

U.S. Nuclear Industry Perspectives on Advanced Manufacturing Technologies

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December 7, 2020



About the Nuclear Energy Institute (NEI)

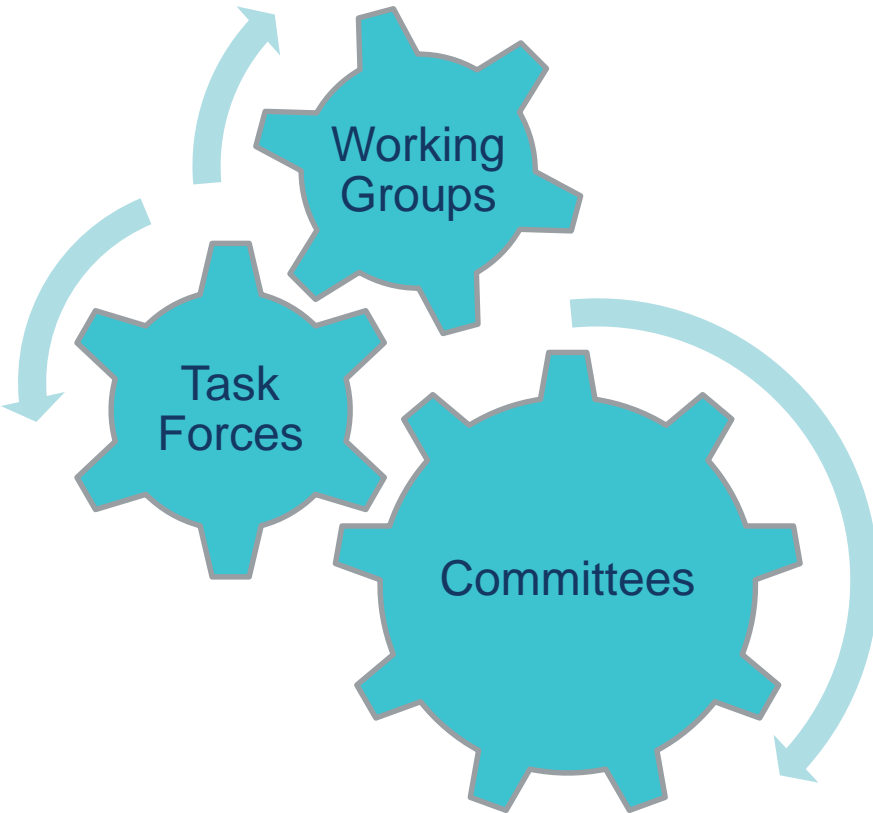


- The Nuclear Energy Institute is the industry's policy organization, located in Washington, DC
- Provides a unified industry voice on generic regulatory, policy, and technical matters
- Its broad mission is to foster the beneficial uses of nuclear technology in its many forms.



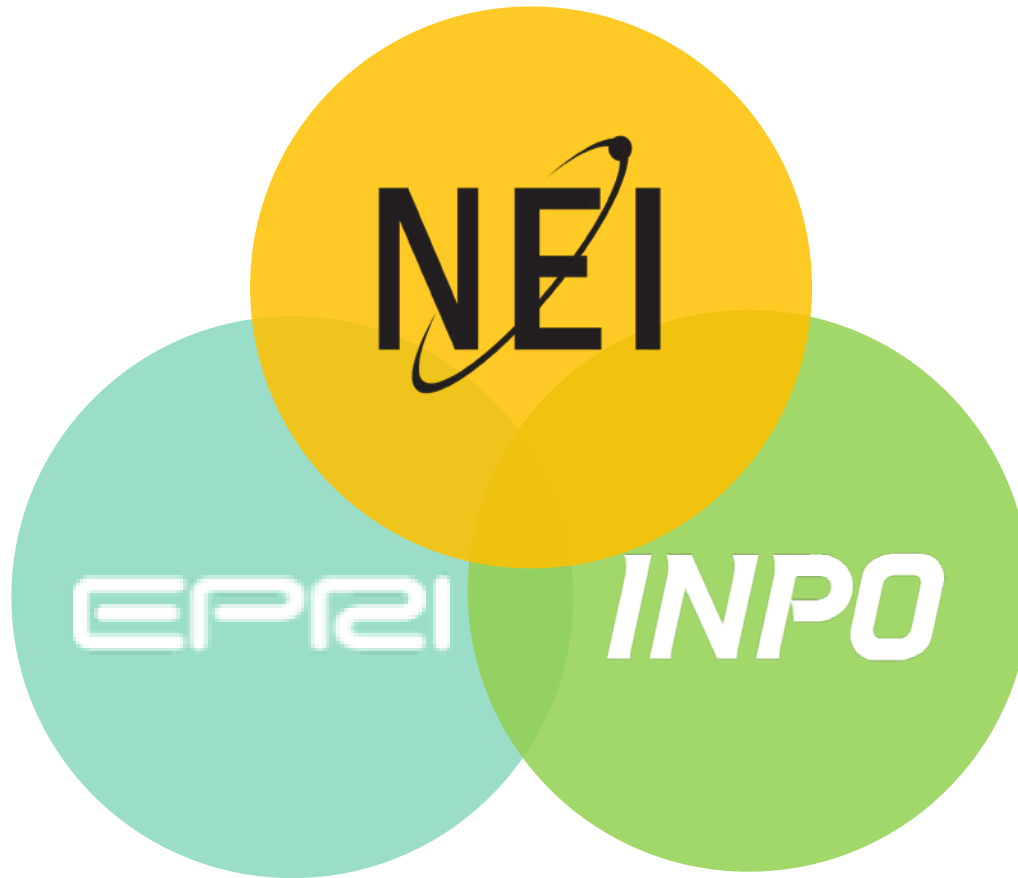
NEI President and CEO
Maria Korsnick

In Collaboration with our Members:

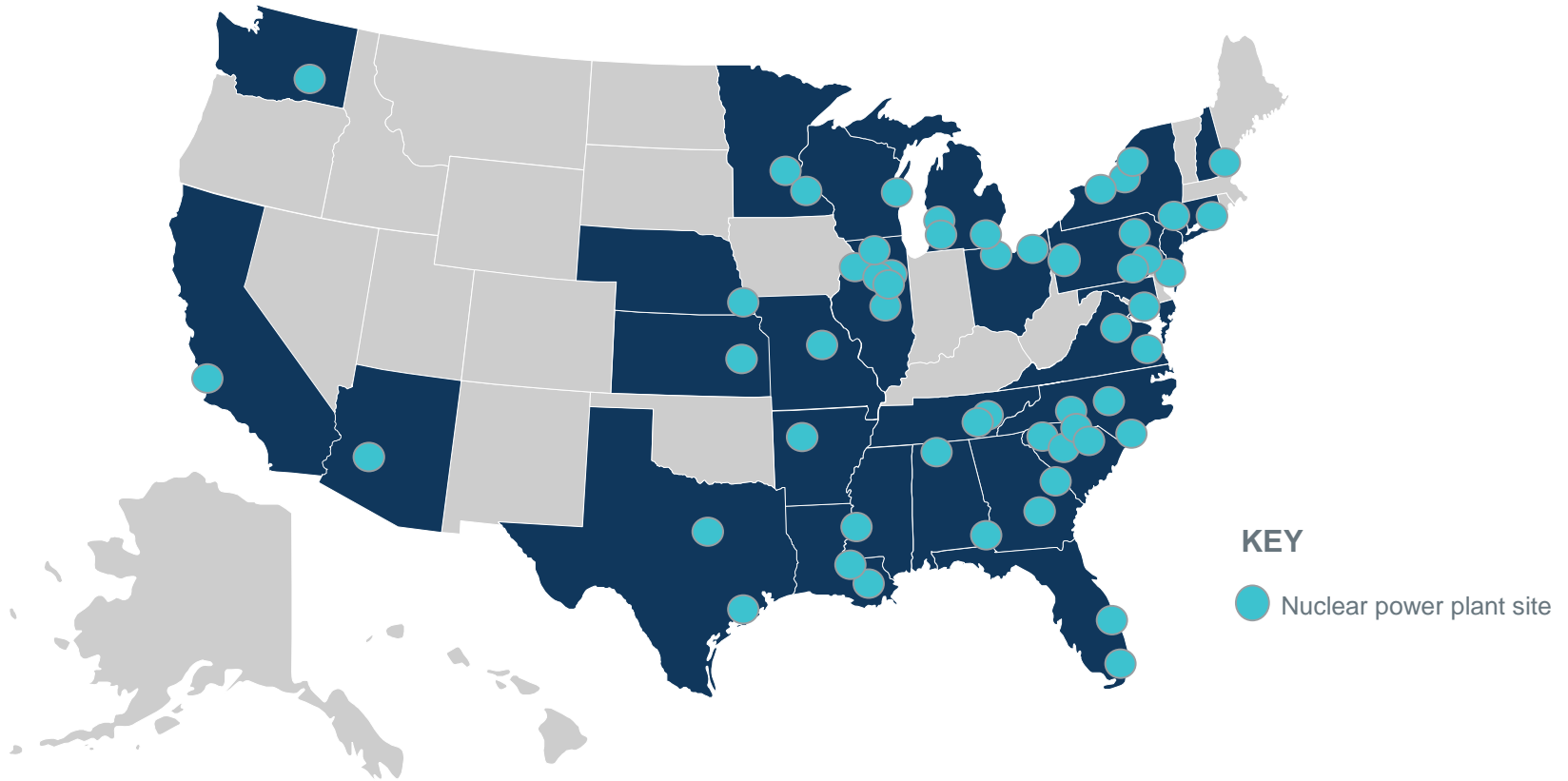


1,800 global member representatives serving on 140 committees, working groups and task forces (i.e. Advanced Manufacturing Task Force)

Supporting Partners

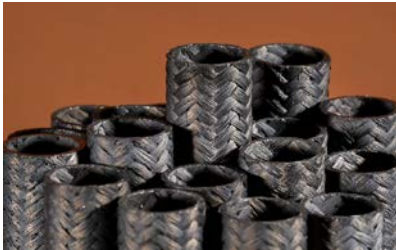


94 reactors at 55 plant sites across the country



Continuum of Innovation

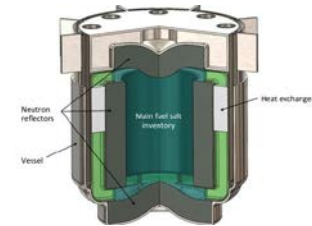
Advanced Fuels



Micro-Reactors



Advanced Non-LWRs



TerraPower

2020

2025

2030

2035

Large Light Water



Vogtle 3 & 4

Oklo Aurora

Small Modular Reactor



NuScale

- Gas cooled
- Liquid metal
- Molten salt

Delivering the Nuclear Promise – Achieved!

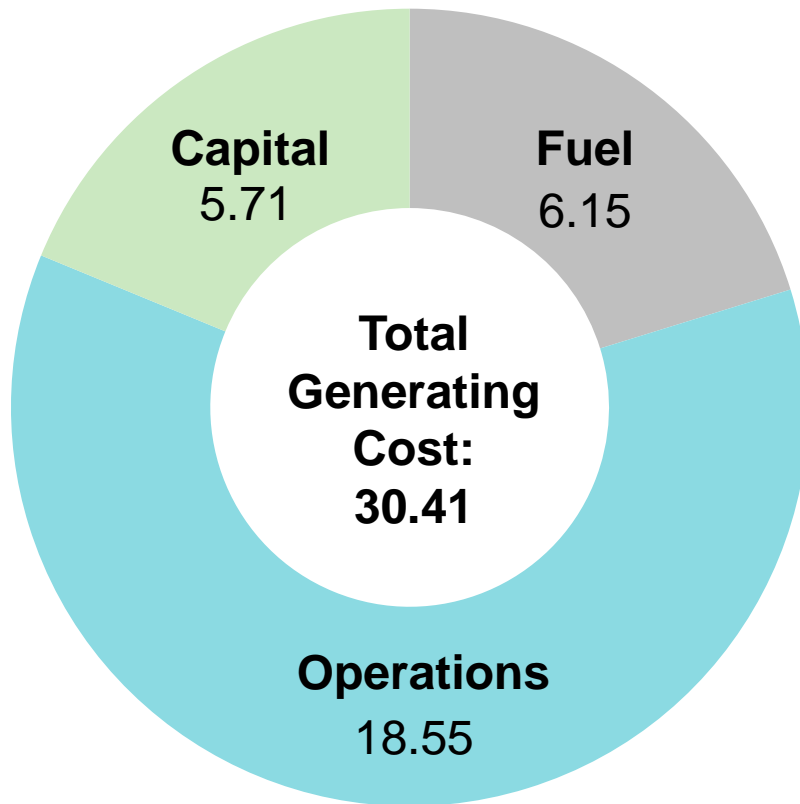


Costs in 2019 dollars (\$/MWh)

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%)

The U.S. nuclear industry achieved the DNP goal.

2019 total generating costs decreased nearly \$2.50/MWh



2019 costs compared to 2018:

- Total generating costs decreased by **\$2.49/MWh (7.6% reduction)**
- Operations costs decreased by **\$1.57/MWh (7.8% reduction)**
- Capital costs decreased by **\$0.61/MWh (9.6% reduction)**
- Fuel costs decreased by **\$0.32/MWh (4.9% reduction)**

“The Big 3”

APPLICATIONS FOR BOTH THE CURRENT FLEET AND ADVANCED REACTOR DESIGNS

Cost

- Less labor; automated
- Less material; less waste

Schedule

- Reduced lead times; some up to 90%

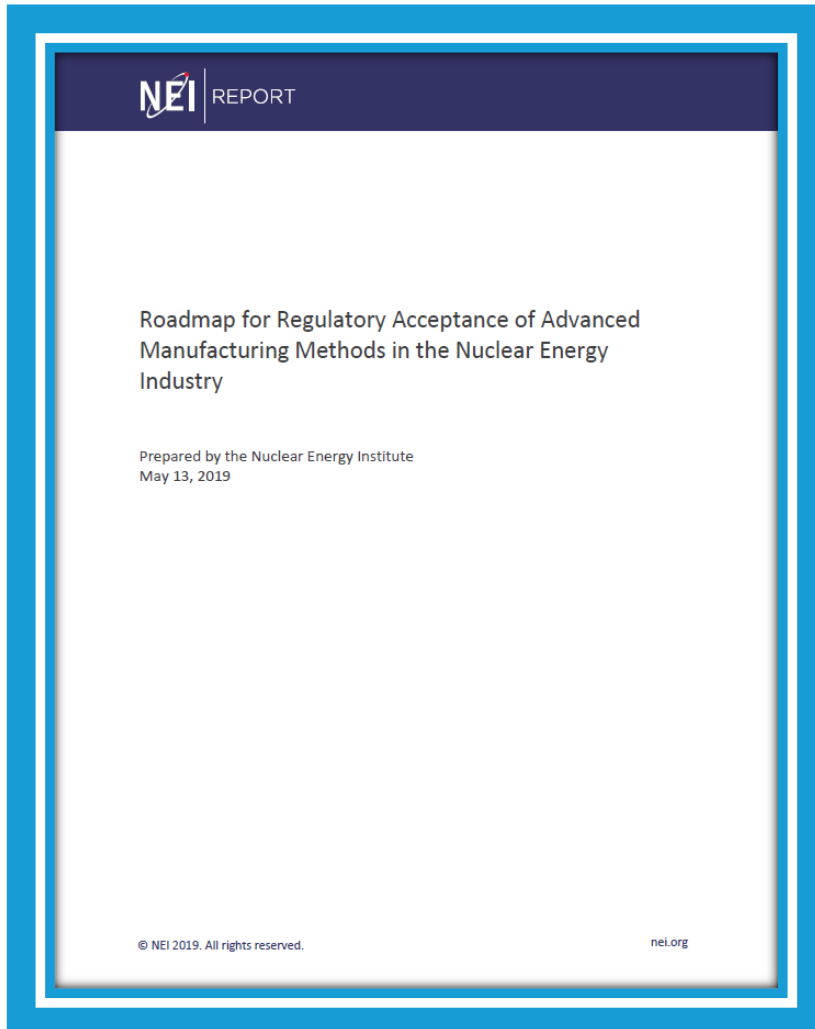
Quality

- Excellent inspectibility
- Excellent material properties
- Homogenous

AMT Good Candidate For:

- ✓ Long lead time components
- ✓ High value components
- ✓ Complex geometries
- ✓ Obsolete parts
- ✓ Mitigation work
- ✓ High T environments
- ✓ Reduced weight
- ✓ Localizing the supply chain
- ✓ True “Nth-of-a-kind”
- ✓ And more...

NEI's Advanced Manufacturing Task Force

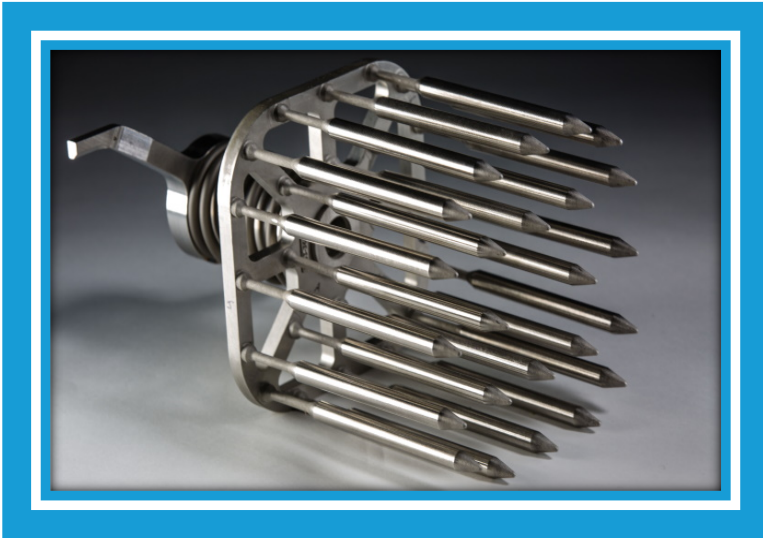


- Broad membership to include:
 - Advanced Reactor designers/developers
 - Suppliers / manufacturers
 - Utilities
 - Law and consulting firms
 - EPRI
 - DOE-NE and DOE National Laboratories
 - Universities
 - Non-profits

Advanced Manufacturing Technologies of Interest...

- 1) Laser Powder Bed Fusion
- 2) Powder Metallurgy – Hot Isostatic Pressing (PM-HIP)
- 3) Electron Beam Welding (EBW)
- 4) Cold Spray
- 5) Directed Energy Deposition (DED)
- 6) And many others...

First of a Kind (FOAK) Deployments...



Courtesy: Westinghouse

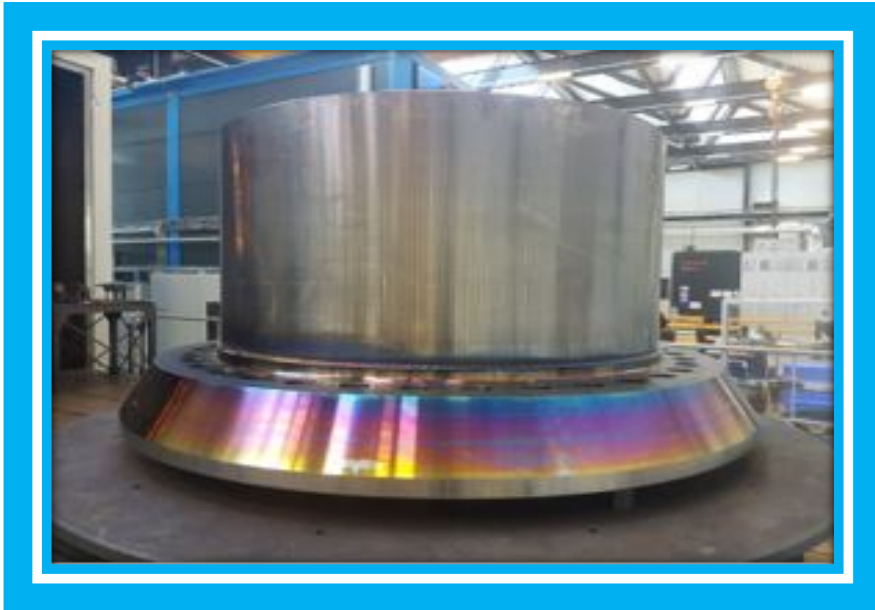


Courtesy: ORNL



Courtesy: Framatome

First of a Kind (FOAK) Prototype Work...

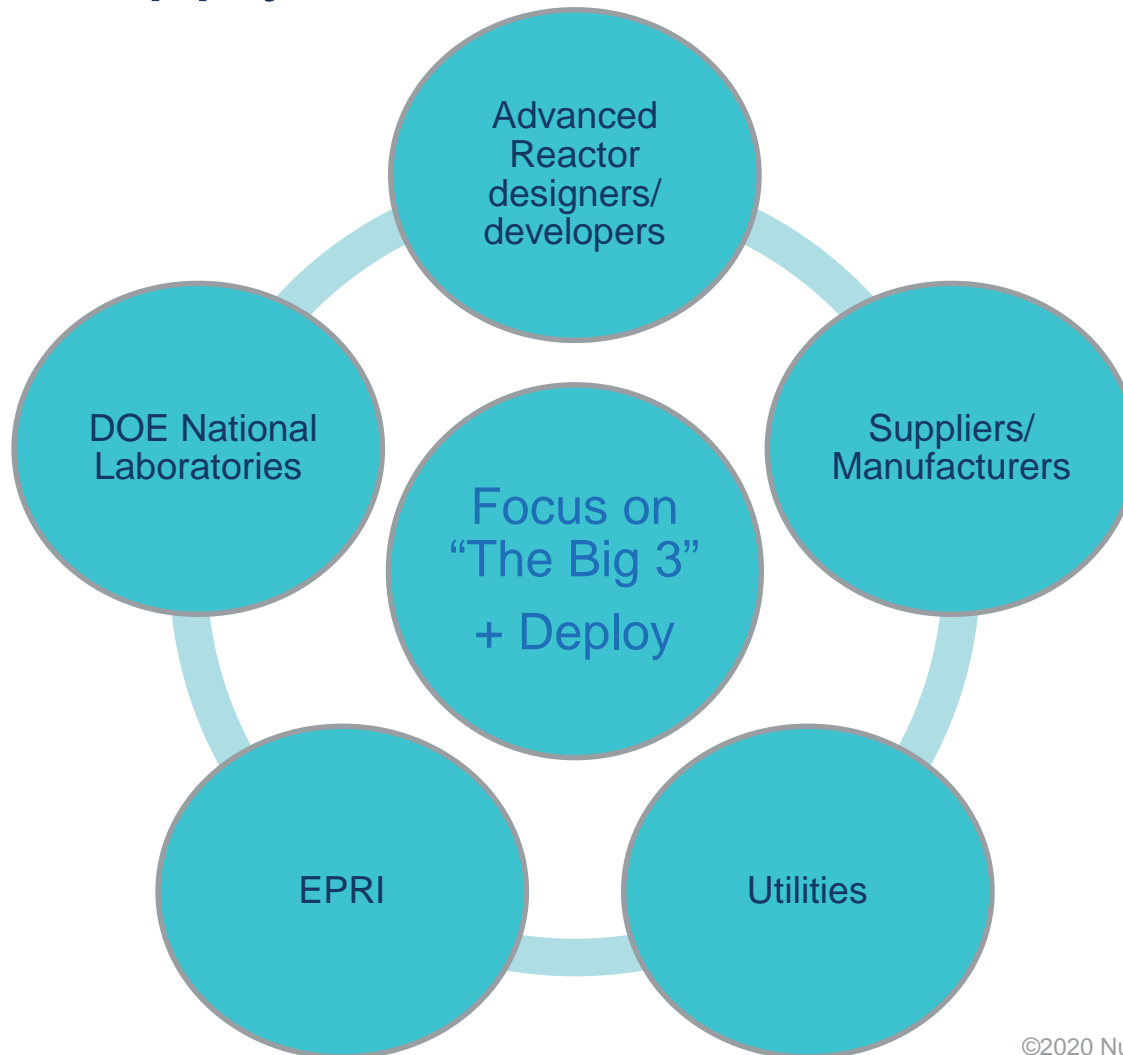


Courtesy: EPRI

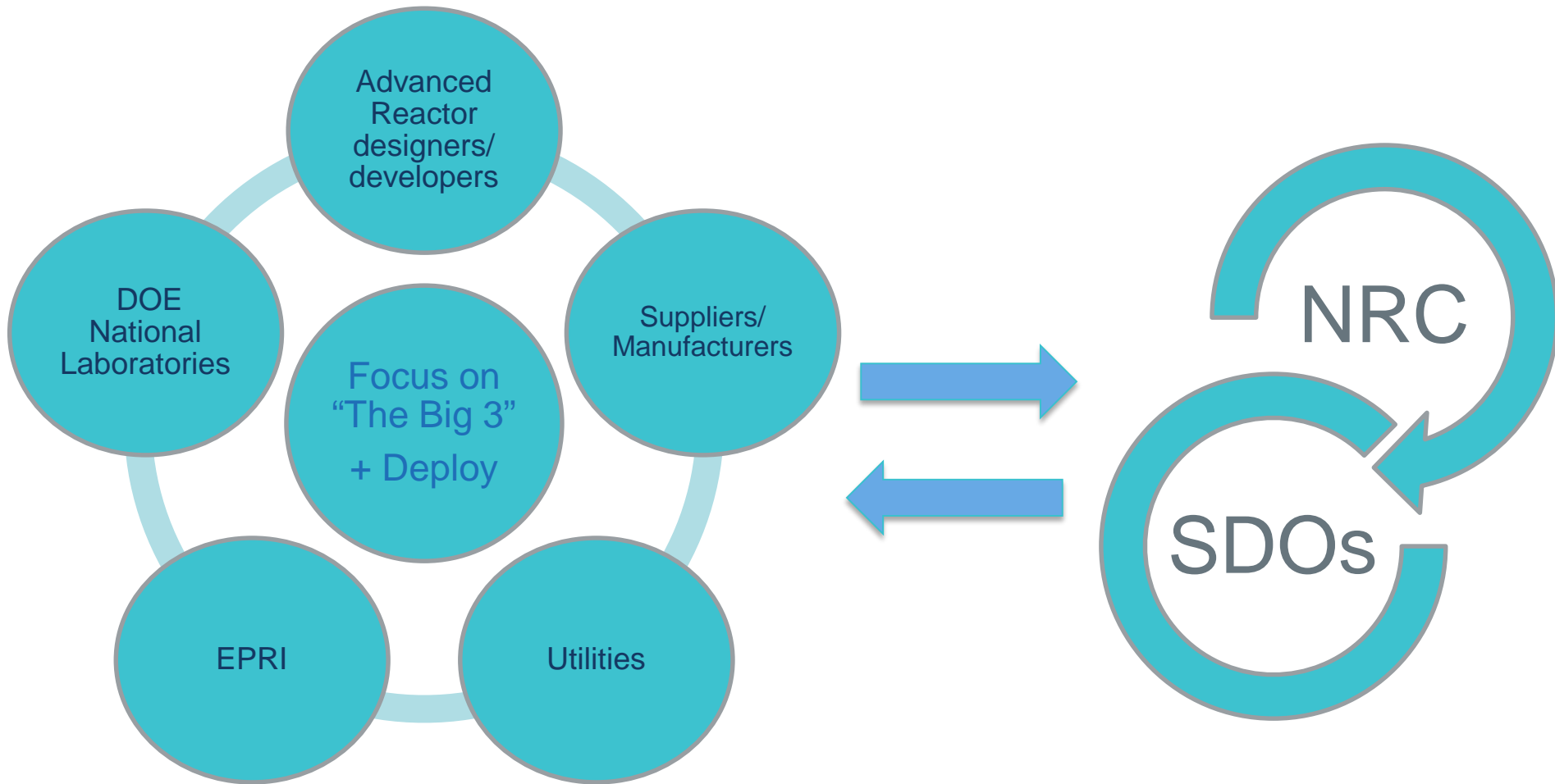


Courtesy: Kairos

Ongoing Collaboration Amongst the Industry, Supply Chain, & Research Arms



Continued Dialogue Needed



Codes & Standards

ACCELERATED ACCEPTANCE NEEDED RE: AMT

- ASME Sec. III Code Case– Submitted Aug. 2019
 - Laser Powder Bed Fusion (316L)
- ASME Special Committee on Advanced Manufacturing (formed 2017)
- Draft Pressure Technology Book:
“Criteria for Pressure Retaining Metallic Components Using Additive Manufacturing”

Where to go next?

DEVELOPMENT & INTEREST IN THE FOLLOWING AREAS

- More fuel assembly focus (current fleet)
- Advanced reactor fuels
- Non-pressure boundary parts
- Pressure boundary parts (i.e. near net shape head)
- Replacement of obsolete parts
- New alloys
- Don't forget about plastics!
- And more...

Industry research & collaboration continues!

Legislative Works in Progress



AMERICAN NUCLEAR INFRASTRUCTURE ACT (ANIA)

PAT20993 NSII S.L.C.

116TH CONGRESS
2D SESSION **S.** _____

To reestablish United States global leadership in nuclear energy, revitalize domestic nuclear energy supply chain infrastructure, support the licensing of advanced nuclear technologies, and improve the regulation of nuclear energy, and for other purposes.

IN THE SENATE OF THE UNITED STATES

Mr. BARRASSO (for himself, Mr. WHITEHOUSE, Mr. CRAVO, and Mr. BOOKER) introduced the following bill, which was read twice and referred to the Committee on _____

A BILL

To reestablish United States global leadership in nuclear energy, revitalize domestic nuclear energy supply chain infrastructure, support the licensing of advanced nuclear technologies, and improve the regulation of nuclear energy, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 SECTION 1. SHORT TITLE TABLE OF CONTENTS.

4 (a) SHORT TITLE.—This Act may be cited as the
5 “American Nuclear Infrastructure Act of 2020”.

6 (b) TABLE OF CONTENTS.—The table of contents for
7 this Act is as follows:



Additional Takeaways

- Utilize the OPEX from other industries (aerospace, defense, etc.) to the extent practicable; **don't re-invent the wheel**
- New-to-nuclear countries are looking to the U.S. to pave the way in AMT deployment
- Continue frequent dialogue amongst stakeholders (industry, NRC, SDOs, etc)

Communicate, Communicate, Communicate!

Looking to NRC for a streamlined approach in line with their efforts to become a modern, risk-informed regulator

Advanced Manufacturing for the Nuclear Energy Industry

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Innovate & Thrive



Thank you

Questions:
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