



Tata Steel Europe has devised a digital toolkit for designing new coal mix options, which has helped it reduce its coking coal costs and improve its financials substantially.

THE CONTEXT



Coke is a critical ingredient of conventional steel making and accounts for 15-20% of the cost price of hot-rolled coils (HRC). Tata Steel Europe spends about \$500 million on coking coal every year and thus, even a minor reduction in its coal-blend costs can have a huge impact on the bottom-line. The challenge is that the cost is linked to the quality of the coke; hard coking coals (HCC) or coals with good coking properties are generally more expensive than those with poor coking properties.

The goal is to design a coal mix that consists predominantly of coals with good coking characteristics even though they may be of a poorer quality than HCC. There is a complex interplay between different coals, which can either boost or reduce coke quality. However, coal is a complex natural resource and the scientific community has not been able to build good models around coal behaviour during heating. There are only a few limited efficacy models that apply only to coals of particular regions such as North America and Australia.

THE INNOVATION



The company overcame the problem by developing a digital toolkit for model-aided coal mix design. The toolkit comprises two tailor-made web-applications (called Octopus and Giraf) that are machine learning models based on over 10 years of process and laboratory data. The Octopus tool permits quarterly/yearly steering of the blend based on specifications of coal available in the market, whereas the Giraf tool permits weekly blend steering based on actual coals in stock. The applications have succeeded in providing better process controls and several revolutionary coal mix options, which have resulted in substantial savings for the company.

KEY CHALLENGE



TO ISOLATE THE FUNDAMENTAL RELATIONSHIPS BETWEEN COKE QUALITY AND THE COAL MIX

When the Tata Steel Europe team sought to directly relate coke quality to the properties of the coal mix used in coke plants, it found that the data was influenced by two different mechanisms. One was the fundamental physio-chemical relation between the properties of coal and the resulting output quality. And two, the data was influenced by the artificial variations imposed on the blend. The team needed to isolate only the fundamental relation and capture it in a model in order to evolve new strategies of coal mix design. The team achieved this by carefully constructing a balanced data set consisting of laboratory test results of single coals and multi-coal blends, and of actual plant data.

THE IMPACT



The new toolkit for designing optimal coal mix options has helped Tata Steel Europe to reduce its costs by

€10 MN PER ANNUM