ENERGY CONSERVATION IN THE OIL REFINERY

Co-Authors :

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The Petroleum Refinery of the Ceylon Petroleum Corporation is one of the biggest energy consumers in the country. Hence it is not strange that the refinery pays a greater interest for Energy Conservation due to the fact that it's current total fuel cost is about 350 million rupees per annum. Infact the refinery started implementing energy conservation measures even before the energy crisis of 1974. With the energy crisis refinery started a systamatic energy conservation programme to cut down energy consumption as a means of coping with the increasing energy cost. As a result of the conservation measures adopted by the refinery it's specific fuel consumption (Kg. of standard refinery fuel per MT of crude processed) came down from 56 in year 1971 to 40 in year 1984. This was a reduction of about 29% of the specific fuel consumption. The refinery had to invest in capital intensive projects and make some institutional changes to achieve the above. Simple pay back period for energy conservation projects were between half a month to 19 months and the highest single investment amounted to rupees 33 million.

It is of considerable importance to describe the fuel and steam system of the refinery before going into details of the refinery energy conservation programme. The refinery uses 3,500 second (Redwood I) fuel oil and refinery fuel gas as energy sources. The fuel gas constitutes light hydro carbons and the composition varies from methane to butane. All the fuel gas produced in refinery process units are diverted into a central fuel gas system, the pressure of which is controlled. Both fuel oil and fuel gas are used in refinery process furnaces while only fuel oil is used in boilers. The maximum possible fuel gas produced in the process units are used in the process furnaces and fuel oil is used to supplement the short-fall in energy requirements.

Refinery needs a steady supply of electricity which is produced in a 4.5 MW thermal power plant. For this purpose steam at 550 psig from the boiler is fed into extraction/condensing turbines. Medium pressure (M.P.) process steam (at 250 psig) is produced by waste heat recovery and the process steam needs are supplemented by extracting steam from the power turbines at 250 psig.

Part of the M.P. steam produced is used in back pressure turbines which vent into low pressure (L.P.) steam system at 40 psig. Most of the L.P. steam is used for heating purposes and the L.P. steam availability has often been in excess of the requirements.

Energy Conservation Programme :

An Energy Conservation Committee headed by the Refinery Manager was set-up in the refinery in 1974. Section Heads, middle grade engineers and technologists were appointed to this committee. This committee identified the areas in which energy conservation could be undertaken. The committee also identified specific proposals and grouped them into short term, medium term and long term projects for energy conservation. It also identified capital intensive and non capital intensive projects and institutional measures that could be taken with the least expenditure. The non capital intensive projects and measures that could be taken in house were given priority and task forces were set-up to implement them immediately. Certain targets were set for implementation of these proposals and measures.

The proposals that have been implemented are :—

Short Term Projects :

(*a*) **Utilisation of L.P. steam to pre-heat fuel oil instead of M.P. steam:**

The original fuel oil pre-heating system with M.P. steam was modified to use L.P. steam which is often in excess. This measure reduced the M.P. steam requirements and hence fuel consumption in the boilers.

(*b*) Elimination of steam leaks.

(*c*) Insulation of hot valves and lines and increasing insulation thickness of the platformer reactors.

(*d*) **Utilisation of hot straight run gas oil for heating up bitumen storage tanks and filling facilities.**

The original heating system for bitumen storage tanks and filling facilities was with circulating hot oil heated up in a furnace. This was modified to use hot process run down gas oil. The furnace which was used to heat up circulating oil was taken out of operation thereby saving fuel.

MAINLY ABOUT MEMBERS

SINHA GOLD MEDAL FOR OUR PRESIDENT

The Sinha Gold Medal 1984-85: for outstanding scientific achievement in Sri Lanka, was awarded to Prof. Mohan Munasinghe, Senior Energy Advisor to H. E. the President and Chairman, Computer and Information Technology Council, by the Lions International Organisation, on 11th May, 1985.

Congratulations Sir.

VICE PRESIDENT'S VISITS MALAYSIA

Mr. E. N. Wijemanne, our Vice President, participated in the preliminary meeting of ADPC. drawing up the details of APENPLAN — held in Kualalumpur in April. He successfully negotiated to have the second seminar for 'Senior Energy Planners' in Colombo.

SHAVI TO BANGKOK

Mr. Shavi Fernando, one of the Joint Secretaries, will 'follow' the first seminar for Senior Energy Managers to be held in Bangkok in September, 1985. This will enable us to organise the Colombo seminar successfully.

WICKS TO BANGKOK

Mr. B. N. I. F. A. Wickramasooriya, a SLEMA member, has been accepted as one of the lecturers at the seminar for Senior Energy Manager, to be held in Bangkok, in September.

SO HE SAYS —

"The commitment of Senior Management is only half the story, even if a crucial component. The other half comprises of Energy Managers like your selves with great responsibility for energy efficiency".

Mr. Peter Walker,
Secretary of State for Energy, U. K.

— *ENERGY MANAGEMENT*

SEVEN ENTER FOR "MOHAN MUNASINGHE AWARD"

At the time of going to press, the following Seven entries have been received :—

Ceylon Electricity Board (2 entries)

Ceylon Tyre Corporation

Richard Peiris Ltd.

Hotel Lanka Oberoi

Pugoda Textile Mills

Thulhiriya Textile Mills

WATCH OUT FOR DETAILED REPORT IN THE NEXT ISSUE

SLEMA JOURNAL CONGRAGULATES THE WINNER

ENERGY MANAGEMENT A GOLD MINE

- Lanka Oberoi saves Rs. 133,000, — per year by switching-off non-essential lights.
- Tyre Corporation saves Rs. 163,744/- per year by replacing 26 Asbestos Sheets with Translusent Sheets.
- Fluorescent street lamps saves Rs. 20,000/- per year for Pugoda Textiles.
- Drying chamber modification at Rs. 60,000/- saves Rs. 752,400/- per year for Richard Peiris.
- Steam leaks stopped means Rs. 200,000/- year for Lanka Oberoi.

ENERGY CONSERVATION — THE ONLY CHEAP ENERGY RESOURCE

FIVE STAR TREATMENT FOR ENERGY MANAGEMENT

Hotel Oberoi, to ward off fierce competition within the hotel trade, has rightly chosen energy management as one of the means of reducing operating costs, and hopes to save Rs. 3.7 million per year.

"Early in 1984, the management set-out targets on Electricity, fuel oil and water consumption which were to be met during the course of the year. The target was to achieve a 10% reduction in heat, light and power expenses without lowering the operating standards of the hotel" says the Engineering Director who has confidently met the challenge with the team of engineers.

Here are some of the areas in which savings have been achieved :—

(1) Switch off non-essential lighting.
(2) Modification to lighting fittings.
(3) Fitting plastic curtains to all freezer doors and cold rooms.
(4) Electrical load management.
(5) Steam system, insulation, stopping leaks, *etc.*
(6) Use of smaller high pressure boiler and large low pressure boiler.
(7) Reducing air conditioning loading.
(8) Proper utilization of kitchen and laundary facilities.

Capital intensive energy saving proposals are being phased out and include major projects such as use of smaller H. P. boiler and a large L. P. boiler, installation of multi-fuel boiler and installation of an absorption chiller

A notable organisational feature of Oberoi's energy conservation programme, is the fixing of responsibility for Energy Management on one of the officials, and the day to day monitering of energy consumption.

The report of the Director Engineering reflects the dedication and determination with which Oberoi is to push the energy management programme. 'Engineers and Management of Lanka Oberoi regard energy management as an important operating tool in their daily duties and will continue to strive for optimising energy efficiency in the future'.

SLEMA journal wishes Hotel Lanka Oberoi success and hopes to publish in the forthcoming issue, a detailed account of its energy saving programme. Incidentally, Hotel Lanka Oberoi is an institutional member of SLEMA.

PUGODA TEXTILES PROFITS — SEVEN MILLION RUPEES A YEAR ON ENERGY CONSERVATION

Pugoda Textile Mill's, Rs. 7 Million a year energy saving success story is certainly news worthy.

The words of Mills Manager perhaps sets the underlying policy of the organisation. "On the subject of Energy Management and Conservation our policy has always been to highlight the importance of conservation of energy to reap the benefits of cost reduction and eliminate waste which is a drain on our resources".

The Pugoda Textile Mill's phenomenal success, surprisingly is born of simple, well-known techniques of energy conservation and is an eye opener for other firms.

Here are the energy conservation methods adopted and the benefits reaped at Pugoda.

		Rs.
1.	Improvement of power factor ...	52,500 *p.m.*
2.	Rationalising steam production ...	170,000 *p.m.*
3.	Increasing combustion efficiency and using heavier grade fuel ...	274,000 *p.m.*
4.	Reducing refrigeration and Air-Conditioning load	80,000 *p.m.*
5.	Conversion of incandacent Street Lighting to flourscent lighting ...	20,000 *p.m.*
	Monthly Savings *Rs.* ...	596,500

"Our engineers operate even in day to day work with strict discipline towards energy conservation and cost reduction. The Engineering Department *as a team* has worked at all these measures undertaken. Implementing conservation measures *is a continuous process*, always to be kept in place with development. We shall endeavour to contribute towards this end always as we are aware that these have a major impact on the viability of any industry"

These concluding remarks of the Mill Manager; no doubt reflects the dedication and determination of the band of energy conscious managers of the Pugoda Textile Mill. We wish the 'team' well in their efforts and thank them for sharing their knowledge with us. (A detailed report will follow in the next issue of this Journal.)

Pugoda Textile Mills Limited is an Institutional Member of SLEMA.

DISTRIBUTION DEVELOPMENT AND REHABILITATION PROJECT OF THE C.E.B.

By

C. RATNAYAKE,
Project Manager,
Distribution Development & Rehabilitation Project,
Ceylon Electricity Board

1. Introduction :

1.1. General

After the high rate of growth of electrical power and energy demand from 1977 onwards, power shortages were anticipated and major capital investments were first committed to generating plant. These have resulted in the commissioning of two phases of gas turbines adding upto a total of 120 MW (in 1980 - 1982) and a diesel generating station of 80 MW in 1984 with respect to urgently required thermal plant. Also investments in the major accelerated Mahaweli Power Projects have also been made and generation of power and energy from these are also being gradually brought into the system with Victoria (3 x 70 MW) already commissioned and Kotmale (2 x 69 MW) presently being commissioned into service. Along with increased generation, transmission facilities too were strengthened and developed by World Bank loan Power Project 6 and Power Project 7.

The low and medium voltage distribution development has invited the least attention in the recent past. With the result increased demands arising from additional houses, industries and commercial establishments as well as increased domestic and industrial equipment that were installed in the existing establishments have had to be supplied with electricity on virtually the same distribution lines. The result of this are manifold and the following summeries a few of them :—

(*a*) overloading of distribution lines and poor voltage conditions, particularly at peak load times.

(*b*) increased technical losses due to higher electrical power and energy being transported on the same lines. Since losses increases as the square of the load current the rate of increases of losses have been considerably high. Further much of the high load growth have occured in areas which already have a high load concentration thus aggravating the problems even more.

(*c*) consequent to the increased loadings on existing distribution facilities many distribution lines which were capable of being fed from more than one source have now been restricted to one feeding source only. This has resulted in increased outages and lower system reliability in many important areas. These additional outages not only cause a financial loss to the CEB but a much greater economic loss to the country.

(*d*) the high loading level on distribution lines as well as equipment such as transformers and switchgear has resulted in a reduction of plant reliability and expected life times. The heating effect caused by high loading levels in the system has had detrimental effects on poorly constructed conductor joints contacts *etc.* The losses caused by damages to equipment had also thus been quite considerable. The 'rehabilitation' component of the project is the result of this overloading situation as well as the lack of suitable material stock for maintenance operations.

1.2 Present System Loss Levels :

The order of magnitude of the present system loss levels are approximately as given below :—

	Energy loss		*Peak time Power Loss*	
	% of gross generation	*% of through put*	*% of gross generation*	*% of through put*
Generation station auxiliaries and gen. transformers ...	1	1	1.5	1.5
Transmission systems and grid substation transformers ...	4	4	6	6
M. V. Distribution system ...	7	8	11	12
Distribution transformers ...	2	2	2	2
L. V. Distribution ...	1	8	3.5	10
Non-Technical	1		2	
	16%		26%	

Continued on Page 16

SRI LANKA ENERGY MANAGER S' ASSOCIATION INSTITUTIONAL MEMBERSHIP

Mem. No.	*Name of Organisation*
IM01	— Pugoda Textile Mills, 422, Galle Road, Colombo 3.
IM02	— Hotel Lanka Oberoi, 77, Steuart Place, Colombo 3.
IM03	— Government Owned Business Undertaking of Ceylon Oxygen Ltd. 50, Sri Pannanda Mawatha, Colombo 15.
IM04	— National Paper Corporation, P. O. Box 1367, Colombo 2.
IM05	— CTC Services Ltd., 29, Horton Place, Colombo 7.
IM06	— Hotel Ceylon Intercontinental, 48, Janadhipathi Mawatha, Colombo 1.
IM07	— Lever Brothers (Ceylon) Ltd., 258, Grandpass Road, Colombo 14.
IM08	— Associated Motorways Ltd., Nagoda, Kalutara.
IM09	— Richard Peiris & Co., Ltd., 69, Hyde Park Corner, Colombo 2.
IM10	— Sri Lanka Cement Corporation, 302, Galle Road, Colombo 4.
IM11	— Industrial Development Board of Ceylon, 615, Galle Road, Katubedda, Moratuwa.
IM12	— Ceylon Petroleum Corporation, P. O. Box 634, 113, Galle Road, Colombo 3.

Continued from Page 15

DISTRIBUTION DEVELOPMENT....

The above values are overall figures at each voltage level. If individual feeders are examined we would find some items at very high losses while a number of lines at low loading levels would have low losses.

2. System studies and organisation arrangements :

With a view to rectifying the high loss levels and deficiencies of the Distribution network, extensive system studies have already been carried out and a project prepared for early funding by the World Bank. Data on the C. E. B. Distribution network in most of the heavily loaded areas have been collected and this data has been subject to system studies using a digital computer. The software available provides the planner with state of the art techniques which enable quick determination of load flow results at varying time periods switching conditions as well as the study of system additions such as capacitors. These studies have produced proposals which would uprate the system network to the required technical and economic standards.

The main components of the proposed project are as follows :—

(*a*) Introduction of thick gauge or "backbone" system of medium voltage feeders which will serve as an "express way" to reduce the overloading conditions of the existing network.

(*b*) Reconductoring of lines to higher cross sections.

(*c*) Uprating certain medium voltage sections from 11 kv. to 33 kv.

(*d*) Installation of capacitors for power facto improvement.

(*e*) Reduction of Low voltage coverage of transformers by decentralising the L. T. network.

The benefits of the above improvements would consist mainly of reducing system losses and increased reliability by the ability to feed system loads from more than one feeder source. Studies indicate that the return on investments is extremely high and the pay back periods often is in the region of about 2 to 3 years. The total cost involved in the project now been formulated is in the region of Rs. 1000 million and World Bank funding for the project is expected to be obtained shortly.

In the next issue we shall discuss methods used in technical and economical evaluation of the new proposals.