WORKSHOP ON
INNOVATION IN NUCLEAR ENERGY

Why We Need Innovation in Nuclear Energy?

Further innovation is necessary for nuclear energy to provide maximum benefits towards our national goals and to maintain the United States' historical leadership in nuclear energy, which is steadily eroding.

First and foremost, in the short-term, innovative ways of extending the life of the existing fleet while maintaining the stellar safety and security performance, including the management of used nuclear fuel is critical.

For the longer-term, the objective is targeted at replacement and expansion of current nuclear capacity in the United States and increased penetration into the export market by technology innovations aimed at

- Affordable electricity generation cost with emphasis on capital cost reduction;
- Better integration with a dynamic grid with large input from renewable energy
- Enhanced safety and security;
- Reduced environmental impact;
- Reduced proliferation risk; and
- Improved resource and waste management.

What Kind of Innovation Will Benefit Nuclear Energy?

It must be recognized that, when we talk about innovation in nuclear energy, we refer to a number of different categories of innovation. They all have an important role to play towards the future vision for nuclear energy, especially when they are all combined in an optimal fashion towards a specific commercialization goal. The DOE-NE roadmap present a comprehensive set of programs at a strategic level that support the vision. Some examples from the existing DOE programs in each category are listed below. Others will be discussed during the workshop.

The focus of the workshop is on technical issues associated with innovation leading to rapid commercialization. However, policy issues also affect innovation and often drive the need and nature of innovation. The workshop is not focused on the policy issues unless policy considerations directly affect one or more of the technical categories discussed below:

1. *Innovative Concepts* – This category includes out-of-the box thinking for the design of nuclear energy systems and subsystems in comparison to evolutionary improvements on traditional systems. They can range from a totally revolutionary reactor design to very innovative components adapted to more traditional reactor concepts. In existing programs, Generation 4 (GenIV) reactors (with design that meet the GenIV goals) are reactor examples; accident tolerant fuels are component examples.

2. *Innovative Use of Existing Technologies* – This category involves using existing or known reactor technologies in a different way than what is being used traditionally. An example would be the nuclear hybrid energy systems. This category also includes technologies that

are currently used outside nuclear energy but that can be adapted for use in combination with nuclear energy (e.g. digital control systems).

3. *Innovative RD&D paradigm* – For any nuclear energy technology, the traditional and prototype based highly empirical way to conduct RD&D is lengthy and expensive, which deters the path to commercialization of innovative ideas. An example of the innovative RD&D paradigm is the "engineering-driven, science-based approach" articulated in the NE RD&D roadmap.

4. *Innovative Licensing Paradigm* – The licensing paradigm must parallel the RD&D paradigm to have the full impact on enabling innovation. For instance, a risk informed decision making process that can translate the results of the engineering-driven science-based approach to a regulatory framework may reduce to cost of and accelerate the licensing process while reducing the overall risk. Risk-informed safety margin characterization (RISMC) methodology is one example that is currently being developed.

What are the Scope and Objectives of the Workshop?

The workshop participants with the necessary spectrum of expertise will discuss the following during the workshop in a moderated forum with specific questions:

- Future nuclear vision (regional, national and International outlook)

- How are the goals for innovation affected by future nuclear vision – relative importance of the different goals

- Relative importance of innovation categories, additional considerations in each category in terms of strengthening the existing initiatives or adding new initiatives to achieve the desired results in each category.

The workshop outcome is a consolidated report that summarizes the technical discussions with specific recommendations to DOE-NE for enhancements or additions to RD&D programs in order to enable innovation for the nuclear energy market of the future.