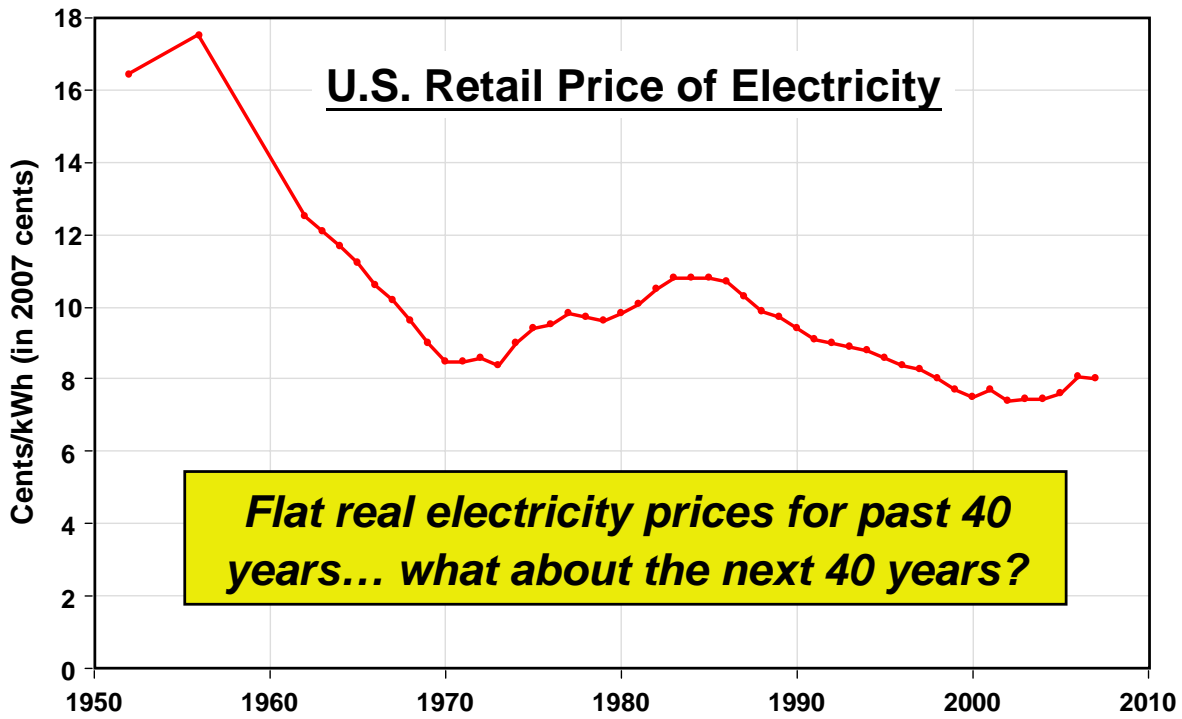
- *De-carbonize the electricity infrastructure*
- *Provide reliable, affordable, and environmentally responsible electricity to consumers*

**Two Key Metrics: CO<sub>2</sub> Emissions and Cost of Electricity**

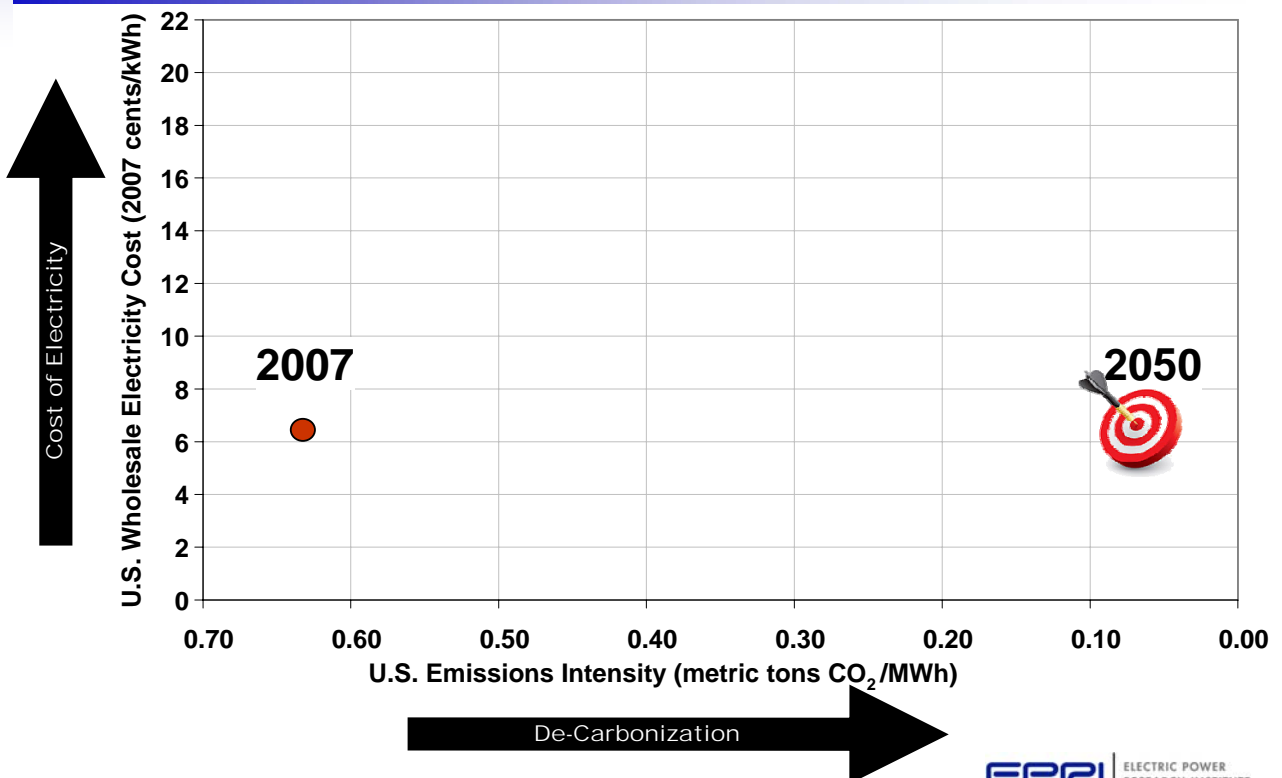
## The U.S. CO<sub>2</sub> Challenge



# The U.S. Cost Challenge



# Visualizing the Technology Challenge

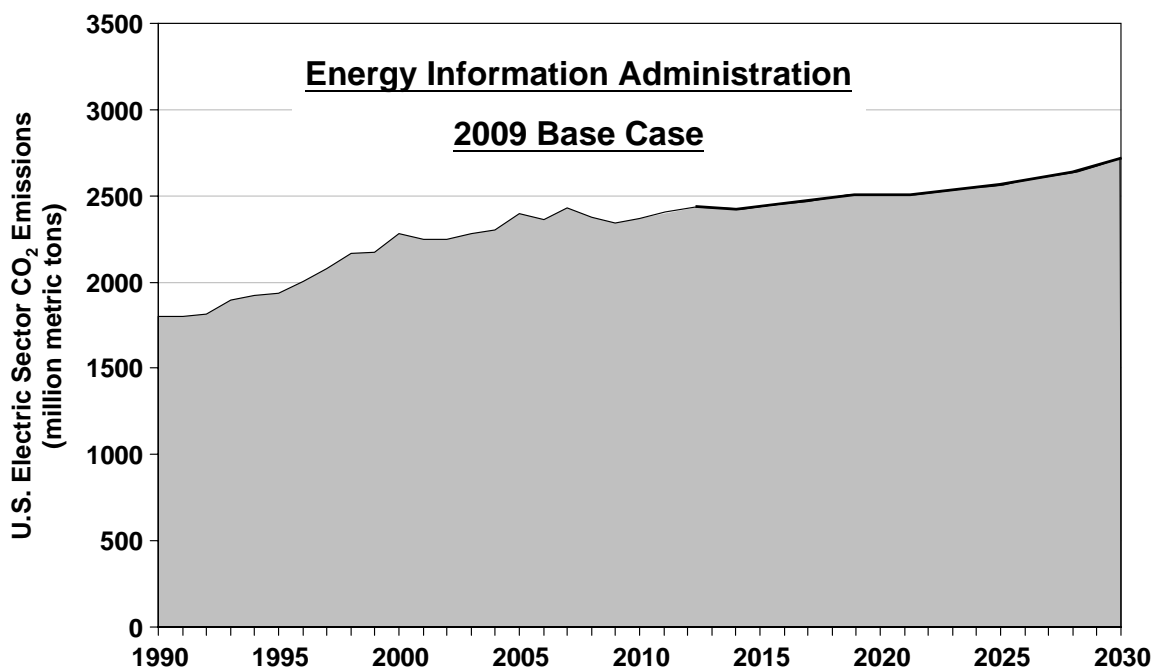


# Understanding the Technology Challenge

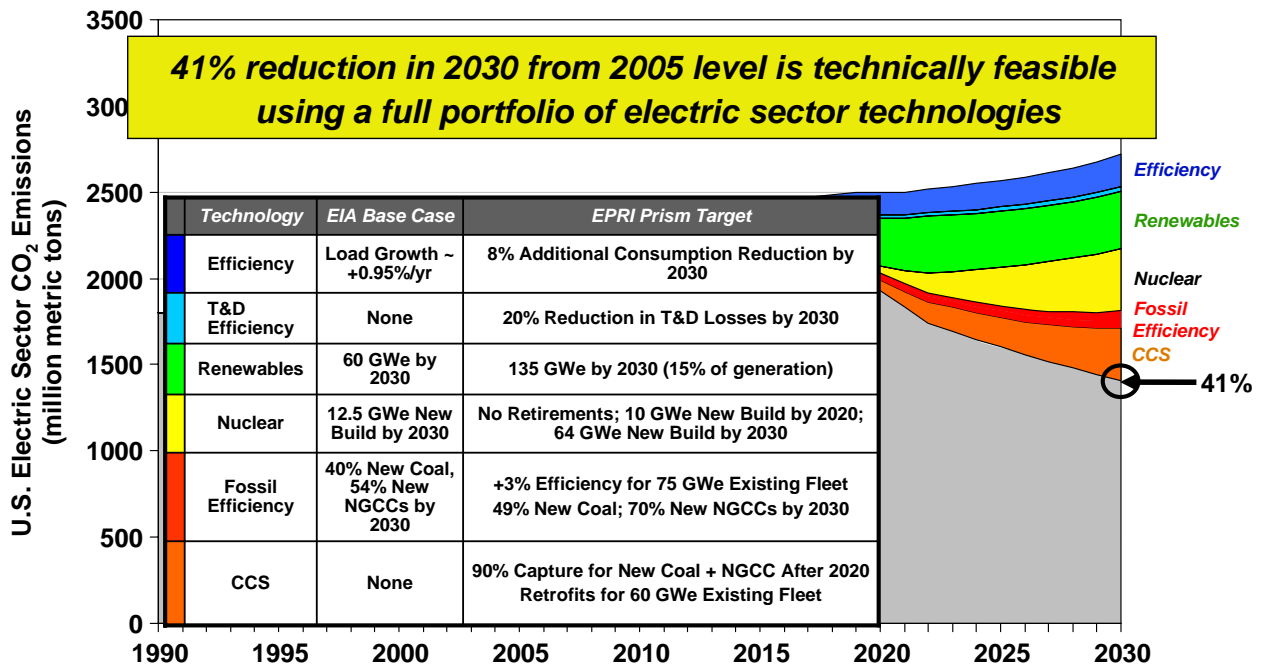
## Insights Provided by Two Different Analytical Models

- **Bottoms-up “Prism” Technology Analysis**
  - *Uses U.S. Energy Information Administration’s (EIA) Annual Energy Outlook as the base case*
  - *Estimates CO<sub>2</sub> 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*

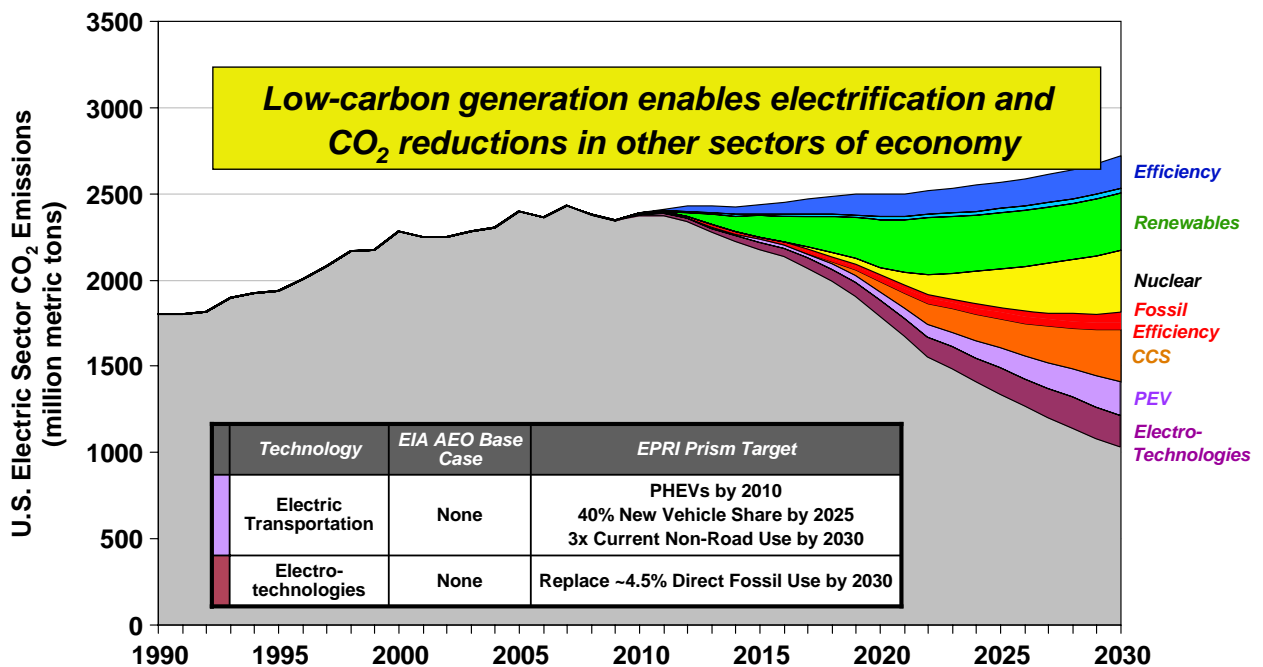
## U. S. Electric Sector CO<sub>2</sub> Emissions



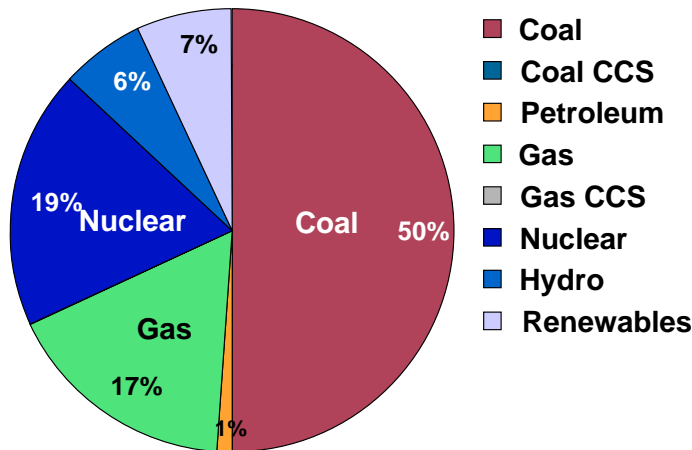
# 2009 Prism



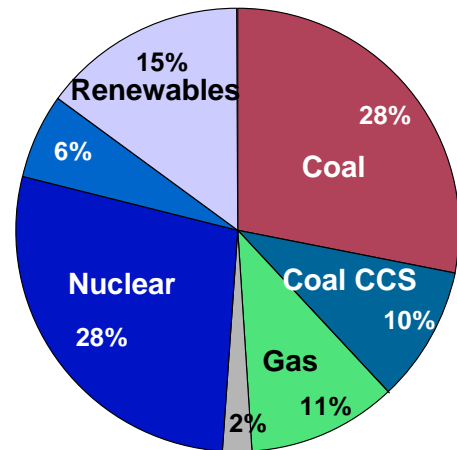
# 2009 Prism – PEV and Electro-Technologies



# Generation by Fuel Source in 2030



**EIA 2030**  
4669 TWh



**Prism 2030**  
4888 TWh

***What if we limit the Generation Portfolio?***

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

# Technology Portfolios

## • Full Portfolio

Coal and Gas CCS available

Accelerated end-use efficiency

PEV's can expand

Nuclear production can expand

## • Limited Portfolio

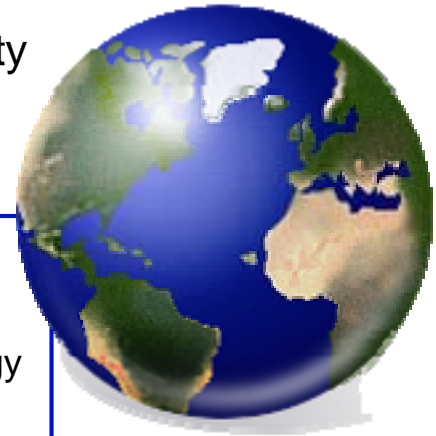
No CO<sub>2</sub> capture and storage (CCS)

Nuclear generation does not expand

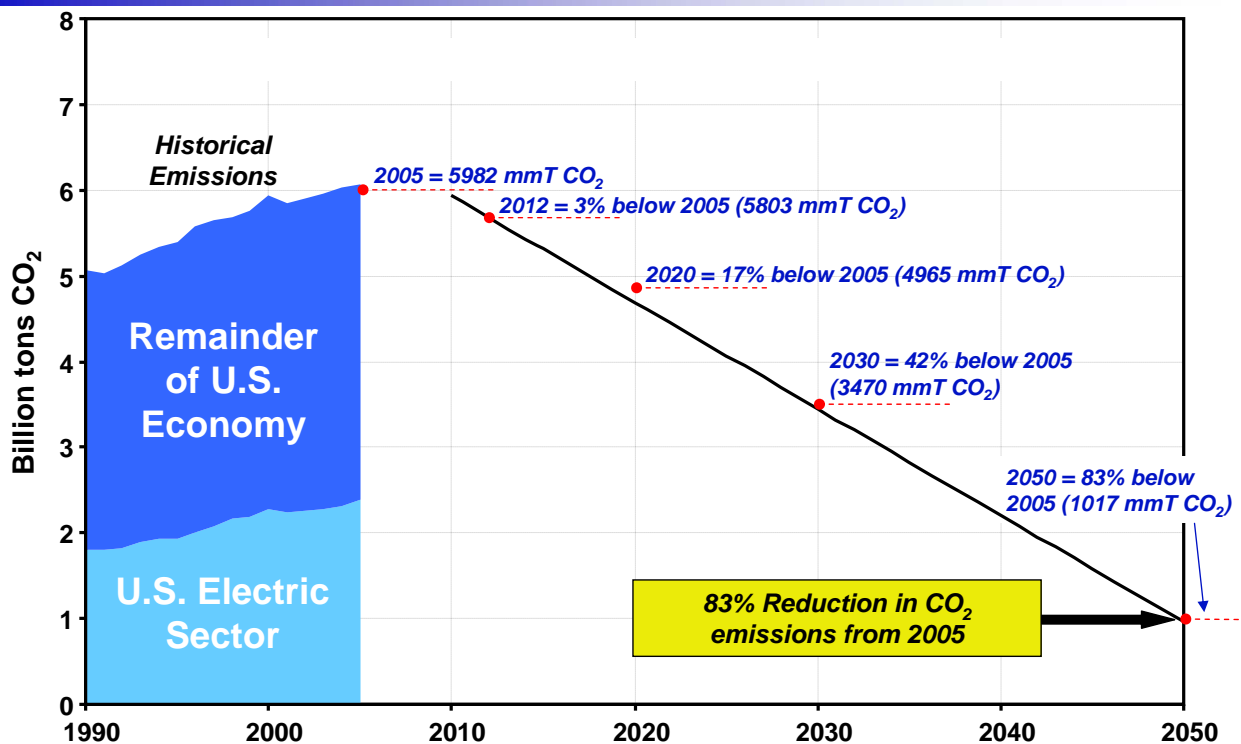
No plug-in electric vehicles (PEV's)

# MERGE Economic Model

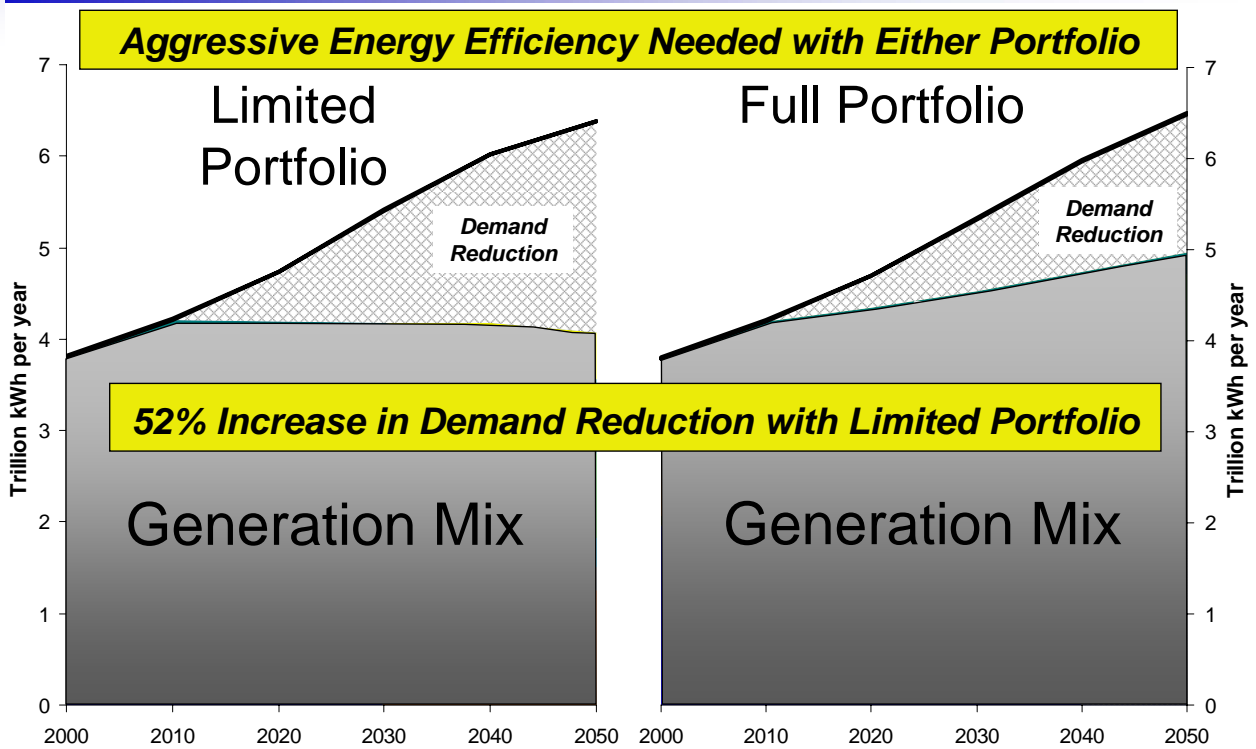
- Optimization Model of Economic Activity and Energy Use through 2050
  - Maximize Economic Wealth
- Inputs
  - Energy Supply Technologies and Costs for Electric Generation and Non-Electric Energy
- Constraints
  - Greenhouse Gas Control Scenarios
  - Energy Resources
- Outputs
  - Economy-wide Impact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



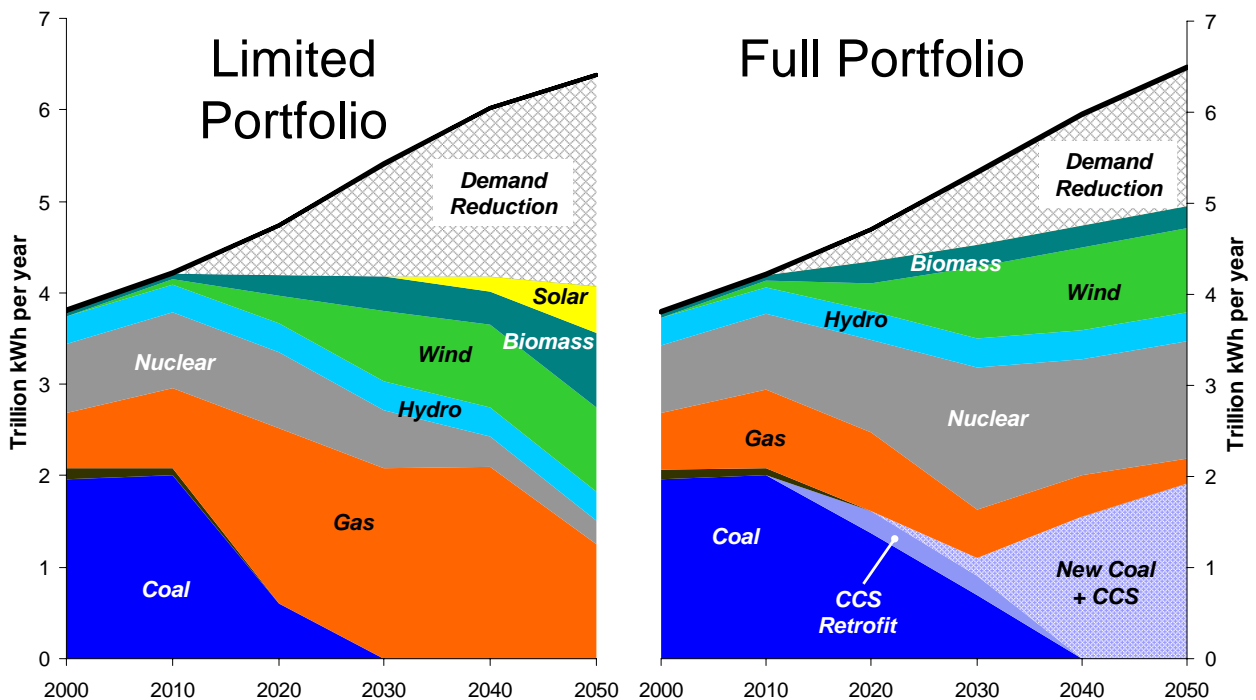
# Assumed Economy-wide CO<sub>2</sub> Reduction Target



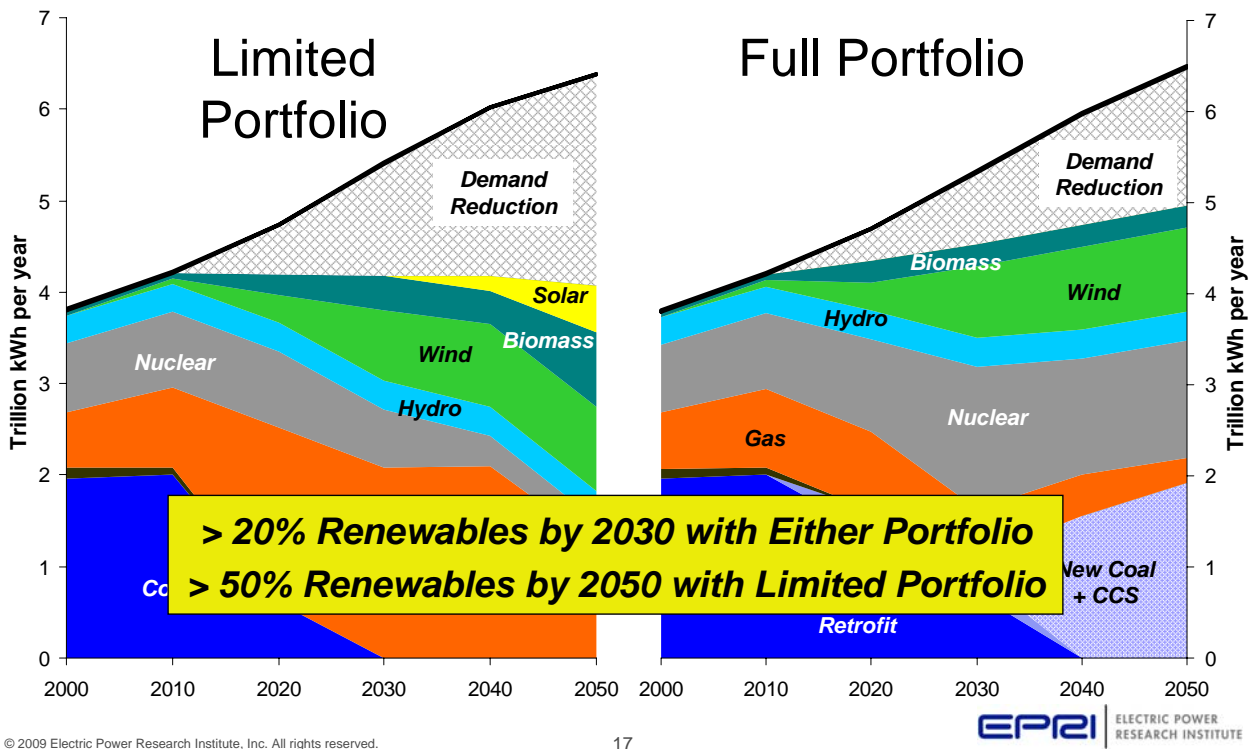
# MERGE U.S. Electric Generation Mix



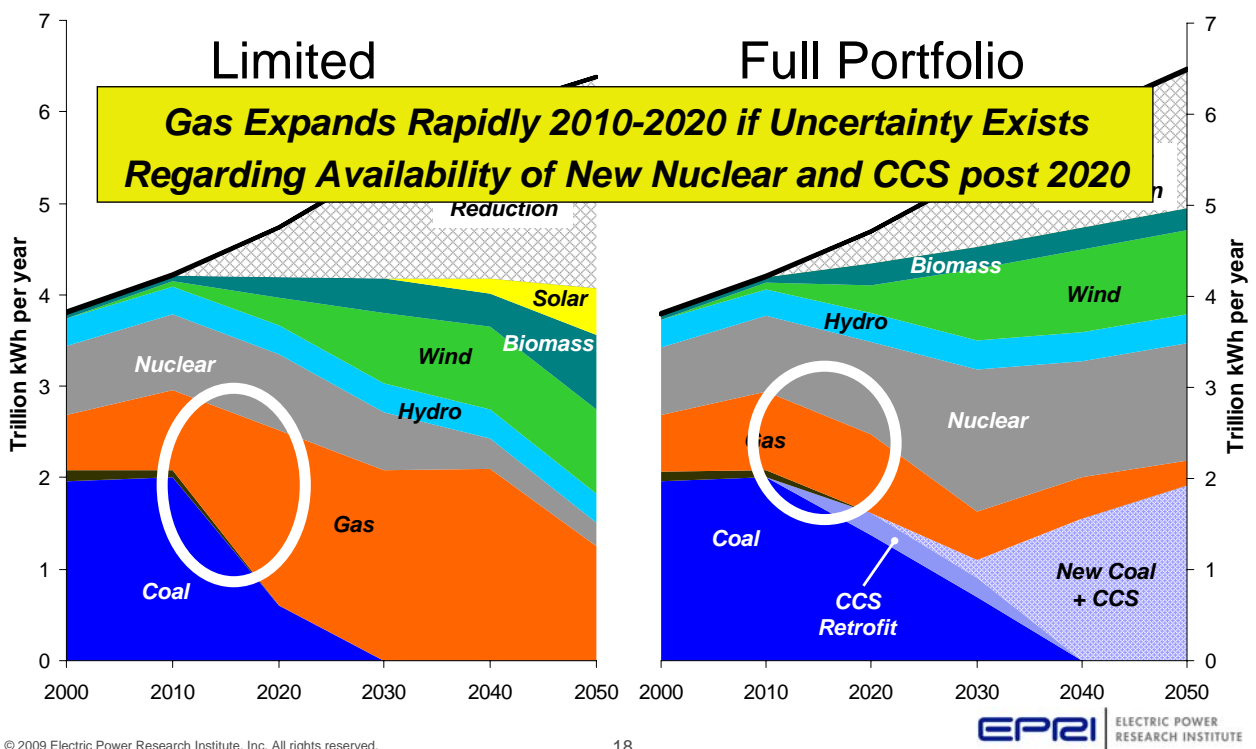
# MERGE U.S. Electric Generation Mix



# Insights – Renewables

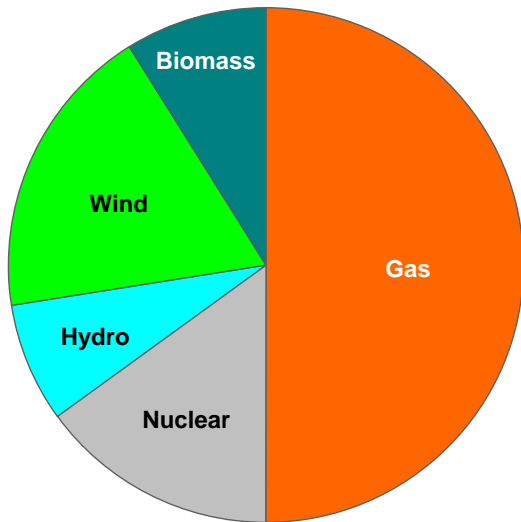


# Insights – Nuclear and CCS

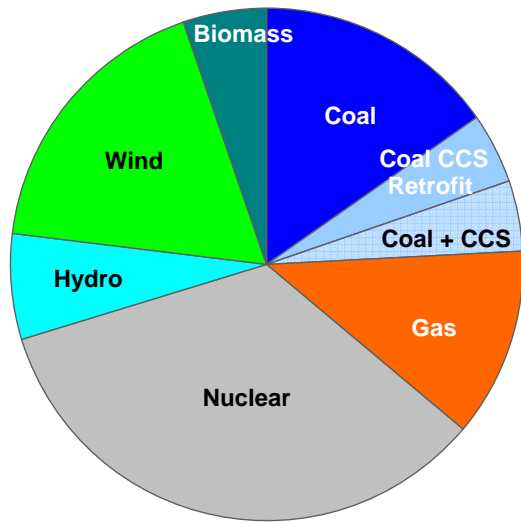


# 2030 Generation Mix

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



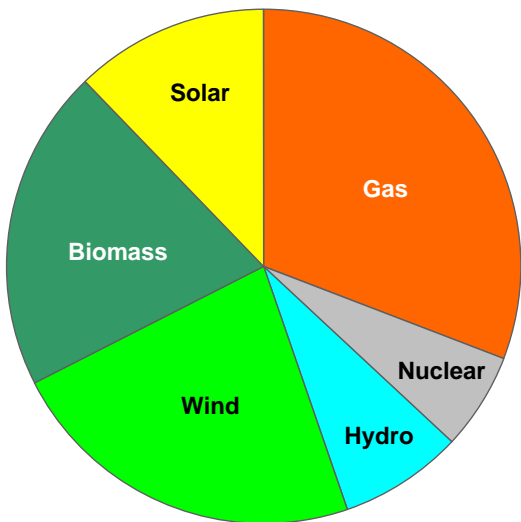
**Limited Portfolio**



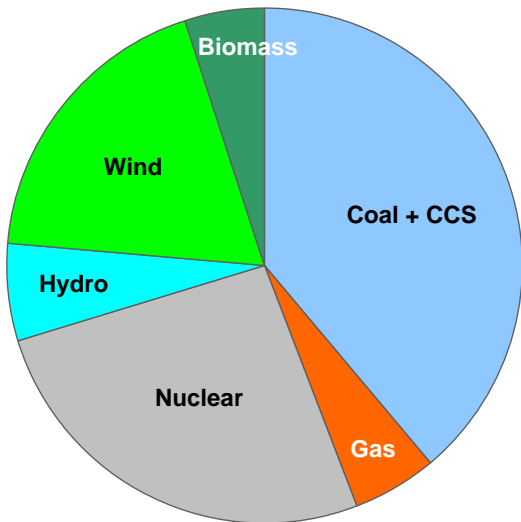
**Full Portfolio**

# 2050 Generation Mix

*Totally different futures in 2050*

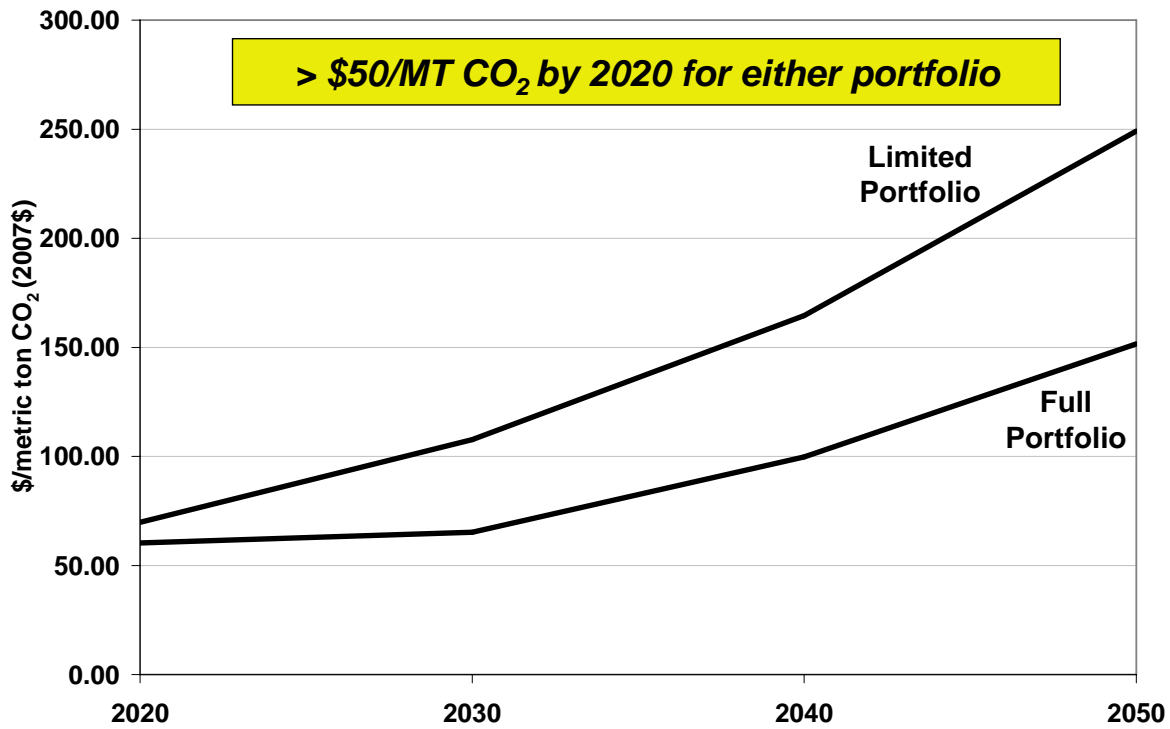


**Limited Portfolio**

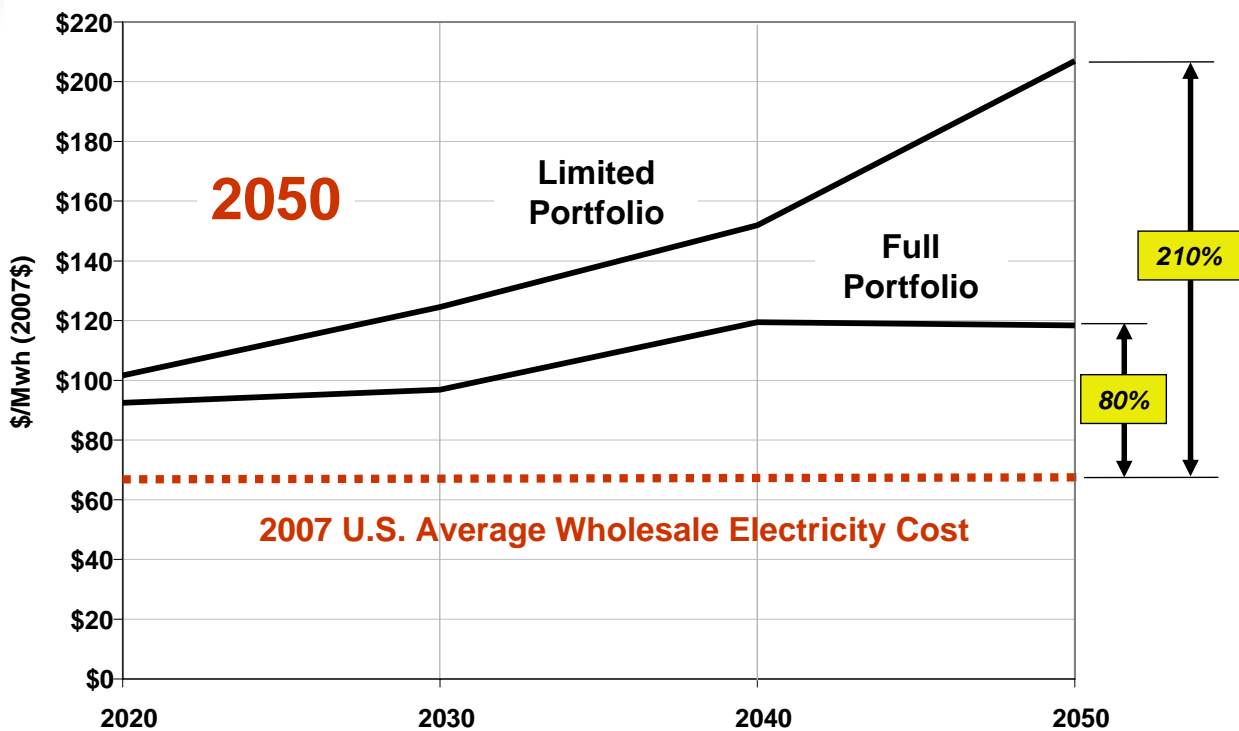


**Full Portfolio**

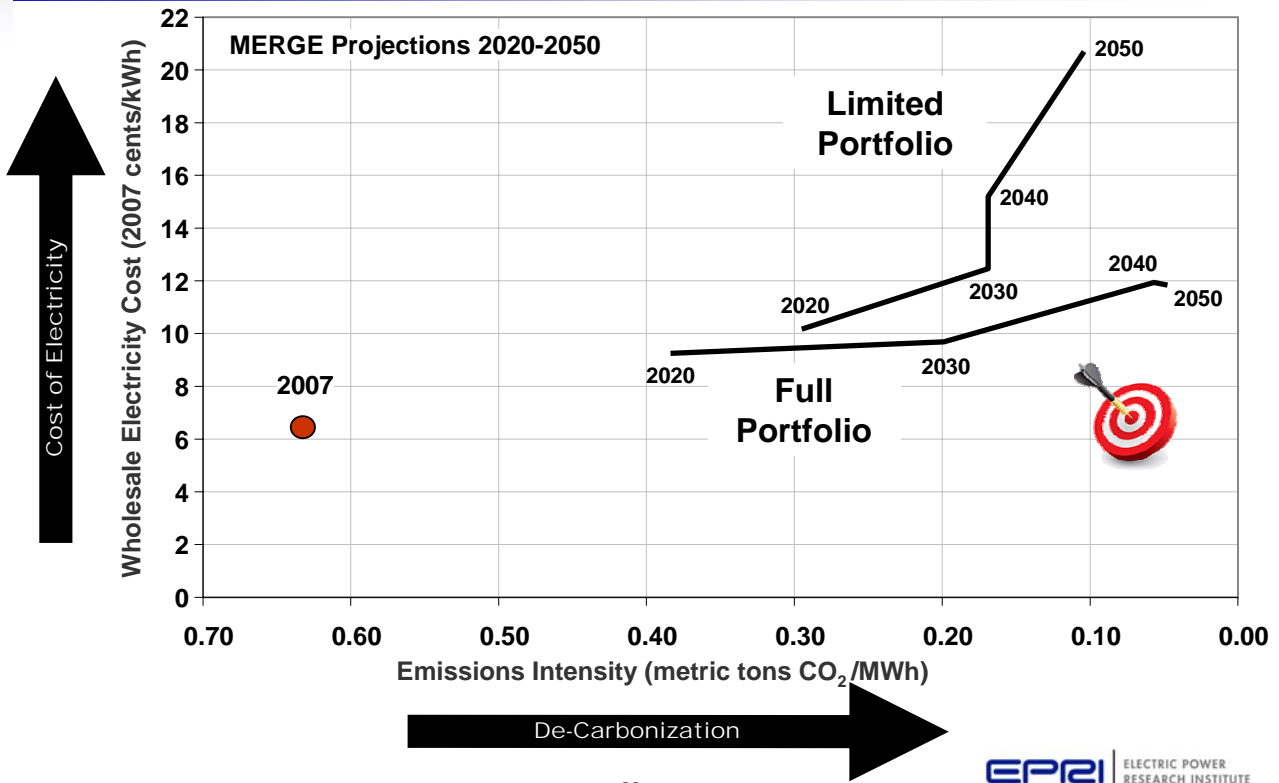
# MERGE CO<sub>2</sub> Price Results



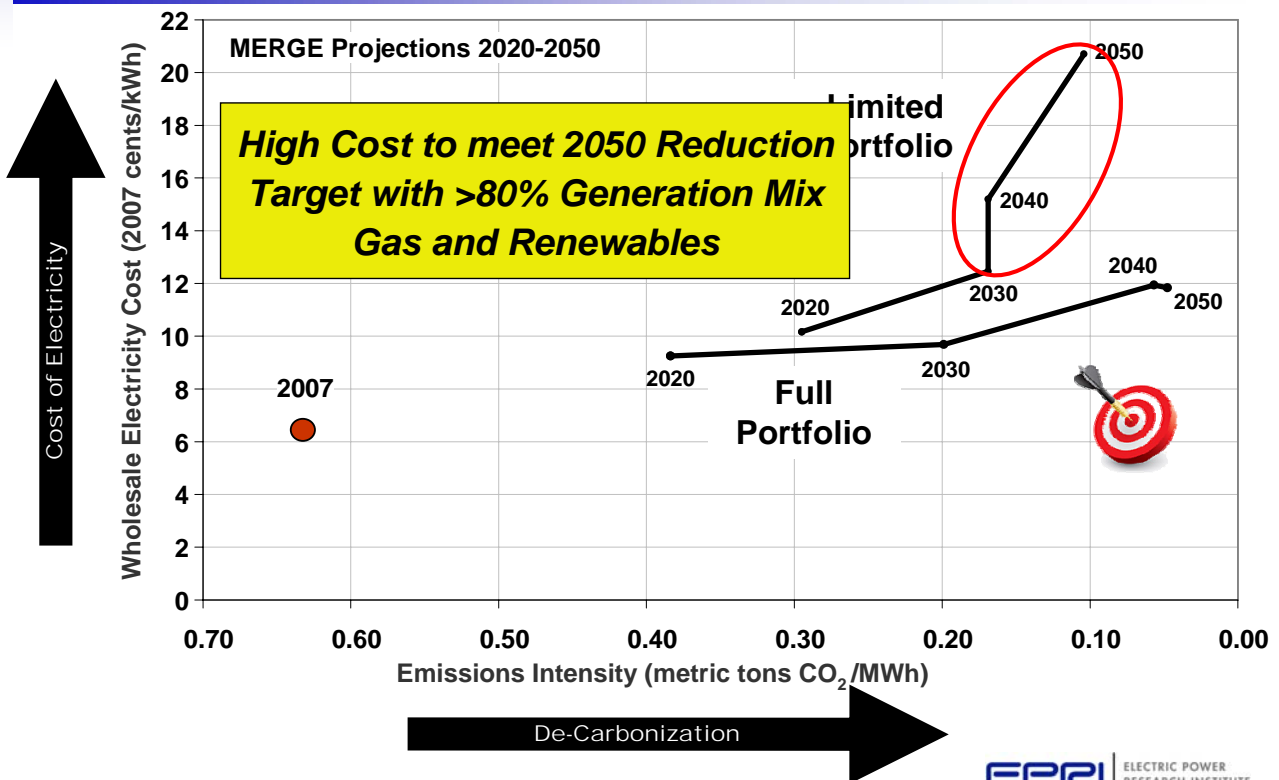
# MERGE Wholesale Electricity Cost Results



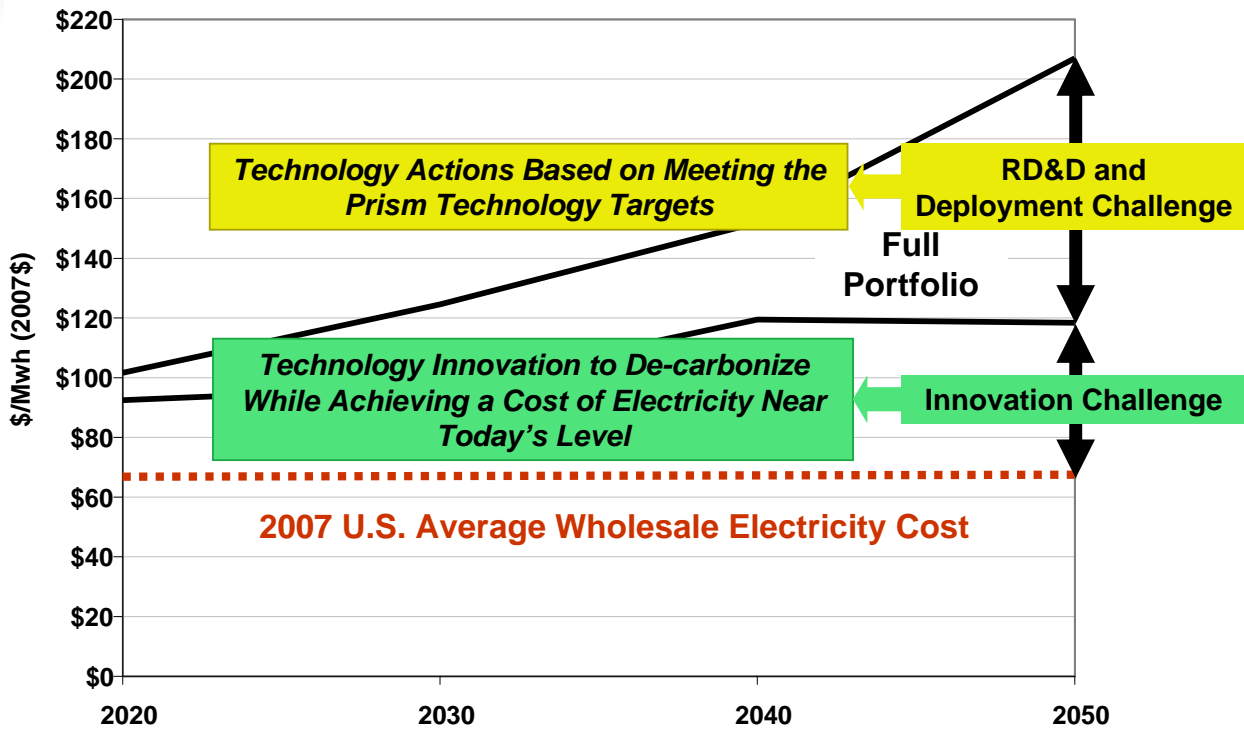
# MERGE De-carbonization Results



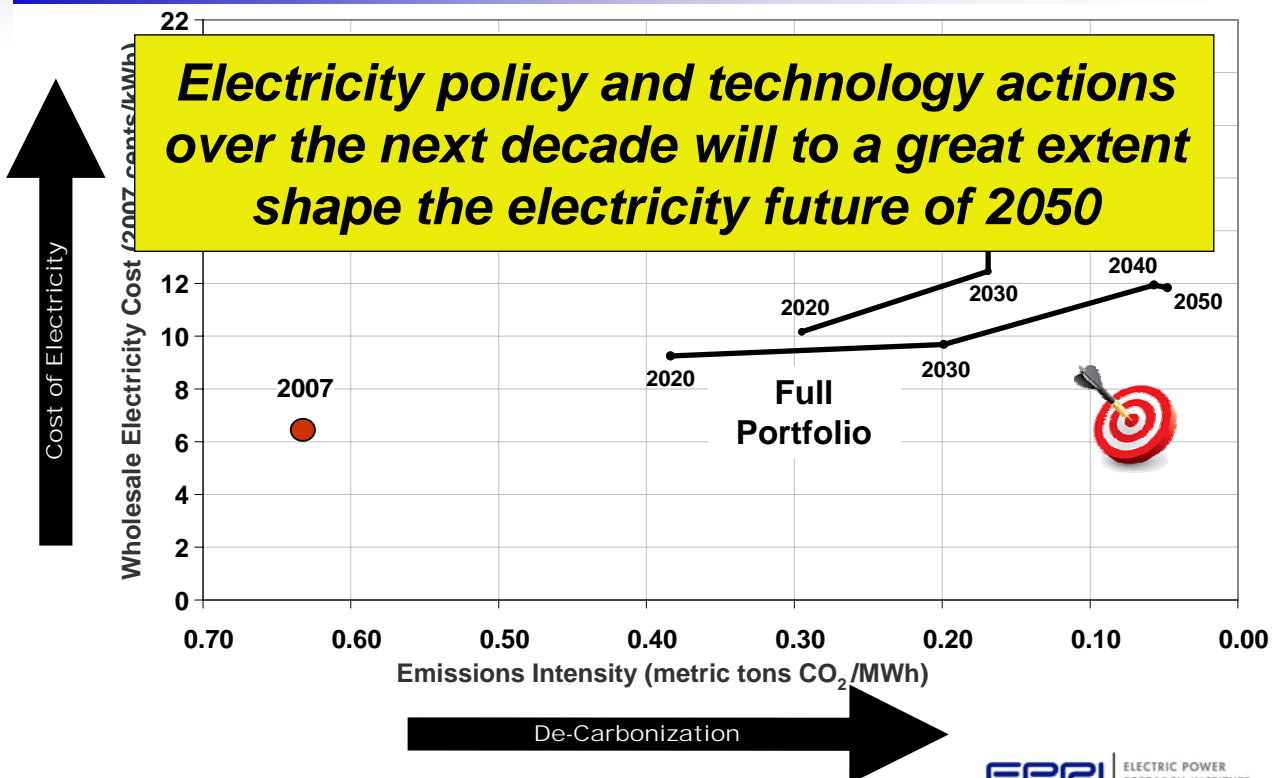
# MERGE De-carbonization Results



# Meeting the Challenge



# Conclusion



Together...Shaping the Future of Electricity



**EPRI** | ELECTRIC POWER  
RESEARCH INSTITUTE

Image from NASA Visible Earth