BIOGAS TV
Biogas RNG Project Delivery Best Practices

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Topics Overview

- Preliminary Design Phases & Level of Cost Definition
- Approaches from an EPC / Professional Services Perspective
- Debunking EPC Myths

What is Front End Planning?

Implementing appropriate stage gates

- Safety Management
- System Studies
- Routing & Siting
- Registrations
- Permitting
- Environmental Monitoring
- ROW/Land Acquisition
- Community Relations
- Preliminary Design
- Detailed Engineering
- Document Control
- Outage Coordination
- Project Controls
- Project Management
- Cost Management
- Schedule Management
- Material Expediting
- Construction Management
- QA/QC
- Testing & Commissioning
- Project Turnover

Feedstock

- Collection
- Processing

Digesters

- Design
- Optimizing
- Digestate and Odor Management

Gas Processing

- Pre-Treatment
- Upgrading
- Compression
- PHA

Gas Logistics

- Interconnects
- Metering Stations
- ROW Acquisition
- Route Permitting

Electrical

- Interconnects
- Substations
- Electric Generation
- Standby Power

Compliance

- Air
- GHG
- Waste
- Wastewater

Why Front End Planning?

- ✓ Improved constructability
- ✓ Early engineer coordination with constructor
- ✓ Value engineering
- ✓ Owner Risk Transfer
- ✓ Improved quality
- ✓ Improved safety

The Knowledge Leader for Project Success

Owners • Contractors • Academics

AACE INTERNATIONAL

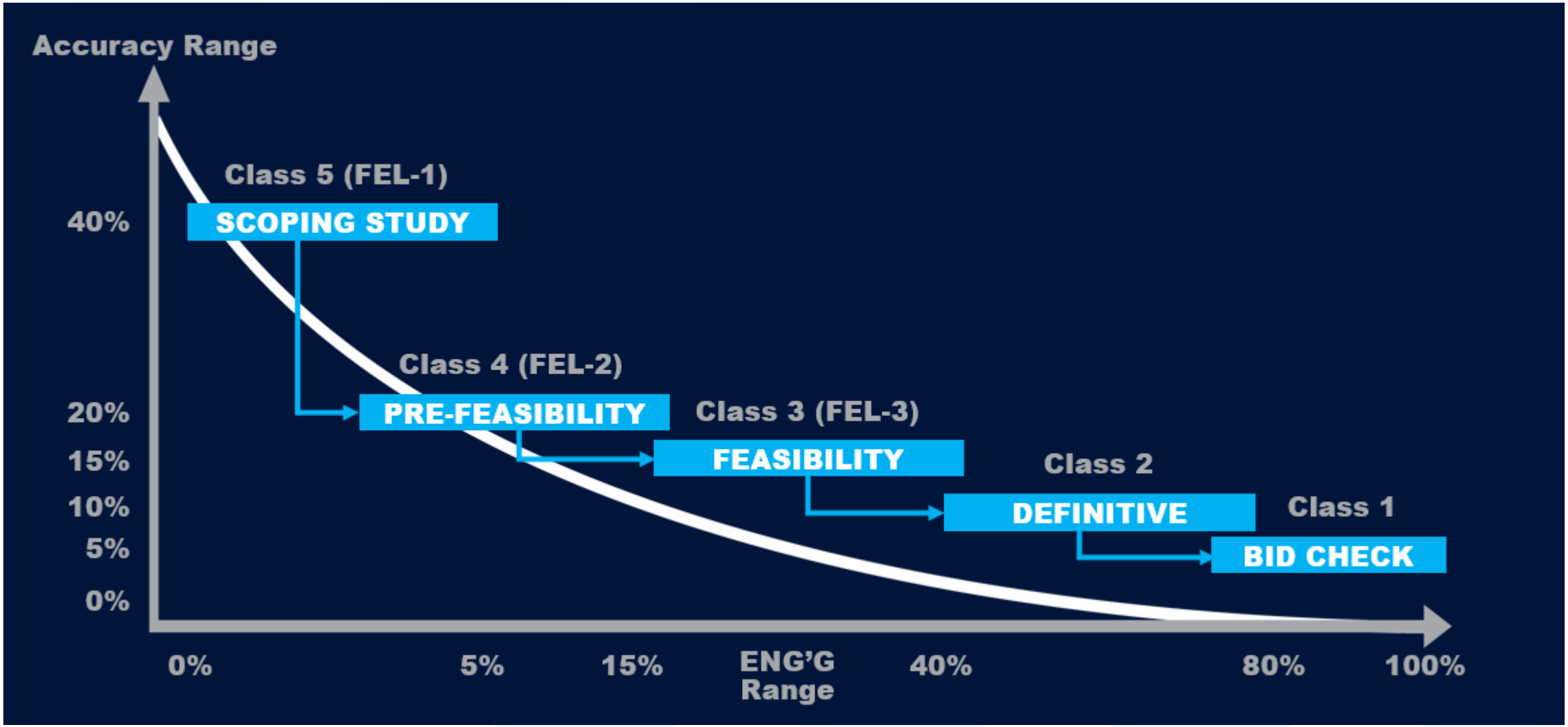
FEP – Construction Industry Institute

METRIC	FEP-1	FEP-2	FEP-3
Estimate Confidence	+/- 50%	+/- 30%	+/- 10–15%
% Engineering Complete	0 – 1%	3 – 10%	15 – 25%
Equipment pricing	Budget quote on critical equipment. Cost History on other.	Budget quotes on all equipment.	Purchase quality, multiple vendors, conditioned.
Material Pricing	Recent purchase comparison on major bulk materials.	Recent purchase comparison on major bulk materials.	Budget pricing on major bulk materials (pipe, steel, electrical). Recent purchase comparison on minor bulk materials.
Labor Pricing	History in area.	Billing rates from area subcontractors.	Subcontractor solicitation for productivity and labor rate confirmation.
Indirects Pricing	Historical percentages.	Historical percentage with sanity checks.	Bottoms up based on staffing plans and required services.
Escalation	Calculated on escalation rates and project schedule.	Calculated on escalation rates and project schedule.	Calculated on escalation rates and project schedule.
Contingency	Historical percentage range.	Historical percentage range.	Built up based on project schedule and risk.

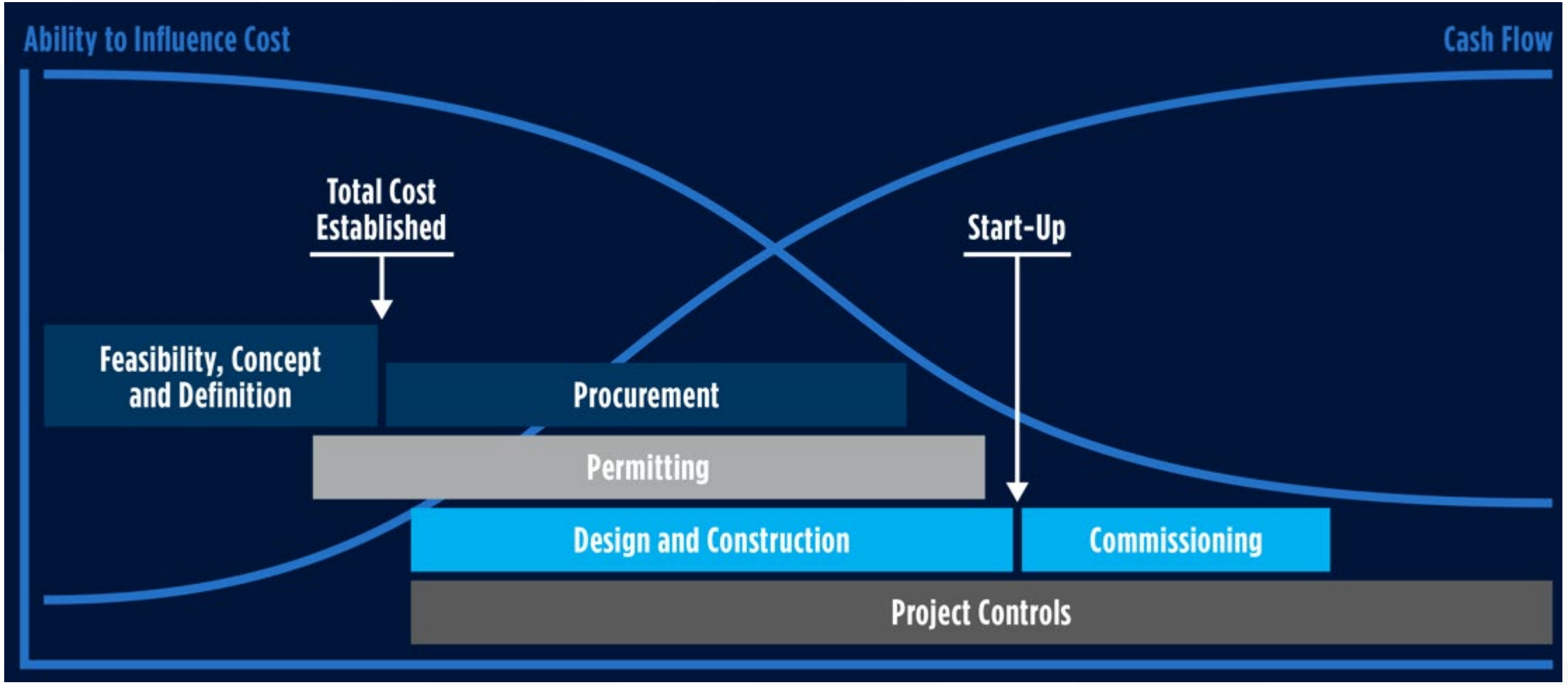
FEP Estimating - AACE

	Primary Characteristic	*Secondary Characteristic*		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Overlay of CII / AACE Accuracy / Definition



Capital Project Influence Curve



Key Variables In Early Phase Estimating

- **Documentation:** Sized equipment list, reviewed plot plans, OSBL piping / one-line takeoffs
- **Equipment pricing:** Budget pricing on process equipment and major electrical EI&C equipment.
- **OSBL:** Definition of OSBL scope is critically important to the accuracy of the estimate.
  - Pipe racks and long run piping to OSBL tie-ins to develop preliminary MTOs. Power supply and controls scope are also defined.
- **Labor Rates:** Craft labor rates are based on recent labor surveys and work recently completed in the region.
- **Freight and Taxes:** On equipment and material costs.
- **Indirect Costs:** Use historical metrics based on % of TIC for construction management and detailed design costs. Cost for FEED engineering is definitively estimated based on a staffing plan.
- **Contingency:** We recommend a contingency which is based on the level of scope development and quality of supporting market pricing.
- **Escalation:** Applied across labor and materials, based on current market research and recent projects.
- **Owner's costs:** With your guidance, we account for your costs as well to deliver a complete picture.

Risk Register

RO System Risk Register

Item No.	Risk Item	Cause	Result/Consequence	Mitigation	Risk / Opportunity	Probability of Occurrence	Potential
1	Equipment Delivery Delay	Delay in manufacturing/delivery of one of the equipment vendors.	A delay in equipment deliveries could delay the COD.	Include schedule delay LD's in equipment suppliers' contracts to offset cost.	Risk	Very Low	$ 300,000
2	Craft labor availability	Difficulty attracting quality labor	Potential increase in wage rates and per diems	Utilzing sub-contractors with knowledge of the local area and labor market. No large simultaneous competing projects are anticipated.	Risk	Low	$ 500,000
3	Labor productivity	Labor productivity worse than assumed	Increased costs and potential schedule impacts.	Utilzing sub-contractors with knowledge of the local area and labor market. Sub-contractors have indicated quality local labor available based on prevoius project history.	Risk	Medium	$ 500,000
4	Market Volatility - Labor	Prices increased due to change in labor market conditions	Increased costs	Major market changes or economic variations resulting in escalation increase is currently expected to be a low likelihood.	Risk	Very Low	$ 50,000
5	Market Volatility - Commodity	Prices increased due to change in commodity market conditions	Increased costs	Major market changes or economic variations resulting in escalation increase is currently expected to be a low likelihood.	Risk	Low	$ 50,000
6	Delay in startup/commissioning schedule.	Due to malfunctions, operational issues, tuning delays, etc.	Increase time for Startup/Commissioning staff, and construction suppport required for startup activities.	OEM startup time to be schedule based to put risk for hours overrun on OEM. Schedule includes reasonable durations for startup and commissioning.	Risk	Very Low	$ 50,000
7	Force Majeure	This could be a range of events such as extreme weather events to lossing equipment in the ocean for overseas delivery	The result is typically schedule delays	None	Risk	Very Low	$ 300,000
8	Geo-tech considerations	No geotech information for the site. Using information from nearby lakeshore projects.	Final, detailed geotech report may result in increasing slab thickness or addition of piles.	Conduct a geotech survey or find existing geotech reports as early in the design process as possible.	Risk	Medium	$ 60,000
9	Procurement delay	Procurement process delays (spec development, addenda, bid extensions, re-bidding, commerical negotiations, etc)	Increased cost and/or schedule	Additional engineering time and/or expediting	Risk	Very Low	$ 250,000
10	Engineering IFC delay	Unable to issue full IFC prior to construction (unexpected complexity, late owner requests, late vendor submittals, etc)	Increased cost and/or schedule	Add duration to construction time	Risk	Medium	$ 150,000
11	Safety	Safety incident, standdown, investigation, etc	Increased cost and/or schedule	Contractors with good safety records	Risk	Medium	$ 250,000

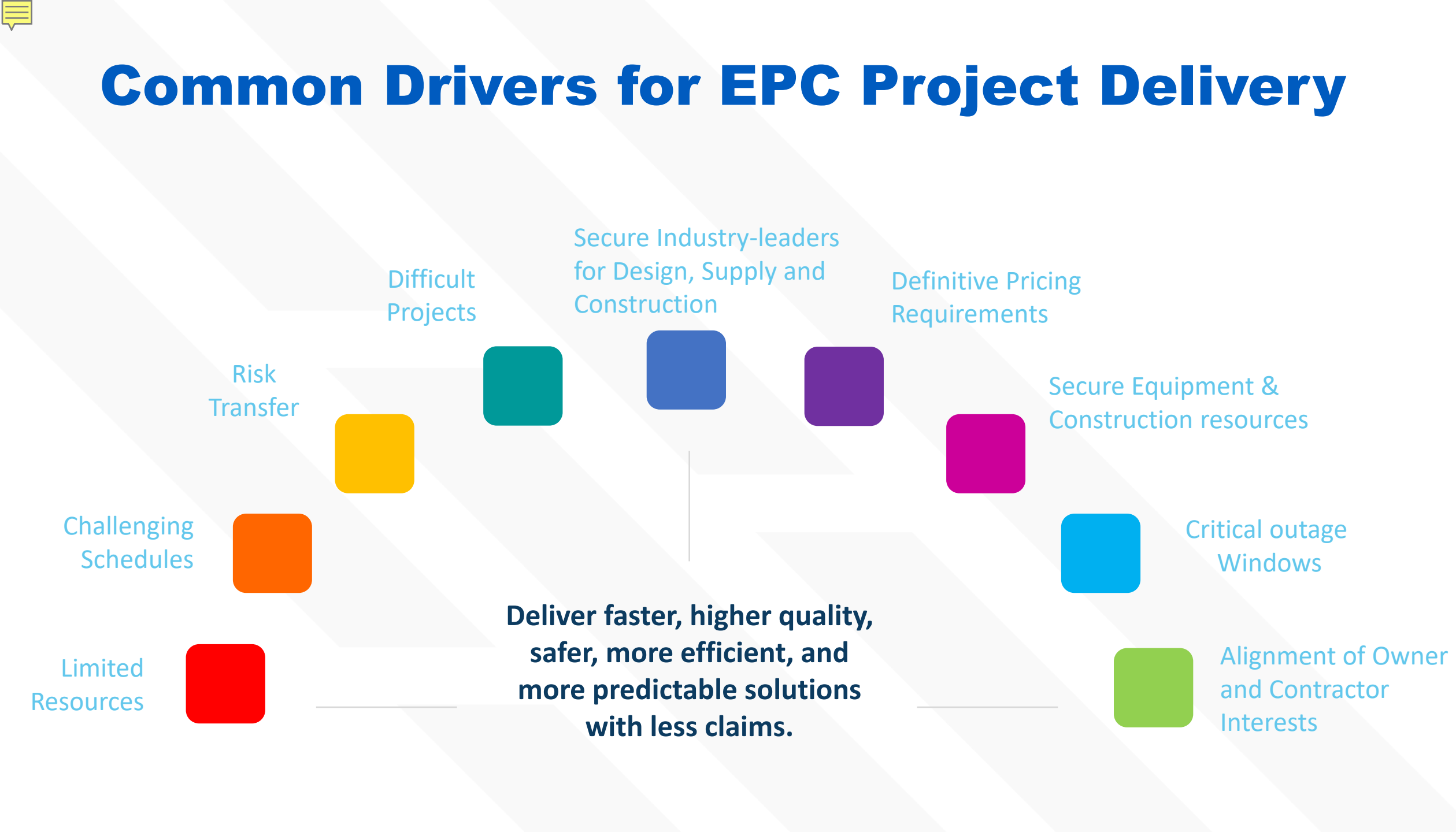
Variables that Influence Project Costs

- Owner Requirements/Standards
- Scope clarity
- Performance Guarantees
- Liquidated Damages
- Force Majeure
- Warranty Durations
- Supplier Technical and Financial Strength
- Payment Terms and Security
- Commercial Security
- Subsurface Risks
- Market Conditions
- Labor Escalation Exposure
- Working Conditions (Weather/Outages/Terrain)
- Commodity Escalation/Indexing/Hedging
- Environmental Requirements
- Permit Requirements
- Schedule

Project Delivery

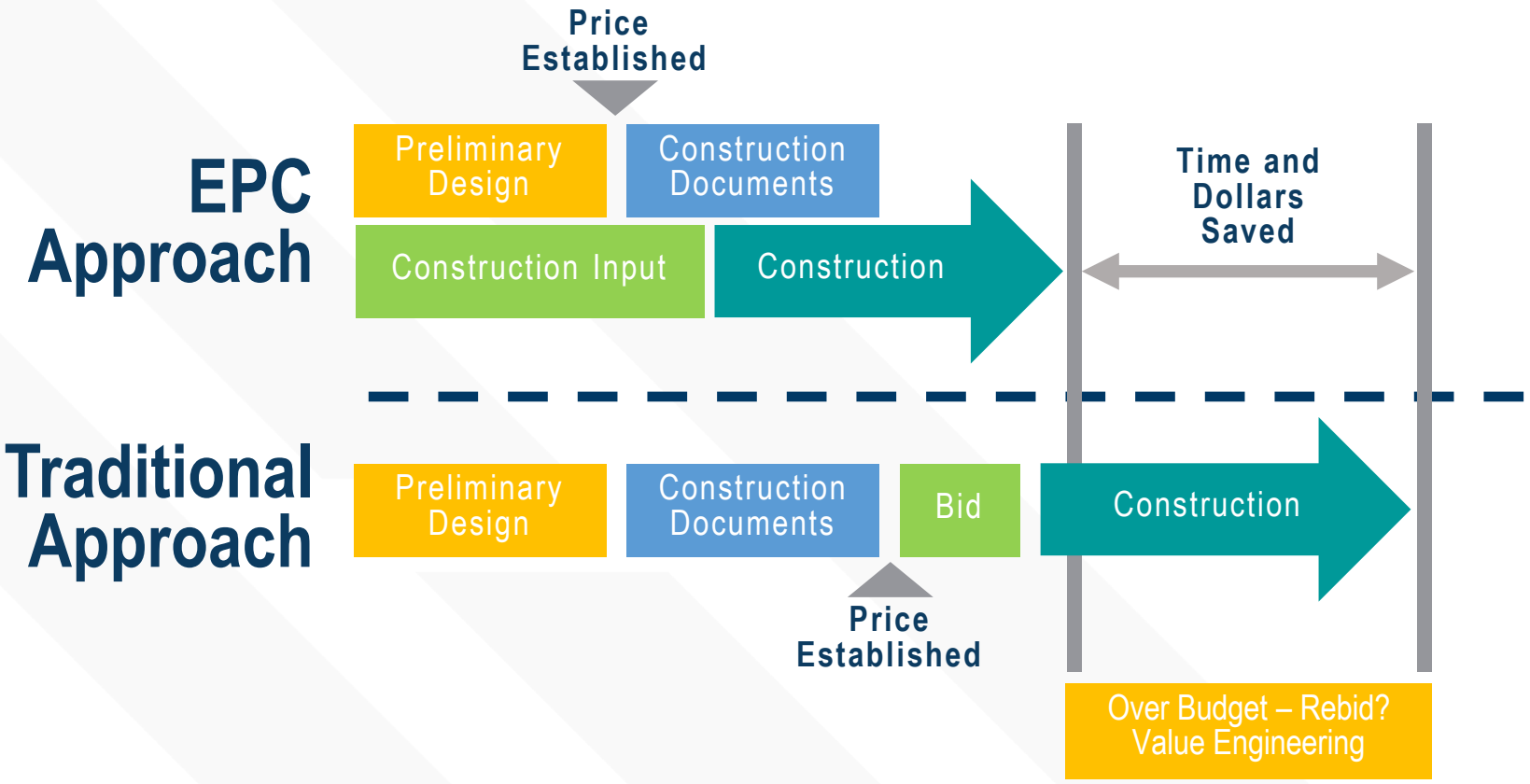
- **EPC:** Contractor performs, engineering, procurement and construction
- **EpC:** EPC contractor performs the engineering and construction. Owner procures major equipment.
- **EP cm:** Contractor provides engineering and procurement services. Construction is managed by contractor, but owner direct contracts with trades for construction.
- **Progressive EPC Models:**
  - **EPC with Multiple Subcontracts**
  - **EPC with Direct Hire Construction**
- **IRA Considerations**

Common Drivers for EPC Project Delivery



Advantages of EPC

- ✓ Parallel paths improve schedule efficiencies
- ✓ Best value with lower overall total installed cost
- ✓ Earlier cost certainty



Debunking EPC Myths

Too expensive
I don't want to pay mark-up

- **CII Study**
  - 351 projects in 37 states
  - EPC/DB cost at least 6% less than DBB
  - EPC/DB is at least 33% faster than DBB
  - EPC/DB provides at least 10% better quality than DBB
- **DBIA has completed similar studies**

- Earliest knowledge of firm costs
- Definitive pricing minimizes exposure for cost overruns and change orders
- Coordination with contractor – Design to optimize total installed cost

Loss of control
I don’t want to turn over the keys
Lack of transparency
I want to choose the equipment suppliers
I want to choose the contractors (bring in out of towners)

- Insert as many hold points as desired
- Open book contracting strategy provides as much transparency as desired
- Review and approve all procurement (including all selections)
- Review and approve all engineering

EPC will Provide Lower Quality

- Pre-qualification allows excellent selection of contractors
- Maximizes selected contractors' strengths and resources
- Superior selection of equipment/materials
- Contractors involved in constructability reviews minimizes construction issues and builds team relationship
- Design innovations

EPC will Cause Large Change Orders

- Elimination of seams
- Increased constructability reduces change orders
- Open book model can decrease risk of change orders