Verwysing
Reference
Isalathiso EG 12/2/3/2/-D6/27-352/06, Patrysfontein 228/1 OCGT

Navrae
Enquiries
Imibuzo D Laidler

Departement van Omgewingsake en Ontwikkelingsbeplanning
Department of Environmental Affairs and Development Planning
Isebe leMicimbi yeNdalo esiNgqongileyo noCwangciso loPhuhliso

Datum
Date
Umhla 05/04/2007

Mr Bret Lawson,
Ninham Shand Consulting Services,
P.O. Box 509,
George
6530

COMMENTS ON MARCH 2007 DRAFT EIR FOR OPEN CYCLE GAS TURBINE POWER PLANT - MOSSEL BAY

1. Chapter 1

1.1 The EIR provides no consideration of the proposed plant in relation to the National Climate Change Strategy for South Africa[1], the latest Integrated Panel on Climate Change (IPCC) reports[2], nor the Stern Review[3] on the Economics of Climate Change.

1.2 The failure to consider alternative technologies to 'Open Cycle' (see paragraph 2 below) is contrary to the objective of the White Paper on Renewable Energy[4] (together with the National Energy Efficiency Strategy[5], to support diversification towards a less carbon intensive energy economy) that requires managing environmental (and health) impacts. How does the proposed plant assist the state to reach its renewable energy target of 10 000 GWh by 2013 set in the November 2003 White Paper on Renewable Energy? And how does the proposed plant assist the province reach its clean energy target of 15% by 2015.

[1] http://unfccc.int/files/meetings/seminar/application/pdf/sem_sup3_south_africa.pdf
[2] http://www.ipcc.ch/
[3] http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm
[4] http://www.dme.gov.za/pdfs/energy/renewable/white_paper_renewable_energy.pdf
[5] http://www.dme.gov.za/pdfs/energy/efficiency/ee_strategy_05.pdf

1.3 This failure to consider alternative technologies also fails to give effect to UNFCC obligations including:

- Promote and cooperate in the development, application and diffusion of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases.

2. Chapter 2

2.1 No comment. These aspects will be left to the Directorate: IEM

3. Chapter 3

3.1 Cleaning of compressor blades

No serious consideration provided in the report about the nature of the hydrocarbon-based solvent used or the nature of the effluent produced by the cleaning and the potential impacts associated with disposing of the effluent at the PetroSA waste disposal site.

3.2 Fuel

No consideration in the report on consideration of different fuels for the turbines (liquid distillate (diesel) fuel cf. natural gas) with respect to carbon dioxide or other emissions. Also no consideration is given to the energy efficiencies of producing and using different fuels.

Propane tanks are a component of the tank farm. It is unclear what the propane is used for in operating the facility or any environmental impacts arising from the production, storage and use thereof.

3.3 Alternatives and their assessment

Alternative power generation technologies to Open Cycle technologies must be seriously considered by ESKOM and examined in detail in the EIR. A cursory internet based review indicates that there are much more efficient technologies available to generate power than Open Cycle technologies.

It is clear that ESKOM have chosen Open (Simple) Cycle gas turbines essentially for the following reasons:

- Smaller capital investment than alternatives;
- Short construction period;

- The ability to be turned on and off within minutes, supplying power during peak demand.

Even cursory internet research indicates that there are alternative technologies that are far more energy efficient with significantly reduced CO_2 emissions. It is clear that there are far more efficient gas turbine technologies available, albeit at higher cost. The Integrated Gasification Combined Cycle, or IGCC, type seems to have the advantage of being able to use about 30% biomass as a supplemental feedstock. This would appear to be a very appropriate technology to consider using at Mossel Bay due to the presence of the regional waste facility in close proximity.

Informative extracts researched read as follows:

"Simple (open) cycle gas turbines in the power industry require smaller capital investment than coal, nuclear or even combined cycle natural gas plants and can be designed to generate small or large amounts of power. Also, the actual construction process can take as little as several weeks to a few months, compared to years for base load power plants. Their other main advantage is the ability to be turned on and off within minutes, supplying power during peak demand. Since they are less efficient than combined cycle plants, they are usually used as peaking power plants, which operate anywhere from several hours per day to a couple dozen hours per year, depending on the electricity demand and the generating capacity of the region. In areas with a shortage of base load and load following power plant capacity, a gas turbine power plant may regularly operate during most hours of the day and even into the evening. A typical large simple cycle gas turbine may produce 100 to 300 megawatts of power and have 35 to 40% thermal efficiency. The most efficient turbines have reached 46% efficiency.)

Combined cycle is a term used when a power producing engine or plant employs more than one thermodynamic cycle. Heat engines are only able to use a portion of the energy their fuel generates (usually less than 30%). The remaining heat from combustion is generally wasted. Combining two or more "cycles" such as the Brayton cycle and Rankine cycle results in improved overall efficiency.

In a **combined cycle** power plant (CCPP), or combined cycle gas turbine (CCGT) plant, a gas turbine generator generates electricity and the waste heat from the gas turbine is used to make steam to generate additional electricity via a steam turbine; this last step enhances the efficiency of electricity generation. Most new gas power plants are of this type. In a thermal power plant, high-temperature heat as input to the power plant, usually from burning of fuel, is converted to electricity as one of the outputs and low-temperature heat as another output. As a rule, in order to achieve high efficiency, the temperature of the input heat should be as high as possible and the temperature of the output heat as low as possible (see Carnot efficiency). This is achieved by combining the Rankine (steam) and Brayton (gas) thermodynamic cycles.

Efficiency of CCGT plants

The thermal efficiency of a combined cycle power plant is normally in terms of the net power output of the plant as a percentage of the lower heating value (LHV) or net calorific value (NCV) of the fuel. In the case of generating only electricity, power plant efficiencies

of up to 59% can be achieved. In the case of combined heat and power generation, the efficiency can increase to about 85%.

This is also an informative extract illustrating the efficiencies obtainable from closed cycle as opposed to ope cycle technologies:

Huntstown: Ireland's most efficient power plant

The Huntstown combined-cycle power plant in Ireland attains an efficiency level of over 55 percent, making it the country's most efficient plant.

Since this combined-cycle power plant meets around ten percent of Ireland's power demand, its availability is of particular significance. Just as important for the operating company is the high level of environmental compatibility of the plant located in the vicinity of Dublin. **Huntstown feeds around 340 megawatts into the country's grid system** and is fired with natural gas, oil being avaiable as alternative fuel.

For the Huntstown multi-shaft plant Siemens PG supplied one V94.3A gas turbine, one steam turbine and the two generators. If the power demand is significantly lower than plant output, the gas turbine-generator in this versatile type of plant can also be operated alone. **In so-called open-cycle operation a around of 220 megawatts are generated**.

http://www.powergeneration.siemens.com/en/press/pg200303017e/index.cfm

Fuel for combined cycle power plants

Typical combined cycle plants are powered by natural gas, although other sources of fuel can be used such as fuel oil or synthetic gas. Supplementary fuel may be natural gas, fuel oil or coal.

Integrated Gasification Combined Cycle (IGCC)

An Integrated Gasification Combined Cycle, or IGCC, is a power plant using synthetic gas (syngas) as a source of clean fuel.

Syngas is produced in a gasification unit built for Combined Cycle purposes, hence name Integrated. Steam generated by waste heat boilers of the gasification process is utilized to help power steam turbines. Heavy petroleum residues and coal with high sulphur content and even **biomass** are possible feeds (raw material) for gasification process.

There are several refinery-based IGCC plants in Europe that have demonstrated good availability performance after initial shakedown periods. Availability in the range of 90%-95% is now consistently being achieved. Several factors are common to these plants that may be contributing to this good performance. For one, none of them use advanced technology gas turbines, but, rather, so-called "E" technology has been employed. This has avoided the problems of those plants that used "F" technology, mostly of one manufacturer, that continue to be a source of downtime.

Second, all refinery-based plants use refinery residues, rather than coal, as the feedstock. This eliminates at least a minor availability detractor in that there is no coal handling and coal preparation, and there is a much lower level of ash to take care of in the raw gas cooling and cleanup train.

Third, these non-utility plants have recognized the need to treat the gasification system as the up-front chemical processing plant that it is and have generally reorganized their operating staff accordingly.

Another IGCC success story has been the 250 MW Buggenum plant in The Netherlands that is also demonstrating good availability. The coal-based IGCC plant **is currently using about 30% biomass as a supplemental feedstock, for which the owner, NUON, is paid an incentive fee by the government**. NUON is planning to build a much larger plant - of about 1200 MW for which siting has begun. Although not confirmed, it is expected that they will specify "E" class gas turbines, the same as being used in the existing plant, to avoid gas turbine reliability issues."

Failure of the EIR to even consider alternative less polluting turbine technologies discussed above equates to a failure of the project proponent and consultants undertaking the EIR in their NEMA duty of care.

Demand side management as a solution or partial solution to the energy issue is not even considered in the EIR. Not even as an adjunct to increasing the available power in the province. Savings of approximately 400MW were achieved during the 'Koeberg crisis' of December 2005. The proposed plant is rated at 450MW.

Notwithstanding the consideration of alternative Gas Turbine power plants to generate power, as discussed above, and particularly as the proposed plant is in any case to be developed in close proximity to the regional waste site at Mossel Bay it is incumbent on any rational environmental assessment to also consider a 'pure' energy from waste power generation alternative to the Open Cycle Gas Turbine plant proposed. This is particularly the case bearing in mind the extreme problems that the Eden District region has in disposing of waste."

4. Chapter 4

Not reviewed.

5. Chapter 5

It is recommended that as well as indicating the percentage of CO_2 that the plant will contribute to the country's total CO_2 emissions it would be informative to include:

- the percentage that the plant will contribute to the CO_2 emissions produced by all ESKOM and other power (grid) generation facilities situated in the province; and
- the percentage that the plant will contribute to the CO_2 emissions produced by all the ESKOM and other power (grid) that is used proportionally in the Western Cape province.

It is anticipated that, due to the relative low power usage within the province and the contribution by non-CO_2 producing facilities such as Koeberg the relative CO_2 contribution by the proposed OCGT facility will

be markedly higher than reporting only CO_2 contributions of the plant relative to the national CO_2 total.

From a climate change perspective water availability is a key issue.

Note is taken of the consideration of wet and dry NO_x alternatives.

The remainder of the issues will be left to the Directorates: IEM and P&WM.

6. Chapter 6

The consideration of impacts on air quality and climate change mitigation would be vastly more informative if comparative emission statistics and costs were provided for different power generation technologies such as coal, OCGT, CCGT, IGCC, wind and energy from waste. The costs of the CO_2 emissions must be internalised in each case.

7. Other issues to consider:

7.1 Has this proposed facility been registered as a Clean Development Mechanism (CDM) project?

7.2 Has consideration been given to converting the existing Open Cycle Systems to Combined Cycle Systems and if so will this conversion be registered as a CDM project?

By way of example see the conversion of two turbines currently operating in open cycle mode to combined cycle operation at the Energia del Sur (EDS) Central Termica Patagonia power station in Comodoro Rivadavia, Argentina[6] [7].

The project activity will convert two turbines currently operating in open cycle mode to combined cycle operation at the Energia del Sur (EDS) Central Termica Patagonia power station in Comodoro Rivadavia, Argentina. This will involve the installation of two heat recovery steam generators (HRSGs) that utilize the waste heat from the gas turbine to raise steam. The steam will be used to generate electricity using a steam turbine. The plant consists of two gas turbines (PATATG01 and PATATG02) currently operating in open

---

6 http://cdm.unfccc.int/Projects/Validation/DB/N9QUZY817C7DW7WOMTYK0YG51FJQVF/view.html; and

7 http://www.netinform.net/KE/files/pdf/Comodoro_PDD_v41.pdf

cycle mode. **The project will result in approximately 73% efficiency increase** of the plant which will allow for additional electricity generation. In order to fully harness the capacity of the new steam turbine the project will also include gas over-firing in the boiler with a consequent increase of the total fossil fuel combustion at the project site. The project will not involve any upgrade or modification to the existing gas turbines that would impact their technical operating life.

7.3 The province has produced a draft integrated energy strategy[8]. The OCGT technology proposed to generate the required power is not in line with the Draft Integrated Energy Strategy for the Western Cape, attached as Annexure A, in that it continues to follow a least cost approach which fails to take into consideration issues of sustainability, social development and environmental protection.

7.4 The EIR does not discuss this plant in the context of the future energy mix for the country as a whole or the Western Cape.

It does not indicate how ESKOM intends to meet the target of 10 000Gwh by 2013 set out in the Renewable Energy White Paper nor the 15% clean energy by 2015 target set by the province.

8. Conclusion

8.1 The Daft EIR needs to consider all the issues raised above, particularly in the light of the Draft Western cape Integrated Energy Strategy, if it is to provide this department with appropriate information on which to make a decision.

8.2 Installation of OCGT technology appears to be merely a mechanism to deal with the current energy needs in the shortest possible time at least expense and fails to take into consideration issues of sustainability, social development and environmental protection. The EIR fails to consider in any way the real costs of the CO_2 emissions of the proposed Open Cycle technology compared to alternative power generation solutions.

8.3 This Directorate can therefore not support the use of additional, inefficient, Open Cycle Gas Turbine technologies to meet the increasing energy needs of the province without thorough

[8] http://www.capegateway.gov.za/Text/2007/2/wc_draft_integrated_energy_strategy_op&tc.pdf (333kb - pdf)

consideration of alternative technologies in the environmental impact report that will contribute to meeting the national and provincial renewable and clean energy targets.

Mr D.F. Laidler
For: Director: Strategic Environmental Management.
Date: 05 April 2007

Copy: Mr D Swanepoel – Directorate IEM, George

Leeusig Building, 4 Leeuwen Street
Private Bag X9086, Cape Town 8000

Tel No.: (021) 483-3925
Fax No.: 086 619 8146