Seeking an RA (100% funding) for Sustainable Energy project.
Supervisor: Koroush Shirvan (kshirvan@mit.edu)
Department of Nuclear Science and Engineering

Highly Compact Gas Cooled Reactor for Sustainable Energy Production

Objectives
Horizontal and Highly compact High Temperature Gas Reactor (HTGR) will be designed by a multi-disciplinary team of nuclear, mechanical, and structural engineers, with a clear focus on minimizing the overnight capital cost of the power-generation system, with explicit considerations of functionality, constructability, transportability, modularity, safety, and future licensing. Knowledge of cost drivers on past nuclear builds, and techno-economic assessment will drive decision making. Engineering challenges associated with the proposed horizontal alignment of the primary components, including support of vessels and their internals, shields to prevent neutron dosing of primary components outside the core and moisture ingress into the core, and a passive, water-based, reactor cavity cooling system will be addressed. Innovative, plate-type steam generation may further shrink the footprint of the reactor building. Analysis will be performed for service, accident, and seismic loadings. To reach an overnight capital cost of less than $3,000/kWe, which is the commercial price point for new build nuclear, modern construction systems will be implemented, the cost impact of the seismic load case will be minimized, and a clear pathway to Nth-of-a-Kind construction will be established. All these proposed strategies to reduce cost with a design-to-built mindset will benefit many other advanced reactor designs. The conceptual design will be delivered at the end of the 3 year project with the plan that a vendor would then attempt to commercialize the MIGHTR concept as the most economical HTGR design in 5-7 year timeframe.

Background
The cost of Nuclear Power Plants (NPPs) has been the biggest challenge for new applications of nuclear energy. In 2020, Department of Energy launched a multi-billion dollar program named Advanced Reactor Demonstration Program (ARDP) to provide cost share funding for industry to deploy advanced fission based nuclear energy systems. The program in parallel launched a track to support promising designs that are aimed for commercialization in 10 years. MIT won a multi-million dollars grant as the only university led project. A startup named Boston Atomics has been launched to take the conceptual design development as part of this work for commercialization.

Students
We are looking for 1-2 graduate students at the Masters or PhD level (Nuclear, Mechanical, Civil, Aerospace or Chemical engineering backgrounds). the student can start immediately. The project is funded through at least the summer of 2024.

Scope of Work (1 or multiple bullets)
- Perform design trade off studies on heat removal strategies
- Perform structural assessment of the horizontally oriented ceramic fuel blocks
- Assess the structural integrity of in-core components with FEA
- Support the safety assessment during maximum credible accident scenarios
- Investigate economic feasibility through detailed cost analysis and techno-economic assessment.

The main deliverables expected for this project are weekly updates during group meetings as well as assistance to the PIs in preparing the semi-annual reports for DOE.

Contact
Students interested in this project should contact Prof. Koroush Shirvan (kshirvan@mit.edu).

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Prof. Koroush Shirvan (NSE)

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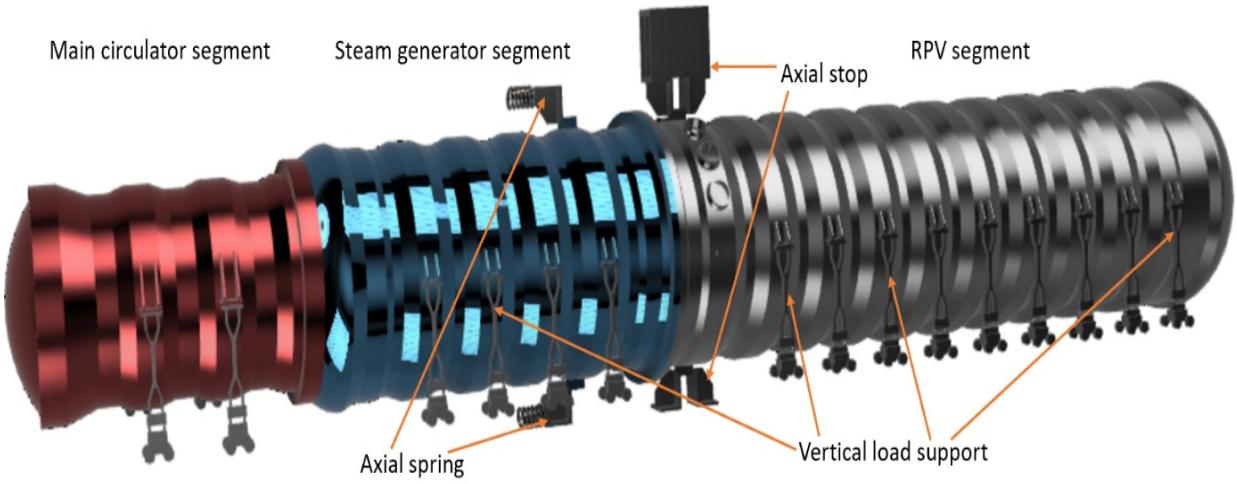

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