Maximizing the Benefits of pre-FEED & FEED in Parallel with Development of Design Documentation

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A complete E&C service offering

From concept to start-up

“SELECT”
- Investment planning
- Concept development
- Feasibility Study
- Pre-FEED

“DEFINE”
- Front-End Engineering Design (FEED)

“EXECUTE”
- Engineer, procure, construct
- Commissioning and start-up assistance
- Project Management Consultant
Road Map for project implementation

- Formation of primary pool of investors - initiators of the project, adjustment of dialogue with local state agencies
- Contracting strategy choice
- Choice of the technology licensor
- Declaration on intentions
- TR on connection to networks
- Societies, Hearings, Prelim. act of land plot choice.
- Prelim. conclusion infect. ecolog. and fire. services for choice constr. site
- Involvement of investors in capital
- Choice of FEED/PD Contractor
- Set of FEED Documentation
- Project Documentation under the 87th resolution of the RF Government (12 volumes)
- Special Technical Conditions
- Engineering surveys (geologist., geodez./topogr., hydrologist., meteor., ecologist.)
- Final Agreement between shareholders
- Loan financing is involved
- Preliminary contracts for delivery of raw materials and sales of products are signed
- The contractor is chosen by EPC and PMC
- The positive decision of Glavgosekspertiz is received
- Act of acceptance by state commiss.
- The delivery-acceptance certificate between the customer and EPC/PMC contractors
- Registration of the rights for a real estate object

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<td>1 year</td>
<td>2.5 year</td>
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<td>Selection of FEED contractor</td>
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### Contract
- PRE-FEED
- Licensee Basic Design
- FEED
- PMC
- EPC
- Operation

### Documents on project
- Business plan
- Financial model with an assessment of expenses ≈ 40%
- Design basis, unit description, utility consumption, economy
- Process diagrams (PFD), general plot plan and assembly diagrams
- Material and thermal balances
- P&ID, Plot Plan
- The list of the equipment, the order of the LLI equipment
- The estimate on an assessment of expenses ≈ 10-25%
- TA on tenders, assessment of results
- Reports on audit of FEED/EPC contractors work on acceptance of expenses, compliance to the best practices and terms of the contract
- The interface of interaction between the contractor and the customer – formats of documents and reports

### Contract
- Selection of EPC contractor
- Tender, analysis and negotiations
- Preparatory and licensing documents
- FEED documentation
- Engineering and construction documents
- Installation and start-up documents
- Operation and maintenance documents
The Amec Foster Wheeler Approach

Our Methodology for Investment Planning & Detailed Feasibility Studies

‘Real project execution experience that adds value to your business’

Agree objectives

Market analysis

Plant configuration study

More detailed reviews

Site selection

Develop offsites/utilities/marine facilities concept

Constructability studies

Cost estimates

Recommend configuration development road map

Economic & financial analysis

Cost estimates

More detailed reviews

Plant configuration study

Market analysis

Agree objectives
The Need for Investment Planning

*The Most Important Phase of any Project*

Investment planning looks at:

- What are the optimum feedstock's and are these available?
- What product are in demand and should be produced?
- What capacity should the plant be?
- Where should the plant(s) be?
- What process / technologies should be used?
- Is capital cost reasonable and are the economics acceptable (IRR, NPV etc)?
- Are logistics feasible?
  - Feedstock supply
  - Product distribution
  - Construction access
- Which project(s) out of multiple options make the most sense?
- If multiple assets / projects, are the projects exclusive or can they be integrated to further optimize the investment plan?
Project Definition: Key components

- **Economic Analysis**
  - Optimised Mass Balance
  - LP Modelling
    - Process Unit Technical Performance
    - Utility Demands
    - NonLicensed Units (Distillation, SWS, Amine, etc.)
    - Select Optimised Configuration of Process Units
    - Mass Balances
    - LP Modelling Generic Data
    - Licensor Information
      - Structural Definition
    - Duty Specs
    - Curve Cost Estimation
    - CAPEX
  - Sited Equipment Lists
  - Interconnect Pipework
  - Ground Condition
    - Port Facilities Local Facilities
  - Site Layout
  - Offsites, Tanks & Utilities
  - Site Report
  - Environmental
    - Utility Demands
    - Inventory Process Unit Sizes Run-Downs Liftings - Shipping
    - From LP Modelling
  - CAPEX/OPEX
  - Project Implementation Plan
The Estimate Basis

A proven combination of technical and commercial expertise

Estimate methodology and work breakdown structure produced early in the study for comment

- Process units based on project outturn costs from similar projects
- Utilities based on major equipment lists
- Offsites based on major equipment lists
- Infrastructure based on plot layout and Amec Foster Wheeler Refining and Petrochemicals plant experience
Capital Cost Estimating

Amec Foster Wheeler provides real cost data based on real experience

EPC Company Project Cost Data

- Process Units
- Site & Constructability
- OSBL
- Plot Plan
- Schedule

Cost Estimate
Role and standard set of services RDI

The role of RDI consists in the following:

► Russian norms and requirements expert.
► PD developer.
► Participant of FEED documentation development and also developer of some FEED documents.

The standard set of RDI services includes the following:

► Provide compliance of documentation to the Russian Norms and Technical Requirements.
► Review of FEED
► Development of parts of FEED documentation.
► Development of PD for GGE.
► Development or participation in development of STC, with the purpose to receive positive conclusion of GGE on PD.
► Support of PD during GGE review
► Other services in support of the project (surveys, translations, etc.)
Special Technical Conditions (STC) are developed every time when deviation from obligatory technical Norms/ Standards is required. For example, deviation from such obligatory parameters as the size of gaps between Units, or ways of cables laying on a cable rack (for example, the Western norms allow to have in some cases cables in one tray "random"), etc.

**Content of STC**

- The description of a deviation from obligatory norm: what solution we propose instead of what the Norm demands
- The reason why we request the deviation, an explanation why the technical solution which is demanded by a Standard is unacceptable or not possible
- The technical solutions and measures directed on compensation of risks and dangers arising in connection with non-compliance with requirements of a Standard
FEED Phase – Preparation for EPC

Summary of FEED work

- Develop Strategies, Procedures
- Procedures, Standards and Specifications
- Beneficial engineering
- Schedule/ Budget Development
- Construction Planning
- Procurement Planning
- Strategy Co-ordination

Execution Phase
FEED Phase – Key Drivers of Scope

Value Improvement – The Amec Foster Wheeler Approach

- Technology Selection
- Innovation Review (process simplification)
- Design Optimization Reviews
- Waste Minimization
- Constructability Review
- Unit Level VE
- Customised Standards & Specifications
- Energy Optimization
- Site Wide Layout Optimization
- 3D Visualization

- Close alignment with the IPA benchmarking process
- Close alignment with others, eg the SGSI Project Value Processes
Implementation – Smart FEED road map

Amec Foster Wheeler Best Practice Approach

Pre-FEED
- Feed Schedule
- Client Documents
- Cost Estimate

FEED Phase
- Studies/Design Basis
  - Setup
  - Project Studies
  - DG1: Basic Design
  - DG2: Comment, Issue specs & Drawings
  - DG3: Prelim. FEED
- PFD’S
- HAZOP P&ID’S
- Final FEED

Bid Phase
- Final
  - Cost Estimate
  - EPC Bid Documents

Cost trends highly visible
Value improvement

GATE REVIEWS
- DG: Design Gates
- CG: Cost Gates

“No surprises” at EPC phase
Development of FEED Package

Engineering Elements

Client Data

PFD

Utility Data

Plot Plan

Civil Design
- Structural Design
- Piping Design
- Construction

Equipment Design
- Instrument Design
- Electrical Design

Process Specs

P&ID's

Inst. and RV

Engineering FEED

Process FEED
FEED Package Technical Deliverables

Examples – Some Key Deliverables at FEED Completion

- Plot Plan
- PFDs Final Issue
- P&IDs Final Issue
- MSDs Final Issue
- Final utility balance
- Final utility system design
- HAZOP report
- Final equipment list
- Final line list
- Final EDRSs (issued by Mechanical)
- Final fire and gas detection and protection design
- Final flaring / venting analysis and recommendations
- Catalyst and Chemicals summary
- Process Instrument datasheets
- Cause & Effect diagrams
- Final process descriptions
- Operational philosophies
- Startup & Shutdown philosophies
Successful control of FEED-PD interface

Amec Foster Wheeler uses 3 tools for effective management of PD development on the basis of FEED with the purpose to optimize interaction and to reduce risks of Schedule and Costs overruns:

► Careful and most detailed scoping of works, study of volume of the services and works performed by RDI and division of amounts of works between the Contractor of FEED and RDI including clear indication of those sections of FEED documents which are developed by RDI or RDI participates in their development.

► Technical requirements to design, obligatory to application when developing FEED (applicability of the Russian Norms); for each Engineering discipline or at least for the most critical.

► Carrying out a number of meetings/sessions on consideration of documentation development in various, most critical disciplines with the purpose to apply as much as possible the Russian norms and PD requirements to FEED documentation.
Scheme for FEED Contractor and RDI joint reviews of documentation
Contracting Strategies

**Best practices for Mega Projects**

- **Low Contractor Risk**
  - Reimbursable at cost rates
  - Reimbursable fixed rates
  - Lump Sum Engineering

- **Client has Maximum Flexibility**
  - Owner controls Contingency

- **High Contractor Risk**
  - Lump Sum Engineering & Materials
  - Negotiated Lump Sum EPC (CLSTK)
  - Competitive Lump Sum EPC (LSTK)

- **Client has Minimum Flexibility**
  - Contractor controls Contingency

- **Client & Contractor Share Risk & Contingency**
Critical Issues Influencing Project Development

**Common issues for PreFEED/FEED:**

- Crude Oil price and availability
- Market Demand profiles
- Capacity – domestic or export
- Refinery / Petchems Configuration – CAPEX
- Refinery / Petchems Configuration – Operational complexity
- Return on Investment (IRR)

- Availability of cost effective fuel – eg gas
- Environmental legislation and permitting for construction and operation
- Plot Availability
- Availability of Finance
- Political influence, sanctions

**Specific issues for FEED/ Design Documentation**

- Partnerships and commercial relationships with reliable and professional RDI
- Proper interaction interface, dispatching of FEED Contractor specialists to RDI and vise versa

- Detailed agreement for a scope split
- Special Technical Conditions (development and agreement)
- Technical Requirements for FEED design