

David Lucas: Cost Management in a Complex Contracting Environment

Contracting is a primary method that both Owners and Contractors utilize to allocate identified risks associated with a project. In today's global construction market, the risks associated with long term major capital projects is high due to various supply and demand factors. This requires both the Owner and Contractor to be innovative in their contracting strategies in order to mitigate their perceived risks.

This practical paper utilizes a sample of projects from American Electric Power's (AEP) environmental retrofit program to evaluate the implications of complex contracting strategies on accurate and reliable cost forecasting. In addition, this paper examines the complimentary balance of technical, business, and interpersonal skills that a cost analyst, or cost analysis team, should possess in order to succeed in this environment.

AEP'S ENVIRONMENTAL RETROFIT PROGRAM

AEP is one of the largest electric utilities in the United States, delivering electricity to more than 5 million customers in 11 states. AEP ranks among the nation's largest generators of electricity, owning nearly 36,000 megawatts of generating capacity in the U.S., and owns the nation's largest electricity transmission system. AEP, based in Columbus, Ohio, celebrated its 100th anniversary in 2006 [1].

AEP is currently engaged in an environmental retrofit program as part of an ongoing strategy to comply with the federally mandated Clean Air Act, Title IV regulations, Clean Air Interstate Rule (CAIR), and begin steps toward compliance with the Clean Air Mercury Rule (CAMR). Investments to retrofit advanced emission control technologies onto existing power plants are a central element to AEP's compliance strategy.

AEP's environmental retrofit program has an overall capital budget in excess of \$3.5 billion to be utilized to install Flue Gas Desulfurization (FGD), Selective Catalytic Reduction (SCR), and associated modifications on six (6) major sites between 2004 and 2010. The program is managed by a Project & Field Services organization within AEP that utilizes various Architect/Engineers, OEM's, and contractors to execute the program [3].

MACRO-ENVIRONMENTAL RISK FACTORS

As AEP developed its contracting and procurement strategy for the environmental retrofit program, the heavy construction market was seeing what some experts characterized as "unprecedented growth." During this time, both the power and process industries undertook significant capital programs. In addition, the re-construction efforts associated with hurricane Katrina were underway.

The non-residential construction market experienced escalations in all sectors, including design fees, commodities, manufactured equipment, and labor. The drastic increases in commodity and material pricing, as well as the availability of fabrication shops, were making vendors unwilling to hold prices for much longer than 30 days.

Consequently, contractors continue to refuse to accept risk even with a substantial risk premium. Now, many contractors are demanding the inclusion of material escalation clauses in the contract. Perhaps even more significantly, contractors are much less inclined to accept labor risk, citing labor shortages and lack of skilled craftsmen as unacceptable risks [2].

ENVIRONMENTAL RETROFIT PROGRAM RISK FACTORS

AEP identified four (4) major risk areas as it began the environmental retrofit program that were of primary focus when developing the overall program strategy.

- **Cost** – The magnitude of investment for this program would require the corporation to acquire additional capital resources. Providing timely and dependable updates to its stakeholders with regard to the cash flow requirements, as well as the overall cost of the program, would be critical.
- **Program / Project Schedule** – A key component of AEP’s environmental compliance program strategy was to be a “first mover” with respect to its peers in the electric utility industry. AEP recognized that it was critical to both schedule and costs to “lock in” key vendors early, before the market conditions changed as more utilities and other industries began their capital investment programs.
- **Internal Resources** – Traditionally, AEP has supported its major construction programs by utilizing internal engineering resources and construction management personnel. It was quickly recognized that this program was too large to undertake internally and that third party architect / engineers and contractors would need to be utilized to execute the program.
- **External Resources** - AEP recognized that in order to complete the program within schedule, the availability of qualified labor, contractors, and fabricators were a potential risk that could affect the overall program.

In order to address these four program risk factors, AEP developed a risk mitigation plan that heavily focused on developing a comprehensive contracting strategy that incorporated the cost and schedule goals for the program. This contracting strategy recognized that in order to mitigate all of AEP’s primary risks, it should continue to work to be a “first mover” among its peers with large capital programs, secure firm price proposals to the fullest extent possible and allocate the majority of escalation and labor risk to the contractors / vendors.

As AEP began to engage third party vendors in the environmental retrofit program, it was initially very successful in executing the “first mover” strategy and secured many of its large material, OEM, and labor contracts under firm price contracts. In many cases, the firm price contracts contained mutually agreed to risk indices that allowed the contractors to keep base cost estimates competitive, while sharing responsibility with AEP for managing identified risks as the projects progressed.

Over time, however, AEP was forced to delay the requests for many labor contract proposals as engineering firms began to become resource constrained and behind schedule. As a result, the market was able to catch up with AEP and the macro-environmental risk factors previously mentioned became common responses to requests for firm price proposals. The contractors / vendors that AEP targeted for this program placed a significant premium on mitigating their perceived risks. In many cases, this premium was so significant that it would not allow AEP to meet its overall goals for the environmental retrofit program.

In order to manage AEP’s program risk, while listening to its contractor / vendors, AEP was required to be flexible by breaking down contract packages further and developing innovative contracting strategies for specific scopes of work. While this approach proved effective in mitigating program risks,

it resulted in several different contractors and contracting strategies being used on each site. This increased the complexity in managing cost, schedule, and overall coordination of the program.

SAMPLE OF PROJECTS

This paper focuses on environmental projects at four (4) major sites in AEP’s environmental retrofit program as depicted in Table 1.0. Each site is performing similar scopes of work, which includes the installation of an FGD and various associated projects. The associated projects typically include boiler modifications, balanced draft modifications, electrical control upgrades, an SO3 mitigation system, and a new waste water treatment facility. In addition to the FGD and associated projects, Site A also includes the installation of SCR’s on two operating units.

Table 1.0 Sample Site Information

Environmental Program (FGD, SCR, and Associated Projects where applicable)				
Data	Site A	Site B	Site C	Site D
Estimated Capital Costs (\$ mil)	\$950	\$500	\$300	\$1,010
Number of Individual Projects	16	7	7	21
Scheduled Start Date	1Q04	1Q04	1Q04	3Q04
Scheduled Completion Date	2Q07	1Q07	1Q08	2Q09

CONTRACTING STRATEGIES USED ON SAMPLE PROJECTS

All of the sample projects began with the philosophy of utilizing firm price contracts to the fullest extent possible and utilizing an Architect / Engineer as the “project and construction manager.” The Architect / Engineer would establish the Division of Responsibility, contract packages, and provide construction management services. AEP would heavily participate, but in an oversight role.

As reflected in Table 2.0, AEP was reasonably successful from a dollar perspective in contracting the majority of the contract costs in a fixed price arrangement. On all of the sample projects, the major equipment suppliers and some program based labor contracts were secured early under fixed price contracts, with varying types of payment terms (i.e. milestones, progress, hybrid, etc.). As the program progressed, however, the macro-environmental factors previously discussed became more prevalent and the ability to secure firm price arrangements in accordance with the original strategy diminished.

Table 2.0 Contract Types by Dollar Volume (% Breakdown of Direct Job Costs)

Environmental Program (FGD, SCR, and Associated Projects where applicable)				
Project / Contract Type	Site A	Site B	Site C	Site D
Fixed Price	69%	70%	68%	66%
Cost Reimbursable	15%	5%	11%	2%
Hybrid (Multiple Components)	15%	24%	1%	17%
Yet to be Awarded	1%	1%	20%	15%
Total	100%	100%	100%	100%

Both tables 3.0 and 4.0 reflect the outcome of the sample projects’ contracting strategies to date. Although the majority of the dollars were contracted under firm price arrangements, the majority of the contracts were executed using an alternate contracting strategy. Due to late engineering and market conditions, AEP has had to become very involved in the contracting process and heavily utilize

established relationships with local contractors and vendors to execute the program. This alternate strategy has resulted in multiple contractors, a significant number of different contracts, and various unique payment methodologies at each site. In many cases, due to the number of different projects, evolution of contracting philosophy, and the late completion of design, one contractor may have as many as eight (8) separate contracts working concurrently at one site.

Table 3.0 Contract Types by Number of Contracts

Environmental Program (FGD, SCR, and Associated Projects where applicable)				
Project / Contract Type	Site A	Site B	Site C	Site D
Lump Sum - Fixed Price	21%	16%	19%	41%
Cost Reimbursable	72%	73%	73%	47%
Hybrid (Multiple Components)	7%	11%	8%	12%
Total	100%	100%	100%	100%

Table 4.0 Number of Contractors during Peak

Environmental Program (FGD, SCR, and Associated Projects where applicable)				
Project / Contract Type	Site A	Site B	Site C	Site D
Number of Contractors on Site	32	26	13	43
Total	32	26	13	43

One of the alternate contracting strategies that has been widely used in the program for construction labor is “alliance based contracting.” Alliance contracts are fundamentally based on the principle of shared risk by the owner and contractor. When establishing these types of contracts, both the owner and contractor identify the primary risk factors and performance initiatives associated with the scope of work to be contracted. The contract then utilizes a hybrid of commercial methods, such as incentives, targets and shared risk clauses, to tie the financial aspects of the contract to the ability of both the owner and contractor to mitigate risks and achieve key performance initiatives.

From a cost management perspective, alliance based contracts typically have multiple components of payment within each contract. The contracts typically have a fixed fee component, a reimbursable component, multiple incentive components, a target feature with shared savings / risks, and an overall contract “not to exceed” amount.

From a forecasting perspective, relative to monthly cash flow and overall contract costs, each of these components must be evaluated utilizing multiple forecasting techniques. In addition, with each contract being negotiated with separate companies and different risk factors, the cost management team must be fully aware of the unique features in each contract and adapt the forecast accordingly.

CONTRACTING STRATEGY IMPACTS ON COST MANAGEMENT

As AEP’s contracting strategy has evolved, it has had a significant impact on the ability to provide predictable, timely, and reliable information to AEP’s Executive Management and shareholders. AEP has managed this issue by establishing a Project Cost Management team for each project that provides professional cost services and reports the status of the overall program to Senior Management.

On each of the sample sites, AEP assigned a cost management team of between two and four cost analysts. The responsibilities of the cost analysts include, but are not limited to, forecasting each of the projects against four (4) measures each month:

- Monthly Cash Flow (Accrual Based) – This measure predicts what contractual liabilities the project will incur, by contract (or work breakdown structure), by month for the duration of the project.
- Annual Budget –The cost analyst(s) provides an annual forecast versus annual corporate control budget variance report for each project, each month.
- Capital Improvement Authorization (CI) – The CI is the amount of money that has been approved by the appropriate authority level within AEP. The environmental retrofit program utilizes a phased funding approach, so the CI amount would represent the funding approved through the designated phase of the project.
- Environmental Long Range Plan – Each project in the environmental retrofit program is allocated a total project budget within the overall program budget. The cost analyst updates the Estimate at Completion (EAC) each month against the environmental long range plan budget.

In forecasting project cost against each of the measures shown above, AEP has identified four (4) project attributes that have a direct correlation to the complexity in providing accurate and timely forecast information:

- Number of Contractors / Suppliers – Obviously from a cost forecasting perspective, the number of relationships that must be monitored has a direct correlation to the complexity of providing consistent information. On the projects where AEP can place all of its focus on working with a limited number of contractors, cost teams, and cost management philosophies, the likelihood of providing accurate and consistent information increases.
- Number of Contracts – The number of contracts that a cost analyst team must evaluate, monitor, and forecast adds to the complexity of tracking the Division of Responsibilities and ensuring there is no scope gap in the EAC. In addition, the number of contracts adds to the complexity of tracking monthly cash flows, due to the number of independent segments of work that must be monitored.
- Contract Type – The types of contracts used on a project have a significant impact on the complexity of providing accurate and consistent information. The cost analysts must recognize the contract types and be able to implement the appropriate forecasting techniques (i.e. earned value management, monitoring milestones, manpower forecasts, etc.) to provide a forecast against each of the four (4) measures on a monthly basis.
- Focus and Skill Level of Contractors / Suppliers – The focus and skill level of the contractors and suppliers that AEP works with to obtain schedule and forecast information has a direct correlation to the complexity of AEP providing predictable forecast to its shareholders. AEP, as well as many other owners, are demanding more out of their vendors and contractors than ever before with

respect to their ability to correctly track costs, implement and demonstrate a well-designed Earned Value Management system, trend performance, and provide reliable and timely estimates to complete. AEP has encountered a wide range of abilities in its contractors to provide quality information, and in some cases, the contractor's inability to provide such information has severely hindered AEP's ability to provide reliable forecasts to its key stakeholders.

AEP's Project Cost Management team is committed to continuing to reduce the complexity of providing accurate and timely project forecasts. In today's construction market, however, it is recognized these factors will continue to exist as AEP works to mitigate the risks of the overall program. AEP's Cost Management Team, therefore, must prepare its cost analysts to effectively manage costs in this environment.

SKILLS AND KNOWLEDGE OF COST MANAGEMENT TEAM

In order to prepare cost analysts to provide timely and reliable forecast information in a complex contracting environment, a cost analyst work force must possess the appropriate skills. Consistent with AACE International Recommended Practice No. 11R-88, "Required Skills and Knowledge of Cost Engineering," AEP has found that its Cost Management Team members must be knowledgeable in the following focus areas in order to adapt to various contracting methods on a single project:

1. Procurement Planning and Contract Management – The cost analyst should be able to explain the advantage and disadvantages of the various contracts from the owner and contractor view points. Also, the cost analyst needs to fully understand payment terms and the change management process for each contract to ensure these contracts are accurately represented in the project cost management plan.
2. Forecasting Techniques – The cost analyst must be able to identify and understand which forecasting techniques should be used for various contracts and articulate the basis to contractors / suppliers. The cost analyst may use multiple methods on one project, or in some cases one contract, for various contract components.
3. Scope and Execution Strategy Development – The cost analyst must fully understand the scope, schedule, and execution strategy within the context of the contracting strategy. The cost analyst ensures that the entire scope of the project is maintained in the forecast and integrated into the project schedule.
4. Performance / Productivity Management – The cost analyst must be able to describe the concept of productivity and be able to engage in discussions with contractors around productivity assumptions, trending in cost estimates, and forecast [4].

In addition to the functional skills or knowledge that a cost analyst must possess, AEP has recognized that it is extremely, if not equally, important that the cost analyst possess certain managerial and behavioral skills to be successful. Within the realm of "Total Cost Management," AEP's cost analysts are as much about "managing relationships" as they are the technical aspects of cost engineering.

The managerial or behavioral skills that cost analysts must possess to succeed in this complex environment include:

1. **Interpersonal Skills / Relationship Building** – The ability to effectively interact with wide ranges of personalities, skill levels, and frames of reference often means the difference between obtaining good information versus bad information.
2. **Inquiry** – The ability to ask the right questions at the right time is essential to ensuring that consistent expectations exist amongst all project stakeholders. Given the wide range of skill levels and experience that are present on each project, it is critical that the cost analyst ensure, through questioning and two-way communication, that all parties work with a common understanding of the project goals, objectives, and requirements.
3. **Initiative** – In a fast pace construction environment with a significant number of stakeholders, it is imperative that a cost analyst be “self motivated” and confident enough in his or her abilities to demonstrate independent leadership in managing the cost of the project. Cost analysts with strong initiative can be an asset to the entire project team by proactively engaging all stakeholders in the project and facilitating solutions that not only impact costs but other areas of the project.
4. **Organization** – When supporting large projects with multiple relationships and complex contracting strategies, the cost analyst must have effective organizational skills to succeed. The ability to manage, understand, interpret, and effectively utilize large amounts of information from many different sources and systems can, independent of all of the other the behavioral or functional skills above, cause a cost analyst to fail.

In order to be most effective in providing professional cost management services in this type of environment, AEP has concluded that it is imperative that its cost analysts, or cost analysis teams, have a complimentary balance of technical skills, project management skills, business skills, and interpersonal skills. Without this balance, teams are unable to fully maximize the resources that are available to provide accurate, timely, and predictable cost information.

To be its most effective, “Total Cost Management” is much more than processes, procedures, and best practice. It is about management, leadership, training, and effective relationships. Cost analysts that work to build synergy among the entire project team with respect to cost management will also play a vital role in contributing to the project achieving its overall goals. A great amount of integration is necessary to keep these relationships working, but with open communication and teamwork, AEP has been able to significantly improve its effectiveness in providing accurate and reliable information to its stakeholders.

REFERENCES

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