



NUCLEAR ENERGY INSTITUTE

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ADVANCED REACTOR FUEL CYCLE ISSUES



NATIONAL NUCLEAR ENERGY STRATEGY

DELIVER THE NUCLEAR NARRATIVE

PRESERVE

Appropriately value nuclear generation

SUSTAIN

Create sustainability via improved regulatory framework and reduced burden

INNOVATE

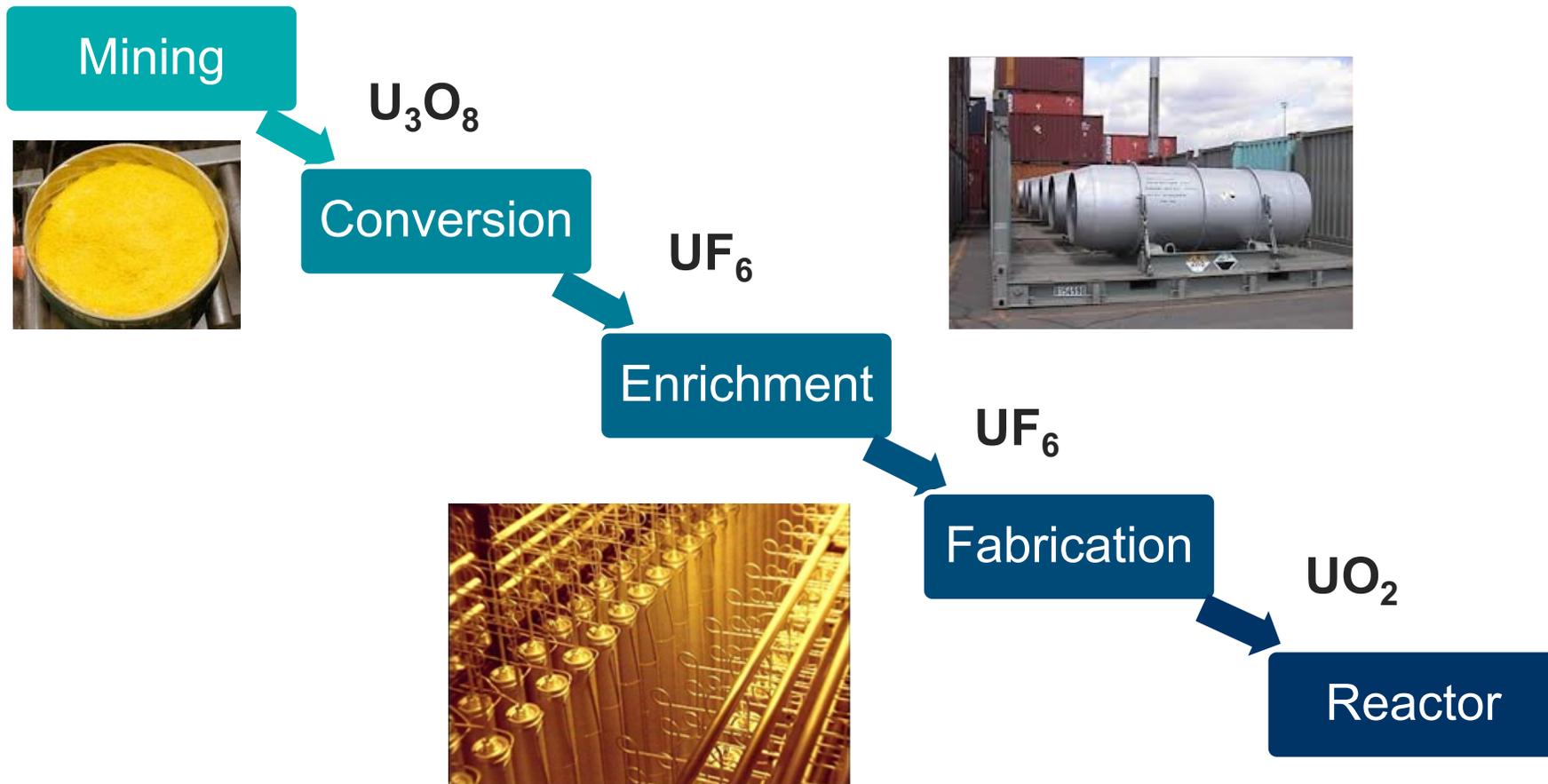
Innovate, commercialize, and deploy new nuclear

THRIVE

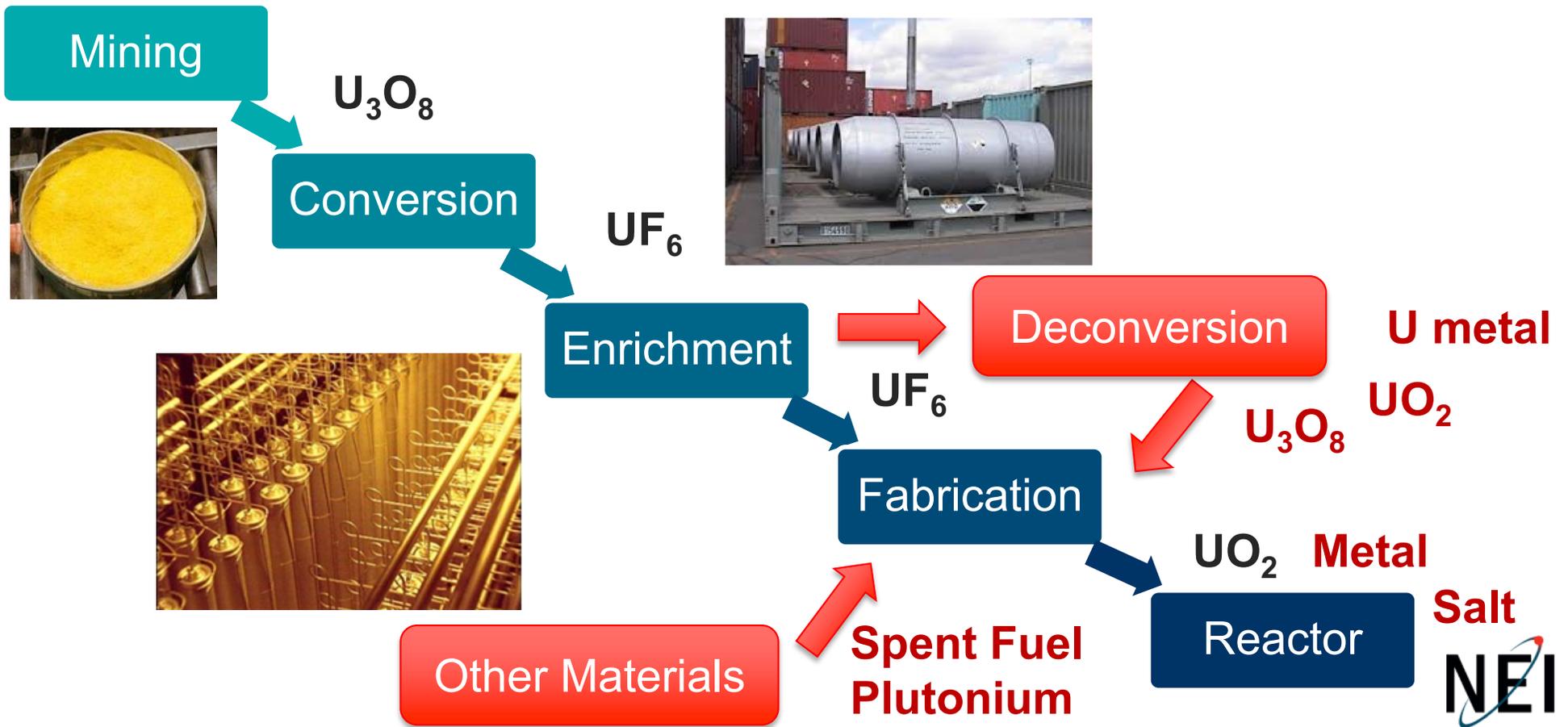
Compete globally



THE FRONT END FUEL CYCLE



FUTURE FRONT END FUEL CYCLE?



ADDRESSING INFRASTRUCTURE CHALLENGES

NEI White Paper



NUCLEAR ENERGY INSTITUTE

Addressing the Challenges with Establishing the Infrastructure for the front- end of the Fuel Cycle for Advanced Reactors

January 2018

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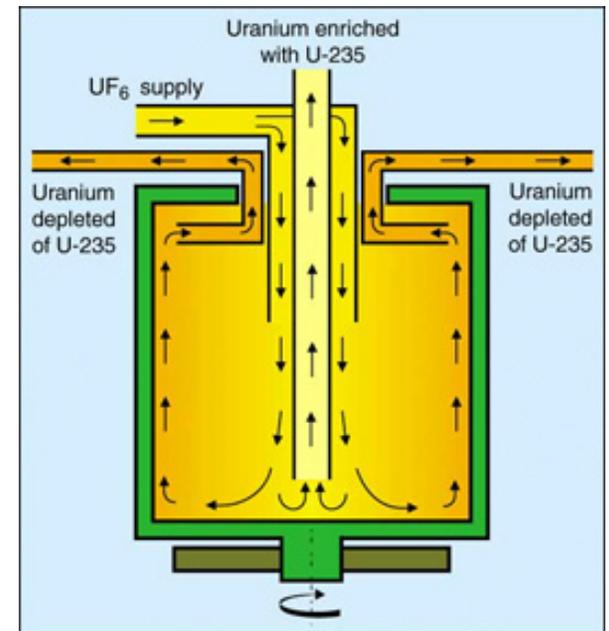


ENRICHMENT ISSUES

- Low Enriched Uranium < 20 wt.% U-235
- ## Needs
- Current fleet uses less than 5 wt.% U-235
 - Many, but not all, advanced reactors and an advanced fuel design for LWRs need up to 20 wt.% U-235 High Assay LEU (HALEU)

Challenges

- Domestic enrichment only goes to 5%
- How to justify investment needed to go to 20%?
- Where to obtain HALEU in the interim?



TRANSPORTATION ISSUES

- 30B cylinder – 2200 kg UF6 – 5 wt.% U-235 limit
- 8A cylinder – 115 kg UF6 – 12.5 wt.% U-235 limit
- 5A cylinder – 25 kg UF6 – 100 wt.% U-235 limit

Needs

- UF6 cylinders for commercial quantities up to 20%

Challenges

- Criticality design above 5 wt.%
- How to justify investment needed for new packages?



CROSSCUTTING ISSUES

- Category III material is less than 10 wt.%
- Category II material is 10 to 20 wt.%
- Category I material is greater than 20 wt.%

Needs

- MC&A guidance for Category II material
- Security guidance for Category II material

IDENTIFYING INDUSTRY NEEDS

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July 5, 2018

The Honorable Rick Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Need for High-Assay Low Enriched Uranium

Dear Secretary Perry:

The Nuclear Energy Institute appreciates the Department of Energy's leadership and commitment to helping preserve and strengthen the civil nuclear energy sector. In particular, the Department's support for the development of innovative technologies, including the next generation of advanced reactors, and advanced fuels for the existing fleet of reactors, will help ensure that nuclear power continues to bolster America's national security by providing the dominant source of resilient, carbon-free power in the United States.

The existing fleet of reactors in the United States runs on uranium fuel that is enriched up to 5% Uranium-235. On the other hand, many advanced reactor designs and at least one advanced fuel design for the existing fleet require High-Assay Low Enriched Uranium (HALEU), uranium that is enriched between 5% and 20%. Currently, commercial nuclear fuel suppliers, with the possible exception of Russia, can only produce uranium enriched to 5%.

To help bridge this gap in supply, NEI, on behalf of the industry, requests that the Department of Energy (DOE) provide an interim supply of HALEU and thereby accelerate the development of both HALEU fuel infrastructure and advanced reactors and advanced fuels that require HALEU. The DOE currently has material that could be used for this interim HALEU supply: DOE possesses an inventory of high-enriched uranium that could be downblended to HALEU, and DOE also manages spent high-enriched fuel that could be processed and converted into HALEU.

The development, demonstration, and deployment of many advanced nuclear technologies is in jeopardy since there is no certainty that a HALEU fuel infrastructure will be in place when they are ready to enter the market. At the same time, investment into a HALEU fuel infrastructure is highly unlikely given the market uncertainty. As the Administration continues to review civil nuclear energy policy, it is important to recognize that the federal government is in a key position to accelerate the development of this infrastructure by providing an interim supply of HALEU fuel and supporting the development of future facilities.

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INDUSTRY HALEU NEEDS

- Values in MTU
- Current fleet uses about 2000 MTU/year
- Letter to Secretary Perry July 5, 2018
- Data from eight companies
- Not all ARs or advanced fuels need HALEU

Year	Total	Cumulative
2018	0.026	0.026
2019	1.506	1.532
2020	2.21	3.7
2021	4.2	7.9
2022	3.7	11.6
2023	18.8	30.4
2024	10.3	40.7
2025	12.4	53.1
2026	57.4	110.5
2027	73.6	184.1
2028	108.1	292.2
2029	111.8	404.0
2030	185.5	589.5

INTERIM SUPPLY OF HALEU

- Industry requests that the Department of Energy (DOE) provide an interim supply of HALEU
- Will accelerate the development of HALEU fuel infrastructure, advanced reactors, and advanced fuels that require HALEU
- The DOE currently has material that could be used for this interim HALEU supply:
 - Inventory of high-enriched uranium that could be downblended
 - Spent high-enriched fuel that could be processed and converted

INTERIM SUPPLY ISSUES

- Surplus HEU is allocated
- Impurities in processed spent high enriched fuel (will vary based on source material)
 - Affects reactor design and fuel fabrication
- Cost and timing to downblend or process spent fuel

NEI FUELS TASK FORCE

- **Mission:** Lead industry efforts in identifying and resolving regulatory and policy issues for the development of the nuclear fuel supply chain for advanced reactors with an emphasis on challenges related to the utilization of high assay low enriched uranium.



GOVERNMENT FOCUS

- DOE Office of Nuclear Energy focused on HALEU
- Congress in FY19 funded DOE \$20 million for highly enriched uranium recovery preparation and testing
- Congress focused on HALEU
 - Senate S 3422 Nuclear Energy Leadership Act – government program to establish minimum amount of HALEU
 - House HR 6140 Advanced Nuclear Fuel Availability Act – support package development and formation of consortium



CONCLUSION

- Many but not all advanced reactors need HALEU
- A commercial supply of HALEU and associated infrastructure is technically feasible with appropriate financial investment
- Industry, DOE, and Congress focused on interim supply of HALEU – solution path still being determined
- Some developers are focused on used fuel or other materials
- Progress being made but domestic interim and long term supply not yet identified

QUESTIONS?



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