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HALF A CENTURY OF HYDRO-ELECTRICITY AT MONMOUTH

The Early Days of Electricity Supply

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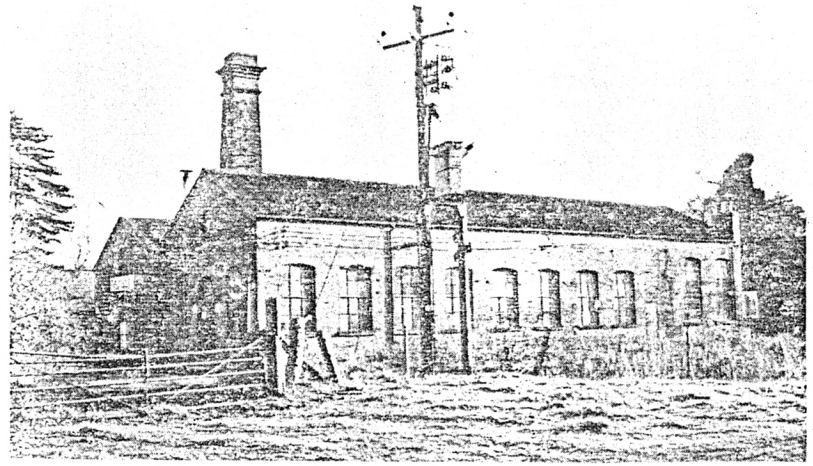
Introduction

The history of the provision of electricity supply in Monmouth is interesting and unusual in a number of ways. First, it was one of the handful of public electricity supplies in Britain generated by water power. Secondly, it was conceived and executed as part of a combined sewage-disposal/electricity supply project. Thirdly, it had an unusually



The building of the Electricity Generating Station as it is now (1973)
(*Photo by Author*)

long gestation period ; born (i.e. opened for use) on 10th June 1899 although conceived (as a combined sewage/electricity system) six years earlier. Fourthly, it was at one stage tied up with local politics and had to await the result of an election before it could proceed. It was not unusual in that the first suggestions for electricity supply in

Monmouth arose as a result of a dispute with the gas company over charges. It was not equipped by the contractor with whom negotiation were first begun and who prepared most of the plans, nor was it built in the place first intended ; and, indeed, it did not draw its water power from the River Wye as originally planned but instead from the smaller River Monnow. However, once built and opened, the generating station served Monmouth for nearly fifty years. The building, at the end of Forge Road, Osbaston, still stands (see Plate 1) ; it is devoid of its electrical and hydraulic equipment and is now used for another industrial purpose. The leat, head-race and tail-race have been filled in. The chimney still stands, however ; it was provided for the boilers which supplied the steam engines, which were originally installed as stand-bys in case of failure of the turbines through water shortage or flooding, and were latterly replaced by a diesel engine. The weir is still in the river, with control sluices.

The story presented here is based on various sources of information. First and foremost comes the long series of reports published in *The Electrical Engineer*—over 60 of them between 1890 and 1923 ; then some similar but generally less adequate reports in *The Electrician*. Minute books of the Monmouth Town Council are preserved (at the County Record Office, Newport, for the years concerned up to 24 Oct. 1906, at the Monmouth Local History Centre for later years) but in the early years these contain less information than the published reports, although occasionally they give additional facts, an example being the list of tenders received for the electrical plant, recorded in the minutes for 20 Nov. 1896. The Provisional Order of 1894 and the associated maps are at the County Record Office (ref. P. & B.R. 617, 8). The Specification for the first contract, the electricity accounts for 1907, and a number of other miscellaneous papers are at the Monmouth Local History Centre. Two very valuable sources of information have been two former workers at the electricity station, Mr. J. Ferneyhough of Church Street, Monmouth, and Mr. R. Windsor of St. James Street, Monmouth, both of whom worked at the station in the years around 1920 ; Mr. Windsor's father was the Borough Electrical Engineer from 1907 to about 1920, when he retired.

Quotations given without reference to source are all from *The Electrical Engineer*.

The beginnings

On 12 September 1890 the *Electrical Engineer* reported as follows : 'Electricity, we should fancy, would soon be a welcome guest in Monmouth. Owing to disputes with the gas company, who want to charge £4 a lamp a year for public lighting, instead of £3, the price offered by the Corporation—at the last meeting of the Town Council, it was practically decided to abandon gas for the use of petroleum. Oil will, therefore, in all probability be adopted,

though not, we think, for permanency. We know the steps : grasping gas company, disputes, discussions, and proposals ; threats of petroleum, advantages of electric light discussed, trial, and final adoption of electric light. Let us hope the dispute will come out this way with Monmouth'.

The optimism seemed justified, for a deputation from Monmouth visited Fareham to inspect the recent installation of public electric lighting there ; they were very satisfied by what they saw and learnt. At a special meeting of the Town Council on 10 October 1890 it was decided to draw up specifications at once and to advertise for tenders. They decided on a low-tension system and required the tenders to be submitted by 1 November. However, nothing came of this. The Council minutes are silent on the matter of dropping the electric lighting scheme, but as the gas company (no doubt as a result of the threat of adopting electric lighting) decided to agree to a charge of £3 per lamp, this was no doubt the reason.

The joint sewage/electricity scheme

In 1892-3 plans were being drawn up for the disposal of sewage in Monmouth. Mr. Beesley, civil engineer, of London had been consulted, and as the use of water power for pumping the sewage had been suggested, the Mayor (Mr. W. Honeyfield) thought that it might be sensible to use the water power for generating electricity as well. He gave some very encouraging figures regarding costs and profits. The profits of the electricity scheme might contribute greatly to the reduction of the cost to the ratepayers of the sewage scheme. At the Council meeting held on 3 September 1893 a sum of £10 was allowed for consulting an electrical engineer, and the Mayor was asked to appoint a small committee to consider his report.

The Brush Electrical Engineering Company was approached and Mr. R. A. Dawbarn of that company rapidly prepared a report which was presented to the Town Council by the Mayor at the end of September. It considered some partial schemes for electricity supply, but also a complete system comprising 106 street lamps of 16 c.p. each and 500 similar lamps for private consumers. For this system 60 h.p. of turbine power was required, provided by two 30 h.p. turbines, both being required for the peak evening load, then one only for the night lighting load and the day-time sewage pumping load. Mordey-Victoria alternators were recommended, with a 1000 V.a.c. mains system. Street lamps would be arranged in groups of 10 connected in series across the 100V. mains, while private consumers would be supplied at 100V. by means of transformers. Mains would be laid in Wye Bridge Street, St. James's Street, Whitecross Street, Monk Street as far as Priory Street, Church Street, Priory Street from Agincourt Square to Market House, Agincourt Square, Monnow Street, St. Thomas's Square.

A stand-by steam engine was to be provided as the turbines would be prevented from operating properly if there was a severe drought or floods.

The sewage disposal part of the scheme was also discussed. Here the consultant had been Mr. C. W. Lailey of London. From the figures available it would seem that the sewage scheme, if carried out alone, would necessitate a rate of 8¾d in the pound ; but the joint sewage/ electricity scheme would necessitate a rate of only 5d in the pound.

In early October 1893 the Town Clerk was instructed to set about obtaining a Provisional Order for electric lighting (under the Electricity Act of 1888). By the end of October it was decided to apply to the Local Government Board for sanction to borrow £18,000 for the purpose of carrying out the joint sewage/electricity scheme.

At this point we may remark that the Mayor showed considerable initiative in proposing a water-powered electricity scheme. Public electricity supply had started only at the end of 1881, and in Britain had not made much progress until after the amended Electricity Act of 1888 which enabled investment in electricity supply schemes to be made on a sound basis. By 1893 the only comparable water-powered public-supply systems actually operating in Britain were at Lynmouth and Keswick, while that at Worcester was under discussion. So Monmouth was showing some originality in its thinking, not only in using water-power to generate electricity, but also in combining this with the sewage works.

As at this time, the estimated costs of the various parts of the scheme were :

Sewers and associated costs	£6,465
Purification works & do.	£3,062
Electricity generation	£5,134
Hydraulic works (head-race, tail-race, culverts &c) and buildings	£4,269
Total	£18,930

The tender of the Brush Co. for the electrical works had been provisionally accepted. After some discussion in Council at the beginning of January 1894 it was decided to obtain further advice from another consulting engineer to be nominated by the Institution of Civil Engineers. In February it was announced that Messrs. Bramwell and Harris were to be the consultants at 30 guineas plus expenses. The Council had also decided to consult Mr. Gilbert Gilkes, turbine maker of Kendal, at 5 guineas a day plus expenses.

By April, Bramwell and Harris's fee had been raised to 100 guineas. Their report and recommendations were accepted by the Council in August 1894. The combined sewage and electricity system was to be adopted, with approximately the same cost as previously estimated, and a cost to the rates of 7d in the pound as compared with 1s for the sewage scheme alone.

By September 1894 the Council had decided to employ Bramwell and Harris to supervise the whole of the electrical work at a commission of 5 per cent plus out-of-pocket expenses, and not to proceed with the previously-agreed arrangements with the Brush Co. (Mr. Graham Harris gave his personal attention to Monmouth and visited the town to make inspections and meet the Council on a number of occasions). Mr. Lailey was to look after the sewage work.

A Provisional Order for the electricity works was obtained during 1894 which specified the streets in which mains were to be laid within two years, and specified the streets and roads which might be broken up by the Undertakers in pursuance of the special powers granted by the Order. An accompanying map showed all the significant works.

Location of the works

When the Provisional Order was applied for, it was intended to have the sewage works and generating station together on the east bank of the River Wye near the northern railway viaduct. It was not thought necessary to build a weir across the Wye. The Brush Co. had agreed to this site without question. However, Bramwell and Harris considered that :

> 'practically, the only suitable place which is available for obtaining water power in or near the centre of the town is the present disused Old Forge Mill in the Osbaston-road. We have already pointed out that this is close to both the suggested sites for the sewage disposal . . . There is ample water power for a reasonably large station . . . we should propose to place at the Old Forge Mill three turbines, each being capable of giving, say, 35 i.h.p.'

So the proposed site changed to the Old Forge site on the River Monnow. The generating station was indeed built there. (Grid ref. So 503137

Bramwell and Harris, it will be observed, had increased the turbine power as compared with the Brush proposals. They now wanted to provide for a maximum of 1700 8-c.p. lamps or their equivalent (the previous proposal was effectively for 1212 such lamps). They also wanted to raise the mains voltage to 2500V. There would be three a.c. motors working at this voltage to pump the sewage, and a transformer at the pumping station would transform the voltage down to 100V. for the low-tension distribution.

Local opposition to the electricity scheme

Things did not proceed straightforwardly in Monmouth. At a special meeting of the Town Council in early March 1895, a member (Mr. Cossens) proposed that the portion of the scheme relating to electric light be abandoned, and that the Local Government Board be approached for permission to drain the sewage into the Wye by gravitation. He obtained considerable support for this, although it was pointed out that the law would not permit the pollution of the Wye. Fortunately Cossen's proposal was later withdrawn.

At the end of June the same year, correspondence appeared in a local paper complaining that the people had not been consulted, and suggesting that there was an immense majority against the introduction of electric light. The Council was urged not to proceed without getting the sanction of the ratepayers.

When the Local Government Board held an inquiry into the Corporation's request for sanction to borrow money (now £19,000), a petition against granting it was submitted, signed by about 100 ratepayers. The Corporation's representative commented on the number of directors and shareholders in the gas company appearing among the petitioners. The L.G.B. proved also rather unsympathetic to the electricity proposal, although in mid-Novemebr it was reported that :

> 'The result of the municipal election is taken as showing that the ratepayers are favourable to the proposed electric lighting scheme, the retiring councillors who supported the scheme having been re-elected by substantial majorities".

Fortunately, by March 1896 the formal approval of the Board of Trade was finally obtained for the scheme and the broad outline of the technical specification laid down by them. However, time under the Provisional Order was running out, and an extension of time had to be asked for.

Slow Progress

At this stage, Messrs. Bramwell and Harris appeared to lose interest in the scheme. In mid-September 1896, the Mayor complained that he had written to them asking what the prospects were of getting the work started, but had got no reply. A month later he reported that he had heard from them ; they would be ready to invite tenders in about 3 weeks. Tenders were indeed invited, and received, and the Council minutes of 20 November 1896 list them. B. and H. told the council that the electricity supply should be working by March 1897. Although the Brush Co. tendered, the offer of Siemens Bros. was judged to be the lowest when all factors were taken into account, and

the contract was awarded to them, on the basis of £6,980 for electrical generating machinery and mains.

By April 1898—i.e. a year later than the estimated completion—the Town Council was complaining that the turbines were not yet ready, and the Deputy Mayor (Mr. Honeyfield) undertook to call on the engineers in London to see if the work could be pushed forward. Mr. Honeyfield had been chairman of the Drainage and Electric Light Committee for nearly 6 years, and in May resigned this position, although in later years he resumed it. There was some trouble in Council over extras on the drainage contract. Lailey had estimated them at £500, but they had reached £6,000. Council ruled that in future there was to be no extra work without prior submission of particulars to Council. The Council had expended all the borrowed money and the work was far from complete. The Local Government Board was not willing to sanction a further loan until they had Lailey's explanation of the extras. So there was deadlock. However, the work did proceed slowly. The Council minutes for 14 July 1898 report that "The work at the Generating Station is now in hand'.

Electricity at last

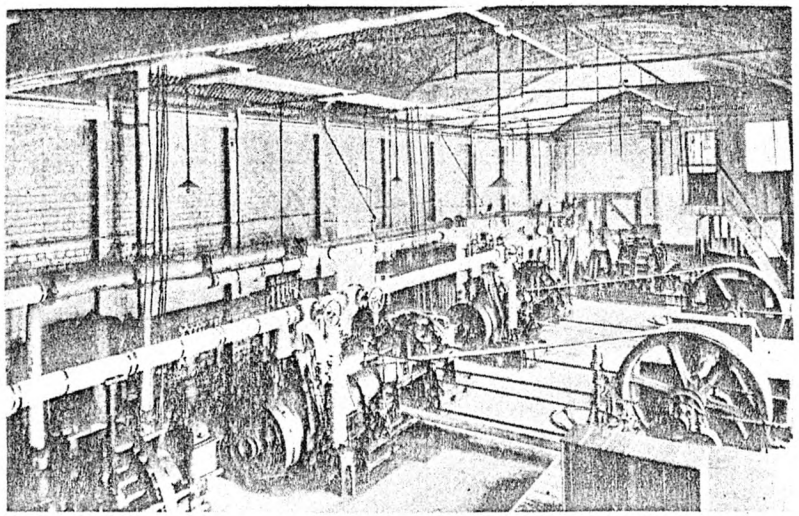
In January 1899 it was reported that:

> 'the electric light is nearing completion and the light will probably be switched on by March'.

However, it was 10 June that year before the station was opened. The charge for electricity for lighting was 6d per BOT unit.

At the beginning of May it was reported that 1,685 8-c.p. lamps (equivalent) had been applied for. In spite of the Mayor's protest, the station had been fitted with only two of the three turbines planned, so that only about 1100 lamps could be supplied simultaneously. This was considered just adequate initially, as not all lamps would be on at the same time. The Council debated once again whether they should purchase and fit a third turbine, and after some delay, eventually decided, in July 1899, to do so. For public lighting they also added two 600-c.p. arc lamps.

By January 1900 the private demand had risen so fast that the Council decided to purchase a fourth alternator, of 60 kw. to be driven by a steam engine of 100 h.p. The first three alternators were of 21 kw. each and were turbine-driven with stand-by steam engines. A photograph of the interior of the station taken around this time is shown in Plate 2. The turbines are underneath the floor on the right-hand side, driving the big pulley (or fly-wheels) via bevel gears and the vertical shafts. The alternators are on the left, driven by the



Interior of Generating Station around 1900
(*from photo in possesion of Mr. R. Windsor*)

belts seen in the photographs. There was a fast-and-loose pulley pair on each alternator shaft ; if there was no water for the turbine, or if it was flooded, the belt would be shifted to the loose pulley and the steam-engine clutch engaged. The 60 kw. steam-driven set can be seen at the back of the photograph. The frequency of the a.c. supply was 60 cycles per second.

The manufacturers were :

Turbines :	Gilbert Gilkes and Co. of Kendal.
Steam engines :	Ransome Sims and Jeffreys of Ipswich.
Alternators :	Siemens Schuckert.

The head of water was stated in the Specification to be 6 ft. 6 ins. maximum.

Operating troubles

Operating troubles were no doubt numerous, and many were recorded in the Council's Minute Book. The following matters are of peculiar interest.

On 27 August 1900 there was a serious accident to the system. Steam had forced a hole through the masonry under the sill of the weir and allowed the whole of the water to escape along another course. The repair cost several hundred pounds. The weir referred to would have been that forming the penstock or turbine pit, not the big weir on the River Monnow at the beginning of the leat.

Much later, in February 1917, the weir on the Monnow itself was broken during a period of severe frost :

> 'The turbines were frozen on one day. The ice on the River Monnow had had to be constantly broken and cleared up to the weir, where it accumulated, and the water, being unable to flow over, caused a much greater pressure than ordinary, the result being that the weir gave way. If they could go on until the Spring then they would have to take the matter in hand and complete what was left undone some years ago'. (*The Electrician*, 16 Feb. 1917, p. 619)

The present weir on the river is thought to be the one that was built as a result of this accident.

Troubles were also experienced with the underground cables. At the period concerned, power-cable technology was not very highly developed, of course, and many other undertakings had cable trouble. However, there is a suggestion that negligence and neglect played some part at Monmouth. There were two main periods of trouble, in 1907 and 1914. The report of the Electric Lighting Committee dated 28 May 1907, which was adopted by the Council on 4 June, stated :

> 'We recommend that Mr. A. W. Blake be called in as Consulting Engineer to test and report on the condition of the Electric cables throughout the Town' . . .

The Committee's report of 2 July 1907 stated :

> 'In the meantime we have instructed Mr. Wilkins (the Borough Electrical Engineer) to take steps to improve the insulation of the low tension network . . . It is gratifying to have an assurance that the high tension cables are in such good order'.

The Committee's report of 15 August 1907 stated :

> 'We were handed a letter from Mr. Wilkins, Electrical Engineer, resigning his office . . ."

At the Council meeting on 3 September 1907 Mr. Wilkins was refused a testimonial, so it is probable that the Council felt it was a case of negligence, and that Wilkins had been asked to resign.

The later period of cable trouble led to an attempt by some members of Council to get rid of the electrical undertaking. The report of the Electric Lighting Committee of 2 January 1914 stated :

> 'We have to report that a Meeting of the Council was held in Committee on the 9th December last when our Chairman explained the failure of the Electric Cables which had involved the town in darkness and caused great inconvenience to private consumers of Electric Light and to the general public which we deeply regret'.

In the ensuing discussion,

> 'Mr. Alderman Tippins moved and Mr. Hancocks seconded that an attempt be made to sell the Electric Lighting undertaking'.

The motion was lost, however, and the Town Clerk was instructed to inform the Local Government Board of the breakdown of the service and that it was the Council's intention to apply for sanction

for a loan for new cables. Council also resolved to order new cables at once from Messrs. Siemens Brothers. Mr. Windsor, then the Borough Electrical Engineer, was praised for his energetic and untiring work throughout the crisis.

Financial Troubles

We have already referred to the overspending, on extras, which had reached £6,000 by mid-1898. This was mainly in regard to the sewage works, and it is believed that the electricity works caused little trouble financially at this time, although considerable extra expense was involved later on when the cables broke down and had to be renewed.

By March 1900 the total cost had reached £49,000, which was £29,000 above the loan of £20,000 which had previously been sanctioned. The Council tried to raise the money as they could, and postponed payment to Siemens Bros. for the electrical generators supplied. The way they had been conducting their affairs can be judged from a letter dated 17 January 1908 received by the Council from the Secretary to the Local Government Board, and reported fully in the minutes of the Council meeting of 4 February 1908 :

> 'It stated that the Report of Mr. Hooper the Board's Inspector showed that the proceedings of the Town Council in connection with their combined Scheme of Sewage and Electric Lighting had been unsatisfactory throughout, that it would seem that the present audit of the accounts of the Council is of a superficial character and that looking to the action of the Council in raising a loan by means of an Overdraft without any legal authority and their proceedings in connection with the Electric Lighting and Sewage Scheme the Board felt that they could not properly sanction any further Loans unless the accounts of the Town Council are in future made subject to audit by a District Auditor . . .'

This seems quite strong criticism. It is mild, however, compared with what was said in the House of Lords. The *South Wales Argus* of 29 July 1908 reported :

> 'Lord Balfour of Burleigh sitting as an unopposed Committee of the House of Lords had before him . . . a Bill to confirm a Provisional Order of the Local Government Board . . . to so alter the various sections of existing Acts of Parliament as to enable the Monmouth Corporation to put their finances in a proper condition, and in this respect Mr. Boyce, of the Local Government Board, who put the case for the Order before the Committee, mentioned . . . that this was one of the worst cases of carelessness and mismanagement of borough finances that had come under the notice of the Board. He mentioned one instance where £10,000 had been borrowed by the Corporation for six years in 1902, with the guarantee of Lord Llangattock, and it had been found at the end of five years that not one penny of the sinking fund had been provided. In connection with a joint sewage scheme the sum of £45,000 had been expended without a single contractor's account to show what the money was for from time to time. Four engineers had been engaged and all that had been done in respect to this expenditure was for the engineer-in-chief to issue a sort of order on a blank piece of paper for the payment of certain sums which were thus certified as due. The Local Government Board inspector . . . had never met a case like this one . . .'

Eventually some further loans were sanctioned, with due safeguards, and the Council managed to continue their work.

Production costs

The Financial Statement and Analysis of Accounts for the year ending 25 March 1907 has survived and shows that the cost of producing electricity at Monmouth was exceptionally low. The 'works cost' came to 1.11d per unit (kWh) and it was claimed that :

> 'The total Works Costs are the lowest of any Electricity Works in the United Kingdom having a similar output to that of Monmouth with the exception of two'.

The fact that water power was used was almost certainly the reason for the relatively low cost ; there were very few other water-powered public-supply stations in Britain. The 'total' production cost per unit was 1.83d. The charge for private lighting was 5½d per unit, for power and heat 3d per unit, and for public lighting 2d per unit. Yet the accounts show a deficit on the year's working of £169 ! The explanation is that the 'total' cost excluded interest on loans and the contribution to the Sinking Fund. These two items amounted to £960 out of a total revenue of £1,824, and converted an apparent profit of £791 into a deficit.

Later history

In 1922 the electricity generated was below the demand, and rather than extend their works, the Council tried to arrange to purchase electricity from the Hereford electrical undertaking and transmit it from Hereford to Monmouth by a special transmission line. However, the Electricity Commissioners would not accept the terms which had been negotiated and instead authorized the Monmouth Council to proceed with the extension of their works. This extension is believed to have consisted in the replacement of one of the 21 kW generators by a new one of 40 kW with a new, larger water turbine, and the replacement of another by a 30 kW generator using its old turbine, together with the replacement of the large steam-driven generator set by a new diesel-driven set.

Later the undertaking was sold as a going concern to the General Electric Co. who replaced two of the turbines, and kept the station running, it is believed, until nationalization in 1948.

Acknowledgments

The assistance of Mr. J. Ferneyhough and Mr. R. Windsor in furnishing information from their experience is very much appreciated, and thanks are due to Mr. Windsor for allowing the reproduction of the old photograph (Plate 2) in his possession. The co-operation of the staff at the County Record Office, Newport, and the help of Mr. K. Kissack at the Monmouth Local History Centre are also gratefully acknowledged.