ENERGY RECOVERY FROM
CAST IRON MELTING FURNACES

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Contract no. EEB-2-152-I
Duration 1981-1982
Contractor TEKSID S.p.A.
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Summary

The aim of the research is to contribute to reduce the energy consumption in a foundry. Experimental tests have been performed in a pilot plant installed at one of TEKSID (FIAT Group) foundries. The pilot plant operation aims to demonstrate the technical and economical possibility of an industrial plant that recovers and converts the latent and sensible heat of the cupola emissions into electric energy by a recovery system composed of thermal and electrical conversion subsystem, considering that the Kwh produced can be directly utilized in the same foundry.

The energy saving test pilot plant has been studied and erected under CEE financing program; being its capacity stated in such a way to obtain the wanted information for the industrial plant. Because of economical reasons the test pilot plant has included the thermal subsystem only, whereas the turbine service is simulated by an aircooled condenser.

According to the author's point of view the research programme has demonstrated the possibility of the energy recovery industrial plant burning such a kind of waste cupola gases: the main results are here illustrated.

1. INTRODUCTION

The foundry industry is a source of basic components, chiefly for the mechanical industry, but also for other branches; it thus plays a very important role in the economy of the industrialized countries.

Because of the difficult energetic situation and in order to reduce the dependence on oil producers, the consumer countries will make every effort for the development of internal resources and obviously for the greatest cut in energy consumption.

The foundry is a great energy consumer: in Europe 45% of total consumption is for industry as a whole; 15% i.e. a third of industrial consumption is for the mechanical and metallurgical branches including foundries.

1.0. The cupola as a possible field of energy recovery

It is well known that the fumes produced during cast iron melting pass through the charges and reach the top opening with some energy both as sensible and as latent heat. The sensible heat is a function of the fume temperature, whereas latent heat is related to the varying, but usually high contents of carbon monoxide, CO.

The composition of emissions from the cupola varies very much dependent on the contents of different components; with reference to the quality we can say that there are no considerable differences from plant to plant.

There are three basic components: Carbon Monoxide, CO; Carbon Dioxide, CO2; and Nitrogen, N2. Besides there are small quantities of steam and sulphur dioxide SO2, as well as a great quantity of solid particles that the gases carry with them.

CO is formed after the combustion of coke; generally the CO contents signify higher quantities of heat recoverable by its combustion, according to the reaction:

\[ 2 \text{CO} + \text{O}_2 = 2 \text{CO}_2 + 2 \times 67.6 \text{Kcal} \]

Energy is gained and great ecological advantages are derived by suitably transforming the heat from CO combustion.

In CO combustion this very poisonous gas is transformed into the non-poisonous CO2, and a serious cause of air pollution is avoided.

In this research the possibility of recovering the cupola fume heat contents by producing electric power is examined. We think that this way of heat recovery is profitable compared with others.

In fact, the need of electric power is very high in the foundry for several uses, such as dust suction, pouring lines motion, holding furnaces and sand mullers: the electric power produced by the heat recovery method can be used on the spot. Its use is not dependent on any environmental or time factor, because the power is required all day long throughout the year from the Pole to the Equator. Finally this