Idaho National Laboratory/Nuclear Power Industry

Strategic Plan for Light Water Reactor R&D

An Industry-Government Partnership to Address Climate Change and Energy Security

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Entergy Nuclear

Entergy®

Strategic Plan for Light Water Reactor R&D

Vision: Nuclear energy will reduce U.S. and global carbon emissions and enhance the Nation's energy security. Greater U.S. reliance on nuclear energy will improve its international engagement and leadership on nuclear safety and security issues.

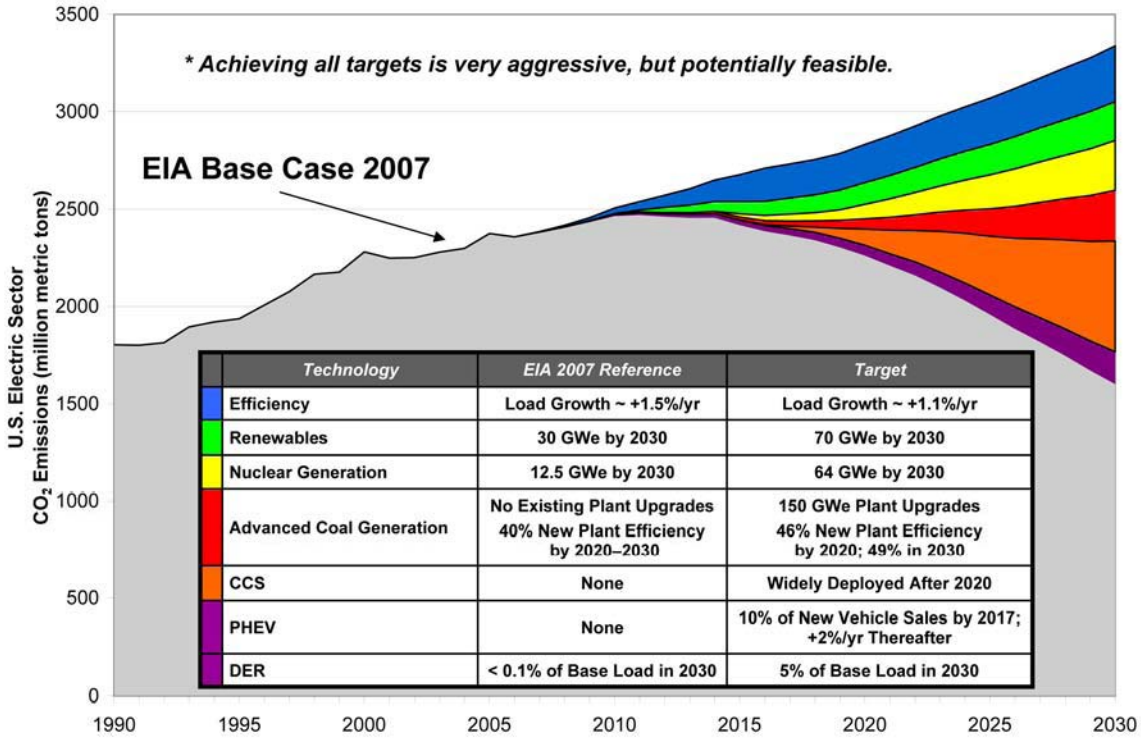
Stretch Goals:

1. Life Extension of Current Fleet Beyond 60 Years
2. Strong, Sustained Expansion of ALWRs throughout this Century.

Strategic Plan Examines the R&D Needed to Expand Nuclear

- To 25% by 2030 and
- To 40% by 2050

EPRI Study-Technical Potential of CO_2 Reductions



Technology	EIA 2007 Reference	Target
Efficiency	Load Growth ~ +1.5%/yr	Load Growth ~ +1.1%/yr
Renewables	30 GWe by 2030	70 GWe by 2030
Nuclear Generation	12.5 GWe by 2030	64 GWe by 2030
Advanced Coal Generation	No Existing Plant Upgrades 40% New Plant Efficiency by 2020–2030	150 GWe Plant Upgrades 46% New Plant Efficiency by 2020; 49% in 2030
CCS	None	Widely Deployed After 2020
PHEV	None	10% of New Vehicle Sales by 2017; +2%/yr Thereafter
DER	< 0.1% of Base Load in 2030	5% of Base Load in 2030

All Options Must Be Promoted Yet All Options Face Challenges that Must Be Overcome Through R&D and Policy Initiatives

Working Group Members – November 10, 2007

Dan Keuter (Chair)	Entergy Nuclear
Doug Chapin	MPR
Bryan Dolan	Duke Energy
Joseph Donahue	Progress Energy
Gene Grecheck	Dominion Energy
Ken Huffman	EPRI
Tom Isaacs	LLNL
Jim Maddox	INPO
Alex Marion	NEI
John Taylor	EPRI (Ret)
Joe Turnage	Constellation Generation Group

<u>Other Attendees:</u>

Bruce Hallbert	INL
Tom Miller	DOE
Joe Perkowski	INL
Pete Planchon	INL
Ted Quinn	Long Necker & Associates
Mike Sellman (UAB Chair)	Nuclear Management Company
Ronaldo Szilard	INL
Gary Vine	EPRI

GOALS

Light Water Reactors Goals:

1. Extend NRC Licenses of LWR to 80 Years
2. Maintain High Capacity Factor, Safety and Performance for 80 Years

Advanced Light Water Reactor Goals:

3. License, Construct & Operate ALWRs
4. Remove Barrier to Deployment of ALWRs
5. Address Lessons Learned from First ALWRs
6. Enable New Mission & Markets for ALWRs Beyond Electricity

R&D Scope and Development (Highest Priority)

1. Sustain High Performance of Reactor Materials
   a. Extend Component Life and Improve Lifetime Prediction
   b. Improve In-Service Inspection, Diagnostic, Maintenance & Repair
   c. Develop Innovative Materials
2. Transition to State-of-the-Art Digital I&C
3. Advances in Nuclear Fuel
   a. Enhance Fuel Reliability & Performance
   b. Develop High-Burnup (HBU) Fuel
4. Implement Broad-Spectrum Workforce Development
5. Implement Broad-Spectrum Infrastructure Improvements & Design for Sustainability
   - Manufacturing Infrastructure
   - Reducing Raw Materials & Alloys
   - Rebuilding of Irradiation Test & Examination Infrastructure
6. Electricity Infrastructure-Wide Problems (Non Unique to Nuclear)
   a. Develop Alternative Cooling Technologies
   b. Expand High-Voltage Transmission Infrastructure

R&D Scope and Development (Continued)

7. Advanced Fabrication, Construction & Inspection Methods
8. Extend the Application of Risk Management Technologies & Understanding of Safety Margins
9. Improve Operational Performance
   - Equipment Reliability
   - Power Uprates
   - Technologies for Security
   - Advanced Power Electronics
   - Spent Fuel Management
   - Low Level Waste Minimization
   - Risk Informed Technologies
10. Expand LWR Technology into New Missions & Markets
    a. Develop LWRs for Regional Markets
    b. Develop Desalination & Process Heat Technologies

Path Forward

Collaborative Program Planning & Joint Funding

1. Collaborative & Cost-Shared Activities
2. Coordination but Independent Activities

DOE/Industry Program & Oversight

- EPRI Nuclear Power (NPC)
- INL Utility Advisory Board (UAB)
- NEI Nuclear Strategic Issues Advisory Council (NSIAC)