General EPC contractors in oil & gas markets
Our Clients: Energy and Petrochemical Companies
General EPC Contractors in oil & gas markets
“Western” and Japanese Contractors have recaptured some ground lost to Koreans

Challenge from new entrants

Source: Saipem Data (2015)
Typical project execution sequence (1/2)
Typical project execution sequence (2/2)

- Evolution: from *designers* to *overall constructors* of the entire new investment project
- Active control of all project phases
- Search for tailor-made ‘engineered-to-order’ solutions

EP(I)C Contract
Often on Lump Sum basis
Investment in Front End phases is essential
Key factors in EPC project success

- Maximize expenditures in Front End Loading
- Work in multifunctional teams, jointly with the Owner Company
- Use throughout the experience in construction
From project to portfolio risk management

...in a portfolio view
Example: Saipem
SAIPEM TODAY: A MAJOR MULTICULTURAL E&C & DRILLING CONTRACTOR

- Operating in more than 60 countries
- ~ 40,000 employees from >120 nationalities
- More than 20 engineering and project execution centers worldwide
- 11 fabrication yards in 5 continents

**REVENUES**

- 2015: 11.50 B€
- 2016: 9.98 B€

**BACKLOG**

- December 31, 2016: 14.2 B€
Shah Gas Development, U.A.E.
CNRL Oil Sands Refinery, Alberta, Canada
Engro Fertilizer Complex, Pakistan
Pipelaying for Nord Stream

Castorone
New Technologies, New Industries
The Consolidation of Deepwater Subsea Production Systems

Brazil
World First Offshore-Moored FSRU
Offshore Wind Farm for Statoil
High tech-applied in difficult, inaccessible, distant markets
Some little known facts about Saipem

- In oil & gas markets, the largest Engineering & Construction general contractor in the world (by revenue)

- In Italy, autonomously, ~7th largest company (by revenue)

- Activity and backlog:
  International markets  97%
  Italy                      3%
Saipem: Pivot in Italy

- Global headquarters, 5 engineering, production and R&D centres

- > 7000 Italian employees
  of which:
  • > 3000 engineers
  • ~ 40% on international assignments

- Purchases of ~1.8 B€/y from >3800 Italian suppliers

- Subcontracts of 1.7 M man-hours to Italian Engineering Companies

- In addition: total indirect, induced, employment: ~ 15,000 people

- Contributing to 0.2% of Italian GNP
A new chapter in Saipem history
The EPC Process
Improving project execution in today’s scenario
Wellington at Waterloo

“Some heavy pounding, Sir”
Time for **Resilience**

For the General Contractors in the oil & gas industry

- Lower new CAPEX demand, particularly in upstream
- Impact of geopolitics
- Shifting markets
- Often unclear new policies (e.g. Local content, permitting, environmental)

**E&C Industry “Risky Business”**

- Pressure to reduce cost of Capex
  Vs. recent cost explosion
- Unclear Clients’ objectives and criteria of success
- Increasing execution complexities
- Substantial competition from new entrants

Great transformations, complex and contracting markets

but

many opportunities for the most competitive and flexible players
INCREASING CAPITAL INTENSITY

Normalized for size, region, forex and inflation

Source: A Definitive 30-year History on Price and Cost E&P Industry, IPA, April 2015

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May 2016
PRODUCTIVITY DECLINES

CONSTRUCTION PRODUCTIVITY NEEDS TO BE INCREASED BY EFFECTIVE PLANNING AND ELIMINATING WASTE

ENGINEERING PRODUCTIVITY CAN BE IMPROVED BY SIMPLIFYING PROCESSES AND AVOIDING REWORK

Industry Construction Productivity

- Rest of economy
- Construction

Source: McKinsey

Shell FEED Engineering man-hours over time.

Source: P&T/G

May 2016
### Pushing More Paper

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<td>Site-Team Size (number of people on team)</td>
<td>40</td>
<td>150</td>
<td>+275%</td>
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Oil & Gas services industry

Main critical issues...

- Industry costs out of line with today’s needs
- Decreasing project execution success
- New entrants, new competitors
"Less Bang, More Buck"
Rapidly rising project execution costs – 2000 – 2015

- More complex and remote environments
- Tight skilled labor market
- Decrease in efficiency and productivity

Source: IHS (2013)
Example: LNG liquefaction plants capital cost escalation (US $)

Drama in “mega projects” execution: increasing cost overruns and delays

500 B US$ incremental cost increase (from US$1,200 BUSS original estimate to US $1,700 B US$) on a sample of 365 projects reviewed

Project delivery success is decreasing, especially in industry segments where complexity and risks are considerably higher
Key factors of success
Clarity of Owner’s objectives: crucial guidance for the contractor

• Set and clearly communicate Owner’s project goals
  • Firm or evolving project definition – market, internal or local influences
  • Owner’s desired role in the project
  • Third parties’s involvement: e.g. Authorities, approvals, ...

• Communicate Owner’s key success factors
  • Achieve schedule ?
  • Achieve cost certainty ?
  • Optimize the project ?
  • Fast track execution ?
  • Achieve lowest cost ?
  • Value Engineering ?

• Define the level and availability of technical and execution competences
  • Owner’s
  • Contractors’ and Suppliers’

• Openly discuss threats and fears

Unclear and undefined project objectives and possible pitfalls: one of most frequent causes of failure
New Investment Preparation and Execution Process

**PROJECT STUDY AND DEFINITION**
- Company Strategy
- Opportunity Identification
- Pre-feasibility Study
- Feasibility Study

**PROJECT SETTING PHASE**
- Project Start
- Basic Process
- Basic Engineering
- Front End Engineering Design (FEED)

**DESIGN AND EXECUTION**
- Project Management
- Control System

**Hand Over**
- Contract Award
- Detailed Engineering
- Procurement
- Construction
- Commissioning

Investment Estimate ± 25%
Preliminary Investment Decision
Investment Estimate ± 10%
Final Investment Decision
For project success, need tighter cooperation between Project Owner/E&C Contractor/Supply Chain

From the earliest project phases – **Front End Loading**

- Maximize investments in **Pre-FEED** and **FEED** (and then stop any changes)
- Utilize **experienced contractors** with thorough **construction** experience
- Form **integrated teams** with "**win-win**" objectives
- Involve **critical equipment vendors** and **certification companies** throughout the process
- Join forces to **broaden vendors list**
Investment in Front End phases is essential
In EPC/EPIC contracts we need to avoid the “Avalanche Effects” of poor or changing FEED / Technical Package.
Maximize the application of new technologies

- Most advanced mega-projects today are based on “new” or “breakthrough” technologies
- Gradually the R&D effort is being outsourced to contractors and suppliers
- **Sharing** Oil Companies’ needs, criteria, targets is essential for the service providers
  - Goals, feedback, certification, guidance
- Joint projects best, when possible

**Successful application of new technologies is key to project success**
Conclusions

In our view, **the most critical factors of project success are decided before starting EPC:**

- Maximize investment in **FEL**
- Choice of **contractor experienced in construction** and outline of supply chain
- Establishment of a tighter, **collaborative, ‘win-win’ attitude**
- **Broader** selection of approved competitive **vendors**
- Wider use of **standardized** and fully qualified **solutions**
- **Realistic** and shared **view** of **local content** maximization
- More **balanced risk-sharing** and evolved contractual forms

**Intense Owner – Contractor cooperation and mutual thrust essential for project success**
Fundamentals of the EPC process
Feasibility Studies

Often also called: Conceptual Design
Objective: Is the project feasible, prior to starting the investments?

- **Project description**
  - Project purpose, stakeholders involved, who will benefit?
  - Preliminary design

- **Market study**
  - Evaluate the market environment, goals, benefits, commercialization obstacles

- **Project goals**
  - Long-term, short-term goals

- **Execution plan**
  - How to achieve the goals?
  - Preliminary design/procurement/construction plan
- Resources
  - Identify all needed resources: technical, human, advisory, equipment, inventories, IT, ...
  - Supplies and suppliers
  - Subcontractors

- Project process
  - How will the project flow?
  - Flowcharts, main project stages

- Timeline
  - Estimated timeline, individual steps, milestones

- Management
  - Identify needed managers, workers and relative responsibilities
Cost and budgeting
- Preliminary investment cost (typically ± 30%)
- Main possible suppliers and subcontractors
- Expenditure sequence
- Financing – sources, modalities

Observations and critical issues

Calculate profitability
- Return on investment
- NPV
- Payout time
Typical outcome:

- **Highlight project problems**
  - Risks? Problem areas?

- **Alternatives**
  - Analyze, recommend alternative approaches -if any

- **The outcome**
  - Conclusions: is the project beneficial or detrimental?
  - Profitability analysis
  - Risk assessment
  - Implementation programme

**Conclusion/recommendation:** The feasibility study should not only lead to a “go/no-go” decision,

but it should become the basis for the project development, indicating major criticalities
Technologies Selection
Example: Synthesis of Urea
Technologies Selection

- Selection of fundamental process solutions and technologies (often licensed)

- A licensor will typically offer
  - License: right to use, according to patents and know-how
  - Technology transfer: know-how, training for its application, start-up assistance ...
  - Package of customized basic specifications (including key equipment)
  - Performance guarantees

- Technologies and licensors are typically selected on competitive basis
  - Performance, references, prices, reputation
Basic Engineering Design, Front End Engineering Design

Often called also:
Basic Engineering and Process Design Package,
Process Specifications,...
A unique Basic Engineering Package, developed for each individual project, typically includes the following deliverables:

- **Design Basis**
  - Site-specific meteorological and ambient conditions;
  - Required characteristics of utility supply systems;
  - Integration with existing facilities
  - Preliminary plot plan

- **Process Description**
  - Process scheme

- **Equipment List**
  - A list of all required process equipment, with relative sizing

- **Process Flow Diagrams (PFDs) and Heat & Material Balances**
  - A process simulation for the plant; definition of all process streams
  - Temperatures, pressures, flow rates, and physical properties;
    operating conditions defined for all process streams

- **Material List**
  - Selection basis and diagrams

- **Piping and Instrumentation Diagrams (P&IDs)**
  - Showing interconnection of process equipment and the instrumentation used to control the process
  - Interconnection of key process utilities (hydrogen, steam, hot oil, etc.).
• **Equipment List**

• **Process Equipment Data Sheets**
  - Process data sheets provided for all Inside Battery Limit (ISBL) equipment items

• **Instrument List**
  - Control valves, level instruments, flow instruments, pressure instruments, temperature instruments and relief devices, identified and specified

• **Piping**
  - Piping specification and piping classification index

• **Plant or Process Control**
  - Control logic and interlock schemes.

• **Effluents Stream List**
  - Quantities and characteristics of all effluent streams are defined. Specifically:

• **Quality Assurance and Laboratory Information**
• Utilities and chemicals consumption
  - Required chemicals and utilities identified and consumption rates shown: treating chemicals, catalyst, steam, water, nitrogen, air, hydrogen, etc.

• Flare loads summary

• Hydraulic calculations

• Piping and Instrumentation Diagrams (P&IDs)
  - Showing line sizes, line specifications, instruments, controls, valves, insulation etc.

• Maintenance & sparing philosophy

• Conceptual fire fighting requirements

• Fire water demand calculation

• HAZOP (Hazard and Operability) study

• HAZID (Hazard Identification) study
On the basis of a typical BED package:

- The Owner Company will issue a “Request for Bids” to EPC General Contractors

- General contractors will develop a detailed offer for project execution, including schedule and firm Lump Sum or indicative bidding price

- On the basis of the above, the Owner Company will make a Final Investment Decision (FID)
Detailed Engineering (1/3)

Process Engineering
- Review for consistency Basic Engineering Design or FEED Package developed by third party / client
- Develop / Review hydraulic calculations
- Develop / Review pressure safety valve calculations for final equipment layout and relieving scenarios
- Obtain / Review package equipment quotations from vendors for process suitability
- Develop utility requirements with regards to vendor data for process suitability and update the utility sizings

Equipment Engineering
- Confirm design basis
- Develop mechanical design for fabricated equipment
- Develop engineering data sheet for fabricated equipment
- Prepare engineering datasheets for package units
- Prepare standard specifications for fabricated equipment and vendor designed equipment
- Prepare fabrication drawings / review the ones prepared by vendors

Piping Design
- Confirm piping design basis
- Develop piping and pipe support standards
- Prepare piping and valve material specifications
- Develop plot plan
- Develop equipment layout plan and elevation drawings
- Develop foundation layout plans
- Prepare equipment nozzle orientations
- Develop 1st MTO (Material Take-Off) for piping, valves, fittings
- Develop piping layout plans / sections
- Prepare isometrics
- Carry out stress analysis
- Prepare isometrics for tie-in points
- Prepare pipe support details
- Prepare specifications and MTO for insulation and painting
- Develop final MTO for piping, valves, fittings, and other piping items.
**Instrument Engineering**

- Confirm instrumentation design basis
- Develop Instrumentation Index
- Prepare standard specification for valves, pressure instruments, temperature instruments, level instruments and PLC system
- Prepare engineering datasheets for field instruments including control valves, relief valves, temperature instruments, pressure instruments, flow instrument, level instruments etc.
- Develop specifications for control system including system architecture and remote data acquisition system.
- Prepare control room layout
- Develop cable and Junction Box schedule
- Prepare instrument hook up diagrams
- Prepare loop wiring diagrams
- Prepare specification and layout for gas detection system
- Prepare instrument installation standards
- Estimate bill of materials for bulk items

**Electrical Engineering**

- Confirm electrical design basis
- Prepare load list
- Prepare single line diagram
- Carry out conceptual design for power source, equipment location and power distribution.
- Develop hazardous area classification drawings
- Develop specifications for power generation
- Prepare specifications for other electrical items like Control Stations, Lighting Fixtures, earthing material, cables & cable trays
- Carry out cable sizing calculations and develop cable schedule
- Prepare Instrument Control room layout
- Develop design & drawings for earthing & lightning protection
- Develop lighting layout
- Develop cable tray layout
- Estimate bill of materials for bulk items
Civil/Structural Design & Engineering

- Confirm civil design basis
- Review contour survey drawing and prepare site grading plan including earthworks and site preparation
- Develop general arrangements drawings for buildings and sheds
- Carry out foundation design and prepare foundation drawings for equipment, building, underground tanks and shed
- Carry out structural design and prepare structural arrangement drawings for shed and platforms
- Carry out foundation and structural design for pipe rack/sleeper and pipe supports
- Develop layout drawings for roads, drainage and paving
- Prepare Bill of Material

Fire Fighting System Engineering

- Prepare specifications and layout for fire detection and alarm system
- Carry out hydraulic calculations and prepare P&ID for fire water network
- Prepare layout for fire water network
- Prepare Bill of Material
Procurement

Includes also major subcontracts
A highly strategic effort, since the ability to purchase certain materials or obtain subcontracts competitively will determine the profitability or even the continuance of Company’s operations.

Typical steps:

- Overall planning
- Standards determination
- Specifications development
- Supplier research and certification
- Certified Vendor list definition
- Reconciliation of Contractor’s and Client’s Vendor lists
- Definition of Terms and Conditions (T&C)
- Issuance of Tenders, receipt of offers
- Price and negotiation
- Contract definition and signature
- Contract administration
- Post-order activities, expediting
- Deliveries on site
- Verification and warranties
Construction
Construction

• In challenging areas, often the most complex and difficult task
• Typically represents about 30 – 50 % of total project cost
• Local experience and local mobilization critical factors of success
• Can be subcontracted to a major construction firm, or to many subcontractors
• Key areas:
  - Site preparation
  - Civil works
  - Mechanical erection
  - Electrical & Instrumentation works
Start-up and Commissioning
Typically a complex and sequential procedure

Test run and performance guarantee verification

Simultaneously, training of Owner Company personnel

Plant acceptance

Future operations
- Sometimes BOO (Build, Own and Operate) or BOT (Build, Own and Transfer)
Improving the EPC Process
Only **lower-cost projects** will see the light

*(Cost curve by market)*

Indicative cost curve of global crude oil supply from new projects in select areas to 2030

- New supply is gross additions — with the exception of tight oil and Canadian oil sands supply, which is net additions.
- Supply depicted in this figure represents more than 70% of total global supply from new projects.

Source: IHS
Key challenge for the EPC General Contractors

Need higher effectiveness, and reduced costs

Lower profitability

Increasing difficulties

- Ever more complex and inaccessible locations
- More sophisticated, advanced technologies
- Major project execution challenges

Scilla and Cariddi
Drastic cost-reductions for new projects are needed

- An **18-22 % cost deflation** has materialized by today, but there are **inflationary pressures** for costs to rise again by the end of decade.

- **Further supply chain savings** based on ‘squeezing’ the service sector are possible, but probably limited.

- **Major structural supply chain** improvements are needed to:
  - Lower costs further
  - Improve reliability and quality and reduce risk

Owners’ challenge:
30 – 50 % reduction
Our industry has been the most resistant one to reduce costs

Cost developments across the Energy spectrum, indexed 2008

-26% Upstream Oil&Gas
-35% Onshore wind
-71% Grid-scale batteries
-83% Solar PV - utility scale
-94% LEDs
Lower prices are possible

Sources: Bureau of Labor Statistics, Baker Hughes, Barclays Research (9/2016)
Further reductions will originate primarily from improved designs and technologies.

Source: IHS

Note: % reduction estimates deduced from announced efforts (both realised and unrealised) by operators and contractors. They are not reflective of what can be achieved.

Source: IHS
More than half of offshore cost reductions due to simplification, design

Breakeven improvement of a “best-in-class” non-sanctioned offshore development USD/bbl

Source: Rystad Energy Research and Analysis
Efforts to reduce CAPEX and improve project execution

- More **design optimization** and value engineering, to reduce overall costs
- More accurate, more realistic **initial project estimates**
  To avoid changes, variations, surprises ...
- Broader acceptance of alternative **Vendors from lower cost markets**
  (particularly from China)
- Re-visitation of **execution approaches** and contractual forms
  - Direct execution of certain EPC components by some IOCs
  - Smaller EPC LSTK packages
  - Return of PMCs
  - Paid offers on large projects
  - Standardization
  - Modularization
  - Frame agreements with quantity discounts - Collaborative sourcing
  - Alternative contractual arrangements e.g. "Hybrid Convertible"
  - Technology development programs for cost reduction

**Cost reduction – the key factor of success in the near future**
Saipem’s new strategic pillars – starting from August 2015

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<th>Number</th>
<th>Area</th>
<th>Actions/Strategies</th>
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<td>Business portfolio refocus</td>
<td>Maintain state-of-the-art fleet, Rationalization, ‘right-sizing’, divestments</td>
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<td>Ongoing strategic review of non-core activities</td>
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<td>De-risking the business model</td>
<td>More top-management engagement on significant decisions, Selectiveness, project screening, Reinforced risk management</td>
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<td>Balanced portfolio of E, EPC, EPCM activities</td>
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<td>Cost optimization and process efficiency</td>
<td>“Fit for the future”: 1.7 B€ overall program savings, G&amp;A optimization, Eliminate overcapacity, Rationalize geographical footprint</td>
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<td>4</td>
<td>Technology and innovation</td>
<td>Enhanced innovation effort, Technology as enabler for commercial opportunities, Proprietary technologies, Overall system design and execution</td>
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<tr>
<td>5</td>
<td>Debt reduction and capital discipline</td>
<td>Rights issue, New credit facilities, Debt refinancing, Focus on cash flow management</td>
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Way forward: Towards improved project execution
(Saipem’s example)

- **Management process** overhaul
  Focus on organizational structure, leadership and human behavior

- **Optimized and innovative project design and execution** approaches
  incl. Standardization, common industry specifications, horizontal integration, networking solutions

- **Technology and business processes innovation**

- **With Owner Companies**
  Cooperation – particularly pre-EPC
  From prescriptive to functional specs
  Balanced risk sharing
  Joint innovation
  ... through better engineering solutions
Way forward: Towards improved project execution
(Saipem’s example) 2/2

- 'Vendor Federations' to reduce costs, allow easier data transfer, standardization and reuse

- **Extensive digitalization**
  Focus on capitalization of Information and Intellectual Assets
  Beyond just ‘lessons learned’
  Much broader networks use

- **"Smart" Supply-chain**
  Extensive digitalization, Post-order management, Material tracking solutions, training for supervision

- Invest in and educate ‘**Top quality local content**’ for bigger EPC challenges

- **Smart logistics**
  ... with suppliers
  ... with complementary and synergistic Partners
DELIVERING SAFER, FASTER, BETTER CAPITAL PROJECTS

ProjectVantage Forum 2016
Featured presentations
## EFFICIENT EXECUTION AND PROJECTVANTAGE

- **Delivering Hard Targets**
  - Cost Zeros
  - Capital Efficiency
  - Breakthrough Affordable Technology

- **Supporting Success Sets**
  - Interim
  - UIC
  - OS
d
  - Systems
don
  - Downstream
don

- **Focusing on Transformation Themes**
  - Supply Chain Transformation
  - Organizational Resilience
  - Technology & Innovation

- **Disciplined Thinking and Planning**
  - Collaboration and Integration
  - Agility and Focus
  - Simplicity
  - Transparency

---

### Designing and Procuring Competitively
- **Train 1 Initiative**
  - Reduce Eng. hours per piece of equipment by 30%
  - Improve Time on Tools by 50%
  - Reduce Field Rework by 50%

### Implementing with Excellence

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<th>ProjectVantage</th>
<th>Reduce Eng. hours</th>
<th>Improve Time on Tools</th>
<th>Reduce Field Rework</th>
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<td>Owners Team Archetypes</td>
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<td>Quality Inspection Systems</td>
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PROJECTVANTAGE REALISES BENEFITS THROUGH THE PROJECT LIFECYCLE

**IDENTIFY**
- Early Replication
- Better Front End Loading
- Fit-for-purpose doc control
- Faster access to legacy information

**ASSess**
- Faster start of Define work via predefined templates
- Improved design validation & scope control
- Consistency/complete mass across disciplines
- Early definition of path of construction

**SELECT**
- Safer working conditions
- Visualised workforce planning and execution
- Frozen engineering deliverables in sequence with the path of construction
- Optimisation of construction planning and execution driving increased Time on Tools
- Auditible completions management
- Pro-active and timely delivery of vendor documentation

**Define (P&ID)**
- Seamless handover from Project to Asset
- Data and documents available and easy to find
- Evergreen data from as-built designs

**Operate**

May 2016
**KEY IS TO DEMONSTRATE MEETING PROJECTVANTAGE INTENT**

EPCs either need to use the ProjectVantage software components OR demonstrate they meet the following requirements in own environments.

### Site Survey

- Affordable storage and re-use of laser scans and 3D models for turnarounds, maintenance & inspection

### Vendor Catalogue

- Re-usable vendor information for Shell projects
- Avoidance of design holds caused by late vendor data
- Single IM review of the same vendor information across multiple POs

### Engineering Tools

- Quality assurance via cloud based, transparent engineering collaboration processes and data shared between EPCs and Shell
- Competitive scope assured via exception based reporting
- Efficient & complete information transfers across phases
- Frozen engineering deliverables at the right time and volume to match construction & commissioning schedule
- Efficient brownfield project set up and execution
AND REALISE BENEFITS THROUGH A DATA-CENTRIC WAY OF WORKING

**Track & Trace**
- Continuous traceability of materials & equipment through the supply chain
- Tracking of materials after delivery to site and in the laydown yard
- Tracking of field personnel for safety and efficiency

**Commissioning Management**
- Electronic commissioning check sheets and punch lists to minimise administration in back offices
- Data-centric reporting of construction and commissioning QC for pareto analysis and proactive correction of systemic errors

**Construction Management**
- Visual work face planning using the 3D model as an interface to the construction schedule
- Visual representation of fabrication and construction 90, 60 and 30 day and weekly look ahead, plus actual status reporting

**Field Mobility**
- Maximising field time for supervisors via electronic download of observations, completed checklists and markups
- Tablet based construction QC via latest drawings and/or 3D model views
- Electronic redlining capability for field changes
- Updating of commissioning check sheets, punch lists
LEVERAGING INDUSTRY’S STANDARD OFFERINGS

CAPEX

- Equipment availability, testing capability & accommodation type
- "Nice to have": spare and low-maintenance equipment, e.g.

Scope:
- Minimum Technical Scope in Industry
- Minimum Technical Scope for Shell
- Competitive Scope
- Overinflated Scope

Shell requirements
ENABLING COMPLETE DELIVERY OF ENGINEERING

Engineering needs to be consistent, targeted and simplified whilst it ensures safe, competitive and operable outcomes.
SUMMARY OF THE GOOD NEWS

EPCs ARE ADOPTING DATA CENTRIC TECHNOLOGY
- Fluor, Jacobs, Worley Parsons…and others
- 4D/5D is gaining traction in the industry

SHELL PROJECTS ARE ADOPTING PROJECTVANTAGE
- Upstream / LNG - Prelude, Browse, Assa North, Majnoon, LNG Canada
- Downstream – Pernis SDA, Geismar AO4
- Design Offices - Penguins

CONTRACTS AND SAMPLE WORKFLOWS ARE READY
- Contract terms and conditions are available
- Example workflows are documented to aid implementation
BUT... PLENTY OF ROOM TO GO FASTER...

Need faster deployments and focus on the KPIs
- Engineering hours
- Construction rework
- Construction Time on Tools

SHELL WILL NOT ACCEPT 2ND PLACE SO...
LEAD, FOLLOW ...OR GET OUT OF THE WAY
A View on EPC Contractual Forms

Balancing the risks
The optimal contractual form will depend on ...

- Owner’s ability to set and clearly communicate firm project goals
  - Firm or evolving project definition – market, internal or local influences
  - Owner’s desired role in the project

- Owner’s key success factors
  - Achieve schedule ?
  - Achieve cost certainty ?
  - Optimize the project ?
  - Fast track execution ?
  - Achieve lowest cost ?
  - Value Engineering ?

- The level and availability of technical and execution competences
  - Owner’s
  - Contractors’ and Suppliers’
No single ‘one-fits-all’ contractual solution for all situations

- Customized project and contracting solutions
  
  EPC  LSTK  EPIC  T&I  Cost-plus  Convertible  Lease & Operate
  
  Historically, approx. 70% of Saipem’s contracts are on EPC LSTK basis
Main EPC contractual forms  
(Among many that are possible and utilized)

- **‘Reimbursable’**
  - The contractor is reimbursed on an hourly basis according to pre-agreed unitary pricing, for E and PM
  - Mostly, no targets on man-hours used or on project schedule
  - All schedule and cost risk with the Owner
  - Occasionally, incentives to finish within a target timing, or develop a project within a target cost
  - Owner carries out the P - procurement and C - subcontracting
  - Very typical in North America

- **‘Lump Sum Turn Key’**
  - EPC or EPIC – I is installation in offshore parlance
  - Very typical in most for the world (but not in Italy)
  - General Contractor commits to total project price and schedule, with project delay liabilities
  - General Contractor responsible for the entire project EPC (within the limitations defined by Owner)
  - Most project cost and schedule risk on Contractor

- **Numerous variations possible**
  - T&I – Transport and installation – in offshore, where the Owner or another contractor performs EP and C (fabrication)
  - EPCM – EP lump sum, only Management for C on LS basis

- **Hybrid ‘convertible’ contracts**
  - Start on reimbursable basis, then switch to lump sum (see later)
Generally, Saipem believes that the EPC/EPIC approach can offer superior performance in large projects execution.
The EPC/EPIC LSTK approach

**Pros:**
- Most efficient and disciplined process
- Predicts final project cost and completion time
- Parallel processes are possible (Indeed essential to capture program value)
- Continuous improvements (Project-to-project learning curve)
- Easier to maximize local content and manage risks efficiently
- More sustainable than best-in-class alternatives
- Simple bid evaluation process
- Lower burden on Owner’s Team

**Cons:**
- More complex/ higher risk for E&C Contractor
- Requires firm and precise execution of each step
- Does not allow project definition changes or post-FEED optimization
- Price affected by uncertainties/un-definitions
- Long bid/evaluation/award time: typically one year
Who runs the project, who is responsible for the outcome under standard ‘Reimbursable’ and ‘Lump Sum’ Contracts?

<table>
<thead>
<tr>
<th></th>
<th>Reimbursable</th>
<th>Lump Sum Turn Key</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Definition</strong></td>
<td>Owner</td>
<td>Contractor</td>
</tr>
<tr>
<td><strong>Contractor selection process</strong></td>
<td>Short, can be subjective</td>
<td>Rigorous and formal, but long</td>
</tr>
<tr>
<td><strong>Overlap between main steps</strong></td>
<td>Easy</td>
<td>Difficult</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>Owner</td>
<td>Contractor</td>
</tr>
<tr>
<td>▪ Leadership</td>
<td>Owner</td>
<td>Contractor</td>
</tr>
<tr>
<td>▪ Location</td>
<td>Owner</td>
<td>Contractor</td>
</tr>
<tr>
<td>▪ Project Risk</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Owner’s involvement</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Allows design development, flexibility, adaptation to evolving and unpredictable circumstances
- Little guarantee on final cost/schedule
- Guarantees defined budget and completion time
- Requires excellent project definition
“Convertible” contracts offer a compromise contractual scheme increasingly attractive in today’s market.

Maintain simultaneously the main advantages of the two extreme contractual forms:

- Reimbursable, Open Book
- Lump Sum Turn Key

Optimize risk balance between Owner and E&C Contractor.

**PROJECT EXECUTION**

**FEED**

Project definition, execution plan, cost estimate

**E**

Conversion

**P**

Project implementation

**C**
Execution Approaches

Open Book Reimbursable

- Feasibility Studies → FEED → EPC (PMC + several subcontracts)
- Bid/Award → Bid/Award → Bid/Award

LSTK

- Feasibility Studies → FEED → EPC LSTK
- Bid/Award → Bid/Award → Bid/Award
- 8-10 months

‘Convertible’ LSTK

- Feasibility Studies → FEED → FEED + EPC LSTK
- Bid/Award → Bid/Award

Conversion Factors

Firm Price/Schedule

Conversion into LS

Cost/Schedule Estimates
Saipem Convertible Contracts Experience

S. Aramco Qurayyah Sea Water Treatment S. Arabia

Eni R&M, Deasphalters and Hydrocrackers

Khursaniyah Central Processing Facilities - S. Arabia

S. Aramco-Khurais Water Injection Facilities and utilities (KUC) Projects, Saudi Arabia

STAATSOLIE Maatschappij Suriname N.V.

Over 10 B€ of such projects either completed, ‘converted’ or today in design phases

... in parallel to many other projects executed on EPC LSTK or other bases
Convertible Contracts - Conclusions

- Significant **time saving** vs. traditional LSTK: almost one year
  Big NPV improvement!
  - Proven experience on parallel projects

- Fully **transparent** process
  - Owner maintains full access to all project data and prices

- **Balanced risk sharing** between Owner and E&C Contractor
  - Reduced risk for Contractor, lower need for contingencies/risk premium

- The process fosters a **co-operative mutual relationship** with Owner’s empowered project team

- Possible **tailoring to Owner’s needs**/constraints

- **The nature of this approach requires a high degree of mutual confidence between Owner and Contractor**
The EPC marketing process
Increased Clients focus today

- Key contractors personnel quality
- Minimal prices, high procurement efficiency
- Execution capabilities and top level project management
- HS&E
- Brownfield activities
  - Revamps, upgrading
  - High level O&M

Source: adapted from Transmar (2016)
## Key Clients requirements today – from EPC contractors

### A Multi-year Comparison In The Ranking Of Buying Factors

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<tr>
<td>Qualification of Key Personnel</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Contractor’ Price</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>3</td>
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<tr>
<td>Project Management Capability</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
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<tr>
<td>HSE</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Procurement Capability</td>
<td>5</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>14</td>
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<tr>
<td>Project Control System</td>
<td>6</td>
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<td>7</td>
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<tr>
<td>Experience with Similar Work</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>5</td>
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<tr>
<td>Construction Management Capability</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>6</td>
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<tr>
<td>Quality of Proposal</td>
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<td>11</td>
<td>13</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Responsiveness &amp; Flexibility</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Detailed Engineering Capability</td>
<td>11</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Experience in Geographic Area</td>
<td>12</td>
<td>14</td>
<td>10</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Quality of Senior Management</td>
<td>13</td>
<td>10</td>
<td>9</td>
<td>18</td>
<td>11</td>
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<tr>
<td>Ability to do Work in One Office</td>
<td>14</td>
<td>19</td>
<td>15</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Size &amp; Location of Offices</td>
<td>15</td>
<td>16</td>
<td>12</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Conceptual Engineering Capability</td>
<td>16</td>
<td>13</td>
<td>17</td>
<td>14</td>
<td>16</td>
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<tr>
<td>Contractor Man-Hour Estimates</td>
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<td>15</td>
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<tr>
<td>Start-up/Training Capability</td>
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<td>15</td>
<td>18</td>
<td>17</td>
<td>18</td>
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<tr>
<td><strong>INDUSTRY AVERAGE</strong></td>
<td><strong>8.12</strong></td>
<td><strong>7.62</strong></td>
<td><strong>7.27</strong></td>
<td><strong>6.39</strong></td>
<td><strong>6.43</strong></td>
</tr>
</tbody>
</table>
EPC General Contractor selection process

Often long, elaborate and occasionally controversial

In most cases, the selection process will involve the following main steps:

- **‘Pre-qualification’** of qualified or acceptable contractors
  - Typically, a formal pre-qualification request/evaluation process for every project, even to known companies, to verify:
    - Experience
    - Willingness to bid and execute a given project
    - Availability of resources and know-how, workload status
    - Acceptance of key project terms and conditions, and any other requirement
  - A ‘short list’ of qualified potential bidders is defined
    - Typically 4 to 6 – 7
  - A few months are normally given to Contractors to prepare the ‘Prequalification submission’

- General contractors will often cascade analogous requests for prequalification to their main suppliers

- **Issuance of EPC Request for Bids** to this short list of selected / qualified General Contractors
  - Includes Basic Design and FEED results
  - Owner’s approved or selected ‘Vendor List’
  - Any other requirement or condition
EPC bid preparation

- A very complex and very costly endeavor – an accurate offer is a critical factor of success

- Contractors have typically 6 to 10 months to prepare a complex EPC LS offer
  - Acceptance of earlier FEED results
  - Risk evaluation
  - Price
  - Schedule
  - Execution plan
  - Key personnel to be utilized, etc.

- The decision to bid is not automatic
  ‘Bid/No bid’ decision – involving the top management, for most large and risky projects

- Contractors will use complex databases with vendor information and prices
  - Request specific and binding offers to key suppliers
  - ’Nominated Vendors’, ’Nominated Subcontractors’

- In addition to expected costs and profits, there will be
  - Currency and raw materials price hedging
  - Contingencies for risk assumption, etc.

- Submission of EPC LS bids – typically with highly secret modalities
  - Often sequentially: technical, then commercial proposal
  - Very iterative process
EPC Contractor selection

- Often, a long ‘bid clarification’ and ‘bid tabulation’ process
  Questions, meetings, ...
- In most cases, the ‘lowest price’ wins, if all the other Owner’s criteria are met adequately
  ...unless the price or the submitting company are not credible
- Occasionally, the Owner will re-calculate the bid prices according to a
  (sometimes not publicly disclosed) evaluation matrix
  Award to ‘corrected lowest price’
- Sometimes, the project is awarded on a ‘points system’
  Highly controversial and potentially subjective
Different contractors have a variety of business models and risk acceptance

Generally:

- Most US and some smaller European contractors are not risk-prone, will accept predominantly contracts on lower-risk ‘reimbursable’ basis only
- Some European (e.g. Saipem, Technip, ...), Japanese and Korean contractors will operate preferably on EPC LSTK or hybrid basis
- A few prefer to work only with their traditional and well known Clients
- In these difficult times, however, all operators are trying to reduce their risk exposure (‘de-risking’) and to better balance the risk distribution with the Owners

Accepting the right risk profile (i.e. appropriate to the project and to the company experience) is one of the key factors of success