

CAPEX VaR: Key to Improving Predictability

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There is a crisis in CAPEX management in the energy industry. With capital expenditure (CAPEX) representing a significant percentage of net income (in some cases, well above 100 percent), the loss of predictability of capital project costs presents a serious challenge in decision making and control.

A significant percentage of a typical oil company's CAPEX plan is likely to be spent on complex and risky "mega-projects" (those that cost more than \$1 billion), which must be planned and executed in a highly demand-driven marketplace. It is not uncommon for the costs of such projects to double. The prospect of this sort of executive surprise is particularly troubling given the increased visibility of project performance resulting from Sarbanes-Oxley requirements and increasing shareholder concerns.

If CAPEX performance is to become more predictable, executives should consider the governance model for CAPEX risk management. Many owners are still using the traditional model, and this may well be the root cause for the lack of confidence in capital-cost outcomes. The traditional model tends to ignore the inherent volatility of project cost estimates, discourage upward communication of uncertainty and risk, and place complete responsibility for the outcome in the hands (or on the head) of the project manager.

Today's CAPEX program requires a better model: one that recognizes the variability of cost outcomes, encourages upward communication and provides clear allocations of responsibility with appropriate authority for addressing both strategic and tactical risks. Large, international mega-projects inevitably have significant strategic risks that a project manager is simply not able to manage.

Value at Risk (VaR) is a well-accepted method that provides an executive with a quantitative measure of the volatility in an investment portfolio. It is time to recognize that a similar volatility exists in a CAPEX portfolio due to the risks of capital-project cost overruns.



This article explains the principles of CAPEX VaR and suggests practical applications to improve capital-project predictability.

The Importance of Predictability

Recent events and trends have brought the issue of CAPEX predictability into sharp focus. For example:

July 15, 2005: The *Wall Street Journal* reported: "Shell's Costs Soar for Russian Project – Price Tag of Sakhalin II May Double to \$20 Billion." At the same time, in conformance with SEC requirements, Shell issued a report attributing the cost overrun to "significant ... cost and schedule challenges." As *Business Week* (May 15, 2006) put it: "Cost overruns are threatening Shell's reputation with investors and the Russians."

How could Shell, well-respected and highly experienced in international project management, have experienced such a major cost overrun?

May 29, 2006: The *Houston Chronicle* reported that Richard Kinder, chairman and CEO of the pipeline company Kinder Morgan, explained the reason he was initiating what could be the largest management buyout in U.S. corporate history by saying: "At (a share price of) \$84.41, investors are saying, 'There are risks to these projects so we are putting a heavy discount on (the share price)!'." Kinder went on to suggest that the company's earlier market price of \$100 was a more appropriate valuation.

Why would the investment community be so concerned about the risks in North American pipeline projects as to significantly downgrade the stock of a well-respected midstream company?

It seems CAPEX predictability is becoming hard-wired to financial performance, and therefore to the investment community's perception of the value of energy corporations. Using the analogy of Value at Risk, it is helpful to recognize that the organization's CAPEX portfolio has a similar aggregation of risk across its capital projects. We therefore refer to this as CAPEX VaR.

The Challenge of Predictability

Why has CAPEX predictability become such a major concern? There are numerous causes:

- **Mega-projects in difficult locations are prone to cost overruns.** As oil and gas exploration has moved into more remote and hostile locations, larger CAPEX budgets are required to deal with the logistics and economies of scale. The resulting mega-projects are much more difficult to plan and control, and as reported in *Upstream* (May 23, 2003), statistics demonstrate they have a 50/50 probability of becoming "mega-wrecks."
- **High oil prices are driving a seller's market for materials, equipment and services for drilling, engineering, and construction.** The rapid increase in engineering and construction market activity has resulted in cost escalation up to 60 percent higher than in 2004. It is now difficult to obtain firm pricing on which to base a sanction-quality estimate.
- **Contractors are less willing to accept risk.** High demand for engineering and construction services, plus a history of past losses on fixed-price contracts, have dramatically reduced contractors' willingness or ability to accept risks they consider excessive. This also extends to a reduced willingness to provide guarantees, as well as increased difficulties in bonding.

- **Smaller companies are doing larger projects with minimal internal resources.** It is not uncommon to find independents with CAPEX budgets well in excess of their net income. In many cases, these companies may be undertaking a project that is far larger than any they have done before, requiring resources that may not be available.
- **Industry demographics are causing larger projects to be managed by less-experienced people.** At the same time that larger projects require experienced project managers and teams, the industry continues to sustain a net loss of experience.

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- **Increased power and expectations of national oil companies impact project plans, economics and execution.** National oil companies expect their international oil company partners to be able to manage costs and maintain value in their deals, while simultaneously placing greater demand on local content and other requirements.
- **Commercial commitments to secure an opportunity are often required well in advance of sanction.** Early commitments to close the deal must often be based on very preliminary cost estimates.

A scan of these risks reveals a common theme: They all require management at an organization level above the project manager and team. We call these strategic risks and suggest that these are key to CAPEX predictability. These strategic risks are most often ignored or undervalued in traditional estimating and risk-assessment techniques that are based on an evaluation of the estimate values.

Governance for Strategic Risk

Improving Risk Governance. In his recent book *Megaprojects and Risk*, Professor Bent Flyvbjerg concludes that cost overruns for multibillion-dollar infrastructure projects (such as the English Channel tunnel) are due primarily to the fact that the project was underestimated to begin with. He goes on to suggest that this "appraisal optimism" represents rational behavior on the part of most participants, who have far more to gain if the project moves forward.

We suggest that this phenomenon is present in the energy industry as well, and that major capital projects are often underestimated, particularly in the early stages when a deal must be captured. When we look at the reasons for this underestimation, our experience suggests the organization's governance model is generally not structured to recognize, quantify or communicate the cost impact of strategic risks. In fact, most current governance structures tend to *discourage* the disclosure of strategic risks.

It should be no surprise that major CAPEX investment decisions are often made without a full understanding of the risks and their likely impact on cost.

If the governance structure is organized such that a management focus is brought to the identification and understanding of strategic risks, and matched with the correct level of authority, many of these risks can be managed or avoided.

What is wrong with the typical governance model for project risk?

First, risk assessment is left to the project team. Risk assessment at the project-team level generally fails to identify all the risks because it is:

- Anchored on the cost estimate and based on a range of possible variations to the assumptions and data on which the estimate was based.
- Limited to the types of risks a project team is permitted and able to control. (For example, scope

risks are generally excluded as they are usually not the responsibility of a project team.)

- Used as the basis for calculating estimate contingency, a number that project teams often fear will provoke criticism if it is perceived as too high.

In many organizations, this restricted, project-level assessment of risk is the only assessment on which the sanction decision is based.

At the project-team level, the strategic risks are generally ignored, specifically excluded or undervalued. This is rational behavior by the project team, whose members know they do not have the authority to address these risks. They therefore focus on their deterministic, "bottom-up" cost estimate, which is of necessity based on a narrow set of assumptions that exclude even more potential variations. As the estimated cost is communicated up the organization, these omissions are rarely highlighted; the result is that management cannot fully understand the true volatility of project cost. So it should be no surprise that major CAPEX investment decisions are often made without a full understanding of the risks and their likely impact on cost.

Barriers to communication are the second reason energy industry executives often lack the information needed to manage CAPEX risk. The usual concerns about the consequences of delivering bad news at high levels are even greater when the subject is risk. When a project manager is held personally accountable (with significant career risk) for meeting budget and schedule – including managing the strategic risks outside his or her authority – it is not surprising that open communication suffers.

With the correct roles and responsibilities for risk, risk management can be effective. Figure 1 illustrates this point.

Organizations that seek to manage CAPEX risk effectively must provide clear accountability and authority to address strategic risks. As Figure 1 illustrates, under this recommended structure, the project manager is responsible for managing the tactical risks (which are covered by contingency), and the project executive is responsible for managing the strategic risks, the funding for which is not released to the project.

The chart illustrates how, when management does not address strategic risks, these eventually are manifested to the project team as tactical problems. For example, failure to manage partner issues can result in approval delays that impact schedule and cost. Although partner issues generally require attention at the executive level, such a management failure makes it seem as if the project manager and team have lost control.

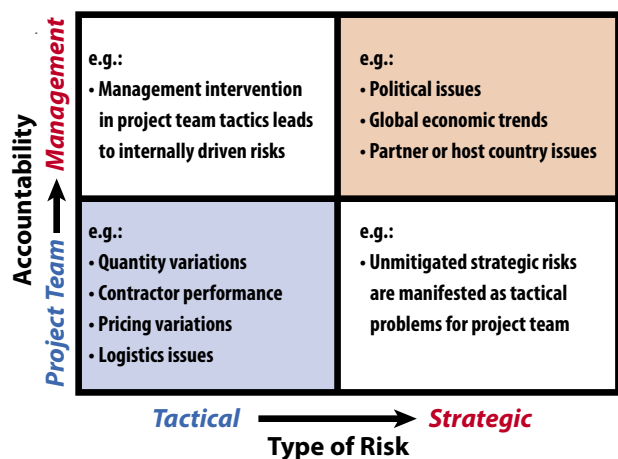


Figure 1: Risk types and responsibilities

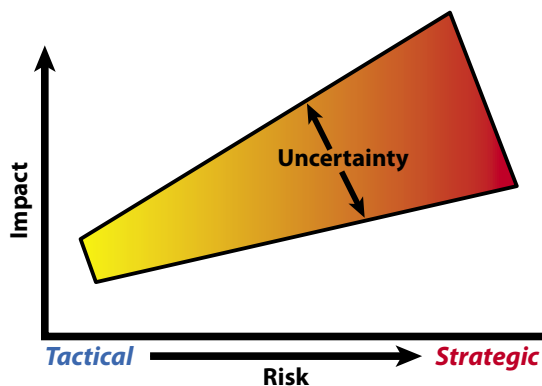


Figure 2: Uncertainty and impact increase as risks become strategic.

Improving Risk Assessment. As risks become more strategic, they tend to be characterized by greater levels of uncertainty, and their potential impact on capital cost increases as well. This is illustrated by Figure 2.

The assessment of strategic project risks requires an approach that recognizes these high levels of uncertainty and potential impact. Our experience shows simplified scenario planning to be a useful approach to identifying strategic risks and impacts.

The strategic project risk assessment begins with defining categories of strategic risk. These should be risks to capital cost that have been ignored or only partially considered in the estimate. For example, the first category might be scope risks. These are usually excluded from the estimate (even if they are likely) since the project team is usually not empowered to control whether they occur.

The next step is to develop scenarios representing the worst and best cases. Using the example of scope risk, some scenarios might reflect risks revealed by new information. For example:

- Yet-to-be-determined issues with site conditions could require significant increases to the civil design.
- Additional power generation might be required.
- Updated reservoir characteristics could require additional topside processing facilities.

Once scenarios have been established, cost impacts are defined. These risks can then be modeled and a probabilistic value calculated. This can be used to establish a so-called financial risk reserve. Note that, unlike project-level risk calculations that are expressed as ranges about the estimate, the calculation of strategic risks is zero-based (i.e., starting with the assumption that no additional funding is required to cover these risks). Best- and worst-case scenario development is enhanced when the anchor to the base estimate is removed.

In order to ensure an open discussion of risks, scenarios and impacts, experience suggests that an objective, third-party facilitator is essential.

Improving Risk Management. Armed with realistic estimates of cost and risk, an executive can understand the risks at a early point in the CAPEX investment process where risk management can be effective. For example, this type of analysis is useful:

- to "tune" the commercial deal consistent with the risks
- to support the financing process
- to educate partners in risk/reward issues

Examples of executive decisions or actions that may be used to address strategic risk include:

- breaking a mega-project into lower-capacity sub-projects to be executed sequentially
- using creative contracting strategies to optimize the allocation and pricing of risk
- applying other resources to address specific risk issues
- deferring or canceling the project

Experience shows simplified scenario planning to be a useful approach to identifying strategic risks and impacts.

When a financial risk reserve is established as a result of the strategic risk analysis, it is clear that, unlike the contingency that is included in the project budget, these funds are released only as each of the strategic risks can be demonstrated to occur. The assessment process described earlier provides sufficient detail on which to base this funding-release process.

CAPEX VaR Provides the Basis for Improved Governance and Risk Management

We have shown how the financial risk reserve can be calculated for a given project. These individual risk reserves can then be aggregated across the project portfolio, using standard techniques such as Monte Carlo simulation.

Executives can take the lead in improving predictability by:

- improving communication to make sure risk information flows freely uphill
- placing accountability and authority for managing strategic risks at a level high enough to be effective
- requiring the assessment of strategic risks (in addition to the traditional project-level risk analysis)

and incorporating financial risk reserve into the management of the capital project portfolio

It is important to recognize that, while tactical risks are usually specific to each project, strategic risks are likely to affect many projects.

CAPEX VaR can be used to manage risks for a portfolio of projects just as VaR is used in the financial community. We define CAPEX VaR as the aggregate risk in a capital project portfolio, expressed as the potential dollar impact. It is important to recognize that, while tactical risks are usually specific to each project, strategic risks are likely to affect many projects. Therefore, CAPEX VaR can be a vital source of information in CAPEX investment decisions. ■

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Author of five books on project management, Mr. Westney has served as a visiting faculty member at Texas A&M University and the Norwegian University of Science and Technology, as well as an instructor for construction executive programs at Texas A&M and Stanford Universities.

Mr. Westney began his oil and gas career in the Project Management Division of Exxon Research & Engineering Company. He formed Westney Consulting Group in 1978.

He is a fellow and past president of the Association for the Advancement of Cost Engineering and received that association's highest honor, the Award of Merit. Mr. Westney received a B.S. in mechanical engineering from the City College of New York and an M.S. in management science from Rensselaer Polytechnic Institute. He is a graduate of the three-year Owner/President Management Program at Harvard Business School.

Keith Dodson is cofounder and senior partner of Risk Resolution LLC, a Westney company, where his focus is on supporting owners and contractors in the identification, assessment and monetization of strategic risks.



Mr. Dodson joined Mr. Westney in founding Risk Resolution LLC in 2003. He began his career with Brown & Root in the project controls and estimating area. At Brown & Root, he held executive roles related to project management and construction, rising to senior vice president and president of Brown & Root Engineering and Construction International. Mr. Dodson then took a domestic assignment as President of Davy McKee, U.S. After Davy McKee was acquired, he then spent several years as vice president of M.W. Kellogg, as CEO of M.W. Kellogg Ltd. and as president of Dresser Kellogg Energy Services.

Later in his career, Mr. Dodson held roles assisting companies who were experiencing troubled projects. During this time he was senior vice president and business unit leader of Stone & Weber Engineering Corporation, senior vice president of Enron Corporation, chief operating officer of Enron Engineering and Construction and president of Petrofac LLC.

Active in numerous professional organizations, Mr. Dodson served as chairman of the Construction Industry Institute and of the Engineering Foundation of the University of Texas at Austin, and he is a member of the National Academy of Construction. He is a graduate of the University of Texas at Austin and the Advanced Management Program at Rice University.