U.S. Nuclear Energy Status

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Introduction and Background

- In late 2013, the U.S. had 104 operating reactors
- In October 2016, Watts Bar 2 commenced commercial operation
- As of September 2019, the U.S. has 97 operating reactors
- There are 2 AP1000s in construction in Georgia
- There are 9 sites in some level of active decommissioning: Zion, San Onofre 2/3, Crystal River 3, Kewaunee, Vermont Yankee, Pilgrim, Fitzpatrick, Fort Calhoun, Oyster Creek, and soon TMI 1/2

Announced Premature Shutdown of Nuclear Plants and Actions in Response

What is contributing to these premature shutdowns of nuclear plants?

- U.S. Electricity Market is severely flawed.
- U.S. Electricity Market favors subsidized wind and solar
- U.S. Electricity Market recognizes no unique value for Nuclear
- Not all KW are created equal:

The unique value of nuclear is:

Energy, Economy, Environment, and National Security

Energy

- Nuclear produces affordable, available, reliable energy 7 days per week/24 hours per day as the only environmentally friendly baseload energy supply
  - **Supports grid stability**
  - **Provides price stability**
  - **Runs when needed**
  - **Contributes to fuel and technology diversity**

Economy

- Each year, the average nuclear unit generates approximately $490 million (U.S.) in sales of goods and services
- The same average nuclear unit will create nearly $46 million (U.S.) in total labor income
- Operation of the same average nuclear unit generates 700-1200 permanent jobs, which pay 36 to 42% more than average salaries in the local area and the state

Economy

- Permanent jobs at nuclear plants create equivalent numbers of support jobs locally- grocery stores, restaurants, dry cleaners, car dealers, services providers, etc.
- Every dollar spent by the average nuclear unit produces $1.04 in the local community- anchors the local community
- Each nuclear unit generates an average of $16 -$20 million (U.S.) in state and local tax revenue for schools, roads and similar needed infrastructure
- And the annual federal tax payments of each nuclear unit is roughly $67 million (U.S.)

Environment

Nuclear produces approximately 20% of the U.S. energy, and provides more than 55% of the carbon-free emitting energy in the U.S.

- **Provides clean air compliance value**
- **Avoids carbon emissions**
- **Vital component of addressing climate change**

National Security

- **Leading in Nuclear Energy Means Leading in the World**
  - America's expertise lets us set international standards and keep nuclear materials out of the hands of bad actors.
  - Reactor exports allow the U.S. to form 100-year strategic relationships around the world that span the construction, operation, and decommissioning of a plant.
- **A Secure Nation Needs a Resilient Grid**
  - Nuclear plants generate electricity 24/7—even in extreme weather—and have up to two years of fuel on-site.
  - Comprehensive safety procedures and stringent federal regulations ensure nuclear plants are protected and robust.
- **Nuclear Powers National Defense**
  - The industry supports a strong supply chain for our nuclear Navy and defense agencies.
  - Since the U.S. DOD depends on the grid to power 99 percent of its installations, nuclear's reliability supports the nation's ability to defend itself.
  - The Pentagon, with Congress' encouragement, is considering the use of small reactors to enhance domestic defense installations.

Nuclear Contributions

AVOIDS
528 MILLION METRIC TONS OF CARBON EMISSIONS EACH YEAR

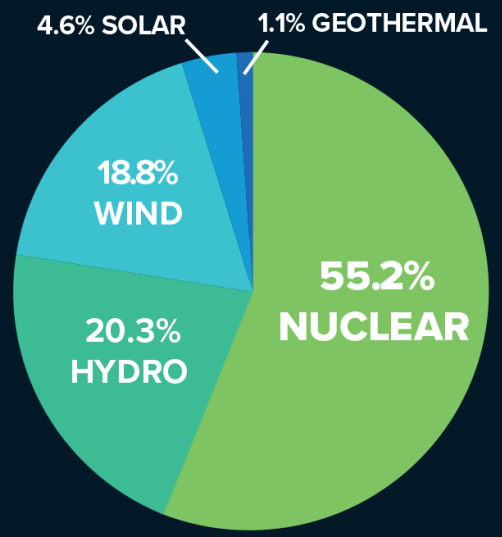
+

PREVENTS **286,516 SHORT TONS** OF **NOX**

AND

346,485 SHORT TONS OF **SO2** EMISSIONS

— AVERAGE —
CAP FACTOR
>90%
OVER THE LAST
20 YEARS



SUPPORTS
475,000
JOBS

SAVES CONSUMERS
AN AVERAGE OF
6%
ON ELECTRICITY BILLS

ADDS
$60 BILLION
TO THE COUNTRY'S
GDP

Nuclear Plants: Premature Closures and Announced Shutdowns

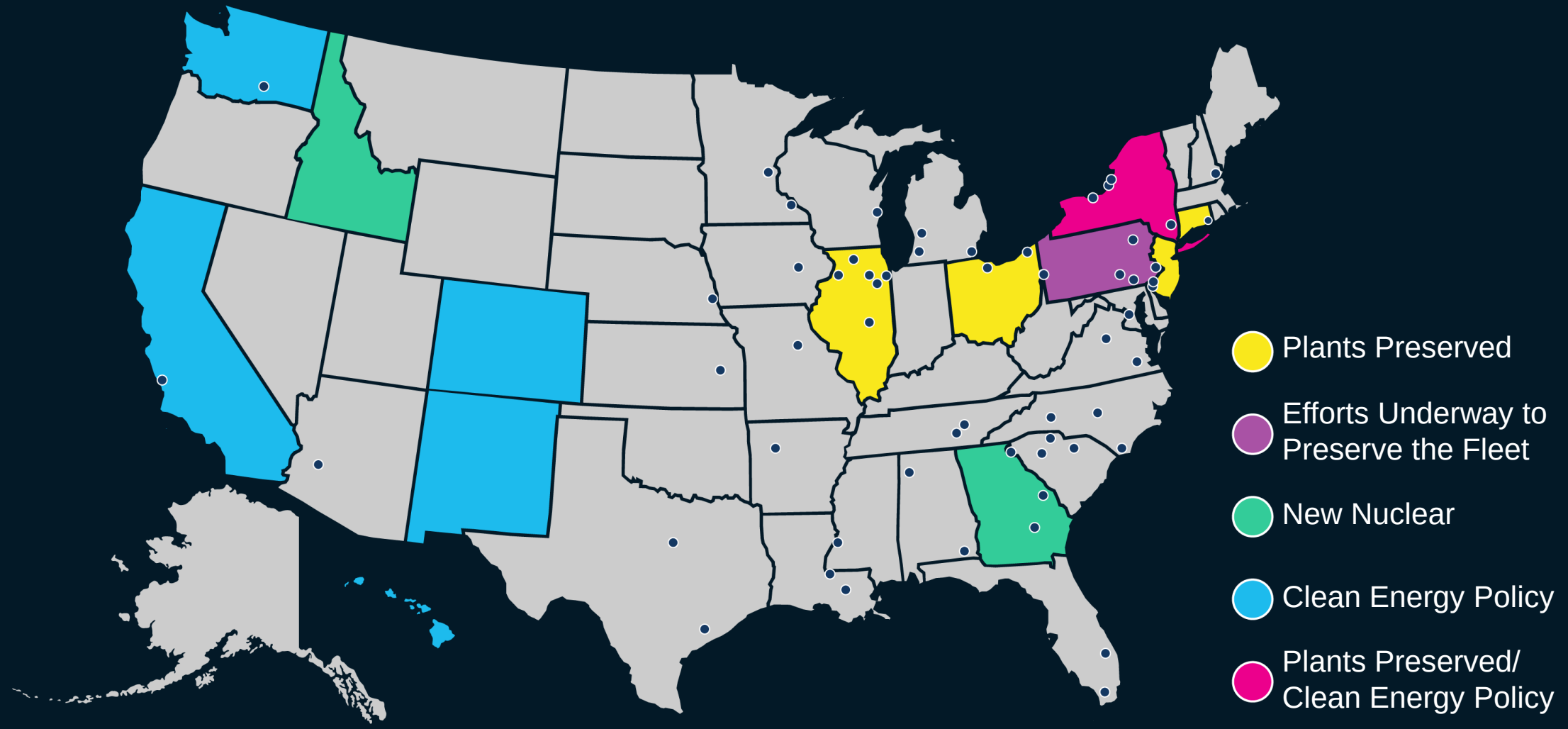
Plant	State	Capacity (MWe)	Closure Year	Latest Year Generation (billion kWh per year)	Latest Year CO2 Avoided (Million tons per year)
Crystal River 3	Florida	860	2013	7.0	4.8
San Onofre 2 & 3	California	2,150	2013	18.1	8.0
Kewaunee	Wisconsin	566	2013	4.5	4.4
Vermont Yankee	Vermont	620	2014	4.8	2.4
Fort Calhoun	Nebraska	478	2016	3.5	3.4
Oyster Creek	New Jersey	625	2018	5.4	4.0
Pilgrim	Massachusetts	679	2019	4.4	2.0
Three Mile Island 1	Pennsylvania	803	2019	7.3	5.0
TOTAL		**6,781**		**55.1**	**33.9**
Duane Arnold	Iowa	601	2020	4.9	4.6
Indian Point 2 & 3	New York	2,057	2020-2021	16.3	7.6
Beaver Valley 1 & 2	Pennsylvania	1,808	2021	14.7	10.1
Palisades	Michigan	804	2022	5.5	4.6
Diablo Canyon 1 & 2	California	2,240	2024-2025	18.2	7.3
TOTAL		**7,510**		**59.6**	**34.2**

Source: Emissions avoided are calculated using regional and national fossil fuel emissions rates from the **U.S. Environmental Protection Agency** and latest plant generation data from the **U.S. Energy Information Administration**.
Updated: September 2019.

Actions to Preserve the Nuclear Fleet

- Zero Emissions Credit (ZEC) Concept
  - New York, Illinois, New Jersey, Ohio, Pennsylvania, and others
- Public Information
- Electricity Market Analysis
- Policies
- Collaboration with other energy assets

State of the States

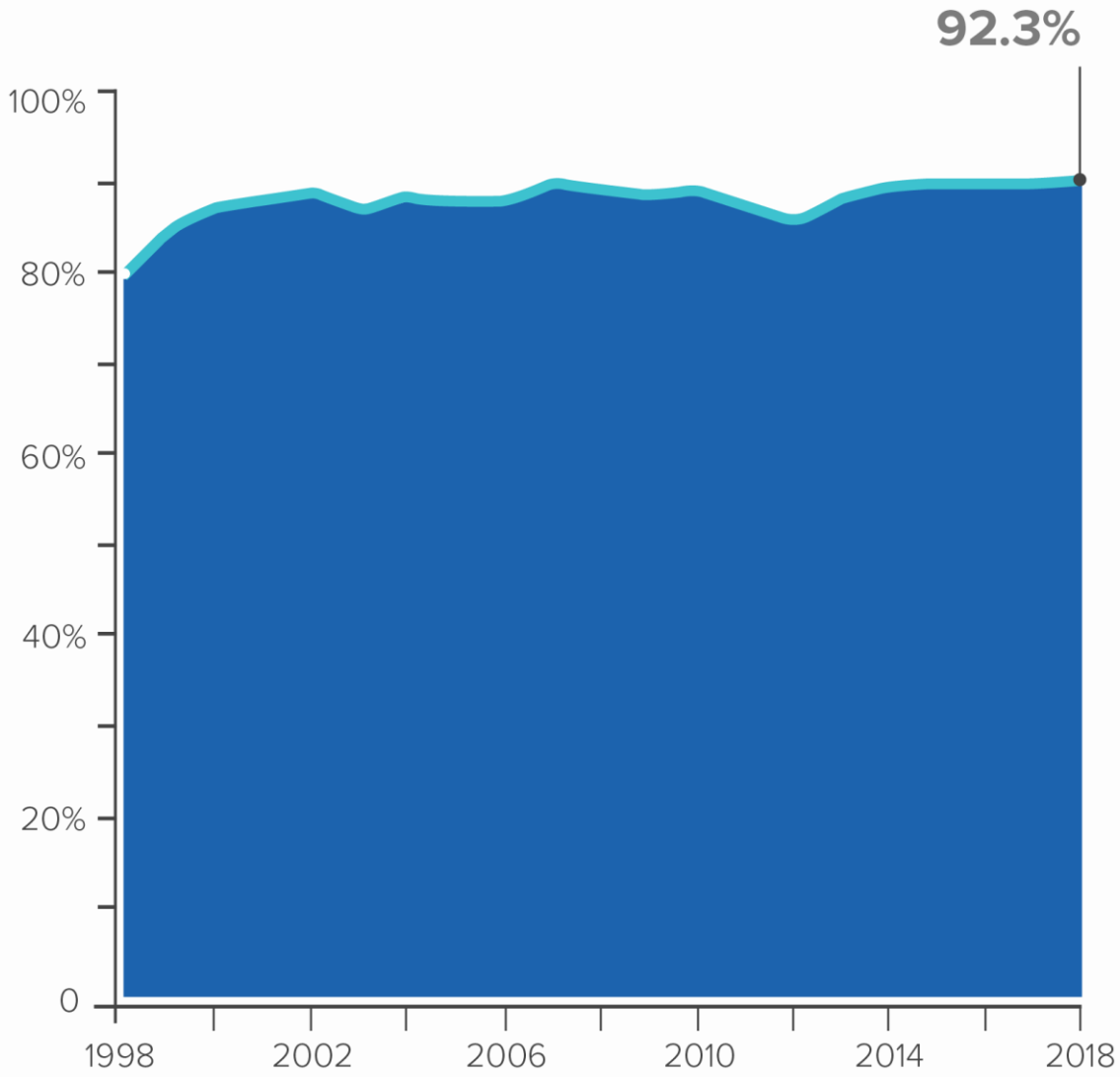


More than 9,100 direct jobs saved from State actions

Plant	State	Capacity (MWe)	Projected Closure Year	Electricity Generated (billion kWh in 2018)	CO_2 Emissions Avoided (Million tons per in 2018)
Clinton	Illinois	1,060	2017	8.3	8.1
Davis-Besse	Ohio	894	2020	7.4	5.1
Fitzpatrick	New York	851	2017	6.5	3.1
Ginna	New York	582	2017	4.7	2.2
Hope Creek	New Jersey	1,172	~2020	9.5	6.6
Millstone 2 & 3	Connecticut	2,088	~2020	16.9	7.6
Nine Mile Point 1 & 2	New York	1,916	2017-2018	15.4	7.2
Quad Cities 1 & 2	Illinois	1,819	2018	15.5	10.6
Perry	Ohio	1,240	2020	10.9	7.5
Salem 1 & 2	New Jersey	2,328	~2020-2021	18.9	13.0
TOTAL		**13,950**		**114.1**	**70.9**

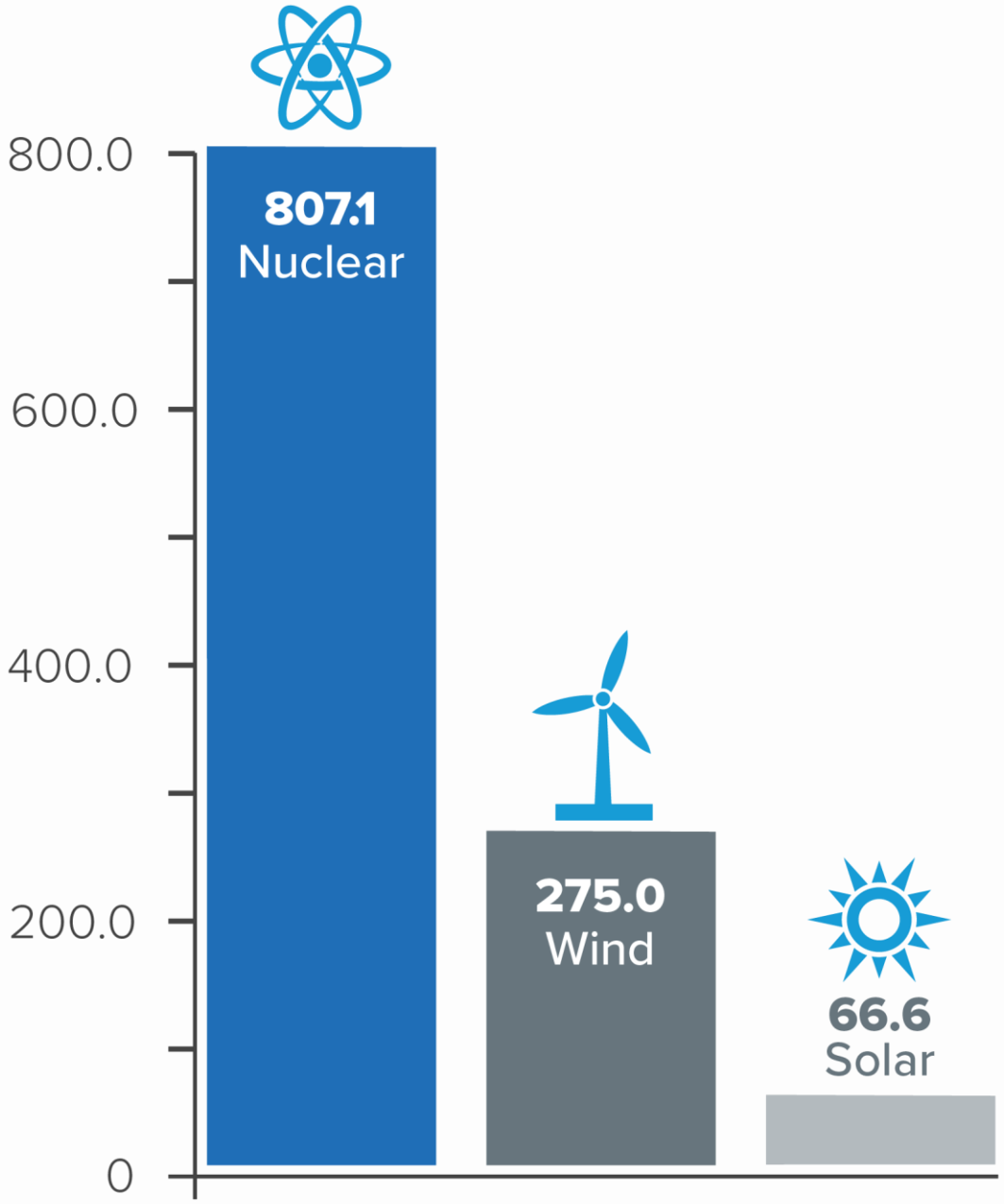
This is nearly **twice** the electricity generation from U.S. utility solar in 2018

Source: Emissions avoided are calculated using regional and national fossil fuel emissions rates from the **U.S. Environmental Protection Agency** and latest plant generation data from the **U.S. Energy Information Administration**.
Updated: July 2019.



U.S Nuclear Industry Capacity Factors

Average capacity factor of 90% over the last 20 years

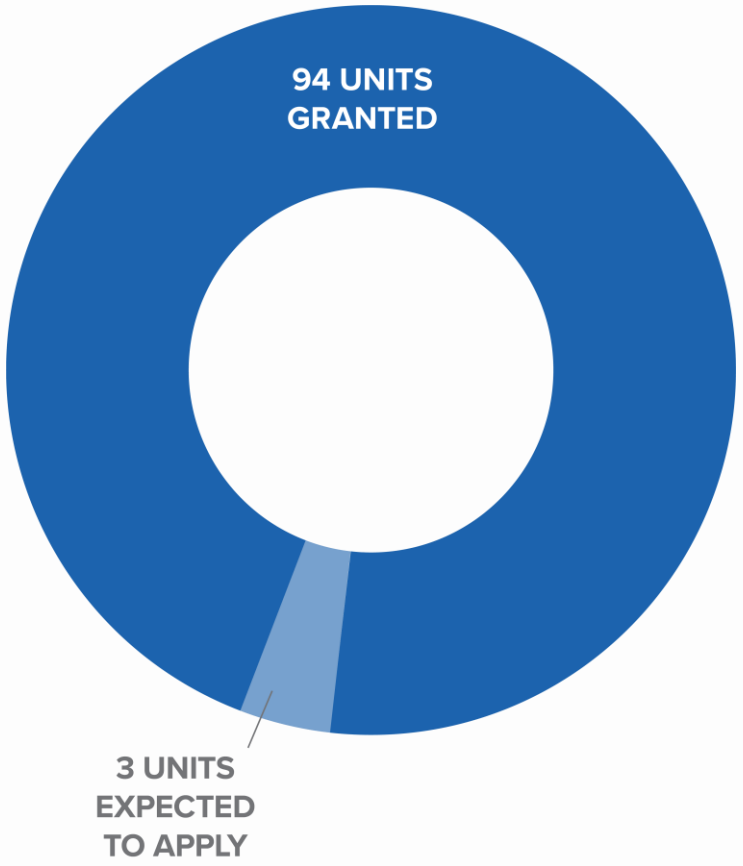


2018 U.S. Nuclear Production

In Million MWh

In Comparison With Solar and Wind

Initial License Renewal



Subsequent License Renewal

Applications submitted for 6 units

- Turkey Point 3 and 4
- Peach Bottom 2 and 3
- Surry 1 and 2

Duke – announced intent to renew all 11 units

A CLEAR CONSENSUS:

NUCLEAR ENERGY MUST BE PART OF ANY CLIMATE SOLUTION

Atlantic Council

C2ES
CENTER FOR CLIMATE AND ENERGY SOLUTIONS

Google

iea International Energy Agency

ipcc

Union of Concerned Scientists

The New York Times

WORLD RESOURCES INSTITUTE

Sensible Energy Policy for the U.S.

- Eight major assets in the U.S. energy portfolio
  - Coal, oil, gas, wind, solar, nuclear, hydro, biomass, geothermal
- Not all energy assets are created equal
- Energy policy based on strengths and weaknesses of each energy asset
  - Not politics and market
- Each energy asset works collaboratively together for the benefit of long term electricity generation for the American people

Abundant, affordable, resilient, reliable, environmentally friendly energy for the future

Questions?

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