AN OVERVIEW OF HOW TO EXECUTE ENGINEERING PROCUREMENT CONSTRUCTION COMMISSIONING (EPCC) PROJECTS

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HOW TO EXECUTE ENGINEERING PROCUREMENT CONSTRUCTION COMMISSIONING (EPCC) PROJECTS

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1. THE PROJECT PHASES AND MANAGEMENT APPROACH

1.1 The Life of a Project

The life of a project starts with the gleam in the eye of a top corporate or governmental executive, when the realism of research or development activities takes hold or the marketing force strikes hard enough or the public out-cry becomes a challenge to satisfy or to forecast. From this gleam to completion, at satisfactory operation, wherein the project achieves its stated objectives of operations and output is the project life cycle.

The illustration shows this life cycle; it is not necessarily determinate. All of the project work illustrated needs to be done but not necessarily by the engineer-constructor; certain phases may be performed by the owner-client or his independently appointed conceptual/process phase consultants. Throughout the project life there are a number of start-stop decision points; it may go into suspension, remain alive but dormant for a while then die completely or spring into life again with an even more vigorous force. The many external influences under which the project life has little control may guide or shape its pattern to a somewhat different form without real change to its basic configuration. There are always the considerations to make changes to use the latest technology or to improve for consideration of plant operation, maintenance or quality of product which may be completely disruptive of the project life. When these are proven to be necessary, due to long-term considerations, that is the plant life, the project rhythm may be broken, but with disastrous results to the satisfaction of the Project Task Force of the engineer-constructor.
The maintenance of the logic sequence of the project life and the planned deployment of resources is all important for the performance criteria in evaluation of the project and its execution. As an incidental to this, one can visualize the project as a live, dynamic force, which may be controlled or not, which may be driven or not, which may be satisfying in its success or depressing in its final outcome. The only reality is that, big or small, there are never two alike, as are human beings.

For all projects, great or small, throughout their life as defined earlier, there are four distinct phases. The first phase is Conceptual and in North America is often performed by the client’s organization or may be contracted out to engineer-constructor companies or specialty process supply organizations or may be handled in combination without commitment for the next phases. The second phase is one of Definition that is the fixing of the project scope and configuration with final appropriation of funds for commitment and the general organization, the planning Phase and to be that, this includes a subphase “Plan the Planning”. The third is the mass Production phase of the project, the E, P and C. The final and fourth phase is the Reduction and turning down of the work, the mechanical acceptance testing, start-up, commissioning and make good. The above mentioned chart indicates for a typical project, the relative magnitudes of such effort, excepting manual Construction labour and equipment or material supply cost. The facility operation phase is usually the owner-client responsibility.

1.2 Conceptual Phase

The Conceptual Phase starts upon realization by the authority, public or private, that the investment of capital in the creation of a structure, physical system, resource development, infra-structure, treatment plant, production facility or however it may be described, will be for the common, specific or particular good.

Even so, the work of the Conceptual Phase, carried out by the small team, is composed of the same attention to detail, thorough checking of facts, compilation of data, analysis techniques, planning, setting of objectives, forecasting results and comparison of Scope, Cost and Time to agreed standards of performance as in the other phase of project work. It is specialized work composed of as many varying disciplines or functions, with many of the same demands of project management such as the responsibility for the interfaces between each function.

1.3 Feasibility

This phase starts when the client’s criteria or supervisor’s satisfaction is achieved. The project appears to be viable, it is in the interest of the good, but it is necessary to check, to review. The client’s C.E.O. needs this for directors’ approval, to fund the project; all of this is to be sure. This phase of project life is the most important for the ensuing work if it passes this inspection at all. The work at this time is to be done well in a most professional manner; it will have to respond faithfully to the scrutiny of the highest echelon of management and perhaps third party funding organizations.

This Phase comprises a review of feasibility; review of the marketing study and the plant location study; sufficient preliminary engineering, an almost fix of the process or layout, the almost decision for standard criteria; a plan and milestone schedule for the project, a preliminary project instruction manual for the Planning & EPC Phase; a preliminary or even a definitive cost estimate; risk and sensitivity analysis; contingency evaluation; escalation and finance cost parameters and an organization structure design to do the work of the following Phases. This is the time during which the major decisions of the project are confirmed.
1.4 THE PLANNING PHASE AND THE PROJECT MANAGEMENT APPROACH

**PLAN THE PLANNING**

**THE PRELIMINARY PROJECT PLAN**

**THE PROJECT PLAN**

**GENERAL SUB-PHASE DESCRIPTION**

This is the phase during which the Project Manager prepares the project Assignment Sheet (Project Charter), reviews available information and the contract, establishes objectives, policies, etc. He/She reviews these with the Chiefs of Disciplines, and the Project Key Managers. He plans how he wants to accomplish the two following sub phases, establishes a budget for it, selects key people for the project and arranges for the project Panel Review.

If the resulting Preliminary Project Plan shows that any of the Project Objectives or Resources required are not acceptable we have to re-do our preliminary planning until we are “in the ball park”. After the necessary approvals we can go to the next sub-phase, to the actual project planning.

The degree of detail required depends on the size of the project, the importance of the portion under consideration, the depth of information available, and most important, the degree of the control required. The closer the control of any portion, the greater the detail required for planning and subsequent monitoring.

**ESSENTIAL ACTIVITIES**

1. **PRELIMINARY SCOPE DEFINITION**
   - Scope of the work (facility)
   - Scope of the services
2. **PRELIMINARY ENGINEERING PART I**
3. **INITIAL SITE INVESTIGATION**
4. **INITIAL LOCAL INVESTIGATION**
5. **PRELIMINARY DESIGN CRITERIA**
6. **ESTABLISH CONTROL SYSTEMS TO BE USED**
7. **PROJECT INSTRUCTIONS – Initial issue/updates**
8. **ESTABLISH RESOURCES REQUIRED AND SOURCES**
9. **INITIAL PROJECT ORGANIZATION CHART**
10. **UPDATE PRELIMINARY SCOPE**
11. **PRELIMINARY PROJECT WORK BREAKDOWN STRUCTURE AND PACKAGES**
12. **PRELIMINARY MILESTONE SCHEDULE**
13. **PRELIMINARY MASTER NETWORK AND SCHEDULE**
14. **PRELIMINARY CAPITAL COST ESTIMATE**

1. **EVALUATING THE PROJECT PANEL REVIEW**
2. **COMPLETE SCOPE DEFINITION**
3. **COMPLETE PRELIMINARY DESIGN**
4. **COMPLETE PROJECT INSTRUCTIONS (PROJECT PLAN)**
5. **FINALIZE PROJECT ORGANIZATION**
6. **FINALIZE PROJECT WORK BREAKDOWN**
7. **FINALIZE PACKAGES**
8. **FINALIZE PROJECT CODING**
9. **UPDATE WORK AND MANPOWER CONTROL**
10. **DEFINITIVE ESTIMATE ASSEMBLY**
11. **SITE MANPOWER AND LEVELING**
12. **UPDATE NETWORK PLAN**
13. **DEFINITIVE ESTIMATE REVIEWS**
14. **UPDATE SERVICE BUDGET**
15. **CASH FLOW PLAN**
16. **DEFINITIVE CAPITAL AND COMMISSIONING ESTIMATES**
17. **PROJECT PANEL REVIEW**
Project Instructions are an essential element of project planning, as it will comprise sufficient principles or details of the execution planning of control procedures, procurement, expediting, shipping, warehousing, inspection, construction management procedures, arrangements for personnel, insurances, travel taxes, coding, time charges, etc. to allow for estimating of cost/duration/manpower of these activities.

THE “PROJECT MANAGEMENT” APPROACH:

1. PROJECT MANAGERS’ FUNCTIONS

   EXECUTIVE
   - Must not be delegated, but worked out with client and parent company
   - Policies and Objectives
   - Decision Making/Getting
   - Course of Action

   LEADERSHIP
   - Get team members to contribute at their optimum

   PLAN & CONTROL
   - We cannot control what we did not plan.
   - We can not plan and control anything.
   - We have to plan what we have to control.
   - We phase our planning

   AREAS OF MANAGEMENT CONCERN

   Objectives
   - Scope
   - Quality
   - Cost
   - Time
   - Relationships
   - Profit

   Resources
   - Manpower
   - Money
   - Machines/Facilities
   - Methods/Systems
   - Information
   - Relationships

   PLAN AND CONTROL

   PLAN: Plan, Organize, Staff, Direct:

   CONTROL: Coordinate, Control, Forecast, Measure Progress, Production & Productivity, Performance, and Appraise, Re-Plan.

2. SKILLS FOR FUNCTIONS

   EXECUTIVE
   - Innovate
   - Anticipate
   - Organize
   - Big Picture
   - No Abrupt Changes
   - Decision/Action Time Lag
   - Balance Objectives/Resources
   - Delegate/Follow Up

   LEADERSHIP
   - Team Builder
   - Communicate (team members understand their tasks)
   - Motivation
   - Get Willing & Able People on Team
   - Personal Relationship
   - Empathy

   PLAN & CONTROL
   - In House Method
   - Planning Orientation
   - Analytical
   - Organize
   - Integrate/Evaluate Control Information
   - Smoothen Information Flow
3. LEVELS OF PROJECT ENVIRONMENT

CLIENT
- In-Line:
  - Project Manager & his Staff
  - Division Manager
  - Executive Sponsor
- Staff:
  - Operation
  - Finance
  - Services
  - Personnel
  - System
  - Legal

PARENT COMPANY
- Management:
  - Director
  - Division Manager
  - Executive Sponsor
- Corporate Services:
  - Marketing
  - Public Relations
  - Support Staff
  - Finance
  - Services
  - Personnel
  - Systems
  - Legal

PROJECT TEAM
- The Project Management Team:
  - Project Manager
  - Project Controls Manager
  - Engineering Manager
  - Project Construction Management Manager
  - Project Commissioning Manager
  - Including all Quality Assurance
  - Senior Staff

EXTERIOR PARTIES
- Utilities
- Regulatory Agencies
- Governmental Authorities & Judiciary
  - Federal
  - Province/State
  - Municipal
- Labour Unions/Associations
- Media
- Banking
- Insurance
- Finance

SUPPLIERS/CONTRACTORS
- Suppliers
- Contractors

4. STRATEGIES OF EACH LEVEL

CLIENT
- Openness
- Close Working Relationship, no Meddling
- No Arms-Length Relationships
- Simple Reporting Schemes
- Establish Relative Importance of Objectives
- Prompt Decisions
- Minimize Public Involvement
- Effective Lines of Communication
- Appropriate Authority of Principal Client Contract

PARENT COMPANY
- Select Project Manager Early
- Close Working Relationship
  - No Meddling with Project Manager
- Enthusiasm
- Simple Reporting Scheme
- Guide Lines for Project Manager
- Project Decisions
- Effective Lines of Communication with Project Manager
- Appropriate Authority of Project Manager

PROJECT MANAGER
- Select Project Team Key Members Early
- Participative Style
- Commitment/Mission Feeling in Team
- Authority/Organization Structure
- Emphasize Coordination & Relationships
- Public Image
- Plan the Plan, then Plan, then Control
- Balance Project Manager Skills/Tools
- Emphasize Quality of End-Item
- Project Change Control
- Plan Completion/Close-Out

1.5 THE EPC PHASE (ENGINEERING, PROCUREMENT, CONSTRUCTION)

This is the phase during which the bulk of the project work is done – It may represent 80 per cent of the skilled engineering, procurement and construction management and supervision man-hours and 95 per cent of manual construction man-hours. This is the phase wherein the big money of the project life is consumed. The efficiency of its consumption is all important. This is where it shows whether the Project Team has come up with good project planning, and whether the Project Management Approach planned in the plan phase is good.

The Project Manager must be alert, to delegate properly, sometimes in massive amounts but retain his assistant, the P.C.O. people, to analyze and evaluate. He/She must know the people of the Project Management Team, and encourage them all, forecast their deficiencies, know intimately the methodology, nomenclature, procedures and policy of the company as it applies to the project, prevent fires, achieve results through people. He should listen to and rely upon the functional chiefs and the specialists of the product divisions of the company, in their independent review and analysis and recommendation for project operations. The other major qualification for the Project Manager requires that he be a team builder and support his people for success. He needs some experience and background in the technology of the industry of the client he/she serves.
He is a quick decision maker based upon the best advice available; decisions based upon production efficiency not specialization of technology, he must understand the rhythm intricacies and inter dependencies of the progress of the work in terms of daily decision-making; the excess costs of disruption of his large team many times over-rides the requests of the specialists, or the functional chiefs.

Much of the Project Manager’s time with the Project Team must be spend in Planning and Control whereas activities are developed and come of Project Engineering and go into Project Procurement, become whole packages, and full under the responsibility of Project Construction Management. The Project Manager may need assistance, as he may delegate this expediting – interoperation and coordination really – but this is still his responsibility, and he follows up on his assistants.

1.6 THE COMMISSIONING PHASE

This Phase starts at a time, normally, when the EPC Phase is between 80 and 90 percent complete. In some cases, for example, the prototype plant will start much earlier. The commissioning team of the client or of the project manager’s company is assembled and started its activities of familiarization some month before.

The action of the Commissioning team is based upon the planning of their phase, which has been done during the EPC Phase really, always involving with the Project Team. And of course should the Commissioning Manager contributes during the other phases also – his life becomes so much easier now, and the facility operation is so much better and attained faster.

2. SUMMARY OF PROJECT SERVICES & PHASES

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<th>PHASE</th>
<th>CONCEPT</th>
<th>FEASIBILITY</th>
<th>PLANNING</th>
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<td>NAME</td>
<td>SUB PHASE</td>
<td>PHASE 1</td>
<td>PHASE 2</td>
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<tr>
<td>10</td>
<td>CLIENT</td>
<td></td>
<td>Concept policies</td>
<td>Meeting/Reviews, Decisions/Approvals, Environment Certification</td>
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<tr>
<td>20</td>
<td>SENIOR MG’T &amp; CORPORATE SERVICES</td>
<td></td>
<td>Concept reviews, decisions, policies.</td>
<td>Meetings/Reviews, Approval.</td>
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</tbody>
</table>
OUTSIDE: AUTHORITIES
REGULATORY BODIES, &
OTHERS

S SUPPLIERS, VENDORS

C CONTRACTORS

- Technical Information
- Budget Price Quotations

D TYPICAL PROJECT
ORGANIZATION CHART

ENGINEER – PROCURE – CONSTRUCT

PHASE 4
Engineering, Procurement, Construction
Organize operations & maintenance, recruitment, training, facilities monitoring, inspection, approvals,
Reviews, monitoring, support (Finance, Legal, Public Relations), site visit, approvals,
Detail Networks, Worksheets, Bid and Construction Packages, Control Scope, Quality, Cost, Time, Resources.
Detail Engineering for Work Packages, Final Specs, Design (all disciplines), Model, Requisitions for Bidding, Bid Analysis, P.O. Requests Manuals, Vendor Print, Approvals, Document Control.
Construction Contracts, Bid Evaluations, Material Procurement, Expediting (Mat., Eq’t., etc.) logistics, Material/Quality Control, Inspection.
Constructability, Site Visits, Tender Reviews, Construction Equipment, Temp. Facilities, Reports, Productivity, Receive, Warehouse, Resident Eng’g., Labor Relations, Mechanical Completion.
Panel/Design Reviews, Operability/Maintainability Reviews, Safety Audits, Recruitment/Training Supervision, Client’s Start-up and other Personnel.

COMMISSIONING & START-UP

PHASE 5
Final Project Report, Commissioning Field Mgt., Historical Data Gathering.

FACILITY OPERATION

PHASE 6
Operate & Maintain, Performance Tests, Acceptance.
Final Review with client.
Cost Close-out.
Final client’s operations Acceptance.
Final Follow-up, Design Updates.
Field Management, Administrative Services, Personnel/Union Affairs, Monitor Commissioning, Laboratory, Services, Etc.
Turnover to Client, Final Report.

Preliminary Approvals, Consult, Advise, Approve, Agree
Agreements
- Technical Information
- Budget Price Quotations

PM
PMS
E
P
CO
CM

Hands-on training, Plant Services, Procurement Inspection, Approvals,
Quality Checks, Panel Reviews.

Field Assistance, Design Corrections.

Turnover Documents.

Follow-up, Support Commissioning, Hold-back Release, Close-out Report.

Turnover to Client, Final Report.
Underwriters’ Tests, Inspections, Dept. of Labour Inspection, Power & Utility Tests, Environmental Tests
Bid, Vendor Data, Manufacture, Pack, Ship, Deliver, Install

Site Visit, Bid, Mobilize, Shop Drawings, Order Materials, Construct

Final Field Certification & Approvals to Operate
Safety & Hazard Audits
Technical Supervision Assistance

MEGA PROJECT TEAM
## 3. PROJECT MANAGEMENT SERVICES & PHASES

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<th>PHASES SERVICES</th>
<th>CONCEPT PHASE</th>
<th>FEASIBILITY PHASE</th>
<th>PLANNING PHASE</th>
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<tbody>
<tr>
<td>NAME</td>
<td>CODE</td>
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<td>Plan the planning</td>
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<tr>
<td><strong>PLANNING &amp; SCHEDULING</strong></td>
<td>32</td>
<td>Preliminary Schedule</td>
<td>Plan this Phase Schedule for Planning and E-F-C Phase</td>
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<tr>
<td><strong>COST CONTROL, ACCOUNTING</strong></td>
<td>34</td>
<td>Preliminary Financial Planning</td>
<td>Plan the Planning, Scope, Coding, Finance Planning</td>
</tr>
<tr>
<td><strong>PROJECT SERVICES CONTROL</strong></td>
<td>31A</td>
<td>Delivery System &amp; Preliminary, Project Instructions for Planning and EPC Phase</td>
<td>Project Controls, Project Services Cost.</td>
</tr>
</tbody>
</table>

### ENGINEER – PROCURE – CONSTRUCT
- Larger Detail Network, Bar Charts, Construction Worksheets, Commissioning Worksheets, Monitor Progress Updates, Progress Reporting.
- Value Engineering (Assist), Control Estimates, Tender Check Estimates, Claims & Change Order Estimates, Forecasts to Complete, Project Historical Data.

### COMMISSIONING & START-UP
- Cost Control, Accounting & Reports, Forecasts to Complete, Cash Flow, Change Control, Plant Ledger.

### FACILITY OPERATION
- Work and Manpower Control, Meeting Control, Project Progress Reporting.
## 4. PROJECT ENGINEERING & PHASES

### CONCEPT & FEASIBILITY

- Basic Data
- Conceptual Process
- Scope, Feasibility, Marketing Study, Plant Location,
- Environmental Study

### PLANNING

**ALL:**

- Plan the Planning (Preliminary Eng’g and Beginning of Final Design, +30%)

**Key Staff**

- Scope of Facilities
- Scope of Services (EPC Phase).

**Assist in Work breakdown**

- Facilities
- Packages

- Plan Information for Estimating.

- Assist in Scheduling.

- Prepare EPC Phase Budget with 2nd level Work and Manpower Control

- Initial Project Instructions (Project Plan).

- Prepare for Panel Review.

- Preliminary Change Order System.

- Freeze Design at End of Planning Phase

**PROCESS SYSTEMS & AUTOMATION:**

- Reviews of Requirements and Regulations

- Design Criteria

- Flow Sheet

- Description

- Data Sheet/Design Briefs

- P & I Diagrams

- Main Requirements List

- Requirement Design Criteria

- List of Authorization Instruments

- Long Delivery Items Requests to Issue Inquires

**PLANT SERVICES & UTILITIES:**

- Services/Utilities Investigation

- Design Criteria

- Flow Sheets

### ENGINEER – PRODUCE – CONSTRUCT

**ALL:**

- Remainder of final design and detail engineering and design to suit schedule: by bid packages, to suit estimated costs.

- Value Engineering

- Discipline, work as shown below, review, monitoring & control of Engineering documents, interface coordination

- Request to issue inquiry/tender call, technical bid comparison, purchase recommendation/requisitions. Vendors’ and shop drawing approvals/reviews process reporting

- Project Change Control

**PROCESS**

- Final required engineering documents such as: Process design criteria, process design brief, process flow sheets, process description, equipment, process data sheets, for the process and the environment systems.

**MECHANICAL** (including layout, piping and equipment)

- Final required engineering documents such as: Design criteria, plot plan, P & I diagram, area layouts, piping specifications, process and utilities equipment specifications, material handling equipment specifications, equipment arrangement drawings, piping arrangement drawings or model, equipment lists, bid evaluation reports, design briefs, maintenance manuals.

**AUTOMATION AND INSTRUMENTATION**

- Final required engineering documents such as: Automation scope of work and design criteria, P & I diagrams, instrumentation loop diagrams and lists, equipment specifications, control wiring diagrams, design briefs control system bid evaluation reports.

**CIVIL**

- Final required engineering documents such as: Design criteria for site grading, roads, railroads, fencing, underground piping, cables, sewers, drain layouts, design briefs.

**STRUCTURAL**

- Final required engineering documents such as: Design criteria for buildings and structures, concrete foundation and structure drawings, steel structure and platform drawings, pipe rack and pipe bridge drawings, equipment and machine support drawings, specifications, design briefs.

**ELECTRICAL**

- Final required engineering documents such as: Plant power requirement report, electrical design criteria, single line diagrams, wiring diagrams, electrical layouts, motor list, electrical equipment and material specifications, motor and electrical equipment bid evaluation reports, design briefs.
Concept of Mechanical Systems

Piping Diagram

Electrical Single Line diagram

Main Equipment List

Long Delivery Items Requests to Issue Inquiries

BUILDINGS & STRUCTURES & SITE:

Local & Site Investigations

Site Survey/Soil Investigation/Data Plot Plan

Layouts, Sections

Configurations

Design Criteria

Preliminary Engineering

Architectural Features

Foundation Features

Structural Features

**5. PROJECT PROCUREMENT & PHASES**

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<tr>
<th>NAME</th>
<th>CONCEPT &amp; FEASIBILITY</th>
<th>PLANNING</th>
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<tr>
<td>CONSTRUCTION CONTRACT ADMINISTRATION</td>
<td>Source &amp; Availability Contracting Policies</td>
<td>Bid Packages, Selection of Bidders, Contract Conditions and Documents.</td>
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<tr>
<td>EXPEDITING</td>
<td>Expediting Concepts &amp; Policies</td>
<td>Expediting Criteria, Expediting Programs</td>
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<tr>
<td>MATERIAL CONTROL</td>
<td>Material Control Concepts</td>
<td>Material Control Criteria, Material Control Program</td>
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<tr>
<td>LOGISTICS</td>
<td>Logistics’ Concepts and Evaluation</td>
<td>Logistics Criteria, Logistics Packages &amp; Program Estimates</td>
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<tr>
<td>INSPECTION</td>
<td>Inspection Concepts</td>
<td>Inspection Criteria, Inspection &amp; Quality Assurance Program</td>
</tr>
</tbody>
</table>
ENGINEER - PROCURE – CONSTRUCT (EPC)

Big Packages Coordination and control

Tender Calls, Tender Openings, Commercial Evaluation and Recommendations, Pre-Contract Negotiations, Methods of Payment, Insurance, Bonding.

Enquiries, Tender, Openings, Commercial Evaluation and Recommendations, Negotiation with Vendors, Warranties, Term of Payments, Bonding, Place Orders.

Vendors Data Index, Vendor Data, Fabrication Schedules, Plant Visits, Maintain Delivery Dates, Sub-vendors, Progress Reporting, Inspection Liaison.

Status Reporting by Package, Item or Material, Receiving, Warehousing, Inventory Control, Issue to Construction.

Traffic, Packaging, Customs, Carrier Selection, Freight Rate Negotiations, International Freight, Insurance.

Shop Visits, Dimensional Checks, Test Witnessing, Non Destructive Testing, Packaging, Release; Field Inspection.

COMMISIONING
## 6. CONSTRUCTION MANAGEMENT AND PHASES

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<tr>
<th>CONCEPT &amp; FEASIBILITY</th>
<th>PLANNING</th>
<th>EPC</th>
<th>COMMISSIONING</th>
<th>FACILITY OPS</th>
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<tr>
<td>• Develop Order of Magnitude Estimate</td>
<td>• Identify and understand Client’s needs, requirements, and expectation</td>
<td>• Develop the Project Life Cycle Cost</td>
<td>• Project Close-Out</td>
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<tr>
<td>• Develop Preliminary Schedule</td>
<td>• Provide Constructability Analysis</td>
<td>• Evaluate Cost Trade-offs</td>
<td>• System Validation, Testing, and Start-up</td>
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<td>• Provide Input to Risk Management</td>
<td>• Identify Potential Major Construction Problems/Risks</td>
<td>• Provide Value Engineering</td>
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<td></td>
<td>• Identify and develop Resource Requirements</td>
<td>• Qualify Potential Bidders</td>
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<td></td>
<td>• Develop Preliminary Estimate</td>
<td>• Procure Long-Lead Items</td>
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<td>• Update Preliminary Schedule</td>
<td>• Finalize Bid Work Packages</td>
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<td>• Develop Definitive Estimate</td>
<td>• Finalize Pre-Qualified Contractors List</td>
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<td>• Finalize Project Schedule</td>
<td>• Finalize Physical Lay-Out</td>
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<td>• Develop the Project Budget</td>
<td>• Finalize Project Control System</td>
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<td>• Develop Cash Flow Projections</td>
<td>• Enforce Project Safety Program</td>
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<td>• Develop Project Control System</td>
<td>• Coordinate Labor Relations</td>
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<td>• Develop Project Safety Program</td>
<td>• Receive/Evaluate Bids and Award Contracts</td>
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<td>• Develop Insurance Program</td>
<td>• Implement Project Control System</td>
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<td>• Develop the Project Plan</td>
<td>• Manage Daily Construction Activities</td>
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<td></td>
<td>• Identify and develop Resource Requirements</td>
<td>• Administer Prime Contracts</td>
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<td>• Develop Preliminary Estimate</td>
<td>• Manage Contractor’s Request for Progress Payments</td>
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<td></td>
<td>• Update Preliminary Schedule</td>
<td>• Administer Contract Changes and Claims</td>
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<td>• Develop Definitive Estimate</td>
<td>• Perform QA/QC</td>
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<td>• Finalize Project Schedule</td>
<td>• Perform Control Estimates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Develop the Project Plan</td>
<td>• Perform Tender Check Estimates</td>
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</table>

**Note:** This section will be refined at a later date
# 7. COMMISSIONING SERVICES AND PROJECT PHASES

<table>
<thead>
<tr>
<th>CODE</th>
<th>NAME</th>
<th>CONCEPT</th>
<th>FEASIBILITY</th>
<th>PLANNING</th>
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</thead>
<tbody>
<tr>
<td>71</td>
<td>TECHNICAL SERVICES</td>
<td></td>
<td></td>
<td>Process Services, Laboratory Services, Planning, Commissioning Brief, Budget.</td>
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<tr>
<td>72</td>
<td>OPERATIONS SERVICES</td>
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<td>Commissioning Schedule, Manpower Planning, Budget.</td>
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<tr>
<td>73</td>
<td>TRAINING SERVICES</td>
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<td>Training Plan, Final Training Aids/Facilities, Manpower Plan, Budget.</td>
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<tr>
<td>74</td>
<td>CONSTRUCTION SERVICES</td>
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<td></td>
<td>Organize and Plan Maintenance, Manpower Plan, Facilities, Tools, and Equipment, Budget</td>
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<tr>
<td>75</td>
<td>MAINTENANCE SERVICES</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ENGINEER – PROCURE – CONSTRUCT (EPC)</td>
<td>PRE-COMMISSIONING &amp; COMMISSIONING</td>
<td>FACILITY OPERATION</td>
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<td></td>
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<td>-----------------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Set-Up Training Program, Training Materials, Recruitment, Operate Facilities, conduct Training Program, Monitor Progress, Reports.</td>
<td>Hands-on Training, Field Inspections, Monitor Results, Assure all Shifts Learn from Others.</td>
<td>Start-up Reviews, Audit of Results.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>