Steel

Total world production of crude steel in 2012 was 1.5 billion tonnes. Only a portion of this is used in the construction industry, principally for structural members, claddings and fasteners or fixings.

Most steel is made by one of two basic routes:

- integrated blast furnace and basic oxygen furnace, using the raw materials iron ore, limestone and coke, possibly with some scrap included
- electric arc furnace, using mainly scrap steel which is re-melted with additives.

Other methods of steel production can be used, but these are reducing yearly as technology improves. Recycling steel dramatically reduces the embodied energy of the end product, avoids mining and the production of coke.

Of the steel produced in 2012, 69.6% was by the oxygen route, 29.3% by the electric route, and 1.1% via the open hearth method.

Extraction and manufacture

Impact of extraction	There is visual impact from removal of ironsand from New Zealand open cast mines, although once the iron is extracted the sand is returned to the mine site and the natural environment reinstated. In New Zealand sand mining and manufacturing plants are generally required to comply with specific environmental conditions under their resource consents. There is also potential for damage to local ecosystems during raw material extraction. Determine if the supplier's manufacturing plant has its own water collection and wastewater recycling system.		
Embodied carbon and embodied energy	**Material** (see notes below table)	**Embodied carbon** kg CO_2eq/kg	**Embodied energy (total)** MJ (NCV)/kg
	Steel, bar (Pacific Steel)	3.97	55.88
	Steel, coil (Pacific Steel)	3.75	52.65
	Steel, rod (Pacific Steel)	3.78	53.95
	Steel, wire (Pacific Steel)	3.90	56.23
	Steel, structural, columns and beams (BlueScope Steel)	2.85	31.86
	Steel, primary (galvanised, both sides, 0.02 mm each, coating class Z275), profile metal sheet, generic all profiles, 0.4 mm BMT	3.74	47.45
	Steel, primary (galvanised, coating class Z275), cold rolled profile metal sheet, trough section 56mm deep at 305mm ctrs, 0.75 BMT	3.30	40.96
	Steel, primary (galvanised, coating class Z275), cold rolled profile metal sheet, trough section 56 mm deep at 305 mm centres, 0.95 mm BMT	3.19	39.44
	Steel, primary (galvanised, 2 sides, 0.02 mm each, coating class Z275), 0.55 mm BMT, stud wall system	3.48	43.66
	Colorsteel® Endura® 0.4 mm BMT (NZ Steel) [Note 3]	4.04	62.78

	Colorsteel® Endura® 0.55 mm BMT (NZ Steel) [Note 3]	3.91	59.41
	Colorsteel® Maxx® 0.4 mm BMT (NZ Steel) [Note 3]	4.08	63.63
	Colorsteel® Maxx® 0.55 mm BMT (NZ Steel) [Note 3]	3.94	60.19
	Note 1: BMT = base metal thickness. Note 2: The data for the four "steel, primary" materials are based on primary production of metal. Note 3: The EPD covers processes up to the gate of the Glenbrook manufacturing site. Onward transport and processing into final product additionally estimated by BRANZ. This contribution adds less than 1%.		
	The figures are taken from BRANZ CO2NSTRUCT v1 June 2019. You can download the data and find explanatory details at: www.branz.co.nz/environment-zero-carbon-research/framework/branz-co2nstruct/		
Sourcing			
Material sources	Steel is manufactured in South Auckland from local ironsand (steel coil produced at Glenbrook) and from recycled steel (reinforcing steel and wire products produced at Otahuhu). Other steel components are imported primarily from Australia, Japan and Korea; steel from China and India may also be available. Locally-made reinforcing steel is available while structural steel sections are generally imported ready to use.		
Availability	Steel components are generally available throughout New Zealand. Some heavy steel sections my need to be specifically ordered from overseas.		
Transport to site	Cladding and framing components are typically light. Large-scale structural components are heavy and require appropriate transportation		
Construction/installation			
Health and safety during construction/installation	Steel cladding needs to be handled carefully as edges are sharp, particularly when cut on site. Safety gear including gloves should be worn to avoid injury.		
Ease of construction/ installation	Framing and cladding are lightweight and easy to handle. Structural sections will require lifting equipment. Limitations exist on the bending method for high tensile reinforcing steel.		
Adaptability	Steel structures can be modified relatively easily. Screw-fixed cladding is easy to replace. Bolted structural steel construction can be readily dismantled.		
Performance			
Health and safety during life of building	Steel is inert and not subject to off-gassing. Unpainted and factory-painted steel cladding is suitable for roof water catchment. Some site-painted coatings may leach chemicals. Consider VOC emissions during application of specialist protective (corrosion resistant) coatings to steel.		
Structural capability	Structural steel has a high strength to weight ratio. Profiled cladding can span further than most other claddings.		
Expected durability (assuming correct installation and maintenance)	Uncoated steel is not durable, but can be made so with the correct level of corrosion protection such as zinc/aluminium alloy coatings, hot-dip galvanizing and painting. Dry structural steel should last 80+ years. Profiled steel wall cladding should last 50+ years (roofing possibly less), depending on material specification, cleaning, maintenance and environment. Site-cut edges of cladding may be more vulnerable to corrosion.		

Maintenance rating	Structural steel requires little maintenance in a dry, protected environment. Maintenance is high when in a corrosive environment. Maintenance requirements are low for unpainted cladding in non-corrosive environments. Cladding must be kept clean, with the frequency of cleaning dependant on the environment and amount of natural rain washing. A medium amount of maintenance is required for painted cladding and intumescent coatings on steel – cladding must be kept clean, with the frequency of cleaning dependant on the environment and amount of natural rain washing. A medium amount of maintenance is required for coated steel components in damp exterior situations.
Moisture resistance	Steel is impermeable to moisture.
Rot, mould and corrosion	Steel will corrode in damp conditions and requires corrosion protection. For high levels of corrosion resistance, stainless steel cladding and structural components (brackets, bolts, nails and plates) may be required.
Thermal performance	Steel has a high rate of heat transfer, therefore does not provide thermal insulation or thermal mass benefits. Steel framing requires thermal isolation to avoid thermal bridging.
Sound insulation	Steel provides little sound insulation – thin material can vibrate and assist sound transfer.
Fire performance	Steel won't burn – but performance in fire is poor if unprotected.
Waste disposal/recycling/re-use	
Re-use	Steel cladding in good condition can be re-used.
Recycling	Steel recycling is well established in New Zealand - approximately 300,000 tonnes of scrap metal is recycled each year. Steel has the highest recycling rates and export earnings of any material. Recycling requires much less energy input than manufacturing new steel. Steel scrap is a valuable material with a well established network of companies purchasing product. Excess steel scrap is exported from New Zealand. Specialist steels such as stainless may be sent overseas for recycling. Some alloys and compounds within the steel may make the steel more difficult to recycle.
Waste disposal	Steel can be disposed of in landfill and will very slowly degrade through rusting but does not leach toxic chemicals.