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Topic 2

The response of the query can be better explained if the meaning of the three crucial terms used to form the query is explained first.

- **Energy Conservation:** is achieved when the growth of energy consumption for the product, process or the area of consumption is reduced. This has simple relation with the reduction in the quantity of energy consumed over a span of time. This can be result of improvement in technology, process, and efficiency or simply change in habit to reduce the consumption. This may also result in the quantity of output, consumption and comfort level achieved out of use of energy.
- **Energy Efficiency:** is achieved when intensity of energy consumption for the product, process or area of consumption is reduced, without affecting the output, consumption and comfort level. This can be result of improvement in technology, process, and efficiency. This, in simple words means use less energy to perform same function.
- **Cost Reduction:** This means simply smaller energy bill, of course without affecting the quality of output. It can be achieved by energy conservation, energy efficiency, better management (adopting alternative cheaper cost sources, better use of resources, lower transportation and storage cost, lower waste etc.). The ultimate aim of cost reduction is to achieve reduction in the energy cost.

Thus from the above it is obvious that the three terms are explicitly different, however related to each other. Cost reduction is achieved, generally when energy conservation or energy efficiency is achieved.

It will be now easier to understand the four questions posed in the query for the week. Let us take hypothetical example of old design Power House, having 100 MW plant size. The plant is having a contract to supply 512 MU during the year. For this the plant is required to generate at 65% PUF. The auxiliary consumption for the lighting load is about 0.50% and 9.50% is consumed by other auxiliaries. The CV of coal received from existing source is 3000 K Cal /KWHr and specific consumption of coal is say 1.00 Kg/KWHr. Present level of efficiency of Boiler + TG sets for converting CV of coal into electrical energy is 25% (Say). From the calculations shown in the table below it is obvious that the plant is consuming 569 Million kg of coal containing 1708200 Million K Cal of Heat costing Rs. 56.94 Cr.Rs and cost of coal for the output is Rs. 1.11 per KWHr. These parameters are now changed to demonstrate the spirit of the questions posed.

Particulars		Base Case	Case 1	Case 2	Case 3	Case 4	
1	Capacity (MW)	100	100	100	100	100	
2	PUF (%)	65.00%	65.00%	64.93%	64.82%	64.82%	
3	Gross Generation (MU)	569	569	569	568	568	
4	Auxiliary Consumption	Lighting (%)	0.50%	0.50%	0.40%	0.40%	0.40%
		Auxiliaries (%)	9.50%	9.50%	9.50%	9.35%	9.35%
		Total (%)	10.00%	10.00%	9.90%	9.75%	9.75%
		Total (MU)	57	57	56	55	55
5	Net Generation (MU)	512	512	512	512	512	
6	Specific Coal Consumption (Kg/KWHR)	1.00	1.04	1.00	1.00	0.92	
7	CV of Coal (K Cal/ Kg)	3000	3125	3000	3000	2769	
8	Boiler +TG Efficiency	25%	24%	25%	25%	26%	
9	Quantity Of Coal Consumed (M Kg)	569	593	569	568	524	
10	Energy Consumed (M K Cal)	1708200	1853516	1706304	1703468	1451476	
11	Rate of Coal (Rs/Kg)	Basic Price	0.80	0.80	0.80	0.80	0.80
		Freight	0.20	0.10	0.20	0.20	0.10
		Total (MU)	1.00	0.90	1.00	1.00	0.90
12	Cost of Generation (Cr.Rs)	56.94	53.38	56.88	56.78	47.17	
13	Coal Cost (Rs./KWHR Sent Out)	1.11	1.04	1.11	1.11	0.92	
14	Difference (-)Savings / (+) Additional	Coal Quantity (M Kg)		23.73	-0.63	-1.58	-45.26
		Energy (M K Cal)		145316	-1896	-4732	256724
		Cost (Cr.Rs.)		-3.56	-0.06	-0.16	-9.77
		Cost (Rs/KWHR)		-0.07	0.00	0.00	-0.19

Case1. One may reduce energy cost but at the same time increase energy consumption

Let us think of the situation when one of the CW pump fails and efficiency of the power house reduces from 25% to 24%. This will result in increase in specific coal consumption from 1.00 to 1.04 Kg/KWHR. However, consequent to the efforts of Coal Manager, the plant is able to get the linkage of same quality coal from alternative source or due to commissioning of Captive conveyor belt / rail line, the cost of transportation goes down to Rs. 100 per MT from Rs. 200 per MT. The calculations shown in the table above clearly explain that the quantity of coal consumed increases, resulting in the energy consumed. However the cost of production goes down by 7 paise per unit and there is net saving of about 3.56 Cr.Rs. during the year.

Case2. One may conserve energy without improving energy efficiency

Let us think of the situation when the management decides to cut the lighting load by 20%, especially in the non critical area. The lighting load has no impact on the energy efficiency of the power house. The auxiliary consumption for lighting load goes down from 0.50% to 0.40% and hence over all auxiliary consumption goes down to 9.90% as against over all 10.00%. Thus the plant is required to generate at 64.93% PUF for meeting the contract supply. This results in saving of 1896 Million K Cal of Energy which is equivalent to 0.63 Million Kg of coal. There is a net saving of About Rs. 6 Lakh. The similar results can also be obtained by conserving energy in office by keeping lights and AC off when officers are not in their chamber, keeping the monitor of on LAN PC off when not using, stopping AC plant for cooling office in winter, putting light switches in street lights etc. These measures result in reduction of energy consumed but do not affect the energy efficiency of system.

Case3. One may conserve energy and improve energy efficiency

The efforts mentioned in preceding para to conserve energy are supplemented by improvement in energy efficiency programme. Let us take the case when auxiliary consumption is reduced to 9.35% from 9.50%. Over all auxiliary consumption shall be 9.75% and the plant will be required to operate at 64.82% to supply 512 MU. As obvious from the table above there are definite savings in energy and cost. Better saving can also be achieved if efficiency of conversion by Boiler +TG is also improved from 25% to a better level.

Case4. One may conserve energy, improve energy efficiency and reduce energy costs.

This becomes the best case scenario when efforts for Energy Conservation (reduction in lighting load from 0.50% to 0.40% etc), improvement on Energy Efficiency (efficiency of conversion by Boiler + TG improved from 25% to 26%, auxiliary consumption reduced from 9.50% to 9.35% etc.) and Cost Reduction Plan (reducing transportation cost from Rs. 200/MT to Rs. 100 /MT etc.) all are done simultaneously. The table above clearly explains that there is reduction in heat rate, energy consumption and hence coal quantity and cost. The cost of production also goes down and there is a net saving of about 9.77 Cr.Rs.