

Memo: Schedule update of Crete-Attica interconnection

27.10.2023

The HVDC electrical interconnection of Crete island Power Transmission System with the Greek Power Transmission System (in Attica Prefecture) through a 1 GW HVDC (High Voltage Direct Current) link constitutes an engineering challenge, rendering it a project of international engineering interest. During the preparation of its Technical Specifications in 2019, the Attica – Crete link was among the two island interconnections with the greatest capacity but also among the top three deepest interconnections, worldwide. Nevertheless, the usage of VSC (Voltage Source Converter) technology for the Converter Stations in a bipolar configuration places the interconnection in a short list of projects exploiting similar advanced technical features.

However, the application of this technology does not exhaust the engineering challenge and the specificity of the project. The specific electrical and geographical area of the project increases the construction and operational challenges. Interconnecting the weak, in terms of power stability, transmission Network of Crete with the strong National Power Transmission System intensifies the challenges and increases the requirements at the level of studies, engineering and testing to achieve a state-of-the-art and environmentally compliant project in terms of both the construction and the operation throughout its design life. The extended construction area poses similar challenges, as this project is positioned at a very high rank worldwide in respect of the length of submarine cable interconnections, while at the same time it lies at a considerably greater sea depth compared to similar interconnections worldwide.

This extended geographical area of the project, its complexity degree, and the technical specificity of its installations resulted to extended and highly specialized permitting requirements in various authorities at all administrative levels, at a national, regional and municipal level. Various specialized issues regarding the project intersect with the authority and the competence of various administrative bodies, which are not under a clear and unified hierarchical structure, and whose competence and procedures do not necessarily converge. Permitting procedures, that involve a huge number of permits issued by the Greek State for almost any type of construction, had to converge on a specific date to allow the timely commencement of the works.

The above convergence exceeded the utmost diligence exercised, for reasons not attributed to the company, and exhausted all due diligence on its part. In particular, the restrictions imposed during the Covid-19 pandemic in the period between 13.03.2020 and 01.06.2020, as well as between 07.11.2020 and 05.04.2021, had a serious impact on the operation and the ability of the permitting authorities to timely respond to the Company's applications which in turn reduced the Company's ability to manage other unexpected and unforeseeable incidents that required the cooperation of specific permitting authorities. The dominant issue with a critical schedule impact was the discovery of antiquities at the areas where the project is constructed and the management of the required archaeological works in relation to the construction works.

A representative example of the permitting challenges is the issuance of the building permits for the construction of the Converter Stations both in Attica (Koumoundouros) and Crete (Damasta). According to the terms of the construction, contracts and the Contractors' schedules, the completion of the entire project, which includes the tests following its energization, was originally planned for 29.05.2023. Achieving the schedule required the issuance of building permits for both

Koumoundouros and Damasta Conversion Stations by 03.11.2020. However, the restrictions imposed due to the pandemic, limited the ability of the permitting authorities to cooperate in the reasonable and expected time on the necessary prerequisites to achieve the above objective. Thus, the building permits, without which it was not possible to commence the works on the sites, were only issued on 01.07.2022 for Koumoundouros Converter Station and on 25.11.2021 for Damasta Converter Station. It is noted that the administrative process for the issuance of the above permit for Koumoundouros Station, required specific legislative actions for urban planning and spatial arrangements, which were imposed by an operational requirement to build the Converter Station adjacent to a strong point of the Greek Power Transmission System, that was selected to be an existing High Voltage Substation of IPTO in Koumoundouros. In addition, for the issuance of the building permit for Damasta Converter Station, decisions by the Central Archeological Council were required twice on 04.06.2021 and 27.05.2022, once for the initial Construction Permit on 25.11.2021 and then for the update of the Permit on 01.08.2022, obstructing in more than one occasions the continuation of the earthworks.

It is clarified here that the extension of the project electrification date to 31.12.2024, due to the delays in the permitting process, was the dominant delay event that overlaid other similar delay events that occurred during the progress of the installation of the cables. Two indicative examples are the delays of several Municipalities in Attica Prefecture to issue permits required for cable installation works in their geographical area of responsibility, during the period between December 2020 and August 2021, raising objections to the acceptability of the project, as well as the delay encountered, for reasons related with archaeological authorities, in the amendment of the environmental permit for the undergrounding of the cable system in Crete, which was submitted by the company on 09.12.2020 and was only issued on 02.02.2022.

The aforementioned schedule deviations have substantially exhausted any available, already limited, float for managing new, unexpected and unforeseeable events intrinsically linked to the execution of the works, which normally arise during the execution of all projects, regardless of the degree of prudence and diligence of its studies. Indeed, during the execution of the excavation works in Converter Station Damasta, the company faced a serious unforeseeable event, which was the finding of karstic cavities in the underground area of the field. The identified cavities jeopardized the stability of the future constructions, and their presence required the suspension of the works followed by meticulous investigation and filling of the cavities with appropriate cement mixture. Although the execution of the restoration works lasted until January 2023, the company along with the Contractor made efforts to diminish their impact to the time schedule, with the final assessment being an additional three (3) months to the updated planned energization date of September 2023, thus moving the project energization date to the end of 2024. In addition, it must be noted that the serious flooding incidents in September 2023 have also affected the production process of the steel structure supplier for the Damasta Converter Station, with the final assessment on its impact not being finalized yet. Another important parameter, which determines the inclusion of this DC interconnection to the Greek Power Transmission System and the commencement of its commercial operation, is the testing requirements arising from its specificness. In comparison to the typical interconnection projects that the Operator has executed to date, i.e. conventional substation projects, the scope of this interconnection project, which is an HVDC link connecting an island of the technical characteristics of the Power Transmission System of Crete, imposes several additional testing requirements. It is noted that numerous tests will take place after the energization of the project, to ensure the smooth and uninterrupted operation of the HVDC link and the Greek Power Transmission System under each operating scenario and resemble the type of tests of a power plant unit that enters the Power

Transmission System for the first time. The sequence and type of testing follows the international practice and meets the requirements of all relevant standards and norms determined by the use of this specific HVDC technology.

Therefore, after the completion of the construction works and the interconnection's initial electrification, it is absolutely necessary to have hot reserves in power production units in Crete throughout the testing period and until at least the successful completion of the trial operation period, so that the TSO can intervene immediately and protect the stability of the System. Considering all the above, as well as the technical specificities that a DC electrical interconnection project of this scale imposes to the Greek Power Transmission System, combined with a demanding testing plan, it is obvious that even when the electrification of the project occurs by the end of 2024, the normal (commercial) operation of the link is expected in year 2025.