



Office of Nuclear Energy

Nuclear Regulatory Commission Public Meeting on New Reactor Issues

**Dennis Spurgeon, Assistant Secretary
for Nuclear Energy**

April 27, 2006





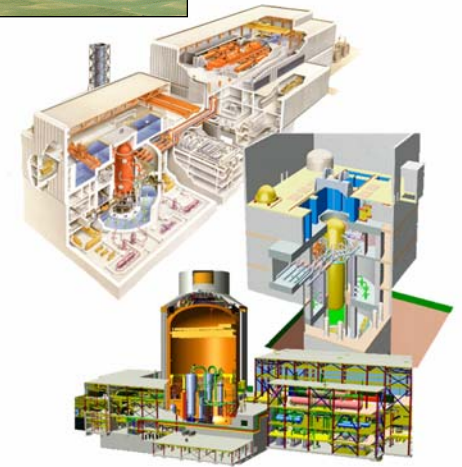
Presentation Topics

- ◆ **Introduction**
- ◆ **Vision of the Office of Nuclear Energy**
- ◆ **Program Goals**
 - NP2010
 - EAct 2005 Incentives for Nuclear Power
 - Generation IV
 - Nuclear Hydrogen Initiative
 - GNEP Update
 - University Nuclear Science and Engineering Support



Nuclear Power 2010 ... *Program Scope and Goal*

- ◆ **Exploring sites for new nuclear plants**
- ◆ **Demonstrating key regulatory processes**
 - Early Site Permit (ESP)
 - Combined Construction and Operating License (COL)
- ◆ **Developing new light water reactor designs**
 - Design Certification for new reactors
 - First-of-a-kind engineering for new standardized nuclear plant designs
- ◆ **Developing concepts to mitigate financial risks**



Program Goal

Pave the way for industry decisions to build new advanced light water reactor nuclear plants in the United States that will begin operation early in the next decade.



Nuclear Power 2010 ... *Early Site Permit Demonstration Projects*

- ◆ **Dominion's North Anna site**
 - Schedule change - ESP supplement submitted for closed cooling water system
- ◆ **Entergy's Grand Gulf site**
- ◆ **Exelon's Clinton site**



Milestone	Dominion	Entergy	Exelon
Early Site permit application submitted to NRC	9/25/2003	10/21/2003	9/25/2003
Draft safety evaluation report (SER) issued	12/20/2004	4/7/2005	2/10/2005
Public meeting to discuss draft EIS	2/17/2005*	6/14/2005	4/19/2005
Final SER issued	6/16/2005*	10/21/2005	2/17/2006
ACRS full committee meeting on final SER	7/6/2005*	12/8/2005	3/9/2006
Final EIS issued to EPA/Issue Notice of Availability	TBD	4/2006	7/28/2006(T)
Atomic Safety and Licensing Board decision	TBD	9/2006(T)	1/2007(T)
Commission decision	TBD	1/2007 (T)	5/2007(T)

T – tentative date * -- Needs to be reissued due to supplement



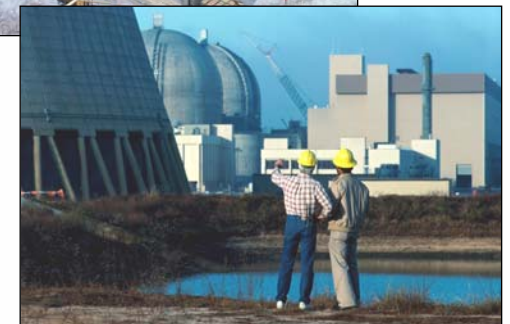
Nuclear Power 2010 ... *New Plant Licensing Demonstration Projects*

◆ Dominion Energy - COL for ESBWR at North Anna Site

- COL Application preparation and NRC review
- ESBWR design certification and first-of-a-kind engineering for standard plant design
- Site deployment planning: financial, legal, and risk assessment

◆ NuStart Energy LLC - COL for single site/technology yet to be selected

- Design certification and COL Application development for two reactor technologies: AP1000 (Bellefonte site) or ESBWR (Grand Gulf site)
- Funding for one COL and completion of standard plant design for selected reactor technology





Nuclear Power 2010 ... *New Plant Licensing Demonstration Project Milestones*

◆ Dominion

- ESBWR Design Certification application to NRC: September 2005
- COL application preparation and submittal to NRC: September 2007
- ESBWR Design Certification: As late as January 2010
- Approved COL issued by NRC: April 2010 (estimated)

◆ NuStart

- AP1000 Certified: December 2005
- AP1000 and ESBWR COL application preparation: October 2006 – February 2008
- ESBWR Design Certification: As late as January 2010
- COL application to NRC: October 2007 (AP1000) or February 2008 (ESBWR)
- COL issued by NRC: AP1000 - July 2010 or ESBWR - November 2010 (estimated)



Nuclear Power 2010 ... *Generic COL Guidance and Issues Project*

- ◆ **Cost-shared Cooperative Agreement with Electric Power Research Institute (EPRI) / Nuclear Energy Institute (NEI)**
 - Identify and resolve generic combined COL technical and regulatory issues
 - Develop industry guidance on format and content of COL application
 - Work with NRC to establish Inspection, Tests, Analyses, and Acceptance Criteria (ITAAC) implementation methodology
- ◆ **Key Accomplishments to Date**
 - NEI 04-01, “Industry Guideline for Combined License Applicants”
 - Completion of ITAAC Demonstration Project with NRC – sample of how ITAAC on system and building could be scheduled and satisfied
- ◆ **Remaining Activities**
 - Resolving Seismic Issues
 - Extensive interaction with NRC
 - New ground motion and structural models
 - Industry input to Part 52 revision and COLA Regulatory Guide



Latest Industry Outlook ... *New Plant Licensing*

- ◆ Three industry teams currently are pursuing new nuclear plant deployment:
 - Dominion – North Anna
 - NuStart – Bellefonte and Grand Gulf
 - UniStar (Constellation, AREVA, Bechtel Power) – Calvert Cliffs or Nine Mile Point
- ◆ Eight U.S. power companies have announced intentions to apply for COLs (Dominion, Entergy, Southern Company, Progress Energy, South Carolina Electric & Gas, Duke Power, Constellation and FP&L).
- ◆ Industry has issued 12 “Letters of Intent” to apply for COLs for a total of 17 new plants.
- ◆ Earliest construction date after COLs are granted is late 2010.
- ◆ Earliest completion date of first plant would be late 2014.



Actions to Accelerate Licensing New Nuclear Plants

COL Project Restructuring – Supports NRC’s Design-Centered Review approach

- ◆ Separate current COL projects into four individual cooperative agreements.
 - Two COL demonstration projects with NuStart and Dominion
 - Two reactor technology development projects with Westinghouse and General Electric
- ◆ Focus power companies on activities on COL application preparation and NRC review.
 - Fund NRC review and approval of one reference ESBWR and one AP 1000 reference COL application
- ◆ Focus reactor vendor activities on completion of standardized nuclear plant designs.
 - ESBWR design certification
 - Accelerated closure of AP1000 COL action items
 - Completion of standardized plant design for both AP1000 and ESBWR



Energy Policy Act of 2005 (EPAct)

- ◆ **Provides 3 key incentives for construction and operation of new advanced nuclear power plants**
 - Section 638, “Standby Support” – Energy (Part of NP 2010)
 - Section 1306, “Production Credits” – Treasury
 - Section 1703, “Loan Guarantees” – Energy
 - Designed to reduce regulatory and financial uncertainties for “first movers”



EPAct, Section 638, “Standby Support”

- ◆ **Risk Insurance to cover delays for first six reactors constructed:**
 - Failure of NRC to complete review and approvals on schedule
 - Litigation that delays start of full-power operation
 - Up to three different advance reactors (certified after 12/31/1993)

- ◆ **Risk insurance provisions:**
 - 100% of delay costs for first two new plants (not more than \$500 million each)
 - 50% (not more than \$250 million each) for third through sixth plant after initial 180 day period of delay

- ◆ **Rulemaking:**
 - Issued Notice of Inquiry – November 2005
 - Held public workshop and received comments – December 2005
 - Publish Interim Final Rule – May 6, 2006
 - Publish Final Rule – August 8, 2006



EPAct, Section 1306, “Production Credit” (Section 45J of IRS code)

- ◆ Treasury lead
 - DOE-NE supporting Treasury in developing process for allocation and approval of production credits
- ◆ Covers advanced nuclear facility placed in service before January 1, 2021
- ◆ Limited to a maximum of \$125 million per 1000 megawatts per year for 8 years (1.8 cents per kilowatt-hour)
- ◆ National megawatt limitation of 6,000 megawatts
- ◆ Treasury to publish IRS bulletin final notice on production tax credit with guidelines for allocation and approval process by May 1, 2006



EPAct Provisions, “Loan Guarantees”

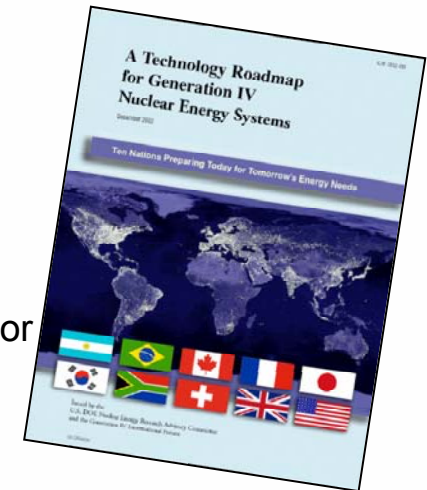
- ◆ Loan guarantees for non-polluting energy technologies (Section 1703)
 - Principal and interest
 - Up to 80% of cost for new nuclear facilities
 - Term shall not exceed 30 years or 90 percent of projected useful life
 - NE providing technical support



Generation IV Initiative – Mission

- ◆ **International initiative under DOE leadership**
 - DOE and other countries to plan next-generation nuclear technology R&D collectively.
 - Governed by Gen IV International Forum (GIF)
- ◆ **Vision**
 - Develop advanced nuclear technologies for deployment by 2030 in collaboration with GIF partners
- ◆ **Forward-looking technology goals established**
 - Economics, safety, waste/sustainability, proliferation resistance and physical protection
- ◆ **Gen IV Roadmap**
 - Identified fuel cycles and reactors to advance goals and serve future energy markets
- ◆ **GIF selected 6 concepts as most-promising**

GFR -- Gas-cooled fast reactor	LFR -- Lead-cooled fast reactor
VHTR -- Very high temperature reactor	SFR -- Sodium-cooled fast reactor
SCWR -- Supercritical water-cooled reactor	MSR -- Molten salt reactor
- ◆ **U.S. now focused on Very-High-Temperature Reactor (VHTR) and Sodium Fact Reactor (SFR)**





Generation IV International Forum – *U.S. Participation*



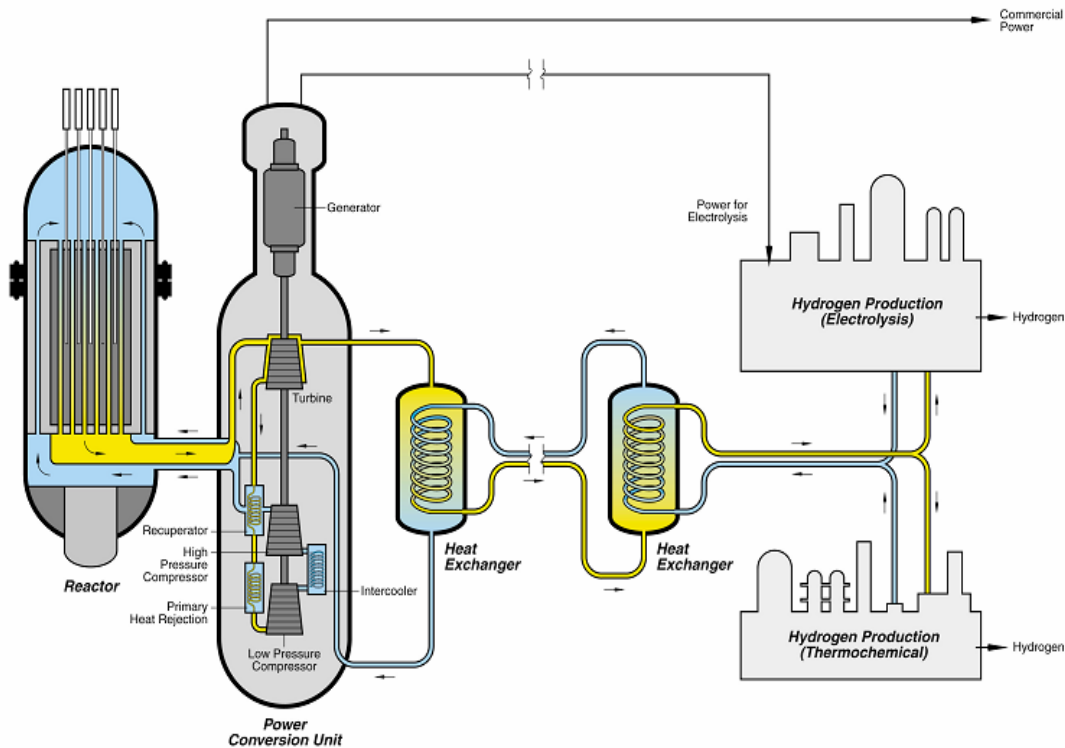
◆ U.S. Gen IV program deeply engaged in international collaboration activities

- Bilateral projects with Brazil, Canada, Euratom, France, Japan, Korea (I-NERI)
- GIF R&D planning activities:
 - System Research Plans
 - Project Plans
- GIF Evaluation Working Groups (Proliferation Resistance & Physical Protection, Economics, Safety)

Jul '01	GIF Charter
Feb '05	<u>GIF Framework Agreement</u>
	<u>GIF System Arrangement</u> System Steering Committee System Research Plan
Feb '06 Next:	SFR System Arrangement VHTR System Arrangement
	<u>GIF Project Arrangement</u> Project Management Board Project Plan
Ongoing:	SFR Advanced Fuels VHTR Materials and Components VHTR Hydrogen Production



VHTR R&D elements



NGNP

**NGNP deployment target -
2021**

Design and Licensing

- Point design
- Trade-Off Studies
- Licensing Strategy

Computational Methods

- Code validation
- Data base for validation

Fuel and Fuel Cycle

- Fuel fabrication
- Fuel performance

Materials & Components

- HT Materials development
- Component development
- Design methodology

Hydrogen Production

- Electro-Chemical processes
- Coupling technology

Helium Turbine and BOP



NGNP Licensing Strategy

- ◆ **EPA Act Title VI, Subtitle C - *Next Generation Nuclear Plant Project*, Section 644 requires:**
 - DOE and NRC to develop jointly and submit to Congress a Licensing Strategy for prototype NNGNP within 3 years
 - DOE to seek active participation of NRC in NNGNP development
- ◆ **NRC-DOE Memorandum of Understanding in development by NRC**
- ◆ **NGNP technology not fixed until 2011 - Licensing Strategy must be flexible**
- ◆ **DOE to provide funding and laboratory support via Idaho National Laboratory**
- ◆ **Strategy due to Congress on August 8, 2008**



Nuclear Hydrogen Initiative

◆ Objective

- Develop hydrogen production technologies compatible with nuclear energy systems and do not produce greenhouse gases (thermochemical and high-temperature electrolysis)

◆ Major Program Milestones

- FY 2007: Complete construction of integrated laboratory-scale hydrogen production experiments
- FY 2011: Complete design and construction of pilot-scale hydrogen production experiments and commence testing
- FY 2019: Demonstrate commercial-scale hydrogen production system for use with nuclear reactors

◆ Recent Major Accomplishment

- February 2006: Completed 1000-hour production run of >100 liters per hour of hydrogen using laboratory-scale high-temperature electrolysis equipment



Global Nuclear Energy Partnership (GNEP) Update

- ◆ **Since GNEP was announced on February 6, 2006, by Secretary Bodman with the FY 2007 budget request rollout, the following activities have been initiated:**
 - On March 17, DOE issued a request for Expressions of Interest with regard to siting integrated spent fuel recycling facilities for GNEP technology demonstrations. 43 responses were received and are currently under review.
 - On March 22, an Advanced Notice of Intent was issued for GNEP Technology Demonstration Program covering three planned demonstration projects – UREX+ Engineering Scale Demonstration (ESD), Advanced Burner Test Reactor (ABTR), and Advanced Fuel Cycle Facility (AFCF).
 - On March 28, Deputy Secretary Sell was presented with justification for mission need for three GNEP projects and approved initiation of conceptual design activities for the projects.
- ◆ **DOE intends to issue a solicitation this year for detailed site proposals for integrated spent fuel recycling facilities. Up to \$20 million in awards, each no more than \$5 million, will be made.**



University Infrastructure, Research, and Education Assistance

◆ University Programs

- Fuel for university research reactors, reactor improvements, and reactor sharing
- Student fellowships and scholarships in nuclear engineering and health physics
- Matching grant program with industry
- Nuclear and radiochemistry research
- Outreach to students and teachers; minority institution support

◆ Nuclear Energy Research Initiative (NERI)

- As of 2006, 36 universities are involved in over 70 NERI projects (over \$24M)
- 24 new university research awards in FY 2006 to 17 universities (\$10M)
 - 13 - Advance Fuel Cycle Initiative
 - 6 - Generation for IV
 - 5 - Nuclear Hydrogen Initiative

◆ Advanced Fuel Cycle Initiative (AFCI)

- 33 Fellowships at 18 universities since 2002 (\$600k)
- UNLV Transmutation Research Program (\$3M)
 - 23 faculty-student projects involving 42 graduate students