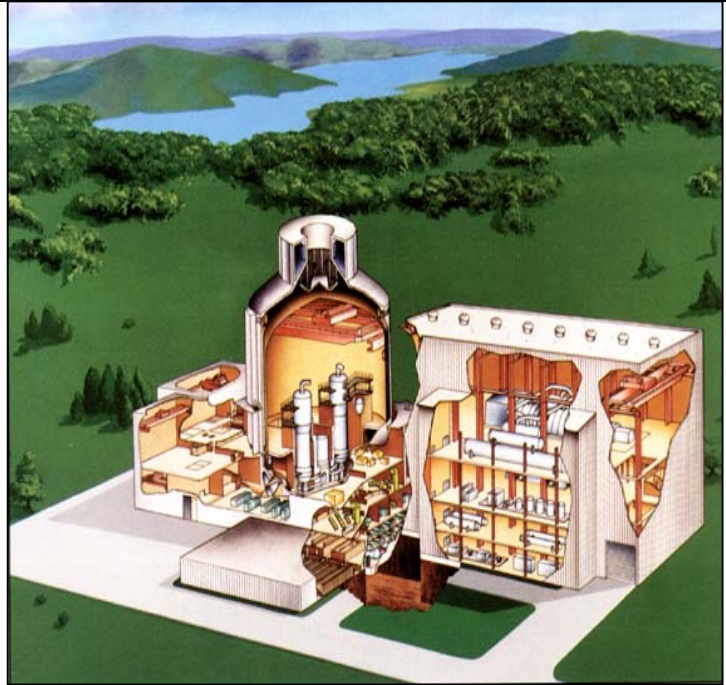


2.4.2 RESEARCH ON NUCLEAR POWER PLANT TECHNOLOGIES FOR NEAR-TERM DEPLOYMENT

Technology Description

Electricity from nuclear power generates no greenhouse gas emissions. To the extent that deployment of near-term nuclear power plants can address prevailing concerns, nuclear power can continue to be an important part of a greenhouse gas emissions-free energy portfolio. In order to enable the deployment of new, advanced nuclear power plants in the United States in the relatively near-term – within a decade – it is essential to demonstrate the untested federal regulatory and licensing processes for the siting, construction, and operation of new nuclear plants. In addition, other major obstacles (including the initial high capital costs of the first few plants and the business risks resulting from this and the regulatory uncertainty) must be addressed. Technology development on near-term advanced reactor concepts that offer enhancements to safety and economics is needed to enable these new technologies to be competitive in the deregulated electricity market, and support energy supply diversity and security.



The *Near-Term Deployment Roadmap* was issued in October 2001 and advises DOE on actions and resource requirements needed to support deployment of new nuclear power plants. The primary focus of the roadmap is to identify the generic and design-specific gaps to near-term deployment, to identify those designs that best promise to meet the needs of the marketplace, and to propose recommended actions that would close gaps and otherwise support deployment. This includes, but is not limited to, actions to achieve economic competitiveness and timely regulatory approvals.

System Concepts

- Advanced fission reactor designs that are currently available or could be made available with limited additional work to complete design development and deployment in the 2010 timeframe.

Representative Technologies

- Certified Advanced Light Water Reactor designs: ABWR, AP600, System 80+.
- Enhancements to certified designs with some engineering work already completed: AP1000, ESBWR. (An NRC design certification rulemaking is scheduled for the AP-1000 in December 2005.)
- Proposed light water reactor designs from overseas with potential for near-term deployment in the United States: ACR-700, EPR.

Technology Status/Applications

- All near-term deployment designs are well-defined concepts in varying stages of development. Most still need significant detailed engineering development and/or regulatory approval.

Current Research, Development, and Demonstration

RD&D Goals

- Research goals are focused on successfully demonstrating the untested regulatory processes for Early Site Permit (ESP) and combined Construction and Operating License (COL) processes and on the regulatory acceptance (certification) and completion of first-of-a-kind engineering and design.
- Specific goals include an industry decision to order a new nuclear power plant by 2008 and deployment of one or more new nuclear power plants in the 2010 time frame.

RD&D Challenges

- Support resolution of the technical, institutional, and regulatory barriers to the deployment of new nuclear power plants in the 2010 time frame, consistent with recommendations in *Near-Term Deployment Roadmap*.
- In cooperation with the nuclear industry, demonstrate the untested regulatory processes for Early Site Permit and combined Construction and Operating Licenses to reduce licensing uncertainties and attendant financial risk to the licensees.
- Provide for technology development to enable finalization and NRC certification of those advanced nuclear power plant designs that the U.S. power generation companies are willing to build.
- Provide for development and demonstration of advanced technologies to reduce construction time for new nuclear power plants and to minimize schedule uncertainties and associated costs for construction.

RD&D Activities

- Demonstration of regulatory processes for Early Site Permit and combined Construction and Operating Licenses.
- Development and NRC certification of advanced nuclear plant designs.

Recent Progress

- Three near-term deployment designs have been certified by the Nuclear Regulatory Commission.
- Reactor vendors are exploring NRC certification of advanced reactor concepts.
- The three cost-shared Early Site Permit (ESP) demonstration projects initiated with industry in FY 2002; power companies submitted ESP applications to the NRC for review and approval. Issuance of NRC approved ESPs is anticipated in calendar year 2006.
- Two cost-shared Construction and Operating License (COL) demonstrations projects were initiated with power companies in FY2005, with activities leading to a decision to submit a COL application to the NRC in 2007.
- A nuclear power plant cost and construction assessment to independently evaluate the cost, schedule, and construction methods of the Advanced Boiling Water Reactor design by GE, as well as identify promising improvements to the construction methods and techniques to support new nuclear power plant deployment in the 2010 timeframe will complete in FY 2005.
- The Advanced Boiling Water Reactor has been deployed successfully in Japan; Advanced Boiling Water Reactors are under construction in Taiwan.

Commercialization and Deployment Activities

- At least two designs and perhaps more can be commercialized in the United States within the next decade. Achieving this goal will require a major effort by industry and DOE to work together to resolve open issues and to share the one-time costs of closing both generic and design-specific gaps.

Market Context

- The focus of the market is in the United States. Due to the uncertainty regarding the impacts of deregulation, designs in the 100-300 MW_e range and the 1,000 MW_e-plus range are both required.