1 EXECUTIVE SUMMARY

1.1 BACKGROUND

The Power Sector of Albania is managed by KESH, a vertically integrated utility with generation, transmission, and distribution assets. KESH is also responsible for purchased power and energy exchange with several neighboring countries. KESH is a monopoly and, for practical purposes, is the only company in the Albanian electricity sector.

Presently, the Albanian electric power system is experiencing severe problems. Hydropower represents more than 98 percent of Albania's domestic generation. According to the Strategic Action Plan, dated February 28, 2001, and prepared by the Albania Power Sector Reform Task Force, KESH is facing unusual severe drought conditions and has had to curtail electricity service to consumers in some regions for up to 10 to 12 hours per day.

The daily electricity consumption in wintertime is about 22 million kilowatt hours (kWh) per day. Under normal weather conditions, the domestic hydroelectric generation is 7 to 13 million kWh per day, while generation from thermal power plants is only 1.2 million kWh per day. Therefore, the domestic electricity production cannot meet the demand, forcing Albania to become a net electricity importer.

As can be seen, Albania lacks reasonable security and reliability of its electric energy supply and the Task Force has recommended that the Parliament should implement a comprehensive energy policy that includes the addition of new generation taking into account both least cost options and fuel diversity to assure a reliable supply of electricity throughout the year. As a result, the Ministry of Industry and Energy and KESH has begun to study the technical and financial viability of installing new base load thermal generation facilities in Albania.

A generation expansion plan was developed for the country by a consortium of European firms. This consortium includes Deutsche Energie-Consult Ingenieurgesellschaft (DECON), Electricité de France (EDF), and LDK Consultants. According to the generation expansion plan, power supply in Albania will become increasingly vulnerable without new thermal generation due to the country's high dependence on hydropower, lack of rainfall, and uncertain power imports. The report stresses the need to accelerate both detailed project design and further project planning to increase the generation share of thermal power generation in the country. Developing more thermal power generation in Albania represents a prudent approach towards avoiding a too high dependence upon potentially uncertain hydropower resources and power imports.

The United States Trade and Development Agency (USTDA) awarded a grant to the Government of Albania to assist in the development of a new thermal generation facility. The Albanian Ministry of Industry and Energy subsequently retained Montgomery Watson Harza (MWH) to perform three tasks. Task One was to evaluate and select the best site, technology, and fuel for a new base load, thermal generation facility. Task Two was to conduct a feasibility study to evaluate the technical requirements as well as the environmental, economic, and financial viability of the generation facility at the selected site.
Finally, Task Three was to conduct an Environmental Impact Assessment (EIA) of the proposed generating facility. This work commenced in 2001.

In Task One, MWH evaluated seven potential sites including sites near Durrës, Elbasan, Korçë, Fier, Shëngjin and two sites near Vlora – Vlorë A and B. The sites were evaluated using an automated methodology, which scored each site on a number of development criteria such as fuel supply, water supply, transmission availability, cost, and environmental considerations, among others. A Draft Siting Report documenting the results of Task One was issued on June 6, 2002 and recommended Vlora B, hereafter refer to as the Vlora site, as the best site and distillate oil-fired, base load, combined cycle generation as the best generation technology. Moreover, the Report did not identify any initial fatal flaws in regards to fuel supply, water supply, transmission availability, and environmental considerations. On June 21, 2002, the Ministry of Industry and Energy and KESH agreed with MWH’s recommendation and provided authorization to proceed with Task Two.

Based on the site location, technology, and fuel selected in Task One, MWH conducted a detailed feasibility study in Task Two to evaluate the technical requirements as well as the financial, environmental, and social viability of the potential generation facility at the selected site. More specifically, MWH:

- Developed technical requirements for the proposed generation facility
- Developed project cost estimates
- Conducted economic and financial analyses
- Conducted a preliminary environmental analysis

The Feasibility Study focused on the development of a facility with an installed capacity range of 90 to 130 MW. The Study reconfirmed the following recommendations that were originally provided in the Siting Study, namely:

- Vlora is the best overall site for the installation of a new base load thermal generation facility
- Combined cycle technology is more advantageous than coal-fired steam technology for new base load generation in Albania
- A distillate-oil fired combined cycle generation facility is technically, environmentally, economically, and financially feasible.
- The Vlora site has the lowest levelized generation cost of power compared to the other sites.

The study was completed on October 21, 2002 and subsequently approved by KESH. MWH was then authorized to proceed with Task Three, which was to conduct the EIA on the Vlora site.
In addition, the generation expansion plan performed by DECON-EDF-LDK independently confirmed the results of MWH’s analysis, that a distillate oil-fired combined cycle generation facility located at the Vlorë site was the best new generation option for Albania.

1.2 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS

1.2.1 EIA Requirements

It is anticipated that the World Bank, the European Bank for Reconstruction and Development (EBRD), and the European Investment Bank (EIB) will jointly provide the debt financing for the proposed Vlorë power generation facility. Each financing institution has specific policies and procedures for promoting environmental protection and sustainable development. These procedures include a detailed environmental review process and preparation of an EIA prior to final approval of financing for the project. The EIA for the proposed Vlorë facility was prepared in accordance with the requirements of all three financing institutions as well as the European Union standards. The requirements of the cofinancers are similar in nature and the most stringent of the four standards have been incorporated into this EIA. For simplicity, the standards are reference hereafter as international standards.

The EIA provides a summary of available information on the baseline site conditions including the physical and atmospheric conditions, water and biological resources, cultural resources and socioeconomic conditions of the area. In the EIA process, information on the baseline site conditions along with the applicable standards and norms are used to assess the potential environmental and social impacts of the proposed generation facility.

The potential environmental impacts considered in the EIA process include impacts to the air quality, water resources, land resources, and socioeconomic/cultural conditions during construction and operation of the generation facility and associated transmission infrastructure. The social/cultural resources evaluated include labor employment, land use, raw material sources, fisheries, coastal navigation, transportation, and local community services.

The EIA also presents mitigation measures to be employed to help prevent or minimize the environmental and social impacts of the project. These are included in an environmental management plan (EMP), which can be seen in detail in the report. The EMP consists of the set of mitigation, monitoring, and institutional measures to be taken during construction and operation of the planned generation facility to eliminate, offset, or reduce adverse environmental and social impacts. The plan also includes the actions needed to implement these measures. Moreover, the EIA outlines specific environmental management and monitoring plans and identifies any necessary reporting requirements and schedules.

1.2.2 Project Description

The following discussion provides an overview of the key features of the planned thermal generation facility in Vlorë as they relate to the EIA analysis.
Site Description

The selected Vlorë site is a six hectare green field site adjacent to the offshore oil tanker terminal located on the Adriatic coast north of the Port of Vlorë. It is located approximately six km from the Port of Vlorë. The site is situated on a relatively barren coastal area with little vegetation or wildlife.

There are no major point sources of air emissions in the Vlorë area. Several industrial facilities that operated in Vlorë in the past were shutdown in the 1990's. In addition, there is no reliable existing air quality data for the Vlorë area. Due to the lack of industrial activity in the area and the lack of reliable data, it is assumed that current air quality conditions in the Vlorë area satisfy a "moderate" air quality classification according to World Bank criteria. Regardless, the Albanian Government should begin collecting site specific air quality data as soon as possible (at least 12 months). As soon as sufficient site data is available, additional air modeling should be performed to confirm the findings of this EIA and recommend any further mitigation measures, if necessary, while the Project is still being implemented.

Plant Technology

The EIA is based upon a two combustion turbines with one steam turbine (2-on-1) combined cycle configuration.

The emissions to the ambient air from combustion of distillate fuel oil in a combustion turbine include sulfur dioxide (SO₂), nitrogen oxides (NOₓ), carbon monoxide (CO), particulate matter less than ten microns (PM₁₀), carbon dioxide (CO₂), and volatile organic compounds (VOC). Computer modeling of the impacts of the emission of SO₂, NOₓ, CO, and PM₁₀ are described later in this executive summary. No air quality standards are set for CO₂, and VOC's; therefore, these pollutants are not modeled. The particulates may contain small amounts of trace metals that are also emitted to the atmosphere. These pollutants are emitted in negligible quantities and are therefore not modeled.

The best available technology for controlling air emissions will be used at the generation facility in order to meet applicable air quality and emission control standards. The combustion turbines will employ good combustion control and water injection technology to control the emission of NOₓ. In addition, the combustion turbines will also use good combustion control to minimize the products of incomplete combustion and reduce emissions of PM₁₀, CO, and VOC's. Limiting the sulfur content of the fuel will control SO₂ emissions as well.

The international air emission standards for thermal power generating facilities are summarized along with the estimated emissions from operation of the planned Vlorë plant in Table 1.1. A computer model, which is described later in this section as well as the body of the report, uses these emission rates to predict the impact of the planned facility on local air quality. As can be seen, the estimated Vlorë plant emissions are well below, and thus better, than the international emission standards. For example, estimated PM₁₀ emissions from the Vlorë plant are over three times better than the standards. Estimated NOₓ emissions from the plant are approximately 40 percent better than the standards. And SO₂ emissions from the plant are several hundred times better than the standards.
TABLE 1.1

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Thermal Generation Facility Emission Standard</th>
<th>European Union</th>
<th>Estimated Vlorë Plant Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World Bank a</td>
<td>European Union b</td>
<td></td>
</tr>
<tr>
<td>PM10</td>
<td>50 mg/Nm³</td>
<td>50 mg/Nm³ (dry @ 3% O₂)</td>
<td>14 mg/Nm³</td>
</tr>
<tr>
<td>NOx</td>
<td>165 mg/Nm³ (dry @ 15% O₂)</td>
<td>450 mg/Nm³ (dry @ 3% O₂)</td>
<td>97 mg/Nm³</td>
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<tr>
<td>SO₂</td>
<td>0.20 TPD/MW</td>
<td>1,700 mg/Nm³ (dry @3% O₂)</td>
<td>0.0048 TPD/MW</td>
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<tr>
<td></td>
<td>2,000 mg/Nm³ (dry @3% O₂)</td>
<td>57.4 mg/Nm³</td>
<td></td>
</tr>
</tbody>
</table>


b Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants. If the total plant capacity exceeds 300 MW, then the SO₂ limit is more restrictive, depending on the size of the plant.

c Sulfur Dioxide emissions based on 0.1% sulfur in the fuel. This is compliant with Directive 1999/32/EC Article 4

Noise

Offsite noise emitted from operation of the planned generation facility will meet the international standard of 70dB(A) for commercial/industrial areas. The combustion turbines should be enclosed in an acoustic enclosure to ensure that noise does not exceed 85 dB(A) at one m.

Fuel Supply

An offshore fuel oil tanker terminal and pipeline is located adjacent to the north boundary of the site. The new distillate oil-fired generation facility will utilize the existing, operating pipelines that run from the offshore terminal to the nearby Narta storage facility.

Potential impacts from distillate fuel oil handling and storage will be mitigated through use of best management practices (BMP), which are, as their name implies, practices that public and private entities adopt to incorporate pollution prevention into their operations. A spill response plan and necessary response equipment should be provided to respond to accidental releases of the distillate fuel oil. KESH is responsible for preparation of this plan during construction of the facility and for providing the necessary response equipment. It is anticipated that as many as 30 deliveries will be made per year. Monitoring and enforcement of sea conditions under which a vessel may make deliveries should be part of the plant procedures and implemented through the delivery contract. Secondary containment should be provided for on-site distillate fuel oil storage tanks.

Transmission

The transmission interconnection will require a seven km line from the planned Vlorë facility switchyard to the planned Babica substation. If the Babica substation is not constructed in time, the interconnection will be to the Vlorë substation, which is located 4.5 km away. Either transmission line will have minimal environmental impact. The typical right of way width for a 230 kV transmission line is between 40 m and 60 m. Clearing only vegetation that interferes
with construction access or line operation will minimize the environmental impact from construction and operation of these lines. Where practical, access areas should be revegetated using indigenous plants.

Water

Once through cooling utilizing seawater is required for the facility. Submerged intake and discharge diffusers are anticipated to be located approximately 600 m offshore. Impacts on the marine environment due to construction of the water intake and discharge will be minimized through siting of the exact location of the intake and outfall. Construction wastes should not be disposed of in the bay.

The potential impacts on the marine environment due to operation of the water intake will be minimized through the exact siting of the intake. Bar screen intake screens with 25 cm spacing at intake should be utilized. Final screening with traveling water screens at cooling water pump suctions should be employed. An inlet velocity less than one m/s to should be used to minimized entrainment of marine organisms.

Potential impacts to the marine environment from the cooling water discharge include:

- Change to the temperature regime of the water column, and perhaps the sediment, of the receiving environment;
- Lethal and sub-lethal responses of marine organisms to the change in temperature regime;
- Stimulation in productivity in a range of organisms;
- Reduction in the dissolved oxygen saturation;
- Changes in the distribution and composition of communities of marine organisms comprising European marine sites (particularly estuaries);
- Localized changes in bird distributions usually in response to increased macroinvertebrate or fish food supplies close to thermal discharges.

The modeled thermal impacts of the cooling water discharge on the marine environment in the Bay of Vlorë are discussed in detail later in this executive summary, as well as the body of the report.

General plant wastewater will be collected and conveyed to the plant wastewater collection and treatment system. The treated effluent and cooling water return is then routed to an offshore outlet diffuser.

Chemical discharge in the plant cooling water is expected to be negligible because the only chemical that will be added to the cooling system is sodium hypochlorite, which is added to prevent biofouling of cooling system components. Other than the hypochlorite addition, cooling water will simply be pumped from the sea, circulated once through the plant and discharged back to the sea. Chlorine concentrations in the process water will be maintained at or below 0.2 mg/l to minimize the effect of chlorine at the cooling water discharge point.
This level meets the requirements of the guidelines for new thermal power plants found in the World Bank Pollution Prevention and Abatement Handbook. The residual chlorine value is typically lower than 0.2 mg/l in practice.

1.2.3 Modeled Impacts

The following discusses the modeled impacts of the generation facility air emissions on local air quality and the thermal impacts of the cooling water discharge on the marine environment.

Air Quality Impact Modeling

The international air quality standards designed to protect human health and the environment for carbon monoxide (CO), nitrogen oxides (NOx), particulate matter less than ten microns (PM<sub>10</sub>), and sulfur dioxide (SO<sub>2</sub>) are summarized in Table 1.2. Computer modeling was used to predict outdoor concentration impacts of facility emissions (see Table 1.1), and to show that the impact from the planned facility will meet the required international standards.

For this analysis, the USEPA model, Industrial Source Complex Short Term - Version 3 (ISCST3) with the Plume Rise Model Enhancement (ISC-PRIME) algorithms, were used to estimate the maximum off-property concentrations of CO, NO<sub>2</sub>, PM<sub>10</sub>, and SO<sub>2</sub> at ground-level. ISCST3 is an internationally recognized air modeling computer program. The model has been validated for coastal environments such as the proposed Vlorë site. The results of the modeling are shown in Table 1.2 along with the international standards. As can be seen, the results are well below, and thus better, than the air quality standards, and demonstrate that the generation facility air emissions will have minimal air quality impact and no appreciable impact on human health.

In addition, the modeling results are well below, and thus better, than the concentration limits designed to protect vegetation and ecosystems from acid deposition. Based on these results, the planned generation facility will have a negligible impact on the flora and fauna in the area. There will be no appreciable effect on other natural resources in the area due to acid deposition from the planned facility.
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Maximum Modeled Impacts (µg/m³)</th>
<th>Ambient Air Quality Standards (µg/m³)</th>
<th>Maximum Modeled Impacts (µg/m³)</th>
<th>Ambient Air Quality Standards (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World Bank⁴</td>
<td>European Union⁴</td>
<td>World Bank⁴</td>
<td>European Union⁴</td>
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<tr>
<td>CO</td>
<td></td>
<td></td>
<td>40.9</td>
<td></td>
</tr>
<tr>
<td>NOx</td>
<td>3.1</td>
<td>100</td>
<td>30⁵, 40</td>
<td>16.2</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>0.3</td>
<td>50</td>
<td>40</td>
<td>150</td>
</tr>
<tr>
<td>SO₂</td>
<td>1.9</td>
<td>80</td>
<td>20⁶</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Notes:
- 1. Not Applicable
- b. Limit values are effective January 1, 2005. All of these limit values include a maximum allowable occurrence of exceedance.
- c. Limit to protect vegetation.
- d. Limit to protect ecosystems.
- e. SO₂ Emission Based on 0.1% Sulfur in Fuel
Marine Environment

In order to assess potential thermal impacts from the proposed facility, modeling was performed to predict the potential increase in water temperature to demonstrate compliance with the international thermal liquid discharge temperature increase limit of less than or equal to three degrees Celsius (°C). The once-through plant cooling water discharged into the Bay of Vlorë will increase water temperatures in the vicinity of the discharge location.

Thermal impact modeling was performed utilizing the Cornell Mixing Zone Expert System (CORMIX), developed by the USEPA and Cornell University. The model is an internationally accepted analysis tool for point source discharges and has been validated with field and laboratory data for use in a coastal bay environment (see www.cormix.info/validations.php). Industry standards concerning thermal discharges generally allocate a specific mixing zone for initial assimilation of process water discharge into a receiving body of water. A 23 m mixing zone was used in this modeling to predict the temperature increase due to the cooling water discharge. This value is within the 100 m mixing zone recommended in the guidelines for new thermal power plants found in the World Bank Pollution Prevention and Abatement Handbook.

The worst-case thermal modeling scenario was evaluated in accordance with the facility water balance. The worst-case scenario was selected for the operating condition resulting in the highest temperature differential between the effluent and the ambient water body temperature of the Adriatic Sea. The modeled outfall pipe consists of a multi-port slotted diffuser that extends 600 m from the shore at a 45-degree angle from the shore (horizontal angle) and 0.15 m from the ocean floor.

The modeling results predict a 0.87°C temperature increase above ambient water temperatures at the edge of the mixing zone. This is more than 60 percent lower, and thus better, than the international impact standard of a maximum temperature increase of less than or equal to 3 °C.

1.2.4 Social Requirements

Given the socioeconomic conditions in the Vlorë area, this facility will greatly benefit the region. It is not anticipated that the construction will cause a significant influx of people from other areas. Therefore, stress on the infrastructure of the Vlorë area from this regard should be minimal.

During the eighteen-month construction period of the facility as many as 500 workers will be necessary. Most of the labor force in the Vlorë District has completed secondary schooling. The schools include 19 elementary schools, three general high schools, one trade high school, one industrial high school and one artistic high school. In addition, Vlorë is home to the Polytechnic University. The university offers undergraduate degrees in engineering and other less technical disciplines. The educational infrastructure of the area is strong and the presence of both the planned generation facility and these institutions may be mutually beneficial.
Any potential negative social impacts of the plant are outweighed by its positive impacts. The facility will be incorporated into the industrial district in Vlorë and contribute to its overall social and economic development.

1.3 CONCLUSION

The analysis performed to fulfill the EIA requirement follows international standards. The EIA establishes the baseline condition of the site and assesses the impact of the proposed generation facility on area resources. The likely positive and negative impacts of the proposed project are identified and quantified to the extent possible. Mitigation measures to be taken during construction and operation of the facility and any residual negative impacts are identified.

The planned generation facility is a state of the art combined cycle unit and will meet all applicable international standards for air emissions. Modeling was performed as part of the EIA to assess the impacts of the air emissions on local air quality. The results of the air modeling show that the plant will meet all international ambient air quality concentration standards. In addition, the modeling demonstrates that the planned facility will not result in degradation of the local air quality or the environment.

Modeling was also performed as part of the EIA to assess the impact of discharging heated cooling water into the Bay of Vlorë. Cooling water discharge modeling shows the discharge will have an acceptable impact resulting in a 0.87°C rise in seawater temperature. This level of temperature increase is better than international standards.

In summary, the planned facility meets all international environmental standards and will have a positive impact on the local economy without stressing the local infrastructure and services. In addition, the facility will alleviate many of the severe problems currently being experienced in the Albanian electric power system.