REINHOLD ENVIRONMENTAL Ltd.

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Effective Implementation Strategies for Complex Wastewater Treatment Projects

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How to Make Wastewater EPC Projects Successful

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Delivery Methods

- Traditional (fixed cost) EPC or EPCM
- Design-Bid-Build
- Transparent (open book / closed book) EPC or EPCM

- Many flavors:
  - Procurement – by who, when
  - Amount of Project Definition done before bid to EPC
  - When close books and move to fixed cost

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Traditional EPC Wastewater Projects Can Have Significant Problems to Overcome

Owner pays the "Risk Premium" $$

Can lose the normal checks and balance between E and C

Lose involvement with the design process

Can lose hoped-for cost certainty due to change orders

Can lead to higher O&M costs, and poor operability

Performance guarantees can be worthless

EPC better for proven technologies

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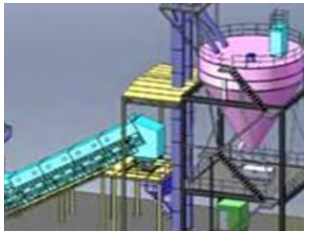
Types of Wastewater Treatment Plants

Tank-based pond replacement

Advanced wastewater treatment to meet strict discharge limits



Bottom ash solids-settling and water reuse

Pond-based treatment

Source water treatment

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Tank-Based Pond Replacement

Method	Role
Separate EP and C	E, P support

- Bottom ash & Other water - phys/chem

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Advanced Wastewater Treatment

Method	Role
EPC	OE

- FGD - evaporation;
  bottom ash - solids settling;
  Other water - phys/chem

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Advanced Wastewater Treatment

Method	Role
EPC+O	EPC+O

- Mine water - biological selenium

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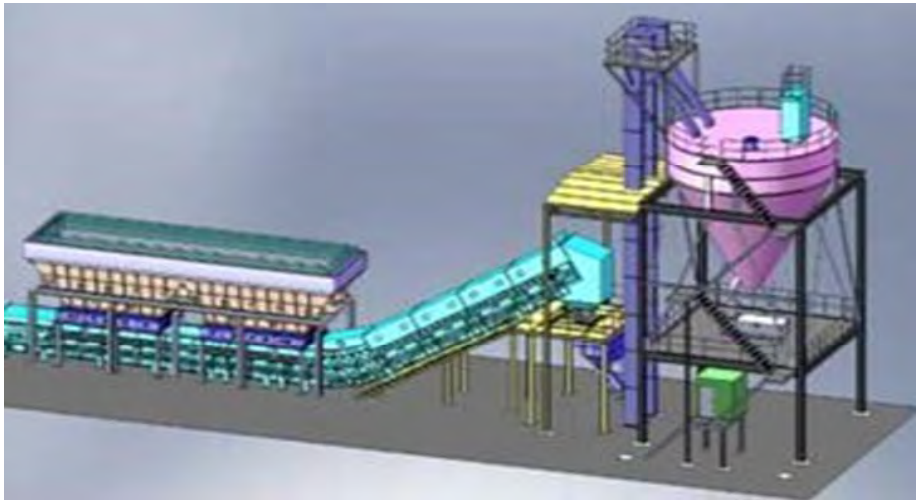
Bottom ash solids-settling and loop

Role
Programmatic pre-design

- Coal ash handling - construction, repair, and upgrade of ash management facilities



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Pond-Based Treatment

Method	Role
Separate E and PC	E and support client's P & CM

- FGD and ash water - phys/chem

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Source Water Treatment

Method	Role
EPCM	E and support P

- Source water: increase capacity municipal effluent supplemental treatment, and storage tank

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Time for a Survey

- Has your company done a >$5M water project in past 5 years?
- If so, was it by:
  1. Traditional (fixed price) EPC or EPCM
  2. Design/bid/build
  3. Transparent (open book/closed book) EPC or EPCM
  4. Other

O&M – Operations and Maintenance

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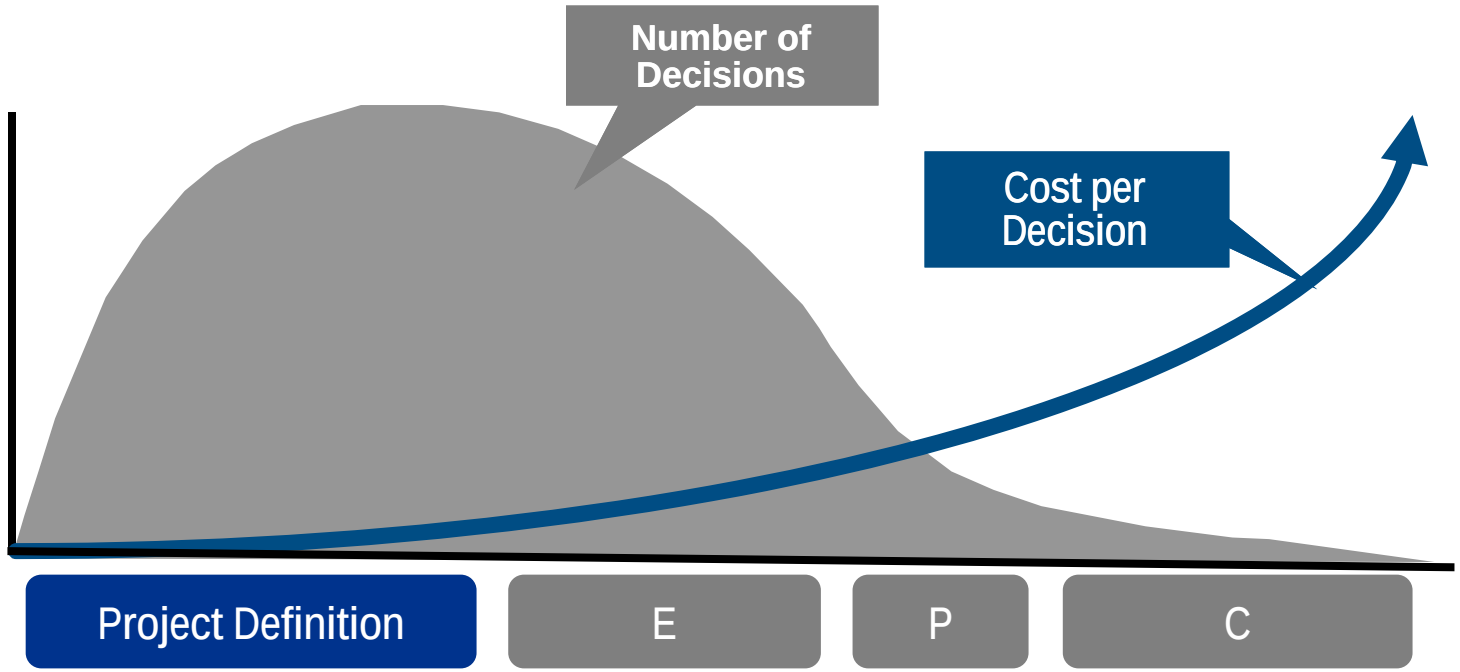
Making Wastewater EPC Projects Successful

Project Definition: early and informed decisions avoid backtracking, costly rework and schedule impacts



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Prepare sufficient project definition (EPC bid documents) to get apples-to-apples bids, and avoid excessive contingency

- Define influent water quality
  - Sufficient to avoid excessive contingency in EPC bid, but no more
  - Recognize difference between “available data” and full range
  - Include infrequent events
- Define type of treatment sufficiently
- Define redundancy

Define project sufficiently to get desired operability, maintainability, compliance, and reliability

- Compliance
  - If type of equipment key to meet limits, spec it. EPC will own perf guarantee so hard to require type after EPC contracted
  - Include storage volume
- Operability
  - Process monitoring: on-site lab, in-line meters, sample taps
  - Access: ladders not steps; shared elevated walkways

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Defining project (cont.)

- Maintainability and Reliability
  - Space to work on equipment
  - Material selection
  - Redundancy
  - Access for cleaning
  - Adequate capacity for unusual events
  - Considerations for filters
  - Define equipment and system warranties

Other lessons on project definition/ EPC bid documents

- If require bid to Owner's Standards, need to send RFP to those familiar with Standards, or give bidders time to digest
- If want control, need to prescribe submittals and reviews
  - Helps Owner have input
  - Helps EPC avoid changes when in field at a fixed cost
- Last but not least … ***allow time for good Project Definition***

EPC Selection

- Technical and Commercial considerations
- Good OE Check Estimate can help in negotiation
  - Example: $50K for OE to do Check Estimate, helped negotiate $15M fixed cost EPC savings

During design, ensure key project definition concepts aren’t lost

- Include review in schedule, and ensure reviewers available
- Especially powerful if in collaborative EPC T&M phase
- OE can help minimize impact of change orders

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More ways get good operability

- Training and O&M Manuals – equipment vs system-wide
- Requiring days of training is easy; getting good training is not
- Include OE in training
- Spec on-site lab

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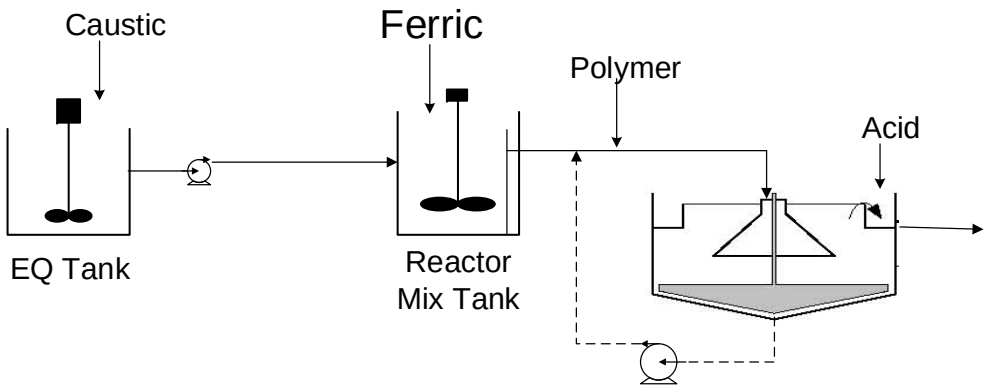
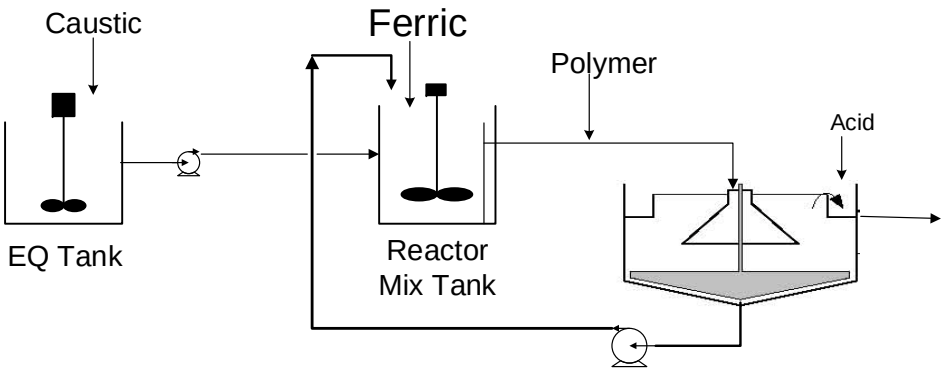
Startup

- Startup is when design problems bear (bad) fruit, especially:
  - Process
  - I&C
- Proactively anticipate to minimize problems:
  - Design and design reviews
  - EPC Bid documents to require startup plan, Owner review/approval
  - Startup Plan to include how to manage change

Treatment Process





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I&C

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Performance Guarantees

- Challenge: Many ww technology are on cutting edge due to:
  - Few full-scale applications – especially at power plants
  - Having to meet lower limits, or on new parameters
- Typical performance guarantee:
  - 30 (or less) days meeting criteria, during which fail means pause not re-start
  - Effluent contingent on defined water quality influent
  - Differs from equipment workmanship warranty

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Setting an effective performance guarantee

- Owner/OE write guarantee terms during project definition
- Require testing across flow and water quality range
- Require performance test be completed well in advance of Owner-motivating deadlines
- Include extended O&M in EPC contract, with teeth

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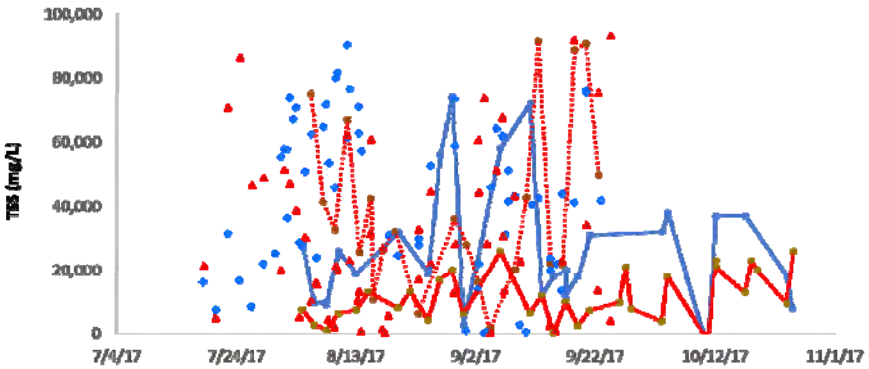
Performance guarantee challenges



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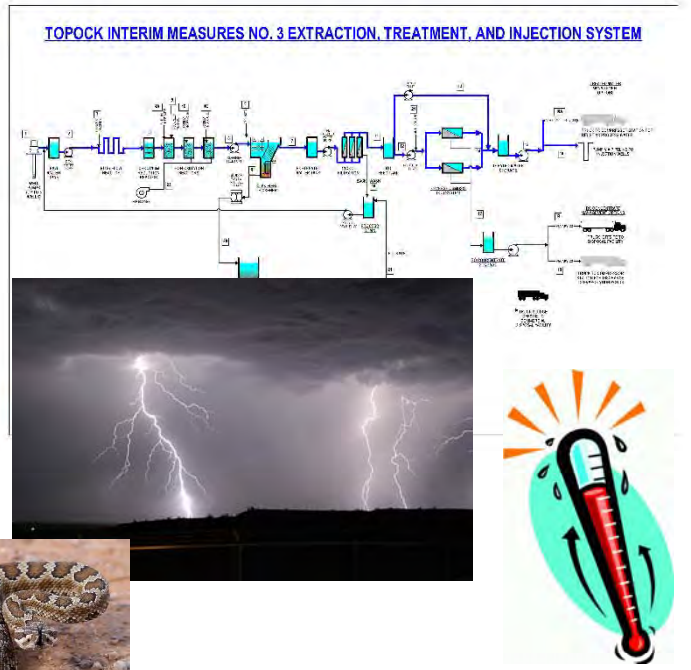

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In conclusion

The EPC approach can work for wastewater projects, if:

- Sufficient project definition in EPC bid documents
- Define a valuable performance guarantee
- OE involvement in engineering review and startup to ensure design intent maintained

Thank you for your time and interest

For further discussion:

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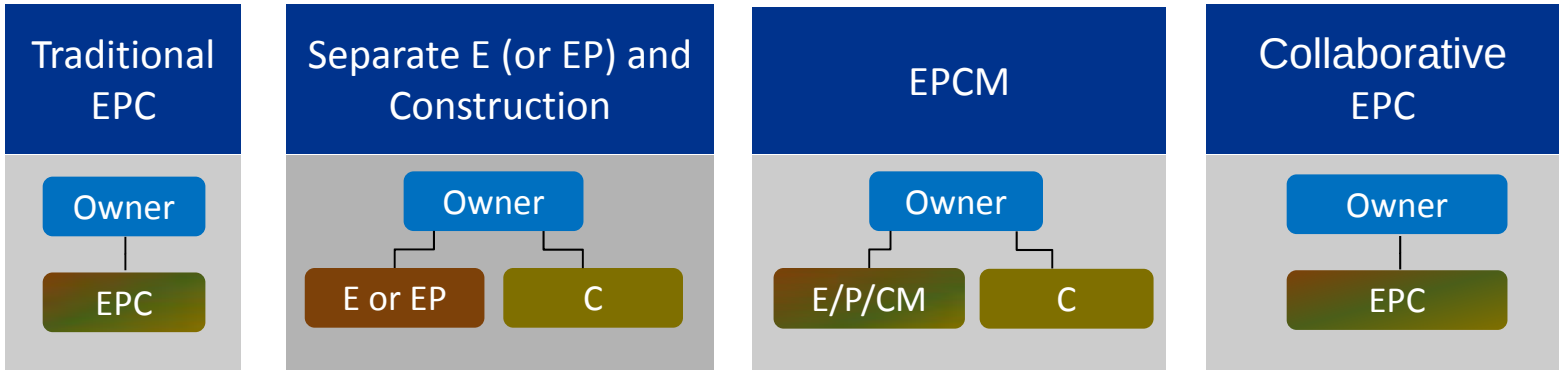
Possible Questions

- How do the Traditional and Transparent EPC models differ?

Delivery Methods



O&M – Operations and Maintenance

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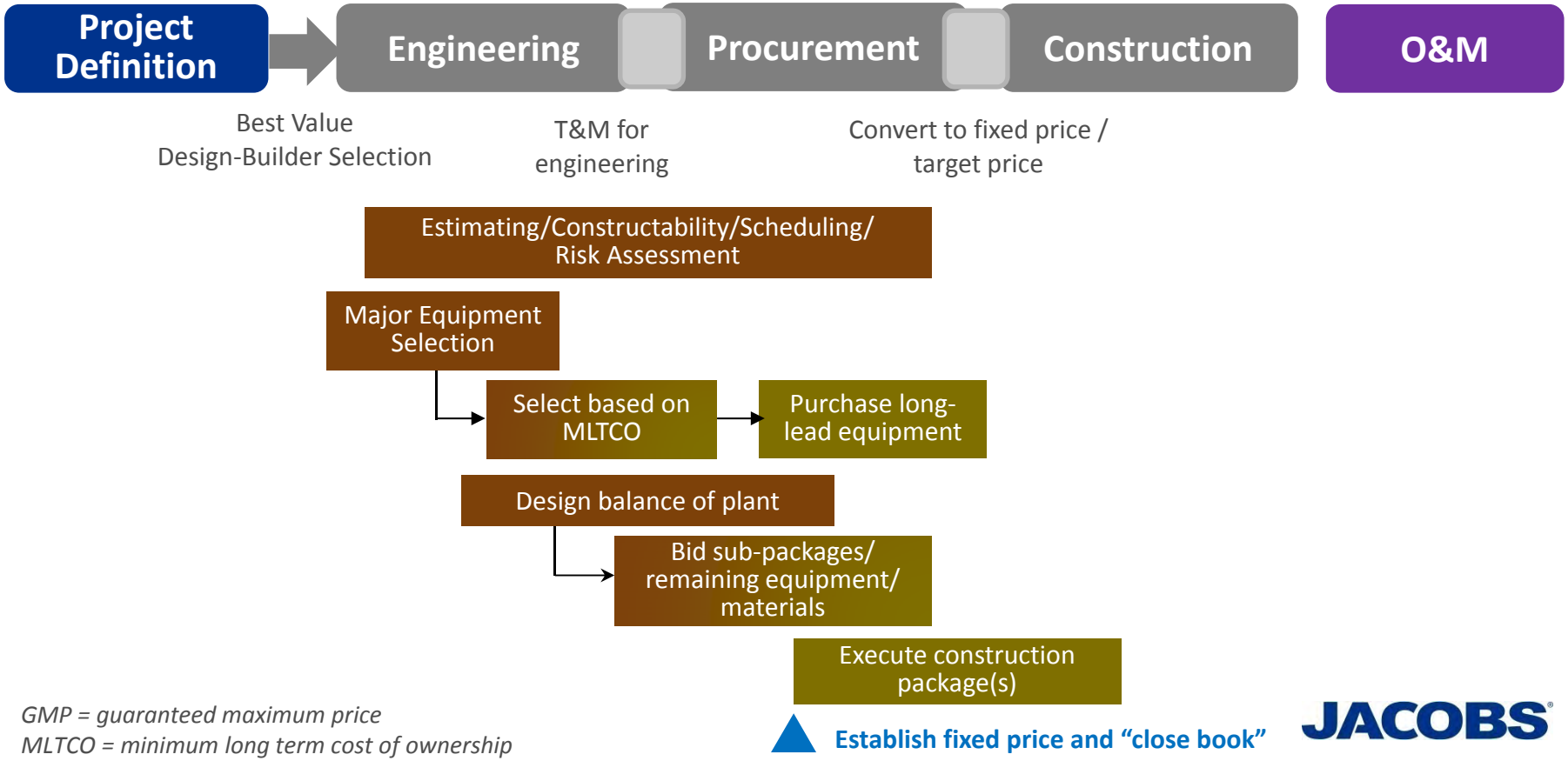
Collaborative EPC Phases



GMP = guaranteed maximum price
MLTCO = minimum long term cost of ownership

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Collaborative EPC Pricing

Phase 1

- Complete engineering to determine GMP
- Manage long lead items
- Performed on T&M basis (maybe fixed price)
- Agree on terms for part 2: markups on subcontracts and equipment, shared vs. separate contingencies, etc.

Phase 2

- Perform purchasing and construction based on competitive bids as appropriate
- Convert to closed book

Phase 3 (if EPC+O)

- Startup and operate plant
- Optimize operations

GMP = guaranteed maximum price

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