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FUEL FROM FORESTS

THE importance of forest fuel is apt to be out of focus in an industrial age where coal, oil and electricity occupy the foreground as sources of industrial power. It is worth while, therefore, to point out that while coal and oil are in the nature of fixed deposits drawn upon by man thereby inexorably diminishing the finite available stocks, fuel from the forest is in the nature of a current account which could continually be replenished; and, there is no reason why this account should not continue to run indefinitely, so long as man operates on it with prudence.

Wood was probably man's first fuel and fuel was probably man's first use of wood. Even to-day when wood has hundreds of other uses, it remains a fact that more wood is used as fuel than for all other purposes combined. Statistics relating to the annual consumption of wood in the world as a whole under various heads make interesting reading. Leloup, in a paper presented in 1949 to a Conference on the Conservation of Natural Resources, sponsored by the United Nations Organisation, made the following estimates:

Annual wood consumption in the world is 1,453 million cubic metres. This consumption is made up as follows :—

Fuel wood	825	million cubic metres	57 per cent. of the total
Sawn Timber	360		25
Pulp	119		8
Industrial wood	149		10

While these figures relate to the world as a whole, the consumption of wood in the individual countries varies, naturally, enormously; but, it is fallacious to assume that industrially advanced countries do not make much use of wood as fuel. For example, in the United States where wood industries are highly advanced and where alternative sources of fuel are plentiful, fuel is even to-day the largest single use of wood. The American Forest Products Industries Organisation estimates the principal uses to which the annual American wood harvest goes as follows : fuel 42 per cent., lumber 34 per cent., pulpwood 13 per cent. and all other uses 11 per cent.

There is also another angle from which we can get a perspective and appreciation of

forest fuel. If we consider the energy resources of the world as a whole, excluding from this survey atomic energy, by far the greater part of these are in the form of coal, peat, petroleum, oil shale, natural gas, wood, vegetable and animal wastes, non-tidal water power, tidal power, wind power, terrestrial heat energy, solar energy, food and man power. Long as this list is, it is far from complete. We may confine ourselves for the present to man's use of solar energy which till our own day has been the traditional and by far the largest single source from which man has drawn.

The forms in which solar energy are available to man are best and simply expressed in terms of a basic unit being the energy equivalent of one million tons of coal. Employing this unit, Parker made the following estimates. The capital resources of energy—mainly in the form of fossil fuels such as coal and petroleum —are of the order of six million million tons of coal. The energy income, mainly in the form of wood, water-power and food, are equivalent to about 5,000 million tons of coal a year. Parker estimates the world's annual consumption of fuel and energy at about 3,000 million tons of coal.

As already mentioned, the world's annual consumption of wood fuel is estimated by United Nations experts at 825 million cubic metres; equating, approximately 1½ cubic metres of wood to be one ton and taking five tons of wood to be equivalent to a ton of coal, this would mean that wood fuel contributes no less than the equivalent of 110 million tons of coal a year. Wood fuel is therefore significant even now in the fuel economy of the world.

Reference may be made here to another rather widely prevalent notion that since forest crops take time to mature, forest growth is a slow medium for the bottling up of solar energy. The facts are otherwise. It is true that as far as timber is concerned, a forest crop normally takes decades to be ready for harvest in contrast to an agricultural crop which often is an annual. But, if one puts into the balance sheet the entire organic matter produced by a forest crop during its normal life time, not excluding the litter produced year after year, and the root system below the ground, then, the figures make surprising reading. Ebermayr in Germany was amongst the pioneers to study this aspect of forest economy. He found that a normally stocked coniferous forest crop produces on an average about 4,000 kg. of dry organic substance per year per acre. This figure is substantially more than the organic matter produced in two typical agricultural crops, *viz.*, 2,000 kg. for hay and 1,500 kg. for beetroot per year per acre. Looking upon vegetation as merely a means of fixing carbon from the atmosphere into burnable carbon compounds, we thus see that a forest crop can be about twice as good as an agricultural crop. The 4,000 kg. of organic matter annually produced by an acre of forest would yield about 2,000 kg. of fixed carbon which on complete combustion should give 16 million kilocalories. This, then, is about the average amount of solar energy trapped by a forest crop per year per acre.

It is thus seen that contrary to appearances, forest crops are efficient converters of solar energy into usable fuel in the form of organic carbon and that wood is an important fuel even in highly industrialised countries.

The hydrolysis of wood into sugar has ushered in yet another technique by which wood is processed to cater to man's energy needs. And, according to present technique and practices in America, roughly 100 tons of wood yields about 35 tons of a 50 per cent. sugar solution. The product could be used as food for man, cattle feedstuffs or for fermentation to alcohol. The significance of the process lies in that the raw material, namely, wood residues are the waste product from wood working industries. Wood sugar thus opens up entirely new vistas of energy sources for use by man.

It is against this background of the importance of wood fuel that the inadequacy of our forest resources in India has to be assessed. International expert opinion prescribes 25 per cent. of the total area of the country as the safe minimum to be dedicated to forests. India has less than 20 per cent. The United States, Germany, France, the Scandinavian countries all have larger proportions; even Japan where the pressure on land of a much more industrialised people is acute has more than half her area under forest. In our country, the inadequacy of the total forest area is further aggravated by its uneven distribution adversely affecting our national economy in diverse ways. One of the most glaring examples and most pernicious in its effects is the misuse of cowdung as fuel instead of its rightful application as manure. This sets up a vicious circle which ultimately makes both food and fuel scarcer and dearer.

In South India, the absence of coal and oil has invested wood fuel with even greater importance. Wartime exploitation coupled with large increases in our urban populations have

compelled control, and sometimes even rationing, of wood fuel. The extent and urgency of the problem is best brought out with reference to figures relating to a typical urban area like Bangalore.

Bangalore with a population of about 700,000 might be reckoned to have 100,000 families. One family would need, confining strictly to domestic kitchen needs, about 2 cwts. of food fuel a month ; even with this modest average, Bangalore needs 10,000 tons of wood fuel per month or 120,000 tons per year. Assuming the very high yield of 18-20 tons of fuel from an acre of forest, some 6,400 acres or 10 square miles of forest are needed to cover the annual fuel indent. And working on a short 30-year rotation, this means that 300 sq. miles of good forest are the minimum needed to ensure merely the domestic fuel indent of Bangalore alone on a none-too-liberal scale. This poses stupenduous problems.

It is probable that these problems are solved not by any single cut and dry method. A many-sided approach is called for. Legislative measures might be considered for regulating the use of wood as industrial fuel. It is obviously not wise economy to feed the factory boiler while the domestic hearth remains unlit. Legislation might also be useful to discourage excessive fellings and to encourage afforestation. Our domestic ovens may be redesigned to lessen dissipation of heat and also to burn waste material. Electric heating may be popularised. Coke may find acceptance in some of the areas. It may even be necessary in the over-all national interests, to gasify coal and lay down domestic supplies of heating gas in the larger cities. Last, but not least, and simultaneously with these measures, trees and more trees should be grown, the costs of their protection being drastically cut down with the active co-operation of enlightened public opinion.

India is said to abound in paradoxes. It is certainly odd that wood fuel—which is merely conserved solar energy—should be in short supply in this tropical country where the sun shines longer and brighter than in other less favoured climes. Some of the fastest growing forest species too are to be found in our country. We are therefore exceptionally well endowed by a kindly nature for the manufacture—if that term be permissible—of wood. The forest is the factory, and fuel one of the manufactured products. And, unless we grow more forests along with more food, the grim prospect of our having to import not only food but *cooked* food as well, is not as remote as some would have us beleive.

M. N. RAMASWAMY.

LADY TATA MEMORIAL TRUST SCHOLARSHIPS AND GRANTS FOR 1952—53

THE Trustees of the Lady Tata Memorial Trust announce the following awards of Scholarships and Grants for the year 1952-53.

The International Awards of varying amounts (totalling £5,000) for research in diseases of the blood with special reference to Leucæmias are made to Doctors A. R. Gopal Ayengar (India), Pascou Atanasiu (France), J. B. G. Dausset (France), Astrid Fagraeus and Bo. Thorell (jointly) (Sweden), N. Harboe (Denmark), Charles Oberling (France), C. C. Ungley (England), J. Kieler (Denmark), C. Merskey (South Africa), R. Rask-Neilsen (Denmark) and R. Robineaux (France).

Indian Scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering from disease are awarded to Messrs. Madhav Vinayak Patvardhan (Coonoor), Anant Vithal Sunthankar (Bombay), P. Venkateswarlu (Trivandrum), Rajaram Vasudeo Bhagwat (Bombay) and Doctors Jandhyala Sri Ram (Bangalore) and Purindra Nath Sen Gupta (Patna).

1851 EXHIBITION SCHOLARSHIP AWARD

THE Royal Commissioners for the Exhibition of 1851, London, have awarded an overseas scholarship for 1952 to Shri H. K. Jain, Indian Agricultural Research Institute, New Delhi, for research in plant breeding at the University College of Wales, Aberystwyth.
