I. Working title: Fuel cycle impacts of deploying High Assay Low Enriched Uranium (HALEU)-fueled reactors

II. Introduction

- A. Purpose of the work: investigate the effect of deploying HALEU-fueled advanced reactors on the nuclear fuel cycle in the US
- B. Scope:
  1. US facilities
  2. select advanced reactors: USNC MMR, X-energy Xe-100, NuScale VOYGR
  3. Front-end and back-end of the fuel cycle
- C. Benefits of using HALEU for reactors – why we care about these reactors

III. Lit Review

- A. The nuclear fuel cycle
  1. Once-through vs recycle
  2. Enrichment facility/SWU calculations
  3. Recycling processe
- B. Fuel Cycle simulators
  1. Cyclus [1]
     a. Cycamore [2]
  2. DYMOND [3]
  3. Use and verification
     a. Verification [3, 4]
     b. SImulators comparison [5]
- C. Fuel Cycle modeling
  1. Department of Energy (DOE) Evaluation & screening [6]
     a.

IV. Material requirements – Once through fuel cycles

- A. Methodology
- B. Scenario Definitions
- C. Results
  1. Reactor deployment
     a. No growth scenarios
     b. 1% growth scenarios
  2. Uranium resources
  3. a. No growth scenarios
     b. 1% growth scenarios
  4. SWU capacity
  5. a. No growth scenarios
     b. 1% growth scenarios

- A. Sensitivity analysis and optimization
- B. 1. Methodology
  2. Results

V. Model fuel cycle with recycle

# Bibliography


[1] K. D. Huff, M. J. Gidden, R. W. Carlsen, R. R. Flanagan, M. B. McGarry, A. C. Opotowsky, E. A. Schneider, A. M. Scopatz, and P. P. H. Wilson, "Fundamental concepts in the Cyclus nuclear fuel cycle simulation framework," *Advances in Engineering Software*, vol. 94, pp. 46–59, Apr. 2016. arXiv: 1509.03604.

[2] A. M. Scopatz, K. D. Huff, M. J. Gidden, R. W. Carlsen, R. R. Flanagan, M. B. McGarry, A. C. Opotowsky, E. A. Schneider, and P. P. Wilson, "Cyclus Archetypes," *Submitted*, 2015.

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[4] J. W. Bae, J. L. Peterson-Droogh, and K. D. Huff, "Standardized verification of the Cyclus fuel cycle simulator," *Annals of Nuclear Energy*, vol. 128, pp. 288–291, June 2019.

[5] D. Djokic, A. M. Scopatz, H. R. Greenberg, K. D. Huff, R. P. Nibbelink, and M. Fratoni, "The Application of CYCLUS to Fuel Cycle Transition Analysis," in *Proceedings of Global 2015*, LLNL-CONF-669315, (Paris, France), p. 5061, Sept. 2015.

[6] R. Wigeland, T. Taiwo, H. Ludewig, M. Todosow, W. Halsey, J. Gehin, R. Jubin, J. Buelt, S. Stockinger, and K. Jenni, "Nuclear Fuel Cycle Evaluation and Screening  Final Report," *Final Report*, p. 51, 2014.