

When the Coal Is Gone

WIND AND WAVE WILL TURN THE WHEELS OF THE WORLD MEN WILL HARNESS THE TIDES A LESSON FROM THE NILE.

While the prophets of disaster fore-see 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 falling 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 sail-boats 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 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.

INCALCULABLE POWER OF WATERFALLS.

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 dynamite 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 many. Next comes Africa, with the great valleys of the Nile, the Zambezi, 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 arts 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, while the water, 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 on it will be speedy until all this group of resources is allied to the arts.

MAN WILL HARNESS THE TIDES.

Next the tides, produced mainly by the attraction of the moon, 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 only were harnessed and set to work no other power would be required for the needs of all the coast which the sea could sustain with the best husbanding.

A few centuries ago there was a tide mill in use. It had a maximum of one horsepower 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 times 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 intermittent and invariable 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 concentrating 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 for a million years to come. But at present this looks unobtainable. The average increase in temperature is only about 100 degrees Fahrenheit per 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. Shaler to last through the next 300 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 unused land. The arid deserts of the world over hitherto have been abandoned as profitless. But with the coming of irrigation these will prove not only 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 time 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 the Colorado, it would take 30 years to produce the same amount of crops as 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.

ARID LANDS PERMANENTLY FERTILE.

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 re-deemed 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 the upper Mississippi rivers.

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

When arid United States alone is reclaimed there will be a gain in the food supply enough 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 fully de-

veloped most of the land water will flow into the sea no longer, but will pass back to 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 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.

RECLAIMING LAND FROM THE SEA.

There also is 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 debateable 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 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 zone zones of the sea.

SOLVING PROBLEM OF THE NILE.

The Nile River long has 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 the present.

It is not enough, however, to have land, nor even to have fertile land. It must be kept fertile. The soil washes away by perpetual cropping, and then men become as the fabled Ethiopians, a rare and scantily fed animal dwelling on the seashore and feeding on the fruits of the ocean.

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state, and in that condition, through the ages slowly regather its mantle of soil.

RESOURCES OF GLOBE WASTED.

In the natural state of 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 fertilizers 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 god 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 see the beginning of the end of the world in the 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 gases are rapidly passing out 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 emanation 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 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 may well be such as to make a new order of man parted from us as we from the lower brutes, yet including a little lives in its great extension."

LEATHER SHOES FOR HORSES.

A new market for leather is to be found in Australia, concerning which this French Journal says: "In districts of Australia the horse is shod with leather instead of iron. The feet receive better support. This novelty is employed only in regions where the ground is permeated with soft grass or fine sand. In a country like Australia, where stocks are sometimes scarce and a horseman may experience great difficulty at a critical moment in finding a horse shoe, such an innovation is a useful novelty. With extra shoes whose weight is

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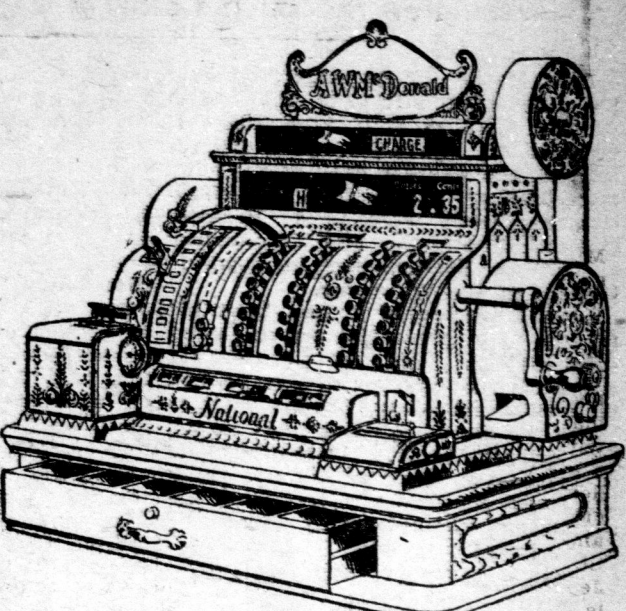
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