Discussion on "Operation of the Electrical System of Crete in Interconnection with the Mainland Grid: A Stability Study"

by Michalis Karystianos, Yannis Kabouris, Thanos Koronides, Stefanos Sofroniou

Discussed by

Yannis Voyatzakis

Former PPC Transmission Engineering and Constructions Director

Abstract

The discussed paper envisages a future interconnection of the island of Crete to the Hellenic Interconnected System. The authors are commented for providing a thorough security analysis of the System of Crete with a future interconnection. However, this planned interconnection has a prior history briefly summarized in this discussion.

Initial Studies for Crete Interconnection

During the 1980s the feasibility and the technical aspects of the interconnection of the island of Crete to the Mainland (Hellenic Interconnected System) was examined in great detail. Due to the large distance between Crete and the nearest part of the Interconnected System in Peloponnese, the connection was only possible with HVDC. The conversion station on the Interconnected System was proposed to be constructed on the strongest network point in Peloponnese, namely the Megalopoli generating station as in Fig. 1.

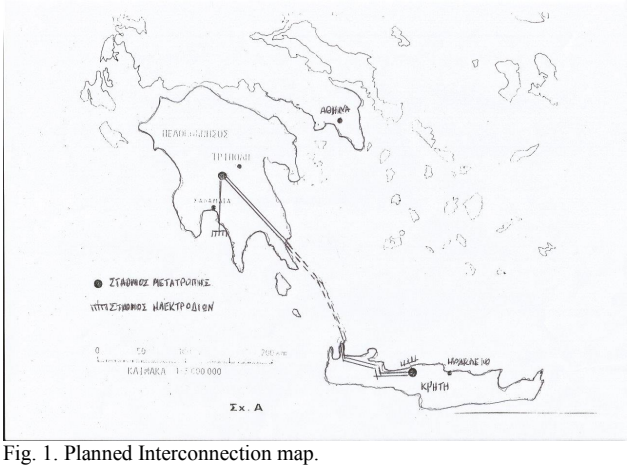

Fig. 1. Planned Interconnection map.

The initial feasibility study was for a two-pole interconnection of a total power of 300 MW (2x150 MW cables) at a DC voltage of 225 kV. With this scheme the power generating stations in Crete remained in operation. Financially this solution was profitable, even without considering the possibility of renewable energy sources in Crete.

In order to verify the technical feasibility of the interconnection project, due to the great sea depths and the large anomalies of the sea bed (in the region the African and European plaques come together and coalesce), a number of morphological and geological studies were carried out for many years that resulted in locating a safe track for laying the submarine cable.

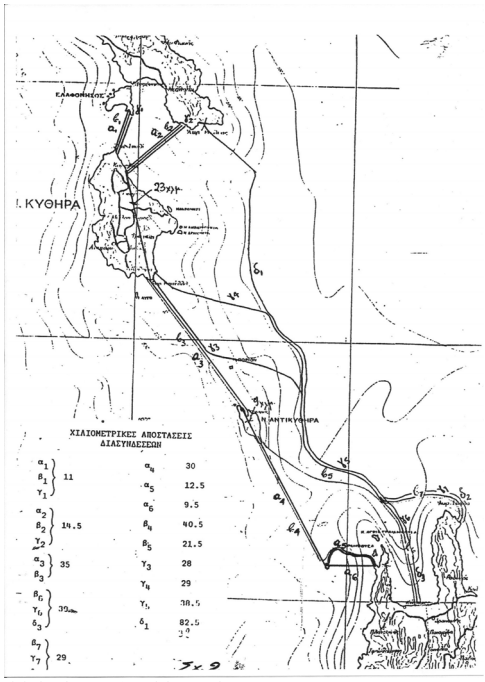

Fig. 2. Initial (shortest) cable track.

The first investigated track was the shortest one along the islands of Kythera and Antikythera (Fig. 2), but the bed morphology between Antikythera and Crete was prohibitive. The investigation then proceeded to a more easterly

978-1-4799-0199-9/13/$31.00 ©2013 IEEE

track between Monemvasia in Peloponnese and Souda bay in Crete.

The final track selection was between Mobemvasia and Cape Spathas in Crete (Fig. 3).

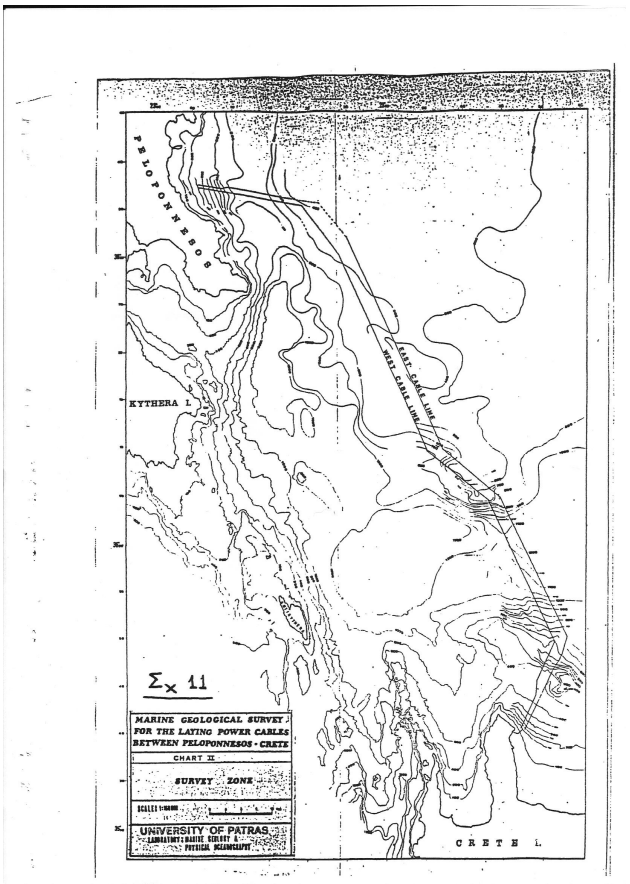

Fig. 3. Final selected cable laying track.

This path presents a uniform relief with slopes not exceeding 25% while the geological properties of the sea bed were examined in order to secure the safe laying and the lasting life of the cables. The length of the submarine path is 150 km and the maximum depth encountered is 1150 m.

The most characteristic feature of this path was the great depth, as the maximum depth for laying a cable up to that time was 650 m. However, PPC with the cooperation of experienced cable manufacturers came to the conclusion that the then existing technology permitted the construction and successful laying of a cable with the above specifications.

Subsequent Interconnection Plans

At a later stage, PPC prepared a tender for the Interconnection of Crete to Mainland Greece with specifications for a 2-pole of 600 MW rating (2x300 MW). The rational was to minimize power generation in Crete, but the tender was never concluded.

It is worth noting that in the 1990s PPC in cooperation with the Italian ENEL were able to study, construct and implement the interconnection between Greece and Italy with an HVDC link, which is single-pole, 500 MW, at 400kV. The submarine cable length for this Interconnection is 160 km with maximum sea depth of 1000m and a maximum slope of 50%. The comparison of this successful project with the features of the proposed Interconnection between Crete and Mainland Greece clearly shows that the latter was indeed feasible.

And of course, the interconnection with Crete is still feasible. However, a different cable path is being proposed now. It seems that the solution adopted in the discussed paper is based on scenario B1 proposed in reference [1] of the paper, but with a reduced power rating of 2x400 MW, instead of 2x500 MW. This scenario proposes a submarine cable of 380 km length with a cost according to [1] much higher than that of scenario A of [1], which is closer to the solution suggested in the 1980s (the difference being that there in no overhead DC line in Crete). Furthermore, the sea-bed properties between Crete and Attica (scenario B1) are largely unknown, whereas the route between Crete and Peloponnese (scenario A) has already been closely examined in the 1980s.