AC Substations – Optimal Contract Approach Decision Support

Submitted to:

Nalcor Energy

9/7/2012

Submitted by:

Power Advocate Canada Ltd.

Boston Headquarters:
PowerAdvocate
179 Lincoln St.
Boston, MA 02111
(857) 453-5700

San Francisco Office:
PowerAdvocate
575 Market Street, Suite 2725
San Francisco, CA 94105

www.poweradvocate.com

Contents

I. Purpose and Background

The purpose of this assessment is to provide decision support to the Lower Churchill project team around the optimal contracting approach for the AC substations – in particular whether to use the EpCM approach currently in place for most work packages or to use an EPC approach that is currently contemplated for a small set of work packages. This assessment includes:

- an analysis of EPC premiums and trends;
- insights on what makes a given project well suited for an EPC, fixed price approach;
- an analysis of the pros and cons for both the EpCM and EPC contracting approaches;
- thoughts on how to maximize the benefits and minimize the disadvantages of each approach;
- PowerAdvocate project case studies;
- lessons learned by a North American utility that is currently executing a major substation project on an EPC basis; and
- PowerAdvocate's recommendation as to the optimal contracting approach for the AC substation.

Prior to performing this assessment, PowerAdvocate delivered a broader Transmission Project Contracting and Packaging Strategy Risk Assessment. Risks/Opportunity 11 of the Strategy Risk Assessment focused on the AC substations to be constructed at Churchill Falls, Muskrat Falls and Soldiers Pond. In performing the assessment herein PowerAdvocate revisited the Overall Contracting Strategy, the LCP Master Package Dictionary, the Project Execution Plan, the Procurement Management Plan, and the Lower Churchill Project – Risk Management Philosophy.

Nalcor's existing plan to build the AC substations relies heavily upon its EpCM Contractor. The EpCM Contractor will be responsible for the engineering and design of all three AC substations, and all efforts associated with the procurement of several major contracting packages including, but not limited to:

- Package No. CD0503 - Construction of Earthworks at Various Power Distribution Sites
- Package No. PD0505 - Supply of Switchyard Equipment, AC Substations at CF, MF and SP
- Package No. PD0537 - Supply of Power Transformers, AC Substations at CF, MF and SP
- Package No. CD0502 - Construction of AC Substations CF, MF SP and Synchronous Condensers Facilities

After successfully procuring the major materials and services, the EpCM Contractor will be responsible for managing and coordinating all construction activities including material management and logistics. Given the recommendation made in the Strategy Risk Assessment and some early project challenges managing interfaces under the EpCM approach, Nalcor is considering whether to add certain packages to the list of packages suitable for execution under an EPC approach and this paper is designed to offer support for the AC substation work packages.

II. Executive Summary

Although the decision to use an EpCM model for the Lower Churchill Project is well supported and is consistent with the most common contracting approach that PowerAdvocate has seen used on large transmission projects, further opportunity may exist in carving out the Churchill Falls, Muskrat Falls, and Soldiers Pond AC substations.

Currently, the LCP Master Package Dictionary identifies nine packages to be executed on an EPC, fixed price basis. For those packages the rationale for the approach is:

- The scope of supply is well understood with a selection of competent contractors available;
- Work scope is well suited to experienced suppliers which typically execute this work on an EPC lump sum basis;
- The package can be isolated from other segments of the project for both engineering and construction work allowing scope of supply limits and interfaces to be identified and managed;
- Interfaces are minimized; and
- A similar strategy has previously been successfully used on comparable projects.

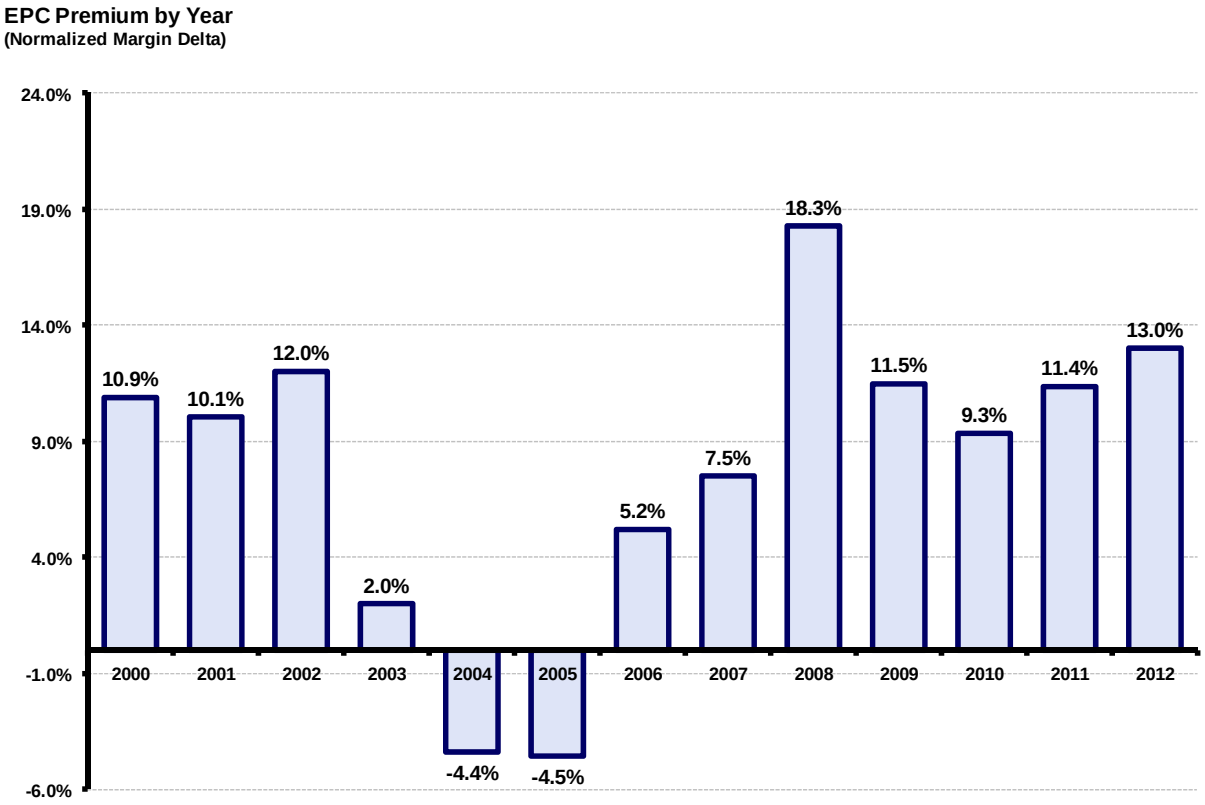
The same rationale applies to the AC substations.

Given the existing market conditions, Nalcor's advanced planning, key characteristics of the AC substations, an analysis of the advantages and disadvantages of both the EpCM and EPC approaches in the context of Nalcor's project objectives, project execution plan and project execution challenges, and concerns associated with the risk of managing critical interfaces, it is prudent to adopt EPC, fixed price approach for the AC substations.

III. EPC Project Premium and Recent Trends

Utilizing PowerAdvocate's data and experience, an estimate depicting the trend of the "premium" typically paid for executing a capital project on an EPC, fixed price basis has been developed. For the purposes of this analysis, EPC premium is defined as the delta between the actual cost to engineer, procure and construct the project using a "multiple contract" approach and the additional fees incurred through a fixed price, EPC contract. Trends and percentages have been adjusted and normalized.

As shown in the chart below, the early part of the decade featured a boom cycle in capital investment in the energy industry, and the corresponding margins were indicative of the higher fee structures charged in a period of declining commodity prices. The trough in 2004 and 2005 can be traced, in large measure, to the decline in new power projects and the corresponding inclination of EPC contractors to reduce their premiums for those projects. However, the trajectory of premiums from 2006 through 2008 illustrates how these contractors successfully shifted part of the burden of commodity price escalation to the owners, while charging higher fees. The drop after 2008 corresponds to the economic crisis, where once again, new projects and the corresponding premiums drastically declined. In 2010 premiums began to recover, as activity in the capital construction market started to rebound.



This EPC premium depicted above is aligned with the findings of a recent IPA report, where it stated that risk premiums for large “international” projects are ten to fifteen percent of the base estimate.

Several years ago PowerAdvocate partnered with CERA to produce a special report titled “Effects of Cost Escalation and Contracting Strategies on EPC Risk Premiums.” The report considered three scenarios, while the details and factors associated with each scenario were quite specific, generally one scenario corresponded to high levels of economic growth, one scenario corresponded to low or moderate levels of economic growth, and one scenario corresponded to economic recession. Based on present day analyses performed in PowerAdvocate’s Energy Intelligence Group (EIG), the most appropriate forecast corresponds to the low or moderate economic growth scenario. The corresponding forecasts for EPC premiums project a continuation of the upward trend through 2013 at the current rate before finally beginning to decline through 2014 and 2015. EPC premiums for 2015 are forecasted to be comparable to those are currently being experienced in the market place today.

The data used to develop this EPC premium analysis has been drawn from a variety of sources and represents a sample of capital project types. Project types include: generation, environmental or back end technology, electric transmission, and AC substations. It is important to note that the project type is an important factor in the equation as the supply and demand for these markets often differs. Although the analysis shown above depicts an EPC premium of thirteen percent corresponding to the present year, opportunities may exist to pay lower premiums for the AC substations of Lower Churchill Project. Over the past three years PowerAdvocate has been involved in some facet with more than ten AC substation projects that were executed using and EPC, fixed price approach. The recent sample depicts a flatter progression of EPC premiums relative to AC substations and suggests that Nalcor may be able to secure an EPC contractor for a premium of eight to twelve percent.

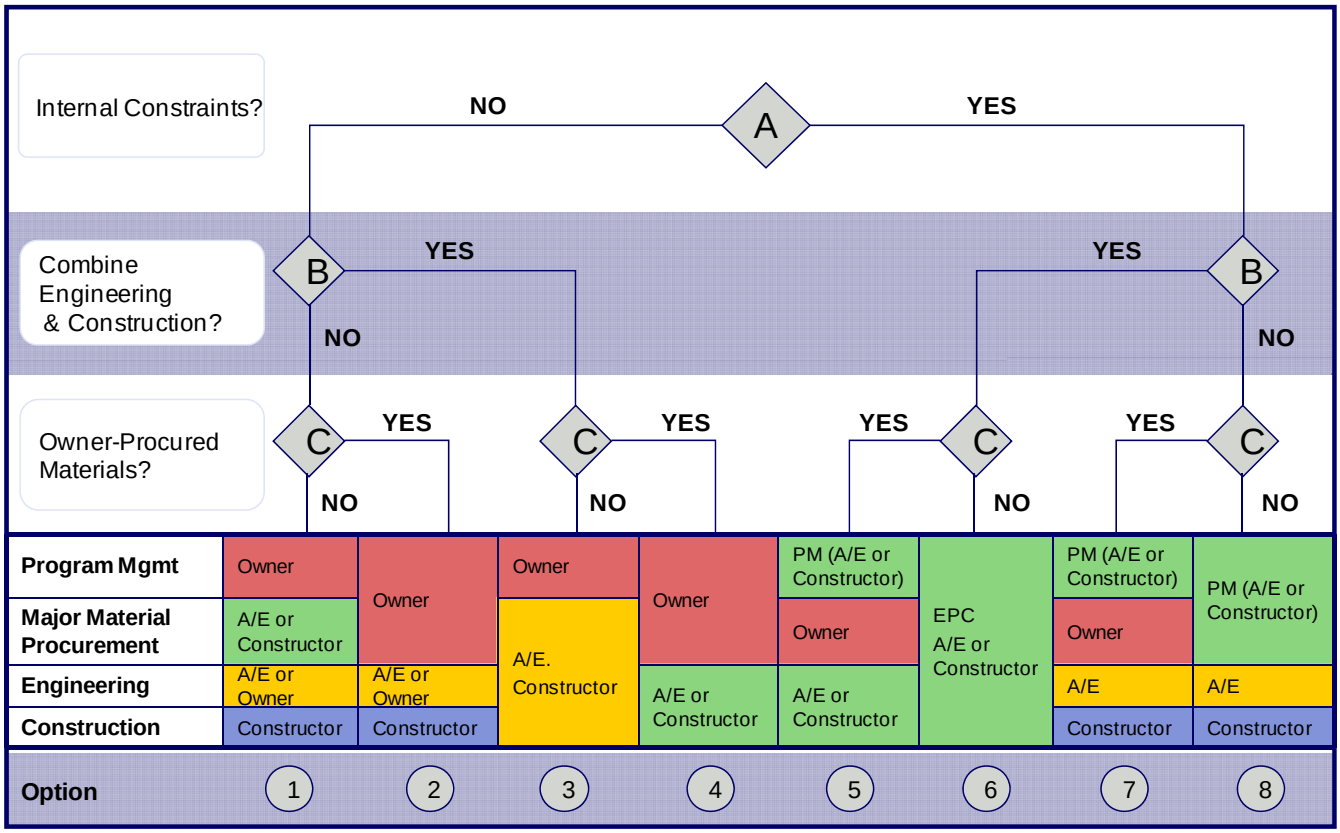
IV. Key Characteristics of a Project Suited for an EPC, Fixed Price Approach

There are pros and cons associated with different contracting approaches but for some projects that choice can be clearer than others. Certain types of projects are simply better suited for the EPC, fixed price contract approach; understanding the factors and project characteristics is integral in making this determination.

The scope of work is the largest single factor to be considered during the contracting approach selection process for a given project. A project with a well defined scope of work and minimal uncertainty is better suited for a fixed price contract structure whereas projects with substantial unknowns and ill defined work scopes often need to be executed on a cost reimbursable basis by default. The working area is a primary component of the work scope and it too drives contract selection. Transmission line construction projects may span long distances over multiple geographical regions. For these expansive projects a substantial number of lengthy preconstruction activities, including route selection, land acquisition, regulatory approvals, permitting processes, subsurface investigation, and design must all be completed to have a fully defined scope of work and limit uncertainty. For many reasons, schedules for transmission construction packages generally necessitate that most of the aforementioned preconstruction activities be performed in parallel. These factors all make it is very difficult to fully define the scope of work and to limit uncertainty for a large transmission line project.

However, greenfield substation projects generally do not encounter similar challenges, and when they do the magnitude of the issues is substantially less. They are designed for a predetermined and confined plot of land where site conditions are easier to establish and account for. The function of any given substation (i.e. switching, voltage change, etc.) is defined through conceptual engineering early in the project life cycle. A simple understanding of the function(s) a substation must perform is enough for most firms to fully design it, and with a design an experienced electrical construction contractor can develop a bottom – up estimate on what it would cost for it to construct it. For these reasons it is often feasible to bid greenfield substation projects on a fixed price basis.

One may question the relevancy of this information as the question at hand is not what projects make good candidates for a fixed price contracting structure but what key characteristics make projects better candidates for an EPC, fixed price approach. One must break the question into its component parts to answer this question, (i.e. what key characteristics make a project a good candidate for an EPC approach, and what key characteristics make a project a good candidate for a fixed price contract structure). To answer the primary question PowerAdvocate refers to the contracting approaches framework previously shared with Nalcor below.



The first question an Owner must ask in making this determination is whether it has internal constraints that will impede project schedule. The question is posed to address a variety of constraints, but internal resource constraints should be a primary focal point. When addressing internal resources it is not only the quantity, but the qualifications as well. If a project involves emerging or complex technologies outside of an Owner's expertise or core competencies it should proceed as though internal constraints exist. When constraints do exist the next question an Owner must address is whether it believes that combining the engineering and construction scopes is in the best interest of the project. Many projects benefit through the integration of these disciplines. Notable benefits include: reduced interface management responsibilities and relative risks for the Owner, and collaborative constructability reviews. When the combination is warranted, the final decision an Owner must make is whether or not it will elect to procure the major material for the project. Common factors influencing this choice include an Owner's buying power (or lack thereof), existing long term relationships, Owner's aversion to risk, and current market conditions.

A simple rule of thumb to consider when determining if a project is well suited for an EPC, fixed price approach is: given the current state of the project at the time the Owner goes to market, can a third party process the information provided through a bid package and develop a clear and concise work plan to construct a facility that will satisfy the Owner's requirements? If the answer to this question is yes, and the Owner has considered the contracting approaches framework discussed above, there is likely an opportunity to pursue an EPC, fixed price contract for the project. Other considerations include whether there is a collection of competent contractors that can perform the work, whether similar projects have been executed successfully using similar approaches, and whether there is a need or desire to minimize the number of interfaces the Owner is responsible for managing. PowerAdvocate has been involved in multiple capacities with projects that meet this description and experience suggests the most successful EPC, fixed price projects are those that meet the criteria discussed above. Sample projects include: gas

and cogeneration facilities, environmental (back end technology) projects, renewable generation projects, and greenfield substations.

V. Benefits and Disadvantages of the EPC and EpCM Contracting Approaches

While the EpCM model for the Lower Churchill Project remains a reasonable and prudent overarching contract strategy, Nalcor has experienced some challenges in practice with the management of the contract package interfaces and is constrained as to procurement and construction management resources. Therefore it makes sense to be opportunistic in identifying packages that might be well suited for being combined into one EPC arrangement to reduce the number of critical interfaces and the resultant burden on the constrained procurement and construction management resources. However, there are inherent benefits and disadvantages associated with both the EPC and EpCM contracting approach. Below is a summary of the benefits and disadvantages associated with the two approaches.

Benefits of the EpCM Approach:

- This approach is a variation of the multiple contract approach often used on large projects
- Represents the most reasonable strategy to obtain most of the benefits and to minimize many of the drawbacks of the multiple contract approach
- Can be structured to provide the up-front engineering and program management support needed for regulatory approvals and right-of-way acquisitions
- Can easily break project components into separate scopes or segments with different construction contractors responsible for each, allowing access to a larger pool of potential construction contractors that would not be capable of supporting the full project scope
- There are a greater number of contractors that can perform program management and “just” engineering or “just” construction management; fewer contractors can perform full program management, engineering and construction
- Owner does not have to increase its internal staffing because, as specific project needs arise, program manager or other contractors can supplement
- Facilitates a fixed price arrangement for the construction scope
- Owner has significant input into final design and equipment/materials selection – which is often in line with its traditional execution approach
- Owner can avoid a scenario where the prime contractor applies a mark-up to subcontracted services (i.e. construction services), material purchases, and third party rentals by contracting with the various suppliers directly

Disadvantages of the EpCM Approach:

- No single point of contact - multiple interface points requires more comprehensive analysis of potential risks/gaps and development of risk mitigation techniques
- Requires closer focus on commercial terms to identify and address potential cost and schedule impacts of poor performance by owner or by one supplier/contractor on another supplier/contractor
- Greater owner oversight needed which may lead to schedule delays and/or increased cost due to duplication of resources

- Having multiple contractors can result in more complex disputes as contractors may try to pin blame on others (the so-called “finger pointing risk”)
- If performed sequentially, up-front engineering may not get the benefit of a constructability assessment from a construction contractor, unless the program manager (or an EpCM contractor) has such responsibility and capabilities
- Breaking construction into multiple segments or scopes:
  - may result in multiple interface points;
  - may require additional internal resources to manage scope overlap and contractor coordination; and
  - may introduce competition among multiple contractors for the same labor resources, thus driving up labor costs
- Difficult to structure and reach agreement on an incentive program tied to overall project success as the EpCM may argue that it does not directly control the actions of Owner’s suppliers/contractors.
- Often does not allocate significant risk to the program manager (or, if applicable, the EpCM contractor) despite that party’s central role in project success

Benefits of the EPC Approach:

- Can provide Owner’s with the ability to take a “hands off” approach to the project
- Owner’s only responsibility is contract management of a single Contractor
- Significantly reduces the strain on engineering, procurement and construction management resources;
- The EPC contractor manages its subcontractors and remains the single point of contact with full contractual responsibility to the Owner
- Owner has minimal responsibility associated with interface management
- Contracts can generally be structured to include performance guarantees and liquidated damages as deemed necessary by the Owner
- Often times, projects proceed ahead of schedule as EPC contractors aim to optimize design, maximize profit, and proactively manage interface issues
- Owner may opt to focus on high profile duties such as environmental and regulatory affairs, permitting, site acquisition, and public relations thereby reducing the risks posed to the EPC contractor
- Risk is consolidated into one entity
- No internal resource increases required, except as necessary for Contract Management
- Beyond what is stipulated in the contract, Owner bears no risk associated with major material procurement
- Contractor is responsible for all purchases, relative escalation provisions and material management and coordination
- Substantial reduction in the number of contract package interfaces to be managed and coordinated by Nalcor and its EpCM Contractor

Disadvantages to EPC Contracts:

- There is a premium associated with the benefits described above in Section III.
- Often, Owner is only capable of providing limited input into the design of the project
- Owner will have minimal control over the project

- If EPC Contractor has performance issues, changing companies likely will result in costly delays to schedule and budget
- Otherwise capable contractors may not have the appetite to take on risk levels above a certain threshold

VI. Steps to Ensure Success for Each Contracting Approach

Maximizing the Benefits of an EpCM Approach:

- Develop a mechanism to allocate risk between the Owner and EpCM contractor
  - Hold EpCM Contractor accountable for developing an estimate of the number of hours required for both Stage 2 and Stage 3
  - Make it a top priority to find agreement and reach conclusion of this issue
- Capitalize on window to complete all front end engineering and design activities by ensuring proper allocation of EpCM resources
- Prior to issuing bids for earthworks and AC substation construction:
  - Obtain all necessary regulatory approvals
  - Finalize outstanding land acquisitions required for each of the AC substations
  - Secure required environmental permits
  - Contract with geotechnical firm to investigate subsurface conditions at each of the project locations
  - Ensure the scopes of work are thoroughly completed and well defined
- Analyze EpCM performance on preliminary work activities to identify critical shortcoming and adjust resourcing plan as required
- Purchase all major materials and services on Nalcor paper to minimize likelihood of significant mark-ups

Minimizing the Disadvantages of an EpCM Approach:

- Ensure all long lead time procurement items are identified and that sourcing schedules are adequate to ensure timely delivery
- Communicate with EpCM Contractor frequently to identify and analyze potential risks and gaps
- Hold EpCM Contractor accountable for its central role in project success and demand proactive development of risk mitigation techniques
- Require the EpCM Contractor to submit regular project status reports in addition to standard cost and schedule reports to help gage need for additional Owner oversight
- Clearly identify and address potential cost and schedule impacts of poor performance by all parties involved
- Ensure EpCM Contractor facilitates constructability assessments by supplying qualified personnel or engaging a qualified third party
- Minimize the number of critical interfaces requiring coordination by the EpCM Contractor through strategic structuring of contract packages
- Establish processes to govern the coordination of activities directly with other project participants to ensure that critical information is exchanged effectively, consider looking into formal interface management software
- Consider assigning contract package interface managers for all contract packages, and make the interface manager the point person for all things related to interface with that contract package

Maximizing the Benefits of an EPC Approach:

- Minimize risk and unnecessary contingency, prior to issuing EPC bids

  - Obtain all necessary regulatory approvals
  - Finalize outstanding land acquisitions required for each of the AC substations
  - Secure required environmental permits
  - Contract with geotechnical firm to investigate subsurface conditions at each of the project locations
  - Ensure conceptual engineering is complete and SOW is well defined
  - Develop Division of Responsibilities that clearly defines roles for Nalcor, its EpCM Contractor, and the EPC Contractor (pay particular attention to design requirements and situations in which Nalcor desires the EPC Contractor to take on the responsibility of external contract package interface management
- Analyze schedule for critical path activities and make determination if incentives, liquidated damages or performance guarantees are warranted
- Negotiate escalation provisions that EPC Contractor has rolled into the fixed price
- Award contract to an EPC Contractor with strong expertise in full scope of services
- Establish strong internal project controls group to work with and manage the EPC contract
- To facilitate communication, designate limited points of contact (single is preferred) for both the Owner and EPC Contractor

Minimizing the Disadvantages of an EPC Approach:

- Competitively bid the contract to all EPC Contractors qualified to perform the work
- Develop and include strong equipment and construction specifications as part of the bidding process
- Prior to contract award work with EPC Contractor to identify risks that would be more cost effective for the Owner to retain
- Require the EPC Contractor to submit regular project status reports in addition to standard cost and schedule reports

VII. AC Substation Case Studies

As part of this assessment Nalcor requested that PowerAdvocate further develop and enhance the substation case studies that were previously presented along with the broader Transmission Project Contracting and Packaging Strategy Risk Assessment. The case studies below provide information on the project background, the Owner's approach, the challenges that were faced, the results of the respective approaches, and the lessons learned.

Case study 1

Project Background

This case study focuses in on a substation project situated on the west coast during a period of time when substantial capital investment in transmission lines and related substation projects were being made by other owners in the region. The Owner had multiple projects that were in various stages of development, including some that were currently being constructed. The Owner expressed multiple concerns, but the most resounding one was related to the availability of qualified skilled labor.

Owner's Approach

The Owner had a fairly traditional Project Management Office (PMO) as it included a planning group, internal engineering staff, project controls, dedicated procurement personnel, regulatory personnel, project management, construction management as well as a materials group. The PMO was structured to effectively support the multiple contract approach and the Owner generally elected to execute capital projects accordingly. The Owner's philosophy was similar to others that generally adopt the same

approach, namely that by successfully managing and performing preconstruction activities, bidding the multiple construction activities (site civil, foundations, steel erection and electrical construction) on a fixed price basis, and effectively managing the interfaces it would be able to effectively limit and distribute risk. The end goal of this philosophy was to realize a cost effective and prudently executed project.

Challenges

For this particular project the internal PMO fell significantly behind schedule on two major activities (despite its belief that there were no internal resource constraints). The substation engineering department had limited experience with the extra high voltage levels associated with the project. There were no existing design or construction specifications to highlight the Owner's basic requirements and the effort associated with developing these specifications was grossly underestimated. The miscalculation caused troubling delays and when procurement processes could wait no longer the group was only able to provide a partial bid package to support the Request for Proposal (RFP) processes.

In addition, internal resources responsible for obtaining the required environmental permits ran into unexpected challenges specific to the site location that they had not previously encountered. When the various RFPs were launched, although permits had yet to be obtained, the group expressed confidence that all would be in order prior to the commencement of construction. This sentiment was articulated to the bidders involved, and bidders were instructed to formulate their proposals around the basic milestones that were provided by the Owner.

Results

Upon completion of the bidding process the Owner realized that there were multiple contractors capable of performing / cost effectively subcontracting all of the construction activities associated with the project and made the decision to pursue that arrangement. The low bidder came in nearly fifteen percent below the next lowest bidder and came out on top of the combined technical and commercial evaluation. The low bidder was subsequently awarded a fixed price contract for the project.

As the date for the commencement of construction neared it became clearer that delays associated with the environmental permitting processes had not been adequately accounted for. In the end the commencement of work was delayed by several months. During approximately the same time frame the engineering group was able to finalize the specifications it had previously shared with the bidders. The combined result of these actions was multiple change orders that essentially reduced the delta between the two lowest bidders by more than fifty percent.

Lessons Learned

Ultimately the project did not suffer considerably, but the key lesson learned was the importance of communication between the internal departments of the PMO and ensuring that key project stakeholders remain informed and aware of all potential threats and project road blocks. The value of detailed regular reporting cannot be stressed enough; in this case study it was internal, but in Nalcor's case it applies to the EpCM Contractor. Non compliance with reporting requirements should be seen as a red flag.

Case study 2

Background

This 230 kV open air substation project was located in the south and occurred at the start of a fairly substantial boom cycle in the region's capital transmission and substation markets. Significant activity was ongoing within the region and even more was planned for the upcoming years. The activity was fairly concentrated in a couple of states just outside the Owner's service territory. Similar to the first case study presented above the Owner was primarily concerned with availability of skilled labor and what price it would have to pay to ensure that its project would be completed on schedule.

Owner's Approach

This Owner also had a very traditional organization where all of the typical PMO groups were integrated and staffed primarily with internal resources. The project was executed using a multiple contract approach.

Challenges

Over the several years preceding the commencement of this project the Owner felt the effect of the retiring baby boomers. In a period of less than three years nearly forty percent of its internal engineering team had retired and only a fraction had been replaced by entry level personnel. To compensate for this loss of knowledge, experience, and pure man power the Owner entered into blanket agreements with a couple of local engineering firms. The integration of these firms was fairly smooth as both had previously performed substantial work for the Owner and were familiar with the Owner's design preferences, requirements, and specifications. The groups were brought in and collocated with the Owner's internal resources on an ad hoc basis to support various design and engineering efforts as needed.

Results

For this particular instance one of the external engineering firms did have the lead on performing the engineering and design for the substation. All preconstruction activities for this project went quite smoothly. Prior to awarding the various construction scopes each was bid out to the relative groups of the Owner's approved contractors. Bidders were asked to develop proposals to perform the work on a cost reimbursable basis. In addition to supplying built up labor rates, equipment rates, mark-ups, per diem rates, bidders were asked to supply level three schedules and estimate of the total cost for construction.

Upon completion of the bidding activity, evaluations revealed that proposed underlying costs were in general alignment with what the Owner expected to pay, however the majority of the bidders estimates for total construction costs were substantially higher than the Owner's internal estimates. The Owner ended up awarding four separate cost reimbursable contracts to suppliers that it historically had strong working relationships with.

Site civil work was scheduled to start in the fall, a season in which the region encompassing the project site was frequently prone to substantial rain fall. Unfortunately for the Owner that fall was no different and heavy rainfall significantly delayed the construction schedule and negatively impacted the total cost. The Owner effectively managed the various interfaces and experienced no measurable shortcomings from missteps with its important responsibility. This in part was likely due to weather delays and the strong working relationships that were already in place between the Owner and the various local subcontractors. Although concerns around a shortage of skilled laborers never materialized, because of the challenges presented by torrential rains, the substation was energized nearly two months behind schedule at a total cost that was nearly fifteen percent higher than the sum of the four estimates (that were developed as part of the bidding process) belonging to the bidders that were awarded the work.

Lessons Learned

The key take away from this case study is that Owners must reserve contingency for projects constructed in regions with notable weather restrictions because as demonstrated here, even when all parties are interfacing like a well oiled machine events outside of anyone's control can hinder project success metrics. This case study also sheds light on the importance of selecting a contract structure that is commensurate with project risks. Had the Owner of this substation project bid the construction scopes on a fixed price basis, although the upfront cost would have been higher than internally estimated, money would have likely been saved in the long run. The contract approach and the strength of the agreement factors into the amount of contingency that and Owner must reserve. Generally speaking, more contingency must be reserved for an EpCM approach than for and EPC approach.

Case study 3

Background

This case study reviews the details associated with an EPC project to build a GIS 500 kV substation with an open air 230 kV substation. The project site was also located in the southeast and took place during a period of time when there was minimal capital construction activity in the localized transmission and substation space. The purpose of the project was to provide increased load to a major industrial customer.

The project also took place during a transition period when the Owner was reorganizing the delivery business unit and preparing to take on more than double the annual historical work load over the next five years to meet a host of reliability requirements. The reorganization included a newly appointed director of project management and capital construction and brought the substation and transmission line engineering departments under a single roof. Given the upcoming increase in capital transmission and substation the Owner was constrained across multiple departments including engineering, project management, procurement, and construction management. The constraints forced the Owner to take a hard look at how it intended to approach the portfolio of projects that lied ahead. Historically, the Owner took the traditional multiple contract approach, but realized that it would not be able to prudently execute the one hundred and fifty plus projects on a timely basis without makings some substantial changes.

Owner's Approach

The Owner decided to take on a hybrid approach in which they would execute a base load of standard projects using their traditional approach and an EPC approach for the larger, complex and highly visible projects. To augment this approach the Owner put open book pricing arrangements in place with preferred construction suppliers to reduce the burden on its procurement resources and developed a process to identify projects that were best suited for the EPC approach. In addition the Owner thought long and hard about the division of responsibilities that would be put in place for those projects executed with an EPC approach. All internal groups had a say in this final product.

Challenges

This particular project was one that the internal substation engineering team had a hard time letting go of, select individuals perceived the change in approach as a threat to their job security and had a difficult time perceiving the expected increase in work load. Reluctantly, the group aligned with the plan and was able to develop the necessary specifications and facilitate the project and construction management groups in the development of the Owner's project execution plan. The project was bid EPC, fixed price to a slew of contractors with a broad range of core competencies. Over the course of the RFP multiple contractors joined efforts to put forth the comprehensive proposal that the Owner was looking for.

The biggest challenges that Owner faced through the execution of the project involved getting its internal resources up the curve on the project's division of responsibilities. Like the internal engineering group, the project and construction management groups were slow to accept the new normal. Differences in opinions between those two groups and the contractor escalated to conflict on numerous occasions. Minor change orders resulted as the contractor claimed it was performing work in accordance with the contract and specifications and changes to how it planned to execute the work meant additional costs cut into the savings number. Another issue that caused the Owner some pain was that it was not clear upfront on its project reporting requirements. Essentially, those details were omitted and rectifying it required additional contractor resources.

Results

The Owner awarded the contract to the second lowest bidder, as the low bidder was not convincing that it had the relevant experience or that it could execute according to its proposal. Even still, the winning bid was substantially below the Owner's internal estimate for the project. Within several weeks of the

award the contractor commenced design activities and began tracking ahead of project schedule. In the end the project was completed one month ahead of schedule and approximately nine percent under budget.

Lessons Learned

Lessons learned from this project include the importance of detailing all Owner requirements during the bid phase and understanding the impact of not adhering to the approved DOR. This case study also demonstrates that, despite some of challenges associated with adopting a different contracting approach, the EPC, fixed price approach is viable for AC substation projects.

VIII. Lessons Learned from North American Utility

Following the presentation of the broader Transmission Project Contracting and Packaging Strategy Risk Assessment delivered by PowerAdvocate, several action items were identified. Nalcor requested that the action requiring PowerAdvocate to facilitate a call with a North American utility currently executing a substation project on an EPC, fixed price basis (with one of the contractors that is also under consideration by Nalcor for the converter station work) be rolled in to this decision support package. On Wednesday August 29th, 2012, a call was set up between a North American utility and Nalcor to share information related to Substation contracting risks and both past and current project experiences.

Given the sensitive nature of the conversation, meeting minutes and specifics of the call are not included in the assessment (to be provided to Nalcor under separate cover). Included below are the key takeaways from the conversation as they relate to the decision of selecting the optimal contracting approach for the AC substations.

Key lessoned learned:

- The EPC contract approach is viable for substation projects
- Major EPC contractors are structured to perform and manage this type of work effectively
- A clearly defined scope of work and division of responsibilities is integral to project success
- Care must be taken to structure the EPC agreement effectively in an effort to avoid unseen costs
- The time it takes to qualify suppliers must be taken into consideration

IX. Recommendation on Optimal Contracting Approach for AC Substations

The Churchill Falls, the Muskrat Falls, and the Soldiers Pond AC substations all appear to be strong candidates for the EPC, fixed price approach. Conceptual / preliminary engineering and design has been performed for each of the facilities. Given the confined nature of the substation sites it is assumed that geotechnical studies have been or will be performed to determine the subsurface soil conditions and that any ROW acquisition or permitting processes are complete or in progress and on schedule. The two substations at MF and SP have additional complexities as they are closely tied to the AC/DC converter stations that will be constructed adjacent thereto. Nalcor and its EpCM Contractor have already made substantial progress with Package No. CD0503 - Construction of Earthworks at Various Power Distribution Sites; it has already been issued for quotation. Continuing the efforts associated with that initiative is aligned with one of the key ways Nalcor can minimize risk and unnecessary contingency, prior to issuing EPC bids. The interface between the earthwork and the AC substation construction will be minimal and it will provide the substation contractor with a construction ready site. Even with the decoupling of these work packages, there does not appear to be a predecessor activity that can negatively impact or change the fundamental requirements of the AC substations. The scopes of work associated with these substations are understood by a strong selection of capable contractors with significant experience in executing these projects on an EPC, fixed price basis.

Based on the foregoing data and analysis, an EPC, fixed price contract approach for the AC substations is recommended. While there will be a premium associated with adopting this approach, it will be a small price to pay in exchange for reducing the risks associated with managing the critical interfaces currently defined by the Overarching Contract Strategy and the LCP Master Package Dictionary. As articulated above in Section III., the EPC premium for an AC substation project is likely somewhere between eight and twelve percent. PowerAdvocate likens this premium to an insurance policy that would protect against much more substantial costs in the event poor interface management were to cause downstream delays. Interfaces will still require attention in an EPC, fixed price approach, but efforts will be pale in comparison to those required to manage the interfaces associated with the current packaging strategies for the AC substations.

This recommendation will require the creation of a new contract package as the construction of the Synchronous Condensers Facilities should be separated from the construction of the AC substations. Nalcor has flexibility relative to Package No. PD0537 - Supply of Power Transformers, AC Substations at CF, MF and SP. If substantial work has been done for this initiative, Nalcor may wish to continue those efforts as there may be benefits associated with securing these long lead time items and free issuing them to selected EPC contractor.

This recommendation is strongly aligned with the fundamental principles and concepts found within Lower Churchill Project's Contract Strategy Guidelines, Contract Strategy Formulation Process and Risk Management Program.

PowerAdvocate understands the importance of the need for consistent technology and workmanship at the two converter stations and recommends that Nalcor invite the qualified converter station bidders to submit a bundled proposal that also includes the construction of the AC substations. Although the bid package for the converter station has priority and will likely be released before the end of the year (2012), Nalcor can describe its intent to allow the converter station bidders the opportunity to propose a bundled proposal that includes the AC substations. These contractors should be well positioned to offer a compelling solution given that they will already be mobilized to perform work at adjacent sites. In addition, PowerAdvocate recommends sourcing the AC substations on an EPC, fixed price basis to a broader group of electrical contractors that may not have the qualifications to handle the converter stations, but are more than qualified to perform the AC substation work. This recommendation will shed some light on whether those proposing a bundled solution are presenting a compelling offer and will allow Nalcor to make a more informed contract award. In addition, conducting the bids this way will significantly reduce the burden of Nalcor's procurement resources as the number of associated packages will be greatly reduced.

One of Nalcor's project objectives is to balance cost certainty and absolute cost as efficiently as possible. Adopting an EPC, fixed price approach supports this objective because the risk premium can be competitively managed and bundling of the AC substations with the converter stations will likely reveal additional cost benefits.

Nalcor's Project Execution Plan references the concept of ***Flawless Execution***, stating it "requires a comprehensive understanding of risk-critical areas for the Project and an early focus on these activities in order to successfully shape the execution approach that will drive the expectant outcomes." The window to change the contracting approach for the AC substations is closing quickly, and the time to focus on that decision is now.