King & Spalding

Controlling Cost and Schedule for New Nuclear Construction

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Financing New Nuclear Construction Roundtable
Hosted by the Kansas Corporation Commission
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Issues to Discuss

Cost

&

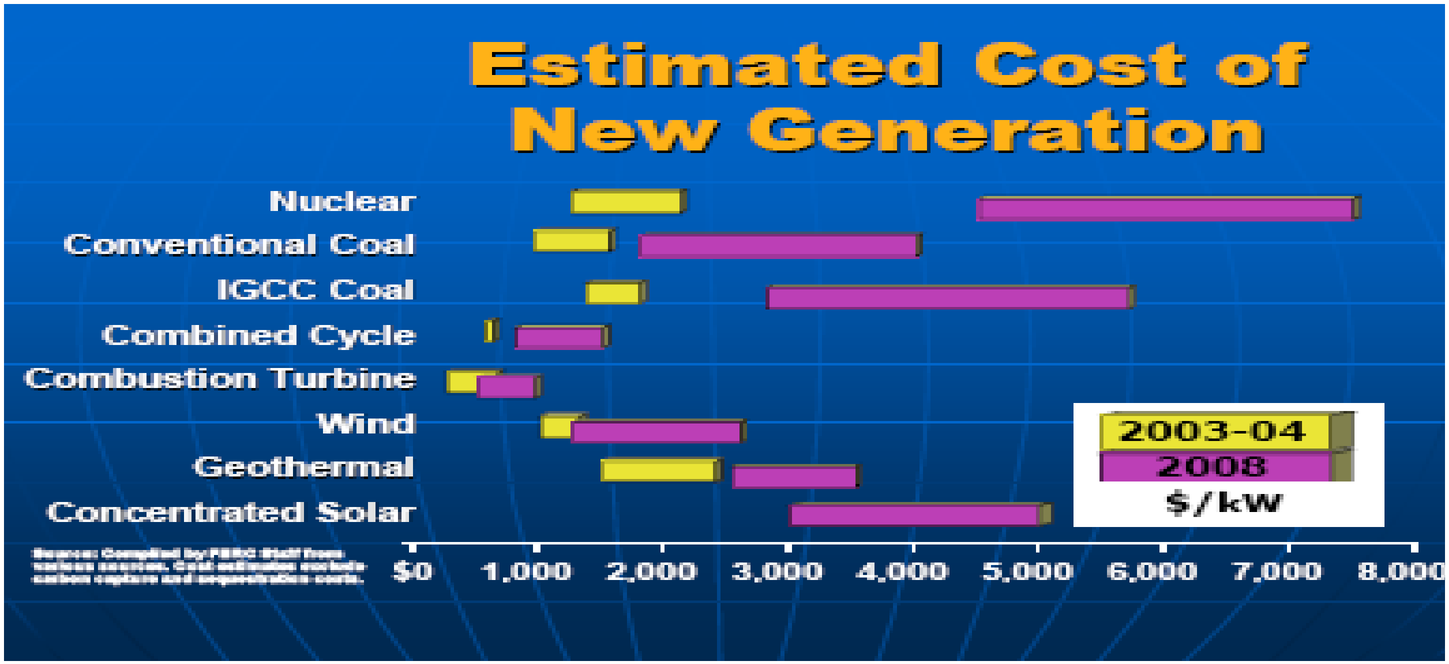
Schedule

Cost

- **"Of all factors affecting prospects for the substantial growth of nuclear power in the 21st Century, cost is the most fundamental" - WNA Report, "*The New Economics of Nuclear Power*"**

Cost - Significance of Construction Cost

- Construction cost is the most significant cost



FERC Report - Increasing Costs in Electric Markets (June 19, 2008)

- Operating Costs are low: nuclear power plants … are the most competitive non-hydro technology on **operating cost** grounds.

Cost - Historical Control of Cost

- Based on historical performance - the ’70’s and ’80’s - concern over controlling construction cost is valid
- *New York Times*, January 18, 1984
  - “3/4 of [USA’s] reactors cost consumers at least double what was promised”
  - “in 28 percent of cases, final cost was more than four times the estimate.”

Cost - Encouraging Recent Trends

- Lump sum pricing for certain portions of work (e.g., major equipment; front end engineering)
- Standardized designs
- Estimated shorter construction times
- More efficient generating technologies
- Governmental programs (e.g., Energy Policy Act of 2005)

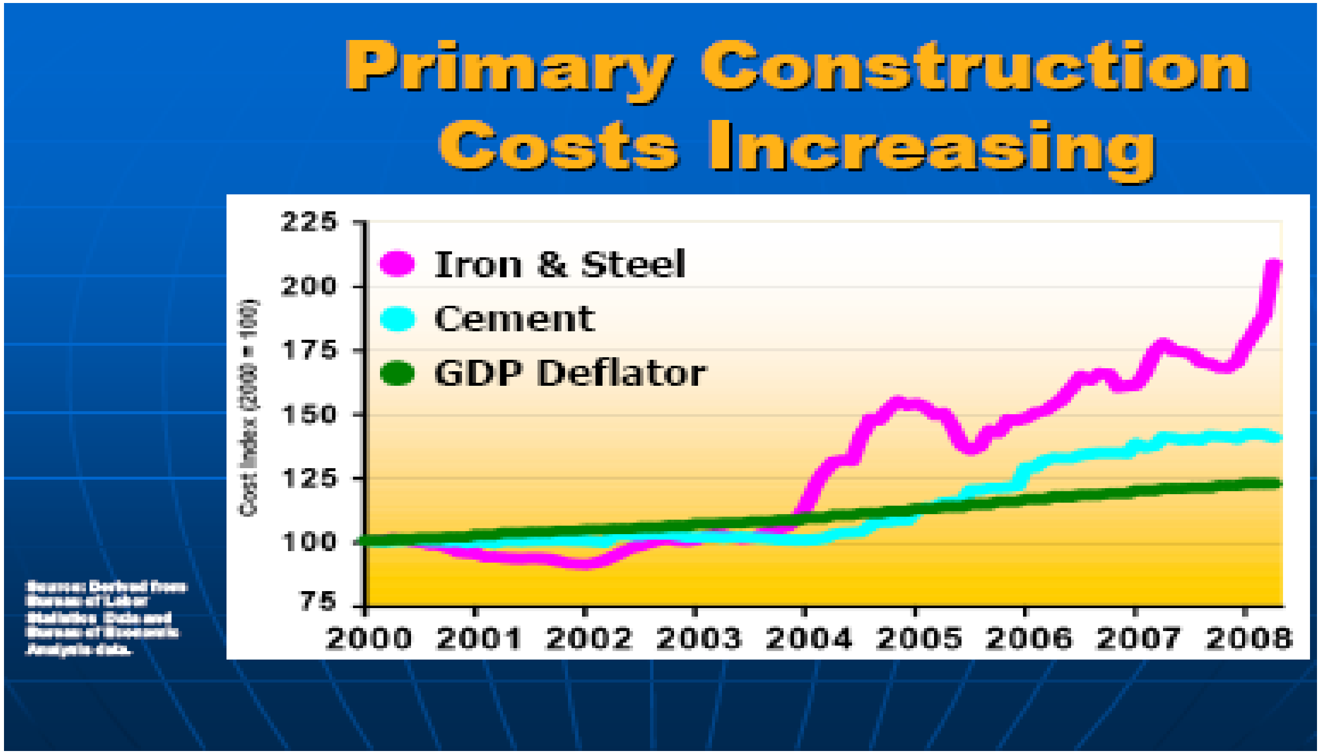
Cost - Recent Construction Cost Challenges

Recent Industry-Wide Challenges

- Material price escalation (although certain materials have decreased in cost in the last few months)
- Labor escalation
- Tight construction market and strong predicted demand

Material Escalation

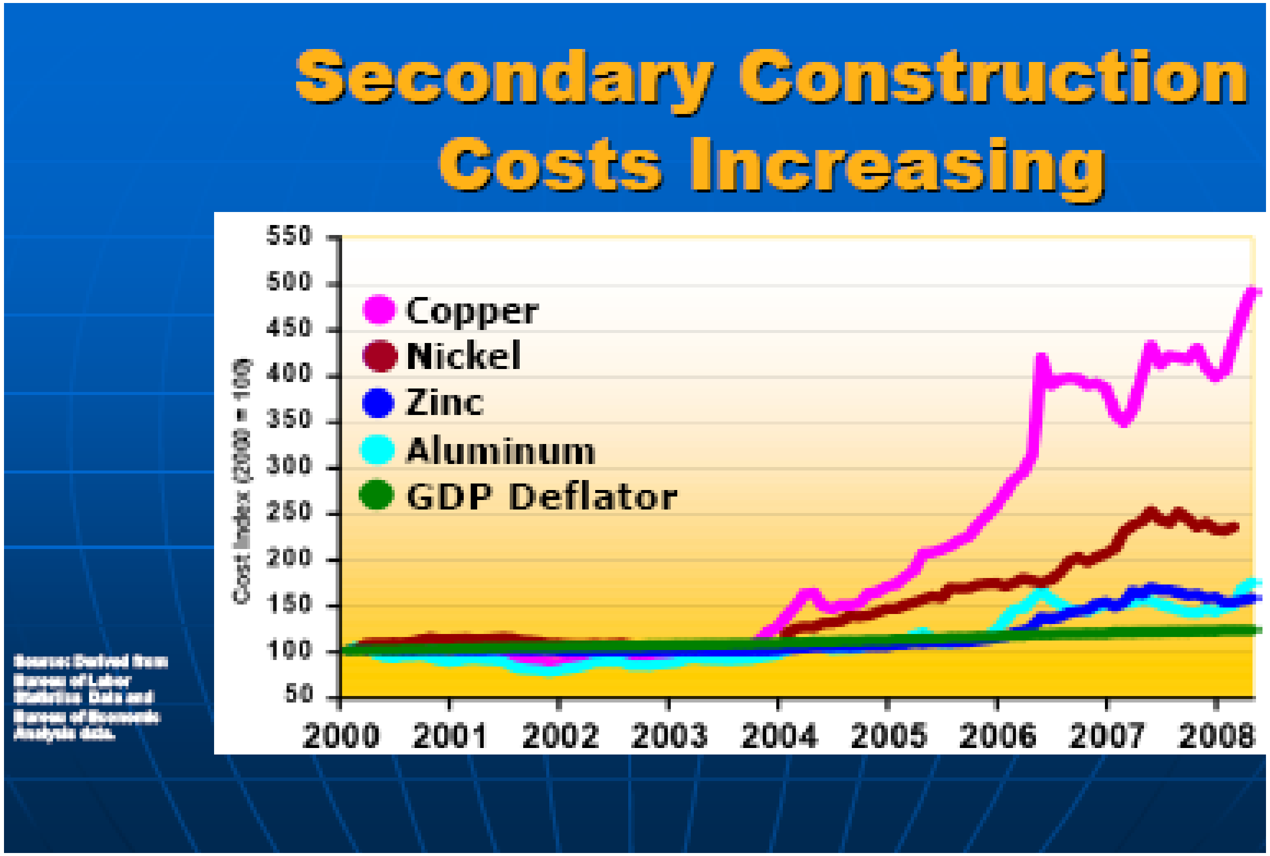
Cost - Material Escalation - General 2008 Trend of Primary Construction Costs Increasing



- As of June 2008, steel was **twice as expensive** as it was four years ago.

Source: FERC Report - Increasing Costs in Electric Markets

Cost - Material Escalation - General 2008 Trend of Secondary Construction Costs Increasing



- The pricing for **four key metals** used in generators is shown above.
- As of June 2008, pricing for copper had **increased five-fold** over the past four years.

Source: FERC Report - Increasing Costs in Electric Markets

Cost - Economic Impact on Material Escalation

Impact of recent economic turmoil on material cost

Cost - Material Escalation - *Recent Trend of Certain Construction Costs Decreasing*

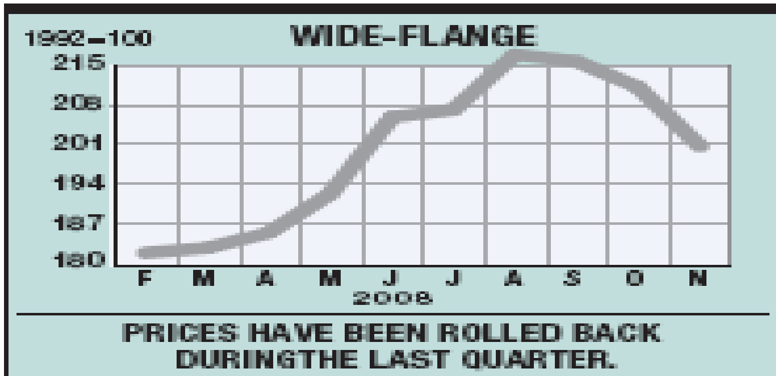
20-CITY: 1913=100	NOV. 2008 INDEX VALUE	% CHG. MONTH	% CHG. YEAR
MATERIALS	2857.17	–1.2	+10.3
CEMENT $/TON	100.42	+0.1	–0.8
STEEL $/CWT	47.98	–1.5	+18.9
LUMBER $/MBF	421.57	–0.5	–3.9

Source: ENR, Construction Economics (November 24, 2008)

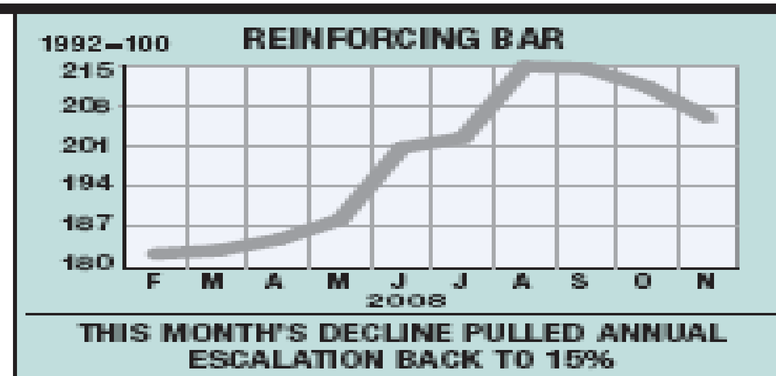
- The Nov. 2008 index value for **steel** shows a **1.5% decline** over the past month, reflecting a recent trend of decreasing prices.
- Cement prices continue to stay relatively flat.
- As of Dec. 2008, the price of key industrial **metals** had **fallen further**, at least in the UK, over the last four months **than occurred during the worst years of Great Depression** between 1929 and 1933, according to research by Barclays Capital.

Cost - Material Escalation - *Recent Trend of Certain Construction Costs Decreasing*

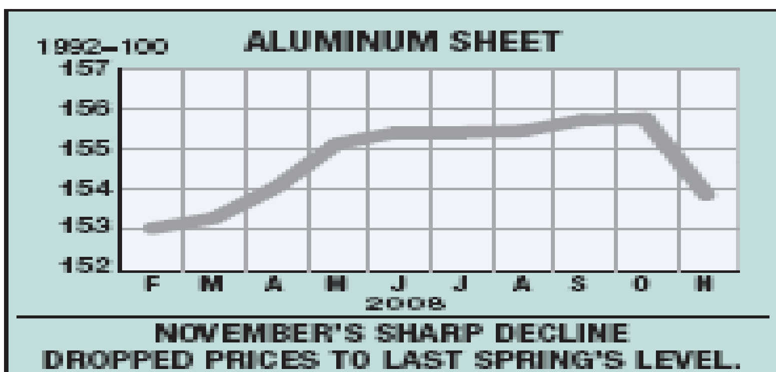
ENR's Materials Price Indexes



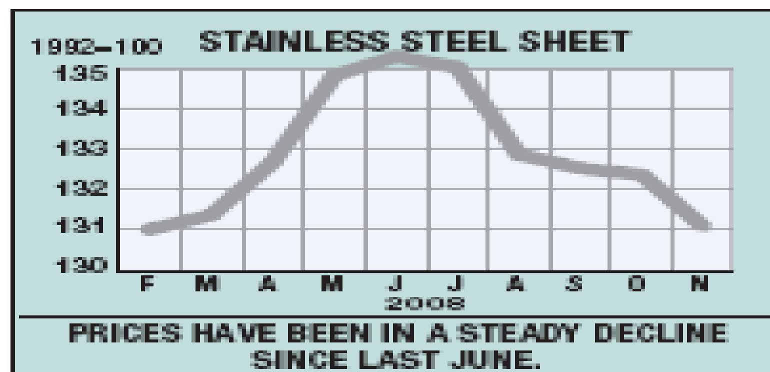
PRICES HAVE BEEN ROLLED BACK DURINGTHE LAST QUARTER.



THIS MONTH'S DECLINE PULLED ANNUAL ESCALATION BACK TO 15%



NOVEMBER'S SHARP DECLINE DROPPED PRICES TO LAST SPRING'S LEVEL.



PRICES HAVE BEEN IN A STEADY DECLINE SINCE LAST JUNE.

Source: ENR, Construction Economics

Cost - Material Escalation - *Recent Trend of Certain Construction Costs Decreasing*

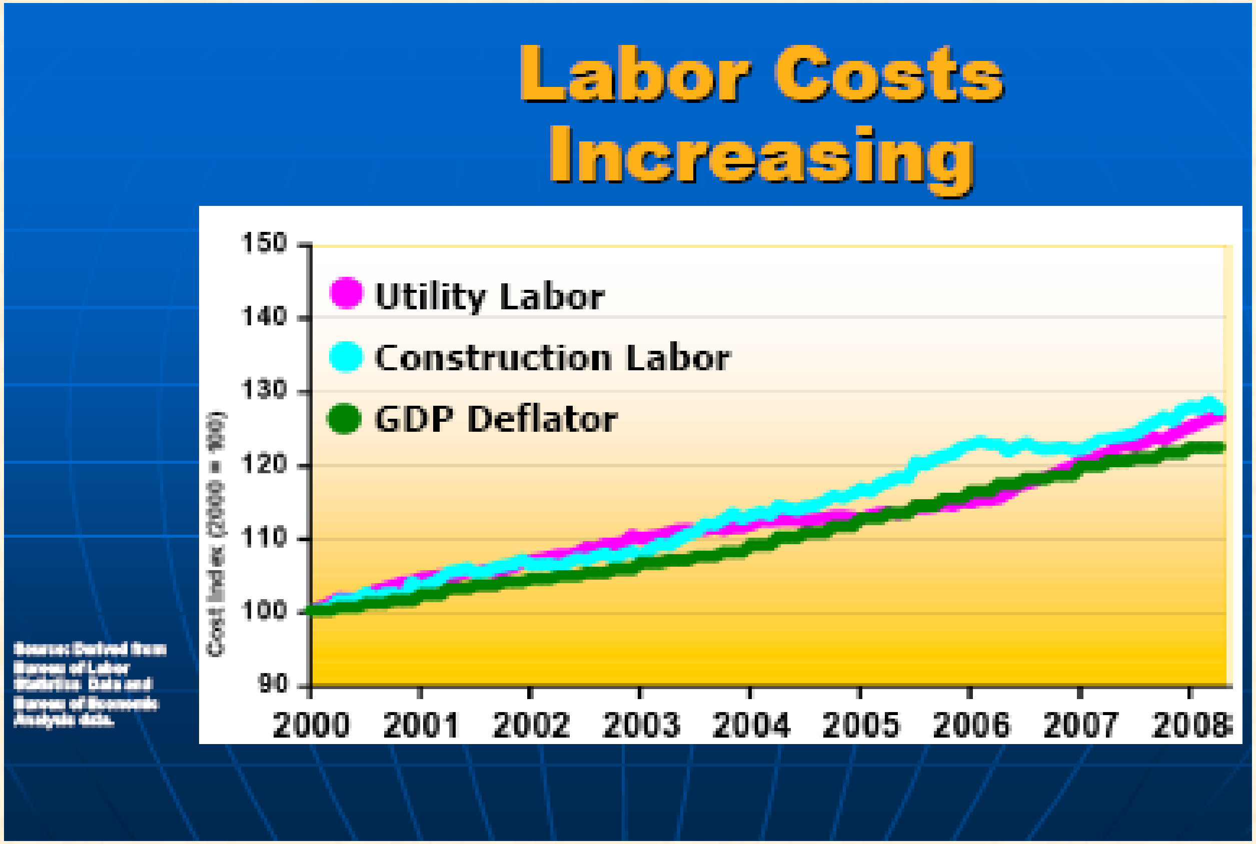
Copper Prices

LME copper price in June, 2008 = approximately $9000 per tonne.
Recently = approximately $3000 per tonne.

Cost - Labor Escalation

Labor escalation

Cost - Labor Costs Increasing



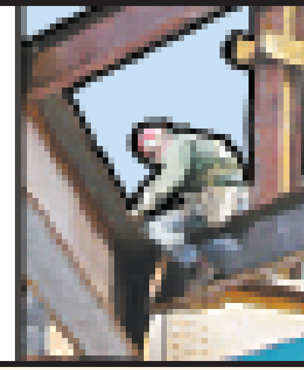
- Since 2000, 27% nominal change in average hourly earnings for both construction labor generally and for non-construction utility labor, outpacing inflation by over 4% for the same period.

Source: FERC Report - Increasing Costs in Electric Markets

Cost - Labor Costs In the Past Year

Building Cost Index

With labor costs holding steady and material costs easing, inflation measured by the BCI fell from 7.3% to 6.4%.



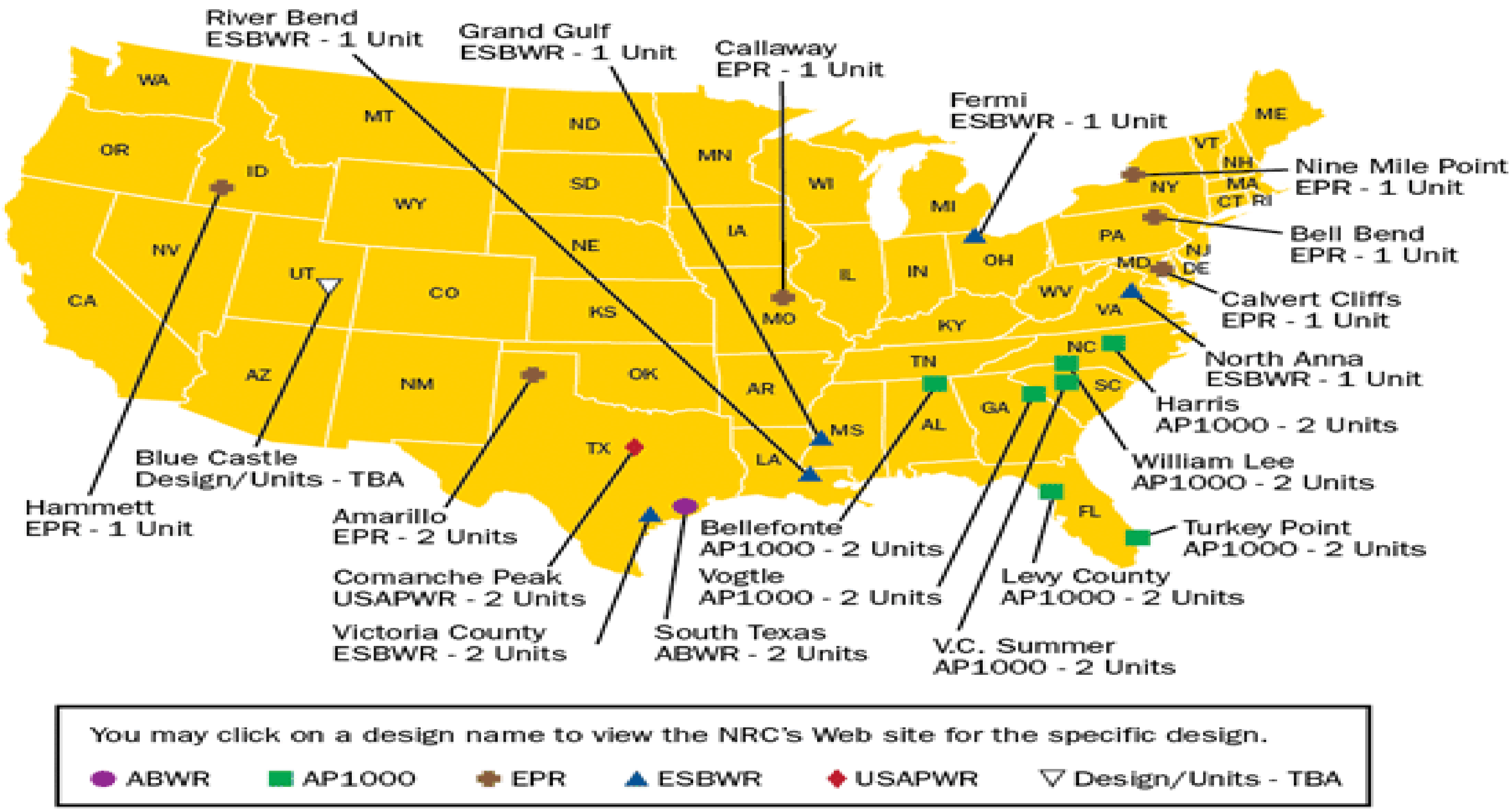
20-CITY: 1913=100	NOV. 2008 INDEX VALUE	% CHG. MONTH	% CHG. YEAR
BUILDING COST	4847.39	–0.4	+6.4
SKILLED LABOR	8105.08	0.0	+4.0
WAGE $/HR.	44.98	0.0	+4.0

Source: ENR, Construction Economics

Cost - Supply and Demand

Supply and Demand

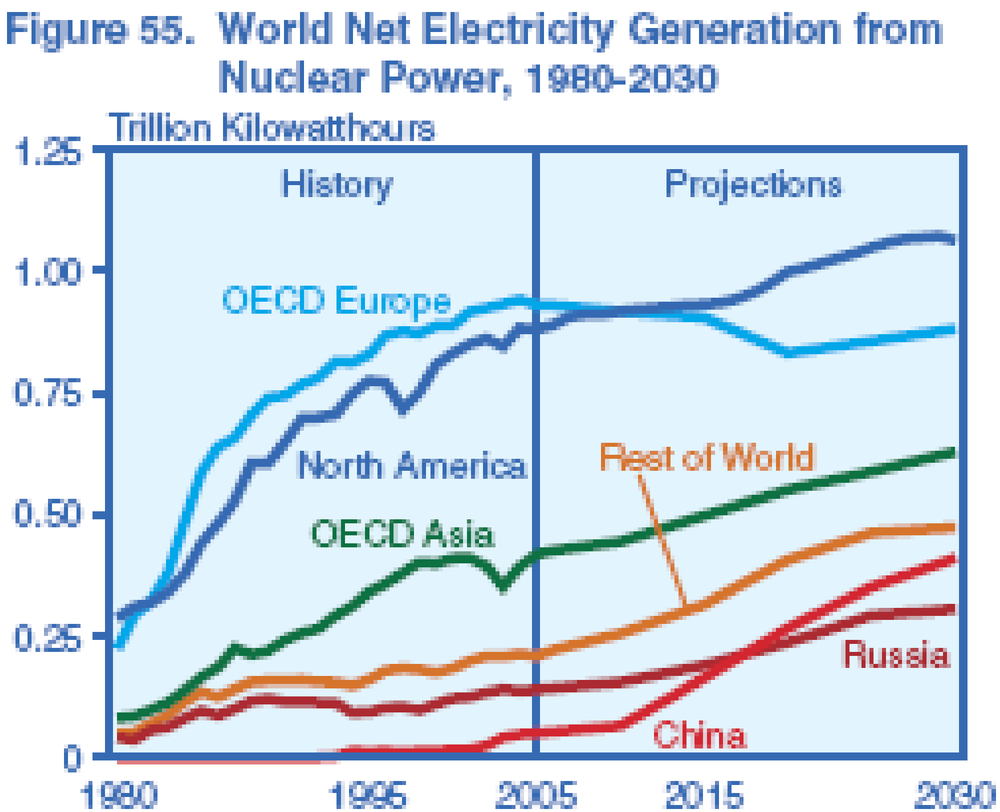
Cost - Currently Planned Nuclear Projects in the U.S.



Source: NRC.gov, November 2008

EIA - 6/2008 - estimate 6 GW to 38 GW additions in US by 2030

Cost - Predicted International Generation Capacity for Nuclear Power by 2030



Source: EIA, International Energy Outlook 2008 (6/2008)

IEO 2008 reference case projects the strongest growth in nuclear power for the countries of non-OECD Asia. In China, electricity generation from nuclear power is expected to grow at an **average annual rate of 8.8%** from 2005 to 2030.

Cost - Summary of Predicted Demand

- **International** - from 367 GW in 2005 to 447 and 679 GW in 2030
- **Predicted demand greatly outstrips 1980's growth** (WNA - 10/07)
  - 1980's: 218 power reactors started up, an average of one every 17 days in world
  - Realistic Estimate for Future Growth: "might be equivalent of one 1000 MW unit worldwide every 5 days.

Cost - But limited Suppliers/Contractors

Lead Vendor	**Reactor Design**
GE	ABWR/ESBWR
Westinghouse	AP1000
Areva	EPR
AECL	ACR700
Mitsubishi	USAPWR
Toshiba	ABWR
General Atomics	GT-MHR
Eskom	PBMR

"Emerging triumvirate" of nuclear reactor vendors who have "scale, reach and LWR designs to make a real impact" (The Future of Power - 2008 and Beyond):
"Areva/Mitsubishi; Westinghouse-Toshiba; and GE-Hitachi"

Cost

Are we seeing cost escalation in current nuclear plants?

Cost - Current Nuclear Projects - U.S.

- **Turkey Point Expansion in Florida (Source: WNN, The Economics of Nuclear Power, 11/2008)**
  - Florida Power & Light in February 2008 released projected figures for two new **AP1000 reactors** at its proposed Turkey Point site, which took into account **increases of some 50% in material, equipment and labor** since 2004.
  - The new figures for overnight capital cost ranged from **<u>$2444 to $3582 /kW</u>**, or when grossed up to include cooling towers, site works, land costs, transmission costs and risk management, the total cost came to **<u>$3108 to $4540 per kilowatt</u>**. Adding in **finance charges almost doubled the overall figures** at **<u>$5780 to $8071 /kW</u>**. FPL said that alternatives to nuclear for the plant were not economically attractive.

Cost - Current Nuclear Projects - U.S.

- **Levy County Greenfield Project in Florida (Source: WNN, The Economics of Nuclear Power, 11/2008)**
  - In March 2008 Progress Energy announced that its two new Westinghouse **AP1000 units** on a **greenfield site** in Florida would cost it about **$14 billion**, including land, plant components, cooling towers, financing costs, license application, regulatory fees, initial fuel for two units, owner's costs, insurance and taxes, escalation and contingencies. The reactors were projected to cost approximate **$2.5-3.5 billion in 1/2007**.
  - If built within 18 months of each other, the cost for the first would be **$5144 per kilowatt** and the second **$3376/kW (average $4260/kW)** - total $9.4 billion. **Interest adds about one third to the combined figure** - $3.2 billion, and infrastructure - notably 320 km of transmission lines - about another $3 billion.

Cost - Current Nuclear Projects - U.S.

- **V.C. Summer Project in South Carolina (Source: WNN, SCANA raises cost estimate for Lee plan, 11/2008)**
  - In May 2008 **South Carolina Electric and Gas Co.** and Santee Cooper estimated the price of new reactors for their Summer plant in South Carolina **at <u>$9.8 billion</u>**.
  - The EPC contract for completing **two 1,117 MW AP1000s** is with Westinghouse and the Shaw Group.
  - Beyond the cost of the actual plants, the figure **includes forecast inflation and owners' costs for site preparation, contingencies and project financing**. The units are expected to be in commercial operation in 2016 and 2019.

Cost - Current Nuclear Projects - U.S.

- **William States Lee Nuclear Project in South Carolina (Source: WNN, Duke raises cost estimate for Lee plan, 11/2008)**
  - Duke Energy now expects the plant (**2 X 1,117 MW AP1000**) to cost some **$11 billion to construct**, excluding financing costs and inflation.
  - In 2005, the company put the cost of constructing the Lee Plant at between **$4 and $6 billion**.

Cost - Current Nuclear Projects - U.S.

- **Bellefonte Project - The Tennessee Valley Authority plans to build two AP1000 nuclear reactors in Bellefonte, Alabama, 100 miles southeast of Nashville, Tennessee**
  - TVA recently estimated that the costs to build the two reactors range from **$9.9 billion to $17.5 billion**. (Source: The Tennessean - **December 9, 2008)**
  - NRC documents show TVA had given a rough figure of $6.4 billion to $7.1 billion on its license application last year for two reactors, based on a Westinghouse AP1000 design.
  - The upper boundary of this estimate is **more than double** TVA's estimate from last year.

Cost - Current Nuclear Projects - International

- **<u>Olkiluoto Island, Finland</u>**: first third generation reactor to commence construction
  - **As reported in press (WNN - 5/12/06; International Herald Tribune 6/9/07; NYT - 11/15/08):**
    - **<u>Original</u>: Price: $4.1B ($2562/kWe); Schedule: 4 years**
    - **<u>Current Estimate</u>: Price: 50% over its budget (over $6 billion or approx. $3800/kWe); Schedule: Delay of "at least two years" (6 years)**
- **<u>China Tianwan Project</u>**:
  - **As reported in press (International Herald Tribune - 6/9/07; WNA - 11/2007; WNN - 8/16/07, 11/2008):**
    - **<u>Original</u>: $2.5B ($1179/kWe)**
    - **<u>As Constructed</u>: $3.8B ($1790/kWe); Schedule: "more than two years later than planned" (almost 7 years)**

Cost - Limited Supply

- **Already starting to see impact of limited supply**
- "New energy in nuclear power supply battle: Firms jostle to be 1st in line for scarce reactor components" - *Chicago Tribune*, 6/1/08
  - For example, with respect to AP1000 Units, only Japan Steel Works is currently capable of making the steam generator forgings and its throughput is limited to 4 vessels per year.
  - Result: Company's are contracting before permit approved
    - ex: NRG order reactor pressure vessels
  - NEI warned that ultra-large forgings will be the "the first major pinch point that the industry will encounter before 2010"
  - Others are starting to boost capability - e.g., JSW expansion (see below), Doosan (South Korea), Le Creusot (Europe)
  - In Nov. 2008, JSW and AREVA sign agreement to supply AREVA until 2016 with large forged parts.
  - In Dec. 2008, JSW announced a plan to triple capacity for manufacturing heaving forged components by 2012.
- US Dep't of Energy concludes in 2005 that enough manufacturing capacity exists to build 8 US projects between 2010 and 2017, but utilities have plans for 17 plants.

Cost - Mitigation Measures

What actions can be taken to take control of costs?

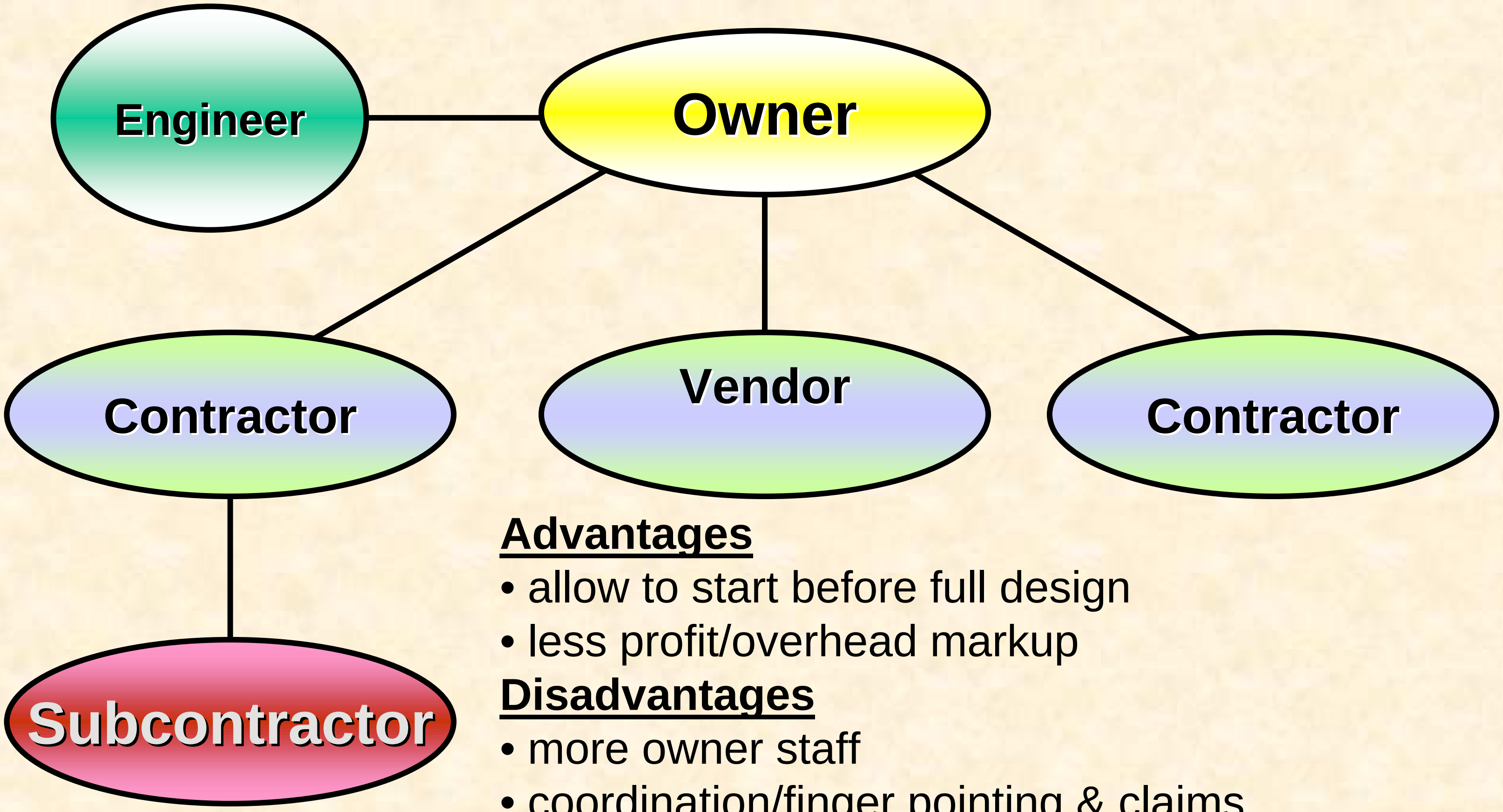
- Increase # vendors and contractors
- Wisely choosing appropriate project delivery structures
- Competitive pricing
- Implementing certain contractual measures
- Timing for contracting

Cost - Project Delivery Methods

- Many projects will need cost certainty for a variety of reasons
  - Desire to avoid cost overruns of 1970's and 1980's
  - Project finance requirements
  - State regulatory approvals
- How obtain certainty?
  - Lump sum turnkey EPC contracts
  - But can you achieve this in the current market?
  - What are the options?

Cost - "Multi-Prime" Project Delivery System

1970's and 1980's - many times "fast-track", multi-prime construction



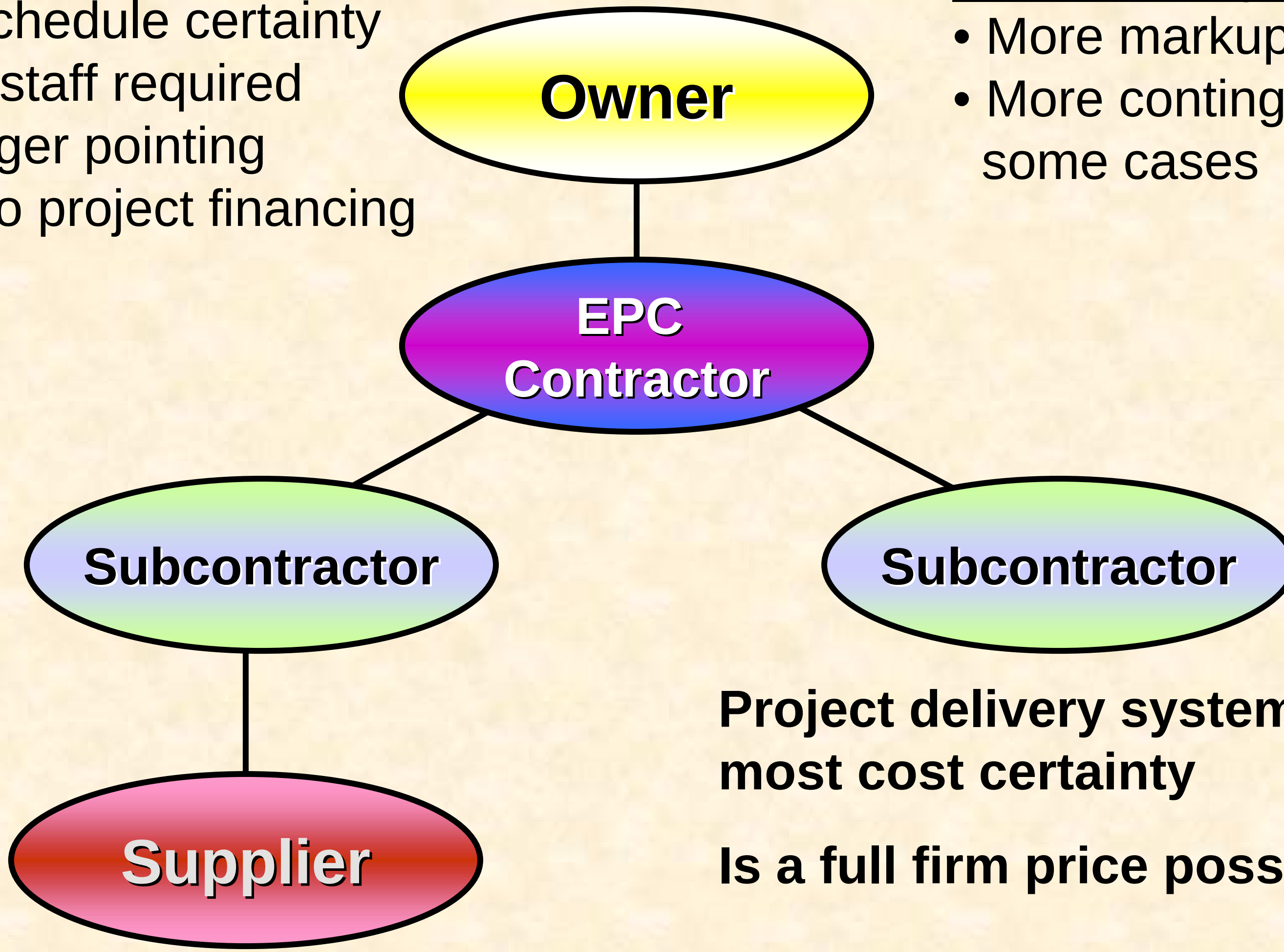
Advantages
- allow to start before full design
- less profit/overhead markup

Disadvantages
- more owner staff
- coordination/finger pointing & claims
- less cost certainty
- likely not work for project financing
- no full-wrap on performance requirements

Cost - Firm Price "Turnkey" EPC Contract

Advantages:
- More cost/schedule certainty
- Less owner staff required
- Reduces finger pointing
- Conducive to project financing

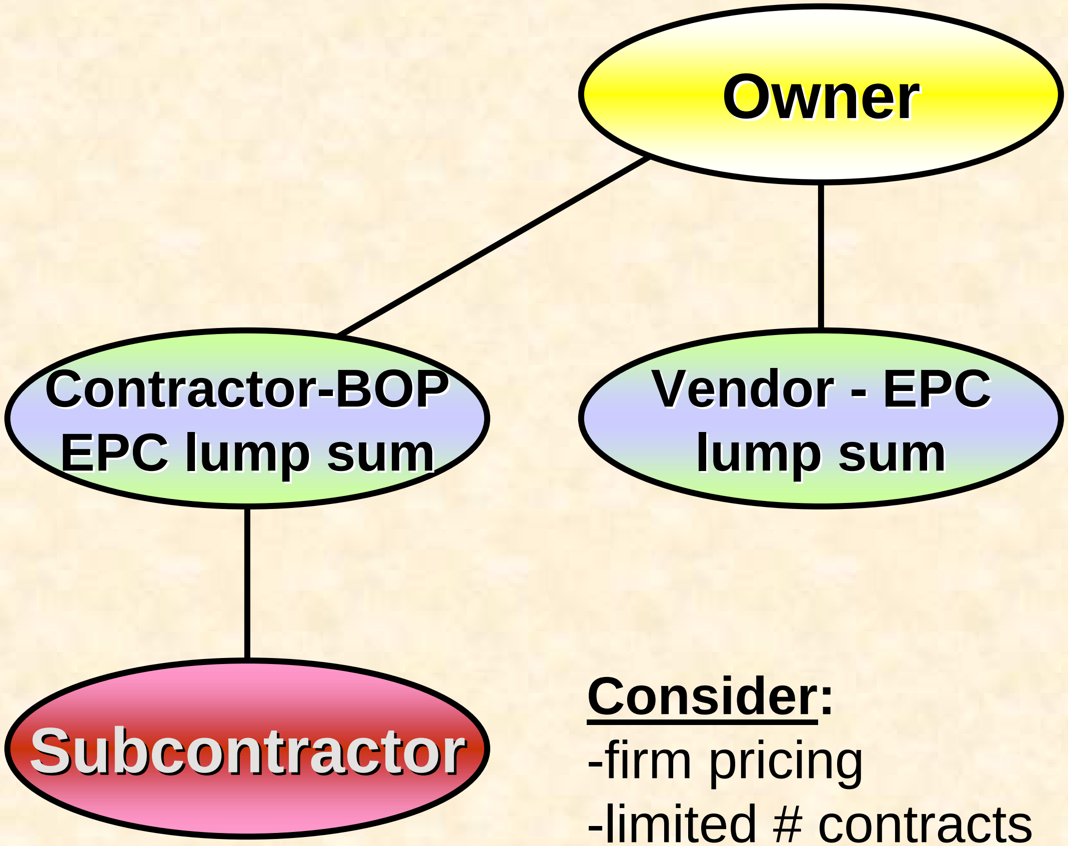
Disadvantages:
- More markup
- More contingency, in some cases



Project delivery system with most cost certainty

Is a full firm price possible?

Cost - Limited Multi-Prime with Firm Pricing



May follow a limited multi-prime contracting strategy, due to licensing requirements and need for locking down key long-lead components, and have owner resources to manage the interface

Consider:
-firm pricing
-limited # contracts
-assignment?

Cost - Cost Structure for New U.S. Projects

- Challenges in contracting on lump sum EPC price basis:
  - contracting years before breaking ground
  - new technology
  - limited availability of experienced personnel
  - material and labor escalation

Cost - Cost Structure for New U.S. Projects

- In the United States, the recent experience thus far has been to use an EPC Contract with a multi-faceted payment structure.
- Payment Methods used recently:
  - Fixed/Firm Pricing
  - Target Pricing
  - Time & Materials Pricing
- Each payment method applies to a particular portion of the Work

Cost - Cost Structure for New U.S. Projects

- Fixed/Firm Pricing
  - Applies to well-defined portions of the work, such as major equipment purchases
  - Fixed has no escalation; firm has escalation
  - Escalation could be tied to indices (e.g., Handy-Whitman) or could be a fixed percentage escalation
- Importance of Timing in Fixing/Firming Prices
  - Eliminate or better quantify risks and contingencies
  - Cash flow benefits

Cost - Cost Structure for New U.S. Projects

- Target Pricing
  - Applies to portions of the work that are less defined but generally understood (e.g., most likely field construction activities)
  - Target Price allows for sharing of risks and benefits
  - How and when to allocate cost-overruns and savings?

Cost - Cost Structure for New U.S. Projects

- Time & Materials Pricing
  - Applies to work that cannot be fully defined at the time of execution of the agreement (e.g., likely includes regulatory support and unit testing)
  - Time & Material rates stated as being reimbursed at actual cost; likely fixed multipliers included for contractor overhead, profit, etc.

Cost - Managing Cost within Existing Framework

- If this commercial structure continues to be used, how can an owner protect itself from cost overruns?
  - Maximize firm/fixed pricing
    - Develop a process to fix or firm prices even after contract execution
  - Reduce potential for Target Price to grow
    - Create incentives for contractor to work within the original target price goals
    - Restrict entitlement to change orders

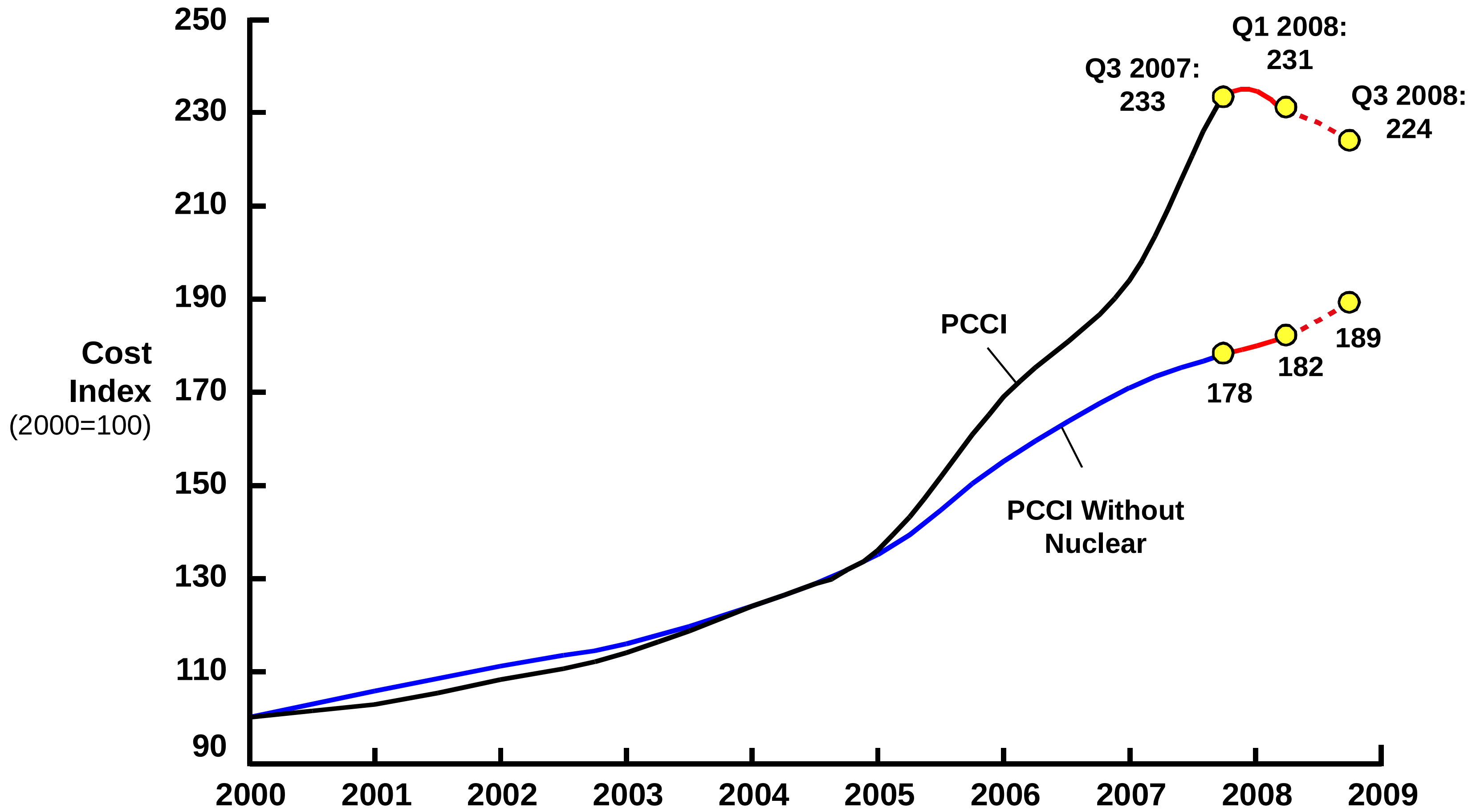
Cost - Managing Cost within Existing Framework

- But some indications that **Toshiba** may be willing to enter into a lump sum turnkey EPC contract. Why?
  - Experience with ABWR (4 operating in Japan, 2 under construction, & 7 other in various stages of development)
  - Significant interest in success of ABWR
  - Japanese government may provide financing of a portion of the plants outside US

Cost - Managing Cost within Existing Framework

- How will the current market affect the contracting for nuclear power plants?
  - contracting structures/pricing?
  - commodities?
  - labor availability?

IHS/CERA PCCI projections: With and Without Nuclear Projects



Source: Cambridge Energy Research Associates. May not be reproduced or distributed without the express consent of IHS/CERA.

Cost - Reducing Change Order Risk

What contractual measures can you implement to reduce Change Orders?

Cost - Contract Provisions

Avoid This!

Cost - Change Orders

Actions Before Contract Signed?

- Good Scope of Work
  - Both parties work diligently on scope
  - Performance based specifications, to the extent possible, but with sufficient detail to describe requirements.
  - Owner should fully vet scope of work

Cost - Change Orders

Contract Measures?

- Get Contractor *contractual* "buy-in" to scope
- Well-defined change order clauses:
  - Change only by change order
    - Unilateral by Owner or mutual
    - Exclusive list of rights to change orders
  - Monthly lien & claim waivers
  - No "cumulative" impact claims

Schedule

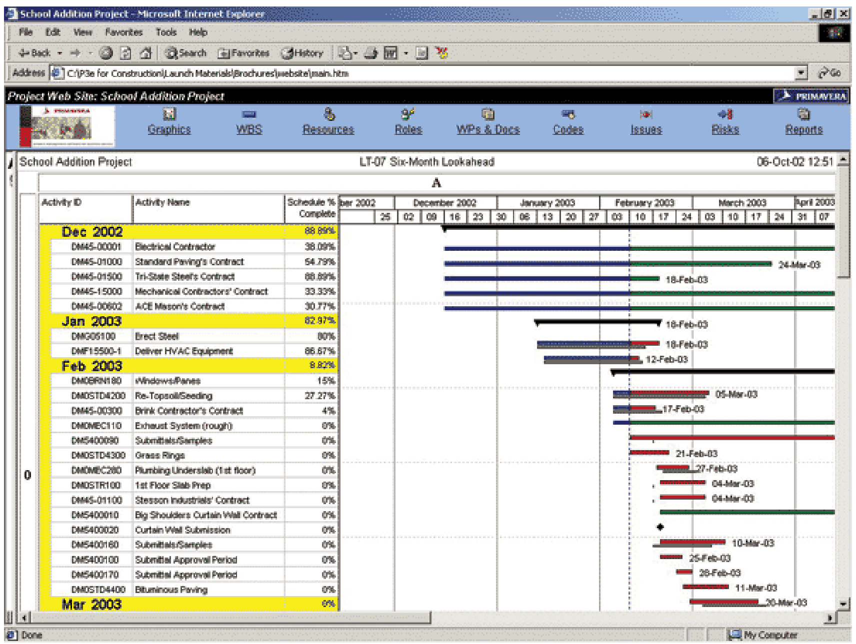
"Time is Money"

- *What measures can you take to reduce your chances of having a late project?*
- *If it is late, what are your remedies?*

Schedule - History of Completion

- History has not generally shown timely completion of nuclear projects
- US Projects - Current operational facilities with start of construction from 1966 to 1977
  - average construction period - 9.3 years
  - longest construction period - 23 yrs, 6 mos.
  - shortest construction period - 3 yrs, 4 mos.

Schedule - Scheduling Obligations



Scheduling Obligations

- Good, detailed CPM Schedule
- Strong contract rights regarding scheduling obligations
- Must tie to commercial obligations (e.g.,PPA)

Schedule - Scheduling Obligations

- Recently executed EPC contracts for nuclear plants included minimal requirements for developing and updating CPM Schedules.
- In fact, one utility has requested a 30-month schedule contingency in its regulatory filing.
- We recommend:
  - Owner-approved baseline CPM Schedule along with Owner-approved periodic updates
  - Expressly including the level of detail necessary for the CPM Schedule (e.g., resource/man-hour loaded Level 4 CPM Schedule)
  - Use of CPM Schedule to justify any schedule extensions entitled under a change order

Schedule - Schedule Delays

Delays Caused by Owner, Force Majeure, etc?

- Clear definition of force majeure
- Clear definition of when schedule extension is justified
  - All entitlements to schedule extensions should be expressly stated within the agreement
  - No cumulative impacts

Schedule - Ensuring On-Time Completion

- Integrated CPM Schedule and Project Execution Plan
- Proper scheduling requirements for equipment suppliers
- Recovery rights
- Acceleration rights
- Delay liquidated damages?

Schedule - Ensuring On-Time Completion

- Schedule incentives versus delay liquidated damages
  - In some cases, Cost/Benefit to Owner may not justify delay liquidated damages
    - Owner carrying costs for its staff as well as replacement power and possibly cost of capital (if no CWIP recovery) could in some cases greatly exceed any potential delay liquidated damages
    - Increase in owner cost from contractor because contractor may price in delay liquidated damages
  - Assessment of delay liquidated damages promotes adversarial relationship
- Schedule incentives may be more helpful to create proper conduct from contractor

Thank You

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