Nuclear Energy Advisory Committee Meeting

John W. Herczeg
Deputy Assistant Secretary
for Nuclear Technology Research and Development
Office of Nuclear Energy

July 9, 2018
Presidential and Departmental Nuclear Energy Priorities

• President Trump ordered review of nuclear energy policy:
  “[W]e will begin to revive and expand our nuclear energy sector...which produces clean, renewable and emissions-free energy. A complete review of U.S. nuclear energy policy will help us find new ways to revitalize this crucial energy resource.”

• Nuclear energy role as clean baseload power is key to environmental challenges:
  “If you really care about this environment that we live in...then you need to be a supporter of this amazingly clean, resilient, safe, reliable source of energy.” Secretary Rick Perry at Press conference, May 10th

• Executive Order Promoting Energy Independence and Economic Growth

• Commercialization of advanced SMRs crucial to future of US nuclear sector
NE-4 Organizational Chart

Nuclear Technology Research and Development

Deputy Assistant Secretary John Herczeg
Associate Deputy Assistant Secretary Sal Golub

NE-41
Office of Advanced Reactor Technologies
Director - Alice Caponiti

NE-42
Office of Advanced Fuels Technologies
Acting Director – Bill McCaughey

NE-43
Office of Materials and Chemical Technologies
Director – Patricia Paviet
Focus Areas: Nuclear Technology Research and Development

- Enrichment & Uranium Supply
  - Uranium Mining
  - Nat'l Enrichment Capability
  - Other Advanced Techniques

- Fuel Fabrication
  - Conventional LWR Fuel Fabrication
  - Accident Tolerant Fuels

- Reactors

- Recycle
  - Used LWR Fuel Recycle
  - Advanced Reactor Fuel Recycle

- Interim Storage
  - Interim Storage

- Final Disposal
  - Geologic Repository

Safeguards and Security by Design -- Materials Protection, Accounting, & Control Technologies (MPACT)
• Phase 1: Feasibility Assessment and Down-Selection
  • Collaborative partnership between DOE, industry, and universities.
  • Completed in FY 2016 with three concepts for further development.

• Phase 2: Development and Qualification
  • Industry led efforts supported by DOE national infrastructure and universities.
  • By the mid 2020s, install first reload quantities in commercial reactors.

• Phase 3: Commercialization
  • Industry commercial activity deploying ATF into existing and future reactor systems.
  • By the early 2030s, full cores of ATF in multiple reactors and benefits realized by utilities.
Industry-led Development of ATF Concepts in Phase 2

- **Framatome**
  - Chrome coated zirconium cladding
  - Doped uranium dioxide fuel

- **General Electric**
  - Iron-chrome-aluminum cladding (FeCrAl)
  - Conventional uranium dioxide fuel

- **Westinghouse**
  - Silicon carbide cladding
  - Uranium silicide fuel
1. Approach to Design: Conducting a 3 year research & development effort on core design.

2. Reach fast flux of approximately $4 \times 10^{15}$ n/cm$^2$·s, with prototypical spectrum.

3. Load factor: as large as possible (*maximize dpa/year to > 30 dpa/year*).

4. Provide flexibility for novel experimental techniques.

5. Be capable of running loops representative of typical fast reactors (*Candidate Coolants: Na, Lead, LBE, Gas, Molten Salt*) – May be a single location with replaceable loops.

6. Effective testing height ≤ 1 m.

7. Ability to perform large number of experiments simultaneously.

8. **Metallic driver fuel** (possible options: HA-LEU, LEU+Pu).
Mission: to develop advanced material recovery as well as advanced waste form development technologies that improve current fuel cycle performance and enable a sustainable fuel cycle, with minimal processing, waste generation, and potential for material diversion.

Electrochemical Processing of Used Nuclear Fuel
- Develop and demonstrate deployable and sustainable technology for fast reactor fuel recycling
- Demonstrate flowsheets with irradiated used nuclear fuel under Joint Fuel Cycle Study with Republic of Korea

Off-Gas Capture and Immobilization
- Management of process off-gasses (I-129, H-3, Kr-85, and C-14) to meet U.S. regulatory constraints

Waste Management
- Demonstrate technologies at laboratory scale for advanced ceramic and glass ceramic waste forms and understand long-term performance of waste forms

Aqueous Processing of Used Nuclear Fuel – CoDCon Project and Advanced Recycling
- Demonstrate recovery of useful materials, Uranium, Plutonium and Minor Actinides from used nuclear fuel thereby enabling recycle options for the sustainability of the nuclear fuel cycle
<table>
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<tr>
<th>Program Name</th>
<th>FY 2018 Omnibus</th>
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<tr>
<td>STEP</td>
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<tr>
<td>Reactor Concepts RD&amp;D</td>
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<td>Advanced Reactor Technology</td>
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In parallel, DOE-NE is also investing in the R&D infrastructures (with emphasis on the test reactor) to assure a sustainable fast-reactor industry in the long-run.

- TREAT already restarted
- Versatile Test Reactor (VTR) targeted for availability by 2026