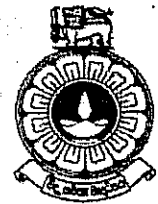


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THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
MASTER OF TECHNOLOGY IN INDUSTRIAL ENGINEERING – LEVEL07
FINAL EXAMINATION – 2008/2009
MEX 7125 – ENERGY MANAGEMENT IN INDUSTRIES



DATE : 04 April 2009
TIME : 0930-1230 hrs
DURATION : Three (03) hours

This paper consists of Six (06) Questions. Answer five (05) Questions including Q1 OR Q6. Do not Answer both Q1 and Q6.

Instructions

1. Read the questions carefully before answering.
 2. Please note that you should write your registration number and your index number in each pages of your answer book. Do not write your name.
 3. In case of doubt, please consult the supervisor or an invigilator conducting the examination.
 4. Answer five (05) questions including **Q1 OR Q6**.
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Q1.

'William Transport' is a reputed goods transporting company having a fleet of 25 Lorries and 5 Passenger Vans. Its head office is at Panadura and has a branch office in Anuradhapura. The main business of the company is transporting vegetables from growing areas to Colombo and other main cities. Recently, the company started a school van service from Panadura to Colombo with 5 passenger vans. When time permits other goods are also transported occasionally if such requests are there. The main trunk routes along which William Transport operates are Colombo-Kandy, Colombo-Thanamalvila, Colombo-Welimada, Colombo-Pollonnaruwa, Colombo-Kurunegala and Colombo-Anuradhapura, and en route most of the other main cities are served. Mr. William is in late fifties and is a hard working person. Apart from drivers and helpers for the Lorries, he employs only a clerk, an account assistant and a helper at the Panadura office, and just one person at Anuradhapura office.

Mr. William started this transport service as a family business with humble beginnings with just one lorry and a delivery van in 1970. Gradually with sheer commitment he built up his business to what it is today. Mr. William is a person with conservative ideas, and does not change easily with time. His fleet of vehicles are fairly old with 80% of the Lorries more than 15 years, but he maintains the vehicles in running condition. He gets the assistance of a motor garage in Panadura to attend to any repairs of his fleet of vehicles. Nevertheless, at least 20% of the vehicles in the fleet are out of service at any given time due to break downs, and the trend seems to be worsening. The garage owner has advised Mr. William several times that the batteries of majority of the vehicles need immediate replacement. Mr William did not take a serious note of this as the drivers have never refused to drive the vehicles, other than reminding him of the problem from time to time. Drivers knew how to deal with the situation, and never bothered about wastage of fuel that would occur due to their actions to overcome the problem of weak batteries. In addition, incidence of breakdowns occurring when vehicles are at outstations began to

increase during the last five years. Mr. William has given advice to drivers to get repairs done from a local garage. But, Mr. William was not very sensitive to the losses incurred due to such frequent breakdowns. In all vehicles a vehicle running log which records fuel taken, places of visit, mileage, etc., is maintained by the driver and checked periodically by the Account Assistant for the purpose of costing only. William has been running the business well, though the profit has started to decline steadily during the last 5 years due to increase in cost of his operations. The main factors have been the maintenance cost, fuel cost, lost opportunity due to breakdowns.

The logistics of the transport service has been done by the Account Assistant on the instructions of Mr. William. It is a common occurrence that Lorries travel empty on either forward or return journeys. However, it was never a problem for Mr. William before his transport charges are fixed to compensate such unproductive travel. In addition, every time the fuel price is increased by the government Mr. William increased his transport charges.

The recent increase in fuel cost has been worrying Mr. William as his cost of operation has further increased and in fact has started to show a negative return for the first time. In addition, he observed a declining trend in the transport contracts he is getting. He came to know that he is losing the business to other competitors, who are providing the service at very competitive rates. For the first time in his 38 years of operation he realised the need for professional advice for revamping his transport business and brought up to compete with other competitors in the market.

Answer the following questions.

1. Analyse the problem faced by the William Transport Service and frame strategies and actions to be taken to rejuvenate the business to be in competition with other operators operating in the market.
2. Highlight specific areas needing attention and explain why, with specific reference to energy.

(30 marks)

Q2. Write short notes on four of the following.

- a. Demand Side Management
- b. Company Energy Policy
- c. Energy Efficiency Indicator
- d. Dendro power
- e. Greenhouse effect
- f. Kyoto Protocol

(15 marks)

Q3. Discuss the role of energy management in controlling energy cost.

(15 marks)

Q4. Coal power is being considered a suitable option for meeting future electrical energy demand in Sri Lanka. Discuss the pros and cons of this decision with reference to energy security, energy cost and environmental performance.

(20 marks)

Q5. Media, in this country, is often blamed for not taking an active role in sensitizing the general public on the energy crisis that has plagued the country for several decades. Discuss the role that the media could play in inculcating a conducive mind set among the public so that their active cooperation and participation could be solicited in implementing programmes aimed at addressing this problem?

(20 marks)

Q 6.

The graph shows the average monthly electricity demand curve of a production factory. In a demand management exercise, the company would like to reduce the maximum demand of their electricity consumption. The following data has been collected by the company.

Monthly average maximum demand - 182 kVA

The contribution of major loads to the maximum demand, and their current average operating times, their service requirements and frequency of use as monitored by the factory are as follows.

No	Load Type	kVA	Service Requirement	Current Operating Times	Frequency of Use
1	Production M/C	25	08.00hr – 20.00hr	08.00hr – 20.00hr	Daily
2	Production M/C	15	09.00hr – 19.00hr	09.00hr – 19.00hr	Daily
3	Production M/C	10	09.00hr – 19.00hr	09.00hr – 19.00hr	Daily
4	Production M/C	08	Flexible	09.30hr – 11.30hr	Daily
5	Electric Steam Boiler	40	08.30hr – 17.00hr	08.30hr – 17.00hr	Daily
6	Air Conditioning	30	08.30hr – 17.00hr	08.30hr – 17.00hr	Daily
7	Air Compressor	12	08.30hr – 17.30hr	08.30hr – 17.30hr	Daily
8	Water pump	05	Flexible	08.30hr – 10.00hr	Daily
9	Fire Protection System (testing only)	14	Flexible	09.00hr – 10.30hr	Once a month
10	Water heaters (Hot water for drinking purposes)	15	Flexible to a certain degree	08.30hr – 10.30hr 15.00hr – 15.30hr	Daily Daily

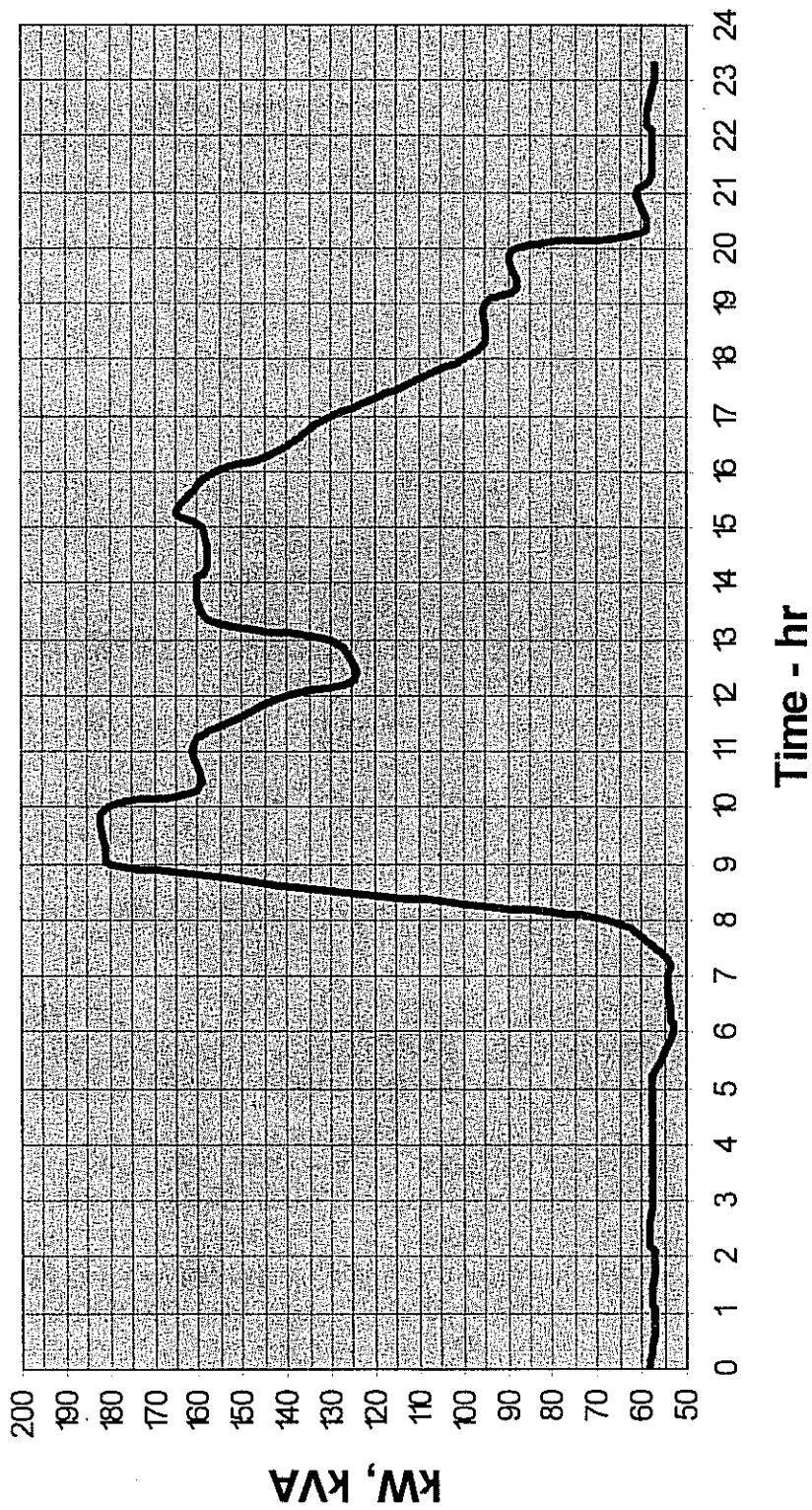
In addition there are other loads such as general lighting, security lighting, office equipment, etc.

Company is aware of the fact that the boiler accounts for the highest electricity consumption in the factory in addition to its contribution to the maximum demand. They have got an offer for an oil fired boiler with steam capacity of 100kg/hr, sufficient to meet the demand, at a cost of Rs. 400,000. Current average monthly electricity consumption of the boiler is 10,200 kWh. It has been estimated that if an oil fired boiler is used to produce steam, the power consumption of the new boiler unit would be only 6.8kW at 0.85 Power Factor.

The electricity tariff currently being used by the company is industrial purpose tariff option 2 (I₂), where the maximum demand charge is Rs. 675 per kVA, and the unit charge is Rs. 9.30 per kWh.

- Discuss the direct options available to minimize the maximum demand of the factory? Determine the optimum reduction in maximum demand that is possible, if these options are implemented.
- Calculate the estimated annual cost savings due to above load management exercise.

Average Monthly Electricity Demand Profile



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