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International Federation of Consulting Engineers



CONSTRUCTION OF A 1,500MW HYDROPOWER STATION IN ECUADOR, UNDER AN EPC CONTRACT

- The following presentation is my personal experience on this type of contract, the first I was exposed to, because previously we had been using only unit-price, estimated quantities, type of contracting, for the electric sector in Ecuador.
- Rather than entering into the characteristics of an EPC contract I'll be focusing on particularities of the application of this contract format in Ecuador, with a Chinese Contractor.
- The name of the project is COCA CODO SINCLAIR, located some 100km east from the Capital of Ecuador, the city of Quito, over the Coca river which flows into the Napo river, a tributary of the Amazonas.
- The maximum installed capacity is 1,500MW

THE FIRST PART IS A DESCRIPTION OF THE MAIN PROJECT CHARACTERISTICS

THE SECOND PART COVERS THE EPC CONTRACT APPLICATION



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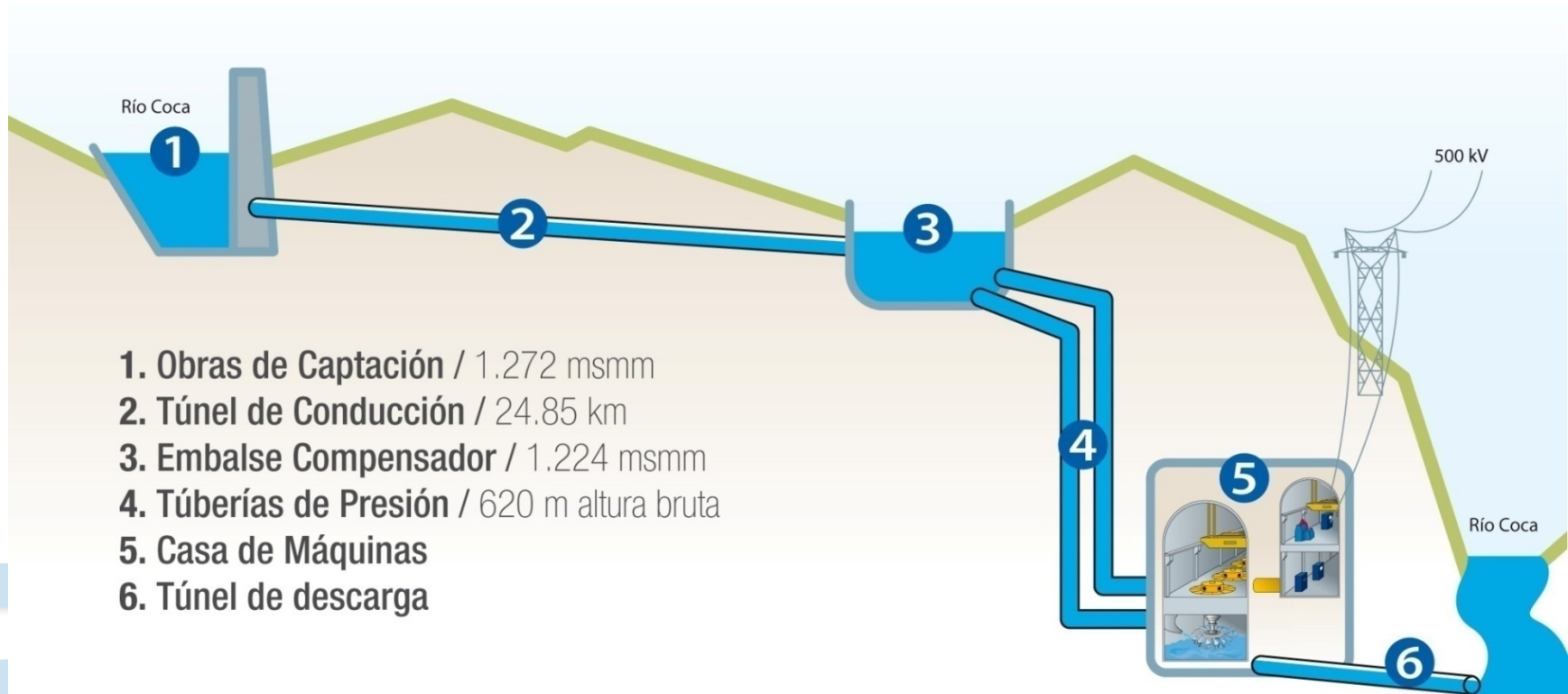
PROJECT LOCATION



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PROJECT PROFILE AND MAIN FEATURES



THE ORIGINAL INTAKE WORKS SITE



THE INTAKE WORKS



HEADRACE TUNNEL Length= 24,850m



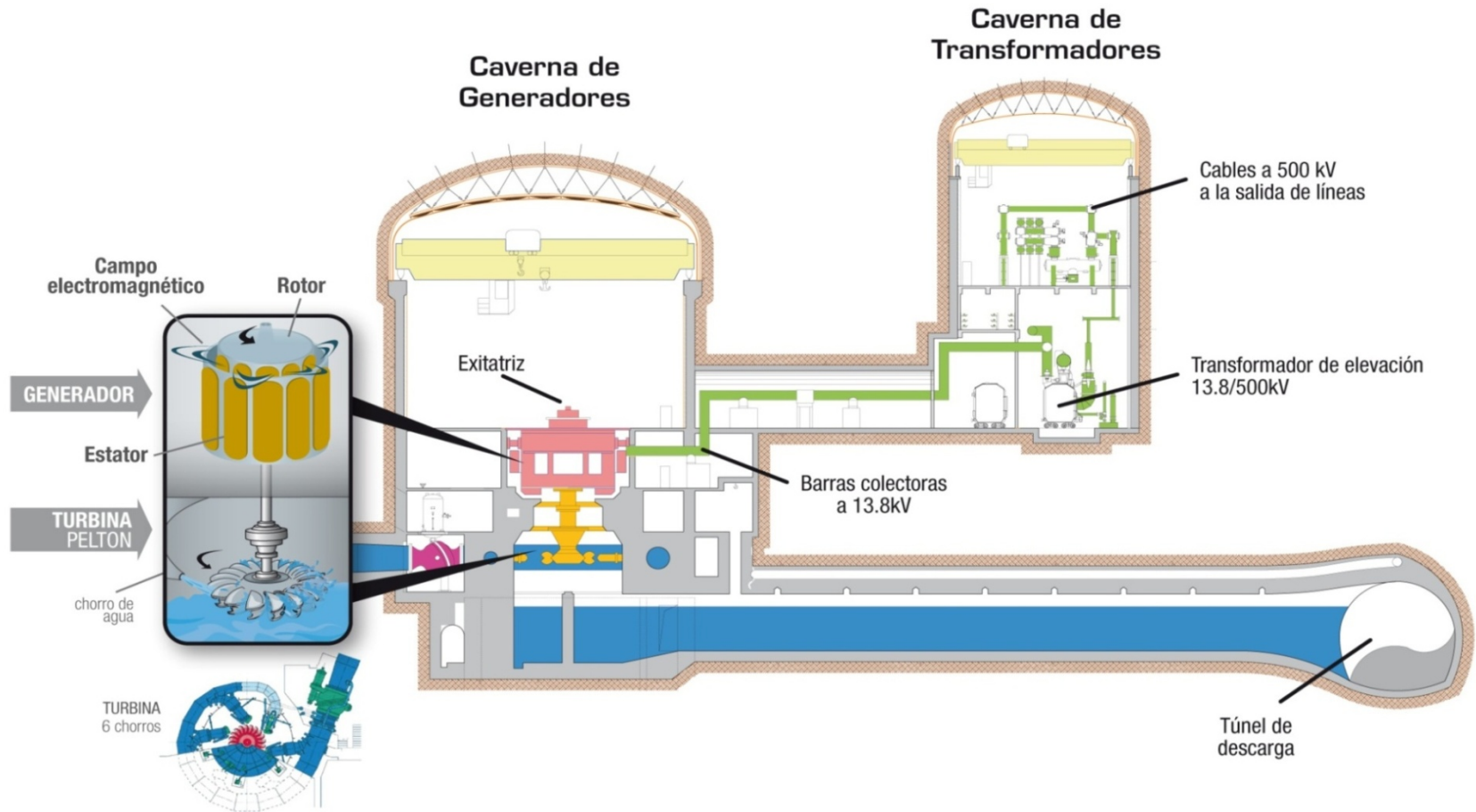
TBM N° 2 D=9.1m



DAILY REGULATING RESERVOIR



GENERATION AND TRANSFORMERS SET UP



PELTON TURBINE INSTALATION



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THE MACHINE HALL: 8 UNITS OF 187.5MW EACH



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THE PRECONTRACTUAL PROCESS

- For the EPC process, a Feasibility Study for 890 MW (finished back in 1992) was available. Then, a Conceptual redesign for 1,500 MW was done in 2008, keeping the same geographical locations for all the project components. These studies are backed up by abundant site investigations such as: Topography, Hydrosedimentology, Geological drillings, Geotechnical investigations, as well as specific studies such as: Rock Mechanics, Soil Mechanics, Environmental impact, among others.
- When the process started, several construction companies showed interest: two from China, one from Iran and one from Italy. On the bidding documents it was required, to present a “firm” financing letter. For this reason, only two Bids from two Chinese companies were submitted.
- After the qualification process (envelope 1), only SINOHYDRO remained.
- The negotiations started in April 2009.



LEGAL AND TECHNICAL CONTRACTUAL NEGOTIATIONS

- Legal and Technical negotiations were difficult and time consuming, because the Chinese delegates and engineers did not speak Spanish, or at least English as a bridge language. Several English and Spanish speaking Experts, from the two parts participated, on the Legal negotiations.
- The Owner Requirements and the Technical Specifications definitions, was a very long and arduous work which took several months, with common language translators, who did not know the exact technical meaning of what was being discussed.
- This great effort was very worthwhile at the time Coca Codo Sinclair Public Enterprise, demanded the fulfilment of the quality of all the works and equipment.
- To make it short, the Contract format is contained in 158 pages, whereas The Owner requirements, Technical Specs and all the Contract Annexes comprises 1,028 pages.



THE OWNER, THE CONTRACTOR, FINANCING

- The Contracting entity or **The Owner** is the Government of Ecuador, through the COCA CODO SINCLAIR Public Enterprise.
- **The Contractor** is the Chinese SINOHYDRO CORPORATION which presented credentials from its participation in the construction of : the Three Gorges and the Shalondy, large hydro power plants in China, and several other good sized projects in southeast Asia, for the qualification process.
- **The Financing** came from the China's Eximbank, covering 85% of the contract cost, while 15% was covered by the Ecuadorian Government. This value was disbursed within the 6 first months of the contract period.



MAIN EPC CONTRACT FEATURES

- The signed document essentially follows the Silver Book format by FIDIC.
- The EPC comprises the **Engineering** (Basic and detailed), the **Procurement** , including installation and testing of all necessary equipment and, the **Construction** of all civil works required for a Hydropower Station for 1,500 MW, installed capacity.
- The Contract is for a Global fixed amount and for a Fixed Term.
- There is a Price Adjustment Formula for the local materials (steel bars, cement, diesel) and local labour.



MAIN EPC CONTRACT PENALTIES

- There is a heavy per/day Economical Penalty, for not complying the fixed deadline for the first 4 Units tested and on line. Another similar one for same default for the second 4 Units.
- There are economic penalties for failing to comply guaranteed Turbine and Generator Output.
- There are economic penalties for failing to comply the guaranteed Turbine and Generator Efficiencies.
- There are economic penalties for cavitation, and for not complying “good performance and absence of defects”, during the testing of each Unit.
- There are no penalties for not completion on time, intermediate important activities, nor for Contractor's failing to meet other contractual requirements.



CONTRACTOR'S PARTICULARITIES

- SINOHYDRO is a state company from the People's Republic of China and therefore subjected to an idiosyncrasy and heavy bureaucracy, not well familiar with the western world, I presume. This fact, besides the language barrier already mentioned, made difficult the discussions and agreements especially during design definitions and at work site, even more difficult.
- At the beginning of the construction, the site staff did not understand Spanish, as required in the contract, and had not enough technical skills, for such a large and complex project, as Coca Codo Sinclair. Serious talks with the Contractor at its Beijing Head Office, were required in order for the Contractor to correct these deficiencies.
- After this meeting, better translators and better qualified technical personnel were dispatched to the Project. Also some English speaking chinese engineers arrived to the project.



LACK OF OPORTUNE PROJECT PLANNING

- A negative aspect (and difficult to understand), was the reluctance of the contractor to present the Master Project Construction Schedule. Although it was a contractual requirement to update this document, during the first 90 days starting from day 1, the Contractor did not meet such requisite.
- Many claiming notes had to be issued by The Owner to the Contractor, in order for him to meet this item. It was finally presented for approval in September 2012, even though the Order to Proceed was issued in July 2010.
- Afterward several Schedule updates were submitted also with delays.



THE ENGINEERING

- The Engineering of the Project was carried out by the Chinese Yellow River Corporation, a subcontractor for Sinohydro.
- For this activity, the main difficulty was again the language. Besides this fact, this consulting firm did not apply the logics of any engineering work, that is: to present first the Design criteria, then the Calculations sheets and finally the Drawings, for approval, in this order. They presented, first the Drawings, in Chinese, with very bad English translations, and afterwards the Technical Criteria and Calculations, also very poorly translated.
- Here the work again suffered from lack of opportune planning, causing months of minimal submissions and other months with stacks of documents and drawings for approval.
- This fact, demanded a lot more from the personnel of the Supervising Consultant Association, that have to be idling or had to do repetitive revisions, even 8 and 10 times, on the same document, whereas the Consulting contract only foresaw 2 revisions. This situation was reflected in more consulting costs to the Owner.



THE COMBINED DISPUTE BOARD

- In the Contract text, the conformation of a Combined Dispute Board, was very well detailed, as well as its scope of work and the nature of its decisions.
- The CDB studied a good number of controversies raised by the contractor and by CCS. The majority of them were settled through decisions of the Board. Some, I presume, still remain in analysis and eventually could end in an arbitration process, contemplated in the contract document.
- In general, the inclusion of the CDB into the contract terms, was very useful to solve controversies, especially those involving term extensions claimed by the contractor, due to unforeseen geological conditions. Three cases can be mentioned as the most impacting on the critical path of the Project: one happened on the downstream reach of the tunnel, one on the upstream reach of the tunnel and one on the vertical pilot shaft of penstock N° 2.
- On the first two events, the corresponding TBM's 2 and 1, were trapped, in different dates for each one. On the third event, a new shaft had to be drilled.



CONCLUSIONS (I)

- The FIDIC Silver Book format, is a quite complete document for project construction, under an EPC modality. It is very necessary though, to have an ample knowledge of the project site conditions and project main features in advance.
- Regarding the site conditions, the Owner needs to have enough information regarding , at least to: Topography, Hydrology and Geology in order to define in the best detail, the Scope of Work and the Technical Specs.
- It is necessary to adapt the Silver Book FIDIC documents, to: 1) the particular legal and technical regulations of the country in which the project is to be built and 2) the main project features.
- The Technical Specifications have to be very complete and detailed, in order to avoid future misunderstandings and claims. Here I have to emphasize, that the Contractor has to be totally familiar with the standards used in this part of the world, to avoid a time consuming work to analyze and homologate standards totally unknown to the Owner (Chinese standards for example).



CONCLUSIONS (II)

- In my personal opinion, it is completely necessary to include in the contract document, penalties to the Contractor for not meeting certain key intermediate dates, especially for a long term work. In the case of the EPC for CCS project, the Basic and Detailed Engineering to be performed by the contractor, suffered several delays which in turn could jeopardize the Critical Path of the Project.
- Lengthy discussions and time waste could have been avoided, should the Contractor had been penalized for intermediate dates delays. Of course it is not the Owner's intention to make "profit" from contract penalties application, but it is the only way to get a timely reaction to delays, from the Contractor.
- The language "barrier" was really a formidable obstacle, during all the Contract execution period. This problem got worse at the jobsite, where the majority of the Chinese Contractor Staff did not understood at least English, that could have helped as a bridge language for easier communication.



CONCLUSIONS (III)

- The Project Master Schedule, was not presented on the date stipulated in the Contract. Updates of this document also were presented with delays. It is difficult to understand, why a contractor of the size and experience of Sinohydro, delayed so long the presentation of this vital tool, which permits to control the good progress of a construction project.
- Despite all the difficulties and problems shortly described due to time limitation, **the Contractor made all necessary efforts and increased personnel and resources, in order to remedy the delays caused by him and by mother nature.** Personnel of the Supervising Consultant and of CCS, also contributed to overcome these difficulties. The Power Station was put on line, at the end of 2016.
- **IT IS WORKING FINE, UP TO THE PRESENT DATE!**

THANK YOU!

