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U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Fuel Cycle Research and Development

Nuclear Fuel Cycle Options Catalog – Status and Plans

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Nuclear Fuel Cycle Options Campaign

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FY15 Fuel Cycle Options Online Catalog Activities

- Create enhanced search facility
- Create Fuel Cycle Evaluation and Screening webpage
- Create “Evaluate My Option” webpage
- Develop on-line FCDP entry process
- Add options and technologies to the catalog
- Conduct ongoing maintenance activities

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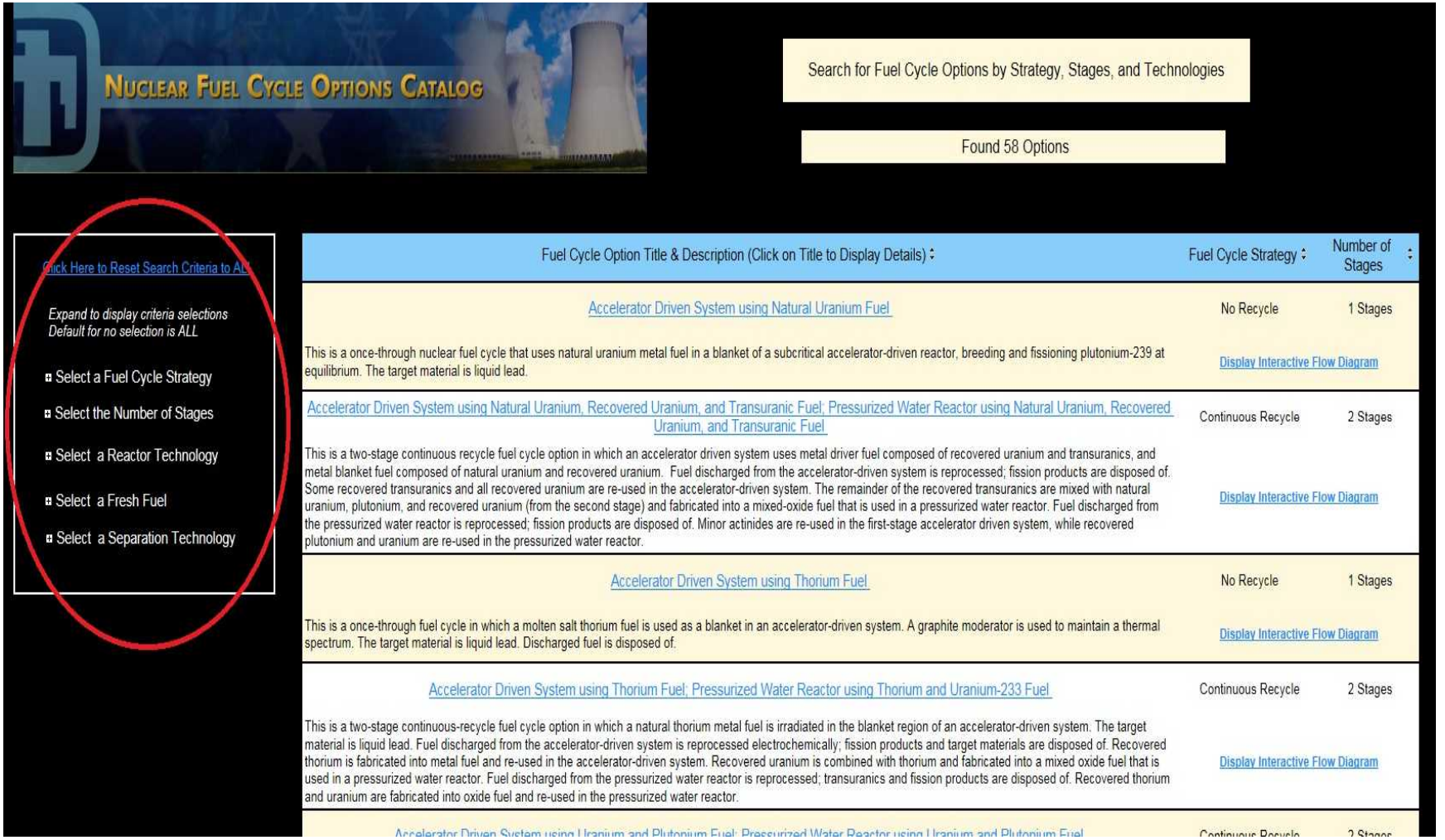
Create Enhanced Search Facility



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Create Enhanced Search Facility (cont'd)

Search for Fuel Cycle Options

Found 58 Options

Reset Search Criteria to ALL

Expand to display criteria selections. Default for no selection is ALL

- Select a Fuel Cycle Strategy
- Select a Number of Stages
- Select a Spectrum
- Select a Reactivty
- Select an Incoming Fuel
- Select a Recycle Element
- Select Enrichment Needed

Fuel Cycle Option Title & Description (Click on Title to Display Details)	Fuel Cycle Strategy	Number of Stages	Reactor Spectrum	Reactor Reactivity	Incoming Fuel	Enrichment Needed?	Recycle Elements
Accelerator Driven System using Natural Uranium Fuel	once-through	1 Stages	Fast	Subcritical	U	No	-None-
This is a once-through nuclear fuel cycle that uses natural uranium metal fuel in a blanket of a subcritical accelerator-driven reactor, breeding and fissioning plutonium-239 at equilibrium. The target material is liquid lead. Display Interactive Flow Diagram							
Accelerator Driven System using Natural Uranium, Recovered Uranium, and Transuranic Fuel; Pressurized Water Reactor using Natural Uranium, Recovered Uranium, and Transuranic Fuel	multi-stage continuous recycle	2 Stages	Fast and Thermal	Subcritical and Critical	U	No	TRU
This is a two-stage continuous recycle fuel cycle option in which an accelerator driven system uses metal driver fuel composed of recovered uranium and transuranics, and metal blanket fuel composed of natural uranium and recovered uranium. Fuel discharged from the accelerator-driven system is reprocessed; fission products are disposed of. Some recovered transuranics and all recovered uranium are re-used in the accelerator-driven system. The remainder of the recovered transuranics are mixed with natural uranium, plutonium, and recovered uranium (from the second stage) and fabricated into a mixed-oxide fuel that is used in a pressurized water reactor. Fuel discharged from the pressurized water reactor is reprocessed; fission products are disposed of. Minor actinides are re-used in the first-stage accelerator driven system, while recovered plutonium and uranium are re-used in the pressurized water reactor. Display Interactive Flow Diagram							
Accelerator Driven System using Thorium Fuel	once-through	1 Stages	Thermal	Subcritical	Th	No	-None-
This is a once-through fuel cycle in which a molten salt thorium fuel is used as a blanket in an accelerator-driven system. A graphite moderator is used to maintain a thermal spectrum. The target material is liquid lead. Discharged fuel is disposed of. Display Interactive Flow Diagram							
Accelerator Driven System using Thorium Fuel; Pressurized Water Reactor using Thorium and Uranium-233 Fuel	multi-stage continuous recycle	2 Stages	Fast and Thermal	Subcritical and Critical	Th	No	U233 with or without TRU
This is a two-stage continuous-recycle fuel cycle option in which a natural thorium metal fuel is irradiated in the blanket region of an accelerator-driven system. The target material is liquid lead. Fuel discharged from the accelerator-driven system is reprocessed electrochemically; fission products and target materials are disposed of. Recovered thorium is fabricated into metal fuel and re-used in the accelerator-driven system. Recovered uranium is combined with thorium and fabricated into a mixed oxide fuel that is used in a pressurized water reactor. Fuel discharged from the pressurized water reactor is reprocessed; transuranics and fission products are disposed of. Recovered thorium and uranium are fabricated into oxide fuel and re-used in the pressurized water reactor. Display Interactive Flow Diagram							
Accelerator Driven System using Uranium and Plutonium Fuel; Pressurized Water Reactor using Uranium and Plutonium Fuel	multi-stage continuous	2 Stages	Fast and Thermal	Subcritical and Critical	U	No	Pu

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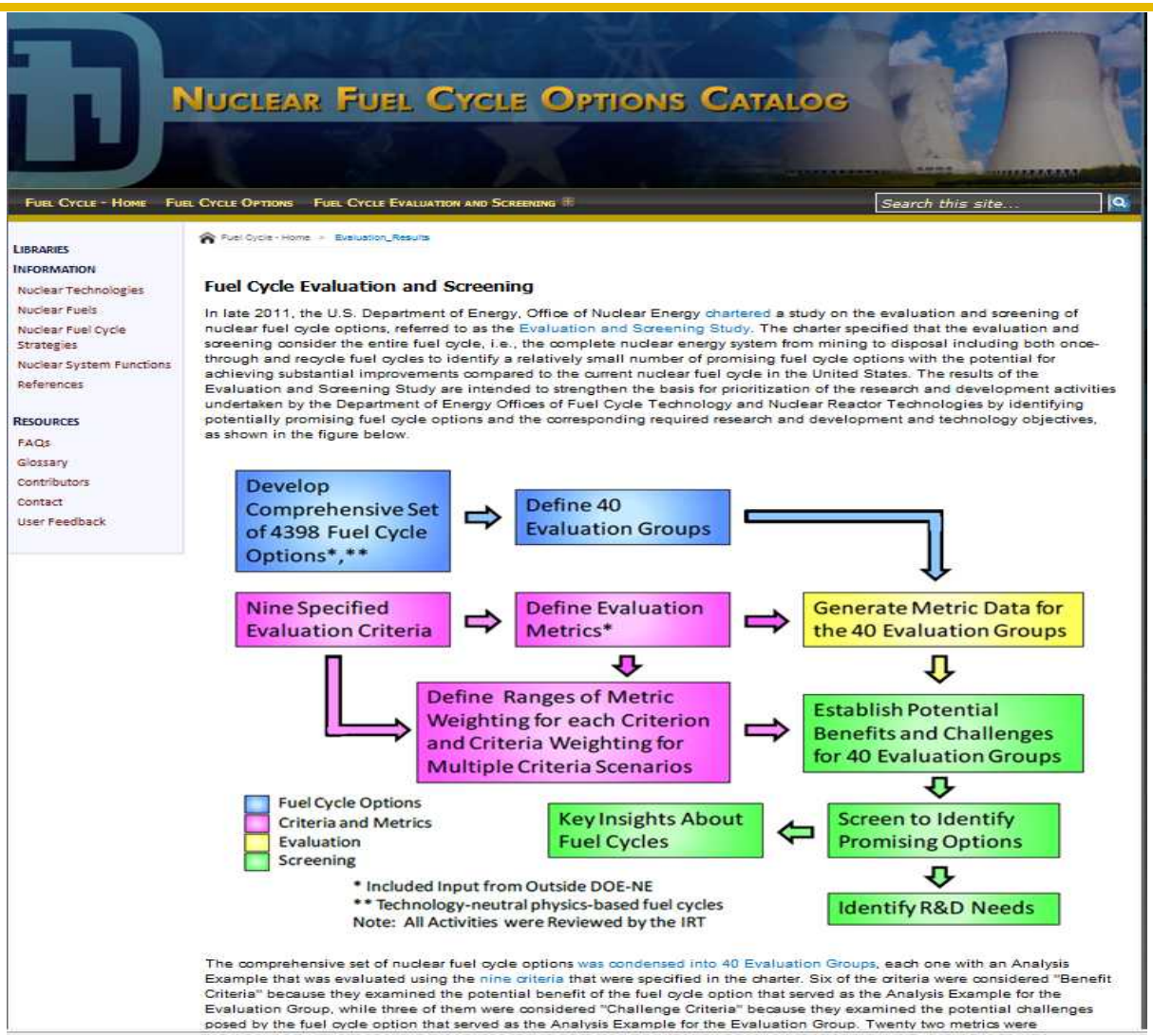
Create Fuel Cycle Evaluation and Screening Webpage



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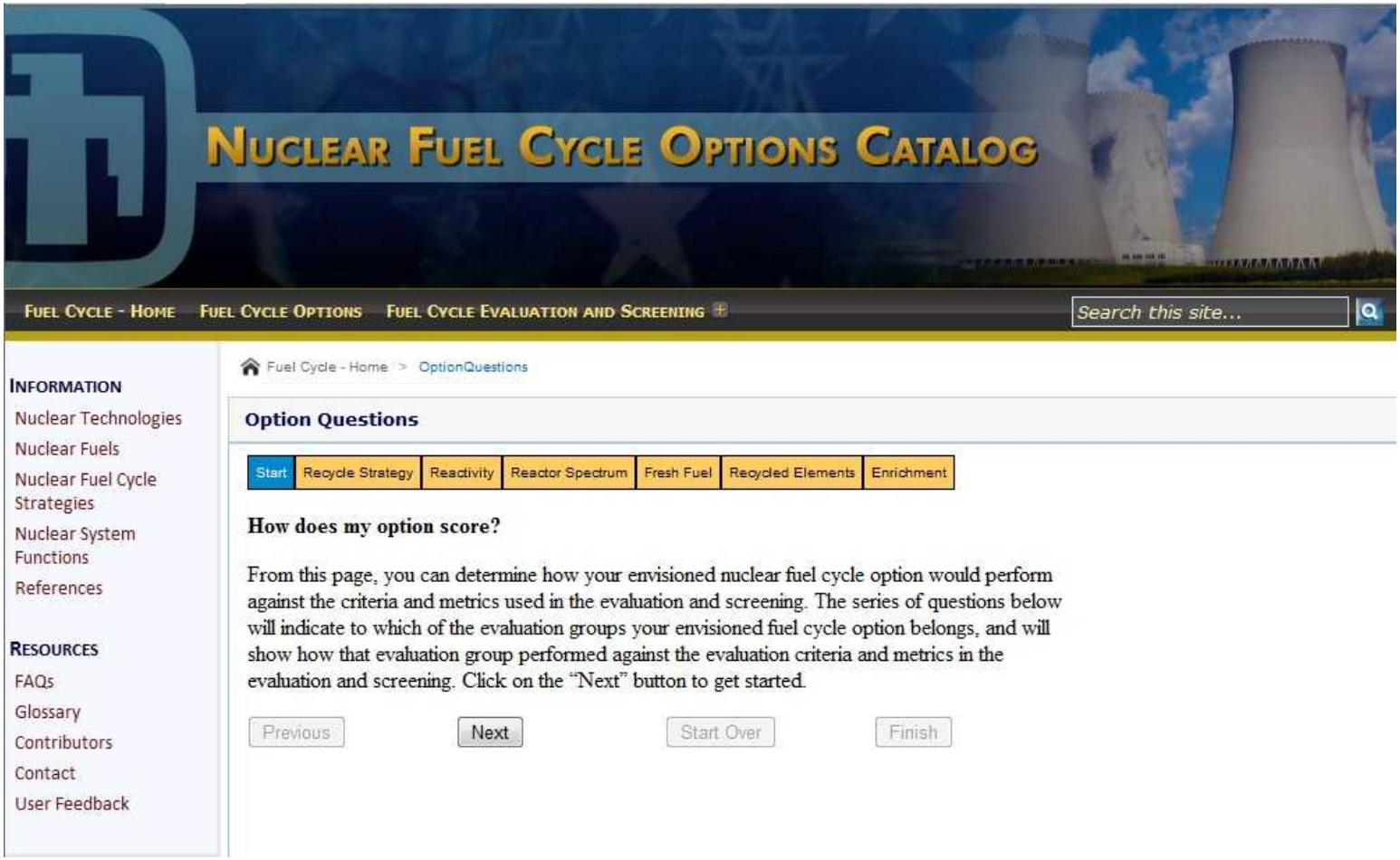
"Evaluate My Option" webpage



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Develop On-Line FCDP Entry Process

Nuclear Fuel Cycle Option Catalog
Option Manager

Edit Technology Parameter Values

Option	Demonstration 1
Stage	Stage 1 - This is a description of Stage 1 of the option.
Stage Architecture	(D) Transmutation Systems
Stage Architecture Technology	Sodium-cooled Fast Reactor (SFR) (breeder or burner)

Technology Parameter	Parameter Value	Parameter Unit	Actions
Average Accelerator Power Requirement	TBD	MWe	Edit Parameter Value
Capacity factor	TBD	%	Edit Parameter Value
Core Configuration	TBD	Text	Edit Parameter Value
Core Thermal Power	TBD	MWth	Edit Parameter Value
Electrical Energy Generation Sharing	TBD	%	Edit Parameter Value
Net Thermal Efficiency	TBD	%	Edit Parameter Value
NPPT Technology Identifier	TBD	Text	Edit Parameter Value
Specific Power Density	TBD	MW/Initial Heavy Metal Metric Ton	Edit Parameter Value
Technology Readiness Level	TBD	Scale from 1 to 9	Edit Parameter Value
Technology Readiness Level - Brief Justification	TBD	Text	Edit Parameter Value

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On-Line FCDP Entry – Still To Do

- Finish on-line interface
- Create user's guide for the on-line interface
- Develop review process for on-line entries
- Test the data entry process and review process

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Fuel Cycle Options Added to the Catalog in FY15

- **The following fuel cycle options were added to the catalog in FY15; these are not analysis examples**
  - PWR using LEU fuel in a seed/blanket arrangement
  - PWR using LEU fuel; PWR with MOX fuel
  - FFH using DU and/or NU fuel
  - PWR using LEU fuel; HTGR using TRISO-TRU fuel
  - PWR using LEU fuel; HWR using MOX fuel (DUPIC)
  - PWR using LEU fuel; PWR using Pu and RU fuel
  - PWR using Th and U oxide fuel; HTGR using recovered Th and U carbide fuel
- **The following fuel cycle options will be added in the first few months of FY16**
  - ADS using Pu, NU, and RU fuel
  - Sodium-cooled intermediate reactor using Pu, NU, and RU fuel
  - Reduced-moderation boiling water intermediate spectrum reactor using Pu, DU, NTh, RTh, RU-233 and RU-238 fuel
  - MSR (fast) using Pu and U fuel
  - Reduced-moderation boiling water intermediate spectrum reactor using Pu, DU, NTh, RTh, RU-233, RU-238, and TRU fuel
  - Sodium-cooled fast reactor using Pu and RU fuel; MSR (thermal) using Pu and RU fuel

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Reactors and Fuels to be Added to the Catalog in FY16

- **The following reactors will be added to the catalog in FY16**
  - Supercritical water reactor
  - High-conversion water reactor
- **The following fuel will be added to the catalog in FY16**
  - Reduced-moderation boiling water intermediate spectrum uranium oxide fuel

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Ongoing Maintenance Activities

- Finish updating the catalog requirements document
- Make sure the database and website continue to work when SNL's network managers updated software or equipment

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On-Going and Future Work

- Finish the on-line FCDP interface, the user's guide, and develop the review process
- Input the six fuel cycle options, the two reactors, and the fuel
- Finish updating the catalog requirements document
- Add content of interest to the Fuel Cycle Options Campaign