the difficulty and expense of producing it by ordinary furnace methods has led to the use of the electric furnace in preference to cupola or crucible furnaces, in spite of the greater cost of electrical heat.

Is it possible, however, that the expensive electrical energy should ever be used commercially for the production of iron or steel, metals which are produced with ease and economy by ordinary furnace methods.

The answer to this question must depend mainly upon the relative cost of fuel and electrical energy. There are at present no electrical iron or steel smelting furnaces equal in size to a modern blast furnace or even an open hearth furnace, so that satisfactory demonstrations of their efficiency on a large scale are still lacking, but the great efficiency of electrical heating enables us to predict with a fair degree of accuracy the amount of energy that such furnaces would require, and such calculations are supported by the working results of small furnaces already in operation.

Taking first the direct production of pig iron from the ore, Albert Keller,* of Paris, states that he has determined, experimentally, that one ton † of pig iron requires ¼ of a kilowatt year, that is 2,190 kilowatt hours for its reduction in addition to the 350 kilos. of coke needed to effect the chemical changes.

Dr. Goldschmidt ‡ in reporting on the Stassano process, which was producing nearly pure iron from the ore, calculates that the production of one metric ton of carbon free iron from a 65% ore would require, assuming an efficiency of 80%, 3,364 horse power hours, or 2,510 kilowatt hours, which is of the same order as the previous figures. In the operation of a small Stassano furnace of about 100 kilowatt's capacity a charge of 70 kilograms of ore mixture was reduced in two hours with an expenditure of electrical power equal to 121.5 kilowatt hours, or 3,945 kilowatt hours per metric ton of iron, a figure which is 57% greater than the calculation, but the discrepancy is not surprising in view of the smallness of the test.

It should be remembered that the production of one ton of pig iron would require somewhat less heat than that of one ton of carbon free iron, both on account of the smaller amount of iron to be reduced and of the lower temperature of its melting point.

In order to realize what these figures mean, we must enquire into the price to be paid for electrical energy.

The cost of electrical energy is, indeed, the most important

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* Journ. Iron and Steel Inst., 1903, vol. I., p. 170.

† One metric ton or 2,205 lbs.

‡ Electro-chemical Industry, March, 1903, p. 247.