bodies under whom they served to initiate something like accurate records of these various factors, which were becoming too large and too expensive to be attacked by private enterprise. Yet at the bottom they involved the economical construction of future large works.

“Smoke Abatement.”¹

By GEORGE THOMAS BEILBY, Assoc. Inst. C.E.

IN an address to the Society of Chemical Industry in July, 1899, the Author attempted to present the whole question of the National Fuel Bill in its relation to smoke prevention.² As the address is accessible to anyone interested in the subject, it is not necessary to repeat the figures there given and the arguments based on them; but, for convenient reference, a Table is appended in which the figures of annual coal-consumption are given in a succinct form. They have been recently brought up to the year 1902 for the use of the Royal Commission on Coal Supplies, and will no doubt be published in due course.

The leading kinds of by-product coke-ovens and the various forms of gas-producers have been frequently described before the engineering and technical societies. Large gas-engines, and the economic possibilities of their use with blast-furnace and producer-gas, have also been fully brought under the notice of engineers and manufacturers, who are now awaiting with interest the results of large installations which have been started or are in course of erection. If these installations in any degree justify the estimates and expectations of their performance, and if it is shown that electricity can be produced in bulk at a cost of 0·1d. to 0·2d. per kilowatt-hour, with a capital expenditure for gas-producers, gas-engines, and dynamos, of £16 to £18 per kilowatt, even the least sanguine must realise that a new era of fuel-consumption has set in.

Not only are power-gas and large gas-engines on their trial, but the replacement of coal-firing by gas-firing is in the same position. From results already obtained it seems not improbable that the economical firing of steam-boilers with washed gas will be firmly established during the present year. The use of washed gas in iron- and steel-making is also receiving most careful

¹ *The Engineer*, vol. xvi. p. 4. *Engineering*, vol. lxxv. pp. 852 and 874.

² *Journal of the Society of Chemical Industry*, vol. xviii. p. 643.

attention; and the results of large installations for this purpose will soon be available.

The amount of coal involved in these departments of consumption is between 80 million and 100 million tons per annum, of which it is estimated that one-third may be saved if the new methods are even moderately successful. When it is added that these new developments, without exception, involve the absolutely smokeless consumption of coal, it becomes evident that the time is near when the nation, if they choose, may abolish industrial smoke. Although therefore these new developments have raised a number of interesting and important points, the present discussion will be mainly confined to the central question:—What steps can be taken to hasten the abolition of the smoke nuisance?

As regards industry, the answer has practically been given above. The means for bringing about the abolition of industrial smoke are already in the hands of engineers; and it will be for them to show the users of power and heat how substantial is the prize which awaits the enterprising manufacturer.

The problem of domestic smoke is in a less hopeful position. The consumption of coal in domestic fires is about 36 million tons per annum. This huge consumption is so completely spread over the whole nation, that it may safely be said there is not a single individual in the population of 40 millions who is not directly interested therein. It is this fact which makes the domestic problem in many respects harder to solve than the industrial. To the manufacturer can be held out, as an inducement to make an end of his smoke, the hope of a handsome premium in the shape of savings on his bill for fuel and power; but for the householder there is no such premium. True, the saving in the cost of cleaning and redecorating the house, and the reduction in the laundry bill, would represent no small amount for an average family; but at present the means whereby these desirable savings may be effected are somewhat vague and uncertain, and are supposed to involve a serious initial outlay.

If the direct inducement for the householder to abolish his smoke is insufficient to overcome his inertia and conservatism, it is clear that pressure must in some way be applied from outside. The following are three ways in which this might be done:—either by a great and permanent rise in the price of coal; or by prosecution and fining; or by the imposition of a tax on the burning of smoke-producing fuel. As to the first, there is no likelihood that the price of coal will rise to a point which would compel the house-

holder radically to alter the whole practice of domestic heating; it may therefore be dismissed without consideration. For the second method—legal conviction—little that is favourable can be said. One effect of the extension of this method from the industrial to the domestic department would be to direct attention increasingly to all sorts of pretentious grates and other nostrums, and to divert it from the broad fundamental proposition that bituminous coal cannot be uniformly and systematically burnt in open fires without smoke. Although there are good grates as well as bad, and although wonderful efficiency and economy can be secured by the skilful designing and setting of domestic grates, yet there are two permanent conditions which render it improbable that any large measure of success will be obtained in this direction. They are:—the irregularity in the quality of the coal consumed; and the dependence of the performance of any grate on the skill and judgment of the person who fires it. The domestic grate is at the mercy of a larger number and greater variety of incompetent stokers than any other coal-consuming appliance.

Recourse must therefore be had to the third means of applying the necessary pressure: namely, the imposition of a tax on the consumption of smoke-producing fuel. A chimney-tax might be so applied as to encourage the widest and most radical improvements in domestic heating. Tax every chimney which is sufficiently wide to vent the products from the burning of raw coal; and leave free all chimneys which are too small to do so. A premium would thereby at once be placed on the use of smokeless fuel, because gas and coke can be satisfactorily burnt with narrow chimneys. The production of these forms of fuel would be enormously stimulated, and the devising of appliances for their combustion would be encouraged. Architects and engineers would have a new and fruitful field for their ingenuity and skill; and their trained efforts would in a short time greatly advance practical knowledge of the subject.

At present the 9-inch chimney holds absolute sway; and a house built without its full complement of such chimneys is looked on as abnormal, and outside the ordinary practice of those who buy and sell house property or lend money thereon. Builders therefore decline to build houses which are really adapted for smokeless firing by gas or coke: with the result that these fuels have never yet had a chance of showing at their best. If there is a really serious intention of dealing with domestic smoke, it must presumably be somewhat on the lines here indicated.

[APPENDIX.

APPENDIX.

ANNUAL COAL OUTPUT AND CONSUMPTION.

Taking the yearly coal output of the United Kingdom at the round figure of 220 million tons, and the exports at 60 million tons, there remains for home use 160 million tons, of which it is estimated that the consumption is:—

- About 78 million tons for the production of power for industrial purposes.
- „ 46 million tons for the production of heat for industrial purposes.
- „ 36 million tons for the production of heat for domestic purposes.

Taking the first two items more in detail, it is estimated that for the production of power the consumption is:—

Railways	12 to 14 million tons.
Coasting steamers	6 „ 8 „ „
Factories	40 „ 45 „ „
Mines	10 „ 12 „ „

For the production of heat for industrial purposes the consumption is:—

Blast furnaces	16 to 18 million tons.
Steel and iron works	10 „ 12 „ „
Other metals	1 „ 2 „ „
Chemical, glass, potteries, and cement	4 „ 6 „ „
Gas works	14 „ 15 „ „

The 36 million tons of domestic coal is burnt in about eight million inhabited houses. At the rate of two working chimneys per house, a tax of 1s. per chimney would yield £800,000.

The following speakers took part in the discussion of the subject:—Messrs. A. Lupton and R. F. Carpenter, Dr. H. A. Des-Voeux, Mr. W. Foulis, Sir C. Cookson, and Messrs. J. F. Simmance, W. Reed, D. E. Benson, and C. Hawksley.