Introduction and Procedure

Many of the new, advanced reactors will use High Assay Low Enriched Uranium (HALEU) fuel. What are the resource requirements to meet expected HALEU demand?

Procedure

Modeled three fuel cycle scenarios using Cyclus. Simulations model materials from mine to final disposal.

- **Scenario 1:** Current fleet of Light Water Reactors (LWRs)
- **Scenario 2:** No growth transition to Ultra Safe Nuclear Corporation (USNC) Micro Modular Reactor (MMR)
- **Scenario 3:** No growth transition to X-energy Xe-100

Table 1: Mico-reactor design specifications

Design Criteria	USNC MMR^{TM}	X-Energy Xe-100^{TM}
Reactor Type	Modular HTGR	Modular HTGR
Power Output (MWth)	15	200
Enrichment (% ^{235}U)	13	15.5
Cycle Length (years)	20	Online Refuel
Fuel Form	TRISO Compacts	TRISO Pebbles
Reactor Lifetime	20 years	60 years
Coolant	He	He

Results

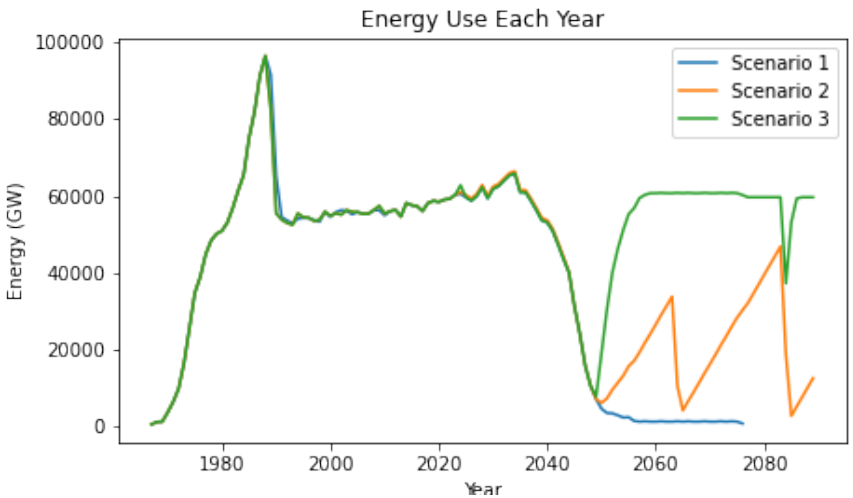

Figure 1: Total energy output of each scenario.

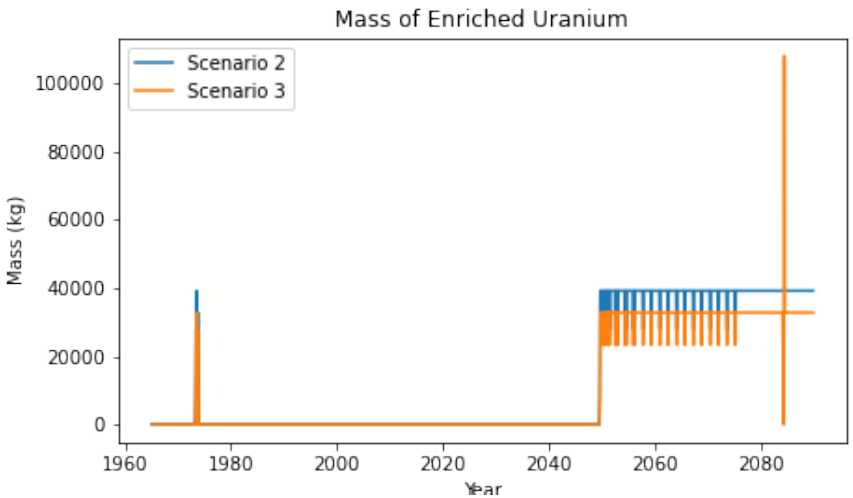

Figure 3: Mass of enriched uranium to supply advanced reactors.

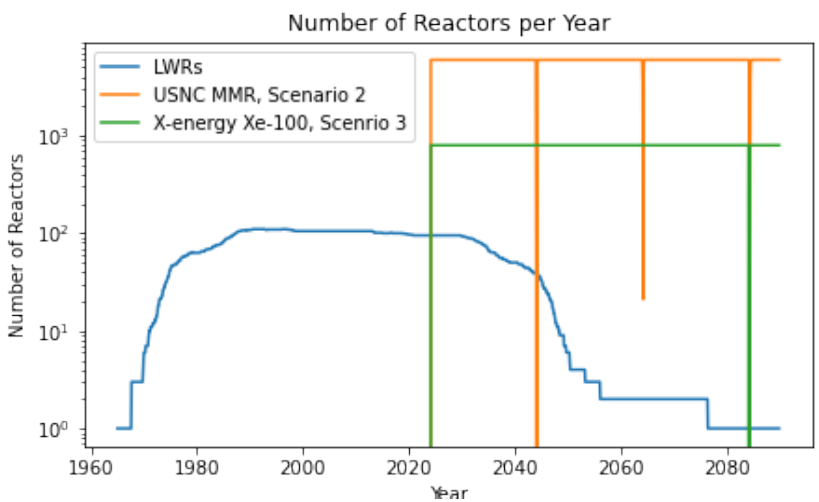

Figure 2: Number of each reactor type deployed.

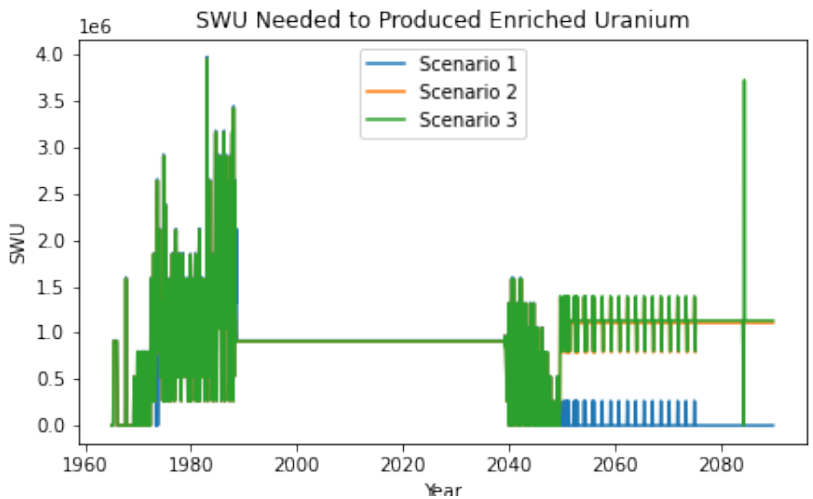

Figure 4: Total SWU capacity required to enrich natural uranium in each scenario.

Conclusions

- Neither of the transition scenarios (Scenarios 2 and 3) meet the desired power level.
- Scenario 2 requires a higher mass of HALEU than Scenario 3.
- Scenario 3 requires the most SWU capacity.
- Scenario 3 involves a large demand in HALEU when new reactors are built.

Ongoing Work

- Ensure energy demand is met by each transition scenario.
- Adjust feed inventory for enrichment facilities.
- Ensure simulations are as realistic as possible.
- Simulate growth transition scenarios.
- Include other reactor types.

This material is based upon work supported under an Integrated University Program Graduate Fellowship. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the Department of Energy Office of Nuclear Energy.