



Electricity Regulatory Board

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Your Ref:

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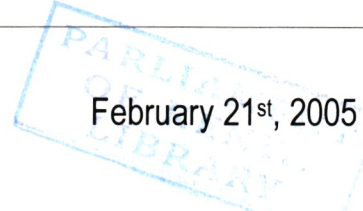
Dear Mr. Ndindiri

REF: ERB's ENVIRONMENTAL, HEALTH & SAFETY POLICY FOR THE ELECTRIC POWER SUB-SECTOR

Section 121 (1) c of the *Electric Power Act, 1997* empowers the Electricity Regulatory Board (ERB) to "... enforce environmental and safety regulations in the power sub-sector"; ERB is therefore the Lead Agency in the sense of the *Environmental Management and Co-ordination Act, 1999* (EMCA, 99); in respect of the electric power sub-sector.

The *Environmental Management and Co-ordination Act, 1999* (EMCA, 99) which is the umbrella legal framework in respect of environmental management in Kenya defines Lead Agencies as any Government ministry, department, parastatal, state corporation or local authority, in which any law vests functions of control or management of any element of the environment or natural resource;

Therefore pursuant to the mandate described above, the Board has prepared the *Environmental, Health and Safety Policy* for the electric power sub-sector. The said policy document is partly based on the results of an Environmental, Health and Safety Audit of all the power generating plants operating in Kenya in the FY 2002/03 conducted by GIBB Eastern Africa on behalf of ERB.



Handwritten notes:
 ✓ DQC
 to inform the
 Committees on Energy
 and Health.
 KICWA
 2/3
 ✓ Ms. Mwangi
 Ms. Mwangi
 03.02.2005

A stakeholder workshop is due to be held on **Tuesday the 5th of April 2005** at the Safari Park Hotel, Nairobi starting at 9:00 a.m. to discuss the policy document. We invite you to attend this workshop to make your contribution to this important process of establishing the rights and obligations as well as the boundaries and rules of conduct for the various role players in the electric power sub-sector. Your participation in the discussions will be instrumental in formulating a comprehensive, relevant and cohesive EHS policy framework.

The proposed draft *Environmental, Health and Safety Policy* for the electric power sub-sector is enclosed herewith for your necessary scrutiny and comment. The same is also available on our website: www.erb.go.ke. In the meantime I should be grateful if you would forward an advance copy of your written comments for incorporation into the proposed draft in order to facilitate deliberations at the workshop

Kindly confirm your participation by telephone (020.271.7627/31/75 or 2717562), e-mail (info@erb.go.ke) or in writing at the address above, with Agnes Githii or Pamela Odundo by the 22nd of March 2005 to facilitate the preparations.

Yours sincerely



Matere Keriri, CBS
EXECUTIVE CHAIRMAN

Encl.

FON/po



ELECTRICITY REGULATORY BOARD

**ENVIRONMENTAL, HEALTH & SAFETY
POLICY
for
the electric power sub-sector
2005**

ENVIRONMENTAL, HEALTH & SAFETY POLICY FOR THE ELECTRIC POWER SUB-SECTOR 2005

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1. INTRODUCTION

1. The government of Kenya is seriously concerned about the quality of the environment and has enacted the Environmental Management and Co-ordination Act No 8 of 1999 (EMCA, 99) thereby establishing the legal framework within which to ensure strict observance of clean production and consumption processes in the economy.
2. Section 3 of the EMCA, 99 entitles every person in Kenya to a clean and healthy environment and bestows upon the individual the responsibility of safeguarding and enhancing the environment
3. The government's commitment to maintaining a quality environment is in keeping with the principles of sustainable development as espoused by the Brundtland Commission: "... *ensuring the needs of the present generation without compromising the ability of future generations to meet their own needs*"
4. The concept of sustainability is more than just an environmental issue; it is also a social as well as an economic issue. It is today accepted that sustainability is built on three pillars: economic prosperity, environmental quality and social equity. It is incumbent upon nations of the world, Kenya included, to ensure that economic growth is not attained at the expense of ecological balance and social equity.
5. The government of Kenya is committed to providing adequate, quality and affordable energy services for sustainable social and economic development. This includes the provision of adequate, quality electricity at affordable tariffs.
6. The electric power sub-sector in Kenya is liberalised and significant progress has been made in restructuring it. The generation function has been opened up to competition and private sector players in the form of Independent Power Producers already make a significant contribution to electricity generation in Kenya.
7. The Minister for Energy is responsible for Energy Policy, including Indicative Energy Planning; and hence has say over the investment in capacity expansion and rehabilitation and hence guides the sector towards sustainable energy systems. The Ministry of Energy chooses the least cost generation to meet forecasted demand with due regard to the quality of the environment. Investments in new and emerging, as well as cleaner technologies; and incentives for innovations and investments in Research and Development are addressed in the Energy policy.
8. The Minister for Energy is responsible for security of energy supply: i.e. the guarantee of present and future energy supplies to meet sustainable development needs of the nation. It is recognised that this is a complex undertaking. On the one hand the aim of the government is to ensure that the operations of the liberalised market are not distorted; on the other hand, government must fulfil its social and environmental responsibilities: it must ensure sufficient supply of energy for the population; it must advocate and stimulate production of environmentally clean energy.

9. The enactment of the EMCA, 99 underscores the government's commitment to keep environmental concerns high on the political agenda and provides the mechanism through which Kenya's environmental policies can be harmonised with similar policies at the international level. It is significant that Kenya is a signatory to various international commitments on the environment.
10. The EMCA, 99 also provides a framework for harmonisation with other national policies. All entities operating in the electric power sub-sector are required to comply with the provisions of the EMCA, 99. Investors are also required to comply as part of the process of investment in new capacity.
11. The Environmental Management and Co-ordination Act, No. 8 of 1999 is the umbrella legal framework in respect of environmental management in Kenya. It is the legal framework under which the National Environmental Management Authority (NEMA) is set up. The EMCA, 99 recognises "Lead Agencies" as any Government ministry, department, parastatal, state corporation or local authority, in which any law vests functions of control or management of any element of the environment or natural resource. The Lead Agencies are therefore key to the implementation of the Act and play an important role in enforcing compliance with its provisions.
12. Section 69(1) of the EMCA, 99 requires NEMA, in consultation with the relevant Lead Agencies, to monitor:
 - a. *all environmental phenomena with a view to making an assessment of any possible changes in the environment and their possible impacts; or*
 - b. *the operation of any industry, project or activity with a view of determining its immediate and long-term effects on the environment.*
13. Section 121 (1) c of the *Electric Power Act, 1997* (EPA, 97) empowers the Electricity Regulatory Board (ERB) to "... enforce environmental and safety regulations in the power sub-sector"; ERB is therefore the **Lead Agency** in the sense of EMCA, 99; in respect of the electric power sub-sector.
14. Section 9 (3) of the EPA, 97 requires ERB to take into account the need to protect the environment, conserve natural resources, and protect the health and safety of service users and the public at large, among other things; when evaluating applications for licences. Licences and PPAs incorporating appropriate environmental standards thus constitute important instruments for enforcing environmental and safety standards.
15. Section 13(c) of the *EPA, 97* requires licensees to comply with all possible safety, health, and environmental laws. Sections 40 and 99 require a licensee not to use or employ any mode, material or apparatus other than that which complies with specifications prescribed by the Kenya Bureau of Standards. Where no such standards exist, the *Act* specifies that any International Standard approved by Kenya Bureau of Standards, or any other prescribed by the Board may be used. In the absence of Kenyan Standards and pursuant to the provisions of the EPA, 97 ERB recommends reliance on the Standards recommended by the World Bank in the latest edition of *World Bank Guidelines on Pollution Prevention and Abatement*.

16. Key features of EMCA, 99 include the requirements for project proponents and operators to:
 - a. Undertake an Environmental Impact Assessment (EIA), upon the acceptance of which NEMA issues an Environmental Impact Assessment Licence. Where applicable other licences required include an emission licence and an effluent discharge licence.
 - b. Mitigate any undesirable effects not contemplated in the EIA report
 - c. Keep accurate records, and make annual reports
 - d. Maintenance of performance standards

17. The EIA is the instrument used to postulate in advance the possible negative impacts of the projects on the social, cultural and bio-physical environment. The positive impacts are usually the reason for the projects hence would easily over-shadow the negative impacts in the absence of the EIA which is an attempt to redress the balance to ensure that the total impact of the project is considered and appropriate mitigative measures put in place.

18. Whereas the EIA is ex Ante evaluation and therefore applies to new plants being set up, the Environmental Audit is ex Post evaluation and applies to existing plants. The Environmental Audit is therefore the instrument for monitoring the environmental performance or impacts of existing projects.

19. All ongoing projects are required to undergo an annual environmental audit with the aim of assessing the actual environmental impact, the accuracy of prediction, the effectiveness of environmental impact mitigation and enhancement measures and the functioning of monitoring mechanisms. Two types of environmental audits are provided for: self audits and control audits. The latter are conducted by licensed NEMA inspectors on ad hoc basis.

20. EMCA, 99 requires NEMA and the Lead Agencies to monitor:
 - a. Environmental phenomena in order to assess possible changes
 - b. The pattern and use of environmental resources
 - c. The operation of industry or project activities in order to determine the immediate and long term impacts on the environment.

21. The EIA regulations require the environmental monitoring process to:
 - a. Determine the indicators to be used in monitoring
 - b. Apply measurable criteria in relation to the chosen indicators
 - c. Recommend the improved mitigation measures to be implemented

22. Section 70 of the EMCA, 99 establishes a Standards Enforcement and Review Committee (SERC) which is responsible for establishing the various environmental quality standards including water quality, ambient air quality, occupational air quality, noxious smells, emissions, noise and vibration. The SERC is also responsible for establishing the criteria and procedures for the measurement of these quality parameters.

23. Apart from the legislations cited above, the Factories Act, Chapter 514 Laws of Kenya is also relevant to the EHS performance in the electric power sub-sector since

electricity generating stations are regarded as factories. The Factories Act has provisions dealing with the safety and health of persons working in factory premises, which description encompasses electricity generating plants.

24. The provisions of the Factories Act are enforced by the Department of Occupational Health and Safety of the Ministry of Labour. The Electricity Regulatory Board will therefore liaise with the Department of Occupational Health and Safety to ensure that the safety and health of persons working in utilities in the electric power sub-sector is safeguarded at all times.
25. A key environmental issue impacting the performance of hydroelectric power plants is the siltation of dams due to the agricultural and forestry activities carried out along the banks of the rivers and reservoirs and in the catchment areas upstream of the rivers and reservoirs. Siltation results in reduced reservoir capacity with negative consequences for power generation.
26. There are a number of laws relating to catchment management including conservation, however, the laws are not harmonised into a coherent framework so that the statutory bodies responsible for the management of the catchment have no statutory mechanism for co-ordinating their activities. The risk of duplication of duties and outright conflicts is therefore substantial. The only exception is EMCA, 99 which is established as a co-ordinating agency working through lead agencies. The Board will therefore research administrative mechanisms and protocols for undertaking its functions without un-necessary duplication of effort or conflict in order to effect its own as well as complementing and supporting the regulatory functions of other agencies. The Board will also share this information with other key agencies.

2. GENERAL PRINCIPLES

1. This policy document is a comprehensive and harmonised compilation of the rights and obligations as well as the boundaries and rules of conduct for role players in the electric power sub-sector in respect of environmental, health and safety performance. It should be read in conjunction with other relevant legislation, especially the Industry Safety Code.
2. The Board will generate credible information that is easy to understand on environmental issues including:
 - a. Information on emissions and associated health and other impacts;
 - b. reports on environmental status harmonised for comparability in time and space;
 - c. knowledge and awareness among the people in a bid to create the “internal pressure” which is desirable for policy development and improvements.
3. International environmental protocols to which Kenya is a signatory shall be observed. It is recognised that such obligations and other similar protocols are key to the harmonisation which is required to avoid market distortions and the dumping of “cheap and dirty energy” services. Harmonisation is essential for maintaining a “level playing field” without affecting Kenya’s legitimate autonomy in determining its national environmental policy and may include:
 - a. Determination of general objectives and country specific minimum standards or international obligations while leaving room for stricter national measures e.g. the Kyoto Protocol¹
 - b. Harmonisation of methods and procedures e.g. for assessing and attaching monetary value to environmental impacts.
4. It is recognised that lack of coherence between environmental and other policies may result in legal and technical barriers from existing policies; for instance it may obstruct the implementation of clean technologies such as cogeneration (Combined Heat and Power – CHP) and Demand Side Management (DSM); or result in subsidies which lead to low energy prices thereby leading to unsustainable increase in demand; and making it more difficult to apply DSM solutions.
 - a. In so far as possible, new policies as well as technical and legal regulations shall be analysed for their environmental impacts, coherence and harmony with existing policies.
 - b. Government shall be informed of any indirect or unintended environmental effects (both adverse and positive) of any emerging legal and technical regulations.
5. The policy instruments that may be used to enforce environmental policy include:
 - a. Command and Control regulations

¹ The Kyoto Protocol is a document signed by about 180 countries in Kyoto Japan, in December 1997. The Protocol commits 38 industrialized countries to cut their emissions of greenhouse gases in the period 2008-2012 to levels that are 5.2 percent below the 1990 levels. As at 15th April 2004, eighty four (84) parties had signed and one hundred and twenty two (122) parties ratified the Protocol. Kenya has neither signed nor ratified it, whereas Uganda, Burundi, Uganda, Zambia, Egypt, South Africa, Senegal, Niger, Namibia, Ghana and Cameroon have.

- b. Internalisation of social costs
 - c. *Voluntary Agreements*
 - d. Public participation
 - e. *Environmental Management Systems*
 - f. Special tariffs for renewable energy
6. In principle *Voluntary Agreements* do not distort the operations of the liberalised market. However, they should be accompanied by an appropriate system of sanctions in case of non-compliance.
7. Public participation is part and parcel of the investment process for new power plants as it is a requirement of the Environmental and Social Impact Assessment. However, individual members of the public are only interested when they are directly affected, and it may be difficult to improve public participation due to the long term, subtle and poorly understood nature of the impacts in question. Public participation through professional environmental Non-governmental Organisations (NGOs) is therefore encouraged.
8. ERB recognises and encourages players in the electric power sub-sector to adopt Certified Environmental Management Systems². This is premised on the understanding that such systems require continuous improvements in the EHS performance of the entity in question. Appropriately defined incentives resulting in reduced regulatory pressure shall be given to utilities subscribing to recognised Certified Environmental Management Systems.
9. Other policy instruments which may be used but would require the involvement of government and other government agencies include:
- a. Subsidies on renewable energy
 - b. Emission taxes
 - c. Emission trading
10. It is recognised that information is more valuable in a liberalised market; hence licensees may be less willing to divulge company-specific information regarded as sensitive for strategic reasons. The Board will within reasonable limits safeguard the confidentiality of information provided by licensees provided such confidentiality is not in conflict with the public interest.
11. The Board requires licensees to provide information to the public on the environmental performance and sources of their electric power. Such information may include, where applicable, eco-labelling³ indicating the proportion of “green watts” in the licensees output.

² Certified Environmental Management Systems (EMS) are internationally recognized quality management frameworks for systematic and continuous improvement of environmental performance by businesses and organizations. Certified Environmental Management Systems facilitate the integration of environmental stewardship into everyday business operations making it the responsibility of all employees. The most widely recognized certified EMS is the International Organization for Standardization (ISO) system.

³ An eco-label is an official label for approved “green products”. Eco-labels identify and promote products that have less impact on the environment. Eco-labeling provides information to consumers to help them choose products that have a reduced impact on the environment. Eco-labels may be issued and endorsed by

12. Subsequent to liberalisation of the energy sector, the government of Kenya has progressively moved away from subsidies due to their distortionary nature and public budget constraints. Environmental subsidies on the generation of renewable energy and conservation will – where applicable - therefore be designed to minimise undesirable producer behaviour which results in distortions of the liberalised market. Examples of undesirable effects of subsidies include windfall profits, and the free rider phenomenon.
13. Non-compliance with the provisions of this Environmental, Health and Safety Policy shall be subject to appropriate sanctions as provided for in the Rules and Regulations pursuant to the Electric Power Act, 1997. However, the due process of law shall be observed.

an independent third party which may be a government department, and fall into categories defined by the ISO. In principle eco-labeling follows a comprehensive multi-criteria and life cycle analysis (LCA) approach. Life cycle analysis is an objective process designed to assess systematically the total environmental impact of particular processes, products and materials from cradle to grave i.e. from raw material extraction to final disposal. The LCA is key to understanding the complex environmental effects of products from “cradle-to-grave”, and hence making environmentally informed production and purchasing decisions.

3. EHS POLICIES FOR GENERATION

- 1) Following the liberalisation of the energy sector and subsequently, the electricity sub-sector; private sector players were encouraged to enter the generation segment of the electricity market with a view to introduce competition.
- 2) The entry of Independent Power Producers (IPPs) into generation has resulted in the reduction of the market share of the incumbent State Owned Enterprise (SOE). However, the incumbent (KenGen) still has considerable market power; and bilateral trading arrangements are still the norm in the market. There is therefore little competition in the market; however, there is competition for the market during capacity procurement.
- 3) The key regulatory instruments used by the Board are the licenses issued to each player and the PPAs governing the trade of bulk power between the generators and the off-taker.
- 4) The generation of electricity has a major impact on the quality of the environment. This is particularly true for fossil-fuel based generation which is a major cause of air pollutants and greenhouse gas emissions.
- 5) Generation from well located renewable energy sources and efficient co-generation are known to provide environmental benefits, have low externalities and add to diversity and sustainability.
- 6) Externalities associated with the generation of electricity are those costs imposed on society and the environment that are not accounted for by the producers and consumers of electric energy, and may include damage to health, landscape, water and agriculture. These costs are not usually incorporated into the market price of electric energy.
- 7) The Energy Policy encourages the use of environmentally friendly and efficient technology for the generation of electricity; and the generation of electricity from renewable energy sources
- 8) The Board recognises that the liberalised electricity market is tilted against power generated from renewable energy sources. Therefore, the Board in consultation with the Minister responsible for energy may take appropriate action to level the playing field to improve the competitiveness of electricity from renewable energy sources.
- 9) It is the responsibility of power generating entities to generate electric power efficiently while conserving resources and with the least possible adverse environmental impact
- 10) Generation plant shall be operated in such a manner as to conserve resources; facilitate the abatement and prevention of environmental pollution; and minimise environmental degradation.

- 11) All generation plant shall comply with prescribed EHS quality and performance standards as well as the statutory annual reporting requirements
- 12) All generating plant shall establish and adopt an EHS policy and ensure that all employees working in the generation plant are familiar with it and are guided by it.
- 13) All the employees working in the generation plant shall receive training and education on matters relating to EHS to ensure effective EHS performance and continuous improvement in the same
- 14) For all generating plant the licensees are expected to audit and review their individual EHS performance with a view to continually improving the EHS performance.

4. EHS POLICIES FOR TRANSMISSION AND DISTRIBUTION

- 1) Despite the liberalisation of the electricity sub-sector; and the introduction of competition in generation, the Transmission and Distribution segments were retained as monopoly entities, currently consolidated under the Kenya Power and Lighting Company (KPLC). These segments of the electricity market are natural monopolies and are therefore regulated in order to achieve stipulated EHS quality standards besides efficiency, cost reduction and quality of service.
- 2) The key instruments used by the Board to regulate the conduct and operations of KPLC as the sole transmission and distribution (T&D) company are the licenses issued to it.
- 3) The EHS impacts of the transmission and distribution network on the quality of the environment are mainly the displacement (permanent or temporary) of persons and communities; emission of noise as well as electromagnetic waves of various frequencies; and the danger of electrocution should a person come into contact with energised conductors.
- 4) The Board shall recognise such expenditure as may be required for EHS reasons in the network operators' revenue requirements and may revise such expenditures to account for changes in EHS legislation which have a material impact on future expenditure.
- 5) It is the responsibility of the T&D entities to operate the network efficiently while conserving resources and with the least possible adverse environmental impact
- 6) The network should be operated in such a manner as to conserve resources e.g. by minimising system losses; facilitate the abatement and prevention of environmental pollution; and minimise environmental degradation in general.
- 7) The network operators shall comply with prescribed EHS quality and performance standards as well as the statutory annual reporting requirements, including minimising system losses
- 8) The network operators shall establish and adopt an EHS policy and ensure that all employees working with the network are familiar with it and are guided by it.
- 9) All the employees working with the network should receive training and education on matters relating to EHS to ensure effective EHS performance and continuous improvement in the same. In addition the network utilities should ensure that staff have appropriate levels of authorisation as appropriate.
- 10) For the whole network the licensee is expected to audit and review the EHS performance with a view to continually improving the same.

5. EHS POLICIES FOR GENERATION FROM RENEWABLE ENERGY SOURCES

- 1) Generation of electricity from renewable energy sources already plays a very significant role in meeting Kenya's electricity needs. The renewable energy sources already harnessed and contributing electricity into the inter-connected grid include large hydro, geothermal, and wind.

	Large Hydro	Geothermal	Wind	Fossil fuel	TOTAL
MW	677.2	122	0.4	407	1,206.4
%	56.1	10.1	0.0	33.7	100.0

- 2) About two thirds of Kenya's installed electricity generation capacity is based on renewable sources; and according to the Least Cost Generation Plan the contribution of geothermal power is set to increase in the current 20-year plan period. This will help diversify the energy source thereby minimising the exposure to climate change and weather variability and hence improving energy security. Most importantly this will yield substantial and significant environmental benefits to the country.
- 3) The Energy Policy articulates the government's strategy in planning for the development of renewable energy to facilitate social and economic development while protecting the environment. Integrated Energy planning is crucial for meeting the government's policy objectives and targets. The Board is a key player in the planning process and participates in the preparation and annual update of the Least Cost Power Development Plan. While articulating its policies in the planning process, the Board is also responsible for monitoring and ensuring that the integrity of the process in respect of EHS performance as well as the end-user tariffs is safeguarded.
- 4) A key role of the Board is to ensure that open and constructive dialogue between prospective operators, the planning entities and local people is maintained with regard to the identification of a suitable site with sensitivity and care.
- 5) The development of most renewable energy sources is relatively more expensive than that of equivalent fossil fuel generation sources. For instance, geothermal resource assessment is an expensive and high risk activity, which subsequently impacts the bulk tariff resulting in a relatively high end-user tariff.
- 6) The government policy on electricity tariffs is that they shall be based on the economic cost of producing and delivering the electricity to the consumer; hence the additional costs of producing electricity from renewable sources are borne by consumers of electricity. However, the government is also committed to keeping the cost of electricity to consumers as low as possible. Thus, in order to level the playing field in favour of renewable energy sources appropriate government policy is required as explained further below.
- 7) Cognisant of the need for appropriate policies, the Government has articulated relevant strategies in the Energy Policy with a view to levelling the playing field and

keeping the costs of renewable energy as low as possible. The Board draws its guidance from the Energy Policy and shall endeavour to implement it as appropriate.

- 8) It is note-worthy that these strategies do not yet include a “Non-Fossil Fuel Obligation” requiring the off-taker to purchase a prescribed quantum of electricity from renewable sources. However, the Board is committed to further research this area and to advise the Minister responsible for Energy Policy as appropriate.
- 9) The board is also committed to researching and documenting the potential barriers to the generation of electricity from renewable energy sources and to address these as appropriate, including advising the minister responsible for energy.
- 10) Renewable sources of energy produce significantly lower levels of environmental pollution than fossil fuels. Renewable sources of energy may be broadly understood to include waste for which there is no further economic use such as agricultural residues, city/municipal waste or garbage. The waste can be used as fuel thereby delivering savings on fossil fuels and simultaneously contributing to appropriate solid waste management. In addition this recycling of waste also reduces GHG emissions.
- 11) Agricultural residues of significance, in respect of electricity generation in the Kenyan electric power sub-sector includes bagasse from the sugar industry, and husks from the coffee and rice milling industry, respectively. However, it is only bagasse that has been used for electricity generation in Kenya.
- 12) The current government policy towards the use of bagasse for electricity generation is encapsulated in the Energy Policy which supports and encourages the sugar industry in particular and any industry where this is feasible to generate electricity for its own use and to export the excess to the grid at competitive bulk tariffs. The role of the Board in this regard is to ensure expeditious and non-discriminatory approval process for the PPA between such a generator and the off-taker.
- 13) Cogeneration – Combined heat and Power (CHP) – is the simultaneous generation of electricity and usable heat from the same plant. In Kenya this is most commonly found in the sugar and paper industry where steam is used for electricity generation and to provide process heat. Such generation achieves a higher overall systems efficiency compared to conventional power stations through the recovery of waste heat. More significantly, cogeneration provides significant environmental benefits due to the improved efficiency and lower overall fuel consumption. In addition cogeneration also results in lower production costs.
- 14) The Board is committed to research and document the most appropriate way of regulating the contributions of distributed generators using renewable energy sources and including cogeneration in such a way as to maintain system reliability, stability and the quality of supply. The issues to be addressed include technical, connection policy; tariffs e.g. net metering for domestic photovoltaic panels, information sharing, incentives, and sustainability issues.

- 15) It is the responsibility of power generating entities to generate electric power efficiently while conserving resources and with the least possible adverse environmental impact
- 16) Renewable energy electricity generation plant shall be operated in such a manner as to conserve resources; facilitate the abatement and prevention of environmental pollution; and minimise environmental degradation.
- 17) Renewable energy electricity generation plant shall comply with prescribed EHS quality and performance standards as well as the statutory annual reporting requirements
- 18) All renewable energy electricity generating plant shall establish and adopt an EHS policy and ensure that all employees working in the generation plant are familiar with it and are guided by it.
- 19) All the employees working in the generation plant shall receive training and education on matters relating to EHS to ensure effective EHS performance and continuous improvement in the same
- 20) For all generating plant the licensees are expected to audit and review their individual EHS performance with a view to continually improving the EHS performance.

6. EHS POLICIES FOR DEMAND SIDE MANAGEMENT

- 1) The Energy Policy recognises the importance of Demand Side Management (DSM) and articulates the policy objectives to be pursued by the Government of Kenya; which in turn provides the guidance for ERB's policy on DSM
- 2) Demand Side Management (DSM) in its broad sense is understood to encompass Energy Conservation and Efficiency measures
- 3) The objective of Energy efficiency and Conservation measures is to save energy. These measures therefore result in scaling down of the capital investments needed to provide additional energy supplies thereby reducing the overall energy resource use with attendant environmental, health and safety benefits to society and individuals, including reduced emissions and a sustainable resource use.
- 4) Demand Side Management as well as Energy Conservation and Efficiency measures are aimed more at end-users than at utilities; however, the utilities too have a role to play.
- 5) The Board recognises however, that these gains come at a cost and are not effective unless applied in tandem with cost reflective tariffs. To this end the Board has already put in place cost reflective tariffs in line with the tenets of the Energy Policy. It is envisaged that this will therefore encourage consumers to use efficient and cost effective energy conservation and efficiency technologies.
- 6) The Board will endeavour, in conjunction with relevant industry stakeholders, to make available information on energy conservation and efficiency to consumers

7. TARIFFS AND TARIFF STRUCTURE IN RELATION TO EHS POLICIES

- 1) The Energy Policy requires electricity tariffs to be cost reflective in order to give signals for efficient resource use by consumers. Ultimately, it is envisaged that this will also convey the right signals upstream to the generators in order to facilitate efficient resource utilisation by electricity utilities and the economy.
- 2) While liberalising and reforming the energy sector, the Government of Kenya also moved away from subsidising the electric power sub-sector and towards economic pricing of electricity to the extent that the current electricity tariffs are largely cost reflective, although there is still a certain amount of cross-subsidy within the tariff structure.
- 3) The electricity tariffs are based on the Long Run Marginal Cost principles and reflect the cost of supplying a unit of electric power to consumers. Generation tariffs, which comprise a significant input into the retail tariff, incorporate environmental costs and hence serve to internalise environmental costs to the generators and ultimately to the consumers.
- 4) Planning for new generation capacity, which is carried out under the Least Cost Power Development Plan (LCPDP), incorporates environmental costs; and where these are material the ranking of a generation project which is otherwise attractive, is adversely affected meaning its coming on stream may be delayed substantially. However, when it eventually does, the generation tariff will necessarily be significantly higher than it would be without environmental costs.
- 5) The most significant cross-subsidies have to do with urban consumers subsidising rural consumers; and large domestic consumers subsidising small and “lifeline” domestic consumers. Thus small domestic and “lifeline” domestic consumers have little incentive for efficient consumption. However, rural consumers relying almost wholly on fossil fuel generated electricity under the Rural Electrification Programme (REP) impose proportionately large impacts on the environment. To redress this challenge the Energy Policy proposes the discontinuation of the Uniform Tariff Policy
- 6) The Tariff Review Policy encompasses a Time of Use tariff for all industrial consumers. This tariff is also applicable to domestic consumers, but is optional.

S. SCHEDULES TO THE EHS POLICY 2004

S1 BASELINE ENVIRONMENTAL, HEALTH AND SAFETY AUDIT OF GENERATION UTILITIES: 2002

In an endeavor to ascertain environmental, health and safety performance of existing utilities with a view to facilitate the enforcement of compliance the Board commissioned a baseline environmental, health and safety audit to, among other things:

- a) Establish the baseline (2002) environmental, health and safety performance for existing power plants: auditing stack emissions, effluents, noise levels as well as fire prevention and containment practices and occupational health and safety practices in the power plants
- b) Formulate procedures and establish indicators for regular monitoring and evaluation of environmental, health and safety performance in the power sub-sector.
- c) Facilitate the formulation of up-to-date environmental, health and safety standards along with appropriate enforcement mechanisms.
- d) Delineate responsibilities between ERB and other statutory agencies with similar or overlapping regulatory functions.

The audit did establish:

- 1) The status of:
 - a) Ambient air quality levels in the vicinity of all thermal (petroleum-fuel fired, geo-thermal and biomass fired) power plants
 - b) Noise levels in the vicinity of all thermal and geo-thermal power plants
 - c) Occupational safety practices in all the power plants.
 - d) Fire audit and preparedness for dealing with fire outbreaks in the power plants.
 - e) Liquid and solid waste management by utilities
 - f) Catchment conservation practices for all hydroelectric power plants
- 2) Procedures, performance indicators and benchmarks for regular monitoring and evaluation of environmental, health and safety performance in the electric power sub-sector
- 3) The responsibilities of ERB *vis á vis* other statutory agencies with similar or overlapping mandates and responsibilities in respect of:
 - a) Occupational and safety practices
 - b) Catchment conservation
 - c) Environmental management in respect of the power sub-sector
 - d) Fire safety
- 4) Modalities for harmonizing the discharge of responsibilities amongst the concerned organizations including NEMA, the Ministries of Labour, Agriculture, Forestry and Water Development.

S2 EHS PERFORMANCE STANDARDS AND BASELINE (2002) PERFORMANCE BENCHMARKS

Wastewater Parameter	Maximum Concentration (mg/l)	Kipevu I	Kipevu II	Kipevu Steam	Kipevu GT	Westmont P. EA Ltd 1997	Iberafrica. P. EA Ltd 1997	Fiat GT 1973	Mumias P. Plant 1973
		1999	2001	1962	1987	1997	1997	1973	1973
Biological Oxygen Demand (BOD)	50	5.0	30			40			
Chemical Oxygen Demand (BOD)	250	46.7	86			194			
Total Suspended Solids (TSS)	50	2	8			10			
Oil and Grease	10	3	10			19			
Total Chromium as Cr	0.5		0.03						
Total Copper as Cu	0.5		0.03						
Total Iron as Fe	1.0		0.14						
Total Zinc as Zn	1.0		0.58						
Total Chloride	0.2		<0.02						
pH	6 - 9 unit less	6.61	8.94			6.34			

Ambient Air Quality	µg/m ³		Kipevu I	Kipevu II	Kipevu Steam	Kipevu GT	Westmont Power EA Ltd	Iberafrica.	Fiat GT	Mumias Power Plant
	24-Hr Average	Annual Average								
Sulphur Dioxide SO ₂	125	50		0.7			0.7	0.9		1.0
Nitrogen Dioxide NO ₂	150	100		1.1			1.1	3.1		1.0
Particulates PM ₁₀	150	50								
TSP	230	80								

Noise Emissions	Maximum Allowable L _{eq} (Hourly) dB(A)		Kipevu I	Kipevu II	Kipevu Steam	Kipevu GT	Westmont Power EA Ltd	Iberafrica.	Fiat GT	Mumias Power Plant
	Day 07:-22:	Night 22:-07:								
Residential, Institutional and Educational	55	45						64.7		
Industrial and Commercial	70	70	68.8-72.2	72.2-75.0	65.9 – 73.4		62.5 – 73.1	60.0-75.3		
Occupational	85	85	82.5-115.5	83.5-114.4			78.3 – 110.4	115		71.1 – 98.0
Other e.g. Game park										

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Wastewater Parameter	Maximum Concentration (mg/l)	Garissa 1994	Lamu 1965	Marsabit 1974	Wajir 1974	Lodwar 1974	Moyale 1983	Mandera 1979
Chemical Oxygen Demand (BOD)	250							
Total Suspended Solids (TSS)	50							
Oil and Grease	10							
Total Chromium as Cr	0.5							
Total Copper as Cu	0.5							
Total Iron as Fe	1.0							
Total Zinc as Zn	1.0							
Total Chloride	0.2							
pH	6 – 9 unit less							

Ambient Air Quality	µg/m ³		Garissa 1994	Lamu 1965	Marsabit 1974	Wajir 1974	Lodwar 1974	Moyale 1983	Mandera 1979
	24-Hr Average	Annual Average							
Sulphur Dioxide SO ₂	125	50	3.3	1.8	27.3	1.9	4.8	3.1	17.0
Nitrogen Dioxide NO ₂	150	100	1.4	2.5	9.4	1.3	2.6	1.7	1.9
Particulates PM ₁₀	150	50							
TSP	230	80							

Noise Emissions	Maximum Allowable L_{eq} (Hourly) dB(A)		Garissa 1994	Lamu 1965	Marsabit 1974	Wajir 1974	Lodwar 1974	Moyale 1983	Mandera 1979
	Day 07:-22:	Night 22:-07:							
Residential, Institutional and Educational	55	45							
Industrial and Commercial	70	70	53.7 - 70.5	62.4 - 84.5		46.8 - 58.8	60.9 - 70.6	52.2 - 52.4	
Occupational	85	85	63.5 - 93.6	74.8 - 101.6	92.1 - 101.1	87.7 - 94.6	94.5 - 101.3	88.9 - 97.8	
Other e.g. Game park									

S3 FIRE HAZARD ASSESSMENT SUMMARY**AN ILLUSTRATION: Mumias Power Plant (July 2002)**

Description	Rating
Assessment within class	High
Risk awareness and management attitude	High
Systems of control	High
Financial stability	High
Fire load	High
Probability of bush fire occurrence	Low
Probability of electrical fire occurrence	High
Probability of rapid fire spread	Moderate
Probability of gas fire explosion occurrence	Moderate
Probability of fire involving flammable liquids	High
Areas susceptible to explosion	Boiler-house
Concentration of values	Power-house
Reliability of equipment	High
Overall fire protection	High
Process spacing	High
Possibility of risk improvement	High
Exposure from adjoining premises	Low
Hazard to adjoining premises	Low
Susceptibility to intrusion	Low
Exposure from natural hazards	Low
Loss history	Minor fires
Key risk area	Power-house
Safety precautions	High
Fire equipment maintenance	High
Hot work permit	Not enforced
Loss Prevention	Rating
Security guards	24 hours
Fire detection equipment	Good
Arson and malicious damage	Rating
Risk location and environment	High
Management/staff relations	High
Security protection	High
Housekeeping	Rating
General	Moderate
Operations	Moderate
No smoking	Poor

S4 WORLD BANK AND NAIROBI CITY COUNCIL GUIDELINES FOR WATER DISCHARGE

Parameter Max. value (mg/l)	World Bank Guidelines	Nairobi City Council Standards	
		Watercourses	Public Sewers
Ph	6-9	6-9	6-9
Temperature (°C)		<25	<35
Total nitrogen, excl NO ₃ excl NH ₃		1 1.5	
Nitrates (NO ₃)		<45	
Absorbed oxygen		<15	<100
COD		<10	
BOD		<20	<450
Total suspended solids	50	<30	<300
Oil and grease	10	<100	<100
Total residual chlorine	0.2		
Chromium (total)	0.5		
Copper	0.5		
Iron	1.0		
Zinc	1.0		
Temperature increase at mixing zone	≤3°C		

S5 ECOLOGICAL EFFICIENCY

- 1) The utilities that fall under ERB's jurisdiction pursue different environmental strategies. It has been observed that investors and shareholders increasingly require the utilities, especially the generators, to adopt and pursue eco-efficient strategies that reduce the damage to the environment while increasing or maintaining shareholder value.
- 2) Eco-efficient utilities use fewer resources, inject fewer emissions into soils, water and air while producing the same output as their competitors. The higher productivity also leads to higher operating margins due to lower costs. Furthermore, the risk of environmental liability decreases, resulting in a lower discount factor and lower contingent liabilities. Lower resource use also leads to lower stocks of materials and energy.
- 3) The Board proposes to keep track of the ecological efficiency of the licensees through the use of an eco-efficiency indicator computed as follows:

$$\text{Ecological Efficiency} = \frac{EPI}{FPI}$$

EPI Environmental Performance Indicators

- (a) Depletion of non-renewable energy resources e.g. coal, oil, gas
- (b) Depletion of fresh water resources
- (c) Global warming emissions (CO₂, CH₄, SO₂, NO₂ etc)
- (d) Ozone depleting emissions
- (e) Solid and liquid waste

FPI Financial Performance Indicators

- (a) Value added (Sales less cost of goods and services purchased)
- (b) Sales
- (c) Operating profit
- (d) Net Income (Net profit after tax)

- 4) Value added covers only that part of the life cycle where the utility transforms the economic inputs into products and services while using environmental resources and producing emissions and waste.
- 5) The Eco-Efficiency performance indicator enables the Board to track environmental performance without losing sight of the all important financial indicators. This is in recognition of the fact that the enterprises are in the business for profit, and should seek to make a profit in an environmentally responsible manner.

S6 THE COST IMPLICATIONS OF INVESTMENT REQUIREMENTS FOR ADDRESSING EHS PERFORMANCE ISSUES IDENTIFIED IN THE 2002 AUDIT

The costs of the recommended mitigative measures to address EHS issues in the power plants amounts to nearly KSh. 100, 000, 000.00 as indicated in the breakdown and analysis given in the two tables below.

Table 1: Mitigation Costs for Addressing EHS Issues in the Power Sub-sector (2002)

Type of Power Plant	Installed Capacity MW	Cost of mitigation KSh	Unit Mitigation Cost KSh/kW
Hydro	675	49,250,000	73
Thermal	463	44,145,000	95
Geothermal	57	2,600,000	46
TOTAL	1,195	95,995,000	80

Table 2: Mitigation Costs by Type of Plant and Plant Ownership/Operator (2002)

Type of Power Plant	Installed Capacity MW	Cost of mitigation KSh	Unit Mitigation Cost KSh/kW	
KenGen	Hydro	675	49,250,000	73
	Thermal	266.8	7,120,000	27
	Geothermal	45	1,520,000	34
	REP	4.1	7,580,000	1,849
KPLC	REP	5.1	24,555,000	4,815
IPP	Thermal	175	4,890,000	28
	Geothermal	12	1,080,000	90
TOTAL	1195	95,995,000	80	

Note: Rural Electrification Programme (REP) plants are owned by the Ministry of Energy and operated by KPLC and KenGen respectively. Except for the Marsabit plant, which is a hybrid, the rest are diesel plants, and all are isolated from the inter-connected grid.

The high cost of mitigation in thermal plants is solely due to the isolated diesel power plants owned by the Ministry of Energy under the REP and operated by KPLC and KenGen respectively. However, the KPLC operated plants are the ones in dire need of EHS performance improvement. Per unit of installed capacity the difference in mitigation costs between the REP thermal power plants and KenGen's thermal plants is extreme. This is a good indicator of the extreme degree of neglect that these plants have undergone. The issues contributing to the high mitigation costs include the installation of fire protection systems i.e. detection and suppression, fuel management, and waste management, especially used oil and waste water.

S7 MONITORING PROTOCOLS

The motivation for monitoring EHS performance in the power sub-sector is the need to provide information about key environmental, health and safety aspects of the operations in the power sub-sector, particularly the adverse impacts and the effectiveness of mitigation measures.

The monitoring protocols herein specify the descriptions and technical details of monitoring measures; as well as the monitoring and reporting procedures.

Monitoring information facilitates supervision and oversight especially evaluating the success of mitigation measures and identification of required alternatives, if any.

S7.1 MONITORING PROTOCOLS FOR GEOTHERMAL POWER PLANTS

Monitoring Issue	Parameter	Monitoring Method	Indicator	Frequency of Measurement	Responsibility
Air emissions/Ambient air quality	Hydrogen sulphide (H ₂ S)	<ul style="list-style-type: none"> Propriety gas measuring meters; Automatic data logging monitors 	24 hour averages and daily maximum concentrations	Twice a week for hand held monitors and continuously for automatic loggers	Generation Utility
	Carbon dioxide (CO ₂)	Stack/ejector emission measurements	24 hour average	Annually	Generation Utility
	Radon	Propriety gas measuring meters	24 hour averages and daily maximum concentration	Twice a week	Generation Utility
	Dust	Visual inspection	Airborne particles	Twice during the dry season	Generation Utility
	Electromagnetic radiation			Annually	Transmission Company

Water quality	Brine discharge	<ul style="list-style-type: none"> Frequent analysis for non re-injection systems Visual inspection of re-injection systems 	Measurements of : <ul style="list-style-type: none"> pH @ 25°C TDS SiO₂ 	Weekly	Generation Utility
	Effluent discharged from oil interceptors/oily water treatment unit	Grab samples for laboratory analysis	Measured levels of: <ul style="list-style-type: none"> Oil and grease Total suspended solids Total chromium, copper, iron and zinc 	Quarterly for the life of the project	Generation Utility using independent laboratory for verification
	Level of water table	Hydrogeological monitoring	Static water level	Every six months	Generation Utility
Noise	Occupational noise	Periodic measurement with a noise meter	Time averaged measurements in dB(A) at work areas within the plant boundary	Weekly	Generation Utility/OHSD (MoL)
	Ambient noise	Measuring noise levels at 100% full load operation using an integrating noise analyzer	Time averaged measurements in db(A) at receptors outside the plant boundary	Annually	Generation Utility/ERB/OHSD
	Solid waste	Tracking the volume of solid waste generated and establishing the treatment, storage, transport and disposal methods	Waste streams and volumes generated on site	Continuous	Generation Utility/ERB/local authorities
Waste Management	Hazardous waste	Tracking all hazardous waste and establishing storage, handling and disposal methods	Generated quantities of: <ul style="list-style-type: none"> Used oils; Solvents; Sludge Process residue 	Continuous	Generation Utility/NEMA/ERB/local authorities

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Health and Safety	Adoption and implementation of EHS policies	Annual EHS audits	Identified and established targets	Continuous as necessary	Generation Utility /ERB
	Employee EHS training	Inspection of records of training programs including fire drills, environmental and safety training	Annual record of staff training programs executed or attended	Annually	Generation Utility
	Development and maintenance of EHS plans, procedures and manuals	<ul style="list-style-type: none"> • Annual EHS audits • Inspection of plans, procedures and manuals 	Annual record on status and updates	Continuous as necessary	Generation Utility
	Occupational Health and Safety monitoring	Reporting of accident and incidents, safety breaches and damage to equipment	Annual statistical records and safety reports	Continuous	Generation Utility /ERB/OHSD
	EHS audits	Inspection of previous EHS internal and external audit records	<ul style="list-style-type: none"> • Number and type of corrective actions raised • Status on implementation of corrective actions 	Quarterly for internal audits and annually for external audits	Utility/independent auditor/ERB

Other Environmental Health and Safety Issues	Flora	Visual inspection	Abundance of indigenous species, monitoring records of cleared, re-vegetated and rehabilitated areas	Monthly	Utility/KWS
Fauna	<ul style="list-style-type: none"> Counting (quadrants) GIS 	<ul style="list-style-type: none"> Abundance of indigenous species, monitoring records of cleared, re-vegetated and rehabilitated areas 	<ul style="list-style-type: none"> Monthly 	<ul style="list-style-type: none"> Utility/KWS 	
Soil contamination	<ul style="list-style-type: none"> Soil analysis Visual assessment of oil stains Soil analysis during spill incidents 	<ul style="list-style-type: none"> Measured levels of Hg, Zn, As, Cd, Cr, B Presence of oil stains Measured levels of VOCs/TPH 	<ul style="list-style-type: none"> Quarterly grab samples Daily visual inspections As necessary 	<ul style="list-style-type: none"> Utility 	
Soil erosion	<ul style="list-style-type: none"> Visual inspection Record of periodic assessment 	<ul style="list-style-type: none"> Vegetation cover on highly erodible sites Re-vegetation of previously eroded sites 	<ul style="list-style-type: none"> Twice a year to cater for seasonal variation 	<ul style="list-style-type: none"> KWS/Utility 	
Maintenance of fire appliances	<ul style="list-style-type: none"> Inspection of maintenance and servicing records of fire appliances 	<ul style="list-style-type: none"> Quarterly record of reports by local fire appliance dealers 	<ul style="list-style-type: none"> Quarterly 	<ul style="list-style-type: none"> Utility/fire appliance dealer 	
Ozone Depleting Substances (ODS)	<ul style="list-style-type: none"> Inspect schedule of phase-out of ODS 	<ul style="list-style-type: none"> Status on the phase-outs of ODS 	<ul style="list-style-type: none"> Every two years or as agreed in the phase-outs schedule 	<ul style="list-style-type: none"> Utility/ERB/NEMA 	
Efficient use of resources	<ul style="list-style-type: none"> Consumption records of water, electricity, fuel and other resources 	<ul style="list-style-type: none"> Financial savings in subsequent bills 	<ul style="list-style-type: none"> Monthly 	<ul style="list-style-type: none"> Utility 	
Social concerns	<ul style="list-style-type: none"> Inspection of record of concerns from the community 	<ul style="list-style-type: none"> Number, type of complaints Socio-economic 	<ul style="list-style-type: none"> Annually Every six months 	<ul style="list-style-type: none"> Utility Utility/KWS/Stakeholders 	

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	Legislation and Standards	<ul style="list-style-type: none"> Review of record of stakeholder consultations Inspection of register for current and anticipated applicable local and international legislation, regulations and standards 	<p>status</p> <ul style="list-style-type: none"> Implementation of agreed actions Valid licenses Inspection certificates Other compliance records 	Annually or as necessary	ERB/relevant legislative authorities
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S7.2 MONITORING PROTOCOLS FOR HYDRO-POWER PLANTS

Monitoring Issue	Parameter	Monitoring Method	Indicator	Frequency of Measurement	Responsibility
Catchment Conservation	Regulatory activities at the catchment areas	<ul style="list-style-type: none"> Inspection of development plans from regional authorities Inspection of monitoring and evaluation programmes Visual inspections GIS 	Status on implementation of plans and activities within the catchment areas	Annually	Regional development authorities/Ministry of Water Resources/Catchment Boards/Ministry of Agriculture/local authorities/ERB
	Soil erosion	<ul style="list-style-type: none"> Visual inspection Record of periodic assessment GIS 	<ul style="list-style-type: none"> Agricultural husbandry practices Vegetation cover on highly erodible sites Re-vegetation of previously eroded sites 	Twice a year to cater for seasonal variation	Regional development authorities/Ministry of Agriculture/local authorities/Local NGOs/ERB
	Sediment load and turbidity of rivers, dams and wells	<ul style="list-style-type: none"> Ultrasonic equipment Portable turbidity meters Depth probing 	<ul style="list-style-type: none"> Measured level of sedimentation Water turbidity 	<ul style="list-style-type: none"> Every two years Quarterly 	Regional development authorities/Ministry of Agriculture/ERB
	Flora/Vegetation cover	<ul style="list-style-type: none"> Visual inspection GIS 	Abundance of vegetation, monitoring records of cleared and re-vegetated areas	Every six months	Regional development authorities/Ministry of Agriculture/ERB
	Fauna to include fish, livestock and other animal species	<ul style="list-style-type: none"> Fisheries department data NMK and KWS surveys Participatory monitoring by pastoralists and fishing communities in the catchment area 	Abundance and diversity (animal numbers, types, movement and distribution)	Every six months	Regional development authorities/stakeholders

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Air emissions/ambient air quality	Ozone	<ul style="list-style-type: none"> Proprietary gas measuring meters 	24 hour averages and daily maximum concentrations	Quarterly for the life of the project	Utility/independent consultant
	Dust	Visual inspection	Airborne particles	Twice during the dry season	Utility
	Climatic conditions	Keeping record of meteorological data from automatic data logger or the nearest KMD station	Wind speed and direction, temperature, relative humidity, solar radiation, rainfall amounts	Continuous recording	Utility
Water Quality	Effluent discharged from oil interceptors/oily water treatment unit	Samples for laboratory analysis	Measured levels of <ul style="list-style-type: none"> Oil and grease Total suspended solids BOD and COD Total chromium, copper, iron and zinc 	Quarterly for the life of the project	Utility/independent laboratory for verification
	River intake	Water samples for laboratory analysis for corrosivity	Concentration of pesticide and fertilizer residues	Quarterly for the life of the project	Utility/independent laboratory for verification
Noise	Occupational noise	Periodic measurement with a noise meter	Time averaged measurements in dB(A) at work areas within the plant boundary	Weekly	Utility/OHSD (MoL)
	Solid waste	Tracking the volume of solid waste generated and establishing the treatment, storage, transport and disposal methods	Waste streams and volumes generated on site	Continuous	Utility/ERB/local authorities
Waste Management	Hazardous waste	Tracking all hazardous waste and establishing storage, handling and disposal methods	Generated quantities of <ul style="list-style-type: none"> Used oils Solvents Sludge Process residue 	Continuous	Utility/NEMA/ERB/local authorities
	Health and Safety	Adoption and	Identified and established	Continuous as	Utility/ERB
		Annual EHS audits			

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implementation of EHS policies	targets	necessary	Utility/ERB/OHSD
Employee EHS training	Inspection of records of training programs including fire drills, environmental and safety training	Annual record on status and updates	Utility/ERB/OHSD
Development and maintenance of EHS plans, procedures and manuals	<ul style="list-style-type: none"> • Annual EHS audits • Inspection of plans, procedures and manuals 	Annual record of staff training programs executed	Utility
Occupational health and safety monitoring	Reporting of accident and incidents, safety breaches and damage to equipment	Annual statistical records and safety reports	Utility/ERB/OHSD
EHS audits	Inspection of previous EHS internal and external audit records	<ul style="list-style-type: none"> • Number and type of corrective actions raised • Status on implementation of corrective actions 	Utility/independent auditor/ERB

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Other Environmental Health and Safety Issues	Soil contamination	<ul style="list-style-type: none"> • Visual assessment of oil stains • Soil analysis during spill incidents 	<ul style="list-style-type: none"> • Presence of stains • Measured levels of VOCs/TPH 	<ul style="list-style-type: none"> • Daily visual inspections • As necessary 	Utility
	Maintenance of fire appliances	<ul style="list-style-type: none"> • Inspection of maintenance and servicing records of fire appliances 	Quarterly record of reports by local fire appliance dealers	Quarterly	Utility/fire appliance dealer
	Ozone Depleting Substances (ODS)	<ul style="list-style-type: none"> • Inspect schedule of phase-out of ODS 	Status on the phase-outs of ODS	Every two years or as agreed in the phase-out schedule	Utility/ERB/NEMA
	Social concerns	<ul style="list-style-type: none"> • Inspection of record of concerns from the community • Review of record of stakeholder consultations 	<ul style="list-style-type: none"> • Number, type of complaints • Socio-economic status • Implementation of agreed actions 	<ul style="list-style-type: none"> • Annually • Every six months 	Regional development authorities/Utility/stakeholders
	Infrastructure (access roads)	Visual inspection	<ul style="list-style-type: none"> • Condition of access roads 	Gravel roads after every rainy season. Bitumen surfaced roads as soon as defects are noted.	Utility
	Legislation and Standards	Inspection of register for current and anticipated applicable local and international legislation, regulations and standards	<ul style="list-style-type: none"> • Valid licenses • Inspection certificates • Other compliance records 	Annually or as necessary	ERB/relevant legislative authorities

S7.3 MONITORING PROTOCOLS FOR THERMAL POWER PLANTS

Monitoring Issue	Parameter	Monitoring Method	Indicator	Frequency of Measurement	Responsibility
Air emissions	Sulphur oxides (SOx)	<ul style="list-style-type: none"> Stack emission measurements Fuel quality measurements 	<ul style="list-style-type: none"> Measured level vis a vis sulphur content in fuel Sulphur content in fuel 	<ul style="list-style-type: none"> Annually Testing each fuel shipment received and at least 4 random samples per year 	<ul style="list-style-type: none"> Utility/independent consultants Utility/independent laboratory for verification
	Nitrogen oxides (NOx)	Stack emission measurements	Measured level of nitrogen oxides	Annually using manual gravimetric method or similar	Utility
	Particulate matter (PM)	<ul style="list-style-type: none"> Stack emission measurements Fuel quality measurements 	<ul style="list-style-type: none"> Measured level of particulate matter Ash content in fuel 	<ul style="list-style-type: none"> Testing each fuel shipment received and at least 4 random samples per year 	Utility/independent laboratory for verification

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Ambient air quality	SOx and NOx	Continually analyzed at agreed locations	24 hour and annual average	Continuous for Kipevu plants and other plants to cater for seasonal variation	MENR/utility/independent consultants
	PM	Continually analyzed at agreed locations	24 hour average	Continuous for Kipevu plants and other plants to cater for seasonal variation	MENR/utility/independent consultants
	Climatic conditions	Keeping record of meteorological data at the station or the nearest KMD station	Wind speed and direction, temperature, humidity	Continuous recording	KMD/utility
	Effluent from storm drains	Continuous analysis	pH measurements	Weekly	Utility
Water quality	Effluent discharge from oil interceptors/oily water treatment unit	Grab samples for laboratory analysis	Measured levels of: <ul style="list-style-type: none"> • Oil and grease • Total chromium, copper, iron and zinc • Total suspended solids • BOD and COD 	Quarterly for the life of the project	Utility/independent laboratory for verification
	Groundwater	Grab samples from water wells or boreholes located within a radius of 2 km from the power plant for laboratory analysis	Measured levels of: <ul style="list-style-type: none"> • Oil and grease • Total chromium, copper, iron and zinc 	Quarterly for the life of the project	Utility/independent laboratory for verification

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Noise	Occupational noise	Periodic measurement with a noise meter	Time averaged measurements in dB(A) at receptors outside the plant boundary	Annually	Utility/ERB/OHSD
	Ambient noise	Measuring noise levels at 100% full load operation using an integrating noise analyzer	Time averaged measurements in dB(A) at receptors outside the plant boundary	Weekly	Utility/OHSD (MoL)
Waste Management	Solid waste	Tracking the volume of solid waste generated and establishing the treatment, storage, recycling, transport and disposal methods	Waste streams and volumes generated on site	Continuous	Utility/local authorities/ERB
	Hazardous waste	Tracking all hazardous waste and establishing storage, handling and disposal methods	Generated quantities of: <ul style="list-style-type: none"> • Used oils • Solvents • Sludge • Process residue 	Continuous	Utility/NEMA/local authorities/ERB

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	Adoption and implementation of EHS policies	Annual EHS audits	Status of identified and established targets	Continuous as necessary	Utility/ERB
Health and Safety Management	Employee EHS training	Inspection of records of training programs including fire drills <ul style="list-style-type: none"> • Annual EHS audit • Inspection of plans, procedures and manuals 	Annual record of staff training programs executed or attended Annual record on status and updates	Annually	Utility
	Development and maintenance of EHS plans, procedures and manuals	<ul style="list-style-type: none"> • Annual EHS audit • Inspection of plans, procedures and manuals 	Annual record on status and updates	Continuous as necessary	Utility
	Occupational health and safety monitoring	Reporting of accidents and incidents, safety breaches and damage to equipment	Annual statistical records and safety reports	Continuous	Utility/ERB/OHSD
	EHS audits	Inspection of previous EHS internal and external audit records	<ul style="list-style-type: none"> • Number and type of corrective actions raised • Status on implementation of corrective actions 	Quarterly for internal audits and annually for external audits	Utility/independent auditor/ERB

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<p>Other Environmental Health and Safety Issues</p>	Soil contamination	<ul style="list-style-type: none"> • Visual assessment of oil stains • Soil analysis during spill incidents 	<ul style="list-style-type: none"> • Presence of oil stains • Measured levels of VOCs/TPH 	<ul style="list-style-type: none"> • Daily visual inspections • As necessary 	Utility/independent consultant
	Maintenance of fire appliances	Inspection of maintenance and servicing records of all fire appliances	Quarterly record of inspection reports by local fire appliance dealers	Quarterly	Utility/local fire appliance dealer
	Ozone Depleting Substances (ODS)	Inspect schedule of phase-outs of ODS	Status on the phase-out of ODS	Every two years or as agreed in the phase-out schedule	Utility/ERB/NEMA
	Efficient use of resources	Consumption records of water, electricity, fuel and other resources	Financial savings in subsequent bills	Monthly	Utility
	Social concerns	<ul style="list-style-type: none"> • Inspection of record of concerns from the community • Review of record of stakeholder consultations 	<ul style="list-style-type: none"> • Number, type of complaints • Socio-economic status • Status on implementation of agreed actions 	<ul style="list-style-type: none"> • Annually • Every six months 	<ul style="list-style-type: none"> • Utility • Utility/stakeholders/ERB
	Legislation and standards	Inspection of register for current and anticipated applicable local and international legislation, regulations and standards	<ul style="list-style-type: none"> • Valid licenses • Inspection certificates • Other compliance records 	Annually or as necessary	ERB/relevant legislative authorities