TE-TO AD SKOPJE

Combined Cycle Co-Generation Power Plant Project Skopje

Environmental Assessment Report

SECTION B
POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

August 2006

Thermal Energy Plants Department

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1 Policy and Project Background

1.1 Power Development Policy

Macedonia has made significant progress in energy sector reform, most notably through adoption of an Energy Law and establishment of an independent energy regulator.

Notwithstanding this, further progress is required if the following objectives for the Macedonian energy sector are to be met:

- To provide secure and affordable energy on a sustainable basis;
- To commercialize the energy industry;
- To improve energy efficiency in Macedonia; and
- To improve environmental performance of the Macedonian energy industry.

These objectives derive from the broader goal of the Macedonian government to promote macroeconomic stability and growth whilst protecting poor groups in the population.

Successful implementation of energy sector reform will support: reduction of the fiscal and quasi fiscal budget deficits; provision of reliable and competitively priced energy to Macedonian industry; provision of affordable energy to residential consumers.

Domestic primary energy resources in Macedonia comprise lignite and hydro power. Crude oil is imported through a pipeline from Greece and refined in Macedonia and in addition some products are imported. A small amount of natural gas is imported from Russia through Ukraine, Romania and Bulgaria.

Furthermore, the lignite source from working mines will become exhausted in the medium term. This is a crucial point given that around 70 percent of power is currently generated from lignite, and power is used extensively in the residential (often for heating) and industrial sectors. In addition, energy demand has increased in recent years; a trend which is likely to continue given forecast macroeconomic growth. In these circumstances, action is required if energy balance is to be maintained.

Options for maintaining energy balance include:

- Opening of new seams in existing lignite mines/opening of new lignite mines;
- Addition of gas fired power capacity;
- Increasing power imports;
- Reduction of losses in power distribution; and
- Increased gasification through construction of new gas distribution networks.

1.1.1 Macedonian Energy Balance

An energy balance taken from the Energy Information Administration shows the energy situation for Macedonia for the year 2002 (Table B- 1).

Macedonia, TFYR Year: 2002

Energy Production (Quads) =.0613 Energy Consumption (Quads) =.1065

Oil (Thousand Barrels per Day)

	Production	Refinery Output	Imports	Exports	Stock Build	Consumption
Crude Oil	0.00		11.04	0.00	0.00	0.00
NGL's	0.00		0.00	0.00	0.00	0.00
Other Oils	0.00		0.00	0.00	0.00	0.00
Refinery Gain	-.13					
Gasoline		1.82	3.25	1.59	0.00	3.48
Jet Fuel		.24	1.69	1.00	0.00	.93
Kerosene		0.00	0.00	0.00	0.00	0.00
Distillate		3.52	3.66	1.37	0.00	5.81
Residual		3.87	1.88	.11	0.00	5.64
LPG's		.30	.76	.03	0.00	1.03
Unspecified		1.79	1.87	.38	0.00	3.27
TOTALS	-.13	11.54	24.15	4.48	0.00	20.16

Natural Gas (Billion Cubic Feet and Quadrillion Btu)

Gross Production	(Billion Cubic Feet)	0.00	Dry Imports	(Billion Cubic Feet)	0.00
Vented and Flared	(Billion Cubic Feet)	0.00	Dry Exports	(Billion Cubic Feet)	0.00
Reinjected	(Billion Cubic Feet)	0.00			
Marketed Production	(Billion Cubic Feet)	0.00			
Dry Production	(Billion Cubic Feet)	0.00	Dry Production	(Quadrillion Btu)	0.0000
Dry Consumption	(Billion Cubic Feet)	0.00	Dry Consumption	(Quadrillion Btu)	0.0000

Coal (Thousand Short Tons and Quadrillion Btu)

	Production		Imports		Exports		Stock Build	
	(1000 Tons)	(Quads)	(1000 Tons)	(Quads)	(1000 Tons)	(Quads)	(1000 Tons)	(Quads)
Hard Coal			4	.0001	0	0.0000	0	0.0000
--- Anthracite	0	0.0000						
--- Bituminous	0	0.0000						
Lignite	8356	.0537	126	.0015	0	0.0000	-453	-.0029
Coke			53	.0013	0	0.0000	7	.0002
Total Coal	8356	.0537	183	.0029	0	0.0000	-446	-.0027

Consumption : (1000 Tons) = 8092 (Quads) = .0538

Electricity (Million Kilowatts, Billion Kilowatt Hours, and Quadrillion Btu)

	Capacity	Generation				
	(Million kw)	(Billion kwh)	(Quads)		(Billion kwh)	(Quads)
Hydroelectric	.436	.749	.0076	Total Imports	.791	.0027
Nuclear	0.000	0.000	0.0000	Total Exports	0.000	0.0000
Geothermal and Other	0.000	0.000	0.0000	Losses	.403	
Thermal	1.132	5.013				
Totals	**1.568**	**5.762**		Consumption	**6.150**	

Table B- 1: Macedonian Energy Balance as of 2002

1.1.2 Power Sector

Installed power generation capacity in Macedonia is 1450 MW, comprising approximately 60 percent thermal and 40 percent hydro plant.

The main thermal generation plant – "Bitola" – has three units each of 225 MW, commissioned in 1982 with planned retirement/rehabilitation from 2013 on. In addition to Bitola, there is a 120 MW lignite fired plant – "Oslomej" – due for retirement in 2013 and a 210 MW oil fired plant – "Negotino" – which, due to extremely high fuel costs, has been used very rarely since it was commissioned in 1978. There are also seven large hydro plants in Macedonia with combined capacity 480 MW, and a number of small hydro plants with total capacity around 50 MW. The forecast of the power demand and supply is presented in Table B- 2 (Based on data provided by ESM).

	1993	1998	2003	2008E	2013E	2019E
Power demand (GWh)	5690	6626	7222	8074	9780	12600
Power production from existing plants (GWh)	5136	6523	6572	5836	1230	1230
Power imports (GWh)	554	103	950	2238	8550	11370

Table B- 2: Macedonian Power Demand and Supply

On the supply side, the table assumes that there are no new additions to capacity and that currently, operating plants are retired at current planned dates. The table shows that absent investment in new capacity and new fuel sources, a capacity imbalance will emerge in the medium term and that by 2013, Macedonia would be almost wholly dependent on imported power.

It is unlikely, however, that this situation will ensue in reality, given the various investment options open to Macedonia, which include:

- opening new lignite seams in existing mines/new lignite mines
- investment in new gas fired capacity (demonstrating actions already in this direction with respect to this CCPP project)

These are now considered in turn, based on the assumption that the Government of Macedonia will aim to select the most economically beneficial investments from available alternatives.

1.2 Project Background

The TE-TO AD Company in Skopje/Macedonia was established in 2005 by Itera Energy Holdings London and Toplifikacija AD Skopje with the aim to own and operate a combined heat and power plant in Skopje.

The intended combined cycle power plant of TE-TO AD in Skopje (CCPP Skopje) shall be constructed and operated on the basis of an IPP Project (Independent Power Producer) and shall supply power to the Macedonian electricity market and in case of electricity excess also to the international market. In addition, the major part of the required district heat demand of Skopje city shall be generated and supplied by this power plant.

The project is intended to be financed through international banks. For the time being, Itera has asked the FORTIS bank in Brussels, Belgium to advice and arrange a project financing guaranteed by one ore more export credit agencies for the realization of this project.

2 Legal Framework

2.1 Objectives

The EA report on hand is based on the World Bank Standard for Environmental Assessments. Since an EA for a similar project and the identical site has already been performed in 200,1 the report on hand refers to the report of 2001 where adequate.

The main objectives of this EA are as follows:

- To submit a report according to the lenders requirements
- To provide the additional information and data, if required

2.2 Legal Background

The EA report on hand is based on the following legal documents:

- Air Emission Guidelines of European Community: EC 2001/80/EC of October 23, 2001
- Ambient Air Quality Standards of European Community: Council Directive 1999/30/EC of April 22, 1999
- Urban waste water treatment Directive of European Community 91/271/EEC of May 21, 1991
- Since no EC Noise regulation exists, local and WB standards for noise have been applied: Thermal Power: Guidelines for new plants; in Pollution Prevention and Abatement Handbook, July 1998
- Involuntary Resettlement Directive: OD 4.30 of WB; June 1990

In order to obtain the environmentally most suitable solution, relevant guidelines of the respective field have been compared and the stricter ones have been applied for the project.

Where no EC guidelines exist, either the respective local guidelines or World Bank guidelines were taken into consideration depending on the strictness.

2.3 Technical Background

The following technical documents and information have been used for the preparation of the EA report:

- Feasibility Study Report of the Skopje CCPP as of March 2006
- Bidding Documents for the Skopje CCPP
- Annual Reports of the Skopje DH company Toplifikacija and further operational data of the existing HPP 'East'
- Existing EA report from February 2000 of an antecedent CCPP project which had not been implemented
- Study on an air pollution monitoring system in Macedonia from December 1998
- Ambient air quality measurements (manual as well as from 4 automatic stations) of the years 2004 and 2005.

3 Administrative Framework

3.1 Project Team

The report on hand was prepared by a team of experts of Colenco Power Engineering Ltd. in Baden, Switzerland. The main expert team is composed of:

Dr. Mehdi H. Javad
Dr. Ludwig Raible
Mr. Jürgen Lobpreis

The team was supported by GefaÖ in Walldorf, Germany and Ingenieurbüro Rau, Heilbronn, Germany

3.2 Applied Methodology

3.2.1 Assessment Methods

Assessment of the possible impacts of the Skopje CCPP on the environment was based on the following methods:

- **Judgment**
  Based on international literature and experience, judgment was used for preliminary assessment of the impacts of the project on the environment.

- **Checklist**
  Based on engineering features, as well as the environmental status, various checklists were set up for identification of the impacts and recommendation of mitigation measures.

- **Environmental Modeling**
  Environmental modeling was applied for computation and assessment of possible air pollution created by the project.

  - SO_2, NO_x, CO particulates dispersion modeling

Methodology of Identification and Classification of Potential Impacts:

Potential environmental impacts of the project were identified based on a series of field surveys of the existing natural environmental conditions within the Project area and meeting the provincial environmental management agencies and possible affected households.

In this study, the anticipated negative environmental impacts are classified into 4 categories *"Strong" "Medium", "Slight"* and "*negligible"*

- A *strong* impact can destroy an element of the environment or create a strong environmental modification. Such an impact can greatly affect an environmental component if it is impossible to adopt adequate mitigation measures.

- A *medium* impact may partially reduce a value or use of an environmental component and have an affect on a limited portion of the population.

- A *slight* impact may slightly reduce the value or use of an environmental component and slightly affect a small group of the population.

- Some activities of the project may not create evident negative impacts on the environment. In such cases, the assessment will not be detailed but some commentaries will be given. This type of impacts is identified as *"negligible".*

3.2.2 Measurement of Ambient Air Quality

The existing air quality (background concentration) at the Skopje CCPP Site has been measured in four monitoring points around the project area (see Section D). The following components have been measured:

- Microclimatic data (temperature, humidity, wind direction and velocity)

- Particulate matter (PM10)

- SO_2 concentration

- NO_2 concentration

- CO concentration

The measurements of the air pollutants based on the following methods/equipment:

- PM: Thermo ESM Andersen; Particulate Monitoring Instrument FH 62 I-R

- SO_2: Thermoenvironmental Instruments; Model 43C, Pulsed Fluorescence SO_2 Analyzer

- NO_2, NOx: Thermoenvironmental Instruments; Model 42 C, Chemiluminiscence NO_x, NO, NO_2 Analyzer

- CO: Ysselbach Envimet Analytical Systems; Model 48 C, Gas Filter Correlation CO Analyzer

3.2.3 Measurement of Noise Emission

Noise level measuring and monitoring data regarding the background situation were obtained from the Ministry of Urban Planning, Construction and Environment. Further long term measurements (24 h) were performed by Toplifikacija during a period of one week at eight measuring points near HPP “East” site. The measurements were done according to the given national regulations (“Law on Preventing Harmful Noise”, “Law on Environment and Nature Protection and Promotion”, “Decision to specify in which Cases and under which Conditions it is to be considered that the Peace of Citizens has been disturbed by harmful Noise”) and by applying measurement devices and appropriate filters in accordance with the requirements of the International Electric and Acoustics Commission (IEC) as well as in accordance with ANSI S1.4 standards and MKS- Acoustics in Construction.

The noise impact of the future CCPP has been evaluated by comparing the new plant with the existing HPP “East”.

3.2.4 Data Source Water and Soil

Surface Water

Data on the classification of surface waters and relevant hydrology data of the river Vardar were derived from the National Hydro-Meteorological Agency. Water quality data of the Vardar River were obtained from the National Institute for Health Protection. Hydrology and water quality were monitored by the named authorities from 1961 to 1999 and from 1995 to 1999 at a measuring point located 250-300 m in front of the location of HPP "East". Data on the water temperature of the river Vardar were available from the relevant authorities for the years 1975-1999.

Groundwater

The regime of underground waters on the site of the future power plant was determined according to data from hydrologic stations or piesometers located near the site.

Drinking Water

Analysis data for drinking water (1995 to 1999) were obtained from the National Institute for Health Protection, performing analyses of drinking water (physical, chemical and bacteriological characteristics) from the city supply system once per month. A relevant measurement point for the Project is located in the city community Avtocomanda, where the HPP "East" is connected to the central water grid system of the city.

Soil

Data were obtained via internet and from a site survey performed in December 2005. Toplifikacija will perform further soil investigations prior to the start of the construction period, comprising test drills and corresponding analysis.

3.2.5 Biological Environment

Available data from the internet and information given in the EA report for the CHP project of 2001 have been evaluated regarding the presence of protected areas, vegetation and fauna in the study area.

Possible impacts on habitats due to air emissions have been assessed on the basis of the performed air dispersion calculation. Impacts on the water fauna of the river Vardar were estimated according to present water quality data.

3.2.6 Socio-Economic

Data from the National Statistic Institute and the National Institute for Health Protection were evaluated.

3.2.7 Solid Waste, Landscape and Cultural Heritage

Solid waste data originate from the internet and the National Environmental Action Plan (NEAP). During a site survey performed in December 2005, the existing landscape was assessed and photographically documented. A baseline study regarding cultural heritage in the country was conducted by the Government of Macedonia.

4 Environmental Requirements

4.1 Emission Standards

For the assessment of the impact of the flue gas emission from the Skopje CCPP the following standards are considered:

- Directive 2001/80/EC of the European Parliament and of the Council; of October 23, 2001; on the limitation of emissions of certain pollutants into the air from large combustion plants,
- Macedonian Act on "Environment and Nature Protection and Promotion",
- Macedonian Act for "Protection of the Air from pollution"

The relevant emission limits of the Macedonian and European Standards are summarized in Table B- 3.

Fuel: Natural Gas **Applicable for: > 70% load**	**EC 2001/80/EC**	**Macedonia**	**Guarantee required for Skopje CCPP**
Unit	mg/Nm^3 Dry @ 15% O_2 *)	mg/Nm^3 Dry @ 15% O_2 *)	mg/Nm^3 Dry @ 15% O_2 *)
NO_X Single GT	50	350	
GT in combined heat and power systems with overall efficiency > 75%	75		75
Average annual electrical efficiency >55%	75		75
CO	-	100	100
Remarks:	95% of all 48 hourly mean values must be < 110% of above limit values	Max. 3% of all ½ hourly values in a year are allowed to reach 120% of above limits (97%< limit)	95% of all 48 hourly mean values must be < 110% of above limit values

Table B- 3: Applicable Emission Standards for Skopje CCPP

4.2 Ambient Air Quality Standards

For the assessment of ambient air quality of the Skopje CCPP site and surrounding area, the following standards will be considered.

- Macedonian Act on Protection of air form the pollution
- Council Directive 1999/30/EC of April 22, 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

The relevant ambient air quality limit values of the Macedonian and European Standards for the protection of human health are summarized in the table below.

Ambient Air Quality Standards		max. single	average		
		1/2 h	1 h	1 day	annual
Macedonian Standard					
PM10	µg/Nm3				
CO	mg/Nm3	3		1	
NOx (as NO2)	µg/Nm3	85		85	
SO2	µg/Nm3	500		150	
European Standard					
PM10	µg/Nm3			50 [4)]	40***
CO	µg/Nm3				
NOx (as NO2)	µg/Nm3		200 [2)]		40*
SO2	µg/Nm3		350 [3)]	125 [5)]	20 [1)]

1) protection for biological environment
2) not to be exceeded for more than 24 times*
3) not to be exceeded for more than 24 times
4) not to be exceeded for more than 35 times**
5) not to be exceeded for more than 3 times

Table B-4: Ambient Air Quality Standards

*): Margin of Tolerance: 50% on the entry into force of this Directive (April 1999), reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010

): To be derived from data and to be equivalent to limit value prior to 1 January 2005 (50 µg/m^3 PM_{10} Not to be exceeded more than 35 times in a calendar year)

***): Margin of Tolerance: 50% on the value of 1 January 2005 (40 µg/m^3 PM_{10}) reducing every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010

4.3 Water Quality Standards

For the assessment of water quality of surface and ground waters the following standards will be considered:

- Macedonian regulation on waters
- Pollution Prevention and Abatement Handbook, WORLD BANK GROUP, Effective July 1998, Thermal Power: Guidelines for New Plants

Since no European Standards are yet available, World Bank Standards for new thermal power plants have been taken into consideration for comparison (see Table B-7).

According to Macedonian regulations, waters (both ground and surface waters) are divided into 4 classes. Each class represents a specific water usage and therefore requires more or less strict thresholds for hazardous substances. A description of the various classes is given below.

- Class No. I: Waters in good natural condition, usable (eventually with disinfection) for drinking and in food industry, and for ground fish nurture;

- Class No. II: Waters in natural condition usable for leisure, water sports, and for ground fish nurture (cipronides-fish). If water shall be used for drinking and food industry, pretreatment is obligatory.

- Class No. III: Waters which can be used for irrigation and, after pretreatment, for industry (except food industry);

- Class No. IV: Waters which are usable only after specific treatment.

The classification of water is done according to its physical, chemical, biological and radioactive properties that are shown in Table B-5 and Table B-6:

		Maximal Level - Concentrations			
Water Quality Indicators	Unit	Class 1	Class 2	Class 3	Class 4
Dissolved Oxygen at least (is not applied for ground waters and lakes)	mg/l	8	6	4	3
Saturation with Oxygen Super-saturation with Oxygen	% %	90÷105 /	75÷90 105÷115	50÷75 115÷125	30÷50 125÷130
Fife-day Bio-chemical Oxygen Demand (BOD)	mg/l	2	4	7	20
Chemical oxygen demand for $KMnO_4$	mg/l	10	12	20	40
Total suspended substances	mg/l	10	30	80	100
Dry sediment of untreated water (dissolved substances): - surface water - ground water (karst) - ground water (non-karst)	 mg/l mg/l mg/l	 350 350 800	 1,000 1,000 1,000	 1,500 1,500 1,500	 1,500 / /
pH – value	/	6.8÷8.5	6.8÷8.5	6.0÷9.0	6.0÷9.0
Coli form germs - in water used for bathing	No./l No./l	2,000 /	100,000 20,000	200,000 /	/ /
Saprogenic degree after Liebman (not applied for ground waters and lakes)	descr.	Oligo-sapro-genic	Meso Sapro-genic	Meso Sapro-genic	Meso & Polisap-rogenic
Degree of biological productivity (applied only for lakes)	descr.	Oligo-trophic	medium	Eutrophic	/
Visual Waste materials	descr.	no	no	no	no
Visual Colors	descr.	no	no	weak	/
Smell	descr.	no	no	weak	/

Table B-5: Macedonian regulation on waters

		MWAC	
Dangerous & Hazardous Substances	**Unit**	**Class 1 & 2**	**Class 3 & 4**
Ammonia	mg/l	0.1	0.5
Ammonia Ion	mg/l	1.0	10.0

Nitrate Ion	mg/l	10.0	15.0
Nitrite Ion	mg/l	0.05	0.5
Hydrogen Sulphide	mg/l	/	0.1
Arsenic	mg/l	0.05	0.05
Antimony	mg/l	0.05	0.05
Copper	mg/l	0.1	0.1
Iron	mg/l	0.3	1.0
Mercury	mg/l	0.001	0.001
Cadmium	mg/l	0.005	0.01
Cobalt	mg/l	0.2	2.0
Molybdenum	mg/l	0.5	0.5
Nickel	mg/l	0.05	0.1
Lead	mg/l	0.05	0.1
Silver	mg/l	0.01	0.02
Chromium - threevalent	mg/l	0.1	0.5
Chromium - sixvalent	mg/l	0.05	0.1
Zinc	mg/l	0.2	1.0
Phenols	mg/l	0.001	0.3
Cyanides	mg/l	0.01	0.1
Chlorine - active	mg/l	0.005	0.01
Alkalibenzolesulphonat	mg/l	0.4	1.0
Avadex	mg/l	0.03	1.0
DDT	mg/l	0.04	0.1
Dieldrine	mg/l	0.017	0.02
Endrine	mg/l	0.001	0.01
Carbophosphate	mg/l	0.05	1.0
Polichlorined Biphenyl's	mg/l	/	/

Table B-6: Allowed Concentrations of Pollutants in Water

Parameter	**Maximum value (mg/l)**
pH	6-9
TSS	50
Oil and grease	10
Total residual chlorine	0.2
Chromium (total)	0.5
Copper	0.5
Iron	1.0
Zinc	1.0
Temperature increase at the edge of the mixing zone	less than or equal 3°C
Source: Thermal Power – Guideline for New Plant (1999)	

Table B-7: World Bank Guidelines for new thermal power plants

4.4 Noise Standards

For the assessment of noise levels, the following local standards (Table B-8 and Table B-9) will be considered:

- Macedonian Act for the "Prevention of redundant noise"

- Macedonian Decision on "Defining the circumstances and the conditions in which comfort and peace of citizens is perturbed because of noise".

For comparison reasons the internationally applied WB standard is shown (Table B-10):

- Pollution Prevention and Abatement Handbook, WORLD BANK GROUP, Effective July 1998, Thermal Power: Guidelines for New Plants

Type of noise exposed object	Unit	Day	Night
Residence Object's (inside)	dB (A)	40	30
Residence and Business Objects (inside)	dB (A)	40	35
Schools	dB (A)	40	40
Hospitals, Spas and Ambulances (inside)	dB (A)	35	30

Table B-8: Macedonian maximum noise levels for noise exposed objects

The terms “Day” and “Night” in Table B-8 and Table B-9 are to be understood as follows:

- Day time from 06.00 – 22.00 h and

- Night time from 22.00 – 06.00 h

Areas of Limited Noise	Unit	Day	Night
Areas of Hospitals, Health Centres, Ambulances, Weekend Houses	dB (A)	45	40
Touristic and Recreative areas, medium surrounding of Hospital	dB (A)	50	45
Clear Residence areas, Schools, Parks	dB (A)	55	45
Residence-Business regions (50 m away from center of the roads)	dB (A)	60	50
Trade and Business areas	dB (A)	65	50
Industrial, Storage, Service and transport regions, without residence objects	dB (A)	70	70

Table B-9: Areas with Noise Restrictions and Corresponding Max. Noise Levels

The maximum acceptable noise levels recorded on receptors on the edges of the property boundary and on an average hourly basis, as defined in the WB Guidelines, are presented in the in the following Table B-10.

	Maximum Allowable Level dB(A)	
Receptor	**Day Time (7:00 – 22:00)**	**Night Time (22:00 – 7:00)**
Residential, Institutional Educational	55	45
Industrial commercial	70	70

Table B-10: World Bank Guideline for Maximum Noise Levels (hourly averages)

4.5 International Environmental Agreements

Macedonia is party to:

Air Pollution, Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection, Wetlands.

All of the above mentioned agreements have been signed and ratified.