Megaproject Risks

Considerations for the Alaska LNG Project

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Pegasus's 2019 Report Overview

- Engaged by the State to provide advice concerning the risks associated with megaprojects, including specifically the proposed Alaska LNG project.
- Reviewed the Trans-Alaska Pipeline System (TAPS) and Strategic Reconfiguration project execution and issues encountered.
- Identified issues commonly realized on megaprojects.
- Discussed impact of cost overruns.
- Provided examples of contract tools to mitigate risks.

Megaprojects Defined

- Typically have costs in excess of $1 billion USD.
- Comparably high benefits and correspondingly high risk.
- Multi-year construction, often longer than a decade from feasibility planning through execution.
- Many diverse stakeholders that can have substantial impacts on the project (strategically, environmentally, economically).
- Unique aspects/scopes (i.e. not a bigger version of a smaller project).
- Conventional project management processes and priorities often not sufficient.

Megaproject Challenges

- Inherent risk exposure due to long planning/execution horizons and complex interfaces.
- Technology/components that are often not standard (including FOAK).
- Decision-making and planning involves multiple parties with conflicting interests.
- Unplanned events (black swans) are often not accounted for, but megaprojects have high exposure and high resulting impacts.
- Over optimism on costs, benefits, and risk treatment.

LNG Project Risks

Examples

Risk Category	Risk Factors	
Economics	• High project costs	• Changing market conditions
Design	• Defective design • Design changes	• Delay in approvals
HSE	• Force majeure (earthquake, pandemic) • Adverse weather • Site safety	• Permit compliance • Accidents (human, vehicle)
Security & Social	• Sabotage/protest	• Labor strike
Supply Chain	• Invalid materials/poor quality • Supplier monopoly	• Delays in material/equipment supply
Financial	• Supplier/contractor bankruptcy • Inflation and interest rates	• Tax burdens
Construction	• Unforeseen site conditions • Low productivity • Equipment failure	• Quality/rework • Missed execution windows

Cascading Project Risks

Examples

Realized Risk	Immediate Impact	Ripple Effects
Weld failure	Hydrotest stop	Rework → schedule slip → in-service delay
Slope failure	Safety hazard	Reroute with new design → new permits → resequencing → schedule slip
Equipment/material delay	Resequencing	Schedule slip → contractor claims → in-service delay
Environmental violation	Stop work order	Regulatory reset → stakeholder backlash → schedule slip
Low productivity	Less work completed than planned	Schedule slip → contractor claims
Contractor bankruptcy	Work stops	Secure site → source replacement contractor → schedule slip → claims from original contractor

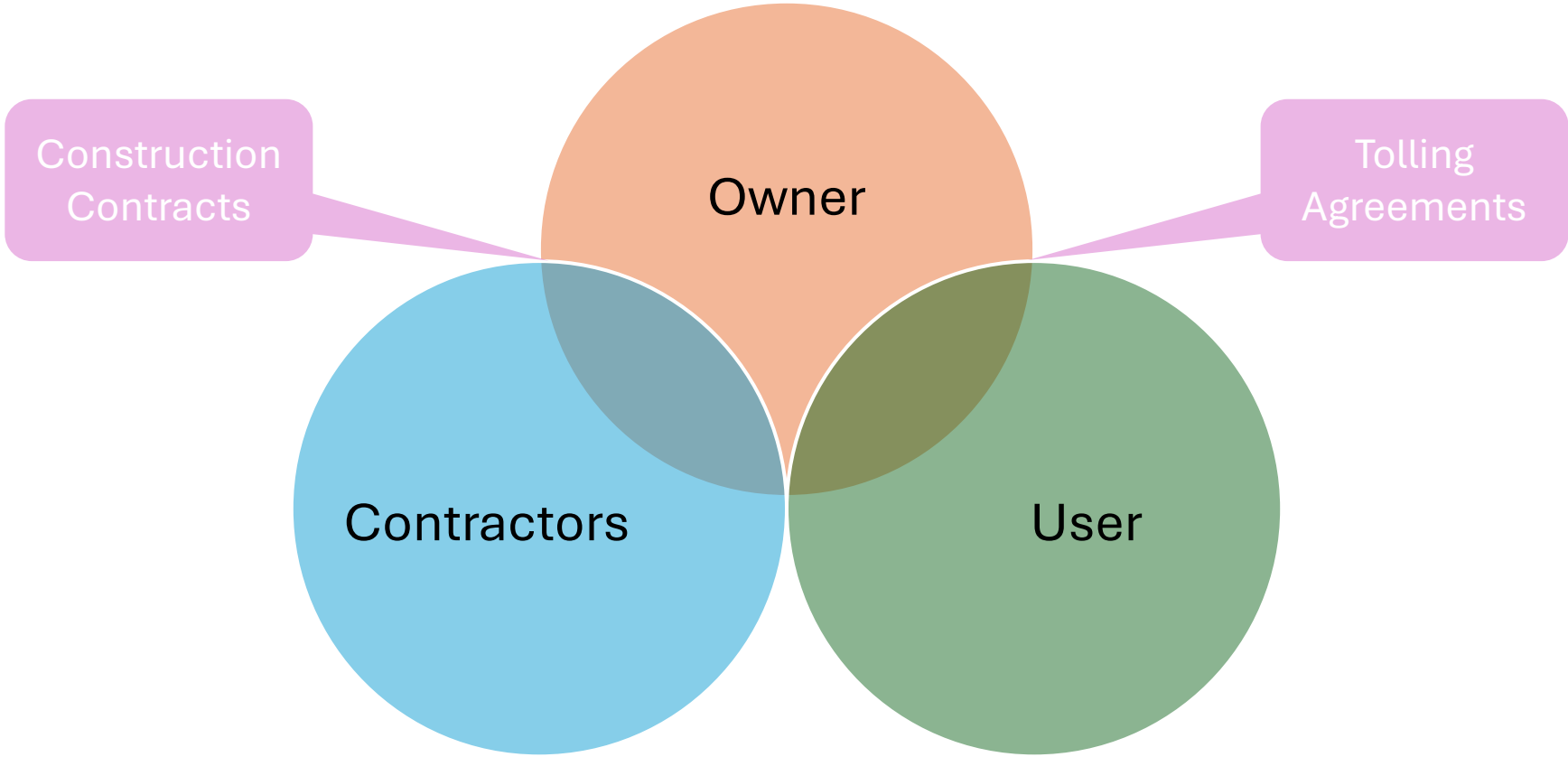
The “Iron Law” of Megaprojects

“Over budget, over time, under benefits, over and over again.”

– Bent Flyvbjerg

92% of megaprojects come in over budget, over schedule, or both!

Who Pays for Project Cost Overruns?



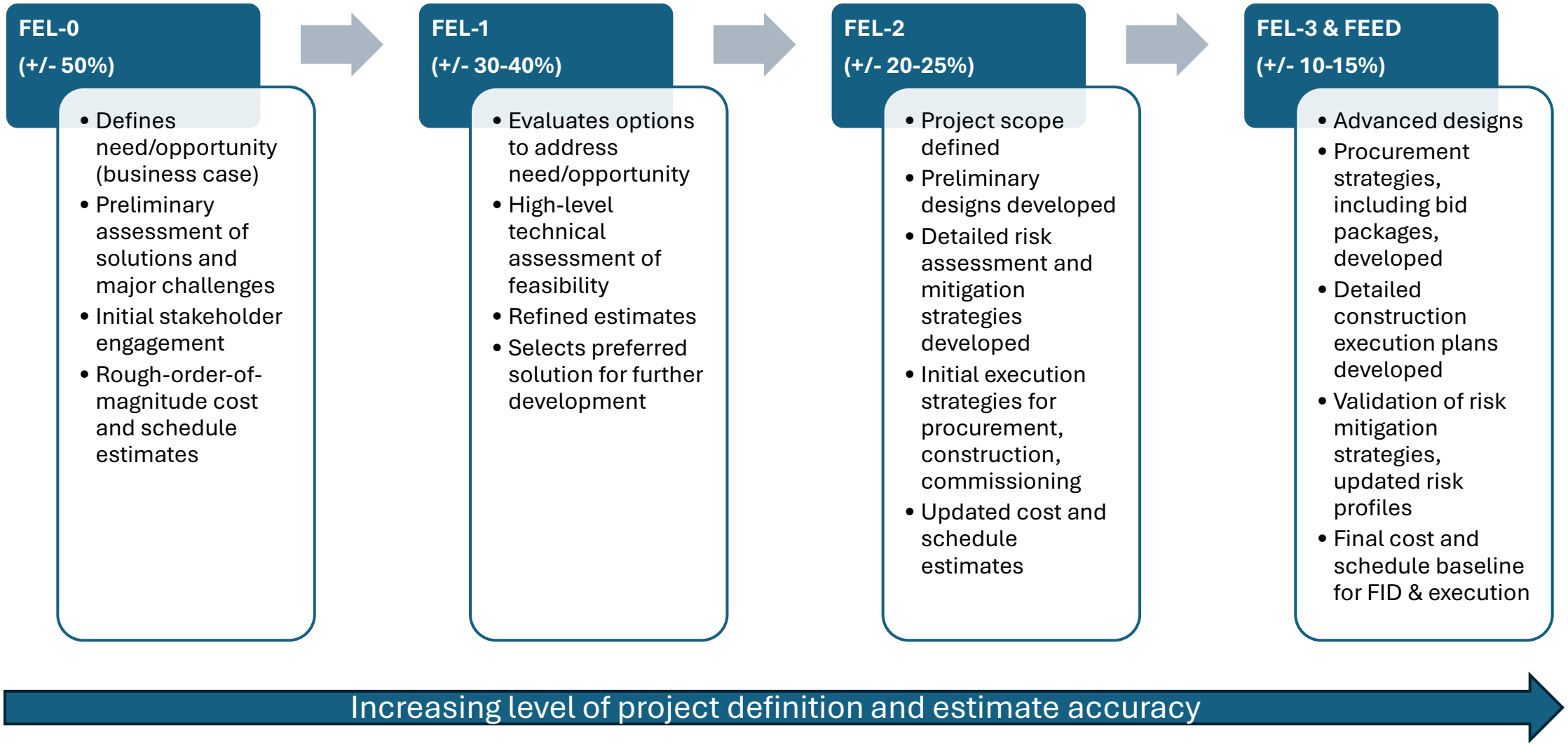
EPC/EPCM Contracting Approaches

Element	Traditional EPC/EPCM	Collaborative EPC/EPCM	Integrated Project Delivery
Contract Structure	Bilateral, risk-transfer	Traditional contract with collaborative elements	Single multiparty alliance agreement
Risk Allocation	Contractor bears major risks	Shared influence, some risk sharing	Fully shared risk/reward pool
Cost Model	Lump-sum, cost-plus, or unit-rate	Hybrid	Target cost
Incentives	Protect margin, avoid liability	Mix of traditional + collaborative incentives	Aligned with project objectives
Transparency	Limited	Moderate	Full open book
Dispute Culture	Adversarial	Reduced	Avoidance

Construction Contracting Considerations

- Size and complexity of megaprojects can require multiple delivery methods and contracting approaches.
- Risk should generally be assigned to the party best able to manage/mitigate it.
- For a contractor to assume a risk, additional costs and/or contingencies are expected.
- Cost-plus and time and materials contracting approaches run the risk of the contractor low-balling the bid to win the award, leading to extensive change orders.
- Firm price/lump sum contracting approaches run the risk of the contractor adding excess contingency – and still has the risk of disputes if major issues are encountered.
- Alliance/collaborative contracting can benefit complex, highly uncertain projects by balancing risk allocation and supporting alignment on project objectives.

LNG Project Pre-Execution Phases



Factors Influencing Project Definition & Estimate Accuracy

- Project site in remote locations with unique logistical and environmental issues.
- Feasibility studies often focus on technical issues and less on business or project delivery issues.
- Stakeholder pressure for a predetermined value (biased estimate).
- Systemic risks, including:
  - Uniqueness of project vs. reference data available
  - Project execution complexity
  - Quality of estimate data/experience of estimate team
  - Market and economic conditions
  - Accuracy of geotechnical data
  - Geo-political, environmental, and regulatory circumstances

Risks of Delayed FID

- Escalating project costs
- Market opportunity loss
- Supply chain disruptions
- Regulatory/permitting challenges
- Erosion of stakeholder confidence
- Project team attrition

Trans-Alaska Pipeline System

GAO Report Findings – Challenges and Cost Overruns

- Site-specific Challenges:
  - More groundwater than anticipated.
  - Underground construction required deeper/wider trenches than planned.
  - Wide variations in soil conditions.
  - Permafrost more difficult to move and drill than planned.
  - Less backfill material sites available, requiring additional hauling.
  - Tolerances for valve support structures far more critical than planned; temperature changes and settlement required realignment.
  - Productivity impacts in cold weather.
- Construction Cost Overruns:
  - Feasibility estimate contained no allowance for escalation (also experienced 4-year delay to start of construction).
  - Insufficient contingency (10%) compared to status of engineering and project risks.
  - Underestimated amount of elevated pipe.
  - Additional infrastructure required, but not in initial scope.
  - Underestimated support structure (camps, airstrips).
  - Underestimated scope for environmental requirements (vapor recovery, ballast water treatment system).

Trans-Alaska Pipeline System

GAO Report Findings – Lessons Learned

- Initial and subsequent cost estimates should be viewed with skepticism.
- As much site-specific data as is feasible should be obtained.
- Technical and geological uncertainties should be thoroughly investigated.
- Government approval should be contingent on detailed planning for management control, including cost controls.
- Future project expenditures should have an ongoing government audit to protect the public’s interest.

Strategic Reconfiguration Project (2004)

Prudence Review Findings

- Project engineer lacked Alaska experience, failed to effectively manage the project.
- Poorly defined scope at sanction, leading to poor cost/schedule estimates.
- Reduction of project contingency to an unrealistic level to improve project economics.
- No meaningful oversight by project owner.
- Failure to rely on internal project risk assessments.
- Assumed control of project at Supplement 1 decision point, despite insufficient resources to do so.

Brief Background on the Alaska LNG Project

Public Cost Estimates

$45 to $65B

$38.7B

$44B

$10.8B (Phase 1)

- 2014: SB 138 establishes the framework for commercialization and development of North Slope natural gas.
- 2014-2016: Preliminary agreements reached with North Slope producers, AGDC and partners advance preliminary design and permitting.
- 2016-2017: Change in administration shifts emphasis towards more state control, private partners scale back involvement.
- 2018-2019: AGDC files applications with FERC.
- 2020-2022: Global LNG market downturn slows progress; continued permitting and environmental reviews.
- 2023-Present: Renewed interest in the project; Glenfarne acquires majority ownership of 8 Star Alaska, leads FEED development efforts towards a FID.

Open Questions on the Alaska LNG Project

- Status of preliminary planning (e.g. geotechnical, constructability, and environmental studies).
- Scope of the FEED Study efforts.
- Strategic approach to Phase I/Phase II.
- Robustness/quality of current estimate supporting FID.
- Status of program management plans.
- Status of the project's risk management program.
- Availability of contractors/laborers to support the project needs.
- Oversight of Glenfarne.

Recommendations

- Detailed review of the FEED Study (including updated cost estimate).
- Readiness reviews prior to FID and prior to execution.
- Perform a contract risk review for the EPC/EPCM contract.
- Independent project monitor/advisory committee during execution.

Thank You

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