NEUP Nuclear Energy University Programs
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Demand Driven Cycamore Archetypes

PI: Anthony Scopatz - University of South Carolina

Collaborators: Kathryn Huff - University of Illinois at Urbana-Champaign

Program: Fuel Cycle

ABSTRACT:

Objectives: Develop an *in situ* demand driven development schedule calculation through non-optimizing, deterministic-optimizing, and stochastic-optimizing algorithms as Cyclus archetypes. Demonstrate these new archetypes in program-supporting fuel cycle scenarios.

Project Description: Modeling of the nuclear fuel cycle (NFC) is often posed as a set of demands coupled with available technologies. Demands may be singular or multi-variant. Additionally, technologies may have constraints on when they are deployable. This proposal aims to bring demand and deployment decisions into the NFC simulator itself, thereby simulating a more realistic process by which utilities, governments, and other stakeholders actually make facility deployment decisions.

To accomplish these aims demand driven archetypes for the Cyclus fuel cycle simulator will be developed using three different types of deployment optimization techniques. Non-optimizing techniques such as autoregressive techniques are being considered as a possible methodology. Deterministic-optimization methods will also be investigated. An example of these types of models are the Global Change Assessment Model (GCAM), and MARKAL. The final set of techniques to be investigated are stochastic-optimization techniques. An example of these methods are the Markov Switching models and the Gaussian Process Regression models.

Using these methods inside of the simulator will allows users to put conditions on, or ask questions directly to, the simulator. Simulations driven by explicit deployment can only answer this question awkwardly as they require pre-calculations on the part of the analyst. Therefore, the work of this project mitigates work the user must do to set up predictive simulations. Ultimately, this reduces the barrier to studying fuel cycles based on particular goals such as maximizing uranium utilization.

This project will consist of three phases. Phase one will be focused on determining a collection of methods to be used and modifications of Cyclus, culminating in a Cyclus release. In phase two, Cyclus archetypes that implement the non-optimizing, deterministic-optimization, and stochastic-optimization demand solvers will be developed. The deliverable for this phase will be implementations of these archetypes. During phase 3, the performance of the demand driven models will be evaluated. A peer reviewed journal article that presents this comparison will be the deliverable.