Global & US Perspective for New Nuclear Generation

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New Nuclear Plants
Global Status (Jan 2008)

- 35 plants under construction ~ 28 GW
- 93 plants on order or planned in 18 countries
  - Expected to be in operation by 2017
- 200 projects under consideration in 27 countries
  - Statement of intent/proposal
- Challenges to expanding & introducing new nuclear

Source WNA Jan 2008
Why the Global Surge of Interest

- Need for power
- Increased awareness of the benefits of electricity
  - Economic
  - Population growth
    - Education & health
- Price of oil
- Climate change
Small Modular Reactors (Less than 1000MWt)

- **Generation** – (300 MWe or less)
  - More compatible with electricity grids in emerging countries

- **High temperature reactors (process heat)**
  - Water purification & desalination
  - Petro-chemical industry
    - Alternative to natural gas
    - Hydrogen generation
    - Coal/gas to liquid fuel processes
    - Non-existent carbon footprint
Challenges of Expanding International Nuclear Energy

- Recognition of demanding technology
  - Respect
  - Continuous drive in the pursuit of excellence

- Supporting infrastructure
  - National safety authorities
  - Training and education of workforce

- Offsite electricity requirements & impact
  - Large generating units not beneficial for small or fragile electricity grid
Challenges of Expanding International Nuclear Energy

- Supply chain
- Financing
- Security – plant & fuel
- IAEA programs to assist embryo nuclear energy programs, provide a framework for oversight & control of material
  - Established nuclear countries can assist
Potential New US Nuclear Plant Sites
Why New US Nuclear Generation?

- Need for power – additional 260 GW by 2030
  - Minimal baseload generation built in last 20 years
  - US Population forecast – up 80+ million by 2030
- Climate change
  - Need for zero/low-emission base-load generation
- High & volatile natural gas prices
- Nuclear lowest cost base-load generating option
Electricity Production Costs
1995-2006, In 2006 cents per kilowatt-hour

2006
- Coal - 2.37
- Gas - 6.75
- Nuclear - 1.72
- Petroleum - 9.63

Production Costs = Operations and Maintenance Costs + Fuel Costs

Source: Global Energy Decisions
Updated: 6/07
Output at Record Levels

U.S. Nuclear Generation (billion kilowatt-hours)

- 807 in 2007
- 787 in 2006
- 782 in 2005
- 789 in 2004
- 764 in 2003
- 780 in 2002
- 769 in 2001
- 754 in 2000

New Designs Build on 40 Years of Operating Experience

- Common set of generic specifications based on operating experience & advances in technology
  - More stringent design specifications
    - Material properties
- Increased safety provided by
  - Increased number of safety systems, or
  - Use of natural phenomena, gravity, natural convection & conduction
- Increased safety and operational margins
Short-Term


Order long-lead items

Site preparation

COL review

Arrange financing

COL submitted

Pre-COL construction

Construction

General procurement

Start-up testing (4-6 months)

Commercial operation

Load fuel

COL Approval

(4-6 months)
# Licensing & Construction
## Then and Now

<table>
<thead>
<tr>
<th>THEN</th>
<th>NOW</th>
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<tbody>
<tr>
<td>Design as you build</td>
<td>Plant designed before construction begins</td>
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<tr>
<td>Changing regulatory standards and requirements</td>
<td>More stable process: NRC approves site, design, construction &amp; operation before construction begins and significant capital is placed “at risk”</td>
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<td>No design standardization</td>
<td>Standard NRC-certified designs – 70+% Standard</td>
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<td>Inefficient construction practices</td>
<td>Lessons learned from overseas projects</td>
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<td>Modular construction practices</td>
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<td>Main opportunity public intervention when plant is essentially complete</td>
<td>More opportunities to intervene at well-defined points in process. Intervention at the end of the process must be based on objective evidence that acceptance criteria, defined in the license, have not been, and will not be met</td>
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Strong Public Support Continues

- 82% Important Future Role
- 71% Plants Are Safe
- 77% Support New Nuclear Incentives
- 59% Definitely Build
- 66% Acceptable at Nearest Site

Source: Bisconti Research Inc.
April 2008 poll of 1,000 U.S. adults; margin of error is +/- 3%
Support for New Nuclear & Expanded US Manufacturing Base

- Bipartisan political support
- Strong support from other industries
- Solid support from labor
- Growing support from environmental community
  - Increasing concern about carbon emissions
Used Fuel Management: New Strategic Direction
US Outlook to 2020 & Beyond

- New nuclear power plants will be built
  - Need for power, environmental limitations and need for long-term stability in electricity prices
- First 4 – 8 plants – start operations in 2016
  - Others under construction
- Success of the first projects – critical
  - Potential for new plants
    - 15 - 20 in 2020; 35+ in 2030
  - Process heat applications post 2020