COAL IN RELATION TO POWER.

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It is unnecessary to discuss questions of power from the sun's heat, the tides, or the wind, as these are not serious considerations at present when we can secure relatively cheap power by well-known methods from hydro-electric sites, fuel oil and coal. It is to these I will draw attention.

Water-power has come to be understood as one of the cheapest means of supply because the cost at Niagara Falls, Kinlockleven (Scotland), and in Norway and Sweden are said to average, respectively, Rs.60, Rs.28 and Rs.16 per kilowatt year or from 0·10 to 0·03 annas per unit (kilowatt hour).

This kind of cheap power may be available in this country when the discharge water is saleable for irrigation purposes and the storage dam a part of an irrigation scheme. This is the case at the Mettur project in Madras which is also close to a railway and to deposits of magnetite and magnesite for the possible preparation of electrically smelted special steels and metallic magnesium.

With regard to oil fuel the demand may be gauged by imports of nearly £2,000,000 from Iran, while the imports of Burmese petrol (£2,000,000) and kerosene oil (£4,500,000) are still higher. These are all costly items and as India produces only about 75 million gallons of petroleum (£1,000,000) the threat of imported oil fuel for power purposes can be discouraged by attending to the subject of liquid fuel by-products from Indian coal.

In 1938 the Indian production of coal was over 28 million tons valued at Rs.1,064 lakhs (£8,000,000) and of this total perhaps one-ninth was used as raw material in making hard coke or in manufacturing gas. The remainder was burnt raw as fuel, largely for steam raising for power purposes in various industries, on the railways and for ships. And most of this coal, which was used as fuel, was burnt as raw coal.

If we consider that, say, 21 million tons of coal were burnt raw, we also conjecture a vast loss of rich gases, upwards of 200 millions of gallons of valuable tars (saleable at £2,500,000—Rs.330 lakhs) and other by-products. However much we may at present deplore this, we must face the actual facts of the case, and these are that the raw coal is cheap and may be burned with great thermal efficiency in boilers.

The average pit mouth's value of Indian coal in the chief producing area of India—the Damodar Valley—is probably Rs.2-12-0 and might sometimes be reduced to Rs.2 in many cases. The calorific value of these coals vary from over 13,000 B.Th.U's. per lb. to 11,000 B.Th.U's. and the average can be taken as about 12,000 B.Th.U's. This represents nearly 27 million B.Th.U's.

per ton so that roughly 2·5 tons of coal can yield 2 kilowatt years of electrical power (3 electrical horse power years).

Turning now to the generation of electrical power in practice we have to allow for losses in transfer of heat through mechanical energy to electrical power which, in an overall system of boilers-turbo-generators, may not exceed 15 per cent. So that roughly 8·34 tons of coal are required per kilowatt year. Presuming the generating station was at or near the colliery and the coal cost Rs.2-8-0 per ton, the cost per kilowatt year would be Rs.21 or 0·038 annas per unit (*i.e.* per kilowatt hour).

Estimating for a 100,000 kilowatt station operating at full load or at least a high power factor we may allow Rs.250 per kilowatt for the cost of the plant (machinery, etc.) or a total of Rs.250 lakhs which at so high an interest at 4 per cent would add Rs.10 per kilowatt year to the price of power. Alluding next for working expenses, upkeep, transmission and profit—say Rs.29 per kilowatt year, we get a total, rather optimistic perhaps, figure of Rs.60 per kilowatt year or 0·112 annas per unit (1·4 pies) which is the same as the average for Niagara.

It is not to be forgotten that I have estimated generously for coal which can be got more cheaply and also for interest on capital, but I have not faced the full question of power factor and some of you may consider that I have overlooked such important details as water supply for the cooling system which may require 6 to 10 million gallons a day. I have found several sites in the coalfields, both for cheap coal and sufficient water, and venture to say that cheap power from coal could be secured at about the cost I have estimated if it can be all sold.

I must again return to the subject of burning raw coal as against recovering the by-products, and I venture to lay down a general principle. This is that the by-product recovery will only lower the power cost where the power station is actually in a great industrial works, but in separate isolated power stations it is better to use raw coal in pulverised form of suitable, though not necessarily of the best, quality. Much of the ease of working will depend on the character and amount of the coal ash. If the coal has a high ash content but the ash is of low fusibility it will readily form slag which will be easy to handle and dispose of.