AES-3C MARITZA EAST 1 E00D

MARITZA EAST 1

ENVIRONMENTAL IMPACT ASSESSMENT EXECUTIVE SUMMARY

FEBRUARY 2005

AES-3C MARITZA EAST 1 E00D

MARITZA EAST 1

ENVIRONMENTAL IMPACT ASSESSMENT EXECUTIVE SUMMARY

FEBRUARY 2005

LIST OF REVISIONS

Current Rev.	Date	Page affected	Prepared by	Checked by (technical)	Checked by (quality assurance)	Approved by
Final draft	Feb 2005	All	R WEARMOUTH	K GRIFFIN	MA MITCHELL	PT CLARK
Final draft	Feb 2005	All	REVISION DETAILS Final issue as Document No 62160A/PBP/000001			

CONTENTS

1. BACKGROUND

The proposed project is the development of a 670 megawatt (MW gross; 600 MW net) lignite-fired power plant, to be constructed adjacent to the site of the existing Maritza East 1 power plant. The proposed site is 40 kilometres (km) south-east of Stara Zagora and 250 km south-east of Sofia, Bulgaria.

The new power plant will be a base-load facility that will operate 24 hours per day and 7 days per week. Planned maintenance activities and estimated forced outages will result in an effective annual capacity factor of 95 per cent (ie the plant is expected to operate approximately 8 300 hours each year). At full output, the plant's two identical pulverized lignite-fired steam generator units will generate a combined total of 670 MW of electrical power. Facility power requirements will consume approximately 70 MW and the remaining 600 MW will be sold to the national electrical power distribution grid, owned and operated by Natsionalna Elektricheska Kompania EAS (NEK).

NEK will be responsible for the construction and operation of a new 400 kV primary substation and the construction of transmission lines from the project site.

The water supply for condenser cooling and for fire protection will be withdrawn from Rozov Kladenetz Lake using the existing intake structure and existing cooling water and fire water pump stations. The water supply for cycle make-up water, service water, and potable water will also be derived from water withdrawn from Rozov Kladenetz Lake. Water will be recycled and reused to the greatest extent practicable, resulting in "zero-discharge" of process waste water.

When the plant is operating at full capacity, one 10-car train of lignite will arrive at the power plant's lignite unloading area every 30 minutes, resulting in a total of 48 train trips per day. Existing off-site rail lines will be used to transport lignite to the power plant site. Approximately 1 km of new rail line will be constructed on-site to serve the new railcar unloading area and new combustion waste loading area. The lignite receiving area and storage piles will be built in the former power plant's No 1 ash disposal area, a relatively flat reclaimed and revegetated area.

The project will help satisfy future demand for electricity in the country as old, inefficient, unsafe and environmentally substandard electric power-generating facilities, both lignite and hard coal burning and nuclear, are decommissioned. Closure of many of Bulgaria's current power generating facilities is scheduled in the next decade. In December 2002 units 1 and 2 of Kozloduy nuclear power plant were decommissioned in an agreement between the Bulgarian Government and the EU. The EU also requested decommissioning of units 3 and 4 at Kozloduy by the end of 2006.

The proposed AES-3-C 670 MW facility will use state-of-the-art technology, with an efficiency of approximately 36 per cent. It will have pollution control equipment to meet World Bank, European Union and Bulgarian air and water pollution control standards.

The estimated start date for construction for the new plant is January 2006.The construction work is expected to take place over a 36-month period with an average of 1245 workers per month being required during this time. All of the construction jobs are expected to be filled from the local and regional work force. Priority will be given to workers from the Municipality of Galabovo (eg the Town of Galabovo and the ten villages in the Municipality).

AES currently owns or has an interest on 113 power plants totalling over 45 000 megawatts in 27 countries. AES also distributes electricity to 11 million customers in eight countries through 17 distribution businesses. In addition to having assets in excess of £21 billion, AES has several projects in construction or late stages of development. The company has placed more than £8 billion of financing with commercial banks, export credit agencies, multilateral financial institutions and public markets. AES employs approximately 30 000 people around the world.

AES's partners, Access International and Delphos International, have experience in developing more than 15 private power projects within the last 10 years in Central and South America, Central and Eastern Europe, and Asia. These projects total approximately 1500 MW of electricity generation.

Contact details for the AES project director are:

Matthew Bartley.
The AES Corporation
4300 Wilson Boulevard
Arlington
VA 22203
USA
Telephone +1 703 682 6311

Fax +1 703 522 1315

2. SITE SELECTION

Both the site and fuel were dictated by the original request for proposal for the project and the Bulgarian Government's strategy to replace aging generation capacity. The larger Maritza energy-producing region was targeted in the 1998 National Energy Strategy report as a priority in the country's efforts to improve air quality and improve the efficiency of energy production. Benefits of the infrastructure associated with the site include:

- A plentiful supply of locally mined lignite fuel, with already existing rail and road access suitable for power plant operation reducing the need for transportation of resources over long distances.
- Nearby sources of water for use as cooling and process waters.
- A local work force with a high skill level associated with work in the power industry including workers employed or previously employed in the 3 existing Maritza East plants.
- A brown field site that would not require the disturbance of any ecologically sensitive land with less work being required with regards to site preparation prior to construction.
- The opportunity to reduce the load on the more polluting plant of the Maritza East area thus improving local and regional air quality.

The new plant output will help Bulgaria meet its overall national objectives for additional power generation, it will also help meet the Government's lignite extraction targets for the Maritza East mines. The use of indigenous lignite will also have a beneficial effect on Bulgaria's foreign trade balance. The price of domestic lignite in Bulgaria is approximately 25 to 50 per cent lower than that of liquid fuels and natural gas, which are obtained primarily through imports. The success of the proposed project may facilitate further deregulation and privatisation of the Bulgarian power sector, paving the way for future independent Power Producer (IPP) projects. However, due to the general low-grade quality of Bulgaria's lignite, achievement of this objective is not possible without using pollution control technologies such as those proposed for this project.

In addition, the project will have other economic and environmental benefits, which are summarized below:

1. **Regional development**. The project represents the largest foreign direct investment in the history of Bulgaria, thereby mobilizing substantial direct capital from private sources. This large infusion of new capital into the region will improve investor confidence in the domestic and international markets. With total construction costs estimated at approximately €700 million, up to €150 million could be earned by local companies. The project will provide industrial and residential users with an efficient and reliable supply of electricity, which could help increase Bulgaria's power exports to neighbouring countries, thereby improving the balance of payments.

2. **Improved air quality**. Sulphur dioxide air emissions from the proposed plant will be significantly reduced over current emission levels at the existing Maritza East 1 power plant. In particular, the AES project will limit sulphur emissions to 400mg/Nm^3 that will lead to a significant long-term improvement in regional air quality. Improved regional air quality will lead to long-term human health benefits, as well as reduced ecological impacts resulting from acid rain.

3. **Local water quality improvement**. The proposed facility will have zero discharge of process wastewater. It is not anticipated that under any conditions there will be a discharge of process water. Thus there will be no discharge of wastewater to Rozov Kladenetz Lake or the Sazlijka River. This will reduce thermal and chemical impacts to surface water quality.

4. **Employment**. At the local level, the project will employ up to 2600 people during the 3 year construction period. During operation, the new power plant will provide direct employment for up to 250 people as well as indirect employment for the lignite mine- and limestone quarry workers, and railway and lorry transport workers.

5. **Continuation of lignite mine and limestone quarry operations**. The project will help secure the long-term future (perhaps another 40 years) of the lignite mine and limestone quarry. The project will indirectly support the employment of thousands of miners at the Maritza East complex, currently estimated at 12 000 workers in total.

6. **Tax revenues**. The project will provide increased tax revenues at both the municipal and central levels of Government, amounting to as much as $22 million per year of

operation. The Project Company will be registered locally and thus pay relevant taxes to Galabovo Municipality.

7. **Related industries**. The project's secondary economic effects will result in a possible increase in new business opportunities associated with the plant operations. The need for services and products to support the new facility will create additional business opportunities in Galabovo.

8. **Technology transfer**. The project will stimulate the transfer of technologies and operating known-how in Bulgaria.

New capacity. The project will provide new electricity capacity to replace the planned decommissioning of units 3 and 4 (2006/2007) and the already decommissioned units 1 and 2 (2002) of the 4760 MW Kozloduy nuclear plant. The proposed AES-3C Maritza East 1 power plant will also provide replacement capacity for old coal, or lignite fired plants which are unable, and are not to be retrofitted with FGD to enable them, to comply with the requirements of the Large Combustion Plant Directive.

3. PUBLIC CONSULTATION PROGRAMME

Development of the proposed project began locally in mid-1997. Consistent with the national energy strategy, the private development of the project was announced by NEK and project award was pursued by 3-C. The construction of new facilities to replace the existing ME1 plant was discussed in newspapers published nationally as well as internationally. As appropriate to this phase of the project, the development team participated in numerous meetings with the parties participating in the project award and gave frequent interviews to newspapers and journals.

AES formally entered the project during the second half of 1999. Following submittal of the Bulgarian EIA to the MEW on 16 December 1999, AES/3-C assumed an active role in the preparations for the public hearing. In accordance with Bulgarian regulations, the project (and its public hearing planned for 16 February 2000) was announced in several newspapers. In addition, announcements were made on the Galabovo cable TV channel, which is viewed by 80 per cent of the local population, and at the Troyanovo North mine and the existing Maritza East power plants.

In addition to complying with the Bulgarian regulatory requirement of announcing the hearing 30 days prior to the event, AES followed World Bank guidelines on public consultation and disclosure in an effort to ensure that potentially affected local stakeholders were aware of the meeting and could attend. Two thousand large posters were prepared and placed in local stores, bus stops, main information points and municipal buildings in Galabovo, Radnevo and surrounding villages. Additionally, 6000 leaflets detailing information on the project and its sponsors were placed throughout Galabovo and mailed to homes in advance of the public hearing.

To ensure that as many people who wanted to could attend the meeting, a free shuttle bus service was provided. Bus routes included the villages of Mustachevo, Sarveo, Razdelna, Velikovo, Aprilovo, Pomoshtnik, Glavan, Mardec, Iskritza, Mednikarovo and Obruchishte. Announcement of the bus schedule was made in the local press, on Galkabovo cable TV and in the flyers distributed throughout the town.

In order to give the local stakeholders an opportunity to meet with the project sponsors and their environment consultants, and discuss issues related to the project, a morning “information session” was held in the Galabovo Hall of Culture on the day of the Public Heating. Approximately 250 people attended the information session, including residents of nearby villages and members of non-governmental organizations. Ten members of the development team were available to answer questions.

More recently the application for an IPPC (complex) permit was submitted to the MEW in March 2004. The application was made available to the public and if sufficient interest was shown a further public meeting would have been held. In fact there was very little public interest shown and MEW did not require a further public meeting. The draft IPPC (complex) permit was issued in February 2005. Again this permit is available to the public for comment. The time for receiving comments from the public has now expired and no comments have been received.

4. PROJECT DESCRIPTION

The proposed project is the development of a 670 megawatt (MW gross; 600 MW net) lignite-fired power plant, (the “AES-3C Maritza East 1 power plant”) to be constructed adjacent to the site of the existing Maritza East 1 power plant. The proposed site is 40 kilometres (km) south-east of Stara Zagora and 250 km south-east of Sofia, Bulgaria. The power plant is being developed by AES-3C Maritza East 1 E00D (the “Project Company”), a 100 per cent owned subsidiary of Consolidated Continental Commerce (Mauritius) Limited.

The AES-3C Maritza East 1 power plant will be a base-load facility that will operate 24 hours per day and 7 days per week. Planned maintenance activities and estimated forced outages will result in an effective annual capacity factor of 95 per cent (ie the plant is expected to operate approximately 8300hours each year). At full output, the plant’s two identical pulverized lignite-fired steam generator units will generate a combined total of 670 MW of electrical power. Facility power requirements will consume approximately 70 MW and the remaining 600 MW will be sold to the national electrical power distribution grid, owned and operated by Natsionalna Elektricheska Kompania EAS (NEK).

4.1 Site location and characteristics

The existing Maritza East 1 power plant is one of three lignite-fired power plants located along the perimeter of Maritza East lignite mines (the largest lignite open pit mines in Bulgaria). All three power plant facilities (Maritza East 1 (ME-1), Maritza East 2 (ME-2), and Maritza East 3 (ME-3) are fired using lignite from the Maritza East mines. The existing Maritza East 1 plant was merged with the adjacent briquette manufacturing facility to form a new company, Brikel EAD.

4.1.1 Site location

The lignite mines and adjacent power plants are located within the Sazlika River valley area of the low-lying Upper Thracian Plain. This south-east portion of the Upper Thracian Plain is bounded to the north by the Sredna Gora Mountains (600 to 900 m elevation; a component of the Balkan Mountains), to the south by the Sakar Mountains (400 to 600 m elevation; a component of the Rodopi Mountains) and to the east by lesser elevation (150 to 200 m) upland areas. The Sredna Gora Mountains, Sakar

Mountains, and eastern upland areas are approximately 50 km north, 60 km south, and 15 km east of the Maritza East 1 power plant site, respectively.

The Maritza East 1 power plant is the further west of the three Maritza East power plant facilities. The existing Maritza East 1 power plant is within the municipality of Galabovo, approximately 1.6 km east of the town of Galabovo. The closest residential community is the village of Obruchishte, located approximately 0.8 km south-east of the site. The power plant property is relatively flat, with an approximate elevation of 107 m above sea level.

The power block and principal facilities of the existing power plant are located to the north of Rozov Kladentz Lake, the man-made cooling water reservoir for the facility. Ash ponds for the existing facility extend for several kilometres to the west of the main power plant area. Ash Pond 1 and Ash Pond 2 have been closed, reclaimed, and revegetated. Ash Pond 3 is currently used by the existing ME1 facility. The Sazlijka River (a north to south flowing tributary of the Maritza River) serves as the western boundary of the ash ponds.

The Maritza East 1 power plant property is bordered directly to the east and the south by independently operated industrial facilities. Across the road from the power plant to the east is the lignite briquette manufacturing facility of Brikel EAD that produces briquettes for use in heating of local homes and, from time to time, for use in electrical power generation at the existing Maritza East 1 power plant. Across the road from the power plant to the south is Energoremont parts repair facility, which restores, repairs, and replaces parts and equipment used at the existing Maritza East 1, Maritza East 2, and Maritza East 3 power generating facilities.

4.1.2 Site history

The existing Maritza East 1 power complex was constructed and began operation in the early 1960s. Between 1959 and 1962 the first 200 MW power generating facility was constructed. This facility consisted of a lignite drying plant, six boilers, four 50 MW steam turbine generators and associated steam extraction equipment. In addition to generating electrical power, the 200 MW facility provided steam for district heating (for the town of Galabovo) and steam used for the lignite drying process at the adjacent briquette manufacturing facility. Between 1962 and 1964, an additional 300 MW of generating capacity was added, consisting of four boilers and two 150 MW steam turbine generators.

The existing 200 MW power plant/steam heating plant (Boilers 1 through 6 and Turbines 1 through 4) continues to operate, providing both electrical power and steam for district heating and for the briquette manufacturing facility. With the closing of the lignite drying plant, the mix of lignite supplied to this power plant has been modified to improve combustion efficiency. High moisture content raw lignite from the mines is now mixed with high calorific value (high sulphur content) lignite briquettes from the briquette manufacturing facility, improving burning efficiency but adversely affecting sulphur dioxide air emissions.

The plant’s hazardous materials are stored in several indoor and outdoor locations, typically in close proximity to the locations where they are being used. The primary hazardous material storage area is adjacent to the existing heavy fuel oil storage tanks. This area is used to store drums of fresh (unused) oil and hazardous material. Adjacent to the drum storage area is a tank farm, with nine aboveground storage tanks. The tanks are used to store fresh and used turbine oil. The plant’s waste oils are collected in drums and tanks and taken by the plant’s oil supplier for recycling.

The plant operates a vehicle fuelling station and an equipment fuelling station. The vehicle fuelling station is located adjacent to the oil storage area and contains two underground storage tanks (ie one for gasoline and one for diesel fuel). Each of the tanks has a capacity of 290 m^3. The tanks were installed in 1994. The equipment fuelling station is located near the existing plant's lignite pile. This station, which contains aboveground diesel fuel storage tanks and a pump dispenser, is used to fuel the heavy lignite handling equipment used in the yard.

The existing Maritza East 1 thermal power plant does not maintain records regarding spills/releases of oil or hazardous materials. Facility management indicate that there have been oil spills at the site as well as several incidents involving the plant's transformers.

4.1.3 Integration of existing and new facilities

Figure 4.1 presents a three-dimensional rendering showing the existing and new power facilities. The main power block for the new plant will be constructed to the north of the existing power plant facilities.

Although much of the future plant area has been cleared, several aboveground and underground structures remain. Aboveground facilities, including the partially demolished lignite drying plant, a centrally located contractor's building, outdoor parts and equipment storage areas, a pipe insulation storage warehouse, a former concrete batch plant, and a former ash pellet plant, are all to be removed to ground level by NEK prior to transfer of the property to the Project Company. Associated foundations and underground utilities will be left in place to be removed as part of the planned power plant construction. Existing rail lines that will serve the planned power plant will be left in place. Existing aboveground ash slurry pipes and an underground industrial sewer line (running from the briquette factory to an existing sewer pump station) are to be relocated by NEK prior to the initiation of new power plant construction.

Other facilities that will be used to support the new power plant include the rail lines to and from the lignite mining area and the overburden disposal area, the Rozov Kladenetz Lake circulating water and fire water intake structure and pump stations, the Sazlijka River pump station, and the existing lignite unloading area, Bunker C (currently used for lignite unloading; planned to be used for limestone unloading).

4.2 Facility description

4.2.1 Process description and site layout

The AES-3C Maritza East 1 power plant will generate 670 MW (gross) of electricity, of which 600 MW (net) will be provided to the local power grid. Power will be generated by means of two pulverized lignite-fired boiler units coupled with two 335 MW steam turbine generators. Electrical power will be provided to the Bulgarian national electrical power company (NEK) for distribution to the national grid. NEK will be responsible for the construction and operation of a new 400 kV primary substation and the construction of transmission lines from the project site.

FIGURE 4.1
THREE-DIMENSIONAL RENDERING OF EXISTING MARITZA EAST 1 AND PROPOSED AES-3C MARITZA EAST 1 POWER PLANTS

Pulverized lignite will be burned within two steam generator tower boilers, each equipped with a series of beater mills and low NO_x burners. Steam will be routed to two 335 MW turbine generator units that will be used within a newly constructed steam turbine building. Exhaust steam will be condensed by means of a cooling tower with the condensate return water routed back to the boilers. After passing through air heater units, exhaust flue gases will be routed through electrostatic precipitators to capture fine dust and through wet limestone flue gas desulphurization (FGD) absorbers to reduce sulphur dioxide emissions. The exhaust flue from each of the two FGD absorbers will discharge into the cooling tower above the cooling water discharge system.

Lignite for the plant will be supplied from the Maritza East lignite mines (mainly from Troyanovo North mine, but also from Troyanovo 1 and Troyanovo 3) located 7 km north of the power plant site. The transportation of lignite from the mines to the power plant site will be by rail car and will be the responsibility of the mining company, Mini Maritza Iztok (MMI). Lignite will be unloaded at the newly constructed lignite train unloading area. Limestone for the FGD system will also be supplied by railcar, with the most likely source being the existing Chala limestone quarry, located approximately 60km south-west of the project site. Limestone will be unloaded at the limestone train unloading area.

The power plant will use heavy fuel oil (HFO) for start-up and low load flame stabilization of the steam generators and will use diesel light fuel oil (DFO) to fire the auxiliary boiler. HFO will be transported to the site by rail (as is currently the practice) and transferred to storage tanks. DFO will be transported to the site by truck. New DFO storage and truck unloading facilities will be constructed as a component of the planned project.

The water supply for condenser cooling and for fire protection will be withdrawn from Rozov Kladenetz Lake using the existing intake structure and existing cooling water and fire water pump stations. The water supply for cycle make-up water, service water, and potable water will also be derived from water withdrawn from Rozov Kladenetz Lake.

Water will be recycled and reused to the greatest extent practicable, resulting in “zero-discharge” of process waste water. Boiler blow down, treated sanitary effluent, plant drains, and lignite pile runoff will be routed to the cooling tower for use as tower make-up water, reducing water withdrawals from the lake. Cooling tower blow down will serve as the water supply for the flue gas desulphurization system and will be used for ash quenching.

4.2.2 Lignite supply and processing

4.2.2.1 Lignite delivery and storage

Lignite for the power plant will be provided mainly from the Troyanovo North mine, located approximately 7 km north of the power plant site. At full load, lignite consumption at the proposed plant is estimated to be approximately 9 million metric tonnes per year or approximately 25 000 tonnes per day.

Lignite will be transported from the mine to the power plant site in 10-car trains, each car with an approximately capacity of 55 tonnes, resulting in a total maximum capacity of 550 tonnes of lignite per train. The lignite rail cars will be top-loading, bottom-dumping wagon type rail cars, similar to those currently in use at the mines and power plant. When the plant is operating at full capacity, one 10-car train of lignite will arrive at the power plant’s lignite unloading area every 30 minutes, resulting in a total of 48 train trips per day. Existing off-site rail lines will be used to transport lignite to the power plant site. Approximately 1 km of new rail line will be constructed on-site to serve the new railcar unloading area and new combustion waste loading area. The lignite receiving area and storage piles will be built on the existing Maritza East 1 power plant's former No 1 ash disposal area, a relatively flat reclaimed and revegetated area.

Lignite will be unloaded at a two-track railcar unloading area, similar to the unloading area currently in use at the Maritza East 2 power plant. Lignite will fall by gravity from the bottom dumping lignite trains and will accumulate on the ground beneath the rail platform. The lignite unloading area will be capable of unloading 10 rail cars at each track. Wheeled reclaimers will move the lignite from the unloading area onto conveyors that will transfer the lignite to a coarse crusher crushing lignite from lumps in the range of 300 to 800 mm in diameter down to smaller lumps that are generally less than 200 mm in diameter. Crushed lignite will be placed on covered belt conveyors and transported to stacking equipment that will form four trapezoidal lignite piles. Each lignite pile will be built on an impermeable base and surrounded by a structure that will collect storm water runoff and route it to the lignite pile runoff pond. A 14-day supply of lignite will be maintained in the lignite storage area throughout the year. The maximum height of an individual lignite pile is expected not to exceed 25 m.

4.2.2.2 Lignite preparation and combustion

Two reclaiming units (each serving two lignite piles) will lift lignite from the lignite piles onto the covered belt conveyors that will transfer the lignite to the fine crusher units. The fine crushers will consist of running hammer crushers that will be capable of further reducing the lignite lump size to around 15 to 40 mm in diameter so that it will be suitable for subsequent milling in the beater mills (pulverizers). After fine crushing, the lignite will be deposited in the boiler bunkers located in the main steam generator building.

Conveyors will be used to transport lignite from the bunkers to the pulverizers (beater mills), located at the base of each tower boiler unit. Each tower boiler will be equipped with six beater mills. The beater mills will serve both as lignite dryers and pulverizers, making the lignite suitable for burning in a combustion system. At peak operation, pulverized lignite will be fed to the boilers at an approximate rate of 505 tonnes per hour per unit.

4.2.3 Fuel oil supply and storage

The power plant will use heavy fuel oil (HFO) for start-up and low load flame stabilization of the steam generators and will use diesel light fuel oil (DLO) to fire the auxiliary boiler and the emergency diesel generator.

Approximately 510 tonnes of HFO will be consumed each year. Significantly less DFO will be required. HFO will be stored in two 2000 m^3 capacity bunded storage tanks. DFO will be stored in several new, lesser capacity DFO storage tanks. HFO will be transported to the site in rail-road tank cars and DFO will be transported to the site by truck.

The HFO unloading area will be capable of simultaneously unloading up to as many as 4-tank cars. For unloading purposes, the viscous HFO is heated to 60°C. Flexible hoses are connected to the tank cars and the heated oil is pumped (by suction pumps) into the fuel oil storage tanks. Prior to use in the power plant, heavy fuel is filtered, heated to 70°C, and pumped to the combustion units. Steam from the existing power facility is currently used to heat the HFO and a similar configuration will be established for the new power plant. Condensate from the HFO/steam heat exchanger will be routed to an oil/water separator prior to subsequent reuse. Storm water collected in the bunded fuel oil storage area will also be routed through an oil/water separator prior to being routed for reuse.

4.2.4 Emissions to Air

The plant will comply with the emissions limits set by the Large Combustion Plant Directive (LCPD) 2001 (2001/80/EC) for new plant generating more than 500 MW using indigenous hard to burn solid fuels. The LCPD that state that such plant should emit no more than 400 mg/Nm^3 Sulphur Dioxide (SO_2), 200 mg/Nm^3 Nitrogen Oxides (NOx) and 30 mg/Nm^3 Dust through the plant flue, at 6 percent oxygen, dry and at 0°C.

The plant will comply fully with Best Available Technology (BAT) as described in the BREF note for combustion plant.

4.2.5 Air emission control systems and associated materials and by-products

Induced draught fans will draw flue gas exhaust from each boiler unit through an air heater (heat exchanger) and into a set of electrostatic precipitators (ESPs). The ESPs will be designed to capture fly ash and dust particles present in the exhaust gas, ensuring compliance with the World Bank, EU and Bulgarian particulate matter guidelines. From the ESPs, the flue gas will be directed into a wet limestone flue gas desulphurization (FGD) system, which will absorb sufficient sulphur dioxide (SO_2) to ensure compliance with the World Bank, EU and Bulgarian SO_2 emission guides. The desulphurized air emissions from each of the 335 MW units will be released using individual flues (one flue per unit) housed within the cooling tower. Each flue will be equipped with continuous emissions monitoring for SO_2, NO_x and particulates.

4.5.2.1 Limestone supply and processing

The wet limestone flue gas desulphurization (FGD) system will require a steady supply of limestone. Limestone for the FGD system will be provided. The most probable source of limestone will be the existing Chala limestone quarry, located approximately 60 km south-west of the project site. Other sources include the existing Ogniznovo and Volvkan quarries. At full operational load, approximately 760 000 tonnes per year of limestone will be required for use in the FGD system.

Limestone will be transported to the site using top-loaded, bottom-dumping rail cars, similar to those to be used for lignite transportation. Also similar to lignite delivery, limestone will be shipped from the quarry to the power plant using 10-car trains, each car with 55-tonne capacity. Each day, three 10-car trains of limestone will be transported to the power plant site. Existing rail lines running north from the Chala quarry will be used to the extent possible, as will existing on-site rail lines currently used in conjunction with lignite loading and unloading. No new rail lines are anticipated for the limestone delivery system.

Each limestone train will be emptied at the rail unloading area and stored in the underlying limestone bunkers. From the bunkers, limestone will be reclaimed, placed on a covered limestone conveyor, routed through limestone hammer crushers and stored in a covered storage area that will be sized to hold a one-week supply of limestone. After crushing, the limestone will be conveyed from the storage area to wet mill grinding units and subsequently mixed with water, to form a slurry, and stored in a limestone slurry storage tank. From this tank, the limestone slurry will be pumped into the FGD wet scrubbers.

4.5.2.2 Gypsum storage and disposal

The flue gas desulphurization system will consist of a wet limestone scrubbing process. In this process, within the FGD absorber, limestone slurry is sprayed downward, counter-current to the upward moving flue gas flow. The limestone slurry reacts with sulphur dioxide in the flue gas and, with subsequent aeration, produces a wet gypsum slurry by-product at the base of the absorber. The gypsum blowdown will be routed to the limestone preparation and gypsum dewatering building, where it will be dewatered to approximately 30 to 40 per cent moisture content. The dewatered gypsum will be temporarily stored in a gypsum silo, to be located at the combustion waste collection building. Gypsum from FGD systems has successfully been used as a raw material for gypsum wallboard manufacturing and as an additive for cement. The Project Company has performed an evaluation to determine whether it will be economically feasible to establish a market for gypsum related products in this region of Eastern Europe. No such market is believed to currently exist. If economically feasible, facilities will be developed to use the gypsum (or at least some portion of it) in a wallboard manufacturing or similar operation. If beneficial reuse of gypsum is not economically feasible, gypsum will be disposed off site. Gypsum stored in the gypsum silo will also be placed in rail cars, and will be transported for disposal in the planned Dryanovo ash/gypsum disposal area. Approximately 3500 tonnes per day of gypsum will be generated. Including the weight of the ash this will result in approximately 7000 tonnes per day of solid waste that will be transported to the ash/gypsum disposal area. Approximately twenty 10-car trains per day will be required to transfer these combined wastes to the disposal area.

4.5.2.3 Ash storage and disposal

The combustion process will generate bottom ash from the boilers and fly ash from the electrostatic precipitators. Bottom ash will be collected in the bottom of each steam generator unit. The bottom ash will be cooled in a water-filled trough (submerged chain conveyor) and, after dewatering, will be stored in a silo located at the combustion waste collection building. Fly ash will be collected from the electrostatic precipitators and from the air heaters using a pneumatic dry system that will deliver the fly ash to silos located at the combustion waste collection building. An estimated 3500 tonnes (dry) of ash will be collected each day from the ESP and bottom ash units.

Ash will be loaded into rail cars, and transported to the Dryanovo overburden disposal area, where it will be disposed of in a newly constructed, lined ash disposal area.

4.2.6 Water and waste water systems and associated materials and by-products

4.6.2.1 Water supply and treatment

Water use at the power plant will include circulating water for the condenser cooling systems (cooling tower make-up), fire water, cycle make-up water, general service water, and potable water for sanitary use.

The source of water for the plant will be Rozov Kladenetz Lake, a man-made reservoir that has historically served as the supply for fire water and once-through condenser cooling water for the existing Maritza East 1 and Maritza East 3 power facilities.

When the existing power plant was constructed in the early 1960s, Rozov Kladenetz Lake was formed by damming the Sokolitsa River (an east to west flowing tributary to the Sazlijka River located approximately 2.2 km south of the power plant site) and diverting its flow into a 3.6 km^2 surface water impoundment. When stream flow is sufficient (typically during the winter and spring months), the diversion of water from the Sokolitsa River to the lake is implemented. A screen house and pump station were also constructed adjacent to the Sazlijka River. This pump station has been and is still used to pump water from the Sazlijka River to Rozov Kladenetz Lake, to maintain the water level of the lake. The Sazlijka River pump station also includes pumps that have been used to withdraw water from the river for use in the existing power plant's steam cycle.

The fire water and cooling water supply for the existing power plant is withdrawn from the lake using separate cooling water and fire water pump housing, located side by side along the north bank of the lake opposite the main gate of the power plant. The new power plant will use three existing refurbished Rozov Kladenetz Lake water supply facilities (intake structure, travelling screens, cooling water and fire water pumping equipment, etc) as part of the new plant's water supply system.

All water pumped to the power plant from the lake will undergo clarification and lime softening. Softened water will be routed to the cooling tower for use as tower make-up. Circulating cooling tower water will be treated with sodium hypochlorite for biological control and sulphuric acid to control scale deposition. Water to be used in the main power plant will be treated for suspended solids, dissolved solids and hardness reduction in the same solids contact clarifier that supplies the cooling tower. This water will undergo filtration and disinfection (sodium hypochlorite) prior to being stored in a filtered water storage tank. Filtered water will serve general service water needs. Potable water and water to be used as boiler make-up in the power cycle will require further treatment to remove impurities. Both will be treated prior to final treatment specific to the intended uses. Potable water will be drawn from the storage tank, stabilized and disinfected, and stored in a potable water storage tank. Demineralized water used to make-up the power cycle, will be further treated by ion exchange demineralization. Water in the condensate-feedwater-steam cycle will be conditioned with hydrazine (an oxygen scavenger), and ammonium hydroxide (for pH control). Trisodium phosphate will be added to the boiler water to minimize scale and corrosion.

4.6.2.2 Waste water treatment reuse

The AES-3C Maritza East 1 power plant will be designed to operate as a closed-loop or "zero discharge" facility for waste water. Facility waste streams will include water treatment system discharges (eg filter backwash and water treatment sludge dewatering effluent), demineralization system discharges (eg neutralized ion exchange system resin regeneration waste water), boiler blowdown, plant drains, and treated effluent from the sanitary waste water treatment facility. These streams will be reused. Cooling tower blowdown will be routed to the flue gas desulphurization system wet limestone scrubber, where it will be both mixed with crushed limestone to form the limestone slurry mixture and directly injected into the FGD scrubber unit. A small quantity of the cooling tower blowdown will also be routed to the bottom ash system for use in ash quenching.

4.6.2.3 Storm water management

The AES-3C Maritza East 1 power plant will have three distinct areas with respect to storm water runoff; the lignite pile area, several outdoor oil handling and storage areas, and the remaining main power block area. Storm water runoff from the area surrounding the lignite piles and lignite train unloading area could potentially have elevated concentrations of suspended solids due to the coal dust likely present in these areas. Storm water runoff from the lignite pile and lignite train unloading area will be routed to a lignite pile runoff pond. The lignite pile runoff pond will be sized to store runoff from precipitation events up to and including the 10-year 24-hour storm event (estimated at approximately 122 mm of rainfall). Water collected in this pond will be treated (eg pH neutralization, if required) and routed to the raw water treatment system.

Storm water from the bunded HFO oil storage tank areas, from the HFO unloading area, from any outdoor DFO storage or handling areas, and from the planned electrical substation area could potentially contain oil and will, therefore, be routed to one or more oil/water separator unit. Clarified effluent from the oil water separators will be routed to the raw water treatment system.

Storm drainage for the new main power block area will be routed to a small runoff pond, sized to store runoff from the 1-year 24-hour storm event (estimated at approximately 50 mm of rainfall). This smaller pond will be sized to capture and allow settling of “first flush” suspended solids (typically runoff from the first 30 minutes of rainfall event).

Occasional storm water overflows from the smaller power block storm water pond and less frequent overflows from the larger lignite pile runoff pond are expected to be generally free of suspended sediment. These overflows will be routed to the Sazlijka River and will be discharged at a point prior to the Sazlijka River’s confluence with the Sokolitsa River.

4.6.2.4 Water and waste water treatment chemicals

A variety of chemicals will be required to support facility water treatment and waste water treatment systems. Water treatment chemicals potentially used on-site and stored in the vicinity of the water treatment building could include the following:

- Boiler water treatment chemicals such as trisodium phosphate, ammonium hydroxide, hydrazine.

- Cooling tower treatment chemicals such as sulphuric acid, sodium hypochlorite, and potentially various additional scale and/or corrosion inhibitors, as determined to be required.

- Raw water chemical precipitants, disinfectant, and clarification chemicals including lime (calcium hydroxide), sodium hypochlorite, ferric chloride, and sulphuric acid.

- Service water and potable water disinfectant (sodium hypochlorite).

- Demineralization system regeneration chemicals and neutralization basin pH adjustment chemicals, sulphuric acid and sodium hydroxide.

All chemicals will be stored in bunded areas.

4.6.2.5 Water and waste water treatment residuals

The chemical addition and precipitation component of the water treatment process will generate a high water content solid waste (sludge), consisting primarily of calcium carbonate and ferric hydroxide. This sludge will be dewatered and used in the FGD plant.

The facility's sanitary waste water treatment plant will also generate a residual solid waste (sludge). This sanitary waste will be tested and, if acceptable, will be used as fertilizer or for land reclamation. If necessary, and as approved by the municipality, this sludge will be dewatered and disposed of in the Galabovo solid waste landfill.

4.7 Existing condition of site

The proposed site consists of land that previously housed 2 150 MW units of the existing Maritza East 1 TTP. These units have been demolished to ground level with some small piles of rubble ready either for removal to a designated land fill or for use in any further levelling of the site.

4.7.1 Planned construction activities

The overall construction of the AES-3C Maritza East 1 power plant, from the issuance of a Final Notice to Proceed to the Engineering, Procurement, and Construction (EPC) contractor to the completion of testing and commencement of operation, is estimated to be 36 months. A Final Notice to Proceed will be issued to the EPC contractor following financial closure, with the potential to issue a Limited Notice to Proceed before financial closure. During this period, final design work and materials procurement can be initiated. On-site construction, beginning with site clearing and underground utility relocation, will be initiated by January 2006. It is anticipated that commercial operation of Unit 1 will be initiated by December 2008 with Unit 2 to follow by 1 April 2009, Construction of the project will, at its peak, involve a workforce of as many as 2 600 workers. It is anticipated that most of these workers will be from the local area.

4.7.2 Site clearing, excavation and utilities relocation

Construction of the project will begin with the clearing of the project site and relocation of existing utilities that are to remain active during the construction phase of the project. NEK will have completed the demolition (to ground level) of existing buildings and structures within the footprint of the planned project site (eg lignite drying factory, the cement plant, the outdoor parts storage areas, and the centrally located contractor's building, etc). The site clearing work undertaken by the EPC contractor will involve the excavation and removal of the remaining building foundations and any abandoned underground utilities. Whereas NEK will be responsible for relocation of the existing active aboveground ash slurry pipelines and underground industrial sewer pipeline (running from the briquette factory to the sewer pump station) that currently traverse the planned power block area, the EPC contractor will be responsible for relocating existing active underground fire protection pipelines located in the planned project area (the fire protection systems serving the existing power plant).

Site clearing debris such as excavated concrete foundations and abandoned utility pipelines, manholes, and cable galleries, will be disposed of in a construction debris landfill designated by the municipality.

It is estimated that approximately 270 000 m^3 of excavation will be required for the construction of the power plant and associated structures. A small portion of the excavated materials will be underground debris associated with the existing power plant. Most of the excavated materials, however, will be on-site soil. The excavated soils will be stored and used on-site and there is no plan for off-site disposal of these soils. Should there be excess excavated soils and/or stone, these materials will either be deposited in the construction debris landfill (possibly used as cover materials) or placed in railcars and disposed of in the Dryanovo overburden disposal area.

4.7.3 Rehabilitation of existing facilities

Several facilities at the existing Maritza East 1 power plant will continue to be used at the new power plant. These facilities include the circulating water and fire water pump stations (and associated screens, pumps, and pipelines). During the final design process, the condition of these facilities will be fully assessed and plans for rehabilitation will be developed. Rehabilitation of these facilities will take place during the early middle period of the construction schedule.

4.7.4 Construction of new facilities

Construction of the new facilities at the project site will generally follow a five step process: final design, materials and equipment procurement, civil construction, mechanical/electrical construction, testing/start-up. Civil construction, beginning in June 2006 and extending through the summer of 2008, will involve site clearing and excavation, construction of concrete foundations and steel superstructures, construction of site roadways and rail spurs, and erection of buildings. Mechanical and electrical construction will begin in the spring of 2007 and continue through the autumn of 2008. Mechanical/electrical construction will involve the erection of boilers, turbine generators, cooling towers and condensers, mechanical piping and pumps, air pollution control equipment (FGD scrubbers, ESPs), and associated electrical equipment. It is anticipated that NEK will be constructing the electrical substation and associated transmission lines during this same time frame. Start-up and testing are expected to begin in August 2008, so that Unit 1 will begin commercial operation in December 2008 and Unit 2 will begin commercial operation in April 2009.

4.7.5 Construction water supply

Bottled water will be provided as drinking water during the construction of the project. Water in support of construction activities will be obtained by way of a connection to the municipal water supply line that currently services the existing Maritza East 1 power plant.

4.7.6 Construction waste water management

A construction workforce of as many as 2 600 people could generate as much as 250 m^3 of sanitary waste water each day. Construction phase sanitary waste water will be collected in on-site holding tanks and transported off-site for appropriate treatment and disposal.

4.7.7 Construction storm water and ground water dewatering discharges

Construction techniques will be implemented that will minimize soil erosion and the quantities of sediment in storm water and ground water dewatering discharges from the construction area. Site grading and materials stockpiling will be performed using techniques designed to minimize potential erosion of topsoil. Where appropriate, hay bales and/or silt fencing will be installed in areas down gradient of construction activities to minimize sediment loading in storm water runoff. If necessary, and where appropriate, a temporary storm water sedimentation basin will be constructed that will control peak flows of storm water runoff and dewatering discharges and allow for the settling of suspended sediment. Storm water runoff and ground water dewatering discharges will be routed to the storm drainage system currently in the existing Maritza East 1 power plant facility.

4.8 Other local facilities potentially affected by the project

As discussed in previous subsections of this project description, there are several facilities not directly related to the AES-3C Maritza East 1 power plant project that could potentially be affected by the new project. These facilities include the existing Maritza East 1 power plant, the Briquette Factory Ltd (ie Galabovo coal briquette manufacturing facility), the Energoremont parts repair facility, and the Rozov Kladenetz Lake fish farm co-operative.

The existing Maritza East 1 power plant (Brikel EAD)

Brikel EAD was formed by the merger of the existing Maritza East 1 power plant and the briquetting factory. The current Maritza East 1 employs approximately 1100 workers. The 200 MW facility is over 40 years old and many of its structural and mechanical components are approaching the end of their anticipated design life. There are no plans to fit Flue Gas Desulphurisation facilities to this plant. Consequently it is planned to operate for only 20,000 hours after 2008 as required by the Large Combustion Plant Directive.

The coal briquette manufacturing facility is located directly east of the existing Maritza East 1 power plant. This facility was constructed and became operational in the mid-1960s and, similar to the existing Maritza East 1 power plant, is approaching the end of its design life. The facility manufactures high calorific value coal briquettes for use in residential coal stoves and, in recent years (since the closing of the lignite drying plant) for use in the existing Maritza East 1 power plant. A specific high calorific value (high sulphur content) type of lignite (referred to as “briquetting lignite”) is transported from Maritza East lignite mines to the briquette plant by rail. The lignite briquettes are manufactured using a process that includes raw lignite crushing and grinding followed by lignite drying and a briquetting pressing operation, and subsequent cooling. The briquette factory’s lignite drying process uses steam extracted from the existing Maritza East 1 power plant as a heat source. Industrial and sanitary waste water from the briquette factory are currently routed to a sewer pump station located at the existing Maritza East 1 power plant (in the vicinity of the Sazlijka Rive pump station), where it is pumped for disposal in the active Maritza East 1 ash ponds. This facility will close when the associated existing Maritza East 1 plant closes.

Energoremont-Galabovo JS Company

This parts repair and manufacturing facility is located just south of the existing Maritza East 1 power plant. This facility employs approximately 1 450 workers and includes boiler and turbine spare part production facilities, boiler and turbine equipment repair workshops, and workshops for electrical and furnace construction and reconstruction work. The facility's principal clients are the Maritza East 1, Maritza East 2, and Maritza East 3 power generating facilities.

Rozov Kladenetz Lake fish farm

A small fish farming co-operative is currently operated along the north bank of Rozov Kladenetz Lake, in the vicinity of the location where the existing Maritza East 1 power plant's heated circulating water system discharge first enters the lake. The co-operative raises perch, carp, and catfish both for direct sale and, to a lesser degree, for stocking of the lake. During the colder months of the year, a stream of warm water is diverted from the thermal discharge canal into a fish farming impoundment. This warm water both prevents the water impoundment from freezing and accelerates the maturing process of the fish raised at the co-operative.

5. ENVIRONMENTAL ISSUES

5.1 Air Quality

The AES-3CMaritza East 1 power project will contribute to the airborne emission of several pollutants for which ambient air quality criteria have been established by Bulgaria, the European Union and the World Bank to safeguard human health and welfare. The existing air quality regulations in Bulgaria: Regulation No 9, addresses sulphur dioxide (SO_2), oxides of nitrogen (NO_x and NO_2), total carbon monoxide (CO), lead (Pb) and PM_{10}, particulate less than 10 microns aerodynamic diameter and $PM_{2.5}$, particulate less than 2.5 microns aerodynamic diameter. In addition, Ordinance No 9 sets forth ambient criteria that become increasingly restrictive between the years 2000 and 2010.

Regulation 9 standards are provided in

Table 5.1. In evaluating future air quality using air dispersion modelling, these Bulgarian standards as well as European Union and World Bank ambient air quality standards will be used. These standards are summarized in Table 5.1.

These standards mirror the European Union Directive (1999/30/EC) and are more stringent than the World Bank ambient air quality standards. The Bulgarian standards include $PM_{2.5}$ (particulate matter of size less than 2.5 microns) that are not included in the EU Directive. The standards are set out below.

TABLE 5.1
SCHEDULE FOR IMPLEMENTATION OF BULGARIAN, EU AND WORLD BANK AMBIENT AIR QUALITY STANDARDS

Parameter	Bulgaria (Ordinance No 9/03.05.1999)			European Union (EU 1999/30/EC of 22 April 1999)			World Bank (July 1998)		
	Maximum single event 1-hour (μg/Nm³)	Average daily 24-hour (μg/Nm³)	Average annual (μg/Nm³)	Maximum single event 1-hour (μg/Nm³)	Average daily 24-hour (μg/Nm³)	Average annual (μg/Nm³)	Maximum single event 1-hour (μg/Nm³)	Average daily 24-hour (μg/Nm³)	Average annual (μg/Nm³)
SO_2	350 exceed ≤24 times/year (meet by 1.1.2005)	125 exceed ≤3 times/year (meet by 1.1.2005)	20 (meet by 1.1.2003)	350 exceed ≤24 times/year (meet by 1.1.2005)	125 exceed ≤3 times/year (meet by 1.1.2005)	20 (meet by 19.7.2001)	-	150	80
NO_X	200 exceed ≤18 times/year (meet by 1.2.2010)	-	40 no_2 human health (meet by 1.1.2010) 30 NO_X vegetation (meet by 1.1.2002)	200 exceed ≤18 times/year (meet by 1.1.2010)	-	40 no_2 human health (meet by 1.1.2010) 30 NO_X vegetation (meet by 19.7.2001)	-	150	100
TSP Total suspended particulate	-	-	-	-	-	-	-	230	80
PM_{10} Particulate matter less than 10 microns (μm) in size	-	50 exceed ≤35 times/year until 2008 exceed ≤7 time/year thereafter (meet by 1.1.2009)	30 (meeting by 1.1.2009) 20 (meet by 1.1.2010)	-	50 exceed ≤35 times/year until 2008 exceed ≤7 time/year thereafter (meet by 1.1.2005)	40 (meet by 1.1.2005) 20 (meet by 1.1.2010)	-	150	50
$PM_{2.5}$ Particulate matter less than 2.5 microns (μm) in size	-	40 exceed ≤14 times/year (meet by 1.1.2009)	20 (meet by 1.1.2009)	-	-	-	-	-	-
Lead	-	-	0.5 (meet by 1.1.2005)	-	-	0.5 (meet by 1.1.2005)	-	-	-
Notes:	1. Bulgarian and European Union standards presented above will be phased in incrementally. The table above presents the ultimate limit that will apply and the year in which it will apply.								

Ambient air quality is currently measured at Galabovo where results show that there are no exceedences of the standards for NOx or for Lead. There are exceedences for total particulate matter (PM10) both for the 24 hour daily average and the annual average. There are a number of exceedences for sulphur dioxide both for short term, daily average and annual average.

While the exceedences for total particulates may be due to local traffic and the siting of the monitoring station, the exceedences for sulphur dioxide are undoubtedly related to the emissions from the 3 power plants in the area, Maritza East 1, Maritza east 2 and Maritza East 3.

The airshed is classified as poor in the guidelines set by the World Bank due to the sulphur dioxide concentrations

5.2 Surface water resources

The Maritza East coal mines and surrounding Maritza East power plants (Maritza East 1, 2 and 3) are all located within the 3293 km^2 Sazlijka River basin. The source of the Sazlijka River is a series of springs located at the foothills of the Sredna Gora Mountains. The river has two main branches, the Sjujutlijka Branch to the west and the Sazlijka Branch to the east, that converge to form the main Sazlijka River to the south of the town of Radnevo. The main river continues flowing to the south, eventually discharging to the larger Maritza River south of the town of Simeonovgrad. The two branches of the river and main river have a total length of 145 km.

The Sazlijka River is joined by numerous smaller tributaries. In the general vicinity of the AES-3C Maritza East 1 project area, the two principal tributaries are the Ovacharitsa River (an east to west flowing river that enters the Sazlijka River approximately 8 km upstream of the town of Galabovo) and the Sokolitsa River (an east to west flowing river at the southern limits of the town of Galabovo). The confluence of the Sokolitsa River with the Sazlijka River is approximately 16 km upstream of the confluence of the Sazlijka River with the Maritza River.

When the existing Maritza East 1 power plant was constructed in the early 1960s, an artificial cooling water reservoir was constructed by damming the Sokolitsa River and diverting its flow, forming what is today referred to as Rozov Kladenetz Lake, a 3.6 km^2 (18.6 million m^3 capacity) surface water impoundment located directly south of the existing power plant. Rozov Kladenetz Lake has since served as the once-through cooling water and fire water reservoir for the power plant. Water has been withdrawn from the lake at ambient temperatures and has been return to the lake as heated discharge. The water level in the existing lake has been maintained by diverting a portion of the flow from the Sokolitsa River (when sufficient flow is available, often for as much as six months of the year) and by pumping water from the Sazlijka River. Since its construction, in addition to serving as the cooling water/fire water reservoir for the power plant, the lake has become an important natural resource, supporting both recreational and commercial fisheries and serving as a gathering point for migratory birds.

5.3 Terrestrial Ecology

The new AES-3C Maritza East 1 power plant project is located near the confluence of the Sokolitsa and Sazlijka Rivers. From the confluence of these two rivers, the Sazlijka River flows in a southerly directly for approximately 25 km, prior to discharging to the Maritza River. This region is known as the Thracian Plan, and is located between the Sredna Gora Mountains to the north and the Rodopi Mountains to the south.

The Thracian Plain is generally flat, with low hills and gentle slopes predominating. Elevations in the vicinity of the project are approximately 100 m above sea level, and regional elevations range from approximately 100 to 200 m above sea level. Agricultural land uses predominate in the region, and include large areas of cultivated crops (eg cotton, maize), meadows, and orchards. Prior to conversion to agricultural land, the Thracian Plan was forested, with fixed oak forests as the dominant cover type. Within the general vicinity of the proposed project, especially along the lowland river valleys, remnants of forest communities remain. Remnant oak forests also occur in mountainous regions to the south of the Maritza River (eg the Rodopi Mountain range and foothills) and to the south-east and east. Many of these areas have remained forested because they are too steep to farm.

5.3.1 Fauna

The AES-3C Maritza East 1 power plant is located in the southern zone of the Thracian zoogeographic region. The Maritza and Tundza River valleys serve as natural corridors for

Mediterranean fauna to enter from the south. Numerous insect taxa found in the Thracian region are of Mediterranean origin. Up to 24 per cent of the region's nesting birds are Mediterranean species, and up to 22 per cent of the region's insectivorous mammals and rodents are Mediterranean species. Euro-Siberian and European wildlife species also occur in the project area. These species are presumed to have migrated to the region from the west, across the mountains in south-west Bulgaria.

Amphibian and reptile diversity in Bulgaria is among the richest in Europe. Sixteen species of amphibians (salamanders, frogs, and toads) and 36 species of reptiles (lizards, snakes, and turtles) have been reported.

Eighty-eight species of mammals occur in Bulgaria, including native and non-native (introduced) species (eg *Dama dama* and muskrats (*Ibdatra zubetguca*)). Nineteen species are included in the Red Data Book. Of these 88 species, four are marine mammals not occurring near the project site, and 27 species are bats (two are rare).

Although the region surrounding the Maritza East 1 power plant is largely in agricultural use, the interspersion of agricultural lands, remnant forest, successional old field, and shrub communities in the area may provide habitat for species such as European hare, fox, weasel, European polecat, badger and European marbled polecat.

The river valleys in the vicinity of the AES-3C Maritza East 1 power plant (eg the Sokolitsa, Sazlijka, and Maritza Rivers) serve as migratory flyways for a wide variety of avifauna. A major bird migration route (the "Via Aristolis" route) occurs along the Maritza River, to the south of the site. Some migrating birds passing through this route continue to the Bosphorus in autumn or to Northern Europe in spring. The primary migration route in Bulgaria is along the Black Sea Coast, and is known as "Via Pontica", or "Western Black Sea Migration Route".

Approximately 397 species of birds have been reported in Bulgaria; 225 of these species are known to nest in the country . This relatively rich avifauna is in part due to Bulgaria's position between wintering areas in Asia and Africa and breeding areas in western and northern Europe, as well as breeding areas in Bulgaria. Some birds from Northern Europe also winter in Bulgaria.

Approximately 100 to 150 bird species are likely to occur in the vicinity of the project. The largely agricultural landscape in the vicinity of the power plant can provide abundant forage for certain members of the bird community.

The presence of the Rozov Kladenetz Lake and Ovacharitsa Lake (both of which are man-made lakes built to support the region's power plants) adds diversity to the region's ecology; in particular, the avifauna benefits from the presence of these lacustrine water bodies.

Rozov Kladenetz Lake is a wetland that is important for wintering geese, pelicans, cormorants and other waterfowl. Several globally threatened species, including the Dalmatian pelican (*Pelecanus crispus*) and pygmy cormorant (*Phalacrocorax pygmeus*) are known to winter on this unfrozen lake. The lake also supports wintering populations of the cormorant (*Phalacrocorax carbo*), as well as a number of other water birds, including grebes, pelicans, geese, and herons. White-eyed bochard or Ferruginous duck (*Aythya nyroca*) have also been observed at the reservoir. Two other internationally endangered species, the lesser kestrel (*Falco naumanni*) and corncrake (*Crex crex*), have been reported in the vicinity of the Maritza 3 power plant.

5.4 Aquatic ecology

Limited information is available regarding the aquatic ecology of Rozov Kladenetz Lake. However, a similar impounded lake (Ovacharitsa Dam Lake) is located approximately 20 km to the north-east of the AES-3C Maritza East 1 power. Given that local experts feel that the two lakes have similar geomorphological and ecological characteristics, the extensive studies done at Ovacharitsa Dam Lake are used to characterize Rozov Kladenetz Lake.

Lowland power station cooling pond reservoirs, such as Rozov Kladenetz Lake or Ovacharitsa Dam Lake, are characterized by an active exchange of water, thick sediment layers with rich benthos, frequent oxygen saturation in the upper layers and low quantities of oxygen in the lower layers, and high maximum summer temperatures. Summer temperatures are typically at the 27 to 29°C range, but may reach summer highs of 37°C. Due to the thermal influence of the power plant, much of Rozov Kladenetz Lake provides year round, open water habitat.

Limited palustrine emergent wetland communities are present around the perimeter of Rozov Kladenetz Lake. Commons species in these areas include *Phragmites australis* and *Typha angustifolia*. Portions of the reservoir's banks have been planted with Austrian pine (*Pinus nigra*) and common locust (*Robinia pseudoacacia*), whereas along the Sazlijka valley typical riparian plants can be observed, such as willows (*Salix sp.*) and poplars (*Populus sp.*).

5.4.1 Fish

Approximately 100 to 122 species of freshwater fish occur in Bulgarian rivers, wetlands, and lakes, including brackish waters. More than 50 species or subspecies occur in southern Bulgaria. Fish species potentially occurring in rivers and lakes of the region include carp (*Hypophthalmichthys molitrix, Ctenopharyngodony idella)*, perch (*Carassius carassius*), chub (*Scardinius erythrophthalmus*), river mullet (*Leucicus cephalus*), black barbel (*Barbus meriodionalis petenyl*), Maritea barbel (*Barbus cyclolepia*), and Crimean barbel (*Barbus tauricus*). Other species known to occur in Ovacharitsa Dam Lake include *Rutilus rutilus, Tinca tinca, Aspius aspius, Albumus albumus, Abramis brama, Vimba melanops, Cyprinus carpio, Carassius auratus gibelio, Aristichthys nobilis, Gambusia affinis, Cobitis taenia, Silurus glanis, Stizostedion lucioperca, Perca fluviatilis, Gymnocephalus cernua, Lepomis gibbosus,* and *Proterorhinus marmoratus*.

The ichthyofauna of the nearby Ovacharitsa Dam Lake has also been well studied (Energoproekt, 1999). About 20 fish species have been observed in this reservoir, including *Rutilus rutilus,* River mullet (*Leucicus cephalus*), *Cyprinus carpio, Tinca tinca,* Perch (*Carassius carassius*), *Perca fluviatilis, Gymnocephalus cernua*, and *Albumus albumus.*

A number of the species found in the area are raised in commercial fish farms, which produce stocking material and fish for consumption. Carp, herbivorous species, silver carp, grass carp, rainbow trout, brown trout, buffalo fish, and channel catfish are among the preferred species for artificial reproduction and distribution. A fishing co-operative (fish farm) has developed along the shore of Rozov Kladenetz Lake. While commercial harvests of up to 20 different species could potentially occur, the numbers of fish harvested on an annual basis are not known.

5.5 Protected areas

The main objective of land protection initiatives in Bulgaria is to preserve both ecosystem biological diversity and the natural processes that occur in them. Specific Bulgarian conservation initiatives, as well as European and global conservation strategies are that are relevant to the Maritza East 1 project are summarized below.

5.5.1 Bulgarian law of protected areas

The Bulgarian Law of Protected Areas defines the following natural categories:

Reserves,

National parks,

Natural parks,

Managed reserves,

Protected sites, and

Natural monuments.

No officially protected areas under the Bulgarian Law of Protected Areas occur in the project region.

5.5.2 Wetland conservation strategies

The preservation of wetlands is one of the main priorities of the National Biological Diversity Conservation Strategy (1994). Wetland conservation is of great significance in Europe, including Bulgaria, where agricultural and industrial land use patterns have altered or destroyed many wetlands. Statistical data show that since the beginning of the 20th century the total area of wetlands in Bulgaria as a whole has been reduced 18-fold. The National Plan for Wetland Conservation gives priority to the most important natural sites. Bulgaria has ratified the Convention for Conservation of Wetlands of International Importance; an element of this initiative known as the Ramsar Convention provides protection for water birds.

The Ramsar Convention is an intergovernmental treaty that was signed in Ramsar, Iran in 1971. The official name of the treaty is “The Convention of Wetlands of International Importance especially as Waterfowl Habitat”. The Convention includes criteria to identify important wetlands and maintains a “List of Wetlands of International Importance”. To date, 119 countries are part of the Convention, including Bulgaria, which was the eighth (8th) country to joint on 24 January 1976. On 27 February 1986, Bulgaria signed the Protocol for introducing amendments to the Ramsar Convention (Paris Protocol).

Five sites in Bulgaria are included in the Ramsar Convention; four of these Ramsar sites are found along the Black Sea coast, and one is located along the Danube River. The first Bulgarian Ramsar Convention site was listed prior to 1981. The remaining four sites were listed in 1981 and 1996. The Bulgarian Ministry of Environment and Waters has the obligation in Bulgaria to establish an administrative structure for management and patrolling of all Ramsar Convention sites. Up until

1999, Bulgaria had a “Ramsar National Committee”, but this committee was recently disbanded and is no longer functional.

The Rozov Kladenetz Lake (approximately 735 hectares), located directly south of the Maritza East 1 project site, is not a Ramsar Convention site, and has not been officially proposed to be listed by Ramsar. The lake is described in The Ramsar Convention on Wetlands National Report of Bulgaria for COP7 (1999), as being “in the process of designation as a protected wetland”. This report also states that this lake is of “international importance due to the wintering of geese, pelicans, cormorants, and other bird species”.

The Rozov Kladenetz Lake is one of 88 water bodies/wetlands listed in the Bulgarian “National Action Plan for the Conservation of the Most Important Wetlands in Bulgaria – 1995”. At that time, Bulgaria proposed to study all 88 sites, but Ramsar did not have funds available to finance the required studies.

In order to formally classify the lake as a Ramsar site, the Bulgarian Ministry of Environment and Waters would have to complete an assessment of the lake and file a formal proposal for the lake. The assessment would need to provide information on the ecological state of the lake/wetland, define the threats and violations to the natural protection of the lake, and outline the priority measures needed to protect the wetland. Like the other sites listed in the National Action Plan, there is insufficient information on which to base a formal proposal.

Experts acknowledge that while the lake has some characteristics of a Ramsar site (ie the attraction to birds), its man-made condition and reliance on human activities to maintain its “bird-attracting” environment, make it unlikely that the necessary studies would ever be undertaken to complete a formal proposal. In 1992, Ramsar representatives visited 17 sites in Bulgaria to determine if further study was appropriate. Rozov Kladenetz Lake was not among the sites that they visited. In order to proceed with the Ramsar designation process, the lake would have to first be formally protected in Bulgaria (which it is not currently) and then be reviewed under the additional Ramsar criteria.

5.5.3 Co-ordination of information on the environment (CORINE) sites

Rozov Kladenetz Lake is listed as one of 141 CORINE sites in Bulgaria. CORINE was established as an experimental project by the Commission of the European Communities (now the European Environmental Agency – Copenhagen) to “gather, co-ordinate, and ensure the consistency of information on the state of the environment and natural resources” in the European Community. Priority areas include “biotopes for conservation, acid deposition protection of the Mediterranean environment, and improvement in comparability and availability of data and methods of analysing data”. This designation carries no national or international regulatory protection.

5.5.4 International protection of avian species

Many of the avian species known or suspected to occur at Rozov Kladenetz Lake are afforded international protection. Several of these species are globally threatened; the Dalmatian pelican (*Pelecanus crispus*), and pygmy cormorant (*Phalacrocorax pygmeus*) are both known to winter in this unfrozen, thermally influenced lake. Use of Rozov Kladenetz Lake by protected bird species, as well as species included in the Bulgarian Red Data Book.

5.6 Endangered and threatened species

The AES-3C Maritza East 1 power plant site occurs in an area of low importance for Biological Diversity in Bulgaria. This determination is from a composite mapping of several indices including species richness, number of endemic taxa, and numbers of rare (protected) taxa. The Red Data Book of Bulgaria, Volume II lists threatened and endangered species known to currently and historically occur in the Maritza East region.

5.6.1 Plants and invertebrates

The largely agricultural landscape in the vicinity of the AES-3C Maritza East 1 plant limits its use by many terrestrial endangered and threatened species. No rare or endangered plant communities are know to occur at or near the project site. Similarly, no Bulgarian or Balkan endemic plants are known from this local area. Although the power plant project site borders a region to the north and west of the Maritza River known to have more than 100 rare invertebrate taxa, no rare and endangered invertebrates are known to occur in the immediate vicinity of the project site.

5.6.2 Mammals

Nineteen mammal species are listed in the Red Data Book of Bulgaria. These threatened and endangered taxa include two species of bats, eight carnivores, one seal, two porpoises, one goat, and five small rodents. Only a few of these species have ranges that include the project site, including *Myotus emarginatus*, *Canis lupus*, *Myomimus roachi bulgaricus*, *Cricetulus migratorius*, *Lutra lutra*, and *Vormela peregusna*. Although several of these species could potentially occur in the region, it is likely that several of these taxa would require more remote habitats than the agricultural region surrounding the AES-3C Maritza East 1 power plant site provides.

5.6.3 Fish

Of 100 species of freshwater fish in Bulgaria, less than 20 species are included in the Bulgarian Red Data Book. Some of these include *Cyprinus carpio* (end.) *Anguilla anguilla* (end.), *Lota lota* (end.) *Lucioperca volgensis* (rare), *Neogobius Kessler* (end.) and *Benthuophilus stellatus* (rare). All of these species occur in the near the Danube River. Only the eel (*Anguilla anguilla*) could potentially occur near the project site in rivers that connect to the Aegean Sea.

5.6.4 Reptiles and amphibians

One turtle species, three species of lizard, eight species of snake, and a toad species are included in the Red Data Book. There are no records of any of the reptilian species (ie snakes, lizards and turtles) occurring near the project site between 1970 and 1985. Although there are no documented occurrence records it is possible that the toad *Polobates syriacus* (an endangered species) could occur in the region.

5.6.5 Avifauna

The AES-3C Maritza East 1 power plant project site is within a region of Bulgaria containing ‘moderate’ numbers of rare (protected) bird species. The largest numbers of rare taxa are in isolated mountain forest habitats, or in coastal wetlands along the Black Sea coast. No unique bird ecosystems or mapped critical habitats occur at the project site; the nearest such habitat is south of the Maritza River, in the eastern Rodopi Mountain Range and at the near Sakar Mountain. However, as discussed elsewhere in this report, Rozov Kladenetz Lake provides important overwintering habitat for a number of species of geese, pelicans, cormorants, and other waterfowl. Several globally threatened species, including the Dalmatian pelican and pygmy cormorant, are known to winter on this thermally influenced, unfrozen lake

5.7 Transport

5.7.1 Regional transportation network

The main means of accessing the region is via roadway and rail. The airport in Plovdiv, approximately 95 km west of the project site, is principally a domestic airport while the Sofia airport, located 245 km away is the main international airport. Passenger trains provide a daily service between Stara Zagora (located approximately 40 km north-west of the site) and Sofia. Otherwise, public transport within the region is principally via bus while private transport includes cars, motorcycles, horse drawn carts and bicycles. Additional rail lines, some owned by NEK and MME, provide direct access for lignite and freight delivery to the plant site.

Highway E-80 is the main roadway connecting southern Bulgaria and Turkey. From the border at Svilengrad, Highway E-80 heads north-west to Haskovo and Plovdiv. In this area the road is largely two lanes (one lane each way) with few traffic signals or other means of controlling traffic or limiting access. In the vicinity of Plovdiv, Highway E-80 becomes a divided four-lane limited access highway that continues west to Sofia.

For traffic heading north, the main highway is E-85, which proceeds north from Highway E-80 at Haskovo to Stara Zagora. Highway E-85 is located approximately 20 km west of Galabovo.

An alternative north-south route begins near the town of Harmanii along Highway E-80 where it proceeds north through Simeonovgrad, Galabovo and Radnevo. At Radnevo, northbound traffic can head north-west to Stara Zagora to connect with Highway E-85, or continue north to Nova Zagora. While traffic maps would indicate that the main north-south road from Svilengrad, Bulgaria on the Turkish border to Ruse, Bulgaria on the Romanian border would be via Highway E-85, observations at the project site indicate that substantial international truck traffic is choosing the second-class road that passes through Galabovo and directly in front of the project site.

5.7.2 Project site access

The access to the project site from Highway E-80, located approximately 22 km south of the site, is provided via the alternate north-south route previous described that passes through Simeonovgrad and then the Galabovo. Direct access to the site from Galabovo is via a two-lane road that connects Galabovo and the village of Obruchishte.

Three key traffic intersections in Galabovo are critical to the movement of the many large trucks that pass through the region. The first intersection is located on the south side of town and is a narrow “T” intersection. This intersection is without any signage or traffic control except to indicate the various destinations. Approaching from the south northbound traffic must execute a sharp turn to the right and cross over a narrow two-lane railroad crossing that has a barrier to prohibit movement when the tracks are in use. The road then heads in an easterly direction and passes by a number of large apartment buildings before making another sharp right turn at the second key intersection.

At the second intersection the main traffic flow is to the east. This traffic has the right of way relative to all other traffic movements that include either a left turn into the town of Galabovo or a continuation straight ahead on a road that passes on the east side of town, generally paralleling the Sazlijka River. After turning right, the road is two lanes in each direction going over the bridge before splitting at a large intersection where traffic flow is controlled by a large island, in the centre of which is the Galabovo town monument. After a right turn, heading east-north-east, the road continues in the direction of the power plant. The road width and condition vary substantially in this very short distance from being new, divided, and well maintained, to narrow and severely deteriorated on the approach to the plant.

In the immediate vicinity of the power plant, the road widens and provides dedicated areas for bus drop off on both the north and south sides of the road. Several elevated steam lines pass over the road with substantial clearance for the large transport trucks.

The third main intersection is immediately east of the power plant. Traffic through this intersection is controlled via three traffic islands. Traffic bound for Obruchishte and the Maritza East 3 power plant is uncontrolled while northbound traffic is controlled via a stop sign. After the stop the roadway is briefly divided as it passes under the steam pipes that connect the briquette plant to the ME1 power plant. Beyond the power plant and briquette plant the road is again two lanes that are undivided.

5.8 Noise

Background sounds in the communities surrounding the proposed project site are typical of rural villages that are adjacent to industrial developments. Primary sources of transient background sounds that influence the acoustic environment include:

- traffic on nearby roadways and railways
- sounds produced by domestic animals (dogs, chickens, donkeys, etc)
- sound produced by human activity
- indigenous sources of sound such as birds, insects and weather.

In addition, steady state background sounds produced by the distant industrial facilities are also audible. These sounds are only audible during periods when there is a void in the previously mentioned transient sounds (typically during the late night and early morning hours).

5.8.1 Representative monitoring locations

For this study, background sounds were monitored at four representative locations in the project area. In general, monitoring locations were selected on the basis of where sound impact from the new facility is anticipated to be greatest.

5.8.2 Sound monitoring programme

In order to document the time varying characteristics of environmental sounds, monitoring at the selected locations was conducted during the daytime and night-time hours of Monday, 14 February and Tuesday, 15 February 2000.

Attended interval (10-20 minutes) monitoring was performed at all four selected locations. These measurements were performed using a Quest Technologies Model 2900 Integrating/Logging should level meter outfitted with a ½ inch measurement interval using a Quest Technologies QC-10 sound level calibrator. During all measurements the sound level meter was tripod mounted with the microphone situated approximately 1.5 m above ground. This instrument confirms to ANSI S1.4-1983, IEC 651-1979 and IEC 804-1985 standards for Type 2 sound measurement instrumentation. For each measurement interval the following A-weighted sound level descriptors were recorded:

- maximum sound level (L_{max})
- minimum sound level (L_{min})
- percentile sound levels (L_{05}, L_{10}, L_{50}, L_{90})
- equivalent sound level (L_{eq}).

Wind speeds, temperature, other relevant meteorological data, traffic counts and subjective observations were also recorded for each measurement interval.

Percentile sound levels (L_{05}, L_{10}, L_{50}, L_{90}) are the statistical descriptors of the A-weighted sound pressure levels exceeded 5 per cent, 10 per cent, 50 per cent and 90 per cent of each interval monitored. The L_{90} represents the nominally lowest levels reached during the monitoring interval. The L_{90} is typically influenced by sound of low level, but nearly constant duration, such as constantly operating equipment or distant traffic lights. The L_{90} is often used to quantify the existing background sound level. Conversely, the L_{05} represents the highest sound levels reached during a monitoring interval. The L_{05} is typically influenced by sound of high level, but short duration, such as that produced by vehicles passing by the measurement location.

The equivalent sound level (L_{eq}) is the energy average sound level and is influenced by both sounds of low level and long duration, as well as sounds of high level and short duration. Bulgarian Standards and World Bank Guidelines use the L_{eq} for expressing limits for time varying sound sources.

5.8.3 Monitored sound levels

Table 5.2 presents a summary of the existing environmental sound levels (L_{eq} and L_{90}) measured at each of the four selected monitoring locations.

TABLE 5.2
SUMMARY OF MEASURED NOISE DATA FOR EXISTING CONDITIONS

	Existing A-weighted sound levels (dBA)			
	L_{eq} (day)	L_{90} (day)	L_{eq} (night)	L_{90} (night)
Location 1	57	41	47	37
Location 2	54	38	53	36
Location 3	50	39	42	38
Location 4	56	43	49	41

With the exception of the night-time measurements performed at Location 3 there is a significant difference between the background (L_{90}) sound level and the equivalent sound level (L_{eq}). This indicates that for the most part, sound at the selected sites is dominated by transient events produced by car and truck passbys. Locations 1 and 4 are the closest to active roadways, and as would be expected the sound levels measured at these locations were higher than at the other two locations. The fact that night-time background sound levels (L_{90}) are typically above 35 dBA indicates that steady-state background sounds produced by existing industrial facilities are audible only when traffic noise is negligible.

6. EXPECTED ENVIRONMENTAL IMPACT

6.1 Ecology

The construction of the new AES 3C Maritza East 1 power plant will largely occur within the boundaries of the existing industrial site and is anticipated to have little to no impact on terrestrial ecology during the construction phase. No significant impacts will occur to the soils and the vegetation outside of the footprint of this previously disturbed area. No rare and endangered species of plants and animals have been identified in the vegetation communities occurring within the proposed construction zone.

Since the new plant will be built within an existing industrial area, any increased noise caused during construction and operation is not expected to have significant impacts on local wildlife.

6.2 Cultural heritage

As proposed, the project is not expected to impact known and identified archaeological or historic resources. Most of the development will take place on already disturbed lands. Of the two Class 1 sites identified in archaeological investigations undertaken for this project, one is within the Maritza East 1 power plant site and already protected by a fence; the second is off site and outside the area of planned construction.

Encroachment into either of the two identified areas would result in additional investigation to further determine archaeological significance. This would be undertaken by the local museum located in Radnevo. Once construction is completed, there is nothing in the on going plant operations that should affect identified cultural resources. The integrity of the protected cultural resource that is on the project site will continue to be maintained so as to insure that routine plant operations do not affect this area.

6.3 Noise

The construction of the power plant will take approximately 36 months. Since construction machines operate intermittently and the types of machines in use at the construction site change with the phase of the project, noise emitted during construction will be highly variable. However since the nearest residential properties are located approximately 1500 m from the project site, it is estimated that construction noise will rarely exceed existing levels. Consequently, construction activities are expected to have minimal and temporary impacts on the noise environment in the communities south and west of the project site.

Once operational the proposed facility will produce noise that will occasionally be perceptible at the nearest residential receptors. The operational levels as estimated for the four measured locations are within both the Bulgarian and World Bank daytime and night-time limit of 70 dBA in industrial areas.

6.4 Socio-economics

The construction of the new plant will not impact employment at the existing Maritza East 1 power plant. The proposed project does not require or mandate the closing of the existing Maritza East 1 power plant or the currently operating briquette manufacturing plant. Throughout the three-year construction period, both plants are expected to continue normal operations.

The most significant socio-economic impact the proposed project will have during the construction period is increased employment in the Galabovo area. This is an important benefit to the local area, as the unemployment rate in the Municipality of Galabovo is estimated at 13.9 per cent.

An average of 1245 workers per month would be required during the construction period. In addition to the direct employment impact during construction, the indirect generation of construction jobs and part-time jobs (ie less than 40 hours a week, or less than a full-time equivalent), would increase the peak construction work force to an estimated 2600 workers.

The project will have positive economic impacts on the local region. Construction of the new plant will result in a large infusion of capital into the project region. The total construction cost of the project is estimated at $700 million, of which up to $150 million could be earned by Bulgarian companies.

6.5 Water Quality

Water discharge related impacts associated with the construction of the power plant include sanitary waste water management, storm water management, and management of construction-dewatering groundwater discharges. Implementation of appropriate controls, best management practices, and mitigation will ensure that construction phase water resources impacts will not be significant.

During operation water for use in the power plant will be withdrawn from Rozov Kladenetz Lake using the pump station serving the existing Maritza East 1 power plant. As a zero-discharge facility the waste waters will be recycled and reused within the facility. As a result there will be no discharges of wastewaters to local surface waters, therefore there should be no impacts associated with waste water discharges.

The cooling towers are BAT as described in the EU BREF notes for large combustion plant and industrial cooling systems.

6.6 Air Quality

Air quality in the Galabovo area has historically been poor due for the most part to high level of emissions of Sulphur Dioxide, Oxides of Nitrogen and particulate matter from the 3 existing power plant, Maritza East 1, Maritza East 2 and Maritza East 3. The high level of emissions for these pollutants is a result of the poor quality of the lignite fuel (mined locally) that has a high sulphur content and the lack of sufficient abatement techniques at these plants to deal with such pollutants. The plants at Maritza East 2 and Maritza East 3 are retrofitting abatement technology that will help reduce their impact to air quality though the existing Maritza East 1 is not.

As part of this Environmental Impact Assessment an air dispersion exercise was undertaken to assess the likely impact of the proposed plant on the surrounding environment. This involved the modelling with a second generation air modelling programme (AERMOD) utilising 5 years of metrological data from a nearby metrological station. This modelling assumed a worst case of the AES-3C Maritza East 1 plant operating continuously throughout the year and assessed the likely concentrations of $SO_{2,}$ NOx and particulate matter. The modelling results for SO_2 showed that;

- Emissions from the proposed AES-3C Maritza East 1 power plant are low, especially when compared with those from the other plant in the Maritza area. The AES-3C Maritza East 1 power plant in isolation provides a maximum of 41.62 $\mu g/m^3$ representing just 11.7 per cent of the Bulgarian and EU 25th highest hourly limits.

- The 4th highest 24 hour maximum observed was 51.85 $\mu g/m^3$ representing 37 per cent of the Bulgarian limit of 125 $\mu g/m^3$. The 24 hour maximum observed was 121.41 within the 150 $\mu g/m^3$ limit set by the World Bank. This figure is nearly twice that of the next highest 24 hour maximum of 68.13 $\mu g/m^3$.

- The maximum annual concentration observed for the AES-3C Maritza East 1 power plant was 1.74 $\mu g/m^3$ representing just 8.7 per cent of the Bulgarian and EU limit of 20 $\mu g/m^3$ and just 2.2 per cent of the World Bank limit of 80 $\mu g/m^3$.

Results for NOx showed that;

- Emissions from the proposed AES-3C Maritza East 1 power plant are low. The AES-3C Maritza East 1 power plant in isolation provides a maximum NOx concentration of 41.62 $\mu g/m^3$ representing just 20.8 per cent of the Bulgarian and EU 19th highest hourly limits of 200 $\mu g/m^3$.

– The 24 hour maximum observed was 60.74 μg/m^3 representing 45.5 per cent of the 150 μg/m^3 limit set by the World Bank.

– The maximum annual concentration observed for the AES-3C Maritza East 1 power plant was 0.87 μg/m^3 representing just 2.9 per cent of the Bulgarian and EU limit of 30 μg/m^3 and just 0.87 per cent of the World Bank limit of 100 μg/m^3.

Results for particulate matter showed that:

– The 36th highest 24 hour maximum observed was 0.27 μg/m^3 representing 0.9 per cent of the 30 μg/m^3 limit set by the EU and Bulgarian legislation while representing just 0.18 per cent of the World Bank limit of 150 μg/m^3

– The maximum annual concentration observed for the AES-3C Maritza East 1 power plant was 0.13 μg/m^3 representing just 0.7 per cent of the Bulgarian and EU limit of 20 μg/m^3 and just 0.26 per cent of the World Bank limit of 50 μg/m^3.

There are other sources of pollution to air from the proposed AES-3C Maritza East 1 Plant. These include the auxiliary boiler fired with diesel oil that will only operate at start up (typically for 50 hours per year), an emergency diesel generator to provide electricity to safely shut down the power plant on loss of normal electricity supplies (which would only operate typically for 12 hours per year for testing), emergency diesel driven fire pump which will only operate to provide fire fighting water during loss of normal electricity supply (that would only operate for 12 hours per year for testing),liquid fuel storage tanks which will emit very small amounts of hydrocarbon vapour and fugitive dust emissions, from lignite and limestone handling areas. All these sources of air pollutants will provide very small, intermittent additions to the main pollutant source, the lignite fired boilers.

The emissions concentrations for the lignite fired boilers are:

–	Sulphur dioxide	less than 400 mg/Nm^3.
–	Nitrogen Oxides	less than 200mg/Nm^3.
–	Dust	less than 30 mg/Nm^3.

These are in accordance with the EU LCPD and the plant used to control these emissions (ESP and FGD) are BAT for lignite fired boilers of this size as described in the EU BREF note for large combustion plant.

The method of storage of lignite is BAT as described in the EU BREF note for large combustion plant.

The storage and handling of all oils, chemicals and water is BAT as described in the EU BREF note on storage.

The emissions monitoring systems are all generally in accordance with the EU BREF note on monitoring and are BAT.

The AES 3-C Maritza East 1 plant meets all emissions criteria as defined by the Bulgarian Government, the EU and all other relevant authorities unlike the plants at Maritza East 2 (smaller units) and 1 which will either have to retrofit abatement technology in the next few years or face the prospect of limited hours operation and eventual closure after 2008.

As part of this EIA ground level concentrations of pollutants emitted from the proposed AES 3-C Maritza East 1 plant have been modelled and found to be well within the Bulgarian and EU limits. It was found that the proposed plant would have an insignificant effect when compared to the existing Maritza East plants, indeed should the proposed AES 3-C Maritza East 1 plant be built and reduce the load factor at these plants an improvement in air quality would be achieved

6.7 Traffic and infrastructure

During the 36 month period of construction, traffic in the site area will increase due to the delivery of goods and materials and the twice-daily arrival and departure of site construction workers. Estimated employment at the peak of construction will be approximately 2600. Based on current employment patterns and the substantial skill base within the larger Stara Zagora economic area, it is expected that most workers will commute to the job site from within the region. Because of the current level of bus traffic in the area, the addition of buses transporting construction workers, when timed to not coincide with the shift changes at existing plant, will result in an overall increase in area traffic but should not result in a substantial increase in the peak average hourly traffic rate.

Delivery of materials and supplies will be by rail and truck. The very largest items, such as the plant turbines, will be sent by ship to the port of Varna, which is east of Galabovo on the Black Sea coast. From there, these as well as materials being sent from Sofia, will be transported to the site by train using a combination of public and private rail lines. Some materials deliveries will also be made exclusively by truck. Vehicles used for such transport will be similar in size and weight to the large, international transport trucks that now frequent the roads in the vicinity of the power plant and should not significantly impact on local or regional traffic patterns.

During operation plant employment is expected to total no more than 250. This increase is not expected to impact the three traffic intersections considered most critical to maintenance of local area traffic flow. Most workers will commute to the plant site via bus. Delivery of supplies to the plant area will increase. Increased coal quantities will be brought by private rail. Limestone will also be delivered via private rail lines. Truck transport will increase but area traffic flow should be unaffected. Facility-related truck traffic is expected to represent only a small increase in overall area traffic but not contribute to a decreased level of service.

6.8 Associated developments

6.8.1 Lignite mines

The operation of the AES-3C Maritza East 1 will ensure the continued operation of the lignite mines in the Maritza East Area. No new permits or consents will be required for the extraction of lignite for the AES-3C Maritza East 1 plant. The environmental impact of the mining operation will be unchanged. There will be a minor increase in the rail traffic in some areas.

6.8.2 Limestone Quarries

The installation of FGD on all the units at Maritza East 2 and Maritza East 3 will result in a large increase in quarrying of limestone. The operation of the AES-3C Maritza East 1 plant will result in a further increase in limestone production and transport. The increased output from the quarries does not require new permits or consents. There will be increase in the environmental impacts from the increased quarrying of limestone. These impacts will include some increase in fugitive dust emissions, noise and transport impacts (both from increased employment and increased rail traffic.

The electrical output of Maritza East 2 and Maritza East 3 exceeds 2000 MW and the limestone supply to these plants will cause the increased environmental impacts from quarrying. The further demands for limestone from the 600 MW AES-3C Maritza East 1 Plant will have a proportionately smaller environmental impact.

6.8.3 Overhead transition lines

To export the 600 MW of electricity from the AES-3C Maritza East 1, modifications will be required to the substation south of Galabovo and a new 400 kV transmission line from the AES-3C Maritza East 1 plant to the substation. The route of the 400 kV overhead lines will probably follow the route of the existing transmission line from the existing Maritza East 1 power plant.

NEK will be responsible for construction of this new overhead line and modifications to the substation. NEK will be responsible for obtaining all necessary consents and permits for overhead lines and substation modifications. As the route of the overhead transmission line is expected to follow an existing line (and possibly replace this line) it is not anticipated that there will be any major issues with regards to permitting and construction of this line.

6.8.4 Ash and gypsum disposal

As described in section 2.2 above it is proposed to store the ash and gypsum in temporary storage silos on site and transport the ash and gypsum separately by rail or private road to the existing Dryanovo dump site. The Dryanovo dump site has been used as an area for disposal of overburden from the lignite mining operation from the lignite mining operation. Revised disposal transport arrangements have resulted in cessation dumping overburden at Dryanovo. It is proposed to create separate landfills for ash and gypsum at Dryanovo. These would be designed in accordance with Bulgarian legislation and the EU Landfill Directive.

Any potential fugitive dust emissions from the transport and disposal of ash and gypsum would be controlled by conditioning of the ash with 15 per cent moisture (the gypsum already contains 30 to 40 per cent moisture). Water sprays would also be installed at the landfill to prevent any fugitive dust emissions during prolonged periods of dry weather. The boundaries of the landfills would be planted with appropriate shrubs and bushes, which would further limit fugitive dust emissions.

Leachate from the landfills and surface water run off would be collected in impermeable ponds and used for dust suppression. No discharges of water from the landfill site are anticipated. The Landfill will require the necessary permits and consents.

7. MITIGATING MEASURES

The Project Company is committed to minimizing environmental impacts of the project during construction and operation. The project is designed to achieve compliance with applicable regulatory limits as they relate to air emissions, water withdrawal and discharge, noise and solid waste management. This Section discusses project design-related mitigation measures as well as mitigation measures that the Project Company is committed to implementing as best management practices during construction and operation of the proposed project to ensure compliance with Bulgarian and European Union environmental regulations and World Bank guidelines.

7.1 Project design-related mitigation measures

The proposed AES-3C Maritza East power plant will be located on the existing Maritza East 1 plant site, north of the current power plant. It will take advantage of some of the existing facility's infrastructure including rail lines, cooling water and fire water intake structure and pumping facilities. As the redevelopment of a brownfield industrial site, there is less potential environmental impact than there would be in developing a comparable facility at a greenfield site. Specific project design mitigation measures are described below.

7.1.1 State-of-the-art pollution control technology

The proposed project will be more efficient and have lower emissions of sulphur dioxide per MW of electricity generated than the existing Maritza East 1 facility. The facility will have low NO_x emissions, use an electrostatic precipitator to control the emissions of particular matter and a flue gas desulphurization system to control emissions of sulphur dioxide.

The existing Maritza East 1 plant discharges heated cooling water to Rozov Kladenetz Lake and storm water and waste water to an existing ash pond. In contrast, the new facility will have zero discharge of waste water. Condenser cooling will be provided by a natural draught cooling tower fed in part by process waters. This recycling of water for the cooling tower will significantly reduce the amount of water withdrawn from the lake. In addition, cooling tower blowdown and other potential facility discharges (e.g. boiler blowdown, plant drains, and demineralisation system reject waters) will be used within the wet limestone flue gas desulphurization system.

7.1.2 Physical plant layout

The location of the cooling tower, in the north-west section of the site, is well removed from nearby residential areas that are south-east and south-west of the site and is beneficial from the standpoint of potential noise impacts. The location of the lignite and limestone unloading facilities is also such that off-site noise impacts are minimized.

A comprehensive list of features built into the design of the project that serve to minimize the potential for environmental impact are summarized below in Table 7.1.

TABLE 7.1
PROJECT DESIGN FEATURES THAT MITIGATE POTENTIAL ENVIRONMENTAL IMPACTS

Feature	Environmental influence
Low NO_x burners	• Reduces nitrous oxide (NO_x) emissions, ensuring compliance with regulatory emission limits and ambient air quality standards.
Electrostatic precipitators	• Reduces particular emissions by >99.5 per cent, ensuring compliance with regulatory emission limits.
Wet limestone flue gas desulphurization system	• Reduces sulphur dioxide (SO_2) emissions by >95 per cent, ensuring compliance with regulatory emission limits.
Use of process water for cooling and the FGD system	• Reduces cooling water withdrawals from the lake.
Zero discharge of process waste water	• Eliminates thermal and chemical impacts associated with discharges to Rozov Kladenetz Lake.
Redevelopment of existing brownfield industrial site	• Reduces construction of new infrastructure • Avoids conversion of land resources to industrial uses, as well as impacts on terrestrial ecology • Minimizes or eliminates visual impact of new facility.
Enclosure of conveyors, crushers, boilers, and air pollution control systems and provision of outlet silencers on induced draft fans	• Reduce noise levels at off-site receptors.
Placement of cooling tower at the rear of the property	• Reduce noise levels at off-site receptors.
Secondary containment of fuel oil storage areas	• Reduces the possibility of a release and the contamination of soil and/or ground water.

7.2 Mitigation measures during construction

The main environmental, social and economic impacts during the construction period are those typical of any large construction project. These include traffic congestion and delays due to the transportation of workers and materials, noise resulting from the operation of machinery, the temporary accumulation of soil and equipment, generation of dust from the movement of heavy vehicles, and localized noise and air pollution from the diesel exhausts of such equipment. These impacts will be temporary and are not expected to be significant due to the site location and favourable conditions of the existing infrastructure in the region.

7.3 Mitigation measures during power plant operation

The power plant has been designed to meet Bulgarian, European Union and World Bank guidelines. Table 7.1 listed the many design features that will minimize the project's impacts to the environment. Additional measures that are anticipated as part of plant operation are summarized below.

7.3.1 Storm water management

The proposed AES-3C Maritza East 1 power plant will have three distinct areas with respect to storm water runoff: the lignite pile area, several outdoor oil handling and storage areas, and the remaining main power block area. Stormwater runoff from the lignite pile and lignite train unloading area will be routed to a newly constructed lignite pile runoff pond. This pond will be sized to store runoff from precipitation events of to and including the 10 year 24 hour storm event (estimated at approximately 122 mm of rainfall). Water collected in the pond will be treated (eg pH neutralization, if required) and routed to the raw water treatment plant.

Storm water from the bermed HFO oil storage tank areas, from the HFO unloading area, from any outdoor DFO storage handling areas, and from the planned electrical substation area could potentially contain oil and will, therefore, be routed to one or more oil/water separator units. Clarified effluent from the oil water separators will be routed to the raw water treatment plant.

Storm drainage for the new main power block area will be routed to a small runoff pond, sized to store runoff from the 1 year 24 hour storm event (estimated at approximately 50 mm of rainfall). This smaller pond will be sized to capture and allow settling of "first flush" suspended solids typically runoff from the first 30 minutes of the rainfall event).

Occasional storm water overflows from the smaller power block storm water pond and less frequent overflows from the larger lignite pile runoff pond are expected to be generally free of suspended sediment. These overflows will be routed to the Sazlijka River and will be discharged at a point prior to the Sazlijka River's confluence with the Sokalitsa River.

7.3.2 Solid and liquid waste management

Solid and liquid wastes generated during the operations phase for which the project company is responsible for disposal will include domestic office wastes (paper, packaging materials, general refuse), non-toxic industrial solid wastes (disposable filters, rags, spent desiccant material, machine shop wastes, empty drums and containers) and water/waste water treatment residuals.

Water treatment process residuals, consisting primarily of a calcium carbonate and aluminium hydroxide sludge, will be discharged to the FGD plant for reuse. Sanitary waste water treatment plant sludge will be tested and, if acceptable, used as fertilizer or for land reclamation. If necessary, and if approved by the municipality, this sludge will be dewatered and disposed of in the municipal solid waste landfill.

Operation of the power plant will generate other non-hazardous wastes, in addition to those previously discussed. These will include domestic office wastes (paper, packaging materials, general refuse) and non-toxic industrial solid wastes (disposable filters, rags, spent desiccant material, machine shop wastes, empty drums and containers). These miscellaneous non-hazardous solid wastes will be collected and, with local approval, disposed of at the Galabovo municipal solid waste landfill.

Ash and gypsum will be disposed of in a landfill (former mine overburden area) that will be designed and managed according to Bulgarian, EU and World Bank standards.

7.3.3 Dust control

All ash and gypsum will be disposed of in a new, off-site landfill. The potential for dust emissions from this facility will be minimized due to the moisture content of the waste produced and the solidification that occurs as gypsum becomes dewatered. Ash will be kept in moist conditions and thus there is no chance of dust formation from this source.

8. ENVIRONMENTAL MANAGEMENT AND MONITORING

The project company is committed to responsible environmental management and monitoring in accordance with applicable regulations. This section provides the outline of the management structure that will be use during construction and operation and summarizes the currently anticipated monitoring and reporting requirements. It is expected that both of these will be expanded upon and formalized later in the project's Environmental Management and Monitoring Plan (EMMP).

8.1 Environmental management

During the construction phase of the project, AES/3-C will establish a three level organizational structure to manage environmental and safety issues. The construction phase of the project is defined as actual construction activities, start-up and commissioning activities, and any other relate activities that occur before the project is certified as operational. This organization will be modified and supplemented as the project moves towards operation, such that at project start-up, a new operational phase organization will be in place.

The Construction Manager, as the first level of organizational structure, will assume primary responsibility as the "Environmental Director" for the construction phase programme. Senior staff, such as the activity based Construction Management Team members, will make up the second level of the organizational structure and will be responsible for ensuring that environmental, health and safety plans and programmes are properly implemented. Construction Management Team members will also monitor contractor's compliance with environmental mitigation measures and contingency plans. The construction contractors, both prime and subcontractors, (i.e. EPC contractor, construction supervisors, construction works, shift technicians, maintenance technicians etc) will make up the third level of the organizational structure and will be responsible for effectively implementing the directives of the EMMP.

The Plant Manager, as the first level of the organizational structure, will assume primary responsibility as the "Environmental Director" for the operational phase of the programme. It is often the case on AES projects that the Plant Manager will have previously served as the Construction Manager and so will already have a good understanding of the project. During operation, function based Areas Superintendents will make up the second level of the organizational structure and will be responsible for ensuring that environmental, health and safety plans and programmes are properly implemented.

The plant operation and maintenance personnel will make up the third level of the organizational structure and will be responsible for effectively implementing the directives of the EMMP.

8.2 Environmental monitoring

Preliminary monitoring plans have been developed for the construction and operation phases of the proposed power plant. An environmental sampling programme has been designed to assess any background contamination at the site. The plans have been designed and will be implemented to collect data on project related releases of pollutants of concern and on ambient environmental conditions, to ascertain the impact of these potential releases. The main elements of the monitoring plans are identification of the parameters of concern, specification of the methods of collecting and handling of samples (including the location, frequency, type and quantity of samples, and sampling equipment), sample analysis, and a format for reporting the results.

Some limited pre-construction site investigations and monitoring are anticipated to address those areas where existing data is insufficient to completely characterize current conditions.

8.3 Employee training

Employee training will be an important component of project development. The project anticipates training relative to all aspects of Bulgarian regulations (environmental as well as occupational health and safety) with which many employees may already be familiar. Just as important it anticipates training relative to its own health and safety standards as well as those of the EU and World Bank. AES corporate goals on health and safety and environmental improvement will be part of the orientation programme conducted for all people employed at the facility, both during plant construction and operation. AES operates an intensive global safety monitoring programme with "task forces" carrying out routine safety audits that will include the Maritza East 1 facility when it is operational. Under the direction of the Maritza East 1 Construction Manager (during construction) or Plant Manager (during operation), employee training programmes will be developed that are specifically designed to address the health and safety and environmental issues that will be faced by the employees working on site.

All employees scheduled to work on site during construction will be briefed on the contents of the more detailed Environmental Management and Monitoring Plan (EMMP) that will be developed for the project. The project site is immediately adjacent to the area that is important for migratory bids and local NGOs have expressed concern about the hunting of protected bird species. The EMMP, therefore, will include training to ensure that any workers from outside the area are fully informed about hunting restrictions and in particular about the protected status of species known to frequent the lake. On an as needed basis, as determined by the Construction Manager and Construction Management Team members, additional training will be provide to specific groups of employees with regard to activity specific health and/or environmental issues and with regard to the specific requirements of the various construction phase monitoring programmes. As construction progresses, additional health and safety or environmental management training may be required to address specific issues that arise.

During operation, all new employees, as a condition of employment, will receive training in health and safety and environmental management prior to beginning work at the facility. Depending on their respective duties, certain personnel will receive additional training related to materials handling, environmental monitoring, environmental compliance auditing, environmental compliance document preparation, emergency response, and other function specific topics. Refresher training will be provide to employees on an annual basis.

Prior to the start of construction a project Environmental Management and Monitoring Plan (EMMP) will be developed. This document will provide an overview of the planned construction and identify the parties responsible for site environmental management. Standards that must be followed to ensure regulatory compliance will be detailed along with procedures to follow in the event of a spill or accidental release. In addition, the EMMP will identify any required monitoring and reporting and the procedures to be followed. As the project nears operation, this will be revised to include reporting and procedures applicable to that phase of operation.

8.4 Integrated Pollution Prevention and Control

The IPPC permit (known in Bulgaria as the Complex permit) is the instrument used by the Bulgarian Authorities to monitor and control operation of the proposed AES-3C Maritza East 1 Power Plant. The IPPC Permit requires operation of the plant and emissions to the environment to be monitored. It requires an Environmental Management system to be in place. The EMS has to:

- List all staff responsible for compliance with the permit.
- All persons responsible for achieving compliance.
- Yearly assessment of the need for training and training programmes.
- Maintaining up to date information of responsible persons and those to be contacted in an emergency.
- Written instructions for monitoring technical and emission parameters in accordance with the permit.
- Written instructions for identifying all non conformities and remedial actions taken,
- Written instructions for updating any operating instructions following an accident or non conformities.
- Written instructions for identifying hazardous substances stored on site.
- Instructions for identifying possible accident scenarios that could cause environmental or health damage.
- An emergency plan including allocation of staff responsibilities, staff availability, meeting points, evacuation routes, and accident warning systems.
- Instructions regarding fire fighting

The IPPC permit also requires record to be maintained of monitoring data, non conformities, remedial actions and operating instructions. The IPPC permit requires the reporting of monitoring results in an annual environmental report. The permit requires monitoring of:

– Continuous emissions monitoring of SO_2, NOx and particulates released to the air.

– Monthly consumption of water (process and cooling water), energy (electrical and heat consumption), and raw materials including fuels.

– Monthly quantity of waste generated.

– Noise levels

– Ambient air quality at Galabovo for SO_2, NOx and fine dust particles.

– Cooling water pH value.

– Ground water.

– Soil.