Environmental benefits

Environmental benefits of advanced stainless steel in piping systems

Did you know that...

- Through using high strength steel with greater corrosion resistance in an urea production plant, the energy use in the production process was cut by 7 %.
- The upgrade results in greenhouse gas emissions, over the lifetime of the piping system, being cut by 265 000 tonnes CO_{2e}.

The world needs Swedish steel

Steel is the world's most used metallic construction material thanks to the material's strength in relation to its weight and price. During 2013 almost 1.6 billion tonnes of steel were produced globally.[1] Sweden's steel industry makes up about half a per cent of the world production. However, Swedish steel companies are highly specialised. In many cases they are world leaders within their respective niches.[2]

Steel forms part of an eco-cycle and can be recycled endlessly as raw material for new steel without any deterioration in quality. This makes it unique amongst modern materials.

New, advanced steel grades are being developed all the time. Many of the steel grades that Swedish steel companies produce today were not even on the market five years ago.[2]

High strength steel is stronger than conventional steel and makes it possible to produce lighter steel designs. A doubling in the strength delivers a weight reduction of about 30 % of the upgraded structural components.[3] Upgrading means replacing with a steel of higher yield strength. Lighter structures lead to lower environmental impact through reduced emissions, more energy-efficient products and the sustainable use of natural resources.

Case study

High alloy steel grades, so-called stainless steel, are normally used in environments which are corrosive or aggressive and where high demands are placed on hygiene.

In a case study[3], the difference in environmental impact has been estimated between a urea production plant where the plant's piping system is built of conventional stainless steel, and one built with a specially developed high strength stainless steel. The conventional stainless steel has a yield strength of 190 MPa while the high strength steel has a yield strength of 550 MPa. The high strength steel also has greater resistance to corrosion than the conventional steel.

[1] *World Steel Association*
[2] *Jernkontoret, Steel shapes a better future*
[3] *The Steel Eco-Cycle, Environmental research Programme D 853.*

STEEL SHAPES A BETTER FUTURE

The environmental impact from the steel production, the manufacture of piping systems, operation of the production plant and recycling of the steel have been calculated with the aid of life cycle assessments. The piping system is estimated to have a useful life of 20 years with an annual urea production of 1.05 million tonnes. The principal fuel in the process is assumed to be oil.

Results

Since the high strength steel has greater resistance to corrosion, it is possible to run the production process with less oxygen content which reduces the energy use of the process. The energy use is estimated to be 7 % lower for a processing plant with piping in high strength steel compared to conventional steel. This is equivalent to a reduction in the annual energy use of 147 000 megajoules (MJ).

Through using high strength steel in the piping system it is possible to reduce the pipe dimensions and thereby the pipe weight. The upgrade to high strength steel means that the weight of the piping system is cut from 32 328 kg to 14 346 kg, a decrease of 56 %.

The total greenhouse gas emissions from steel production, manufacture of the piping system, operation of the plant and recycling is 265 000 tonnes CO_{2e} lower for a piping system in high strength steel compared with a piping system using conventional steel.

It is principally during the operation of the production plant that the emissions are reduced owing to lower energy use. A very small part of the emission reduction arises, however, during the steel production as a consequence of there being less demand for steel to produce the upgraded, lighter piping system.

Weight reduction, reduced energy use and reduced greenhouse gas emissions for the production plant when the piping system is built of high strength steel instead of conventional steel.

Weight reduction (%)	Reduced energy use (%)	Reduced greenhouse gas emissions (tonnes CO_{2e})
56	7	265 000

Conclusion

The high strength steel in the example has been specially developed for use in urea production. It possesses properties that make it possible to run the production process withless oxygen in order to reduce thereby the energy use. This is one example of how steel producers can collaborate with customers to develop new specially customised steel grades.

Swedish steel and the companies' knowledge of its applications create possibilities for producing more efficient structures that reduce the environmental impact when the products are used. This is exemplified in the piping systems in urea production plants.

It is essential to pay attention to the environmental impact during the entire life cycle of the steel products and not just examine the environmental impact from the production of the steel.

The properties of steel in terms of high strength, long operating life and recyclability make the material a significant component of sustainable development.

Do you wish to know more? Please contact us at Jernkontoret.

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