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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

PROJECT TITLE: ASSESSMENT OF ENERGY USE AT A LIQUID CARBON DIOXIDE PRODUCTION PLANT

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ABSTRACT

Energy acquisition and use have been of increasing concern. This being a valuable resource, many people are looking at it with a view of either reducing overall energy used or improving efficiency. An assessment of energy use was done at CO_2 producing plant. The aim of the assessment was to find out the working condition of equipments and energy use, identify energy saving opportunities and determine potential savings. The plant is situated 30 kilometers from Nairobi city on Nairobi - Nakuru road. It produces an average of 11,000 tonnes of CO_2 per year and records an average use of 180 kWh/tonne. It has two major sources of energy namely electricity and diesel. Major energy consuming equipments at the plant include: compressors, motors, fans, refrigeration coolers and lighting.

The assessment was narrowed down to major energy consuming equipment. It was executed in two phases first being, the plant energy historical data analysis and secondly a detailed assessment which involved taking site measurements and recordings.

Analysis of historical data shows increase in energy consumption over the years. Intensities had too much scatters that is associated with inefficient operation. Most of the equipments were found to be in good working condition. However, a belt at one of the compressor was torn as a result of vibrations due to misalignment of the compressor and the motor.

Analysis of site metered data shows that compressors consumed most of the energy at the plant. Power consumed at the R22 compressor fluctuated over a long period of time. The plant looses energy through exposed surfaces which can be insulated. The plant has 67 fluorescent fittings in number that can be changed to electronic ones. Standard motors used at the plant can be replaced by energy efficient types. The cooling process utilizes a heat exchanger with a fan. A lot of heat is dissipated to the atmosphere which when harnessed can be used at the plant. The plant is billed on C1 tariff which is slightly higher than C12.Savings can be achieved by changing to the later.

The plant will make a saving of Kshs. 2,579,750/= annually by changing the tariff from C1 to C12 with payback period of 3.8 years. A saving of Kshs. 319,939/= will be realized by coupling the motor directly with the compressor and thus eliminating energy losses due to the drive. Electronic ballast fittings used in the place of fluorescent tubes will result to an annual saving of Kshs. 113,082.28 with payback period of 11 months. Change of motors from standard to energy efficient will result in a saving of Kshs. 640,926/=. Lastly, modifying heat exchanger to be used to heat water may save the plant Kshs. 8,002/= annually.