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OUR COAL RESERVES AT THE CLOSE OF THE NINETEENTH CENTURY. BEING THE ANNUAL ADDRESS OF THE VICTORIA INSTITUTE FOR 1900.

By Professor EDWARD HULL, LL.D., F.R.S., F.G.S.

AT the invitation of the President, Professor Sir George G. Stokes, to deliver the Annual Address this year, I have selected for my subject "Our Coal Reserves at the Close of the Nineteenth Century," as it is one to which public interest has been recently directed. This is owing to two causes—first, the general rise in the price of coal, which touches the pocket of every householder, be he rich or poor; and second, the remarkably increased production of our coal mines, which reached, in 1899, the unprecedented figure of 220,085,000 tons,* being about eighteen millions of tons over that of the previous year.

Is it to be wondered at that with such a rapid increase of production, and such a quantity extracted from British mines, those who take an interest in the commerce and manufacturing industries of this country should ask themselves, "For how long a period can our coalfields bear such rapid depletion?" For, be it observed, the quantity raised is more than double that of Germany, which is the largest producer amongst the Continental States, and is only equalled, or approached, by the production of the United States of America, whose coal resources are largely in excess of our own.†

Reverting for the moment to the historical aspect of the question, it will be in your recollection that in 1866 a Royal Commission, under the presidency of the late Duke of Argyll, was entrusted with the task of reporting on the quantity of

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* *Return issued by the Board of Trade*, April 9th, 1900.

† *Board of Trade Returns*, p. 4. The output of Germany is stated to be (1899) 101,622,000 tons, that of the United States 218,376,000 tons.

coal remaining to be worked in the British coalfields, and the probable period for the duration of the supply, and in 1871 the Report of the Commission was issued, dealing with these and other cognate subjects in a very exhaustive manner. Many eminent geologists and gentlemen connected with the coal industry gave evidence, and the names of Murchison, Prestwich, Ramsay, Hussey Vivian, and Woodhouse, amongst others, afford a guarantee for the ability with which the subject was treated. But I have on several occasions maintained, and still maintain, that the returns of the Commissioners regarding the quantity of workable coal were excessive, chiefly because very thin seams were included which I consider to be unworkable at great depths. But as regards the output of coal it is a remarkable fact that in 1870 the quantity raised was only about one-half that of the year 1899, so that in less than thirty years the output has doubled,* a fact little foreseen by the Commissioners, and thus reducing the estimated period of duration of our supplies by one-half.

Let me here explain that in speaking of "the duration" or "exhaustion" of our coal reserves, these terms are only used in a conventional sense. The "exhaustion" of our coalfields is an event out of the question, as long as there are seams of coal at depths of over 4,000, 5,000, or even 6,000 feet—because it may be impossible to work them. The practical exhaustion will be reached when, owing to increased depth and expense of mining, to actual diminution of supply and other causes, the cost of coal will tend to become prohibitive; and our manufacturing industries will be heavily weighted as compared with those of other countries where coal is more abundant and easy of access. The approach of such a period is seriously apprehended by many observers. Mr. Ellis Lever, in a letter to the *Pall Mall Gazette*,† has expressed the opinion that before the year 1950 "there will be such a coal famine in Great Britain as will paralyse our railways, gasworks, iron and steel, cotton and chemical, and all other industrial undertakings." On the other hand, Mr. H. C. Peake, the President of the Institution of Mining Engineers, in his recent address takes a less pessimistic view of the

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* The quantity raised in 1873 was 110,431,192 tons, *Mineral Statistics, U.K.*, collected by the late Mr. R. Hunt.

† April 10th last.

situation, but at the same time acknowledges that "it behoves us to take stock of the position."* It may, however, be inferred from articles which have recently appeared in several mining journals and the public press that much anxiety is felt with regard to the question of our coal resources; and there is a widely expressed desire that Her Majesty's Government should institute fresh inquiries into the problem of the coal reserves of the British Isles.

One of the most important questions for our consideration in reference to our coal industry is that of the export of this mineral to foreign countries. As long as coal is raised from the mines and made use of at home, we are all agreed that there should be no artificial limitations placed upon its exploitation, because it is being used for the general benefit and prosperity of the country. But it by no means follows that foreign countries should have equal facilities for its use with ourselves; or at least that they should not be made to contribute something to those material resources of which they are depriving us when they help to deplete our coal reserves. To this question we shall return; meanwhile, let us see to what extent we are exporting coal from British ports.

We find from the Board of Trade returns just issued, that in the year 1898, the quantity of coal exported from the United Kingdom amounted to 48,268,000 tons, which is nearly one-fifth part of the total output. This includes of course the quantities supplied to our colonies, dependencies, and foreign depôts or coaling stations as well as those sent to foreign countries; and which are, therefore, to some extent utilised by our Royal Navy and merchant ships; but coal for the use of steamers engaged in the home or coasting trade is excluded from these returns. The following are the quantities, amounting to a total of 37,607,000 tons, which were exported to Continental ports from the United Kingdom in the year 1898:—

France	11,713,000 tons.
Belgium	2,758,000 „
Germany	5,820,000 „
Austria-Hungary	6,004,000 „
Italy	4,432,000 „

* Address delivered on June 14th last, before the members at the rooms of the Geological Society.

Spain	1,441,000	tons.
Sweden	2,458,000	„
Russia	2,981,000	„
Total	37,607,000	tons.

We shall not be far wrong if we assume that the quantity exported to these countries in the past year, 1899, amounted to forty millions of tons, and I wish to call special attention to this point.

Now the question arises. What benefit does this country AS A STATE derive from the continuous outflow of this natural product so essential to her prosperity and the position she occupies as a great manufacturing and commercial centre? Doubtless the State benefits by the profits of the coal-owners who export and sell the coal to the foreigners; but it seems only reasonable that the latter, who are benefited by the sale of the mineral, should contribute something towards the prosperity of the country from which the mineral is derived. For, recollect that coal is not a commodity which, like animal or vegetable substances, can be reproduced. Once extracted from the ground it cannot be restored; and thus foreign countries, which in many cases have little claim to our generosity, and are (as they have a right to be) absolutely selfish where their own interests are concerned, are helping to deplete our mineral resources—in other words, to drain the life-blood of our commerce and manufactures. I hold, therefore, very strongly the view that in the case of such products of Nature as coal and petroleum, the country which produces them has a claim, or lien, upon them beside that of the owner of the soil under which the minerals are found; and if this be so, the State as such has a right to be recouped for the benefit of the whole community. In the case of the owner and the utiliser, this is done through taxation on his profits; so that he is in a worse position than the foreigner who uses the mineral, but pays no tax for the benefit of the country from which the mineral is drawn. On these grounds it seems to me that an export duty on coal from this country to Continental States may be advocated and defended; and the amount should not be less than five shillings per ton, payable at the port where the coal is shipped. If we take the export to Continental States at 40 millions of tons (as shown above), an export duty of five

shillings would amount to £10,000,000 per annum, which might go to the relief of our increasing taxation, or form a sinking fund with the same object in view. In any case it would to some extent help to recoup the State for the drain on her mineral resources. Lord Salisbury has recently expressed his astonishment at the patience with which the public bear the burdens of taxation imposed upon them; and I venture to think that if our Continental neighbours could be made to contribute towards the relief of these burdens to the extent of ten or twelve millions sterling, the result would be hailed with gratitude. Nor do I believe that such a duty would have an appreciable effect in diminishing the output from the mines. In the first place forty millions of tons is only a small proportion (less than one-fifth) of the total output; and in the second, the use of our best steam coal is of such prime importance to Continental States, especially for their fleets, that an additional charge of five shillings a ton would be no impediment to their demand for it. In support of this view it may be observed that the average price of coal in these Continental States is higher than in the United Kingdom; for while in this last named, the price in the year 1898 was 6*s.* 4½*d.* per ton, in Germany it was 7*s.* 4½*d.*, in France 9*s.*, and in Belgium 8*s.* 9½*d.* per ton, in Britain it was about 5*s.* 6*d.* per ton; so that by comparison of averages the price of British coal with an export duty of five shillings would not be increased to the full extent for these countries above that of their own averages.

I do not therefore fear that a small export duty such as is here suggested would injure the foreign coal trade, while on the other hand it would benefit the country generally; nor can I admit for a moment that it violates the principle of Free Trade taken in its legitimate sense; for in the words of a recent writer, Free Trade is not a law, but a "variable expedient."

I now come to consider the question of a Royal Commission. It is urged in several quarters, and amongst members of Parliament especially by Mr. D. A. Thomas, the representative of one of the principal mining districts in Wales, that Her Majesty's Government should be asked to appoint a second Royal Commission for the purpose of ascertaining what is our real position as regards our coal reserves. It is now about thirty years since the first Commission held its investigations, and, as we have seen, the increase of consumption since that period has been remarkable—I might even say, phenomenal.

The close of the nineteenth century seems a fitting time for such an inquiry. This century marks a special epoch in the history of our race, and in this history is included discovery of the operations of Nature, and the increase of mechanical inventions far beyond that of any other age. It is the epoch of railway locomotion, of steam navigation, of manufacturing industry such as the world has never before seen—and all these industries have to depend for their sustenance on COAL—the only great source of power, as far as we know, available in the British Isles. The subjects which a Coal Commission for 1900 would have to investigate would not necessarily be so large or elaborate as those undertaken by the Argyll Commission of 1871, as some points have been already practically settled and need not be reopened. But those which in my view would require investigation are somewhat as follows :—

First. In the words of Mr. Thomas's proposed resolution it would be necessary "to investigate the quantity of coal available for naval, commercial, and other purposes contained in the coalfields of the United Kingdom." For this subject the results obtained by the Argyll Commission would form the basis of inquiry.

Second. The next subject would be the area and resources of the concealed coalfields (that is, those coal-producing strata covered by newer formations). This subject was handled by the Commissioners of 1871, but since that time there has been much additional light thrown upon it—by fresh boring experiments south in the midland districts and south of the Thames valley—from which more accurate information might be obtained.

Third. The third subject is one suggested by the terms of Mr. Thomas's resolution, namely, "to report whether any means should be taken to prevent the too rapid exhaustion of coal, and to preserve it for the use of British subjects." This would include the question of an export duty on coal; but it is one of much wider scope.

Fourth. Another subject might be an inquiry how far an additional rise in the price of coal would place our manufacturers at a disadvantage as compared

with foreign countries and encourage the import of coal from America and other coal-producing countries.

There may be other subjects which a Royal Commission might see fit to investigate, but the above appear to be the most evident, and worthy of attention. For myself, I consider that such a commission ought to be constituted in the near future. Its investigations cannot fail to be of interest, and may prove of the greatest importance to the whole community.

And now, before I conclude, I must add a few words regarding the Society whose anniversary we are here assembled to commemorate. The Victoria Institute has well maintained its position as a means for diffusing knowledge of very wide scope, and calculated to interest, not only the general public, but the specialist in various branches of science and literature. In the forthcoming volume of *Transactions* will be found papers dealing with physical and biological subjects; with those touching on historical, mental, and moral aspects of man and appealing to our most sacred affections and beliefs; while, lastly, there are those of a more purely scientific character. The discussions, also, are often of great interest, and their publication with the papers afford opportunities for those living in distant countries, or unable to attend the meetings, to make known their views on the questions raised by the authors of the papers. For these reasons the Institute seems to occupy a position of value, and supplies a want amongst the learned societies of the Kingdom; and we would welcome additional Members and Associates, as well as fresh communications of a nature embraced within the scope of our objects.

Discussion.

The Rev. Canon Girdlestone, M.A.—It has been assigned to me to propose a vote of thanks to Professor Hull for his most instructive address:—

We are all interested in the subject of coal, even although we are rather at this time suffering from too much heat. I don't know how far Professor Hull's address will influence the coal

market, but we shall all be most grateful to him if the result of his address should be that the coal merchants should draw in their horns. I do not know how that may be; I am afraid we must not be too expectant on this topic; but I think we all welcome the suggestion that coal purchased by foreigners of us should be very highly taxed (hear, hear), so that we might expend the ten or twelve millions so raised in the construction of weapons of precision, to use against them if needed. Coal is at the root of all manufactures, and when you consider the various manufactures that go on in this country, I think you will come to the conclusion that they are all affected by the price of coal. People say, "Why not substitute electricity?" But how are we to get our electricity? When you push the matter back, in order to generate electricity you must have coal.

One other thought has often struck me, and I should think other people. It is sometimes said that we imagine too freely that the earth and its contents were made for man and that all things would be quite as useful, somehow, if there were no men. But take the case of coal. There are many definitions of man; but I think we may add this—that man is a coal-consuming animal! I do not know that any other animal is! I was born in the black country of South Staffordshire, and have been down in a coal mine many times. If you want to point to something that lies near the surface of the earth, which ministers to the necessities of man, and man alone, you will point to coal and you would say, "Why is it that this coal exists? How is it that we have this storage of heat beneath the surface of the ground?" It is undoubtedly because He, who founded the earth and established it, knew what would be needed for the human race, and so ordered that this coal should be provided against the time when it was needed; and so the heat that was stored up, untold ages ago, is now given forth again from the combustion of coal for the benefit of the age, for which, I think, we may thank the Creator.

I have great pleasure in proposing a vote of thanks to Professor Hull for his most valuable address.

Professor LOGAN LOBLEY, F.G.S.—I have great pleasure in seconding that. We all know that for a considerable time Professor Hull has been of great service to the Institute, and has brought before the Institute subjects of great importance and of exceedingly great interest. He has written a number of papers

on subjects which have attracted considerable attention, both of the scientific world and (what I may call) the lay world outside; but perhaps he has exceeded those efforts by bringing before us to-day the subject of the reserves of coal in this country; for, as Canon Girdlestone has justly said, it is a subject that appeals to all people and is of the greatest importance, not only to the present inhabitants of the country, but the future.

With respect to Professor Hull's political proposition I need not say anything; but with respect to the general reserves of coal in this country, we may say that we have a very large reserve of coal—much larger than most people imagine, not a very great distance from London—putting out of sight altogether the coal south of the Thames; there exists in the middle of the county of Warwick an enormous store of coal at a very easy accessible distance from the metropolis. There are large stores of coal to the north-west and also in the north, which, as Professor Hull calls them, are "concealed stores" of coal, but yet to the knowledge of geologists, they are there; and they are substantial sources of fuel only awaiting the operation of mining to make them of use to the community. But there is one species of coal that we ought to prize exceedingly, and that is the semi-anthracite, or steam coal. That is limited, in great measure, to one area of the British Islands, and for that store of fuel we should have a special care and any proposition for its preservation, or economical use, ought to meet with the most generous support. The other coals, bituminous coals generally, are common to France, Belgium, and other parts of the earth; but the store of semi-anthracite, in the South Wales coal fields, is of great price, and we should set the highest possible value on it and should economise its use and exportation for future time.

On these grounds I think you will all agree with me that our heartiest thanks are due to Professor Hull for his address to-day. (Applause.)

The vote of thanks was then put to the Meeting and carried unanimously.

Professor HULL.—Mr. President, ladies and gentlemen, I thank you very much indeed for the vote of thanks you have given me. I have spoken so much already that I do not intend to detain you any more to-night.

Sir JOSEPH FAYRER.—There is one duty that still remains before

we separate, and I ought to congratulate myself that that duty devolves upon me. It is to ask you to return your thanks to the President, Sir Gabriel Stokes, not only for what he has done for us this evening, but for what he has done for us for some years past—for the influence which he has exercised over this Institute —for the prestige he has conferred upon it for doing so much to place the Society in the prominent position for which it was originally intended. It was founded for the purpose of diffusing knowledge—not of special kinds of knowledge as opposed to religion, for there is no such opposition—none whatever (hear, hear); but it is to teach the truth (that is science), and under the influence of such men as Sir Gabriel Stokes, Lord Kelvin and others whose names I have heard mentioned, it is impossible that such an Institute should do anything but good and should succeed. I have watched its growth for many years and am deeply interested in it. I have seen the steady development and the improvement of the Institute, and I am proud to belong to it. I think it is doing most excellent work. It is diffusing that knowledge which is so much needed throughout the world generally that I believe we owe many thanks to those who founded it, and more thanks still to those eminent men who, like the President, preside over it.

It is not necessary for me to make any further remarks on the subject. It is quite sufficient that I name the man. I call upon you to return a vote of thanks to Sir Gabriel Stokes—that most eminent man of science—who presides over this Institute.

Professor HULL.—I have great pleasure in seconding the resolution, in which I heartily concur. I consider the Institute owes a great debt of gratitude to the President, not only for his presence this evening, but for the way in which he comes, year by year, from Cambridge, at personal inconvenience, to preside at our Ordinary and Special Meetings such as this to-night. Therefore I heartily concur in the vote of thanks.

The resolution was then put and carried.

The PRESIDENT.—I must express to the members of the Institute my hearty thanks for the vote that has just been passed. I confess that my labours in the cause of the Institute are hardly those which a President might be expected to accomplish. In excuse for that I have only to say that in the first instance I live a good distance from London, and in the second place I have a

good many "irons in the fire." I am sure I deeply feel how much of the little that I have been able to do has depended on the labours of our indefatigable Hon. Secretary, whom we regret so much not to see amongst us on the present occasion.

The session of the Institute has now come to an end. We do not meet again till towards winter, and we all hope, when the time comes for us to reassemble, we may again see the face of Captain Petrie, to whom the Society owes so much.

I will not detain you any longer with words of my own, but thank you once more for the kind manner in which you have recorded your vote of thanks.

Sir JOSEPH FAYRER having warmly eulogised the services of Captain Petrie, the Meeting then closed.

POSTSCRIPT.—The hope expressed by the President, and shared by all those present, was not destined to be fulfilled. Captain Petrie expired peacefully at his residence in Campden Hill on Saturday, July 21st, regretted by all those who had the privilege of his acquaintance both at home and abroad.—E. H.

1*st September*, 1900.