Fakenham Gasworks: Over 150 Years of History

by

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With the introduction of North Sea gas during the late 1960s many old town gasworks became redundant, and as a result their machinery was dismantled and their sites sold. Fakenham Gasworks, Norfolk closed in 1965, but for various reasons was not immediately dismantled. As a result it became the only complete coal-gas works remaining in England and Wales, and subsequently was recognised as being of national importance. Its scheduling as an ancient monument and survival as the home of a museum to the town and gas-making industry have brought both problems and rewards, and now, over 150 years since its opening, the gasworks is again the subject of interest and concern. This essay considers the history and development of gas-making with reference to the Fakenham works, and examines some of the philosophical and technical issues raised by repairing, maintaining and presenting what remains of a small town gasworks.

INTRODUCTION

Fakenham Gasworks, in its heyday, was a small town works providing gas to local inhabitants and businesses. Today it is scheduled as an ancient monument, and is the last remaining gasworks of its type in England and Wales. Why, and what are we keeping it for?

The importance of town gas and the changes that it brought to the lives of those who lived through its introduction, development and eventual demise should not be underestimated. In particular, not until the arrival of cheap gas in the mid-nineteenth century was it possible for humbler houses to have a single powerful light in a room, instead of several oil lamps or candles.[1] Gas represented the first transportable ready-to-use form of energy for light, heat and power, whose only rival was, and has remained, electricity. Today, however, there is often little that survives of the multitude of gasworks that existed up and down the country, apart from later gas holders now used for the storage of natural gas, or the occasional

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reference in the name of a road or street.

At the peak of coal-based gas production in the mid-1950s, the industry employed one per cent of the nation's total workforce (from coal mine to gas appliance), and was serving 13.4 million customers at the start of conversion to natural gas in 1967. Fakenham, however, had one of the smallest works, employing eight men and supplying 500 customers when production ceased in 1965, yet its importance in the town was undeniable. Fakenham Gasworks is something much more significant than just the site of a disused gasworks. It is a tangible reminder of a way of life, complete with social and technological consequences, that has now passed into history (Fig. 1). This legacy of coal-gas production deserves to be better known and protected for future generations.[2,3]

The manufacture and use of gas for illumination, heating and power is a vast subject that combines aspects of practical engineering, science and trade. It is therefore beyond the scope of a single essay, and can only be hinted at in the context of the present work.[4] There have been a variety of different gases used over time for domestic, commercial and industrial purposes, and this essay considers only

Fig. 1
Fakenham Gasworks in 1925 showing the original retort house and two gas holders (compare with Fig. 9)
Courtesy of Fakenham Town Gasworks Museum Trust.

that produced by the carbonisation of coal (coal gas). Other forms, such as gas derived from oil, wood, calcium carbide (acetylene), petrol and natural sources, are worthy of study, but must be pursued elsewhere.

THE EARLY YEARS OF GAS

The experimental burning of coal and ignition of the resulting gas has occupied the minds of many since the later years of the seventeenth century and included the collection of the inflammable gases in a bladder by John Clayton (known as the 'father of the gas industry') in 1684 and the use of firedamp by Carlisle Spedding (the agent for Lord Lonsdale's mines) to light his office in 1765.

The date for the first recorded use of gas to produce a sustainable light is subject to interpretation and may be taken as 1786 when J.G. Pickel lit his laboratory at Würzburg in Bavaria, 1787 when Lord Dundonald installed gas at Dundarane Abbey in Scotland, or 1792 when William Murdock (originally Murdoch, 1754–1839) lit his house at Redruth in Cornwall. The first significant use of gas is similarly open to speculation, being either the demonstration provided by Philippe Lebon at the Hôtel Seignelay in Paris in 1801 or the illumination of the Soho Foundry in Birmingham to celebrate the Peace of Amiens in 1802. Demonstrations of public lighting came in 1807 with the illumination of Pall Mall and Carlton House Terrace in London by Frederick Winsor (formerly Frederich Winzer, 1763–1830). Winsor went on, in 1812, to found the Chartered Gas Light and Coke Company at Cannon Row in Westminster from where he pumped gas to light prominent landmarks such as Westminster Bridge and the Drury Lane Theatre. Two years later additional gasworks opened in Shoreditch, Spitalfields and Finsbury, and by the mid-1820s Winsor was supplying gas to 70,000 domestic and street lamps in the capital.[5]

By 1820 fifteen cities had coal-gas plants erected by private companies or municipal authorities, and over the next thirty years most towns and villages of any consequence acquired a piped mains supply.[6] Where possible such works were built near navigable waterways and later alongside railways for the convenient delivery of coal. Many large private houses (such as Holkham in Norfolk and Dunham Massey in Cheshire), public buildings and manufactories in isolated areas constructed their own private gas-making plants,[7] while others installed small petrol-driven generators (such as the Willett Light Generator exhibited at Fakenham) and acetylene generators (also exhibited at Fakenham) to provide gas for both light and heat.

Early gas lighting was typically restricted to street lamps, public buildings and the homes of the wealthy – Girouard recounts the installation of gas into the hall of Dundarane Abbey by Lord Dundonald in 1787, modification of the chandeliers in the music and banqueting rooms at Brighton pavilion for gas in 1818, and the introduction of gas to Abbotsford by Walter Scott in 1823.[8] Gas lighting, however, remained an expensive novelty until the 1860s, and was considered to be expensive, hot and malodorous, and not practical for private houses.[9]

In terms of the influence that gas had on everyday life, it is the presence of gas lighting that is most reflected in contemporary writing. In spite of the effects of

heat and smoke,[10] which remained until the introduction of the incandescent mantle in 1887, gas lighting has been seen as a major influence on the nineteenth-century interior, although it has also been blamed for the often uncomfortable proportions seen in rooms of the period.[11] Gas was not in common use for cooking until *c.* 1870, and developed with the invention of the pre-payment meter and cooker rental schemes in the following decade, whilst reliable gas heaters, which reduced significantly the labour and dirt associated with room heating, were not produced until the late 1880s.

FAKENHAM AND THE ARRIVAL OF GAS

Fakenham developed as a Saxon settlement in the sixth century, and is recorded as having 130 inhabitants and three mills in 1086. Its market was established in 1250 and John of Gaunt, Duke of Lancaster, became Lord of the Manor in 1377, giving the town its full name 'Fakenham Lancaster'. Part of the town was destroyed by fire in 1738 and many of its present buildings date from the subsequent rebuilding. The railway arrived in 1849, with a later line, which carried coal to the gasworks, being installed in 1880. The population of the town rose gradually during the nineteenth century (1801 - 1,236; 1845 - 2,158; 1851 - 2,240; 1863 - 2,461; 1925 - 2,966), and is at the present time around 7,000.

Newspapers and local directories published during the nineteenth century record gas being introduced and used in Fakenham – 'Fakenham has just been lighted by gas through the persevering and highly creditable exertions of Mr R.P. Spice whose engagements as a gas engineer are of an extensive character. The works are an ornament to the town and the gas supplied of an unusual purity';[12] and, later, the introduction of electricity – 'The town is lighted with gas from works on the south side of the river, the property of a company, and also with electricity'.[13]

Early production of gas in Fakenham was under the control of a local partnership, who ran the works until 1909. The Fakenham Gas and Coke Company Limited was formed on 13th December of that year, and was subsequently purchased by the Worthington Church Organisation in 1920. On 1st May 1949 this company was vested in the Eastern Gas Board, which operated the site until September 1965 when production ceased as new feeder mains enabled gas to be brought in from the Board's transmission system. The works remained in partial use (for local fitters and paying bills) into the 1970s, before being closed completely in 1983.

GAS PRODUCTION AT FAKENHAM

The production of coal or town gas from the destructive distillation of coal, as opposed to the natural emissions of inflammable methane, involves heating the coal in ovens or 'retorts' to approximately 750°C, which releases a mixture of coal gas, tar, sulphur, ammonia and other vapours as a thick, brown smoke.[14] The coal remained in the retorts for between eight to ten hours, with the coke residue raked out and used to fuel the furnaces or crushed (the most recent coke crusher at Fakenham, by Robert Cort and Son Limited of Reading, was powered by an electric motor and stands outside the 'exhauster house') and sold as mixed coke or coke-

breeze for the manufacture of breeze-blocks and non-loadbearing concrete.

The existing 'retort beds' at Fakenham were constructed in 1907 and 1910, one set of eight retorts bearing the name of GIBBONS BROS LTD, DUDLEY on their doors and WESTWOOD & WRIGHTS LTD OF BRIERLEY HILL on the other set of six (Fig. 2).[15] The two furnaces beneath the retorts bear the name of BATES AND COOK LIMITED, F2, LEEDS on their doors and are connected to a 10.3m-high brick chimney standing separate from the retort house. A full-size replica of the face of one of the two retort settings at Fakenham can be seen in the Gas Gallery of the Science Museum in London.

From the retorts the gases rose up 'ascension pipes' into a water-filled 'hydraulic main', this acting as a trap to prevent the backward flow of gases when the retorts were opened, and from there via a 'foul main' to an atmospheric 'condenser'. The purpose of the condenser was to cool the gases and remove the remaining ammoniacal liquor and tar, and at Fakenham this was done within a 6.9m-high vertical tower manufactured by Firth Blakeley, Gas Engineers of Church Fenton, Yorkshire in 1953. The liquor and heavier tar passed into an underground tank,

Fig. 2
Stoker emptying coke from retort following carbonisation of coal (September 1965)
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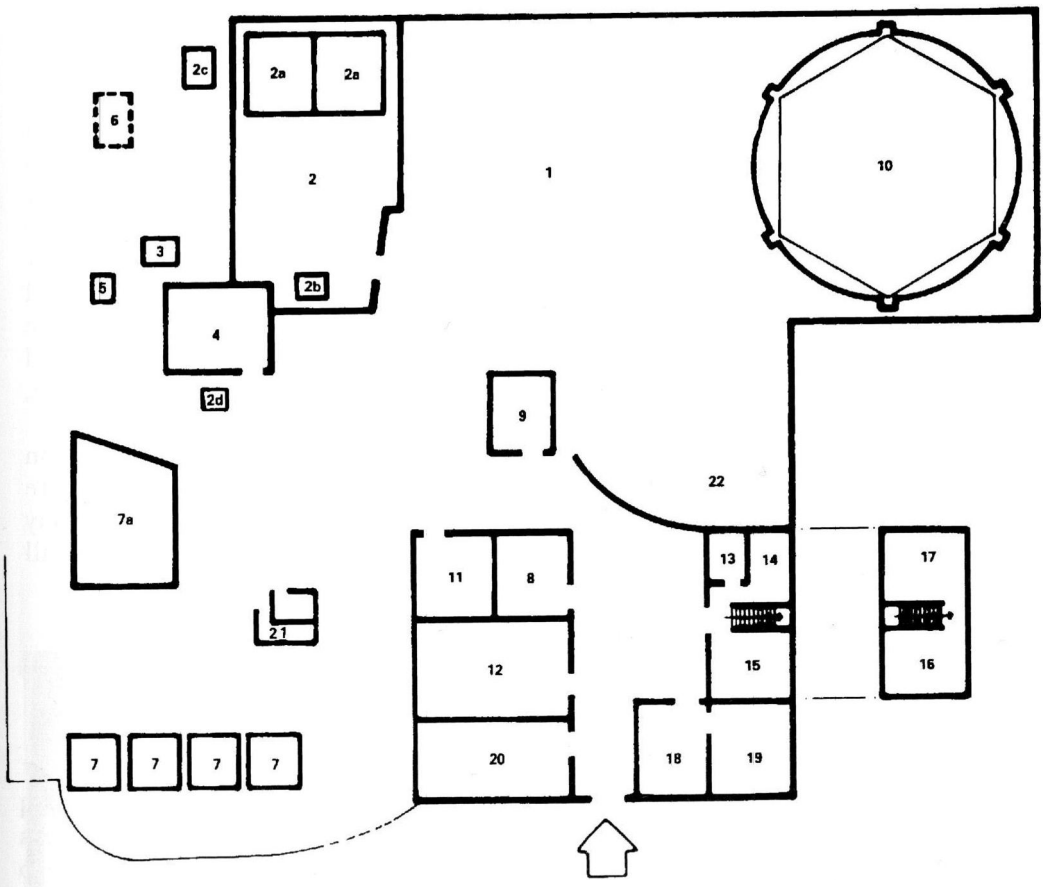
from which each could be pumped for disposal. Although the ammoniacal liquor was of little worth, and had to be removed from the site on a regular basis, the coal tar had many uses,[16] and in its original form was used in the maintenance of roads and as a waterproof coating for walls, both at the gasworks and elsewhere in the locality.

Once the gas had been cooled and partly cleaned it was drawn by two 'exhausters', driven by a gas engine (manufactured by G. Waller in 1910), through a 'washer' (the Livesey Washer at Fakenham was built by Firth Blakeley in 1920) using a dilute solution of ammoniacal liquor to remove the remaining ammonia and tar. From there the gas passed into a series of 'purifiers', which used a mix of iron oxide and sawdust to remove hydrogen sulphide. The early lute-design purifiers at Fakenham, bearing the names THORNCLIFFE IRONWORKS, SHEFFIELD 1906 and ERECTED BY NEWTON CHAMBERS AND CO. LTD, were fitted with valves to allow the rotation of flow and isolation of sections for replacement of the purifying medium.

When the spent mix of iron oxide and sawdust had been removed from the purifiers it was spread out on the ground in the open-sided 'oxide shed', where the iron sulphide reacted with oxygen to release sulphur and iron oxide (Fig. 3).[17] This, in part, could then be re-used for further purification. Remains of the blue-coloured

Fig. 3
Oxide shed with condenser, retort house and gas holder to rear



1 Site of coal stocks
2 Retort House
- 2a Retort setting
- 2b Boiler
- 2c Chimney
- 2d Coke crusher

3 Condenser
4 Exhauster house
5 Livesey washer
6 Tar well with pump over
7 Purifier
- 7a Oxide shed

8 Station meter house
9 Valve house
10 Gas holder
11 Booster house
12 Workshop
13 Workmen's bath
14 Calorimeter room
15 Museum office
16 Gallery 4
17 Gallery 5
18 Gallery 2
19 Gallery 3
20 Gallery 1 and shop
21 Toilet block
22 Site of former gasholder

Fig. 4
Site plan
Courtesy of Fakenham Town Gasworks Museum Trust

crust from the last charge of 'Blue Billy' can still be seen and presents an intriguing long-term conservation problem.

Gas from the purifiers passed through the 'station meter' (at Fakenham this is a wet drum meter built by the Gas Meter Company Limited of Oldham in 1929), which measured the volume being produced (comparison with the weight of coal being used provided a simple indication of the efficiency of the process), and on to the gas holders, where it was stored until required. The one remaining holder at Fakenham is of a single-lift, column-guided design with a capacity of 14,000 cubic feet (396 m^3). Built in 1888, the holder was constructed with a riveted steel bell or lift riding on a water seal within a bolted cast-iron tank. The weight of the bell acting on the gas provided the basic pressure needed for distribution to the customers, although in times of heavy demand the pressure would be supplemented by a booster pump. A steam boiler, housed in an extension to the retort house, ensured that the water seal did not freeze during the winter months.

Aside from the buildings, plant and machinery associated with the production of gas, there are also showrooms, workshop, offices, bath room and former site manager's accommodation remaining (Fig. 4). These are now used for the display of calorimeters, gas meters and domestic appliances (Figs. 5 & 6), and a small display charting the history of the town.

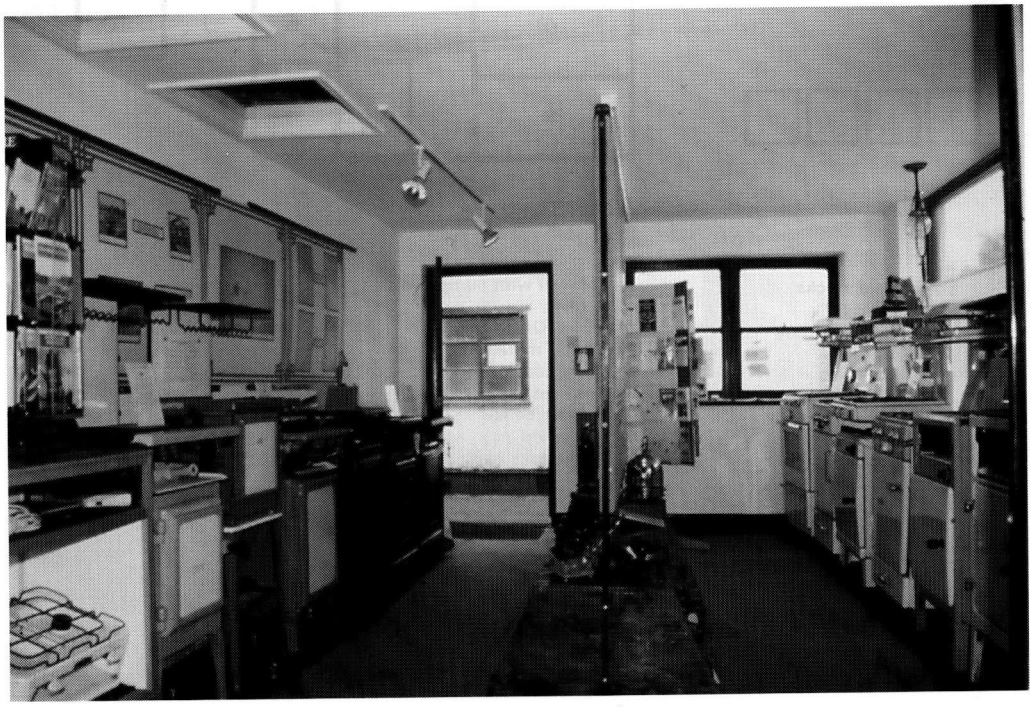


Fig. 5
Gallery 1/Shop with collection of gas appliances

Fig. 6
Workshop with collection of gas meters and other appliances

The output of gas from sites such as Fakenham cannot, without original production records, be assessed accurately, and in practice this would have been affected both by the quality of the coal being burnt and the conditions of carbonisation (particularly the temperature of the retorts). A typical yield per ton of coal to the retort is given in Table 1, with approaching 30 tons of coal being used on site per week.

Table 1 Typical yield per ton of coal to the retort.[18]

coal gas	14,550 cu ft (411 m^3) at a calorific value of 480 BTU/cu ft (17,885 kJ/m^3)
tar	9.5 gallons (43 litres)
coke	13 cwts (660 kg)
breeze	1.5 cwts (76 kg)

THE FUTURE OF THE GASWORKS

When gas production ceased at Fakenham in 1965, the Secretary of the Norfolk and Norwich Archaeological Society alerted the Industrial Monuments Society to the historical importance of the works. In subsequent years British Gas plc entered

into negotiations with the Department of the Environment, intending to have the works taken into guardianship. Although proposed arrangements and terms of guardianship were agreed, the Department, apparently for economic reasons, decided not to proceed with this proposal. As a result of this decision, the Directors of the Norfolk Historic Buildings Trust decided in June 1983 to take the initiative and commenced negotiations with British Gas (Eastern Region) for a lease of the site.[19] At the same time a schedule of essential repairs was prepared and costed, and pressure brought to bear on the Department of the Environment to schedule the works as an ancient monument (this was done in 1984) and assist with substantial grant aid.

In 1986 the Trust secured a 125-year lease from British Gas plc at a peppercorn rent, but with the use of the site limited to that of a museum to the gas industry. The Fakenham Town Gasworks Museum Trust (registered as an educational charity) consequently was established,[20] and has continued to run the site as a museum to the town and gas-making industry, under a management agreement with the Norfolk Historic Buildings Trust, to the present day. Experience has shown that present legal and financial arrangements are not satisfactory and new arrangements are being negotiated. Here, as in other respects, Fakenham has had to learn by experience, there being little relevant guidance available from other sites.

THE GASWORKS AS A MUSEUM

Fakenham Gasworks has seen many changes, both during its active life and since it finally became obsolete in the early 1970s. Built and opened in 1846, it is understood that the first retort house was situated to the north of the site, adjacent to the road (see Fig. 1), and that there was a separate building on the site of the present purifiers. A circular area and section of curved wall to the west of the 'valve house' marks the site of an earlier gas holder,[21] and evidence to the west of the present retort house indicates the site of an earlier building and the base for a steam boiler.

The plant and machinery has also changed over the years, with repairs to the retort setting and other parts of the system undertaken as required. Maintenance during the later years was reduced and several items were replaced from other works already forced to close. The present purifier thus came to the site from North Walsham, the condenser from Thetford, and the Livesey washer from Brandon via Thetford. Only the regulators and gas holders were maintained for use (with gas piped from Norwich) after production ceased in 1965, while the rest of the site was left untouched.

Much of the work carried out by the Norfolk Historic Buildings Trust in 1986-8 was thus required to bring the buildings and structures back into good (non-operational) repair, albeit for a different use, and involved basic repairs and general maintenance of the associated plant and machinery. The single-lift gas holder required particular attention and approximately £30,000 was spent on repairing and lining (with a waterproof neoprene membrane) the riveted steel lift to allow it to be operated using compressed air from the original exhausters driven by a coal-gas engine now converted to run on natural gas (Fig. 7). With both the site and its

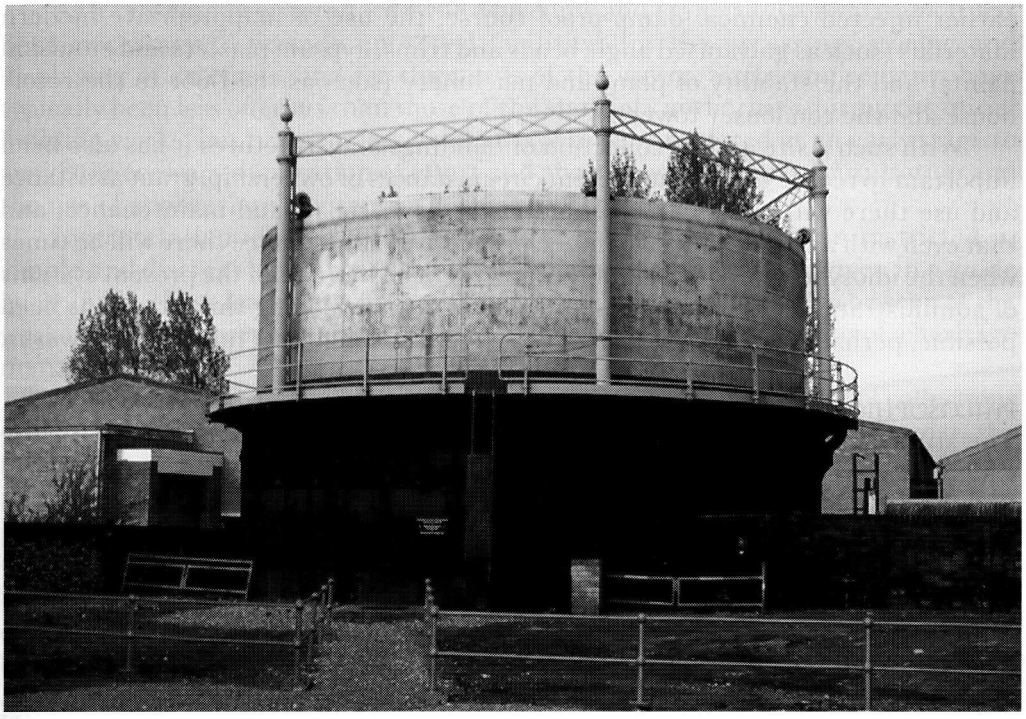


Fig. 7
Gas holder

buildings it was important to retain what remained of their industrial character, evidenced by often high levels of wear and tear, and so easily compromised by the stage-set antics of heritage site managers. The forms and standards of construction employed in the building of the works, and the manner in which the buildings, plant and machinery were intended to be used, have played an important part in defining standards of repair and maintenance. As a museum to the early gas industry, many of the requirements of the statutory authorities have been met in a discreet and thoughtful manner.

During its years of operation the site and buildings at Fakenham would have been constantly in use, with running repairs carried out by the men employed on the site. More complex, but less frequent, activities, such as the re-building of the retort setting, would have required outside assistance, usually from specialist companies. As the site, buildings, plant and machinery are no longer used for their original purposes, and different requirements are made on them in terms of environmental conditions, personal comfort and museum needs, it has been important that appropriate criteria have been used to assess and respond to defects, deterioration and decay. More recently, it has been necessary to undertake further work, both to attend to continuing levels of deterioration and decay and to respond to failures in the earlier work. Of particular concern has been the efficacy of an

earlier injected chemical damp-proof course, the use of inappropriate modern materials (such as galvanised angle beads and trims, gypsum plasters and emulsion paints) and the stability of plant and machinery (such as the floor to the retort house and the condenser tower).

With such a site and its collection of buildings and structures it has also been important to realise that in the present circumstances of ownership, grant assistance and use there will always be outstanding items of repair and maintenance, and that even with a programme of planned preventive maintenance there will be times when the idiosyncratic demands of the site will need more than the present systems of administration and funding can provide. In acknowledging this fact it has been possible, perhaps for the first time, to consider the long-term future of the works.

PHILOSOPHICAL AND TECHNICAL PROBLEMS

The study and display of industrial sites has progressed in recent years beyond what was once termed the 'cuckoo in the nest of the archaeological and historical buildings establishment'.[22] Today, industrial archaeology (defined evocatively as an 'appreciation and understanding of the genius of innovation and the skill in making things, combined with recognition of the practical and aesthetic qualities of workmanship'[23]) is recognised as 'an enormously important component of conservation policy in England'[24] and increasingly is being seen as a valuable ally to heritage tourism.

Taking the remains of an industrial site and displaying them to the public is, however, seldom as simple as with a furnished house or designed landscape. Such sites are rarely attractive, and often what is left suffers from public indifference and dislike.[25] Many contain hazardous equipment, processes and wastes that have to be removed, contained or avoided in order to provide safe access for staff and the public, whilst issues of location (including site and environment), ownership, documentation, physical condition (including design, construction, inherent defects and later alterations or adaptations), architectural and archaeological features, compliance with current requirements and standards, and the suitability of modern materials and methods of construction for repair and maintenance have also to be considered.[26] Conflict between display and preservation, and issues of how to incorporate modern facilities or provide appropriate levels of interpretation without destroying the essential industrial character of a site, similarly require careful thought and an awareness of what is being attempted elsewhere. In attending to the repair, maintenance and display of Fakenham Gasworks there has been a number of specific, and often unusual, problems to consider and resolve.

CONSERVATION AND PRESENTATION

In attempting to achieve sympathetic standards of conservation and presentation, but without compromising the industrial nature of the site, there have been occasions where modern approaches and standards have had to be compromised. More recent demands, such as those for health and safety and access for the disabled, have required careful assessment and remain to be fully addressed.

As a museum registered with the Museums and Galleries Commission, it has been necessary to provide approved facilities, for the accessing, storing and displaying of artefacts, and for the needs of the visitor. Such requirements have typically been less onerous than those of the statutory authorities during the initial building works, but nevertheless need always to be considered at an early stage to avoid unnecessary duplication of effort and abortive works. Early consultation and the use of appropriate advisers is, in this respect, essential.

Interpretation of the site for the visitor has deliberately been restricted to simple and discreet labelling, with reliance placed on information given in a guide book and by those leading parties around the site. Much of what is to be seen at the works is easily discerned and does not need the over-zealous attentions of a heritage manager.

With the recent and continuing closure of museums and dispersal of collections owned by British Gas (such as those at Bromley by Bow, Hitchin and Leeds), the facilities at Fakenham are becoming increasingly important as a source of information for researchers. The growth in display and library material therefore has required careful thought to be given to monitoring and modifying environmental conditions, and additional accommodation in the form of two Portakabins has been acquired to provide much needed space for meetings and future displays.

REPAIR AND MAINTENANCE

Aside from the current division of responsibilities between British Gas, the Norfolk Historic Buildings Trust and the Fakenham Town Gasworks Museum Trust, many of the difficulties encountered in repairing and maintaining the buildings, plant and machinery have arisen from the lack of a clear preventive maintenance policy and a consequent reliance on corrective action. Although the need had been identified in various reports,[27] changes in personnel and policy have meant that such action has yet to be fully implemented.

The requirements of the Ancient Monuments and Archaeological Areas Act 1979, particularly in relation to the need for scheduled monument consent, has itself posed difficulties in the delays experienced between identifying a defect (such as a leaking valley gutter) and obtaining consent for the necessary repair. At the present time there is no class consent under the Ancient Monuments (Class Consent) Order 1981, amended 1984, for general maintenance of built fabric (although Class IV allows works for the repair or maintenance of machinery, being works which do not involve a material alteration to a monument), and it is currently proposed to prepare and submit an application for a standing consent covering a range of specified activities such as repairs to joinery, masonry and roof coverings. Class V, which allows works that are essential for purposes of health and safety, has been relied upon for the partial taking down of the front façade of what is now Gallery 1 after a vehicle crashed into the building in January 1998.

The extent of the scheduled site contains not only the buildings and structures, but also plant and machinery associated with the production of gas at the works. This includes the condenser, washer, purifier, gas holder, and all associated pipes

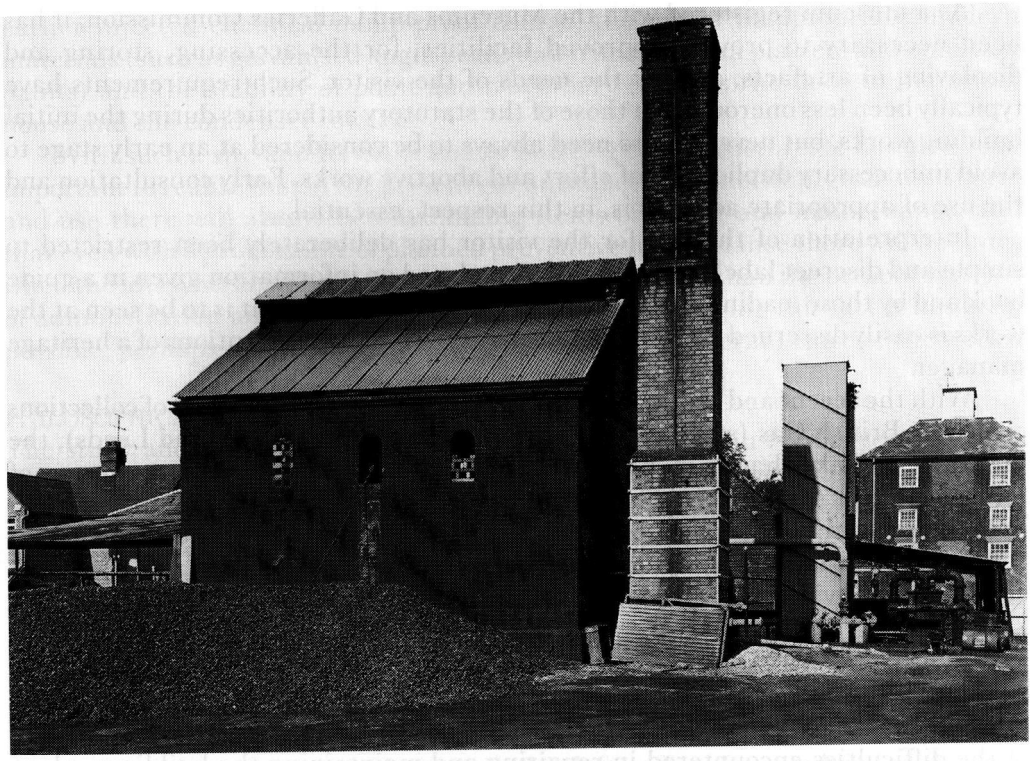


Fig. 8
Retort house with condenser, washer and oxide shed to right side (September 1965)
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and mains (Fig. 8). Many of the present museum exhibits, relating both to the production and supply of gas (such as exhausters and meters) and its use in the home (such as gas cookers, irons and other domestic appliances), have, however, come from other sites and localities.

The continued operation of various pieces of plant and machinery (such as the exhausters, gas holder and associated underground pipework) for display and interpretation has raised the question of whether such use is justified. In operation the parts will, despite continual maintenance, wear out and require replacement, but if unused will clog, seize and corrode. It has been agreed, in consultation with English Heritage, to continue their present occasional usage until such time as this becomes impracticable. At that time they will remain as static exhibits – in the case of the gas holder, one solution might then be to drain the tank and secure the lift in a raised position (as has been done at Biggar in Scotland).

Basic maintenance and operation of machinery is undertaken by a volunteer labour force, including some who were employed at the Fakenham works prior to its closure. Despite their age, such volunteers provide much-needed information on coal-gas production, and are a sympathetic source of labour.

RISING AND PENETRATING DAMP

Many of the problems experienced at Fakenham relate to excess moisture – rising damp, penetrating damp, condensation and leakage. The site lies at about 34m above mean sea level and the course of the River Wensum takes it to less than 40m from the site. On average throughout the year the level of the water table is about 300–400mm below ground level, measured within open chambers on the site. These conditions have led to high levels of moisture within the walls of the buildings and resulted in often severe levels of disruption to surface finishes. An electric float-activated pump beneath the floor of the retort house keeps the level of water within a sump below that of the retort setting.

The walls of the buildings on the site are either of one or two bricks' thickness and protected externally by early applications of coal tar or more recent masonry paint. The exposed and underlying bricks are typical soft Norfolk reds, and are susceptible to damage by salt crystallisation and frost action. The rear boundary wall and part of the east wall to the exhauster house are constructed of uncoursed flintwork with a coal-tar coating. Open and defective joints have led to moisture penetration with consequential deterioration and decay. The failure of an early chemical damp-proof course and the perceived need for such protection in two main blocks led to the installation of an active electro-osmotic system. This solution was chosen since it is theoretically capable of achieving continuous protection where floor levels are lower than the outside ground surfaces, and where the usual link between damp-proof membrane and damp-proof course is not possible owing to the required exposure of the internal bare brickwork. At the time of writing the system appears to have reduced the upward movement of moisture and, despite the appearance of surface efflorescence as the walls continue to dry out, promises to offer a useful solution to forms of construction employing variable thicknesses or a rubble core. The potential effects of unknown groundwater contaminants on the efficacy of the chemical damp-proof course and the general well-being of the building fabric also have been considered, but no conclusions drawn. The results of British Gas borehole tests on the site are not known, although much of this ground contamination is considered to have been naturally dissipated since production ceased over thirty years ago.

MUSEUM ENVIRONMENT

Repair and maintenance of the buildings and structures at Fakenham, and consideration for the growing collections of books, gas appliances and other memorabilia related to the town and gas industry, have presented particular problems. Monitoring of environmental conditions has shown consistently high and fluctuating levels of relative humidity (% RH) within the main museum spaces,[28] well above the levels that are usually recommended for the well-being of building fabric and museum contents.[29]

Works, such as the introduction of an electro-osmotic damp-proof course and damp-proof membranes, together with repairs to roof coverings and associated valley gutters, have reduced the high levels of water vapour passing into the spaces,

while increased levels of natural ventilation, the use of a portable dehumidifier and judicious use of the gas-fired central heating system have achieved improved levels of comfort and control.

Such considerations, and the need to monitor and control internal environmental conditions, raise important issues when considering the re-use of redundant buildings. Those at Fakenham were built to house a manufacturing process and its associated activities, and as such were simple and often poorly built. The introduction of new uses, particularly those requiring controlled conditions, may require extensive works and servicing, or preclude such usage altogether. Complete environmental control, however desirable, is at present too expensive for the resources available.

CONCLUSIONS

In the years since Fakenham Gasworks ceased supplying gas to the local population the importance of what is now the only remaining small town gasworks left in England and Wales has been recognised, and the site and its buildings put to good use (Fig. 9). The history of town-gas production, and of the industry that grew up to meet the commercial and domestic demands of nineteenth- and twentieth-century Britain, is one of international importance in terms of both scientific and

Fig. 9
Fakenham Gasworks showing retort house and gas holder to rear (compare with Fig. 1)

technological development, and social and economic growth. In combination with buildings of often high architectural merit, what remains of the town-gas industry is now being recognised as being of national significance.[30] That so little remains of the once numerous town gasworks implies a greater importance for what remains.

The survival of Fakenham Gasworks may, in the present heritage-conscious climate, be taken for granted, yet at the time when the works became redundant and its future was being considered it was all too easy to wipe away such a filthy reminder of town gas production in favour of the clean and modern image of North Sea gas. The cynicism and indifference that were met at all levels was matched only by the hard work and determination of those attempting to highlight the importance of the works. The actions of the Norfolk Historic Buildings Trust, operating in this case as a 'trust of last resort', the Fakenham Town Gasworks Museum Trust, and some present and past employees must be acknowledged and praised.

Fakenham Gasworks, with its assorted collection of buildings, plant and machinery, has posed, and no doubt will continue to pose, often unique problems that have not and will not respond to standard solutions. Each solution to a particular problem has come as a result of careful consideration and when, at times, this has not been given, the results have usually been disappointing. There are few precedents for how to conserve the remains of such an all-embracing industry, which, for many, continued into living memory.

It is clear that in dealing with such a complex set of conditions and problems, a clear philosophy must be developed at an early stage to inform later decisions and action. In many cases the eventual use of a site or building is not known and flexibility must be built into whatever administrative, managerial, financial or curatorial systems are adopted. In order to identify as many unknown factors as possible it is crucial that advice is sought at the earliest stages from those who have appropriate levels of knowledge and experience. Where this is not available it is of the utmost importance to canvas the opinions of as wide a selection of people, both lay and expert, as time and resources permit.

What has been achieved at Fakenham, particularly in terms of preserving the tangible remains of an industry that, in its heyday, touched the lives of nearly all those who lived in urban settings, should be acknowledged and applauded.

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NOTES AND REFERENCES

1. Burton, N., 'Plasterwork', in Artley, A., ed., *Putting Back the Style*, (London, 1988), 74.
2. Aside from the works at Fakenham, there are other sites and museums for those interested in the history of gas production – Biggar Gasworks Museum in South Lanarkshire (tel: 01899-221050), Carrickfergus Gasworks Museum in Northern Ireland (tel: 01960-351438) and Leicester Gas Museum (tel: 0116-250 3190). Museums with material relating to the gas industry include the Science Museum in London and the Manchester Museum of Science and Industry (Gas Gallery).
3. For a detailed description of the Carrickfergus Gasworks and discussion regarding the future of the works (including the formation of the Carrickfergus Gasworks Preservation Society Limited), see: Hamond, F., 'Like a Phoenix from the Flames: Carrickfergus Gasworks', *Carrickfergus & District Historical Journal*, IV (1988/9), 23–40.
4. For further information on the history and use of gas, see:
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   Everard, S., *The History of the Gas Light and Coke Company 1812–1949*, (London, 1992).
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5. Georgian Group, *Lighting: A Brief Guide to the Lighting of Georgian Houses*, Georgian Group Guide 13, (London, 1992), 5.
6. Palmer, M., and Neaverson, P., *Industry in the Landscape 1700–1900*, (London, 1994), 64.
7. For an informative study of the subject, see: Murray Somerville, J., 'Gas-Producing Apparatus for the Illumination of Country Houses', in Lister Sutcliffe, G., ed., *The Principles and Practice of Modern House-Construction* V, (London, 1902), 305–20.
8. Girouard, M., *Life in the English Country House: A Social and Architectural History*, (Harmondsworth, 1980), 265.
9. Chapman, M., 'Lighting', in Artley, A., ed., *Putting Back the Style*, (London, 1988), 120.
10. Gas lighting is known from contemporary sources to have caused discoloration of decoration. For a summary of recent investigations showing how hydrogen sulphide given off by gas lamps and open fires in the British Museum during the last century caused pigments in the illumination of a Byzantine manuscript to undergo chemical conversion and darken, see Coghlan, A., 'Angels with Dirty Faces', *New Scientist*, 157, No. 2122, (1998), 7.
11. Durant, D.N., *Living in the Past: An Insider's Social History of Historic Houses*, (London, 1988), 69.
12. *The Norwich Mercury*, 21st November 1846.
13. *Kelly's Directory of Norfolk*, (London, 1933), 145.
14. The main constituents of a typical coal-based gas, representing 85% of the total output, are methane and hydrogen, together with carbon monoxide. In addition, however, there are quantities of many impurities, such as carbon dioxide, ammonia, hydrogen sulphide, organic sulphur compounds, benzole and cyanogen. This gas would have been very wet in comparison with natural gas, as it was purified and stored using water.
15. It took between four and six weeks to bring the retort up to operating temperature; too quick and the bricks were liable to crack.
16. Coal tar produced as a by-product of gas making was seen as a nuisance, but a tar distillery in Edinburgh was producing naptha from it in *c.*1820. By *c.*1840 creosote, which was derived from

coal tar, was being used in the preservative treatment of timber sleepers for the rapidly expanding railway system, and by 1856 it was being used in the manufacture of synthetic dyestuffs. By the end of the nineteenth century, this by-product was fetching £1 per ton, with total production in 1900 being 650,000 tons.

17. From *c.*1850 iron oxide began to be used for the purification of gas (following dry and wet liming). Noxious sulphur compounds in the raw gas, notably hydrogen sulphide, combine with the iron oxide to form iron sulphide. On exposure to air the latter is slowly converted back to iron oxide ('revivification'). This conversion is not complete, however, because only some of the sulphide is converted to elemental sulphur, but the oxide could in practice be used several times over. The nature and extent of these reactions would vary depending on the quality of coal being used and the operating conditions under which the coal gas was made. For further information on the processes of purification by iron oxide, see: Newbigging, T., *Handbook for Gas Engineers and Managers* (7th edn.), (London, 1904), 127–8, 418–9; and Hornby, J., *A Text-Book of Gas Manufacture for Students* (6th edn.), (London, 1911), 206–7.
18. Eastern Gas, *Fakenham Gasworks, Fakenham, Norfolk*, (Potters Bar, 1974).
19. The Norfolk Historic Buildings Trust was founded in January 1977 with the aim of rescuing historic buildings at risk that have failed to gain the interest of private buyers. For further information, see: Norfolk County Council, *The Work of the Norfolk Historic Buildings Trust 1977–93*, (Norwich, 1993).
20. The Fakenham Museum of Gas and Local History was inaugurated by HRH the Duke of Gloucester on 19th May 1987. At the time of writing, the museum is open to the public on advertised days and by prior appointment (tel: 01328-863150/855237/851696). For further information regarding Fakenham and the Fakenham Museum of Gas and Local History, see: *Fakenham Pages* on <http://www.fakenham.org.uk>.
21. This gas holder is understood to have been of riveted steel design built by R. & J. Dempster Limited in 1924, with a capacity of 50,000 cubic feet (1,415 m^3).
22. Cossons, N., *The BP Book of Industrial Archaeology* (3rd edn.), (Newton Abbott, 1993), 16.
23. *ibid.*, 13.
24. English Heritage, *Industrial Archaeology: A Policy Statement*, (London, 1995).
25. The dry coal store at the Carrickfergus Gasworks Museum was destroyed by arson in 1996, and objects have also been stolen from the former manager's house (personal communication with Helen Rankin, Honorary Secretary to the Carrickfergus Gasworks Preservation Society Limited, March 1998).
26. Watt, D.S., and Swallow, P.G., *Surveying Historic Buildings*, (Shaftesbury, 1996), 207–21.
27. Watt, D.S., *Fakenham Town Gasworks Museum: Report on Condition and Maintenance Requirements*, report prepared on behalf of the Fakenham Town Gasworks Museum Trust, (Norfolk County Council, 1992).
28. Watt, D.S., *Practical Preventive Conservation – Environmental Survey and Report*; Watt, D.S., *Practical Preventive Conservation – Influence of Moisture on the Museum Environment*; and Watt, D.S., *Museum Environment*, unpublished reports for MSc Conservation Science, (Leicester, 1996–7).
29. Recommended levels of relative humidity for mixed collections are typically quoted as 50–65% RH, although it is recognised that this level of environmental control cannot readily be achieved in existing buildings. Fluctuating conditions should be avoided, with a maximum 5% change over twenty-four hours. For further information, see: Committee of Area Museum Councils, *Museum Factsheet: Temperature and Humidity*, (Cirencester, 1991); Sandwith, H., and Stainton, S., *The National Trust Manual of Housekeeping* (2nd edn.), (London, 1991); Cassar, M., *Environmental Management*, (London, 1995).
30. Draft findings of the Monuments Protection Programme survey of the gas industry, intended to set a framework for the 'identification, recording and evaluation of industrial monuments and, where applicable, their selection for statutory protection under existing legislation', indicate that there are three gas industry sites in England that are scheduled as ancient monuments (Fakenham Gasworks in Norfolk, Shaw Lodge Mills gas plant in West Yorkshire and the Lavenham Gasworks site in Suffolk) and fifty-eight buildings and structures listed as

being of special architectural or historic interest (including the Birmingham Gas Street retort house, parts of the Canons Marsh gasworks in Bristol, and gas holders at Warwick, Fulham and St Pancras). For further information, see: Trueman, M., *Monuments Protection Programme: The Gas Industry*, unpublished Step 1 report prepared for English Heritage, (Lancaster, 1997).