

The importance of higher education in MSR R&D and deployment

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Presentation outline

- Credible experts are mandatory for all steps of MSR R&D and deployment. Very few available with credentials and working knowledge of MSRs.
- How can the academic program at UTK NE help? Develop training materials for short courses and academic institutions!

Thorium Energy Alliance Conference #4, May 2012, Chicago IL

The need for accredited experts and expertise

- Besides the need for educated public, and beyond obvious needs for informed researchers and operators to develop and deploy the MSR technology:
- For R&D to progress, the government has to cooperate. Decision makers need experts to ask.
- For reactors to be licensed, licensing agency needs staff of experts with working knowledge.
- We also need validated codes for licensing and regulations (such as the SCALE package) with MSR specific capabilities.

We lack in all these areas!

MSR specific areas which need to be addressed

(not an extensive list...)

- Core neutronics with moving fuel.
- High temperature instrumentation, pumps, valves, ...
- Salt chemistry: redox control in various salts, material degradation, salt processing for FP removal and fuel addition, gas (T, Xe, Kr) capture & storage, etc.
- Radiation source control in accident scenarios: can MSRs be better than LWRs? Needs proof & quantification.

How can UTK NE help?

- Department of Nuclear Engineering at University of Tennessee, Knoxville (**UTK NE**) has faculty (and students) interested in MSR; it is closely coupled to ORNL where most of the MSR experts reside.
- It can develop high profile **academic program** to address the education needs at undergraduate and graduate levels; complemented by **short courses** aimed at decision makers and professionals already working in the field to add MSR related knowledge.
- Our graduate **students** regularly work on state-of-art code development (such as SCALE): a cost effective way of adding MSR relevant features.

Recent efforts at UTK NE

- MSR related graduate students works: senior design projects, masters project, PhD dissertation in progress
- ARPA-E proposal (1) in 2009 (#25A4106) LWR waste transmutation in MSR without reprocessing and long term storage – REJECTED
- NEUP proposal (2) in 2012 (#3668) for LWR actinide elimination in FS MSR with a strong education & curriculum development component - REJECTED

US DoE is not currently funding MSR related work:
Do we have a chicken or egg problem?

Path forward – other funding sources?

- UTK NE is well staffed, well positioned, and greatly interested in developing academic courses for use in NE curriculum at other colleges also, and education materials for short courses for policy makers, nuclear industry professionals, journalists, etc.
- Many short courses could be commercial – avenue for return of investment.
- Level of support consistent with the level of effort, depending on time spend and audience targeted.
- UTK team is flexible, efficient, and cost effective.

Anyone interested in funding, please contact me :)

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Backup slides

(1) An End-to-End Integrated Liquid-Salt Reactor System for Nuclear Waste Transmutation without Reprocessing and Long-term Storage

G.I. Maldonado, L.F. Miller, A.E. Ruggles, K. Sorensen, University of Tennessee, Knoxville; J.C. Gehin, D.E. Holcomb, G.D. DelCul, Oak Ridge National Laboratory

<http://www.energyfromthorium.com/pdf/ARPAE-25A4106.pdf><http://energyfromthorium.com/2009/08/06/utkornl-proposal-to-arpa-e/>

(2) Assessment of a Fast Spectrum Molten Salt Reactor for Power Production and Elimination of Actinides Produced by Light Water Reactors for Sustainable Nuclear Energy

L.F. Miller, A.E. Ruggles, R.M. Counce, J.S. Watson, University of Tennessee, Knoxville; B. Spencer, G.D. DelCul, G. Flanagan, Oak Ridge National Laboratory