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Nuclear Industry Update

February 2008

Public Utility Research Center

Jerry Paul

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Topics

- Current industry conditions
- Future industry
  - factors influencing renewed interest
  - new regulatory environment
  - new plant technologies

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Current Nuclear Statistics

- United States
  - 104 operating reactors
  - 64 plants
  - 0 new plants under construction (1 recently restarted)
  - last unit ordered in the 1970s
- Worldwide
  - 436 operating reactors
  - 30 countries
  - 30+ under construction in 12 countries
  - China plans ~40 new plants by 2020

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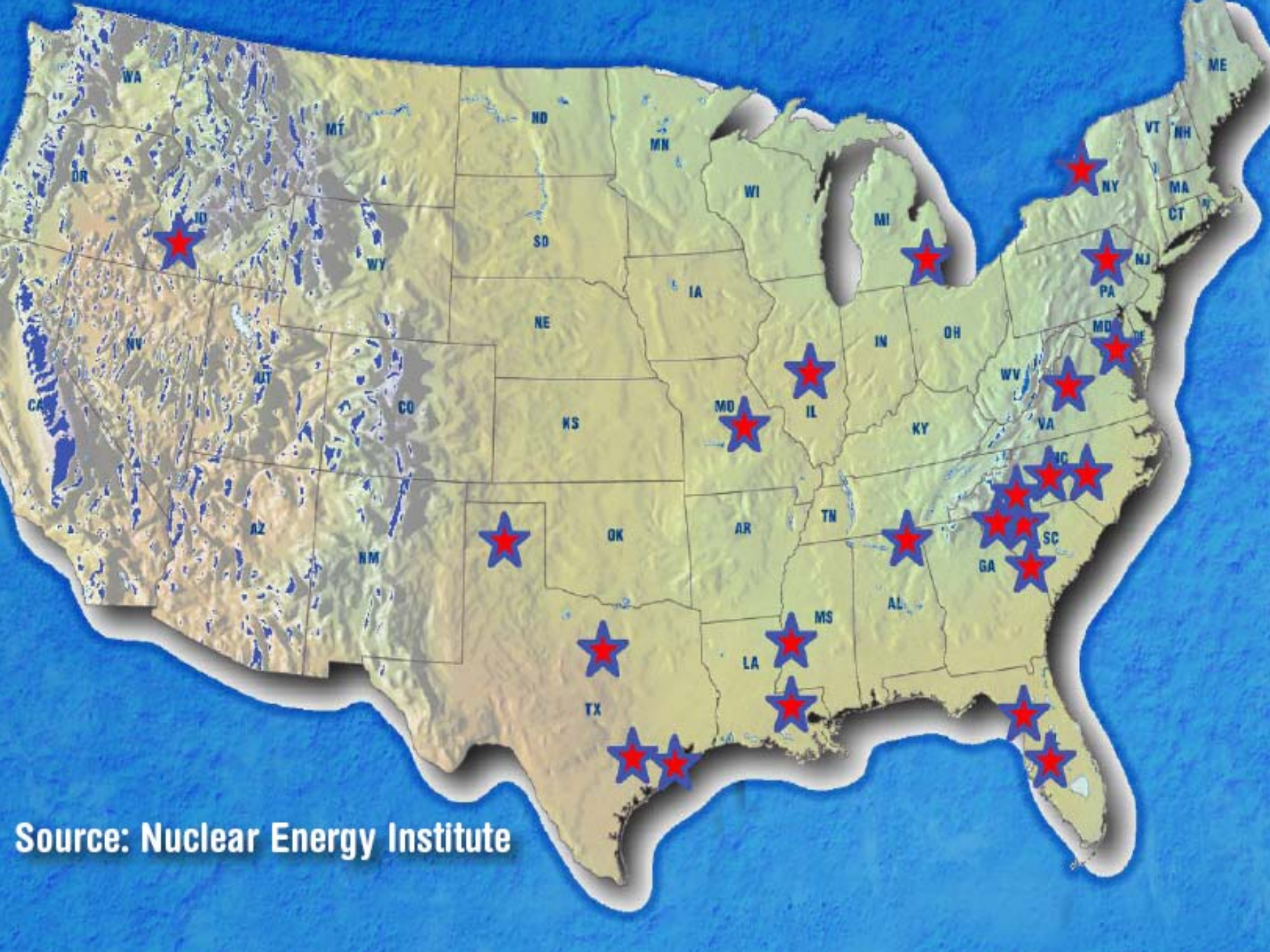
Future Nuclear?

- 17 companies have announced plans to prepare combined construction permits and operating licenses (four submittals in 2007, remainder expected in 2008)
- Three sites approved through the Early Site Permit process, one under review
  - Others combining siting and licensing stages
- Five designs approved or under review
- Estimate that 15 – 20 new plants could be on-line by 2020
  - *If first projects are completed on schedule and within budget projections*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Source: Nuclear Energy Institute

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Why Are Companies Considering New Nuclear?

- Need for additional generating capacity
- Fuel diversity / price volatility
- Reliability and performance of existing plants
- Environmental benefit
- Public support
- Competitive cost

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Capacity Needs

- By 2030, DOE projects electricity nationwide demand will increase 35%
- By 2030, 40% of the nation's population will live in the South
- In the next 15 years, projections indicate electricity demand in the Southeast will increase 30%

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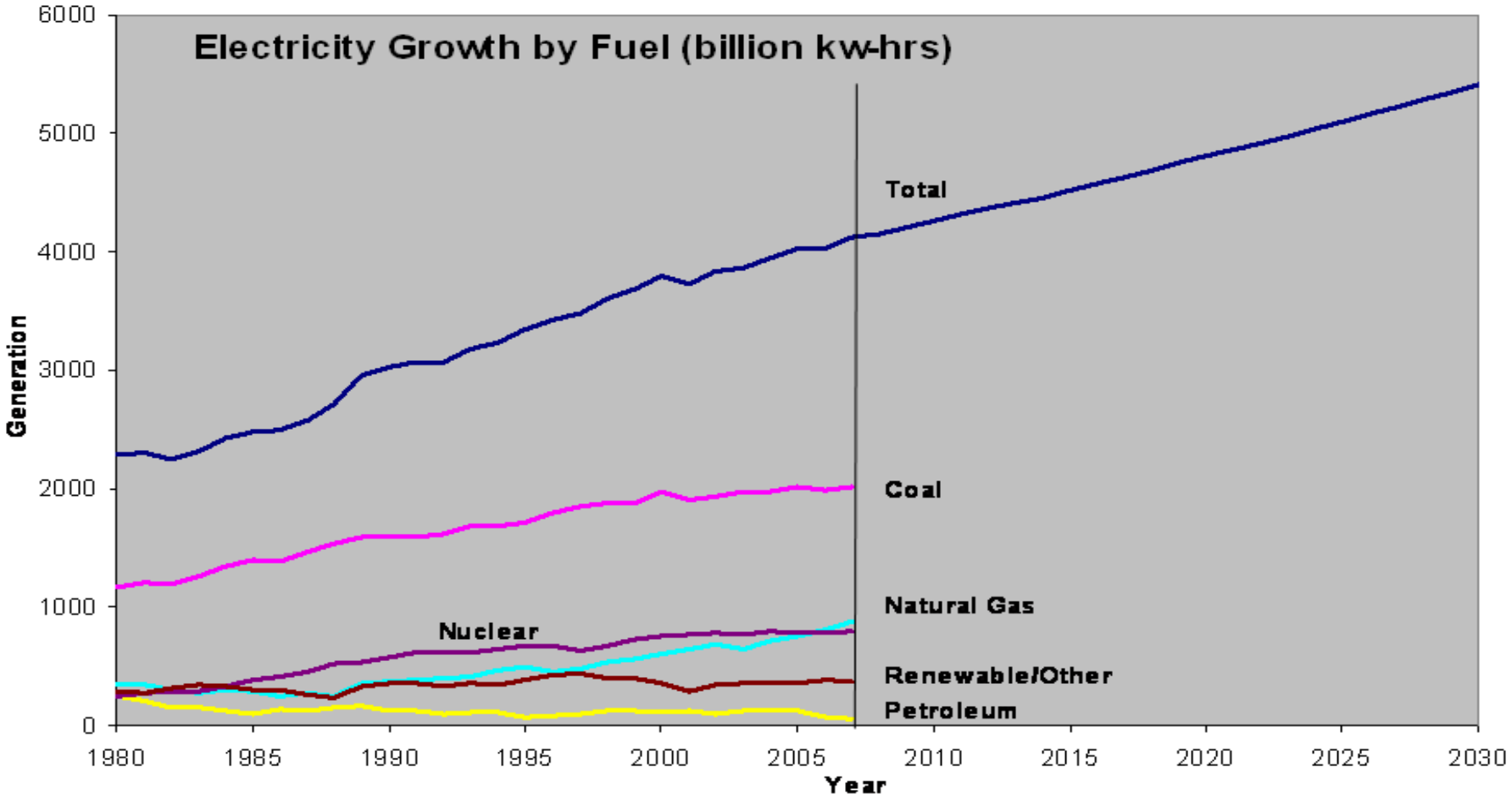
U. S. Projected Energy Growth Needs



Source: DOE Annual Energy Outlook, Dec 2007

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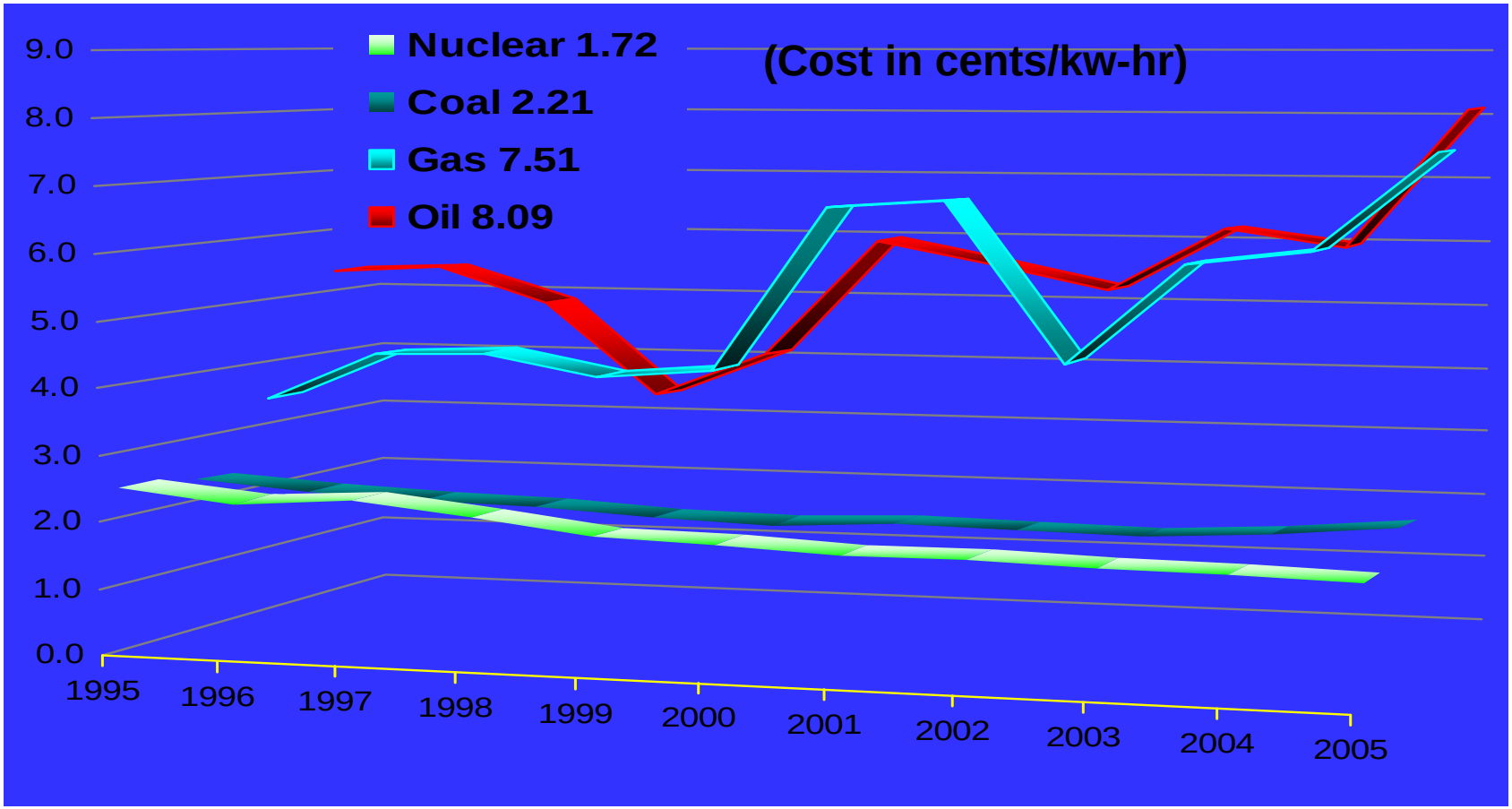
Production Costs



Source: Global Energy Decisions, NEI

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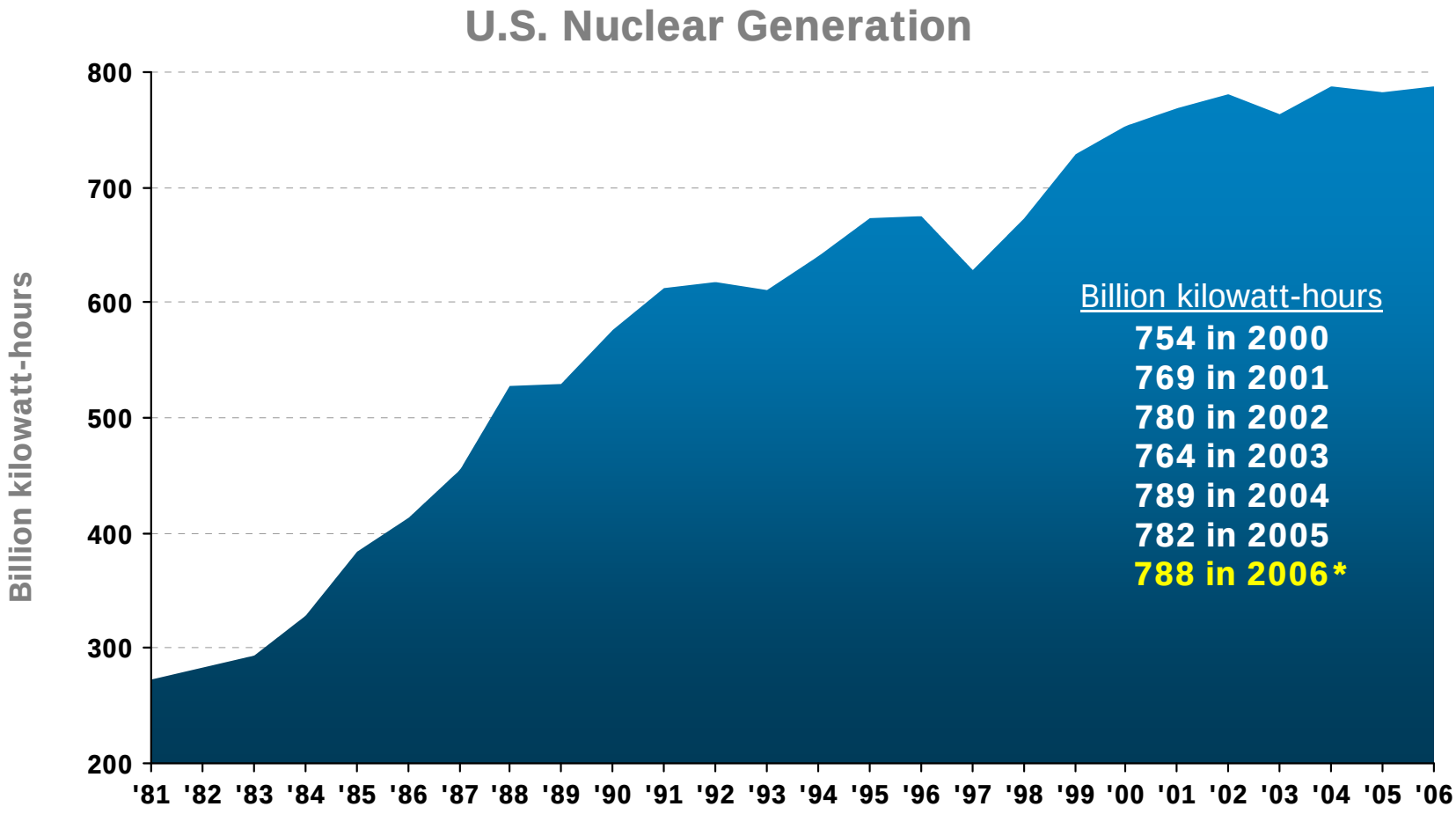
Performance of Existing Plants



Source: Global Energy Decisions / Energy Information Administration

** NEI estimate for 2006*

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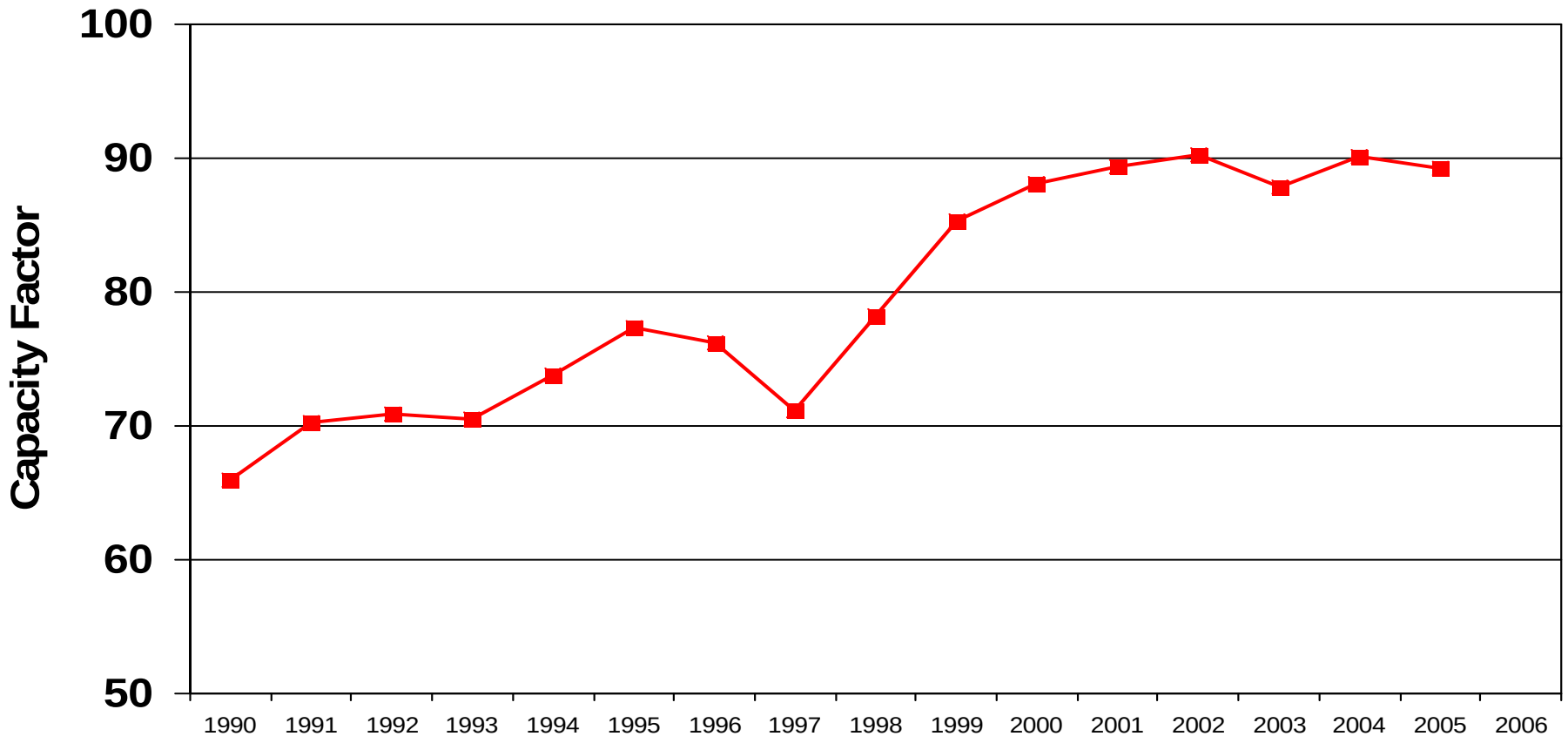
Reliability and Performance of Existing Plants



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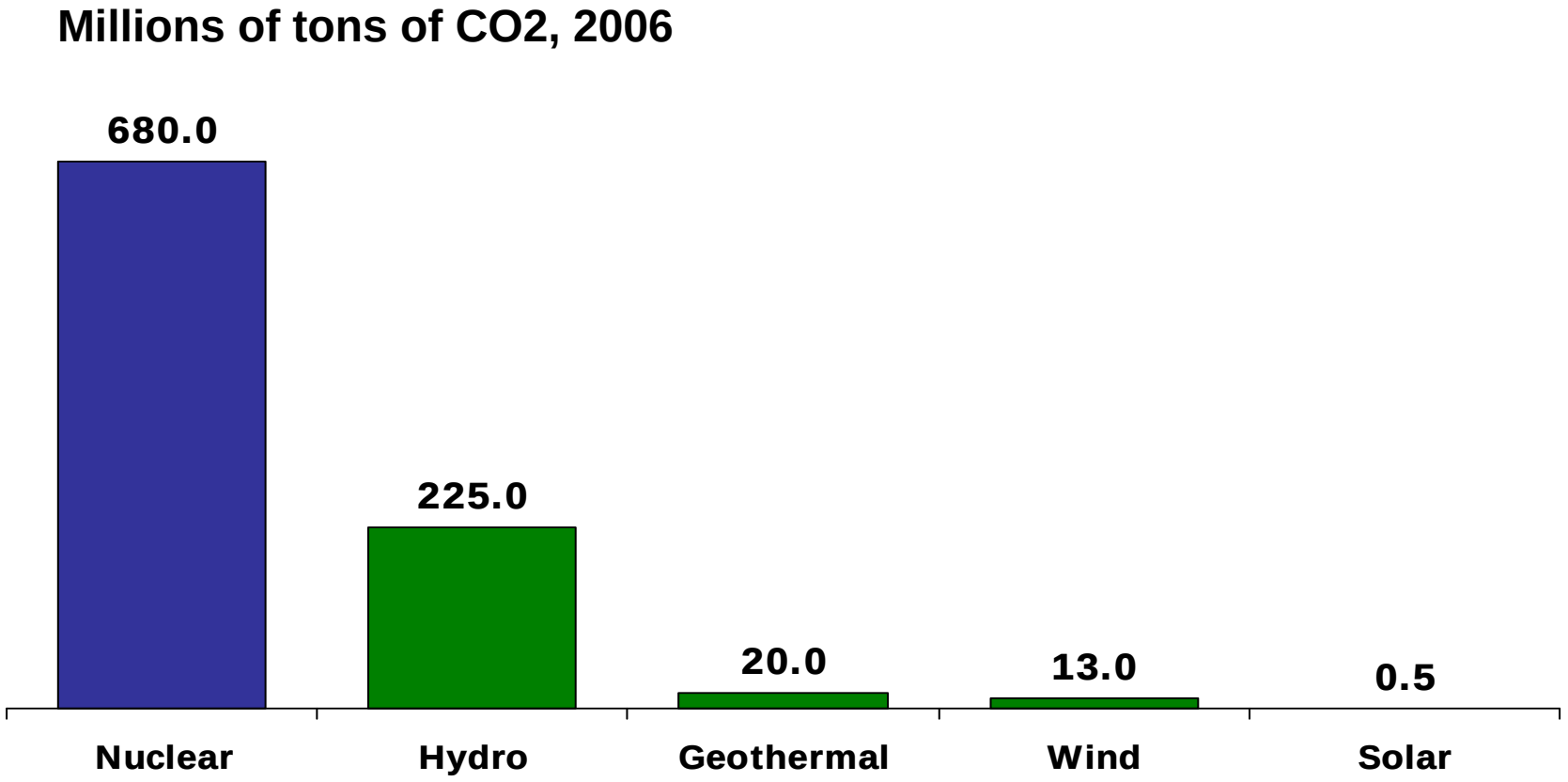
Avoided Emissions



Source: Emissions avoided are calculated using regional and national fossil fuel emissions rates from the Environmental Protection Agency and plant generation data from the Energy Information Administration.

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Public Support

2007 Survey of People within 10 Mile Radius of a Operating Nuclear Power Plant

- **88%** Have favorable impression of the local plant
- **71%** Thought adding a new unit at the local plant acceptable
- **82%** Favor the use of nuclear energy

Source: Bisconti Research, Inc.

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Competitive Cost

- Revised Nuclear Regulatory Commission Licensing Process
- Use of Standardized Designs
- Industry Cooperation
- Effective Project Execution
  - Integrated Design/Procurement/Construction Plan
  - Modular Construction

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New Regulations

- Old Process - Licensed during Construction
- New Process – Licensed before Construction

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’70s & ’80s & New Plant Deployment Issues

- Licensing proceedings occurred at the end of the process
- Configuration control
- Project management
- Design – often only 20% complete at start of construction

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Part 52 Process (NEW)

- Resolves safety issues before the start of construction
- Increases public involvement
- Makes more information available to the public at the appropriate time in the process
- Adds certainty & predictability
- Increases public & investor confidence

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New Licensing Process (Cont'd)

- Three-part process:
  - Early site permit (ESP)
  - Design certification (DC)
  - Combined license for construction and operation (COL)
- Applicant can combined the three parts into one application
- Safety issues are resolved prior to construction
- More information available to the public earlier
- More opportunity for public participation at the appropriate time

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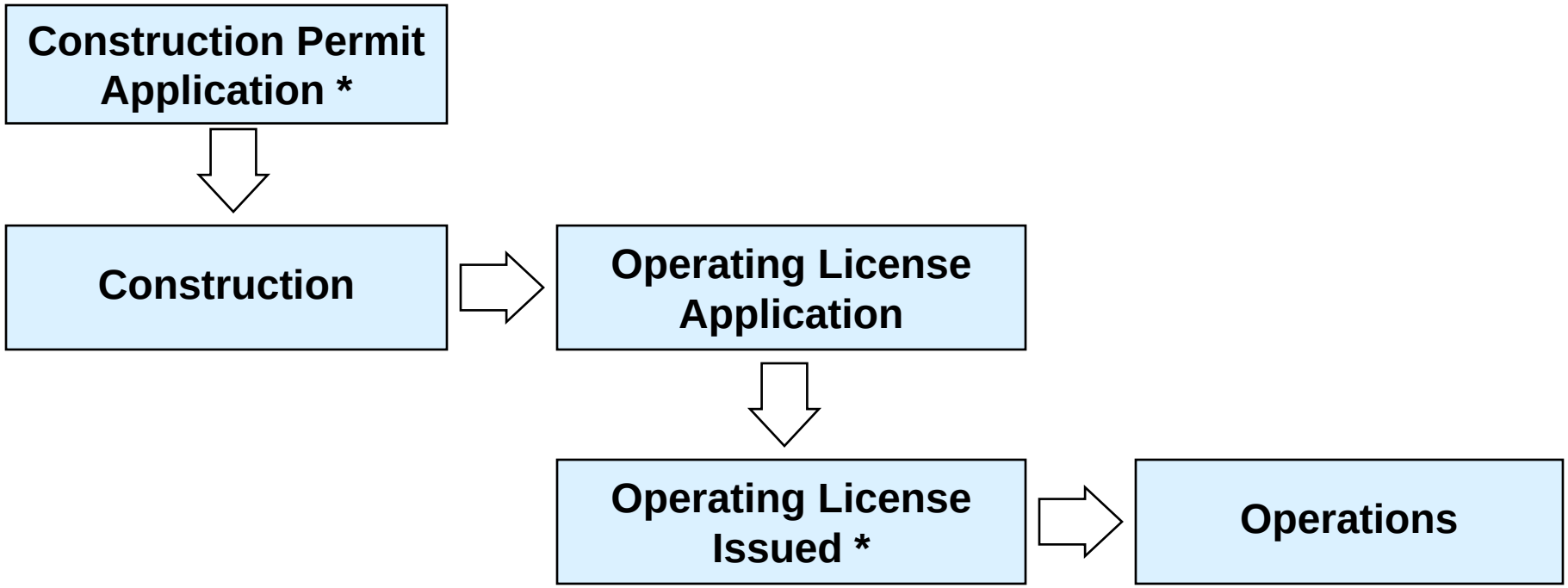
Public Comment Opportunity: Old Licensing Process



* Public Comment Opportunity

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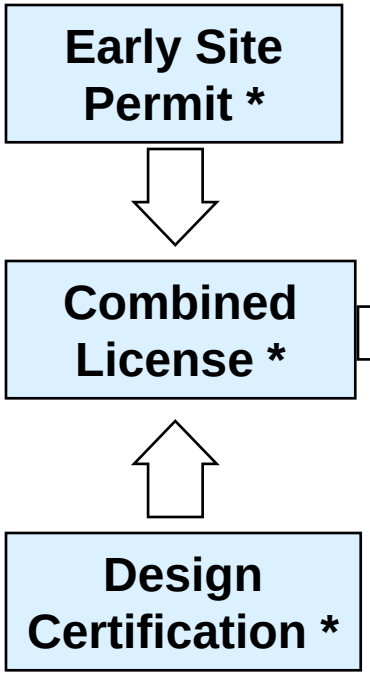
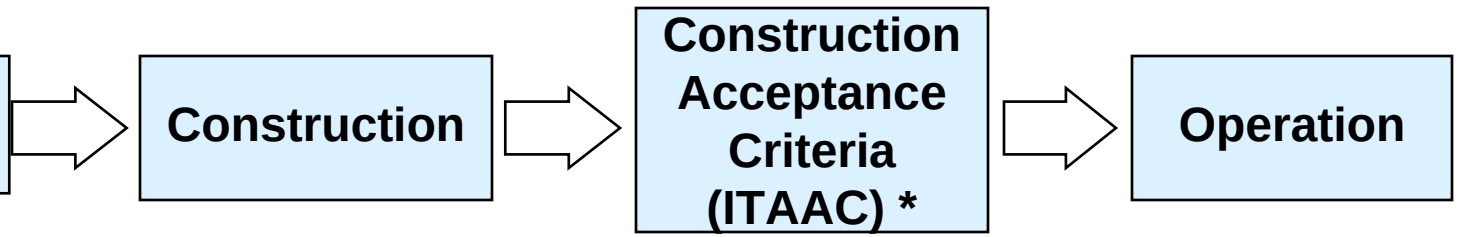
Public Comment Opportunity: New Licensing Process





- At each stage of the licensing process, design finality applies
- More information is available to the public earlier
- Safety issues are resolved prior to construction

* Public Comment Opportunity

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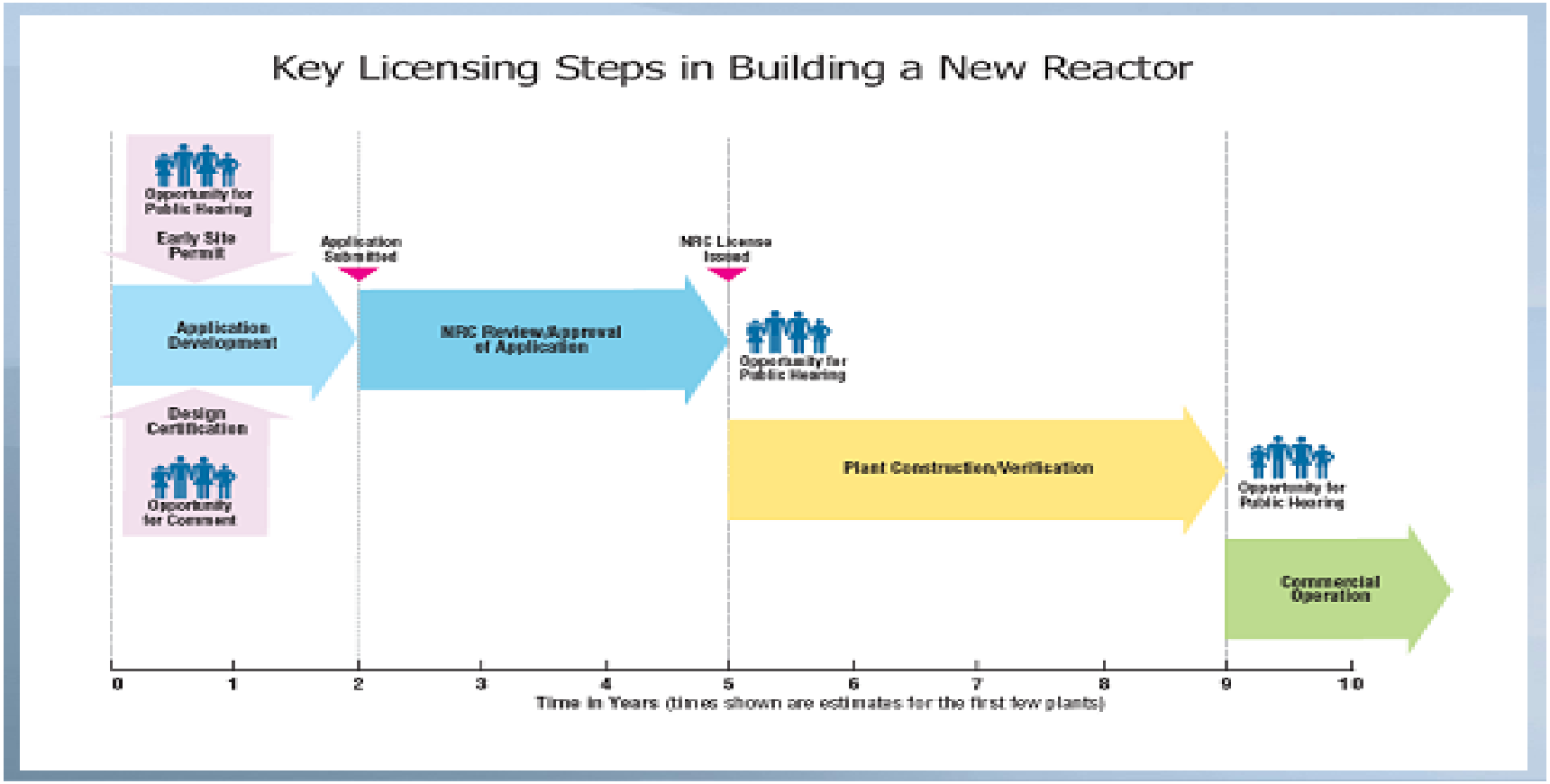
Key Licensing Steps in Building a New Reactor



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Nuclear Plant Licensing & Construction: "Then and Now"

THEN	NOW
Changing regulatory standards and requirements	More stable process: NRC approves site and design, single license to build and operate, before construction begins and significant capital is placed "at risk"
Design as you build	Plant designed before construction begins
No design standardization	Standard NRC-certified designs
Inefficient construction practices	Lessons learned from nuclear construction projects overseas incorporated, and modular construction practices
Main opportunity to intervene when plant is essentially complete	More opportunities to intervene at well-defined points in process. Intervention at the end of the process must be based on objective evidence that the construction acceptance criteria, defined in the license, have not been, and will not be met

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Design Certification

- NRC can certify reactor designs for 15 years through the Part 52 rulemaking process
- NRC review of design certification application addresses safety issues of an essentially complete nuclear power plant design, independent of a specific site
- Certified Designs are incorporated into NRC Regulations as Part 52 Appendices
- 4 designs certified to date (GE ABWR, ABB-CE SYSTEM 80+, Westinghouse AP600, Westinghouse AP1000)
- 3 designs pending approval (GE-ESPBR, ARIVA EPR, MHI-US-APWR)

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Early Site Permits (ESP)

- Early site permitting process establishes site suitability.
- Focus is on land issues, environmental issues, seismology, and emergency planning, site redress, and decommissioning.
- General schedule is 15 months to develop application; 36 months for NRC review; $20 million cost.
- The permit is valid for 20 years.

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Combined Operating License

- Regulatory process to obtain **BOTH** construction **AND** operating license **BEFORE** construction begins. Focus is on applicant being satisfactory, seismic design, non-safety side of plant, and security
- General schedule is 24 months to develop; 42 months for NRC review; $50 million cost.

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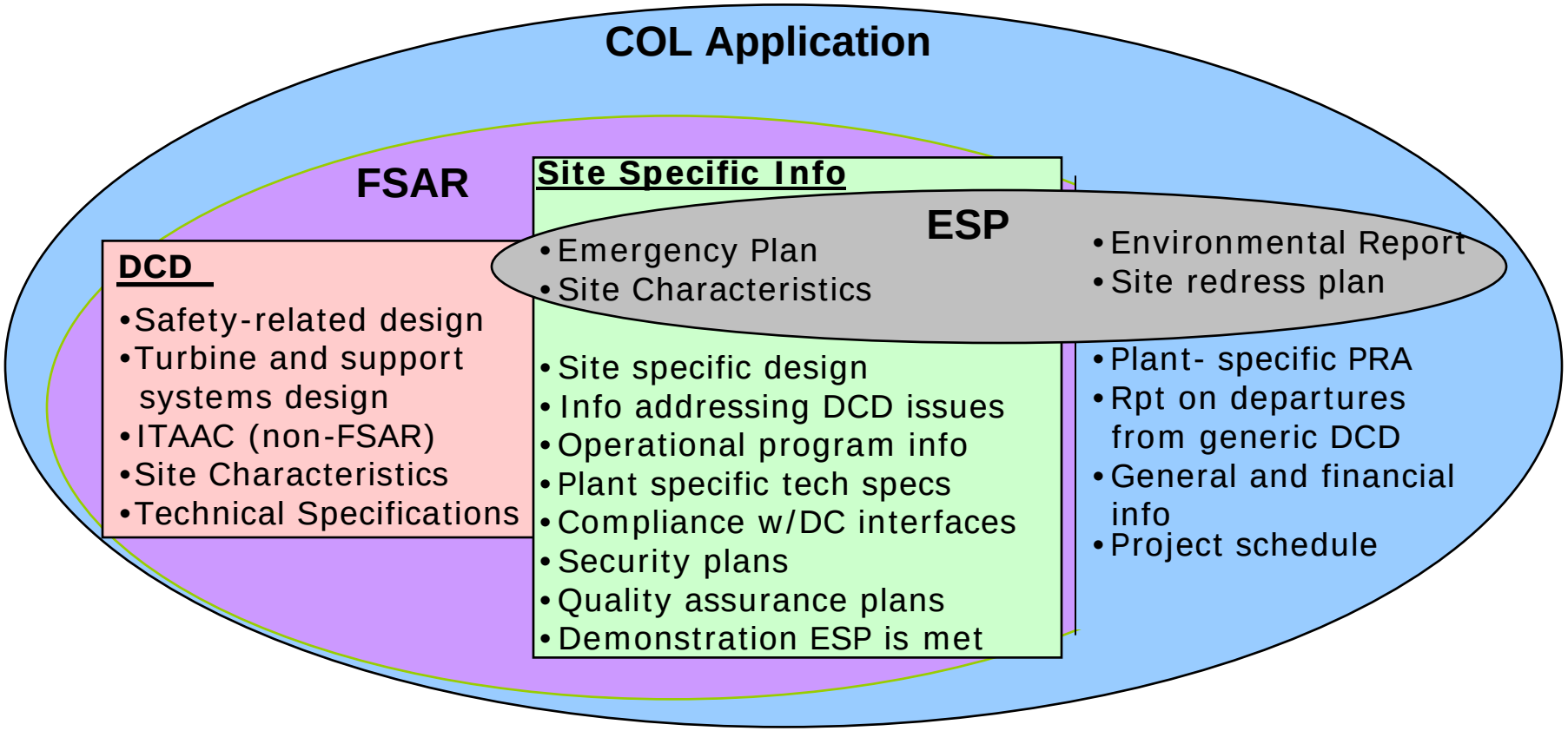
DCD, ESP, COLA Relationships



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Recent Issues

- Aircraft Hazards
  - NRC proposed rule requires applicants for new reactor designs to assess effects of impact of a large, commercial aircraft on the plant. Not applicable to existing design certifications.
- Limited Work Authorization (LWA)
  - New revised rule allows certain non-safety work activities on production and utilization facilities to commence before a construction permit or combined license is issued. LWA required for safety-related activities prior to COL issuance.
- Fitness for Duty/Access Authorization
  - Proposed rule requires fitness for duty testing of construction workers and supervisors of new plants (prior to operation). Issues relates to access authorization requirements and random testing requirements.
- ITAAC
  - Inspections, Tests, Analyses and Acceptance Criteria to provide evidence that new plants are constructed and will operate in accordance with the combined operating license. Issues relate to defining the ITAAC process

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Standardized Designs w/COL Applications

- AREVA (1600 MWe Four-Loop PWR)
  - Evolutionary Power Reactor (EPR) - Application Dec 07
- General Electric (1350 &1500 MWe)
  - Advanced BWR (ABWR) - Certified 5/97
  - Economic Simplified BWR (ESBWR) - Application Aug 05
  - **Operating in Japan & under construction in Taiwan**
- Westinghouse (600 & 1100 MWe Two-Loop PWR)
  - Advanced Passive (AP600) - Certified 12/99
  - Advanced Passive (AP1000) - Certified 1/06
    - Amendment May 07
- Mitsubishi (1700 MWe Four-Loop PWR)
  - Advanced PWR (US-APWR) -Application Dec 07

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New Plant Schedule

ESP	4 to 5 Years
COL	5 to 6 Years
Construction	3 to 4 Years
Startup	½ Year
Total	8 to 13 (Avg 10) Years*

* Some activities can be performed in parallel

New Reactor Licensing Applications (Site and Technology Selected)

An estimated schedule by Fiscal Year (October through September)