The European Union's 2008 IPA Programme for Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Kosovo*, Turkey and Iceland

Infrastructure Project Facility Technical Assistance Window (IPF TA) Western Balkans

EuropeAid/128073/C/SER/MULTI

WB4bis-REG-ENE-01:

Feasibility Study and ESIA for Elbasan (AL) - Bitola (MK) 400 kV Transmission Line

FEASIBILITY STUDY

General Project Description and Summaries of the Separate Sector Studies

Vers. 3 - FINAL

31.01.2013

This project is funded by the European Union

COWI • IPF CONSORTIUM

*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.

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Infrastructure Projects Facility

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Document no.	WB4bis-REG-ENE-01: Feasibility Study
Version	Vers. 3 - FINAL
Date of issue	31/01/2013
Prepared	WB4bis-REG-ENE-01 Project Team
Checked	Heikki Lehtimaki
Approved	Ole Johansen

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LIST OF ABBREVIATIONS

AL/ALB	Albania
ALL	Albanian currency
AO	Administrative Order
ASG	Albanian Geological Survey
BENEFICIARIES	OST and MEPSO, the Transmission System Operator of ALB and MKD, respectively
BiH	Bosnia and Herzegovina
BP	Budget and financial plans
CA	Contracting Authority
CAPEX	Capital expenditure
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CBT	Cross-border Trade
CD	Completed designs
CEB	Council of Europe Bank
CfP	Call for Proposals
CM	Country Manager
CO	Country Office
CoE	Council of Europe
CONSULTANT	COWI - IPF Consortium, led by COWI A/S
COWI - IPF	The Consortium implementing WB4bis-REG-ENE-01
DK	Denmark
DPM	Deputy Project Manager
DTL	Deputy Team Leader
EBRD	The European Bank for Reconstruction and Development, London
EC	European Commission
EEF	Energy Efficiency Facility
EES	European Employment Strategy
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ELARG	
ENTSO-E	European Network of Transmission System Operators for Electricity
ENVE	Environmental sector infrastructure expert
EPPF	Environmental Project Preparation Facility
ERE	Energy Regulatory Entity of Albania
ESKE-2	IPF-2 Energy Sector Key Expert
ESC	Economic and Social Cohesion
EU	European Union
EUD	European Union Delegation to Albania
EUR	European Union currency
FS	Feasibility studies [and financial affordability analysis]
GB	Great Britain
HPP	Hydropower Plant
HR	Croatia
HV	High Voltage
IA	Implementing Agency
IEC	International Electrotechnical Commission
IFI	International Financial Institutions
IIP	Infrastructure Investment Project
IPA	Instrument for Pre-accession Assistance
IPF	Infrastructure Projects Facility
IPF1	Infrastructure Projects Facility in the Western Balkans -Technical Assistance Window, 1st contract between DG ELARG and WYG Intl
IPF2	Infrastructure Projects Facility in the Western Balkans -Technical Assis-

	tance Window, 2nd contract between DG ELARG and COWI
IR	Inception Report
IW	Implementation Works
JGF	Joint Grant Fund
KESH	Albanian Power Corporation
KfW	KfW Bankengruppe, Frankfurt am Main, Germany
KOS	Kosovo (under UNSCR 1244/99)
LENDERS	EBRD and KfW
LFC	Load Flow Curve
MD/md	Man-days
ME/MNE	Montenegro
MEPSO	Transmission System operator of the Republic of Macedonia
METE	Ministry of Economy, Trade and Energy of Albania
MH	Ministry of Health of Albania
MK/MKD	The Republic of Macedonia
MKD	Macedonian currency Denar
MoEI	Ministry of European Integration of Albania
MoEFWA	Ministry of Environment, Forestry, and Water Administration
MoM	Minutes of Meeting
NIPAC	National IPA Coordinator
NGO	Non-governmental Organisation
NTS	Non-Technical Summary
OHTL/OHL	Overhead Transmission Line
OPGW	Optical Fibre Earthing Wire
OPEX	Operational expenditure
OST	Transmission System Operator of Albania
PCM	Project Cycle Management
PDF	Project Description Form
PFS	Pre-feasibility studies
PIU	Project Implementation Unit
PM	Project Manager [of WB4bis-REG-ENE-01]
PMU	Project Management Unit
PROJECT	Feasibility Study and Environmental and Social Impact Assessment to develop a 400 kV connection between Elbasan (AL) and Bitola (MK), including the terminations in the respective substations
PROMOTERS	OST and MEPSO
PSS/E	Power System Simulation [programme] for Engineers
PTF	Project Tracking Form
P&L	Profit and Loss
RCC	The Regional Cooperation Council
RDA	Regional Development Agency
REPA	Regional Environmental Protection Agency
ReREP	Support for the Regional Environment Reconstruction Programme
RoW	Right of Way
RPM	Regional Project Manager
SA	System Analysis
SAP	Stabilisation and Association Process
SC	Steering Committee
SECI	Southeast Europe Cooperative Initiative
SEETEC	Southeastern Europe Electrical System Technical Support project
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SOCE	Social sector infrastructure expert
SRB/SER	Serbia
SS	Substation
TA	Technical Assistance

TBA	To be appointed
TF	Task force
TL	Team Leader
TM	Task Manager
TNA	Training Needs Analysis
ToR	Terms of Reference
TP	Preparation work for the tender process
TPPF	Transport Project Preparation Facility
TSE	Transmission System Engineer
TRAE	Transport sector infrastructure expert
TSO	Transmission System Operator
TTFSE	Trade and Transport Facilitation for South East Europe
UCTE	Union for the Coordination of the Transmission of Electricity
UGCL	Underground Cable Line
VET	Vocational Education and Training
WB	World Bank
WBIF	West Balkans Investment Framework
WG	Working Group

1 Project Executive Summary

- The Feasibility Study and ESIA have been conducted in a stepwise way by studying various technical Options via System Analysis and subsequent Technical, Legal, Environmental and Cost-Benefit Analysis methods.
- The results of the analysis indicate that the **economic environment in Albania and Macedonia is favouring the implementation of the Project**. Moreover, implementation of this transmission system upgrade Project is likely to produce significant economic gains to both Countries.
- Also, **the financial situation of MEPSO and OST is satisfactory** for pursuing with the implementation of this Project, although some concerns regarding OST remain (e.g. related to the ongoing difficulties around CEZ Shperndarje in Albania).
- Finally, from all technically, socially and environmentally viable Variants, Variant One encompassing **construction of the new 400 kV single circuit line between Elbasan in Albania and Bitola in Macedonia** is the most attractive option from the financial / economic perspective.
- **This best Variant for implementation of the Project (with Variant 1B with a Shunt Reactor for Albania) is characterised by the following financial and economic parameters (estimates for 35 year period):**

No	Main Indicator	Macedonia	Albania
1	Required investment:	**€43.5 million**	**€24.6 million**
2	NPV (for transmission operator):	**€6.3 million**	**€1.7 million**
3	Simple Payback period	**15 years**	**11 years**
4	Benefit cost ratio	**2.0**	**2.6**
5	IRR	**12.5%**	**11.8%**
7	Impact on national economy	**€37.8 million**	**€42.9 million**

Table: Best Variant Characteristics

- **In terms of the Risk and Sensitivity Assessment of the Financial and Economic Assessment of the Project**, it is addressed to in Chapter 5 of the FERS Report. It delivers a detailed "what-if" analysis of the selected technically, financially and economically most viable Variant for implementation of the 400 kV transmission line between Elbasan in Albania and Bitola in Macedonia.
- Technical (including the regional System Analysis), Legal and Environmental Analysis show that project implementation can be carried out in a feasible way and potential limited risk factors can be duly mitigated.
- This Feasibility Study and ESIA have been conducted on a Business as Usual Basis. The suggested schedule is calling for a 5-year implementation period and Project completion in late 2017. In case the overall political situation in the region would change for whatever reason or in case the present difficulties around the activities of CEZ Shperndarje in Albania would worsen, the schedule should be changed accordingly.

2 Synopsis and Project Status on 17.12.2012

Project Title:	Feasibility Study and ESIA for Elbasan (AL) - Bitola (MK) 400 kV Transmission Line
Project Number:	WB4bis-REG-ENE-01
Contractor:	COWI-IPF Consortium
Beneficiaries:	OST (AL) and MEPSO (MK)
Lenders:	EBRD, KfW
Location:	Tirana and Skopje
Project start date:	26/01/2012
Project Duration:	12 months
Anticipated completion:	January 2013

This is a General Description and a Summary of the WB4bis-REG-ENE-01 Project publications. The project has produced the following Sub-Reports:

#	Publication	Date	Status
1.	**Inception Report**	04.04.2012	Endorsed by OST, MEPSO, KfW and the EBRD
2,	**System Study Analysis Interim Report**	30.04.2012	Endorsed by OST, MEPSO, KfW and the EBRD
3.	**ESIA GAP Reports for AL and MK**	29.05.2012	Endorsed by OST, MEPSO, KfW and the EBRD
4.	**System Study Analysis Final Report**	28.09.2012	Endorsed by OST, MEPSO, KfW and the EBRD
5.	**ESIA Scoping Reports for AL and MK**	14.10.2012	Under Stakeholder review
6.	**ESIA SEP Reports for AL and MK**	30.10.2012	Under Stakeholder review
7.	**ESIA ESAP Reports for AL and MK**	03.12.2012	Under Stakeholder review
8.	**Financial and Economic Assessment**	01.12.2012	Under Stakeholder review
9.	**Technical Assessments for AL and MK**	01.12.2012	Under Stakeholder review
10.	**Feasibility Study Report**	17.12.2012	Under Stakeholder review
11.	**Institutional and Training Materials**	17.12.2012	Under Stakeholder review
12.	**ESIA Reports for AL and MK**	17.12.2012	Under Stakeholder review
13.	**Workshop materials for AL and MK**	18.12.2012	Under Stakeholder review

Table 1: List of Project Documents Uploaded on an Internet Page for Stakeholder Review and Comments by 14 January 2013

#	Name of the Document
1	AL: Inception Report
2	AL: Inception Report Annexes
3	AL: System Study and Option Selection Reports
4	AL: Technical Report
5	AL: Technical Report Annexes
6	AL: Financial and Economic Analysis Report (FERS)
7	AL: Financial and Economic Analysis Report (FERS) Annexes
8	AL. Institutional and Training Requirements
9	AL: FEASIBILITY STUDY REPORT
10	AL: FEASIBILITY STUDYE REPORT Annexes
11	AL: ESIA GAP Analysis Report
12	AL: ESIA GAP Analysis Report Annexes
13	AL: ESIA Scoping Report
14	AL: ESIA Scoping Report Annexes
15	AL: ESIA Stakeholder Engagement Plan (SEP)
16	AL: ESIA Stakeholder Engagement Plan (SEP) Annexes
17	AL: ESIA Environmental and Social Action Plan (ESAP)
18	AL: ESIA ESMPP Monitoring Plan
19	AL: ESIA FINAL REPORT
20	AL: ESIA FINAL REPORT Annexes
21	AL. ESIA Final Report Non-Technical Summary (NTS)
22	AL: Workshop in Ohrid 18.12.2012
31	MK: Inception Report
32	MK: Inception Report Annexes
33	MK: System Study and Option Selection Reports
34	MK: Technical Report
35	MK: Technical Report Annexes
36	MK: Financial and Economic Analysis Report (FERS)
37	MK: Financial and Economic Analysis Report (FERS) Annexes
38	MK. Institutional and Training Requirements
39	MK: FEASIBILITY STUDY REPORT
40	MK: FEASIBILITY STUDYE REPORT Annexes
41	MK: ESIA GAP Analysis Report
42	MK: ESIA GAP Analysis Report Annexes
43	MK: ESIA Scoping Report
44	MK: ESIA Scoping Report Annexes
45	MK: ESIA Stakeholder Engagement Plan (SEP)
46	MK: ESIA Stakeholder Engagement Plan (SEP) Annexes
47	MK: ESIA Environmental and Social Action Plan (ESAP)
48	MK: ESIA ESMPP Monitoring Plan
49	MK: ESIA FINAL REPORT
50	MK: ESIA FINAL REPORT Annexes
51	MK. ESIA Final Report Non-Technical Summary (NTS)
52	MK: Workshop in Ohrid 18.12.2012

2.1 Project Background

Western Balkans Infrastructure Projects Facility (WBIPF) is being implemented by two consortia of international expertise led by WYG International (GB) / COWI (DK). The countries that are supported by the WBIPF are Albania, Bosnia and Herzegovina, the Republic of Macedonia, Kosovo, Montenegro, Serbia and Croatia. In the Fourth Round of project selection, the WBIF Steering Committee selected this project (WB4bis-REG-ENE-01) for support to undertake this regionally significant transmission connection and the associated environmental and social studies, in order that financing for this connection can be considered by the TSOs and their respective line Ministries in Albania and in the Republic of Macedonia.

This project has been studied previously, in the context of establishing a major East - West power transmission corridor between Bulgaria, the Republic of Macedonia, Albania and Italy (via a planned submarine cable). Since that time, the section between Bulgaria and the Republic of Macedonia has been completed, and the submarine cable has been planned between Italy and Montenegro. In addition, the 400 kV connection between Albania and Montenegro is in operation, while the construction of Albania and Kosovo connection has been tendered (but suspended for the moment).

This connection between Albania and the Republic of Macedonia is part of Corridor 8. The basis of Corridor 8 is the signing of the Memorandum of Understanding on the 9th September 2002 in Italy. Most of the projects related to Corridor 8 have been developed and their implementation was started with the creation of the Stability Pact in 1999. Funds have been provided in Italy to establish the International Secretariat in Bari. The main objective of the Secretariat is the coordination of all projects related to construction of Corridor 8.

Albania, Bulgaria, Italy and Republic of Macedonia (on 13th April 2005 in Sofia) signed a "Joint Statement for energy infrastructure cooperation" to support the implementation of energy infrastructure projects in accordance with EU legislation, including projects in the Trans European Networks (TEN) and the European - Mediterranean Energy Ring.

In terms of electrical energy, the implementation of the last part of Corridor 8, connecting Albania with the Republic of Macedonia and allowing transfers to Italy (the interconnection between the Republic of Macedonia and Bulgaria was implemented in January 2009) will provide the possibility for enhanced connection within the countries of Italy and Southeast Europe through better connecting the Albanian power system with the region.

2.2 Regional Aspects of the Project

Undertaking this FS and ESIA, and subsequently implementing the project, is planned to achieve the following regional targets:

1. A structured approach to justifying, constructing and developing this 400 kV transmission connection, closing the 400 kV Ring Albania - the Republic of Macedonia - Greece.
2. Improved network capacity to facilitate anticipated load and transit growth, new generation connections, in the context of improving transmission capacity in Albania and in the Republic of Macedonia, and in the Balkans Region generally speaking.

3. Improvement of the reliability of the regional network, the overall security of supply, and system operational issues such as stability.
4. A decrease of the technical losses in the transmission system,
5. Improving the quality of electricity supply (normalise the voltage levels, stabilize the load flow and the frequency fluctuations, etc)
6. Supporting the potential to develop the regional energy market in South East Europe and creating trading opportunities with Bulgaria and Italy.
7. Mutual support between the Republic of Macedonia and Albania to complement power generation types (Albania - hydro, the Republic of Macedonia - thermal)
8. Reducing the cost of providing reserve capacity, and providing mutual emergency support.

2.3 Project Purpose, Detailed Objectives and Schedule

The purpose of this FS + ESIA is to examine the 400 kV connection between Albania and the Republic of Macedonia as a standalone project without the direct interconnection to Italy originally proposed in the SEETEC study. The FS and ESIA will determine if this proposed connection is feasible and if so, whether it is economically viable for both Albania and the Republic of Macedonia to construct it.

This project is contained in the Energy Strategies and Action Plans of both countries and is supported by the two electricity transmission companies, OST and MEPSO, and their respective line Ministries. A meeting on this project was held in Vienna in April 2010, organised by the Energy Community Secretariat and with the participation of both TSOs, DG Energy, and the EBRD. At this meeting both OST and MEPSO reconfirmed their interest to proceed with the FS and ESIA.

Both OST and MEPSO will make counterpart staff available to support the contractor, especially with respect to data on land availability for the transmission project, and access information with respect to the current system, technical parameters, budgetary costing information, load growth and demand forecasts, strategic intentions at regional and county levels, financial capacities and data / system models used in the previous SEETEC project.

This project is of regional significance, and will be implemented with one project team operating in the two countries – with offices in Tirana and Skopje. Project management, system analysis studies, system planning, border crossing point and definition of the main technical characteristics of the transmission line has been common to both countries. Line route determination, terminal substation arrangements and ESIA has been undertaken on a per-country basis. **The financial and economic analysis has been undertaken on a per-country basis, and then aggregated for the project as a whole.**

The EBRD has indicated that they are interested in financing this project (especially in the Macedonian section of the line), subject to the outcome of this Feasibility Study, and KfW are also interested in financing the line, especially with respect to the section in Albania.

Figure 1: Planned 400 kV Connection (in Dotted Line) between Elbasan (AL) and Bitola (MK)

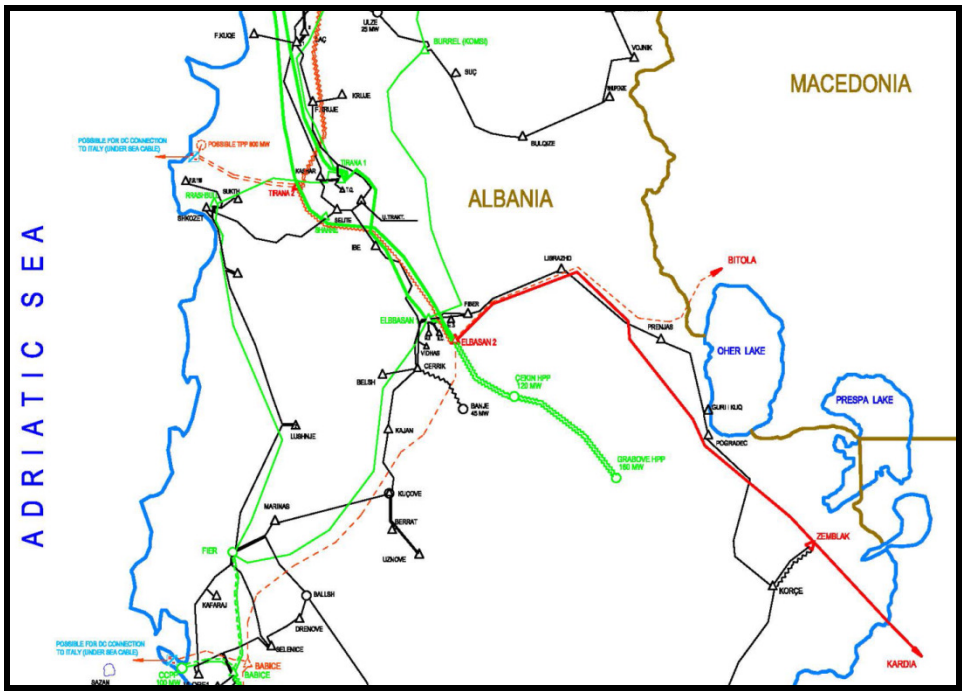


Figure 2: Details of the Albanian Section of the Transmission Line (Source: OST)

Figure 3: Details of the Macedonian Section of the Transmission Line (Source: MEPSO)

Figure 4: Location of Elbasan and Bitola - regional map

The concrete detailed FS + ESIA Study Objectives are as follows:

1. Review the previous studies for this project, other regional studies, load flow data and other current project documentation, regarding this project[1].
2. Undertake discussions with OST / MEPSO, line Ministries and Agencies in both countries, and where necessary regional bodies (ENTSO, UCTE) in order to gain full stakeholder engagement with this transmission system development project.
3. Develop the previous and existing system and market studies, the preliminary technical, financial / economic and environmental / social aspects of the project and the spatial options available for transmission lines.
4. Based upon the system analysis and the determined technical and spatial parameters, a number of different options for the specific line routing along the previously established corridor will be developed. These options will then be evaluated on a preliminary basis from the following perspectives:
    - **Spatial** - Consideration to the line routing options from the point of view of potential positive planning consent and land acquisition.
    - **Technical** - The attractiveness of the technical solution from the point of view of system security, losses, ability to connect new planned generation, strengthening of the lower voltage networks (such as connecting the new 400/110 kV SS Ohrid to the 400 kV line Elbasan - Bitola) etc.
    - **Environmental / Social** - Only line routes / options that are feasible from the environmental and social perspectives, in that they are expected to achieve a positive ESIA and public consultation process, will be considered.
    - **Cost / Economics** - for each detailed line route option a preliminary financial estimate for construction project costings, a preliminary socio-economic cost benefit assessment (if different between the options), and an indicative cost-benefit assessment will be undertaken.

    In this way, it is expected that the project team, together with the project stakeholders, **will firstly determine if any option is feasible and economically viable, and if so, will then select and determine the preferred line routing for further detailed examination.**
5. Once the optimal solution is found viable and agreed, further develop the technical, spatial, economic financial and socio-economic assessments for the preferred line routing, selecting the best approach and

[1] The previous project recommended that the connection between Albania and Macedonia will be a 400 kV standard design with steel-lattice poles, conductors type ACSR 2x490/65 mm2 rated at 1920 A or 1330 MVA, together with two earth conductors, one of which has an optical fiber (OPGW). Using fiber optic cable in one protective conductor will achieve direct telecommunication link between the two neighboring national dispatching centers.

developing the sequencing for implementation, recognising the requirements for land acquisition and detailed spatial planning process in each of the two countries. Develop the investment package proposals as the FS proceeds.

6. Develop the associated project-level environmental and social impact analyses (ESIA), together with mitigation strategies, assisting with the public consultation process, if agreed by the two TSOs.

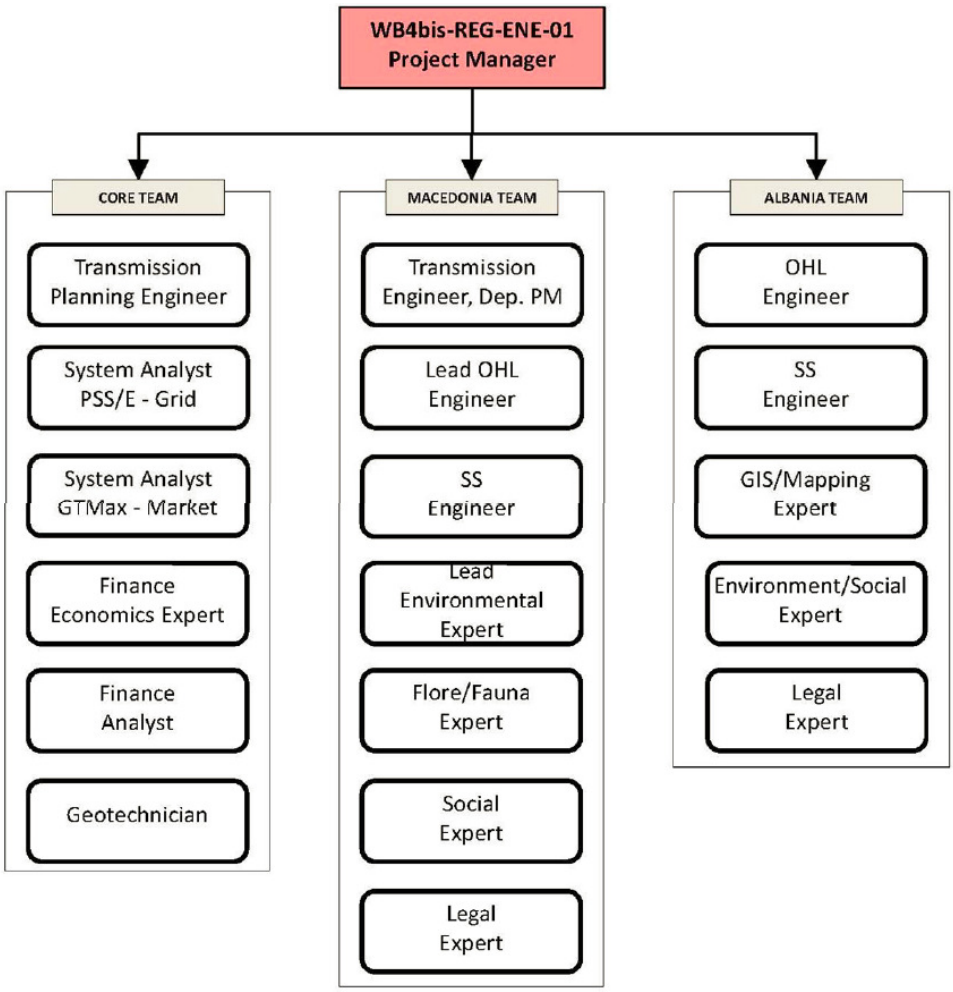
The FS and ESIA stage is expected to complete within 12 months of project commencement (i.e. in January 2013), and the start date for network construction is targeted for 2015.

2.4 The Team of Experts

As per the Administrative Order No 83 (Contract Numbers: 2009/224-490 and 2011/273-396) of the Enlargement Directorate-General, dated 11 January 2012, the Team of Experts were mobilised 26 January 2012 in Skopje and on 01 February 2012 in Tirana at Project Kick-off meetings to undertake this Feasibility Study and the ESIA. The Team with specified tasks is shown in Table 1:1 and the enclosed chart.

Table 2: Project Team and Organizational Chart

#	Position	Name
1	Project Manager (PM)	Heikki Lehtimaki
	Core Team:	
2	Transmission Planner	Djordje Dobrijevic
3	System Analyst, Grid	Milos Stojkovic
4	System Analyst, Market	Dragana Orlic
5	Finance/Economy Expert	Aleksander Golas
6	Finance Analyst	Zef Preci
7	Geotechnician	Mitko Dimov
	Macedonian Team:	
8	Transmission Engineer, DPM	Sinisha Stanchevski
9	Lead Overhead Line Engineer	Nikola Nikolic
10	Substation Engineer	Evica Rumenova
11	Lead Environment Expert	Konstantin Siderovski
12	Flora / Fauna Expert	George Paraskevopoulos
13	Social Expert	Ilija Todorovski
14	Legal Expert	Bogoljub Sofronievski
	Albanian Team:	
15	Overhead Line Engineer	Andy Zhugli
16	Substation Engineer	Fatmir Elezi
17	GIS / Mapping Expert	Namik Kopliku
18	Environmental and Social Expert	Ardian Shehu
19	Legal Expert	Blerte Kraja



2.5 Project Offices

This Project has been executed from two dedicated project offices in Albania and the Republic of Macedonia with the contact information is as follows:

Albania:

Str. Ismail Qemali 34/1, 5th Floor

Tirana

Albania

Telephone: +355 4 225 96 37

Republic of Macedonia:

Bul."Partizanski Odredi" No.15A/1-11

1000 Skopje

Republic of Macedonia

Telephone: +389 2 3212 582

2.6 Activities Carried Out in 2012

Table below is providing a list of major Project activities during the Project implementation period 11.01. - 18.12.2012:

#	Date(s)	Activity	Additional Information
1.	11.01.	EC DG ELARG Project Administrative Order received	Administrative Order No 83
2.	17.01.	MEPSO + Stakeholder Kick-off meeting in Skopje	MoM available
3.	20.01.	OST + Stakeholder Kick-off meeting in Tirana	MoM available
4.	26.01	MK Staff meeting #1 with PM, DPM, CM in Skopje	MoM available
5.	26.01.	Project Team Kick-off meeting with OST/MEPSO in Skopje	MoM available
6.	28.01.	Substation Engineer's (AL) preliminary visit to SS Elbasan 2	Conclusions included in IR
7.	31.01.	Project Finance team meeting with KfW in Skopje	MoM available
8.	01.02.	Project Tech & ESIA team meeting with MEPSO in Skopje	MoM available
9.	01.02.	Project Finance team meeting with MEPSO in Skopje	MoM available
10.	02.02.	AL Staff meeting #1 in Tirana	MoM available
11.	02.02.	Project Finance team meeting with EBRD in Skopje	MoM available
12.	02.02.	Project Finance team meeting with ERC in Skopje	MoM available
13.	07.02.	Project Finance team meeting with EBRD in Tirana	MoM available
14.	07.02.	Project Finance team meeting with KfW in Tirana	MoM available
15.	07.02.	Project Finance team meeting with ERE in Tirana	MoM available
16.	09.02.	AL Staff meeting #2 in Tirana	MoM available
17.	13.02.	System Analysis Scope of Work document approved	Annexed to IR
18.	14.02.	MK Staff meeting #2 in Skopje	MoM available
19.	17.02.	MEPSO updated National System Analysis model received	
20.	17.02.	OST updated National System Analysis model received	
21.	17.02.	Draft Tech Assessment Scope of Work doc. sent to MEPSO	Final version Annexed to IR
22.	22.02.	MK Staff meeting "3 in Skopje with ESKE-2, PM, DPM, CM	MoM available
23.	23.02.	ESKE-2, PM, DPM, CM meeting with MEPSO (Ms Siljanovska - Atanasova and Mr Bitrak) on data requirements, site visits, Line Corridor preferences + Interconnection projects	MoM available
24.	24.02.	Updated Regional SA Model sent to OST/MEPSO for approval	
25.	01.03.	AL Staff meeting #3 in Tirana with ESKE-2, PM, DPM, CM	MoM available
26.	01.03.	ESKE-2, PM, DPM mapping meeting with GIS Albania	Conclusions included in IR
27.	01.03.	ESKE-2, PM, DPM + CM meeting with METE (Mr Bregasi) on Line Corridor preferences and Interconnection projects	Conclusions included in IR
28.	02.03.	ESKE-2, PM, DPM + CM meeting with OST (Mr Demiraj) on data requirements, site visits, Line Corridor preferences and Interconnection projects	Conclusions included in IR
29.	03.03.	Regional System Analysis Model verified by OST + MEPSO	
30.	12.03.	Draft Inception Report submitted to ESKE-2 for a review	
31.	26.-30.03	DPM + Skopje Tech and ESIA teams visit to Tirana	OHTL - ESIA liaison
32.	26.-30.03.	PM, DPM + Tech and ESIA teams visit to SS Elbasan 2	First official visit
33.	02.-13.04.	PM, DPM + Tech and ESIA teams visit to SS Bitola 2	First official visit
34.	02.-13.04.	Tech and ESIA teams to start Line Corridor investigation	Field visits to start

35.	30.04.12	System Study Analysis – Interim Report approved	By Stakeholders
36.	29.05.12	AL and MK ESIA GAP Analysis Reports approved	By Stakeholders
37.	12.09.12	System Study Workshop for Stakeholders in Tirana	For OST and MEPSO
38.	28.09.12	Final System Study Analysis Report approved	By Stakeholders
39.	Oct – Nov	OHL Corridor and Substation locations approved	By OST and MEPSO
40.	22.11.12	Interim Project results presentation to MEPSO	
41.	26.11.12	Interim Project results presentation to OST	
42.	27.11.12	Interim Project results presentation to OST and ERE	
43.	18.12.12	Project final Workshop in Ohrid	Main Stakeholders
44.	14.01.13	Stakeholder comments on Project Docs expected	
45.	Jan 2013	Final approval of Project Documents	

Table 3: List of Major Project Activities

3 Executive Summary of the System Study Analysis

3.1 Background

- This document has been prepared on the basis of a comprehensive review of the project related publications and other types of information collected and received during the Inception Period as well as the system and market analyses calculations conducted during Interim and Final Report finalization.
- Documents that have been obtained from OST, MEPSO, industry organizations, the EU and public sources have been used in preparation of the background for the System Analysis work.
- Background for the detailed transmission network model and methodology that was applied for the grid analyses is presented in the document.
- Simplified presentation of the power systems that was used for the market simulations is given in the document, as well as methodology that was applied. According to that, a complete market analysis is conduced for both existing and future expected electricity network.
- The results of the final grid analyses gave an assessment of both the existing and future electricity network situation between Bitola and Elbasan and the regional context. The analyses took into account realistic scenarios of demand growth, generation expansion, transit flows, RES integration and HVDC options as well as network topologies and regimes for the years 2015 and 2020.

This Final Report consists of body text and 5 Appendices. The report body text as the main part of the Report consists of 10 Chapters, including this Executive Summary. The first Chapter is the Synopsis and it gives the main information about the Study and the second one is this Executive Summary. In the third introductory Chapter the main idea of the Study is explained.

The fourth Chapter deals with the description of input data, scenarios and grid models used in this Study. In this Chapter target years, Regimes and Variants for analyses are listed. After that, a process of construction of regional models is described with special attention paid to new (planned) elements included in analyses. This Chapter also consists of description of power systems of Albania and Macedonia as well as of the relevant Topology Cases. Concerning analyzed Interconnection between Albania and Macedonia, there are three Variants:

Variant 0. No tie-line (without SS 400/110 kV Ohrid),

Variant 1. Single circuit tie-line Elbasan - Bitola (with in-out connection to SS 400/110 kV Ohrid),

Variant 2. Double circuit tie-line Elbasan - Bitola (with in-out connection to SS 400/110 kV Ohrid on one circuit only).

In Chapter 5 a description of methodology and approach in analyses is given. It consists of very short description of methodology for steady-state and contingency analyses, TTC/NTC and GTC calculations, methodology for short-circuit currents calculation including calculation of maximum short-circuit currents, methodology for dynamic and voltage stability analyses and methodology for reliability calculation.

Chapter 6 gives information on market simulations. It starts with approach and methodology followed by Topology applied for GTMax analyses. Next, there are descriptions of electricity demand, load demand profiles and generation portfolio for Albania and Macedonia. At the end of this Chapter, information on GTMax generation modeling and update of capital and fuel costs are given.

Results of conducted grid analyses are given in Chapter 7. These analyses have been made for 2015 (Winter Peak, Summer Peak and Summer Off-peak) and 2020 (Winter Peak) development stage for all the above mentioned variants. There are identified the main characteristics of the observed network models in terms of the basic grid analyses such as load flows, voltage profiles and analyses of losses. Also, the key findings are provided in terms of the security assessment and NTC/GTC calculations. Results of load flows, power exchanges and security assessment are given only for Winter Peak Regime in 2015 and 2020 while the rest of results from these calculations for other regimes is given in Appendix 4. All of the 110, 220 and 400 kV lines are taken into account as well as all of the 400/220, 400/110 and 220/110 kV transformers. Finally, there are also presented obtained results of short-circuits, dynamic and voltage stability analyses as well as energy not served calculations.

Results of market simulations are given in Chapter 8. This Chapter also includes the CO_2 emission penalties and ancillary services analyses. Chapter 9 gives summarized conclusions and assessment of the Benefit Categories – as per the ENTSO-E methodology. Finally, Chapter 10 consists of the List of References used in this Study.

At the end of the Report there are five Appendices. Appendix I gives description of the calculations agreed to be performed in this Study.

Appendix II consists of short description of PSS/E software which is the main tool for load flow, short-circuit and stability analyses.

Short description of the GTMax software is given in Appendix III. This software is the main tool for the market simulations.

As it was mentioned before, additional results of grid analyses are given in Appendix IV.

Finally, Appendix V gives the results of additional load flow analyses and security assessment for the extreme regimes in the Albanian transmission network. There are observed Winter Peak Regime in 2015 with maximal import and Summer Off-peak Regime with minimal consumption.

Presented results show that new 400 kV line Elbasan - Bitola would have a positive effect on the operation of the Albanian and Macedonian power systems enabling more efficient operation of the generating units in both systems and a more secure and reliable energy transfer.

Maximum loadings of analyzed lines are given in following table.

Exchange scenario	Variant	Line	With HVDC Albania - Italy				Without HVDC Albania - Italy			
			ABS(P)	ABS(Q)	S		ABS(P)	ABS(Q)	S	
			[MW]	{Mvar]	[MVA]	[%]	[MW]	{Mvar]	[MVA]	[%]
Base case	V1	Bitola - Ohrid	434,7	71,5	440,5	33,1	279,8	65,0	287,3	21,6
		Ohrid - Elabasan	385,1	71,7	391,7	29,5	281,3	41,0	284,2	21,4
	V2	Bitola - Ohrid	332,0	77,3	332,8	25,0	207,2	77,3	221,1	16,6
		Ohrid - Elabasan	277,8	50,7	280,2	21,1	205,2	50,7	209,9	15,8
		Bitola - Elbasan	292,8	78,5	296,1	22,3	205,8	78,5	209,5	15,8
Reached maximum exchange (MK->AL or East->West)	V1	Bitola - Ohrid	538,9	110,8	550,2	41,4	481,6	65,0	485,9	36,5
		Ohrid - Elabasan	574,1	110,6	584,7	44,0	470,6	49,5	473,0	35,6
	V2	Bitola - Ohrid	434,3	77,3	436,6	32,8	364,4	77,3	365,0	27,4
		Ohrid - Elabasan	400,7	60,5	403,2	30,3	343,5	60,5	343,6	25,8
		Bitola - Elbasan	407,5	80,9	409,0	30,7	351,0	80,9	351,0	26,4

It can be seen that maximum loadings of these lines appear in Winter Peak 2020 scenario with HVDC Albania - Italy. Loading of these lines in Base Case Scenario is 30 - 33 % in case of single connection (**Variant 1**) and 21 – 25 % in case of double connection (**Variant 2**). In case of reaching maximum exchange from Macedonia to Albania or from East to West, loading of the lines increases up to 40 – 44 % in case of single connection and up to 30 - 33 % in case of double connection.

In all other cases (except Winter Peak 2020 with HVDC Albania - Italy), loading of these lines in Base Case scenario is around 22% in case of single connection (Variant 1) and around 16% in case of double connection (Variant 2). In case of reaching maximum exchange from Macedonia to Albania or from East to West, loading of the lines increases up to 37% in case of single connection and up to 27% in case of double connection.

Performed analyses show that there were no problems with high voltages in all analyzed regimes, except in Summer Off-peak, Variant 2 Regime. Referring to the fact that for the Albanian Off-peak Regime, voltages at 400 kV busbars in Elbasan area are close to the upper limit (even in case of Variant 1), and that it can be possible that, in some Albanian absolute minimum regimes, the voltages breach the upper limit, as well as expectations of moderate deviations from the overall results of the study, **further analyses concerning installation of Shunt Reactor(s) should be performed, in order to solve the problem with high voltages. Such analyses should give result about how many and where to install the Reactor(s).**

Comparison of the analyzed connection Variants, from technical point of view, is shown in the following table:

GENERAL COMPARISON	Load Flow, Security	Voltages	Losses	TTC/NTC and GTC
	Compared to Variant 0 – Without 400 kV OHL Elbasan-Bitola			
Variant 1 - single circuit tie-line	+/–	+	+	+
Variant 2 - double circuit tie-line	+/–	+	+	+
Variant 1 - single circuit tie-line + tie-line Kosovo C - Skopje	+/–	+	+	+
Variant 2 - double circuit tie-line + tie-line Kosovo C - Skopje	+/–	+	+	+
Variant 1 - single circuit tie-line + HVDC AL-IT	+	+/+	+	+
Variant 2 - double circuit tie-line + HVDC AL-IT	+/+	+/+	+	+
Variant 1 - single circuit tie-line + HVDC GR-IT	+/–	+	+	+
Variant 2 – double circuit tie-line + HVDC GR-IT	+	+	+	+

– = No improvements
+/– = Minor improvements
+ = Improvements
+/+ = Significant improvements

It can be seen that the single connection (Variant 1) improves operation of the Albanian and Macedonian power systems in all analyzed cases and exchange scenarios.

The double connection (Variant 2) makes additional improvemens only in regimes in 2020 with Topology Scenarios with HVDC Albania - Italy and Greece - Italy. Its contribution in case with topology scenario with HVDC Albania - Italy is significant, because the second connection makes significant improvements in system security and voltage profile.

Summarized table with the **ENTSO-E Benefit Categories** is presented below. Categories with achieved benefits are marked green (higher benefit = darker green).

Variant	GTC*	B1*	B2**	B3**	B4*	B5***	B6*	B7*
Var.1 Single	200 MW	93.4 MWh	5.4 milion Euro	112 GWh	23 GWh	-161000 t	No impact	Moderate impact
Var.2 Double	400 MW	124.1 MWh	5.4 milion Euro	112 GWh	28 GWh	-155000 t	Moderate impact	

* - Grid analyses
** - Market simulations
*** - Grid analyses and market simulations

B1. Improved security of supply
B2. Social and economic welfare
B3. RES integration
B4. Variation of losses
B5. Variation in CO_2 emissions
B6. Technical resilience/system safety
B7. Flexibility

From the results it can be seen that the analyzed single connection between Albania and Macedonia makes improvement on all the analyzed categories except in the CO_2 emission and technical resilience/system safety. Achieved benefits are increased GTC on level of 200 MW, reduced ENS by 93.4 MWh, EUR 5.4 million as social and economic welfare, 112 GWh as the unlocked "green" generation, reduction of 23 GWh in annual losses and better flexibility of the systems operation where spinning reserve can be more efficiently distributed between the systems in Interconnected operation. There is no impact on technical resilience/system safety. On the other hand, market analysis shows increase in CO_2 emission on the level of 155 and 161 thousands of tonnes with included impact of emission reduction due to reduction of losses.

Connection with the double circuit line between Albania and Macedonia makes additional improvements in 5 Categories. Practically, there is no influence on social and economic welfare and RES integration. Additionally, achieved benefits are increased GTC on level of additional 200 MW, reduced ENS by additional 30.7 MWh, additional reduction of 6 GWh in annual losses, moderate impact on technical resilience/system safety and flexibility in interconnected operation.

Based on the analysis performed in this Study, the following general conclusions can be listed:

- **Single circuit connection (Variant 1) from the technical point of view fulfils all the necessary technical requirements, improves operation of Interconnection and increases exchange possibilities within the region;**
- **Double circuit connection (Variant 2) makes additional improvements in operation of Interconnection as well as additional increase of exchange possibilities.**

4 Executive Summary of the AL and MK Technical Assessment

4.1 Technical assessment report

The new 400 kV line will be erected between 400/110 kV Substation Bitola 2 (MK) and 400 kV Substation Elbasan 3 (AL) with an in/out connection to the new 400/110 kV Substation Ohrid. Detailed technical assessment of the new 400 kV line and following substations have been performed during the course of the Feasibility Study:

- New 400 kV line Bitola (MK) – Elbasan (AL),
- New 400 kV Elbasan 3 Commutation Point
- New 400/110 kV Substation Ohrid
- Extension of 400 kV Substation Bitola 2

4.2 400 kV line - Albanian part

This part of the Feasibility Study deals with the construction of a new 56 km long 400 kV OHTL line between Elbasan (AL) and Albanian/Macedonian border. In addition to the assessment of the constructability of the new OHTL, the assessment of line entries rearrangement to the SS Elbasan 2&3 has been performed.

Initially, two variants were considered: single circuit 400 kV line (**Variant 1**) and double circuit 400 kV line (**Variant 2**). Single circuit 400 kV line (Variant 1) from the technical point of view fulfils all the necessary technical requirements, improves operation of Interconnection and increases exchange possibilities within the region. Based on the Cost-Benefit analyses, Variant 2 (double circuit 400 kV line) is not viable and therefore has not been assessed further for its constructability. The Cost-Benefit Analysis for both Variant 1 and Variant 2 is presented in Annex 3.

In order to assess the constructability of the new 400 kV single OHTL a wide array of data was considered. First, different types of maps of the area were gathered (geographical, hydrological, geological, seismological, agricultural, environmental, settlements, etc.). Secondly, electrical networks in the area were identified and relevant electrical transmission information was gathered (Albanian Building Code for Transmission Lines, and data about transmission construction costs in the region). Thirdly, data about land prices and expropriation issues were gathered from both local authorities and other stakeholders. All these collected data were useful in the subsequent investigations and engineering assessments for the new 400 kV line.

In the subsequent site investigations, it was revealed that the general area is diverse (varying from fertile plains to steep mountains and deep river valleys). After a general assessment of the terrain, the region near River Shkumbini was deemed more viable for a feasible OHTL corridor. The areas outside this river valley were too rugged for line construction and without access roads. Howev-

er, even within Shkumbini River valley, there are regions affected by detrimental natural phenomena such as landslides and tectonic faults. Consequently, the team factored all these hazards in a progressively detailed analysis of alternatives. In addition to geographical and geological criteria, the population settlements were considered in the option selections. Specifying corridors away from the densely populated areas minimizes the impact of the overhead line on the population and the respective expropriation costs. Furthermore, the feasible corridor was chosen with the intention to avoid environmentally sensitive areas and archaeological sites. As a result of this laborious process of alternative's assessment and elimination a viable alternative was singled out. For an overview of the feasible OHTL corridor, see the topographic map attached to this report.

The proposed new 400 kV line corridor goes in parallel, where practicable, with the nearby existing 400 kV line SS Elbasan 2 – SS Zemblak. The feasible corridor is divided into four major sections. The **first section** from SS Elbasan 2 to Shushica Village is located south of Shkumbini River. The terrain is characterized by rolling hills and dense population settlements. There are no major geological hazards in this area and many access roads are available.

The **second section** from Shushica Village to the town of Librazh is located south of Shkumbini River and characterized by steep hills. The area is sparsely populated and has few access roads. There are a few a few tectonic faults and landslide prone areas in this section. However, these areas are very limited in relation to the length of the line and the amount of risk is acceptable.

Meanwhile, the **third section** from Librazhd to Qukes Village is located to the north of the River Shkumbini and is more uniform in its general appearance. It is characterized by relatively flat mountainous terrain, which has sufficient access roads. The area is relatively sparse in population settlements and the geological hazards are limited only to a few locations along this section.

The **fourth section** (Qukes Village to the border) is east of the River Shkumbini. There are two possible areas for feasible corridors in this section. One area is north of Prrenjas Town and is characterized by steep terrain and sparse access roads. The other area is located south of the fertile Domosdova Plain, on a relatively flat terrain. The assessment of both areas revealed that options in the area north of Prrenjas Town are much shorter. In addition, land prices in this area are much cheaper. As a result, the team chose a feasible corridor North of Prrenjas Town, which is located near the national highway. This choice will minimize construction costs and the future maintenance of the line.

The OHL crosses the MK/AL border on 500 m west from the border crossing "Kafasan".

The arrangement of the overhead lines around SS Elbasan 2 has to change in order to accommodate the new line. SS Elbasan 2 will extend to the west and this 400 kV extension is named SS Elbasan 3. The team designed a sequence of steps for re-arranging the overhead lines and to accommodate for the construction of SS Elbasan 3 in the shortest time (to minimize long disconnections of power). The sequence consists of three major steps. In the **first step** the

construction works for SS Elbasan 3, which do not interfere with the existing 400 kV lines will be performed. During the **second step** the towers outside the substation will be re-arranged to accommodate the new configurations. During this re-arrangement some towers will be demolished and some new towers will be erected instead. In the **third step** all the remaining substation construction works from step one will be completed.

For estimating the construction costs of the new line the prices of previous OHTL construction projects in the region were compared. Fortunately, a significant number of OHTL projects have been completed recently in Albania and in the regional countries with similar economic standards. These previous projects provided a good indication of the OHTL construction price ranges. The project costs are presented in Annex 4.

4.3 400 kV line - Macedonian Part

This part of the Feasibility Study deals with the construction of the Macedonian part of the new 95 km long 400 kV OHTL line between Bitola (MK) and Macedonian/Albanian border.

In general, the corridor follows, as much as practicable, the corridor of the existing 110 kV OHL Bitola-Resen-Ohrid-Struga.

Bitola area

The wider area around the OHL's starting point at SS Bitola 2 to the crossing point with the regional road and railroad Bitola – Prilep and the regional road Bitola - Kicevo, belongs to the Pelagonija Field and represents large-scale open and flat landscape on about 580 m a.s.l.

Resen area

In the Resen area (between villages Bratin dol and Gjavato) the OHL corridor goes on north side of the road Bitola-Resen. From the locality Gjavato to locality Ceso Glava (area nearby the new Ohrid substation) and further on to the crossing point with the road Ohrid-Kicevo, the proposed OHL corridor passes over hilly and mountainous landscape on altitude in a range from 800 m to 1,200 m, following the existing 110 kV OHL Bitola-Resen and the road Bitola-Resen on variable distances.

Ohrid and Struga area

The OHL goes further via hilly and mountainous northern slopes of the Baba Mountain through the Prespa valley to the Struga Field at the northern side of the Ohrid Lake and south and eastern parts of the Jablanica Mountain. In general, the corridor follows, as much as practicable, the corridor of the existing 110 kV OHL Bitola-Resen-Ohrid-Struga. This corridor bypasses all various categories of nationally designated protected areas in the project region, including both NPs (Pelister and Galicica) and, consequently, avoids any eventual impact on their natural values or their protection status. It passes through peripheral northern part of the World Heritage Site (WHS) Ohrid Region, distant from the area with main natural values of the site – the Ohrid Lake itself. The affected area mainly consists of cultivated land, pastures and occasional woodlands and the cities of Ohrid and Struga with their fast developing suburbs and

with the accompanying infrastructure (airport, roads, commercial developments, transmission lines, other energy infrastructure, etc.).

4.4 Technical data for the new 400 kV line

Technical details of the OHT line components and elements are defined in accordance with relevant international standards, MEPSO and OST codes and regulations.

The system operating conditions relevant for the design and supply of equipment for this 400kV single circuit line are as follows:

***Title of project*:**	400 kV OHL SS Bitola – SS Elbasan
***Title of design*:**	Feasibility Study
***Nominal voltage level*:**	400 kV
***Conductors*:**	ACSR 3x2x490/65 mm2
***Towers*:**	Single circuit, steel lattice ''Y'' shape with two earthwire
- **Number of towers:**	390
- **Suspension:**	332
- **Angle-tension**	58
***Length of line*:**	151 km
***Average span*:**	380 m
***Line route altitude*:**	200 m up to 1391 m

4.5 New SS Elbasan 3 400 kV Commutation point

The existing Substation Elbasan 2 in current condition it is not suitable to be extended with new 400 kV bays as the 400 kV switchyard is composed of an "H" schema. In order to have the possibility to extend the 400 kV switchyard with new line bays and fulfil reliability requirements, a completely new 400 kV switchyard is necessary to be constructed.

We have assessed 2 different possible substation locations for new Substation 400 kV Elbasan 3. Technically both options are possible but after a detailed assessment, the second option nearby existing substation Elbasan 2 have more advantages and it is recommended future Elbasan 3 substation location.

The new SS Elbasan 3 means actually construction of 400 kV 6-bay switchyard Commutation Point with double bus bars. The existing 400 kV lines to Zemblak and Tirana 2 will be transferred from SS Elbasan 2 to the new SS Elbasan 3. The existing primary and secondary equipment in SS Elbasan 2 are new and can be reused in the new substation. Technical team, as agreed with OST, recommend the existing 400 kV line bays equipment (primary and secondary equipment) Tirana 2 and Zemblak to be reused for the new respective bays in substation Elbasan 3.

The Technical team have assessed in detail 2 Variants for new substation Elbasan 3:

Variant 1A, Single Circuit 400 kV line Elbasan 3 – Bitola 2 (Ohrid) and Elbasan 3 commutation point without a Shunt Reactor

Variant 1B, Single Circuit 400 kV line Elbasan 3 – Bitola 2(Ohrid) and Elbasan 3 commutation point with a Shunt Reactor

Referring to the System Analysis Report findings about the 400 kV voltage profile which is close to the upper limit during off-peak regime, and OST requirements, the Technical team have considered a single circuit 400 kV line Elbasan 3 – Bitola (Ohrid) including a Shunt Reactor installation in the new SS Elbasan 3 as recommended option.

The new 400 kV Substation Elbasan 3 configuration will be: Six line bays, (one spare bay not equipped for future usage), coupler bay and one bay for a Shunt Reactor installation.

The planned substation location is in an open agriculture area. An air insulated substation with double busbars and single circuit breaker per bay is proposed. The technical team have designed a general layout for new substation Variants 1A and Variant 1B. The new substation designs comply with the Albanian and EU standards.

We have considered SS Elbasan 2 operation during SS Elbasan 3 construction and have prepared a tentative work program, describing the SS Elbasan 3 phased construction with Zemblak, Tirana 2 line bays equipment relocation.

4.6 Substation 400/110 kV Ohrid

The 400 kV Ohrid substation is located 1 km north-west from the village Livoista and 8 km from Ohrid, between localities Gorno Livage and Staro Selo on altitude of 800 m a.s.l.. The wider area is characterized with open landscape and different agricultural land. This location is distant from any residential property and positioned between the existing 110 kV line Struga – Ohrid and the future new 400 kV line Bitola - (Ohrid) – Elbasan. The slope is gently dipping towards south. Western, northern and eastern sides of the location are sheltered with hilly topography.

Based on the joint site visits with MEPSO representatives, and detailed assessment of the three Substation location options, it was concluded that Option 3 has several advantages over the other two options. The planned substation location is in an open agriculture area. An air insulated substation with double busbars and single circuit breaker scheme is proposed.

The 400 kV switchyard will consist of four equipped bays and one spare bay. There is an available space for additional one spare bay:

1. Coupling bay
2. Line Bay to SS Elbasan 3
3. Power Transformer bay 1

4. Spare bay (second power transformer or future line)
5. Line Bay to SS Bitola 2)

The 110 kV switchyard will consist of six equipped bays and one spare bay. There is available space for additional two spare bays:

1. Line Bay to SS Struga
2. Line Bay to SS Ohrid 3 (1)
3. Power Transformer bay 1
4. Line Bay to SS Ohrid 2
5. Line Bay to SS Resen
6. Spare bay (Power transformer 2)
7. Coupling bay

The Technical team have designed a general layout for new substation as shown in the report Annexes. The new substation designs comply with the Macedonian and EU standards.

The new 400 kV line is going to be connected to SS 400/110 kV Ohrid from north-west side as in-out connection. The 110 kV line Struga-Ohrid 1 will be connected to SS Ohrid 110 kV switchyard with in-out connection. In the region Ceso Glava there is going to be built a new 2x110 kV tower near the existing 2x110 kV tower. The new 2x110 kV tower will accept 110 kV line from SS Resen (first system) and SS Ohrid 2 (second system) and as double system OHT line (3km) will go in the new SS Ohrid 110 kV switchyard.

4.7 Substation Bitola 2 Extension (equipping spare bay)

The new 400 line Elbasan - Ohrid - Bitola termination point in Macedonia will be the existing 400/110 kV Substation Bitola 2. SS Bitola 2 is one of the most important substations in the Macedonian electric power transmission system built in the early 1980's.

SS Bitola 2 is located 10 km from Bitola city and next to the Thermal Power plant REK Bitola which is connected to this substation. The existing 400 kV switchyard has a typical double bus bar single breaker scheme.

The 400/110 kV substation Bitola 2 400 kV switchyard consists of ten bays. One of the existing two spare bays, spare bay B10, will be equipped to accommodate the new 400 kV line Elbasan - Ohrid - Bitola termination into SS Bitola 2.

Arrangement of the new 400 kV OHTL bay Elbasan (Ohrid) shall be on the existing fundaments basically in line with the existing 400 kV bays, but modified in details as required to accommodate the selected equipment. All equipment supplied and installed in the new 400 kV bay to SS Elbasan 3 (SS Ohrid) should be designed to become integral part of the entire control, measuring and protection system of the substation Bitola 2.

All 400 kV line maps, substations layouts, single line diagrams, projects costs and implementation plan are presented in MK Technical Report Annexes 1,2,3,4.

5 Executive Summary of the Finance, Economic, Risk and Sensitivity Assessment (FERS)

The Terms of Reference for the Finance / Economic work group calls for implementation of four sub tasks, these include:

- **Sub-Task 4(i)** Cost-Benefit Analysis – Develop detailed construction cost estimates, based on recent procurement experience / budgeting data from MEPSO and OST.
- **Sub-Task 4(ii)** – Procurement Plan – Create a procurement plan for the project, based upon the protocol and procedure favoured by the nominated IFIs (KfW in Albania and the EBRD in Macedonia);
- **Sub-Task 4(iii)** Risk and Sensitivity analysis – Prepare a Risk and Sensitivity analysis comprising of legal, political, technical and financial / economic risks and sensitivities.

The end-result of work of Finance / Economic Team comprises of Financial and Economic Report on the economic assessment of the project, including the financial and economic cost-benefit analyses together with the risk and sensitivity analysis and the procurement plan. Associated with these will be the full Financial and Economic Model.

The Financial and Economic aspects of the Project Terms of Reference called for implementation of four sub-tasks. The first of them is **Sub-Task 4(i) Cost-Benefit Analysis of the Project.**

The overarching goal of the Feasibility Study was to develop a detailed analysis of the financial viability of the project itself, in order to efficiently complete project appraisal process, including assessing the potential sensitivities of the project and risks associated with its implementation.

However, the overall benefits deriving from implementing new transmission projects are very often difficult to quantify. Especially in the context of modern, unbundled energy systems where every single actor (generators, transmission, market operators and distributors) generally concentrates on maximizing their own profitability, such focused, specific project-oriented analyses may be missing identification of broader potential benefits resulting from large infrastructure investment to the entire national economy.

For this reason, the Financial and Economic Report of the Feasibility Study comprises of a more comprehensive analysis, consisting of three major elements:

- An overview of the **general economic environments** in Albania and Macedonia, their potential impact on the Project's viability and impact on economies;
- An assessment of **current financial standing of MEPSO and OST** as business operators and their ability to take additional loan obligations; and

- The actual **cost/benefit analysis** of the project itself in both financial and economic terms.

FERS Report Sections 2 through to 4, which effectively contain the **Financial and Economic Cost-Benefit Assessment (as per Sub-Task 4(i)**) and which follow below, focus on these three elements of this comprehensive financial and economic analysis.

Specifically, Report Sub-Sections 2.2 through to 2.6 examine impacts from Albanian and Macedonian economies on the Project's implementation and potential feedback response from the upgraded network on economies. In doing this, they focus on current situation and forecasts regarding national GDP, and developments within the region that will be affected by the Project's implementation. **Summary of their findings are included in the final Paragraph of this Sub-Section, i.e. 2.7.**

Report Sub-Section3, using a set of standard financial analysis tools and indicators that are normally utilised by financing organisations, reviews current financial situation of OST and MEPSO and reviews the applicable regulatory framework for setting tariffs of both operators. This includes comparison with previous periods. Sub-Section 3.1 is devoted to analysis of OST as a business entity, while Sub-Section 3.2 focuses on review of MEPSO. Each of these Two Sub-Sections contains a paragraph at the end of it summarizing the main findings from financial review of both transmission system operators.

Sub-Section 4 concentrates on reviewing economic, financial and cost efficiency of all the possible Variants for the implementation of this Project. Using the most important conclusions arrived at in previous Sub-Sections as well as a number of initial assumptions, a Financial Model has been developed which allows for a detailed financial modelling for each of these Variants.

This model, amongst others, analyses potential impacts on MEPSO's and OST's financial situation and Albanian and Macedonian economies, after Project's implementation resulting from:

- Reduction of technical losses;
- Reduction of unsupplied electricity;
- Increased generation in both interconnected systems;
- Increased transfer capacity and ability to participate in cross-border electricity exchanges.

In conjunction with the Risk and Sensitivity Assessment (Sub-Task 4(iii)), this model enables smooth and efficient examination of the sensitivities of the Project to changes of important assumption parameters.

At the end of this Section, Sub-Section 4.8 summarises the main conclusions from this comprehensive analysis of possible Variants.

The results of the analysis indicate that the **economic environment in Albania and Macedonia is favouring implementation of the Project**. Moreover, implementation of the transmission upgrade Project is likely to produce significant economic gains to both Countries.

Also, **the financial situation of MEPSO and OST is satisfactory** for pursuing with the implementation of this Project, although some concerns regarding OST remain (e.g. related to CEZ).

Finally, from all technically, socially and environmentally viable Variants, Variant One encompassing **construction of the new 400 single circuit line between Elbasan in Albania and Bitola in Macedonia** is the most attractive option from the financial / economic perspective.

This best Variant for implementation of the Project (for Albania, Variant 1B with a Shunt reactor) is characterised by the following important financial and economic parameters (estimates for a 35-year period):

No	Main Indicator	Macedonia	Albania
1	Required investment:	**€43.5 million**	**€24.6 million**
2	NPV (for transmission operator):	**€6.3 million**	**€1.7 million**
3	Simple Payback period	**15 years**	**11 years**
4	Benefit cost ratio	**2.0**	**2.6**
5	IRR	**12.5%**	**11.8%**
7	Impact on national economy	**€37.8 million**	**€42.9 million**

Table 4: Best Variant Characteristics

In terms of the Risk and Sensitivity Assessment (Sub-Task 4(iii)), it is addressed to in Chapter 5 – Risk and Sensitivity Analysis. It delivers a detailed "what-if" analysis of the selected, technically, financially and economically most viable Variant for implementation of the 400 kV transmission line between Elabasan in Albania and Bitola in Macedonia.

It comprises of a comprehensive risk and sensitivity analysis, encompassing three major elements:

1. The identification and review of potential risks deriving from the general economic environment in Albania and Macedonia, together with a sensitivity analysis of potential impacts from these risks on the Project's implementation;
2. The identification and overview of potential risks deriving from the financial standing of MEPSO and OST, together with a sensitivity analysis of the potential impacts from these risks on the Project's implementation;
3. The identification and overview of potential risks deriving from Project-specific implementation issues, together with a sensitivity analysis of these potential impacts from these risks on the Project's implementation.

By doing that, it focuses on these three elements of this comprehensive financial and economic analysis.

Sub-Sections 5.1.1 through to 5.3, focus on these three elements of this comprehensive analysis. At the end of this Section, Sub-Section 5.4 summarises the main conclusions from this analysis.

Sub-Section 5.1.1.1 examines potential risks from broadly understood Albanian and Macedonian economic and political environments. In doing this, this Sub Section focuses on analysing risks to the assumed base-case scenario forecasts regarding national GDP, population growth and electricity consumption as well as forecast political developments.

Sub-Section 5.2 concentrates on the analysis of risks from the current and forecast aspects of MEPSO's and OST's financial standing, together with the assessment of potential impacts from a number of risks, such as variation of revenues, indebtedness, losses, etc. Finally, this section also looks at operator's ability to repay future debts, in light of existing schedules for loan repayment.

Sub-Section 5.3 in turn focuses on reviewing the risks for economic, financial and cost efficiency of Variant One from potential changes in several most significant financial and economic parameters, which were adopted during the initial analysis for implementation of Option Two for this Project. More specifically, the following risks were taken under closer examination:

- From the discount rate (5.3.1);
- These related to interest rate (5.3.2), which may also serve the purpose of assessment of possible impacts from Public-Private Partnership (PPP) financing;
- These associated with the increasing investment cost (5.3.3);
- These associated with increased indebtedness and debt servicing (5.3.4);
- These related to valuation of grid losses (5.3.5);
- These related to forecast generation increases (5.3.6);
- These connected with the forecast provision of balancing and ancillary services (5.3.7);
- Risks to alternative valuation of electricity non-served (5.3.8)
- Impacts from potential inclusion of a scenario encompassing construction of a cable between Italy and Albania (5.3.9)
- Impacts from realisation of a number of negative scenarios at once (5.3.10);

Finally, at the end of this Section, Sub-Section 5.4 summarises the main conclusions from this comprehensive risk and sensitivity analysis.

The results of the analysis indicate that the risks to the Project from the general economic situation in Macedonia and Albania increased in recent years but are not threatening the realisation of 400 kV interconnector Project between Albania and Macedonia. Both Countries face economic slowdown and are likely to suffer to some extent from economic downturn amongst their main trading partners, especially these from the EU like Italy or Greece. However, in both of them levels of electricity consumption remains relatively low, compared to other European Countries. As a result of that, it may be expected that a long-term increase in the demand for energy in Macedonia as well

as in Albania will be a very probable long-term energy sector development scenario. Also, gradual deepening of the integration of energy markets in the Balkans with these in the EU (which may be potentially also joined by Turkey and Ukraine) is likely to result in a long-term increase of cross border energy flows and even greater utilisation of transmission assets. Similarly, **it is currently assessed to be highly unlikely that future political developments in Macedonia or Albania would create any significant threat to successful implementation of this Project.**

With respect to the risks to OST financial situation:

- OST's revenues are almost fully dependent on ERE-approved tariffs. Any % change in tariffs translates into almost the same % change of the overall Company's revenues. The likelihood of downward tariff review is extremely unlikely though and any upward tariff modification means additional revenues to OST, improving its ability to fund this Project.
- Compared to last year, risks from negative impact from exchange rate developments increased considerably. This said however, it is assessed that even a 10% negative exchange rate change would be still manageable and not endangering Company's financial standing and the probability of materialisation of this scenario is assessed to be very low;
- **Risks from indebtedness are assessed to be moderately increased, but still manageable within the framework of current OST's revenues and profitability.** This said however, it is inevitable for the Company to get attain some significant tariff increases from ERE in the period to come as well as it has to more thoroughly track revenues from invoices already issued, should it wish to proceed with implementation of its ambitious investment program in future (especially if other Projects, such as Tirana-Rrashbull and the Tirana Ring Enforcement were about to be implemented) and at the same time for it to be able to meet the obligations against the organisations financing these investments.

With respect to risks to MEPSO financial situation:

- Since 2009 MEPSO has been consistently able to secure profitability of its business though the tariffs approved by ERC. ERC tariff policies are promoting new investment and provide for return on investment as well as approval of tariffs for longer periods of time, securing the financial stability of electricity licensees in the Country. Current tariff runs through to the end of 2014 and already includes some preliminary provisions for realisation of the Project being subject of this study. Despite that it is unquestionable that the two biggest long-term risks to Company's revenues derive from ERC's tariff setting policies and dependence upon the revenues from the biggest customer – EVN, it is **currently assessed that the possibility of materialisation of negative consequences from these risks is regarded to be very small.**
- In terms of its indebtedness, MEPSO's liabilities reduced recently and the Company's current financial standing allows for acquiring additional debt financing for the Project being subject of this study. This assessment was based on the premise that the Company will be able to address a 14% part of investment from its own sources.

In terms of MEPSO's ability to address future forecast burden from repayment of the loan necessary to be drawn for the purpose of construction of the transmission line under this Project, taking into account Company's profitability and overall financial situation during the last three years, this ability is assessed to be satisfactory.

The project-specific risk and sensitivity assessment presented in the Sub Sections above leads to several important conclusions, namely:

- In terms of the discount rate:

  The Project shows high sensitivity to changes in the discount rates adopted for parts of the Project in Macedonia and Albania.

  The first +1% increase in initially assumed discount rates results in changes of the NPV valuation for MEPSO close to 30% and 50% in case of OST.

  Overall, the discount rate would have to increase to approximately 12.4% in order for the Project to become financially unviable for at least one of the operators (OST).

- In terms of interest rate:

  The Project shows high sensitivity to changes in the interest rate. A +/-1% change in the interest rate from the base-case of 2% results in approximately -/+27% change in the Project's NPV for MEPSO and a 49% change for OST. Nominal interest rate above approximately 5% would mean a Project getting into negative territories in terms of its profitability to both MEPSO and OST.

- In terms of investment cost:

  The Project indicates an increased sensitivity to changes in investment cost, although not as high as is the case of discount or interest rates. A 10% increase in investment cost above the base-case assumptions would translate into more than twice times that figure worth of loss of the NPV for MEPSO and a 50% loss of value to OST. Investment cost increases above 20% from the Base Case scenario assumed investment cost would mean the Project getting into negative NPV valuations for the Albanian part of the Project. In case of Macedonia this non-viability margin is shifted by approximately a further 25%.

- In respect of the valuation of energy losses:

  The analysis **indicates low sensitivity to changes in the cost of the energy purchased for serving the losses in case of OST (a 10% change in cost of covering the losses translates into an increase equal to only 1/7th of that in the way of impact on OST's NPV). In case of Albanian economy, 10% reduction in the cost of energy for purchasing the losses translates into an almost equal reduction of NPV to Albanian economy, which is almost twice as high as the impact on Macedonian economy.**

The sensitivity to impacts from valuation of energy for covering the losses on MEPSO is much higher than the same on OST, due to that the forecast reduction of losses, owed to this Project, is much higher in case of Macedonia than in Albania.

- In terms of forecast transmission revenues from decreased generation:

  From the perspective of both Macedonian and Albanian economies, the Project is economically justified throughout a huge range of variations of the value of electricity to the national economies and value of imported electricity, mainly owed to the forecast benefit from increased generation in both countries.

  The analysis **indicates Project's very high sensitivity to changes in the additional generation in case of OST as 10% of change in possibility to generate additional electricity owed to this Project translates into an impact equal to more than three times that figure in NPV. In case of Albanian economy, 10% reduction in this ability translates into an equal reduction of NPV to Albanian economy.**

  The sensitivity to impacts from ability to produce additional electricity on MEPSO is lower as 10% reduction in ability to generate additional electricity translates into a 12.5% reduction of NPV to MEPSO. This is owed to the fact that the effects from the ability to provide increased generation are reducing with time in case of Macedonia.

- In terms of potential benefits from provision of balancing and ancillary services:

  The analysis **indicates that Project is characterised by a moderate sensitivity to changes in provision of balancing and ancillary services in case of OST (10% of change in possibility to secure such services translates into a 17% impact in terms of NPV).**

  The sensitivity to the same impacts in case of MEPSO is even lower, as 10% reduction in ability to secure such services translates into a 7% reduction of NPV to MEPSO.

- Project's sensitivity to commencement of a cable between Italy and Albania:

  - **In case of Variant One, it produces marginally better results for OST, with deteriorating negative valuations of the project for Variant Two on OST's side of the project.**
  - **On the other hand, on Macedonian side of the Project, putting the cable from Italy to Albania in service would result in a minor deterioration of Project's NPV in case of Variant One but significantly improved Project's NPV to MEPSO, should the Variant Two were realised.**
  - **For both Variants concerned, positive impacts on both Albanian and Macedonian economies are significantly better in case of commencement of Italy - Albania cable.**

Overall Project-specific sensitivity to compounded risks indicates that the **Project is characterised by increased sensitivity to numerous risks, which understandably may, but also may not materialise in the course of its implementation.**

Among major risks, the ones concerning discount rate and applicable interest rates are of specific concern, materialisation of which compounded with non-realisation of some assumed transmission and generation volumes may mean the Project turning into negative NPV valuations to both Transmission Operators concerned. At the same time however, it is very much unlikely that the project could produce negative effects to either Macedonian or Albanian economies.

This Report is supported by FERS Annex 5.1, setting out **the Financial and Economic Model** Analysing different technically possible Variants for both Macedonia and Albania. Also, FERS Annex 5.2 is setting out the schedule of repayments of the applicable Transmission System Operator. FERS Annex 5.3 encompasses training material from training sessions delivered to Operators under finance component.

The same model also allows for a smooth "what-if" analysis of all Variants for implementation of the Project in question, with numerous financial and economic parameters subjected to variations from these used in the Base Case scenario.

6 AL: Executive Summary of ESIA Analysis

Conclusions on the Main Impacts of the Project

According to the environmental and social assessment and to the classification of the impacts based on the criteria shown in section 5.1, it results that the impacts of the project activities on the biophysical and social environment are as follows:

Main adverse impacts:

a-Moderate residual impact on local scale from permanent land use (2.65 ha) for substation construction in agricultural land, from 140 towers footprints (1.75 ha) and any remaining access road in forest, shrubs, and degraded forest areas;

b-Moderate residual effects on local scale from permanent impact on landscape/visual from substation, 140 towers, and any remaining access road in forested area;

c-Low residual effects on biodiversity, at local scale, from operation phase;

d-Moderate temporary impacts on biodiversity, at local scale, from construction and decommissioning activities; and

e-Moderate to low temporary impacts on health from construction and decommissioning activities.

The permanent land use for substation construction in arable land cannot be mitigated. The other above-mentioned impacts (b, c, d, and e) can be mitigated if appropriate measures are taken.

Main positive impacts:

a- High to very high positive impact, at regional scale, from connection with the 400 kV regional transmission network connecting Bulgaria, Macedonia and Albania, and further on Italy; and

b- High permanent positive impact (on comprise life quality, education, health, employment, economic activities, tourism, etc.) at local, district and national scale from improvement of power supply.

Final conclusion:

Based on the above mentioned analyse of impacts, it results that the main adverse environmental and social impacts of the project activities are the residual ones, which affect only the local environment in a low to moderate scale. These impacts are of minor importance compared to the high positive effects of the project at local, district, national, and regional scale.

AL ESIA NTS: Introduction

Albanian Transmission System Operator (OST) proposes to design, construct, and operate a new 56 km long 400 kV Overhead Transmission Line (OHL) from Elbasan to Albanian /Macedonian border[2)], and to construct and operate a new 400 Substation near Elbasan. This document is a Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) of the proposed project.

The main national and regional benefits from the proposed project are summarized below:

1. Significantly better, more powerful transmission network in Central – East Albania;
2. More reliable power supply and reducing electrical supply constraints for further economic developments in the wider project region;
3. Improved network capacity to facilitate anticipated load and transit growth, new generation connections, in the context of improving transmission capacity in Albania and in Macedonia, and in the Balkans Region;
4. Improvement of the reliability of the regional network, the overall security of supply, and system operational issues such as stability;
5. A decrease of the technical losses in the transmission system;
6. Improving the quality of electricity supply (normalise the voltage levels, stabilize the load flow and the frequency fluctuations, etc);
7. Supporting the potential to develop the regional energy market in South East Europe and creating trading opportunities with Macedonia, Bulgaria and Italy;
8. Mutual support between Albania and Macedonia to complement power generation types (Albania - hydro, Macedonia - thermal); and
9. Reducing the cost of providing reserve capacity, and providing mutual emergency support.

Based on detailed Feasibility Study and multi-disciplinary analysis consisted of technical, environmental and socio-economic appraisal, OST selected a preliminary OHL route as shown in Appendix 1.

OST is seeking financing from the German KfW Bankengruppe, and an ESIA to evaluate potential impacts from construction and operation of the proposed OHL was prepared to meet the Albanian and KfWs requirements.

OST has made this NTS, the ESIA, a Stakeholder Engagement Plan (SEP), and an Environmental and Social Action Plan (ESAP) available to the public for review and comment. The ESIA as well as the SEP, the ESAP and this NTS are

2) This transmission line is interconnection between Albania and Macedonia. From Albanian / Macedonian border it continues to Bitola (Macedonia).

available to the public on the websites of OST (www.ost.al), the Ministry of Economy, Trade and Energy(www.mete.gov.al), the Ministry of Environment, Forests, and Water Administration (www.moe.gov.al), as well as at the following locations:

- **Ministry of Environment, Forests, and Water Administration**

  Address: Durresi Street, No 27, Tirana, Albania

  Phone: +355 4 2224537

  Fax: +355 4 2270627
- **Offices of the concerned municipalities: Elbasan, Librazhd and Prrenjas.**
- **The central premises of OST in Tirana**

  Address: Bulevardi ”GjergjFishta” Nr. 10, Tirana, Albania

  Phone/Fax: +355 422400586
- **KfW offices in Tirana:**

  Address: Rr. "Skenderbej", 21/1 (Kati 3), Tirana Albania;

  Phone: +355 42 22 78 69;
- **KfW offices in Germany:**

  Address: KfW Bankengruppe,

  Palmengartenstraße 5-960325 Frankfurt am Main, Germany.

  Phone: +49 69 74 31-42 60

Description of the Project

The proposed 56 km long OHL route lies in central-eastern region of Albania The starting point of the OHL route within the Albanian territory is located in the peripheral southwest of the city of Elbasan, joint to the Substation Elbasan 2, and close to the Shkumbini River bed.From Elbasan to Qukes (Elbasan-Librazhd-Qukes) it passes along and/or close to the Shkumbini River valley. At Qukes, the potential OHL router leaves the valley of Shkumbini River and continues in the direction west-east toward the Thana Pass (border AL/MK).

In general, from Elbasan to Qukes, the proposed OHL corridor follows, as much as practicable, the corridor of the existing 400 kV OHL Elbasan-Zemblak.

From Elbasan to Librazhd the OHL route passes on the left side of the Shkumbini River. Its starting point is located joint to the existing substation Elbasan 2. From Elbasan 2 to Shushica Village, the line passes through hilly areas and crosses agricultural lands and shrubs. At Byshek, the OHL passes sufficiently far from the touristic area of the Oriental Planes of Byshek) and of the Shushicariparianforest (NM's).

From Shushica to Little-Polis Village the OHL route passes through a forested area that is traversed from some rural and forest roads. From Little-Polis to Murrashi Bridge, the line passes along a hilly slope, away from the Shkumbini Riverbed and from the Elbasani-Librazhd higway. Near Murrashi Bridge the line crosses over the existing 400 kV line Elbasan-Zemblak. From Murrashi Bridge to Librazhd town the line runs parallel to the existing 400 kV OHL Elbasan-Zemblak and avoids the crossing of Shkumbini River valley along Murrashi Gorge-2km long). The river crossing is proposed parallel to the existing OHL Elbasan-Zemblak, in an area of low biodiversity values, in the North of Librazhdi town.

From Librazhd to Qukesthe prospective OHL corridor runs in the right side of Shkumbini River Valleyparallel to the existing 400 kV line Elbasan-Zemblak, and to Shkumbin River and Highway #3. The area is relatively populated, and settlements are spread over wide areas. The line goes through a hilly terrain, which is traversed from numerous streams, and covered mainly from shrubs, sparse forests and agricultural lands.

From Qukes Village to Thana Pass (border Al/Mk) the line route would cross mainly some inhabited mountainous terrain of poor biodiversitytraversed from small streams, and covered mainly from shrubs and sparse forests.

A map of the project area with the route of the proposed transmission line is given in Appendix 1.

The proposed transmission line includes following main components:

- ✓ Towers. The transmission line will be constructed of 140 steel-latticesingle circuit self-supporting towers (Figure below), each with

four legs and a single concrete foundation per leg, with horizontal configuration of conductors and two earth wires.Depending on their position in the OHL, the types of towers could be suspension towers (total number – 115) used for straight section of the line, or angle towers (total number – 25) used where the line changes direction.

- ✓ Phase conductors. Two conductors (wires) per phase are planned at a mutual distance of 400 mm. Characteristics of the conductors will be in compliance with the national standards.
- ✓ Substations. The project includes construction of a new 400 kV substation in the peripheral south of Elbasan.

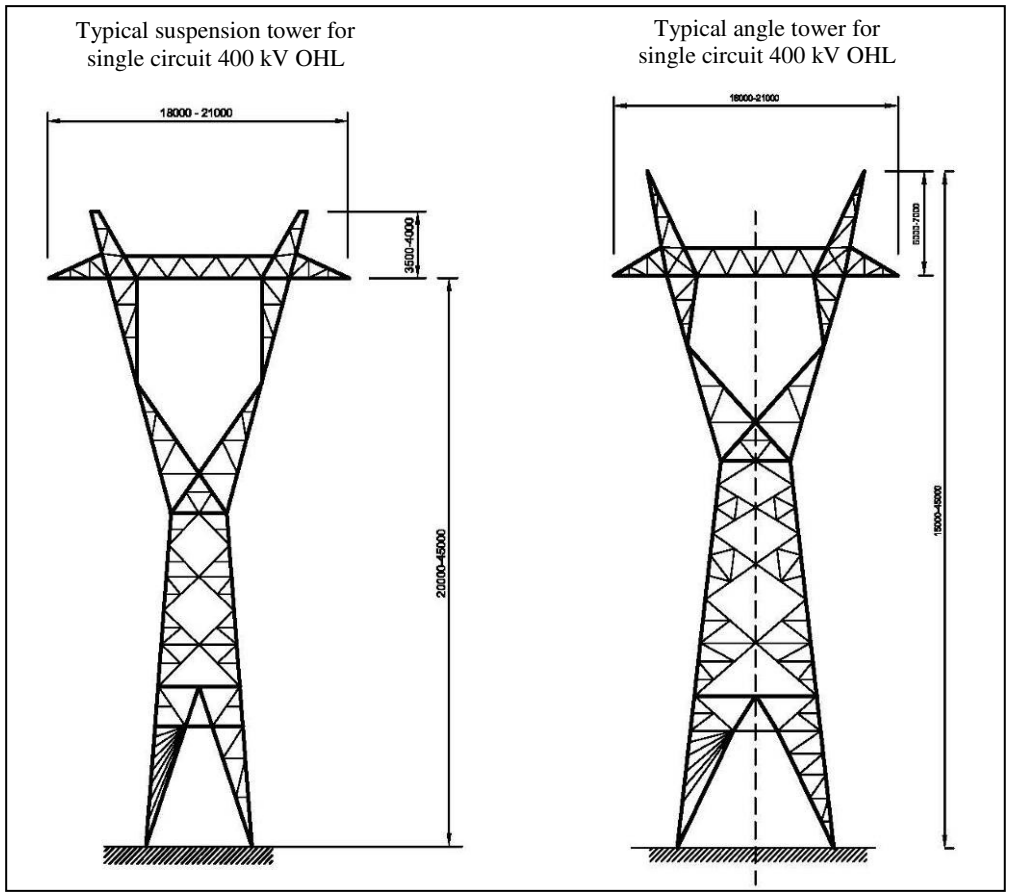


Figure 5: Typical single circuit 400 kV OHL tower types

Project Status and Level of Details

The project has been developed to a feasibility level, i.e. to a detail considered sufficient to establish that the proposed line is technically feasible and to allow environmental effects to be assessed. Final design, including precise location of towers and access roads would be undertaken once the main technical design is developed and prior to construction commencing.

This refinement of the current design would be within the limits of deviation defined for the 500 meters wide transmission line corridor.

Considered Alternatives

New 400/110kV Substation in Elbasan Area

Two alternative locations for the new 400 kV substation in the peripheral South of Elbasan town were considered. Both these potential sites are located close to the existing substation Elbasan 2, in a flat terrain, close to the Shkumbini river-bed. Alternative 1 is located joint to the existing substation, while alternative 2 is located 400 m west of this substation. Both these potential sites have not any protection status, and lie in agricultural land, cultivated partly with olive trees and partly with alfa-alfa.

Upon thorough evaluation of the proposed sites, Alternative 1 is considered as more favorable due to lesser impact on the biophysical and social environment. OST has concluded that both these alternatives are acceptable, but the alternative 2 is an optimal choice for a location of the planned new substation and, therefore, this alternative has been selected future SS development site.

Overhead Transmission Line

Fundamentally different alternative OHL corridors for interconnection between Macedonia and Albania (further on to Italy) have been evaluated at a strategic and spatial planning level, which resulted in proposal for a general OHL corridor that should accommodate the OHL route.

Two main alternatives for the OHL corridor from Bitola to Albanian coast (further on to Italy) have been considered:

i. Alternative corridor 1: Bitola 2 (Macedonia) – Elbasan 2 – Vlore (Albania) – Brindisi (Italy)
ii. Alternative corridor 2: Bitola 2 (Macedonia) – Elbasan 2 - Tirana 2 - Durres (Albania) – Foggia (Italy).

Two possible alternatives have been taken in consideration for the OHL route Elbasan-Bitola:

1-Elbasan –Zemblak – Bitola, via North of Prespa Lake (transboundary protected area); and

2-Elbasan – Qafe Thane – Bitola, via Librazhd and Qukes within the Albanian Territory.

The route variant passing from Qafe - Thane has been preferred because of the lesser environmental and social impacts. This choice complies also with the National Strategic Documents for Biodiversity, and for Tourism Developments, as well as with the international agreements on biodiversity, where Albania adheres.

A map of the strategic alternatives (SEETEC study) of the OHL Elbasan-Bitola is given in Appendix 2.

Key Environmental and Social Issues

Environmental issues	Social and economic issues
Air quality	Settlements
Water quality	Health and safety
Soils	Land acquisition
Biodiversity (flora and fauna, habitats)	Nuisance impacts
Land use	Visual appearance
Waste management	Electromagnetic fields and interference
	Cultural heritage

Table 5: Main environmental and socio-economic aspects of the project

Settlements

The proposed OHL corridor passes through the territory of two Albanian districts (Elbasan and Librazhd). Within the above districts, the line route passes close to the municipalities of Librazhd and Perrenjas, and transverses the territory of the municipality of Elbasan, and of seven communes (Shirgjan and Shushica, within Elbasani district; Polisi, Librazhd Centre, Hotolishti, Qukesi, and Rrajca, within Librazhd district).

Figure 6: Route of the transmission line and overview of concerned municipalities

Affected settlements across or in vicinity to the proposed OHL corridor are given in the table below.

District	Affected municipality	Affected commune/	Affected village	Population	Distance from OHL
Elbasan				278,448	
	Elbasan			124,435	>400m
		Shirgjan		9,232	
			Mjekes	1,301	>200m
		Shushice		10,138	
			Hajdaran	785	150m
			Vreshtaj	1,135	150m
			Shushice	3,469	100m
			Polis i Vogel	708	>100m
			Polis Vala	377	>200m
Librazhd				76,139	
	Librazhd			10,137	
		Polis		4,928	
			Gostime	1,135	400m
			Mirake	1,400	400m
		Qender		11,060	
			Arrez	256	40m
			Librazhdqender	473	110m /
			Librazhdkatund	881	>110m
			Spathare	1,187	>500m
			Dragostunje	1,565	>100m
		Hotolisht		6,979	
			Dardhe	1,584	>500m
			Xhyre	1,689	>500m
			Hotolisht	1,588	>100m
			Vuhcan	614	>100m
			Vehcan	775	>100m
		Qukes		10,431	
			QukesShkumbin	1,772	100m
			QukesSkenderbe	871	>500m
			Skroske	1,607	>400m
			Pishkash	1,003	>150m
			PishkashVeri	719	100m
	Prrenjas			8,256	
			Perrenjasfshat		>400
			Rashtan		>500
		Rrajce		10,620	
			Katjel	1,869	>500
			Kotodesh	1,125	>500
			Urake	806	>200
			Rrajce	3,343	50m
			Sutaj	1,925	>200

Table 6: Settlements along the proposed transmission line corridor

Air Quality during Construction

During the construction of the proposed OHL, there will be site preparation and construction activities, all of which have the potential to generate air emissions, including dust and small particulate matter (PM10-particles less than 10 microns in diameter). The main sources of dust and PM10 include:

- construction vehicle movements and other project related traffic on unpaved roads
- soil excavation, handling, storage, stockpiling
- site preparation and restoration
- construction of towers and access roads
- internal and external construction works on substations.

Depending on wind speed and turbulence during construction, nearly all dust will be deposited on the ground within about 200 meters of the construction site. Therefore, only properties within 200 meters of a construction site would experience nuisance if dust is not controlled. Even then, the nuisance would be temporary, since there will be only a week to 10 days at construction activity at each tower location before the crew moves to the next location. When there is visible dust during dry periods, OST will apply water to dusty areas and use other practices to reduce dust. This will prevent any major impacts from dust and PM10. The impact on air quality from dust and PM10 is expected to be very minor, local, and temporary. There will be no impact on air quality during operation.

Noise and Traffic Impacts during Construction

Construction works for the proposed OHL is estimated to take twoyears along the approx.56 km long route, while for the substation in Elbasan area construction will last about two years.

Construction works, heavy machinery and large transport vehicles and increased intensity and volume of the traffic will generate increased noise level and will affect the normal traffic regime in the project area. This kind of likely impacts would be temporary and minor, since there will be only a week to 10 days at construction activity at each tower location. No blasting is expected. Construction will take place in daylight hours, so there should be no noise during the night. In addition, all equipment will be maintained in good condition and fitted with mufflers or silencers whenever possible. Overall, noise impacts on the transmission line should be very temporary and localized, with very little noise audible over 200 meters from construction site. At the Elbasan substation site, construction activities will take approx. two years. Again, however, noise should not reach beyond 200-400 m from the construction site.

The table below identifies the main construction routes which would be used for the import of machinery and equipment, materials and labour for construction of the proposed transmission line.

OHL section	Principal routes	Access routes
Elbasan-Shushice	• Elbasan- Gramsh	-Elbasan-Mjekes -Mjekes-Topcias -Elbasan-Hajdaran-Byshek-Shushice
Shushice-Librazhd	• Elbasan-Librazhd	-Shushice- FusheBuall -Elbasan-Arrez -Librazhd-Semaj
Librazhd-Qukes	• Librazhd-Qukes	-Librazhd-Qender -Librazhd-Hotolisht -Hotolisht-Qukes
Qukes-Qafe Thane	• Qukes-Qafe Thane	-QukesShkumbin-Pishkash -Prrenjas-Pishkash -Prrenjas-Rrajce -Prrenjas-Qafe Thane (border AL/MK)

Table 7: Key construction transport routes

The number of truckloads for all construction works is currently estimated to be in the range of 2,000 for the transmission line and between 2,000 and 3,000 truckloads for the substation during the entire construction period. The heavy machinery will remain on the construction site during overall construction works. Except in a few places where construction equipment and materials will be stored, increases in traffic at any tower location will be very temporary, involving about 3 – 4 truckloads a day and lasting less than a week. OST will develop a traffic management plan and train all drivers, and also consult with road authorities and local authorities. As a result, effects on local traffic will be minor, and even then impacts will be carefully controlled so there should be limited impacts. Special attention will be paid on the control of the traffic and placement of warning signs at places and road sections where the geometry of the road may potentially cause safety problem.

Nuisance Impacts during Operation

Energized electrical lines can produce a “corona” noise (a buzzing sound), especially in wet weather. However, there are no properties and other sensitive receptors along the OHL route at distances where the corona noise would cause nuisance effects and thus, it is not likely that impacts on people from corona noise will occur.

At the new substation, most noise will be from transformers (a constant low humming noise), coolers (more broadband and not constant), and switchgears (circuit breaker clicking or a short period). The distance of the closest residential properties to the new substation in Elbasan area is more than 100m and acoustic nuisance to residents will not occur.

Landscape and Visual Effects

Some segments of the proposed transmission line passes through or in vicinity to areas where the landscape values are medium to high. These areas (Shkumbini riverbed along the Murrashi Gorge, Shkumbini riverbed from Librazhd to Qukes, MNR of Kuturman-QafeBushi, and NMs of Shushica riparian forest, and of Oriental Planes of Byshek) are avoided during the OHL route selection process.

Number of scenic landscapes are present in the wider project region:

- The left side of the Shkumbini River Valley, in the vicinity of the alluvial Shushica forest and Byshek oak forest, which are natural monuments;
- Shkumbini River Valley from Murrashi Bridge to the town of Librazhd;
- Two geo-monuments: the caves of Pishkash and the Stone of Pishkash, both situated in the north of the village of Perrenjas; and
- Other cultural objects, like Kamara bridge (of the Otoman period), Topcias, Miraka, and Qukesi bridges (Roman period), as well as the ancient Egnatia road (Roman period).

The Shkumbini river crossings is reduced to once crossing, which is proposed parallel to the existing OHL Elbasan-Zemblak, in an area of low scenic values and outside the Managed Nature Reserve of Kuturman, as well as far from the areas affected from geological hazards that also avoids the adverse effects on landscape.

Careful corridor alignment resulted in avoidance of all above-mentioned protected areas / scenically important areas in the project region. Furthermore this alignment also resulted in avoidance of the visibility of the OHL from the main part of the length of the national road Elbasan – Macedonian border.

Geoology and Soils

The proposed OHL corridor traverses various geological formations. The study area is affected from active tectonic fault, and from geological hazards (landslides, rock falls, erosion, possible soil liquefaction, etc.), as follows:

From Elbasan to Shushica the expected geological hazards are represented from possible soil liquefaction in case of earthquakes (Quaternary alluvium deposits of Shkumbini riverbed), and erosion from this river.

From ShushicatoLibrazhd the geological hazards are represented from possible soil liquefaction (Quaternary alluvium deposits of Gostima riverbed), and landslides (the left side of the Shkumbini River Valley at the riber crossing near Librazhd. Tectonic foults in this section lie mainly in the direction of the Shkumbini River. Negative impacts may occur mainly through falling rocks (which are more pronounced in the ultra basic geological formations) and the increased erosion and sedimentation from the construction of temporary and any eventual permanent access roads in the areas where the slopes are too steep (Shushica to Little-Polis Village and south of the Kamara Bridge at the segment from Murrashi Bridge to Librazhd).

From Librazhd to Qukes, where the geological formations are represented from the mollassic deposits of Librazhdi reddish sandstones and conglomerates, the abovementioned geological hazards are not present.

FromQukes to Thana Pass (border Al/Mk) moderate erosion phenomena mayoccurs because of the steep terrain and ultra basic formations where the thickness of topsoil is insignificant.

Careful corridor alignment resulted in avoidance of the areas affected heavily from geological hazards. The project will foresee the possible adverse impact and use the best national and international practice and technical standards to avoid/mitigate the possible adverse impacts from geological hazards.

Water resources

The project area is rich in ground and surface waters. From Elbasan to Qukes the line route runs parallel to the Shkumbini River, and traverses a number of small rivers and streams.

The proposed OHL route in general avoids the pollution of ground waters. The only aquifer, which is present in the project area is the Elbasan aquifer, which supplies with drinking water the town of Elbasan. The transmission line overlies a small area of this aquifer near the village of Gostima. The pollution of this aquifer will be avoided by spaning OHL towers outside the gravel deposits of Gostima riverbed.

Watercourses will be crossed by the wires in a span with standard length shorter than 600meters and with towers located at least 10 meters from the riverbank.

The project will use best practice techniques to avoid damage to soils and erosion into rivers. This is especially important in steep terrain and where there may be limited vegetation cover. Land disturbance will be kept to a minimum, and drainage will be carefully controlled to avoid erosion. As soon as construction is complete, disturbed land will be restored, with seeds or young plants will be planted to re-establish the vegetative cover.

Water protection measures against transformer oil spill will be installed in the new substation. These will include oil / storm water tank, placed bellow energy transformer on a concrete foundation with capacity to hold the oil as the transformer unit. Regular inspection throughout substation operation period will be performed.

Vegetation, Flora and Fauna

There may be various adverse impact on forests from the construction activities, but the primary impacts will be loss of biomass (economic value) and fragmentation effect due to the establishment and maintenance of the corridor, as well as due to construction of new required access tracks.

Impact from forest fragmentation was estimated as low due to following facts:

- Absence of tall forest in the project region. Consequently, the vegetation clearance along the proposed OHL route would be limited.
- The forests in the OHL corridor are already fragmented and the actual level of fragmentation is low since clearing of the forest belt of approx-

imately 30 m width represents the distance that can be passed by almost all vertebrate animals and most of invertebrates.

- There is enough distance from the tops of the vegetation to the line, grass, herbs, young trees, and shrub vegetation will be re-established once construction activities are complete, and even some trees will grow back, although they will need to be trimmed periodically.

The effects on birds and other fauna during construction will primarily be from disturbance due to human activities and fragmentation of habitats. As far as disturbance is concerned, it will affect birds and mammals the most. In general, the impact along the proposed transmission line will be low and limited in sense of size. To reduce any impacts on protected and important species, experts will survey the route before construction and if there are protected species of nesting birds, breeding animals, etc., construction will be scheduled so as to avoid their disturbance.

During operation of the proposed transmission line, tall trees and other tall vegetation will be cut or trimmed in the OHL safety corridor. The impacts will be similar but less than the original clearing, and again birds and fauna would return immediately after the activities are completed.

Youth mammals and slow-moving fauna are potentially the animal group the most vulnerable from transmission line developments. Specific measures to avoid/mitigate adverse impacts on terrestrial fauna, include:

Avoiding the construction works during the reproduction periods in areas rich in terrestrial fauna (section Shushica-Murrashi Bridge); and displacement of the youth mammals and of the slow-moving fauna along the construction areas (location of towers and temporary/eventual permanent access roads).

Potential adverse effects on birds would be due to:

1. Collision with wires, especially larger birds such raptors, and smaller birds that move in large flocks. The line lies parallel to the Shkumbini Valley, thus the possibility of bird collision is minimized as a result of sound OHL route selection.
2. Electrocution. Electrocution will not be a problem for this line since the distance between the conductors is large enough, more than 500 cm, even for the biggest known raptor birds in Albania.
3. Damages to nesting areas during construction activities. As mitigation measures, in this case, it is suggested to develop and implement site-specific measures to avoid/mitigate adverse impacts on avifauna and avoiding the construction works during the nesting periods in areas rich in bird populations (sections Shushica-Librazhd, and forested area North of Prrenjas).

Other key measures to reduce impacts on flora and fauna will be to use existing roads as much as possible so as not to have to cut vegetation except when necessary; prohibiting any fires; and quick restoration of top soil disturbed during construction. Workers will be warned not to do disturb or destroy plants and

animals, with particular attention to avoiding: a- disturbance and hunting of game, birds, etc.; and b-collection of eggs from birds and other, etc.

Waste

Wastes that will be generated during construction will include excess rock and soil excavated at tower foundations, packaging wastes from supplies and equipment, wood waste from tree and shrub cutting, small quantities of waste oil and paint,wastefrom construction camps and work sites and sanitary wastes from workers. Wastes that will be generated during the maintenance of the proposed transmission line include consumables, spare parts and obsolete equipment. All wastes will be managed according to Albanian law and EU waste management requirements. All wastes except excess rock and soil will be removed from the construction sites by licensed haulers and managed or disposed properly. Recyclable wastes will be recycled wherever possible.

Land Acquisition

Some land will be permanently acquired, mainly land needed for the construction of the new substation in Elbasan area (approx. 2.6 Ha), the construction of the towers (approx. 1.75 Ha) of the proposed transmission line and for temporary and any eventual remaing access roads,where such roads do not exist. The OHL corridor was designed to avoid houses, so no one will lose their house or have to move. A Land Acquisition and Compensation Framework will be developed to guide OST in acquiring land and also for compensating people for any losses they may suffer (damaged fences, accidents with livestock, damaged crops, etc.). This Framework will comprise the principles of the Albanian law and the requirements of KfW and best international practice. After compensation, no one will suffer any economic loss as a result of the project.

Cultural Heritage

In the Shkumbin River valley, from Elbasan to Qukes, and in the segment from Qukes to Thana Pass there are several historical and archaeological sites. According to the Law “On the cultural heritage”, before beginning of the construction works the approval of the Albanian Archaeological Institute is required. This approval must be preceded from an overview of the existing cultural heritage and archaeological sites in the vicinity of the proposed corridor and eventual spatial restrictions to be considered during OHL routing exercise. All contractual personnel will be trained to stop all activities if any artifacts or other valuable historical or pre-historical items are found. If this happens, construction will not begin again until authorized by the competent public institution for protection of cultural heritage.

Electric and Magnetic Fields

Electromagnetic fields (EMF) will be generated around energized electric wires (conductors). For this single-circuit 400 kV OHL, EMF intensities even right under the wires will be below exposure limits determined by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and EU regulations. The OHL safety corridor will be at least 30 meters wide so there should be no exposure over the limit by any person.

Radio and TV Interference

The transmission line should not interfere with television and radio reception due to the fact that it passes within the permited legal distance to residential properties.

Work Force Safety

OST and its contractors will employ about 200 people for 24 months construction. There are serious hazards working with heavy equipment and also from working with electricity. All work will follow an Occupational Health and Safety (OHS) Plan that will help every worker know the hazards of his or her job and how to avoid any dangers. All workers will receive training also.

Community Safety

Construction may disturb local people for short periods of time during construction—towers and construction will be visible, there will be additional traffic to and from construction sites, and there could be small amounts of dust and noise. However, each tower should take no more than 7-10 days to construct, after which the construction work will move to the next tower. Therefore, construction of the transmission line will not affect any people for more than one or two weeks, and impacts should be minor.

Construction at the Elbasan substation site will last about 24 months. During that time, nearby residents will experience increased automobile and truck traffic and will be able to see construction as it takes place. In addition, there could be some noise during daylight hours from equipment and machinery and possibly some dust during dry periods. All these impacts will be controlled as much as possible, so the impacts on any people should be relatively minor.

During the operational phase, no one should suffer any impacts from the occasional maintenance and repairs. There could be one or a few days of traffic and noise during major repairs, but it will not last long and will not create major disturbance. There will be some additional traffic at the Elbasan substation, but this will not have a negative effect on anyone.

Environmental Management

Many actions have been described in the ESIA to avoid, reduce, or control potential impacts on people and nature, and the most important ones are summarized in this NTS. All of these actions are included in an Environmental and Social Action Plan (ESAP) that will be part of the legal agreement between OST and KfW. This ESAP is available for public review at the websites and locations shown at the beginning of this NTS.

7 MK: Executive Summary of ESIA Analysis

Conclusions on the Main Impacts of the Project

Consideration of the key effects of the proposed project indicates that the careful routing of the new 400 kV transmission line together with the identification of a comprehensive set of mitigation measures, which when implemented, reduces the potential effects of the transmission line significantly.

The findings of this ESIA 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.

The construction and operation of the proposed transmission line and associated substations is considered as justified because:

- ✓ Environmental issues related to all stages of the life cycle of the proposed project are identified and taken into account.
- ✓ The assessment of the environmental and social impacts is based on best available information and consideration of cumulative impacts.
- ✓ The identified likely impacts can be prevented, reduced or compensated and, therefore, the proposed project is not a threat for adverse or irreversible damage to the natural and social environment in the project area.
- ✓ The proposed project will not cause significant impacts on biodiversity and ecological integrity of the area.

The environmental and social impacts associated with the proposed project are identified and addressed in this ESIA report according to the requirements of the relevant Macedonian regulation, the European Bank for Reconstruction and Development (EBRD) and best international practices.

MK ESIA NTS: Introduction

Macedonian transmission system operator (MEPSO) proposes to design, construct, and operate a new approx. 100 km long 400 kV overhead transmission line (OHL) from Bitola to Macedonian /Albanian border[3)], to construct and operate a new 400/110 kV substation near Ohrid, and to modify the existing substation Bitola 2 to accommodate the proposed 400 kV OHL. This document is a Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) of the proposed project.

The main national and regional benefits from the proposed project are summarized below:

1. Significantly better, more powerful transmission network in South – West Macedonia.
2. More reliable power supply and reducing electrical supply constraints for further economic developments in the wider project region.
3. Improved network capacity to facilitate anticipated load and transit growth, new generation connections, in the context of improving transmission capacity in Albania and in Macedonia, and in the Balkans Region.
4. Improvement of the reliability of the regional network, the overall security of supply, and system operational issues such as stability.
5. A decrease of the technical losses in the transmission system.
6. Improving the quality of electricity supply (normalise the voltage levels, stabilize the load flow and the frequency fluctuations, etc).
7. Supporting the potential to develop the regional energy market in South East Europe and creating trading opportunities with Bulgaria and Italy.
8. Mutual support between Macedonia and Albania to complement power generation types (Albania - hydro, Macedonia - thermal).
9. Reducing the cost of providing reserve capacity, and providing mutual emergency support.

Based on detailed feasibility study and multi-disciplinary analysis consisted of technical, environmental and socio-economic appraisal, MEPSO selected a preliminary OHL route as shown in Appendix 1.

MEPSO is seeking financing from the European Bank for Reconstruction and Development (EBRD), and an ESIA to evaluate potential impacts from construction and operation of the proposed OHL was prepared to meet the Macedonian and Bank's requirements.

MEPSO has made this NTS, the ESIA, a Stakeholder Engagement Plan (SEP), and an Environmental and Social Action Plan (ESAP) available to the public

3) This transmission line is interconnection between Macedonia and Albania. From Macedonian / Albanian border it continues to Elbasan (Albania).

for review and comment. The documents are on the internet at MEPSO's website - www.mepso.com.mk, website of the Ministry of Environment and Physical Planning - www.moepp.gov.mk and EBRD's website - www.ebrd.com and are also available at following locations:

- Ministry of Environment and Physical Planning (MEPP), Blvd. Goce Delcev b.b., (MRTV, floor 10-11-12)
- Offices of the concerned municipalities: Novaci, Mogila, Bitola, Resen, Debrca, Ohrid and Struga
- The central premises of MEPSO in Skopje, Orce Nikolov str b.b., 1000 Skopje

EBRD offices in Skopje (Soravia Centre Skopje, 7th floor, Vasil Adzilarski b.b., 1000 Skopje) and London (One Exchange Square, E14 8RP

Description of the Project

The proposed 95 km long OHL is situated in south-western region of Macedonia. It passes various geographical features from its starting point in flat area of the Pelagonija Field via hilly and mountainous northern slopes of the Baba Mountain through Prespa valley to Struga Field at the northern side of the Ohrid Lake and eastern bottom edge of the Jablanica Mountain.

In general, the proposed OHL follows, as much as practicable, the corridor of the existing 110 kV OHL Bitola-Resen-Ohrid-Struga.

Its starting point is the existing MEPSO's substation Bitola 2 in the locality Tebalica at the immediate vicinity of the thermal power plant (TPP) REK Bitola. From SS Biola 2, the OHL continues toward north-west over the Pelagonija Field, avoiding the settlements in its surroundings (Dobromiri, Trn, Mogila). At the locality Karamanski Pat it turns to south-west, crossing the roads Bitola-Prilep and Bitola-Kicevo to the hilly area above the village Krklino. From the locality Korija (in immediate vicinity to the road Bitola-Ohrid on its north side) the proposed corridor turns toward west up to a point in the area of the village Gjavato, passing north from the road Bitola-Resen in an unpopulated area. At the locality Gradiste on the southern slopes of the Bigla Mountain, the OHL turns to north-west, following the existing 110 kV OHL, avoiding the settlement Sopotsko and bypassing the town Resen in wide ring. Further on to north, it avoids villages Kriveni, Leva Reka as well as Krusje karst area (water supply facilities for Resen).

At the area of the village Svinista, the OHL turns to western direction, avoiding the villages Rasino and Livoista and enters the Struga Field by crossing the road Ohrid-Kicevo. Within the Struga Field, at the locality Veljo Pole, the OHL turns to south-west and avoids the villages Volino and Moroista. On the western edge of the Struga Field, at the locality Belicka Krasta the proposed OHL turns to south toward the crossing point on the Macedonian-Albanian border (locality Kafasan) following bottom east slopes of the Jablanica Mountain. It avoids the villages Zagracani, Radolista, Frangovo and Mali Vlaj.

A map of the project area with the route of the proposed transmission line is given in Appendix 1.

The proposed transmission line includes following main components:

- ✓ **Towers.** The transmission line will be constructed of 250 steel-lattice single circuit self-supporting towers (Figure below), each with four legs and a single concrete foundation per leg, with horizontal configuration of conductors and two earth wires. Depending on their position in the OHL, the types of towers could be suspension towers (total number – 217) used for straight section of the line, or angle towers (total number – 33) used where the line changes direction.
- ✓ **Phase conductors**. Two conductors (wires) per phase are planned at a mutual distance of 400 mm. Characteristics of the conductors will be in compliance with the national standards.

- ✓ **Substations**. The project includes construction of a new 400/110 kV substation in Ohrid area in vicinity to village Livoista and upgrading of existing substation Bitola 2 to allow it to accommodate the proposed transmission line.

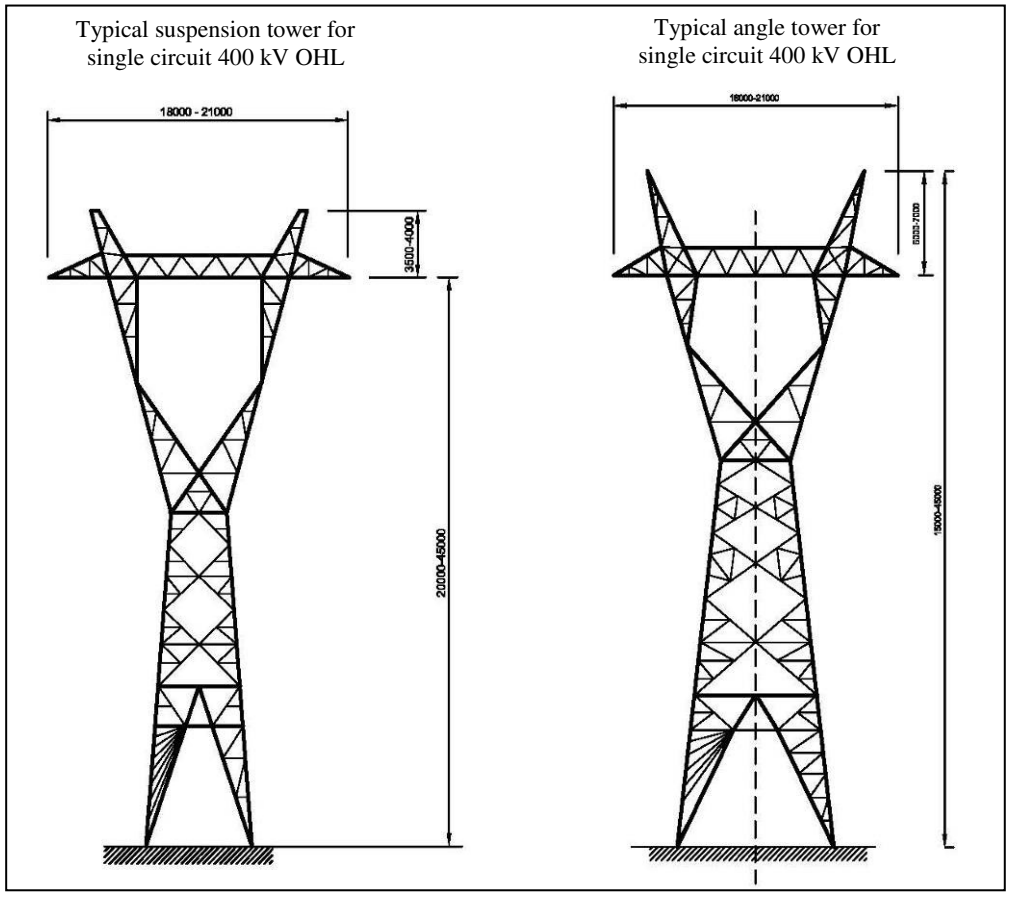


Figure 7: Typical single circuit 400 kV OHL tower types

Project Status and Level of Details

The project has been developed to a feasibility level, i.e. to a detail considered sufficient to establish that the proposed line is technically feasible and to allow environmental effects to be assessed. Final design, including precise location of towers and access roads would be undertaken once the main technical design is developed and prior to construction commencing.

This refinement of the current design would be within the limits of deviation defined for the 500 meters wide transmission line corridor.

Considered Alternatives

New 400/110kV Substation in Ohrid Area

A number of alternative locations for the 400/110 kV substation in the area of the villages Vapila and Livoista (Ohrid area) were considered. These were:

- **Alternative 1**, located at north from village Vapila, on a hilly locality on altitude of 800 m a.s.l. in immediate vicinity of the hill Ceso Glava, a point where the OHL branch to Ohrid from the existing 110 kV OHL Bitola-Resen-Ohrid-Struga is created. Construction on this location would cause transport difficulties due to the steepness of the access road and significant nuisance to local population due to construction traffic and noise. No operational environmental and social effects are likely.
- **Alternative 2**, located on the locality Livage on altitude of 760 m a.s.l. on western bottom area of the hill Ceso Glava. It is easily accessible via network of existing local roads. This location is close to several houses. Construction on this location would cause significant nuisance to local population due to construction traffic and noise as well as loss of agricultural land. Operational social effects are likely due to risk of EMF exposure and operational noise from the substation equipment.
- **Alternative 3**, located at north-west from village Livoista at relative distance of more than 1 km, on the locality Staro Selo on altitude of 800 m. It is well accessible via existing unpaved road Trebenista – Livoista, rarely used by local residents. No significant environmental and social impacts during project construction and operation are expected.

Upon thorough evaluation of the proposed sites, MEPSO has concluded that the alternative 3 is an optimal choice for a location of the planned new substation and, therefore, this alternative has been selected future SS development site.

Overhead Transmission Line

Fundamentally different alternative OHL corridors for interconnection between Macedonia and Albania (further on to Italy) have been evaluated at a strategic and spatial planning level in 2007, which resulted in proposal for a general OHL corridor that should accommodate the OHL route. Two main corridor alternatives of the section between Bitola and Elbasan as a part of the overall OHL corridor have been considered. These are:

1. **OHL Corridor 1,** from the SS Bitola 2 toward the Resen area bypassing city of Bitola and the National Park Pelister. In Resen area the corridor turns to south toward connection point with Albania passing through the National Park Galicica in Macedonia and National Park Prespa in Albania and reaches Zemblak (Albania).
2. **OHL Corridor 2,** from the SS Bitola 2 through Pelagonija Field via Prespa valley to Struga Field at the northern side of the Ohrid Lake and south and eastern parts of the Jablanica Mountain toward connection point with Albania – border station "Kafa san". This alternative avoids all existing protected areas in the wider project region and passes in ar-

eas with various human developments and land-uses. As such, this option is considered as most favourable alternative of the proposed transmission line and selected for further detailed examination and development.

A map of the above strategic transmission line corridors on Macedonian territory relative to the selected OHL corridor (red line) is given in Appendix 1.2.

Key Environmental and Social Issues

Environmental issues	Social and economic issues
Air quality	Settlements
Water quality	Health and safety
Soils	Land acquisition
Biodiversity (flora and fauna, habitats)	Nuisance impacts
Land use	Visual appearance
Waste management	Electromagnetic fields and interference
	Cultural heritage

Table 8: Main environmental and socio-economic aspects of the project

Settlements

The proposed transmission line passes through the territory of seven Macedonian municipalities: Novaci, Mogila, Bitola, Resen, Ohrid, Debrca i Struga (Figure below).

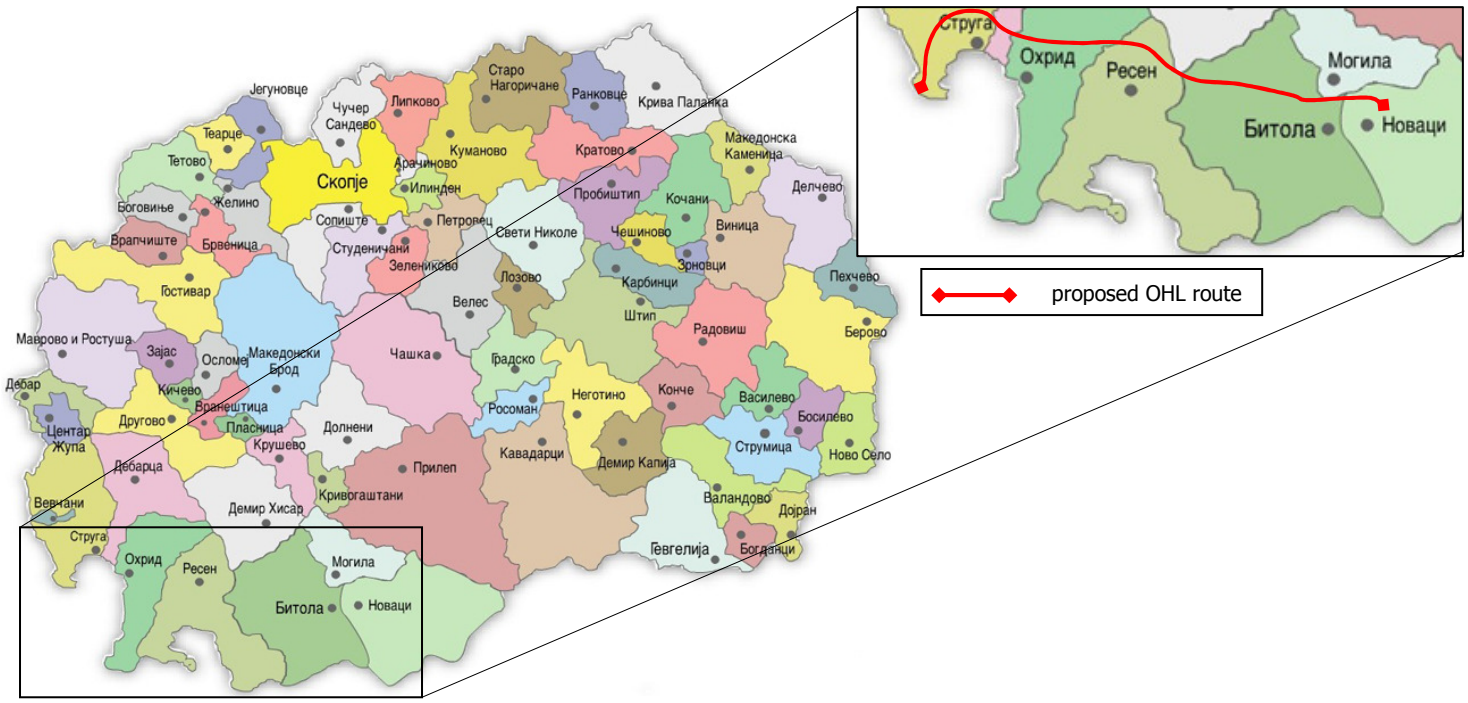


Figure 8: Route of the transmission line and overview of concerned municipalities

Settlements close to the proposed transmission line as well as their relative distance to the proposed transmission line are given in the table below.

Settlements – by Municipality – close to the proposed OHL line			
Municipality	**Settlement**	**Population 2002*)**	**Relative distance from the proposed OHL**
Novaci	Novaci	1,054	>1,000m
	Dobromiri	285	500m
Mogila	Mogila	472	>1,000m
Bitola	Trn	30	1,000m
	Krklino	205	> 1,000m
	Kukurecani	1,121	> 1,000m
	Bratin Dol	154	> 1,000m
	Rotino	106	> 2,000m
	Capari	422	> 2,000m
	Kazani	65	> 1,000m
	Gjavato	111	600m
Resen	Sopotsko	184	500m
	Kriveni	25	400m
	Leva Reka	54	600m
Ohrid	Svinista	63	300m
	Rasino	8	200m
	Vapila	97	1,000m
	Livoista	150	1,000m
Debrca	Volino	362	750m
Struga	Moroista	224	750m
	Vranista	1,174	> 1,000m
	Dolna Belica	693	> 1,000m
	Zagracani	753	1,000m
	Radolista	1,961	500m
	Frangovo	1,154	500m
	Mali Vlaj	61	750m

Table 9: Settlements along the proposed transmission line corridor

*) Source: Census of Population, Households and Dwellings in Macedonia, 2002

Air Quality during Construction

During the construction of the proposed OHL, there will be site preparation and construction activities, all of which have the potential to generate air emissions, including dust and small particulate matter (PM10-particles less than 10 microns in diameter). The main sources of dust and PM10 include:

- construction vehicle movements and other project related traffic on unpaved roads
- soil excavation, handling, storage, stockpiling
- site preparation and restoration
- construction of towers and access roads
- internal and external construction works on substations.

Depending on wind speed and turbulence during construction, nearly all dust will be deposited on the ground within about 200 meters of the construction site. Therefore, only properties within 200 meters of a construction site would experience nuisance if dust is not controlled. Even then, the nuisance would be temporary, since there will be only a week to 10 days at construction activity at each tower location before the crew moves to the next location. When there is visible dust during dry periods, MEPSO will apply water to dusty areas and use other practices to reduce dust. This will prevent any major impacts from dust and PM10. The impact on air quality from dust and PM10 is expected to be very minor, local, and temporary. There will be no impact on air quality during operation.

Noise and Traffic Impacts during Construction

Construction works for the proposed OHL is estimated to take three years along the approx.100 km long route, while for the substation in Ohrid area construction will last about two years.

Construction works, heavy machinery and large transport vehicles and increased intensity and volume of the traffic will generate increased noise level and will affect the normal traffic regime in the project area. This kind of likely impacts would be temporary and minor, since there will be only a week to 10 days at construction activity at each tower location. No blasting is expected. Construction will take place in daylight hours, so there should be no noise during the night. In addition, all equipment will be maintained in good condition and fitted with mufflers or silencers whenever possible. Overall, noise impacts on the transmission line should be very temporary and localized, with very little noise audible over 200 meters from construction site. At the Ohrid substation site, construction activities will take much longer – approx. two years. Again, however, noise should not reach beyond 200-300 m from the construction site.

The table below identifies the main construction routes which would be used for the import of machinery and equipment, materials and labour for construction of the proposed transmission line.

OHL section	Principal routes	Access routes
Bitola – Resen	• Prilep - Bitola - Resen	• Bitola – Novaci • Novaci – Dobromiri – Aglarci • Bitola – Orizari –Karamani –Trn • Bitola - Mogila • Bitola – Kicevo • Road to Krklino • Road to Ramna / Lera / Strezevo Lake • Kazani - Dolenci
Resen region	• Bitola - Resen - Ohrid	• Sopotsko – Zlatari • Resen – Zlatari • Road to Kriveni • Road to Leva Reka
Ohrid region	• Resen – Ohrid • Kicevo - Ohrid	• Road to Svinista • Vapila – Rasino • Vapila – Sirula • Trebenista – Volino • Trebenista – Livoista

Struga region	• Ohrid – Struga • Struga – Debar • Struga - Cafasan	• Mislesevo – Moroista • Sum – Dolna Belica • Struga – Radolista

Table 10: Key construction transport routes

The number of truckloads for all construction works is currently estimated to be in the range of 2,000 for the transmission line and between 2,000 and 3,000 truckloads for the substation the entire construction period. The heavy machinery will remain on the construction site during overall construction works. Except in a few places where construction equipment and materials will be stored, increases in traffic at any tower location will be very temporary, involving about 3 – 4 truckloads a day and lasting less than a week. MEPSO will develop a traffic management plan and train all drivers, and also consult with road authorities and local authorities. As a result, effects on local traffic will be minor, and even then impacts will be carefully controlled so there should be limited impacts. Special attention will be paid on the control of the traffic and placement of warning signs at places and road sections where the geometry of the road may potentially cause safety problem.

Nuisance Impacts during Operation

Energized electrical lines can produce a "corona" noise (a buzzing sound), especially in wet weather. However, there are no properties and other sensitive receptors along the OHL route at distances where the corona noise would cause nuisance effects and thus, it is not likely that impacts on people from corona noise will occur.

At the new substation, most noise will be from transformers (a constant low humming noise), coolers (more broadband and not constant), and switchgears (circuit breaker clicking or a short period). The distance of the closest residential properties to the new substation in Ohrid area is more than 1 km and acoustic nuisance to residents will not occur. There are no residential properties in vicinity of the existing substation SS Bitola. No new transformers are planned in this substation as it will be upgraded only with switchgear in order to accommodate the new OHL and increased noise levels would not be significant in comparison to the current level.

Visual Effects and Landscape

The proposed transmission line does not pass through or in vicinity to important scenic areas or areas of landscape that is highly valued, rare or distinctive. Overall, the landscape along the proposed OHL route is not sensitive and is tolerant to changes and this is reflected in the absence of any designations.

Careful corridor alignment resulted in avoidance of all existing protected areas / scenically important areas in the project region.

The proposed transmission line will be visible from the roads in both the immediate and wider area around the route of the line. Views from roads are transient views, in that the view changes as the traveler passes through the landscape, and are therefore less sensitive than views from fixed locations such as

residential properties. In many areas along the route, there are already transmission lines crossing the landscape, so this new one would not have a major effect in those areas. Even in other areas where there are no other lines, the OHL towers will be noticeable at first, but nearly all people would become adapted to them so they become part of the landscape.

The proposed OHL will be visually exposed and visible where its route passes through open terrains. Such cases are Pelagonija Field and Struga Field. The OHL will be also visible from the road Bitola-Resen between localities Korija-Prevalec (hilly open landscape) and between localities Prevalec and Gjavato (flat agricultural area) as well as in the area of village Livoista, where the new substation is planned. These areas represent landscapes with number of anthropogenic land uses and developments and as such their scenic quality is low and tolerant to change. Therefore, the proposed OHL would be experienced as part of the wider landscape and would cause only indirect visual effects in conjunction with existing features in the landscape. From the locality Gjavato to village Sopotsko, further on to village Zlatari and Kriveni (Resen region), the proposed OHL route would pass distant from the road Bitola-Resen, through hilly and mountainous terrain. Therefore, it would not be visible from the road with certain exceptions in the area around the village Gjavato and from the road section from village Jankovec to village Izbista. From village Leva Reka to village Svinista, further on to Rasino in Ohrid region the OHL will be not be exposed to the road Resen-Ohrid as it would be sheltered by the topography and vegetation. It would be exposed to local residents in the project area at the crossing points with the local roads leading to settlements in this region (Sopotsko, Zlatari, Kriveni, Svinista, Rasino, Vapila, Livoista and Sirula). The section of the proposed OHL which passes through lower parts of the Jablanica Mountain will be exposed to the residential areas along the local road Dolna Belica-Radolista, sheltered in particular sectors by the topography. Due to scenic values, the landscape in this area could be classified to be of moderate sensitivity, but due to existing developments and various infrastructure, it could be considered as tolerant to moderate change. The route avoids highly valued scenic landscape and touristic areas along the western shore of the Ohrid Lake at the area of village Radozda as experienced from the lake.

Hydrology and Soils

The route of the proposed transmission line will intersect number of watercourses which belong to two large catchment areas:

- Aegean catchment area – the OHL section in the Bitola region, i.e. from its starting point (SS Bitola 2) to the mountain pass “Gjavato”. This area is characterized with well developed hydro-graphical network with one main watercourse – Crna River, which is tributary to the country’s longest river – Vardar River. In this section, the proposed OHL crosses number of natural watercourses (Dragor River (tributary to Crna River), Bratindolska River, Rotinska River, Shopnica and Caparska River) as well as man-made drainage and irrigation channels in the Pelagonia Valley.
- Adriatic catchment area – the OHL section in Prespa region and Ohrid-Struga field, i.e. from the mountain pass “Preseka” to the mountain pass

"Kafa San" (crossing point to Albania) represented by one main watercourse – river Crn Drim. This area includes two regional basin catchments – Prespa Lake and Ohrid Lake. The proposed OHL crosses number of watercourses in Prespa area: Kriva River (occasional character of flow), occasional stream from Zlatari village to Resen, Cheshinska River, Kriveshnica and Leva Reka, as wella as in Ohrid-Struga region: Mokresh, Starechki Dol, Trebishki Dol, Rasinska River, Sirulska River (ocassional character of flow), Sateska River channel (artificially changed flow into the Ohrid Lake), Moluzja channel, Crn Drim River, Shum and Vishenska River.

Watercourses will be crossed by the wires in a span with standard length shorter than 600 meters and with towers located at least 10 meters from the riverbank.

The project will use best practice techniques to avoid damage to soils and erosion into rivers. This is especially important in steep terrain and where there may be limited vegetation cover. Land disturbance will be kept to a minimum, and drainage will be carefully controlled to avoid erosion. As soon as construction is complete, disturbed land will be restored, with seeds or young plants will be planted to re-establish the vegetative cover.

Water protection measures against transformer oil spill will be installed in the new substation. These will include oil / storm water tank, placed bellow energy transformer on a concrete foundation with capacity to hold 1.1 times the oil as the transformer unit. Regular inspection throughout substation operation period will be performed.

Vegetation, Flora and Fauna

There may be various adverse impact on forests from the construction activities, but the primary impacts will be loss of biomass (economic value) and fragmentation effect due to the establishment and maintenance of the corridor as well as due to construction of new access tracks (where necessary). A total of approx. 78 hectares of forest along the OHL route will be affected. Impact from forest fragmentation was estimated as low due to the following facts:

- the forests in the corridor are already fragmented and the actual level of fragmentation is low since clearing of the forest belt of approximately 30 m width represents the distance that can be passed by almost all vertebrate animals and most of invertebrates.
- although tall trees in the corridor will need to be cut so there is enough distance from the tops of the vegetation to the line, grass, herbs, young trees, and shrub vegetation will be re-established once construction activities are complete, and even some trees will grow back, although they will need to be trimmed periodically.

The effects on birds and other fauna during construction will primarily be from disturbance due to human activities and fragmentation of habitats. As far as disturbance is concerned, it will affect birds and mammals the most. In general, the impact along the proposed transmission line will be low and limited in sense of size. To reduce any impacts on protected and important species, ex-

perts will survey the route before construction and if there are protected species of nesting birds, breeding animals, etc., construction will be scheduled so as to avoid their disturbance.

During operation of the proposed transmission line, tall trees and other tall vegetation will be cut or trimmed in the OHL safety corridor. The impacts will be similar but less than the original clearing, and again birds and fauna would return immediately after the activities are completed.

Birds are potentially the animal group most vulnerable transmission line developments. Potential adverse effects would be due to

4. Collision with wires, especially larger birds such as geese, ducks, swans, and birds of prey, and smaller birds that move in large flocks. Pre-construction bio-survey will be executed to allow sound micro-sitting of towers and access tracks and to identify eventual need of bird diverters on selected OHL sections, in particular Pelagonija and Struga Field.
5. Electrocution. Mortality due to power line electrocution is directly related to the spacing between elements, which makes large birds more vulnerable. Electrocution will not be a problem for this line since the distance between the conductors is large enough, more than 500 cm, even for the biggest known birds of prey in Macedonia.

Other key measures to reduce impacts on flora and fauna will be to use existing roads as much as possible so as not to have to cut vegetation except when necessary; prohibiting any fires; and quick restoration of land disturbed during construction. Workers will be warned not to do disturb or destroy plants and animals, with particular attention to avoiding (i) the collection of medicinal plants, mushrooms and fruits, (ii) collecting snails, (iii) disturbance and hunting of game, birds, etc., (iv) collection of eggs from birds and other.

Waste Management

Wastes that will be generated during construction will include excess rock and soil excavated at tower foundations, packaging wastes from supplies and equipment, wood waste from tree and shrub cutting, small quantities of waste oil and paint, waste from construction camps and work sites and sanitary wastes from workers. Wastes that will be generated during the maintenance of the proposed transmission line include consumables, spare parts and obsolete equipment. All wastes will be managed according to Macedonian law and EU waste management requirements. All wastes except excess rock and soil will be removed from the construction sites by licensed haulers and managed or disposed properly. Recyclable wastes will be recycled wherever possible.

Electric and Magnetic Fields

Electromagnetic fields (EMF) will be generated around energized electric wires (conductors). For this single-circuit 400 kV OHL, EMF intensities even right under the wires will be below exposure limits determined by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and EU regulations. The OHL safety corridor will be at least 30 meters wide so there should be no exposure over the limit by any person.

Land Acquisition

Some land will be permanently acquired, mainly land needed for the construction of the new substation in the area of the village Livoista (Ohrid region) (approximately 3.5 Ha)[4)], the construction of the towers of the proposed transmission line and access roads, where required access does not exist. The corridor was designed to avoid houses, so no one will lose their house or have to move. A Land Acquisition and Compensation Framework will be developed to guide MEPSO in acquiring land and also for compensating people for any losses they may suffer (damaged fences, accidents with livestock, damaged crops, etc.). This Framework will comprise the principles of the Macedonian law and the requirements of EBRD. After compensation, no one will suffer any economic loss as a result of the project.

Work Force Safety

MEPSO and its contractors will employ about 270 people for 36 months construction. There are serious hazards working with heavy equipment and also from working with electricity. All work will follow an Occupational Health and Safety (OHS) Plan that will help every worker know the hazards of his or her job and how to avoid any dangers. All workers will receive training also.

Community Safety

Construction may disturb local people for short periods of time during construction—towers and construction will be visible, there will be additional traffic to and from construction sites, and there could be small amounts of dust and noise. However, each tower should take no more than 7-10 days to construct, after which the construction work will move to the next tower. Therefore, construction of the transmission line will not affect any people for more than one or two weeks, and impacts should be minor.

Construction at the Ohrid substation site will last a longer time, about 24 months. During that time, nearby residents will experience increased automobile and truck traffic and will be able to see construction as it takes place. In addition, there could be some noise during daylight hours from equipment and machinery and possibly some dust during dry periods. All these impacts will be controlled as much as possible, so the impacts on any people should be relatively minor.

[4)] No additional land is needed for the operations pertaining to SS Bitola 2, as they only involve upgrading of the substation.

During the operational phase, no one should suffer any impacts from the occasional maintenance and repairs. There could be one or a few days of traffic and noise during major repairs, but it will not last long and will not create major disturbance. There will be some additional traffic at the Ohrid substation, but this will not have a negative effect on anyone.

In Pelagonija, MEPSO will ensure that the OHL design does not pose operational safety risk during irrigation activities that include water cannons.

Cultural Heritage

No archeological sites and areas of cultural heritage were identified within the 500 meters selected corridor that would constitute a limiting factor in the implementation of the project. All contractual personnel will be trained to stop all activities if any artifacts or other valuable historical or pre-historical items are found. If this happens, construction will not begin again until authorized by the competent public institution for protection of cultural heritage.

Radio and TV Interference

The transmission line should not interfere with television and radio reception due to the fact that it does not pass in immediate vicinity to residential properties.

Environmental Management

Many actions have been described in the ESIA to avoid, reduce, or control potential impacts on people and nature, and the most important ones are summarized in this NTS. All of these actions are included in an Environmental and Social Action Plan (ESAP) that will be part of the legal agreement between MEPSO and EBRD. This ESAP is available for public review at the websites and locations shown at the beginning of this NTS.

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