

General Hydro-electric Masterplan of Tekhuri River, in Georgia – The importance of the local engineering geological conditions

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A Feasibility Study Layout Masterplan of the Tekhuri River located on the south-west slopes of Caucasus Mountains, in North-west Georgia, had been prepared in 2015. That Masterplan included five (nr. 5) individual hydro-electric projects containing five (nr. 5) dams (one rockfill type embankment dams with central clay core and four of the RCC gravity type dam), their height varied between minimum 23m over to 47m without taking into account the foundations excavations. In addition, the full initial project, included five (nr. 5) headrace tunnels, of diameter ranging between 2.5m to 4.0m with their lengths ranging between 3.6 over to 5.0km linking the reservoirs with the relevant provided five (nr. 5) power houses downstream, of total then provided installed of 112MW. The prevailing engineering geological conditions of the three upstream dam and their reservoirs are geologically characterized by the presence of a volcano-sedimentary folded sequence of, thick to medium layered, sandstones, siltstones, mudstones, andesitic lavas and tuffs. From the engineering geological point of view, the aforementioned sequence is characterized by relatively high strength, generally low deformability and low permeability, that practically secure both the dam and reservoir feasibility. However, the two downstream dams and their reservoirs geologically develop over karstic limestone formations outcrops which from the engineering geological aspect are characterized by very high permeability, with serious potential reservoir water-tightness and associated dam stability problems. In the beginning of 2016, a private investing company undertook the carrying out of the missing designs and the submission of the relevant application to get the permission for the implementation of the whole cascade hydro project to the Georgian Authorities. Within the obligations of the application procedure for obtaining the relevant concession permission by the Georgian authorities, there was carried out the necessary Feasibility Study by a local (Georgian) consulting company. The candidate Developer for the concession contract, just before the submission of the official application to the Georgian authorities, assigned to an Austrian consultancy the carrying out of the Technical Due Diligence Study of the Feasibility Study of the project which had been carried out by the local Georgian consultancy, focusing in particular on the Hydrological, Hydraulic, Geological and Geotechnical and the Energy aspects of the design. Within the framework of the Due Diligence study, a Greek team of Geologists and Geotechnical Engineers from the Greek branch office of an Italian consultancy based in Thessaloniki, Greece, undertook the geological and geotechnical part of the aforementioned study. In the presentation, there are described, first, the unsuccessful ways of the input and the essential incorporation of the geological information in the Feasibility Planning and Design of the Project Masterplan and in general, all of the hydroelectric projects in Georgia. Then, there are presented the final evaluation of the proven “non-feasible” of some of the provided dams and reservoirs of the previously developed project Masterplan. Finally, there are presented the Masterplan modifications based on the geological proposals to be in full alignment of the hydrological, hydraulic and energy considerations of the project, in order to achieve the technical and financial feasibility of the General Masterplan of the Hydro-electric Development of the river Tekhuri in the area of the South Caucasus mountains of Georgia.