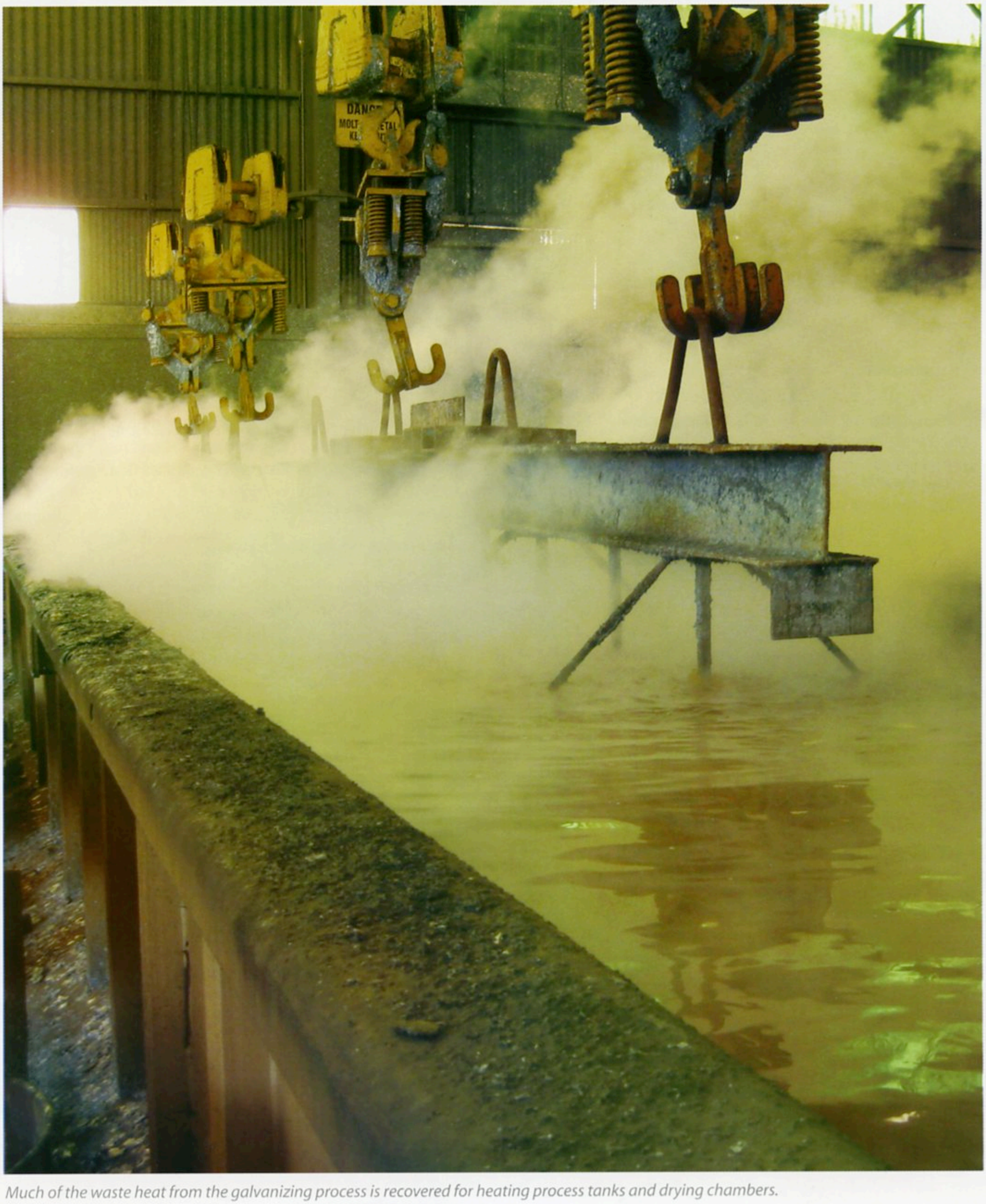
GLOBAL WARMING, CLIMATE CHANGE & GALVANIZING



Much of the waste heat from the galvanizing process is recovered for heating process tanks and drying chambers.

The Newcastle Dockyard building on Dyke Point in the foreground is being recycled into a luxury yacht service facility. The purlins are newly galvanized, but the 100 year-old major structural steel sections have been retained and repainted.

INTRODUCTION

As the climate change debate heats up, all industries need to look at the carbon footprints they make and develop strategies to ensure this footprint is minimised and that their products will have the 'green' credentials to meet future environmental responsibilities.

Steel is obviously one product that is essential for the construction and manufacturing industries, while also requiring significant amounts of energy for its extraction and refining. It not only requires energy to smelt it and refine it, but is also a large carbon consumer in the use of coal (transformed into coke) to reduce the iron ore to metal.

Zinc is the other metal that has a vital role to play in ensuring the durability of steel structures and products, and it too requires energy for its extraction and refining. While some pyrometallurgical technologies are used for zinc refining, it is predominantly an electrolytic process, requiring significant amount of power for this process. The source of the power may be from coal fired power stations on mainland Australia, to hydroelectric power in Tasmania.

100% of the zinc used by Industrial Galvanizers is either sourced as prime metal from Nyrstar in Tasmania using hydroelectricity or as recycled zinc generated by residue reprocessing in Industrial Galvanizers Auszinc Alloys facility in Port Kembla, NSW.

In addition, the energy component of the hot dip galvanizing process itself is very low. Although all of Industrial Galvanizers plants around Australia heat their galvanizing baths with gas, the relatively low temperatures (455°C) required to keep the zinc molten mean that energy costs represent only about 5% of the cost of production.

Industrial Galvanizers Australian Galvanizing Division has had an ongoing energy management program operating for over 10 years that has reduced the energy usage across the Galvanizing Division by almost 50% using waste heat recovery, improved insulation and improved burner management systems. For these reasons, the zinc component in the galvanizing of steel has a small carbon footprint, almost all of which is in the form of natural gas, which makes a significantly lower CO_2 contribution than that of coal fired electricity.

THE GALVANIZED STEEL EQUATION

It is obvious that any manufacturing operation involving the extraction, smelting, refining and processing of metals requires significant amounts of energy. Galvanized steel is no exception and the sustainability of the end product will be measured by the amount of energy required to produce it in the first place against its durability and ability to be recycled hot dip galvanized steel is among the world's most durable materials of construction.

In other than very aggressive corrosion environments, most hot dip galvanized structures will provide a service life of 50 years or more, with ongoing case-history studies indicating that 100 years + is achievable in many structural applications.

The amount of zinc applied to structural sections when they are hot dip galvanized is relatively small - typically 3-5% of the tonnage of steel protected. At the end of the steel's service life, this zinc coating has been largely removed by the corrosion mechanisms that determine the service life of the galvanized coating, leaving the steel to be recycled.

GALVANIZED STEEL - THE ENERGY EQUATION

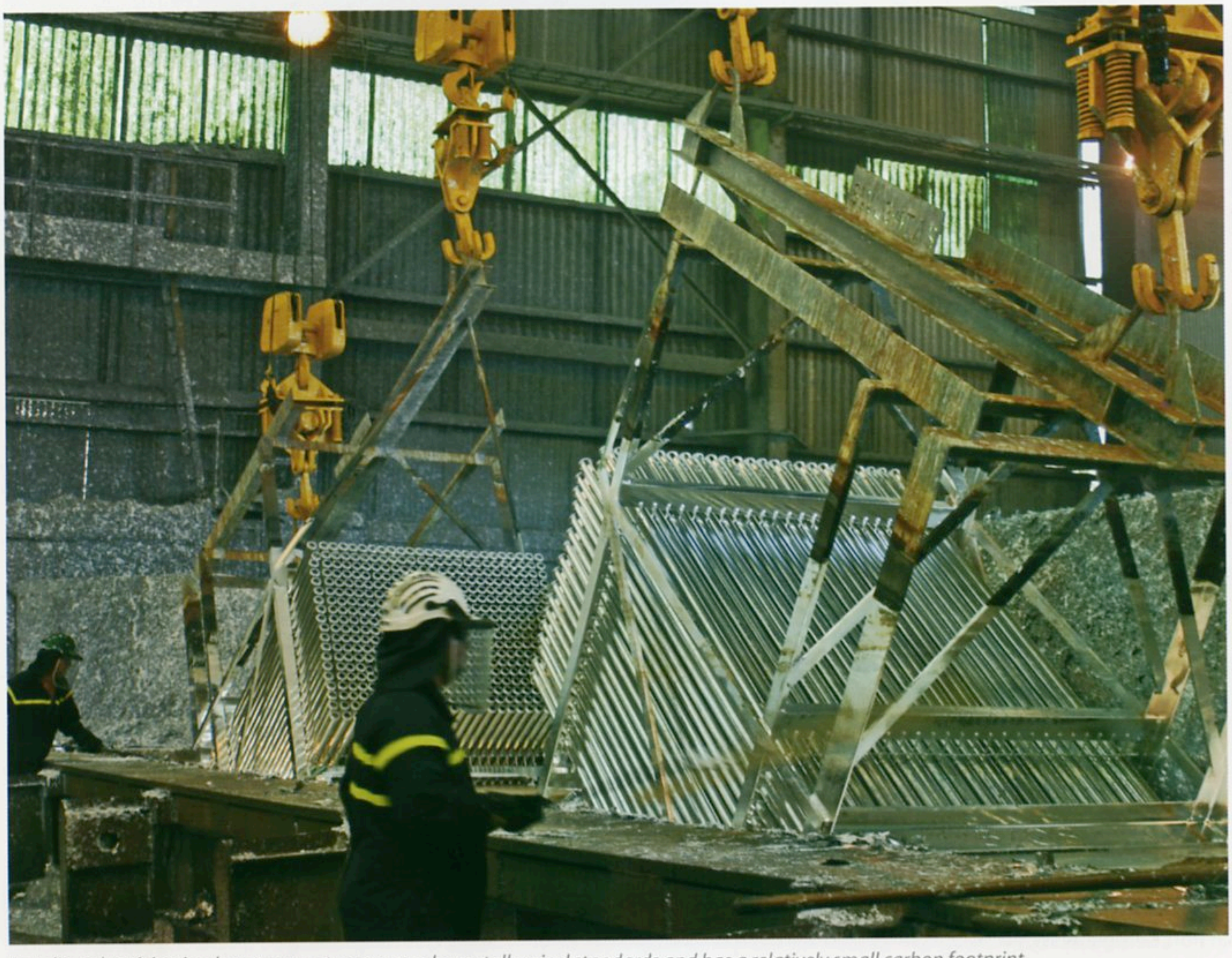
The amount of energy use in producing a tonne of galvanized steel will also determine its greenhouse (CO_2) contribution. The following figures one energy usage for steel manufacture have been obtained from OneSteel and BlueScope steel who make all Australian steel between them. The zinc energy information comes from Nyrstar, who has zinc refineries in Hobart, Tasmania and Port Pirie, South Australia and is the world's largest zinc producer, while the energy usage of the hot dip galvanizing process is derived from galvanizing industry average operating statistics.

Nyrstar has adopted a standardised fossil fuel protocol for its energy use statistics from its Hobart operations to bring them in line with its other Australian and International refining operations. This effectively doubles its theoretical CO_2 contribution compared to its actual contribution, as the Nyrstar Hobart refinery was large a user of hydro-electric power. Since Tasmania has connected to the Victorian coal-fired power grid through the Bass Link project, the method of calculation for CO_2 emissions has been changed to reflect that.

Table 1 lists the typical energy consumption for each component of the hot dip galvanizing process.

TABLE 1

Material/Process	Gigajoules/ tonne	CO_2 Contribution - kg CO_2/tonne
Steel	20	1800
Zinc*	15	250
Hot dip Galvanizing	2.5	40



Hot dip galvanizing is a low-temperature process by metallurgical standards and has a relatively small carbon footprint.

* The energy use figures for Nyrstar have been taken from the Hobart (Risdon) plant data whose primary product is zinc. The CO_2 emissions from the Port Pirie arise from more complex operations, with the primary product being lead, with only 15% of the site's production being zinc.

Using this data, an accurate estimate can be made for the total energy use/CO_2 contribution embodied in one tonne of hot dip galvanized structural steel with an average zinc pick-up of 4%. This is shown in Table 2.

TABLE 2

Material	Weight	Gigajoules	CO_2 contribution - kg
Steel	1000 kg	20.0	1800 kg
Zinc	40 kg	0.6	10 kg
Hot dip Galvanizing	N/A	2.5	40 kg
TOTAL			**1850 kg/t**

It should be noted that the zinc smelters/refiners in particular produce significant volumes of commercially valuable by-products from the refining operations, including sulfuric acid, silver, copper and gold whose energy consumption is included in the figures used above.

It can be seen that the relatively small energy contribution made by the galvanizing process (3.1 gigajoules - 50 kg/t of CO_2) has a significant effect in preserving the energy already embodied in the manufacture of 1 tonne of steel for the practical service life of most steel structures.

In addition, the recycling of steel uses approximately 25% of the energy required to make steel from raw materials so the overall equation for steel sections made from scrap steel would reflect a total energy usage of well under 10 gigajoules per tonne with a corresponding reduction in greenhouse emissions.

This galvanized bracket was salvaged from the Townsville to Charters Towers telegraph line built in 1888. Its galvanized coating exceeds 300 microns, indicating a service life expectancy of 1000 years.

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COVER

Phil Layton, Industrial Galvanizers Newcastle Marketing Manager, demonstrates the flexibility of a finished Steel-Flex guide post.

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CORROSION MANAGEMENT is published for those interested in the specification, application and performance of corrosion management systems.

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