Welcome to this presentation.
It explains how the investment cost for an Oil & Gas facility is estimated.
After a short introduction, the 3 common methods of cost estimate are shown.
Common ratios, such as $/kg for equipment, pipe etc. are given.

Comments are most welcome (herve.baron@gmail.com), which I will incorporate for the benefit of all.

Hervé
Agenda

Introduction

The different estimation methods:
- Capacity factored
- Equipment factored
- Analytical
What will be the overall cost of this facility?
Cost estimate of Oil & gas facilities

Cost = \sum \text{Quantities} \times \text{item costs}

All items

How would you determine quantities?
Cost estimate of Oil & gas facilities

Quantities estimates:

• Ratio from past projects
• Material Take-Off
Cost estimate of Oil & gas facilities

Cost = \( \sum \) Quantities * item costs

All items

How would you determine quantities?

What is an item cost made of?
Cost estimate of Oil & gas facilities

Item cost = Supply cost + installation cost

How would you each one?
Cost estimate of Oil & gas facilities

Item cost estimates:

Supply + installation

• In-house data from past projects
• Inquiries
Cost estimate of Oil & gas facilities

Item cost estimates:
Supply + installation
  • In-house data from past projects
  • Inquiries

Sensitivity to:
Raw materials
Cost estimate of Oil & gas facilities

Item cost estimates:

Supply + installation

- In-house data from past projects
- Inquiries

Sensitivity to:

Raw materials

- Steel, alloy steel, copper, cement, iron
Cost estimate of Oil & gas facilities

Item cost estimates:
Supply + installation
  • In-house data from past projects
  • Inquiries

Sensitivity to:
Raw materials
Construction market
Cost estimate of Oil & gas facilities

Sensitivity to:
Raw materials
Construction market
Purpose of estimate:
- Concept screening
- Study of feasibility
- Decision to invest

Estimate type:
- Capacity factored
- Equipment factored
- Analytical
Purpose of estimate:
• Concept screening
• Study of feasibility
• Decision to invest

Estimate type:
• Capacity factored
• Equipment factored
• Analytical
Cost estimate of Oil & gas facilities

• Capacity factored

\[ \frac{C_1}{C_2} = \left( \frac{P_1}{P_2} \right)^e \]

\[ e \sim 0.6 \]

Ci: Cost of facility with production capacity Pi
Cost estimate of Oil & gas facilities

- Capacity factored
  \[ \frac{C_1}{C_2} = \left( \frac{P_1}{P_2} \right)^e \]
  \[ e \approx 0.6 \]

\( C_i \): Cost of facility with production capacity \( P_i \)

Exercise: what is the increase in cost for +50% capacity increase?
Cost estimate of Oil & gas facilities

• Capacity factored

\[ \frac{C_1}{C_2} = \left( \frac{P_1}{P_2} \right)^e \]

\[ e \approx 0.6 \]

Ci: Cost of facility with production capacity Pi

Exercise: what is the increase in cost for +50% capacity increase?

In your opinion, what is the limit of such estimate?
Cost estimate of Oil & gas facilities

• Capacity factored

\[ \frac{C_1}{C_2} = \left( \frac{P_1}{P_2} \right)^e \]

\[ e \sim 0.6 \]

\( C_i \): Cost of facility with production capacity \( P_i \)

Exercise: what is the increase in cost for +50% capacity increase?

In your opinion, what is the limit of such estimate? It takes into account neither market conditions nor plant location (labour cost)
• Equipment factored
  \[ C = f \, M \]
  
  $C$: total installed cost of facility
  $M$: cost of main equipment
  $f$: factor
Cost estimate of Oil & gas facilities

- Equipment factored
  \[ C = f \times M \]
  
  C: total installed cost of facility
  M: cost of main equipment
  f: factor

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main equipment</td>
<td>100</td>
</tr>
<tr>
<td>Secondary equipment &amp; materials</td>
<td>73</td>
</tr>
<tr>
<td>Erection Main equipment</td>
<td>7</td>
</tr>
<tr>
<td>Construction Piping, E&amp;I</td>
<td>90</td>
</tr>
<tr>
<td>Construction: Civil, steel structure, painting, insulation</td>
<td>69</td>
</tr>
<tr>
<td>Services (Engineering, Project Management)</td>
<td>104</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>443</strong></td>
</tr>
</tbody>
</table>

Note: Typical figures for Petrochemical Plant
What’s the main equipment?

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
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<td><strong>443</strong></td>
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</table>
How is the cost of main equipment evaluated?
Equipment factored

\[ C = f \, M \]

\( f \): factor

\( f \) depends on

- type of facility (petrochemical, refining, LNG, off-shore)
- Size
Cost estimate of Oil & gas facilities

- Equipment factored
  
  \[ C = f \, M \]

  \( f \): factor

  \( f \) depends on
  
  - type of facility (petrochemical, refining, LNG, off-shore)
  
  - Size

Typical figures for a chemical plant

<table>
<thead>
<tr>
<th>Item</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>large facility</td>
</tr>
<tr>
<td>Main equipment</td>
<td>100</td>
</tr>
<tr>
<td>Main equipment erection</td>
<td>10</td>
</tr>
<tr>
<td>Piping</td>
<td>100</td>
</tr>
<tr>
<td>Electrical</td>
<td>15</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>75</td>
</tr>
<tr>
<td>Civil</td>
<td>20</td>
</tr>
<tr>
<td>Steel structure</td>
<td>20</td>
</tr>
<tr>
<td>Painting, insulation</td>
<td>10</td>
</tr>
<tr>
<td>Engineering</td>
<td>70</td>
</tr>
<tr>
<td>Construction facilities</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>440</strong></td>
</tr>
</tbody>
</table>

In your opinion, how can we refine the estimate?
• Equipment factored

\[ C = \sum fi Mi \]

\( Mi \) Cost of all type i Main equipment
\( fi \): factor
• Equipment factored

\[ C = \sum fi Mi \]

Mi  Cost of all type i Main equipment
fi: factor

Why do you think justifies such an approach?
• Equipment factored
  \[ C = \sum fi \cdot Mi \]
  \( Mi \)  Cost of all type i Main equipment
  \( fi \): factor

Why do you think justifies such an approach?
Cost estimate of Oil & gas facilities

• Equipment factored

\[ C = \sum f_i M_i \]

- \( M_i \): Cost of all type I Main equipment
- \( f_i \): factor

In your opinion, what is the limit of such estimate?
Cost estimate of Oil & gas facilities

• Analytical
  – Main equipment supply + install
  – Piping supply + install
  – Electrical supply + install
  – Instrumentation & Control system supply + install
  – Civil Works
  – Steel structures
  – Painting, Insulation
  – Temporary construction facilities
  – Engineering & Project Management
  – Miscellaneous
• **Analytical**
  
  – Establish the bill of quantities (BOQ) in each trade: equipment, civil, piping, structural steel etc.
  
  – BOQ = Material Take-Off (what is measured from available drawings at this stage) + allowances for design development + allowances for what is not yet on drawings + contingencies
  
  – Apply ratios to get supply + installation cost
  
  – Installation cost = qty * manhours/ton ratio * labour cost
  
  – Labour cost is all in, i.e., includes construction equipment (crane, scaffolding)
  
  – The ratio is based on standard manhours, i.e., home country,
  
  – Localization factor (productivity) to be applied, i.e., actual installation manhours = ratio * productivity
  
  – Example: piping installation cost, ratio: 250 std h / ton
    
    • Western Europe, labour cost $100/hr yields $20k/ton
    • Middle East, labour cost $18/hr, productivity 2.5 yeilds $16k/ton
Cost estimate of Oil & gas facilities

- Analytical
  - Main equipment supply + install
  - Piping supply + install
  - Electrical supply + install
  - Instrumentation & Control system supply + install
  - Civil Works
  - Steel structures
  - Painting, Insulation
  - Temporary construction facilities
  - Engineering & Project Management
  - Miscellaneous
• Main equipment supply + install
  • Supply
Cost estimate of Oil & gas facilities

- Main equipment supply + install
  - Supply: eqt list (dimensions) => weight
Main equipment supply + install

- Supply: eqt list (dimensions) => weight
- Rate?
Cost estimate of Oil & gas facilities

• Main equipment supply + install
  • Supply: eqt list (dimensions) => weight
  • Rate:
    USD 4/kg for CS – depends on eqt size: 4 (large) – 10 (small)
    USD12/kg for SS
    USD 300-500 /m² for Shell&Tube / Air-coolers
    USD 1000/kW for pumps
Cost estimate of Oil & gas facilities

• Main equipment supply + install
  • Supply: eqt list, dimensions/capacity/weight
  • Installation
• Main equipment supply + install
  • Supply: eqt list, dimensions/capacity/weight
  • Installation ratios: % supply cost, typ. 8%
Cost estimate of Oil & gas facilities

• Main equipment supply + install
  • Supply: eqt list, dimensions/capacity/weight
  • Installation ratios: % supply cost, typ. 8%

  30 std manhours/ton (includes labour and equipment)
Cost estimate of Oil & gas facilities

- Analytical
  - Main equipment supply + install
  - Piping supply + install
  - Electrical supply + install
  - Instrumentation & Control system supply + install
  - Civil Works
  - Steel structures
  - Painting, Insulation
  - Temporary construction facilities
  - Engineering & Project Management
  - Miscellaneous
Piping supply + install

• Qty: ratio (eqt weight), typ. 40%
Piping supply + install

- Qty: ratio $f$ (eqt number)
Piping supply + install

- Qty: ratio \( f \) (eqt number)

<table>
<thead>
<tr>
<th>Item</th>
<th>qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>10</td>
</tr>
<tr>
<td>Isometric / eqt</td>
<td>6</td>
</tr>
<tr>
<td>average length (m) / iso</td>
<td>10</td>
</tr>
<tr>
<td>average line diameter (inch)</td>
<td>12</td>
</tr>
<tr>
<td>material of construction</td>
<td>CS</td>
</tr>
<tr>
<td>total length (m)</td>
<td>600</td>
</tr>
</tbody>
</table>
Piping supply + install

- Qty: ratio \( f \) (e qt number)

Remark: Unit vs Interconnection

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Cost estimate of Oil & gas facilities

Piping supply + install

• Qty: ratio (eqt number, eqt weight)

MTO
Cost estimate of Oil & gas facilities

Process design

- PFDs
- H&M balance
- P&IDs
- Equipment list
- Plot Plan
Cost estimate of Oil & gas facilities

P&IDs

Plot Plan

Piping Layout
Cost estimate of Oil & gas facilities

For more information on Engineering, look up in:

THE OIL & GAS ENGINEERING GUIDE
Hervé Baron
Editions TECHNIP

A unique synthesis for the busy Project professional
200 pages, 250 illustrations
Piping supply + install

• Qty: MTO
Piping supply + install

• Qty: MTO
  » Item count: P&IDs
  » Lengths: Piping Layout
Piping supply + install

- Qty: MTO
  - Item count: P&IDs
  - Lengths: Piping Layout
  - Both Process & Utility lines
  - Both Above Ground & Underground lines, Fire water
Piping supply + install

- Qty: MTO
  - Item count: P&IDs
  - Lengths: Piping Layout
  - Both Process & Utility lines
  - Both Above Ground & Underground lines, Fire water

Allowances added for:
Piping supply + install

- Qty: MTO
  - Item count: P&IDs
  - Lengths: Piping Layout
  - Both Process & Utility lines
  - Both Above Ground & Underground lines

Allowances added for:
- what is not taken-off, e.g., small diameter and design development (P&ID completion) to obtain *quantities to erect*
Piping supply + install

- Qty: MTO
  - Item count: P&IDs
  - Lengths: Piping Layout
    - Both Process & Utility lines
    - Both Above Ground & Underground lines

Allowances added for:

- what is not taken-off, e.g., small diameter and design development (P&ID completion) to obtain quantities to erect

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<th>Discipline</th>
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<tbody>
<tr>
<td>Piping</td>
<td>All piping except valves</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Manual valves</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Motorised valves</td>
<td>0</td>
</tr>
</tbody>
</table>
Piping supply + install

- Qty: MTO
  - Item count: P&IDs
  - Lengths: Piping Layout
  - Both Process & Utility lines
  - Both Above Ground & Underground lines

Allowances added for:

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<tr>
<td></td>
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- cut and losses to obtain quantities to be supplied
Piping supply + install

- Qty: ratio (e qt number, e qt weight)
- MTO
- Rate: Supply
Piping supply + install

• Qty: ratio (equivalent number, equivalent weight)
• Rate Supply $/kg, typical USD 3/kg for CS
Piping supply + install

- Qty: ratio (eqt number, eqt weight)
- MTO
- Rate Supply $/kg, typ. USD 3/kg for CS
- Install
## Piping supply + install

- **Qty:** ratio (eqt number, eqt weight)
- **MTO**
- **Rate**
  - Supply: $ /kg, typ. USD 3 /kg for CS
  - Install: std mhrs/ton, typ. 200-250 in unit, 100 on interconnecting pipe-racks, applied to the total piping weight, including fittings & valves.
Cost estimate of Oil & gas facilities

Electrical supply + install

- Price ratio % Main equipment, typ. 15-20%
Cost estimate of Oil & gas facilities

Electrical supply + install

- Price ratio % Main equipment, typ. 15-20%
- Quantities: Consumers list
- Rate (supply+install):
  - USD 50k / consumer (w/o generation)
  - USD 520 / installed kW
Cost estimate of Oil & gas facilities

**Consumers list**

**Single Line Diagram**

**Plot Plan**
## Cost estimate of Oil & gas facilities

<table>
<thead>
<tr>
<th>Equipment No.</th>
<th>Description</th>
<th>Absorbed Load (A)</th>
<th>Load Rating (B)</th>
<th>Efficiency at Load Factor C (D)</th>
<th>Power Factor at Load Factor C (E)</th>
<th>Continuous (F)</th>
<th>Intermittent (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TML-001A</td>
<td>AIR COOLER TRANSFORMER 001 A</td>
<td>X</td>
<td>C</td>
<td>726</td>
<td>1000</td>
<td>0.82</td>
<td>625</td>
</tr>
<tr>
<td>TML-002A</td>
<td>AIR COOLER TRANSFORMER 002 A</td>
<td>X</td>
<td>C</td>
<td>675</td>
<td>1000</td>
<td>0.81</td>
<td>600</td>
</tr>
<tr>
<td>TML-002B</td>
<td>AIR COOLER TRANSFORMER 002 B</td>
<td>X</td>
<td>C</td>
<td>675</td>
<td>1000</td>
<td>0.81</td>
<td>600</td>
</tr>
<tr>
<td>TML-003A</td>
<td>POWER PLANT UNIT TRANSF 003 A</td>
<td>X</td>
<td>C</td>
<td>809</td>
<td>1000</td>
<td>0.83</td>
<td>529</td>
</tr>
<tr>
<td>TML-004B</td>
<td>POWER PLANT UNIT TRANSF 004 B</td>
<td>X</td>
<td>C</td>
<td>703</td>
<td>830</td>
<td>0.80</td>
<td>566</td>
</tr>
<tr>
<td>TML-005A</td>
<td>POWER PLANT UNIT TRANSF 005 A</td>
<td>X</td>
<td>C</td>
<td>0</td>
<td>630</td>
<td>0.11</td>
<td>0</td>
</tr>
<tr>
<td>TML-006A</td>
<td>Feeder for external P&amp;I load</td>
<td>X</td>
<td>C</td>
<td>70</td>
<td>400.00</td>
<td>1.00</td>
<td>70</td>
</tr>
<tr>
<td>TML-007A</td>
<td>Supply to fire building</td>
<td>X</td>
<td>C</td>
<td>250</td>
<td>400.00</td>
<td>0.60</td>
<td>80</td>
</tr>
</tbody>
</table>

### Consumers list

- [Plot Plan](#)
- [Single Line Diagram](#)
Cost estimate of Oil & gas facilities

Instrumentation & Control system supply + install

- Price ratio % Main equipment, range: 40-120%
Cost estimate of Oil & gas facilities

Instrumentation & Control system supply + install

- Price ratio % Main equipment, range: 40-120%
- Qties
Instrumentation & Control system supply + install

- Price ratio % Main equipment, range: 40-120%
- Qties nb equiv. loops (CV, 0.5 ON/OFF, Analyser)
Instrumentation & Control system supply + install

- Price ratio  % Main equipment, range: 40-120%
- Qties  nb equiv. loops (CV, 0.5 ON/OFF, Analyser)
- Rate
Instrumentation & Control system supply + install

- Price ratio: % Main equipment, range: 40-120%
- Qties: nb equiv. loops (CV, 0.5 ON/OFF, Analyser)
- Rate: supply: $ /equivalent control loops, typ. 90k
         install: hrs / equivalent control loops, typ. 750
Instrumentation & Control system supply + install

• Price ratio % Main equipment, range: 40-120%

• Qties Instrument list
Cost estimate of Oil & gas facilities

Instrumentation & Control system supply + install

- Price ratio  % Main equipment, range: 40-120%
- Qties Instrument list
- Rate Supply+install: $ / I/O, typ. 1000
Civil Works

- Price Ratio % Main equipment cost, typ. 15-20%
Civil Works

- Price Ratio  % Main equipment cost, typ. 15-20%
- Qty
Civil Works

- Price Ratio  % Main equipment cost, typ. 15-20%
- Qty Dimensions/Weight of equipment & structure => size of foundations (m³)
Civil Works

- **Price Ratio**  % Main equipment cost, typ. 15-20%
- **Qty**  Dimensions/Weight of equipment & structure => size of foundations (m³)
- **Rate**
Civil Works

- Price Ratio  % Main equipment cost, typ. 15-20%
- Qty Dimensions/Weight of equipment & structure => size of foundations (m³)
- Rate all-in (materials & labour) rate $/m³, typ. 1000
Civil Works

- **Price Ratio** % Main equipment cost, typ. 15-20%
- **Qty** MTO: excavation, formwork, rebar, etc.

<table>
<thead>
<tr>
<th>Steel Pipe Racks Foundations</th>
<th>TOTAL CONCRETE</th>
<th>Section excavations by machine in earth</th>
<th>Backfill</th>
<th>Steel Reinforcement</th>
<th>Anchor Bolts</th>
<th>Non-shrink Grout</th>
<th>Lean Concrete</th>
<th>Foundation concrete</th>
<th>Surface treatment of foundation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VOLUME</td>
<td>Down to 2 m depth</td>
<td>From Excavation</td>
<td>Rebars for footings</td>
<td>(m² unit)</td>
<td>25 mm thick</td>
<td>&quot;t&quot;</td>
<td>(m³)</td>
<td>(m²)</td>
</tr>
<tr>
<td></td>
<td>by dimens.</td>
<td>(m³)</td>
<td>(m³)</td>
<td>(kg)</td>
<td>(kg)</td>
<td>(kg)</td>
<td>(m²)</td>
<td>(m³)</td>
<td>(m³)</td>
</tr>
<tr>
<td>105-PR-03</td>
<td>130</td>
<td>445</td>
<td>296</td>
<td>9 504</td>
<td>1 078</td>
<td>818</td>
<td>11</td>
<td>225</td>
<td>130</td>
</tr>
</tbody>
</table>
Civil Works

- Price Ratio % Main equipment cost, typ. 15-20%
- Qty MTO: excavation, formwork, rebar, etc.
- Rate Mhrs/operation + labour cost

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<td>Rebars for pedestals</td>
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<td></td>
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<td>130</td>
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</tbody>
</table>
Steel structures

- Price Ratio: % Main equipment cost, typ. 10-30%
Steel structures

- Price Ratio % Main equipment cost, typ. 10-30%
- Qty Ratio
Steel structures

- Price Ratio
- Qty Ratio

% Main equipment cost, typ. 10-30%
pipe-racks: 90% of piping weight
platforms: 10% of equipment weight
Steel structures

- Price Ratio  % Main equipment cost, typ. 10-30%
- Qty Ratio  pipe-racks: 90% of piping weight
- Rate  platforms: 10% of equipment weight
Steel structures

- **Price Ratio**  % Main equipment cost, typ. 10-30%
- **Qty Ratio**  pipe-racks: 90% of piping weight
- **Rate**  platforms: 10% of equipment weight

Supply USD 2/kg
Erection 20 std manhours/t
Cost estimate of Oil & gas facilities

• Analytical
  – Main equipment supply + install
  – Piping supply + install
  – Electrical supply + install
  – Instrumentation & Control system supply + install
  – Civil Works
  – Steel structures
  – Painting, Insulation
Cost estimate of Oil & gas facilities

- Painting, Insulation
  - Price ratio % eqt, piping, str cost, typ. 5% each
Cost estimate of Oil & gas facilities

- Painting, Insulation
  - Price ratio % eqt, piping, str cost, typ. 5% each
  - Qty MTO
Cost estimate of Oil & gas facilities

- Painting, Insulation
  - Price ratio: % eqt, piping, str cost, typ. 5% each
  - Qty: MTO
  - Rate: supply + install h / m²
typ. 0.5 for painting, 1.5 for (hot) insul.
Cost estimate of Oil & gas facilities

• Analytical
  – Main equipment supply + install
  – Piping supply + install
  – Electrical supply + install
  – Instrumentation & Control system supply + install
  – Civil Works
  – Steel structures
  – Painting, Insulation
  – Temporary construction facilities
  – Engineering & Project Management
  – Miscellaneous
Cost estimate of Oil & gas facilities

- Temporary Construction facilities
  - Ratio % total cost, typ. 5% for new site
  - Detailed
Cost estimate of Oil & gas facilities

• Analytical
  – Main equipment supply + install
  – Piping supply + install
  – Electrical supply + install
  – Instrumentation & Control system supply + install
  – Civil Works
  – Steel structures
  – Painting, Insulation
  – Temporary construction facilities
  – Engineering & Project Management
  – Miscellaneous
Cost estimate of Oil & gas facilities

- Engineering & Project Management = all Project services
  - Price ratio % total cost, typ. 15%

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Cost estimate of Oil & gas facilities

- Engineering & Project Management = all Project services
  - Price ratio \( \% \) total cost, typ. 15\%
  - Qty ratio
Cost estimate of Oil & gas facilities

- Engineering & Project Management = all Project services
  - Price ratio  \% total cost, typ. 15\%
  - Qty ratio  hrs / eqt item, typ. 1800 for Refining, 2500 for gas, 4000 for LNG
• Engineering & Project Management = all Project services
  • Price ratio % total cost, typ. 15%
  • Qty
Cost estimate of Oil & gas facilities

• Engineering & Project Management = all Project services
  • Price ratio % total cost, typ. 15%
  • Qty home office: tasks list + std manhours
    field supervision: ratio to labour, typ. 1/7
Cost estimate of Oil & gas facilities

- Analytical
  - Main equipment supply + install
  - Piping supply + install
  - Electrical supply + install
  - Instrumentation & Control system supply + install
  - Civil Works
  - Steel structures
  - Painting, Insulation
  - Temporary construction facilities
  - Engineering & Project Management
  - Miscellaneous
  - Contractor’s cost
• Miscellaneous
  • Earthworks: always specific
  • Special foundations
  • Infrastructures: roads, buildings
  • Spare parts, typ. 5% main equipment cost
  • First fill (catalyst, lubes, chemicals)
• Analytical
  – Main equipment supply + install
  – Piping supply + install
  – Electrical supply + install
  – Instrumentation & Control system supply + install
  – Civil Works
  – Steel structures
  – Painting, Insulation
  – Temporary construction facilities
  – Engineering & Project Management
  – Miscellaneous
  – Contractor’s cost
• Contractor’s cost
  – profit,
  – risks,
  – sales cost,
• Contractor’s cost
  – profit, typ. 7%
  – risks,
  – sales cost,
  typ. 10-15%
Cost estimate of Oil & gas facilities

- Main equipment supply + install
- Piping supply + install
- Electrical supply + install
- Instrumentation & Control system supply + install
- Civil Works
- Steel structures
- Painting, Insulation
- Temporary construction facilities
- Engineering & Project Management
- Miscellaneous: catalysts etc.
- Contractor’s cost

<table>
<thead>
<tr>
<th>Typical breakdown of overall facility cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Services</td>
</tr>
<tr>
<td>Equipment &amp; materials supply</td>
</tr>
<tr>
<td>Construction</td>
</tr>
<tr>
<td>Contractor's profit, risks, sales cost etc.</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>
Main features:

• Different level of Cost estimate accuracy
  – Feasibility study +/-30% accuracy
  – Final Investment Decision (FID) +/- 10%

Which of the methods we have seen would you use for each case?
Main concepts:

• Different level of Cost estimate accuracy
• Factored / Detailed
• Qty estimate: allowances for design development
• Rates:
  – In-house historical data – similar Plant
  – Cost estimate: Contingencies for cost escalation
  – Inquiries + provisions for cost adders (supplies), additional works/re-works (construction)
• Direct costs / Indirect costs
Historical evolution:
+ Increased instrumentation & control costs
- Engineering low cost centers
- Low cost sourcing – 20% cheaper
- Increase in productivity (3D model)
+ Additional requirements: safety, environment
Cost estimate of Oil & gas facilities

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- Contract Management
- Project Control

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