

Used Fuel Storage and Transport for Shutdown and Decommissioning Nuclear Plants

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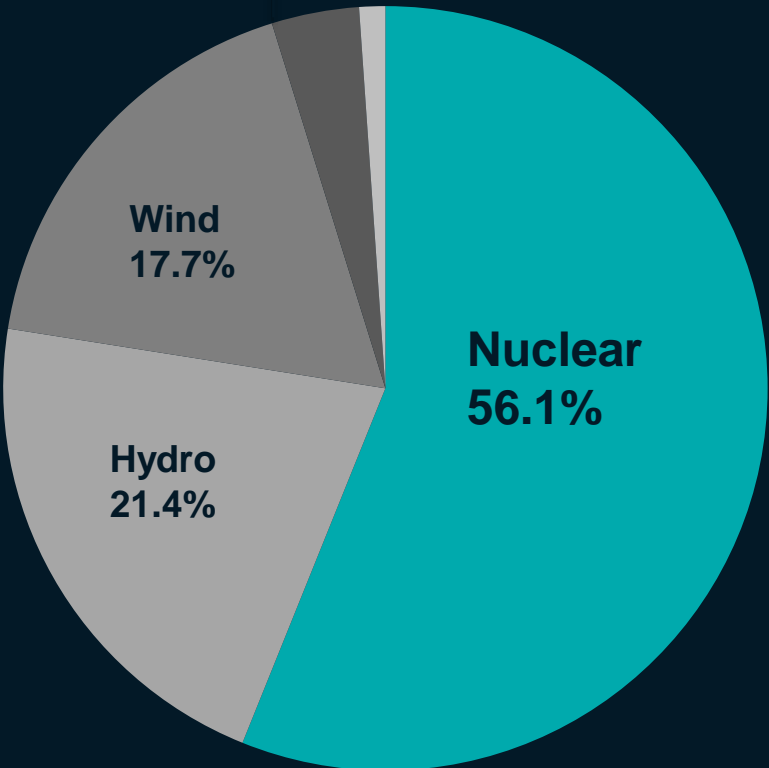


Nuclear Power in the U.S.



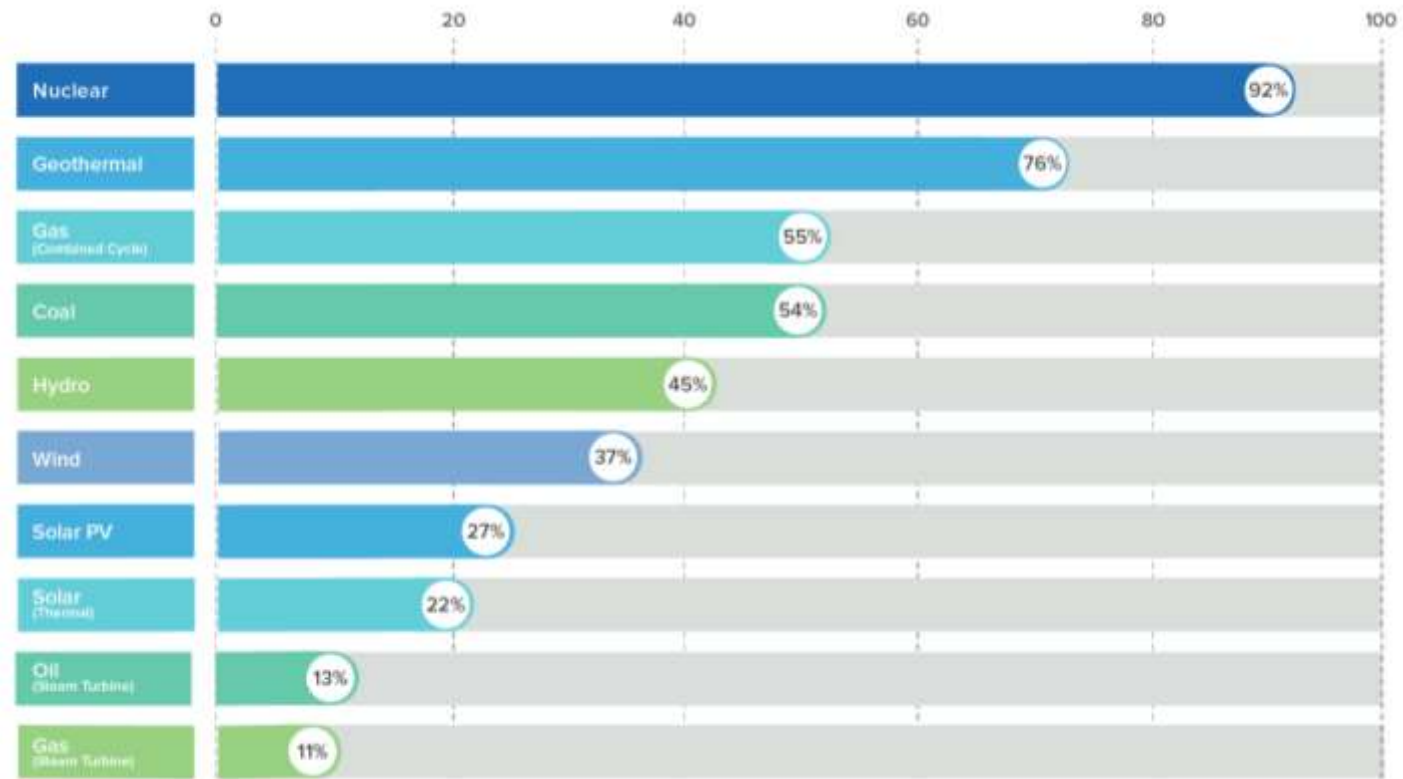
- 98 operating reactors at 59 sites, in 30 states
- 99,010 MWe of baseload capacity
- 20% of the U.S. energy generation comes from nuclear

U.S. Emissions-free Fuel Shares In 2017

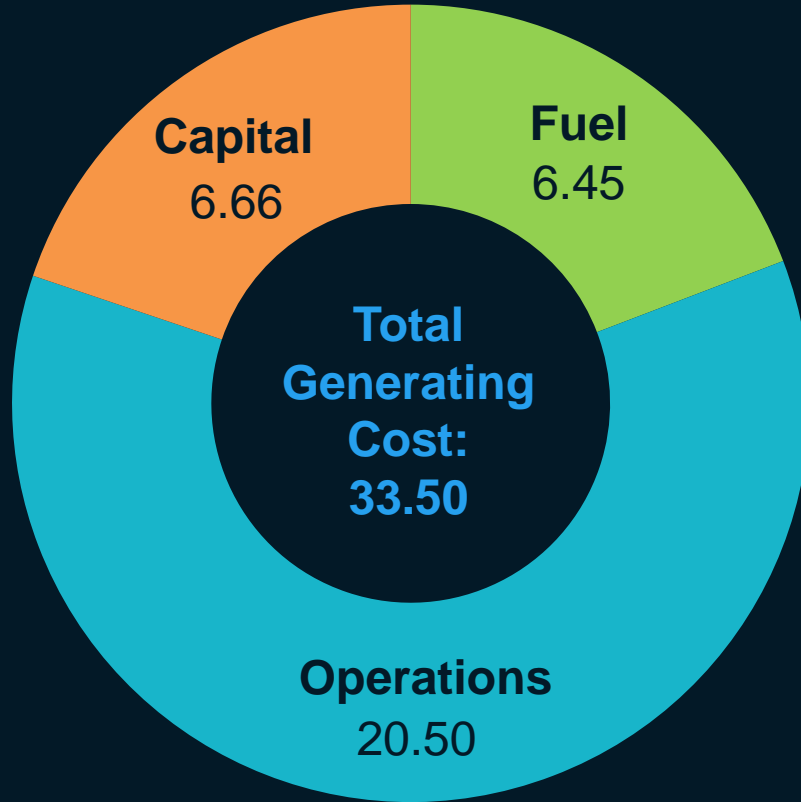


Over 56% of the U.S. Clean Energy Comes from Nuclear

Capacity Factors by Fuel Type in 2017



2017 Nuclear Power Generating Costs (\$/MWh)

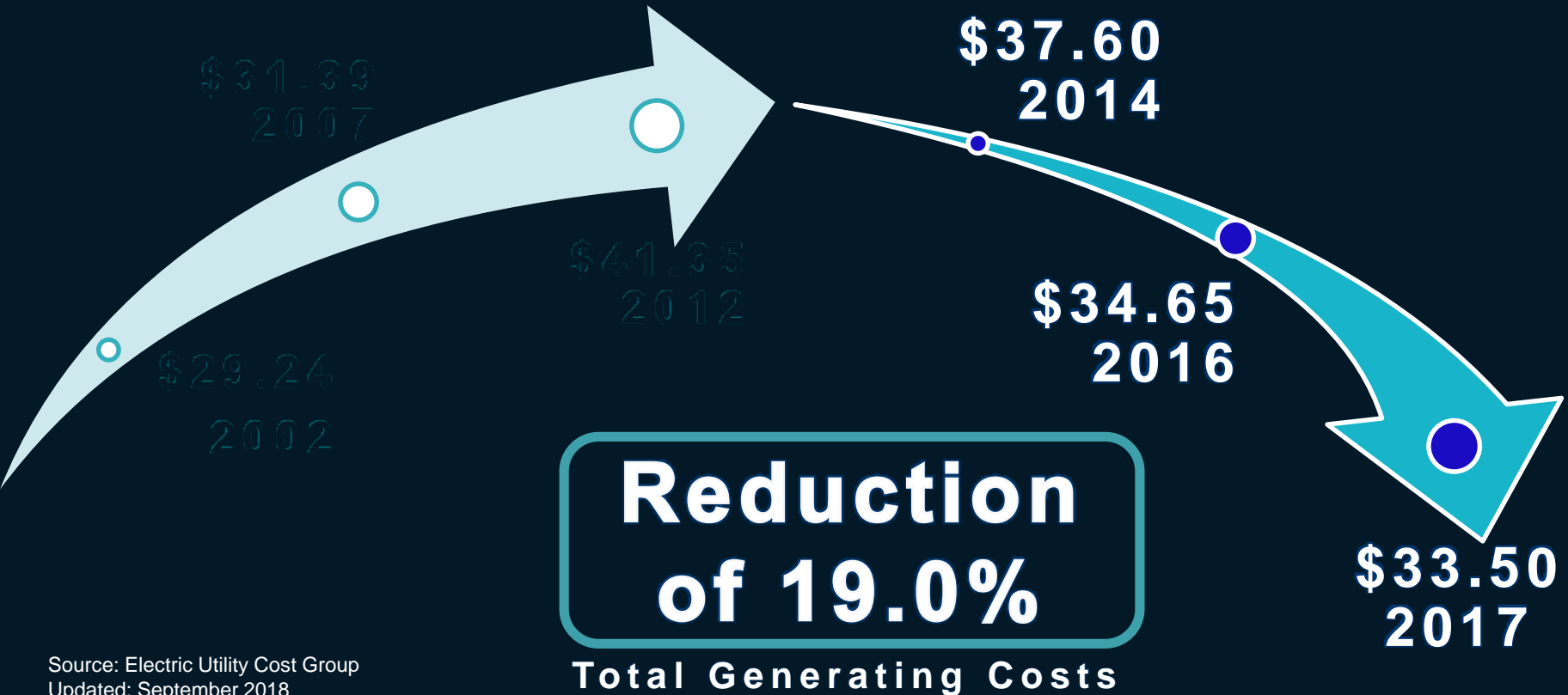


- Generation: 804.9 billion kWh
- Capacity Factor: 92.2%

2017 costs compared to 2016:

- Fuel costs decreased by \$0.46/MWh
- Operating costs decreased by \$0.44/MWh
- Capital costs decreased by \$0.25/MWh

Efficiency Improvements



Source: Electric Utility Cost Group
Updated: September 2018
\$/MWh in 2017 dollars

NATIONAL NUCLEAR ENERGY STRATEGY

A horizontal process flow diagram consisting of four colored circles connected by a dashed white line. The circles are orange, teal, dark blue, and light green from left to right. Each circle contains a white text label: 'PRESERVE', 'SUSTAIN', 'INNOVATE', and 'THRIVE'. Below each circle is a corresponding white text description.

PRESERVE

Appropriately value nuclear generation

SUSTAIN

Create sustainability via improved regulatory framework and reduced burden

INNOVATE

Innovate, commercialize, and deploy new nuclear

THRIVE

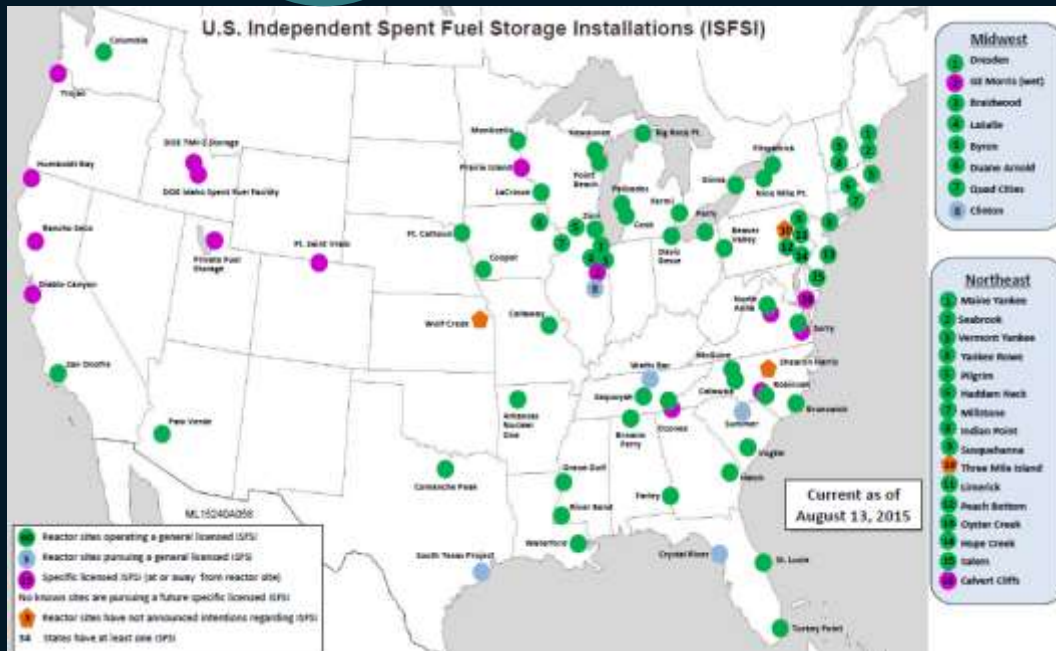
Compete globally

Used Nuclear Fuel in Storage

SUSTAIN

NEI

- Used fuel inventory*
 - Approximately 80,960 MTU
 - Increases 2 - 2.4k MTU annually
- ISFSI storage*
 - 117,579 assemblies
 - 33,515 MTU (39%)
 - 2,698 casks/modules loaded
 - 72 Operating ISFSIs
 - 1 pool ISFSI, 1 modular vault
- Projections for 2020
 - Estimating 86,000 MTU total
 - Estimating 35,000 MTU at ISFSI
 - 3,200 casks/modules loaded
 - At 76 ISFSIs
 - Almost all plant sites + Morris & INEL
 - Fuel from 119 reactors



*As of December 31, 2017

Used Fuel in Storage at Shutdown Plants

- **California**

- Humboldt Bay
- Rancho Seco
- San Onofre



- **Colorado**

- Ft. St. Vrain



- **Connecticut**

- Connecticut Yankee

- **Florida**

- Crystal River

- **Illinois**

- Zion

- **Maine**

- Maine Yankee

- **Massachusetts**

- Yankee Rowe



- **Michigan**

- Big Rock Point

- **Nebraska**

- Ft Calhoun

- **New Jersey**

- Oyster Creek

- **Oregon**

- Trojan

- **Vermont**

- Vermont Yankee

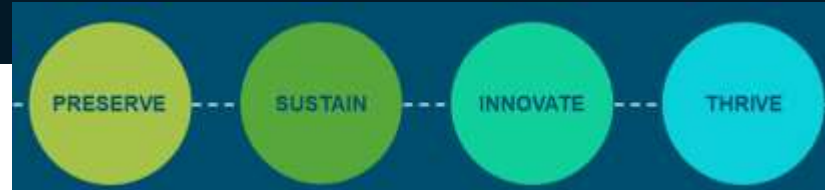
- **Wisconsin**

- LaCrosse
- Kewaunee

Pending Growth of Shutdown Plants

Plant	MWe	Closure Year	Reason	Final Year Generation (billion kWh per year)	Final Year CO2 Avoided (M tons/year)
Crystal River 3	860	2013	Mechanical	7.0	3.8
San Onofre 2 & 3	2,150	2013	Mechanical	18.1	8.0
Kewaunee	566	2013	Market	4.5	3.8
Vermont Yankee	620	2014	Market	5.1	2.4
Fort Calhoun	478	2016	Market	3.4	3.3
Oyster Creek	625	2018	Policy	5.4	4.0
TOTAL	5,299			43.5	25.3
Three Mile Island 1	803	2019	Market	6.9	5.0
Pilgrim	678	2019	Market	5.1	2.3
Davis-Besse	908	2020	Market	7.9	5.7
Duane Arnold	619	2020	Market	5.2	5.0
Indian Point 2 & 3	2,061	2020-2021	Market & Policy	15.3	7.1
Beaver Valley 1 & 2	1,872	2021	Market	15.3	11.1
Perry	1,268	2021	Market	9.8	7.1
Palisades	789	2022	Market	6.1	5.3
Diablo Canyon 1 & 2	2,240	2024-2025	Policy	17.9	6.9
TOTAL	11,238			89.5	55.5

Decommissioning and The Nuclear Value Chain



Success Factors

- Efficient Regulatory Framework
 - NRC rulemaking ongoing
- Planning for Best use of Resources
- Innovative Business Models
 - Energy Solutions (Zion, Lacrosse, & San Onfre)
 - Accelerated Decommissioning Partners (Vermont Yankee)
 - Holtec (Oyster Creek, Pilgrim, & Palisades)
- Minimizing the Impacts of Used Fuel

Industry Driving to Faster Decommissioning

Consolidated Interim Storage and Yucca



Target Date to Enact Comprehensive Used Fuel Legislation



The Future of Radioactive Materials Transport

- Movement to accelerate decommissioning at increasing number of plants will increase LLW shipments
- Used Fuel will begin moving from commercial reactor sites in the next 5 years – with or without federal action
- Used Fuel transportation will be **THE** topic of greatest interest as large scale used fuel movements approach
 - **Third party experts will be an important part of the dialogue**
 - NEI will conduct transportation tabletop exercise to demonstrate process
 - NEI is developing resources to support effective public communications

Used Fuel Transportation Table Top

- Exercise scheduled for May 21, 2019
- Will test assumptions/challenges/processes and identify opportunities for improvement
- Virtual site to represent physical attributes of Kewaunee and political, community and tribal aspects of Prairie Island
- Private shipment model for initial scenario
- Routing will utilize intermodal transportation resources
- Consolidated Interim Storage location reflects the border between New Mexico and Texas
- Exercise NRC and Price-Anderson requirements
- Video will be made available afterwards



Questions?



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