

Nuclear Education and Federal Support: Stability Needed

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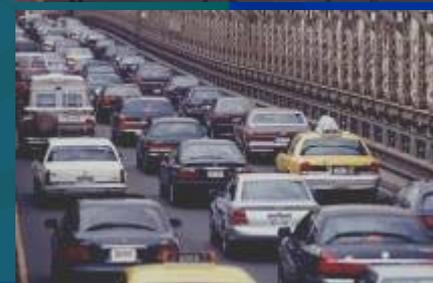
Outline

- Nuclear Renaissance in the U.S.
 - Nuclear Status
 - Evidence of Nuclear revival
- Nuclear Education in the U.S.
 - Work force demographics
 - University Nuclear Education
 - Federal Stewardship – DOE/NRC
- Looking ahead to '09
- Nuclear Education “Must Haves”
- Conclusion

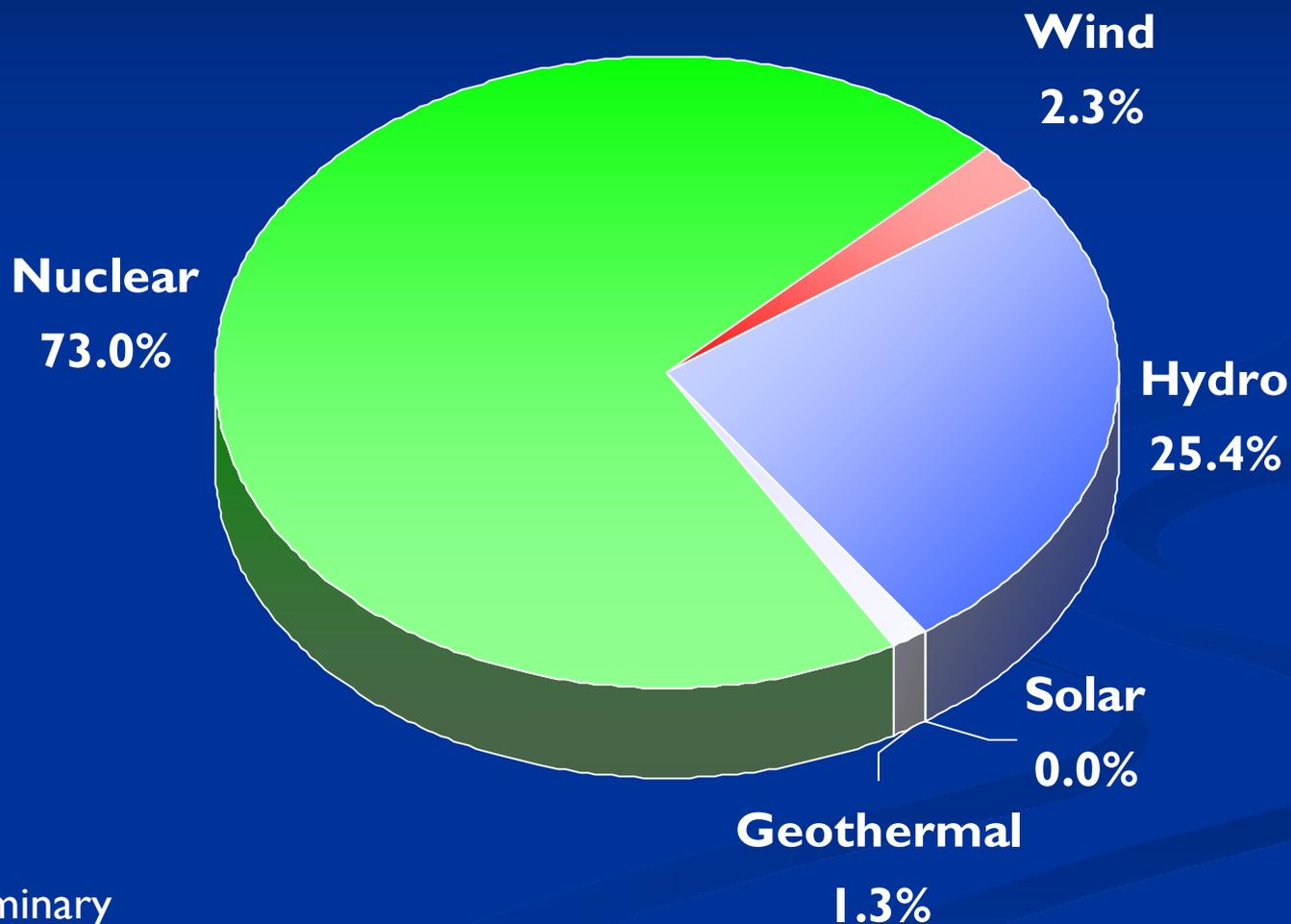
U.S. View of Nuclear Energy

■ Quick facts

- 104 nuclear plants
- 20% of the nation's electricity
- Displaces 680 million metric tons of CO₂/yr
- Equivalent to 131 million passenger cars/yr



U.S. Sources of Emission-Free Generation (2006*)

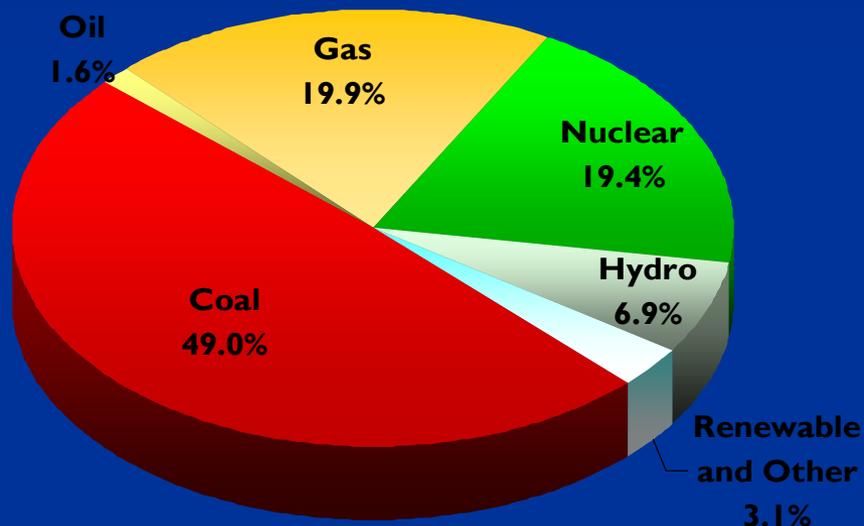


* Preliminary

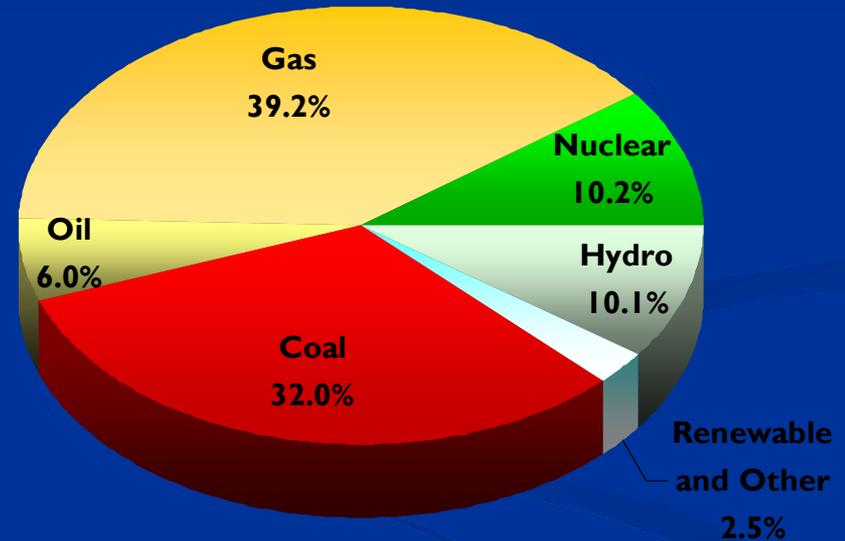
Source: Energy Information Administration

U.S. Electricity Generation and Net Summer Capacity Fuel Shares

Generation, 2006*



Net Summer Capacity, 2005



* Preliminary

Source: Global Energy Decisions / Energy Information Administration

Updated: 4/07

U.S. Capacity Factors by Fuel Type 2007*

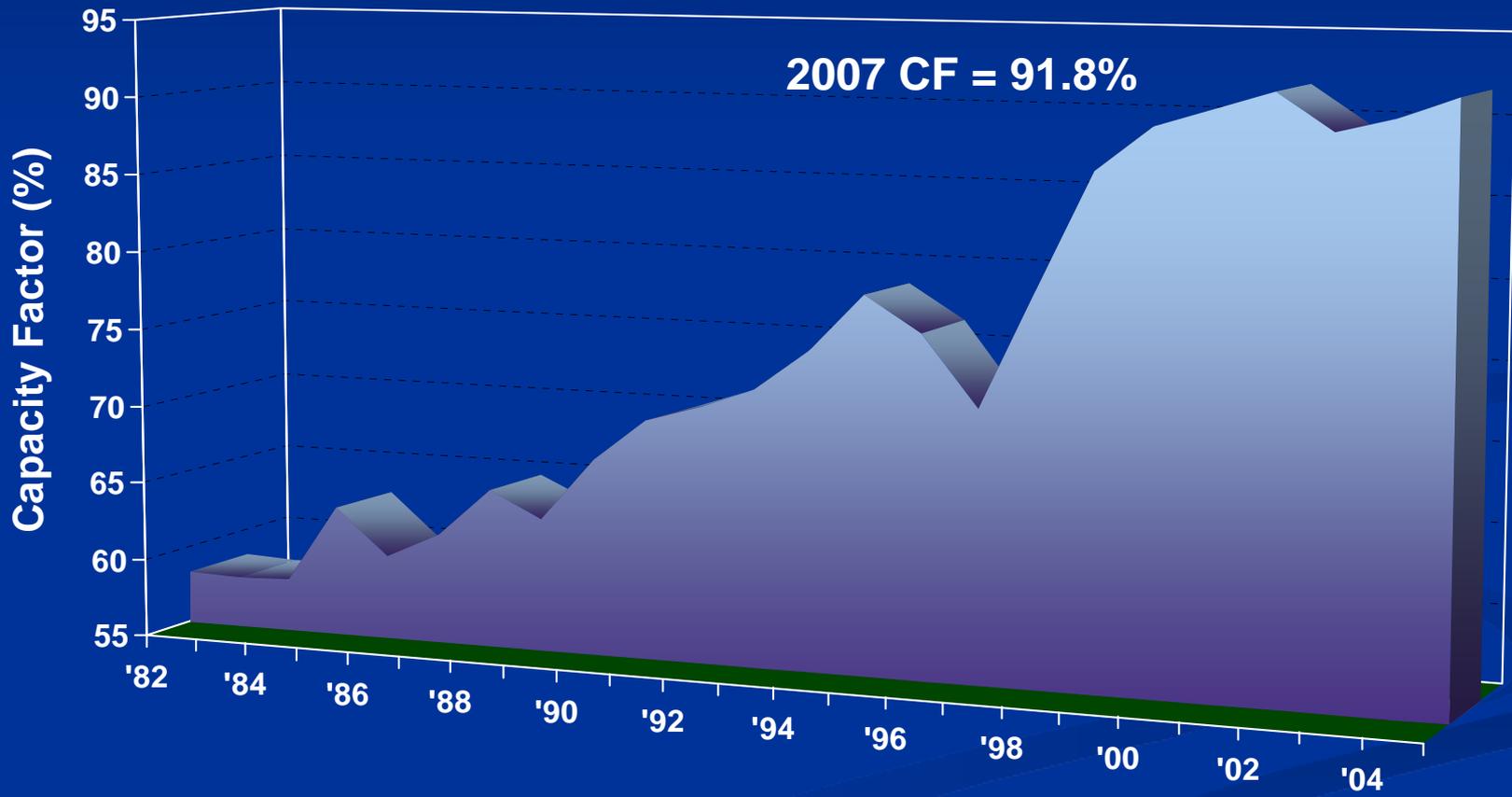
Fuel Type	Average Capacity Factors (%)
Nuclear	91.8
Coal (Steam Turbine)	71.8
Gas (Combined Cycle)	43.3
Gas (Steam Turbine)	16.0
Oil (Steam Turbine)	19.6
Hydro	27.8
Wind	30.4
Solar	19.8

* Preliminary

Source: Global Energy Decisions / Energy Information Administration

Updated: 4/08

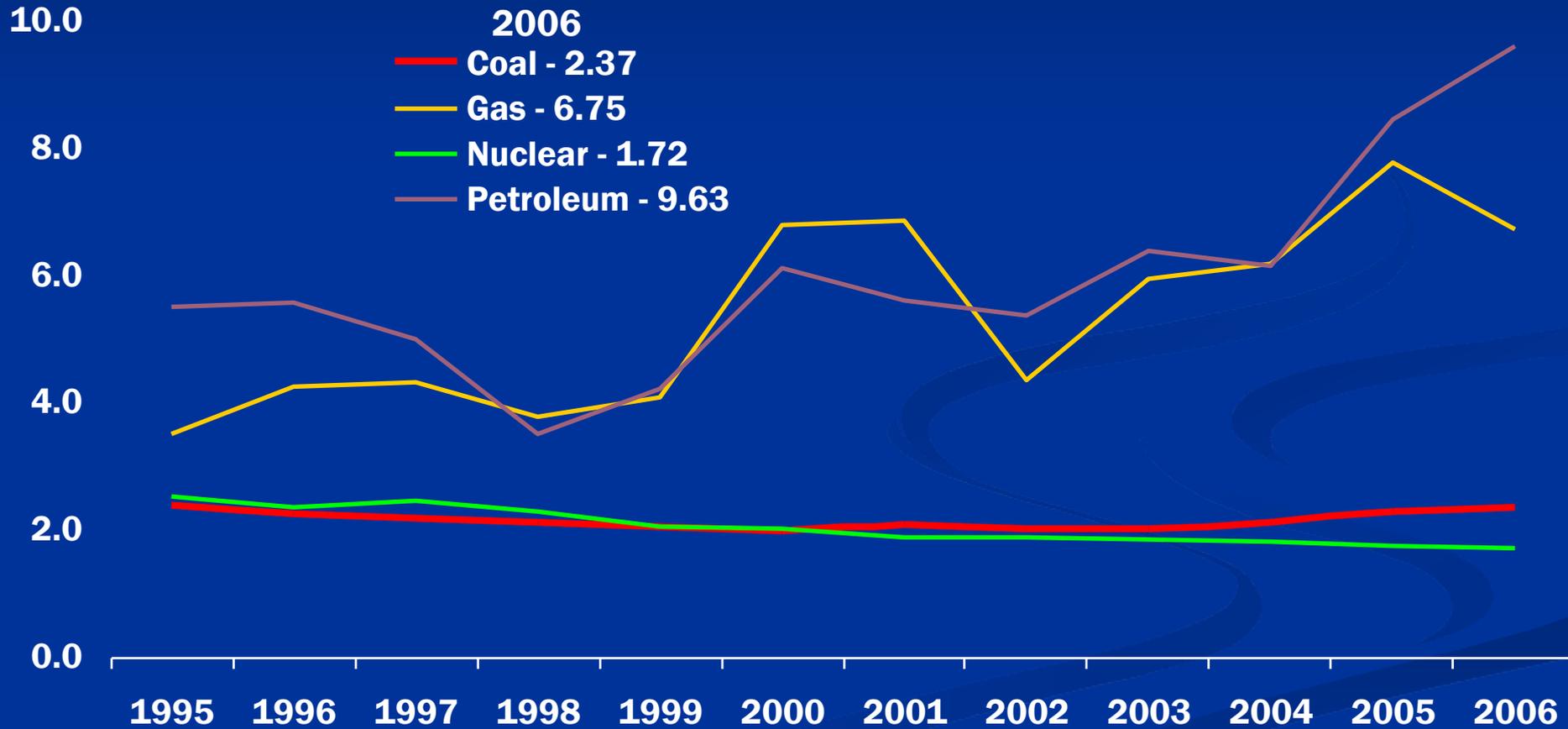
Proven Performance



Source: Energy Information Administration/Nuclear Regulatory Commission

U.S. Electricity Production Costs

1995-2006, *In 2006 cents per kilowatt-hour*

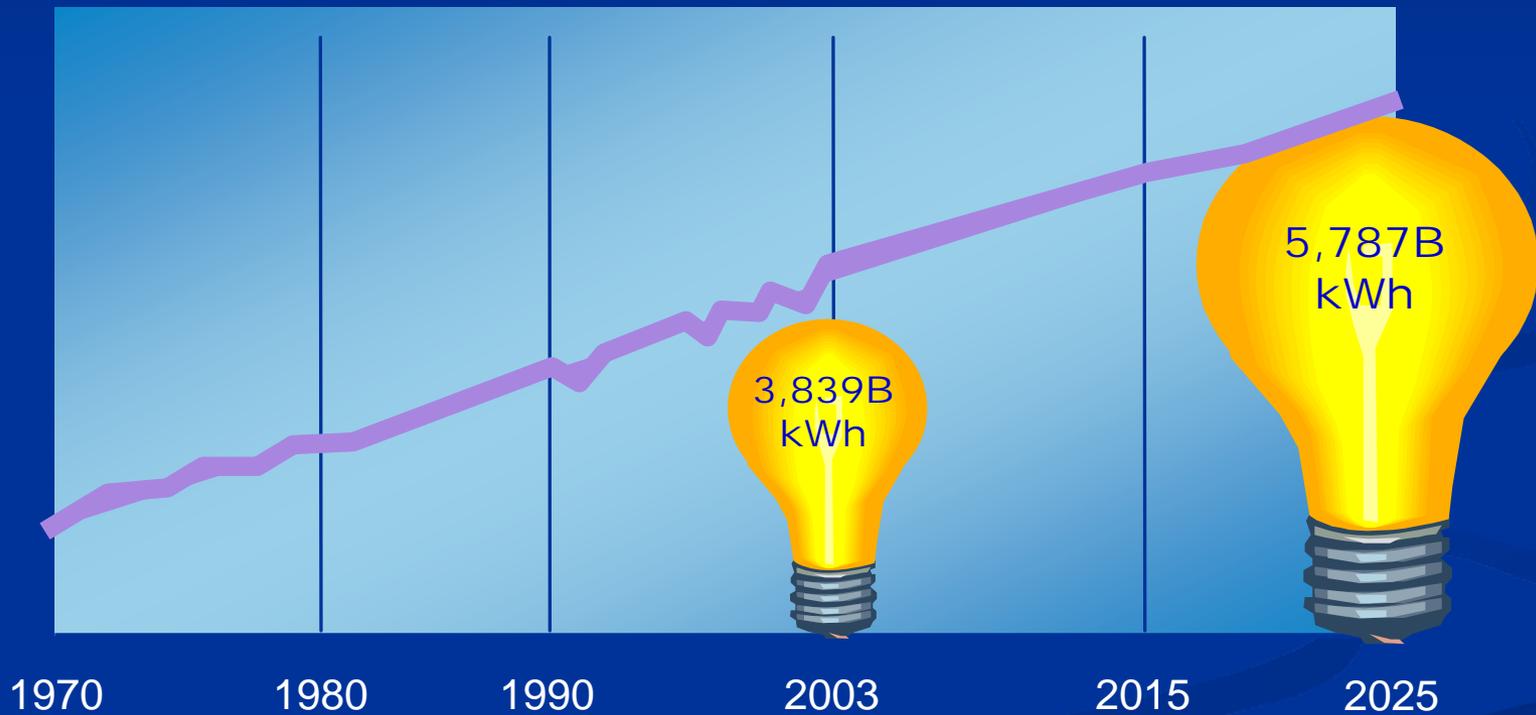


Production Costs = Operations and Maintenance Costs + Fuel Costs

Source: Global Energy Decisions
Updated: 6/07

U.S. Energy Demand

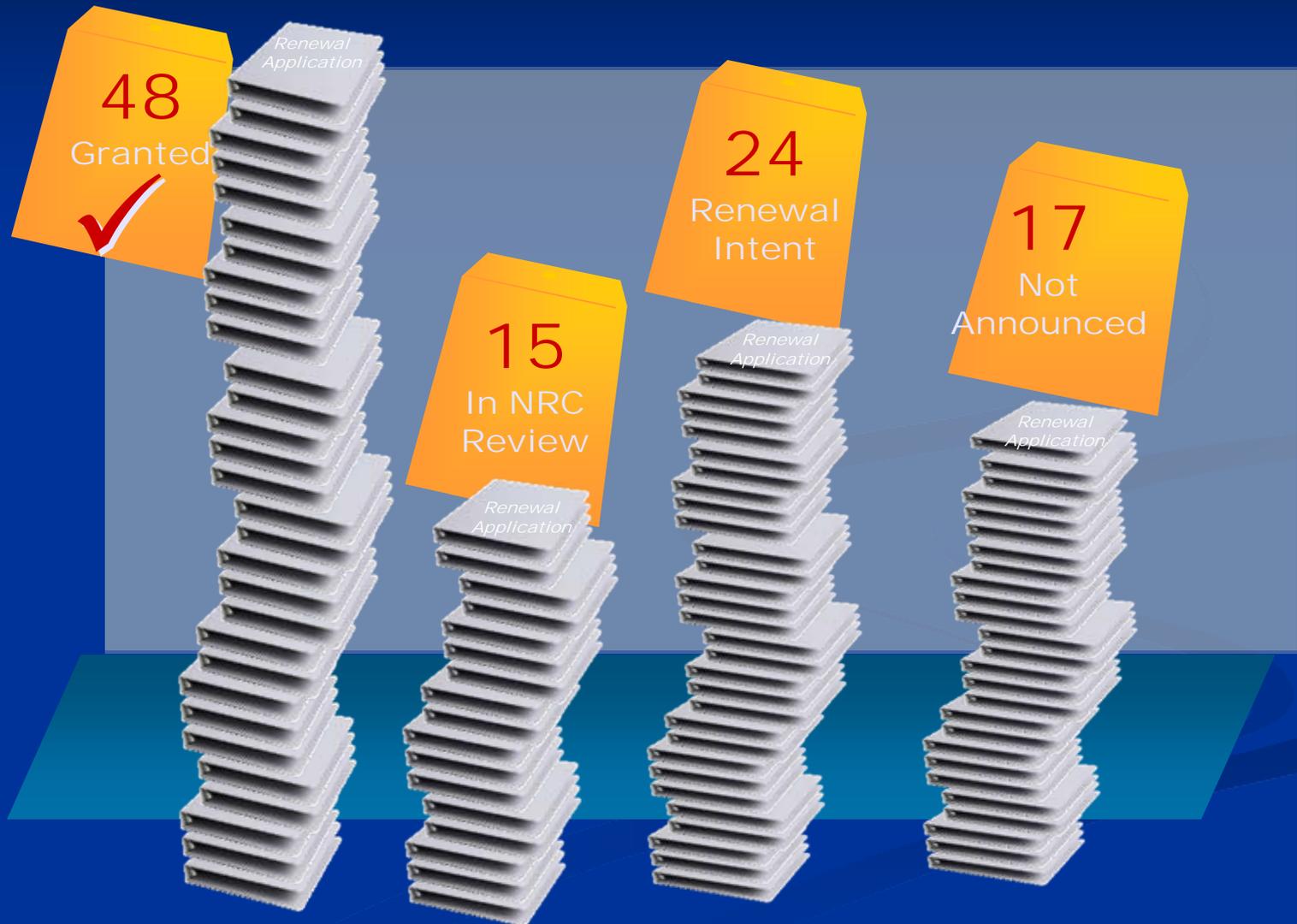
50% More Electricity by 2025



Source: U.S. Department of Energy

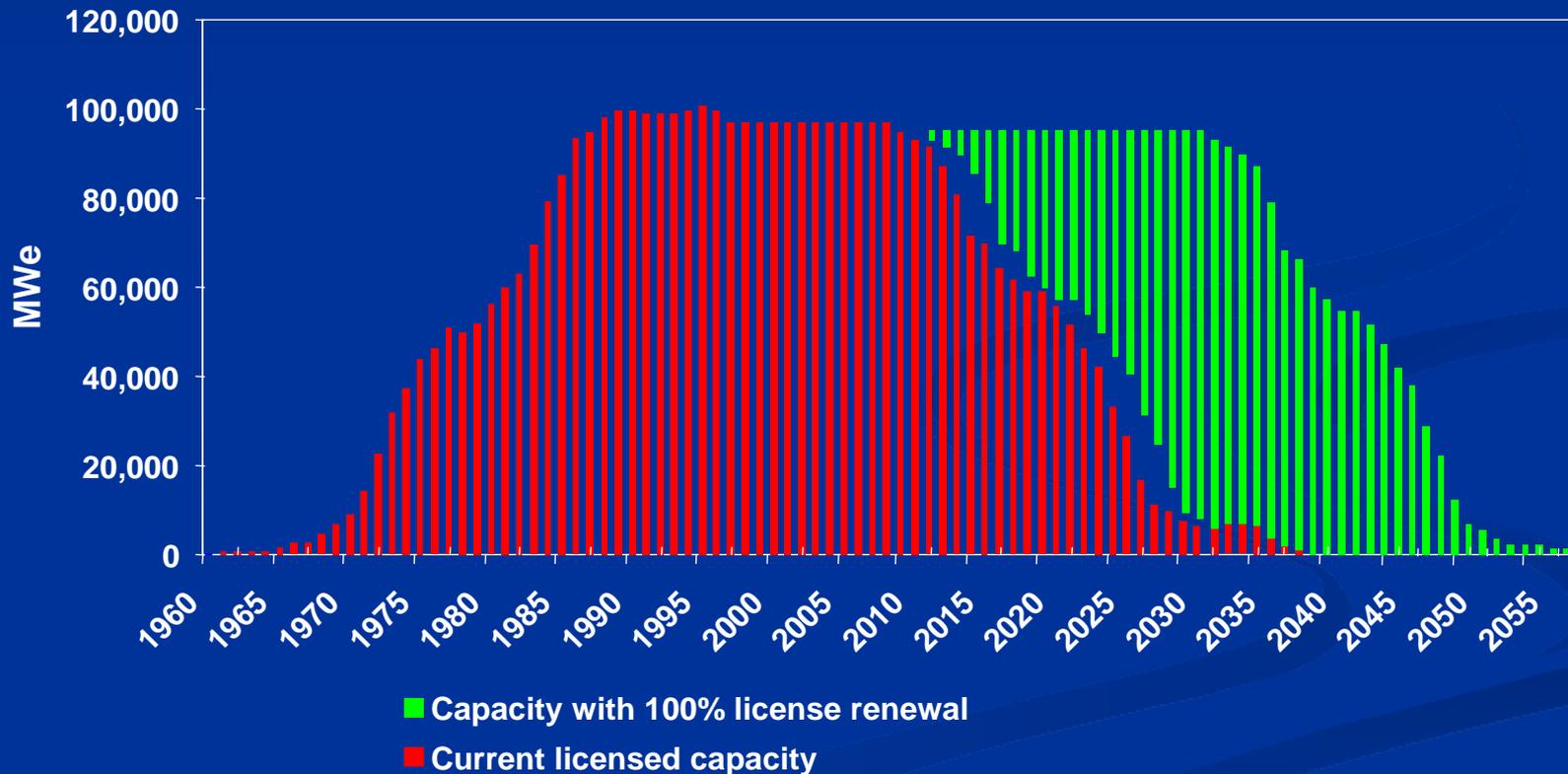
Evidence of Nuclear Revival – 1

License Renewals



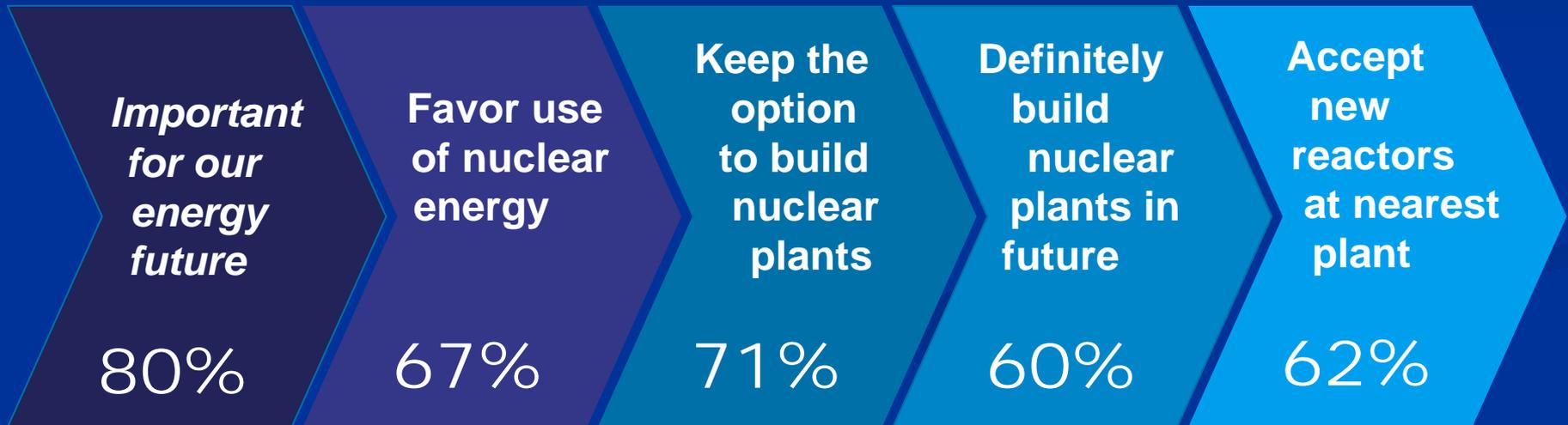
Source: *Nuclear News*, March 2008

U.S. Nuclear Generating Capacity With and Without License Renewal



Evidence of Nuclear Revival -2

Increasing Public Support



Source: *Bisconti Research Inc.*

Evidence of Nuclear Revival - 3

Existing or Expected Applications

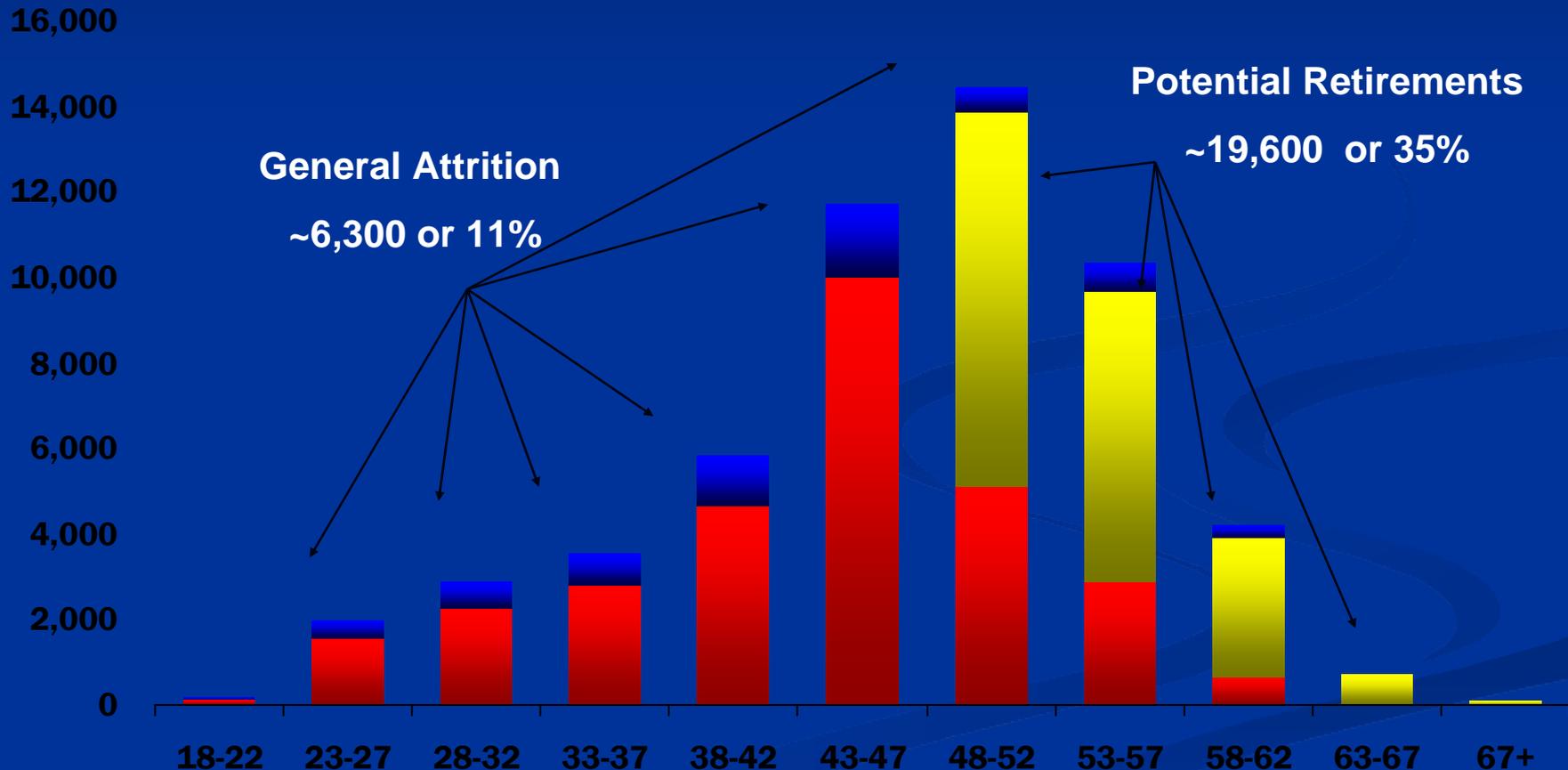
Reactor Type	Number
AP1000 (Westinghouse)	11
EPR (AREVA)	5
ABWR & ESBWR (GE)	7
TBA	10
Total	33

New Reactors Planned



Demographics of Today's Workforce

~56,000 direct nuclear plant employees



Potential Retirees are defined as employees that will be older than 53 with 25+ years of service, or older than 63 with 20 years of service, or older than 67 within the next five years.

Source: 2007 NEI Pipeline Survey

U.S. Nuclear Industry Workforce

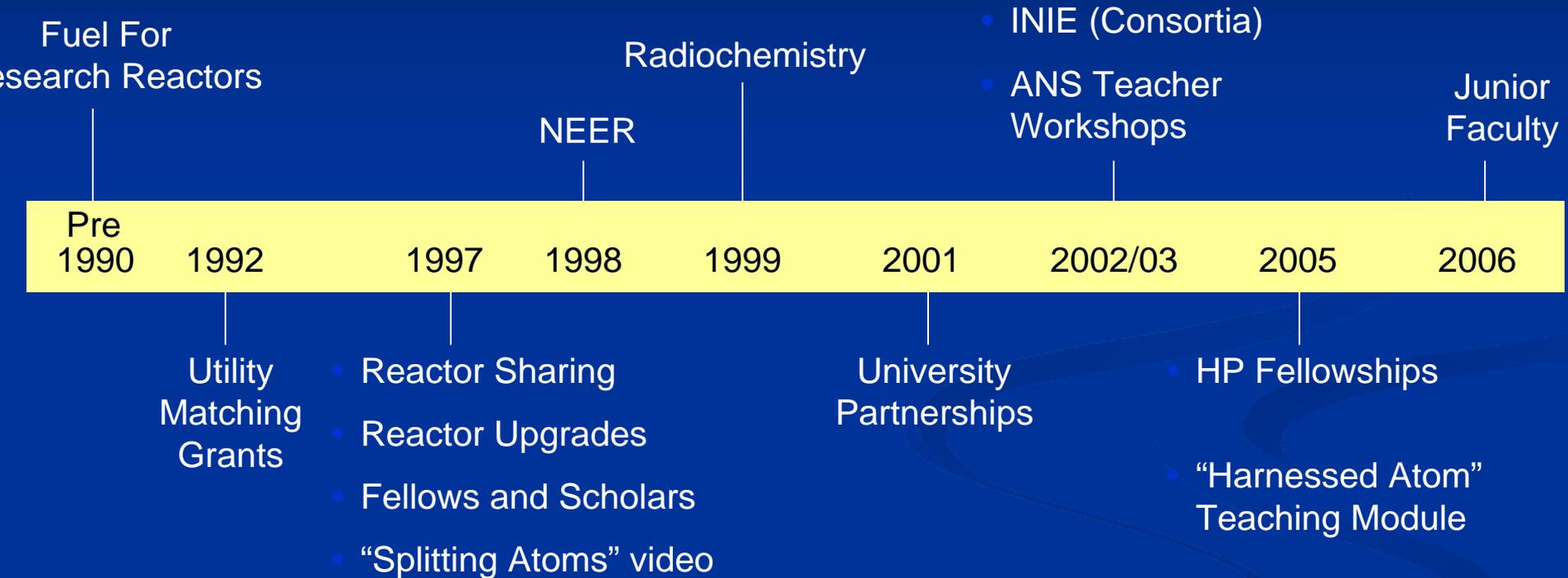
- Ageing Workforce – approaching retirement
~ 35% eligible to retire next 5 years
- Entry level workers – Everyone is hiring
~ 90,000 engineers, operators, technicians
needed over the next 10 years
- Nuclear Engineering Education Programs –
needed to help supply the needed workforce

University Nuclear Education Historical Overview

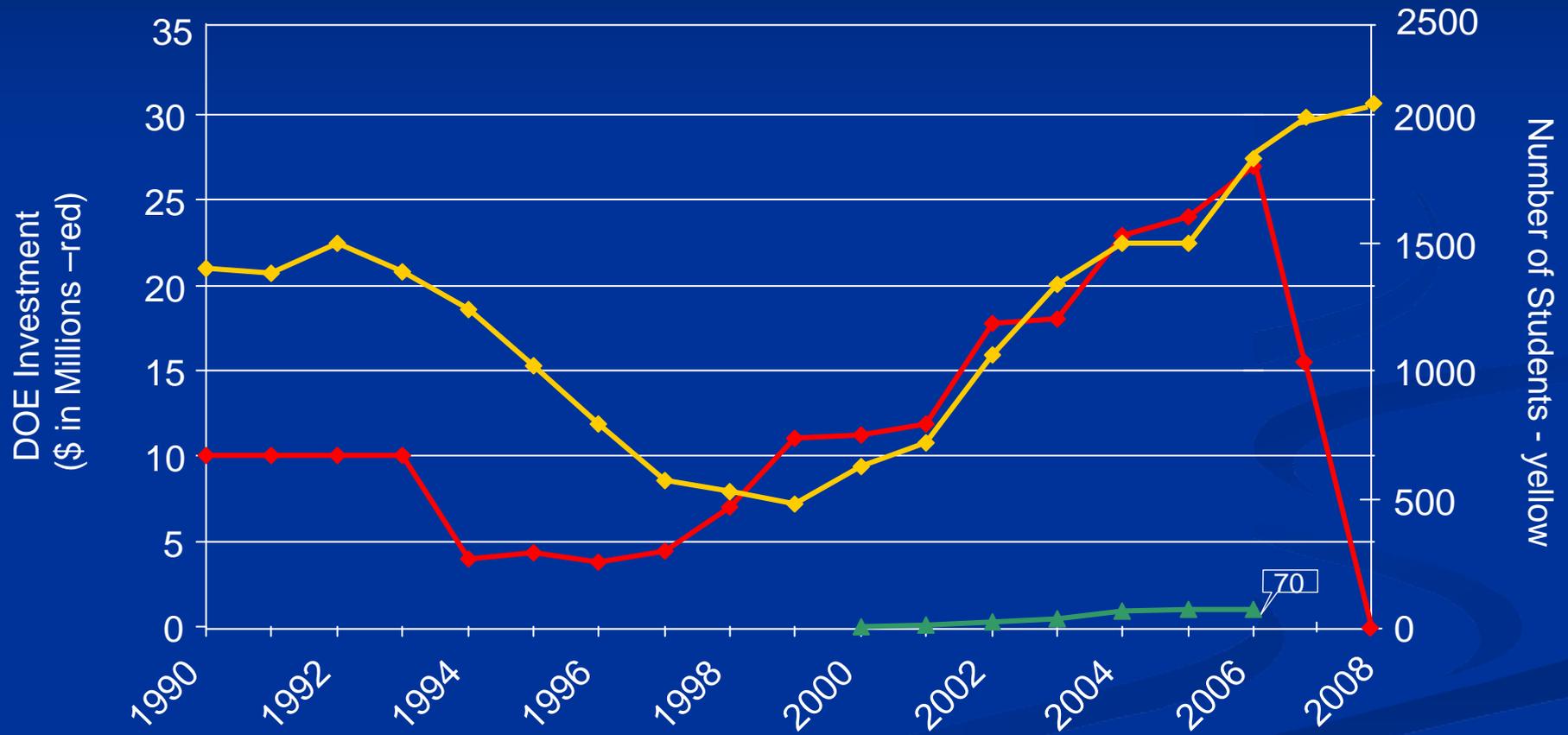
- University Research Reactors
declined from ~ 66 to just 26
- NE student population
1800 to 600 to 3300 and counting
- University Nuclear Engineering Programs
~ 50 to ~25, but growing to more than 30
- Federal Investment in NE Education Infrastructure
10 MM to 5 MM to 27 MM, now 15 MM
(Source of Funding: DOE-NE until 2007, now NRC)

University Program Timeline

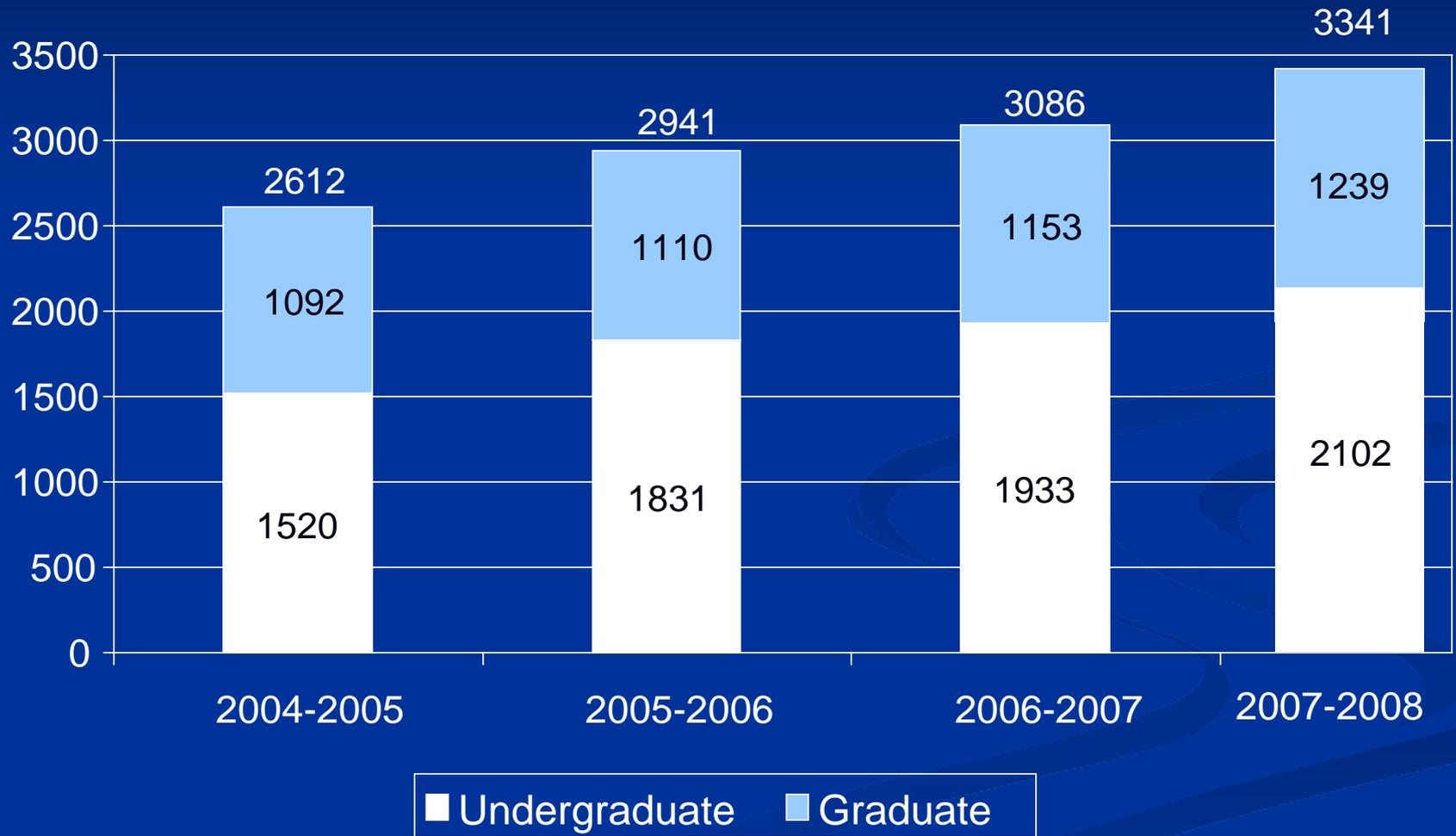
(How we spent \$27 million.)



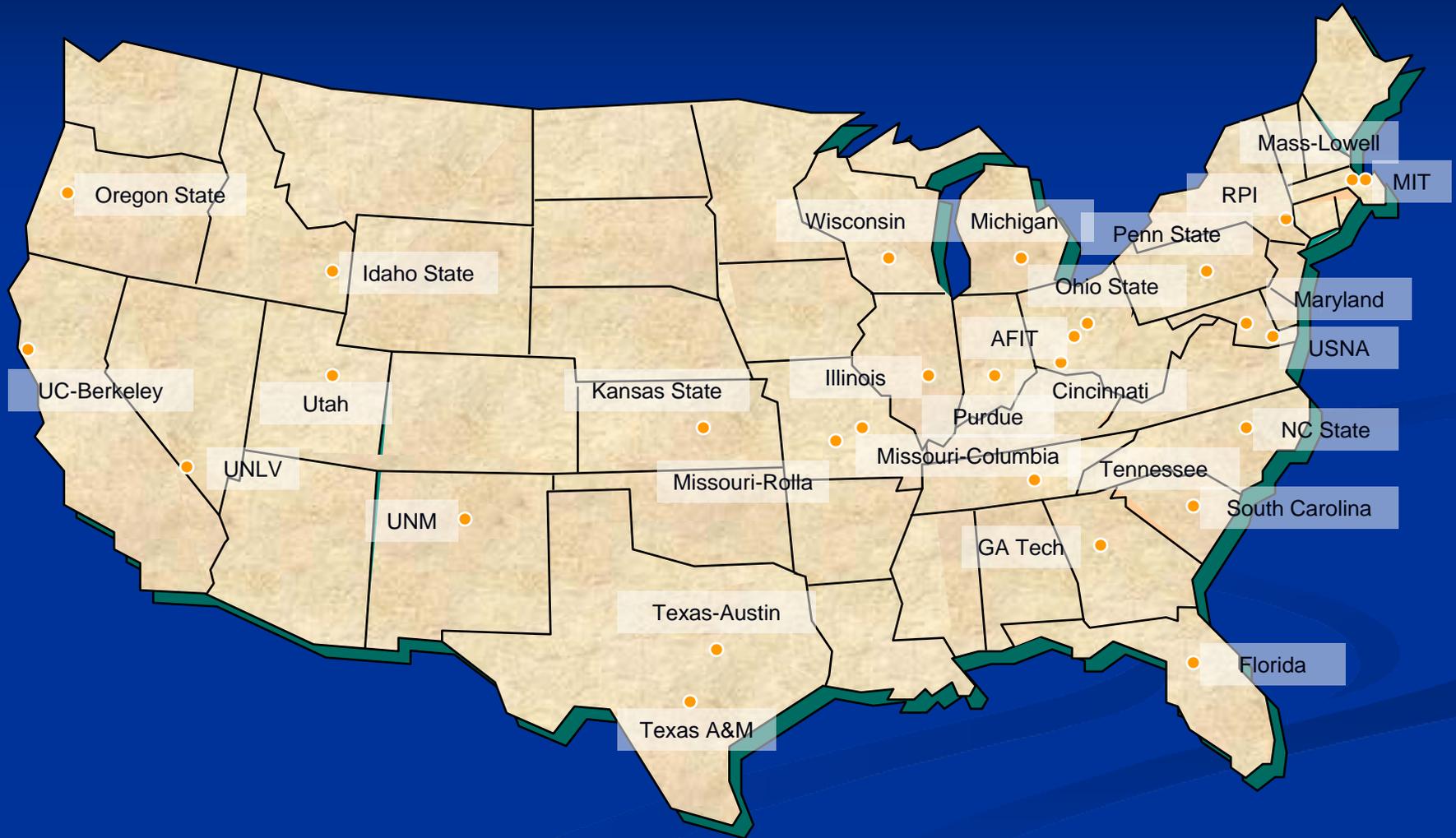
Trends In UG Enrollment and DOE Investment



Recent NE Enrollment Trends (2004-2008)



Nuclear Engineering Programs



Federal support for NE Programs

The “End of the Beginning”

- Summer 2006 – “Enrollment Metric” reached - Most nuclear engineering education funding terminated within the DOE-NE – **“the University Program is no longer considered essential to encourage students to enter into nuclear related disciplines.”**
- FY 2007 – No funds requested but Congress directs DOE to fund NE education programs
 - DOE funds only university research (NERI) - No funds for university infrastructure/workforce
- FY 2008 – limited NE funds for University Research

A New Beginning: A Shift To NRC Stewardship

FY 2008 Legislative Language For NRC

- ... develop a workforce capable of the design, construction, operation, and regulation of nuclear facilities and the safe handling of nuclear materials
- ...funds are to be used for
 - undergraduate student scholarships
 - graduate student fellowships
 - faculty development
 - trade schools scholarships
- benefit the nuclear sector broadly rather than solely to benefit the NRC

NRC Programs

- FY 2008 – \$15 M to Support NRC Programs
- NRC issues 3 Solicitations in February 2008
 - Fellowships and scholarships
 - Faculty development
 - Trade school scholarships
- Awards made summer 2008 for up to 4 years

NRC Grant Program Status

- A total of 99 proposals were received: 32 for Faculty Development, 61 for Scholarships and Fellowships, and 6 for Trade and Community College Scholarships
- Each group of proposals was peer-reviewed by at least three experts from universities, industry, national laboratories, and NRC
- Proposals were received from 49 institutions representing 24 states and Puerto Rico
- Preliminary results indicate that approximately 49 of the 99 proposals (~50%), representing 18 of the 24 states, and 33 of the 49 educational institutions will receive funding

Other Areas Requiring Support

- **University research reactors** – fuel and facility upgrades
- **Student Internships** – in agencies, laboratories, and industry
- **Faculty Research Grants** in nuclear engineering and science
- **Student Exchange** - International component.
- **Pre-college outreach** - Teacher workshops, Harnessed Atom
- **Cooperative programs** - universities, government, industry
- **Community College programs** - nuclear trained workers (e.g. technicians, radio-chemists, welding, NDT, construction trades)

Current Thinking: What's in Mind for FY '09

- House subcommittee has indicated funding of \$15M for essentially the same NRC program as FY '08
- Senate subcommittee language states “To be effective Nuclear engineering programs must have sustained support for multiyear research projects and modern curricula.”
- The Senate subcommittee added \$15M each to NE, NRC and DNN (NNSA) of which “\$10M shall be used by each organization to support university R&D in areas relevant to the organization’s mission; and \$5M will be used by each... to support a Nuclear Science and Engineering Grant Program.”
- “The grant program will be coordinated and jointly implemented by NE, NRC and DNN.”

Thoughts on “Must Haves” to Build the Future Workforce

- **Sustainability** – Workforce development and infrastructure support must be an integral part of the budget for the foreseeable future
- **Sponsors** – NE, NRC, NNSA/DHS and others
- **Division of Labor** – Mission and non-mission-related research, fuel (NE); workforce development and some infrastructure (NRC); non-proliferation (safeguards/forensics -NNSA/DHS)
- **Innovative approaches** (not prescribed) and educational outreach (NE and NRC)
- **Non-government support:** Industry, university, and utility cooperation and cost-share

Conclusion – Sustaining Nuclear Education

- Nuclear Industry serves the national interest by providing 20% of electrical output without CO₂ emissions by starting to build the next wave of needed nuclear plants
- Nuclear Engineering Programs serve the national interest by providing required well educated and trained workforce
- Federal government provides stewardship support by providing funding for nuclear engineering and related programs (graduate, undergraduate, community college, trade schools, and K-12) to rebuild the workforce
- Federal support must be an integral part of the budget and not dependent on annual congressional add-ons and political winds
- All areas must be funded: research, infrastructure, workforce, outreach, etc. but funding must be available for innovative ideas that arise

