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North Macedonia, Strengthening the
Transmission Network in the Southeast
Region of North Macedonia -
Component 1

Feasibility Study Summary Report

December 2022



The Western Balkans Investment Framework (WBIF) is a financing facility launched in December 2009 by the European Commission, together with the Council of Europe Development Bank (CEB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), Bilateral Donors, and Western Balkans countries with the purpose to deliver funding for strategic investment projects in beneficiary countries. Eligible sectors include infrastructure development in the environment, energy, transport, social and digital sectors as well as private sector development. KfW and the World Bank subsequently joined the Framework. In July 2017, the KfW became a partner organisation.

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Abbreviations

Abbreviation	Meaning
CBA	Cost-Benefit Analysis
CD	Conceptual Design
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMP	Environmental Management Plan
E&S	Environmental and Social
ESAP	Environmental and Social Action Plan
ENTSO – E	European Network Transmission System Operators – Electricity
EENS	Electricity Energy Not Served
ESIA	Environmental and Social Impact Assessment
EU	European Union
EUD	EU Delegation
F/E	Financial/Economic
GTC	Grid Transfer Capacity
IFI	International Financing Institution
IPA	Instrument for Pre-accession Assistance
IPF7	Infrastructure Project Facility, Technical Assistance 7
MEPSO	Transmission system operator of North Macedonia
NTS	Non-Technical Summary
OHL	Overhead line
PE	Public Enterprise
PFS	Pre-feasibility Study
PSC	Project Steering Committee
RoL	Route of Line
SEP	Stakeholders Engagement Plan
SEW	Social Economic Welfare
SS	Substation
SWY	Switchyard
TA	Technical Assistance

ToR	Terms of Reference
TSO	Transmission System Operator
WB	Western Balkans
WBIF	Western Balkans Investment framework

1. Executive summary

The electricity transmission infrastructure facilities which were subject of this subproject, WB21-MKD-ENE-03, relate to the Strengthening the Transmission Network in the Southeast Region of North Macedonia. The TA grant for WB21-MKD-ENE-03 was approved at the 20th meeting of the WBIF Steering Committee in June 2019 with a total grant amount of €780,000. The scope of WB21-MKD-ENE-03 comprises:

- Component 1: (this assignment)
 - Feasibility Study (FS) and ESIA for optimal configuration of the transmission grid in the southeast region;
 - Smart grid – Study on the implementation of Dynamic Line Rating;
 - Smart grid – Study on the implementation of a platform for the management of transmission grid assets
- Component 2: (subject to other assignment following completion of Component 1)
 - Detailed Design and Tender Documents for the reconstruction of the existing 110kV line (Dubrovo – Valandovo – Strumica 2 – Strumica 1).

In accordance with the ToR assigned to IPF7 for implementation, this document describes the implementation of Component 1 (FS and ESIA) of the subproject. Component 1 has an indicated TA budget of €650,000. The expected duration of the assignment was 15 months. The main beneficiary of the project is the Transmission System Operator of North Macedonia (MEPSO), and the lead IFI is EBRD.

This Report is a general description and a summary of the WB21-MKD-ENE-03 Feasibility Study and ESIA deliverables. The overall suite of documentation prepared as part of the Feasibility Study comprises of the following sub-reports¹/deliverables:

#	Deliverable
1	Feasibility Study summary report (this report)
2	Technical Options Analyses – System studies stage 1
3	Technical Options Analyses – System studies stage 2
4	Selection of preferred Option
5	Financial and Economic Assessment report
6	Environmental and Social Assessment report

Table 1.1: Feasibility study deliverables

The subproject kick-off meeting was held on 06 August 2020. Due to the COVID-19 pandemic outbreak, the meeting was held as a teleconference, over the Zoom platform. After the kick-off meeting, the IPF7 subproject team initiated a series of Inception phase activities. The draft Inception report

¹ References given in this Feasibility Study report refer to these separate deliverables/reports

was completed on 28 October 2020, and after addressing comments the final IR was finalised on 10 December 2020.

Following completion of the Inception Phase of the subproject, the subproject team continued with finalization of the models for system studies and market assessment, in line with the assumptions and options for the system study activities part of the technical options analyses. The Technical options analyses report was delayed due to the complexity of the transmission network modeling process, delayed data collection and processing, adjustment of models due to new RES connection points and beneficiary request to change the system studies and market analyses to address the recent change in national strategic documents. The Technical Options analyses report was finalised on 12 August 2021.

The draft "Selection of preferred option" report was completed on 29 July 2021. Both Beneficiary MEPSO and LFI EBRD comments have been addressed and at the PSC meeting held on 14 October 2021 the report was officially approved. The Option 2, Alternative 2 was selected as the most preferable Option, comprised of two main components for which a Detailed system studies and technical analysis were performed: 1. Component 1 - Construction of new substation (SS) 400/110 kV Miletkovo with connection to existing 400 kV and 110 kV network, 2. Component 2 - Reconstruction of the 110 kV line Valandovo-Strumica, report completed in July 2022. The Financial and Economic analyses report was completed in June 2022.

The draft ESIA scoping report was completed in December 2021. The draft E&S assessment package for Sub-project 1 (Component 1) was completed and issued to both MEPSO and the EBRD on 7 March 2022. The E&S assessment package for Sub-project 2 (Component 2) was issued to MEPSO and EBRD on 6 April 2022. A "no objection" on these report was received by the beneficiary MEPSO in May 2022. EBRDs comments on E&S assessment package for Sub-Project 1 (Component 1) and Sub-Project 2 (Component 2) were received and addressed and E&S reports finalised in October 2022 (two round of clarification).

1.1 Conclusions

The Selection of preferred Option report recommends the Option 2-2 (New 400/110 kV substation Miletkovo and lead in-out of existing 400 kV OHL Dubrovo – Thessaloniki) as preferable development option by a significant margin, and therefore was put forward for further detailed analyses.

The detailed system studies report concluded that the proposed transmission network upgrades, with 400 kV substation Miletkovo, satisfy all steady state and security criteria and will enable full integration of the planed RES in the project area.

The substation (SS) 400/110 kV Miletkovo and the reconstruction of the 110 kV line Valandovo-Strumica have been identified as the main components in the Detailed technical assessment report, together with the necessary connections with the 110 kV network in the region. The new transmission assets have been assessed, together with the a basic design and projects costs, and it was concluded that the proposed development is technically viable considering the actual terrain conditions and the urbanized parts of the Project area.

The findings of the environmental and social assessment indicate that the Project objective of identifying technically feasible and economically viable solutions which on balance causes the least disturbance to the environment and to the people who live and work in its surrounding has been met. Provided that the proposed mitigation strategy is implemented, the construction and operation of the Project is considered as justified.

The results of the economic analysis suggest that realization of the project brings sufficient monetised benefits to the Republic of North Macedonia and its society, and that it is economically viable for the society and national economy to invest in its implementation. The beneficiary MEPSO is financially capable of financing the project, as the values of the DSCR ratio and key financial indicators confirms MEPSO's ability to progressively pay off debt while increasing earnings throughout repayment period.

The results of the Financial and Economic analysis are valid under the assumption of stable regulatory framework in the whole period of the project, which make them sensitive to the eventual change in the regulatory framework. Therefore, an investment grant value of at least 20% of total investment sum, has a positive impact on this project from the point of view of tariff change (it decreases the tariff), and brings benefits for MEPSO and society.

Based on these findings, the Feasibility study recommendation is as follows in the next paragraph.

1.2 Recommendation

This Feasibility Study and Environmental and Social assessment demonstrated that the proposed project is technically feasible, acceptable from environmental and social point of view and economically & financially viable. It is supported by the Transmission system operator and the EBRD.

It is recommended that the Beneficiary MEPSO proceeds with the implementation of the Component 2 of the project – Technical design and Tender documents.

2. Project overview

2.1 Subproject background and context

In order to meet the goals of the European Union for the integration of energy from RES, North Macedonia makes efforts to maximize the integration of RES into the national power system. Due to the favourable climate (wind, solar and hydro) conditions, the investments are most cost-effective in the southeastern region of North Macedonia, so the RES are (will be) located mostly there. (see Figure 2.1: Project area)

The Electricity Transmission System Operator of North Macedonia (MEPSO) already faces several requests for new connections of RES in the local transmission grid in the southeast region. Newly installed capacities of RES, up to 350 MW, are expected in a mid-term horizon in this region (WPP Demir Kapija, WPP Miravci, WPP Gevgelija, WPP Dojran and WPP Bogdanci 2, HPP Gradec, several new small HPPs, and solar power plants-SPP). In addition, new WPP - 536 MW, HPP - 185 MW SPP - 250 MW are foreseen until year 2040 in a long-term horizon.

Transmission grid in the southeast region (110 kV line Dubrovo – Valandovo – Strumica 2 – Strumica 1, 57.5 km long) is approaching the end of the lifecycle and is a candidate for reconstruction due to ageing process. In addition, while analysing the midterm forecasted regimes, there are contingency cases with a higher risk of security of supply (breach of N-1 criteria). The recent studies proposed a pragmatic solution to construct a new double-circuit line on the corridor Dubrovo – Valandovo – Strumica with new type of conductors AAAC-Z 324 mm², rating 149 MVA.

Having in mind uncertainties of the forecast and project realization, as well as the future role of the grid in this region, the development concept of the southeast region is a specific challenge. All possibilities for network reconstruction, upgrade or expansion, either on 110 kV or 400 kV level, should be investigated in detail.

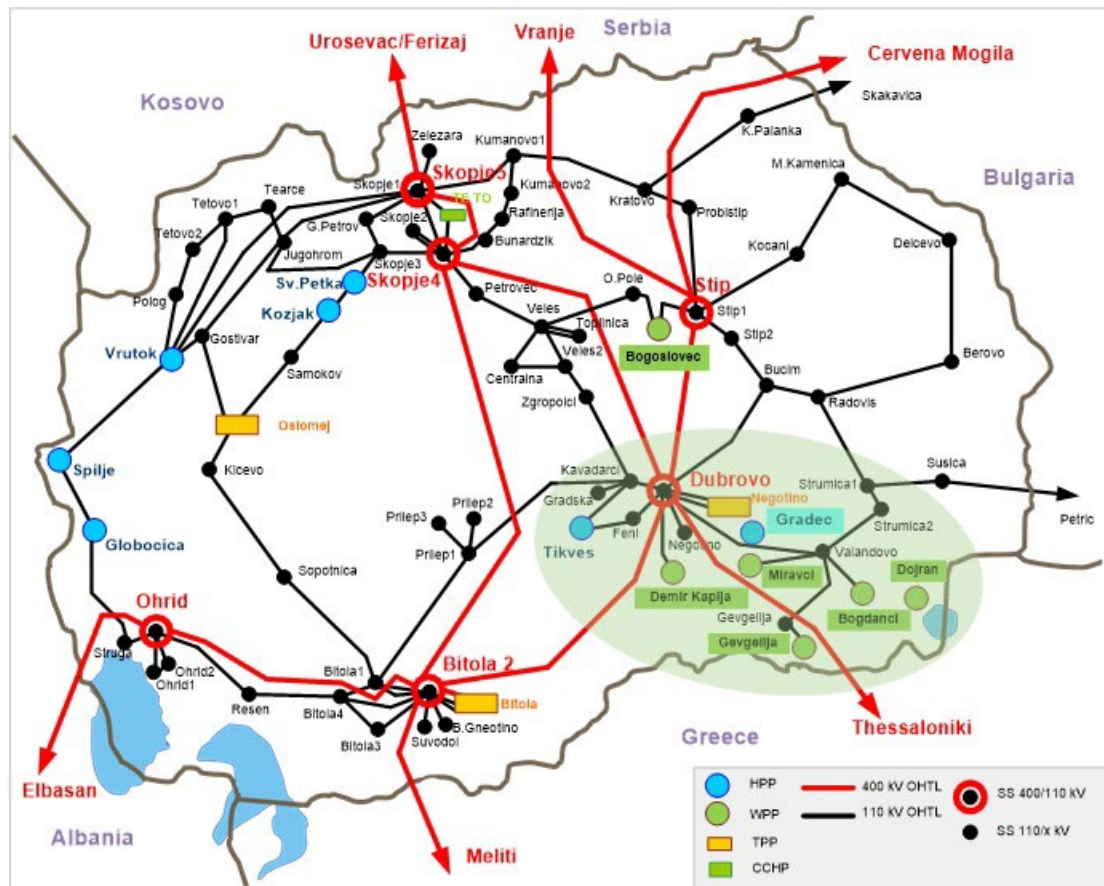


Figure 2.1: Macedonian grid and project area mid-term topology

New Interconnections

ENTSO-E planning process during the Identification of the System Needs in TYNDP 2016 identified the need for strengthening the interconnection Bulgaria - North Macedonia –due to high integration of RES in the Eastern part of South East Europe on the long term. Similar needs are identified in TYNDP 2018 for strengthening the transmission corridor Greece - North Macedonia.

Having in mind the geographical and electrical location of the project while investigating options for the upgrading of 110 kV nodes (SS Valandovo or SS Strumica) on 400 kV level, the impact on the Project of a possible new 400 kV interconnection with Greece or Bulgaria should be investigated as well. This interconnection is not part of the FS and ESIA prepared under this WBIF Grant.

Smart Grid

Renewable Energy Sources (RES) production is intermittent in nature; produced energy is not constant and varies during the time. Nominal capacity of production is evacuated only for a limited number of hours, depending on climate conditions (wind velocity and solar radiation). The aim is to develop Smart Grid as an energy network, using digital and other advanced technologies to monitor and manage the transmission of electricity from all generation sources to meet the varying energy demands of end-users, in order to maximize system efficiency, reliability, resilience and stability, and minimize costs and environmental impacts by coordinating the needs and resources of end-users and generation, grid and market operators. Therefore, implementation of smart control over the rating of overhead lines, such as the system for Dynamic Line Rating (DLR), could optimize/reduce investments in the grid and improve the security level of operation.

Special software and hardware platform for management of the transmission grid requires interactive on-line coordination of works and improvement of efficiency, rapidity, precision and range of activities. That kind of high-level management (maintenance and revitalization) imposes the use of special software and hardware platform. This platform should comprise smart grid functionalities for management of the transmission grid.

Special software and hardware platform needs to be designed for data acquisition and processing, planning, monitoring and execution of activities related to maintenance and revitalization of transmission assets, including lines and respective fittings, as well as high voltage equipment.

2.2 Subproject purpose and detailed objectives

Key components of the subproject are related to the development of the required Feasibility study (FS) together with an ESIA in accordance with lead financial institution (LFI) EBRD requirements.

The team of experts chosen for this subproject have been carefully selected to provide necessary combination of management capability and technical know-how to respond to the needs of the ToR.

The Beneficiary (MEPSO) made counterpart staff available to support the IPF team, especially with respect to enable access to information with respect to the current system, technical parameters, budgetary costing information, load growth and demand forecasts, strategic intentions at regional and country levels, financial capacities and data/system models.

2.3 Institutional context

2.3.1 Project stakeholders

The subproject administrative framework consists of the institutions representing the main project stakeholders. Key stakeholders in this subproject are the Ministry of Economy, the Ministry of Transport and Communication and the Electricity Transmission System Operator (TSO) of North Macedonia.

Similarly, the National IPA Coordinator (NIPAC) office, which is responsible for the coordination of programming and for monitoring implementation of the IPA in the beneficiary country, is an important subproject stakeholder. The NIPAC is responsible for representing beneficiary country within the WBIF framework.

The processes of planning and development of the electricity transmission network infrastructure are overseen and governed by the National Energy and Water Services Regulatory Commission (ERC). Because of electricity sector unbundling, the ERC approves transmission network tariffs and hence the regulated income of the TSO. This includes their approval of the ten-year transmission network development plans and the inclusion of newly commissioned transmission infrastructure into regulated assets.

The final beneficiary of subproject deliverables and the main participant in subproject implementation is the Electricity Transmission System Operator of North Macedonia (MEPSO). MEPSO is a company fully state-owned, established in 2005 after the transformation of the Electric Power Company of Macedonia. The core MEPSO activity and business is a smooth electricity transmission via the high voltage network, electric power system control and regular and duly electricity flow to its clients

such as the large industrial consumers (Bucim, OKTA, Maksteel, Mitalsteel, USJE, Silmak, and FENI Industry), and to the low voltage grids of EVN Macedonia and ELEM Energetika.

The Lead IFI of the subproject is the European Bank for Reconstruction and Development (EBRD).

Finally, EU Delegations in the beneficiary countries represent EU Directorate General which is coordinating at a national level the entire WBIF implementation framework.

All subproject stakeholders will be involved either directly through the Project Steering Committee or indirectly through the WBIF regular reporting process, in the coordination of the subproject implementation.

3. Project implementation

3.1 Activities carried out throughout duration of the subproject

The subproject kick-off meeting was held on 06 August 2020. Due to the COVID-19 pandemic outbreak, the meeting was held as a teleconference, over the Zoom platform. After the kick-off meeting, the IPF7 subproject team initiated a series of Inception phase activities. The draft Inception report was completed on 28 October 2020, and after addressing comments the final IR was issued on 10 December 2020.

As it can be concluded from the list of activities, Activity 2.1 Technical option analyses and Activity 2.2 Selection of preferable option represented a central part of the subject subproject. Within the analysis of the Macedonian network and market, possible corridors of new 110 kV and 400kV line and locations for new substation 400/110 kV, including connection to the existing 110kV and 400kV network lines and their lead-in into the new substation, the subproject team, especially technical and ESIA team undertook a series of actions:

- Collection and study of network and market models and generation / consumption patterns;
- Development of models for network and market analysis and methodologies for system studies (System Study Stage 1 Report);
- System network and market analysis of the project based on the ENTSO-E CBA methodology and subproject adjusted approach (System Study Stage 2 Report);
- Collection and study of all available relevant documentation for studying overhead line corridors and substation locations, including spatial planning documents and legislation and acts issued by relevant institutions;
- Collection and study of all available technical documentation, including documentation received from MEPSO during the inception period
- Collection and study of documentation related to the environment and social environment collected by the ESIA team;
- Site visits to specific points of interest, made by the technical and ESIA team members;
- Meetings with the beneficiary (MEPSO) and several stakeholders;
- Based on the developed technical solution (for all project options) – calculation of the project costs, which represented the basis for the financial and economic analysis;
- Presentation of the results of the Multi-Criteria Assessment (MCA) of project options to MEPSO, EBRD and project stakeholders via Report on Selection of Preferred Project Option and the PSC Meeting / Workshop;
- Perform Detailed system studies and technical assessment for the preferred Option, together with financial and economic assessment and CBA.
- Development of Environmental and Social assessment set of documentation
- Finalization of subproject deliverables and obtaining of no-objections from PSC members;

3.2 Results achieved & deliverables

All activities performed were according to the ToR and in agreement with the beneficiary. The team addressed all comments and requests during the implementation of the TA assignment. The beneficiary MEPSO supported the project team in all possible ways in their capacity.

As indicated here above, the following activities were performed and respective reports prepared:

- Activity 2: Feasibility study
 - Activity 2.1: Technical Options Analyses
 - Activity 2.2: Selection of preferred option
 - Activity 2.3: Detailed System studies and Technical assessment
 - Activity 2.4: Financial and Economic assessment
 - Activity 2.5: Procurement Plan
- Activity 3: Environmental and Social Assessment

In parallel with the development of the FS and ESIA, IPF7 subproject team prepared two additional studies:

- Activity 4: Smart Grid – Dynamic Line Rating
- Activity 5: Smart Grid – Implementation of a platform for the management of transmission grid

3.3 Technical options analyses and selection of preferred Option

In order to complete activities for the connections of RESs in southeast part of North Macedonia up to 2040, it was necessary to assess several options and to select one which will be analysed in detail, including the selection of the optimal route as well, which would provide the optimal technical and economic benefits. As a result of these analysis, the project stakeholders decided to develop three (3) options which will also facilitate further integration and expansion of the RESs in North Macedonia. The purpose of these analyses was to present the results of the assessment of physical, environmental, economic aspects of each developed project option, together with a summary of the electrical and market-based assessment results.

Based on the network topologies defined in previous System Study activities Technical Options Analyses - Interim Report 1 & Interim report 2, three options were created (including alternative corridors for each option), in order to make a clearer distinction between different configurations. They are all built on top of the Base Case topology, which represents the basic development of the local transmission networks for 2025, 2030 and 2040:

1. **Option 1** includes the following main components:
 - a. Construction of new double circuit 110 kV OHLs AL/Fe 2x360 mm² 1580 A between Valandovo and Dubrovo
 - b. New 400/110 kV power transformer in 400/110 kV Dubrovo, with respective 110 kV and 400 kV bays
 - c. Reconstruction of existing 110 kV OHLs Valandovo – Strumica 2 – Strumica 1 (240/40 mm², 645 A)
2. **Option 2** which includes the following main components:

- a. Construction of new 400/110 kV SS Valandovo (TR 2x300 MVA)
 - b. Introduction of existing 400 kV OHL Dubrovo – Thessaloniki (GR) into new SS Valandovo
 - c. Reconstruction of existing 110 kV OHLs Valandovo – Strumica 2 – Strumica 1 (240/40 mm², 645 A)
3. **Option 3** which includes the following main components:
- a. Construction of new 400/110 kV SS Valandovo (TR 2x300 MVA)
 - b. Construction of new 400 kV OHL Dubrovo – Valandovo – Thessaloniki (GR), 2x490 mm² 1920 A
 - c. Reconstruction of existing 110 kV OHLs Valandovo – Strumica 2 – Strumica 1 (240/40 mm², 645 A)

3.3.1 Economic assessment of options

Based on the input data from the System Study and additional information sources, the economic net present value (NPV) of the costs and benefits arising from the construction of the new transmission network elements in the area of Dubrovo, Valandovo and Strumica with 110kV and 400kV alignment at the substations is calculated for North Macedonia. The baseline scenario takes into account all the previously referenced benefits and costs generated by the project implementation.

The following is a comparative overview of the results of the economic analysis. The results of this economic NPV calculation and economic indicators for North Macedonia are summarised in the following table.

Economic indicators	Option 1 Alternative 1	Option 1 Alternative 2	Option 2 Alternative 1	Option 2 Alternative 2	Option 3 Alternative 1	Option 3 Alternative 2
Investment cost (000 €)	16,890	20,390	21,530	18,960	36,000	39,920
NPV (000 €)	52,407.00	48,676.10	158,023.00	160,763.00	85,408.00	81,229.00
ERR (%)	13.99	12.70	17.87	18.71	12.15	11.51
B/C Ratio	3.89	3.23	7.85	8.91	3.22	2.9

Table 4.1 – Options economic NPV calculation and economic indicators

Observing the values of positive NPV, the total benefit that the construction brings to the North Macedonia amounts from 48.68 million EURO in Option 1-Alternative 2 to 160.76 million EURO in Option 2 Alternative 2 (expressed in the present value of money).

On the basis of the presented economic indicators for, it was concluded that this project brings significant benefits for North Macedonia.

3.3.2 Multi-criteria assessment

Based on the developed and agreed methodology and assessment of the options/sub-options from different perspectives, the IPF Project Team was able to quantify the results and integrate them through a holistic multi-criteria assessment.

The summary and total scores are presented in the following table.

Option	Final assessment score - options	Rank
Option 1-1	68,39	6
Option 1-2	70,02	5
Option 2-1	86,42	2
Option 2-2	90,85	1
Option 3-1	76,54	4
Option 3-2	77,71	3

Table 4.2 – Option scores and ranking

3.3.3 Conclusions and recommendation

According to the results of the Multi-criteria analyses (MCA), the IPF7 subproject team recommends the Option 2-2 (New SS Valandovo and lead in-out of existing 400 kV OHL Dubrovo – Thessaloniki) as preferable development option by a significant margin, which will be put forward for further detailed analyses.

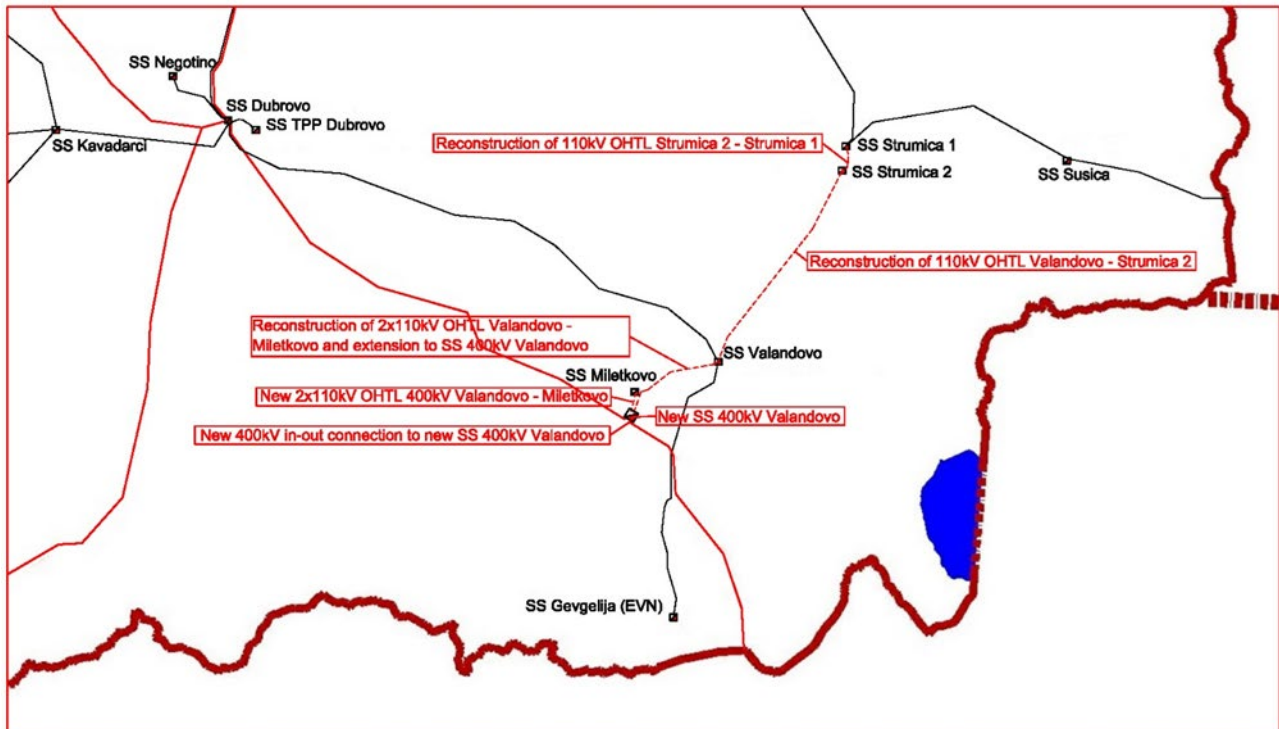


Figure 4.1: Selected preferred Option 2.2

The preferred option was confirmed by the Project Steering Committee (PSC) held on 14.10.2021, and the remaining activities on this subproject were completed, as defined by the ToR and Inception Report:

- Detailed system studies and technical assessment for the preferred option
- ESIA Scoping Report and ESIA Report
- Financial and Economic assessment
- Preparation of final reports according to defined requirements

3.4 Detailed System studies and technical assessment

The Option 2, Alternative 2 analysed and selected as the most preferable Option in the previously completed Selection of preferred option Report, consists of several components, for which a Detailed system studies and technical analysis were undertaken.

The substation (SS) 400/110 kV Miletkovo and the reconstruction of the 110 kV line Valandovo-Strumica have been identified as the main components for technical assessment. The remaining parts have been introduced taking into consideration the actual 110 kV OHL network in the region and the actual terrain conditions in the urbanized parts of the Project.

The new substation (SS) 400/110 kV Miletkovo will be constructed in the vicinity of Miletkovo with an in/out connection to the existing 400 kV OHL SS Dubrovo - MK/Greece border. The detailed

technical assessment of the new SS and following OHL's have been performed for the following project components:

1. New SS 400/110 kV Miletkovo
2. 400 kV OHL Dubrovo – Thessaloniki (GR), in-out connection in new SS 400/110 kV Miletkovo
3. Reconstruction of existing two phase 2x110 kV SS Valandovo – SS 110/25 kV Miletkovo in three-phase 110 kV OHL (AAAC 324) and extension to SS 400/110 kV Miletkovo
4. New two phase 2x110 kV OHL SS 400/110 kV Miletkovo – SS 110/25 kV EVP Miletkovo
5. New 110 kV OHL Valandovo – Strumica 2 (Part 1 - OHL (14,2 km) and Part 2 - cable line (2,2 km))
6. New 110 kV cable line SS Strumica 1– Strumica 2
7. SS 110/35/10 kV Valandovo (Dismantling two two-phase bays and installation of one three-phase bay)

3.4.1 Project costs

For the purpose of the cost-benefit analyses, the main transmission assets were identified. The unit prices of the equipment items were estimated based on the market analyses, previous MEPSO development projects as well as on data from other projects in the region.

In addition, as discussed and agreed with the beneficiary MEPSO, the latest global economy developments and increased equipment and labour prices have been considered and reflected in the total project cost. This price increase is the same for all project options and alternatives proportionally, and therefore has no impact on the selection of the preferred Option performed in June 2021 with a lower unit prices.

The project cost for land acquisition and expropriation, right of way, compensations and forest is estimated according to similar project costs that are under construction.

The total project costs for all the project components are given in the summary table below:

	Projects	Investment, € (excluding VAT)
1	New SS 400/110 kV Miletkovo	23.104.000
2	400 kV OHL Dubrovo – Thessaloniki (GR), in-out connection in new SS 400/110 kV Miletkovo	331.000
3	Reconstruction of existing double phase 2x110 kV SS Valandovo – SS 110/25 kV Miletkovo in three-phase 110 kV OHL (AAAC 324) and extension to SS 400/110 kV Miletkovo	1.087.000
4	New two phase 2x110 kV OHL SS 400/110 kV Valandovo – SS 110/25 kV EVP Miletkovo	535.000
5	New 110 kV TL Valandovo – Strumica 2 (Part 1 - OHL (14,2 km) and Part 2 - cable line (2,2 km))	4.484.000
6	New 110 kV Cable Line Strumica 2 - Strumica 1	1.667.000
7	SS 110/35/10 kV Valandovo (Demounting two two-phase bays and installation of one three-phase bay)	414.000
	Total	31.622.000

Table 4.3 – Project costs

3.5 Project implementation plan

The Project Implementation Plan has been composed taking into account the realistic minimum periods for the activities that have to be done during the Project implementation.

Common activities on the project comprise:

- Internal approval process within MEPSO, MoTC, MoF, GoMK
- GoMK/IFI/MEPSO negotiations
- ESIA procedures
- Design & Bidding documents
- Land Expropriation, right of way & construction permit
- Bidding & Contracting
- Supply of equipment
- Civil works, installation works, ets.
- Tests & Commissioning

The project Components with the corresponding subcomponents are:

1. Component 1 - New 400/110 kV Substation Miletkovo with connection to the existing 400 kV and 110 kV Transmission Network
 - Subcomponent 1.1 - New SS 400/110 kV Miletkovo
 - Subcomponent 1.2 - 400 kV OHL Dubrovo – Thessaloniki (GR), in-out connection in new SS 400/110 kV Miletkovo

- Subcomponent 1.3 - Reconstruction of existing two phase 2x110 kV SS Valandovo – SS 110/25 kV Miletkovo in three-phase 110 kV OHL (AAAC 324) and extension to SS 400/110 kV Miletkovo
 - Subcomponent 1.4 - New two phase 2x110 kV OHL SS 400/110 kV Miletkovo – SS 110/25 kV EVP Miletkovo
 - Subcomponent 1.5 - Dismantling two two-phase bays and installation of one three-phase bay in SS 110/35/10 kV Valandovo
2. Component 2 - Reconstruction of 110 kV Valandovo - Strumica 2 - Strumica 1
- Subcomponent 2.1 - New 110 kV TL Valandovo – Strumica 2 (Part 1 - OHL (14,2 km) and Part 2 - cable line (2,2 km))
 - Subcomponent 2.2 - New 110 kV cable line SS Strumica 1– Strumica 2

3.6 Financial and Economic assessment

3.6.1 Economic Assessment

The results of the **economic assessment** for the base case scenario can be summarized as follows:

1. The results of the NPV analysis suggest that sum of the monetised project benefits outweighs the sum of the discounted investment and O&M costs. The NPV value is positive suggesting that realization of this project brings to North Macedonia approximately 126 million euros (expressed in the present value of money).
2. The benefit/cost ratio amounts to 4.84, indicating that project benefits exceed costs.
3. The economic rate of return (ERR) is positive and amounts to 14.69%, which is higher than considered discount rate, confirming the economic viability of the investment in project realization.
4. The results of the economic analysis suggest that realization of the project brings sufficient monetised benefits to the Republic of North Macedonia and its society, and that it is economically viable for the society and national economy to invest in its implementation.

The results of the economic analysis are presented in the table below:

Economic Indicators	Units	
Investment cost	x 1,000 EUR	€ 31,814.2
NPV	x 1,000 EUR	€ 125,702.2
ERR	%	14.69%
B/C ratio	1	4.84

Table 4.4: Results of the Economic Analysis

3.6.2 Financial Assessment

Summary results of the financial assessment under current “regulated asset base and cost pass-through” regulatory regime is presented in the table below. The results suggest that this project has positive effect on the MEPSO financial position. NPV was calculated based on the yearly free cash flow to equity holders and residual asset value at the end of the model period. The table also presents the project P&L and balance sheet figures, as well as the average debt service coverage ratio (DSCR) for the duration of the investment loan, after the grace period.

	EUR '000
FCFE	7,041
Residual value	1,196
NPV with residual value (EUR '000)	8,237
Average DSCR	
	1.16
IRR	23.4%

Table 4.5: Results of the Financial Analysis

The results of the **financial assessment** for the base case scenario can be summarized as follows:

1. Calculated NPV in the amount of 8.2 mil. EUR including residual value 1.2 mil. EUR show positive economic results for MEPSO, which is a consequence of the current regulatory regime in the Republic of North Macedonia based upon the “regulated asset base and cost pass-through” methodology.
2. MEPSO is financially capable of financing the project, as the values of the DSCR ratio and key financial indicators confirms MEPSO’s ability to progressively pay off debt while increasing earnings throughout repayment period.
3. Consumers in the North Macedonia will finance the costs of the implementation through a moderate tariff increase. This increase in the period 2025-2039 would range from 0.31% to 0.64% of the EVN's average supply price for tariff consumers and in the range between 5.35% and 11.19% of the MEPSO transmission tariff (reference to the Energy and Water Regulatory Commission of the North Macedonia tariffs applied as of 1st Jan 2022);
4. As the NPV is sensitive to the regulatory framework, the decisions makers are advised to carefully consider the overall economy wide impact of the project to balance the revenues and costs at the company level and society as a whole.

The conclusions of the **financial and economic assessment** of the project for scenario in which **30% investment cost overrun** was incurred (sensitivity scenario) can be summarized as follows:

5. Economic analysis shows that NPV amounts to approximately 115 mil. EUR, indicating that project monetised benefits still outweigh the sum of the discounted investment and O&M costs (the benefit/cost ratio amounts to 3.71). The value for ERR is still above the considered discount rate and amounts to 13.01%.
6. The results of the economic analysis suggest that even if the investment cost overrun for 30% the realization of the project brings sufficient monetised benefits to the Republic of North Macedonia and its society, and that it is economically viable for the society and national economy to invest in its implementation.
7. The results of the financial analysis calculated NPV with residual value for the project amounts to EUR 10.7 mil., while the residual value amounts to EUR 1.555 mil. IRR amounts to 23.4% (in case if the CAPEX overrun is fully approved by the regulator and recognized within RAB). Positive results obtained for NPV under investment cost overrun suggest that the project still represents rationale undertaking for MEPSO. Nevertheless, the impact on the end users through is greater through tariff increase in the period 2025 – 2039, that ranges from 7.13% to 14.43% of the current transmission tariff (5.35% to 11.19% in the base case), and from 0.41% to 0.83% (0.31% to 0.64% in the base case) of the EVN’s average supply prices (reference tariffs according to the decision from the Energy and Water Regulatory Commission of the Republic of North Macedonia applied starting from 01.01.2022.). This effect on the tariff can be alleviated through partial financing of the project with 20% grant. Transmission tariff increases in the range between 5.77% and 12.30%, while the tariff increase for end consumers range from 0.33% to 0.71%. These results are based upon regulatory framework allowing full recognition of the investment cost overrun in the regulated asset base.
8. NPV values rapidly decline in case if the regulatory framework does not accept the investment cost overrun. In the supposed scenario of regulator accepting only initially anticipated investment cost, NPV value rapidly declines but remains positive. The results suggest the project represents rationale investment, although it is more sensitive to cash flow variations as the average DSCR is lower. The effect on the end users through tariff increase is controlled by the limits on the investment costs recognised in the regulated asset base.

9. Hypothetical scenario in which hypothetical 5-years deferral of the calculated economic benefits was combined with the investment cost overrun in the amount of 30% implies the necessity for partial project financing through grant, in order to make the project economically viable for the society and national economy to invest in its implementation. The outcomes of these high-level considerations are suggested for further investigation based upon additional separate market study results outcome.

The results of the Financial and Economic analysis are valid under the assumption of stable regulatory framework in the whole period of the project, which make them sensitive to the eventual change in the regulatory framework. Therefore, the decisions makers are advised to carefully consider the overall economy wide impact of the project to balance the revenues and costs at the company level and society as a whole.

On the basis of the presented indicators, it can be concluded that approved grant value of at least 20% of total investment sum, has a positive impact on this project from the point of view of tariff change (it decreases the tariff), and brings benefits for MEPSO and society. In other words, we can see positive financial effects on company and the business measured by calculated financial indicators.

3.7 Environmental and Social assessment

The findings of the environmental and social assessment indicate that the Project objective of identifying technically feasible and economically viable solutions which on balance causes the least disturbance to the environment and to the people who live and work in its surrounding has been met.

Provided that the proposed mitigation strategy is implemented, the construction and operation of the Project is considered as justified because:

- ✓ The environmental and social aspects related to key phases of the life cycle of the Project are identified and taken into account.
- ✓ The assessment of the environmental and social impacts is based on best available information.
- ✓ The identified likely impacts can be prevented, reduced or compensated and, therefore, the Project is not a threat for adverse or irreversible damage to the natural and social environment in the project area.
- ✓ The Project will create employment opportunities as well as opportunities to the local economy and supply chain.
- ✓ The Project will strengthen the power transmission system in Macedonia thus contributing to the overall economic development and social welfare in the wider region.
- ✓ The Project will not cause significant impacts on the environmental media (air, water and soil) and will not generate excessive waste.
- ✓ The Project will not cause significant adverse impacts on biodiversity and ecological integrity of the area as well on the valued landscapes, nor will compromise the conservation goals of the concerned protected areas.
- ✓ The Project will imply only very limited long-term residual land acquisition.
- ✓ The Project will not cause significant health and safety risks or disturbance to the neighbouring communities.

- ✓ The Project will not imply impacts to known cultural heritage in the area.

The environmental and social aspects associated with the Project were identified and addressed in the E&S Assessment Report according to the requirements of the relevant Macedonian regulation, the EBRD standards and best international practices.

3.8 Recommendation

This Feasibility Study and Environmental and Social assessment demonstrated that the proposed project is technically feasible, acceptable from environmental and social point of view and economically&financially viable. It is supported by the Transmission system operator and the EBRD.

It is recommended that the Beneficiary MEPSO proceeds with the implementation of the Component 2 of the project – Technical design and Tender documents.