

Nuclear Energy: Seizing the Opportunities

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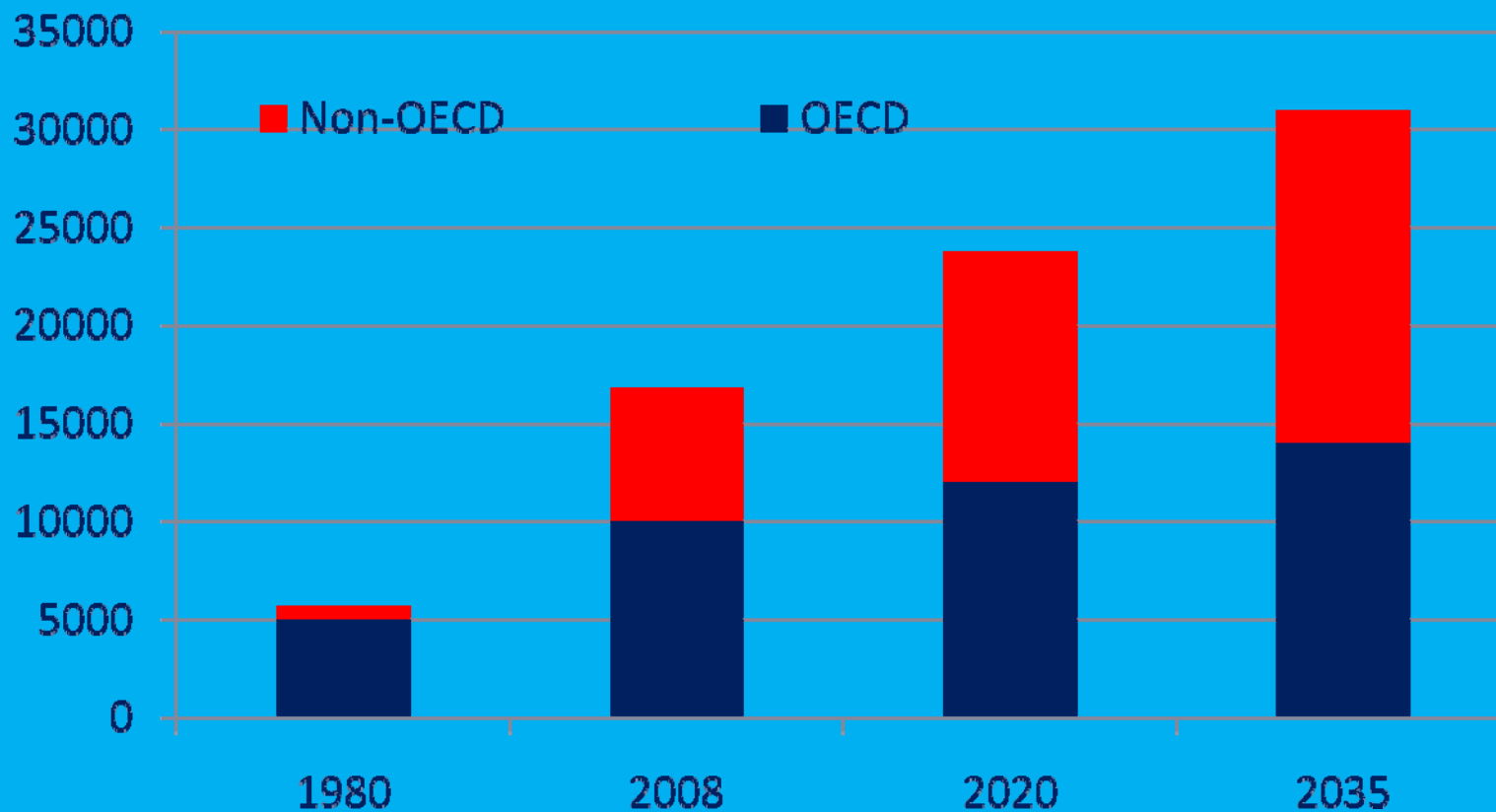


Outline

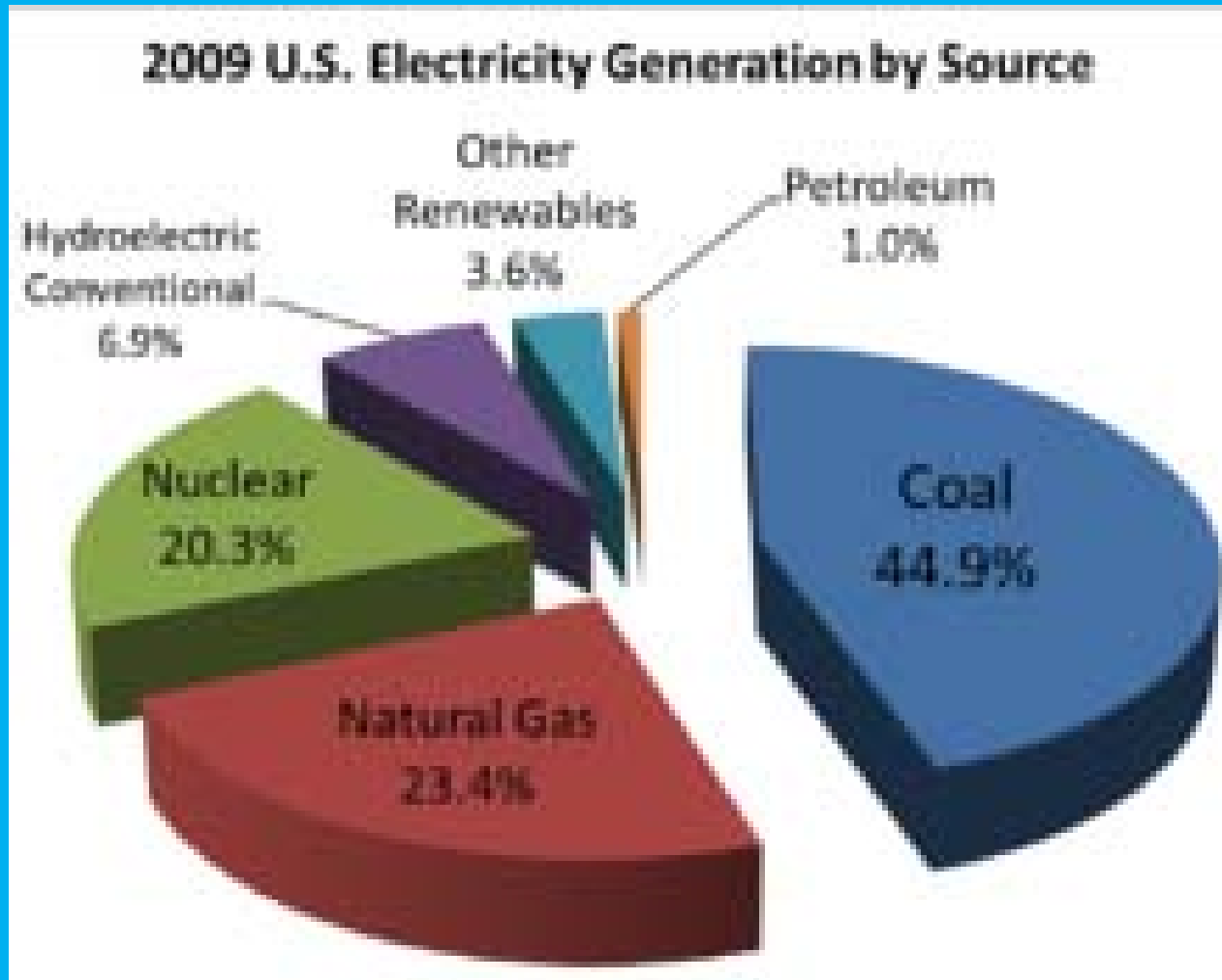
- Electricity Overview
- New Nuclear Plants: Progress and Expectations
- The New Politics of Nuclear Energy
- Fukushima Accident



World Electricity Consumption 1980-2035 (TWh)



US Electricity Generation by Source 2009



Comparison of Production Costs and Capacity Factors

- **2009 Production Costs**

- Nuclear: 2.03 c/KW
- Coal: 2.97 c/KW
- Gas: 5.00 c/KW
- Oil: 12.37 c/KW

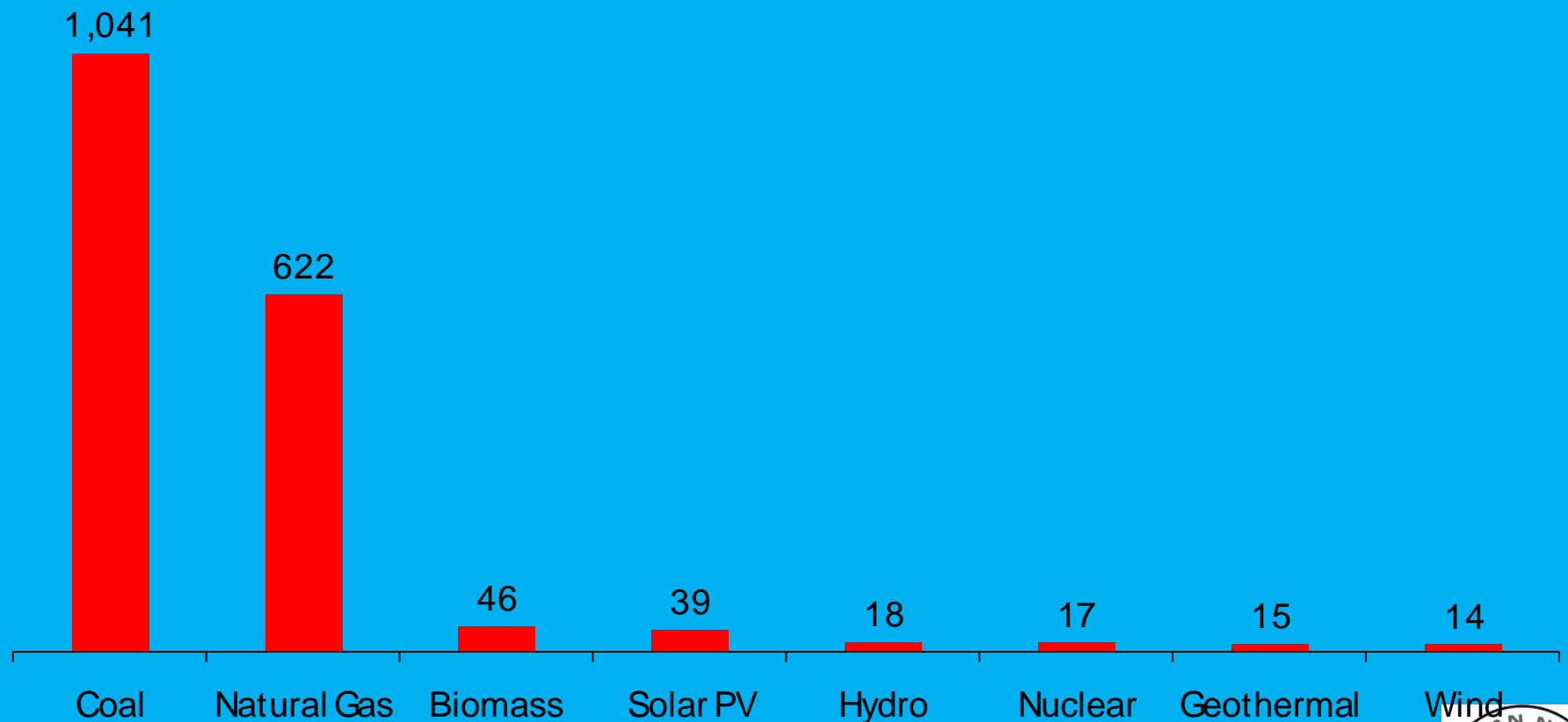
- **2009 Capacity Factors**

- Nuclear: 90.5%
- Geothermal: 71.5%
- Biomass: 66.0%
- Coal (steam): 63.1%
- Gas CC: 44.7%
- Hydro: 29.4%
- Wind: 27.8%
- Solar: 23.5%
- Gas (steam): 13.3%
- Oil (steam): 7.4%



Comparison of Life-Cycle Emissions

Tons CO₂ per gigawatt-hour

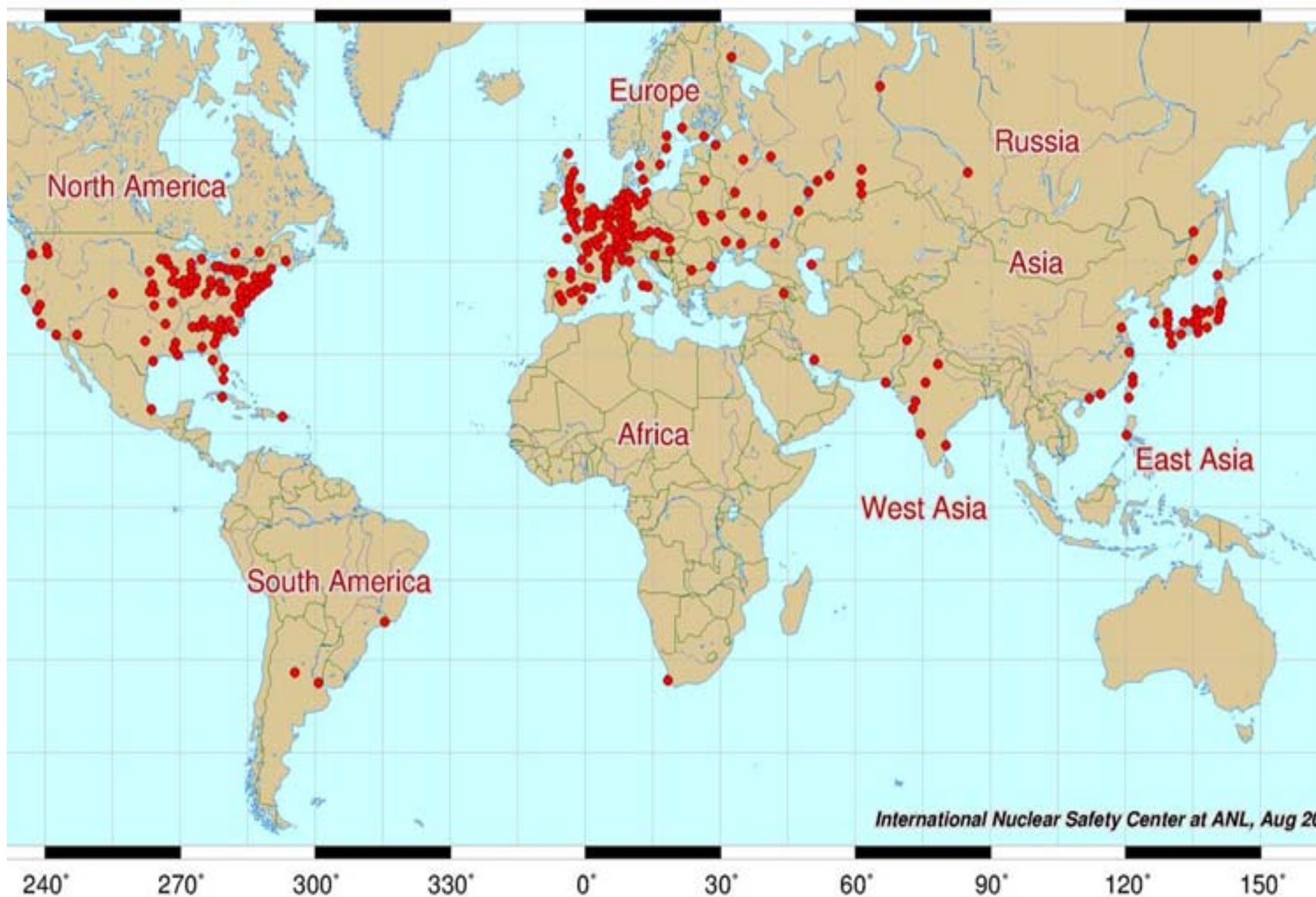


Source: "Life-Cycle Assessment of Electricity Generation Systems and Applications for Climate Change Policy Analysis,"
Paul J. Meier, University of Wisconsin-Madison, August 2002.

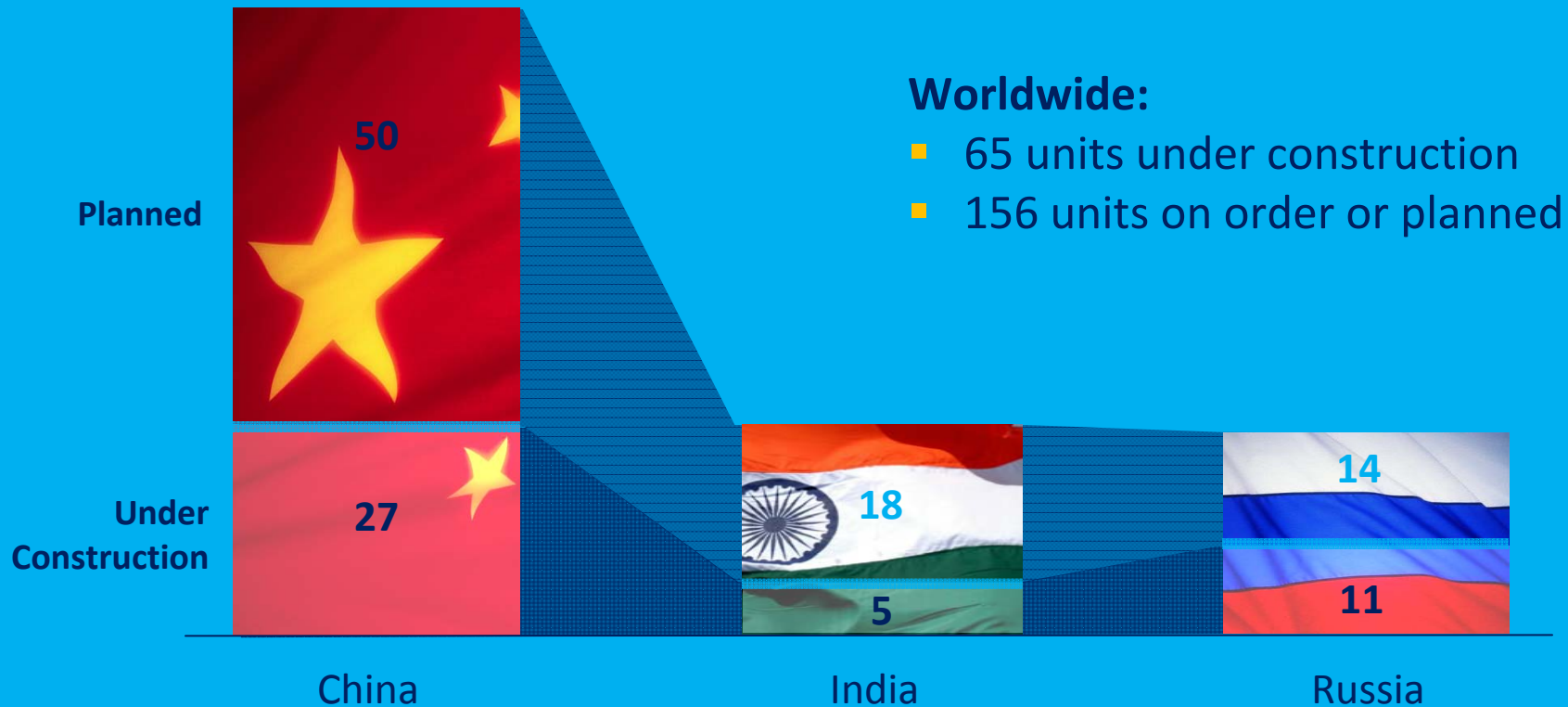


New Nuclear Plants: Progress and Expectations





Global Nuclear Construction Market Over \$400 Billion

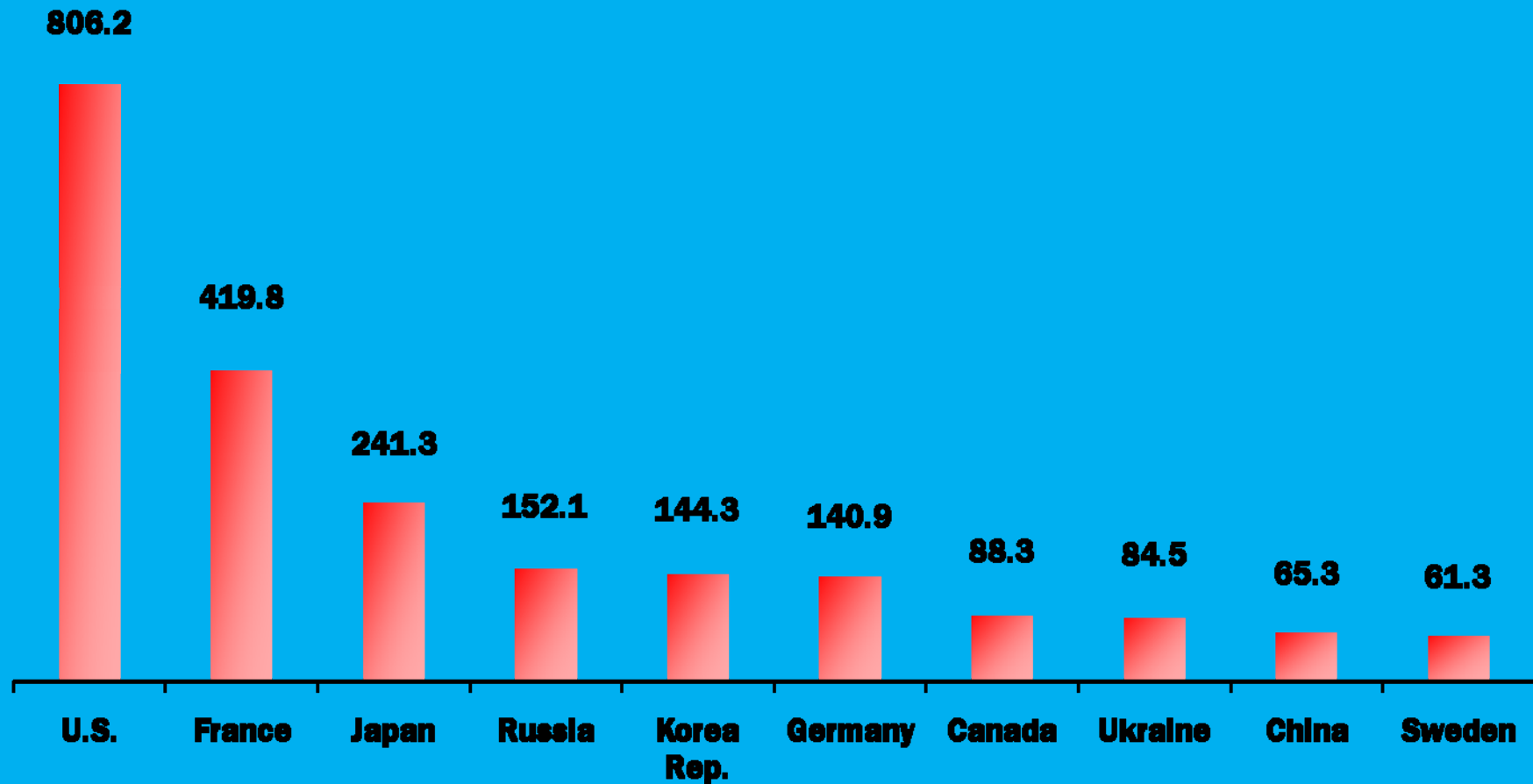


Sources: International Atomic Energy Agency, World Nuclear Association



U.S. Is Global Leader in Nuclear Energy

(Billion kilowatt-hours of electricity)



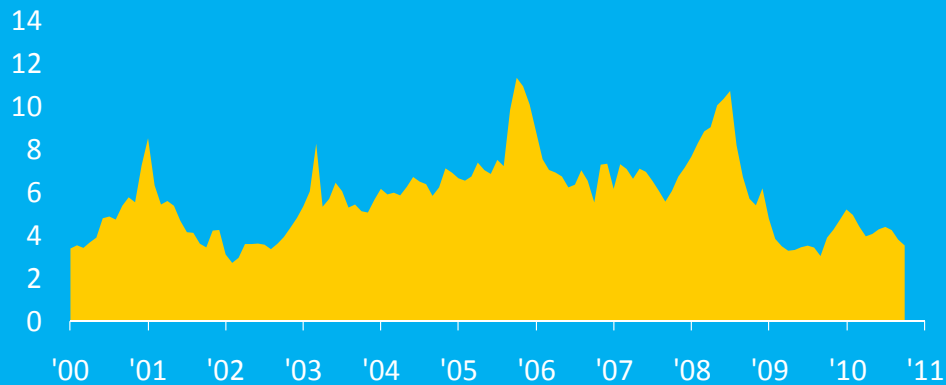
Source: International Atomic Energy Agency, U.S. is from Energy Information Administration. Updated: 9/09



Long-Term Fundamentals Remain Solid

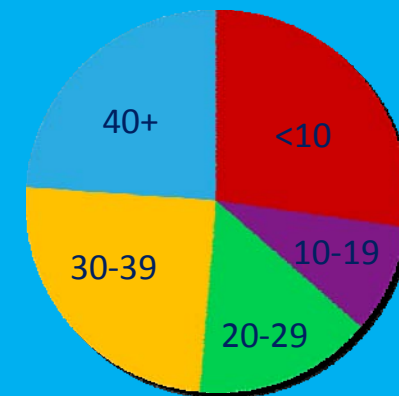
U.S. Natural Gas Wellhead Prices

(In 2010 dollars per thousand cubic feet)

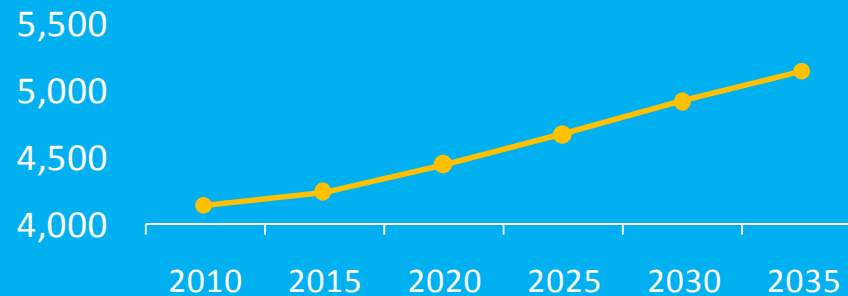


Age of U.S. Generating Capacity

Years



U.S. Needs 24% More Electricity by 2035



Sources: Energy Information Administration, Ventyx Ventures



New Nuclear is Competitive

Levelized cost of electricity (2007 cents per KWe)

- Nuclear 6-13
- Combined Cycle 4-16
- Combined Cycle-CCS 7-21
- Coal 5-9
- Coal-CCS 9-15
- Wind 4-18
- Solar 14-30
- Biopower 8-10

CCS=Carbon Capture &
Storage



US Nuclear New Build: Progress Continues

- 13 COL applications (22 reactors) and three early site permits under NRC review
- Two combined construction/operating licenses expected this year
 - Vogtle 3 & 4
 - V.C. Summer 2 & 3
- Three design certifications expected this year
 - ABWR
 - AP1000
 - ESBWR



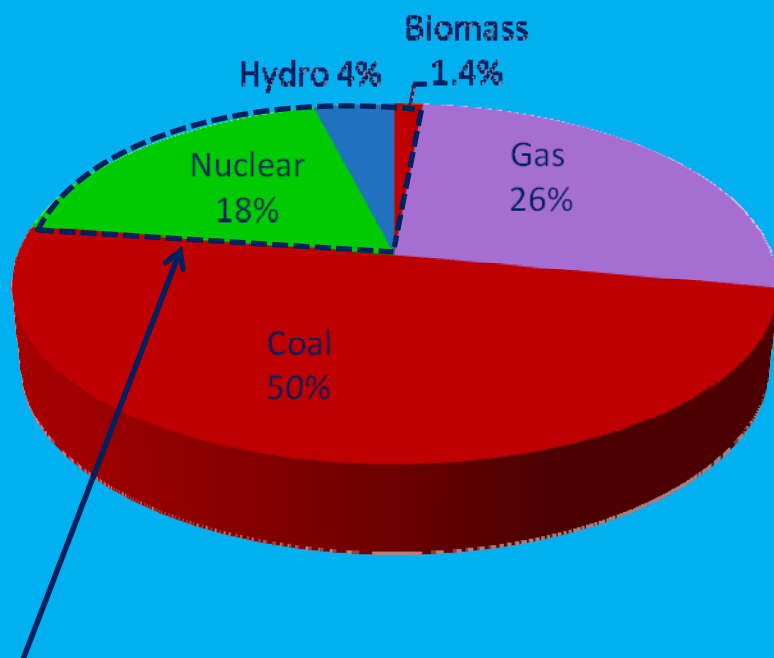
V.C. Summer 2 & 3

- Owners: SCANA 55%, Santee Cooper 45%
- Location: Jenkinsville, S.C.
- Design: AP1000
- Anticipated COL approval: late 2011/early 2012
- Spending as of Sept. 2010: \$1.38 billion
- Scheduled start-up: 2016, 2019

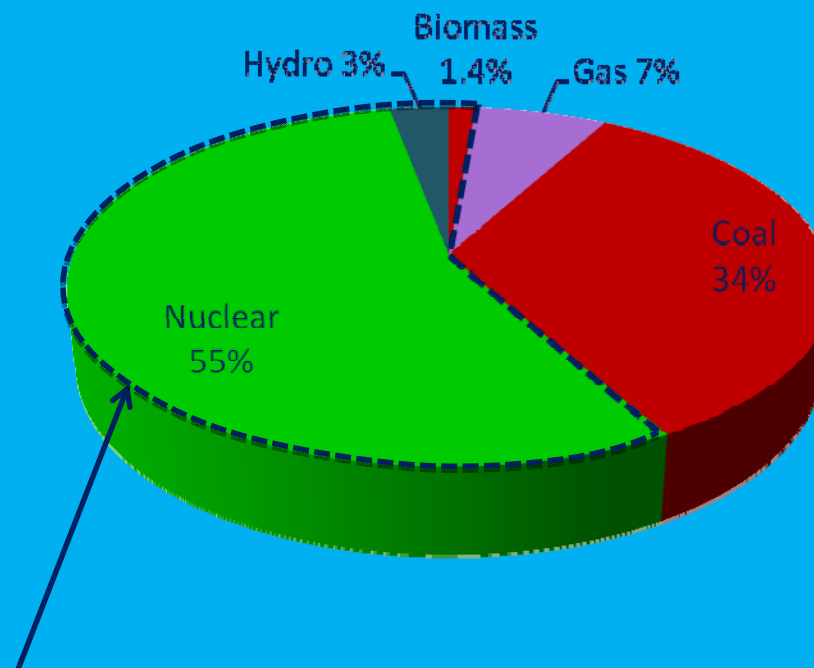


SCANA Generation Mix – 2009 and 2019

2009 Generation Mix



2019 Generation Mix



Vogtle 3 & 4

- Owners: Georgia Power 45.7%, Oglethorpe Power 30%, MEAG 22.7%, Dalton Utilities 1.6%
- Design: AP1000
- Location: Burke County, Ga.
- Anticipated COL approval: late 2011
- Employees on site: Currently 1,500, at peak about 3,500, permanently about 800
- Scheduled start-up: 2016, 2017



Construction site with Modular Assembly Building and Plant Vogtle Units in background December 2, 2010 © 2010 Southern Company, Inc. All rights reserved



Sanmen Basemat Rebar



Sanmen Containment Vessel Bottom Head



Sanmen Structural Module



The Priorities for 2011 and Beyond

- **Operating plants:** Safety, reliability is top priority
- **New plants:** Risk management is highest priority
 - Disciplined project management essential
 - Ensure certainty, predictability in the licensing process
 - Firm up financing plans
 - Sustain programs to grow nuclear work force
 - Provide investment stimulus to expand nuclear supply chain
- Industry's major opportunity: Reinforcing and strengthening the new political mandate



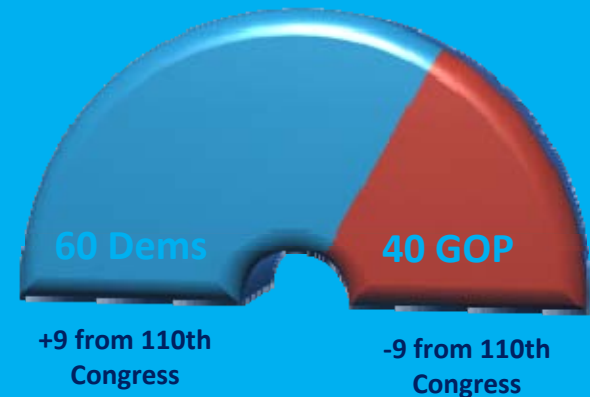
The New Politics of Nuclear Energy



For Nuclear Energy, Political Uncertainty At the Beginning of 2009

- Increased Democratic control of House and Senate
- Lost a number of pro-nuclear champions (Sen. Pete Domenici)
- Rep. Henry Waxman (D-Calif.) replaced Rep. John Dingell (D-Mich.) as chairman of House Energy and Commerce Committee
- Obama: Terminate Yucca Mountain project

Senate



House



As 2009 Unfolded, Bipartisan Support For Nuclear Energy Increased

- Strong support for nuclear energy in Congress among Republicans, conservative Democrats, progressive Democrats
- House, Senate legislation included strong nuclear provisions
- Strong nuclear component a prerequisite for energy/climate legislation

The Washington Post

Nuclear power regains support

TOOL AGAINST CLIMATE CHANGE

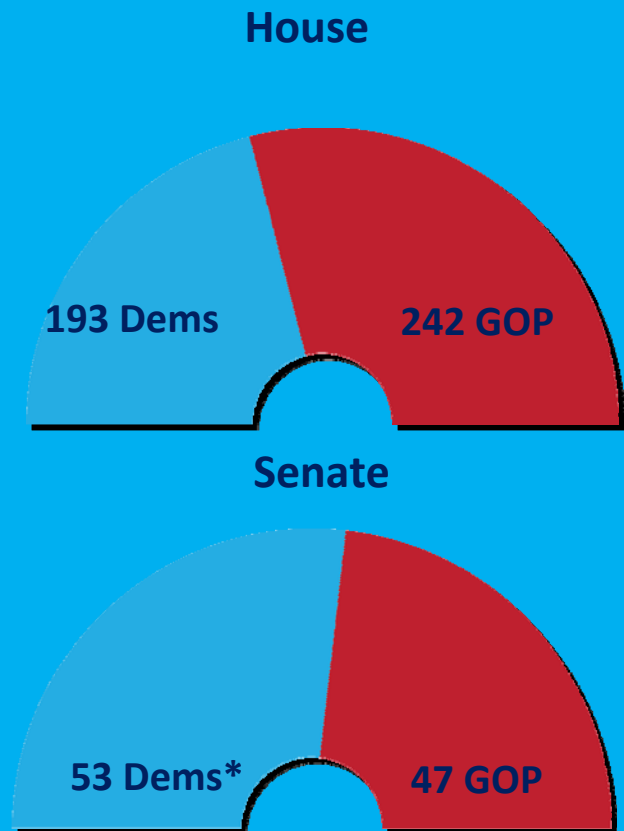
Even green groups see it as 'part of the answer'

Washington Post, November 24, 2009



A Charged Political Environment, But...

- Continued Administration support
 - Loan guarantee program
 - Three new commissioners for Nuclear Regulatory Commission
 - Negotiated key 123 nuclear trade agreements with UAE, Russia, Australia
- Continued bipartisan support in Congress



* Includes 2 Independents



President's Challenge: 80% Clean Electricity by 2035



“Some folks want wind and solar. Others want nuclear, clean coal, and natural gas. To meet this goal, we will need them all – and I urge Democrats and Republicans to work together to make it happen.”

President Barack Obama
State of the Union
January 25, 2011



Path Forward for Used Nuclear Fuel Management

- Create a federal corporation for managing used fuel
- Develop a centralized interim storage
- Complete the Yucca Mountain licensing process
- Used fuel is not an impediment to operation or licensing of nuclear power plants



Lee Hamilton, right, and Brent Scowcroft, center, co-chairs, Blue Ribbon Commission on America's Nuclear Future Agenda, talk with former New Mexico Sen. Pete Domenici.



Japan Accident and U.S. Response

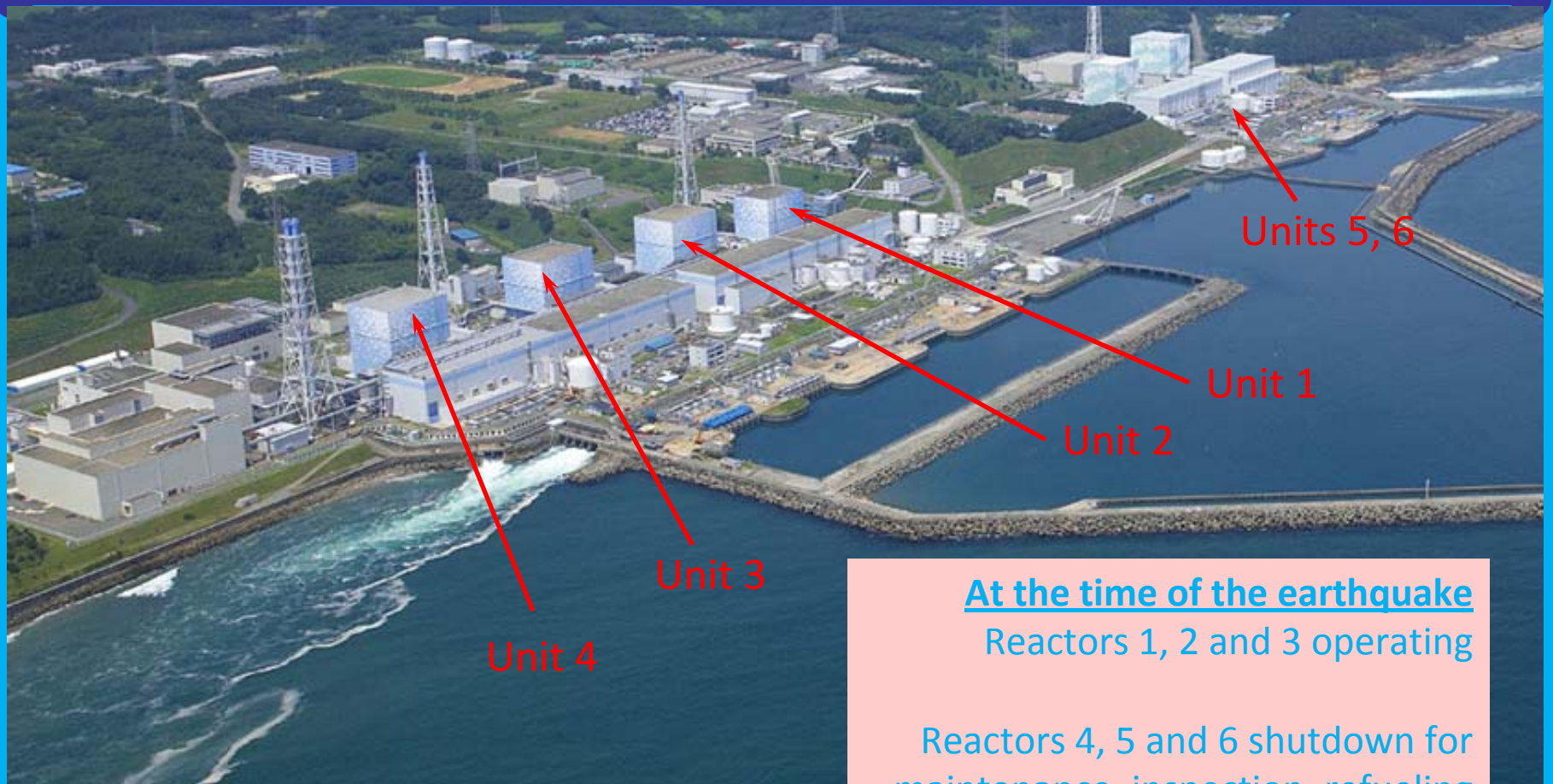


Nuclear Energy in Japan

- 54 operating nuclear reactors (49 gigawatts)
- Two nuclear plants under construction
- Tokyo Electric Power Co. produces 27% of Japan's electricity
- 12,000 MW of nuclear energy capacity shut down



Fukushima Daiichi Nuclear Power Plant Before the Accident



At the time of the earthquake

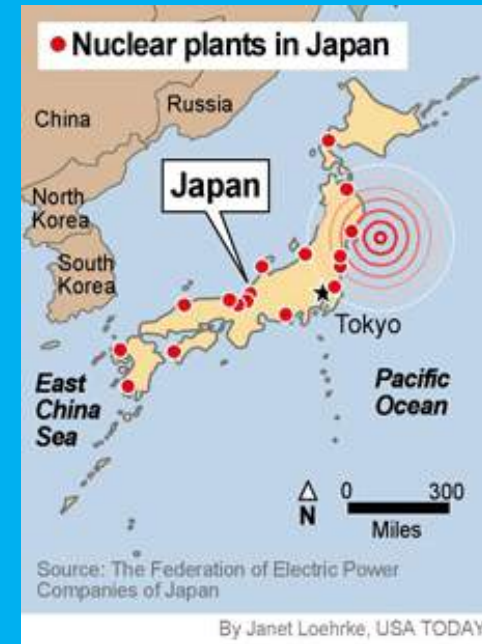
Reactors 1, 2 and 3 operating

Reactors 4, 5 and 6 shutdown for maintenance, inspection, refueling



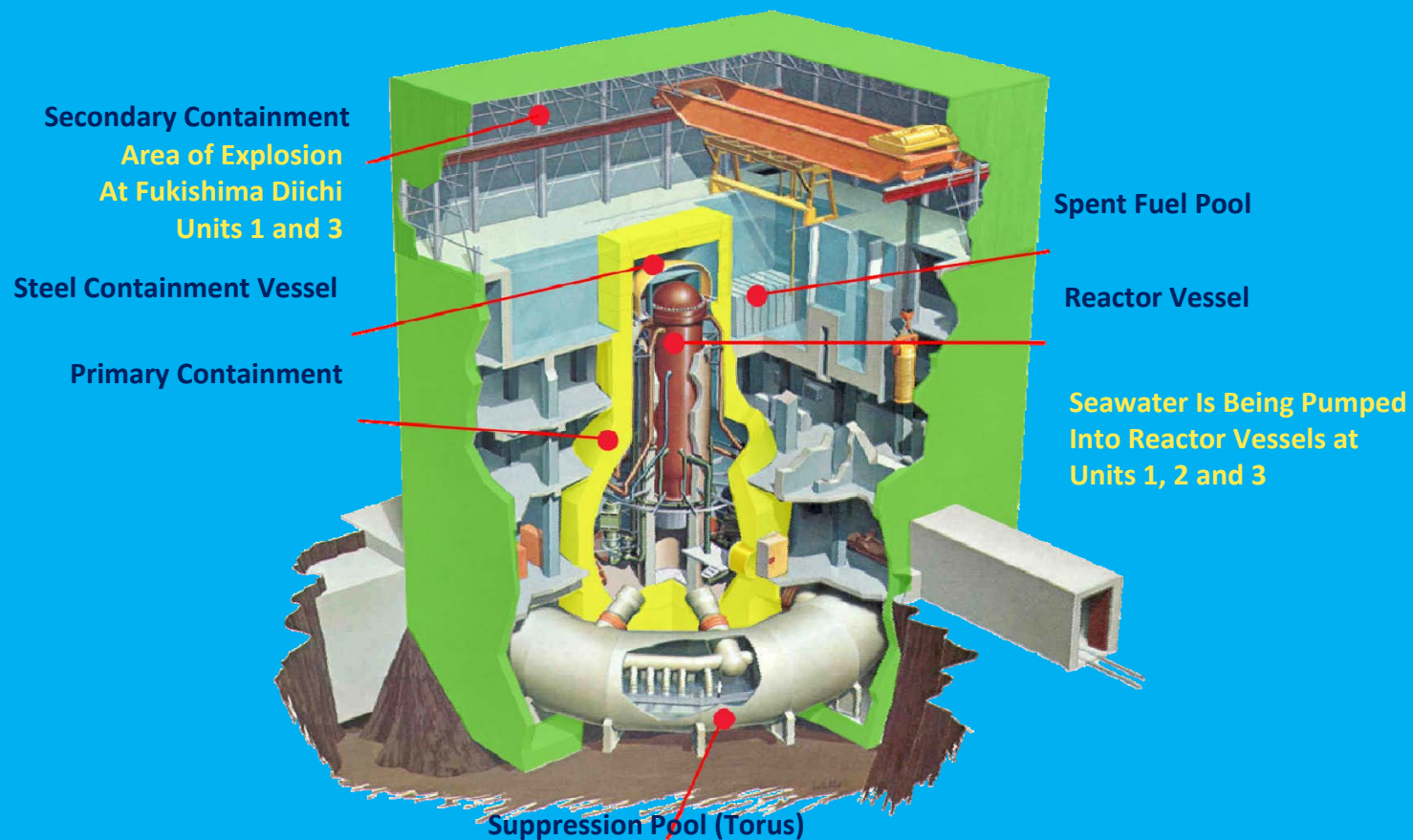
Event Initiation

- The Fukushima nuclear facilities were damaged in a magnitude 9.0 earthquake on March 11 (Japan time), centered offshore of the Sendai region, which contains the capital Tokyo.
 - Plant designed for magnitude 8.2 earthquake. An 9.0 magnitude quake is 7 times in greater in magnitude.
- Serious secondary effects followed including a significant tsunami, significant aftershocks and a major fire at a fossil fuel installation.



Boiling Water Reactor Design

Fukushima Daiichi



unit 1

Saturday, March 12, 2011

3:36 pm local, 1:36 am EST





units 2 (partial) and 3
Wednesday, March 16, 2011 – helicopter video
screenshot



Unit 4

Wednesday, March 16, 2011 – helicopter (Tepco photo)





Roadmap Toward Restoration from Accident at Fukushima Daiichi Nuclear Plant

- Achieve stable cooling condition for Reactors/spent fuel pools
- Maintain stable cooling by N2 gas injection; Flooding up to top of active fuel; Implement heat exchanger functions
- Mitigate release of radioactive materials
- Secure sufficient storage space to keep high-rad water from being released off site
- Store and process water with low radiation levels
- Prevent scattering of radioactive materials on buildings and grounds
- Timeframe: 3-6 months



Fukushima Daiichi Unit 4 Spent Fuel Pool- April 30, 2011



U.S. Nuclear Plants Are Safe



“Our nuclear power plants have undergone exhaustive study, and have been declared safe for any number of extreme contingencies. ”

President Barack Obama
March 17, 2011

“All the plants in the United States are designed to deal with a wide range of natural disasters, whether it’s earthquakes, tornados, tsunamis, other seismic events. We require all of them to deal with those.”

NRC Chairman Gregory Jaczko
March 17, 2011



U.S. Industry Taking Steps to Ensure Safety at Nuclear Power Plants

- Nuclear energy industry will take short-term and long-term actions
- Short-term: Verify readiness to manage extreme events
- Long-term:
 - Careful analysis of Japanese accident and how reactors, systems, structures, components, fuel and operators performed
 - Incorporate lessons learned into U.S. reactor designs and operating practices



Short-Term Industry Actions to Ensure Safety

- Verify each plant's capability to manage major challenges, such as aircraft impacts, loss of large areas of plant due to natural events, fires or explosions
- Verify each plant's capability to manage loss of off-site power
- Verify capability to mitigate flooding and the impact of floods on systems inside and outside the plant
- Perform walk-downs and inspection of important equipment needed to respond to extreme events



Reaction in United States

- NRC will conduct comprehensive review of all U.S. nuclear power plants to ensure safety
- Measured response from political and policy community
 - Focused on learning, applying lessons
- Marginal decrease in public support for new nuclear plants
- Likely increased attention to U.S. used fuel management policy
 - Centralized interim storage a strategic priority
- Little impact expected on new nuclear plant development

