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Mountains, Museums and Mill Meece

'Technological activities are now firmly established in schools. They have been introduced by diverse methods, but they are here to stay'. Not my words, but those used to introduce each Project Technology Handbook published since 1967 when Project Technology was set up by the Schools Council. By 1973, Handbook No. 10 – Industrial Archaeology for Schools – had been published, serving as an excellent guide for any school attempting activities of this type and also giving accounts of studies which had already been developed in areas which were littered with relics of an industrial past. Hayle Secondary School in Cornwall was in just such an area and teachers and pupils took full advantage of their unique opportunities.

The Ordinary National Diploma in Technology (Engineering)

There has been a parallel and not dissimilar development in technological opportunities in the colleges of further education through the Ordinary National Diploma in Technology (Engineering). The Council of Engineering Institutions had recognised that a full-time, college-based alternative to the old industry-based sandwich Engineering Diploma was needed and that its replacement should be not only a modern technology-orientated course but also a recognisable alternative route to a degree course in many of the disciplines which we bracket within the wider meaning of 'Engineering'.

In 1972 the new OND was launched after a CEI-sponsored working party had produced an extraordinarily comprehensive guide scheme which sets out both the philosophy and details of the syllabuses for the 2-year course. The first year is intended literally to be a sorting out period, with suitable sympathetic counselling for those students who clearly would not be able to achieve a Diploma in the second year of the course. Everyone has the opportunity to show his or her ability in traditional subjects such as Mathematics, Physical, Electrical and Mechanical Science and no less than 200 hours of tuition time is devoted to Materials Science. In all these subjects, the idea of integration was introduced. If the topic is Energy, for example, why not cross the conventional subject boundaries and show the inter-relationship of all energy forms?

Team-work is essential

The formation of a team of lecturers willing to work on a continuing basis is crucial and the success of the OND as an inspired piece of curriculum development has been largely due to the efforts of these teams in different colleges, all co-operating within the broad framework of the course. If the integration of topic areas is considered useful in the first year of the course then there can be no doubt as to its desirability in the second year. The very titles of the subjects proclaim that, in technology, none should be treated in isolation. Thus, in Power Transfer and Energy Conversion, while the energy conversion systems used by an engineer, combinations of electrical, mechanical, chemical and heat energy and other forms, are being comprehensively considered, the relationships between electrical, mechanical, fluid and mechanical power and heat transmission are fully explored.

Early in the second year of the course, another group of hitherto separately taught subjects is introduced, namely Measurements, Instrumentation and Data Transmission. As well as complementing Power Transfer and Energy Conversion, this area of study enables the student to tackle more effectively an assessed project which takes up no less than 100 hours of his time. One of the advantages of the integration of subjects is that the student appreciates far more readily the final subject of the course. Systems had not been taught at OND level before 1972 and, for that matter, not much elsewhere but after studying electrical, mechanical, fluid, thermal and control systems, as well as organisational, distribution and economic systems, a student should be able to *think* in systems terms. The systems engineer is aware of the total interdependence of all things and is often the first to be aware of a need to recognise the feedback signals when, for example, a production system affects an environmental system.

Studies which complement the Technology subjects

The common-sense thinking that enabled the boundaries of technical subjects to be crossed made it easier, and even more sense, to extend the idea in Communications and the aptly named Complementary studies. Graphical Communications already included Engineering Drawing and Design but in the area of Communications/Complementary Studies there was ample scope for the development of projects and assignments for which the resources of individual colleges were best suited. These subjects contribute 20% of the marks towards the award of a Diploma and are given a generous allocation of time. The following is an account of how part of that time is being used in one college to enlarge the student's experience of the technological world.

The Outdoor Activity Link

The OND guide scheme includes the strong recommendation that students and staff should spend some time away from the college engaged in suitable outdoor activities. After all, if they are to be working closely together for two years the sooner they get to know each other the better. Also, counselling and career advice benefit from improved understanding. But what outdoor activities? And where? In any large college of further education, the resources in material and human terms are formidable and it was no

coincidence that the choice of activity was influenced by the ability to utilize the know-how and experience of a number of lecturers within the OND team and also others from the nine departments of the college.

The Engineer In Society

The CEI lays great stress on the role of the Engineer in Society and no one denies the importance of bridge builders, road makers, railway engineers and scores of other essential occupations. There are two areas of engineering activity, however, which, one may argue, are literally essential to civilised life as we know it today. The supply of water and electricity are now absolute necessities which engineering and science have provided us with and because both services are so readily available at the turn of a tap or flick of a switch, they are in danger of being taken for granted.

The Water 'Project'

The decision to study these two topics would have been taken even if the outdoor activity link had not been there but because the college has two fully qualified mountain leaders, each study was extended into an outdoor activity week and, as a direct result, gave an added dimension and quality to both. In the first year of the course, at least one lesson a week for one term is spent considering the water supply system in one area of Staffordshire and comparing it with the way water is abstracted in the Lake District. A visit to a local pumping station is followed just before Easter by a week in Cumbria with visits to a water treatment plant and pumping station combined with an introduction to fell-walking which allows time for a look at the ways in which the abundance of Lake District water was used for power in the relatively small and now virtually extinct mining industry. This opportunity is too good to miss and is prepared for in advance with lectures by a geologist.

Historical considerations

No comparative study of this nature can ignore the historical background of the water supply industry and it is in the context of the History of Technology that the greatest benefit to students can be derived. Throughout the ages, societies have accepted and absorbed new technologies, consciously or otherwise, and have been changed by them. In his book, 'Technology, Science and History', Professor Cardwell discusses the consequences of innovations such as the weight-driven clock and the printing press and of the discoveries such as that of the atmosphere with its inevitable connection with the steam engine. James Burke in his T.V. series and book has more recently pursued similar 'connections' and this technique is extremely valuable in showing students how changes have occurred. It also enables them to recognise the technological advances which have transformed our society, particularly in the last 250 years and to discuss rationally the imminent changes today. With 200 years of hindsight, it is tempting, for example, to make an analogy between the steam engine and the computer, the silicon chip being to the computer what the separate condenser was to the steam engine. And just as the motive power of Watt's engine was developed for economic reasons, so will the control function of the chip. Perhaps the social upheaval will not be so drastic as those of the post 1779 period but the redundant weaver is sure to have his modern counterpart.

But what has all this to do with industrial museums and how old does a relic of the past have to be before it can qualify as an exhibit? I can vividly remember, only a few years ago, actually *walking through* a first generation computer that needed fans to dissipate the heat from its hundreds of valves. More recently, whatever happened to slide rules? So, a 65 year-old water pumping station attracts the interest of industrial archaeologists because it is the last one of its type working and its preservation maintains an unbroken link in the history of the development of this complex water supply industry.

Water supply in North Staffordshire

The supply for any area depends on whether it is more convenient and economical to take water from springs, rivers, lakes or from underground and, in North Staffordshire, the latter form of extraction predominates. All large-scale organised public water supply can be traced back to the Royal Commission of 1844 (The Buccleugh Commission) which was set up to 'look at the supply of water in the large towns and populous districts, whether for the purposes of health or for the better protection of property from fire', and recommended that it should be imperative on local authorities to procure sufficent supplies for all these purposes.

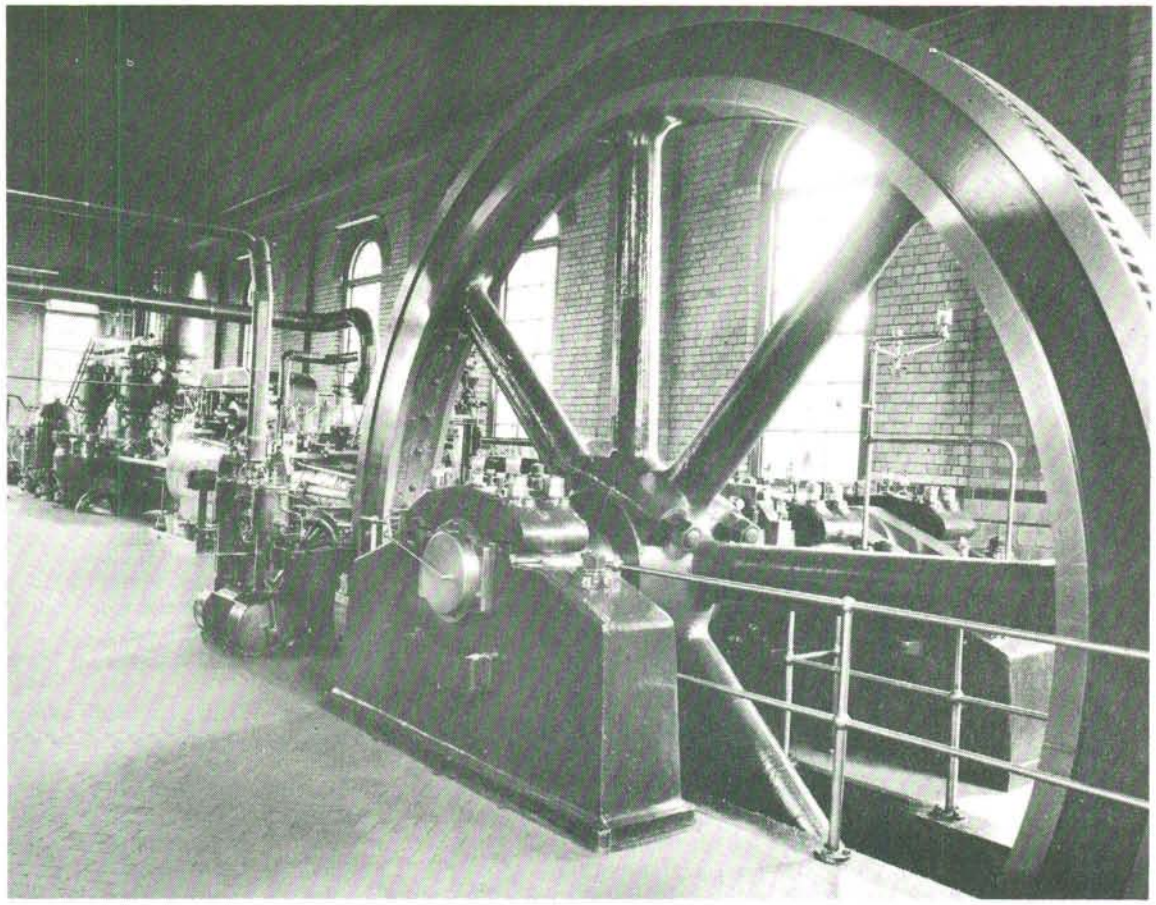
The first of many 'Water' Acts of Parliament

An Act of Parliament in 1847 enabled the Staffordshire Water Company to be formed and water from the Wall Grange springs, near to Leek was collected and pumped to a reservoir at Ladderedge over 700 feet A.O.D. Two steam engines did the work of giving the water this vital head so that it could flow by gravitation to towns in the Potteries. These were Cornish beam pumping engines, direct descendents of the Newcomen engines which kept the tin mines of Cornwall free from water and were scrapped in 1932 when they were replaced by electrical surface pumps. It is indeed fortunate that some superb examples of this type of engine have been preserved – at Brighton Engineerium, based on the Goldstone Water Works, at Blagdon, Kew and so on.

The Growing Demand for Clean Water

As demand for water grew the water engineers turned to the geologists for advice about underground supplies and with the excellent geological maps which the Ordnance Survey were producing in the mid 1800s pin-pointed a number of sites where sandstone formations could be certain to yield adequate and consistent supplies of *clean* water

Mill Meece Pumping Station, Staffordshire: the right-hand engine.



(an essential prerequisite as chlorine was not used for large-scale sterilisation until the 20th century). In various parts of North Staffordshire, bore-holes were drilled and steam-engines installed to fill the reservoirs which in turn fed the pipe-lines to the taps. The generations of steam pumping engines from 1847 onwards are themselves a record of the steam engine until in 1914, and after a delay due to the War years, in 1927, two horizontal compound tenden rotary steam pumping engines costing about £12000 each were put into service at the then remote Mill Meece. Like railway steam engines these were reaching their maximum efficiency just as electricity was really beginning to oust steam as a source of power.

Dubbed plain 'Left Hand' and 'Right Hand', but nonetheless affectionately cared for, these two giants have been kept in splendid condition by the staff, some of whom have spent most of their working lives at Mill Meece and obviously took pride in the appearance of their charges. The 1927 Right Hand engine, built by Hathorn Davy to the same design as the 1914 Ashton Frost Left Hand engine, still performs the original function of pumping water from a 120 feet depth (the bore-hole is actually 1200 feet deep) and also lifting the water to the service reservoir at Hanchurch, a height of 728 feet and a distance of 4 miles.

Obsolescence is inevitable

One by one, all the engines in North Staffordshire, many of which, like ships, had actually been 'launched' with the traditional wine bottle, were unceremoniously replaced and scrapped, unfitting and ignominious ends for truly great examples of the skill and, indeed, art of the engineer. In 1976, it was the turn of the Mill Meece engines to be discarded. It wasn't just because the Severn Trent Authority had taken over from the Staffordshire Potteries Water Board in 1974 – rising costs had forced the decision to be made. Submersible electric pumps which can be controlled from a central point now make water supply very much a computerised operation which does not need the constant attendance of boiler men and enginemen.

Preserve if of outstanding value

Happily the STWA did not approach the demise of the engines with the bull-dozing haste all too often associated with sites of historical interest. Despite the tempting calculation that the cost of demolition would be met by the scrap value of materials the idea that an end-of-the-steam-era pumping station should be preserved as an example of 20th century water-works practice gained many supporters, amongst them quite a number of STWA officials. Mill Meece is believed to be the last complete pumping station of its type left in the country and can therefore rightly take its place alongside more venerable examples of preservation.

The Problems of Preservation

In fact the Authority has shown a remarkably co-operative attitude in steering a Mill Meece Preservation Society through the lengthy legal procedure of formation. An Open Day in September 1978 drew 5000 people and this highlighted many of the problems associated with allowing public access to isolated waterworks. For example, more stringent safety measures have been introduced, especially around the massive 30 ton fly-wheels and toilet facilities will depend on a monster fibre-glass collecting tank, particularly necessary as water will continue to be extracted by electric submersibles from the existing bore-holes.

More help and encouragement in making a historical record of the pumping station has been afforded to a group of students from the University of Nottingham Department of Adult Education. Led by Roger James, himself an engineer with the Derwent Division of STWA and with the guidance of Ian Duncan of the Adult Education Department, who had already surveyed the triple expansion engine at Cresswell, a group of part-time students have carried out what can only be described as a classic example of a thorough

Industrial Archaeological study. The past records of the old SPWB were made freely available also for the OND water supply study and sufficient material was gathered for a video recording about the engines at Mill Meece to be made with the full co-operation of the Educational Television Unit of the Staffordshire County Council.

All this work was carried out initially, of course, because there was a possibility of the engines being scrapped but now the Preservation Society will begin its stewardship with not only two gleaming, fully-working steam giants which have been used in the service of society for all their working existence, but also with a mass of definitive background information. Dr. James' report even includes an account of how to start the engines – no mean task with a 66 foot length of machinery – contributed by Bill Buckley the station engineer. The problems, then, are not the same as with other groups faced with the dereliction of age and neglect but the more mundane ones of boiler insurance, the least quantity of coal required to maintain a head of steam and of ensuring that the station can be shown to the public on a commercial basis. The testing time for engineering skills will inevitably come later when major repairs have to be carried out. At present, almost unbelievably, after 52 years of regular operation no-one has seen the inside of the original cylinders of the Right Hand engine!

Use for educational purposes

Clearly the opportunity should not be lost to use the pumping station as one link in educational programmes in which the inter-disciplinary aspect of water supply can be made a strong feature. It is almost a cliché nowadays to say that clean water has done more for public health than medicine but that clean water is available at all is now a fact of history and has been achieved by combining the expertise and knowledge of a great many people. The geological know-how is essential – Mill Meece itself actually lies across a geological fault – and the guarantee of purity comes from the constant supply of chlorine produced by the chemical industry, but so much more depends on the engineers who have designed, built and, above all, maintained the many types of waterworks on a non-stop take it for granted basis.

It is a question of energy after all

There is plenty of water in this country but it all has to be extracted, treated, pumped up to service reservoirs and disposed of after use and this uses energy, mainly electrical nowadays. If there is one item the STWA would like to see grow smaller it is their energy bill. In 1978 this was nearly £1,000,000 and although industry, in general, is much more water conscious than it used to be, overall demand for water is still rising. But when it rains every day, the message is still the same – 'Don't waste water, you're wasting energy!'

The Second Year Project

During the first term of the second year of the OND course, the students begin their study of power generation and supply and this neatly complements the academic work of the course previously referred to, namely Power Transfer and Energy Conversion. A visit to a local coal-fired power station and coal-mine is followed by a week in North Wales with visits to nuclear, pumped storage and hydro-electric power stations. The opportunity is also taken to look at the slate-mining industry, the Ffestiniog rail link to the coast, to safely explore a slate mine, thanks to full and excellent documentation by the Industrial

Archaeology Unit of Hull University and to take part in some tougher mountaineering. An all too brief description of the second year 'project'!

Co-operation does move mountains

The two programmes have been developed and modified with experience, always taking into account the restraints and yet using resources to the full, the former often appearing insuperable, the latter frequently being, quite simply, co-operative people. Because of the College's connections with Civil Engineering, a number of the STWA engineers are ex-students, giving the obvious advantage of acquaintanceship and yet an engineer in Wales has been equally helpful and provided us with literally hundreds of 56 year old photographs of the construction of a hydro-electrical station we visit. It is now possible to make a more realistic comparison with what is happening at Dinorwic and to illustrate more vividly the technological changes in a mere half century, showing clearly that the study of any area of engineering technology will benefit from being considered in a historical context. It is not only technology students who should be able to appreciate what society's demand for megawatts means in energy terms.

The Place of the Industrial Museum

There are few areas in this country which have not been affected by the Industrial Revolution and its after effects and the rapid spread of Industrial Museums is now providing centres of interest which deserve careful scrutiny as educational resources *before* parties are taken there. With each group of OND students we try to visit the Gladstone Pottery, Ironbridge Gorge Museum, the North-West Museum of Science and Technology, and this year, the recently opened Mining Museum at Chatterley Whitfield, all relatively near to the college. They have notbeen established solely as extensions of the educational system but the museum organisers do realise the value of their exhibits to schools and colleges. At Ironbridge, where the concurrence of raw materials and inventive minds came at a time in history synonymous with the start of the Industrial Revolution, a great deal of attention is being paid to the development of resource material suitable for use in schools. And at Manchester, where Professor Cardwell had such an influential hand in setting up the museum, the theme of his previously mentioned book is projected into weaving and printing exhibits, all working, as well as the one-third scale Newcomen engine and electrical machines which ideally complement the OND water and energy projects.

Although widely differing in what they offer, all the museums record tool-using man's use and exploitation of energy in its various forms and in many schools and colleges there are pockets of curriculum development with energy as its central theme and who can doubt the importance of such studies for *all* types of students after the oil-price alarm bells of 1973 and the repeater alarm of 1979? But when considered in the context of the History of Technology, such work can be particularly rewarding especially when the museums – and Mill Meece in one unique case – are used to provide the historical links and connections.