Nuclear Energy Inclusion in Renewable Portfolio Standards

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Radioactive & Hazardous Materials Committee

Santa Fe, New Mexico

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New Mexico and Nuclear Power

- New Mexico has relied on electricity from Palo Verde for several decades
  - PNM owns ~10%
  - Power for roughly 400K homes
- 2014 House Memorial 57
  - Called for evaluation of small modular reactors (SMRs)
- 2015 Energy Policy & Implementation Plan
  - “All of the above” philosophy
  - Focus on SMRs as a carbon-free alternative to coal
  - Creation of a post-2020 Low Carbon Electricity Portfolio Standard

Vision

Nuclear energy is critical to the U.S. infrastructure. It is essential to achieving domestic and global energy, clean air, public health and economic growth goals

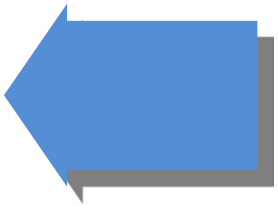
- An indefinitely sustainable electricity generation portfolio
- Economy-wide decarbonization through electrification
- A diverse portfolio of nuclear reactors producing electricity and process heat for multiple uses

Nuclear is Vital to a Sustainable Energy Portfolio

Environmental Goals

- No criteria pollutants
- No greenhouse gas emissions
- Very low volume solid waste

Economic Development

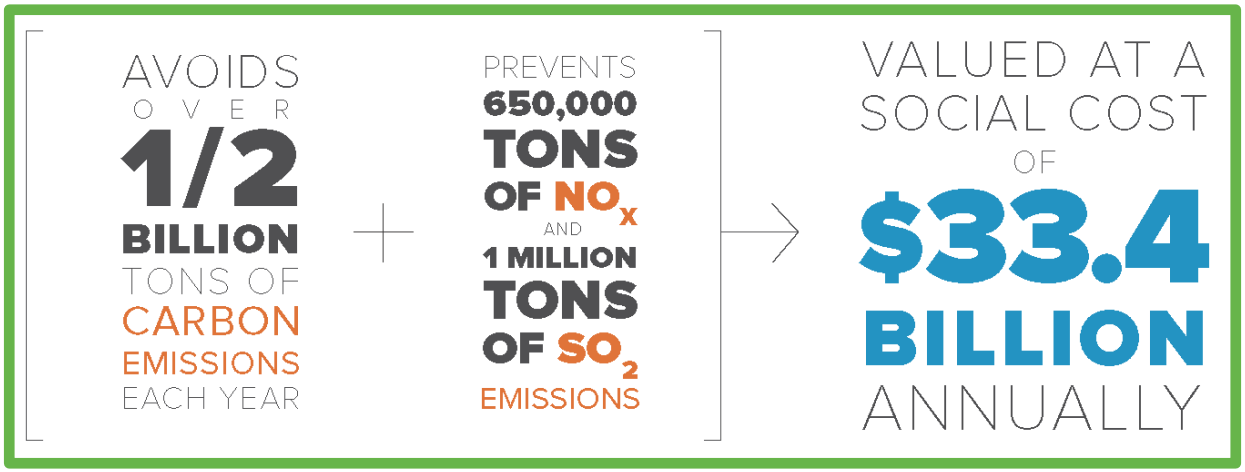


- Significant state, federal tax revenues
- Large number of high-pay jobs
- Critical local/regional economic driver

Sustainable Future Grid

- Vital to grid stability
- Keeps grid resilient
- Stabilizes electricity prices

Nuclear Energy is Key to Clean Air

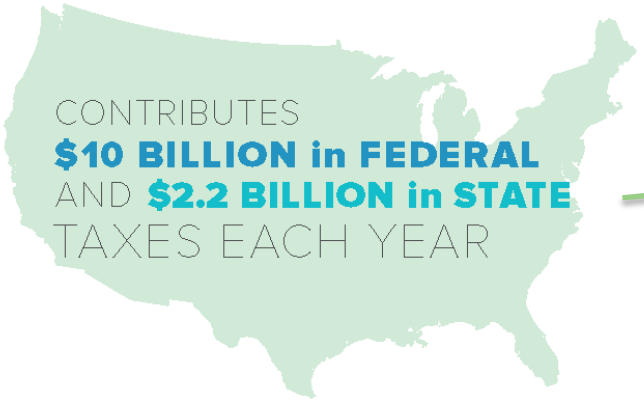


Source: *The Nuclear Industry's Contribution to the U.S. Economy*, The Brattle Group, July 2015

Loss of clean generation from prematurely closing 13 reactors

- Energy for 10M people
- Cancels out 16% of Clean Power Plan's 2030 goal

The Value of Nuclear Energy to America



ADDS
$60 BILLION
TO THE
COUNTRY'S
GDP

SUPPORTS
475,000
JOBS

SAVES CONSUMERS
AN AVERAGE OF
6 PERCENT
ON ELECTRICITY BILLS

13 premature reactor closures (actual/planned)
⇒ Loss of 9000 direct jobs
⇒ Loss of $949M federal/state annual tax revenues

Source: *The Nuclear Industry's Contribution to the U.S. Economy*, The Brattle Group, July 2015

Nuclear Power Critical to a Balanced Portfolio

- Diversity in electricity generation portfolio is very important
  - Balances out disadvantages of any one technology
  - Stabilizes fuel prices

- Multiple attributes are key to a sustainable electricity generation portfolio:
  - Cost-effective electricity production
  - Reliability and availability
  - Resilience
  - Low emissions

Clean Energy Standards

- Ultimate goals are minimal emissions and clean air
- Clean energy standards allow use of technologies that make the best contribution to these goals.
- Nuclear power is highly valuable to achieving clean energy
  - Example: New York Clean Energy Standard

States/Regions Recognize Need for Action

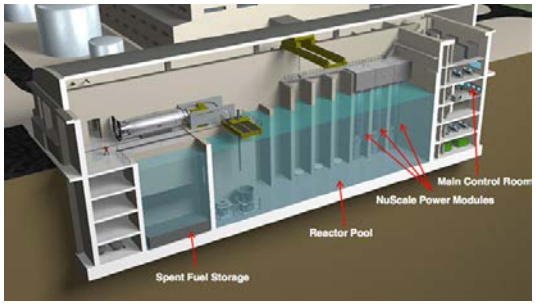
- New York – NY PSC has made nuclear plants eligible for emissions credits under Clean Energy Standard.
- Illinois – Considering a low-carbon portfolio via a clean energy standard
- Connecticut – Potential legislation allowing nuclear to compete with other non-emitting sources for long-term contracts.
- ISO New England - Evaluating possibility of a "carbon adder" which results in compensation for non-emitting plants.

Closing nuclear facilities "would eviscerate the emission reductions achieved through the state's renewable energy programs, diminish fuel diversity, increase price volatility, and financially harm host communities."

– New York Gov. Andrew Cuomo
Dec. 2, 2015

Small Modular Reactors

- Offsite module fabrication
- Onsite modular construction
- Lower capital investment
- Ranging from 45 – 200 MW in capacity
- Simple designs, passive safety features
- Siting flexibility
- Operational flexibility
- Greater efficiency
- Nonproliferation
- International Marketplace



Looking to the Future

- Nuclear power assures a sustainable future for many decades

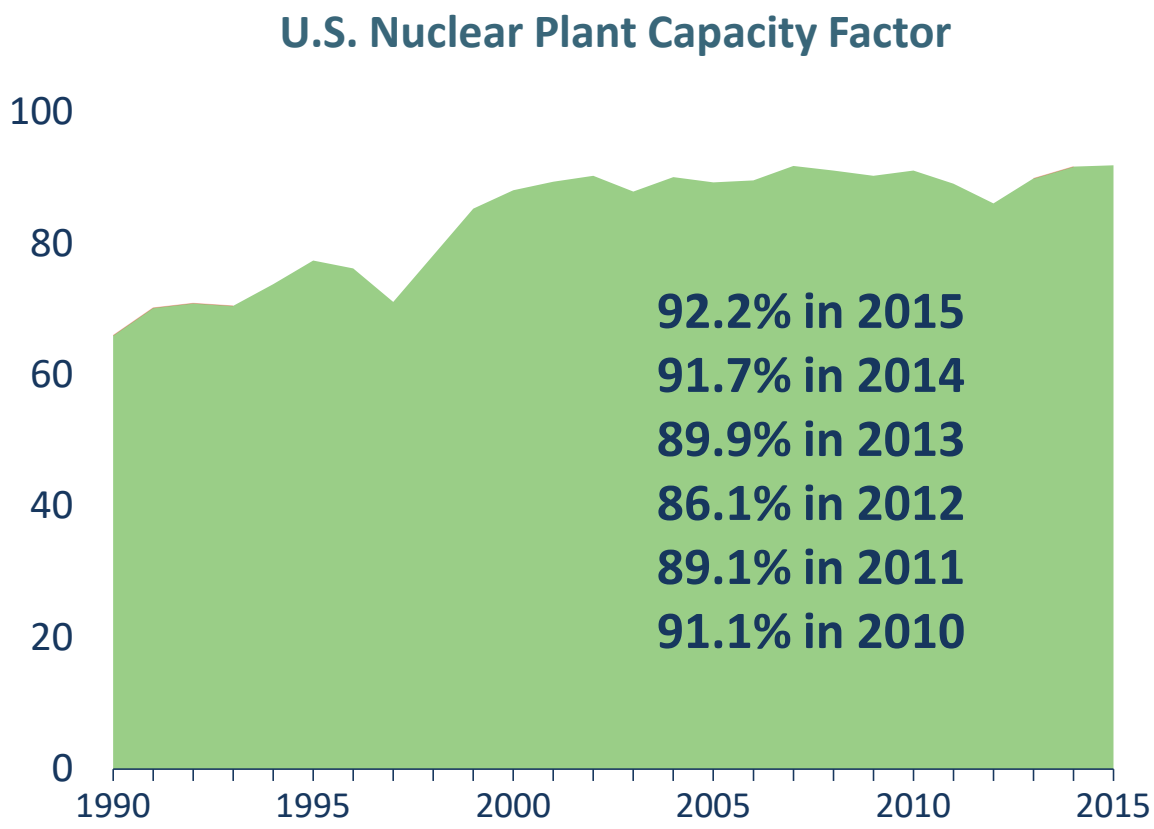
- Small modular reactors (SMRs) will be very valuable
  - Provide all of the values that current nuclear does
  - Adds siting and operational flexibility
  - Inherent safety features, smaller footprint
  - Facilitate investment through incremenal capacity addition

- Opportunity to spur economic development

Reference Slides

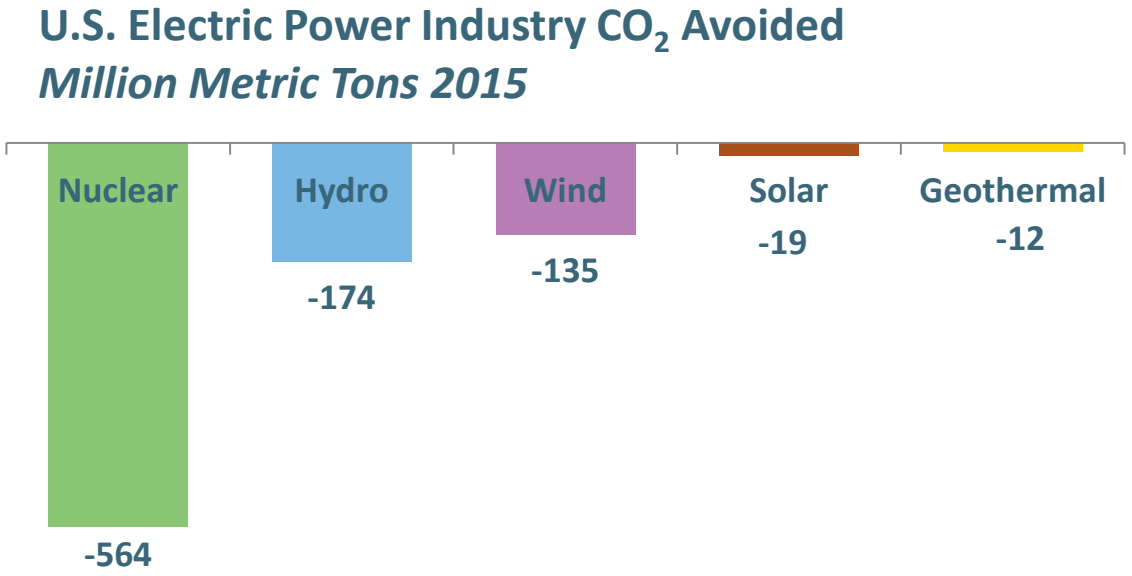
Nuclear Energy is Highly Reliable, Resilient

- U.S. reactors set record capacity factor: 92.2%
- Nuclear plants generated ~19% of electricity in 2015
- Nuclear plants are highly secure, operate under nearly all weather conditions.



Source: Energy Information Administration

Nuclear Electricity Generation is Essential to Achieve Climate Goals



- **Nuclear power is almost 2/3 of all clean electricity generation**
- **Nuclear power avoids emissions equivalent of more than 1/2 of the cars and trucks operating today.**
- **Nuclear power avoids emissions equivalent to 2/3 of the EPA's Clean Power Plan goal.**

Sources: Emissions avoided are calculated using regional and national fossil fuel emissions rates from the Environmental Protection Agency and generation data from the Energy Information Administration.

Premature Nuclear Plant Shutdowns

Plant	MWe	Reason	Closure Year	Latest Electricity Generated (bkWh/year)	Latest CO2 Emissions Avoided (million tons/year)
Crystal River 3	860	Mechanical	2013	7.0	5.3
San Onofre 2 & 3	2,150	Mechanical	2013	18.1	8.8
Kewaunee	566	Market	2013	4.5	4.8
Vermont Yankee	620	Market	2014	5.1	2.7
Fort Calhoun	479	Market	2016	3.5	3.7
Clinton	1,065	Market	2017	8.7	9.2
Quad Cities 1 & 2	1,819	Market	2018	15.6	13.2
Pilgrim	678	Market	2019	5.0	2.6
Oyster Creek	610	Policy	2019	5.3	4.4
Diablo Canyon 1 & 2	2,240	Combination	2024-2025	18.5	8.3

- 11,087 MWe of baseload capacity
- 63 million short tons of CO_2 avoided
- 15% of Clean Power Plan's 2030 414-million-ton target
- Approximately 8,500 direct jobs

Losing Nuclear Plants has Tremendous Impacts

CURRENT AND PLANNED PREMATURE RETIREMENTS

- **13 REACTORS**
- **MOST IN NEXT 3 YEARS**

JOB LOSSES

- **9,000 DIRECT JOBS**

LOSS OF CLEAN ELECTRICITY GENERATION

- **12,000 MW**
- **NEGATES 16% of 2030 CLEAN POWER PLAN GOAL**

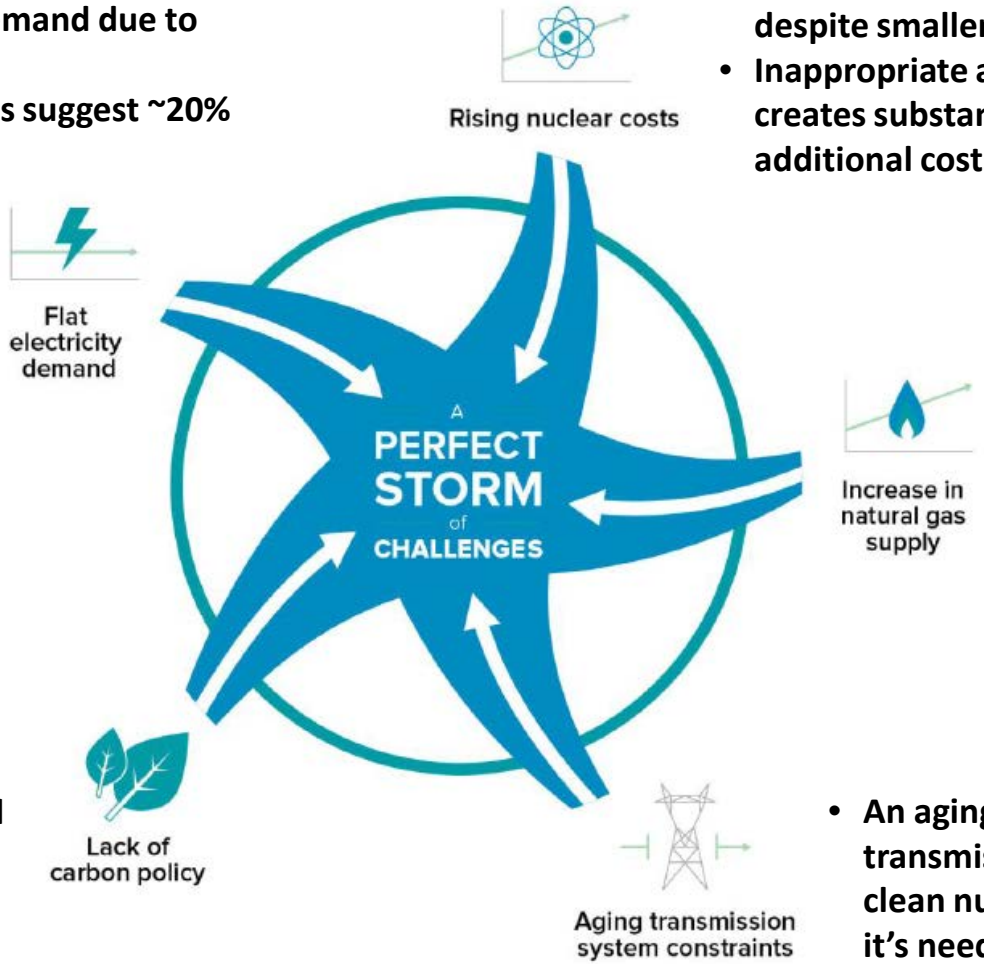
LOSSES IN FEDERAL AND STATE TAX REVENUES

- **$949 MILLION LOST**

Current Challenges Threaten a Sustainable Future

- Virtually no growth in demand due to sluggish economy
- But long-term projections suggest ~20% growth in U.S. demand.

- Total NRC fees to industry continue to rise, despite smaller fleet.
- Inappropriate application of regulations creates substantial, unnecessary additional costs



- Wholesale power prices driven down by plentiful natural gas supply.
- But long-term, emissions from a large natural gas power fleet will be unacceptable.

- Nuclear energy receives no compensation for emissions-free generation.
- But other technologies are subsidized at federal and state level, artificially driving down energy prices.

- An aging, constrained transmission system limits moving clean nuclear electricity to where it's needed.

Movement on Market Policies and Practices

- FERC and RTOs taking actions that would help to prevent closures, but pace is slow
  - Price formation in energy markets
  - Design of capacity markets
- As risk of shutdown has become clearer, states are stepping in to preserve plants
- Growing concern over impact of state policies on viability of markets