Metals Processing Business Division

Managing of large turnkey projects and optimizing the output: overview and case examples

More out of ore!
MetPro – Typical MetPro Projects

Type of MetPro Projects

**EPC / Turnkey (€ 15-200 million, 15-36 months)**

- Basic and detail engineering, full supply, erection, training of customers’ personnel and commissioning of the plant, performance and other guarantees for OT’s supply scope

**Technology Package (€ 3-70 mio, 10-36 months)**

- Basic and detail engineering, supply of typically proprietary and/or key hardware components, erection supervision, training of customers personnel and commissioning of the plant, performance guarantee for OT’s supply scope

**Equipment Deliveries (up to € 10 million)**

→ Delivery of proprietary technology is an essential part in all project types
## LSTK Projects

**Trends require LSTK Approach**

### Industry Trends

What means LSTK / EPC to the Client:
- An obligation to deliver a plant:
  - Complete and ready for operation
  - For a fixed lump sum price
  - Within a set time frame and
  - Maintaining project targets
  - With given completion guarantees
  - With minimum interfaces
  - With quality and safety commitments
- Reduction of clients risk by transfer of tasks and challenges to a professional organisation

### Demands on OT

Availability of resource and competencies beyond technical core skills:
- Project management skills
- Risk management skills
- Supervisory skills for eng. + construction
- Extensive local/global procurement knowl.
- Strong local knowledge of:
  - Taxes and duties
  - local execution partners
- Outstanding competencies and personnel based on clear execution processes with internal rules and regulations to handle complex LS projects with local challenges
LSTK Projects -
Summary of Execution Procedure

- Process oriented Project Execution

[Diagram showing the execution procedure with steps such as Contract, Project implementation, Engineering, Procurement, Off-Site Fabrication, Expediting and Inspection, Subcontracting of Site Work, Construction, Commissioning, Start-up, Performance Tests, Project Finalisation, and related management and controlling aspects.]
LSTK Projects -
(1) Business Dynamics

- Increased market activity increases order intake and order backlog.
- Sales impact is spread over a longer period due to large project sizes and project tenors up to three years.
- A significant part of profits is generated only when the project is completed and the provisions related to the project are released.
LSTK Projects -
(2) Profit Recognition – EPC/LS Turnkey Example

Timing of large project completions affects quarterly earnings

NOTE: The figures are illustrative and vary project by project
LSTK-Project
Key Elements of Project Execution Procedure

• Project Management
  • Execution Concept
  • Project Organisation

• Project Control

✓ Kick-Off Meeting

• Main Work Packages
  • Engineering
    • Design Reviews and Approvals
  • Procurement
    • Fabrication
    • Expediting
    • Transport
  • Construction
  • Commissioning, Start-up and Performance Tests
LSTK Projects - Project Management
Project Execution Concept

Basis for the Project: Who does what and where!!!
LSTK Projects - Project Management

Project Organisation

- Project Manager
- Commercial Manager
- QA/QC Manager
- Engineering Manager
- Process Engineer
- Procurement Manager
- Controls Manager
- Construction Manager
- Commissioning Manager
LSTK Projects - Project Control

Key Elements of Project Control

- Time Schedule and Control
  - Planning of activities in a network diagram
  - Generating of activity arrow diagrams acc. to critical path method
LSTK Projects - Project Control

Key Elements of Project Control

- Progress Planning and Control
  - Allocation of work units to activities
  - Control of actual monthly progress
LSTK Projects - Project Control

Key Elements of Project Control

• Development of Project / Actual Status
  • Current Items of Concern / Deviations to Plan
  • Corrective Measures / Actions
  • Consequences
• Progress and Milestones
• Change and Claim Management
• Financial Status
• Cost and Profitability Status
• Bank Guarantees / Payment Securities
LSTK Projects - Project Control

Key Elements of Project Control

Continuous Risk Monitoring

- Early risk assessment already in the proposal stage (‘Prima‘ and ‘FRP‘ risk tools)
- Continuous risk monitoring throughout the execution with continuous reporting
  - To the project steering committee as part of monthly project report
  - To the OT Excom as part of the monthly report using a ‘Traffic Light Signal’
- Additional quarterly steering meetings on top level with the client to allow early warning of red flags and development of respective action plan

<table>
<thead>
<tr>
<th>Project</th>
<th>Contract Value (rough Euro mio figures)</th>
<th>Technological Risks</th>
<th>Contract Commercial</th>
<th>Project Implementation</th>
<th>Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backlog Value</td>
<td></td>
<td></td>
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<tr>
<td>Project A, Pelletizing Plant</td>
<td>147</td>
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<td></td>
<td>106</td>
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<td>Project B, Sulphuric Acid</td>
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<td></td>
<td>18</td>
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<td>Project C, Pelletizing Plant</td>
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<td></td>
<td>19</td>
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</tbody>
</table>
LSTK Projects – Main Work Packages

Engineering

Main Disciplines

- Process Engineering
- Plant Engineering
- Mechanical Engineering
- Piping Engineering
- Electrical Engineering
- Instrumentation Engineering
- Civil and Structural Engineering
- Construction Engineering
LSTK Projects – Main Work Packages

Procurement

Main Tasks

• Purchasing of all Equipment and Materials
• Off-Site Fabrication by Subsuppliers
• Quality Assurance through
  • Expediting
  • Inspection
• Transportation / Shipment to Site
• Subcontracting of Site Work
LSTK Projects – Main Work Packages

Construction

Main Tasks

• Planning of Site Activities
  • Constructability Analysis
  • Scheduling (Bar Chart / Network Diagram)
  • Planning of Progress and Manpower
  • Planning of temporary Site Facilities
  • Structure Site Organisation

• Selection of suitable Subcontractors

• Execution of Construction by Subcontractor(s)

• Construction Management and Supervision
LSTK Projects – Main Work Packages
Commissioning

Main Tasks

- Cold Commissioning
  - No Load Tests
  - Cold Load Tests
- Hot Commissioning
  - Hot Load Tests
  - Feed-in of Raw Materials
  - First Start-up of Production
  - Optimising of Production Parameters
  - Execution of Performance Test Runs
LSTK-Project
Example Project Execution

• Main Work Packages
  • Engineering
    • Design Reviews and Approvals
  • Procurement
    • Fabrication
    • Expediting
    • Transport
  • Construction
  • Commissioning, Start-up and Performance Tests
LSTK Projects – Engineering
Data based plant engineering interfaces

- Equipment Guide Drawings
- Parametric Equipment Design
- P&I Diagram
- Instrument List
- Valve List
- Piping List
- Arrangement Plan
- 3D - model
- FEM stress analysis.
- Design regulations - Company Standards
- Steel - Structure
- Ducts
- Piping
- MSR location plan
- Cable routing
- Link to Documents
- FEM stress analysis.

Process Data with PFD and Equipment List
LSTK Projects – Engineering
Acid Plant – Block Diagram

- BFW
- Sulphur
- Dry Air
- Ambient Air
- Tail Gas
- Steam
- Diluted Acid
- H₂O
- Product Acid
- SO₂
- SO₃
- SO₃+SO₂
- SO₂
LSTK Projects - New Technologies
Sulphur Burning Plant – Simplified Flowsheet

- Sulphur
- Combustion furnace
- Waste heat boiler
- Drying tower
- Main blower
- Air
- Sulphur burning
- Superheater
- Evaporator
- Economizer
- Converter
- Intermediate heat exchanger
- Intermediate absorption tower
- Final absorption tower
- Atmosphere
- Product acid stack

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LSTK Projects - Engineering
3D-CAD Plant Design - Interfaces

Eng. Disciplines
- Equipment (incl. Ducts)
- Piping
- Structural
- Civil
- Instrumentation
- Electrical

Central 3D Model
- P&ID Data
- DIN/ANSI Catalogues
- Plastic Model Substitute
- Collision Check
- MTOs

Technical Documents
- Arrangement Dwgs.
- Piping Drawings
- Isometrics
- Struct. & Civil Dwgs.
- E-Consumer Dwgs.
- Cable Routing Plans
- Instr. Location Plans
- FEM Calculation

Technical Documents
- Arrangement Dwgs.
- Piping Drawings
- Isometrics
- Struct. & Civil Dwgs.
- E-Consumer Dwgs.
- Cable Routing Plans
- Instr. Location Plans
- FEM Calculation
For model-supported systems, components are joined together similar to a construction set. The components originate from libraries where the dimensions are derived from standards and specifications. (piping and beam sections, etc.)
LSTK Projects – Engineering

Site Plan & Crane Location
LSTK Projects – Construction
Site Located Tower Cranes
LSTK Projects – Construction

Construction Study – Acid Plant 4,800 t/d
LSTK Projects – Construction
Phase 1 – Converter + Stair Tower
LSTK Projects–Construction, \( \text{SO}_2 \) Converter–Core and Shell

390 to
LSTK Projects - Construction, Heat Exchanger

65 ... 350 to
LSTK Projects–Construction
Phase 3 - Vessels
LSTK Projects–Construction, **Phase 4 – Towers + Hx**
LSTK Projects–Construction
Phase 4 – Towers + Hx
LSTK Projects–Construction, **Phase 4 – Towers + Hx**

95 to each

CMA101,102,103- View of final coating
LSTK Projects–Construction
Phase 5 – Sulfur Area
LSTK Projects—Construction, Phase 5 – Sulfur Area

STORAGE BIN BIN-101
LSTK Projects–Construction
Phase 6 – Waste Heat Boiler
LSTK Projects–Construction, Phase 6 – Waste Heat Boiler

260 to
LSTK Projects–Construction
Phase 7 – Structural + Machinery
LSTK Projects–Construction, Phase 7 – Machinery
LSTK Projects–Construction
Phase 8 - Ducting

600 to ducts
LSTK Projects–Construction, HP-Steam Generation
LSTK Projects–Construction
Phase 9 – Stack + Piping
LSTK Projects–Construction, **Phase 9 – Acid Cooler**
LSTK Projects—Construction
Phase 10 – Insulation + EI&C
LSTK Projects–Construction
Phase 11 - Complete
## MetPro – Typical MetPro Projects
### Key Projects 2007

<table>
<thead>
<tr>
<th>Customer:</th>
<th>Samarco Mineracao (CVRD 50%, BHP 50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project site:</td>
<td>Brazil</td>
</tr>
<tr>
<td>Delivery:</td>
<td>Turnkey/EPC (Pelletizing plant)</td>
</tr>
<tr>
<td>Project value:</td>
<td>€ 160 million</td>
</tr>
<tr>
<td>Outokumpu Technology’s Role:</td>
<td>Outokumpu Technology delivers the plant’s core technology (proprietary technology), including test work, engineering, supply of equipment, construction/erection, commissioning</td>
</tr>
<tr>
<td>Duration:</td>
<td>29 months (8/05 - 1/08)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer:</th>
<th>LKAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project site:</td>
<td>Sweden</td>
</tr>
<tr>
<td>Delivery:</td>
<td>Turnkey/EPC (Pelletizing plant)</td>
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<tr>
<td>Project value:</td>
<td>€ 60 million</td>
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<tr>
<td>Outokumpu Technology’s Role:</td>
<td>OT delivers the plant’s core technology (proprietary technology), including test work, engineering, supply and erection of core equipment, supervision of construction/erection, commissioning</td>
</tr>
<tr>
<td>Duration:</td>
<td>24 months (11/04 - 10/06)</td>
</tr>
</tbody>
</table>
# MetPro – Typical Projects

## Key Projects 2007 (cont’d)

<table>
<thead>
<tr>
<th>Customer</th>
<th>Alcan Gove</th>
<th>Codelco (Corporación Nacional del Cobre)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project site:</strong></td>
<td>Australia</td>
<td>Chile</td>
</tr>
<tr>
<td><strong>Delivery:</strong></td>
<td>Technology Package (Alumina Calciners)</td>
<td>Technology package/EPC (Sulphuric Acid Plant)</td>
</tr>
<tr>
<td><strong>Project value:</strong></td>
<td>€ 26 million</td>
<td>€ 16 million</td>
</tr>
<tr>
<td><strong>Outokumpu Technology's Role:</strong></td>
<td>Outokumpu Technology delivers proprietary Circulating Fluidized Bed technology, including engineering, supply of key equipment, supervision, commissioning</td>
<td>Outokumpu Technology delivers proprietary technology, including engineering, supply of equipment, erection/construction, commissioning</td>
</tr>
<tr>
<td><strong>Duration:</strong></td>
<td>24 months (2/05 - 2/07)</td>
<td>28 months (11/04 - 3/07)</td>
</tr>
</tbody>
</table>

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**Alcan Gove**

- **Customer:** Alcan Gove
- **Project site:** Australia
- **Delivery:** Technology Package (Alumina Calciners)
- **Project value:** € 26 million
- **Outokumpu Technology’s Role:** Outokumpu Technology delivers proprietary Circulating Fluidized Bed technology, including engineering, supply of key equipment, supervision, commissioning
- **Duration:** 24 months (2/05 - 2/07)

**Codelco**

- **Customer:** Codelco (Corporación Nacional del Cobre)
- **Project site:** Chile
- **Delivery:** Technology package/EPC (Sulphuric Acid Plant)
- **Project value:** € 16 million
- **Outokumpu Technology’s Role:** Outokumpu Technology delivers proprietary technology, including engineering, supply of equipment, erection/construction, commissioning
- **Duration:** 28 months (11/04 - 3/07)
More out of ore!

www.outokumputechnology.com