EPRI | ELECTRIC POWER RESEARCH INSTITUTE

U.S. Women in Nuclear® DC WIN Chapter

The Nuclear Low-Carbon Conversation

Bob Coward, Principal Officer, MPR Associates, Inc.
DC WIN Opening Remarks

Emma Wong, Principal Technical Leader, EPRI
EPRI Co-Host and Moderator

Ashley McKendry, Engineer, MPR Associates, Inc.
DC WIN Co-Host

The Nuclear Low-Carbon Conversation

"Nuclear energy needs to be recognized for its reliability and should be treated on equal terms as other low-carbon technologies as part of a robust low-carbon mix."

– World Nuclear Association

Katie Jereza
Vice-President,
External Relations and Communications,
Electric Power Research Institute

Jennifer Uhle, Ph.D.
Vice-President,
Generation and Suppliers,
Nuclear Energy Institute

Rounette Nader
Director of Nuclear License Renewal,
Duke Energy

The Nuclear Low-Carbon Conversation

Katie Jereza
Vice-President,
External Relations and
Communications, Electric
Power Research Institute

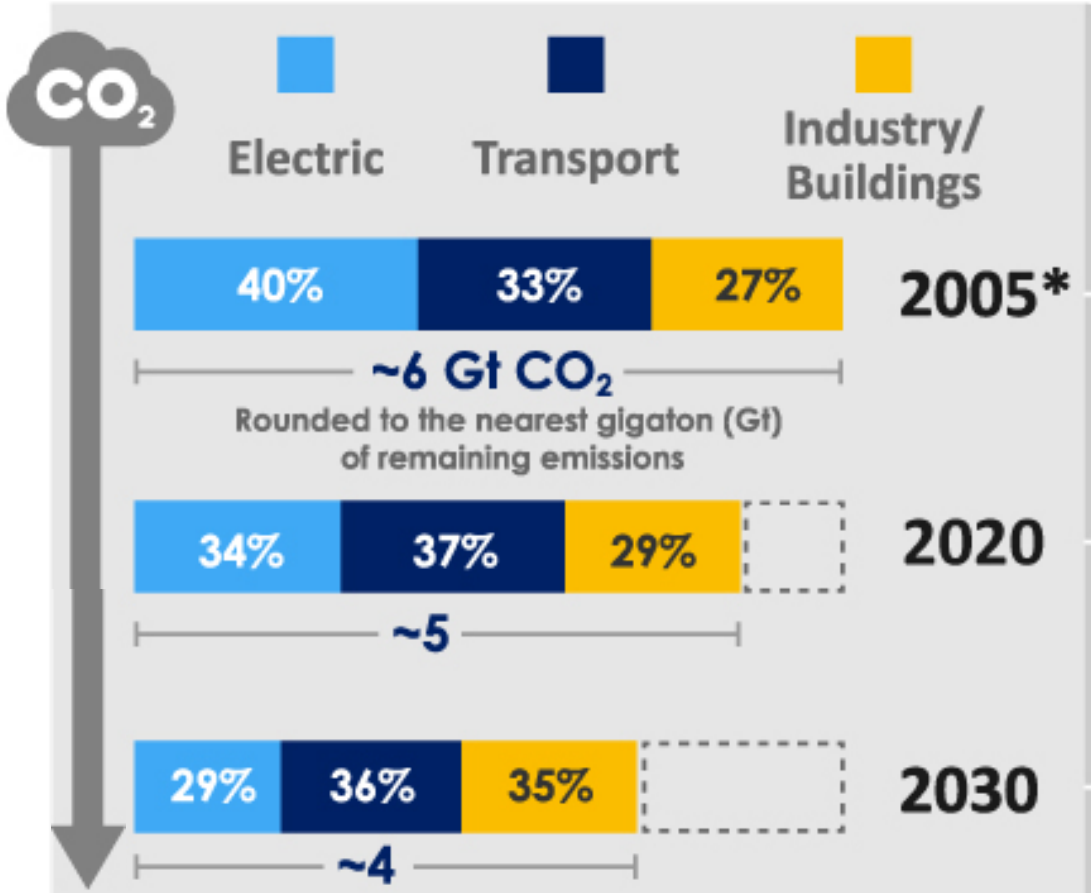
Bridging the Decarbonization Gap

Through Nuclear Innovation

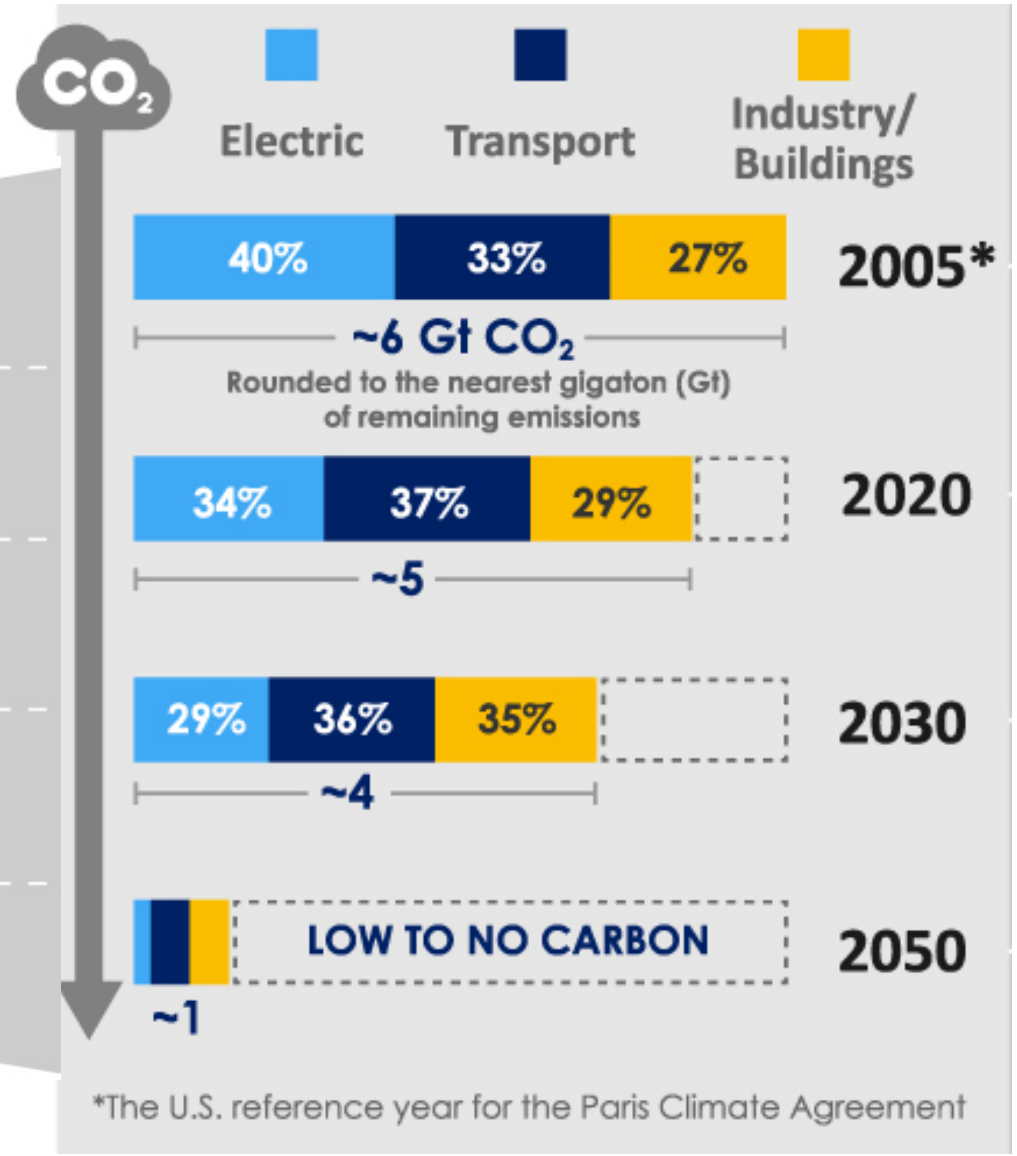
Katie Jereza
VP, External Relations and Communications, EPRI

October 22, 2020

U.S. Energy-Related CO_2 Emissions



The Carbon Reduction Technology Timeline



The Three Ds

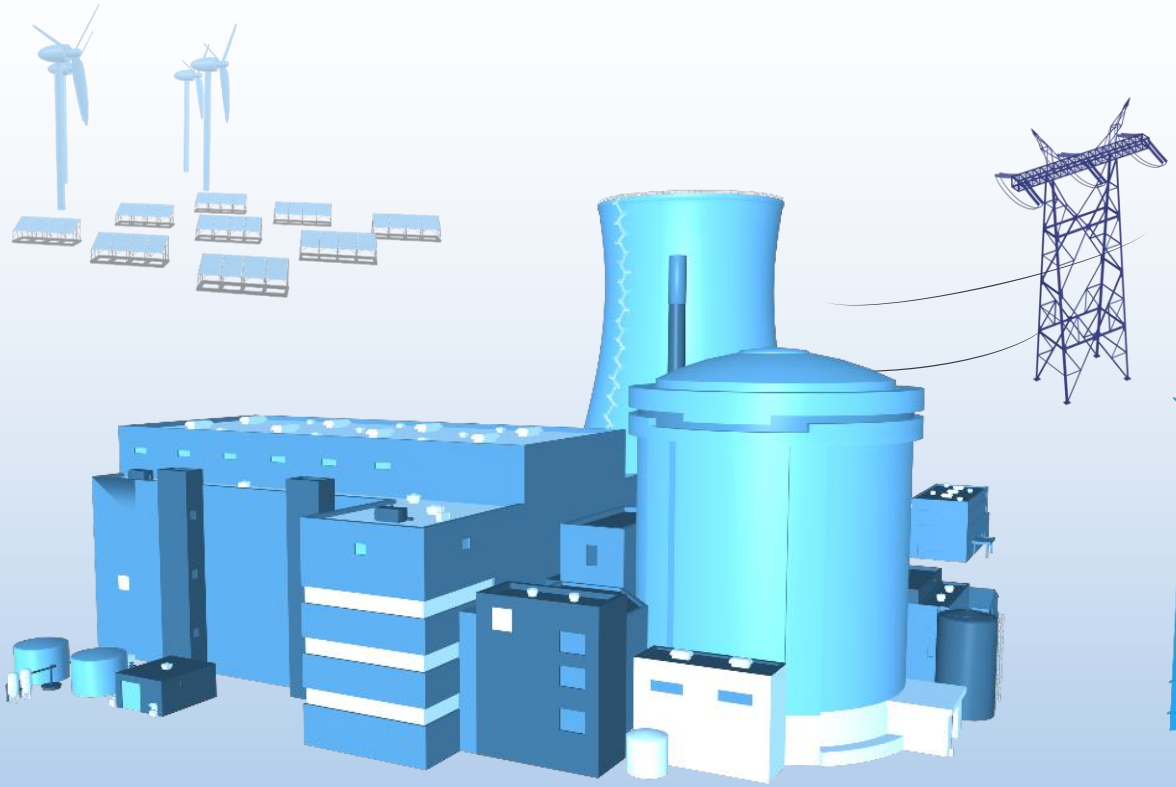
3 Ds

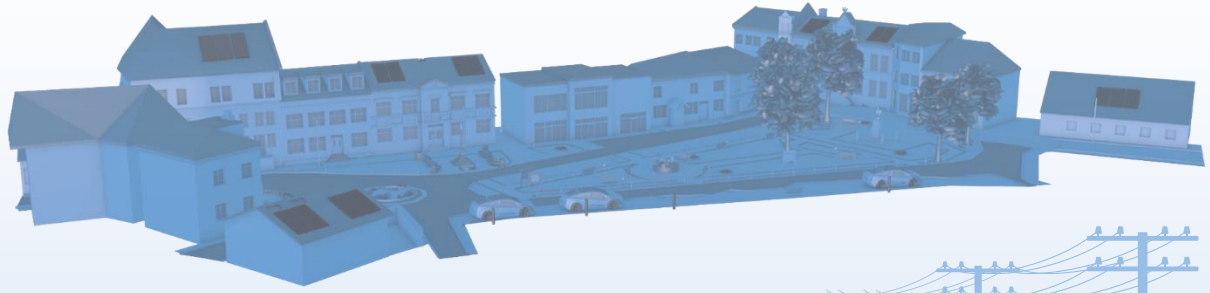
Digitalization

Demand

Decarbonization

Growing nuclear beyond electricity production





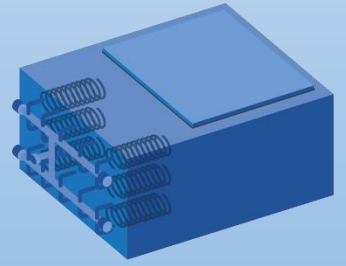
Life-saving isotopes

1 1s¹

H₂

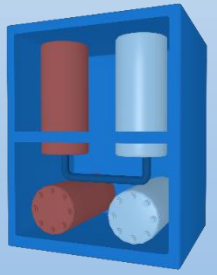
Hydrogen

Hydrogen Generation



Thermal storage

Electrical storage



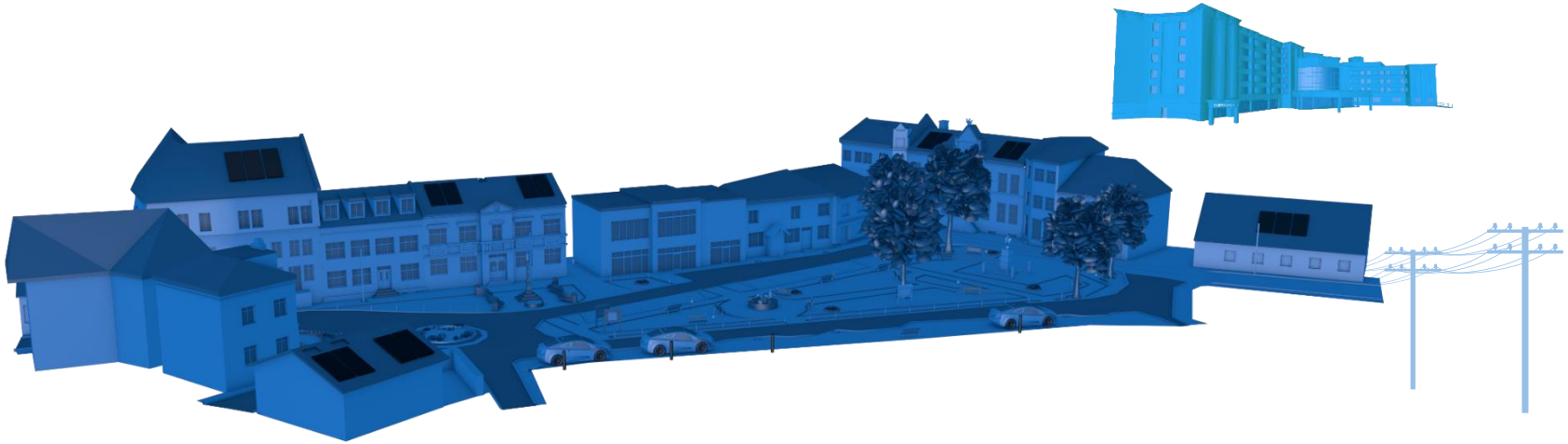
Water de-salinization

Demand

The big D

Decarbonization

The two Is



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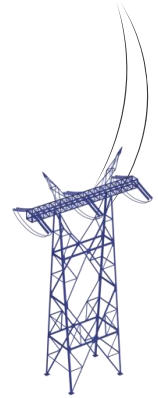
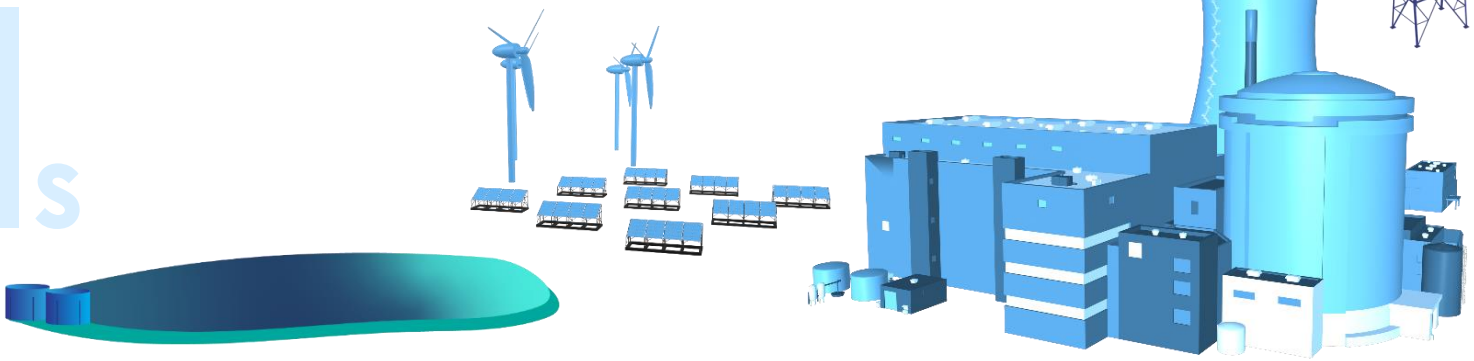
Innovation

Interconnectedness

I s



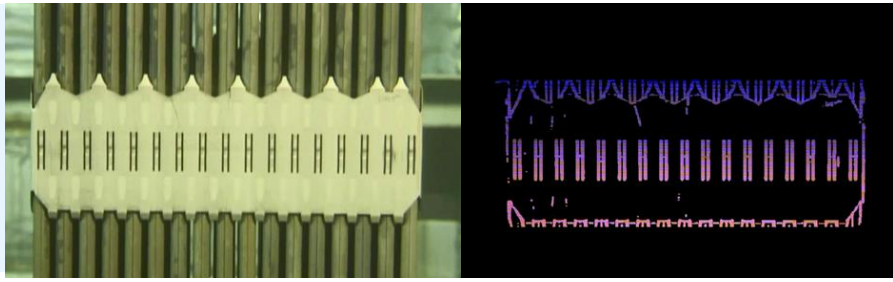


LCRI

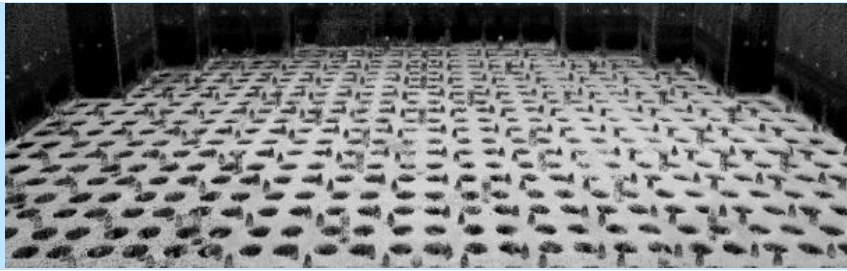
LOW-CARBON RESOURCES INITIATIVE

Machine Learning

Automated, Enhanced Evaluation of Fuel Inspections



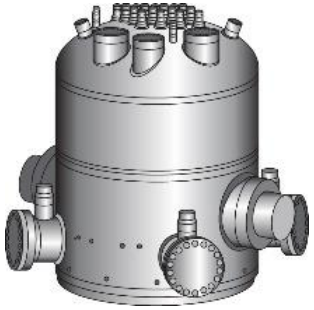
Light Detection and Ranging (LiDAR)



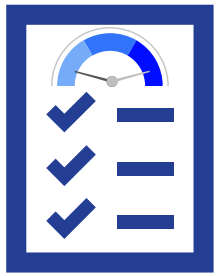
Digital Twin Technology

Better informing decisions, and enhancing analytics

Small Modular Reactors



Ready-Made For Flexible Operations



An actual SMR vessel head at 2/3rd scale in EPRI's Charlotte lab

Making energy more accessible

An evolving energy system

Together...Shaping the Future of Electricity

The Nuclear Low-Carbon Conversation

Jennifer Uhle, Ph.D.
Vice-President,
Generation and Suppliers,
Nuclear Energy Institute

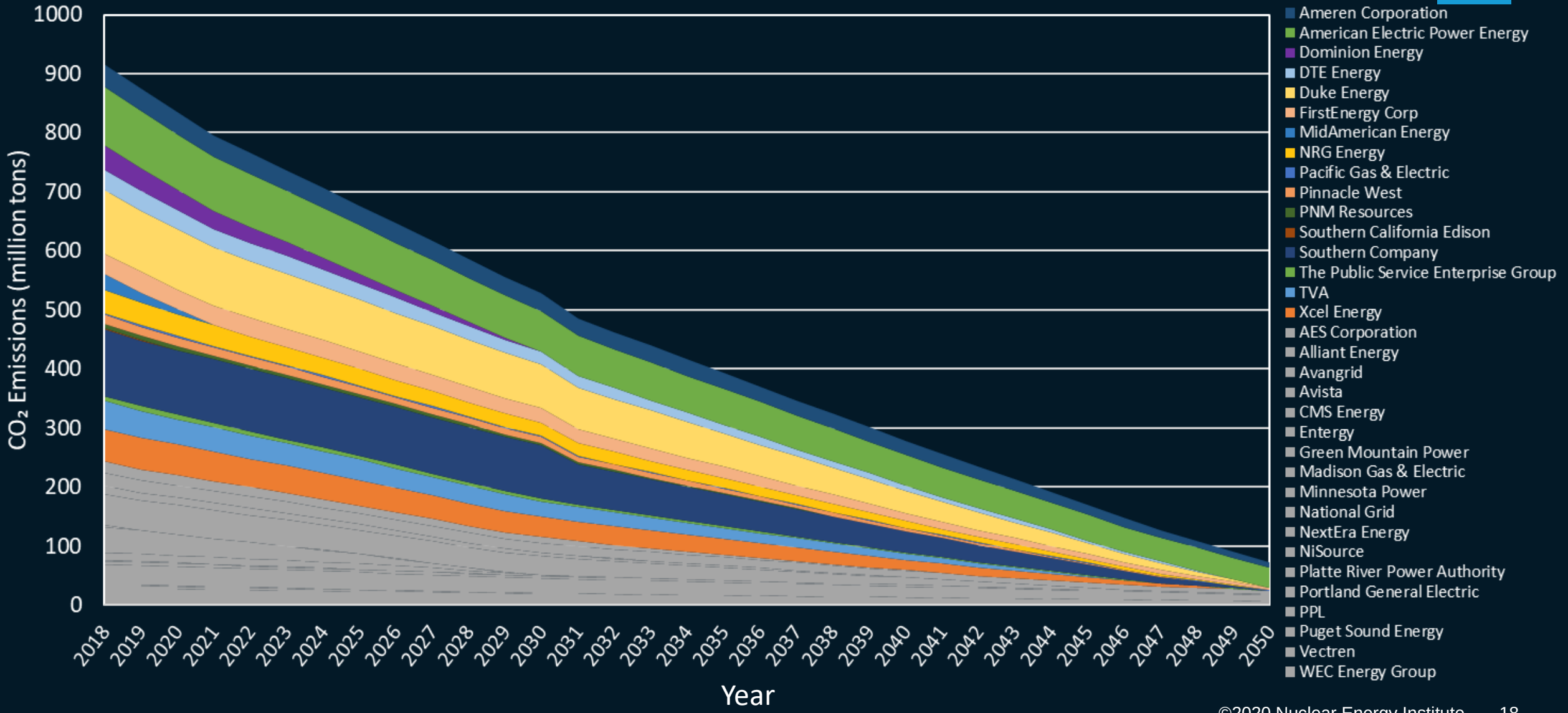
U.S. Industry Future

Jennifer Uhle
VP, Generation and Suppliers

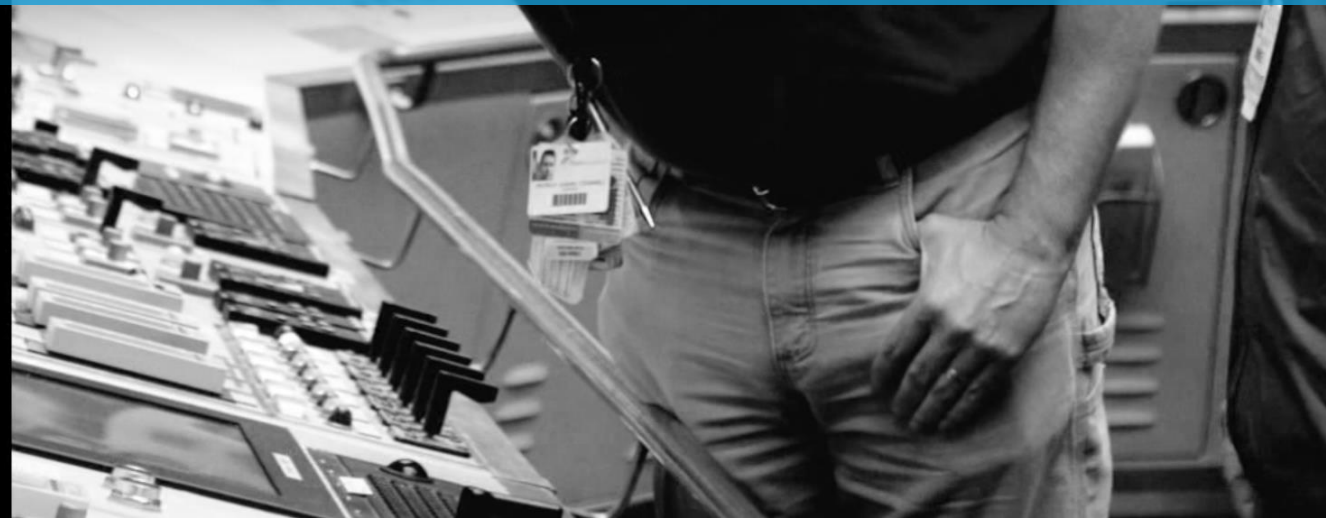
NUCLEAR ENERGY INSTITUTE

October 15, 2020

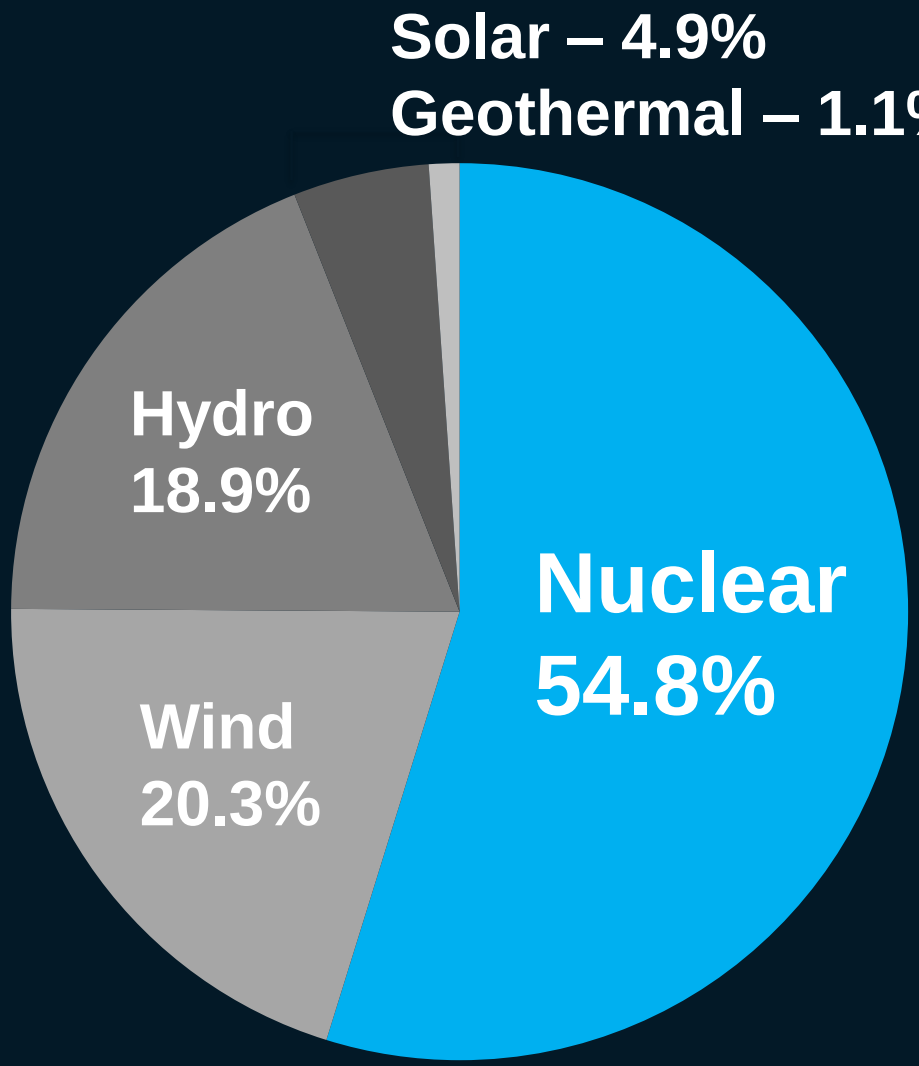
Decarbonization Trajectory of U.S. Utilities



Wind + Solar + Nuclear (24/7/365) = 80% of America's Carbon-Free Energy



Nuclear supplied more than half of U.S. carbon-free electricity in 2019

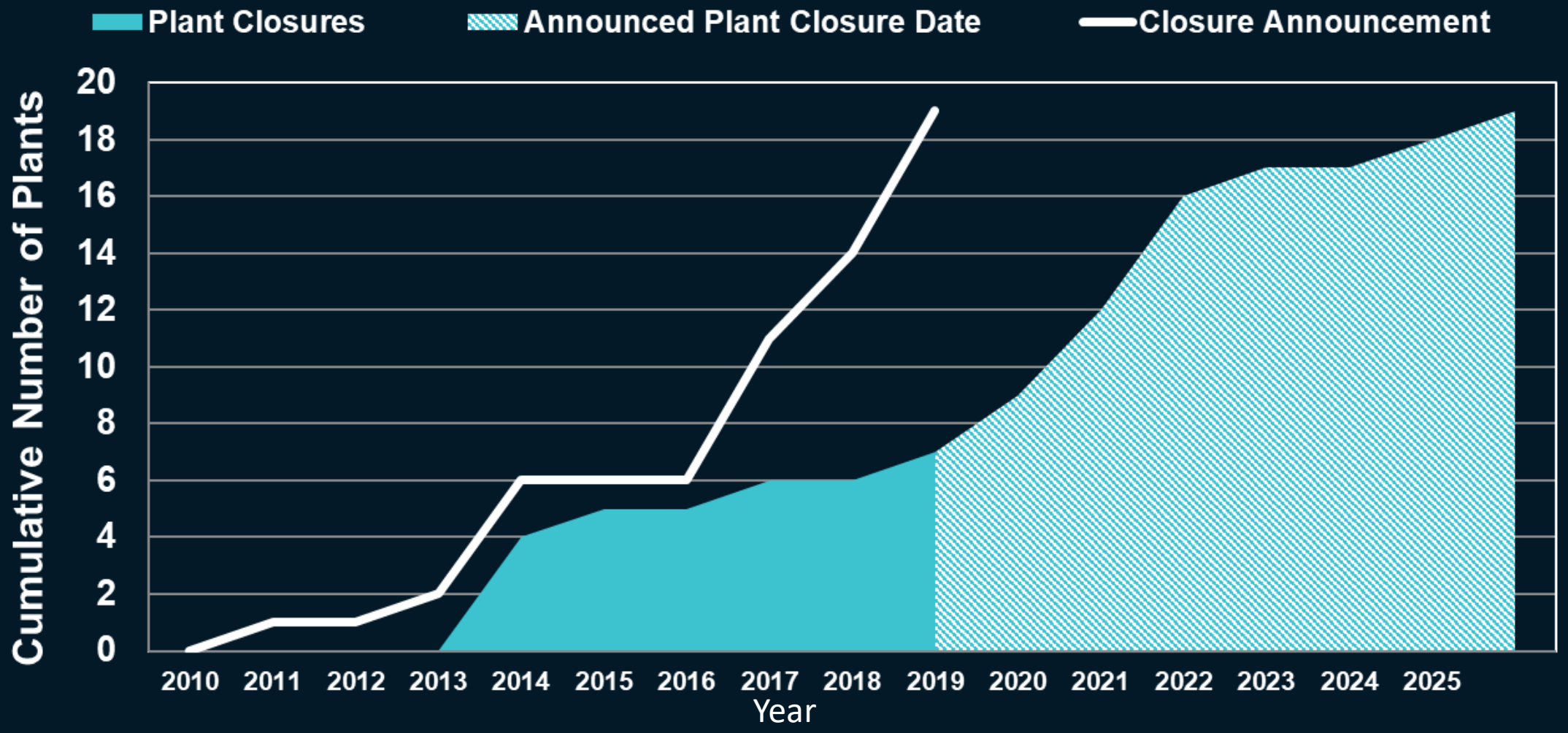


Carbon-free generation increased by net 18.2 million MWh

TMI-1 and Pilgrim closure: future 11.8 million MWh of annual carbon-free generation lost

Source: U.S. Energy Information Administration
Updated: March 2020

Decisions on Plants are Being Made Now



Delivering the Nuclear Promise – Achieved!

Costs in 2019 dollars ($/MWh)				
Cost Category	**Reduction Goal**	**2012 Costs**	**2019 Costs**	**Realized Reductions**
Fuel		$7.97	$6.15	$1.81 (23%)
Capital		$12.19	$5.71	$6.48 (53%)
Operations		$24.41	$18.55	$5.86 (24%)
Total Generating	**$13.36 (30%)**	**$44.57**	**$30.41**	**$14.15 (32%)**

Efficiencies were gained while safety and reliability improved

Source: Electric Utility Cost Group
Updated: July 2020

Nuclear power reliability breaks records in 2019

- **809.4 million MWh of electricity generated – highest ever**
- **93.4% capacity factor – highest ever**

NEI's capacity factor calculation (93.4%) accurately accounts for Three Mile Island I and Pilgrim generation in 2019.
U.S. Energy Information Administration reports 93.5% as nuclear energy's capacity factor.
Source: U.S. Energy Information Administration
Updated: March 2020

Innovation is a Key Element

Advanced Technology

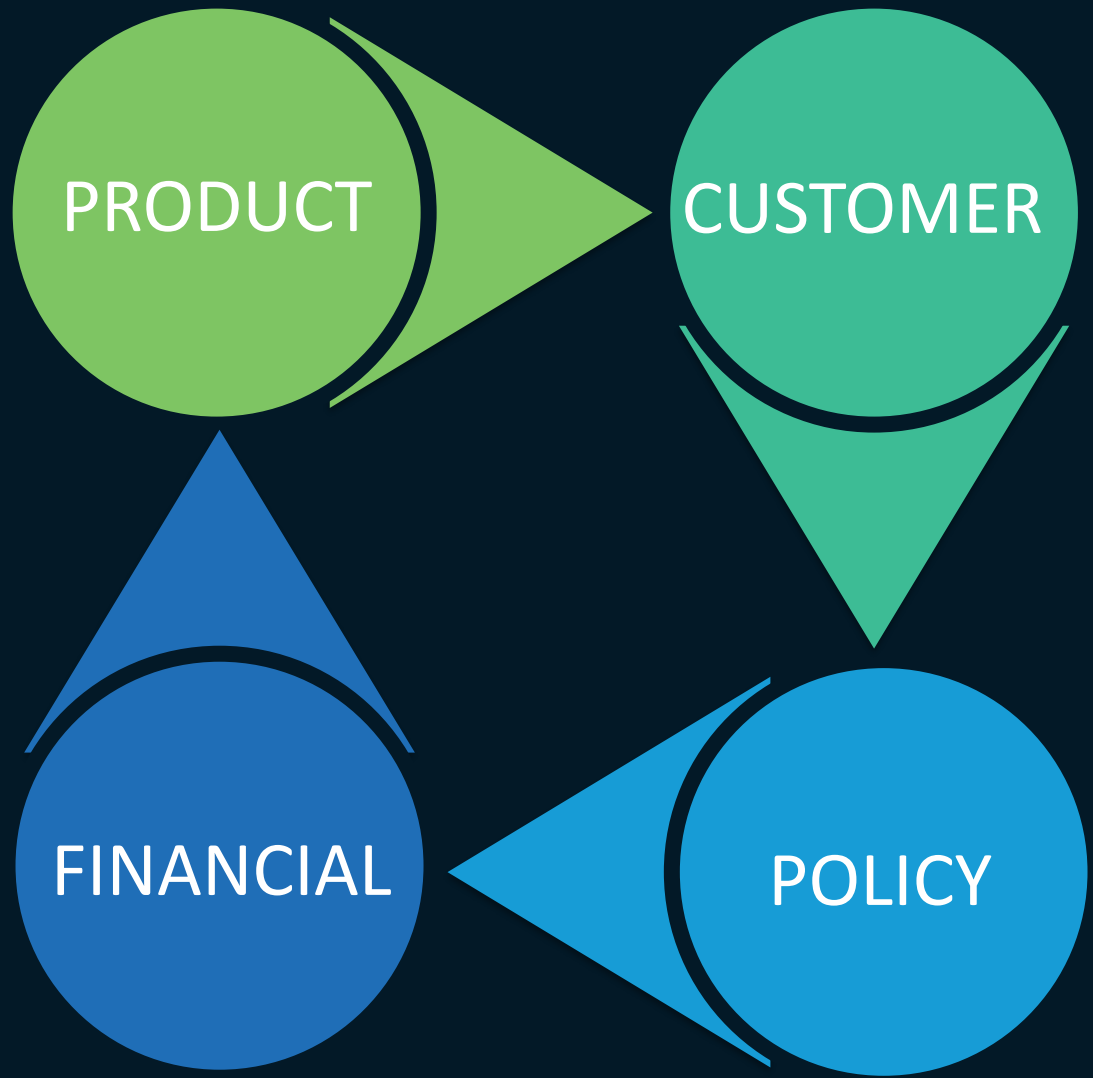
- Advanced Fuel
- Reactor Designs
- Automation
- Manufacturing
- Digital Technology

Cost Reduction

- Cost of Licensing & Construction
- Cost of Operations

Strategy for Accelerating New Nuclear

- Cost-competitive
- Credible
- Timely



- Utilities Needs
- IRP Support

- Federal Backing
- Private Support
- Public-private Partnerships

- Federal Clean Energy
- State Clean Energy

SMR & Advanced Reactor Role in Addressing Carbon

- NuScale and Oklo reviews underway
- Growing number of NEI member companies showing interest in new nuclear
- DOE's Advanced Reactor Demonstration Project (ARDP) is key:
  - 2 demonstration projects (on-line within 5-7 years)
  - 2-5 risk reduction projects
  - ARC20 conceptual projects

NRC transformation plays a key role

NUCLEAR ENERGY INSTITUTE

A world powered by clean and reliable energy.

The Nuclear Low-Carbon Conversation

Rounette Nader
Director of Nuclear License Renewal, Duke Energy

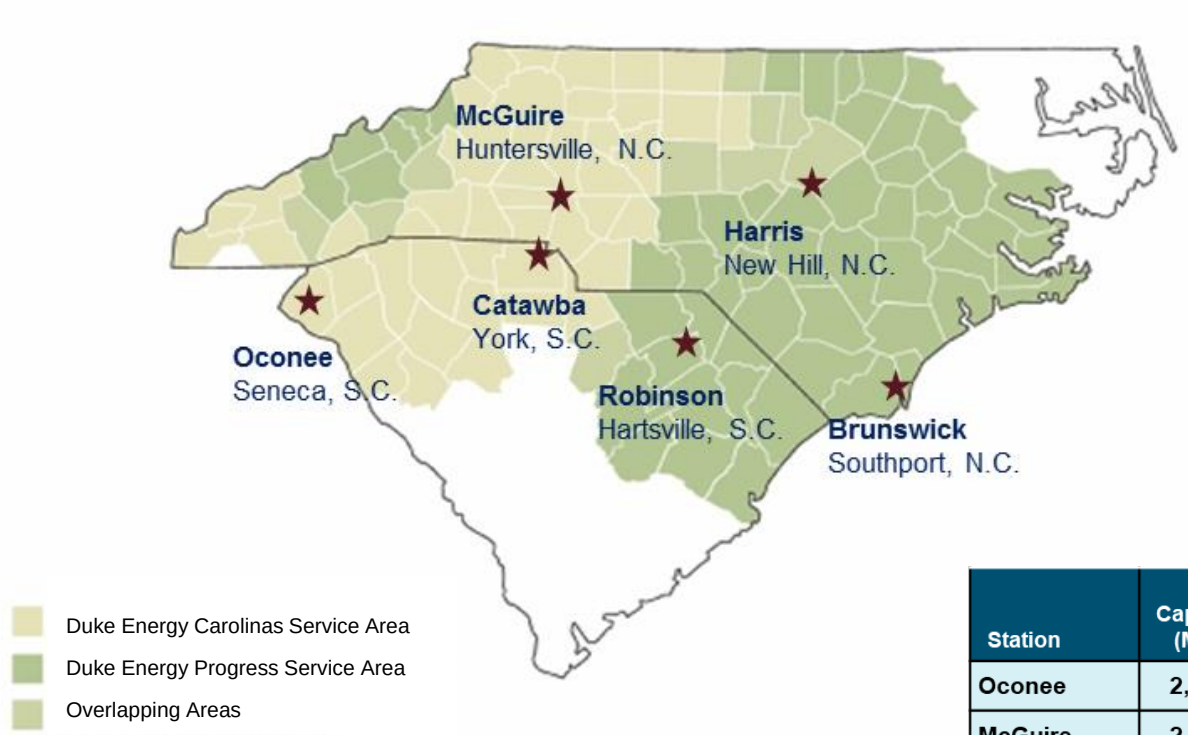
The Nuclear Low Carbon Conversation
A Utility Perspective

Rounette Nader – Director, License Renewal

October 22, 2020

DUKE ENERGY®

Duke Energy Current Nuclear Fleet



Duke Energy owns 100% of all units except the Catawba units.

Station	Capacity (MW)	Units	Commercial Operation	License Expiration (current)
Oconee	2,554	3 PWR	1973	2033, 2034
McGuire	2,316	2 PWR	1981	2041, 2043
Catawba*	2,310	2 PWR	1985	2043
Brunswick	1,870	2 BWR	1975	2034, 2036
Harris	964	1 PWR	1987	2046
Robinson	741	1 PWR	1971	2030
Total	10,755	11		

DUKE ENERGY®

Duke Energy Climate Goals

Companywide CO_2 Emissions Reduction Goals

BY 2030

Cut CO_2 emissions by **at least 50%**

BY 2050

Attain **net-zero** CO_2 emissions

Passenger Vehicle Equivalent of Duke Energy's Goals

TARGET YEAR	2018	2030	2050
Duke Energy CO_2 Reductions**	31%	50%	100%
Passenger Vehicle CO_2 Equivalence***	More than 9 million vehicles	More than 14 million vehicles	More than 29 million vehicles
= 1,000,000 passenger vehicles			
Equivalent to taking all the cars off the road in:			

* All calculations are expressed in short tons
** Calculated from a 2005 baseline of 153 million tons
*** Source: EPA Greenhouse Gas Equivalencies

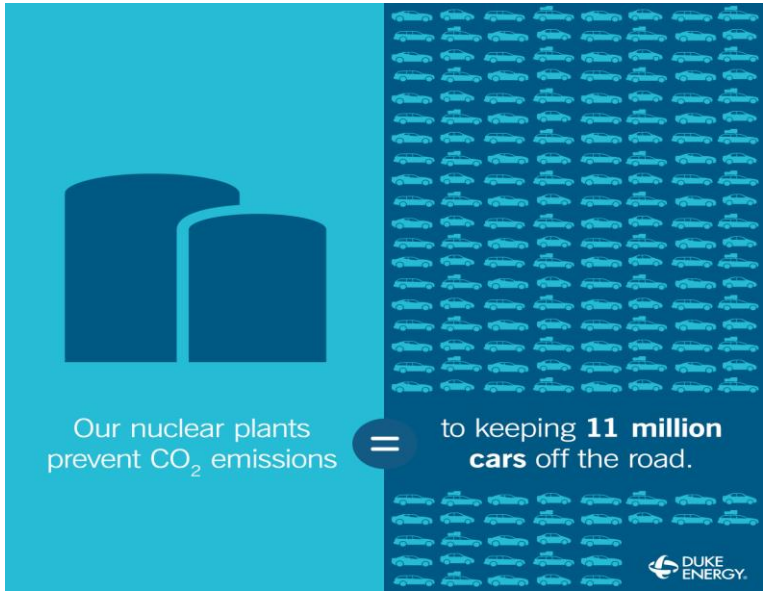
DUKE ENERGY®

Nuclear Fleet Operation

Meeting Customers' Energy Needs with Safe, Clean, Reliable Electricity

Supports company's response to climate change by:

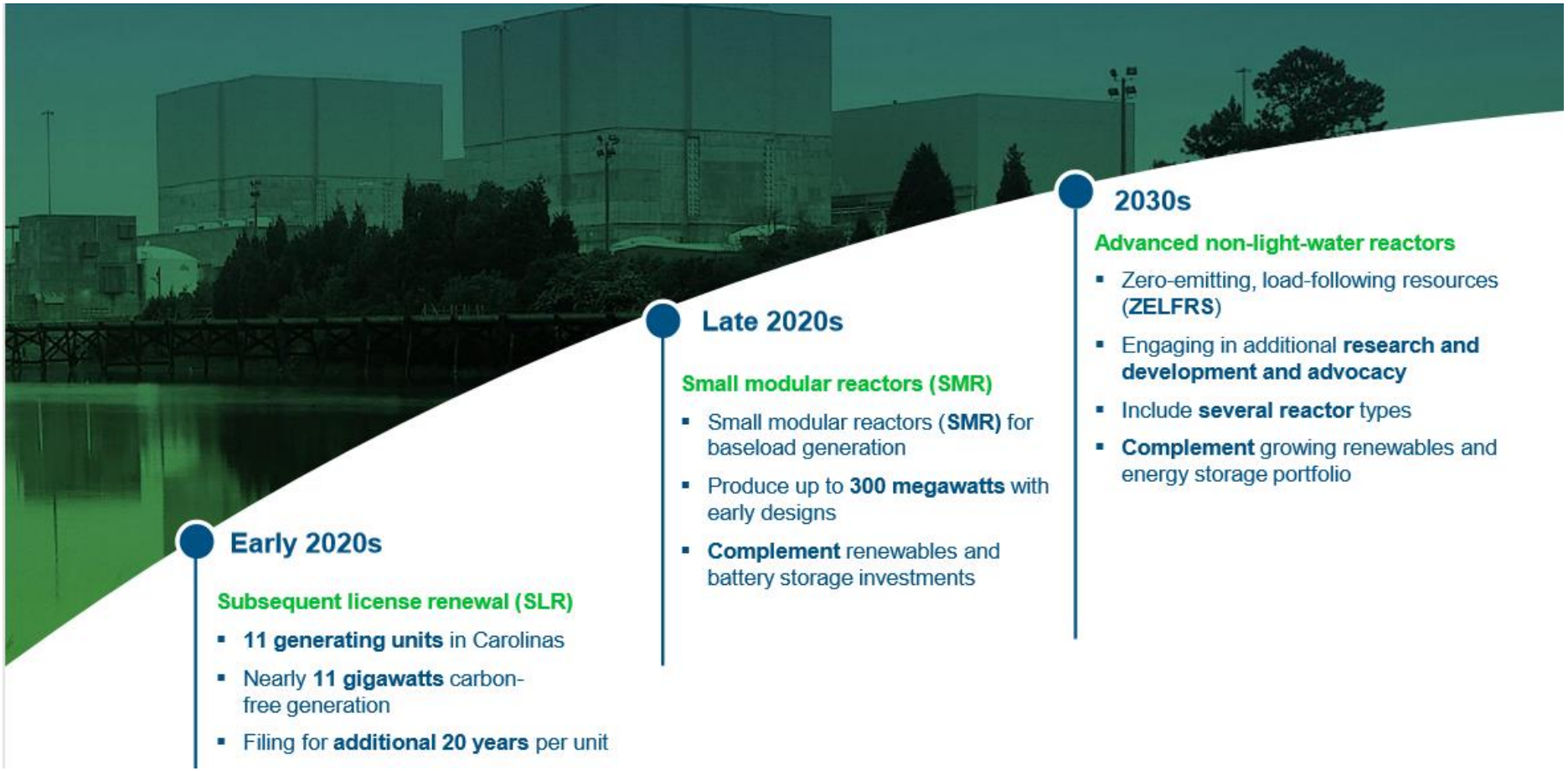
- Delivering clean energy – provided 86% of the company's carbon-free generation in 2019
- Operating with high capacity factors (measure of reliability) – greater than 90% for 21 consecutive year providing half of Carolinas generation
- Avoiding release of carbon dioxide = 52 million tons in 2019



Subsequent license renewal for all 11 Duke Energy-operated nuclear units is the only way to achieve carbon reduction goals until new technologies come to market.

DUKE ENERGY.

Duke Energy Investing in the Future of Nuclear



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Questions and Answers

Closing Thoughts