

# Nuclear Energy: Focus on Value

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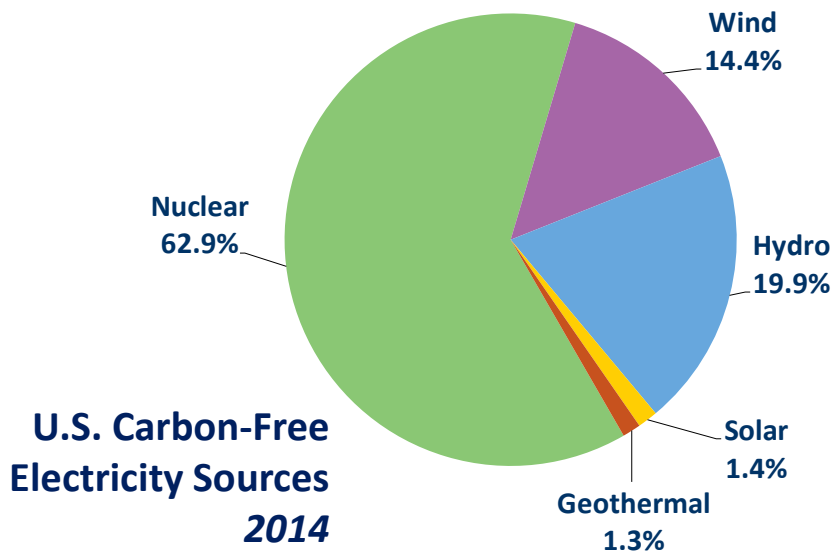


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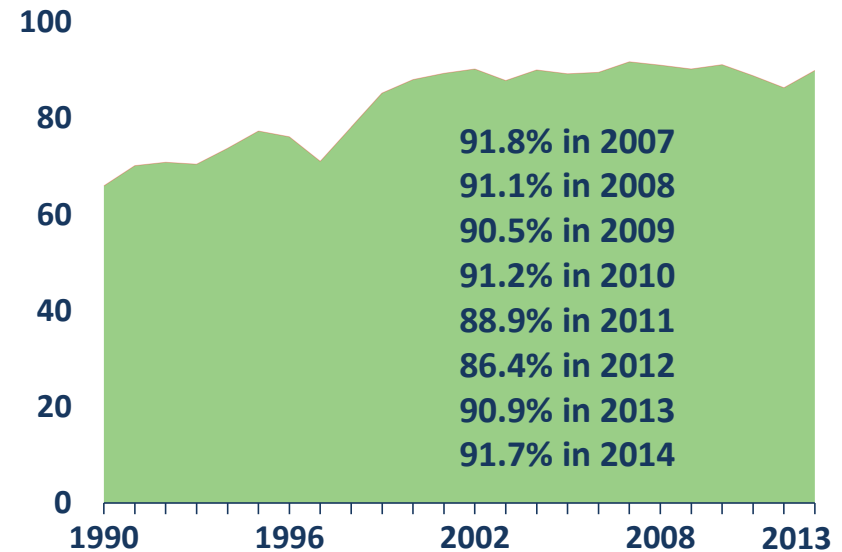
nuclear. clean air energy.

# U.S. Nuclear Industry ... At a Glance

- Consistently high levels of safety, reliability
- Capacity factor in 2014: 91.7%
- Nuclear plants generated 797 billion kWh in 2014
- 63% of U.S. carbon-free generation



**Sustained Reliability and Productivity:  
U.S. Nuclear Plant Capacity Factors**

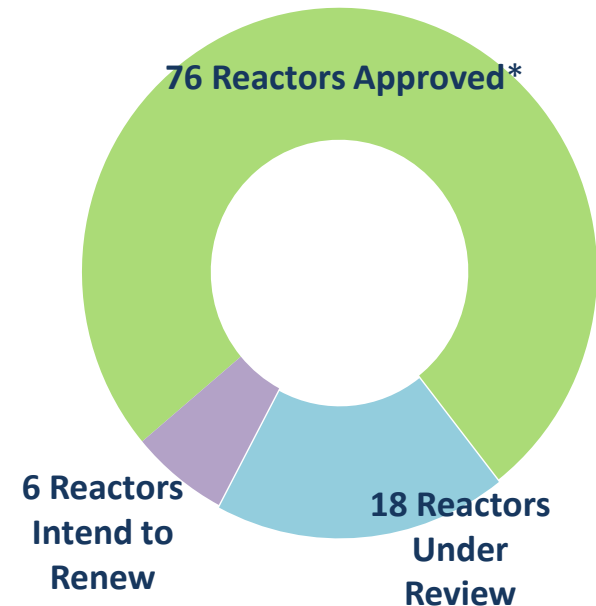


Source: Energy Information Administration

# U.S. Nuclear Industry ... At a Glance

- License renewal: rigorous, predictable regulatory process
  - Now planning for second license renewal
- Halfway through a 30-billion-dollar-plus construction program
  - Vogtle 3 and 4 in Georgia
  - Summer 2 and 3 in South Carolina
  - Watts Bar 2 in Tennessee (commercial operation early 2016)
- Incorporated lessons learned from Fukushima = increased safety and ability to handle extreme natural events
- Substantial annual investment by industry to maintain reliability and safety, increase output

Status of License Renewal

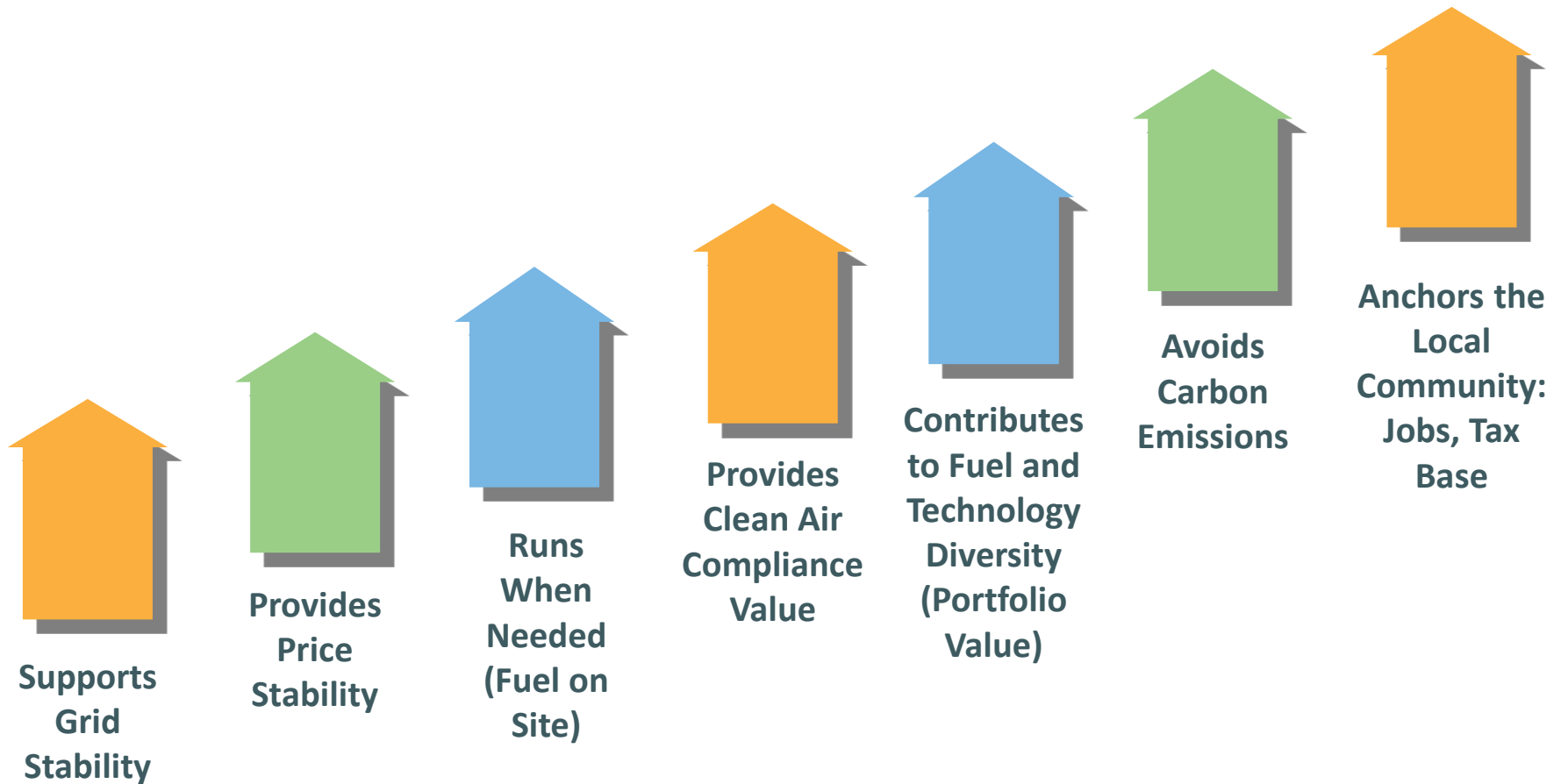


\* Seventy-four of these are operating.

Source: Nuclear Regulatory Commission

# Nuclear Energy: A Solid Value Proposition

## Safe, Reliable Electricity 24-by-7-by-365 Plus ...



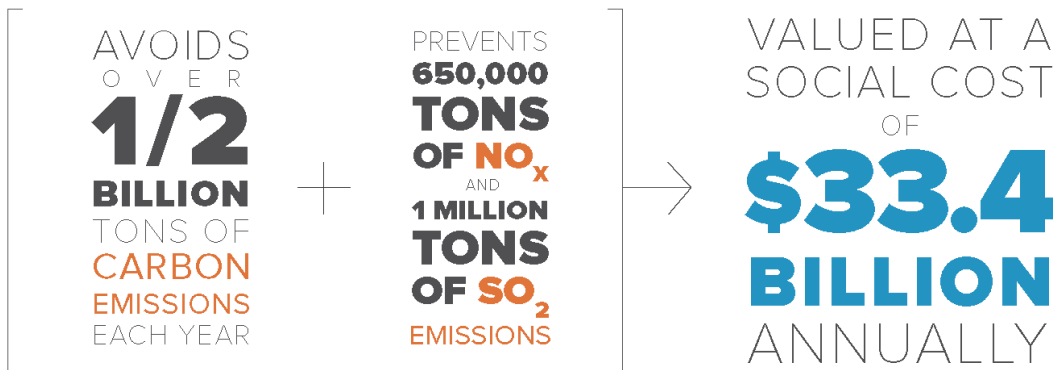
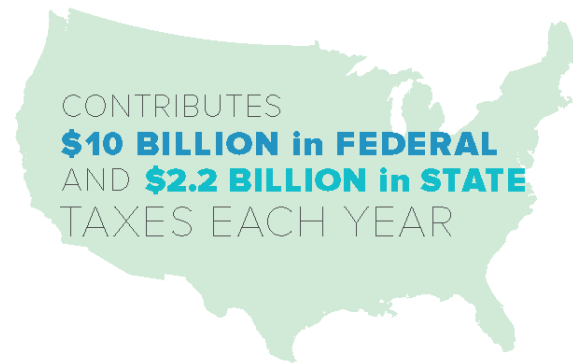

# The Value of Nuclear Energy



SUPPORTS  
**475,000**  
JOBS



SAVES CONSUMERS  
AN AVERAGE OF  
**6 PERCENT**  
ON ELECTRICITY BILLS



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

# Nuclear Plant Shutdowns: The Situation

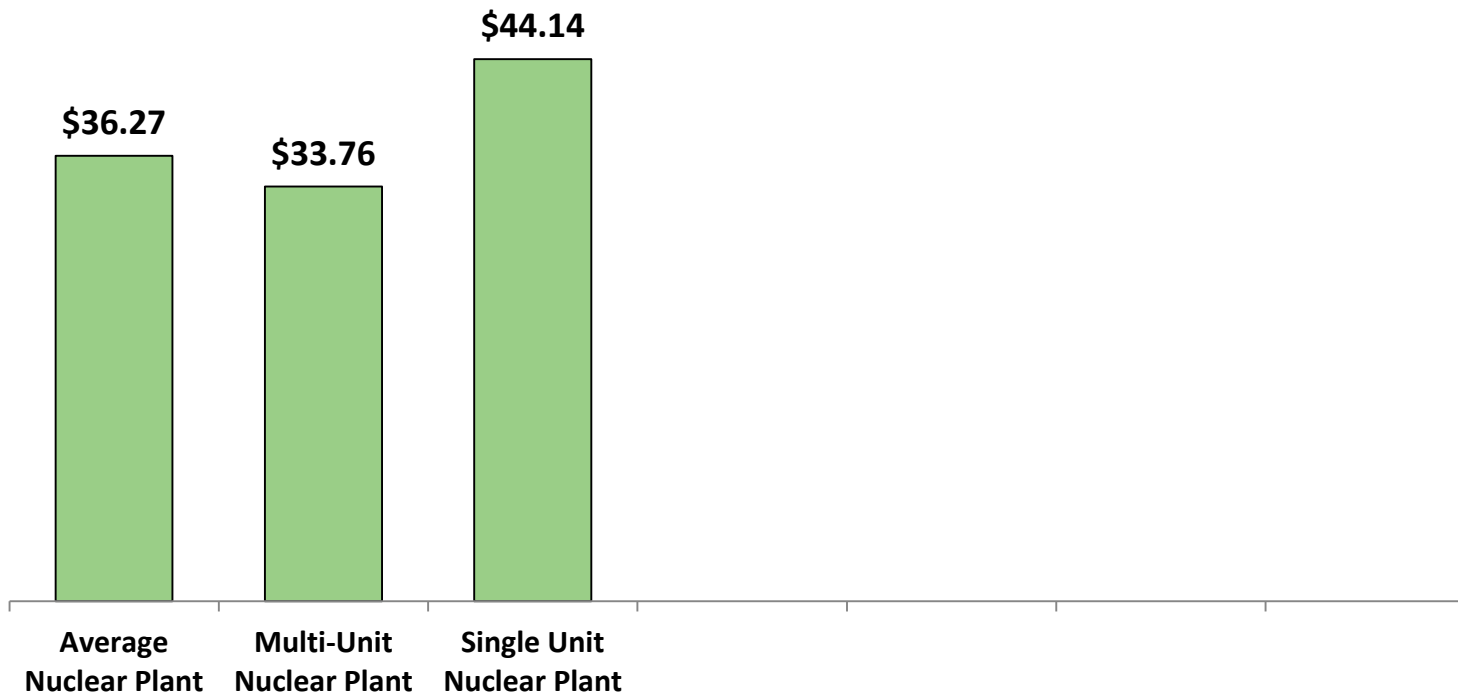
- Crystal River 3 (2013), San Onofre 2 and 3 (2013) were unique events (failed steam generator replacements)
  - ❖ Over 110 PWRs (57 in the U.S.) have replaced steam generators
- Adverse market conditions:
  - ❖ Kewaunee (2013)
  - ❖ Vermont Yankee (2014)
  - ❖ Pilgrim (June 2019, possibly sooner)
  - ❖ FitzPatrick (late 2016-early 2017)
- Others at risk

# Market Issues ... In Brief

- Low growth (in some cases, no growth) in electricity demand coming out of 2008 recession
- Continuing surge in supply of low-cost shale gas
- Transmission constraints
- Price signals inadequate to support operating capacity, or investment in new capacity (except gas-fired)
- Prices suppressed by RTO policies and actions, and by state and federal mandates and subsidies
- Fuel/technology diversity is taken for granted and undervalued

**Failure to address problems could (1) expose consumers to higher prices and increasing price volatility, (2) frustrate efforts to reduce carbon emissions, (3) compromise resource adequacy, reliability, portfolio value**

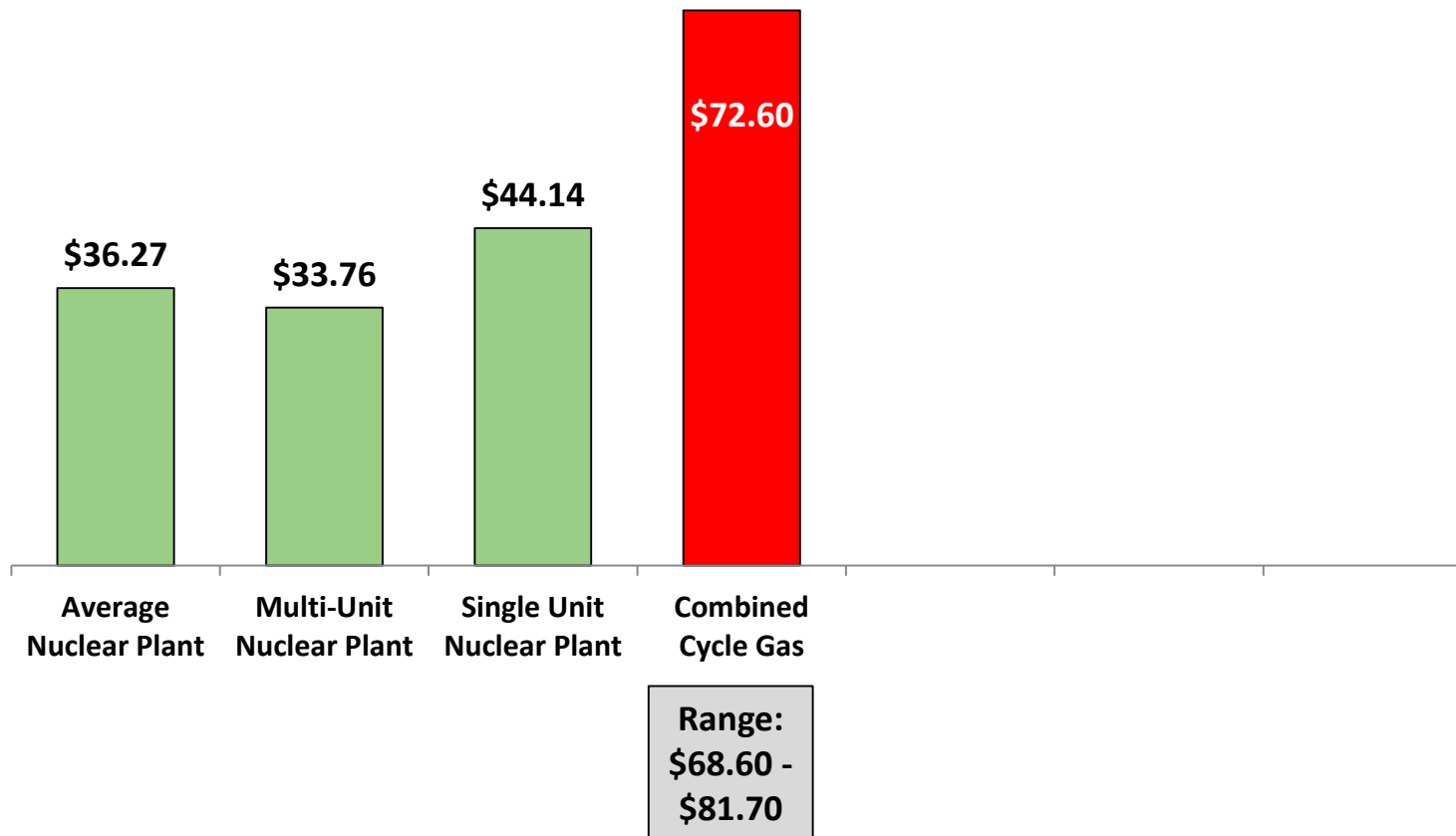
# Replacing a Nuclear Power Plant with New Generating Capacity 2014 \$/MWh



Sources: Existing nuclear costs are 2014 total generation costs (fuel, O&M, capital) from Electric Utility Cost Group. Canadian hydro from "Proposed Senate Bill No. 1965: An Act Relative to Energy Sector Compliance with the Global Warming Solutions Act," The Analysis Group, September 2015. Gas-fired combined cycle, wind and solar generating costs from Energy Information Administration, *Annual Energy Outlook 2015*.

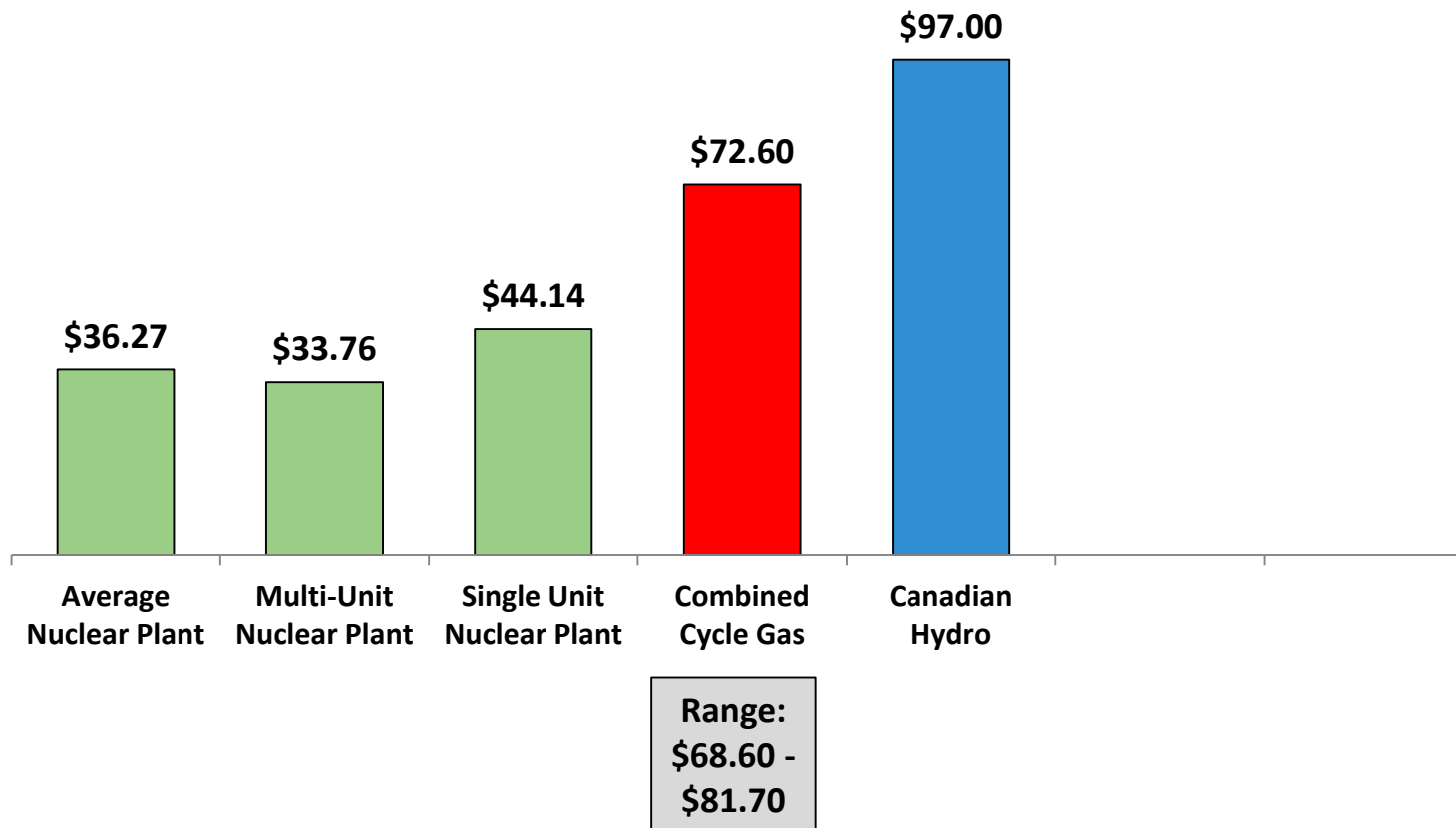


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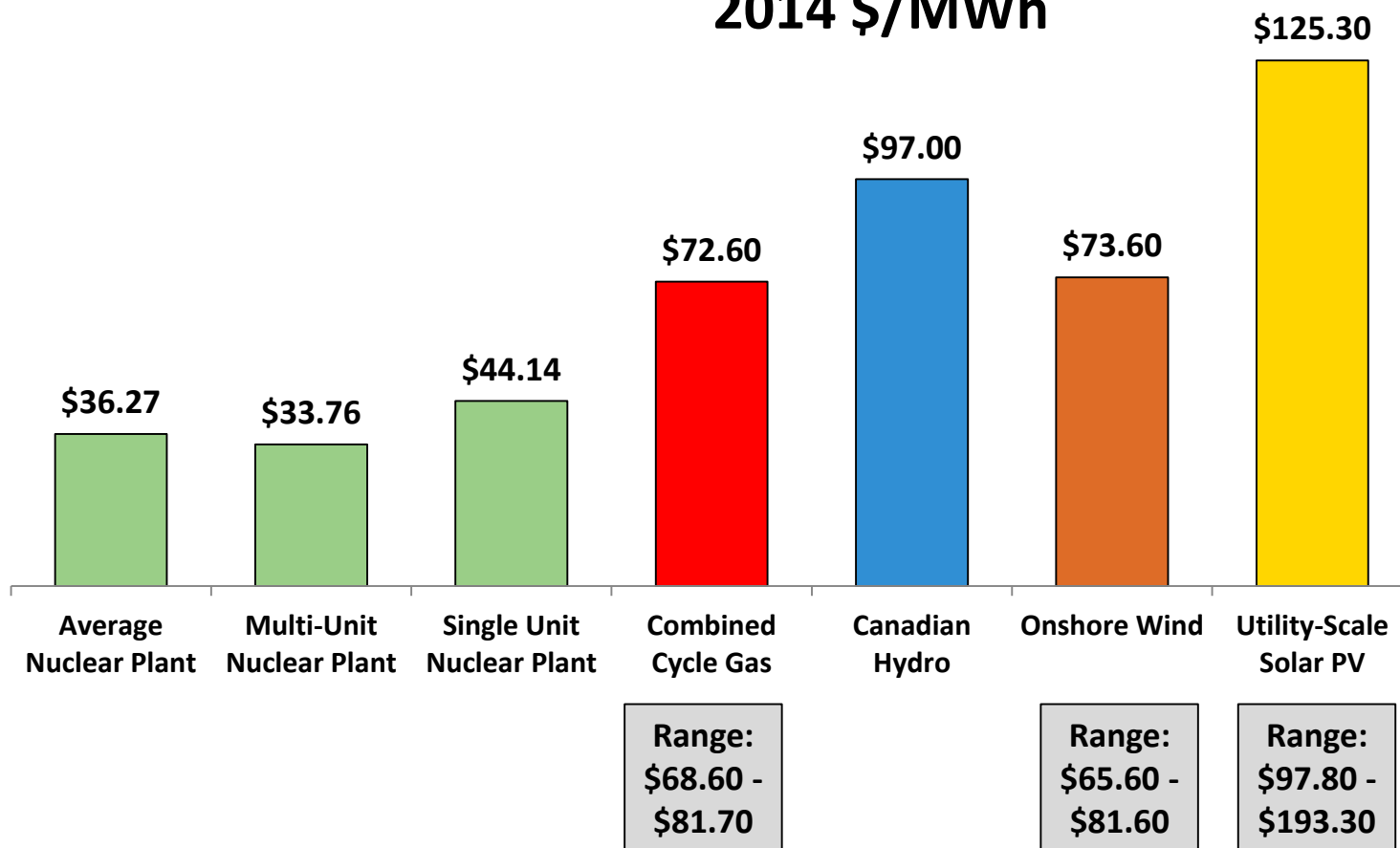
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# Impact of Plant Shutdowns in Illinois

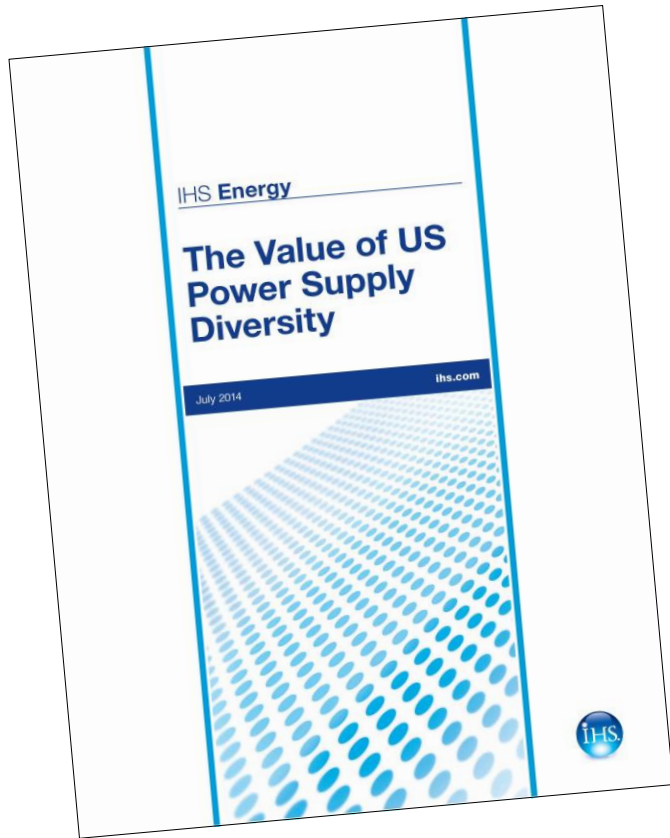
- PJM analysis for Illinois Commerce Commission:
  - \$307 million-\$437 million annual increase in load payments in ComEd zone
  - \$752 million-\$1.3 billion annual increase in load payments in PJM
  - “Significant thermal and voltage violations”
- NEI analysis:
  - 2,500 direct jobs lost; 9,000 direct and indirect
  - \$2.4 billion in direct lost economic value; \$3.6 billion direct and indirect



# CO<sub>2</sub> Impact When a Nuclear Power Plant Shuts Down

| State 2030 Compliance Target                             | CO <sub>2</sub> Emissions Avoided 2014        |
|--|---|
| Massachusetts:<br>Approx. <b>1-million-ton reduction</b> | Pilgrim: <b>3.1 million tons</b>              |
|  | Quad Cities 1 and 2: <b>12.4 million tons</b> |
| Illinois:<br>Approx. <b>30-million-ton reduction</b>     | Byron 1 and 2: <b>15.5 million tons</b>       |
|  | Clinton: <b>8.6 million tons</b>              |
|  | <b>Total: 36.5 million tons</b>               |

# Impacts of Losing Electricity Diversity



- \$93 billion increase in cost of electricity per year
- 25% increase in retail power prices, along with increased price volatility
- \$200 billion reduction in GDP each year due to higher electricity prices
- 1 million fewer jobs resulting from lower GDP
- \$2,100 increase in electricity costs per year for the typical household

# What Can States Do?

- Clean Energy Standard (stand-alone or consolidated with existing RPS)
- Power purchase agreements (lock in price stability, protect consumers from price volatility, recognize value of fuel/technology diversity)
- Encourage urgency at FERC, RTOs to address defects in market practices and rules
- Address transmission constraints
- Recognize nuclear energy's compliance value when developing SIPs under Clean Power Plan
- Think and act long-term