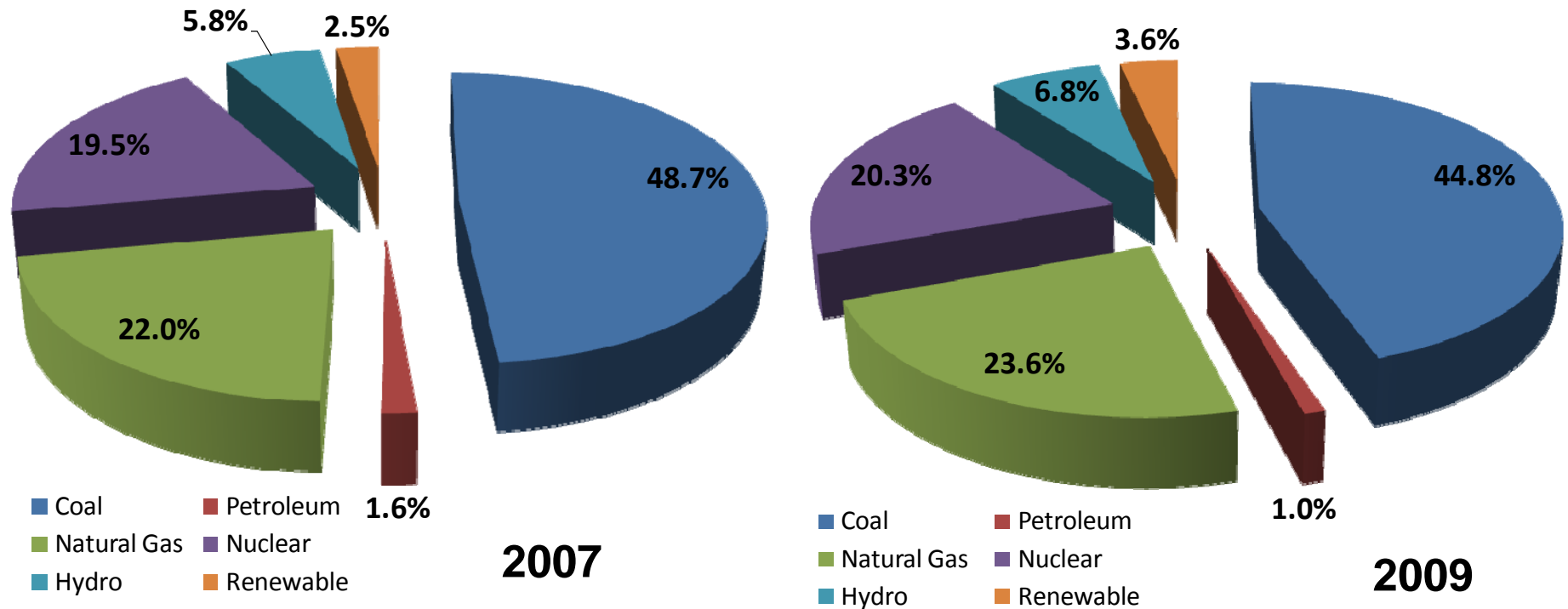

***Competitiveness, Economics and Intangibles
of New Nuclear Power Plants -
An Implementation Perspective***

Bob Coward
MPR Associates

Trends in Energy Generation



Trends from 2007-2009:

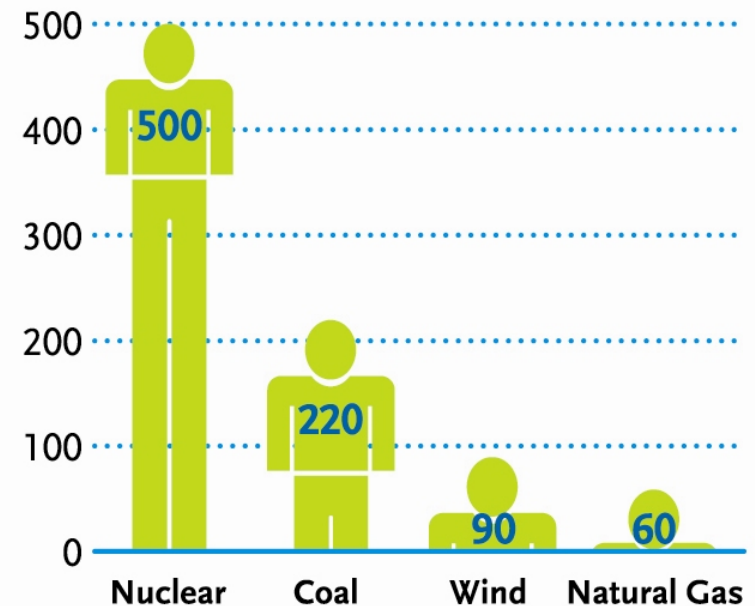
- Increasing Renewables, Natural Gas
- Steady: Nuclear, Hydro
- Decreasing: Coal, Petroleum

Why is Nuclear so Important?

- Nuclear power plant projects address important national and societal needs:
 - Climate concerns
 - Energy independence
 - Diversity of energy resources
 - Predictability and reliability of electricity generation
 - Stability of electricity costs
 - Jobs!

Jobs Created for Operating Energy Plants

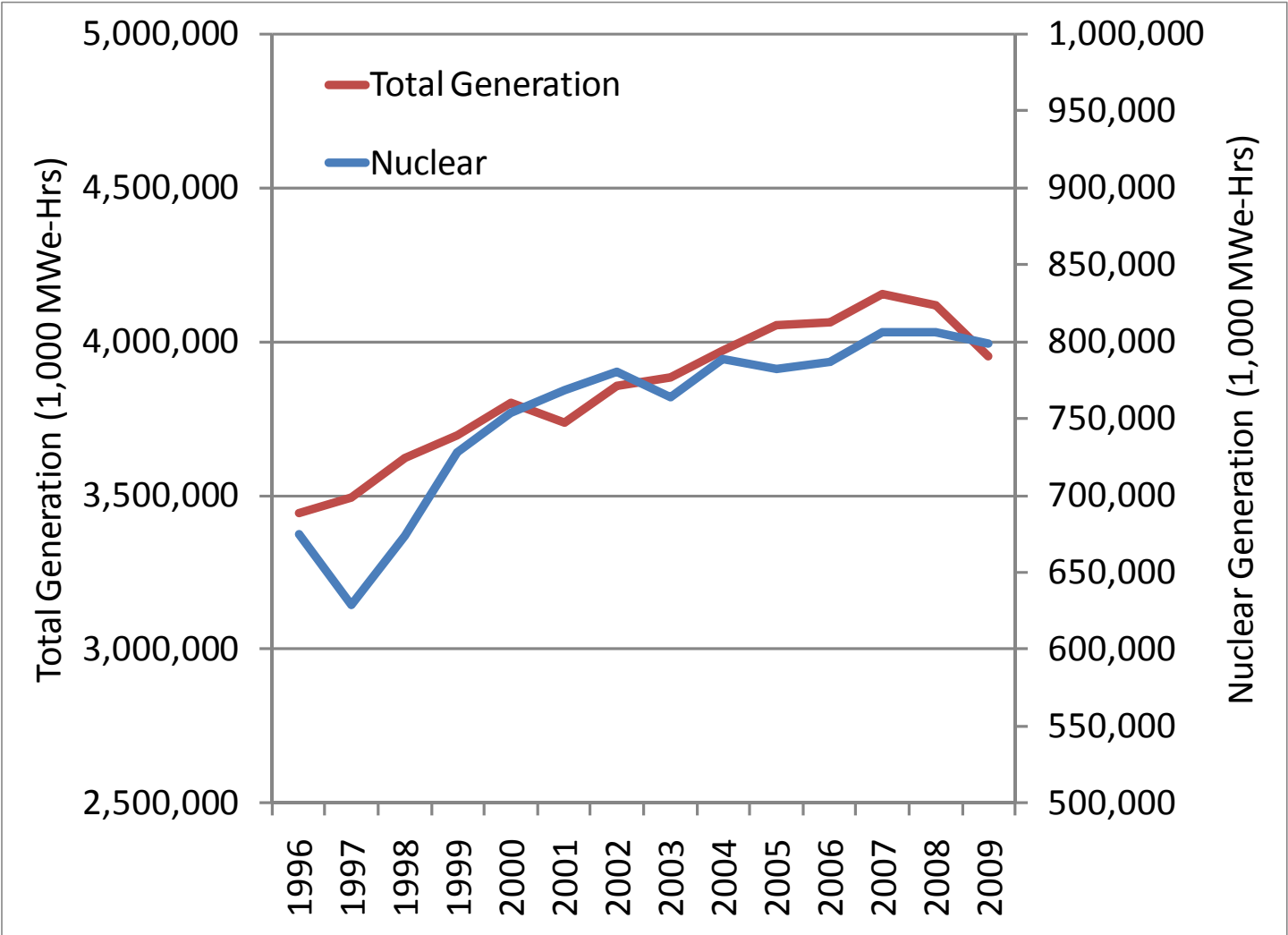
Jobs per 1,000-megawatts of capacity



Sources: Ventyx and U.S. Department of Energy

*Figure from the Nuclear Energy Institute

US Electricity Generation



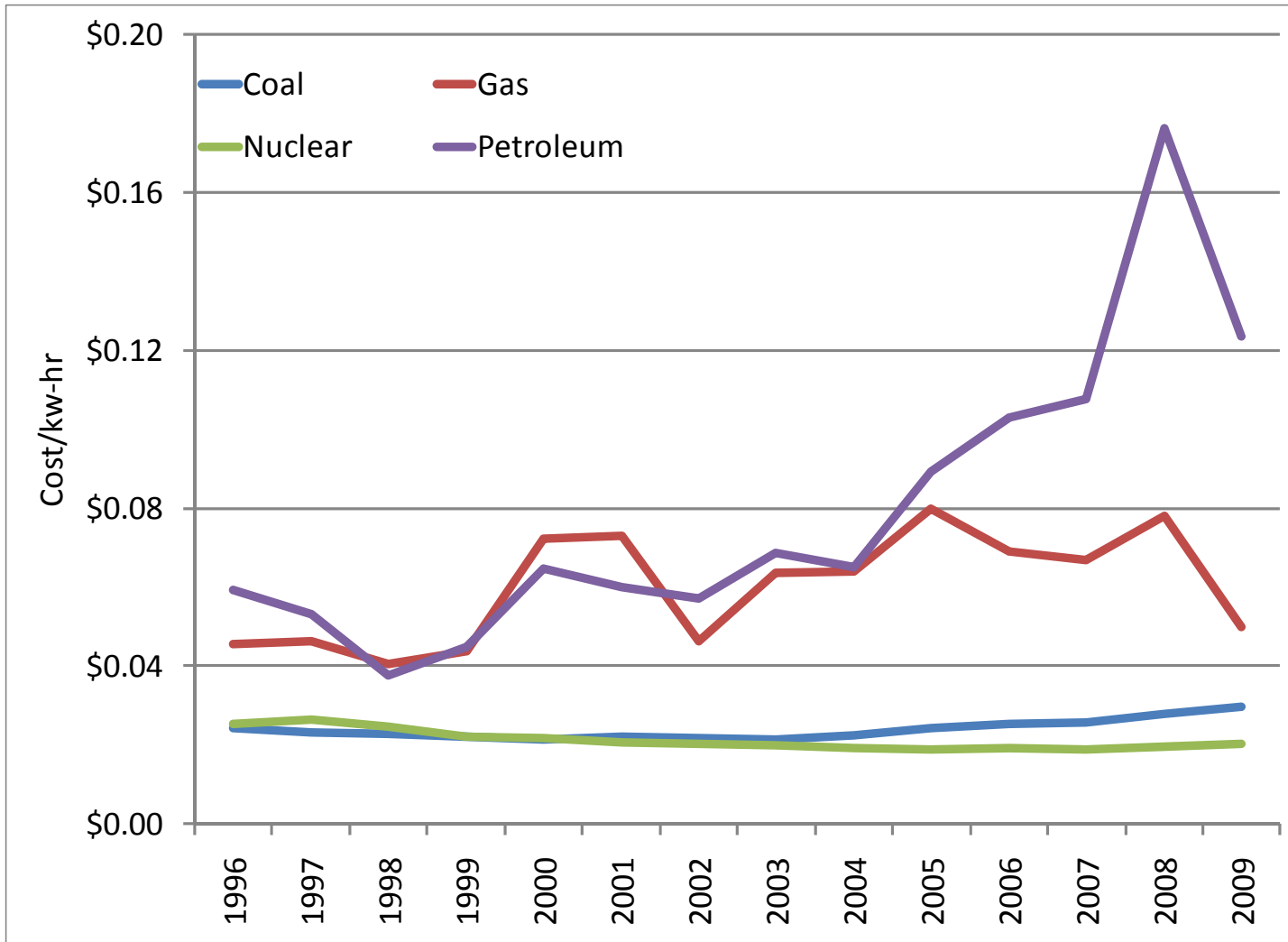
*Data from U.S. Energy Information Administration

Nuclear Role

- In recent years, nuclear power has consistently provided about 20% of US electricity generation*
- Nuclear power is the largest contributor to “clean” electricity generation
 - In 2009, nuclear power accounted for 69% of US emission-free generation*
- Nuclear power is the most predictable and reliable generation option
- Nuclear power provides low production cost generation

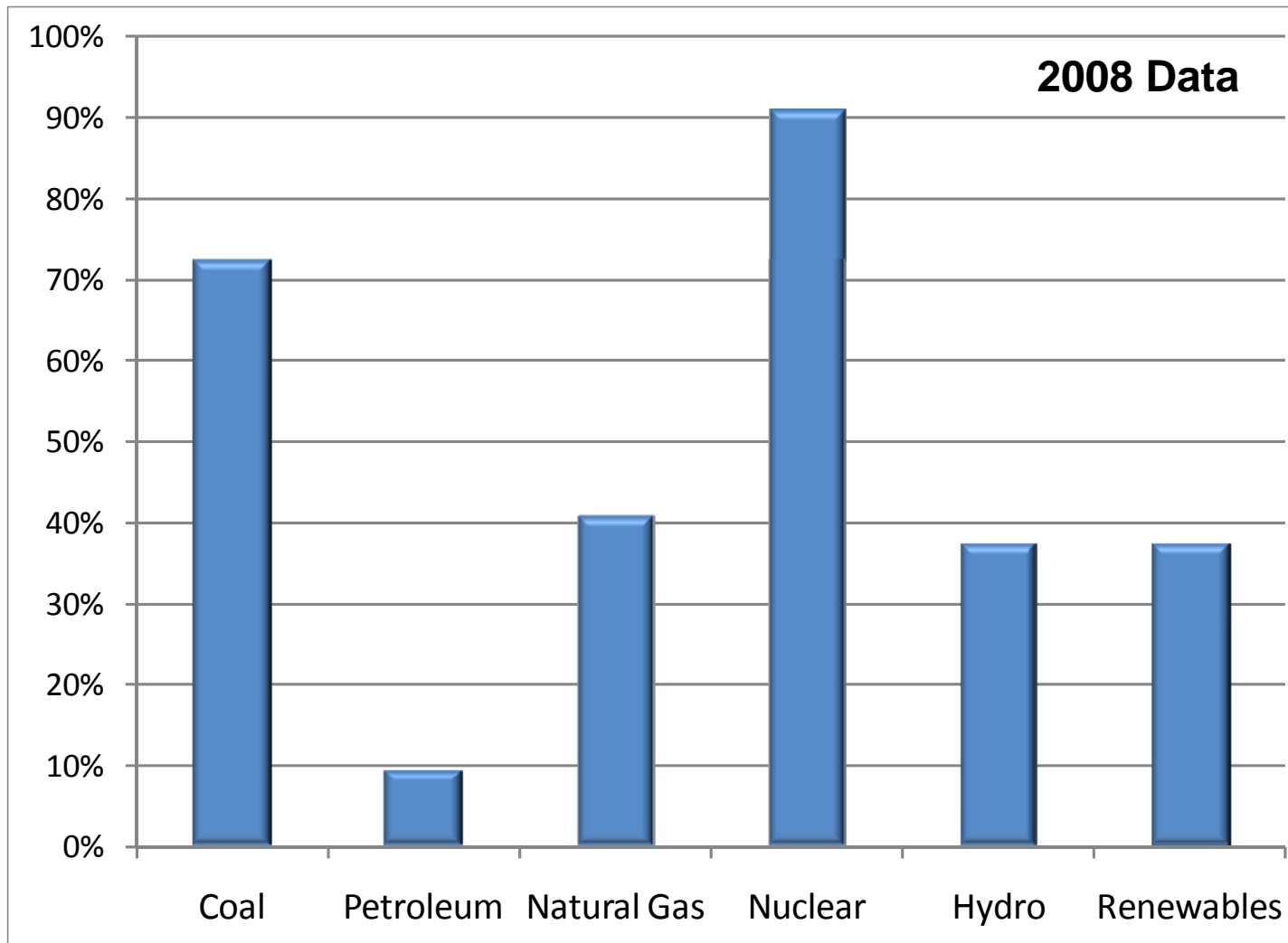
*Data from Nuclear Energy Institute Resources & Stats

Production Costs



*Data from U.S. Energy Information Administration

Capacity Factor



*Data from U.S. Energy Information Administration

Understanding the Challenge

- It is important to understand industry status as the Energy Policy Act 2005 was passed:
 - New, incomplete plant designs
 - Where a design did exist, significant “Americanization” and/or “Tropicalization” was required
 - New NRC Licensing Process (10 CFR Part 52), along with lingering, unresolved Digital I&C Licensing Issues
 - New construction approaches and methods (for US)
 - Degraded Supplier infrastructure
 - New commercial models
 - New and unproven EPC Teams
- Collectively, these factors represented a considerable challenge

We've Made Considerable Progress

- Experience from previous generation US projects and recent overseas projects were studied to incorporate applicable lessons learned into the new US projects
 - Studies on previous lessons learned have been prepared and are being used by all new projects to incorporate key concepts in project planning
 - STP 3&4 being informed by Kashiwazaki, Hamaoka, Shika, Shimani, and Lungmen projects
 - Calvert Cliffs 3 being informed by Okiluto , Flamanville, and Taishan projects
 - Vogtle 3&4 and Summer 3&4 (and other AP1000 projects) being informed by Sanman and Haiyang projects
- Supplier/vendor infrastructure is improving significantly
 - Number of potential suppliers has increased, with major investments in QA Programs, Staff, and facilities

We've Made Considerable Progress (Cont'd)

- Important steps forward in NRC Licensing:
 - 10CFR52 Licensing process “bumps” are being smoothed out
 - Design Certification issues being resolved (albeit more slowly than desired in some cases) and COLA reviews proceeding
 - Manageable COL contentions expected for lead projects
 - Observable progress and improved industry/NRC cooperation on digital I&C licensing
- Investments by Owners and Vendors to advance construction and fabrication methods, including modularization and open-top construction
- Considerable progress on detailed designs for ABWR, EPR, AP1000, APWR, as well as active engineering on Small Modular Reactor designs

We've Made Considerable Progress (Cont'd)

- Lead projects are procuring Long Lead Material and Equipment
 - Strategies developed to effectively use both US and overseas suppliers
- EPC Teams continue to improve integration, alignment, and effectiveness
- Implications of the commercial terms are being learned and factored into project implementation
- Significant resources invested in detailed EPC project implementation schedules, project controls processes, and project management
- Numerous new jobs created with level of excitement and interest very high

We've Made Considerable Progress (Cont'd)

- Cumulative result of this progress is an industry that collectively:
 - Is better prepared to deploy new plants in the US than at any time before
 - Understands project needs, risks, and schedules
 - Continues to complete non-recurring engineering, procurement, and construction planning work that will be usable on future projects
 - and ...
- *Has set the stage for success, numerous times over*
 - *While at the same time understands, respects, and is addressing the project challenges*

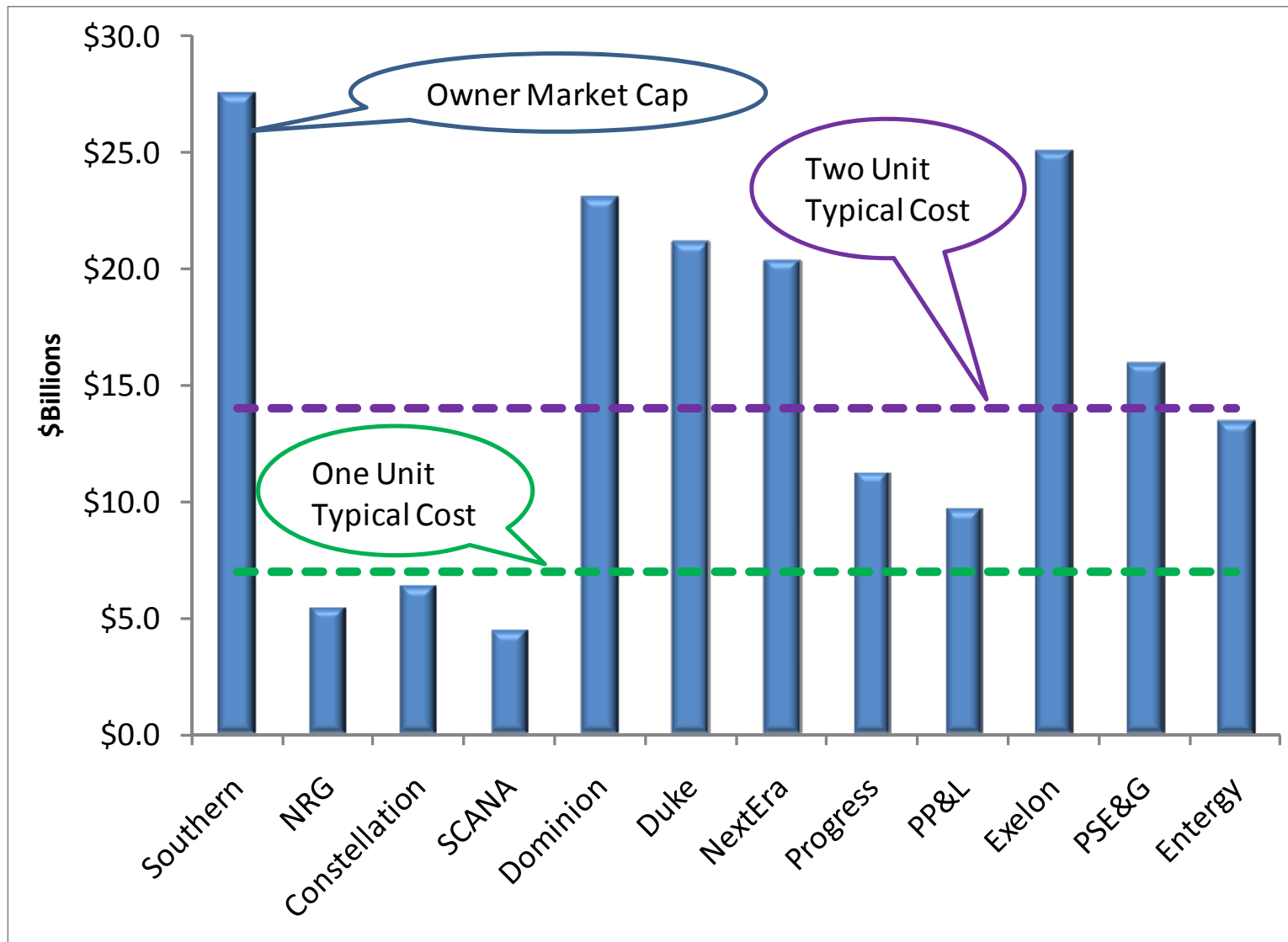
Current Challenges For New Nuclear Projects

- Reduced demand for electricity pushing some projects out in time
 - Recession impacts
 - Natural Gas prices remain low, with many forecasts showing low prices for the foreseeable future
- Carbon regulation remains a question impacting economics
 - Nuclear is clearly a major contributor to climate solutions, the question is timing of regulation
- Although Licensing processes continue to improve, increased confidence in schedules is also needed
 - NRC has goals to reduce review durations for future applications
 - NRC and industry need to continue efforts to align performance and increase confidence in schedules

Current Challenges For New Nuclear (Cont'd)

- Cost and Cash Flow remain significant challenges
 - “Bob – the \$/kw number, we like that number a lot, it’s the total cost number that is the problem”
 - Current public estimates are overnight costs of \$6B to \$8B per unit (or more)
 - Project costs can rival the total market capitalization of the owner
 - These projects can be “bet your company” decisions
 - Project cash flow, and potential diluted earnings during construction, are a significant challenge, especially for projects without “pay as you go” cost recovery
 - Remaining on an aggressive implementation schedule can require spending on the order of 20% to 30% of the cost before the NRC issues the COL (and the Loan Guarantee is finalized)

“A Large Pill to Swallow”



*Data from Google Finance

Current Challenges For New Nuclear (Cont'd)

- Loan Guarantees and Production Tax Credits reduce risks and improve the overall economics (and help) ...
- However – Loan Guarantees in the current form do not fully address the major challenges of the size of the investment required, the pre-COL cash flow, and dilution of earnings
 - They are insufficient alone to provide the “societal push” needed for a robust nuclear renaissance
- These concerns are major drivers for the increasing interest in Small Modular Reactors (SMRs) which:
 - Are typically smaller with corresponding reduced total cost
 - Can be constructed and brought on-line faster and/or incrementally to manage cash flow

What Can We Do?

- A more “Societal Approach” focused on the major challenges
 - Increased efforts to promote/stimulate energy companies to collaborate on new plant projects to share the risks and benefits
 - Partnerships?
 - JAPC Model?
 - Consideration of additional incentives and programs to ease the cash flow and potential dilution of earnings on these capital intensive projects
 - Pre-COL access to Loan Guarantee funds or Bridge Loans?
 - Pre-Operation Tax Credits for investments?
 - Other “Pay as You Go” cost recovery options?
 - Industry wide effort to revisit the bases for total cost to understand drivers and assess options to reduce costs
 - Regulatory?
 - Single vs. multi-unit economics?
 - Cash flow impacts?
 - Other?

Going Forward

- Patience and Perseverance are important
 - The industry is successfully implementing a “plan the work and work the plan” strategy
 - All stakeholders need to support the strategy, stick with it, and allow/support it to play out successfully

- Nuclear power plant projects address important national challenges – We need to be successful !
 - Climate concerns
 - Energy independence
 - Diversity of energy resources
 - Stability of electricity costs
 - Jobs