



## Grid Reliability and Nuclear Power Plants– A U.S. Perspective

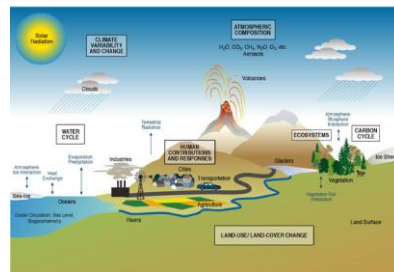
IAEA Expert Panel NPPs & Grid Stability  
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## Talk Overview

- Nuclear Power and Climate Change
- Needs for Grid Stability for Nuclear Plants under a CO<sub>2</sub> constrained generation portfolio
- Challenges for the U.S. Grid and Recommendations



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## My Background

- 3+ decades in the Electric Power Industry
- 20 years with EPRI
- Nuclear, Fossil- and Power Delivery Experience
- Participation in IAEA Expert Discussions
  - Grid Stability & Nuclear Power
  - On-Line Monitoring for Improved Instrument Channel Reliability
  - Equipment Condition Monitoring
  - Wireless Sensors

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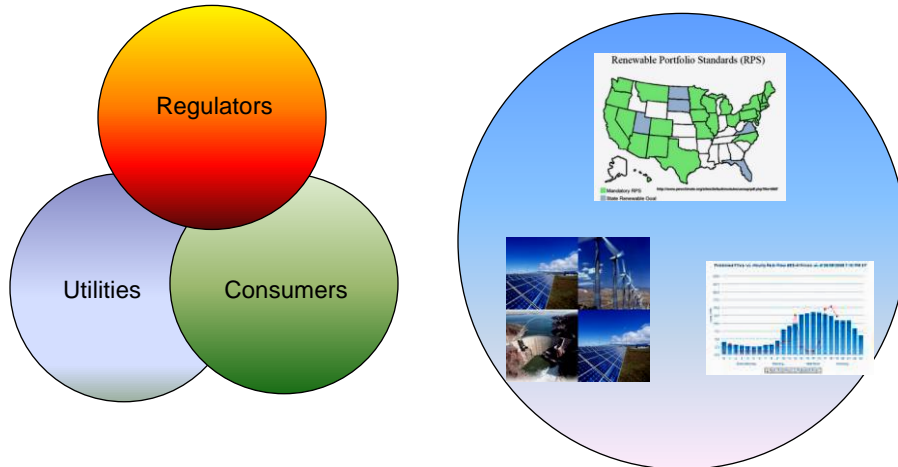
## US and International Standards

- NRC Regulations on Electric Power supply found in Title 10, Code of Federal Regulations, Appendix A, GDC 17.
- Industrial Standards such as: IEEE Std 308-1980, IEEE Std 741-1990 provide further technical guidance acceptable to US NRC.
- Similar requirements found in IAEA Safety Guide No. 50-SG-D7 (Emergency Power Systems at Nuclear Power Plants).

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## Confluence of Interests



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## A Nuclear Renaissance?

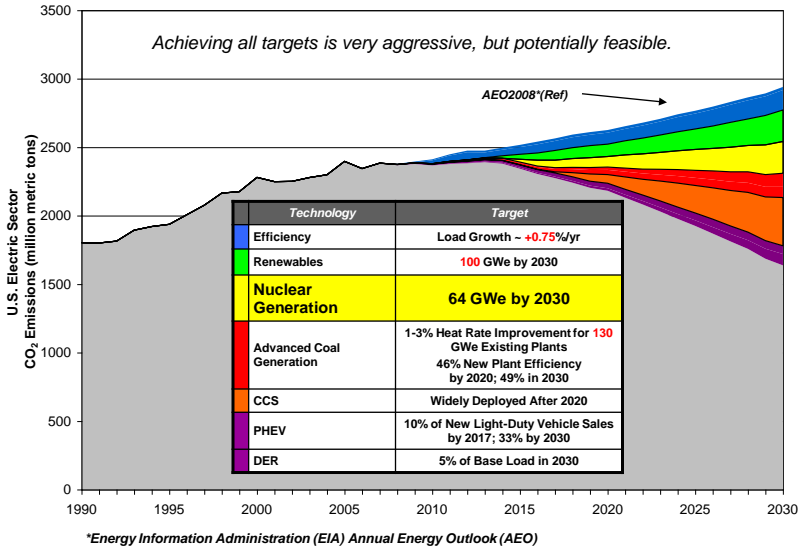
- The Energy Information Administration estimates need to increase generation 21% by 2030
- HR 2454-- Cap and Trade legislation
  - 17% reduction of GHG by 2020; 42% by 2030
  - India and China not covered
- EPRI study on Climate Change – no silver bullet solution

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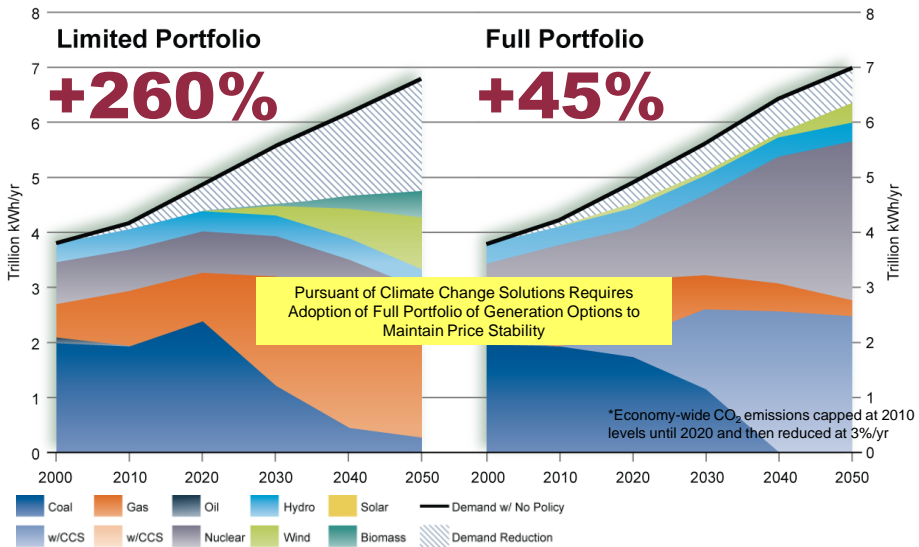
# No Silver Bullet

Graph Courtesy of the Electric Power Research Institute, Palo Alto, CA



# Economic Modeling Results

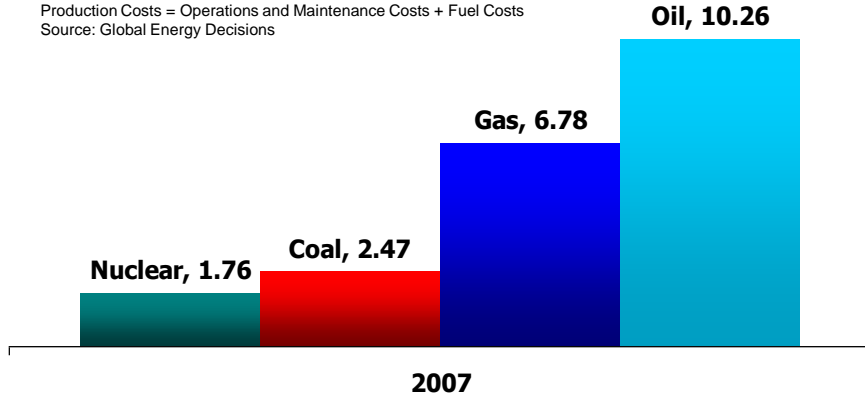
Courtesy of the Electric Power Research Institute



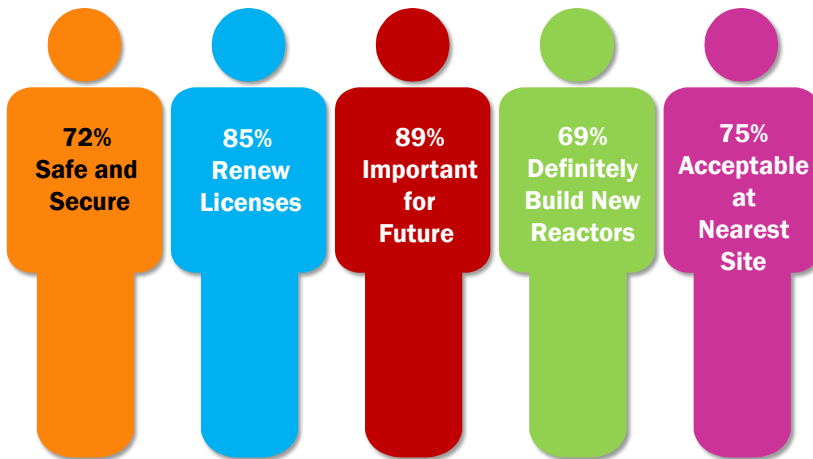


## Nuclear Energy is the Lowest Cost Producer (cents/KWH)

Production Costs = Operations and Maintenance Costs + Fuel Costs  
Source: Global Energy Decisions



## Strong Public Support





## But....

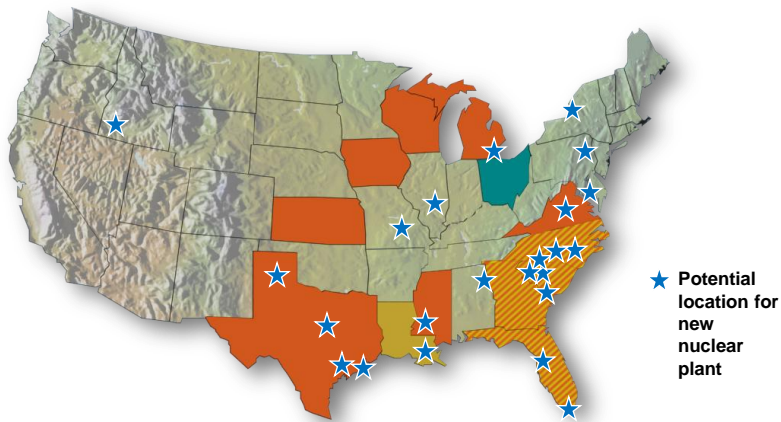
- Skepticism about waste disposal
  - Yucca Mountain fiasco
- The industry is always poised on the brink: one accident away..
- NIMBY syndrome
  - No nuclear plants, no transmission lines,
- Terrorist threats fear

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## State Policies Favoring Nuclear Power

- |  |  |
|--|--|
|  Legislation in place that helps secure financing |  Legislation that includes nuclear in clean portfolio standard  |
|  Regulation in place that helps secure financing  |  Legislation and regulation in place that help secure financing |





## Construction and Operation Licenses

- Diversity of Advanced Reactor Designs
- NRC adoption of Grid Standards that acknowledge Advanced Reactor Safety Designs
  - Passive Safety Features
  - Standard Designs
  - Coordination between Vendors and Utilities
- 30+ COLs filed

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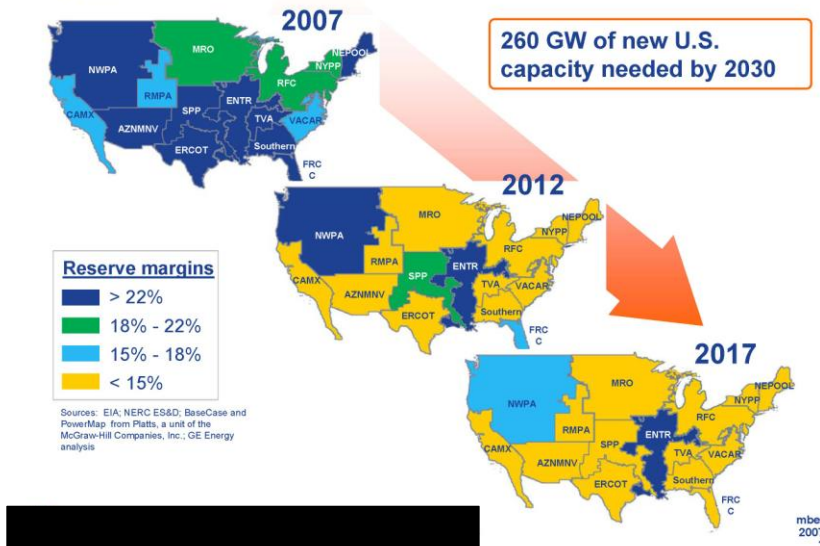


## Sample Construction & Operating Licenses (COLs) Filed

- Luminant Comanche Peak -- 2 new reactors  
APWR design, MHI is a partner
- DTE Fermi – ESBWR GE Hitachi Design
- Progress Energy Levy Plant – 2 AP1000 reactors
- Ameren Callaway Plant– Areva US EPR
- PPL Susquehanna Plant – Areva USEPR
- Exelon Texan plant – ESBWR Design
- Duke Cherokee Plant– William States Lee III plant

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## U.S. reserve margins ... falling ... new additions are needed



## Important Issues to Consider

- Modeling NPP/Grid Interface
  - for LOCA and LOOP Scenarios
  - Impact of Renewable Energy Resources on the Grid
  - Voltage/Frequency thresholds to isolate NPP from Grid



## Important Issues to Consider (continued)

- Smart Grid Safety & Security Issues
  - Impact on NPP of Energy Efficiency Strategies (Energy Efficiency Strategies, etc.)
  - Possible High Penetration of Plug-in Hybrid Vehicles Impact
- Asian Grid capability to respond to NPP/Grid Stability
  - 65+ GW planned in China & India

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## My view

- As coal-based power diminishes due to carbon costs, nuclear is expected to gain
- Best alternative for base-load power
- Strong nuclear safety culture has played a vital role
- New modular designs, passively safe

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## But...

- Caution on wide spread deployment in countries with immature and/or unstable grids
- Need for strict adherence to LOCA and LOOP conditions
- Ever present threat in unstable countries
- Developed nations reluctance to share technology

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