



Phased Engineering Approach to

RNG Project Delivery

August 3, 2023



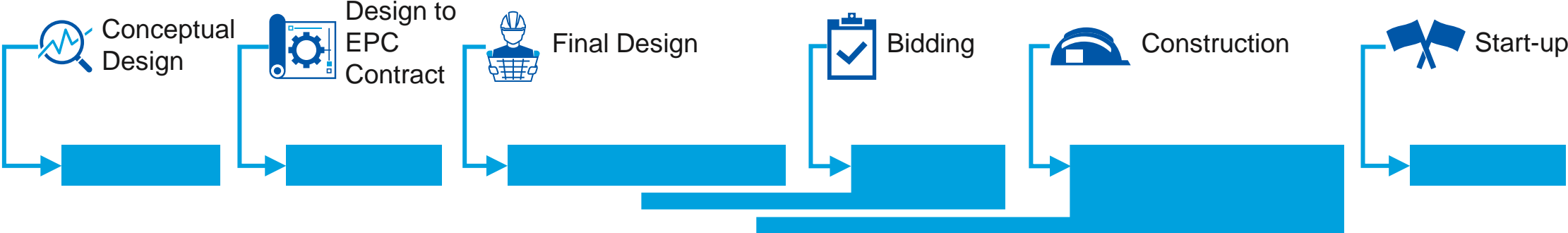
Mead&Hunt

 **SYMBIONT**
A Mead & Hunt Company

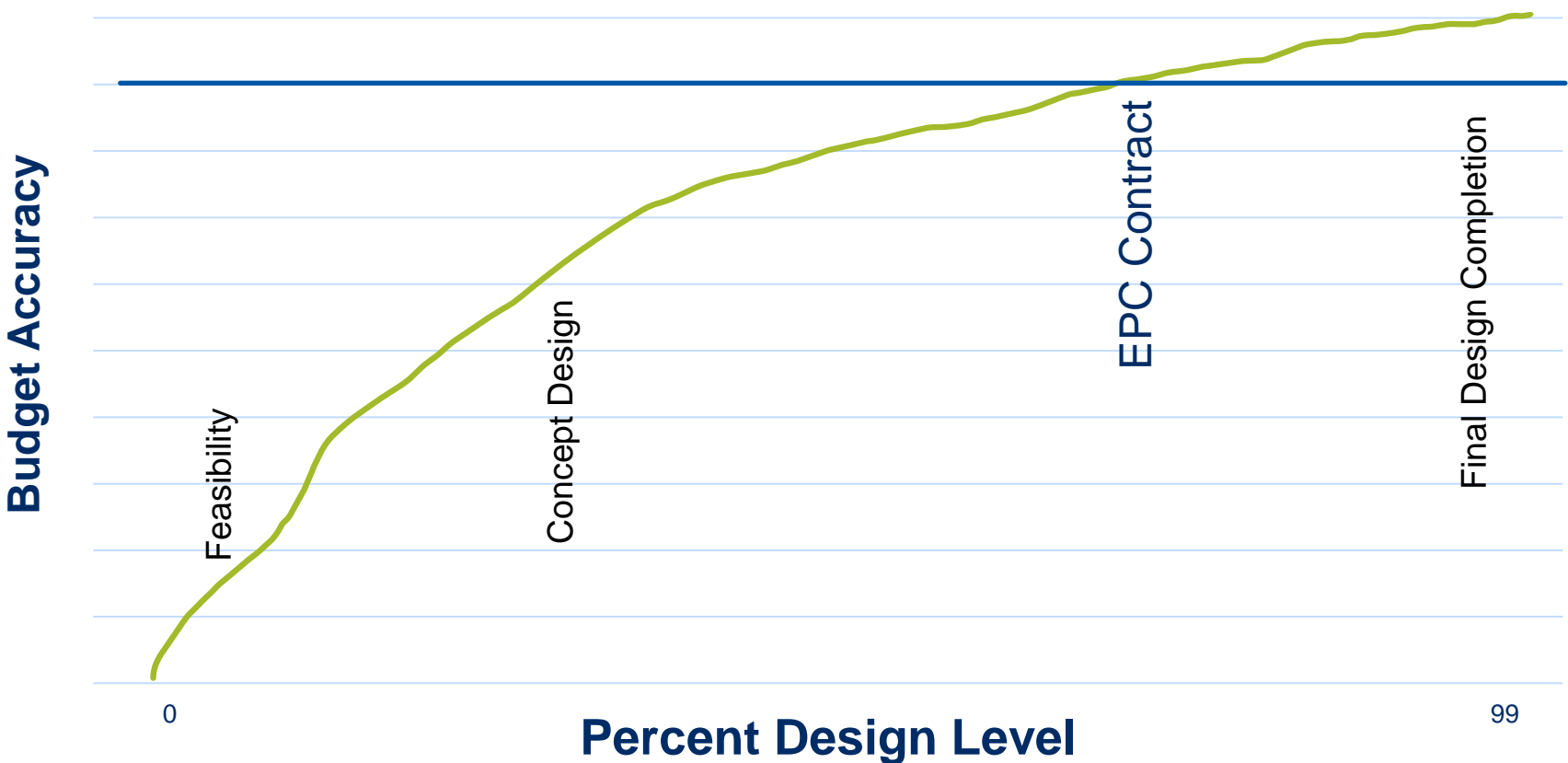
- Employee-Owned Engineering, Procurement, Construction & Architecture Firm
- 1,200 Employees Nationwide
- 40 Office Locations
- EPC & Renewable Energy Group
- Fabrication Shop



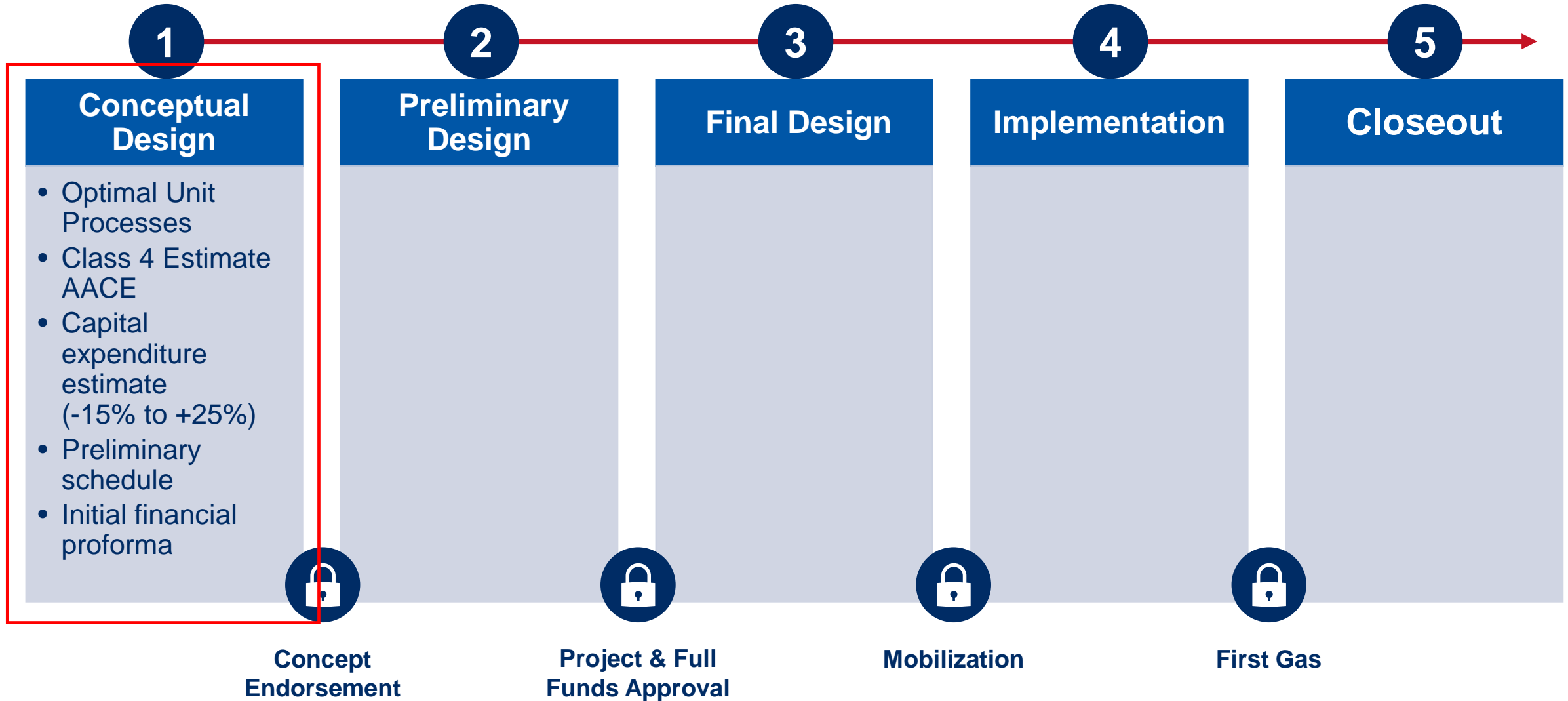
Schedule Driven Project Timeline



Progressive Design



Phase Gate Process



Risk Minimization



Identify Red Flags

**Prevent Misalignment Of Roles
Or Responsibilities**

Minimize Upfront Capital Commitment

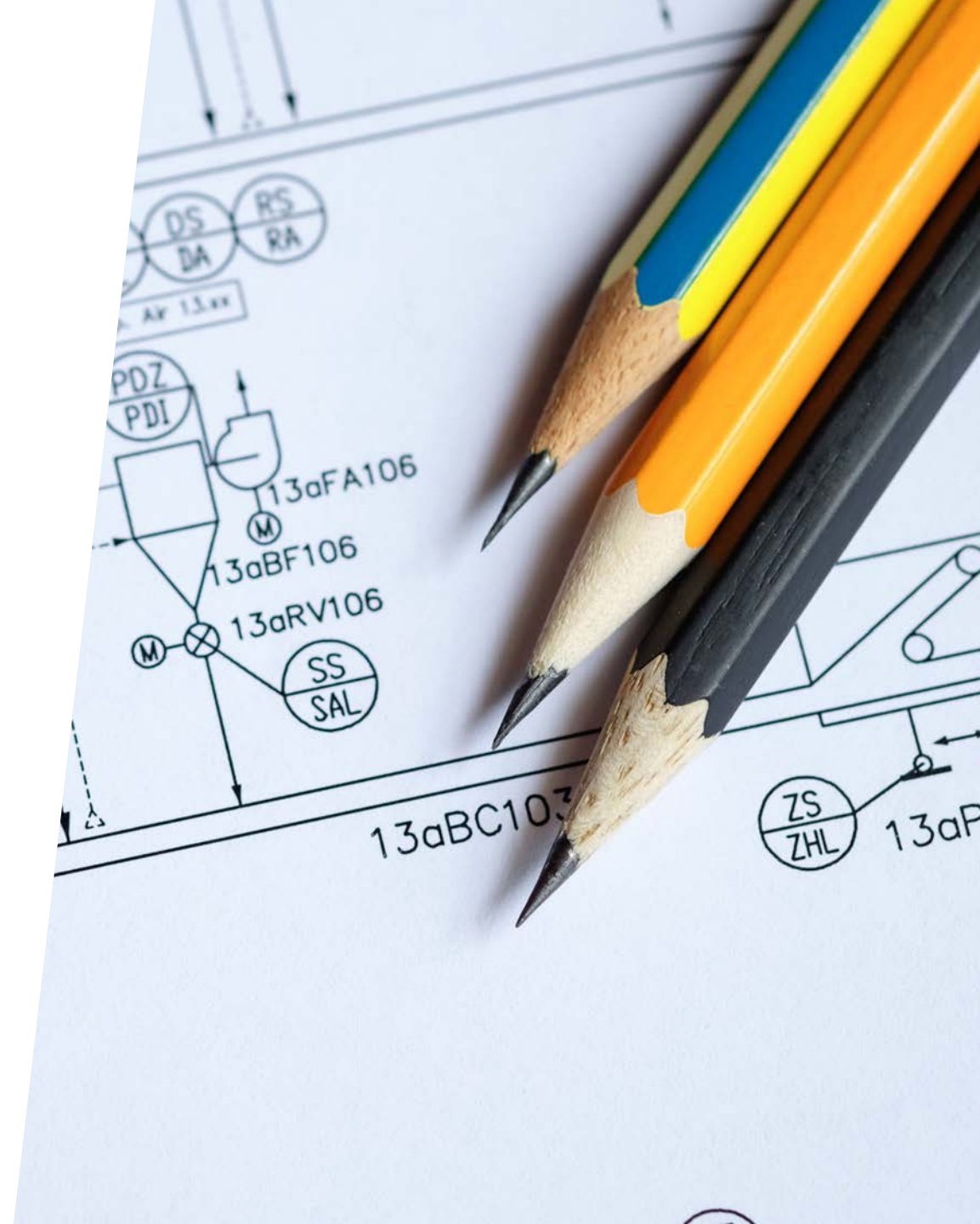
Typical Feasibility Deliverables

- Substrate Analysis
- Initial Design Basis
- Major Inputs and Outputs
- Selecting Major Unit Processes
- Block Flow Diagram
- Rough Order of Magnitude Budget
- Around 5% Design



Typical Concept Design Deliverables

- Formal Basis of Design
- Major Equipment Sizing
- Preliminary Mass Balance
- Process Flow Diagram
- Site Plan/ GA
- Responsibility Matrix
- Class 4 Budget (-15 to +25%) & Schedule
- 10-15% Design Level



Technology Agnostic Collaboration With Vendors

- Technology type
- Vendor selection
- Performance: X in, Y out guarantee
- Schedule
 - Delivery timeline
 - If EPC contract has liquidated damages, need buy-in from vendors
 - Incentives for early completion
- Vendor who adds value to the overall team



Responsibility Matrix

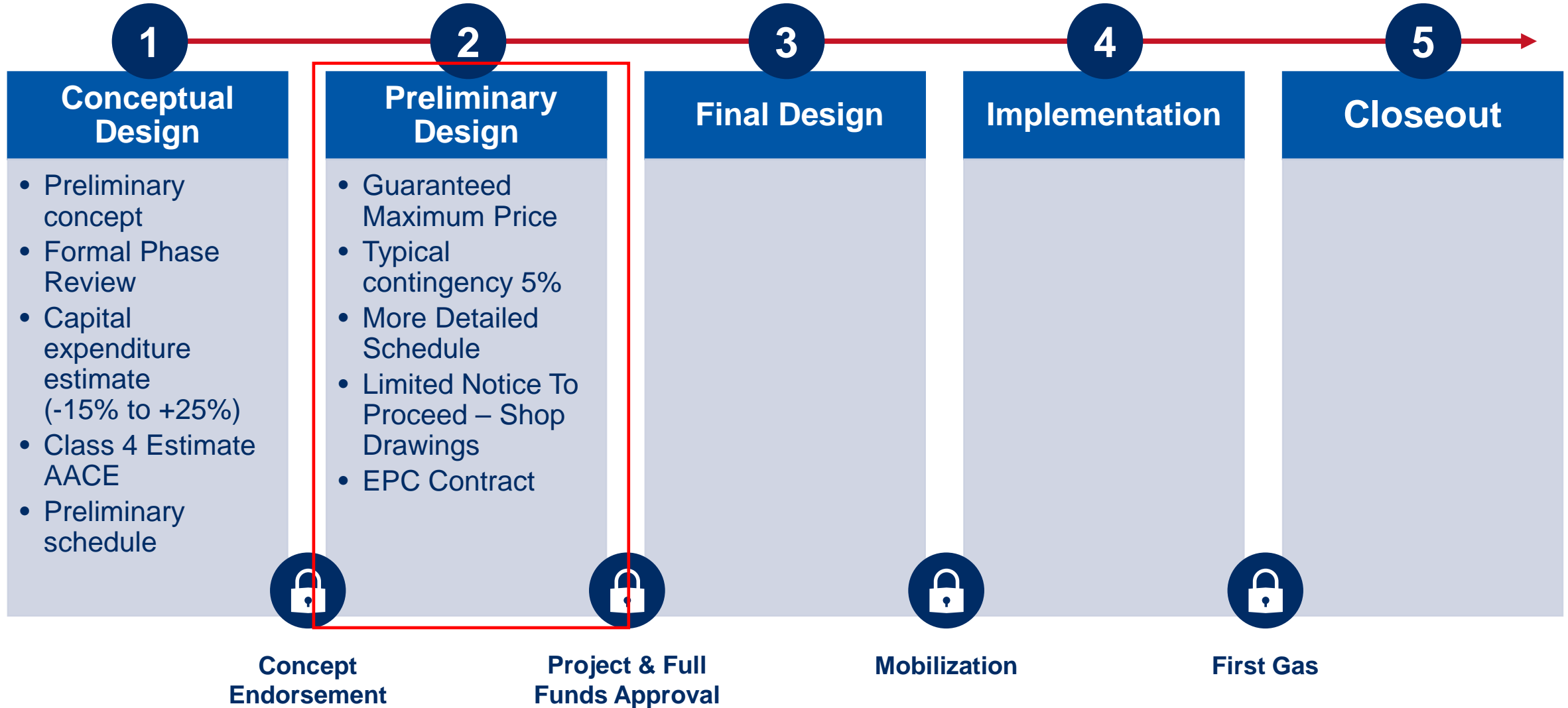
- Mead & Hunt develops a detailed responsibility matrix at the outset of each project
 - Streamlines collaboration
 - Saves time
 - Provides transparency

TASK		Owner	M&H	Other
COMMISSIONING				
	Construction Completion Report		X	
	Commissioning Plan		X	
	Functional testing		X	
	System testing		X	
	Startup and Training		X	
	Commissioning spares - Owner Supplied Equipment	X		
	Commissioning spares - Symbiont Provided Equipment		X	
	Performance testing	X	X	
	Sampling		X	
	Consumables	X	X	
	Spare Parts	X		
GENERAL SITE ACTIVITIES				
	Safety Management		X	
	Material and equipment unloading and storage		X	
	Temporary Utilities		X	
	Offices/accommodation/welfare		X	
	Power		X	
	Water/Waste		X	
	Security		X	
	Lighting		X	
	Telephones and faxes		X	
	PC's		X	
	Test equipment		X	
	Construction plant		X	
NEW DIGESTERS				
	Localization of design to Larson site for codes/permits and integration with balance of plant		X	
	Preliminary Design - Provide Tank Size and Loads (Statics)		X	
	Preliminary Design - Provide Preliminary Mass Balance			
	Preliminary Design - Provide Preliminary P+ID			
	Preliminary Design - Provide Preliminary SLD			
	Preliminary Design - Coordination Meetings			
	Pre- Engineering - Manufacturing Shop Drawings			
	Pre- Engineering - On Site Coordination Meeting			
	Detailed Engineering Structural Engineering Tanks and Foundation		X	
	Detailed Engineering Mechanical Engineering of AD-Process			
	Detailed Engineering Electrical engineering of AD Process			
	Detailed Engineering On Site Coordination Meeting	X	X	
	Project and Construction Management - Shipment of Materials			
	Project and Construction Management - Documentation			
	Tank Construction			X
	Access door			X
	Perimeter Drainage System			X
	Drainage Sump incl. Pump			X
	Wall Protection Epoxy Coating			X
	Insulated Base			X
	Insulated Walls			X
	Cladding			X
	In-Tank Heating System			X
	On-Wall Stainless Steel Pipe Heating System			X
	Technical Cabinet incl. Wall/Base Heat Manifold			X
	In-Tank Plumbing Installation			X
	Sulphur Removal System			
	Gas Extraction Pipe (CHP)			
	Gas Overflow			
	Insulation and heat trace Gas Overflow			

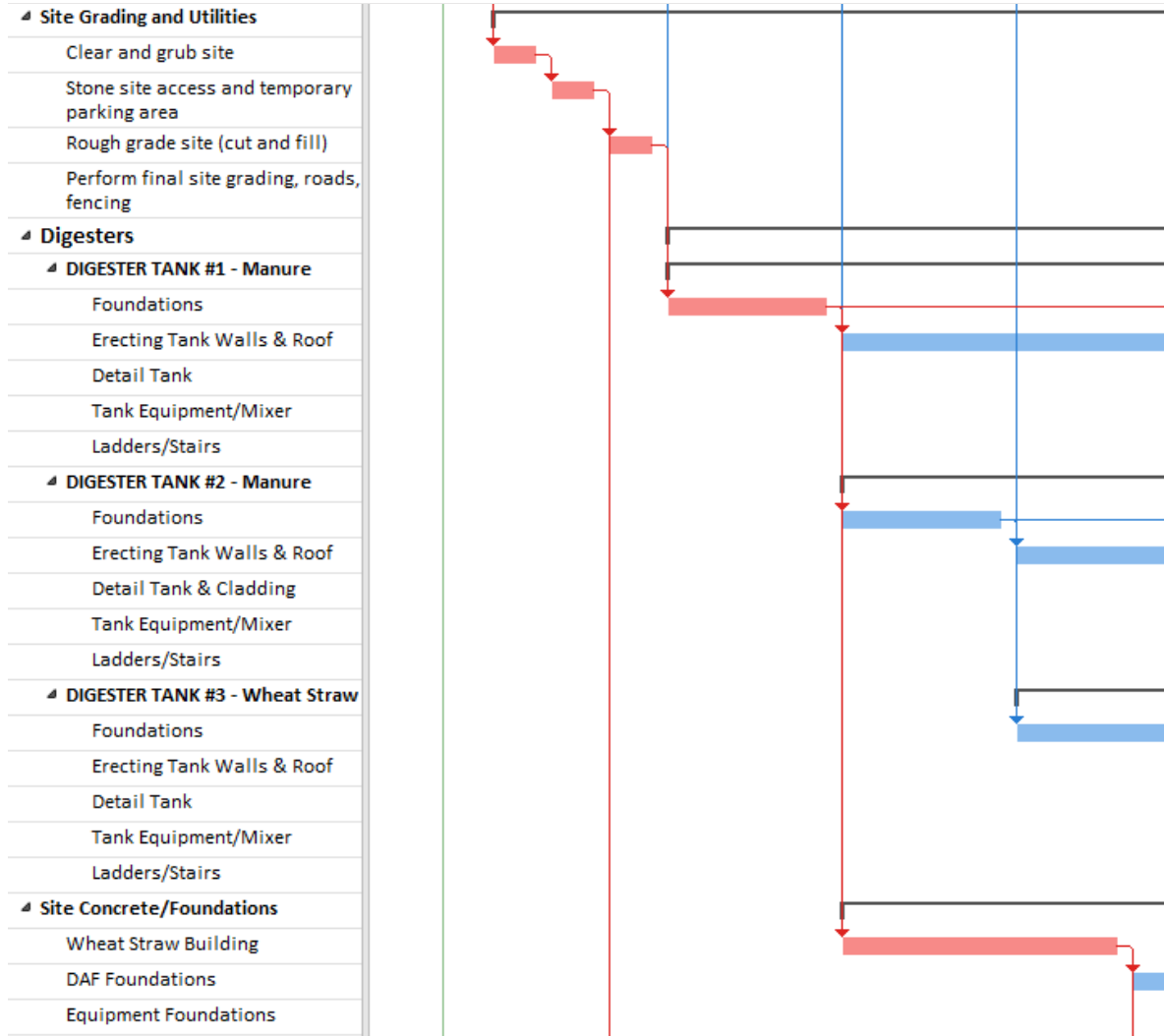
Class 4 Cost Estimate

Phase	Description	CURRENT Phase Budget (with Contingency & Fee)
100	Detailed Design, Project Management and ESDC	\$ 1,270,000.00
200	Construction Management - This is based on a 46 Week Construction Schedule. Any overage will be charged at a weekly rate.	\$ 840,000.00
300	General Conditions, Expenses	\$ 550,000.00
400	Commissioning & Start-up	\$ 290,000.00
450	Consultant Services (Geotech, Soil Bearing Capacity Testing, Concrete Testing)	\$ 140,000.00
500	Major Equipment	\$ 7,110,000.00
550	Minor Equipment	\$ 870,000.00
600	Earthwork & Site Improvements Including Structural Excavation/Backfill	\$ 460,000.00

Phase Gate Process



Risk Minimization



Minimize Budget Risk

Minimize Quality Risk

Minimize Schedule Risk

Subcontractor Bid Sets

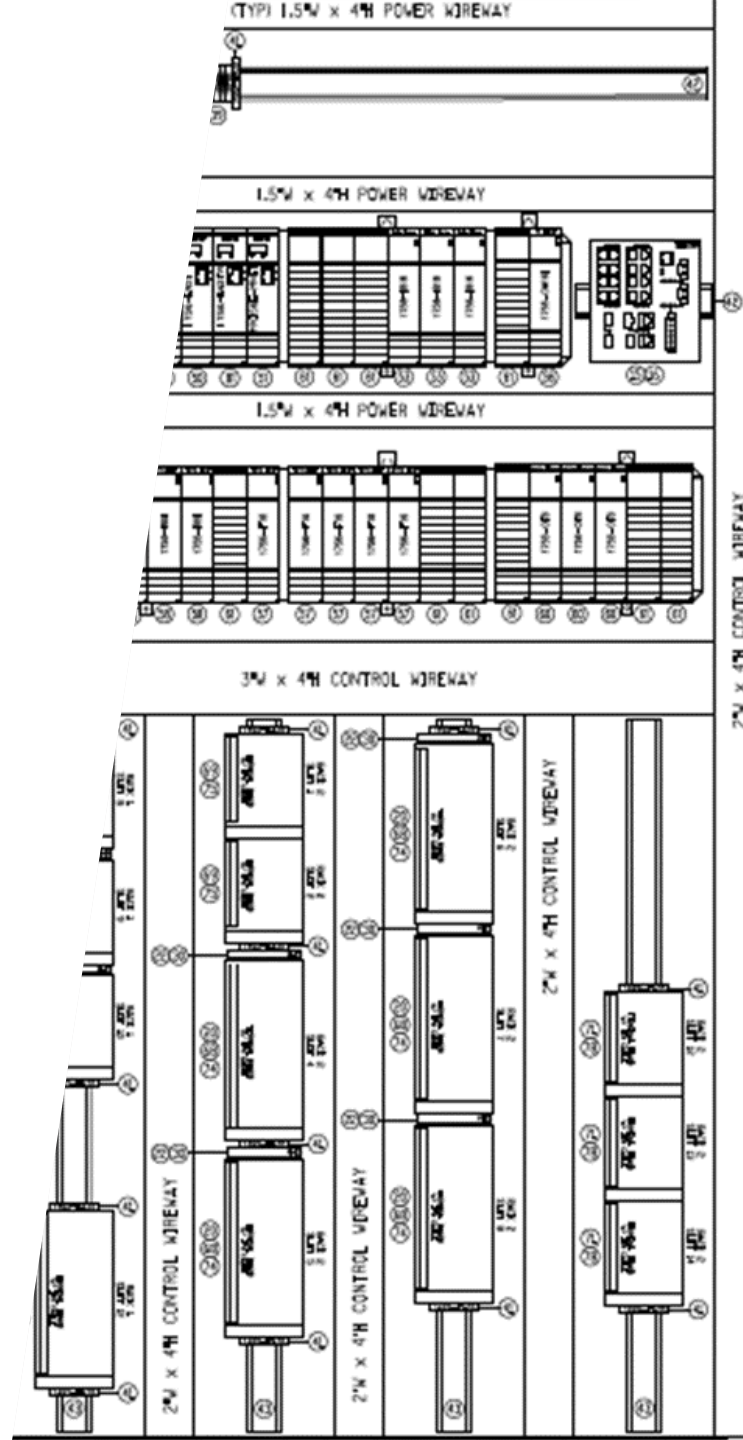
PIPING LINE LIST

LINE TAG	PID SHEET	SIZE	SERVICE	LINE	MATERIAL	FROM	TO	Flow	Temp. F	Pressure
6"-MN-100-SS1	P001	6"	MN	100	SS1	MANURE BUFFER TANK	DIGESTER	70-150 gpm	45-110	30-50 psig
6"-MN-101-P2	P001-2	6"	MN	101	P2	MANURE BUFFER TANK	DIGESTER	70-150 gpm	45-110	30-50 psig
6"-MN-102-SS1	P002	6"	MN	102	SS1	MANURE BUFFER TANK	DIGESTER	70-150 gpm	45-110	30-50 psig
6"-DIG-103-P2	P002-1	6"	DIG	103	P2	CLEANOUT MANHOLE	DIGESTATE TANK	70-150 gpm	45-110	1-30 psig
6"-DIG-104-SS1	P002	6"	DIG	104	SS1	DIGESTER	CLEANOUT MANHOLE	70-150 gpm	45-110	1-30 psig
6"-BG-200-SS1	P002-4	6"	BG	200	SS1	DIGESTER	BOOSTER BLOWER SKID	300-450 scfm	80-105	6-10" wcg
8"-BG-201-SS1	P004	8"	BG	201	SS1	PRE-BOOSTER BLOWER SKID	GASHOLDER	300-450 scfm	80-105	6-10" wcg
8"-BG-202-P2	P004	8"	BG	202	P2	PRE-BOOSTER BLOWER SKID	GASHOLDER	300-450 scfm	60-100	6-10" wcg
8"-BG-203-P2	P004-6	8"	BG	203	P2	NEAR GASHOLDER	FLARE	300-560 scfm	60-100	6-10" wcg
6"-BG-204-SS1	P004	6"	BG	204	SS1	BOOSTER BLOWER SKID	H2S VESSELS	300-450 scfm	80-115	30-45" wcg
6"-BG-205-SS1	P004-5	6"	BG	205	SS1	H2S VESSELS	PRE-BIOGAS PRE TREATMENT SKIDS	300-450 scfm	80-115	10-35" wcg
4"-BG-206-SS1	P005	4"	BG	206	SS1	PRE-BIOGAS PRE TREATMENT SKIDS	PRE-TREATMENT SKID 1	150-280 scfm	80-115	20-35" wcg
4"-BG-207-SS1	P005	4"	BG	207	SS1	PRE-BIOGAS PRE TREATMENT SKIDS	PRE-TREATMENT SKID 2	150-280 scfm	80-115	20-35" wcg
4"-BG-208-SS1	P005	4"	BG	208	SS1	PRE-TREATMENT SKID 1	PSA ENCLOSURE 1	150-280 scfm	80-115	5-30" wcg
4"-BG-209-SS1	P005	4"	BG	209	SS1	PRE-TREATMENT SKID 2	PSA ENCLOSURE 2	150-280 scfm	80-115	5-30" wcg
3"-BG-210-CS1	P005	3"	BG	210	CS1	PSA ENCLOSURE 1	FLARE	0-160 scfm	<120	< 1 psig
3"-BG-211-P2	P005	3"	BG	211	P2	PSA ENCLOSURE 1	FLARE	0-160 scfm	<120	< 1 psig
3"-BG-212-CS1	P005	3"	BG	212	CS1	PSA ENCLOSURE 2	FLARE	0-160 scfm	<120	< 1 psig
3"-BG-213-P2	P005	3"	BG	213	P2	PSA ENCLOSURE 2	FLARE	0-160 scfm	<120	< 1 psig
0.5"-BG-214-SS1	P004-2	0.5"	BG	214	SS1	H2S VESSELS	GAS ANALYZER			
0.5"-BG-215-SS1	P002	0.5"	BG	215	SS1	DIGESTER	GAS ANALYZER			
6"-BG-216-P2	P006	6"	BG	216	P2	OFF SPEC GAS	FLARE	300-560 scfm	60-100	6-10" wcg
6"-BG-217-SS1	P006	6"	BG	217	SS1	OFF SPEC GAS	FLARE	300-560 scfm	60-100	6-10" wcg
2"-RNG-301-CS1	P005	2"	RNG	301	CS1	PSA ENCLOSURE 1	PRE-PRODUCT COMPRESSORS	40-160 scfm	110-120	80-90 psig
2"-RNG-302-CS1	P005	2"	RNG	302	CS1	PSA ENCLOSURE 2	PRE-PRODUCT COMPRESSORS	40-160 scfm	110-120	80-90 psig
3"-RNG-303-CS1	P005-7	3"	RNG	303	CS1	PRE-PRODUCT COMPRESSORS	PRODUCT COMPRESSOR 1	80-320 scfm	110-120	80-90 psig
3"-RNG-304-CS1	P005	3"	RNG	304	CS1	PSA ENCLOSURES	PRE-PRODUCT COMPRESSORS	80-320 scfm	110-120	80-90 psig
3"-RNG-305-CS1	P005-7	3"	RNG	305	CS1	PRE-PRODUCT COMPRESSORS	PRODUCT COMPRESSOR 2	80-320 scfm	110-120	80-90 psig
0.75"-RNG-306-CS3	P007	0.75"	RNG	306	CS3	PRODUCT COMPRESSOR 1	PRE-PIPELINE	80-320 scfm	110-120	600-850 psig
0.75"-RNG-307-CS3	P007	0.75"	RNG	307	CS3	PRODUCT COMPRESSOR 1	FLARE	80-320 scfm	110-120	600-850 psig

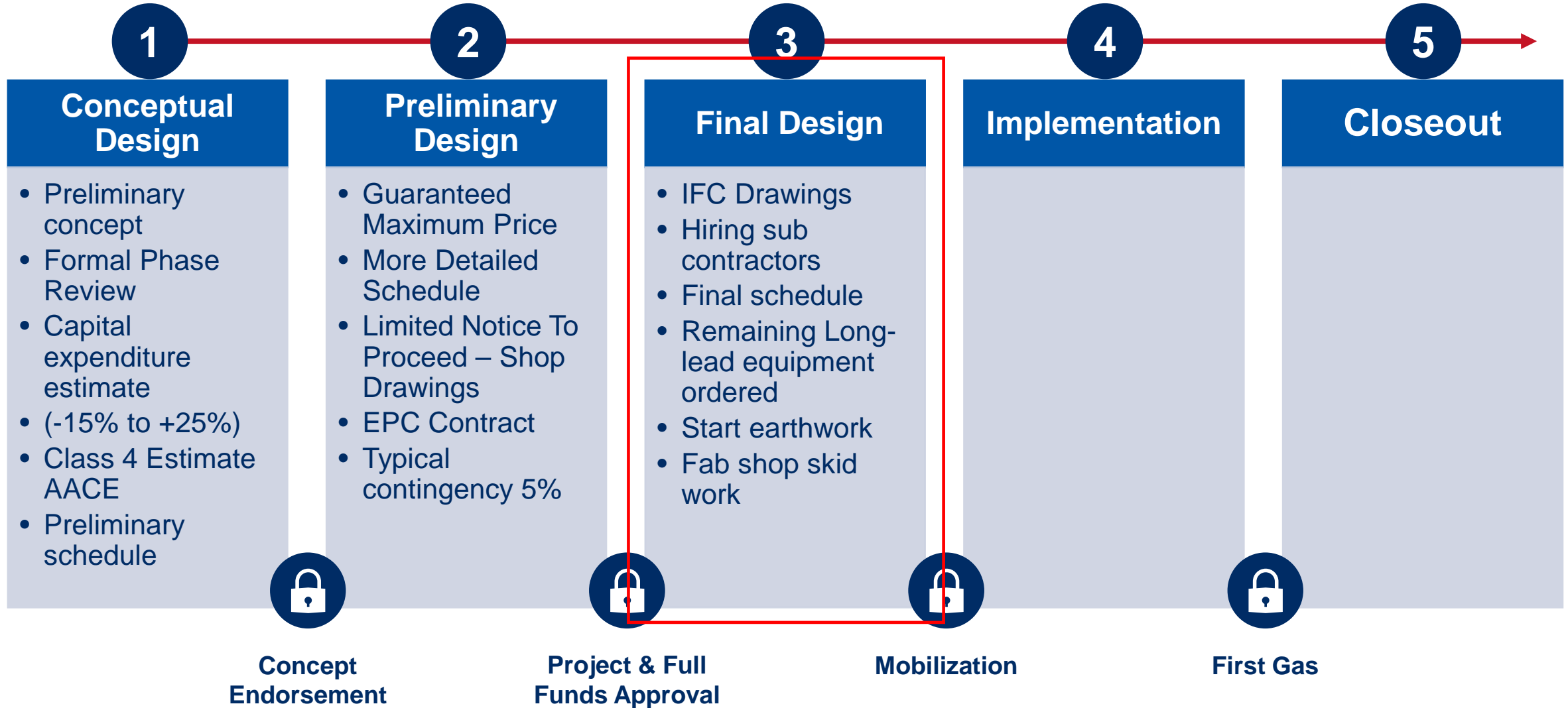
Typical Preliminary Design Stage Deliverables

- Preliminary:
 - Mass/Energy Balance
 - P&ID
 - Equipment List
 - Structural/Architectural Design
 - Civil Design
 - Site Plan/GA
 - Mechanical & Yard Piping
 - Electrical Diagrams
 - Controls

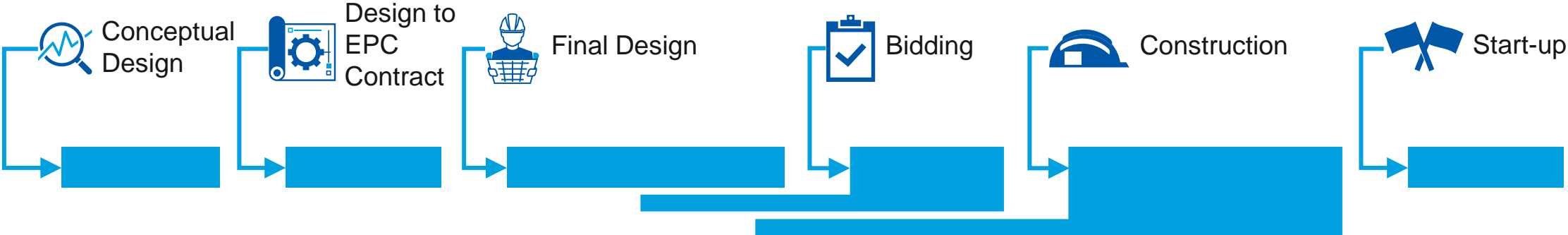
GMP – Including Costs For Final Design and Installation
EPC Contract Document and Exhibits



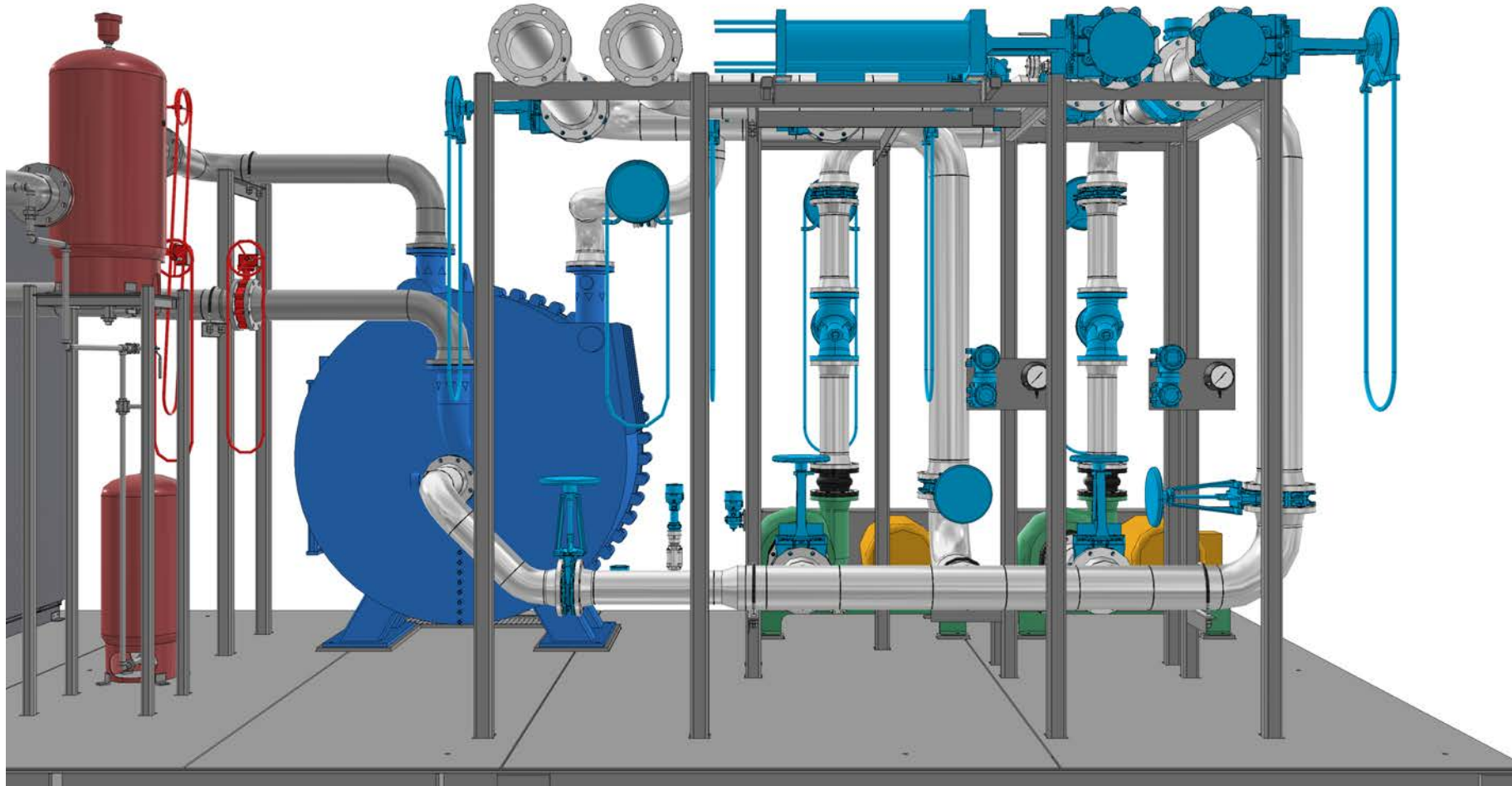
Phase Gate Process



Flexible Project Delivery



Example Plan

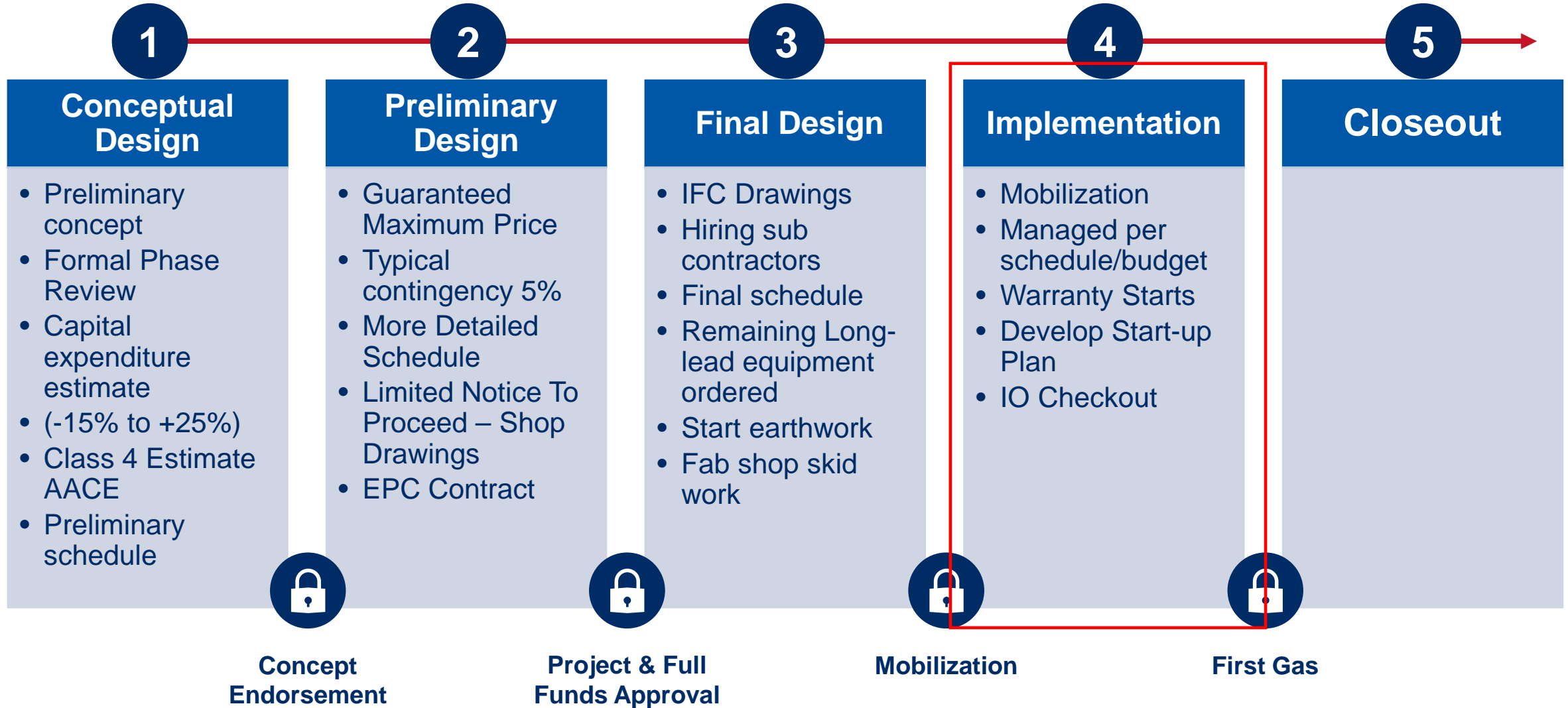


Integrating European Equipment Into US Market

- Time zone difference with European counterparts
- Different design standards, including safety.
 - NFPA as an engineering guide in US
 - OSHA standards
 - Impact on permitting
- Power feeds
- Nominal sizes are different. Nozzles and flange adapters costs add up
- Shipping terms
 - Items stuck in port can get expensive quickly
 - Delivery Duty Paid- vendor pays insurance and customs



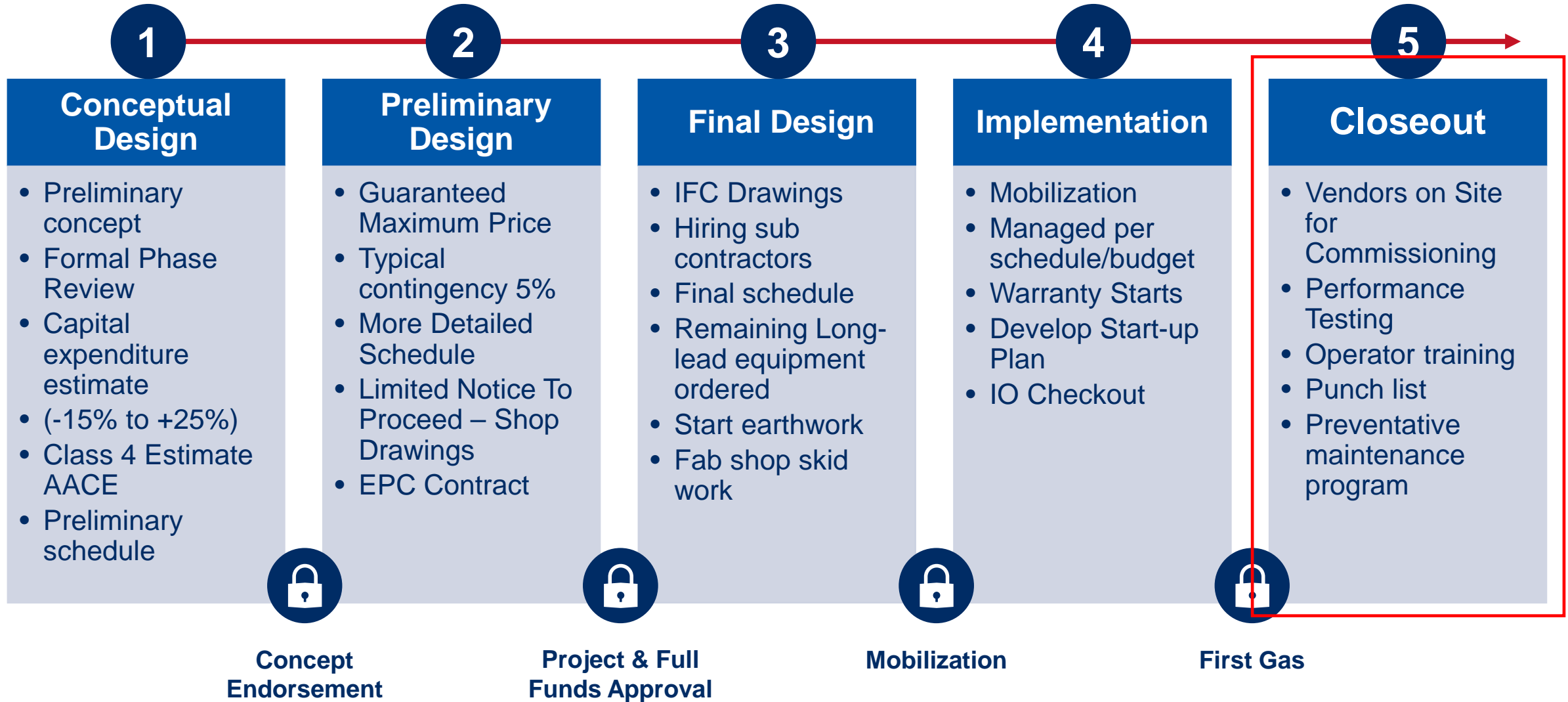
Phase Gate Process



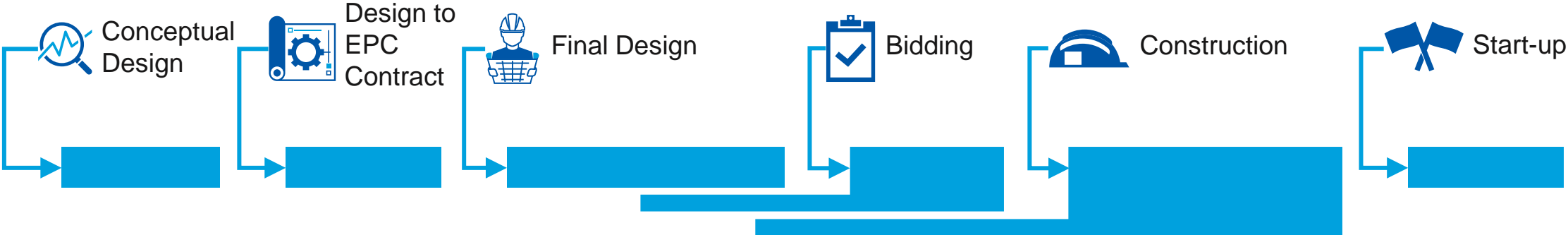
Fabrication Shop



Phase Gate Process



Flexible Project Delivery





Thank You!

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