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EFFICIENCY OF MECHANIZATION AND AUTOMATION IN THE IRON AND STEEL INDUSTRY

ECONOMIC ASPECTS OF COMPUTER CONTROL OF THE OXYGEN STEELMAKING PROCESS[1]

prepared by

the Secretariat of the United Nations
Economic Commission for Europe

SUMMARY

The report attempts to give an economic evaluation of computer control of the oxygen steelmaking process and discusses its various economic advantages. The first introductory chapter which reviews some general aspects of computer control in the iron and steel industry gives statistics of the numbers and kinds of computers installed as of the time of writing and shows that a certain hierarchy in control is needed. For instance, automatic production co-ordination is only possible if a properly working control system is well established.

Turning more particularly to computer control of the oxygen steelmaking process, the point is made that in view of the great speed of the refining process in the oxygen converter, the difficulty for the operators is to know when to stop the blowing process. In a non-automated process this moment is chosen on the basis of the judgment of the operator. Steel temperature and analysis are checked and if they are within the set specifications the steel is tapped, otherwise the

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[1] The document is presented as submitted, without re-editing.

heat is reblown. As the reblow absorbs much time and energy and as the quality of the reblown steel is also lower, the main effort of improving the oxygen steelmaking process is centred on the elimination of the reblow procedure; in other words, on a correct steel analysis and temperature range at turndown.

In general terms the cost composition of the oxygen steelmaking process is: 80 per cent of cost is raw materials costs, sixteen per cent operating cost, and four per cent capital costs. The cost for installing a computer is only a small part of total capital cost (about five per cent), while a large part of this amount (about two thirds) is to be spent on instrumentation that will be needed in any case also when no computer is to be included. Expressed as a fraction of total steelmaking costs, total computer costs become less than one per cent of the dollar-per-ton cost price, and consequently an improvement of the process or a cost reduction of one per cent or more will make the installation of computer control worthwhile.

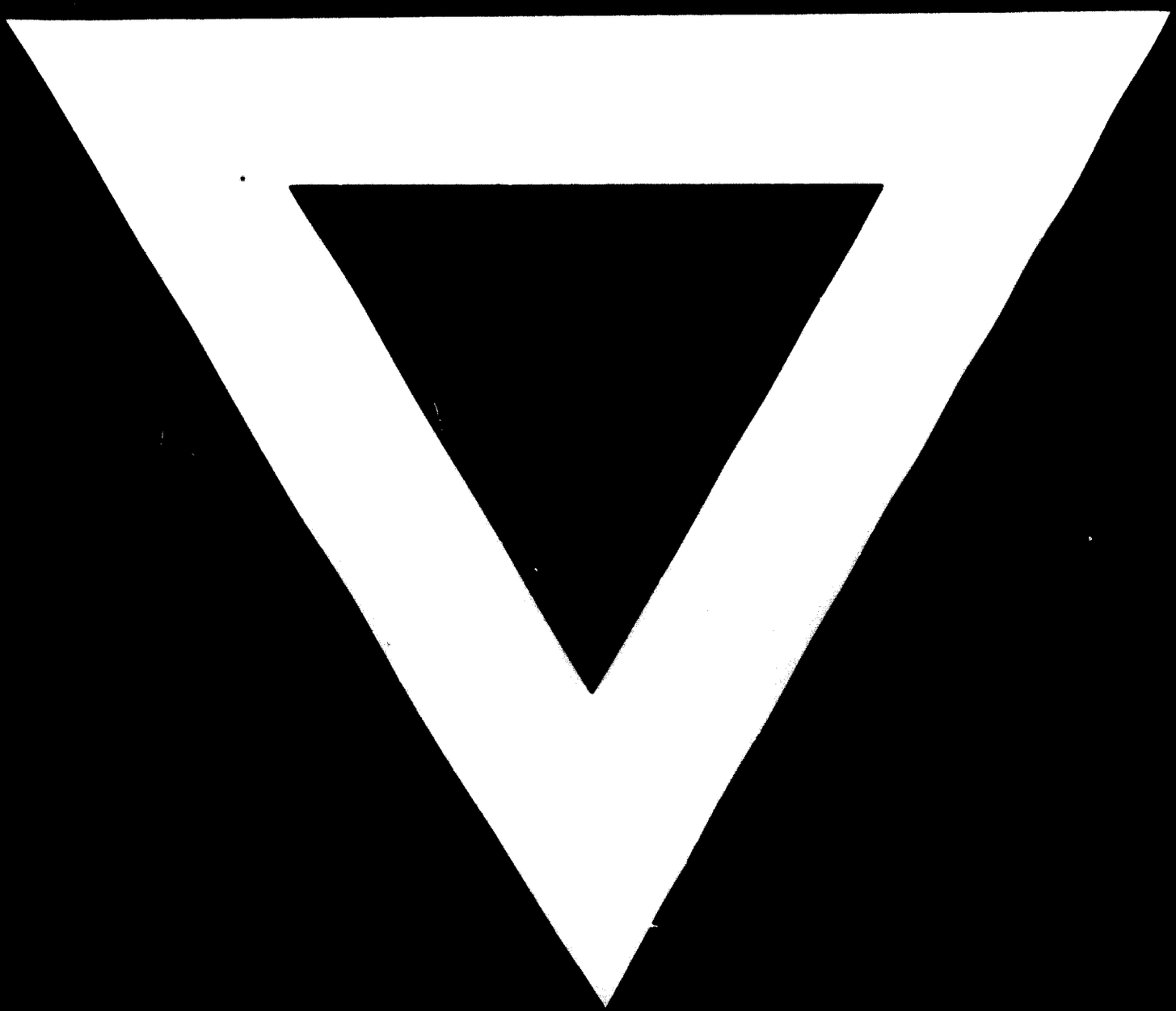
Improvements that can be expected from computer control of the steelmaking process relate to the iron yield, the production rate and the steel quality. While capital and operating costs or manpower requirements for a given installation are not likely to change due to the introduction of computer control, the increase in production rate and iron yield will bring these costs down when expressed as an amount per ton of steel produced. Moreover, the possibility of improving over-all production planning and co-ordination will have to be added to the specific advantages to the process. Such advantages, however, are not automatic, they are difficult to assess precisely and can usually be achieved in the long run only.

The report contains an evaluation of the economic advantages of improved technical performance of the oxygen steelmaking process, in order to show how in practice computer control can make and has made the oxygen steelmaking production process more economical. The main items of production efficiency are analysed by taking into account the iron yield of the process, its production rate, the lining life of the converters and the final steel analysis.

It has been demonstrated that through automation, the iron yield of the process can be increased by one to two per cent, thus reducing total costs by 0.75 to 1.5 per cent. This would in terms of money, for instance for a

one million ton/year steel plant, amount to around $5 million/year. The production rate can be increased by three to four per cent, thus reducing capital and other fixed costs by the same amount. Furthermore, an increase in the life of the vessel decreases scrap consumption, increases iron yield and lowers the cost of refractories. One of the most important results of automation, however, is the greater regularity of the turndown analysis and temperature of the steel which, in turn, considerably improves final steel quality and hence the price obtainable for the steel.

The conclusion of the discussion on the economic aspects of computer control of the oxygen steelmaking process is that raw materials are better utilized, the final product has a more consistent quality and the process itself, in addition to showing some savings, becomes more regular and runs closer to time schedules. Some of these improvements are essential for the proper co-ordination of the oxygen steelmaking process with the adjacent departments, which are of great importance especially if continuous casting is involved. Moreover, the use of data logging and data analysis equipment, which are part of many computer installations, will help to arrive at a better understanding of this new steelmaking process. Another important aspect of computer control equipment is its function of safeguarding the steelmaking installation through safety interlocks and alarm systems from inadequate operational procedures. Computer control of the oxygen steelmaking process, therefore, can be expected to expand the application of the oxygen steelmaking process as it brings these installations rapidly but safely to their optimum degree of utilization. It makes the process more independent from the qualifications of the operating staff to which it is of great help for maintaining a high standard of the quality of its work.



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