

The author suggested a novel method of distribution by means of secondary batteries, which, apart from the insuperable practical difficulties involved, had a fault that would prohibit its adoption, viz., that as the batteries were all connected in series, the circuits of the houses on the two extreme parallels would have to be insulated for 1,000 volts, as that would be the difference of potential between them. Disregarding the expense and the fire insurance difficulties of such an arrangement, it was sufficiently condemned by the fact that a solitary earth upon any portion of the circuit of one of these houses would produce a difference of potential of 1,000 volts between the earth and the internal circuits of all the houses upon the other parallel, which would jeopardise the safety of the consumers themselves. The other parallels would be open to the same objection, though only to an extent proportional to their distance from the middle parallels, which could only have a difference of potential of 500 volts between them and earth.

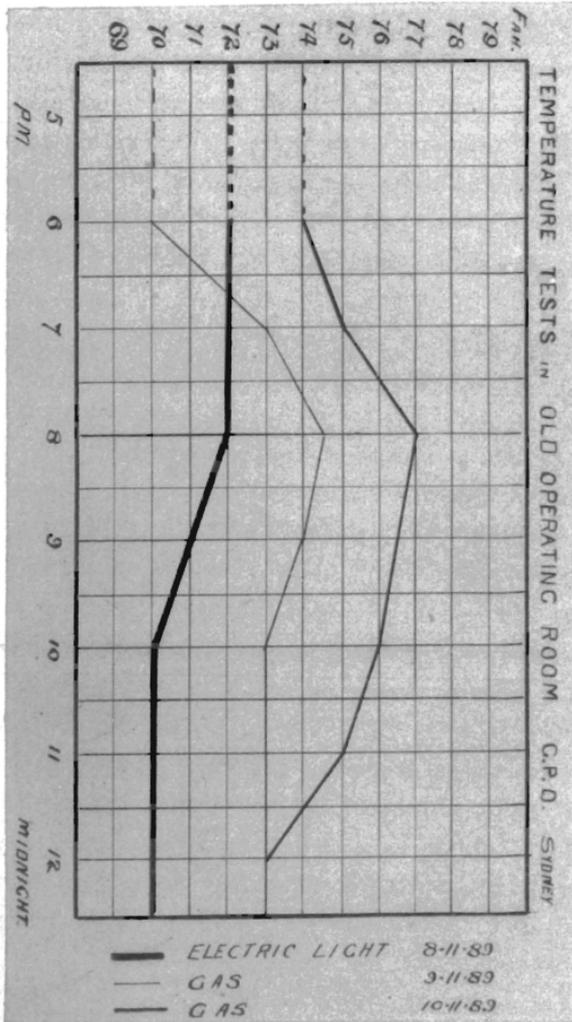
The author had a more extensive knowledge of Sydney streets than he (the speaker) had, but he could not help thinking the allowance of arc lights rather extravagant. Without, however, going into the figures, that the ratio of indoor lighting to outdoor should be only two-and-a-half to one, was a self-evident disproportion.

With regard to the three schemes referred to, it was evident that only by handing over the lighting of Sydney to the Gas Company could a monopoly be made of it, and that, therefore, was the chief evil to be avoided. That Company would certainly place every impediment in the way of its general adoption, and a perpetuity of gas for Sydney would be the result. That the Council seriously contemplated the lighting was not credible when they merely proposed a house lighting plant for 16,000 lamps. It appeared too evident that the main object was to obtain the rights that now belonged to Parliament in order to raise money by selling them, an obstacle to central station lighting which had already presented itself in England,

and in referring to which a scientific paper remarked that the municipality, like an ordinary tradesman who bought goods to sell again at a profit, desired to lease its powers and transfer its liabilities to the electrical company which would either pay the highest rent during the contract, or pay down the largest sum of money. In other words, "we have spent a few hundred pounds in promoting and obtaining our order, and now intend to make as much money out of it as possible." This step was not a judicious one to take; it was unsatisfactory and unfair to electrical companies, and could only be characterised as an unwarrantable demand and a proposed abuse of powers granted by the Board of Trade to a local authority. Now the firms in Sydney had certainly no advantage over those at home that would tend to modify that expression of opinion, or make the impost easier to bear.

Mr. J. S. Fitzmaurice said it would be idle to expect more than a general discussion on a subject which opened up such a large area for debate and thought. The author's reference to the number of arc lamps in King Street as being excessive was without a doubt correct, but this was just what might be expected in any busy thoroughfare, where competition was keen, and every shopkeeper endeavouring to outdo his neighbour. Mr. Cruickshank was rather severe on the electricians when he asserted that if the prices did not work out right on our side, we said "the price is so much more for electricity, but we give you so much more light for it," but he must know that to compare gas and electricity for lighting purposes, every detail should be considered, especially the candle-power and safety. If it could be proved that the present coal gas in Sydney was a cheaper, better, and safer illuminant than the electric light, every electrician will gladly give way. By experiments made with the London gas, Messrs. W. H. Preece and Vernon-Harcourt found that the gas supposed to be burning 5 cubic feet per hour through an ordinary burner, and giving 16 candle-power, really only gave 10 candle-power.

ELECTRIC LIGHTING OF SYDNEY AND SUBURBS.



PROCEEDINGS OF THE ENGINEERING ASSOCIATION OF N.S.W.,
SESSION 1891-92.

With our Sydney gas we could not expect any better results. Then again, the excessive heat generated by gas was in very many cases oppressive and injurious. The diagram would give some idea of the difference in temperature, the results of observations made on three consecutive nights in the old operating room at General Post Office in 1889. The dotted lines in each curve showed the temperature of room before lighting up. It would be seen that on November 10th the temperature before lighting up stood at 74° Fah., immediately the gas was lighted, at 6 o'clock, the temperature commenced to rise, until at 8 o'clock the maximum was reached, viz., 77° Fah. At this hour all the suburban lines were shut down, and the afternoon staff of about 50 or 60 operators retired. After this hour only about 10 operators were employed, consequently the temperature fell considerably, as shown in curves. On Nov. 8th the temperature before lighting was 70° Fah., and on lighting the gas, practically the same increase of temperature was noted as on the 10th. On Nov. 9th the electric light was used. The temperature of room before lighting up was 72° Fah., and on switching on the light the temperature remained constant till 8 o'clock, and then gradually decreased, proving conclusively the advantage of the electric light.

In quoting the price fixed by the Board of Trade the author stated that a Board of Trade unit was equal to 100 cubic feet of gas, but if Messrs. Preece, Vernon-Harcourt, Killingworth-Hedges, and Dr. Hopkinson's figures were correct, this was decidedly an error. According to these gentlemen's calculations, a Board of Trade unit was equal to from 133 to 142 cubic feet of gas; therefore, electricity, to be sold at Sydney gas prices, would cost from 8'3d. to 9d. per Board of Trade unit. Again, the paper stated that coal was about one-half the price in Sydney that it was in London. This statement was also incorrect, for, by Messrs. Birch & Co.'s price list of April, 1892, the 1st quality of South Wales and Lancashire steam coal, colliery screened, was sold at 13/- per ton, and the

best Newcastle at 11/6; second qualities at 12/3, 11/-. and 10/6 per ton respectively—double screening, 6d. per ton extra. Of course, very much depended on the situation of plant. From information on very reliable authority, the best double-screened coal could be delivered at pit's mouth for 7/6 per ton, or at Darling Harbour at 9/6. With coal at that price, and gas at 5/3 per 1,000 cubic feet, a comprehensive scheme of house and street lighting should be able to compete very easily with the Gas Company. In England the competition was very keen in every way. The cost of labour was low, gas was cheap (ranging from 1/10 to 4/- per 1,000), and coal was about equal. Yet, contending with all these obstacles, the electric light was forging ahead in England.

In assuming that 90 per cent. of the inhabitants would adopt the electric light, the author had taken a very high estimate, and one that would not probably be realized, as there were a great number of struggling property owners who could not afford the comforts of gas let alone the electric light. The probabilities of lighting an area as propounded in the paper were very remote, although not by any means impossible, and it was difficult to say without having a detailed plan of the city and suburbs, whether the sites mentioned were suitable or not for central station work. For lighting the city and a few of the adjoining suburbs from one central station, a better site could not be found than at the head of Darling Harbour, for it was practically the centre of Sydney, Pyrmont, Glebe, Waterloo, Moore Park, and Paddington, all of which were thickly populated. To lay down plants and install the lights of the capacity mentioned, viz., 57,500 I.H.P., would cost at least £3,000,000. The consumption of coal per day of 10 hours would be about 500 tons, and the consumption of water about 1,150,000 galls., which was equal to 182,500 tons coal, and 419,750,000 galls. of water per year.

Mr. Franklin threw out a suggestion which should not be overlooked, viz., that taking an air line from Sydney of about

30 miles, and close to Penrith, a splendid body of water, with a head of about 100 feet could be obtained. It was somewhat surprising that Penrith did not avail itself of this effective and inexpensive motive power, as it certainly would have proved the cheapest and most reliable for their lighting system. If water were used to generate the power mentioned in the paper, at the Falls, 174 turbines of 330 h.p. each would be required, or a smaller number of larger units, and, roughly speaking, the consumption of water would be about 350,000 cubic feet per minute. With regard to the multiphase alternate current transformer system he was inclined to think it premature to advocate this system for general lighting and power purposes combined. One advantage to be gained from the three-phase current, according to Prof. Elihu Thomson was that they might readily be converted into continuous currents by a motor generator of special construction, the armature of which had two sets of windings, one for the multiphase current and another connected to commutator segments for the continuous current, from which brushes, suitably adjusted, took off continuous currents. These might be used for lighting, or running continuous current motors, etc. He fully endorsed the author's remarks relating to the control of electric lighting of Sydney, but did not think any obstructions should be raised against the work being carried out by private enterprise if the Government or municipal authorities are unwilling to take the work in hand.

Mr. Tournay Hinde, in reply to the various comments on his paper, said that the objection to applying water as the generating power around Sydney was the smallness and uncertainty of the supply. With regard to the consumption of coal at the Australia Hotel, it certainly was high, but he ought to have stated that it was of very inferior quality.

Exception had been taken to the magnitude of the proposed scheme, although he had suggested three stations it was not

intended that they should all be erected at the same time, and were only mentioned as advantageous sites for such a plant as would be required for the future.

Referring to the question, whether electricity should be supplied to the inhabitants of Sydney by private companies or by the State, it must be borne in mind that in Sydney the tenure of any area granted to a Supply Company must be definitely limited in order to prevent a permanent monopoly. The result would, in all probability, be that the cost of the article supplied would be more than if this limited tenure did not exist, so as to ensure to the shareholders a certain return on the money invested in the allotted time. When a concern of this kind was carried out by the State, for the sole purpose of benefitting the people such restrictions did not exist, and moreover, it would not matter if the undertaking did not pay in the first two or three years, ultimately it would, and any profits made would go towards reducing the cost of the light instead of increasing it.

With regard to the efficiency of transmission at Frankfort, the results were as follows:—

Turbine	30 per cent. loss
Dynamo	5 " "
Transformer, up	5 " "
Line	11 " "
Transformer, down	5 " "
Motor at Frankfort	5 " "
Total	61 " " or 39 per cent. transmitted.

Half the entire loss being in turbine. The efficiency of the electrical portion being 31 per cent.