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ON THE BACK OF THE TIGER
CONTROLLING CAPITAL COSTS FOR LNG PROJECTS

GENERAL

For owners, controlling LNG capital costs must be a bit like riding a tiger. Once the Financial Investment Decision (FID) is achieved, commitments made and contracts signed, the owner and contractor have to ride it together to a conclusion. If they do not have a sturdy saddle, and good reins, they could lose control and effectively be eaten up with greatly increased capital costs, schedule delays and even sizable consequential costs related to LNG sales, shipping and partners.

This paper focuses on capital costs. Industry realities have struck hard in Australia, estimated costs are steep in Canada and the story is repeated in varying degrees in other parts of the Americas and the rest of the world. We will examine two aspects:

- Before FID – how to configure the project in a manner in which it can be executed with minimum change, delay and risk in accordance with the Engineering, Procurement and Construction (EPC) contract
- After FID – philosophy for working with the EPC contractor(s) to successfully complete the project.

REDUCING CAPITAL COST BEFORE FINANCIAL INVESTMENT DECISION (FID)
The best opportunity to reduce capital cost is before FID and before the EPC contracts are signed. A proven model is to select an EPC contractor who will work with the owner to structure the project in a way that meets all of the owner’s requirements with a cohesive execution plan for dealing with the influences of capital cost. Let us focus on some of the larger capital cost influences:

Influences on Capital Cost
- Health, Safety and Environmental (HSE) Requirements
- Security Requirements
- Approach to Social Responsibilities
- Relationship with Local Government
- Meeting Regulatory Responsibilities
- Site Selection – Impact on Capital Cost
- Execution Model
- EPC Schedule
- Budgets & Schedules for Front End Engineering and Design (FEED) - pre-FEED & FEED
- Contract Terms
- Application of Cost Reduction Techniques
- Owner’s Key Agreements
- Working with an EPC Contractor
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Health, Safety and Environmental Requirements
A safe and environmentally friendly project will have an edge in terms of capital cost. The Pre-FEED and FEED phases should maintain HSE as the top priority by selecting an EPC contractor with a proven safety and environmental record. Thereafter, and before any EPC contract is executed, the owner and EPC contractor should agree on a joint HSE program that addresses the project risks and pro-actively puts into place an HSE model that will succeed.

Security Requirements
Project security requirements are another factor to address. Depending on the site location, local issues and transportation issues, there are potentially large costs associated with:

- Security infrastructure
- Security forces
- Secure transportation
- Productivity
- Emergency evacuation readiness

Contractors need to examine options for each category of security costs that absolutely provide a secure environment, but look for creative ways to get there. For example, use of local government protection for outside the plant perimeter, but project-hired protection inside the fence.

Approach to Social Responsibilities
From a capital cost viewpoint, an owner and contractor’s actions in social responsibility make good sense. Excellent community relations can simplify project execution and set up the plant for success in the future.

Relationship with Local Government
A good relationship with the local government (within the framework of applicable legislation) will help to reduce project execution risk. For example, importing of equipment and materials through local customs can be problematic. Strong, but appropriate owner relationships can quickly solve problems and avoid force majeure incidents and associated EPC cost.

Another piece of the local government puzzle relates to the owner’s legal agreements with the local government. Pre-planning for problems will set the project up for easier problem solving during execution, and lower costs.

Meeting Regulatory Responsibilities
Simplistically, this is a case of knowing the regulations and including the necessary capital cost to comply with the regulations. However, several factors can affect assumptions for capital cost:

- Uncertainties in interpretation of the regulations
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- Could there be changes in regulations during the life of the project – is grandfathering acceptable?
- Probability of success in obtaining deviations from the rules

The project team needs to work to identify uncertainties in regulations interpretation, and either get answers before FID or deal with the potential capital cost risk in contingency.

In the case of a request for deviations, given the lengthy time frames under which governments typical operate, one must obviously start early. However, there can be significant capital cost advantages in doing so.

The timing of regulatory approvals can affect capital cost. For example, in the case of Federal Energy Regulatory Commission (FERC) Approval to Construct (ATC), the owner and contractor are limited in the work that can be done onsite before ATC. This can lengthen the project schedule, which usually adds capital cost.

**Site Selection – Impact on Capital Cost**
There is a great opportunity to save capital cost in the initial site selection. Large costs can be saved or added in areas such as:

- Site soils – as related to needs for piling, rock removal and foundation design
- Seismic conditions – effects on foundations, steel, equipment and buildings
- Site topography – extent of cut/fill, elevation for loadout and site access
- Proximity to feedstock and product loadout
- Weather – effects on construction productivity and winterizing
- Labor availability
- Proximity to local housing versus labor camp size
- Site bathymetric – LNG ship access, water depth
- Marine facilities – loadout jetty length, need for breakwater, dredging
- Marine Offloading Facility (MOF) – proximity to a port; necessity to build an MOF; heavy haul road requirements
- Marine influences – impact on local fisheries, sensitive coral reefs and other environmental impacts
- Local stakeholders alignment with the project objectives
- Local content requirements
- Availability of local utilities, such as electrical power, well water, etc.
- Wetlands – removal, relocation
- Proximity of neighbors – relocation of residents, noise boundaries, prevailing winds, etc.
- Site remediation – demolition and removal of existing structures, hazardous waste removal and trees
- Site protection – for example, berms to protect against storm surges
- Relocation of existing structures such as pipelines, power lines and roads
- Availability of access roads and bridges for heavy haul, construction traffic and plant traffic
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- Adequate lay down area for construction, including space, if needed, to accommodate weather-related sea lifts
- Availability of brownfield facilities, such as existing LNG storage, LNG loadout facilities and buildings
- Extent of modifications to the existing facilities to accept the new plant
- Archeological finds
- Emissions limitations

**Execution Model**
Achieving a fit for purpose, low capital cost LNG project is greatly facilitated with a cost conscious and stakeholder aligned Project Execution Plan (PEP). Some of the PEP-related cost reduction opportunities are addressed below:

**Engineering Execution Model**
Many engineering related costs can be reduced by judicious instructions from the owner, including decisions on what criteria is required of the Pre-FEED and FEED contractors to apply to design. For example, is initial capital cost more important than operating and maintenance costs? The owner can help the contractor find the balance to meet the project needs. When we look at how engineering affects capital cost, some of the major impacts include:

- **Minimum Bulk Materials** – Construction craft labor is heavily linked to bulk materials. Construction cost is a large portion of capital cost. The PEP for pre-FEED and FEED should require a front end design that needs minimum bulk materials. A minimum bulk materials strategy starts with a well-designed plot plan. It continues with project execution strategies that examine the civil/structural, piping, electrical and instrument/control aspects of the project from a bulk material and tagged item minimization point of view.

- **Minimum Kit** – can be defined as the physical facilities to be built on the project. Each of these facilities and equipment items comes with a multiplier of capital cost. For example, if we are able to eliminate a pump, we also eliminate its foundation, piping, electrical and instrument/controls. Engineering studies can facilitate decisions on kit during the pre-FEED and FEED. Many owners will conduct studies to make design decisions for items such as refrigeration compressor driver selection, flare, power supply, gas treatment, LNG tank technology, LNG loadout jetty design and MOF. Such studies, when combined with economics, will yield much better capital cost decisions.

- **Plant Design – Fit for Purpose**
  Major factors influencing plant design include, but are not limited to:
  - **Plant Capacity**
    Plant capacity can have a significant impact in evaluation of project economics. Higher production achieved with fewer pieces of equipment, less bulk material and correspondingly less installation cost will generally result in a lower unit cost of production. Moreover, matching plant capacity with standard supplier equipment design may offer more savings.
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- Technology Selection
  With an eye on capital cost, the following needs to be considered as part of the technology selection process:
  - Proven track record in similar service and an EPC contractor that brings lessons learned from multiple plants in the same technology
  - Analysis of capital costs for other facilities which utilize a given technology
  - Published data
  - Licensor data
  In the case of LNG technology, an owner can select a technology, such as APCI, that does not require an exclusive relationship with a single EPC contractor.

- Avoiding Changes in Design Basis
  Avoiding change starts with the creation of a firm and accurate Project Design Basis for the new facility. Accuracy and consistency will avoid potentially very expensive changes later in the project.

- LNG Tank Design
  Selection of appropriate LNG storage tank design should be assessed via a pre-FID study. The study would analyze the trade-off of required plot space for single containment versus full containment. It would also consider environmental requirements.
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- Owner’s Specifications
  Owner’s specifications can easily impact capital cost. Depending on owner needs, the EPC contractor can either follow owner specifications or propose its own specifications. Often, the EPC contractor specifications will be more cost effective. Why? EPC contractors have to compete and their specifications have been tested for capital cost. In the pre-FID period, an owner can evaluate the EPC contractor specification against operating and maintenance requirements, striking a balance of capital cost versus future plant needs.

- Accuracy of Third Party Data
  For new LNG facilities, owners normally obtain third party data such as gas composition, soils, LIDAR, metocean and bathymetric surveys. A strong focus on quality and accuracy of data will avoid expensive errors and rework in the future.

- Brownfield Work and Multi-Use
  Brownfield facilities are a key part of site selection. There are several opportunities and risks to examine for brownfield work, including:
  - Availability and capacity of existing tie-ins
  - Condition (service life) of existing capacity
  - Accurate scope definition
  - Simultaneous Operations (SIMOPS) issues during construction, commissioning and start-up
  - Avoidance of project creep – addition of out of scope projects increasing the capital cost
  - Consideration of multi-use buildings. For example, a construction warehouse designed for permanent plant use after construction
Procurement Execution Model
In preparation of the Approved Supplier List, owners have an opportunity to take advantage of cost savings in the use of the contractors’ recommended suppliers. This could mean a retreat from one’s comfort zone and fabrication in lesser utilized locations. Consideration of such suppliers has to include:

- Track record of successful performance for the item being considered
- Supplier’s current workload
- Financial condition of the supplier

The owner’s technical and purchasing requirements for suppliers versus that of the EPC contractor constitute another opportunity for review. There may be cost reduction opportunities related to:

- Instrumentation
- Metallurgy
- Valves
- Equipment spacing
- Extent of modularization
- Spare parts philosophy
- Capital spares philosophy
- Shipping requirements
- Fit for purpose philosophy, e.g., be careful about using an offshore specification in an onshore environment
- Owner’s local content requirements

The owner’s commercial purchase order requirements can also have an impact on supplier’s costs. Savings can be had with flexibility in terms such as payment schedules, extended warranties and consideration of owner’s own purchase agreements with suppliers versus those of contractors.
Logistics Execution Model
A project Logistics Study will identify costs and cost reduction opportunities. On a large LNG project, items to consider include:
- Optimization of module size, ship selection, MOF design, dredging and heavy haul road/route/bridge modifications
- Cost savings through use of existing MOF facilities
- Impacts of shipping windows associated with weather, nearby spawning and fishing
- Can the number of seasonal sea lifts be reduced?
- Costs of purpose built carriers
- Agreements with local government which include provisions for material and equipment receipt (at government run ports), handling, storage, security and import duties

Materials Management Execution Model
A good materials management program is necessary to control execution costs and to reduce execution risk. Some of the factors to consider in the Materials Management Plan include:
- Minimize multiple handling during shipping and quarantine
- Strategy for division of responsibility across multiple contractors
- Strategy for free issue of materials to the module fabrication yard and division of responsibility for materials management in the yard
- Strategy for materials in fabrication shops for steel and pipe
- Project-wide bar coding
- Integrated material tracking system – across the project
- Equipment and materials preservation strategy

Modularization Execution Model
Some projects can benefit by increased modularization. A pre-FID module strategy can evaluate and address each of the criteria affecting the decision and extent of modularization.

Items affecting the potential cost savings associated with modularization include:
- Labor availability, skills, wages, labor relations, attitudes toward other country nationals, local government requirements and local content goals
- Configuration of the project to avoid major changes and engineering/procurement delays which could lead to expensive module carryover work at the site
- Configuration of the project to handle modules at an MOF and/or via truck
- Module sizes and site hookup costs
- Selection of the module fabrication yard (MFY) with its corresponding fabrication costs
- Reduced labor costs in the MFY versus the site
- Reduced construction camp costs

We also have to consider the added costs and risks of modularization:
- Shipping costs for equipment and materials to the MFY
- Shipping costs for the modules to the site
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- Costs for MFY management team, over and above the site construction management team
- Additional structural steel required for design and shipping
- Indirect costs of a longer EPFC schedule that are likely required by modularization
- Possible risk of labor unrest (e.g., a requirement for a union stamp)
- Increased schedule risk to the sequence of work required supporting a major module effort
- Costs of unplanned carryover work from the MFY

In the right situation, modularization can save capital cost and reduce capital cost risk. In other situations, it can increase capital cost and overall schedule. If increased modularization is planned, the key to achieving the estimated cost savings will lie in project execution.

**Construction Execution Model**
In terms of capital cost, construction normally represents the biggest part of the estimate. It is well worth pre-FID focus on the construction costs to ensure that these are minimized with a good strategy.

**Construction Labor Costs**
The biggest savings come from not doing work! The above section - Engineering Execution Model, addresses two big influences on construction labor hours: reduction of bulk materials and kit. A strong focus on these will result in significantly lower craft labor hours, and with it, lower capital cost.

Construction wages are another big factor. A pre-FID labor strategy can set forth a basis on how the project will cost-effectively manage the following factors:
- Wage rates - taking into account conditions that may include unions, requirements for local hires, imported labor and other country nationals
- Decision regarding union versus managed open site
- Competitive projects that may drive up wages
- Incentives
- Workforce attraction and retention
- Potential need for a project labor agreement

Such a labor strategy should be based on a formal labor study.

**Constructability**
It is a common LNG industry practice to conduct constructability reviews of key documents. We further propose that the owner put a stronger emphasis on this in the pre-FID phase by working with a direct hire EPC contractor. Such expertise will help greatly in the process. Constructability reviews should not only look at traditional areas such as safety and ease of construction but should aggressively look for construction cost reduction opportunities.

**Craft Labor Productivity**
Further cost savings can be achieved with labor productivity gains. This is a case of the owner working with the EPC contractor in the pre-FID phase with a view towards maximizing productivity in execution. Examples of these opportunities include:

- Site layout – construction friendly
- Temporary facilities – evaluated with a temporary facilities study to examine productivity aspects of the planned temporary facilities. Productivity gains can be had with good layout in areas such as:
  - Adequate and nearby lay down areas
  - Location of tool rooms
  - Site drainage
  - Ablution facility locations
- Path of construction should be examined with respect to costs, looking for opportunities such as:
  - Efficient erection
  - Efficient use of cranes
  - Management of SIMOPS issues with brownfield and/or multiple LNG trains
- Path of construction should be examined with respect to costs, looking for opportunities such as:
  - Efficient erection
  - Efficient use of cranes
  - Management of SIMOPS issues with brownfield and/or multiple LNG trains
- Work hours and rotation cycle - study of these areas can not only yield productivity optimization, but also cost savings associated with overtime
- Effect of transportation on productivity - labor planning for movements to enhance productivity
- Labor planning, supported by a labor study, discussions with local unions, discussions with subcontractors and decisions on the owner’s goals with respect to local hiring and craft training
- Evaluation of the construction camp role in productivity

**Cost of Construction Temporary Facilities**

- Construction camp study work can ensure that the right number of beds have been specified and costs optimized

**Reduced Risk in Construction Costs**

Another aspect of construction costs relates to the pre-FID planning to recognize and avoid costs associated with certain construction risks. Risks such as:

- Labor relations, strikes
- Storm surge, high winds, earthquakes

**EPC Schedule**

EPC Schedule – A cost-effective EPC schedule should be aggressive, but not so short as to create unnecessary risks. A good EPC schedule facilitates cost-effective work, very little risk engineering and minimum workaround(s). If modularization is involved, additional time in the schedule must be allowed for the out of phase work.

**Budgets & Schedules for Pre-FEED & FEED**
Pre-FID planning will be critical to achieving the lowest capital cost. Such pre-FID work, unfortunately, requires a lot of effort. The owner is strongly encouraged to authorize appropriate budgets and schedules for pre-FEED and FEED phases.

**Contract Terms**

Owners can save money with risk-managed EPC contract terms. From a capital cost view, the party best able to handle a risk should take responsibility for it. Examples of risk areas which can, if overly stringent, add additional cost:

- Terms of liquidated damages associated with schedule
- Payment terms
- Process guarantees
- Extended warranties

**Application of Cost Reduction Techniques**

It is sometimes necessary to reduce a capital cost estimate in order to reach FID. The cost reduction techniques will vary, but the following are common reasons:

- Technical Basis can be adjusted to save money
- The execution model can be revised for lower cost
- Scope included that may not be cost effective
- Contingency can be adjusted and added cost risk is assumed

In any of the above situations, it is recommended that the project team prepare an execution plan to achieve the desired cost reductions.

**Owner’s Key Agreements**

Early work with a major EPC contractor can identify key issues that need to be negotiated with host governments. Some of the issues that emerge are:

- Taxes
- Customs and importing
- Use of local utilities
- Local waste disposal
- Traffic

Development of such host government agreements will improve capital cost certainty.
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**Working with an EPC Contractor**
During the pre-FEED and FEED Phases, an EPC contractor can work with the owner to prepare a cohesive and consistent project model that meets the owner’s requirements. Capital costs can be evaluated at the end of pre-FEED, as a checkpoint, to ensure that the capital costs are in line with expectations. The FEED phase then adds detail, further cutting costs, as appropriate. Near the end of the FEED, the contractor can prepare an open book estimate, permitting the owner to closely examine the detailed project costs. Such a model works quite well for the owner, permitting negotiation of a capital cost that is solidly based on a detailed scope and a cohesive execution plan.

**AFTER FID - WORKING WITH THE EPC CONTRACTOR TO SUCCESSFULLY COMPLETE THE PROJECT**

After FID, the owner’s task will be to manage the EPC work in such a manner as to meet or improve upon the project goals related to HSE, quality, budget, schedule, commercial, local content and stakeholder engagement.

**Minimum Change from the Basis of the FID**
Hopefully, the owner is starting with a robust FEED, a solid Project Execution Plan, a great price, a good EPC schedule and a clear contract. The key now is to execute the project, while minimizing changes from the FID basis. Minimum change permits work to be done on an orderly basis according to the model that formed the FID.

**Working with the EPC contractor**
One of the keys in meeting the budget is to work closely with the EPC contractor. Let us examine some of the methods successfully used on past projects.

**Contractor Team**
Contractor team selection is one of the keys to success (and controlling capital costs). One of the first steps will be to get to know them very well to understand their roles, such that the owner team can effectively integrate.

**Resident at Contractor Offices, Module Fabrication Yard and at Site**
Owners who put in the time at contractor offices are rewarded with timely information, which permits *early* action to assist the contractor to resolve cost issues.

**Avoiding a Slow Start**
Projects that start out behind schedule usually struggle all the way through. When this happens, the project team can spend more time defending than recovering progress. Working with a single EPC contractor pre-FID facilitates a fast start at FID. The project leadership is already in place and the owner/contractor team will already have experience working together.
Meeting Schedule Dates
EPC projects usually succeed or fail because of performance early in the project. This is particularly true for module projects. A wise old project control manager once told the writer that, in his experience, “Projects that make their schedules always finish within their capital cost budget.” While this cannot be guaranteed, the odds of making budget are greatly improved. The point is that the owner and the contractor should work together early on to achieve the engineering dates that support the procurement and vendor data. The vendor data will support the detail engineering to support the module, pipe and steel fabrication. Construction managers are almost always successful if they have the correct drawings, equipment, modules and materials on site when they need them. So the first focus from the project kickoff needs to be on achieving the engineering and procurement dates. If the project does not achieve the engineering and procurement schedule, module fabrication and construction will have difficulty in rescuing the schedule. With the schedule delay comes the increased capital costs due to schedule mitigations and extended indirect costs.

Further Suggestions for Working with Your EPC Contractor
The following are additional suggestions for working with your EPC contractor, to control capital cost and avoid unnecessary cost risks:

Engineering
Key principles to control post-FID capital costs include:
- Minimize engineering change from the basis of the FID
- Support the contractor in achieving the engineering schedule dates, especially in the early part of the project
- Support the contractor in preparation of high-quality detail engineering documents by carefully defining and agreeing on the owner requirements for any engineering deliverable prior to start
- Perform owner reviews of documents that, if changed later on in the project, can have a big cost impact on the project. Typical big-impact engineering items will include:
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- Basis of Design
- Process design and driver selection
- Surveys: geotechnical, bathymetric, topographic, metocean
- Brownfield assumptions
- Plot Plan
- Module configurations, weight limits, envelope limits
- P&IDs
- Electrical One Lines
- Control philosophy
- Piling design
- LNG tank design
- LNG loadout jetty configuration
- Major equipment requisitions

Procurement
Owners can contribute a lot to the procurement success on the project. Some of these opportunities include:
- Integration of the owner’s and contractor’s Approved Supplier Lists
- Advance planning for owner review of supplier drawings. This will enable the contractor to ensure that schedule time is included
- Advance planning for the owner’s desired supplier inspection hold points in fabrication

Module Fabrication
Module fabrication comes with its own requirements. There are a number of keys to success and cost management for module projects:
- The engineering must be completed on schedule
- Timely engineering will lead to procurement of free issue materials, fabricated materials and equipment on schedule
- The module yard will have a high chance of success when they have what they need and when they need it
- The remaining focus will be on finishing the module in the yard to avoid unplanned carry over work to the site

Construction
Remember the commonly discussed “Cost Influence Curve”? The one that shows the best opportunity to influence capital cost is early in the project and that the opportunities to influence progressively diminish as the project proceeds? By the time that the construction ramps up, we will have set the stage for a successful project with engineering, procurement and fabrication work on schedule. The Construction PEP and the site team will set the stage for success in the field.
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It is suggested the project center of gravity move to the site when the engineering is mature. Joint contractor and owner presence at the site will facilitate early coordination to solve problems and make decisions.

Local government relations can have a large impact on project execution success and associated costs. Owners can add a lot to the cost predictability and risk mitigation with a government relations team during construction.

It is easier to understand a plant design and layout when one physically sees it in the field. From a cost (and schedule) viewpoint, this can lead to late and costly changes. Many of us have heard comments during construction, such as:

- “It is not going to be easy to maintain this pump in its present location. It really needs to be moved to [fill in the blank]”
- “I didn’t know that we have a valve there. Can’t we move it, so it can be [fill in the blank]”

The key is to get owner Operations involved in engineering, starting in pre-FEED. Try to assign operations personnel who will be able to stay with the project through the initial operation. Assignment of new Operations personnel in future phases will greatly increase the risk of costly changes late in the project.

**Commissioning/Turnover**
Some projects experience painful system turnovers due to lack of alignment of the requirements for turnover package documentation. This is a case in which early planning for systems and turnover packages can avoid costly delay.

**Brownfield Interface**
Another area in which owners can avoid costly delay is in the interface with brownfield operations. An example of this would be agreement on how tie-ins are to be made to existing facilities for control systems. Close communication and planning throughout the project will help to avoid any surprises.

**Project Controls**
Project controls are a critical tool for both contractors and for owners seeking to stay within their capital cost budgets. Cost control, when teamed with robust forecasting, provides the advance information for owners to take early mitigating actions to solve problems.

Cost control of lump sum contracts – The key to success on lump sum contracts is to minimize change from the basis under which the contract and price were set. High-quality pre-FID work and a commitment to the post-FID plan will reduce cost risks.

Cost control of reimbursable contracts – As with lump sum contracts, high-quality pre-FID work and a commitment to the plan will promote cost predictability. However, it is critical to execute the reimbursable work with a lump sum mentality, managing change and working to budgets.
Contractor Joint Ventures
An area of cost exposure relates to contractor joint ventures and the success of such joint ventures. We suggest that owners select EPC contractor joint ventures that have a track record of successful LNG projects.

Cost Decisions during Execution
Even with the best EPC contractor, best contract, best PEP and best budget, we likely will need to make cost decisions during execution. Such decisions often require tradeoffs between capital cost, schedule and quality.
  o In making tradeoffs, it is suggested to start with quality – the project needs to conform to the facility requirements. Requirements can be adjusted (e.g., shift in scope), but the project has to be fit for purpose and produce LNG.
  o Schedule – The discipline of working to a good EPC schedule promotes predictability on cost. In some decisions, overall project-wide cost ramifications have to be considered for a schedule deviation. For example, releasing a module from the yard before it is finished. Schedule delay decisions have to consider not only CapEx but also delays to LNG production.
  o Cost – ultimately, after HSE, it is about the money. Estimates of cost impacts will help to make the right calls when making decisions.

Force Majeure Events and Mitigation
Force majeure events can hurt the cost performance of an otherwise well-executed project. One of the keys to mitigating the cost impact is in the risk analysis completed before FID. A good risk analysis will examine the potential force majeure events, assign probabilities and determine if/how much contingency should be included to address them. One cannot remove all uncertainty without over-pricing projects, but we can address or soften the blow of the higher probability occurrences.

SUMMARY
To summarize, the best opportunity to lower capital cost is before FID. We have the flexibility before the EPC contract to adjust scope, execution model, plant design, layout and kit. After FID, the die is cast, the EPC contract is signed and changes can be more costly. Completing the project within budget becomes a matter of working to the PEP while diligently anticipating and solving problems. A good risk analysis will help to ensure that additional costs will be within the contingency. The contractor and owner will have successfully ridden the tiger to project completion and within the budget!
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