

THE BEGINNINGS OF ELECTRICITY SUPPLY IN BRISTOL 1889 - 1902

by D.G.Tucker

The Bristol electricity undertaking commenced the commercial supply of electricity in the autumn of 1893 and it was the first such undertaking of any size to be operated by a local authority. By 1894 its capital expenditure exceeded £80,000. The only earlier l.a. system was that at Bradford, and this was a small one of about £15,000 capital investment. This is the only claim to fame which the Bristol undertaking had. Unlike Edison's Pearl Street (New York) system and the Edison-Swan system at Holborn Viaduct, both in 1882; the Grosvenor Gallery scheme of 1883 and its associated high-voltage development by Ferranti at Deptford in 1889; and the St. Pancras electricity station of 1891 - all of which had outstanding novel features - the Bristol system does not appear in the history books. Nevertheless the story of the Bristol undertaking is an interesting one in many ways, and well worth recording.

A brief outline of the development of electricity supply in Bristol has been given by Buchanan and Cossons ⁽¹⁾, and an outline account of the equipment installed in the various stages of development by Watkins ⁽²⁾. The present article is an attempt to give the story of the first phase of Bristol's electricity undertaking in its more human context, for it is this which gives it some individuality. The two main sources of information used are the Bristol Corporation Committee papers in the Bristol Archives Office, and the several hundred separate, frequent, but irregular reports in the contemporary technical press, particularly in "The Electrician" which was almost certainly the most reliable journal. All information may be assumed to have been obtained from these sources unless individually referenced; chapter and verse will be given only for information from other sources.

In Britain the unwise Electricity Act of 1882 had seriously set back the development of electricity supply before it had really begun by its discouragement of investment through the requirement for all undertakings to be taken over by local authorities after 21 years. But Bristol Corporation obtained powers at this time, and under this Act, to set up an electricity undertaking itself. It did not proceed with the scheme, however, being advised by its consultant that the time was not yet ripe, that it would be better to wait until the technology was more advanced and less experimental. The Electricity Act of 1888, by extending the period of companies' operation before take-over to 42 years,

largely removed the disincentive to investment, and the immediate expansion of electricity supply led to rapid improvements. In 1889, therefore, Bristol's consultant felt free to recommend a start on Bristol's electricity undertaking. This was still only ten years after the first demonstration of the practicability of an electric incandescent-filament lamp, by Edison in America and by Swan in Britain.

W. H. PREECE AND HIS RECOMMENDATIONS

The consultant concerned was Mr. W.H. Preece, F.R.S., later Sir William Preece. He has been rather extravagantly described by an American ⁽³⁾ as "the outstanding English electrical engineer of the 1880's" - he was Welsh, anyway! - but it is certainly fair to say that he was an outstanding electrical engineer. He achieved his fame in communications engineering, having made many notable advances in telegraphy and in early radio experiments. He was Electrician, and later Engineer-in-Chief, to the Post Office from 1877 to 1899. His obituaries ⁽⁴⁾ are full of praise for his communications work, but not one so far seen makes any mention of his consultancy work in electricity supply before his retirement from the Post Office in 1899. It is indeed curious that as a civil servant he was able to do private consultancy; it is curious that as Engineer-in-Chief of the Post Office he could find time to do it - the Bristol work necessitated frequent attendance at meetings in Bristol; and it is amazing that he should have such a wide grasp of all technical developments that he could be an effective consultant in electrical power systems. His private practice did not escape the eye of Parliament; on 20 May 1892, Mr. Labouchere, M.P., spoke in the Commons ⁽⁵⁾ thus:-

"I beg to ask the Postmaster General whether he is aware that Mr. W.H. Preece, the chief electrical engineer at the Post Office, is in the habit of taking private practice in electrical work; and whether, in view of the fact that he is a Civil servant in receipt of an annual salary, this is in accordance with the Rules of the Civil Service?"

Sir J. Fergusson replied:

"The case of Mr. Preece is exceptional. . . . with the knowledge of the Department, he has continued to advise on great electrical questions outside of his regular duty, he being an expert of the highest standing. Such advice has been generally afforded to

Public Bodies. For instance, in the lighting of the House of Commons, of the British Museum, the Dublin Museum, and the principal cities. His action in this respect has been quite public, and his reports have been published. . . . As I have said, his case is altogether exceptional and cannot form a precedent."

And thus, with presumed official approval, Preece had been advising Bristol Corporation for some years when at last, in his report of 31 May 1889, he recommended that they should start an electricity supply and operate it themselves.

"The reasons in favour of the Corporation doing it themselves are (1) they can borrow money under more favourable circumstances than any private company can secure it, and the light could be supplied at a price which would be less to the consumer and equally profitable to the Corporation. (2) If the business which would accrue would be profitable, this profit might be applied to the reduction of the rates . . . (4) The profits derived from Private lighting would pay the cost of Public lighting. (5) The last and great reason in favour of self-manufacture is that the Corporation retains for itself the control of the whole system."

Preece did, however, warn that

"The Corporation would enter into a competitive business with an existing commercial interest. A gas shareholder might very properly object to the rates he pays being applied for the purpose of supporting an industry that was running in opposition to his source of income."

In this last matter, Preece was certainly a prophet, for at the end of August 1893, at the half-yearly meeting of the Bristol Gas Company, the Chairman, Mr. Alderman J.W.S. Dix, made exactly that complaint but nevertheless "looked forward without concern to the competition . . .".

Preece stated that electric lighting could not be as cheap as gas; he quoted Post Office experience as being that a gas light more-or-less equivalent to ten candles, maintained alight during normal working hours, cost 18 shillings per annum, while an electric light giving a similar amount of light, "with greater uniformity, with greater comfort, with infinitely less heat" cost 22 shillings per annum. He went on to say:

"The price that regulates both gas and electricity is the price of coal. In London the price of coal for motive purposes varies from 12/- to 15/- per ton. In Bristol it is probably about half of this."

and finally these prophetic words:

"My view is that the electric light is the light of the future, but I do not anticipate that it will do the

least harm to gas, for the future of gas is the supply of fuel and of heat."

Perhaps Preece only caused a lot of unnecessary bother by referring to the effect of the cost of coal, for the Corporation did not like Preece's later recommendation that Welsh coal of a fair average quality be burnt in locomotive-type boilers for economy of space, and wished to use inferior coal which was readily available locally. Preece's assistant, Gisbert Kapp (of whom more later) had to re-design the steam system using Lancashire boilers. He pointed out in his report to Preece dated 19 October 1891 that this would require more space and thus reduce the capacity of the station; but nevertheless Lancashire boilers were used, burning "Welsh small peanuts".

Preece also recommended that the "alternate current system" (nowadays called alternating current or a.c.) be used with high-voltage feeders to transformer sub-stations. Then

"The central station can be erected anywhere within the limits of the City; by preference it should be near the water or where coals are cheap."

While he was clearly recommending that street lighting be provided by arc lamps (the private lighting was by incandescent lamps), he did not, in this report, make any suggestion that a.c. would not be suitable for it. Nor did he in his more quantitative report of 29 December 1890. Yet the final system used separate continuous-current (nowadays called direct current or d.c.) dynamos for supplying the street lighting.

ACTION: GISBERT KAPP

Bristol Corporation had set up an Electric Lighting Committee as far back as 1884, and it was this Committee that dealt with Preece's report. It accepted the proposed scheme, debating it in some detail during the remainder of 1889 and all of 1890. They recommended to the Council that the Corporation should "take the electric lighting into its own hands", and this was agreed. A site was chosen for the central station at "Temple Backs" (later called Temple Back) beside the Floating Harbour, and in March 1891 the Committee resolved to clear the site at once for building purposes. Action was now imminent and in April 1891 it was announced that arrangements had been made by Mr. Preece by which Mr. Gisbert Kapp would co-operate with him in preparing plans and specifications.

Kapp was by 1891 one of the best known electrical engineers in Europe. He was born in Vienna in 1852, trained as a mechanical engineer in Zurich, and had eleven years of varied experience as a mechanical engineer before turning to electrical engineering in 1882. After two years with Crompton at Chelmsford he set up in practice as a consulting engineer. In this capacity he supervised until 1890 the electrical depart-

ment of W.H. Allen and Co. of London and designed some very successful electrical machines. He did a great deal of research, and published numerous papers. His name appears in practically all the history books on electrical engineering; he was later the first professor of electrical engineering at the University of Birmingham and, like Preece, he served as President of the Institution of Electrical Engineers.

Thus the Bristol undertaking had the services of two of the best-known and most successful electrical engineers and it is therefore not surprising that technically the undertaking was very good.

It is interesting that after this first announcement, Kapp's name never again appears in the published reports on the Bristol electricity works and very seldom in the official records. All contact between the consultant-designers and the Corporation appears to have been maintained by Preece. Nevertheless, there is some indication of the time Kapp had to put in on the Bristol work in the fact that he at this time gave up the London editorship of the important weekly journal "Industries", and in the greatly reduced flow of articles and papers from his pen.

At this stage (early 1891) the estimated cost of the project was £55,000, made up of £5,000 for buildings, £24,000 for machinery and plant, £20,000 for mains, and £6,000 for local distribution. This was to provide for an initial load of 10,000 lamps of 16 candle-power, each lamp requiring 60 watts of electrical power. (N.B. Lamp efficiency has been increased more than tenfold since then!). There was also to be street lighting based on 500 watt arc lamps.

BUILDING WORK

The Electric Lighting Committee went out to tender for the building work, but in July 1891 had to report, that they had been boycotted by the trade. It seems that Mr. H. Williams, architect to the Committee, had not drawn up the specifications according to "the orthodox and eternal traditions of the building trade". However, the difficulty was eventually overcome after the Committee had appointed two of its members to confer with two representatives of the Master Builders Association, and in October 1892 the Committee accepted the tender of Mr. C.A. Hayes which, at over £13,000 was not the lowest.

Additional cost to the extent of nearly £10,000 was incurred by the decision made at the beginning of 1892 to pile the whole of the site to ensure good foundations, and of course this lost more time.

There were apparently "unpleasant difficulties" in laying the foundations, but in June 1893 the contractor's request for extra payment because of these

was rejected.

Still further delay in the building work was caused by a bricklayers' strike in the summer of 1892, which held up work on the river wall. The project got badly behind schedule - certainly a year or more - and by June 1893 "The Electrician" felt impelled to refer to "the long incubating Bristol electric-light station"!

MACHINERY AND PLANT

By May 1892 the Committee had received tenders for dynamos (which term was presumably intended to cover alternators as well as d.c. generators) and for boilers. There was a good deal of competition, around ten tenders being received for each. The lowest tenders were accepted, £14,011 from Siemens Brothers and Co. for dynamos and £7,450 from Tinker Brothers for boilers; the tenders ranged up to maxima of £20,000 and £10,000 respectively.

In February 1893 the Committee, on Preece's advice, accepted the tender of Siemens Brothers for the distributing mains of £17,200 subject to certain modifications bringing the figure down to £16,580. There were three tenders lower than this - figures ranged from £14,700 to £24,000 - but Preece stated that these lower tenders did not comply with the specifications. The sub-contract for the trenching and laying of the cables was given to Mr. Krauss of Bristol, 5 miles of mains being involved.

The contract for the supply and erection of condensers, pumps, steam pipes, etc. was in December 1892 transferred from Woodhouse and Rawson United Ltd. to W.H. Allen and Co. (the reason was not announced), and Allens installed the equipment in the summer of 1893. ". . . the extreme dirtiness of the river water, and the strong chemicals dissolved in it, make it necessary to have a special form of condenser".

Not until May 1893 were the contracts for sub-station transformers and for the switchboard and battery placed, with the Brush Electrical Engineering Co. and F.M. Newton (of Taunton?) respectively. These were small contracts, of £1,752 and £1,553 respectively.

INDUSTRIAL AND FINE ARTS EXHIBITION, 1893

An incentive to get the central station completed by August 1893 was the request in June 1893 to the Committee to provide electric lighting for the Bristol Industrial and Fine Arts Exhibition which was to open on 28 August. The Committee achieved this somehow, for on 1 September 1893 it was announced:

"The Industrial and Fine Arts Exhibition, opened on Monday, is lighted by electricity generated at the Corporation's new central station. In the building are 20 arc lamps of 1000 candle-power

Fig.2

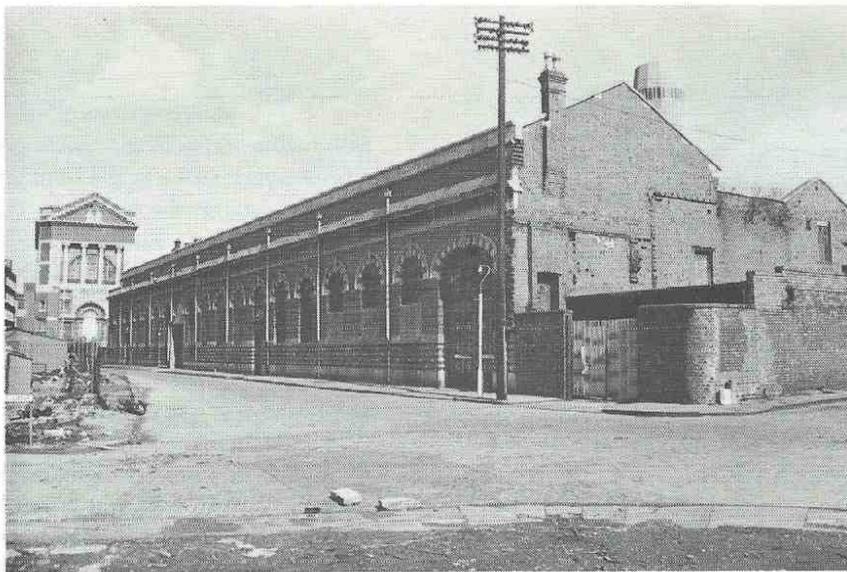


Fig.3

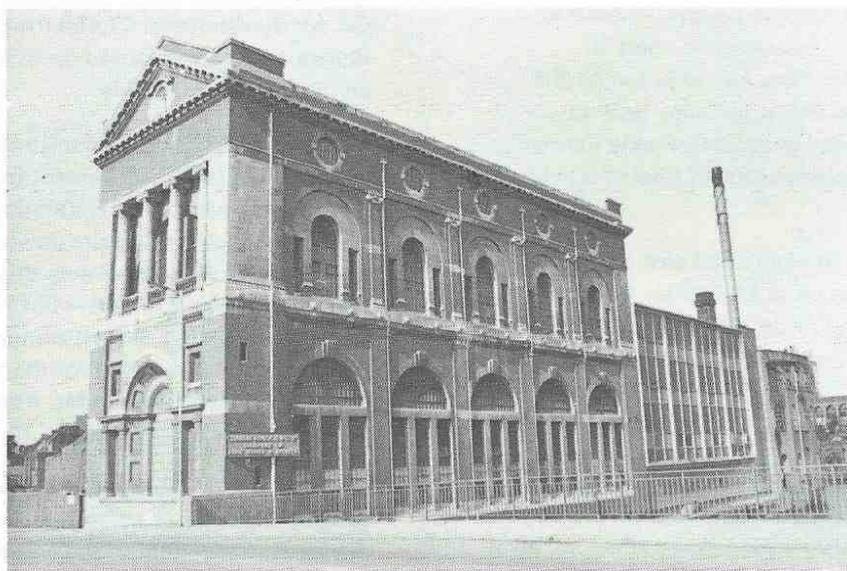
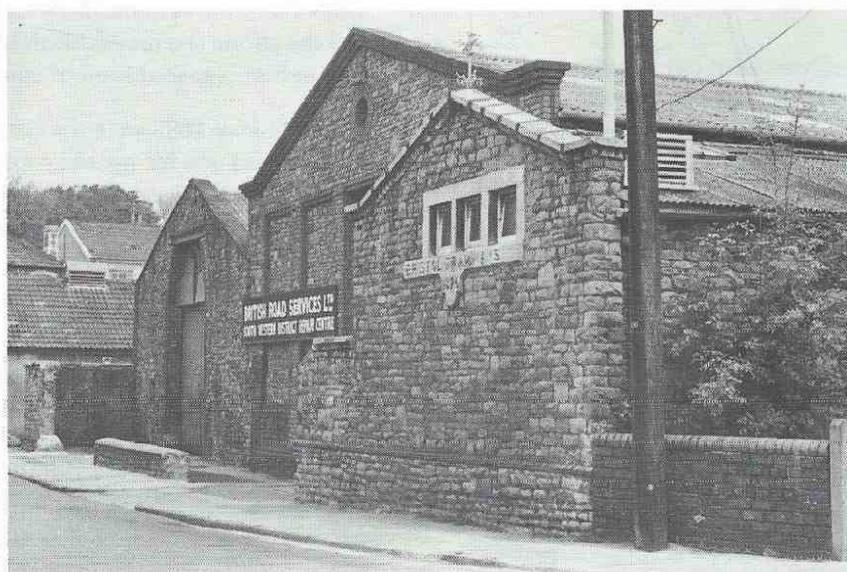


Fig.4



each, and between 300 and 400 incandescent lamps, mainly of 16 c.p. The Industrial Section is illuminated by 18 arc lamps, arranged two in series on circuits of 105 volts, and underneath the galleries, and elsewhere where necessary, are incandescent lamps. The arts section is lighted entirely with incandescent lamps, electroliers of numerous designs being brought into requisition. The electric current from the Corporation works is conveyed to a station within the building, which is an exact model of the numerous sub-stations in different parts of the City which the Corporation will own. From this chamber the whole of the lamps in the Exhibition will be controlled. The search-light in one of the towers is to be ready shortly. . . ."

This was evidently an immensely successful start to the electric era in Bristol.

TECHNICALITIES OF THE SYSTEM

The private lighting supply was provided by four 210 kW alternators and two of 88 kW. The frequency was the unusual one of 93 cycles per second, and the voltage applied to the feeders was 2100V. Sub-stations were installed in cellars (later in specially-built man-holes beneath the footpaths) and each comprised essentially two 25 kW transformers stepping the high voltage down to 210V for a three-wire local distribution which could provide 105V as well as 210V. The feeder and local cables were of the concentric type (i.e. the core was one conductor, and the other one or two conductors - one in the feeders and two in the local cables - were effectively tubes encircling the core with insulating layers in between), were armoured with steel wire, and laid in trenches. By December 1893 about 14,000 lamps were joined up (40% more than had been estimated); this represented a load of about 1000 kW if all were switched on together, and this was just about the maximum capacity of the generators.

The public street-lighting commenced in November 1893 and provided for 108 arc lamps. Of these, 12 were a.c. arcs connected either two in series across 105V or four in series across 210V. (N.B. It was a.c. arcs that were used in the exhibition, for the d.c. supply was not then available.) 96 arcs were d.c., operated in eight strings of 12, on the d.c. mains which were supplied at 650V from two 80-amp dynamos. The d.c. cables were, of course, distinct from the a.c. mains, and were single-conductor armoured cables laid in the trenches, with twin-conductor unarmoured cables up the lamp posts. A series string of 12 lamps was, of course, very vulnerable to failure, since if any one of the arcs failed to strike, none could. Thus on each route two cables were laid, with lamps connected alternately to one cable or the other; a failure would then leave alternate lamps alight. This scheme also provided an

economy measure, since alternate lamps could be extinguished after a certain late hour of night.

Why some of the arc lamps were a.c. whilst most were d.c. is not at all clear.

A very full technical account of the equipment is given in "The Electrician", Vol. 36, 6 March 1896, pp. 613-623. A map of the early distribution system, reproduced from this article, is shown in Fig. 1

STREET LIGHTING

The street lights were placed at intervals of 50 yards on alternate sides of the thoroughfare; this fitted in well with the two-cable distribution previously mentioned. In one unusually wide thoroughfare the lamps were in the centre. It had been proposed that the lamps should be suspended over the centre of the streets, but this idea was abandoned because of "difficulties with regard to fire escapes".

In October 1893 it was complained, in a Bristol newspaper, that the heavy character of the arc-lamp poles was quite unsuited to the narrowness of the streets; but consolation was found in the idea that there might be

"some excuse for these massive castings if they are taken as a symbolical assurance that there is no fear of a breakdown of the electric lighting plant."

An earlier decision of the Corporation, announced in December 1892, was

"to have handsome gas standards placed upon St. Augustine's Bridge, notwithstanding that the electric light mains are to be carried over the structure. The standards will, however, be suitable for electricity as well as gas."

This was playing safe indeed!

By February 1900 the effect of the electric light on the gas company was shown by the figures: 306 electric street lights replacing 599 gas lights, and a rapid fall in gas consumption amounting to about 5 million cu.ft. per annum.

EXPANSION: AVONBANK, 1902

The demand for electric light increased rapidly, and a demand developed for power for electric motors, so the system had to expand. More and more machinery was fitted into Temple Back until by 1901 it was absolutely full, with connections totalling a potential load of over 4000 kW and a maximum recorded actual load of 2535 kW. As this situation became imminent, the Committee made plans to cope with it, and announced in September 1899 their decision to purchase a large new site of 9.5 acres at St. Philip's Marsh from the

Avonbank Estate Co. for £14,500 approximately. On this site would be erected a new power station, not to replace Temple Back, but to take the additional load. This plan, of course, committed the Corporation to continue the old system of single-phase a.c. and a separate d.c. supply. Details of the new Avonbank Power Station, opened in February 1902, can be found in "The Electrician", Vol. 48, 14 February 1902, pp. 643-8.

ENGINEERS EMPLOYED BY THE COMMITTEE

On 21 October 1892 it was announced that Mr. H. Faraday Proctor had been appointed as resident electrical engineer. His salary was £260 p.a. Not least among his qualifications must have been his second name "Faraday", for Michael Faraday (1791-1867) must surely be regarded as the father of electrical engineering. He was then in his twenties; he retired in 1930.

On 12 June 1896 it was reported that Mr. Proctor had given service to the entire satisfaction of the Committee, and as his salary had not been increased since his appointment, it was to be raised to £400 rising by £25 increments to £500 p.a., Mr. Proctor agreeing not to determine his engagement for three years after the grant of the increase.

On 25 January 1901 it was reported that Proctor's salary had been increased to £600 p.a. with a further increase to £700 on 1 January 1902. This was a very good salary for those days.

Proctor had some assistants; it is recorded that Mr. J.R. Blaikie was Chief Assistant Engineer in 1896; his salary of £130 was raised then to £175, increasing to £200 after another year.

COMPETITION FROM OTHER ELECTRICAL SUPPLIES

Two items under this heading have been noticed; the major one relating to the tramway company is dealt with in more detail below. The lesser item concerned the Dock Committee, which reported to Bristol Council in October 1900 that they had been requested by the Petroleum Co. to furnish a supply of electric current, and being in a position to do this from their works at Avonmouth, recommended that they be empowered to do so. Alderman Pearson, chairman of the Electrical Committee

"questioned the advisability of two committees supplying electricity, possibly in competition with each other. Some time ago the Electrical Committee were asked if they were prepared to supply electric current at Avonmouth, and declined, not realising the large demand that was likely to arise. Had they been informed the demand would have been so large, it would have been worth while

considering whether the supply could not be economically given from the central station. It was, he feared, too late for his committee to intervene now."

So the Petroleum Co. was supplied with electricity by the Dock Committee.

THE ELECTRIC TRAMWAY AND THE CORPORATION'S TAKE-OVER BID

The Bristol Tramway and Carriage Co. ⁽⁶⁾ had been operating horse tramways in Bristol for nearly 20 years when they made their proposal for electric operation of a new extension from St. George to Kingswood. This came before the Sanitary Committee of the Council early in January 1894; it was stated that the overhead system was proposed. The Town Clerk wrote to Gisbert Kapp direct on this occasion, asking for his advice as to whether there would be any interference with the Corporation's electricity supply mains. Evidently he was reassured, for by the end of February the Corporation agreed to grant the Company the necessary powers. There had been considerable pressure put on the Corporation by public meetings and the Company in turn agreed to spend between £2,000 and £3,000 in widening the roads; the total cost of the electric line would be about £50,000. The only opposition appears to have come from tradesmen in West Street, Kingswood, on the grounds of the narrowness of the thoroughfare.

The Company proceeded quite rapidly. The report of the Directors for the half-year to 30 June 1895 stated that

"the construction of the line between the City and Kingswood, which is to be worked by electricity, and the conversion of the St. George's depot into a generating station, are approaching completion. . . . This may fairly be claimed as one of the smartest bits of work in the way of rapid tramway laying ever effected in this country. The extent of the reconstruction is two miles but, with the large portion of double line, the actual run of single line laid has been three miles, and this work has been done in six weeks, or at the rate of a mile a fortnight."

The line was actually opened on 14 October 1895, and was a great success; 92,516 passengers were carried in the first week.

Further extensions were immediately planned. In February 1896 the Company applied to electrify the whole tramway network in Bristol. The Sanitary Committee recommended the Council to give further consideration to the whole problem, and the Electrical Committee insisted that if any further extensions after that from West Street to Fishponds Road were

to be sanctioned, the Corporation must supply the power. The Town Council debated the matter and resolved

"that a committee, consisting of the Sanitary and Electrical Committees, be appointed to consider, and report upon, the desirability of introducing the overhead trolley system in the city, and, if such system should in their opinion be sanctioned, to report upon the terms on which such sanction should be given."

The Company stated, in the same month, that if the Corporation seriously meant to impose the condition that power must be taken from the Corporation's station, the Directors would abandon their electrification plans. For

"The production of the motive power was one of the most vital parts of the Company's working, for which the Directors were responsible to the public, and they would not undertake that responsibility unless they had full control of the management of their own undertaking."

And thus battle was commenced. Clearly electrification had to proceed, and the Directors' threat was a serious one.

The Joint Committee consulted Preece in the matter, and he opened his report of 24 October 1896 by saying:

"The safe, smooth, and rapid working of tramways has become such a want of the age in every large city that I propose in this report to show:

1. That their construction, maintenance, and working are the proper function of the Municipal Authority
2. That they are best worked by electrical energy.
3. That they are worked most cheaply when they are worked in conjunction with a system of electric lighting."

In November the Corporation confirmed that extensions of the electric tramway would be sanctioned only upon the condition that power was obtained from the Corporation. In December the Company formally notified the withdrawal of their proposals except for the Staple Hill extension which was entirely outside the Corporation's territory. The Corporation retaliated by appointing a Committee to consider the question of purchasing the tramways. The Chairman of the Company responded that:

"the Company had no desire to sell the undertaking, and did not intend to do so, by arrangement or otherwise."

It quickly became clear that the other local authorities into whose areas the tramways were to run had no

sympathy with the Corporation.

On 15 October 1897 it was announced that the City Council on the recommendation of the Tramway Purchase Committee, had decided to open negotiations with the Company for the purchase of their undertaking.

"The Committee were not asking that the tramways should be compulsorily purchased at the present time, but that the Council should give them power to negotiate with the Company to see if they could obtain the undertaking upon satisfactory terms."

On 28 January 1898 it was announced that the Company had declined to discuss the matter with the Council. They then started to promote two Bills in Parliament, one for the construction of additional lines and the extension of their system, and the other for powers to introduce electric traction on the existing tramways. The Corporation decided to oppose both Bills.

Then ensued much correspondence between the two sides from 21 February to 18 March. The Corporation sought to impose many conditions relating to hours of work of employees, use of posts and fixtures, the universal use of the overhead system, etc. but in particular to bring forward the date at which it could compulsorily purchase the tramway undertaking. Under the original Tramways Act of 1870, local authorities had the option to purchase 21 years after the authorization of a line. The Corporation did not want to wait 21 years before being able to purchase the new lines now in question, and demanded that the date of purchase be agreed as that of the existing horse tramways, i.e. about 1912. (This was already a considerable retraction on the part of the Corporation). The Company, while making some concessions in the minor matters, were adamant in their opposition on this matter. On 1 April it was announced that the negotiations had been broken off.

On 29 April 1898 the announcement appeared that agreement had been reached. However, the "agreement" was virtually a complete capitulation by the Corporation. There were, of course, all the minor points of agreement (which took up a lot of words and are not worth listing here), but on the two major points, viz. the supply of power to, and purchase of, the undertaking, the Corporation gave in completely. The Company had won a resounding victory, and went ahead with confidence. On 5 August 1898, the Company announced:

"A site has also been purchased for the purpose of erecting a central power station."

This was the site of Finzel's defunct sugar refinery on the Counterslip, next door to Temple Back!

THE POWER STATION BUILDINGS

The buildings at Temple Back, and at Counterslip, still remain in good condition and a photograph of the former is shown in Fig.2, and of the latter in Fig.3. Other photographs of the Temple Back and Counterslip buildings appear in the book by Buchanan and Cossons already referred to. The building at Beaconsfield Road, St. Georges, in which the first tramway power station was accommodated, still exists and is shown in Fig.4.

REFERENCES

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2. G. Watkins, "Bristol electricity supply", B.I.A.S.J., 3, 1970, pp. 22-25.
3. H.C. Passer, "The Electrical Manufacturers 1875-1900", Harvard University Press, 1953, p.33.
4. e.g. "The Electrician", 72, 14 November 1913, p. 253 and "The Engineer", 14 November 1913, pp. 517-518.
5. Parliamentary Debates, 4, 3-26 May 1892, pp. 1443-4.
6. For a long and detailed account of Bristol tramways (which nevertheless has little to say on the matters discussed here) see J.B. Appleby, "Bristol's Trams Remembered", published by the author at Westbury-on-Trym, Bristol, 1969.

ACKNOWLEDGEMENTS

Thanks are due to Miss Mary E. Williams, Bristol City Archivist, for much help regarding Committee Papers in the Bristol Archives Office, and to the Post Office Records Office for information regarding W.H. Preece

ILLUSTRATIONS

Fig 1. Map of the Bristol Municipal Electric Light System (from The Electrician, 6 March 1896, p. 614)

-  Distribution mains and Arc mains in original contract.
-  ditto since added.
-  Extensions of feeders where there are no distribution mains.
-  Electric tramway terminus in Old Market Street.

Fig 2. The Central Electric Lighting Station at Temple Back, in 1972.

Fig 3. The Tramway Central power station at Counterslip, in 1972.

Fig 4. The old tramway depot at Beaconsfield Road in which the first tramway power station was accommodated. (Photo by Roy Day).

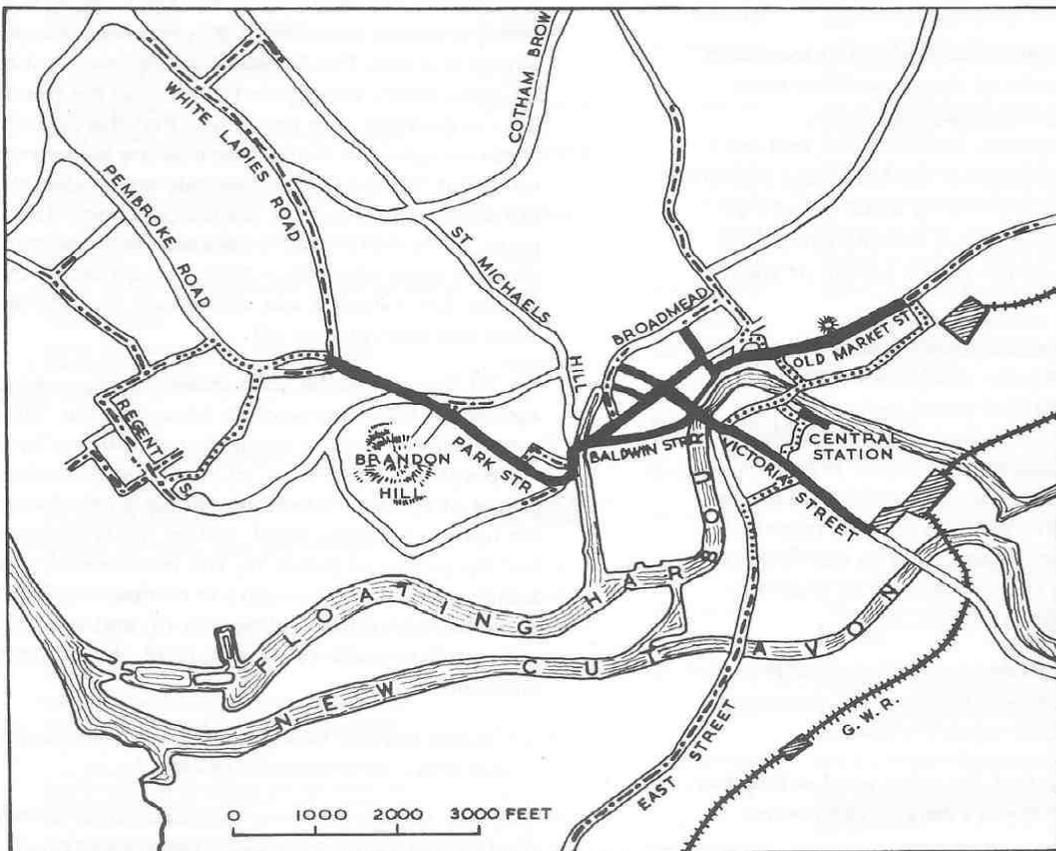


Fig. 1