

Hydropower Risk Mitigation During Development Stage: EPC's Missing Piece

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Water, energy and climate demand-pull policies coupled with global recognition of climate change risk is driving a paradigm shift in the hydropower sector. Frontier markets offer new opportunities to meet the low carbon economy.

The EPC model was designed to control the multitude of diverse risks inherent in hydropower by creating a single point responsibility contract for the engineering-procurement-construction of the facility.

Still, many projects struggle with commercial viability once they enter the construction phase?

This paper reviews the critical nature of technical criteria and explores underlying structural trends leading developers to underestimate such risks in the first place.

Keywords: hydropower development, risk mitigation, private investment, design-build, EPC, risk ownership, design-bid-build, DBB, engineer-procure-construct, risk assessment, risk outcomes

INTRODUCTION

Prior to the 1990's, most new hydropower was developed by the public sector. The most widely used development model was Design-Bid-Build (DBB). Under the DBB model, vertically integrated public utilities would finance the development process and assume all risk related to studies, site investigations and design of the project. With the move from public to private sector financing, a new development model and contracting strategy was required.

The EPC model, now in its third decade, was designed to take advantage of the untapped synergies between designers, builders and equipment suppliers by creating a single point responsibility contract for the engineering, procurement and construction of the facility. The idea was expected to bring significant benefits to the private sector. Despite these synergies, hydropower projects still struggle to get off the ground. Many that do start construction suffer cost overruns and delays, often due to risks that should have been foreseen. Awojobi and Jenkins (2016) report that "hydropower investments are usually exposed to construction cost and time overrun risks", that "Many studies have documented the severity of overrun in power projects", and that "nine out of ten dams suffered cost overruns". They further explain

that the average real cost overruns for a portfolio of hydropower dams financed by the World Bank was found to be 27 percent and that “the uncertainties in hydropower investment estimates at appraisal stage are quite substantial”.

Given the failure of the EPC model to deliver on its promise of fixed costs and fixed delivery dates, many ask whether it is possible to build a hydroelectric project without problems during the design-construction phase. Is there a missing piece in the development process that leaves hydropower projects particularly vulnerable to disputes, cost overruns and delays under the EPC model? This author posits that EPC is yet to deliver the desired outcomes, in part due to two structural flaws:

- 1) The EPC structure allows owners to transfer risks to contractors without ever truly addressing them during the development stage; and
- 2) Strong incentives to reach financial close, supported by power dynamics between owners and contractors lead owners to fast-track the development process, leaving some risks concealed.

This paper is structured as follows:

Section 1: Introduction

Section 2: Transitioning Project Risk Ownership

Section 3: Reaching Financial Close

Section 4: Changing Risk Outcomes: The New Paradigm

Section 5: Conclusion

TRANSITIONING PROJECT RISK OWNERSHIP

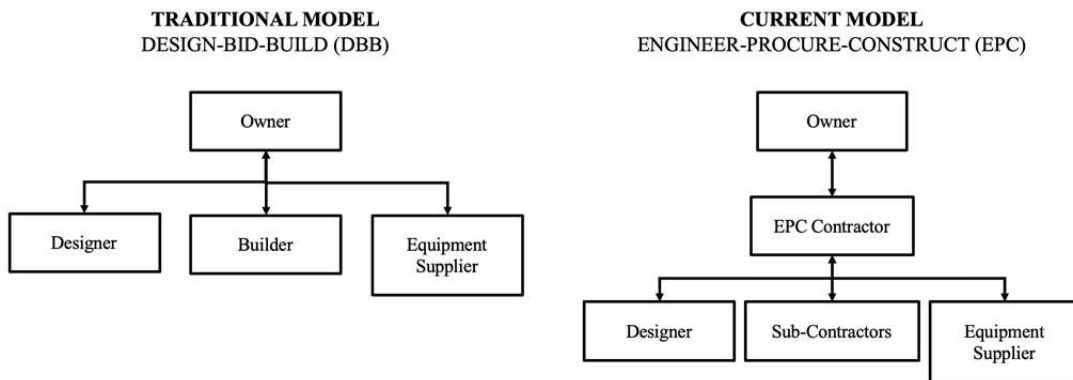
The EPC model rose into prominence in the mid-1990’s. EPC recognized the diverse set of disciplines required to implement hydropower by assigning each party a defined role and set of objectives in the development-construction process based on their respective skill sets. It was the cornerstone of the transition to private power. The model assumed that owners would define the main aspects of a project and then carry out a bidding process in which teams of engineers, equipment suppliers and contractors would come together under a single entity – an EPC contractor – to enter into a fixed-cost, date-certain contract subject to liquidated damages for underperformance and delays (Candee, Larson, 2013). Candee and Larson continued: “(the) EPC concept was developed under the premise that the party that can best control the risk is the one that should accept contractual responsibility for the risk.”

The EPC model works fabulously on paper. Each party to the contract carries the risk and responsibility for the aspects that the given party is best able to control. However, if responsibilities are defined based on that premise, why do hydropower projects continue to be plagued by cost overruns and delays? This author posits that despite EPC being the favoured contracting modality in today’s hydropower market, it has not proven itself as a reliable means to stop cost overruns and schedule delays without a serious, comprehensive and substantial in-depth technical-commercial approach during the development stage.

Under the traditional DBB model, owners and their engineers conceptualized, investigated and designed hydropower facilities, followed by a bidding process to select the best contractor and equipment supplier and where risk ownership transfer was clear, well-defined and well-understood. To facilitate the move to private sector participation and under the promise of development time savings and EPC synergies, roles shifted to combine the entire technical scope of design, equipment procurement and construction into a single point responsibility entity, the EPC contractor. Figure 1 shows the structure of these two project delivery methods.

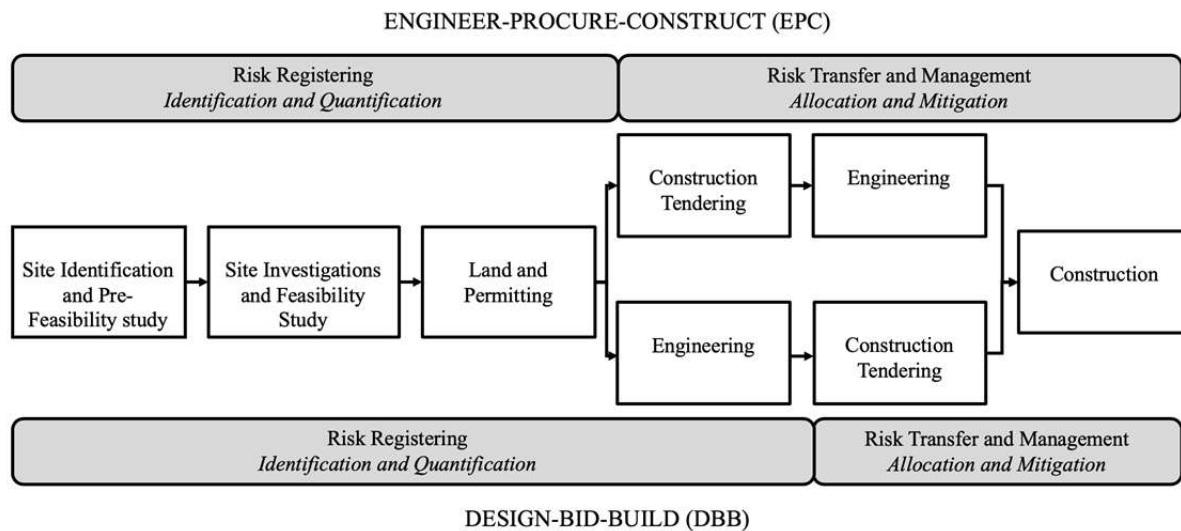
Private developers, acutely conscious of their cost of capital and the time value of money, welcomed the EPC model, which promised to be more efficient and expeditious for them than the DBB model. The transition to EPC, however, inadvertently created an environment in which critical development activities traditionally performed by owners are frequently shifted to the contractor. Many of those activities, including flood analyses, sedimentation studies and geotechnical investigations are critical to the risk mitigation phase of development.

FIGURE 1
STRUCTURE OF DESIGN-BID-BUILD (DBB) AND
ENGINEER-PROCURE-CONSTRUCT (EPC)



In some instances, key development studies end up being foregone once the risk ownership is transferred to the EPC contractor. Since EPC contractors are typically given only a few months to bid on a tender and are later expected to commence construction after financial close on date certain contracts, their ability to perform adequate site investigations is severely compromised. On a recent project in South America, the owner, recognizing the technical requirements of the project needed additional investigations and studies, signed an advance works contract with the EPC contractor, with the express purpose of allocating additional time to perform critical site investigations and data collection. When problems later appeared during the construction stage, it was revealed that in lieu of additional site investigations, the EPC contractor had used the additional time and funds to commence the mobilization and construction of camps instead.

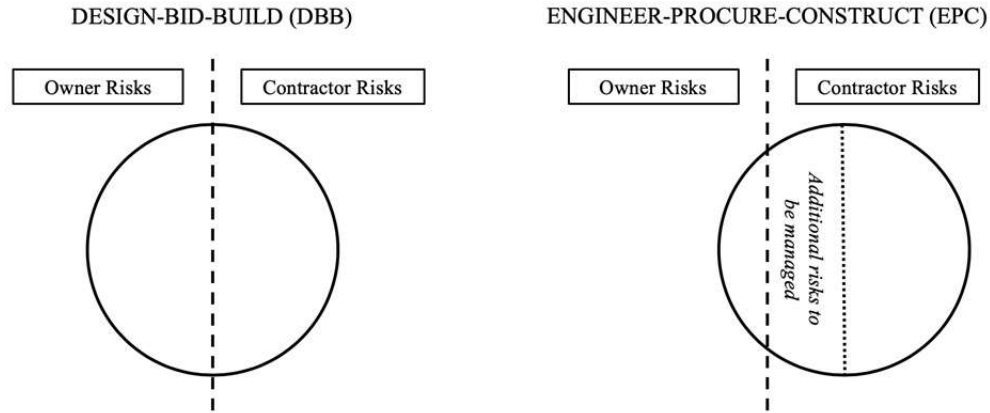
FIGURE 2
RISK TRANSFER COMPARISON BETWEEN DBB AND EPC MODELS



By virtue of its comprehensive scope, the EPC model allows owners to transfer certain risks to contractors which were previously mitigated during the development phase. Even if provided a risk premium, the concern is that a risk is being transferred to another party before its potential impact is

completely understood. By doing so, the owner is not only transferring that risk, but also the responsibility for managing it.

FIGURE 3
ADDITIONAL RISKS TO BE ALLOCATED AND MANAGED UNDER EPC



Unless the contractor has both the understanding and the tools to mitigate that risk, it remains in the project and its impact and probability are unaffected. Figure 2 compares the transfer of risk from the owner to the contractor under the DBB and EPC models. Figure 3 illustrates the share of total risks affected by this transfer that need to be additionally managed.

An unintended consequence of the comprehensive scope of the EPC is to drive risk allocation earlier in the process before risks are completely understood. Simple transfer and allocation of a risk to a contractor with little regard as to its likelihood of occurrence or its magnitude does little to mitigate that risk at a project level. When risk transfer is adopted over risk mitigation, the reality is that there is little more than an illusion of risk management. As a result, more uncertainties are left in the EPC model, which makes EPC projects riskier for contractors, and eventually owners.

REACHING FINANCIAL CLOSE

The development stage of a hydroelectric project is a complex series of activities, each with their own diverse objectives, but all with the singular goal of a reaching a financially robust, bankable project with an appropriate level of risk. Development is much more than just a series of technical studies and commercial documents: it establishes the entire implementation strategy.

Completely addressing the long array of risks inherent in hydroelectric project development requires significant time and money. Private developers are under considerable pressure to reach financial close. Compared to public utilities, these developers often have a higher cost of capital and more limited funds for development activities. Whereby the EPC model sets the stage for broader risk transfer, the pressure of reaching financial close is an important driver of hasty risk allocation within that structure. Developers, under the joint pressures of proving success and the time value of money, are pushed to fast-track the development process, leaving some risks concealed.

One of the key environmental factors that facilitates fast tracking the development process through hasty risk allocation is the power dynamics between owners and contractors. Candee & Larson (2013) posit that risk between parties is not balanced, with the strongest party forcing the other party to carry undue risk ownership. History has shown that the strongest party during the contracting stage - typically the owner - frequently strives to allocate as many risks as possible to the EPC contractor. However, if a contractor is not in a position to mitigate the probability of occurrence or the impact of a risk, then that risk is simply allocated and not mitigated, thus preserving the illusion of risk management. In some cases,

these risks materialize and can result in claims and delays by the contractor. In other cases, contractors, obliged but unable to bear the financial burden, have gone bankrupt. In both cases, the initial allocation of risk was only temporary, and the burden of a risk materializing was inevitably borne by both parties.

Another environmental factor enabling hasty risk allocation is information asymmetry between the owner and the contractor. A key guideline in determining whether or not a risk should be transferred is whether the receiving party has both the expertise necessary to control or minimize it and the competence to fairly assess that risk (Baloi and Price, 2003). For risk management to be effective, “all parties must understand risk responsibilities, risk event conditions, risk preference, and risk management capabilities” (Bakr, Hagla and Rawash, 2012). The illusion of risk management under the EPC model is epitomized by the fact that sometimes the only contractors willing to accept the technical and financial risks are those that don’t have the technical experience or financial strength to assume such risks in the first place. Smaller run-of-river hydropower projects, especially in frontier markets, face difficulty in attracting tier-one contractors with strong balance sheets and ample experience. The EPC consortiums are typically led by smaller civil contractors. Experience shows that these contractors, while sufficiently capable in construction of civil structures, frequently lack expertise and experience in hydraulic design, complex electromechanical systems and even river diversion. The EPC model assumes that the lead firm fully understands all technical and financial aspects of hydropower design and implementation. Without the right understanding, contractors are led to accept risks of which they are not fully aware, leaving them unprepared for risks that materialize and exposing owners to disputes, cost overruns and delays.

Within this enabling environment and under pressure to succeed, owners have taken advantage of the wide scope offered by the EPC model to fast track the development process and shift critical studies and risk mitigation activities to a later date and to another party, often leaving risks overlooked and both parties exposed.

CHANGING RISK OUTCOMES: THE NEW PARADIGM

Avoiding many of the delays and cost overruns that are suffered by hydropower requires real changes. As mentioned previously, the EPC model works fabulously on paper and by itself is not fundamentally flawed. If done properly, it could be able to deliver on its promise to reduce cost overruns and delays. To do so, we consider a few concepts that could address some of the issues leading owners to transfer risks hastily within the EPC model and miss out on comprehensive risk management:

- Some owners, new to the hydropower field, often lack the experience to fully appreciate the future implications of allocating risks to a contractor with no consideration for whether or not the risk will actually be mitigated. The illusion of risk management during the contracting stage is only possible because owners believe that they will be fully immune to allocated risks that materialize during construction. However, experience shows that when significant risks materialize during construction, they inevitably lead to disputes, cost overruns and delays (either directly or indirectly). Adequately identifying, investigating, mitigating and managing the plethora of risks inherent in hydropower development requires depth and breadth of technical and commercial experience from other similar projects. Complementing development teams with experienced cross-disciplinary individuals during the final project definition stage would help dispel the illusion of risk management and enable owners to further study their projects and make them more robust during construction.
- By virtue of its comprehensive scope, EPC sometimes leads owners to believe that contractors can effectively handle all project risks. Understanding the contractor’s limitations with respect to risk management would help ensure a more efficient allocation of risks between the parties. If some risks cannot be mitigated effectively by the contractor, the owner may be better served to accept the risk instead of allocating it and avoid paying the risk premium charged by the contractor.

- Owners should beware of using coercive power when allocating risks during the contracting stage. Experience shows that although the owner holds power over the contractor during the contracting stage, the power balance reverses itself during the construction stage.
- Owners and contractors should work closely together to build a common understanding of risk responsibilities, risk event conditions, risk preference, and risk management capabilities. When owners rely on information asymmetry to allocate risks during the contracting stage, those risks are only passively retained by the contractor, leaving the owner exposed, nonetheless.
- The allocation of responsibilities and risks in an EPC contract is in and of itself a risk due to the inherent misaligned interests between the two parties: contractors are looking for low costs and high profits, while owners are focused on high quality at reasonable costs. Bringing the EPC contractor into the shareholding structure could help align interests between the parties and create a constructive environment for risk management during the development and construction stages.

CONCLUSION

Experience shows that there is no silver bullet to project success. A clear, comprehensive risk management strategy starting during the early development stages and continuing throughout the life of the project is required to avoid the pitfalls so frequently seen in hydropower.

The EPC model has widened the scope of contractors compared to the traditional DBB model. This new structure has allowed hydropower developers to transfer risks to the contractor without ever truly addressing them during the development stage and, in some cases, even forego critical development studies. As a result, more uncertainties are left in the EPC model, which makes EPC projects riskier for contractors, and eventually owners.

Owners face considerable pressure to reach financial close. In an attempt to reach financial close faster and with power dynamics and information asymmetry working in their favour, owners may be enticed to hastily allocate risks to contractors instead of taking the time to study and mitigate them during the development stage. As a result, some risks remain concealed and both parties are exposed.

Solutions leading to efficient risk allocation within the EPC model could include: Having experienced development teams that are not prone to the illusion of risk management; Creating a clear understanding of each party's limitations with respect to risk management; Resist using coercive tactics and information asymmetry in the risk allocation process; Building a common understanding of the project's risk register; Considering joint shareholding between owners and contractors to align interests.

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