



Top Ten Issues for the Renaissance of Nuclear Power in the U.S.

Remarks to the Atomic Energy Society of Japan

by

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ANS President

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The American Nuclear Society

**The Society for the
advancement of nuclear
science and technology
to benefit humanity**



The American Nuclear Society

- Founded December 11, 1954 at the National Academy of Sciences in Washington, D.C.
- Founded as a not-for-profit, international, scientific and educational organization
- Integrates all disciplines of nuclear science and technology



ANS Membership

11,000 individual members

- 800 (7%) outside the United States
- 47 countries represented
- 8% under 35; 15% over 66
- ~700 with less than 5 years experience
- Under 35 group increased by ~40% from 1999 to today



ANS Membership Also Consists of:

- 19 Divisions/Technical Groups
- 70 Organization Members
- 37 U.S. Local Sections
- 9 Non-U.S. Sections/Affiliated Societies
- 30 formal agreements for cooperation with international organizations
- 14 Plant Branches
- 31 Student Sections



ANS' 19 Divisions/ Technical Groups

- Aerospace Technical Group
- Accelerator Applications
- Biology & Medicine
- DD&R
- Education & Training
- Environmental Sciences
- Fuel Cycle and Waste Management
- Fusion Energy
- Human Factors
- Isotopes & Radiation
- Materials Science & Technology
- Mathematics & Computation
- Nuclear Criticality Safety
- Nuclear Installations Safety
- Operations and Power
- Radiation Protection & Shielding
- Reactor Physics
- Robotics and Remote Systems
- Thermal Hydraulics



ANS Activities

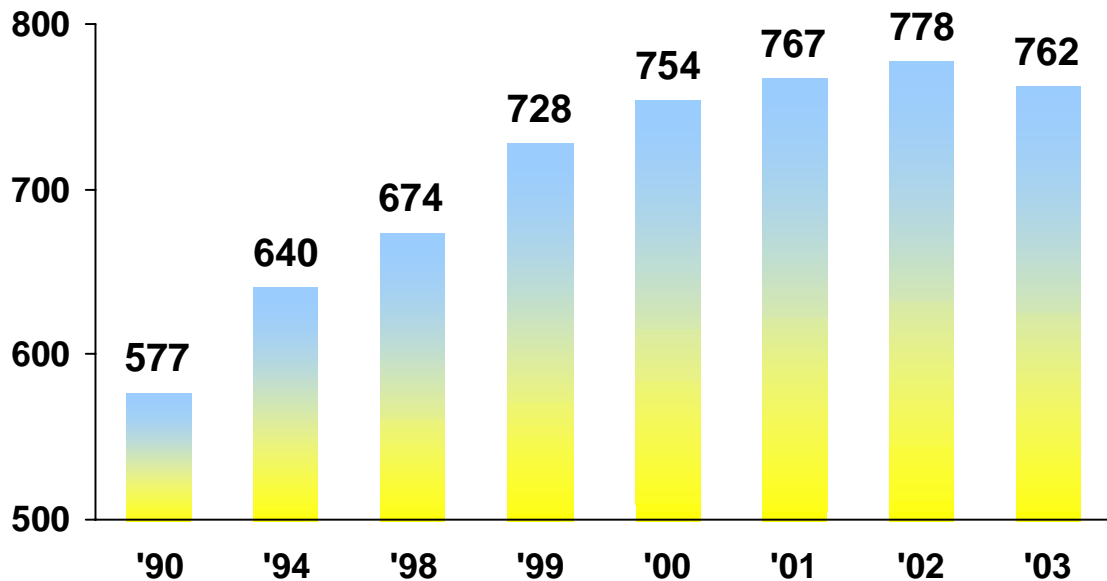


Top 10 - Nuclear Good News

- **Delivery of record outputs; playing vital role in nation's energy supply**



Record Nuclear Electricity Production Is Sustainable



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- **Only environmentally acceptable option for reliable and secure energy supply**



Fossil Fuel Supplies

- **Western World must reduce their dependence on oil**
 - Limit influence on foreign policy
 - Reduce cost to economy of oil price shocks
 - Reduce greenhouse gas emissions
 - Prepare for inevitable resource depletion
 - Husband oil for other uses
- **Reducing oil use is not a solution to terrorism but it may help**



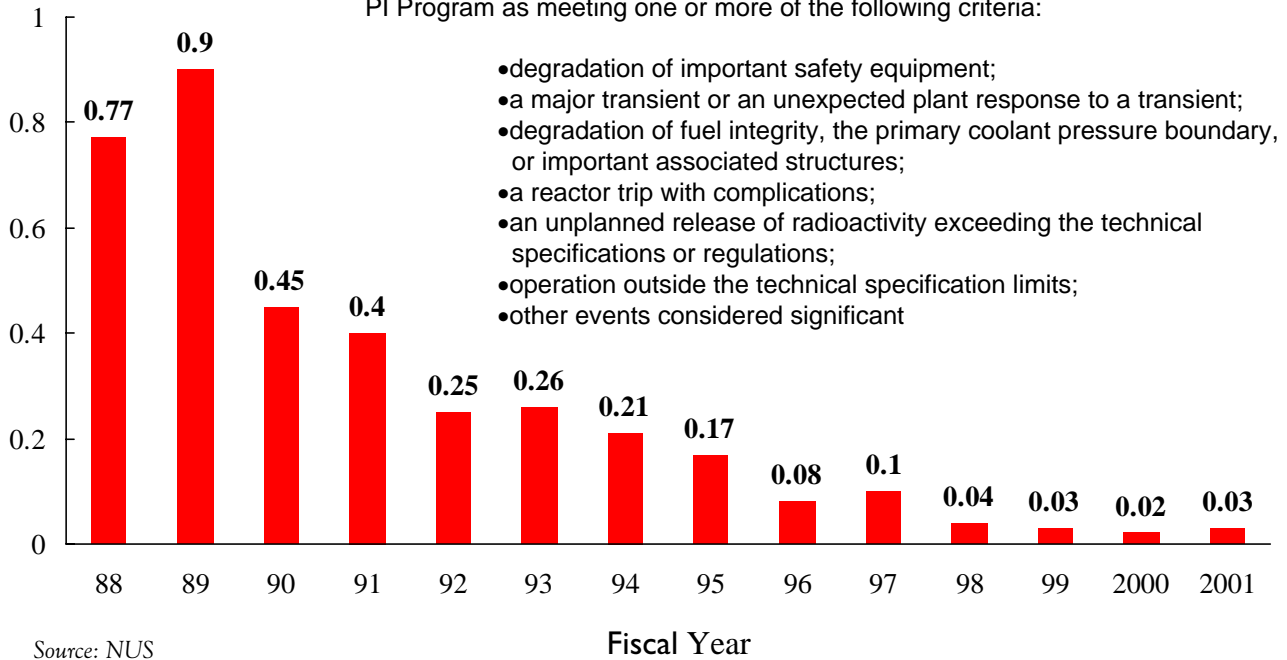
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- Only environmentally acceptable option for reliable and secure energy supply
- **Excellent safety record**



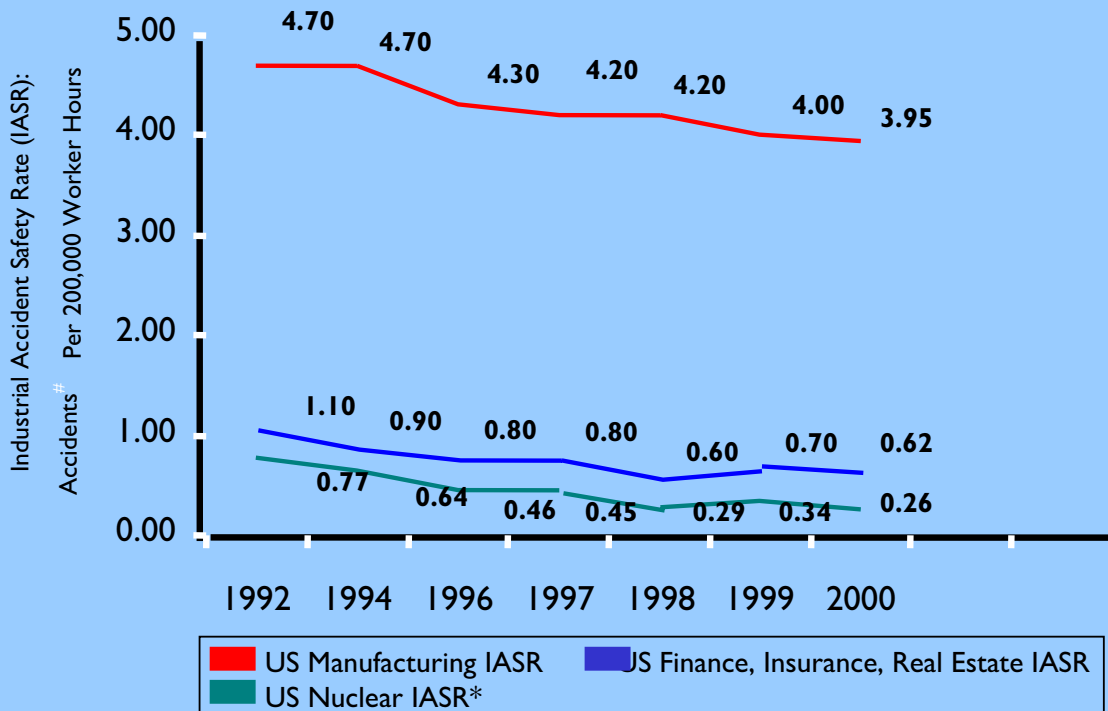
Significant Events: Annual Industry Average (1988-2001)

Significant Events (SEs) are those events that the NRC staff identifies for the PI Program as meeting one or more of the following criteria:



- degradation of important safety equipment;
- a major transient or an unexpected plant response to a transient;
- degradation of fuel integrity, the primary coolant pressure boundary, or important associated structures;
- a reactor trip with complications;
- an unplanned release of radioactivity exceeding the technical specifications or regulations;
- operation outside the technical specification limits;
- other events considered significant

Nuclear's Superior Safety Record



#Number of accidents resulting in lost work, restricted work, or fatalities per 200,000 worker hours

*Full-time, on-site employees



Selected U.S. Accident Fatalities 1966-1997

(Ref: Various)

Highway	1,511,272
Falls	457,389
Poisons	186,354
Fires	175,074
Rail	21,018
Drowning in bathtub	6,344
Electrocution - Domestic	4,559
Lightning	2,954
U.S. Airlines	2,210
Venomous plants and animals	1,885
Natural Gas - Pipelines, T&D	257
Radiation from Nuclear Power Plants and fuel cycle (inc. TMI)	0

Nuclear power has best safety record

Deaths from Accidents from Generating Electricity per Billion MWe-hr

Hydro  **101**

Coal  **39**

Gas  **10**

Nuclear* | 1

*Includes Chernobyl

400-page study of 4,290 energy-related accidents: 15,000 deaths related to oil, 8,000 related to coal, 5,000 related to gas.

Paul Scherrer Institute,
Switzerland, 2001

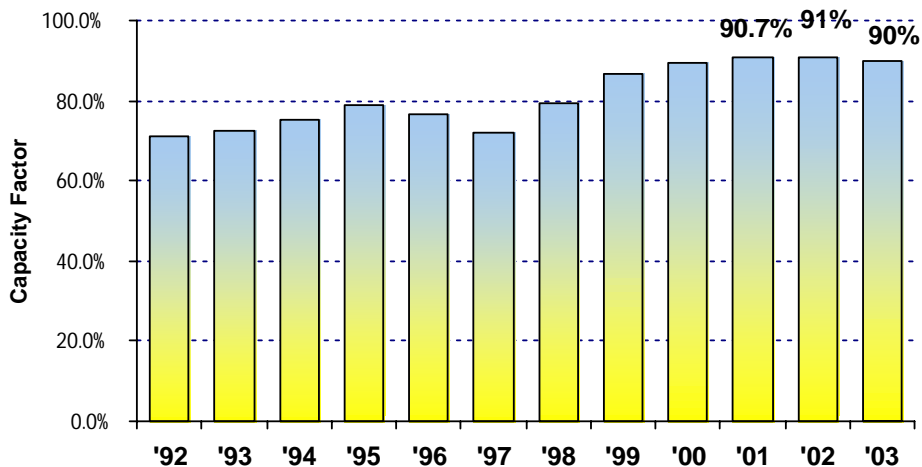


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- **Capacity factors at record high levels**



Nuclear Plant Efficiency At Record High-Levels





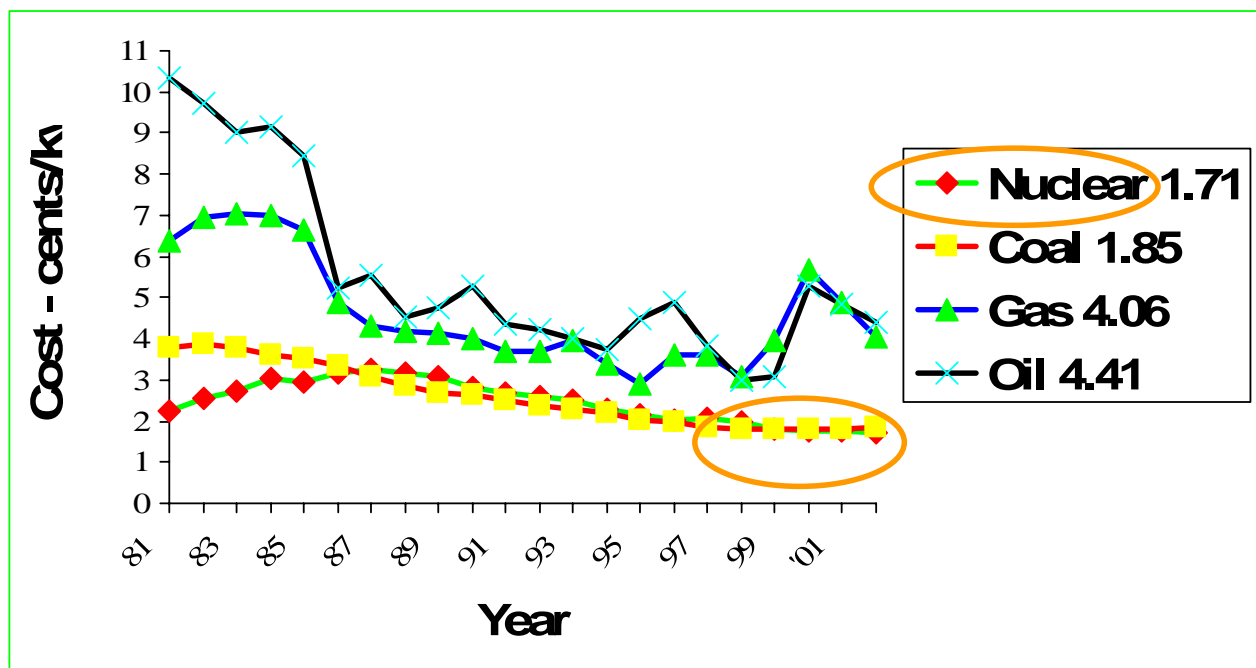
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- **Good economic performance**



US Electricity Production Cost Estimates (1981-2002) (in constant 2000 cents/kWh)

Note: Amortization of Capital Costs not included



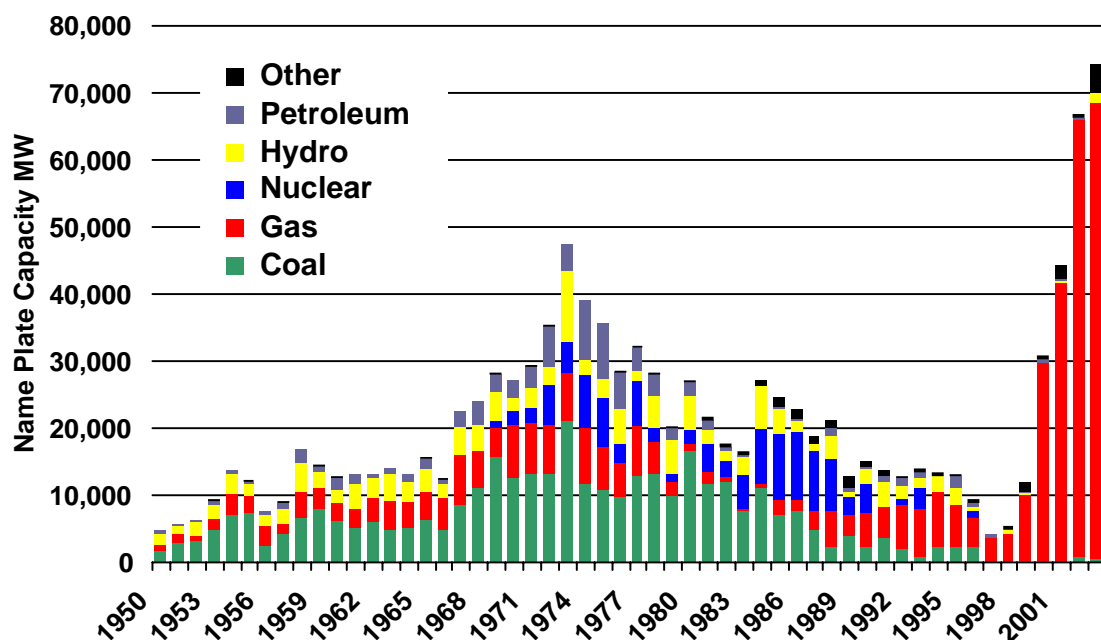


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- **Expect significant increase in future electricity demand**



Capacity Brought on Line by Fuel Type (1950-2002)



Source: RDI PowerDat database. Last updated 9/15/03.

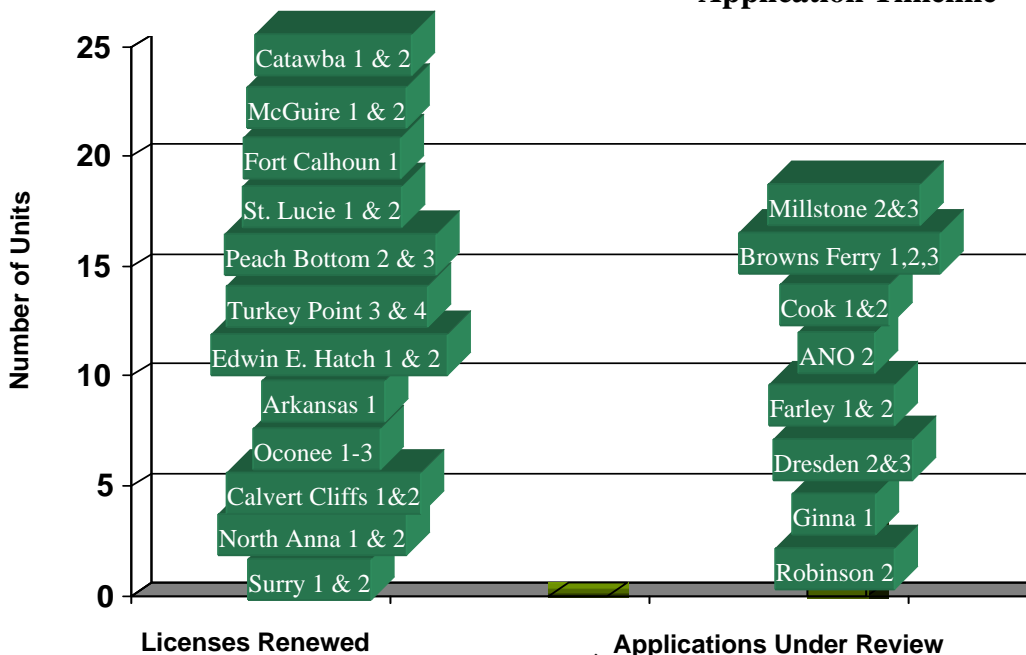
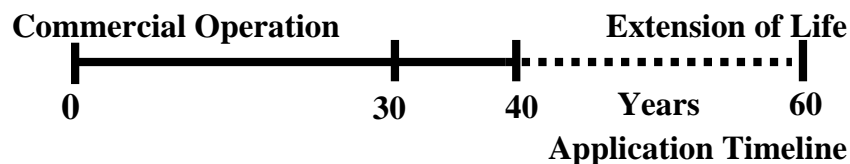


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- **License renewals and plant life extension**



Plant Life Extensions





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- **Environmental quality benefits**



Environmental Effects

- Concerns about Environmental Effects of Fossil Fuels are becoming widely recognized
- Emissions from fossil plants are killing > 30,000 people per year in the U.S. (Pope, 1995)
- Oil products and refining are responsible for more than 40% of US and global emissions of CO₂
- Cost of this oil use includes
 - Health care costs
 - Economic aspects of climate change
 - Cost of military presence



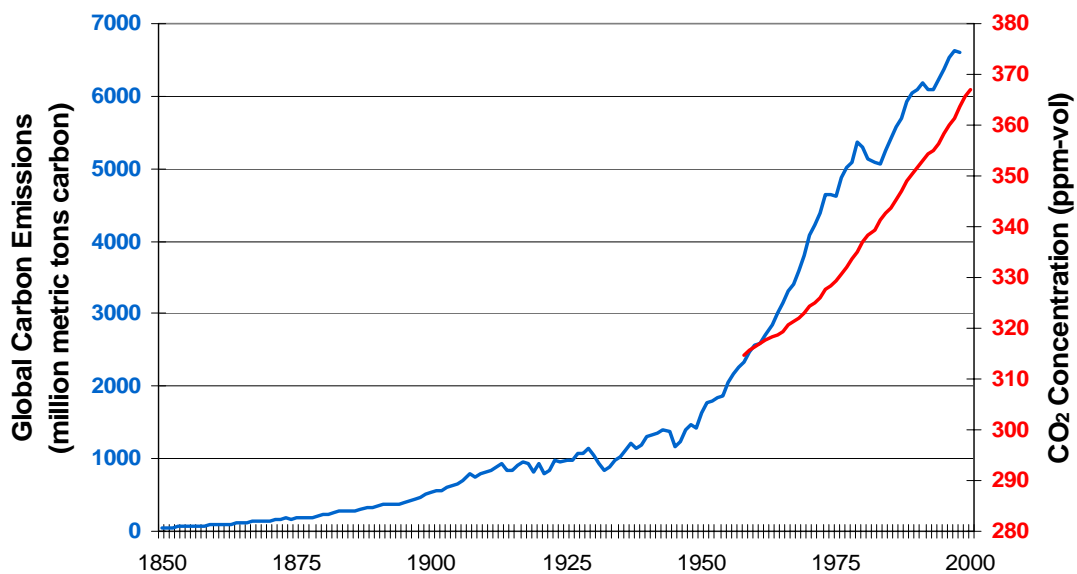
Coal poised to make a comeback

- At least 94 coal-fired electric power plants are now planned across 36 states.
- 50 new coal fired plants will add 120 million cubic feet of exhaust gas every minute.
- Would keep electricity prices low and boost energy security by offering alternatives to foreign oil and gas.
 - Christian Science Monitor, Feb 26, 2004



Long-Term Development of the Climate

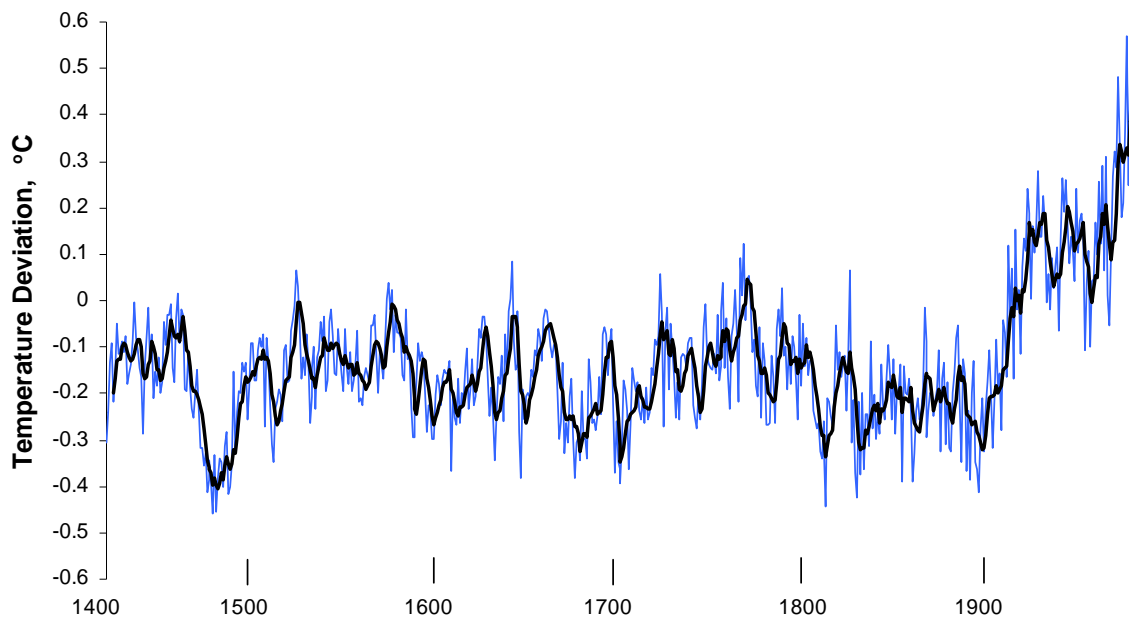
(Ref: Marland et al, Carbon Dioxide Information Analysis Center, 2003 and Keeling et al, Atmospheric CO₂ Record: A Compendium of Data, ORNL, 2004)



*** Atmospheric CO₂ concentrations (ppmv) derived from flask
*** and in situ air samples collected at the South Pole 10-Dec-01



Northern Hemisphere Mean Annual Temperature (1400-1998)



Ref: Alverson, et al, Paleoclimate, Global Change of the Future, 2003



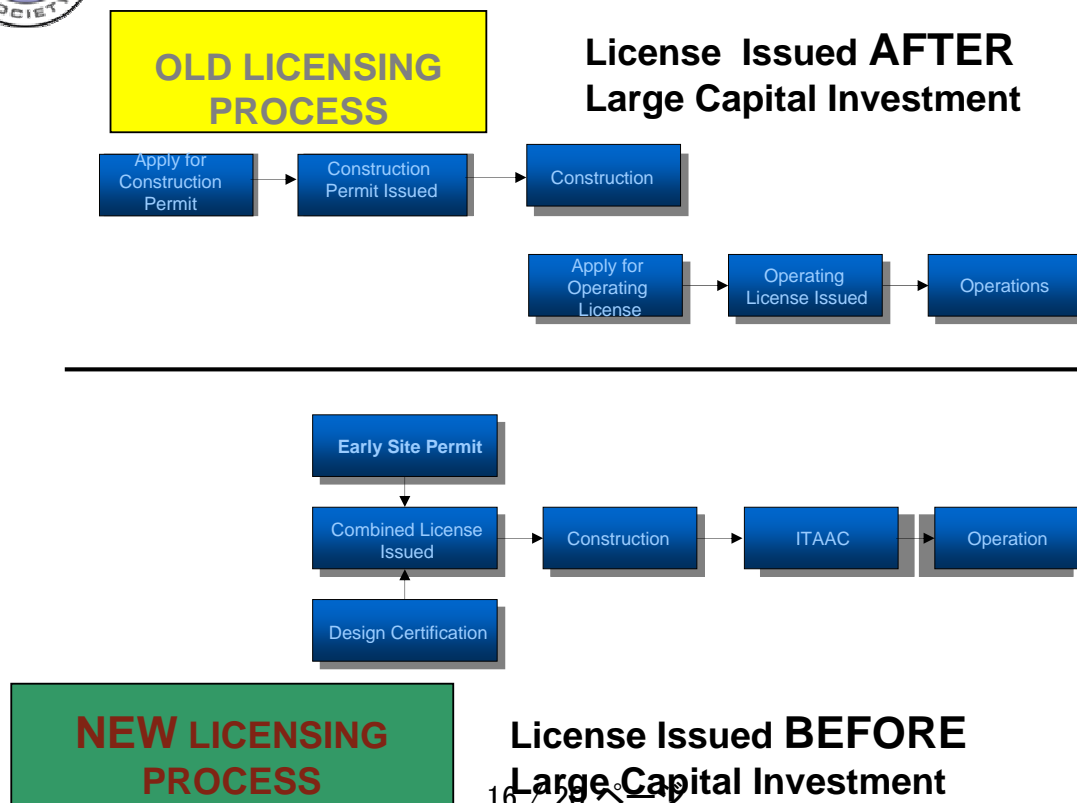
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- Environmental quality benefits
- **DOE 2010 Kick-in**



DOE 2010 Kick-in

- Three applications for Early Site Permits in review by NRC
 - Exelon, Entergy, Dominion
- On March 30, 2004, two consortia announced for demo of Combined Construction & Operating License (COL) process
 - Exelon, Entergy, Constellation, Southern, EdF, Westinghouse (AP1000), General Electric (ESBWR)
 - Dominion, AECL (ACR-700)
 - 50-50 cost share with DOE





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- DOE 2010 Kick-in
- **Energy for Hydrogen Production**



Hydrogen

- Reduces dependency on foreign oil, gas
 - Worldwide production of fossil fuels (oil and gas) expected to peak in 2007 and decline thereafter
- Can be renewable energy's best friend
 - Serve as the battery for renewables
 - Overcome some of the limitations for solar, wind, hydro and biomass

Hydrogen economy only makes sense if hydrogen is produced with non-fossil, non-emitting generation



Hydrogen from renewables

<u>Method</u>	<u>Needed for 1000 MW Electrical</u>	<u>Land Area</u> <u>(square miles)</u>
Photovoltaic	100 km ² @ 10% efficiency	40
Wind	3,000 Wind Turbines @ 1 MW ea.	40 - 70
Biogas	60,000,000 pigs or 800,000,000 chickens	
Bioalcohol	6,200 km ² of sugar beets	2,400
	7,400 km ² of potatoes	2,800
	16,100 km ² of corn	6,200
	272,000 km ² of wheat	104,000
Bio-oil	24,000 km ² of rapeseed	9,000
Biomass	30,000 km ² of wood	12,000
Nuclear	<1 km ²	1/3

Source: Dan Keuter, Entergy



However, even with all this good news . . .

No new plant orders in 25 years

WHY?



Top 10 - Nuclear Issues for Next New Plant in the U.S.

1. Financial markets
2. High cost for first new plant
3. Deregulation
4. Current low electricity demand
5. Lack of agility (construction time, licensing risk)
6. Infrastructure (workforce, lack of momentum)
7. Waste / transport
8. Safety culture tuning
9. Public perceptions (safety, security, terrorism, proliferation)
10. Never ending challenges (DB, TEPCO, Tokaimura)



Financial Issues in the U.S.

- Financial markets not prepared to finance high costs of first new plants
- Power company concerns about earnings dilution
- Concerns about delays in construction
- Concerns about recovering costs in a deregulated market
- No credits for non-financial benefits



Potential Mitigating Actions

- Equity investment, loans, loan guarantees, investment tax credits, accelerated depreciation
- “Standby credit facilities” for delays due to acts of government (regulator)
- Power purchase agreements
- Financial credits for non-financial benefits



Summary ...

- Political support for nuclear energy has not been this high since the 1960's.
- Power company interest in new build is returning.
- The business case for new build (or not) in the 2010-2015 timeframe will be largely made in the next two to three years.
- Industry and the Federal government are acting to identify and mitigate the business risks.