When All the Coal Is Used, What Then?

WHILE the prophets of disaster foresee shortage in power, coal and iron, perils of fire and water, within the world and without, to destroy man's place or cut short his career on terra firma, Nathaniel Southgate Shaler, professor of geology at Harvard university, finds the sources of earth's energy as yet almost untouched and the resources of old Mother Earth for her children hardly tapped. For 100,000,000 years or more there will be more than enough for the sons of men, who are destined to evolve into beings beside whom the present human race will be but brutes.

The failing treasure store of coal and wood is no menace to mankind. These are trivial energies compared with those locked in wind and sea and river. The wind alone contains many times the power now utilized by man from all other sources combined. The winds propel the sailboats and grind much corn and pump much water, but after all their possibilities are fairly untapped. And that because of the great variations in the speed of the air currents and in the long periods in which the movement is so slight that they afford no effective power whatever, together with other periods when the speed is so high as to be destructive to most machinery.

But Dr. Shaler expects the methods of the storage battery and its cheapened cost and greater efficiency to enable us to capture and utilize this oldest servant of man to incalculably better advantage.

Next to wind power is the energy of falling water, until the most recent years almost untouched because it had to be used at most but a few hundred feet from the water. Today the energy of falling water can be turned into electricity and thence back to dynamic power. And this energy can be transmitted several hundred miles already, while in the future the distance of transmission will be unlimited.

And as continents go at present, North America is the richest part of the world in "streams fitted to drive wheels." The famous Mississippi, Ohio, and Arkansas valleys are only some of the many. Next comes Africa, with the great valleys of the Nile, the Zambesi, the Congo and the Niger.

Considered as a whole, the rivers of the earth promise, with the aid of the engineer, to afford far more dynamic help to the arms than all that now serves them. Moreover, this help will be from sources of continuous supply and not like that from coal in the way of speedy exhaustion.

Further, the full utilization of the streams as sources of power because it involves the process of holding back the flood waters, will in a considerable measure aid in diminishing the speed with which the soil passes to the sea, after it has been used to turn the wheels to a great extent may be made to serve the purposes of irrigation.

The increase in the use of this source of energy probably will not continue to be rapid until the supply of the fossil fuel approaches exhaustion. From that time it will be speedy until all this group of resources is allied to the arts.

Next the tides, produced mainly by the moon's attraction, and swinging from ten to twenty feet along thousands of miles of coast line. There is so much energy in the tides alone that if they were only harnessed and set to work no other power would be required for the needs of all the hosts which the soil could sustain with the best husbanding.

A few centuries ago there was a tide mill in use. It had a maximum of several horse power and was imported to America from England, but was hard to manage because of the tidal irregularities.

With the development of the storage battery system, however, methods will improve and enable the people of the twenty-third century to find a valuable resource in the tide.

The sea waves in time of storm have an energy of about 10,000 pounds to the square foot, or about that in an ordinary low pressure boiler, but their action is so intermitent and variable that they are unlikely to be utilized save as in extremity.

In ancient story Archimedes set fire to ships in the siege of Syracuse by reflecting sun rays on a mirror and thus reflecting their heat. In low latitudes, where the sky is scarcely clouded, about a hundred square feet of mirrors some hours each day yield about one-horsepower.

The central heat of the earth is so abundant that if it could be utilized no other energy would be needed for a million years to come. But at present this looks unreachable. The average increase in temperature is only about 100 degrees Fahrenheit to the mile, and at less than three miles down the pressure would close any pipe bored down, as has been proposed. So that this does not seem promising at the moment. Nevertheless, the energy is there, and superabundantly. And none can predict what science will do with it.

The coal, the rock, gas, and petroleum are not expected by Prof. Shaller to last through the next three hundred years, but there are oils plentiful in certain carbonaceous shales in various parts of the world and almost unsuspected. In the Ohio valley alone the professor has computed that the oil will much exceed in volume the amount of water contained in Lake Superior.

Not only is there much unused power awaiting application by mankind. There is also much unwon land. The arid deserts the world over hitherto have been abandoned as profitless. But with the coming of irrigation these will prove not only very fertile but twice and thrice as productive as the naturally fertile lands.

Given the suitable temperature, the crop giving value of a soil is in proportion to the amount of sunshine and the supply of water furnished at the time required for the growth of plants. When the needed water comes directly from the sky the sunshine is interrupted, and if the rainfall is ever so little delayed beyond the critical times when the plants need it, their growth is interrupted. It may be roughly estimated that at the rate of growth in an irrigated desert, such as we find in Utah, the yield of an acre, owing to these advantages, is likely to be about twice as great in a like area in a humid district such as Illinois. In the more fertile portions of the tropical and subtropical regions irrigation often makes it possible to raise three crops in a year where but one could be assured by the direct rainfall.

The irrigable soils also are more permanently fertile. The supply of water is controlled so that the washing of the soils into the rivers can be entirely avoided. A large amount of soluble material lies in the subsoil, so that wastes can be restored readily.

"As possessions of the race the redeemed deserts are of far more value than the richest naturally well watered fields. They are likely to afford sustenance to men long after the soils lying on steep slopes have gone away to the sea."

The largest and most numerous fields for irrigation Dr. Shaler places in the twin continents of America, particularly in North America. In the United States are four great valleys, besides many smaller areas. These four are the valleys of the Rio Grande, the Colorado, the Arkansas, and upper Mississippi rivers.

By far the most important field is the upper Missouri and its numerous branches, from the Platte upward. Even in the summer season there is water enough in this system of rivers for several million acres.

When arid United States alone is reclaimed there will be a gain in the food supply for something like fifty times the present number of people.

Prof. Shaler expects the irrigation methods to extend to other lands now accounted fertile and thereby at least to double their yield all over the continent.

When the world will be fuily developed most of the land water will flow back into the sea no longer, but will pass back into the air by evaporation from irrigated fields. Many good results will accrue from this. There will be larger crops and less variable, a marked gain over the present where there is a serious waste of effort, due to want of uniformity in return for a given amount of work in tillage. This variation is the "primal curse of agriculture," and when it is removed will allow farming to enter a new realm, becoming a true art.

There is also land to be won from the sea. Nearly all over Europe this has been done over and over again, especially by Holland. In America around the Chesapeake and Delaware bays, along the Florida coast, and elsewhere, many sunken acres are waiting to be reclaimed by man. Although Dr. Shaler declares his basis for computation to be imperfect he reckons that in the debatable ground of mud flats, marshes and mangrove swamps there are no less than 200,000 square miles that sometime will be utilized and afford food for several hundred millions of people.

"As this land is of rare fertility and enduring to the tax of cropping beyond that of any upland fields, it has a perspective value as a human asset far beyond an equal area of ordinary ground."

Inland swamps and bog lands along the larger streams of Africa, the Americas, and northern Asia furnish additional prizes for the future engineer, the largest part of the earth's surface that can be won from the covering of water being about 300,000 square miles. "Should it prove possible to develop tillage in any considerable part of the tundra of Siberia the total may much exceed that amount; it may on those conditions arise to near half a million square miles."

From the drainable lake beds come possibilities of tillage lands, comparable in area to that which may be had from the deserts, the morasses and the shallow shore zones of the sea.

The Nile river has long been a problem, and when it has been solved, as it now promises to be the population of Egypt is likely to increase by one-half. Although there is lack of data for anything like an accurate reckoning in this matter, it appears evident that, with an adequate and possible storage of the flood waters of the Nile, desert lands in Nubia and along the lower reaches of the river can be won to cultivation, which will afford food for a population of at least five times as numerous as that dwelling between Khartoum and the sea.

It is not enough, however, to have land, nor even to have fertile land. It must be kept fertile. The soil washes away to the sea, it becomes sterile by perpetual cropping, and then men become as the fabled icthyopophagi, a rare and scantily fed animal dwelling on the seashore and feeding on the fruits of the ocean. Although it may seem preposterous to imagine that the soil is constantly slipping away beneath our feet into the sea, yet it is true, in tilled and untilled fields alike, but particularly in the ploughed lands, which lost their natural protective coating of vegetation.

In the natural state the seaward movement of the particles composing a large area of the soil possible may be as small as a foot in a century. From something like that minimum it increases until it becomes so rapid that there is no soil coating retained on the surface, as is the condition on the area where the bare rocks are exposed.

The critical point in man's relations to the earth is to be found in that coating of "detritus" on its way from the bedrocks to the sea. Although the real coating is a mere film on the surface of the rock sphere, still it is the basis of all its higher life. The life of the lands depend upon it absolutely, and the sea life also in a large measure. Indeed, this layer of water which is forever slipping away in the streams to the sea enables living beings to feed upon the earth.

"In it the substances utterly unfit to nourish plants in the state in which they exist in the rocks are brought to the soluble shape whence they may be lifted into life.

"The whole process depends upon the adjustment of the rate of rock decay to that of the movement of the renewing soil, from the point where it formed to the ocean, where it enters once again as stratified deposits in the crust of the sphere, in time, perhaps, "to tread again the round from rock to soil, and thence back to sea."

Despite man's evident duty by the soil, nearly all the fields of all the countries have been made to bear reference to the interests of future generations.

Here and there in vineyards particularly some care is shown—not for bettering the crops of the present.

We may search the world over, says Dr. Shaler, and not find a field which has been tended for the sake of the men to be. Of all the sinners in this regard, the worst are the Americans, who developed an almost incredible carelessness in their tillage of their boundless domains.

About one-thirteenth of the state of Kentucky cannot be restored to its original fertility in any foreseeable time. It must revert to the forested state, and in that condition, through the ages slowly regather its mantle of soil.

In the natural state the wasting processes are counterbalanced by natural processes of restoration. And this average of waste and repair must be maintained by man if he is to inherit the earth. A few centuries ago in England they began to cover impoverished soils with burnt limestone. This was the beginning of the mineral fertilisers of ammonia, nitrogen, potash, lime phosphate which Dr. Shaler regards as the "most significant and important of the great winnings of the last half century." All the other improvements in the arts but add to our range of action or increase the comfort of life; this insures the permanence of civilization when else its end was to be reckoned on in historically brief time.

With energy, soil and food concerned the possible perils besetting the race are still not all abolished. Among the prophets of disaster are those who suggest that the earth's atmosphere is in process of being deprived of the most important of its constituents, oxygen and carbon dioxide; by the daily routine of its organic life. It is undeniable that both these substances are rapidly passing into the solid crust, each thousand years takes of them a notable amount from the air. In the case of carbon, however, the withdrawal is compensated by the emanations of the gas from volcanoes and by carbon meteorites issuing into the atmosphere from the celestial spaces.

In the case of oxygen it seems in some way to be fed into the air perhaps in the atomic state from the spaces. The mass of air is demonstrated by geology to be about the same now as it has been in the past during a hundred million years or more.

Conditions of Life Do Not Change

Organic life seems to have begun with the atmosphere substantially as it now exists; and throughout its history has found these conditions unchanged. Prof. Shaler thinks we may reasonably assume that it is not likely to be disturbed for an indefinite time in the future.

"We assume that for a future probably as long as the geologically recorded past the sphere will go onward through time and space, free to work out its problems of life, with no break in the succession due to accidents coming from within or without.

"The most important elements in the future of man is the extent to which he may be able to obtain control of the forces of his own body, those which determine health, longevity, and above all, his inheritances."

Prof. Shaler looks forward confidently to a race of men who are to look back upon ourselves as we do to our ancestors of the bone and cave age—"not despisingly, as we look upon those troglodytes, for the man to come will have too large a sense of relations for that, yet with a judgment that we were far back in the night when we thought we dwelt in the day. We may be sure that they will take us largely and tenderly, these folk of mayhap a million years hence, for they will feel the unity of life, while we merely discern it, and that only in part.

"It is this sense of the human bond of all life that those who are to look upon us from afar will have their greatest enlargement. In that field the gain made will be such as to make a new order of man parted from us as we from the lower brutes, yet including our little lives in its great extension."

FEEDING LONDON'S MILLIONS

At all hours of the day and night food in one form or another streams into London. Huddled together up and down the Thames are 7,000,000 people, and all they eat comes from the outside—a little from near at hand, most from beyond the seas.

Millions of persons in various parts of the world are busy producing for London. The Canadian and American farmers are prominent among these. The bacon eaten here is Dutch, the eggs Russian and Danish, the butter Norman, the fish from the North sea, the fruit from Spain, the West Indies and California, and the tea and coffee from India, Ceylon and South America.

Baking the bread for London keeps an army of toilers going through the night. Between 3,000,000 and 4,000,000 loaves are consumed daily. All early incoming trains are laden with milk, some from nearby meadows, some from a distance of 100 and 200 miles. The cans are hauled to the shops in horse carts and the milk distributed in the populous quarters in hand carts. The daily consumption is over a quarter of a million gallons.

The various food handling centers are the busiest places in this crowded and busy town. Billingsgate is the greatest fish market in the world, and visitors never tire early or late of seeing the bewildering rush of work at these places. Smithfield is also the greatest meat market in the world. First of the market attractions, however, particularly at this season of the year, is Covent Garden, where are massed incredible quantities of the produce of the earth.

Long ago the market gardens all around London became too small to meet the colossal demand on Covent Garden. Although the carts and wagons converging on this market in the grey dawn are legion in number, and loaded to a dizzy height, they bring in only a small fraction of the great garden produce stream that passes to the people in the course of a day. In some parts of Covent Garden one might easily imagine one's self in California. In other portions one is lost among the apple riches of the American North-west.

How much produce actually passes through this market in a day no one knows. The owner is the Duke of Bedford and his grace declines to let the London county council into the statistical secrets of his produce emporium. However, it is estimated that London eats 3,000 tons of potatoes a day, three-quarters of a million cabbages, and in the season 10,000 pecks each of peas and beans. Just now the strawberries are rushing on Covent Garden in full flood, coming principally from the fields of Kent. The berries are especially fine this year—huge, red, tender and juicy—and the growers expect to make twice as much from the crop this year as they made last year.

The Story of Canada's Childhood

DISCUSSING Prof. Egerton's book, "Canada," the London Times says:

With the awakening of interest in the history of Canada caused by the celebrations which have been in progress in Quebec, Professor Egerton's volume appears at a timely moment. It gives us the story of the evolution of the Dominion through its various stages within the compass of a volume of such moderate size that even a busy man need not shrink from reading it; and it is a story of which England has little cause to be ashamed.

When the territory passed into our possession it contained a French population of about 70,000 Roman Catholics. The Protestant English numbered some 450, whom Murray, the first governor, summarily lumped together as a body of "contemptible traders and sutlers;" and it was from these traders and sutlers that magistrates had to be appointed and most of the material chosen for the administration of the country. There had until that time been no printing press in Canada. There was no system of general education, and the "habitants" were, in the mass, so ignorant that as much as half a century later it was estimated that only about one-tenth of the population could write, "and that, for the most part, very imperfectly." The Canadians under French rule had had no training in public affairs, and were, as Professor Egerton says, "singularly unfitted for the task of self-government." There had been nothing in the semi-feudal social system to breed in the peasantry any power of initiative, while the comparative ease with which they came by something more than the necessaries of life had made them indolent and apathetic. Their apathy, indeed, was all to our advantage; for there was not much in the generality of those few English with whom they came in contact to create in them great respect for their new rulers; and, had the people been of a restless or discontented disposition, trouble must have arisen sooner than it did, and when it came it could hardly have failed to be more serious than it was.

But it came soon enough, and in a form sufficiently grave. "Uninstructed, inactive, unprogressive" though (as Lord Durham called them) they were, the "habitants" were not without a natural feeling of racial jealousy, and it was inevitable that sooner or later the preachings of demagogues of their own nationality would have its effect. The first representative Assembly of Lower Canada, that of 1792, contained necessarily a large French majority, and many of its members were quite illiterate. "The interests of no inconsiderable portion of the concerns of the British empire were in the hands of six petty shopkeepers, twelve lawyers, fifteen ignorant peasants, a blacksmith, a miller, a doctor, an apothecary, together with four so far respectable people that they did not keep shops." These constituted a chamber entirely inexperienced in politics, which acted illegally at times, perhaps in mere ignorance.

Luckily, England was, on the whole, in spite of some exceptions, happy in the choice of the men who went out as governors. To Carleton probably more than to any other man we owe the fact that the great northern possession did not slip from our hand at the most critical period of its history; but it is also no small debt that we owe to the memory of such men as Durham, Sydenham, and Metcalfe. As too often elsewhere, British achievement fell far short of British intention; but it was not from lack of either good intention or good advice that British ministers failed on so many conspicuous occasions to take the course which might have bound the French population more closely to their allegiance. Before the end of the eighteenth century religious jealousies alone prevented the inauguration of a system of popular education which might have helped Canada on her road by fifty years and prevented altogether the growth of those animosities which culminated in the rebellion of 1837.

It may be that that rebellion failed less by any virtue of the government than by the inherent incapacity of the insurgents. It may be that at the time of the American Revolution Canada was only saved to us by Montgomery's almost accidental death. It may be that we hardly deserve to have Canada today, when we remember that as late as 1870 we valued her so little that a British minister could say that Great Britain was "willing and even desirous" to have a separation, and Americans like James Russell Lowell were content not to push the point, because they believed that the Dominion must ultimately fall to them "by natural gravitation." On the other hand, the worst of our difficulties were not of our making. They fell to us by the sins of omission of the French who had gone before. While, however, accomplishment may at times have fallen short of profession or endeavor, if we compare the early history of our rule in Canada with, for instance, that of Spanish rule at the other end of the same continent, we can afford to review the incidents of the Quebec pageant with at least reasonable satisfaction.

In telling his story Professor Egerton reminds readers that the book is "intended primarily for the advanced classes in secondary schools;" but there are times when, in the need of condensation, he seems to us to make rather difficult reading for such a clientele, by incidental allusions to events apart from the main current of the narrative, which would better have been omitted or given a few lines of explanation. Also there are occasional signs of what looks like haste in sentences not characteristic of the scholarly author. On page 151 we read:—"Neither Durham nor Buller nor Wakefield were the first to advcate responsible government," a sentence which is not a wholesome example for the classes in secondary schools. On page 123 is a curious confusion of statement as to the respective badness of the local government in the towns and in country districts, when each in turn is said to be worse than the other. A seeming uncertainty as to whether the United States should be spoken of as an "it" or a "they" results in the nation being both singular and plural in the same sentence on page 2. An erratum in detail, which should be corrected when opportunity offers, occurs on page 80, where Mackenzie's crossing of the Rocky Mountains is spoken of as being "south of Mexico." But such things are, perhaps, inevitable. For the rest, the volume excellently fulfils its purpose. The author has a thorough grasp of his subject, and gives the facts as fairly established by the latest research without bias or prejudice, from an English point of view, but not so English as to be partial or to give offence either to ultra-colonial Canadians or in any other quarter. Each chapter has a useful bibliographical appendix. The volume is furnished with what, after test, seems to be a first-class index and with a series of maps, rough, but adequate, which are judiciously selected to illustrate the successive stages in the growth of the Dominion, the chief danger to which now "seems," Professor Egerton thinks, "to arise from its own too great prosperity."