Energy targeting and monitoring in the private steel sector

The Department of Energy has awarded BNF Metals Technology Centre a two year contract to demonstrate the principles, techniques and benefits to be obtained from energy monitoring and target setting in the private steel sector. This is part of a sustained effort by the Government to promote energy conservation in British industry.

Experience in USA, Canada, France and in other UK sectors has shown that the monitoring of energy use and the setting of targets for improving energy performance is an effective plant management procedure for gaining greater overall operational efficiency and helping individual companies to improve profitability.

Under the terms of the contract, BNF will work closely with the management of four major steel companies to develop an appropriate methodology, to devise an energy management system which provides for an ongoing control of the energy used and seeks to establish realistic targets for energy saving in each company, together with a 12 months detailed monitoring programme.

Although commercially sensitive detail will remain confidential, the results of this exercise will be widely publicised to encourage other companies to follow suit. The intention is to establish an energy management system suitable for swift and efficient implementation throughout the steel sector.

Development of acid pickles and high efficiency recovery systems for the stainless and high alloy steel industry

The Division is to develop new regenerable acid pickles for stainless steel and high alloy steels, together with high efficiency acid recovery systems. The project, which is being financed jointly by a number of private UK alloy steel companies, service companies and the Department of Industry, is expected to reduce pickling costs by at least 25% and to produce important environmental advantages.

The oxides and scales on stainless and high alloyed steels are very tenacious and require highly aggressive acidic mixtures to remove them. During this pickling process large quantities of iron and alloying elements are dissolved that quickly reduce the effectiveness of the acid.

There has been no systematic study of the problem. Therefore traditional sytems have been continuously used over the years without particular regard to their efficiency and the increasing cost of disposing of resultant waste products.

The proposed system, based on ion exchange regeneration, could also: relieve the load on sewerage treatment services; reduce demand on landfill sites and improve the working environment.

The regeneration of the ion exchange resins will be studied to determine the most cost-effective method of regeneration and final disposal of the removed metals.

In short, the challenge is to find a pickling solution that is less expensive, that is at least as effective as conventional solutions, that uses less environmentally polluting ingredients, and that is amenable to ion exchange regenerative treatment.

A great deal of work on ion exchange techniques has already been carried out elsewhere and the basic information necessary for the development of a regeneration system for acid pickles exists.

BNF already has considerable experience in developing pickling systems for the non-ferrous sector and the task is to adapt and transfer the technology to the iron and steel sector.

Transformation of as-rolled black bar to bright steel

The Metals Technology Centre is seeking industry support for proving the feasibility of a new method for surface transformation of as-rolled black bar to bright steel.

The proposed route, which involves the rapid removal of oxide scale by reduction in nitrogen-diluted hydrogen gas, would offer considerable advantages over the conventional processes of acid pickling and shot blasting.

The latter procedures, not only present a number of operational difficulties but also commonly remove up to 1.5% of steel bar. Loss of steel through the hydrogen reduction process is estimated to be less than 0.5%.

A preliminary survey of the industry has indicated keen interest in application of the idea to both batch and continuous treatment of bar, wire and strip.

Phase I of the BNF project, expected to commence early in 1984, will consist of a nine-month laboratory feasibility study to define the processing conditions which give the required rate of reaction for continuous processing, and the most economic use of reducing gas and furnace time for batch processing.

Subject to a satisfactory outcome of the laboratory work, and the necessary industrial support, independent phases would then follow on batch and continuous operations. These would include the design and construction of pilot plant equipment and the production of material under optimum processing conditions.

Investigations into powder technology

BNF Metals Technology Centre has established an activity, known as the Powder Technology Programme, to carry out research and development in this area. Initially, the Centre has installed a 100t double-acting hydraulic press, a Royce 5in dia hydrogen sintering furnace, a vacuum sintering furnace, a blender and a Fitzmill homeloid mill, together with associated equipment.

The programme is directed by Dr Dennis Hadfield, a leading authority on powder metallurgy, particularly in hard magnetic materials.

The United Kingdom has a relatively small powder metallurgy industry, with a modest annual turnover of some £25M. It is heavily dependent on the automobile sector and up to now has not had the benefit of coordinated research support.

BNF hopes to encourage ventures into new applications and the use of novel metals, alloys and non-metallic materials. In particular, through its contacts with universities and technical colleges, which are breaking new ground in powder technology, BNF's retention is to assist the speedy and efficient transfer of new technology to industry, a process with which it has extensive experience in many fields.

Dr Hadfield is convinced that powder technology offers a very attractive route for the creation of certain new specialised products. One promising avenue to explore is the production of special alloys which simply cannot be made by normal melting processes.

The work at BNF will not be restricted solely to processing of powders into components. Investigations will extend to new methods of powder production, treatment of novel powders, process design, die design and many other aspects.

BNF can draw on a wide range of relevant skills from its existing staff and is now actively seeking contract work in this area. Additional specialists and equipment will be acquired as the demand increases. ●

Reduced Production Costs — The Role of Energy Conservation in the Steel Industry

The industrial energy thrift scheme for the ferrous sector has been operated by the Industrial Studies Group of the BNF Metals Technology Centre since 1979 on behalf of the Department of Industry energy unit. About 100 industrial sites have been surveyed and reported upon individually, these forming the basis of the 11 technical papers presented at the one day seminar held recently in Sheffield and organised by BNF Metals Technology Centre for the Department of Trade and Industry in cooperation with BISPA and the Department of Energy.

Almost 100 delegates attended the seminar from areas as diverse as the public and private steel sectors, consultants, equipment suppliers and Government departments.

In his keynote address, technical manager of BISPA Mr D F Waterhouse said that energy saving was surely a good thing. Apart from reducing industrial costs it also saved world energy reserves for our descendants. "We all believe this and are willing to take action but we have to convince those not here, including people in our own organisations. I could simply say *keep up the good work* and sit down. However, this review of many years of effort between Government departments, BNF Metals Technology Centre, Harwell and industry calls for more than *stand up, speak up and shut up.*"

Mr Waterhouse explained that £500M are accounted for in the UK steel industry by gas, electricity and oil every year plus 7Mt of coal. This very large bill totalled some £800-900M. Total sales revenue for the UK steel industry is currently running at some £4000M thus energy costs are an important part of total steelmaking costs. Gas, electricity and coal are produced in nationalised industries and the speaker suggested that recent publicity of cabinet or star chamber decisions indicate that prices are sometimes based on political and not only economic factors.

"The steel industry will continue to press for prices that are no higher than those of our overseas competitors and which reflect the abundance of gas, oil and coal in Britain," Mr Waterhouse emphasised and added that he was gratified to read in the newspapers that the electricity Boards are hoping to hold down prices to current levels until September 1984, despite attempts by the Chancellor to take one further bite into manufacturing industry by putting up the costs.

"However," Mr Waterhouse continued, "we are not here today to talk about price but the quantity of energy units used for each unit of salable production. By saving energy in every possible way we strengthen our arguments for competitive prices for this energy." The speaker then went on to explain that the papers to be given that day illustrate the real and continuing gains to be won by saving energy. He emphasises that *effort* was the key word, effort by management and people in plants. No savings were possible without attention to details of the processes and the uses of energy. Mr Waterhouse felt that if management effort is in part devoted to a systematic attack on energy consumption, real and continuing reductions in consumption of 15-20% could be achieved. If UK steel industry reduced consumption of gas, electricity and oil by 20%, this would be an annual saving of £100M for all future years. Coal savings would add to this figure.

The audience was told that energy costs could be as high as 25% of total costs of production for plants melting steel, reducing to 7-10% for plants using energy only for heat treatment and driving machinery.

If there was to be a keynote point to Mr Waterhouse's keynote speech, he felt that it should be *don't use less energy but possibly more*. If instead of exporting about half our oil output we could use it more frugally and well in the UK to make our products more competitively, exporting them and reducing imports, Mr Waterhouse felt that this would have the consequence of lowering unemployment, increasing growth, thereby helping solve the Chancellor's problem.

Presented papers

Energy use in the private steel industry. Sector report produced by BNFMTC for the Department of Trade and Industry; Mr P J Roughley, Ferrous Operations Division, BNF Metals Technology Centre.

This paper summarised the findings of the Department of Trade and Industry's energy thrift scheme on the use of energy within the private steel industry. It considered those firms involved in the general steel industry and those in the production and subsequent processing of steel tubes. The information given was based on the results obtained during visits to 82 companies in the private steel sector. The main areas in which it was found energy conservation could have a major impact in reducing consumption were those associated with improvements in control, reduction in heat loss and recovery of waste heat from melting, reheating and heat treatment furnaces.

Energy conservation in high temperature furnaces by A Watson and G Leek of Wellman Furnaces Ltd gave practical insight into methods of energy recovery in high temperature furnaces. The brief overview of the present energy scene in the furnace industry, served to indicate that the technology is available to minimise production costs, but the science is in the application. The paper emphasised that the rewards could only be gained through investment, with typically a two year or less period to recover investment being acceptable.

Impulse control system for high-velocity burners by R A Freeman of Stordy Combustion Engineering Ltd looked at some of the operational problems and disadvantages connected with impulse injection of energy into various types of industrial processes. Burner and control equipment was reviewed and specific details of impulse control systems were examined by the author.

The use of oxygen to save energy in large steel reheating furnaces by A Felski and S Grainger of BOC Ltd and D P Jenkins and G Boydell of BSC, Port Talbot explained that oxygen enrichment of combustion air is an accepted procedure in a variety of combustion processes. In the past it has been applied to reheating furnaces as a means of increasing output at low capital cost, but, as a means of saving fuel it was thought the oxygen cost rendered it uneconomical. The BSC Port Talbot Works investigated the possibility of using enrichment on their slab reheating furnaces, with oxygen supplied from a BOC tonnage oxygen plant. The net result was that enrichment of the preheat zones gave fuel savings up to 1.6 therms/t at an oxygen consumption of 7m^3/t.

Targeting and monitoring — preliminary results by C Hoskins of BNF Metals Technology Centre described the development of a targeting and monitoring type of approach to improve control and reduce consumption of energy. The project consisted of two phases. Firstly, the development of the various systems and the setting of targets, and, secondly, the monitoring of progress towards those targets. The paper reported progress up to the end of the first phase and presented some initial results of post-target monitoring.

Recent advances in the use of ceramic fibre in the steel industry by R Baker of Morganite Ceramic Fibres Ltd outlined the benefits resulting from a vaneer — a thin layer of ceramic fibre cemented on to the hot face of existing refractory. Complete ceramic fibre lining systems were also examined using the recently developed mixed fibre compositions. The paper also highlighted the practical steps required to prepare for a modification, the value of making a change and the need to modify previous furnace practice in order to optimise the value of the new insulation system.

Coal fired fluidised bed boiler, burning washed blended smalls by R Davies and I D Jones of Brymbo Steel Works Ltd described the initial trials that followed the installation of a fluidised bed boiler at this North Wales steelworks.

Recent developments in efficient gas utilisation by J R Cornforth, British Gas School of Fuel Management, Solihull reviewed heat recovery from ceramic recuperators, self recuperative burners and compact regenerators; improved burner systems such as high velocity burners, flat flame burners and radiant tube burners; novel methods of air gas ratio control such as differential pressure control valves, electronic ratio control and oxygen trim. Rapid heating systems were also reviewed.

Attack on a £4,000,000 fuel bill by S Robinson of TI Weldless Ltd outlined what one company had already done to reduce its energy bill, the results and problems encountered and what it considered to be the best way forward under current conditions.

Energy management in the steel industry — surmounting the barriers to technological improvement by F J Feltoe, Frank Feltoe Associates, discussed the role of energy management in producing savings in its own right and in establishing an order of priority for certain technical changes and attempted to identify most of the many possible areas that would benefit from technical improvement.

Advances in emissivity and radiation control in furnaces by I J Mann, M H Detrick Ltd, described the effects that had been achieved with the introduction of a new range of high temperature refractory and metal coatings, used to extract the maximum performance from new and existing plant.

Address by the Earl of Avon

At the conclusion of the morning session, delegates to the seminar were addressed by the Earl of Avon, Parliamentary Under Secretary of State for Energy with special responsibility for Energy Conservation.

Lord Avon said that he was well aware the personnel in the steel industry were faced with rising costs which critically affect their ability to compete. One of the ways to cut costs was to use energy more efficiently. He said that recent studies suggested that most companies could achieve energy savings of one sixth of their budget through investment in cost effective measures with paybacks of less than three years.

"This seminar," Lord Avon continued, "is concerned with techniques for achieving more efficient energy use and such techniques include assistance provided, for example, by BNF itself and also Government schmes providing information and advice. It was to help ensure energy savings like these were exploited that Peter Walker recently established the Energy Efficiency Office which has specific responsibility for promoting energy efficiency in industry and commerce. It will spearhead a major effort by Government with a goal of 20% improvement in energy efficiency as soon as possible."

Lord Avon said that last year it was estimated that the UK spent £9bn on energy and the Government's findings show that industry could save over £300M per annum from energy saving investment which would payback themselves in less than one year.

The speaker then went on to describe the various Government schemes that were available to help people such as those engaged in steelmaking, reduce their energy bills. He said that the objective was to achieve 10Mt of coal equivalent per annum of energy savings from project replication during the 1990's, with an interim target of 1.5Mt per annum by December 1985.

Lord Avon described some of the achievements already made and suggested to delegates that they could well ask themselves whether they could afford *not* to implement a disciplined energy management approach.

"There is an important prize to be won through improving energy efficiency. If we can win it it is not too much to say that we stand to strengthen our economy against international competition, we stand to improve our balance of trade, to cut our operating costs and strengthen our companies and become as energy efficient as the best of the international competition. ●