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Lessons from the Prior Cycle

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Senior Partner

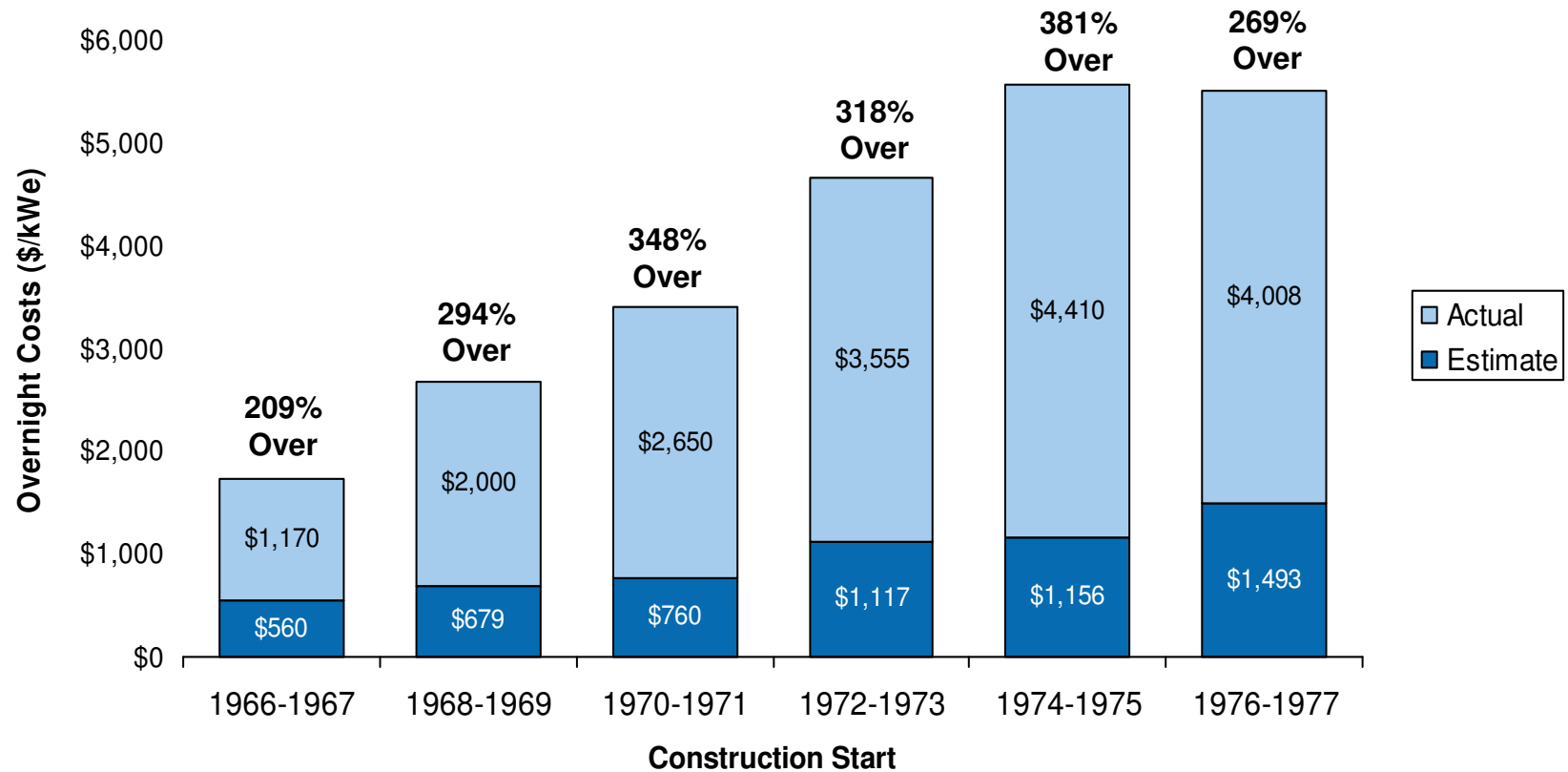
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Recognizing the Challenge

- Prior cycle nuclear project construction performance provides an unwelcome backdrop for the current planned cycle ...
- ... though poor construction performance was not unique to the nuclear sector, with many mega – projects experiencing under-performance ...
- ... and, many underlying root causes extending across projects – regardless of type
- Nonetheless, solving the dilemma of large project construction performance remains a critical challenge to current new build owners ...
- ... with the lessons of the last cycle providing an important foundation for better informed project planning ...
- ... though, early indications are that these lessons have not been adequately captured and embedded by owners

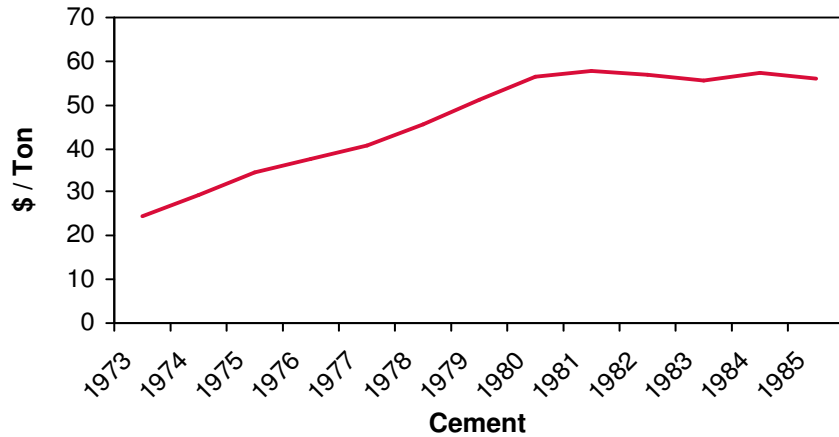
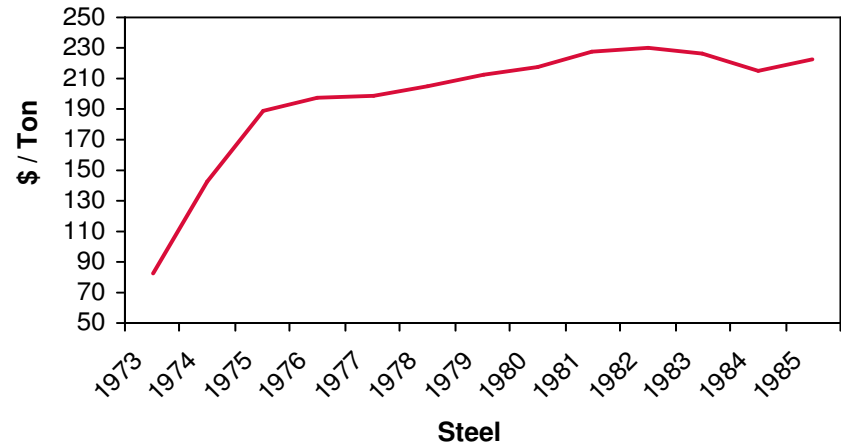
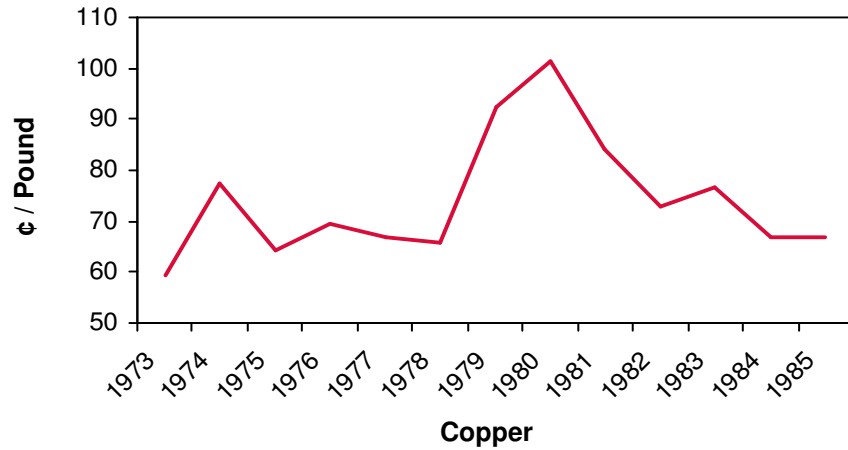
Planned-to-Actual Comparisons

Cost Projections vs. Realized Costs



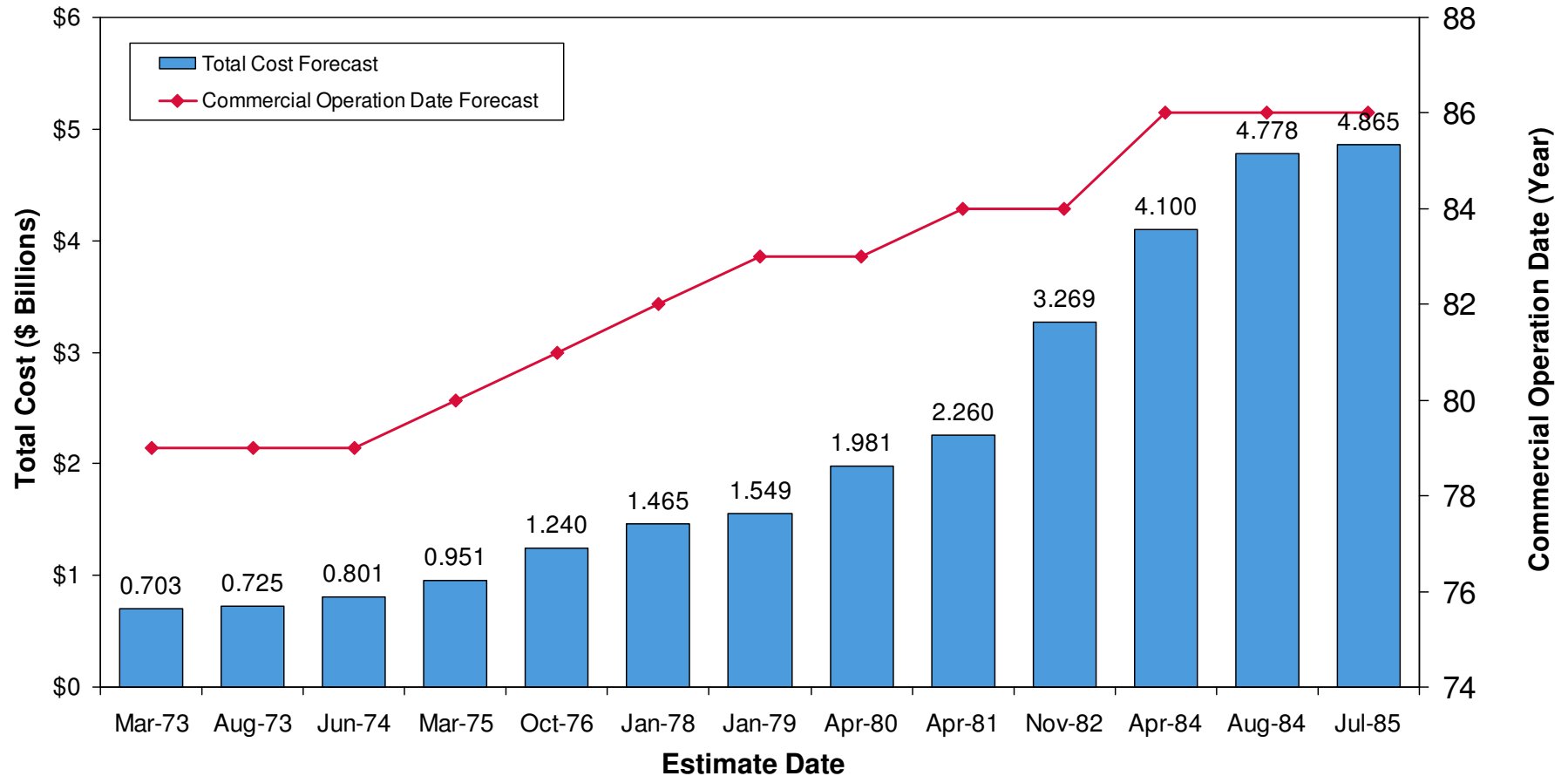
* Estimated range
Source: EIA

Historical Commodity Price Pressure



Source: Booz & Company analysis

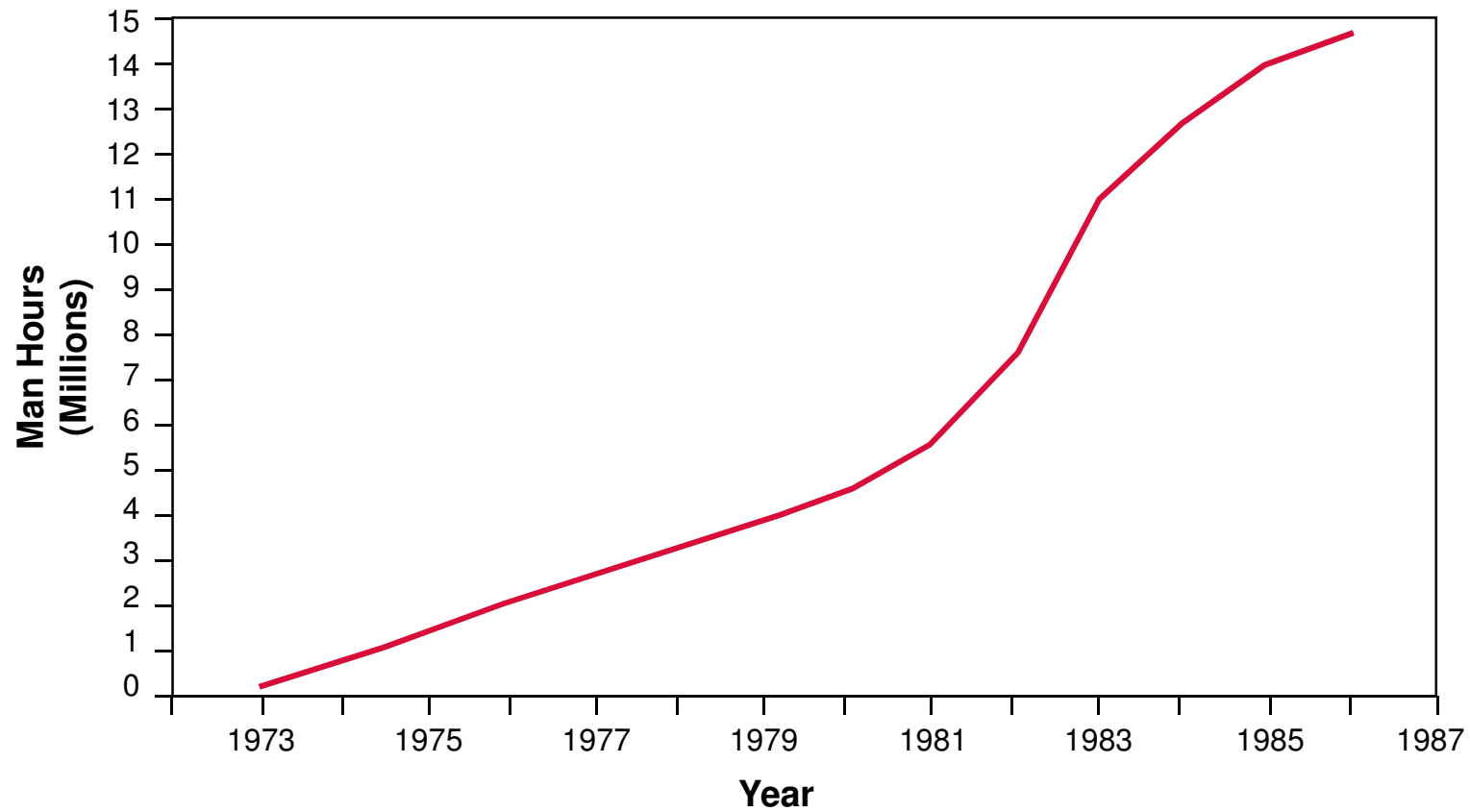
Plant Example – Seabrook



Source: Company information

Seabrook Engineering Hours

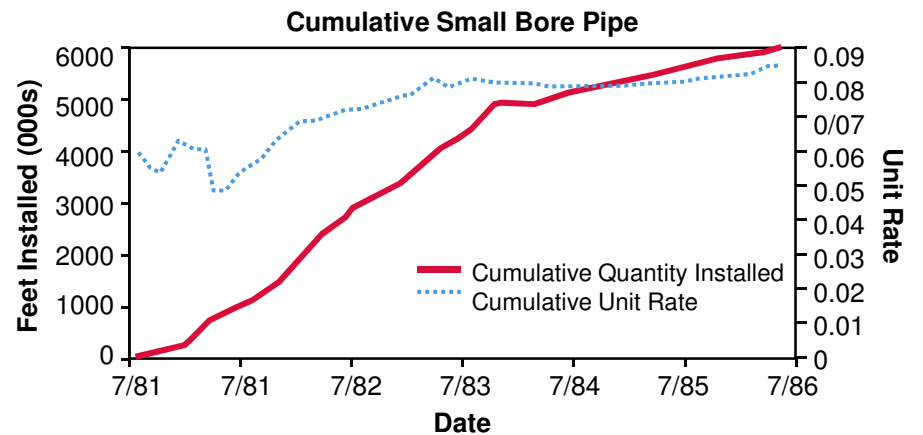
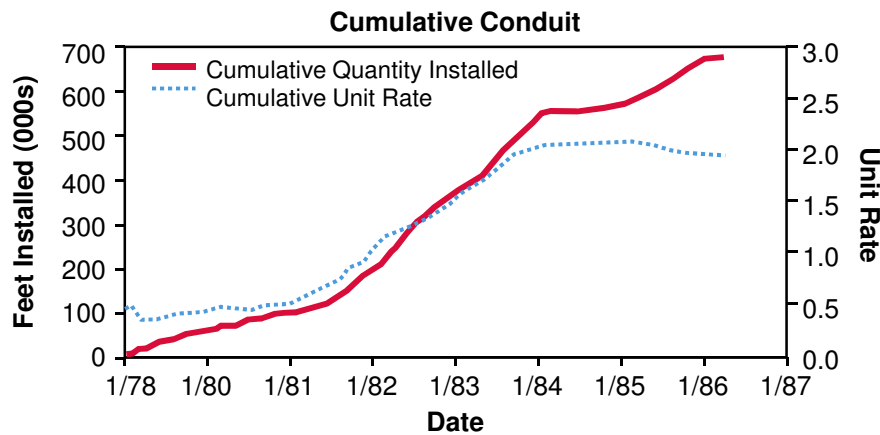
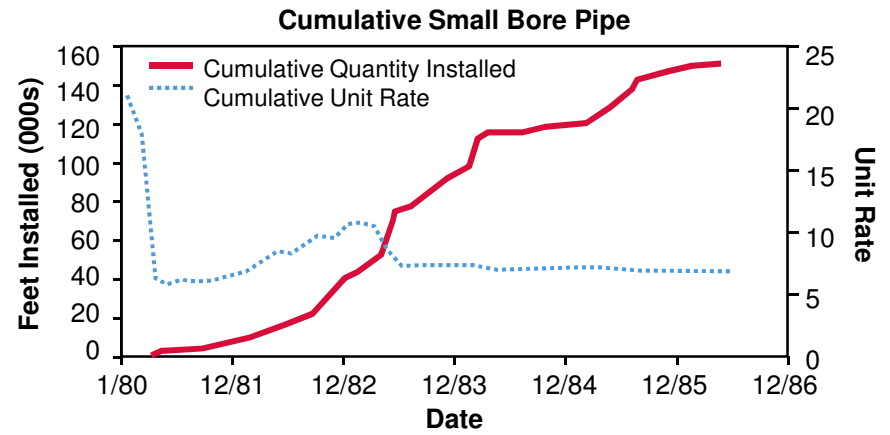
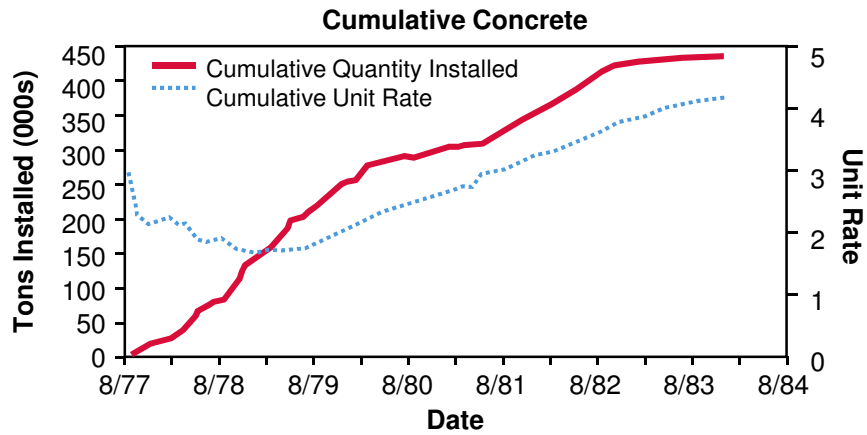
Seabrook Station
Total Engineering Cumulative Man Hours



Source: Company information

Seabrook Commodity Profile

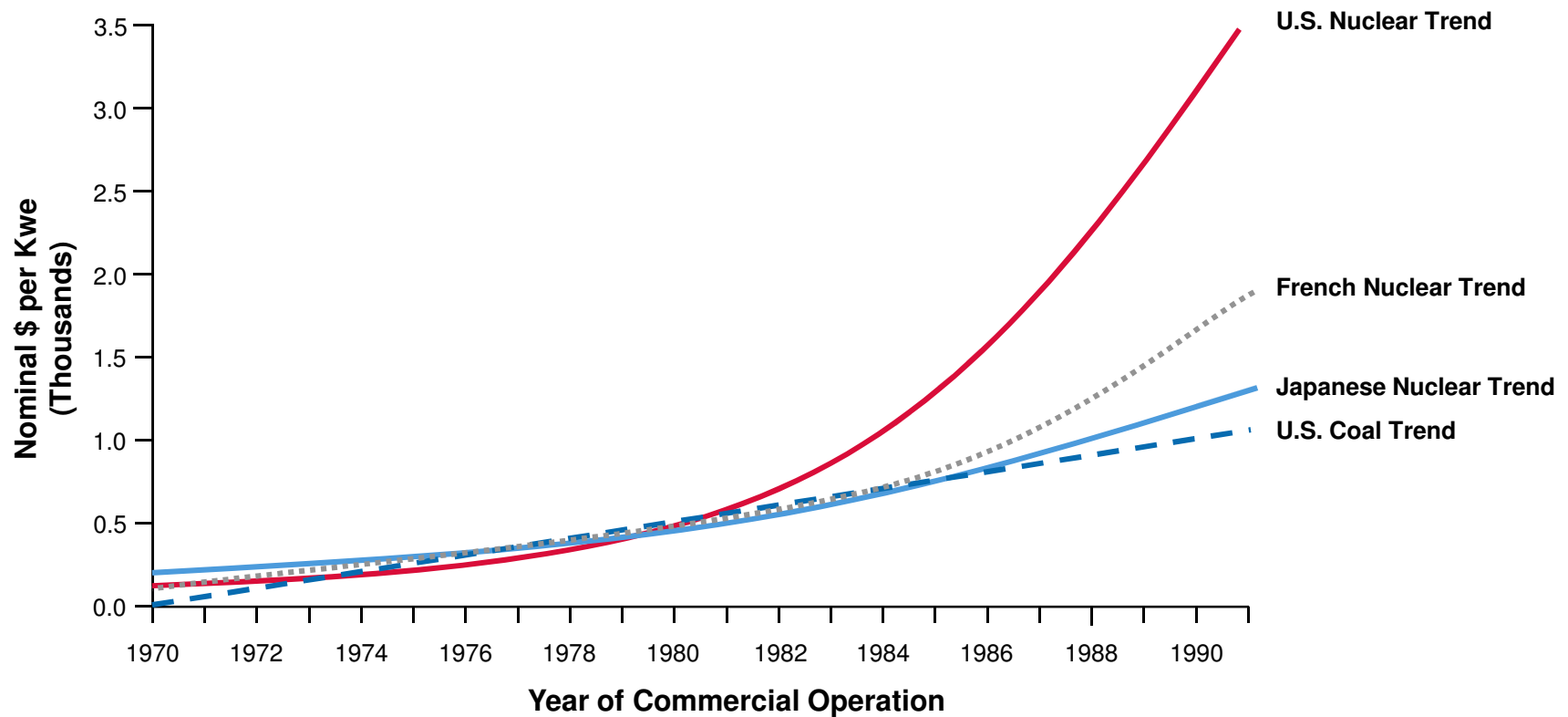
Seabrook Station



Source: Company information

Selected Country Cost Comparison

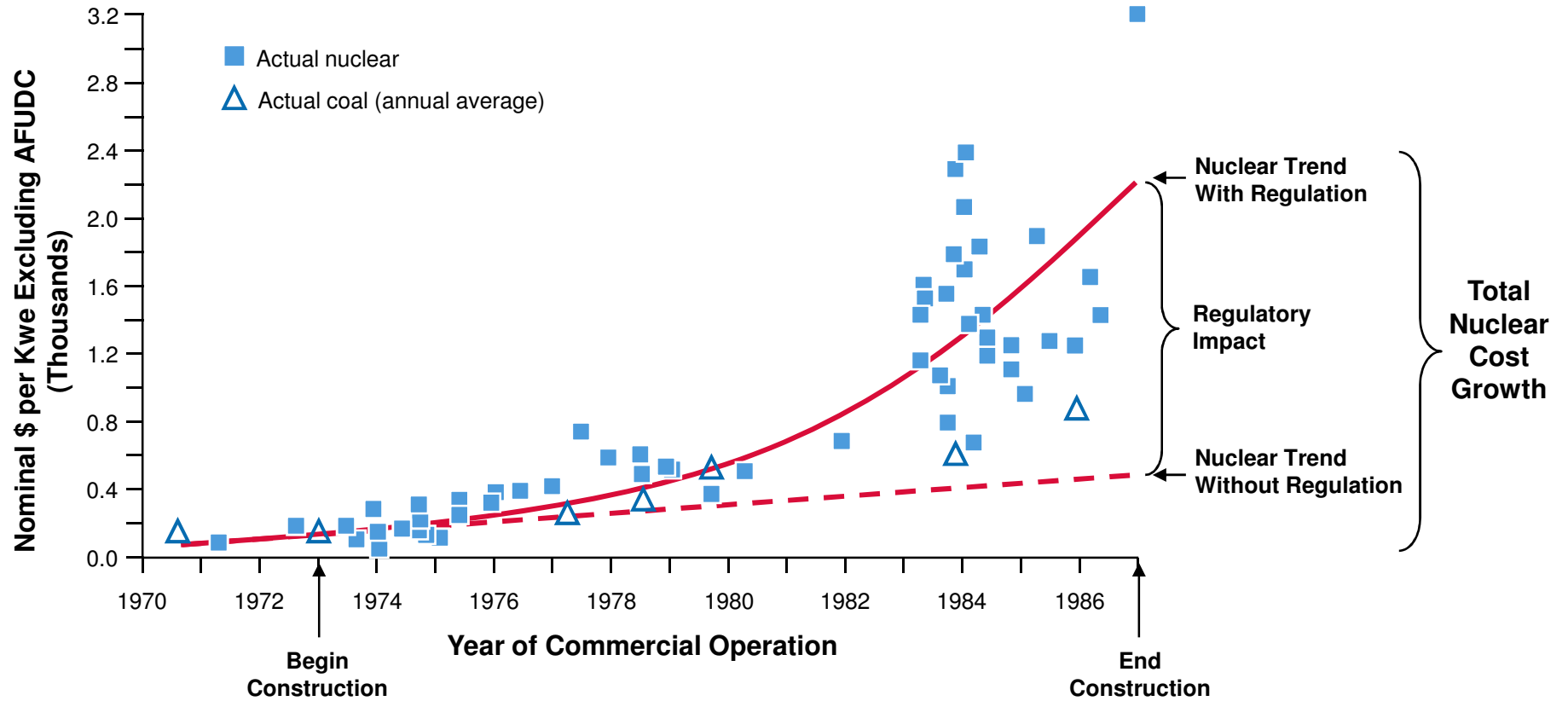
Comparison of U.S. Nuclear, Foreign Nuclear, and U.S. Coal-Fired Power Plant Construction Cost (Excluding AFUDC)



Source: Booz Allen Hamilton analysis of construction cost data

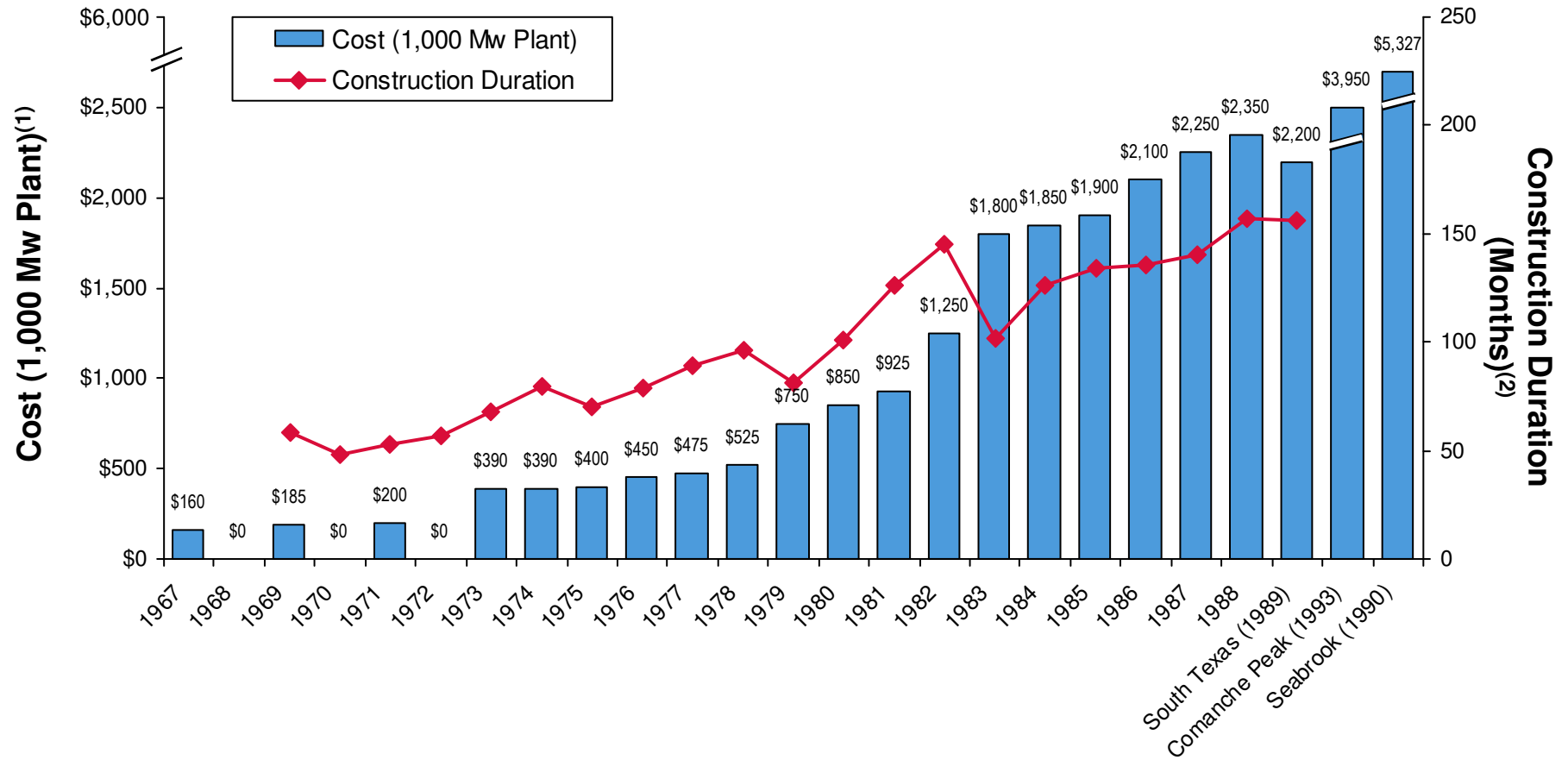
Impacts of Regulation

Estimate of Regulatory Impact on Nuclear Power Plant Costs



Source: Booz Allen Hamilton analysis of TVA nuclear, UDI coal (pre 1984), and UE&C coal (post 1984) data

Prior Cycle Changes



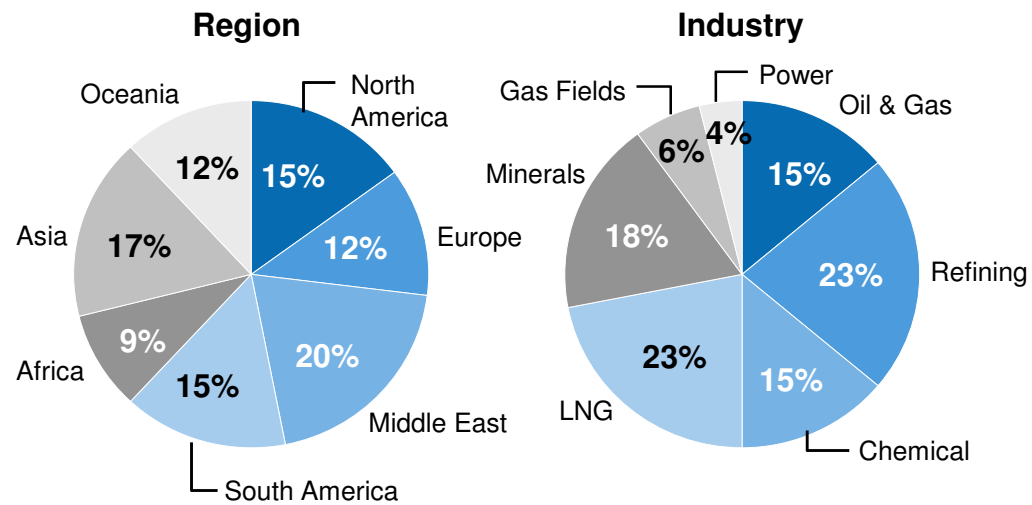
⁽¹⁾ Reflects the median cost of building a hypothetical 1,000 MW nuclear plant at current price of labor and materials

⁽²⁾ Reflects duration between construction permit and operation

Source: Energy Economics Database, NRC

Mega-Projects Summary

Projects Categorization

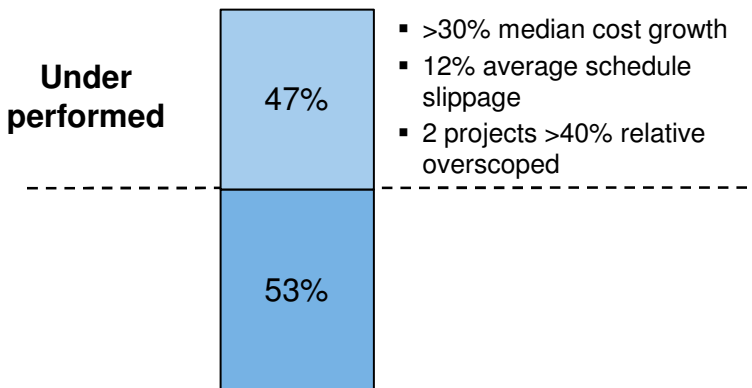


Summary of Outcomes

- Number of projects: 34
- Average cost: \$1.5 B (\$ 2005)
- % projects with new technology: 28%
- % projects as joint ventures: 72%

34 Projects

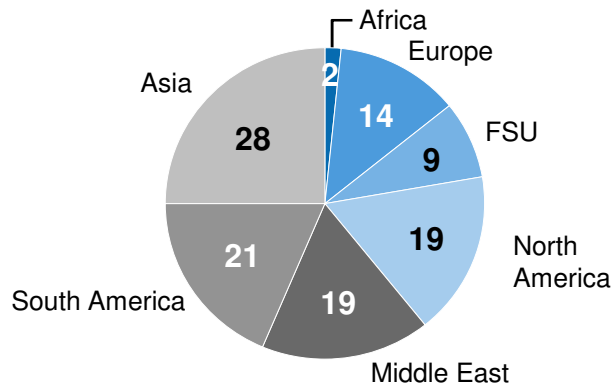
Under performed



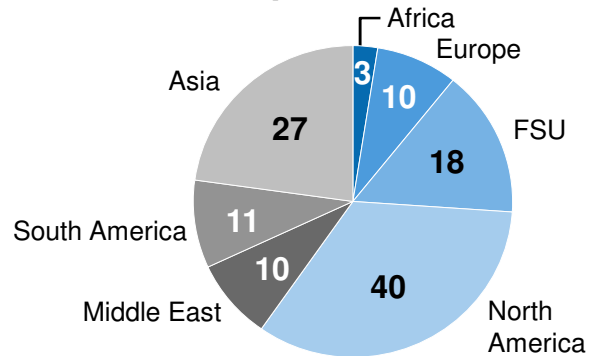
Sources: Canadian Institute, Independent Project Analysis (IPA)

Mega-Project Results – Energy Only

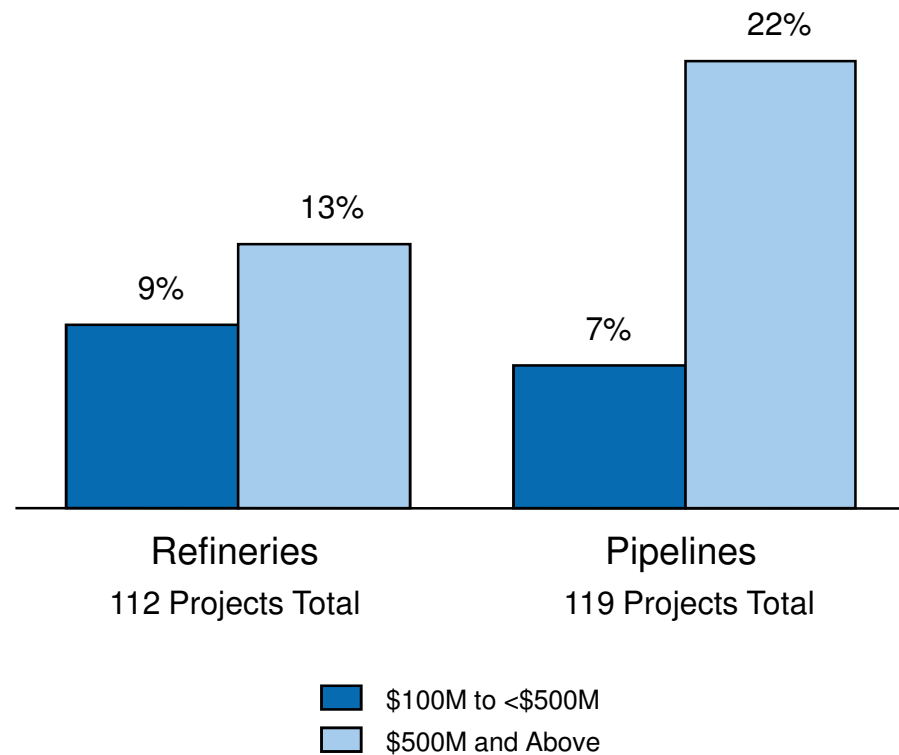
**Regional Representation
Refinery Data**



**Regional Representation
Pipeline Data**

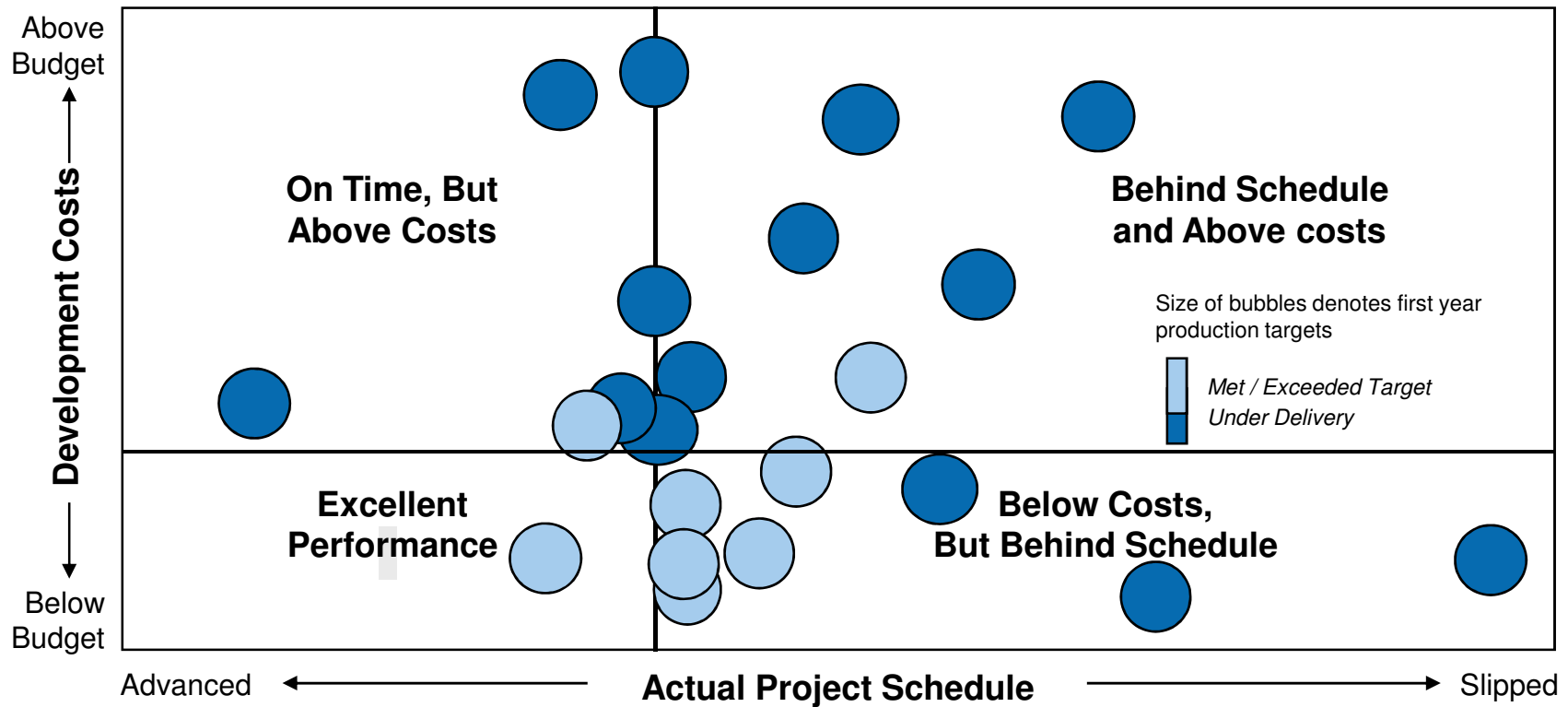


**Percentage of Projects
Falling Behind Schedule**



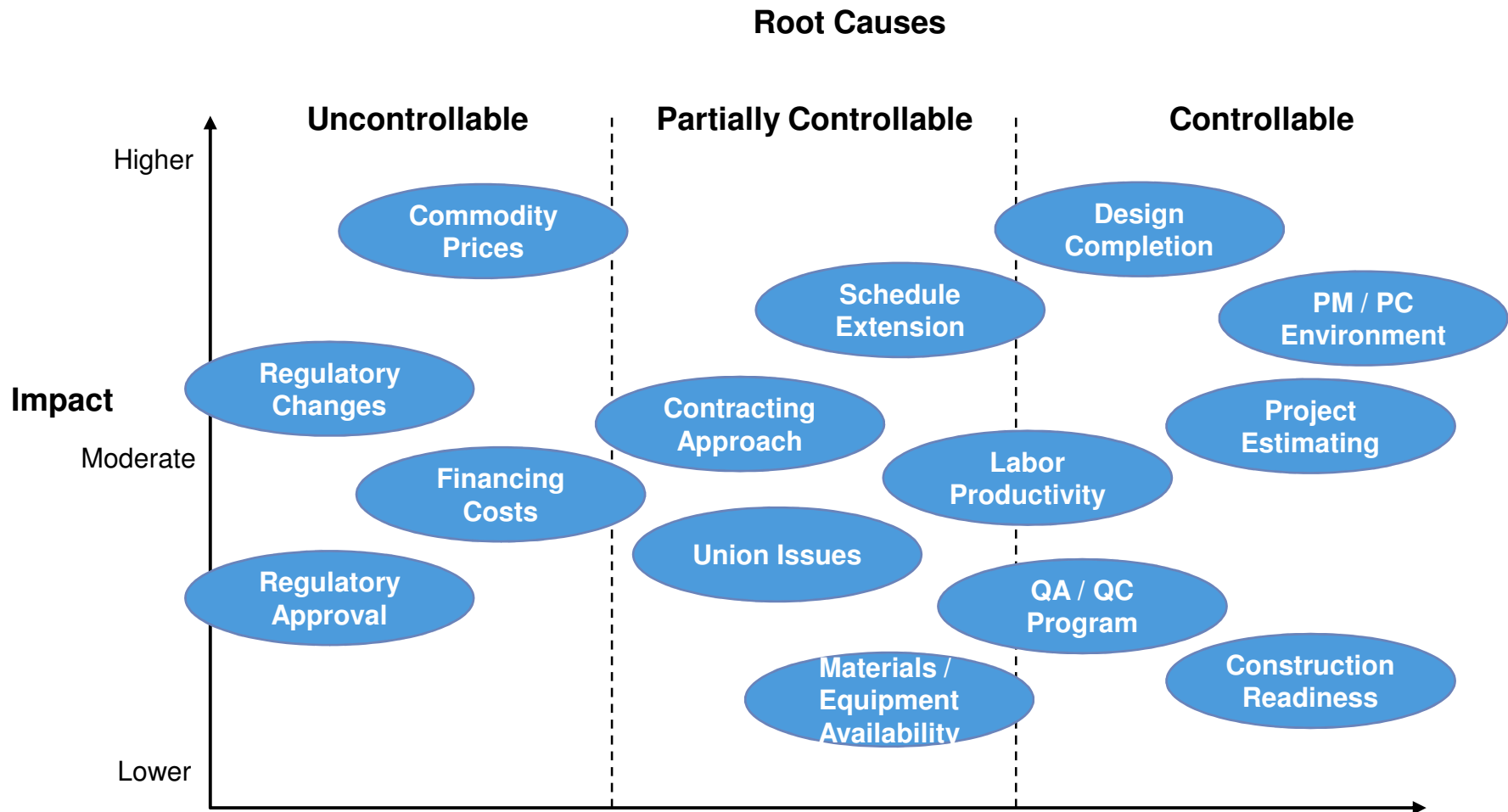
Correlation: Size and Outcomes

Typical Company Project Performance



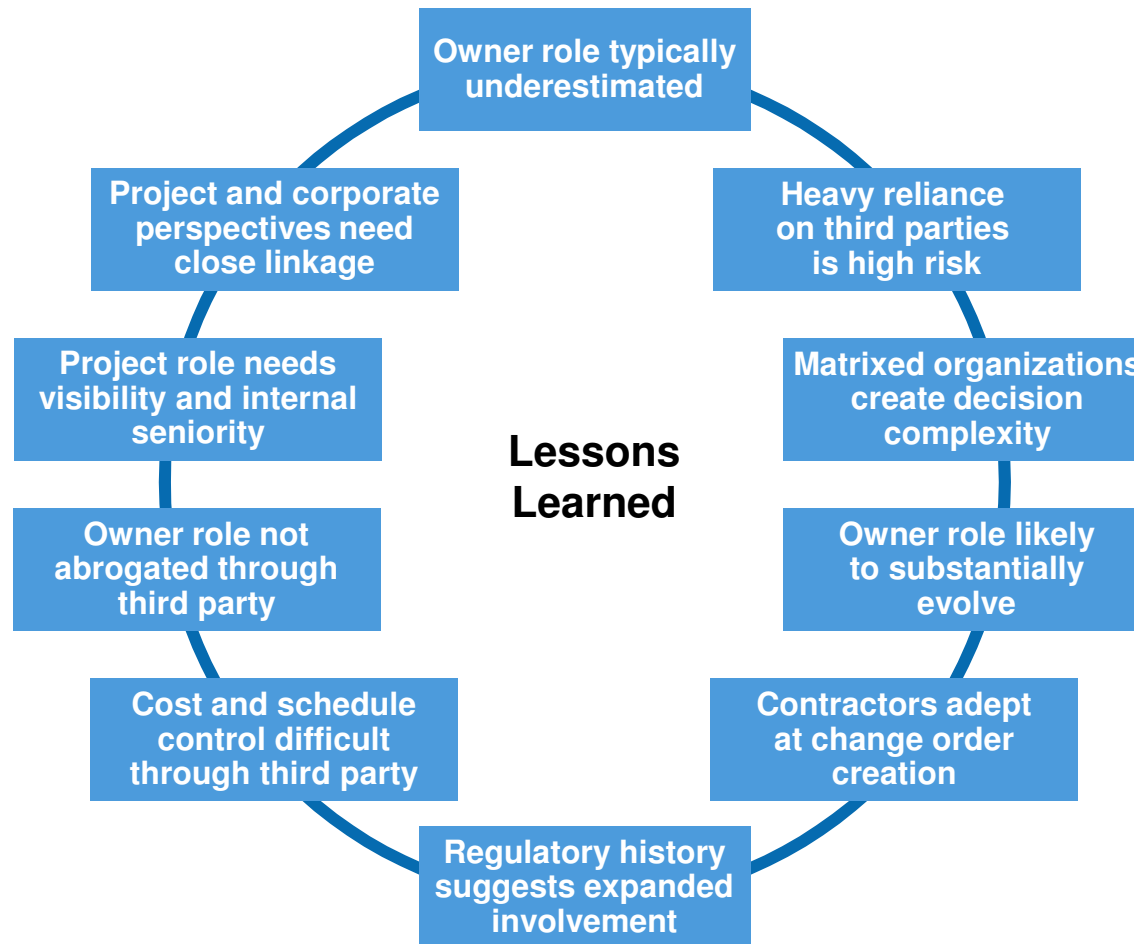
Source: Booz & Company analysis of over 20 projects

Project Under-Performance



Source: Booz & Company analysis of over 20 projects

The Key Lessons

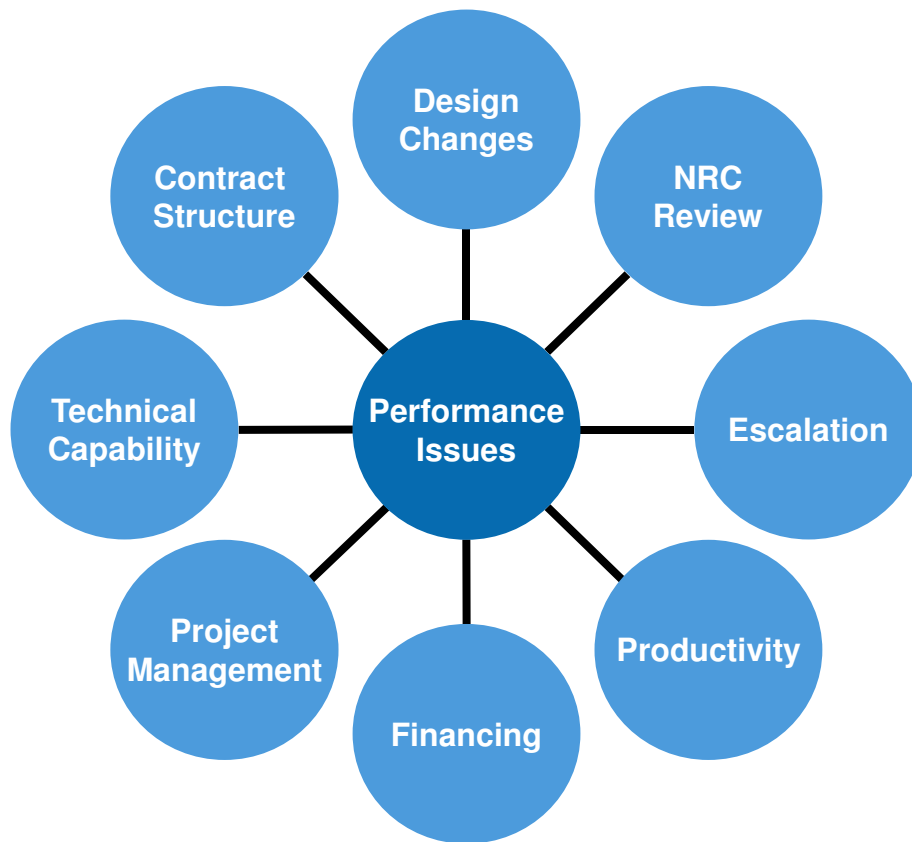


Implications

- Project-focused organization needs to be created for execution
- Recognition of owner role needs to be reflected in the contract
- Gameplan for contractor interface needs to be developed early
- Resource level needs to be recognized and planned
- Prudence standards need to be defined and agreed to early
- Alignment with corporate objectives needs to be achieved early
- Standards of performance for suppliers and contractors needs to be defined early

Common Problems Continued?

Common Problems with Nuclear's Initial Cycle

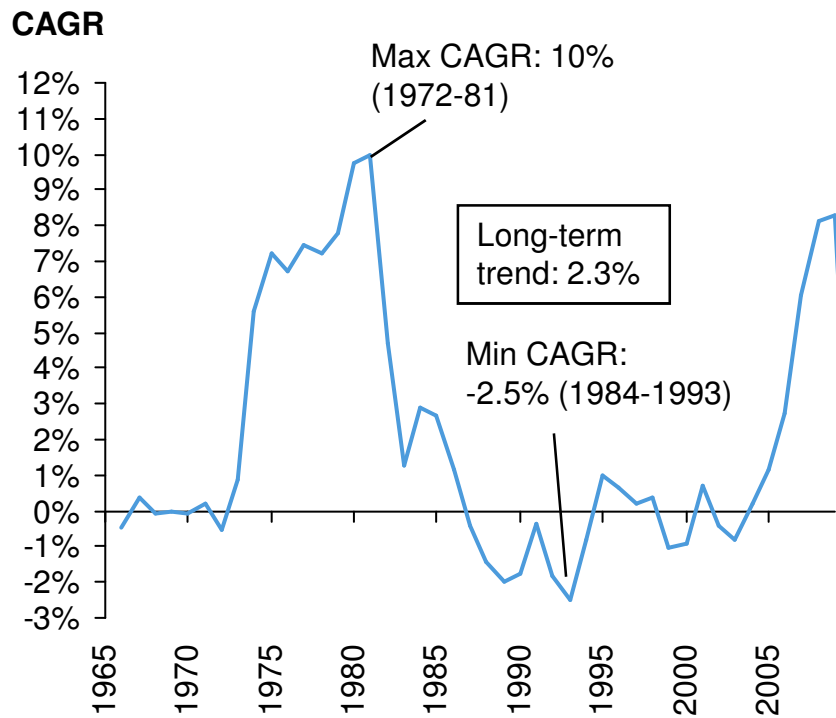


Carryover Issues to the Current Cycle

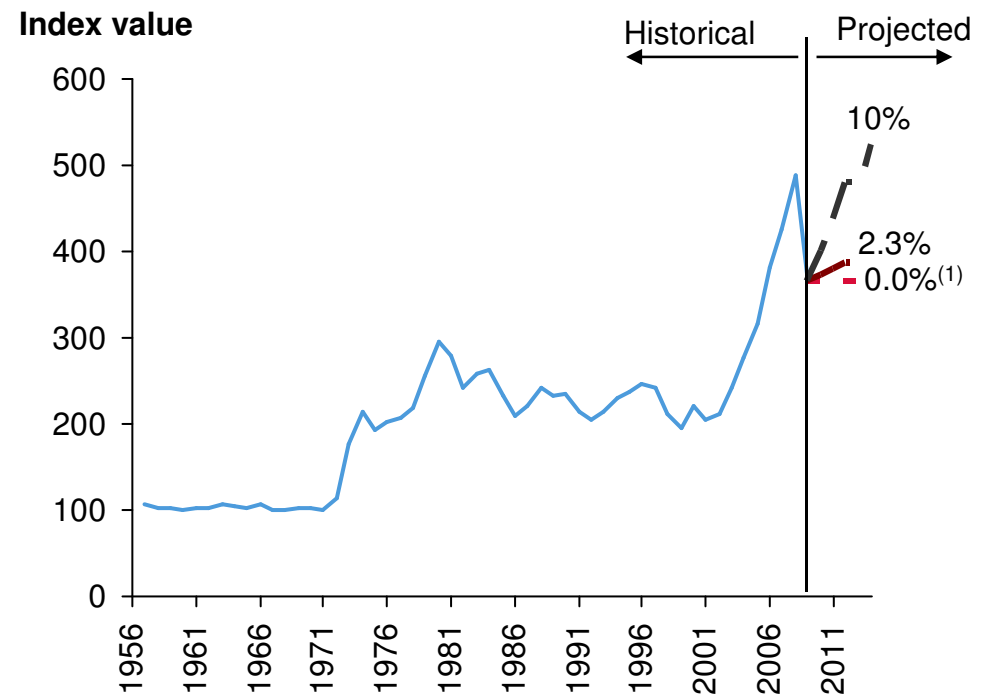
	<u>Observed Challenges</u>	<u>Potential Impact</u>
▪ Design Changes		<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ NRC Review		<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ Escalation	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ Productivity		<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ Financing	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ Project Management	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ Technical Capability	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>
▪ Contract Structure	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>	<div style="width: 100%; height: 15px; background-color: #4F81BD;"></div>

Commodity Price Escalation

10 Year CAGR



CCI index

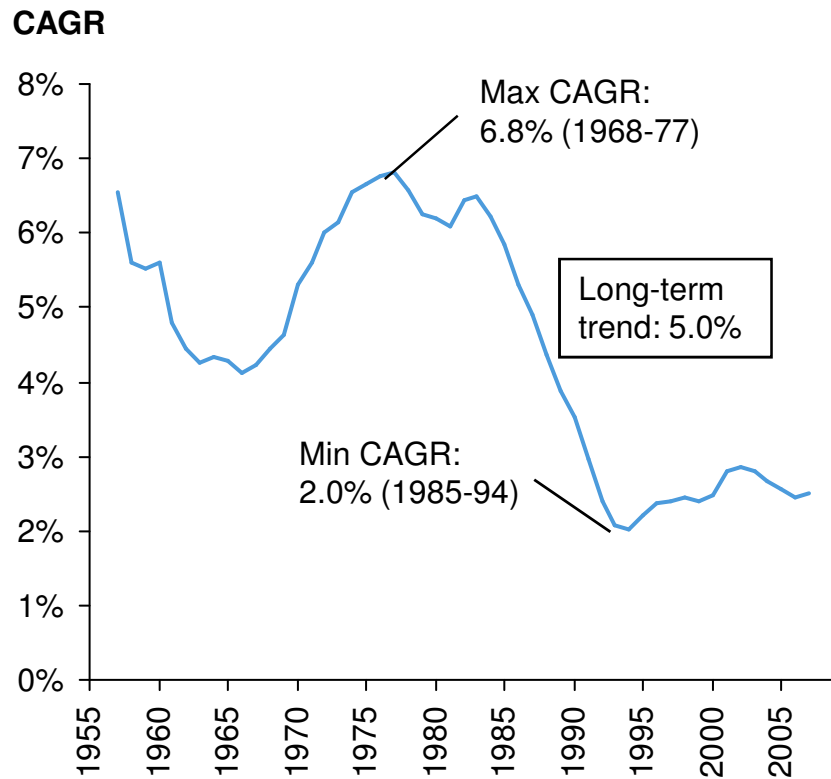


Source: Commodity Research Bureau, CCI Index

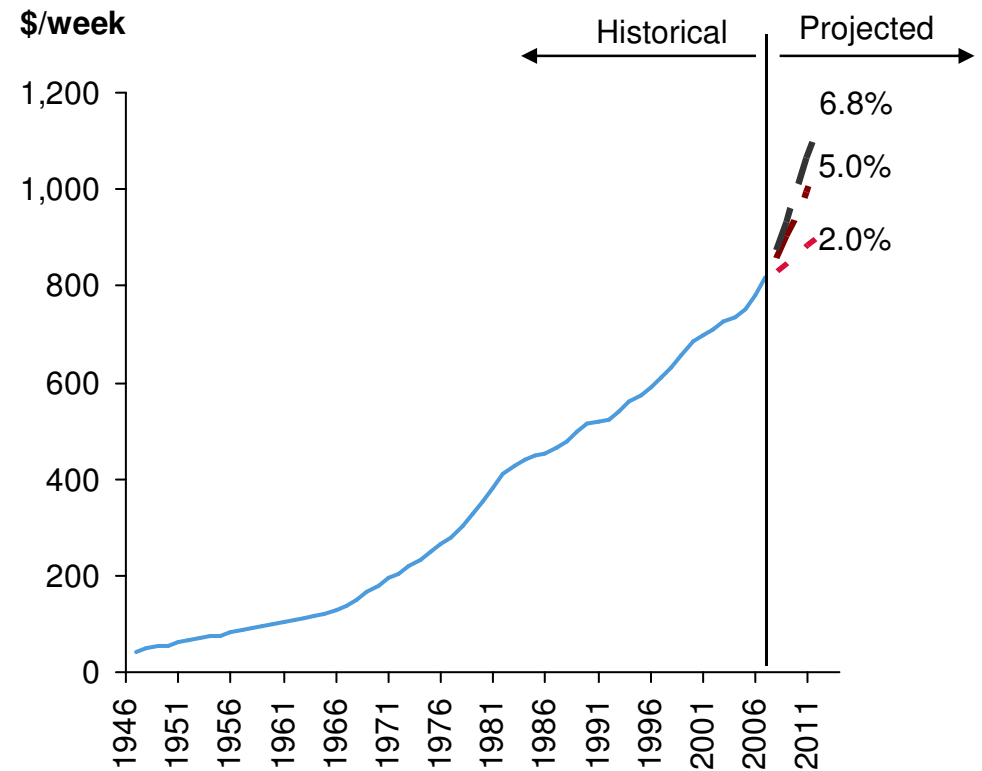
⁽¹⁾ Minimum rate adjusted for the recent drop in commodity prices from -2.5% to 0.0%

Craft Labor Cost Escalation

10 Year CAGR



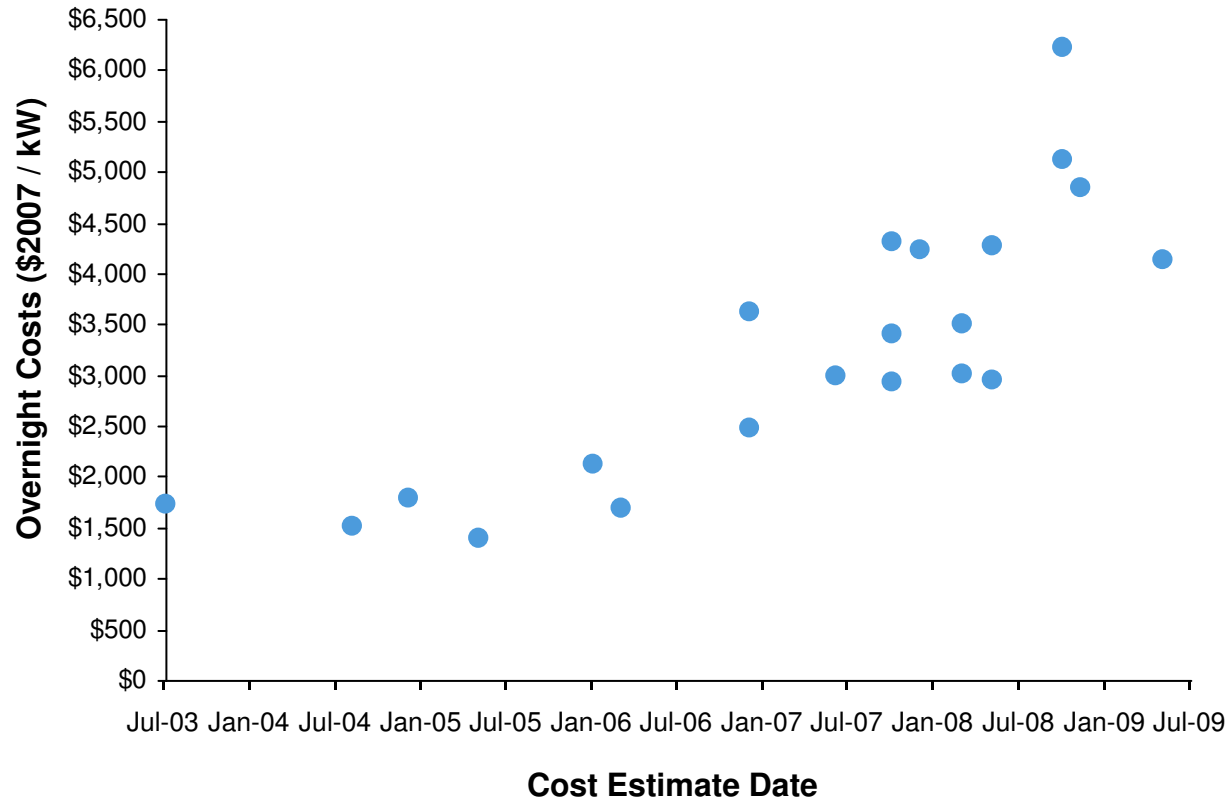
Weekly Labor Prices



Source: Bureau Labor and Statistics and Booz & Company analysis

Critical Requirements for Success

Nuclear Overnight Costs



Owner Focus Areas

- EPC contract structure
- Owner involvement level
- State legislation parameters
- Financing sources and requirements
- Regulatory participation level

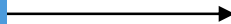
Selected False Premises

Selected Owner Beliefs

Adequate protection in the contract



Limited project management requirements



Sufficient technical and labor resources



Construction techniques universally applicable



Issues

- All parties are risk averse
- Risks not being mitigated through experience
- Stakeholders look through the EPC
- Internal capability has atrophied
- Demographics not entirely favorable
- Competition is fierce given capacity and avoidability
- Plant sites not equally enabled
- “Stick-built” still being actively discussed

Changes to Contracting Models

Reported Change in Type of Contract Mechanism Used



Reported Current Distribution of Contract Mechanisms (%)

Contract Type & Usage	Lump Sum / Turnkey	Fixed with Escalation	Hybrid Structures	Target Price with Incentives	Time and Materials
	15%	20%	50%	5%	10%



Contract Structure Observations and Implications

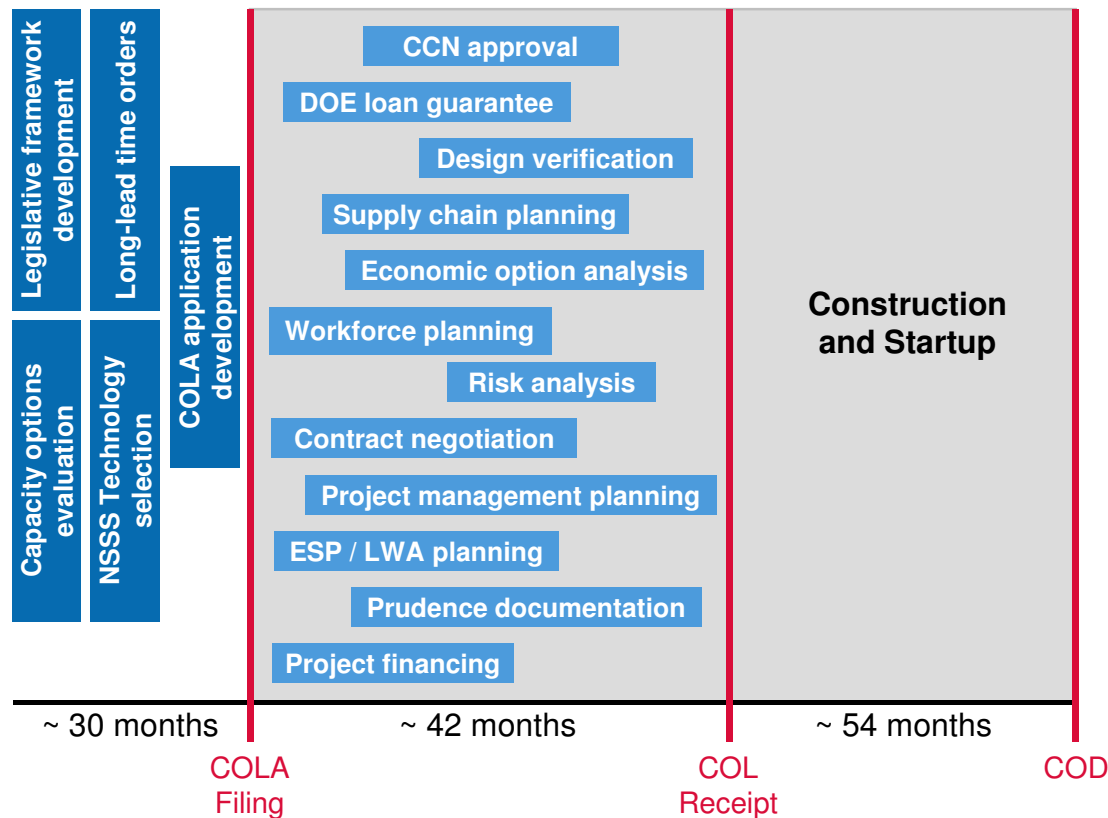
Observations:

- 65% of owners reported that EPC contractors had become more risk averse
- Only 15% of owner projects discussed were LS-TK and these were agreements that they could not likely get if negotiated today
- Increased use of hybrid contract structures that decompose projects into smaller, less risky and better defined elements
- Increased use of targets with incentives to help align interests
- Increased focus on building “win-win” long-term relationships

Source: External interviews, research documents, Booz & Company analysis

Leveraging the Planning Window

Project Development Life-Cycle (Illustrative Activities)



Considerations

- Critical planning issues
 - Regulatory issues
 - Project planning issues
 - Financing issues
 - Risk issues
 - Process issues

Balancing the Focus

Current Focus

- EPC contracting
- CCN approval
- Design certification
- COLA development / review
- DOE loan guarantee
- Regulatory models
- Financing structure
- Cost and schedule estimate

Illustrative Areas for Additional Emphasis

Owner project management requirements

Supply chain development

Long-lead components queue

EPC management capability

Regulatory interfaces and processes

Craft and technical availability