thebabcock&wilcoxcompany

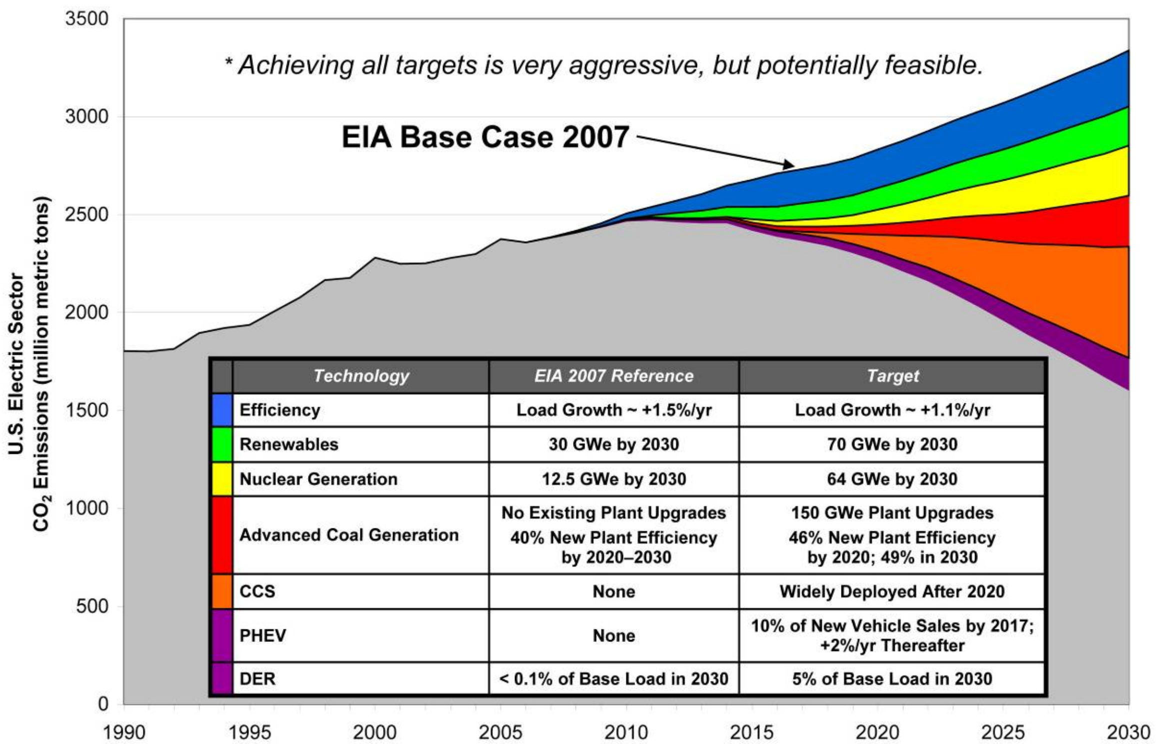
American Nuclear Society

Precision Manufacturing

Craig Hansen

Vice President, Washington Operations

CO_2 Reductions … Technical Potential*



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

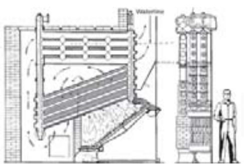
- CO_2 reductions are going to be required from many economic sectors
- CO_2 emissions from electric power sector are 35% of total manmade U.S. greenhouse gas emissions
- CO_2 reductions via advanced efficiency coal-based generation and Carbon Capture and Sequestration (CCS) on fossil electric plants will make the largest contributions to reductions
- U.S. $800 million/yr in funding beginning 2009 essential to demonstrate technology NOW for commercial deployment in 2020-2025 timeframe

Our Roots: Harnessing the Power of Steam

Over **140** years of manufacturing and operations for civilian, national security & high-consequence applications

Civilian Applications

(Coal, Nuclear, Biomass)



1867

B&W invents water tube boiler

1881

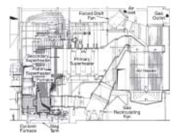
First U.S. utility boiler is supplied by B&W

1918

First pulverized coal plant provided by B&W

1957

First supercritical pressure coal-fired boiler supplied by B&W



1967

Largest boiler (1300 MW) built for TVA

1960s-present

B&W designs & manufactures heavy nuclear components for new, re-emerging commercial nuclear power

1973-present

B&W leader in coal-fired emissions environmental controls for SO_X, NO_X, Mercury

2006-present

B&W developing oxy-fuel technology for carbon capture

2008

National Security & High-Consequence Applications

(Coal, Oil, Nuclear)

1907-09

Teddy Roosevelt's Great White Fleet powered by B&W boilers

1944

Provided components & process development for Manhattan Project

1945

Over 95 percent of U.S. Fleet in Tokyo Bay at Japanese surrender are powered by B&W boilers

1953-1955

Built components for the USS *Nautilus*, the world's first nuclear powered submarine

1983-present

Environmental Management: D&D Nuclear Material Stabilization

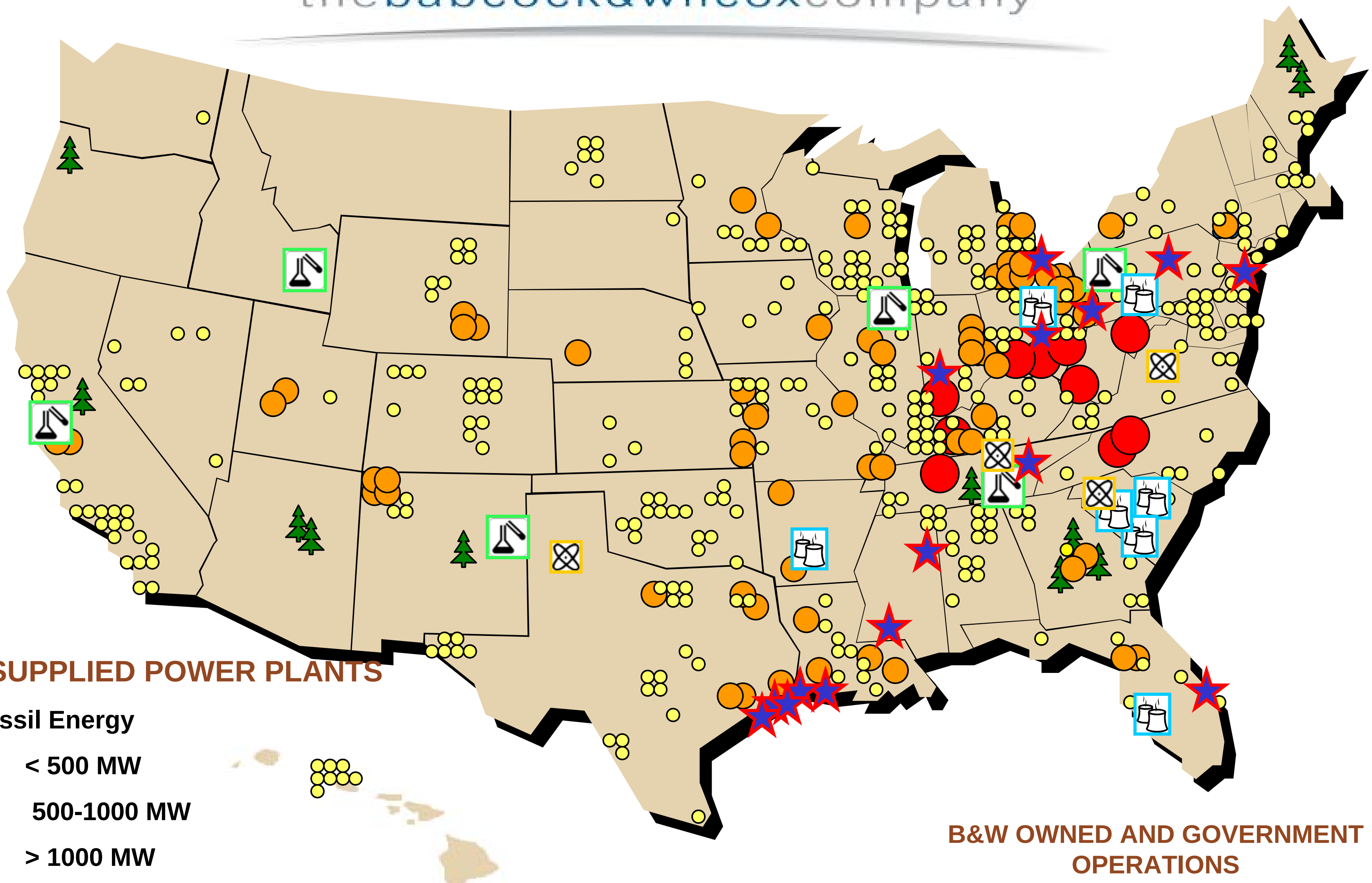
1998-2007

Nuclear Non-proliferation: downblending HEU from U.S. nuclear weapons

2000-present

DOE Nuclear Weapons Complex & Laboratory Nuclear Operations

thebabcock&wilcoxcompany



B&W-SUPPLIED POWER PLANTS

Fossil Energy

- < 500 MW
- 500-1000 MW
- > 1000 MW
- Nuclear
- Biomass

B&W OWNED AND GOVERNMENT OPERATIONS

- Laboratory and R&D Operations
- Nuclear Manufacturing Operations
- Manufacturing and Operations

thebabcock&wilcoxcompany

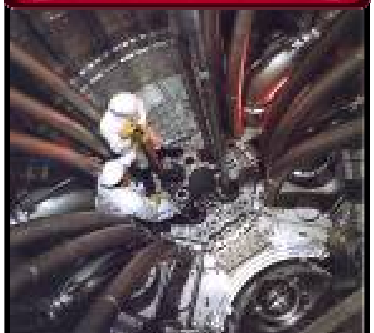
McDermott International ·········· J. Ray McDermott

The Babcock & Wilcox Company

B&W Nuclear Operations Group

- Government Components
- Management of Weapons-Grade Uranium

B&W Technical Services Group



- Nuclear Research
- Nuclear Weapons Programs

B&W Nuclear Power Generation Group

- Nuclear Products
- Nuclear Services
- Nuclear Construction

B&W Power Generation Group

- Power Generation Systems
- Power Plant Services
- Construction

B&W Nuclear Power Generation Group, Inc.

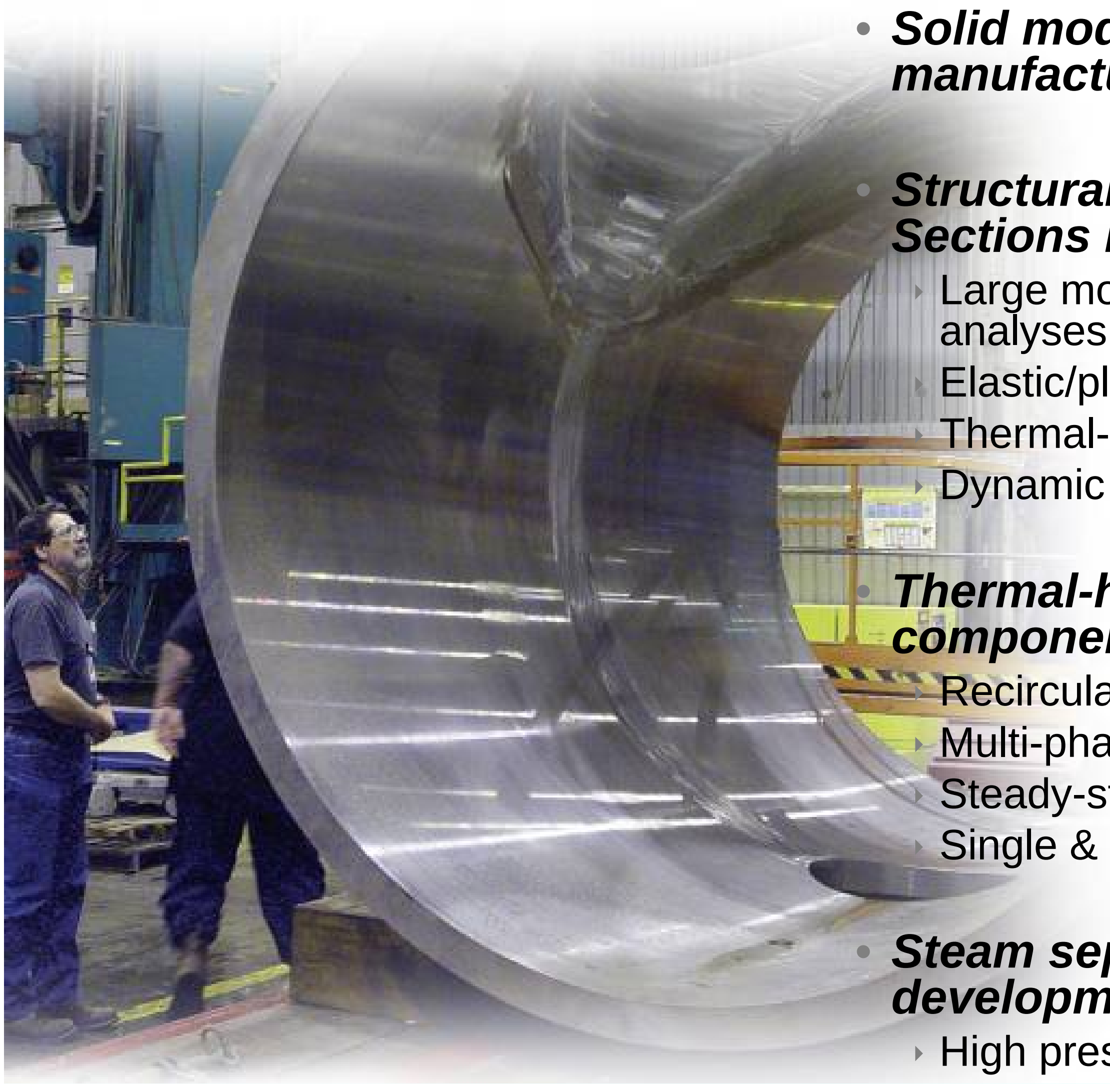
- **Full design engineering to ASME for pressure vessels**
- **State-of-the-art manufacturing equipment**
  - **Large machining centers**
  - **Robotic welding**
  - **Full component stress relief furnaces**
- **Rigorous quality systems/controls**
- **Welding engineering and process development**
- **Heavy lift capability**

Mount Vernon Facility

99 acre secured site strategically located along the Ohio River

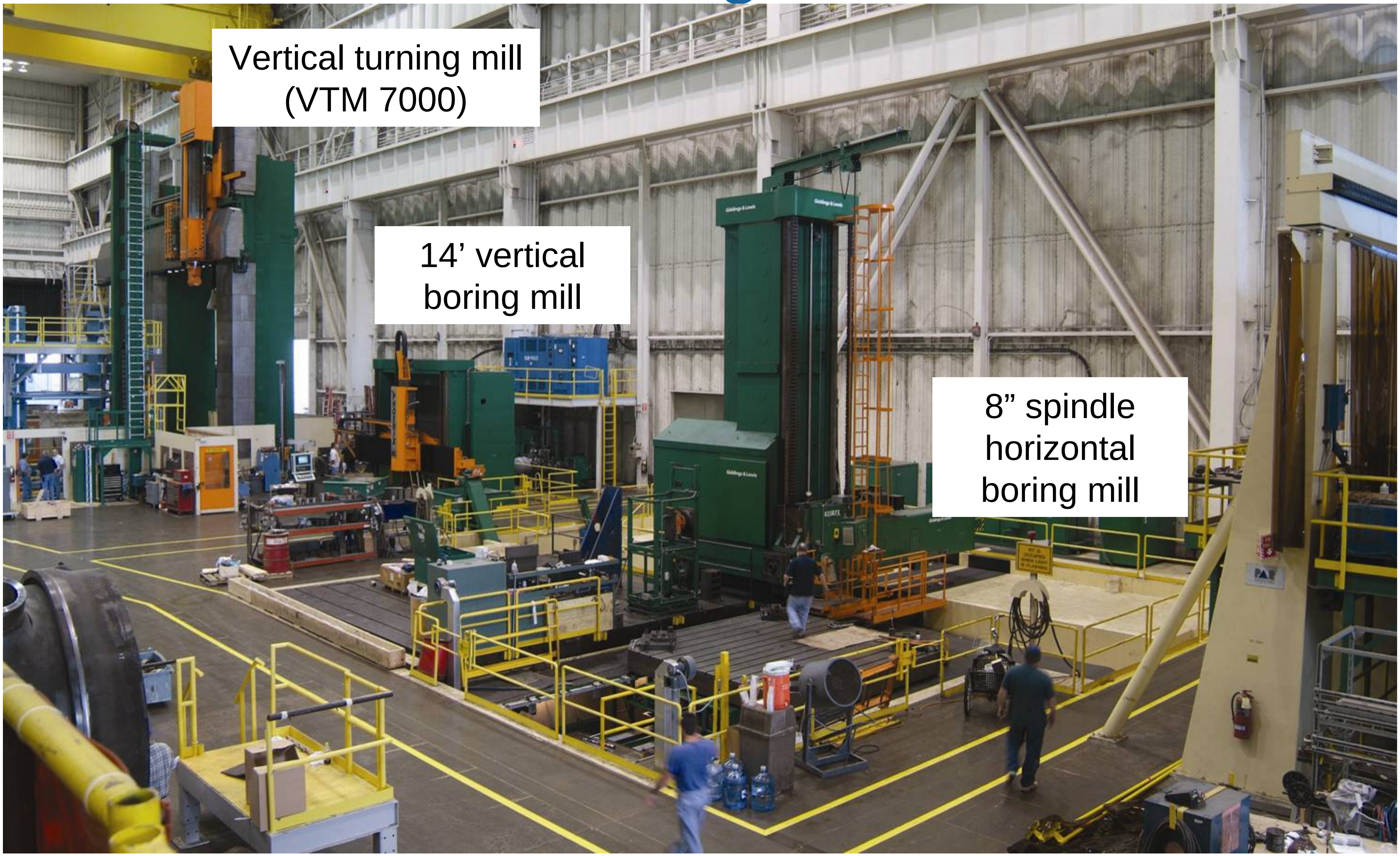
580,000 square feet of modernized operating plant

Design Engineering



- ***Solid model CAD/CAM integrated with manufacturing***
- ***Structural component design to ASME Sections III, VIII and XI***
  - Large model linear/non-linear finite element analyses
  - Elastic/plastic component sizing
  - Thermal-mechanical fatigue & fracture mechanics
  - Dynamic analysis & flow induced vibration
- ***Thermal-hydraulic design of reactor plant components***
  - Recirculating steam generator design/analysis
  - Multi-phase heat exchanger sizing & evaluation
  - Steady-state & transient multi-phase flow analysis
  - Single & multi-phase computational fluid dynamics
- ***Steam separation equipment design & development***
  - High pressure/high flow steam test facility

State-of-the-Art Large Machine Tools



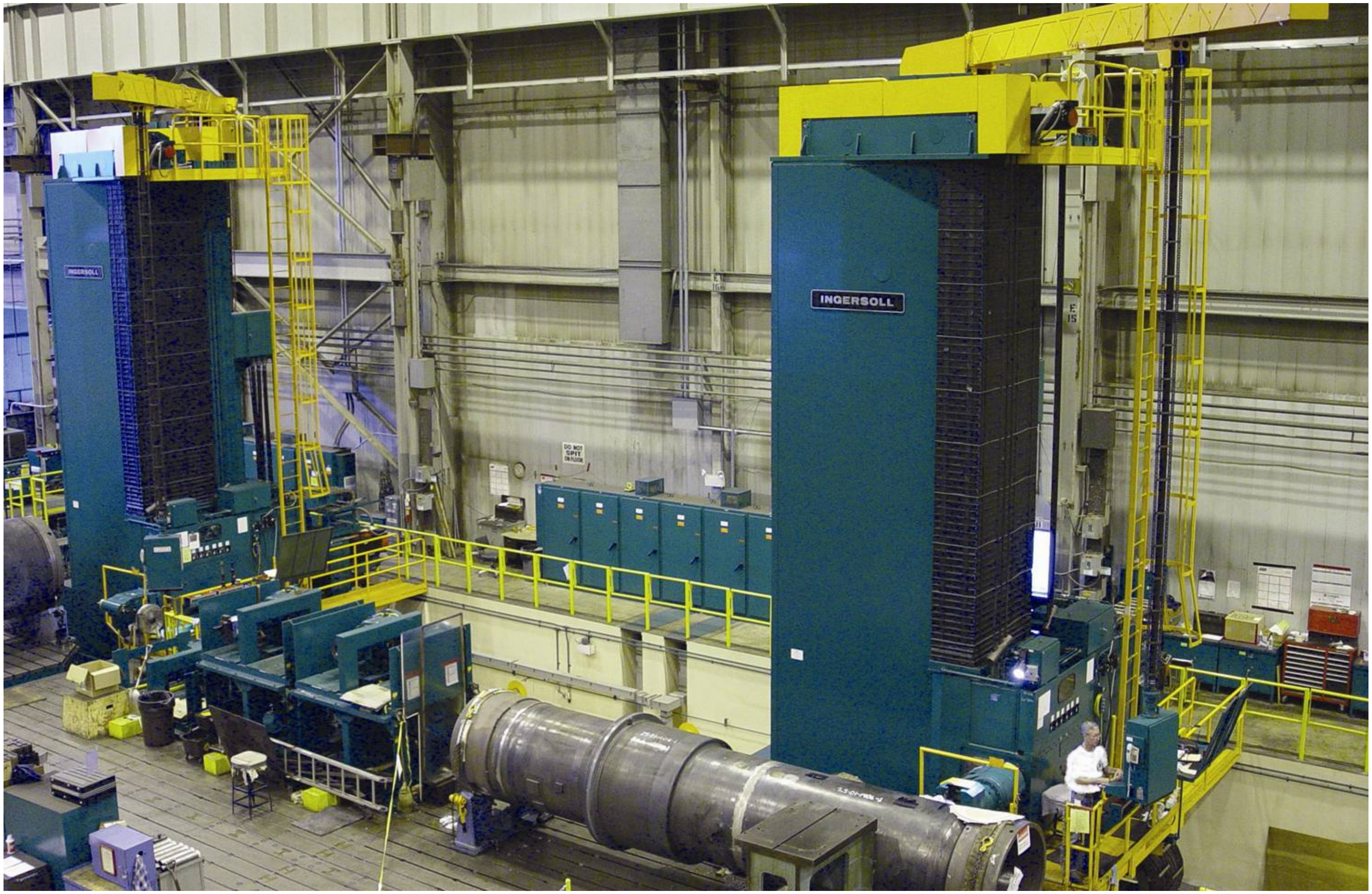
VTM 7000 Vertical Turning Mill

Optimizes efficiency through vertical turning and both vertical and horizontal milling, combining the work of two machines

Features:
Automatic tool changer
7-axis contour capability
330 ton table capacity

Working envelope:
358”H X 157”W X 236”L

Two large vertical machining centers share a single bed to allow optimization of a common floor plate, along with individual rotary table capability

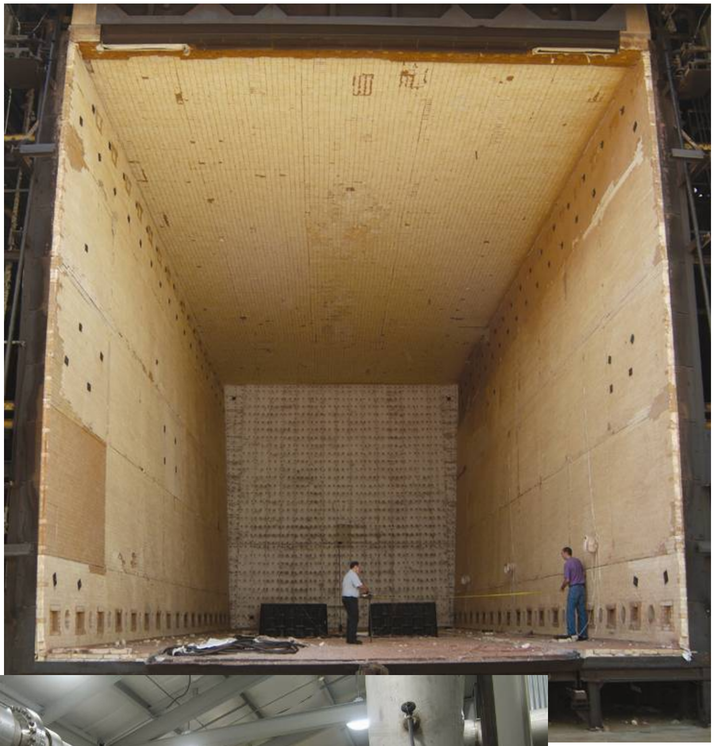


Gundrill Machines

Two multi-spindle gundrill machines capable of drilling thousands of holes through very thick material while maintaining position, straightness and diameter tolerances to thousandths of an inch

Heat Treatment & Stress Relief

Several large furnaces used for heat treatment and stress relief of vessels



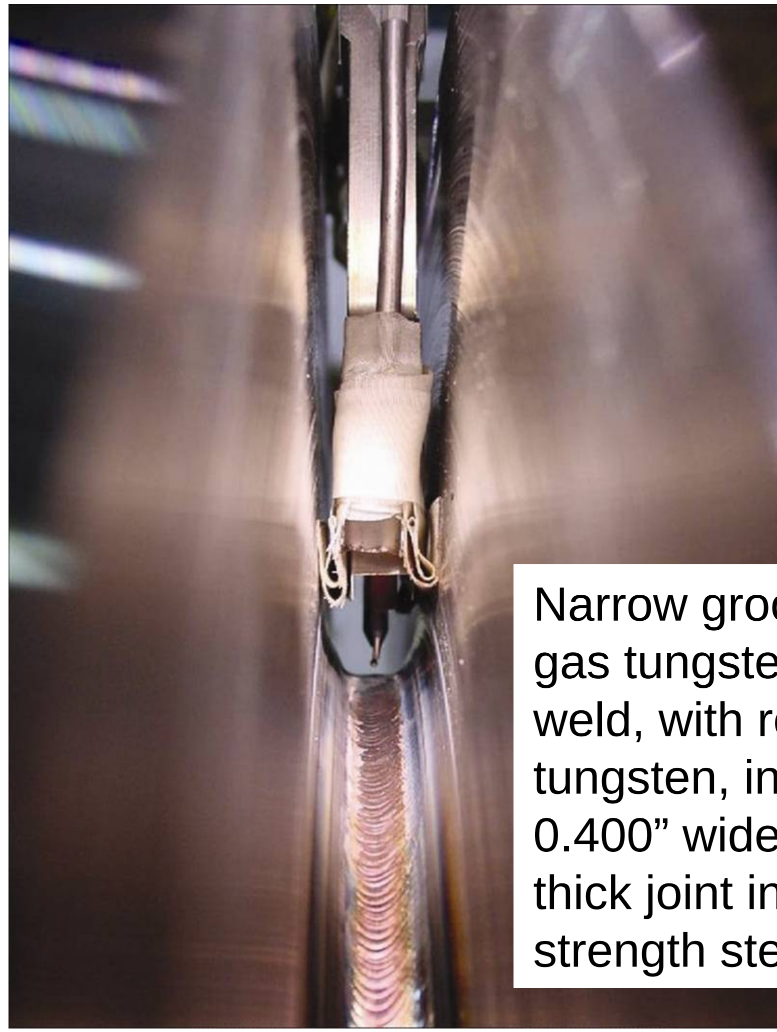
This gas-fired furnace has a capacity of 1000 tons

This stainless steel argon heating/cooling loop system provides uniform temperature control of components in electric furnaces

Welding & Robotic Engineering

Full range of manual and automatic/robotic weld processes

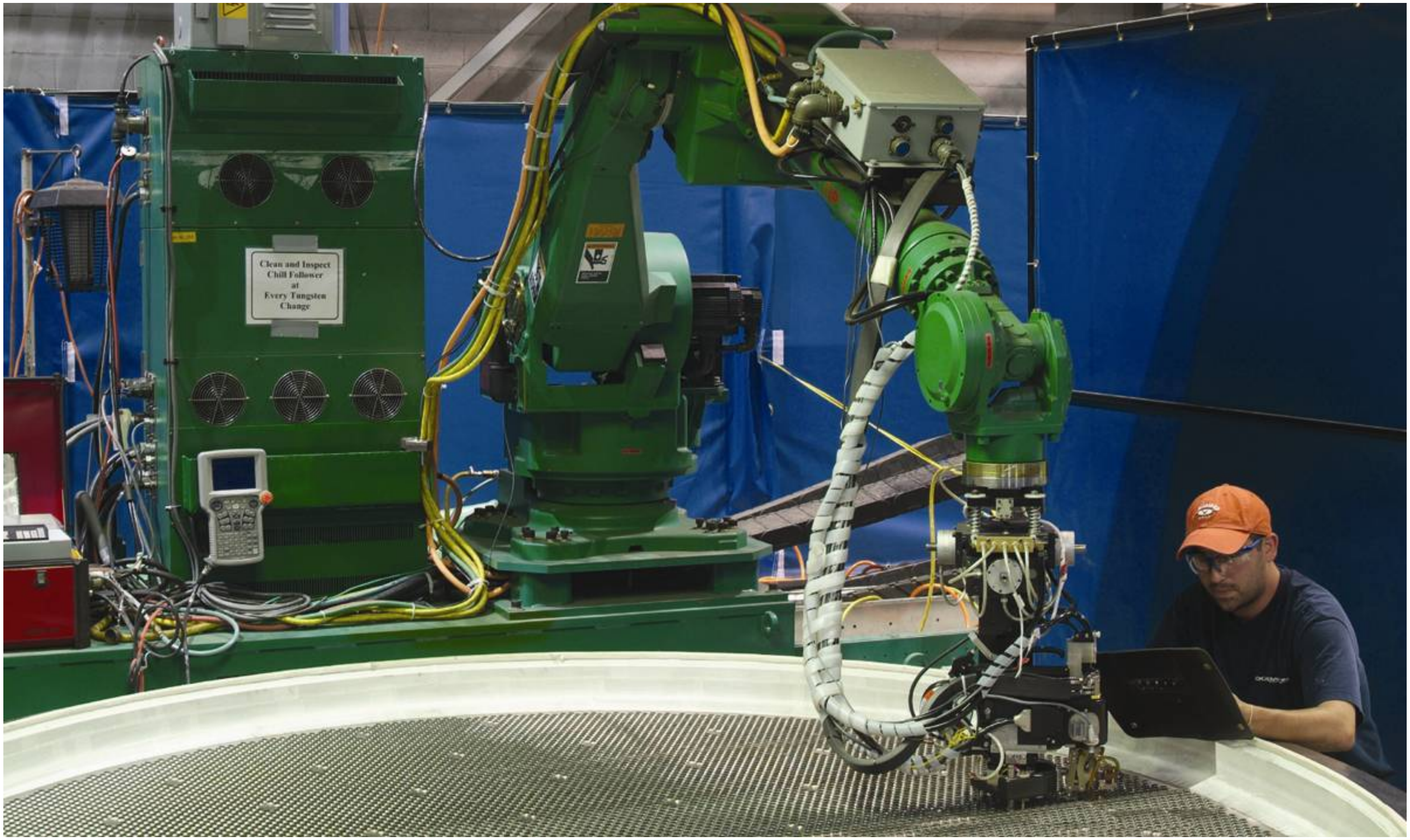
- Materials:
  - Carbon/Low Alloy Steel
  - Monel
  - Inconel
  - Stainless
  - Titanium
- Certified to ASME, AWS and Mil Standard Codes
- Narrow groove welding to 12-inch thickness



Narrow groove gas tungsten arc weld, with rotating tungsten, in a 0.400” wide by 4” thick joint in high strength steel

Robotic Welding

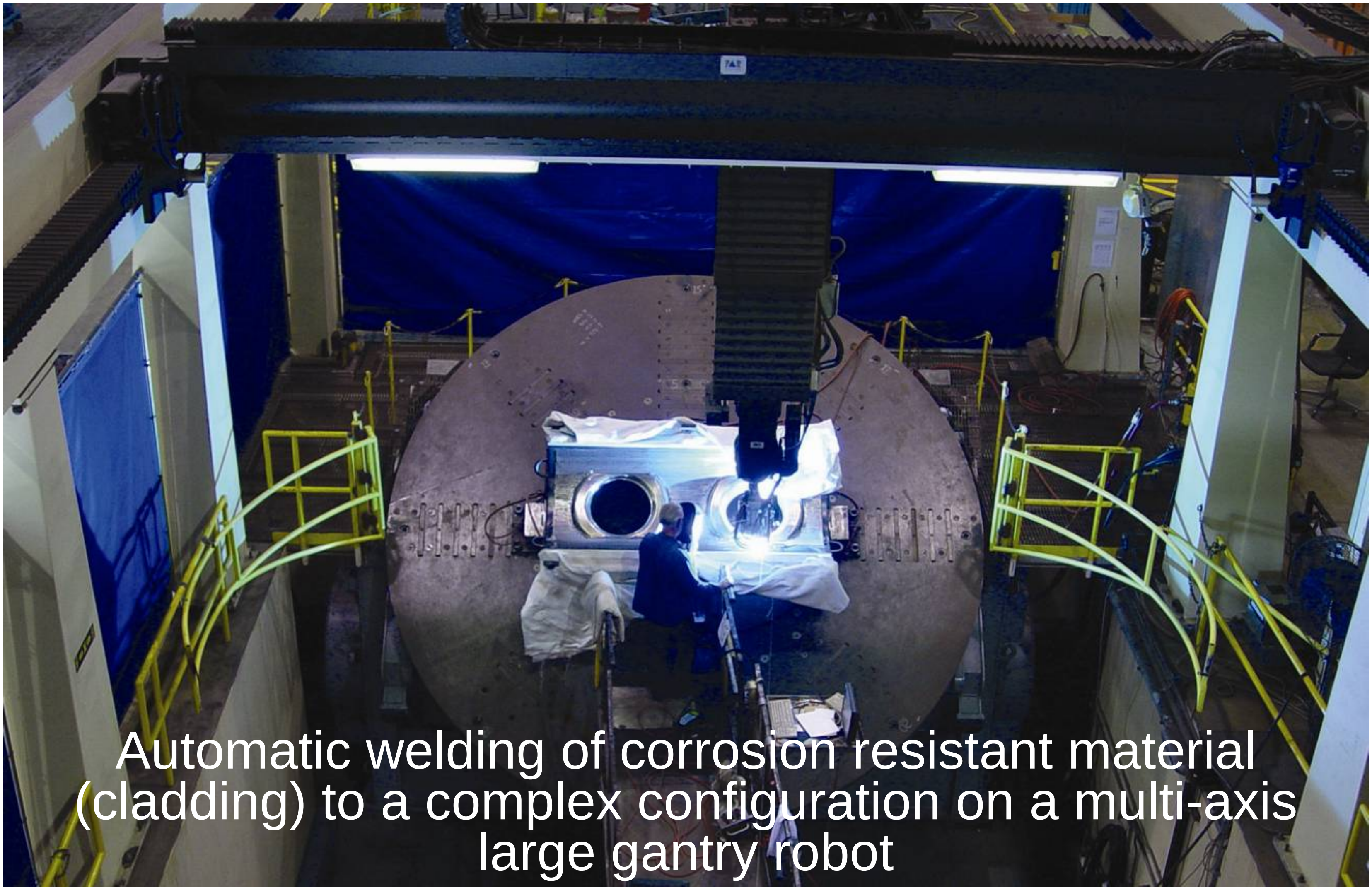
Robotic gas tungsten arc welding of tubes to a tubesheet in a heat exchanger using fully programmable computer controlled welding equipment



Automatic Cladding

A large gantry robotic welding station performing cladding of a head with the world's largest fully integrated robotic positioner (450 tons, 204" diameter)

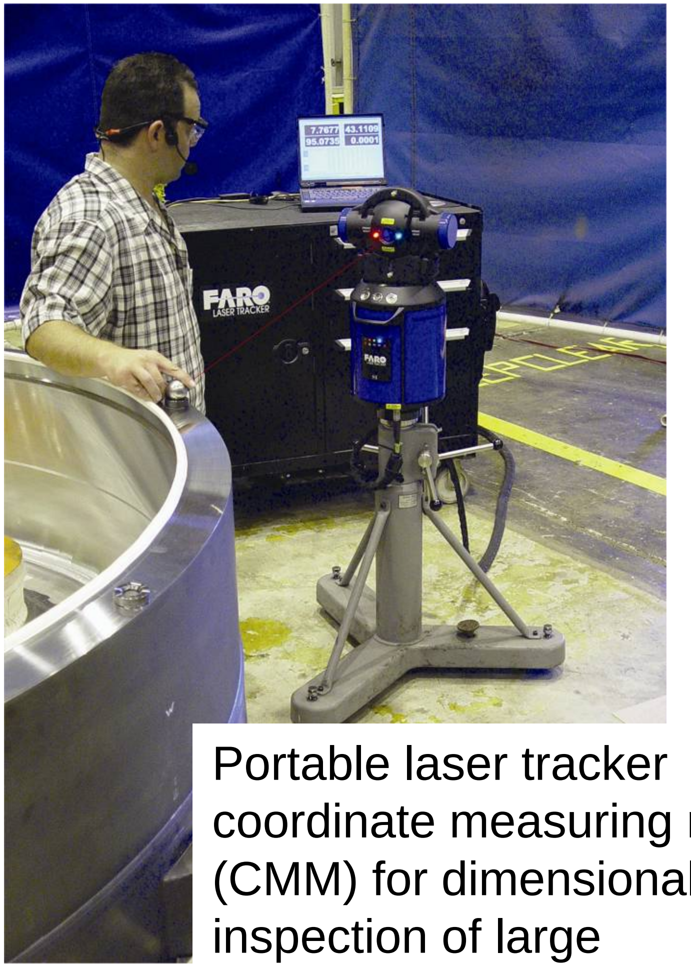
Automatic Cladding



Automatic welding of corrosion resistant material (cladding) to a complex configuration on a multi-axis large gantry robot

Quality Assurance

- ASME Section III Code Stamps (Spring 2006)
- Non-destructive Examinations:
  - Radiographic testing (RT or X-ray)
  - Dye (liquid) penetrant testing (PT)
  - Magnetic particle testing (MT)
  - Ultrasonic testing (UT)
  - Eddy current testing (ECT)
  - Hydro test (water pressure test)
  - Visual testing (VT—1x or magnified)
  - Helium leak test
  - Portable coordinate and laser measurement systems



Portable laser tracker coordinate measuring machine (CMM) for dimensional inspection of large components, with accuracy of 0.0022 inches @ 33 feet

Radiographic Testing

Radiographic testing capabilities include 8 MeV and 9 MeV machines (shown) capable of penetrating through more than 18 inches of steel, for components up to 41'H X 45'W X 87'L

Shipment Capabilities

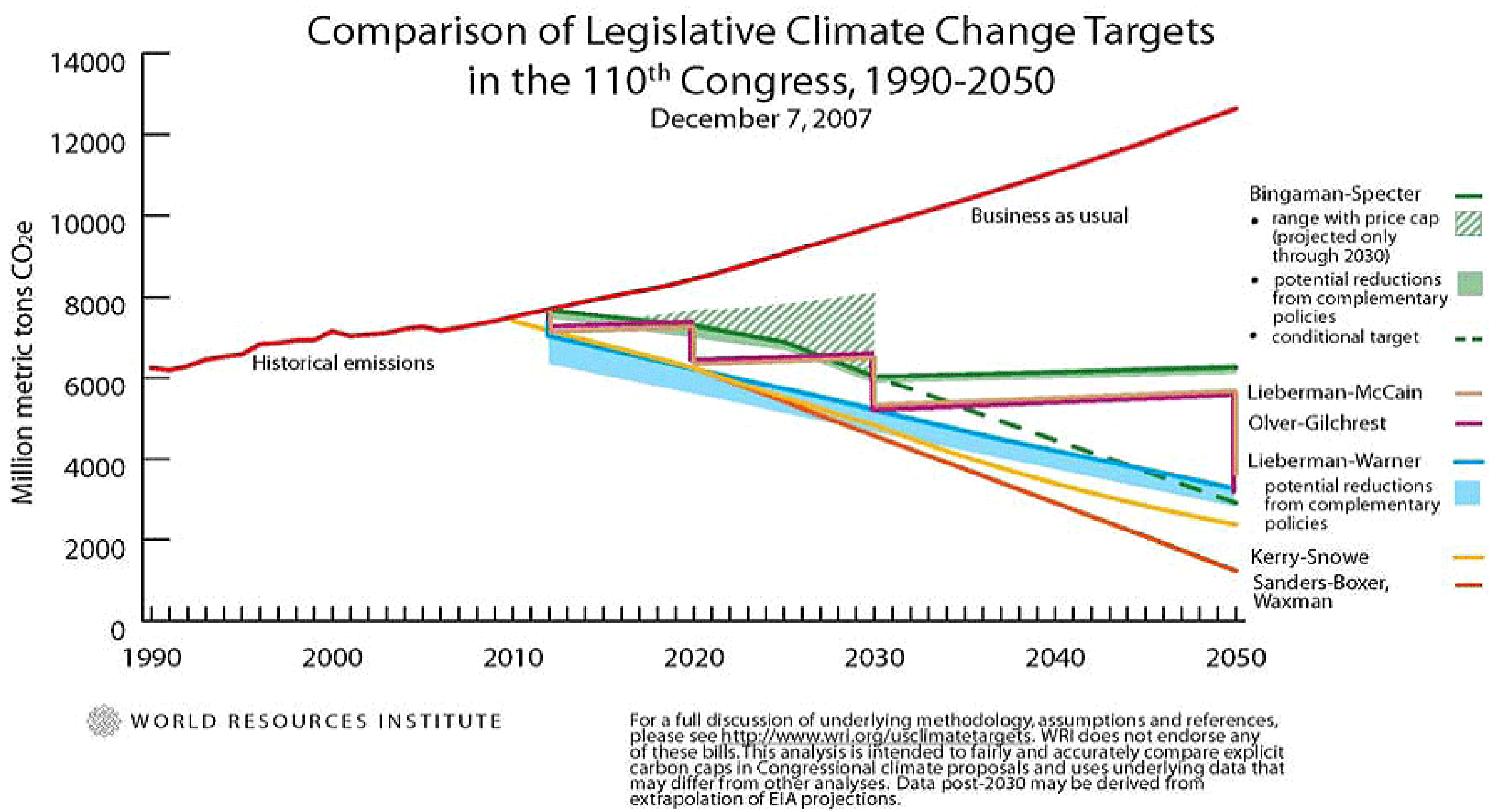
Barge—main bay serviced by two 500-ton cranes

Runway extends over barge dock situated on Ohio River

125-foot width crane ways

Up to 150-foot vessels loaded to barge

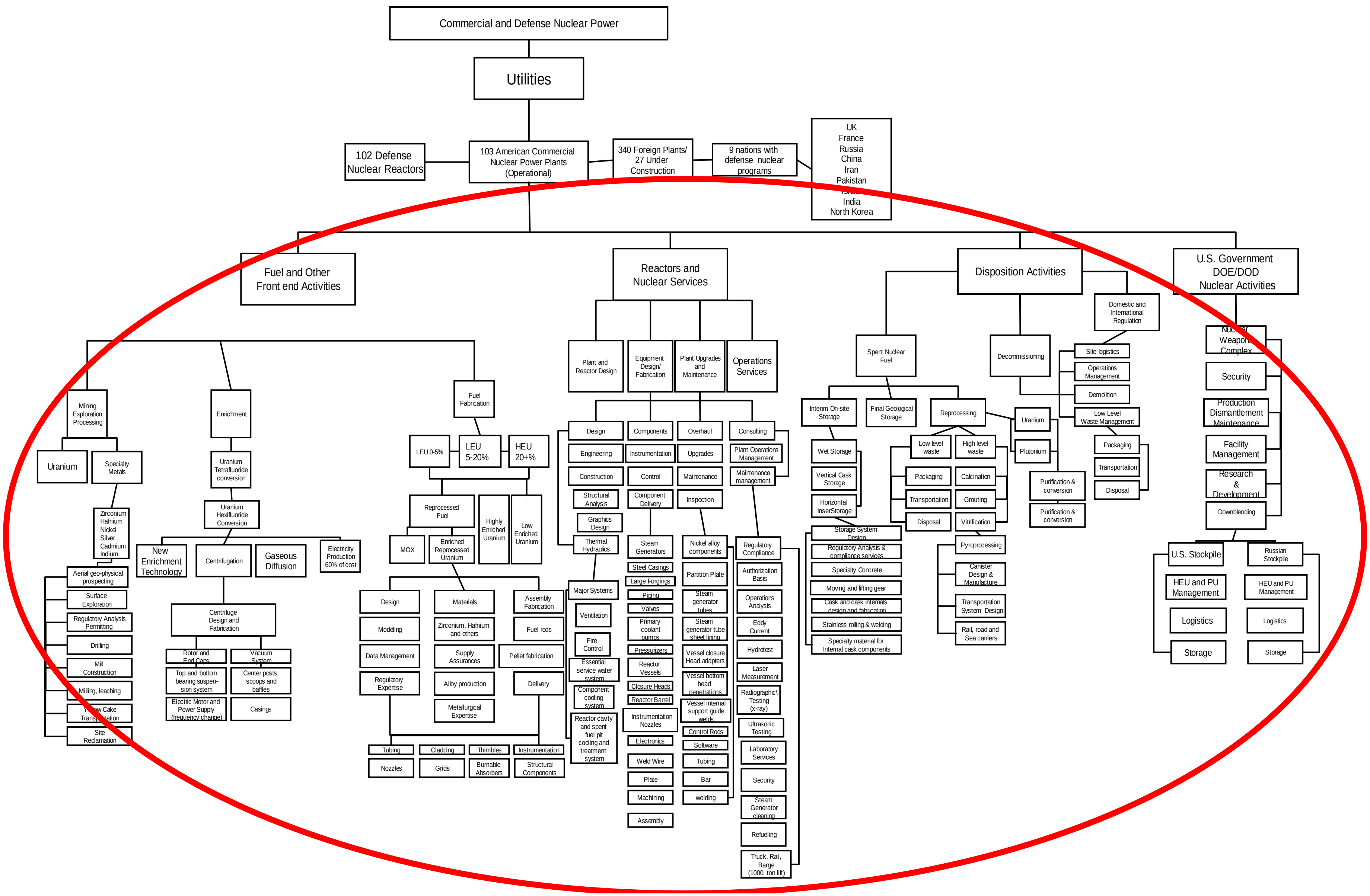
Truck and rail access



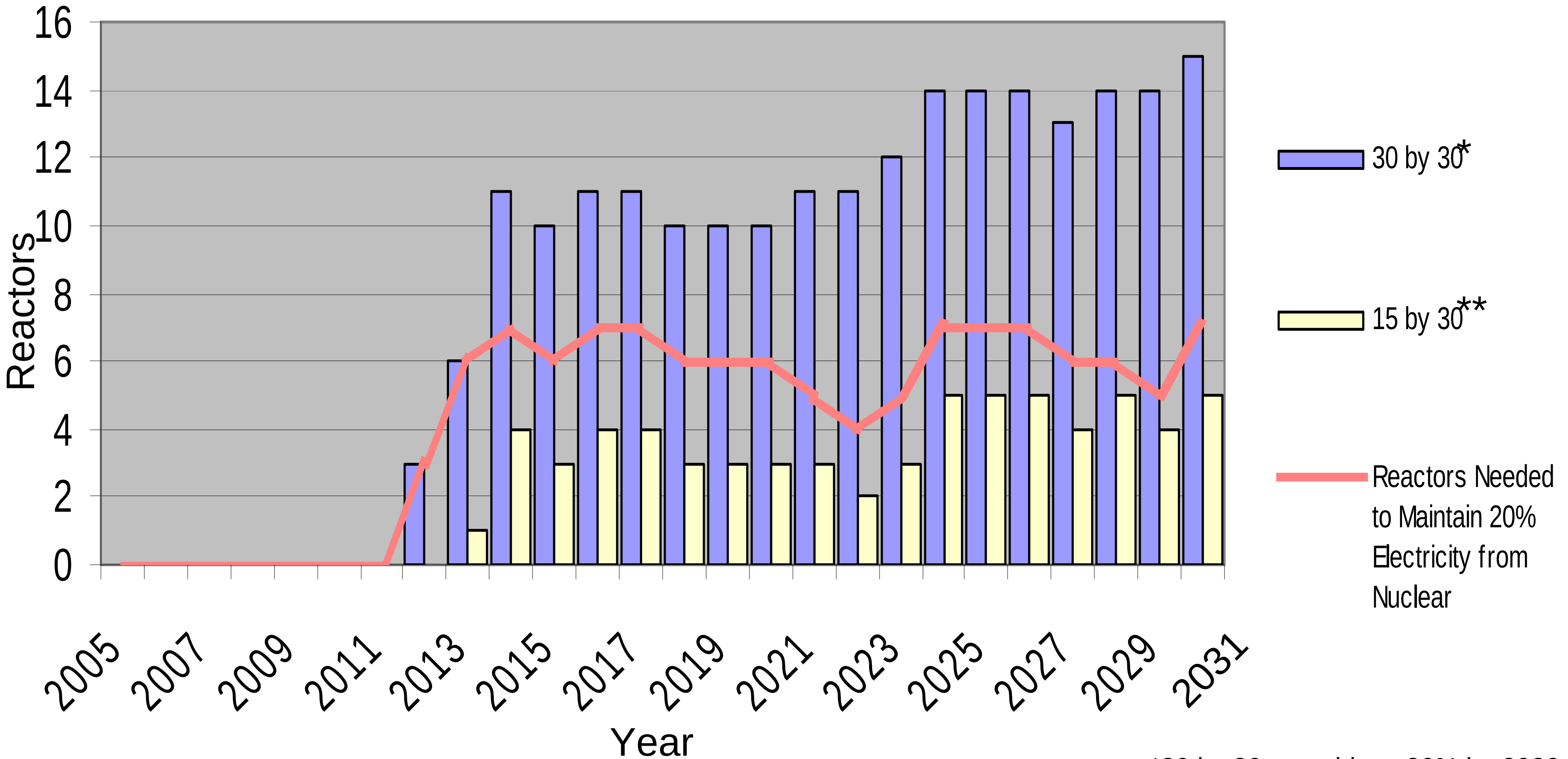
- Vast reductions of CO_2 required under all legislative proposals
- At-scale CCS technology demonstrations and deployment in power sector are indispensible
- Must drive down cost of CCS technologies for affordability and U.S. competitiveness
- At-scale CCS demonstration projects take 6-8 years but none are going forward anywhere in the world
- Timing: 2009-2018 funding of $800 million/yr for at-scale, first-of-a-kind CCS demonstrations under government-industry partnerships

thebabcock&wilcoxcompany

Integrated U.S. Nuclear Industrial Base



Possible U.S. Annual Reactor Builds



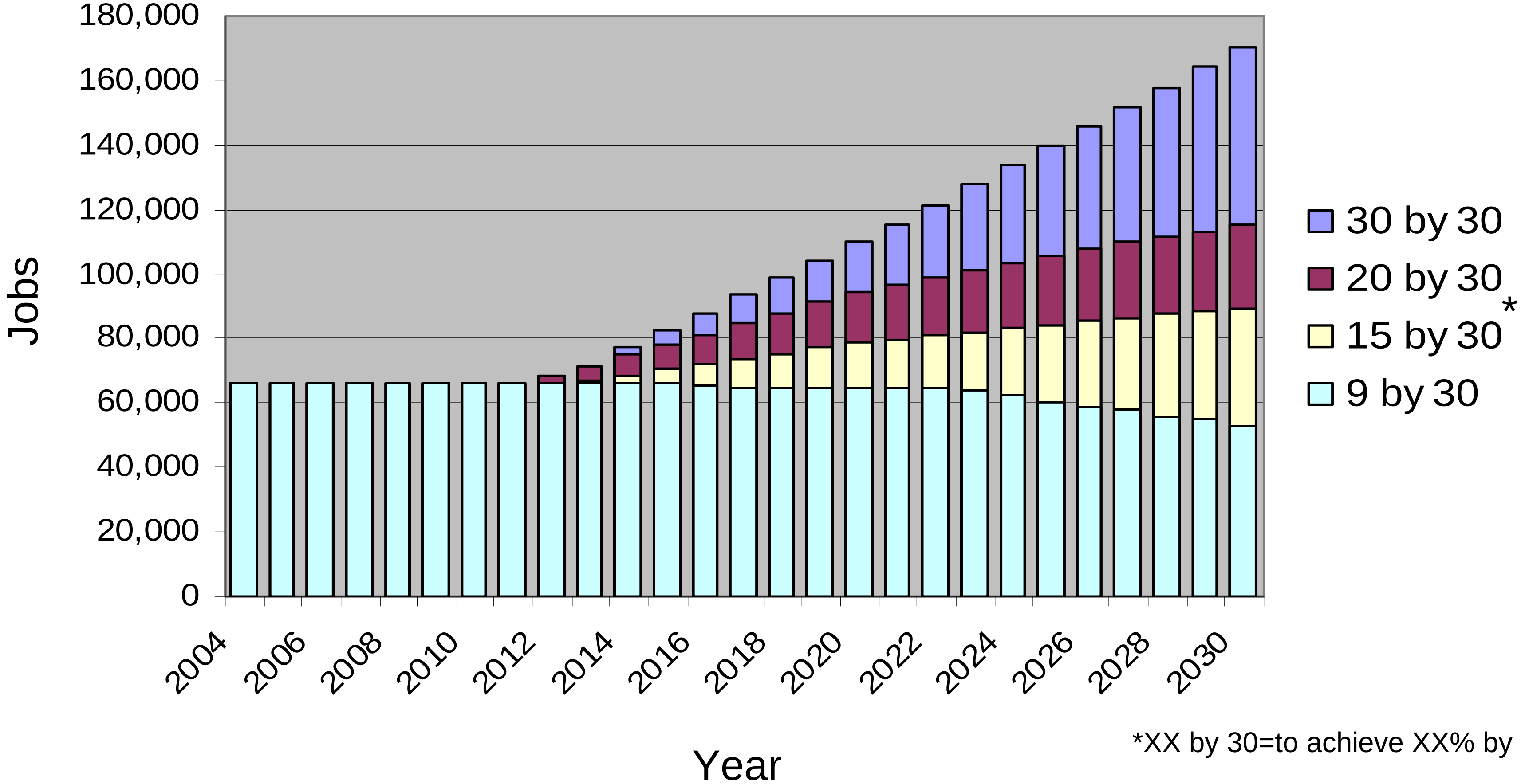
*30 by 30=to achieve 30% by 2030
**15 by 30=to achieve 15% by 2030

Based on IAEA energy demand projections.

Reactor estimates are based on current electricity generation and not on possible future capacity.

The analysis assumes a constant reactor/TW-h ratio over time based on IAEA's 2004 numbers, i.e. higher output reactors would yield fewer builds.

Predicted Plant Employees (Permanent Jobs)

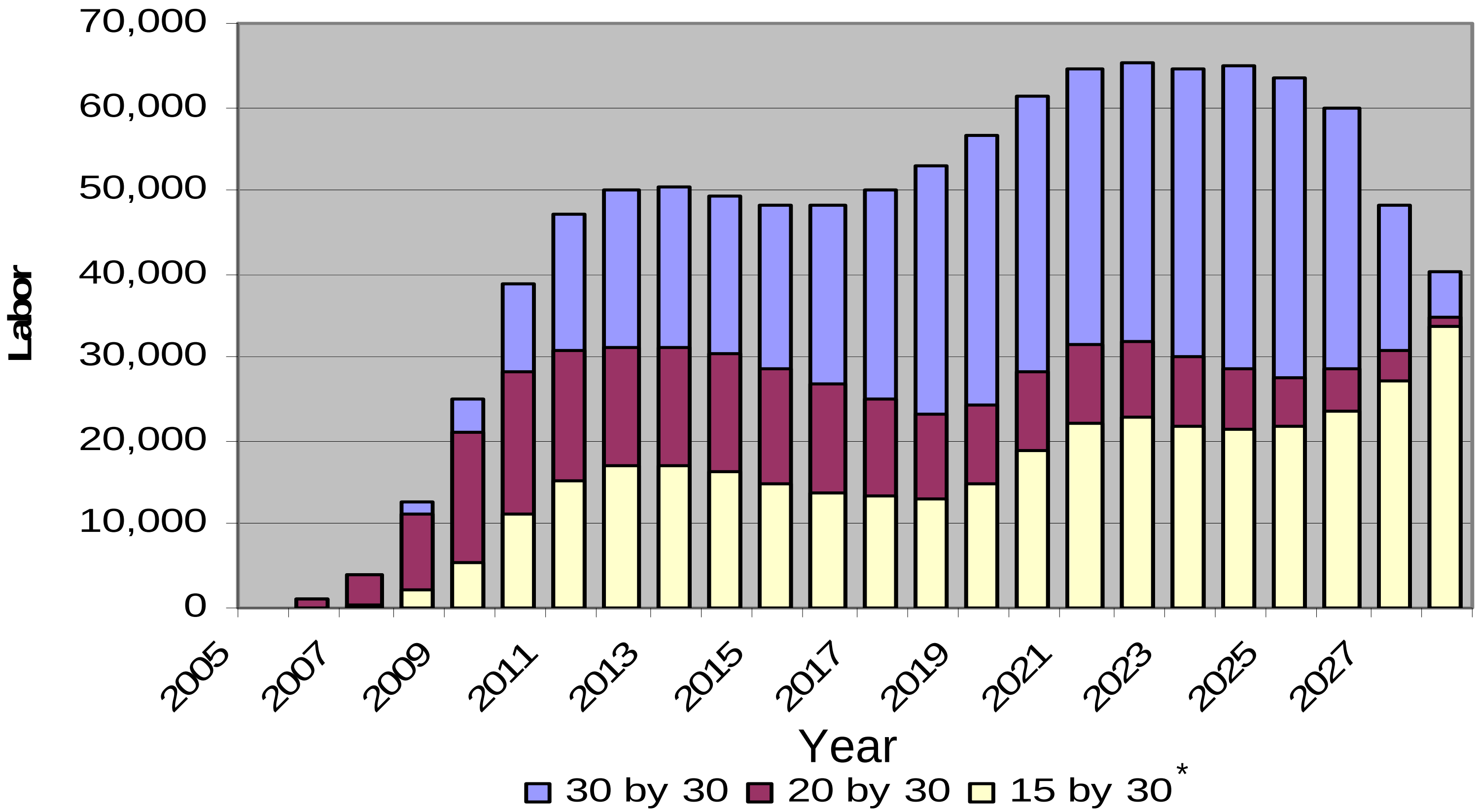


*XX by 30=to achieve XX% by 2030

Note: Includes existing plants and new plant construction

thebabcock&wilcoxcompany

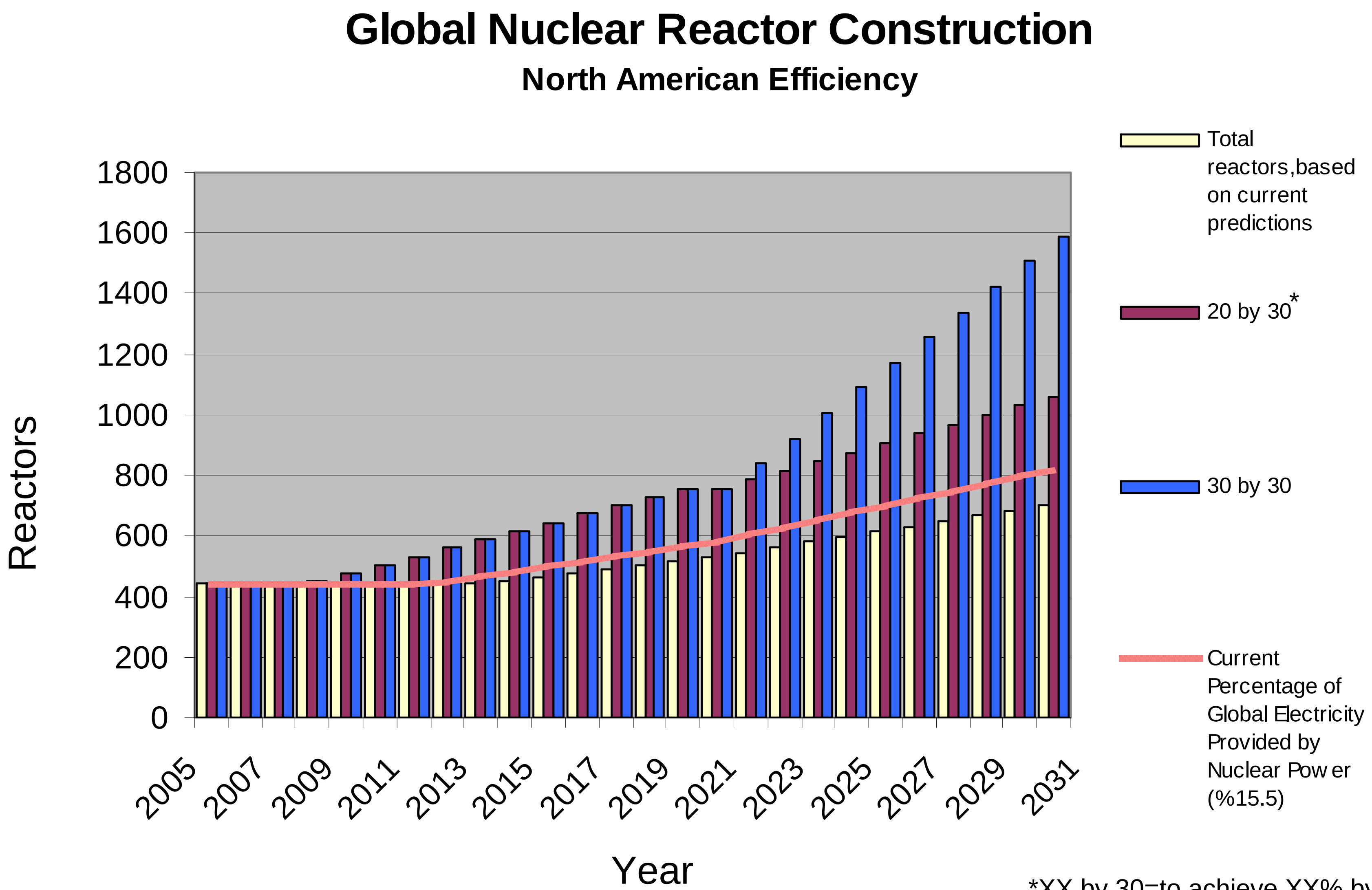
Predicted Craft Labor Requirements



*XX by 30=to achieve XX% by 2030

Dynamic Labor Analysis assumes a five year construction schedule with the following labor profile: y1-20%, y2-45%, y3-100%, y4-90%, y5-40%. This profile assumes that there will be some delays that require greater labor inputs in the latter half of the construction to maintain a five year construction schedule. It further assumes that beyond 2030, reactors will be built at approximately the replacement rate, plus one to accommodate increased electricity demands. From 1971-1975 reactors came on line at the following pace: 5, 6, 8, 12, and 9, respectively.

Possible Global Annual Reactor Builds

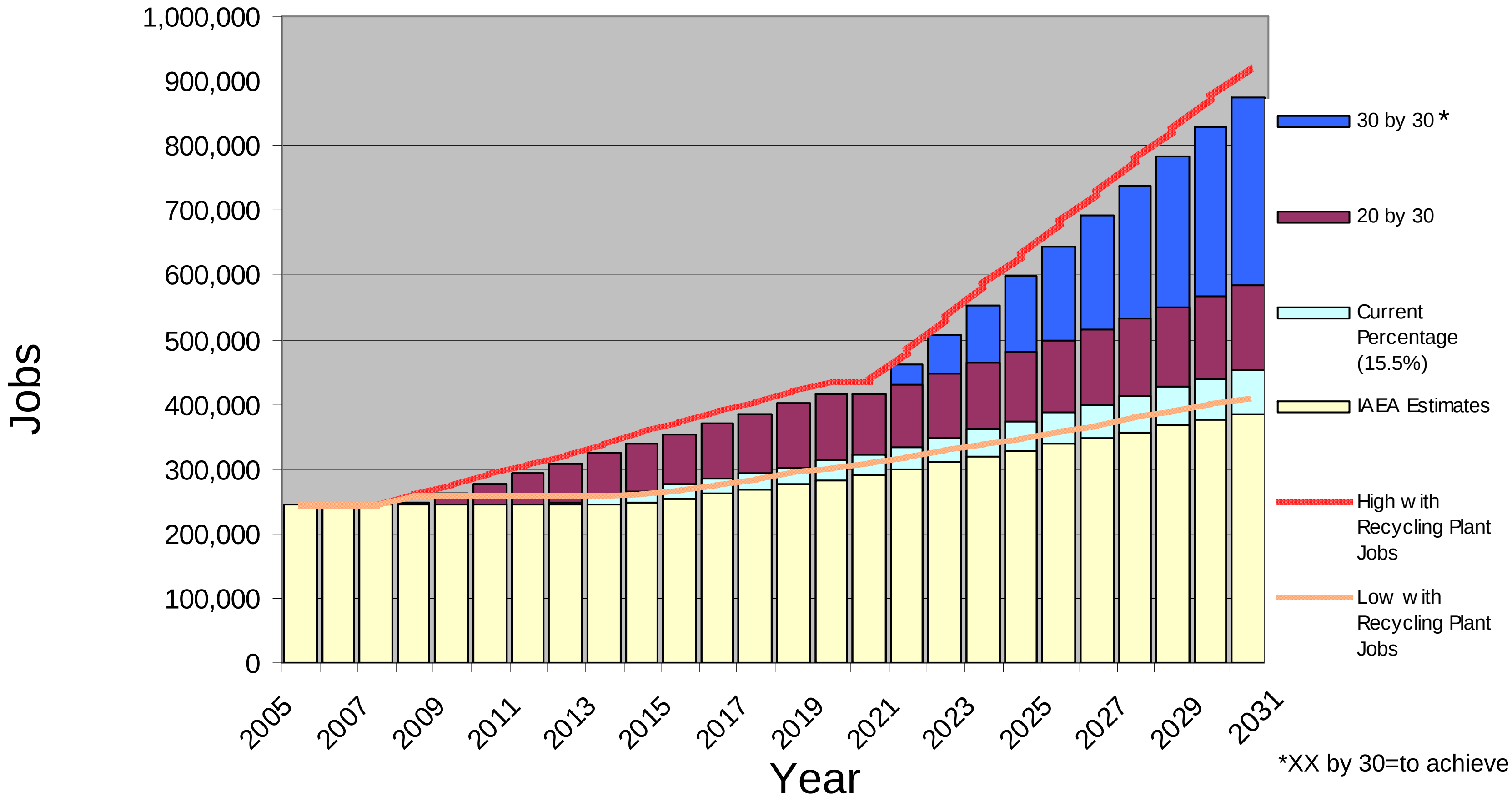


*XX by 30=to achieve XX% by 2030

Predicted Global Workforce Requirements

Nuclear Power and Fuel Recycling Plant Workers

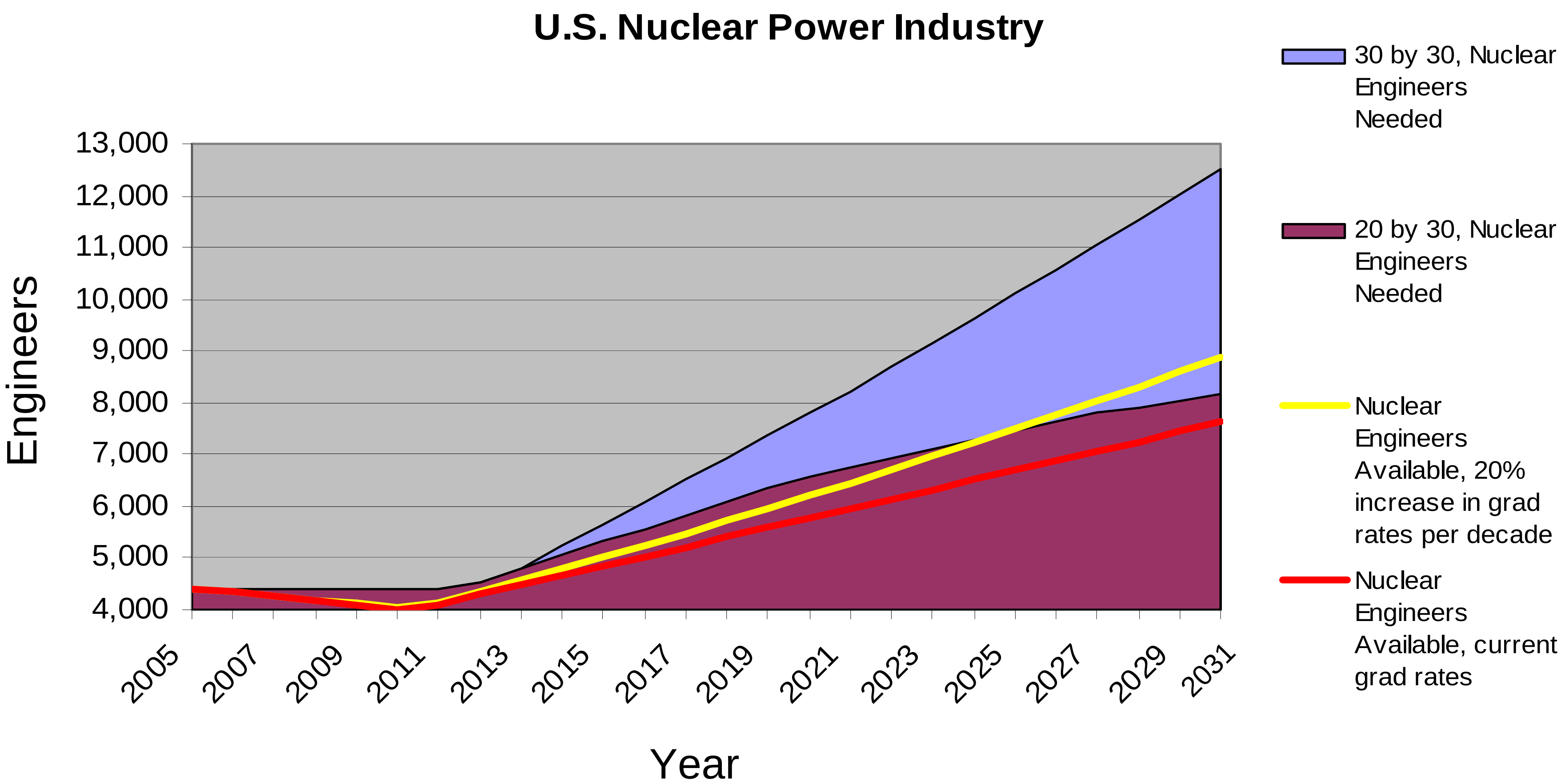
North American Average Efficiency



*XX by 30=to achieve XX% by 2030

North American Average Efficiency is based on the per reactor contribution to total amount of electricity produced by all nuclear reactors. The current per reactor output in North America is greater than that of the world as a whole. It is assumed that, on the whole, new reactors constructed globally will yield greater efficiencies.

Predicted Nuclear Engineer Shortage



Nuclear Engineering estimates assume that the average number of nuclear engineers per reactor (42.8) based on 2005 US Department of Labor, Bureau of Labor Statistic are consistent over time. Nuclear Engineering per plant numbers are produced by dividing the total number of engineers working in power generation and supply by total number of reactors. Nuclear Engineers, as defined by the Department of Labor, are those who, "conduct research on nuclear engineering problems or apply principles and theory of nuclear science to problems concerned with release, control, and utilization of nuclear energy and nuclear waste disposal." Total Nuclear Engineers: Today there are 4409 nuclear engineers employed by power plants. The Nuclear Energy Institute estimates that 30 % of all nuclear workers will be eligible to retire over next 5 years. Daniel M. Kammen, Professor, Energy and Resources Group, UC Berkley, testified before Congress that nuclear industry workers will retire at approximately 3% per year. DOE's report, "Education in Nuclear Science" recommends increasing the percentage of PhD graduate by 20% over the next 10 years. The Department of Labor estimates that 36.1 percent of nuclear engineers are employed by power plants. Thus, this analysis decreases the nuclear engineers available by 30% over the next five years, then reduces the workforce by 3% annually through 2030, then adds new engineers over the next 25 years. The additional engineers estimate assumes a 20% increase at BS, MS, and PhD levels over each of the first two 10 year periods and 10 % over the final five years.

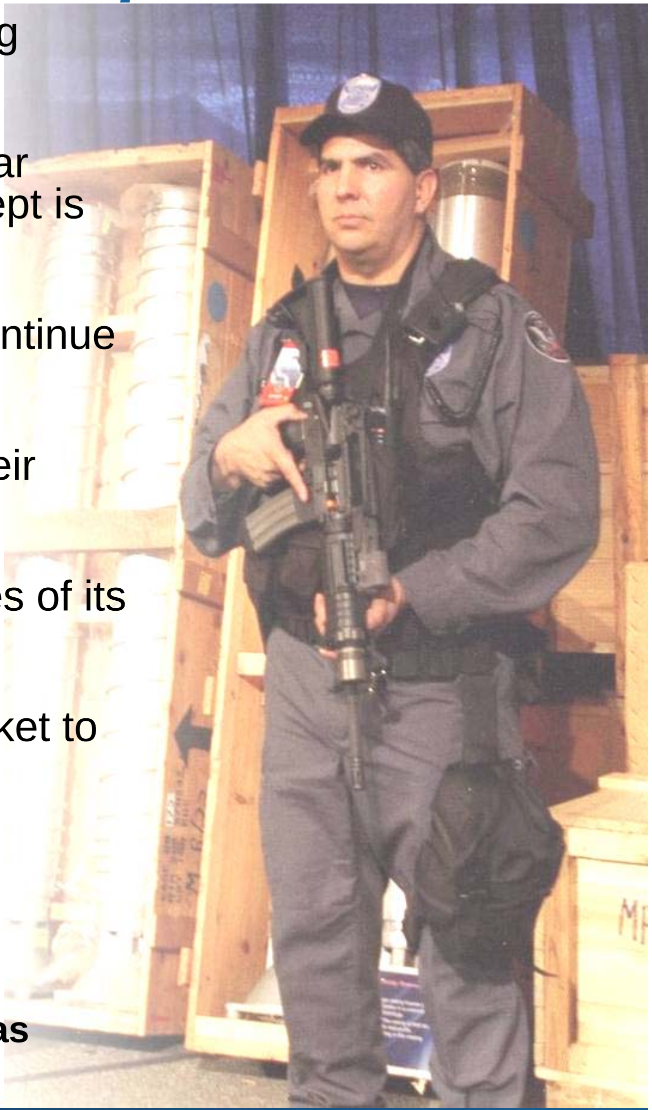
B&W: An Industry leader in Nuclear Non-proliferation

B&W has a history of effectively implementing nuclear non-proliferation technology and regimes requirements:

- Manages and operates U.S. nuclear weapons production complex
- Unmatched nuclear material processing knowledge
- Conversion of research reactor fuel from HEU to LEU
- Key participant in past and current international non-proliferation efforts
- Realistic training scenarios for first responders

Developing Global Nuclear Energy Market Requires a New U.S. Approach to Non-proliferation

- Current U.S. nonproliferation policy does not address the growing complexities of the current **multi-polar, energy scarce world**
- For many nations, the decision to proceed or not with new nuclear industrialization under the Nuclear Non-proliferation Treaty precept is fundamentally changing
- "**Globalization**" of nuclear power is already occurring and will continue to occur with or without U.S. participation
- Other nations are thinking strategically about how to leverage their existing or potential nuclear capabilities
- **The U.S. must act now** to strengthen the increasing weaknesses of its nuclear non-proliferation policies
- **The U.S. must participate** in the developing global nuclear market to keep its seat at the nuclear non-proliferation table
- **We must**:
  - **Re-establish a position of worldwide leadership in nuclear energy**
  - **Strengthen our Nation's commercial nuclear industry, including advanced technologies and reprocessing**
  - **Lead the development of international nuclear partnerships such as GNEP and assured fuel supplies**



Nuclear Industry Challenges

- **Workforce**
- **Capitalization**
- **Quality**
- **International Market**
- **Liability**
- **Resources**
- **Regulation & Security**
- **Public Education**

Nuclear Power: An Essential Part of Any Realistic U.S. Climate Change Agenda

Legislative Requirements for a Successful U.S. Nuclear Industry:

- Formal Articulation of a U.S. Nuclear Agenda
  - 30 by 30: Advocate production of 30% of U.S. electricity by nuclear power by 2030
  - GNEP: International cooperation is essential to re-establish the U.S. as a global leader in nuclear technology and non-proliferation
- Removal of Barriers to International Market Entry
  - Convention on Supplementary Compensation for Nuclear Damage (CSC)
  - Tariff Parity
  - 123 Agreements
- Economic Support
  - Loan guarantees for power reactors and manufacturing capability such as forging capacity
  - Tax credits for investment in manufacturing facilities and workforce development
- Industry and Government Coordination
  - Coordination between industry and the Departments of Energy, State and Commerce through a Federal Advisory Board

Questions?

Craig Hansen

Vice President, Washington Operations