Cost-Benefit Analysis (CBA) of APOLLO-LINK

Undersea Power Cable between Spain and Italy

Executive Summary

This is a high-level Cost-Benefit Analysis (CBA) that examines the feasibility and advantages of the proposed APOLLO-LINK undersea cable between Ramis, Spain and La Spezia, Italy. Overall, while the initial investment with 3.5 billion Euros is substantial for a cable of 700 km, the long-term benefits are high with the net benefit ranging from 250 million Euros per year to 720 million Euros per year depending on the scenario under which the market simulations are performed. In addition the interconnector has significant non-monetised benefits such as RES integration and security of supply adequacy benefits.

Project Overview

The APOLLO-LINK project aims at establishing a critical energy connection between Ramis, Spain, and Spezia, Italy, through the implementation of a 525 KV DC undersea cable thereby connecting the bidding zones Spain and Italy North. This cable is set to traverse approximately 660 km beneath the Mediterranean sea, boasting a capacity of around 2 gigawatts. In addition to its undersea segment, the project encompasses roughly 40 km of underground onshore cable infrastructure, accompanied by the integration of 4 to 6 transformers and the construction of 2 High Voltage Direct Current (HVDC) converter stations.

In its current state, the APOLLO-LINK project finds itself in the pivotal project development phase. The meticulous planning and construction stages are slated to commence in 2026 and extend until 2029, with operational activities projected to commence in 2032. This timeline reflects the deliberate and methodical approach undertaken to ensure the successful realization of this essential energy initiative. The APOLLO-LINK aspires to serve as a pivotal conduit for power and progress, bridging the gap between these two nations with precision and innovation.

Quantitative Cost Benefits Assessment

While the preceding section provided a high-level overview of the project and its timeline, this section offers a quantitative assessment of the direct net benefit of APOLLO-LINK.

First and foremost, it is necessary to outline key assumptions that are universal across the approach. All figures are presented in Euros using 2023 real terms. Additionally, values are annual and thus do not require seasonal adjustments. The cost-benefit calculations are carried out over a 25-year operational period, starting in 2032 and running to 2057.

Furthermore, the benefit numbers presented below represent the Socio-economic welfare (SEW) benefit of the project and are based on 2024 TYNDP market simulations in which the impact of the cable on the markets has been evaluated under different scenarios. Simulation data is considered for the scenarios National Trends for the years 2030 and 2040, and Distributed Energy for the year 2040. For the National Trends scenario the SEW benefit has been linearised between 2030 and 2040 based on the values attained

through the simulations and the yearly values for the years after 2040 are kept at the level of 2040. For the Distributed Energy scenario only values for 2040 are available, which are used as yearly values over the entire operational period.

Cost

APOLLO-LINK's cost is expected to be around 3.5 billion Euros. Of these, OPEX is estimated to be around 20 million Euros per year over a period of 25 years, amounting to around 500 million Euros.

Project management & development	€ 195,000,000
Permitting, studies, and land acquisition	€ 50,000,000
Consenting Cost and CSR	€ 35,000,000
DC 525kV bi-pole cable	€ 1,630,000,000
HVDC Converters	€ 160,000,000
Transformer	€ 30,000,000
Power stations	€ 100,000,000
Contingency & Allowance	€ 870,000,000
Total	€ 3,070,000,000

Figure 1: Total CAPEX cost

The predominant portion of the project expenditure is anticipated to manifest in the form of capital expenditure (CAPEX), estimated at approximately 3.1 billion Euros. Within this allocation, the most substantial share is attributed to the offshore DC 525 kV cable, with an estimated cost of more than 1.6 billion Euros.

Furthermore, it is noteworthy that most CAPEX expenses is slated for disbursement during the final three years of the construction phase. Specifically, the financial commitments in 2029 and 2032 are projected to account for approximately 96% of the total CAPEX cost.

Benefit

The quantifiable benefit stemming from the APOLLO-LINK project pertains to the arbitrage value generated by the electricity transmitted via the undersea cable, multiplied by the price differential it captures between Italy North and Spain. In addition, consumer and producer surplus changes are included in the SEW benefit of the cable.

The SEW figures for the two considered scenarios naturally diverge significantly as their underlying assumptions of how the energy system will evolve in the coming years is also assumed to be drastically different under them. The calculated project SEW benefit for National Trends is 547 million Euros per year in 2030 and 860 million Euros per year in 2040. For Distributed Energy on the other hand the SEW value for 2040 is calculated to 382 million Euros per year.

The calculation of the net benefit of the project based on these numbers yields 250 million Euros per year under the Distributed Energy scenario, and 720 million Euros per year under the National Trends scenario equalling 6.3 billion and 18.1 billion Euros respectively.

Non-monetised Benefits

Apart from Socio-economic welfare benefits APOLLO-LINK has numerous additional benefits, which have been evaluated under the 2024 TYNDP market simulations.

The RES integration benefit, which reflects both the avoided RES curtailment as well as additional RES integration facilitated by the interconnector, amounts to 2.7 TWh in 2030

and 7.3 TWh annually under the National Trends scenario, while this value is 2.6 TWh under the Distributed Energy scenario.

Furthermore, the security of supply adequacy benefit, which reflects the ability of an interconnector to enhance adequacy by pooling the risk of loss-of-load while simultaneously pooling the generation capacity, amounts to 171 MWh in 2030 and 302 MWh annually under the National Trends scenario, while this value is 536 MWh under the Distributed Energy scenario (2040).

Conclusion

The APOLLO-LINK cable between Spain and Italy presents a promising opportunity to promote renewable energy integration, exploit arbitrage opportunities, enhance grid stability, and contribute to Europe's clean energy transition. While the initial investment with 3.5 billion Euros is substantial, the long-term benefits are high with the net benefit ranging from roughly 250 million Euros per year under the Distributed Energy scenario to 720 million Euros per year under the National Trends scenario.