Environmental benefits

Environmental benefits of high strength stainless steel in storage tanks

Did you know that...

- The weight of a storage tank is cut by 33 % when the steel in the tank is upgraded to high strength steel.
- The upgrading results in greenhouse gas emissions being cut by almost 50 % since lesser amounts of steel are needed to manufacture the lighter tank.

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. The use of high strength stainless steel makes it possible to reduce the amount of steel in the construction.

A storage tank used to store marble slurry has been upgraded from conventional stainless steel to high strength stainless steel. Through the upgrade it is possible to reduce the thickness of the steel plates in the tank walls and thereby reduce the tank's weight. In a study[3], through life cycle assessments, an investigation has been carried out into the environmental benefits of upgrading the steel in the storage tank.

The calculations include the environmental impact from the steel production, the transportation

[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 storage tank's properties, both before and after the upgrading.

	Yield strength (MPa)	Weight (tonnes)	Volume (m^3)
Tank in conventional stainless steel	210	57,4	3178
Tank in high strength stainless steel	480	38,3	3178

of structural elements, the installation of the storage tank as well as the recycling of the steel.

The storage tank's wall segments are manufactured in the workshop and the tank is then assembled on site. The tank's useful life is estimated to be 30 years.

Results

Through upgrading of the steel in the storage tank it is possible to reduce the tank's weight by 19.1 tonnes, or 33 %. This results in greenhouse gas emissions from production of the steel, transportation, manufacture of the tank and recycling being cut by 65 tonnes CO_{2e}. This, in turn, is equivalent to a cut in emissions of 47 %.

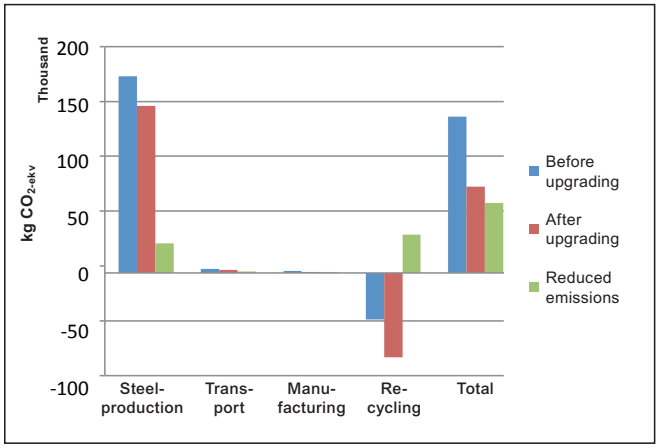
Weight reduction, reduced emissions and reduced energy use on upgrading to higher strength steel

Weight-reduction (tonnes)	Weight-reduction (%)	Reduced greenhouse gas emissions (kg CO_{2e})	Reduced energy use (kWh)
19,1	33	65 000	227 500

The major part of the environmental impact from the storage tank's life cycle, 99 %, arises during the steel production. Since a lower amount of steel is needed to manufacture a tank in high strength steel, compared with a tank in conventional steel, the environmental impact from the steel production is lower for the upgraded tank. Since a smaller quantity of steel needs to be transported the environmental impact from the transportation is also reduced.

During installation of the upgraded tank, the consumption of welding wire and energy use during welding is about 50 % lower for the upgraded tank, which also results in reduced environmental impact.

The upgraded tank's environmental impact is further reduced after taking into account the scrap input in the steel production (environmental impact) and the scrap generated when the tank is recycled (environmental credit).



Emissions of greenhouse gases from steel production, transport, manufacturing and recycling, before and after upgrading as well as the difference in emissions between the two tanks

The stainless steel in the upgraded tank has greater resistance to so-called pitting corrosion than conventional steel. This probably affects the tank's useful life and consequently its environmental impact, but the effect has not been evaluated in the study.

Apart from the reduced environmental impact, the costs of the upgraded tank are reduced by about SEK 440 000 or 45 % during the tank's useful life. The greater part of the saving is due to a lesser amount of steel being used in the upgraded tank. The fact that the need for welding decreases for the thinner, upgraded tank also results in cost savings.

Conclusion

Through upgrading the steel in the storage tank, the emissions of greenhouse gases are reduced by almost 50 % and the life cycle costs by about 45 %.

The utilisation of steel continues to increase driven by the growth of population and increased living standards in various parts of the world. To meet the increased demand it is essential to develop resource and carbon efficient structures.

Swedish steel and the companies' knowledge of its applications create opportunities for producing resource and carbon efficient structures.

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.

Telephone +46 8 679 17 00 | E-mail office@jernkontoret.se | www.jernkontoret.se

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