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PROCURING CONSTRUCTION CONTRACTS FOR AFFORDABILITY AND RISK SHARING

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Introduction

Getting hydroelectric projects off the ground is increasingly challenging in terms of affordability (the sites are now generally more remote and in more challenging topography); the ever-tightening social and environmental restrictions (during construction and operation); and the availability of finance. This has led to the exploration of different methods for the procurement of construction in an attempt to reduce costs whilst still managing risks and providing a fair deal to all the parties concerned. This paper provides case studies of four different strategies employed recently by international consulting engineers Knight Piésold (KP), in Africa and Canada, for the development of hydroelectric projects.

Types of Construction Contract

The following types of contract are discussed in this paper:

- Design-Bid-Build (DBB) Model. Also known as Schedule of Rates or Prices, Unit Price or Bill of Quantities. This is the old traditional model for procuring construction contracts. It has proved over time to provide a fair deal to all parties, by sharing the risks – essentially the owner and his consulting engineer take the design risk (which includes unforeseen conditions, primarily geotechnical foundation and weather) and the quantity risk, while the contractor takes the pricing risk. Failings of this model are that it allows no design input from the contractor, in terms of possible more constructible and affordable alternatives than that presented in the owner's design, and that there is no price certainty when the contract is awarded – the final price depends on final quantities which are not guaranteed to be the same as those tendered.
- Engineer, Procure, Construct (EPC) Model. Also known as Design-Build. This is an attractive model for the owner because it essentially assigns all risks to the contractor, has price certainty (which has become a requirement of many lending agencies), and involves minimal administration for him. Failings include the fact that it is typically more expensive (the contractor has to include a premium to cover the risks), and the owner loses full control of the design (here the ultimate responsibility of the contractor).
- Owner Procurement and Construction (OPC) Model. This model is similar to the DBB model in that design is the owner's responsibility but construction is done not by a procured contractor but by the owner, using his own equipment and other resources. This is a good model if the owner has good resources – equipment and technical and administrative manpower.
- Alliance Model. Also known as Target Price. In this model, the owner and contractor work together to obtain the most economical contract cost, based on a target price set between the two parties at the outset. Actual contractor costs are open book and monitored against the target. Mechanisms are included to deal with variations between actual and target costs and which party pays for (or benefits from) them.

1,333 MW Ingula Pumped Storage Scheme, South Africa (DBB Model)

The 1,333 MW Ingula Pumped Storage Scheme in South Africa has been procured in a number of conventional unit price contracts, with financing by the client (the South African electrical utility Eskom) together with long term debt provided by international finance and development banks. The project is nearing completion, with COD anticipated in 2016. KP was involved from the outset, including identifying the site and optimizing the layout. KP then formed a consortium with two other South Africa engineering consultants to form the Braamhoek Consultants Joint Venture (BCJV) which took on the responsibility of Owner's Engineer for Eskom and completed the site investigation, detailed design, tender documents and tendering, procurement and construction supervision for all aspects of this US$2.2 billion development. In order to help provide price certainty on the project, which included upper and lower reservoirs, 4.5 km of water conveyance tunnels, underground powerhouse and access tunnels, extensive site investigations were completed prior to project tendering. This included surficial mapping, test pit, drill holes, seismic surveys and exploration tunnel down to the powerhouse level. The tender designs were also advanced significantly prior to tendering in order to reduce "design creep" after the contracts were awarded.

Building a hydroelectric project of this size in South Africa also had other challenges that the BCJV team together with their Partners Eskom had to overcome, including:

- Eskom had not built a hydro project of any significant size in 25 years, and therefore much of their in-house hydropower expertise had already retired. They therefore needed to rely more heavily on their Engineers to take on more of the responsibilities to make the project a success.
- Numerous contracts were let with companies from all over the World, including Civil Contractor from Italy, Turbine Supplier from Germany, and numerous smaller South African consortiums and contractors. In South Africa there is a huge drive for Black Economic Empowerment (BEE), and numerous smaller BEE contracts were also let. This required a huge amount of coordination by the Eskom-BCJV team.

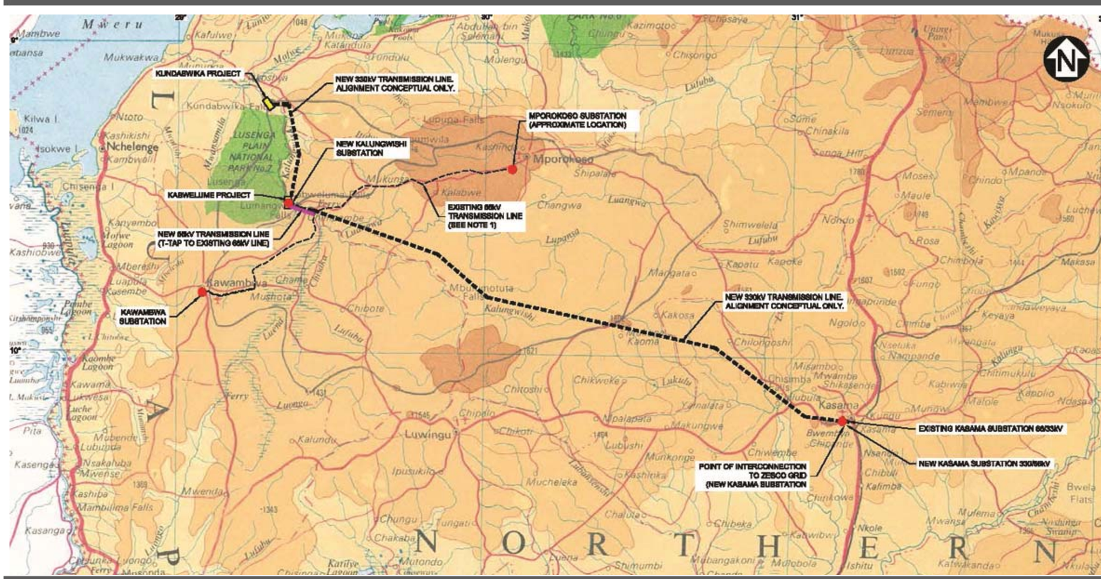
Ingula PS - Lower Reservoir RCC Dam

Ingula PS - Site Layout

247 MW Kalungwishi River Hydroelectric Project, Zambia (EPC Model)

The Kalungwishi Project in Zambia is in the process of being procured as an EPC (aka Design Build or Fixed Price) contract, with international contractor and private sector developer (Lunzua Power Authority, LPA). Fixed price contracts offer price certainty by assigning all risks to the contractor but in many cases this strategy has proved to make projects unaffordable – there is a premium to be paid for the contractor assuming all the risks. This is a private sector development where LPA won the concession to develop the hydropower potential on the Kalungwishi River in a competitive bid process. Energy generated by the Project will be sold to Zambian utility Zesco under a long term Power Purchase Agreement (PPA).

Kabwelume Falls



Kalungwishi Hydroelectric Project - Site Layout

Knight Piésold
CONSULTING

22 MW Nzoro II and 11 MW Ambarau Hydroelectric Projects, DRC (OPC Model)

The Nzoro II and Ambarau Projects in the Democratic Republic of Congo provide hydroelectric power to the operating Kibali Mine. Nzoro II has been completed and is operating and Ambarau is presently under construction. Construction has been and is presently being handled directly by the owner of the mine, with the assistance of DRA out of South Africa that is assisting with engineering, procurement and construction management (EPCM). This method effectively puts all the risk on the owner/developer but has the potential of minimizing cost if the process is well managed.

22 MW Nzoro II Powerhouse

22 MW Nzoro II - General Arrangement

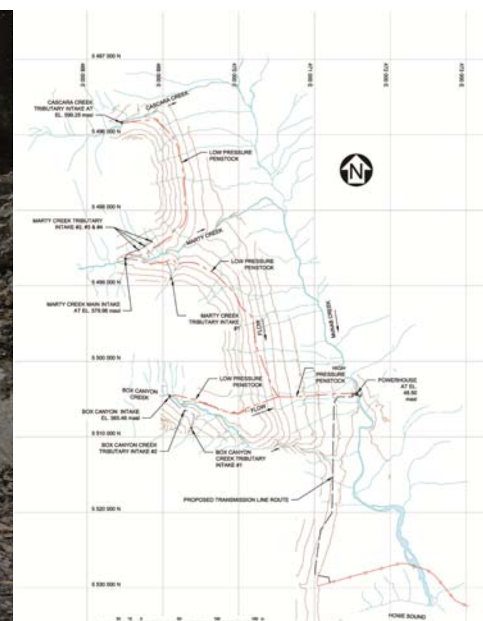
15 MW Box Canyon Hydroelectric Project, British Columbia, Canada (Alliance Model)

The Box Canyon Hydroelectric Project will divert flows from Box Canyon Creek, Marty Creek, and Cascara Creek to a shared powerhouse in the McNab Creek Valley near Port Mellon, BC, Canada. With an output of approximately 15 MW the project will tap into an existing 138 kV transmission line. The project has an Energy Purchase Agreement with provincial utility BC Hydro following a competitive Clean Power Call by BC Hydro in 2008. KP has been retained by owner/developer Elemental Energy Inc. to optimize and design the project, providing all required engineering services.

The Box Canyon Project is being procured with an Integrated Project Delivery Alliance (or Target Price) contract. The basis of this contract is that the contractor is reimbursed his costs (in an open book process), including indirects and profit, up to an agreed negotiated target price, after which the risk of exceeding the target price is shared by the owner and the contractor in accordance with a predefined process. The Alliance Model has provided the owner with the cost certainty and confidence needed to secure the project at a price they can afford and the lending banks accept (i.e. not paying the EPC risk premium). For this model to work, all team members (i.e. owner, design engineer and contractor) need to buy fully into the whole process and work as a cohesive team. The initial buy-in from all parties took a little time to establish at the outset of the project, but now all team members are fully engaged and working as a cohesive team.

At the time of writing (January 2015) the project is now halfway through construction with 2 of the 3 major intakes complete as well as half the penstock installed. To date the project is meeting its key milestones in terms of cost and schedule.


Box Canyon Hydro - Penstock



Box Canyon Hydro – Project Overview

CONCLUSION

The paper has explored the relative merits of four different methods of procurement for the development of hydroelectric power projects, balancing owner requirements and control of design against financing requirements, including the sharing of risk, in order to make the projects affordable. There is no one solution fits all and the parties should be prepared to look at all options in the interests of developing projects that are affordable while still meeting design and performance objectives, and the right for all parties to make a reasonable profit from their labours.

AUTHOR BIO's

Mike Robertson

Mr. Mike Robertson is a Specialist Engineer / Project Manager at Knight Piésold. He is a Civil Engineer with over 40 years of experience, primarily in hydropower, dams and water resources development. His career has included time spent with consultants in London designing large irrigation schemes in Iraq; with the Ministry of Water Development in Zimbabwe planning, designing and building large dams and bulk water supply schemes for primary and irrigation use; with consultants in South Africa working on dam safety and water resources planning and design and construction of infrastructure; and with consultants in Vancouver, Canada working mainly on dam safety, run-of-river hydroelectric and mining projects.

Sam Mottram

Mr. Sam Mottram is the Managing Principal of Power Services at Knight Piésold. He has over 20 years of experience in management, design and development of hydroelectric projects. He specializes in project concept development and optimization, including project identification, planning, environmental baseline studies, feasibility studies, contractual arrangements, permitting, impact assessments, risk assessments, design and financial viability. He has direct hydropower project involvement on more than 100 projects in North, Central and South America, Africa, Europe and SE Asia.

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