Project Delivery and CAPEX Challenges in the Construction Market

With EPC v. EPCM Risks and Rewards

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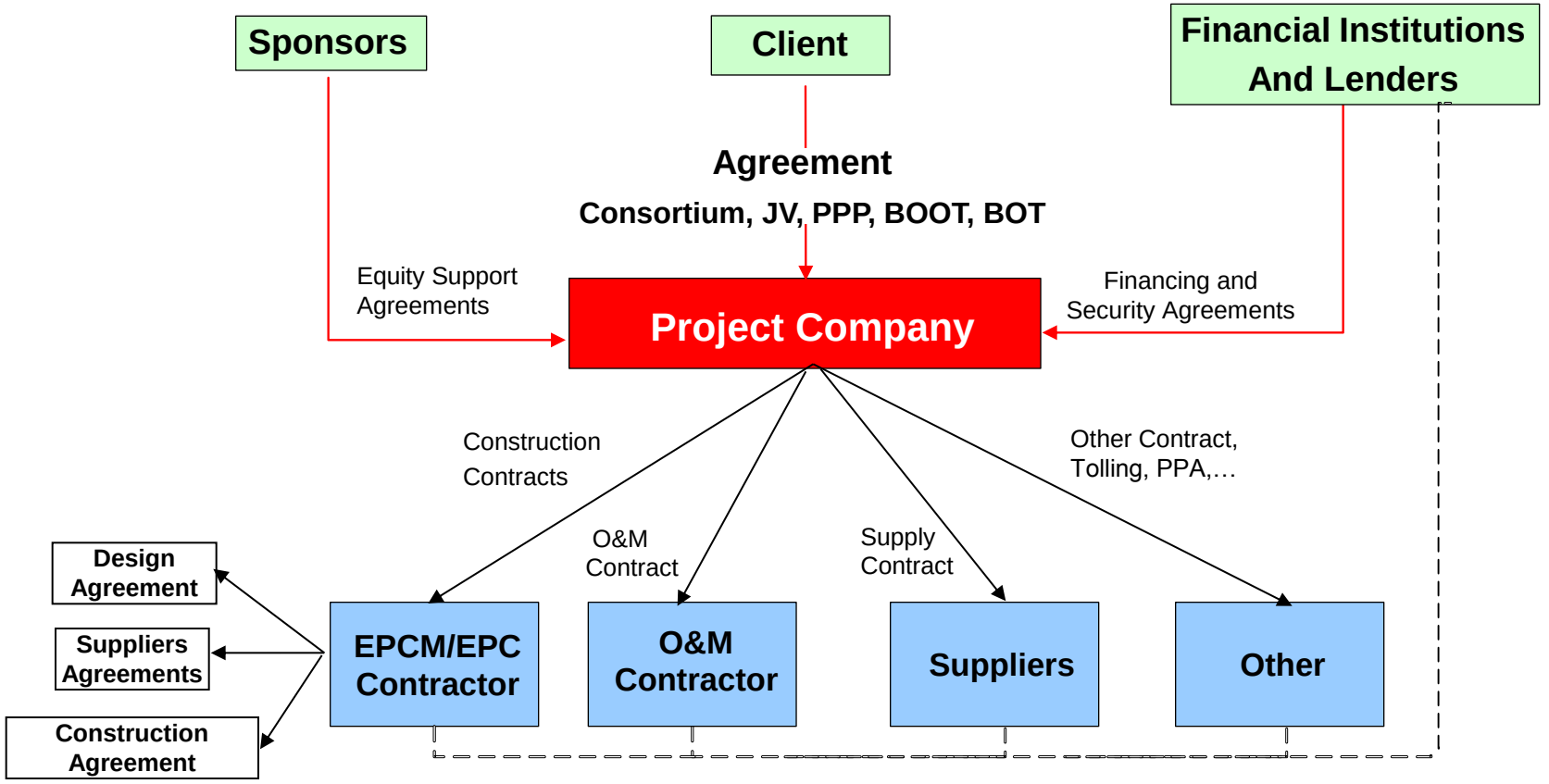
Presentation Content

- **Definitions and Common Understanding**
  - **Project Delivery Methods in Construction - Owners and Contractors' Perspective – EPCm v. EPC**
- **The Challenges in Today's Market**
  - **Contractual Challenges - Risk Issues & Concerns**
  - **Other Challenges: Technical, ESIA, Resources, Market**
- **The Impact**
  - **On CAPEX**
  - **On Schedule and Execution Plan**
- **Conclusion**

Contractual Arrangements and Project Model

A Typical General Contractual Structure Involving an EPC/M Agreement



O&M – Operation and Maintenance
PPA – Power Purchase Agreement
JV – Joint Venture Agreement
BOT – Build Operate Transfer
BOOT – Build Own Operate Transfer

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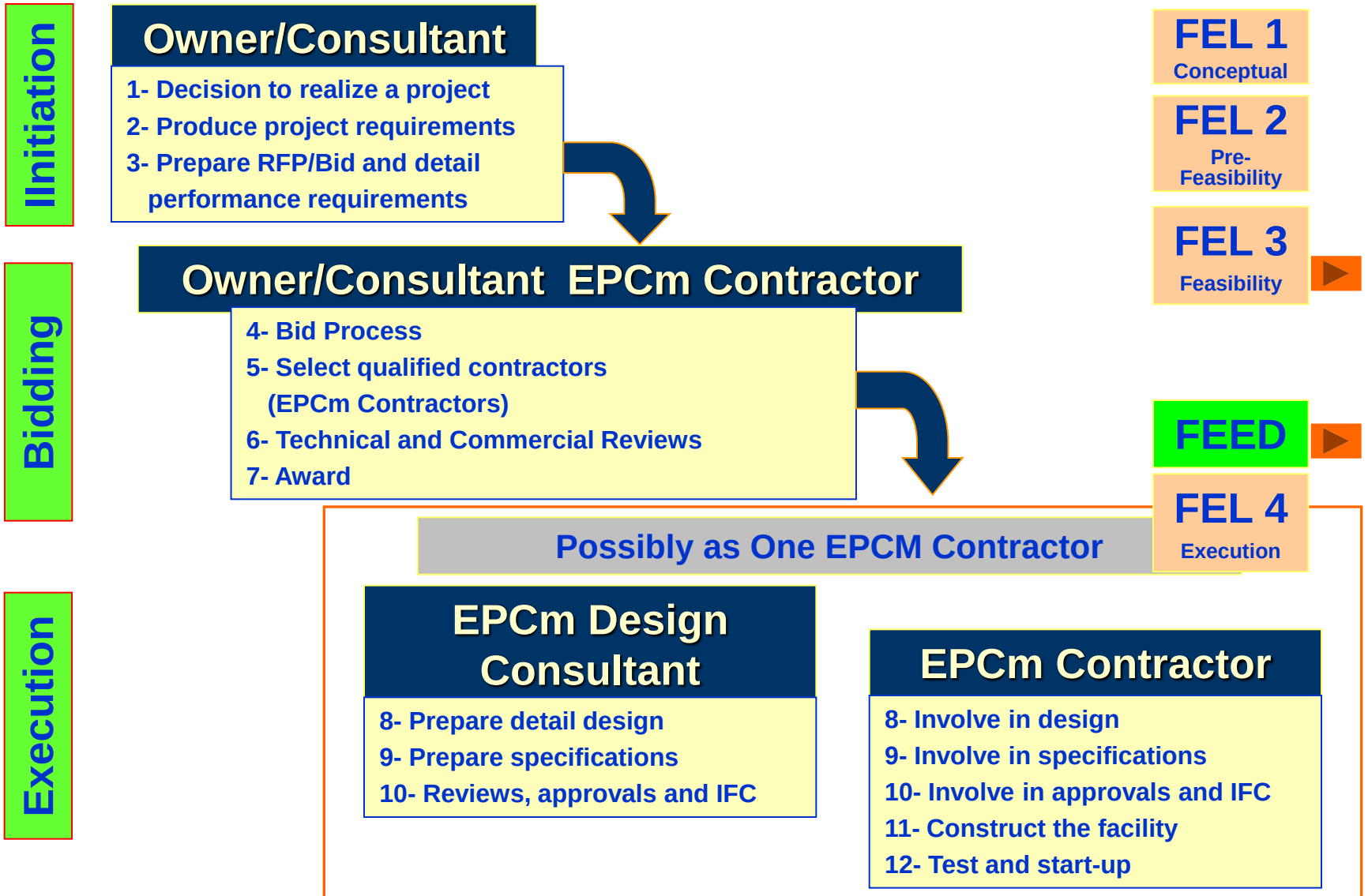
EPCM Contracting

- **EPCM** = Engineering, Procurement, Construction Management
  - Contractor manages for the principal (Owner) the overall design and project delivery on a fee basis
  - Risks remains with the project Owner
- **Alternatively known as:**
  - *Cost Plus Fees Contract*
  - *Cost Plus Fees with Incentives (better arrangement for the Owner)*
  - *Unit Price*
  - *Combination of the above*

The EPCM Process



EPC Contracting

- **EPC** = Engineering, Procurement, Construction
  - Contractor takes on the overall design and project delivery on a fixed price basis including risks – Therefore; Single Point Responsibility

- **Alternatively known as:**
  - *Turnkey Contract*
  - *Design Build Contract*
  - *Supply and Install Contract*
  - *Lump Sum Contract (Fixed Price or Stipulated price Contract)*
  - *"Hard" Money Contracts*

The EPC Process

Initiation

Owner

1- Decision to realize a project
2- Produce project requirements
3- Prepare RFP/Bid and detail performance requirements

Bidding

EPC Contractor

4- Bid Process
5- Select qualified contractors (EPC Contractors)
6- Technical and Commercial Reviews
7- Award

Execution

EPC Contractor

8- Prepare detail design
9- Prepare specifications
10- Reviews, approvals and IFC
11- Construct the facility
12- Test and start-up

FEL 1
Conceptual

FEL 2
Pre-Feasibility

FEL 3
Feasibility

FEED

FEL 4
Execution

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Contractual Obligations Risk From Pre-Award Arrangement – Risk Evaluation Phase

- Technical – proven technology?
- Commercial - The need, the market and the competition
- Capital Cost Estimate and Contingency
- Schedule – The feasibility of the schedule
- Political, Country and Location
- Permitting Risk – Environmental local issues
- Client technical knowledge, flexibility and communication skills
- Financial – Credit availability Risk
- Insurance and Bonds
- Special Considerations:
  - Limits of Liabilities: Technical Guarantees, Indirect and Consequential damages, Liquidated damages, Performance Bonds
  - Letter of Credit and Guarantee
  - Bonding: Bank Guarantees and Surety Bonds
  - Cash flows: Positive Cash flow, by Currency including interest charges
  - Taxation: Corporate, Local and Expatriate
  - Dispute resolution and Arbitration: Governing Law, Local v. International Law
  - Partnership: Subs and locals

Contractual and Legal Challenges – Post Award Phase

Need Common Understanding of the Most Important Contractual "Risk Shifting Clauses"

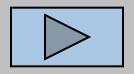
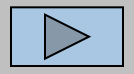
- LOI, NTP, Start Date
- Site Access and Availability
- Site Conditions and Soil Test Investigation
- Notices
- Liquidated Damages
- Differing Site Conditions
- Changes and Variations
- Time Extension and Delays
- Schedule Requirements, Interface and Coordination with Others
- Submittals and Approvals
- Payments
- Force Majeure
- Inspection
- Suspension of Work
- Termination
- Dispute Resolution

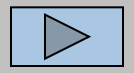
EPCM versus EPC

Contractual Clauses in Everyday Language :

- Responsibility for Design and Construction
- Cost and Schedule Risk
- Knowledge of the Total Scope, Cost & Timing
- Control of Scope Changes
- Ability to Obtain Guarantees
- Guarantee in Performance and Workmanship
- Management Oversight/Improve Risk Management
- Overall Delivery Period
- Ability for "Fast Tracking" Construction
- Delivering Contractually Obligated, High Quality Project
- Possibilities for Innovation
- Procurement Process
- Conflicts and Disputes



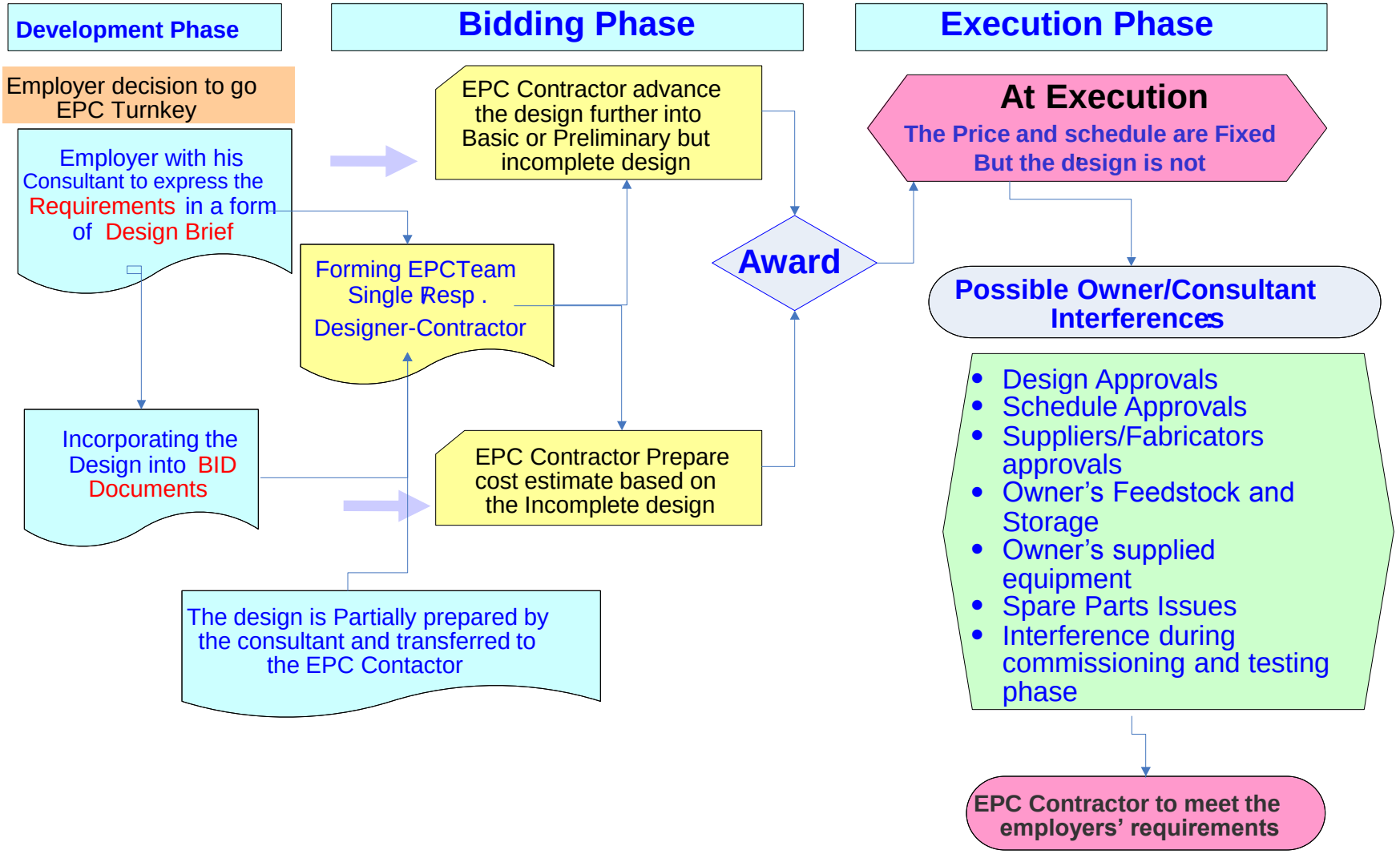



Responsibility for Design and Construction

	Owner	Contractor
EPCm	**Risk remains with Owner** Coordination and deliverables of E P and C is managed by the EPCm contractor.	**Less control with Less Risk** Requires considerable project management and Project Controls. Especially if the Owner's team lack experience and resources
EPC	**Some loss in control especially Quality** May require hiring design professional (rep) for Inspection	**Single Point Resp.** High Risk taking with better Control May require close PM and close cost/time control. Exposure to Cost overrun and delays?

EPCM v. EPC Advantages and Disadvantages

Responsibility for Design and Construction - What is the Catch?



Risk Transfer – Cost, time shift to contractor

	Owner	Contractor
EPCm	**Cost and time may grow.** Requires strong follow up through its own resources or with external consulting firm.	**Control with less risk** Requires strong coordination with Owner's team in managing Scope, cost and schedule.
EPC	**Cost and time is known up-front** Even before the start of the detail design. Owner should not be worried about changes and errors or omissions	**Possibility of cost/time overrun** Especially if design was not finalized during the bid process Contingency Control and Design/Scope Creep

Control of Scope Changes

	Owner	Contractor
EPCm	**Risk remains with Owner** Changes are common with possibility of Scope or design changes	**Responsible for justifying the changes** Depending on the nature and cause of the change, contractor may become accountable.
EPC	**Risk shifted to contractor** No changes are allowed. Requires considerable front end project definitions and scope management to meet client requirements	**Higher risk exposure** Especially if design was not finalized during the bid process. Last minute addenda or requirements may become too costly

Risk Transfer – Performance Warrantees

	Owner	Contractor
EPCm	**Owner's Risk**	**No Risk.** However, EPCm contractor will coordinate and manage work to achieve the Performance required.
EPC	**No Risk** Risk transferred to EPC Contractor	**High risk in meeting performance** Fitness for Purpose: Ensure the facility is "Fit" for its intended purpose

Ability to Obtain Guarantees (Contractor)

	Owner	Contractor
EPCm	N/A	**Easy and quick process**
EPC	N/A	**Difficult process** - May be expensive if Performance is the contractor's resp. - Errors and Omissions Insurance

Management Oversight and Improve Risk Analysis

	Owner	Contractor
EPCm	**Oversight required to ensure objectives** Requires strong steering and involvement in decision making and mitigation measures.	**Coordination with Owner' team** Limited options in handling risk in coordination with Owner. Deciding on risk methods, tools and techniques, priorities and response
EPC	**Oversight Shifted to Contractor** Less project personnel and steering. Less administration Less contracts to manage	**Higher risk exposure** Freedom in Risk Mitigations. Require close monitoring and cost / schedule/scope control Also periodic oversight

Conflicts and Disputes ?

	Owner	Contractor
EPCm	**Dealing with more than one party** Owner's get into direct involvement in dispute, settlement and litigation	**Proper Control** Involves with Owner, in dealing with prime and sub-contractors. Including, arbitration and litigations.
EPC	**Dealing with one party – Minimize Dispute**	**Higher risk exposure** **Dealing with different parties** Require proper subcontracts management and controls. Including design responsibility

Survey identifying top 10 Lessons learned in Construction Contracting *

	Challenge	Lessons	Solution
1	Documentation	**Provide common understanding of relationships, Keep honest people honest, used in future, Helps to avoid law suits,**	**Logs, meetings notes, photos, letters,…**
2	Tried and Tested Contracts	**Misunderstanding will be avoided. Familiarity with all conditions will ensure more comfort with project.**	**Use standard contact**
3	Arbitration Clause	**Less time and money will be expended. Arbitrator have a better understanding of construction**	**Ensure that an independent arbitrator is used.**
4	Payment Clause	**Ensure timely and correct payment. Allows you to know your liquidated damages costs**	**Read the payment clause. Negotiate changes**
5	Deal with Reputable Firms	**Avoid potential problems in slow or nonpayment; lawsuits; delays and poor quality**	**Research past performance Ask suppliers and others.**
6	Review of The Contact	**Ensure that the agreement is complete. Know what you are agreeing to.**	**Read the contract. Review the drawings and specs. Visit the site.**
7	Change Orders	**Ensure that there is a document trail. Ensure that there is an agreement on payment and time changes**	**Determine who has the authority to issue and approve changes. Calculate the impact (time / cost)**
8	Familiar Work	**Knowledge of how the job goes together. More competitive. Higher potential for profit. Supervision and resources are available. Less risk**	**For Larger jobs: make small incremental increases.**
9	Relationships	**Attract ethical and professional customers. Give the benefit of the doubt. Have a friend to turn to.**	**Be fair and honest. Realize everybody has a mission. Be active in professional organization.**
10	Ethical Conduct	**Repeat and negotiated work is more often obtained. Better treatment by all parties. A person sleeps better at night.**	**Walk in the potential victim's shoes. Do not become associated with unethical firm.**

* AACE International – Journal of Cost Engineering – May 1996)

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Other Challenges - Technical

- **Technology**
- **Patent and Ownership**
- **Availability of Technical Skills**
- **Local Content and Training (Technical Skills)**
- **Market and Competition Challenges**

Other Challenges - Environmental and Regulation

- **Current Demands**
  - Greenhouse Emissions: SO_2, HF, NO_x, CO_2, etc
- **Future Demands**
  - Global Warming and Higher Standards, Alternative Energy
- **Permit Requirements and Compliance**
- **Cost and Schedule Impact of the above**

Other Challenges - Resources

- **Skilled Labor Availability**
  - Quality of Skilled Labor
  - Quantity of Skilled Labor - (Construction)
- **Raw Material Supplies**
- **Limited Specialized Suppliers and Fabricators**
- **Limited Specialized Contractors**
- **Contractor's Risk Appetite**

Other Challenges - Market and Competition

- **Competing Projects for Similar Resources - Oil and Gas, LNG, Power and Residential**
- **Market Conditions and Price Competitiveness**
- **China and India Effects – Consuming Resources and**
- **Driving Raw Material Prices Higher**
- **Limited number of Skilled Professionals**
- **Fuel Diversity and Pricing**
- **Transportation and Delivery**

Therefore; ***ESCALATION***

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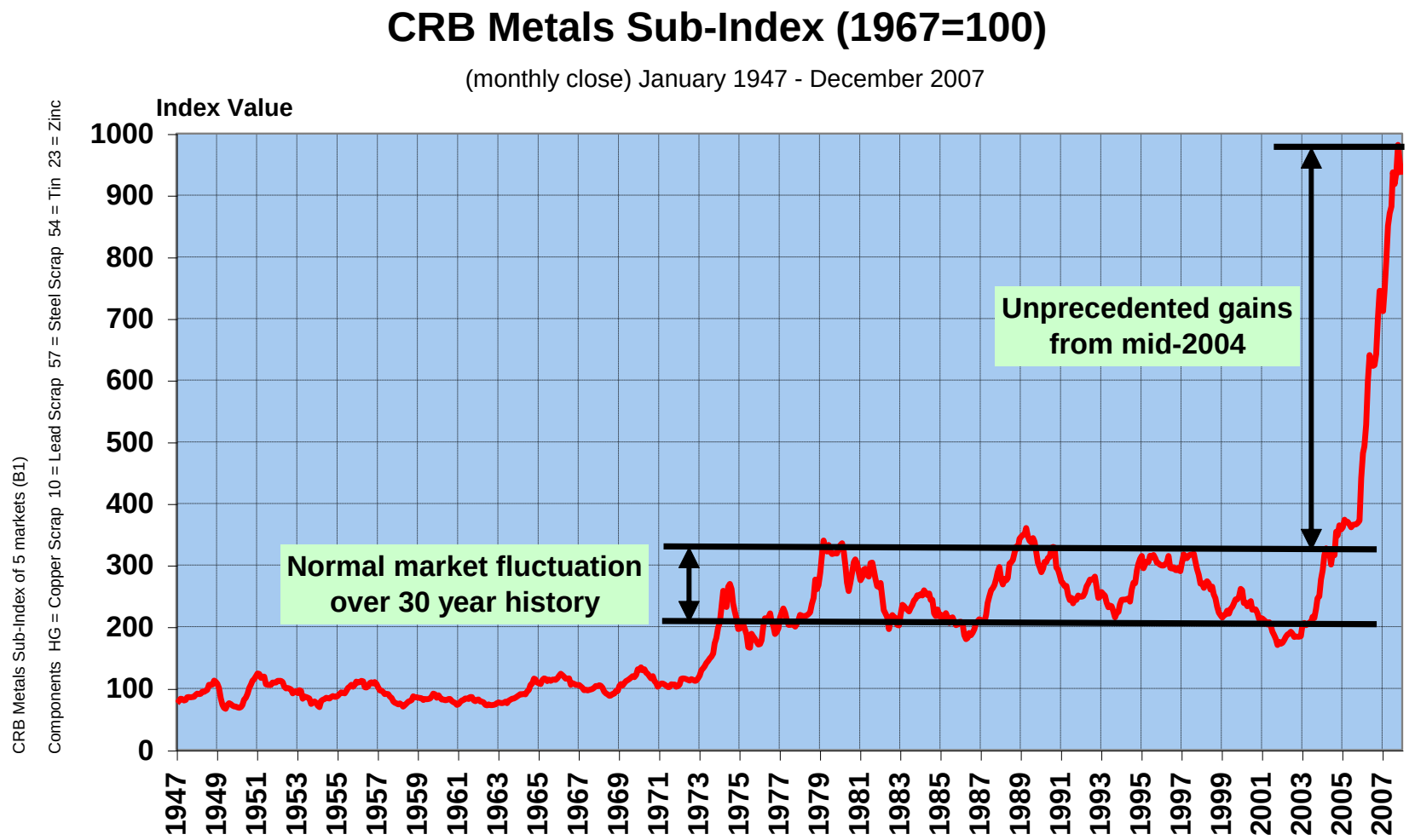
The Increase in Commodity Prices Since 2003 is One of the Most Significant in the Past 50 Years



Source: CRB

The Impact of Bulk Materials Escalation for a Typical Project on Project Pricing Can be Calculated From a Representative Index of Commodity Prices

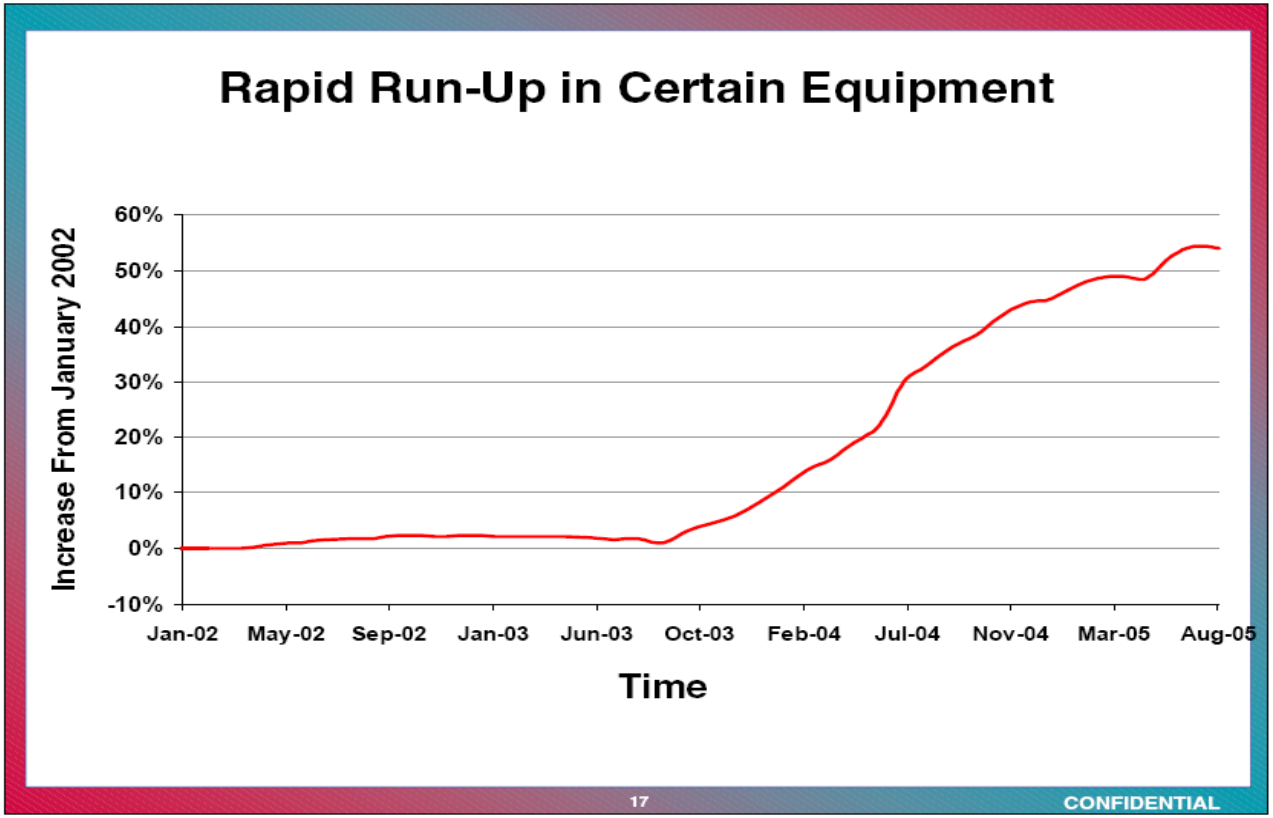
Price Increase Ratios for Selected Commodities *

	2003 to 2006 Price Increase Ratio	Weighting	Weighted Index
Concrete	1.28	10%	0.13
Structural Steel	1.64	20%	0.33
Copper	4.61	5%	0.23
Titanium	7.50	5%	0.38
HR Plate	2.13	35%	0.75
Other Bulks	1.30	25%	0.33
Total		100%	2.13

Factor A: Bulk Materials Growth Ratio = 2.13

* (Hatch presentation Capital Cost Estimate 2007)

Independent Project Analysis (IPA) Estimates Increases of Over 50% in Project Related Equipment Costs Between 2003 and 2006



Factor B: Equipment Pricing Growth Ratio = 1.54

Source: The Cost of Project Risks, Merrow & Ratliff, IPA 2005

Hatch Experience on Cost and Delivery Times on Typical Equipment Items Verifies These Findings

Price Escalation for Selected Equipment Items *

Equipment Item	2004 Pricing	2006 Pricing	Escalation
Titanium Ball Valves	$8,385,477	$12,041,015	**144%**
Agitators	$3,623,891	$4,802,615	**133%**
FRP Tanks	$8,700	$15,000	**172%**
Pump	$6,500	$8,450	**130%**
Thickener Mechanism	$1,746,000	$2,367,365	**136%**
Autoclave Feed Pump	$613,000	$759,507	**124%**
Autoclave Agitators (Titanium)	$335,900	$714,198	**213%**
		Average	**150%**

Current Delays for selected commodities

Equipment Item	Current Delays
Stacker Reclaimers	6 months
Portable Control Rooms	3 months
Ball Mills	6 months
Jaw Crushers	5 months
Pressure Vessels	8 months

* (Hatch presentation Capital Cost Estimate 2007)

Labour Rates Have Also Escalated Dramatically, With Contractors Demanding Higher Prices and Providing Lower Levels of Responsibility and Accountability…

Example of Escalation in Labour Rates *

Typical Australian Hourly Labour Rates	2003	2006	Escalation
Base Rate (AUD)	$ 55.30	$ 67.39	122%
All In Rate (AUD)	$ 99.65	$ 163.34	164%

All in Rate includes Additional Mobilisation, Site Establishment, Site Indirect Labour, Small Tools & Consumables, Site Amenities, Construction Plant, Accommodation, Weather & IR, Overhead and Profit & Risk. No change in labour productivity has been assumed.

Factor C: Labour Rates Growth Ratio = 1.64

* (Hatch presentation Capital Cost Estimate 2007)

Typical Two Potline Aluminum Smelter with Power Plant – Direct Cost by Area

Direct Cost Breakdown *

Ref.		Area	Total US$
04	7%	Site Preparation and Infrastructure Facilities	210,000,000
31	7%	Subtation	190,000,000
32	36%	Reduction	1,050,000,000
33	7%	Gas Collection and GTCs	215,000,000
34	2%	Potline Services	60,000,000
35	10%	Cast House	290,000,000
36	6%	Green Anode	175,000,000
37	5%	Anode Baking	160,000,000
38	5%	Anode Assembly,Rod Shop & Service Plant	145,000,000
60	2%	General Services, Incl. Plant Wide Buildings	70,000,000
70	3%	Power - Networks, Yard	90,000,000
80	5%	Raw Materials Handling and Storage	140,000,000
90	4%	Port Facilities	125,000,000
	100%	*Total Smelter Direct Costs:*	2,920,720,000
		Power Plant	900,000,000
		Total Smelter + P. Plant Direct Costs:	3,820,720,000

Smelter and Power Plant General Specifications:

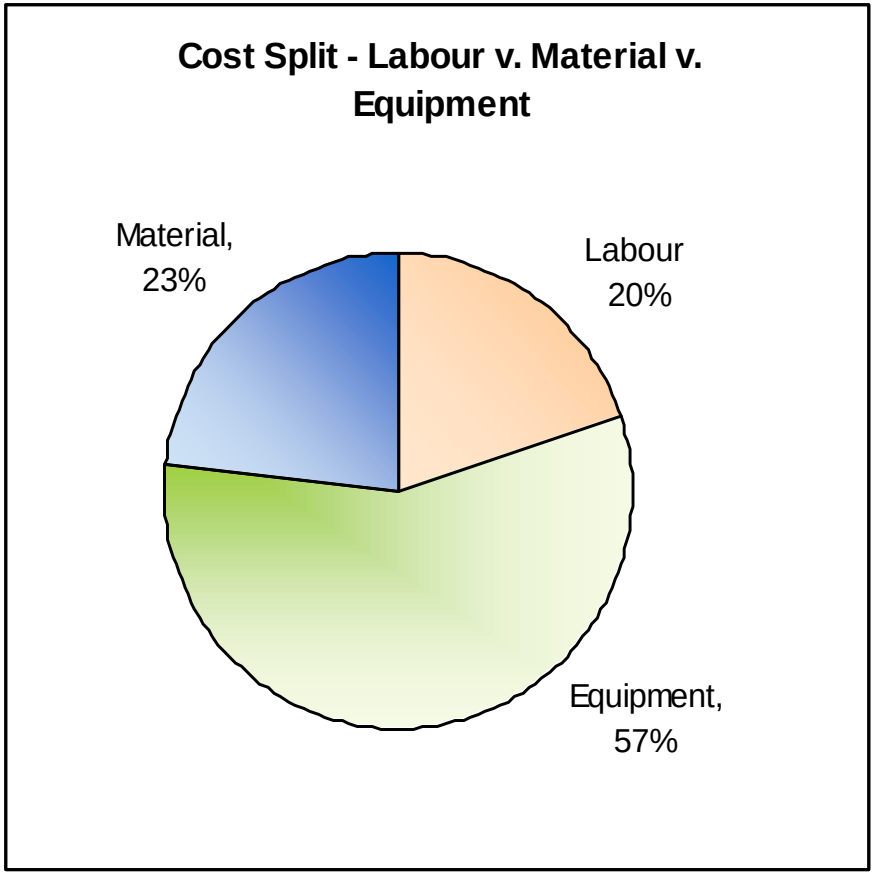
Complete New Port with Facilities
Carbon Anode Plant
2 Potlines with approx. 720,000 tpa
4 Gas Treatement Centers with SO2
Cast House with Ingot and Billets Options

Power Plant with 1,250 MW

* Based on 6 smelters estimated and actual costs during early stages of studies and execution phases. Accuracy of estimate ranges from 10% to 20%, escalation excluded.

Typical Two Potline Aluminum Smelter with Power Plant – Direct Cost Breakdown

Direct Cost Breakdown



The Effect of 2003 to 2006 Cost Escalation in Labour, Bulk Materials, Equipment Pricing and Foreign Exchange is Seen Below

To understand the overall project cost, we start with a typical project cost structure *:

Smelter and Power Plant

Cost Area	Average Cost Component	Based on 100%	Escalation Factors ABC		Impact of Escalation
Equipment	57%	40%	B	1.54	62%
Bulk Material	23%	16%	A	2.13	35%
Labor	20%	14%	C	1.64	23%
Total Direct	100%	70%			119%
General Indirects Incl EPCM	15%	11%		1.2	13%
Other Indirects	8%	6%		1.2	7%
Owner's	9%	6%		1.22	8%
Contingency	10%	7%			7%
Total Indirects	42%	30%			34%
Grand Total	**142%**	**100%**			**154%**

This increase represents cost changes only, for the 2003 to 2006 period.
It does not include:
Scope variations or creep
Direct labour productivity loss
Costs associated with schedule delays

* Although ratios vary by geography and project type, the above represents a typical ratio of equipment, bulk material and labour cost components

Although ratios vary by geography and project type, the above represents a typical ratio of equipment, bulk material and labour cost components

Cost Challenges

Cost Escalation for Major Equipment Items

Contract/PO or Major Equipment	Capacity and Specs.	Traditional Type	% Increase
Supply or Turnkey Packages			
Transformers and Rectifiers	10 for 2 lines	Turnkey	**39%**
Paste Plant	2 x 35 tph	Turnkey	**32%**
Gas Treatement Centers (GTC - Reduction)	2 x 2 GTCs	Turnkey	**69%**
Baking Furnace	2 Anode BF	Turnkey	**40%**
Pot Tending Machines	22 PTMs	Turnkey	**19%**
GIS Switchgear	HV + 4x 220kv	Turnkey	**38%**
Anode Rodding Shop		Turnkey	**48%**
Fume Treatement Center (Carbon Area)	2 FTC	Turnkey	**40%**
Supply Superstructure	for 2 lines	Supply	**18%**
Fabricate Superstructure	for 2 lines	Fabricate	**21%**
Supply Busbars	for 2 lines	Supply	**23%**
Fabricate Busbars	for 2 lines	Fabricate	**32%**
Potlining material including cathode blocks & cathode bars		Supply	**70%**
Construction or Installation Contracts			
Concrete - Reduction Area	2 Lines	Install	**22%**
Concrete Piling	12,000 Piles	Install	
Install/Erect Busbars	for 2 lines	Supply	**29%**
Structural Steel - Reduction/Potline Area	2 lines	Install	**23%**

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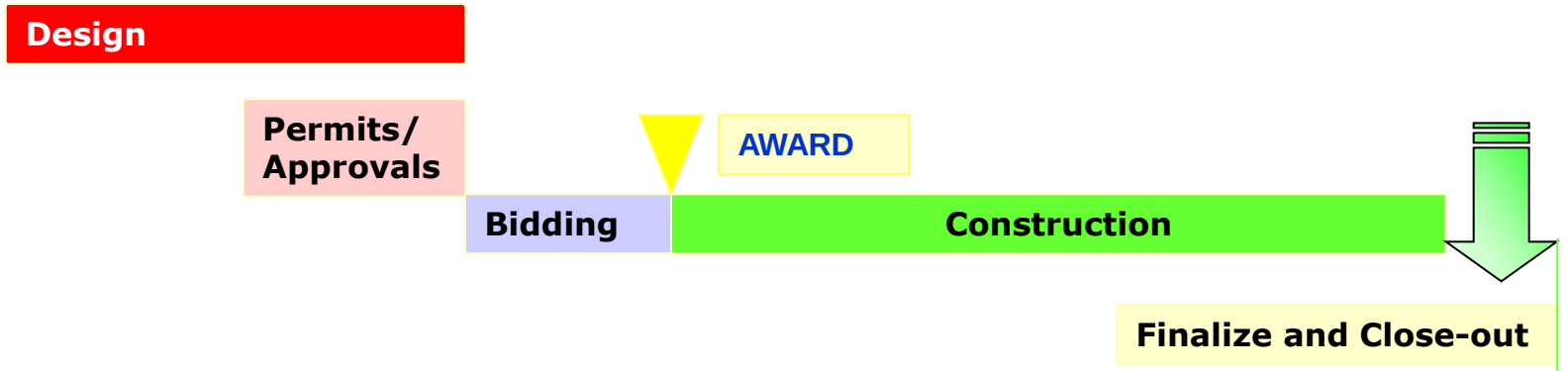
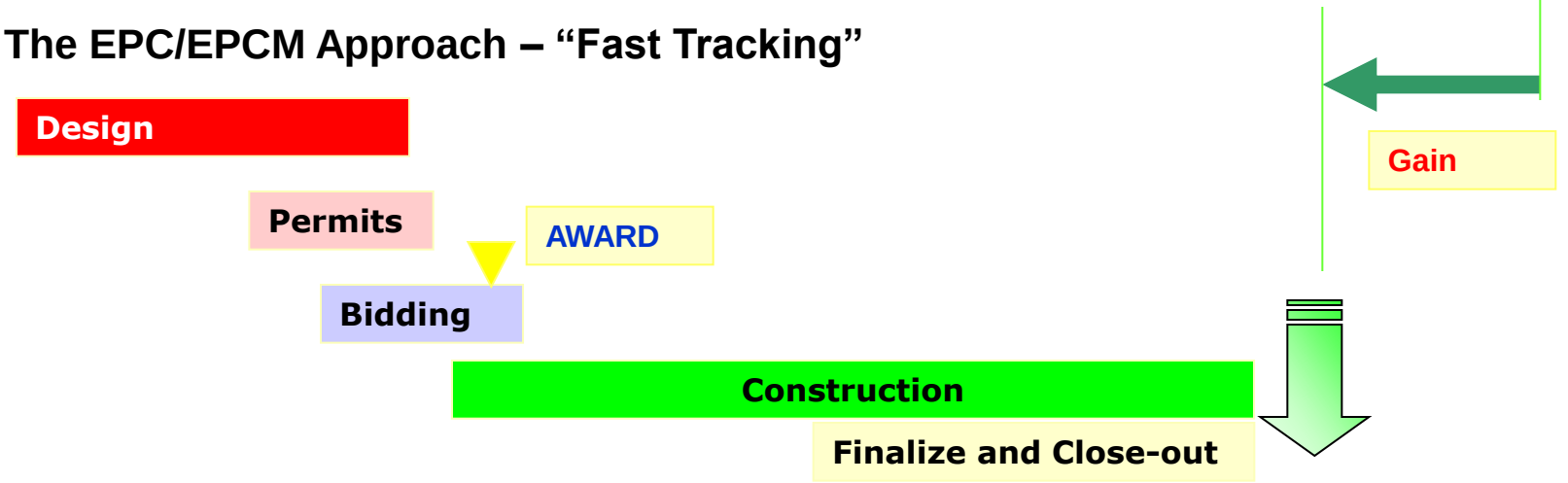
Targeting Shorter Project Duration?

The "Traditional Approach" Design-Bid-Build (DBB)



The EPC/EPCM Approach – "Fast Tracking"



Schedule Challenges

Schedule Increases for Major Equipment Items

Contract/PO or Major Equipment	Capacity and Specs.	Traditional Type	Traditional	Current (2006 and Forward)
Supply or Turnkey Packages				
Transformers and Rectifiers - Supply/Install	10 for 2 lines	Turnkey	27	34
Paste Plant - Supply/Install	2 x 35 tph	Turnkey	21	25
Gas Treatement Centers (GTC/Reduction) - Supply/Install	2 x 2 GTCs	Turnkey	23	27
Baking Furnace - Supply/Install	2 Anode BF	Turnkey	23	**27**
Pot Tending Machines - Supply/Install	22 PTMs	Turnkey	26	**32**
Gas Insulated Switchgear GIS/ 220 kv - Supply/Install		Turnkey	21	**24**
Anode Rodding Shop - Supply/Install		Turnkey	18	20
Fume Treatement Center (Carbon) - Supply/Install	2 FTC	Turnkey	16	20
Supply and Fabricate Potshells	for 2 lines	Supply	20	26
Supply and Fabricate Busbars	for 2 lines	Supply	15	**18**
Construction or Installation Contracts				
Concrete - Reduction/Potline Area	2 Lines	Install	18	**22**
Concrete Piling	12,000 Piles	Install	10	**12**
Structural Steel - Reduction/Potline Area	2 lines	Install	16	**20**

On average, a 5-month longer delivery period is experienced, which may project a similar extension to the total project delivery period

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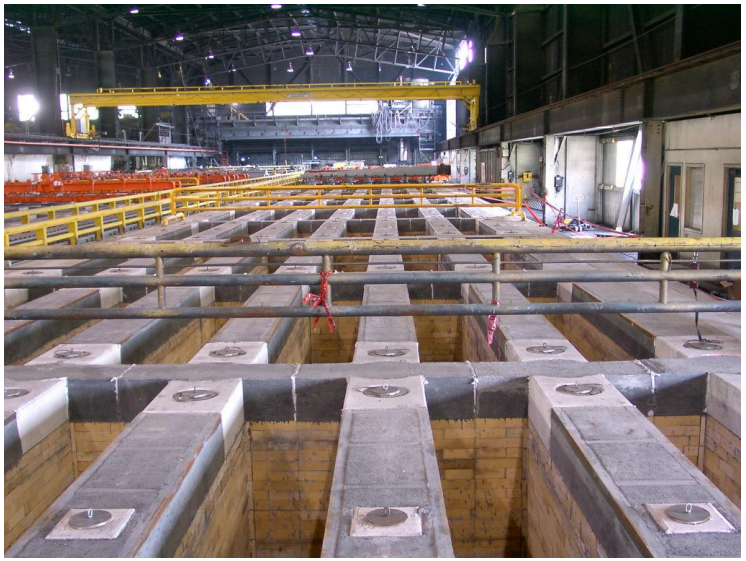


Conclusion - Which Project Delivery Method?

Today's contractual arrangements and "Risk Shifting Clauses" drafted in contracts require proper balance and considerable sharing of responsibility between the Owner and the Contractor

Questions to be Answered:

- What is the level of the design definition?
- How mature and demanding are the contractual arrangements?
- How is the Division Of Responsibility (DOR) addressed?
- How is the Approval Process addressed?
- How much risk can the Contractor take?

Conclusion - Which Project Delivery Method?

Main Contractual Challenges differentiating the EPCm and EPC Contracts

- Guarantees in “Performance” of the plant or Facility
- Shared Responsibility Arrangement - Contractor v. Client
- Shared Responsibility Arrangement - Designer v. Builder
- Payments Arrangements and Guaranteed Maximum Price
- Project Schedule and Guaranteed Delivery Date

Conclusion - Most Difficult Challenges and Opportunities

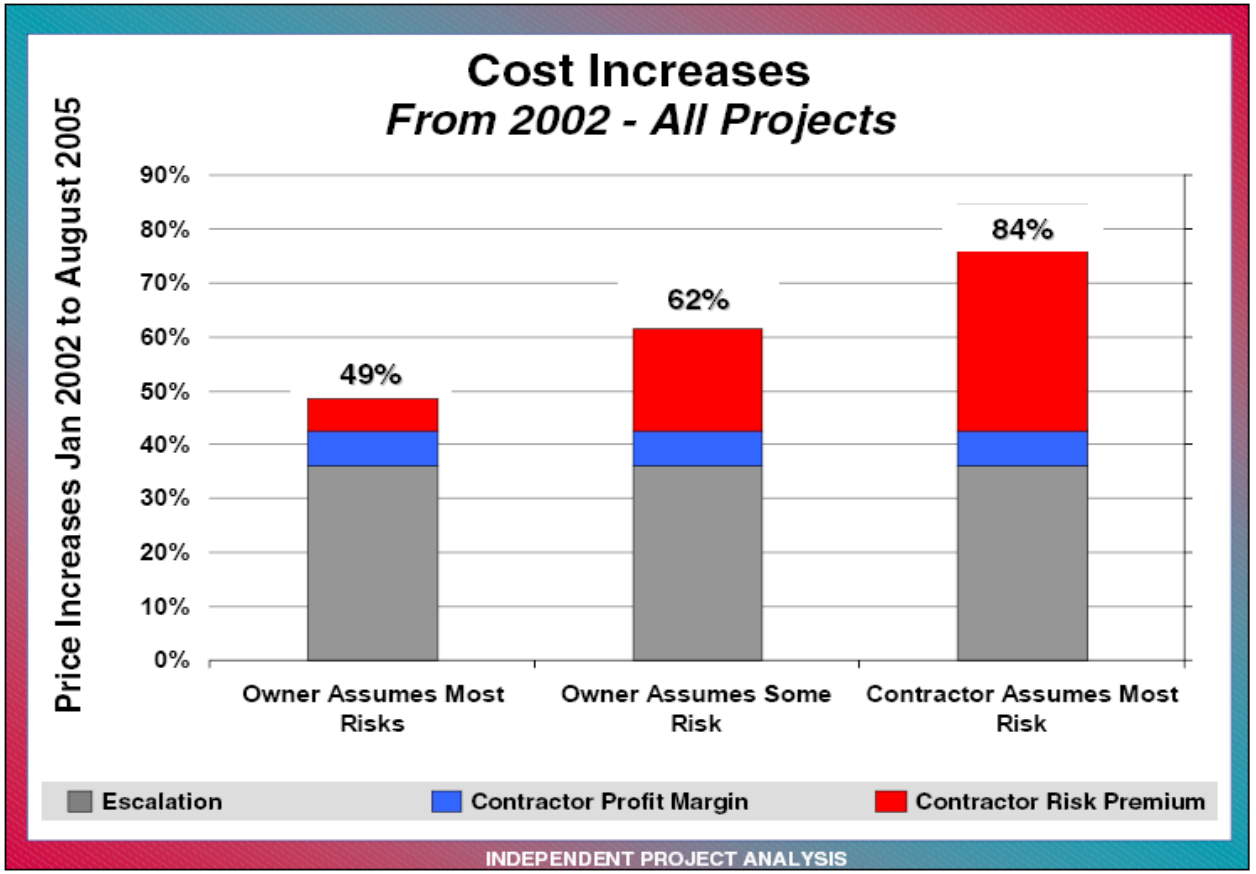
	Challenge related to:	Most Difficult issues	Result %
1	Pre-Design Phase	Need to Spend more time in pre-design	88 %
2	Design Phase	Lack of Coordination and collaboration among team members Review of the Technical design Details	71 % 67 %
3	Procurement Phase	Pre-Qualification of the Bidders Past performance data not provided on finished projects	77 % 69%
4	Construction Phase	Team, People and Performance (Lack of clarity in the definition key roles (Communication Matrix) Getting the right team and people – Leadership Issues	65 % 45%
5	Post-Construction Phase	Start-Up/Turnover process – Commissioning As-Built drawings for operations Whole facility testing procedures	70% 60% 49%

Conclusion - EPCM Versus EPC : The Main Issues

	EPCM Contract		EPC Contract	
	Design-Bid-Build	EPCM	Design-Build	Turnkey
Shared resp. Arrangements	Between Designer and Contractor		Between Owner and Contractor and/or between Designer and Builder	
Payment Methods	L. Sum Cost + fees Unit Price	Fees Unit Price	L. Sum Cost + Fees Unit price	L. Sum (LSTK)
Guarantees in Performance of Facility	Contactor or Negotiation	Owner	Contractor or Negotiation	Contractor
Risk (General) • *Cost* • *Schedule* • *Changes/Scope*	Medium	Low	High	V. High

Conclusion - Relationship Between Cost & Risk

IPA research suggests similar project cost escalations have been seen worldwide (Analysis of 118 projects, from $260m to $3.3b)



Source: The Cost of Project Risks, Merrow & Ratliff, IPA 2005

Conclusion – Final Thoughts

- The lack of skilled and specialized resources have an impact on cost, schedule and on quality on the long term. Compromise is a must
- Given today's market conditions, reasonableness in assessing time delivery of major projects is required
- Price escalation on major elements are still on the rise due to the world wide market demand for raw material and fabricated equipment
- Double digits rise on some major items is still a considerable factor