

Forging ahead

Technical report

Created by thinkstep-anz on behalf of SSC, BIP & BRANZ

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Executive summary

The steel industry in Aotearoa New Zealand is committed to reducing its greenhouse gas (GHG) emissions to net-zero by 2050. In support of this commitment, the steel industry launched “Forging ahead: A roadmap to net-zero greenhouse gas emissions for Aotearoa New Zealand’s steel industry” on 21 April 2026.

What the roadmap covers

This roadmap covers all steel used in New Zealand buildings and infrastructure between 2020 and 2050. It includes both steel produced domestically and steel imported from overseas.

There are two different sets of results with two different system boundaries:

1. **Direct and electricity-related emissions** from ironmaking, steelmaking and steel fabrication. These are the emissions the steel industry most directly influences and this approach best aligns with other decarbonisation roadmaps globally.
2. **A full life cycle view**, including indirect emissions like raw material extraction, coatings, transport and end-of-life processing. This approach was designed to align with the scope of Environmental Product Declarations (EPDs).

Achieving steel with net-zero GHG emissions is possible

The steel industry in New Zealand has set the following decarbonisation targets:

By 2030 Reduce direct and electricity-related emissions from steel used in New Zealand by more than 30% compared with 2020.

By 2050 Reduce these emissions by more than 90%.

These targets assume that steel demand increases in line with projected population growth of around 31%, reaching approximately 6.7 million people by 2050. The emissions reductions are achieved through lower emissions per tonne of steel, not through reduced economic activity. They are based solely on direct emissions reductions and greenhouse gas removals. Carbon offsets are not used.

When indirect life cycle emissions are included, the projected reductions are:

- around 20% by 2030
- around 70% by 2050.

Strategies for decarbonisation

Achieving this level of reduction within 25 years will be challenging and requires coordinated action across the entire steel value chain. This technical report considers both demand-side strategies that reduce the amount of steel needed per person and supply-side strategies that reduce the emissions per unit of steel.

Adaptive reuse

The lowest-emissions building is the one we do not need to build. Adaptive reuse means extending the life of structural elements instead of demolishing and rebuilding. By keeping steel elements in use for longer, we reduce demand for steel.

Design & construction

We can reduce emissions by using steel more efficiently. Better coordination between architects, engineers and builders can reduce over-specification and unnecessary material use. Early design decisions have the biggest impact.

Renewable energy

Renewable electricity is essential to low-emissions steel. Electric arc furnaces (EAFs) use electricity to produce steel from scrap. Renewable electricity is also needed to produce green hydrogen for low-emissions ironmaking.

Steelmaking

Steelmaking must shift away from coal-based processes. EAFs are an important part of this transition. The share of steel produced by EAFs is expected to grow globally as the availability of recycled steel and direct reduced iron (DRI) increases.

Ironmaking

Ironmaking is the most emissions-intensive step in steel production. While recycled steel will play a larger role, virgin iron will still be required. Low-emissions alternatives include hydrogen-based DRI and carbon capture applied to existing plants. These technologies are developing and currently cost more than conventional production. They are expected to become more significant from the 2040s onward.

Actions to enable the transition

The 2020s

The biggest gains in the 2020s will come from proven technologies and smarter demand. By late 2026, direct emissions from steel consumed in New Zealand are forecast to fall by around 25% compared with 2020 levels. This is driven by:

- commissioning the new EAF at Glenbrook
- increasing use of recycled steel
- sourcing more steel from lower-emissions EAF production overseas.

By 2030, this roadmap forecasts direct emissions reductions of more than 30% compared with 2020. The main drivers to 2030 are:

- expanding scrap-based EAF production
- increasing renewable electricity supply
- improving material efficiency in design and construction
- beginning to embed adaptive reuse into planning and asset decisions.

The 2030s

The 2030s are the critical transition decade. By 2040, the steel industry must be firmly on track to achieve more than 90% emissions reduction by 2050. During this period, the focus shifts to scaling emerging technologies and accelerating system-wide change.

On the supply side, this includes:

- accelerating the global shift from basic oxygen furnace (BOF) production to EAF
- rapidly expanding renewable electricity generation
- switching fuel in DRI plants, from coal/gas to green hydrogen
- narrowing the cost gap between conventional and low-emissions steel.

On the demand side, this includes:

- making adaptive reuse the default option where feasible, including reuse of existing assets and designing new assets so they can be adapted in the future
- embedding carbon considerations alongside cost, quality and timeline in early design decisions
- continuing to optimise structural design to reduce material use.

Progress by 2040 is a key checkpoint. The steel industry needs to achieve savings of around 45% by 2040 to be on track towards its targets.

The 2040s

By 2050, near-zero emissions steel must be the norm. On the supply side, steel used in New Zealand buildings and infrastructure must come from facilities operating with minimal GHG emissions. This may include:

- scrap-based EAFs powered by renewable electricity
- EAFs supplied with green hydrogen-based iron
- conventional blast furnaces retrofitted with carbon capture, utilisation and storage.

On the demand side, this roadmap assumes:

- a 20% reduction in steel use in new construction through better design
- a 10% reduction in demand through greater adaptive reuse.

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1. Introduction

1.1. Background

The steel industry in Aotearoa New Zealand is committed to reducing its greenhouse gas (GHG) emissions to net-zero by 2050. thinkstep-anz was commissioned to work with industry and draw up a roadmap demonstrating how this goal could be achieved.

The purpose of this document is to provide the supporting technical information behind “Forging ahead: A roadmap to net-zero greenhouse gas emissions for Aotearoa New Zealand’s steel industry” (SSC, BIP & BRANZ, 2026), launched on 21 April 2026.

1.2. Aims

This study aims to:

- Create a shared vision for decarbonising steel used in New Zealand.
- Map out decade-by-decade steps to reach net-zero GHG emissions by 2050.
- Support joint advocacy with government and non-governmental organisations (NGOs).
- Create a benchmark from which industry can track progress over time.
- Support specifiers and their final clients with future decisions.

1.3. Scope

This study covers:

- All steel consumed in New Zealand for buildings and infrastructure, including domestically produced and imported steel, low alloyed steel and stainless steel.
- The entire steel value chain, from specification to end-of-life.
- The time horizon 2020 (baseline year) to 2050.

To qualify as a net-zero GHG emissions roadmap, over 90% of direct GHG emissions must be abated without carbon offsets by 2050.

1.4. Funding bodies

This study was funded by:

- Building Research Levy (administered by BRANZ)
- Building Innovation Partnership at the University of Canterbury
- Sustainable Steel Council NZ Incorporated (SSC)
- Ministry of Business, Innovation and Employment (MBIE)
- Heavy Engineering Research Association (HERA)
- Steel Construction New Zealand (SCNZ)
- Metals New Zealand (Metals NZ).

1.5. Peer review

Peer review was conducted by Jill Cooper. Jill is a materials engineer with over 30 years' experience in the steel and manufacturing industries. She has significant knowledge of green steel making, acting as an advisor to Helios and a past advisor in green steel to CarbonScape. Other relevant past roles include BlueScope New Zealand Steel, BHP Research Laboratories and CSIRO.

The peer review was primarily conducted on the underlying modelling and the roadmap itself in the period February to April 2026.

2. Background

2.1. Why steel?

Steel is the most widely used metal alloy on Earth, with 215 kg per person manufactured each year (worldsteel, 2025). While humankind has used iron and steel for millennia, mass production only started in the late 1800s as new furnace technologies were developed.

Steel's low cost (relative to other metals), high durability and high strength-to-weight ratio make it ideal for a wide range of applications. Around half of all steel goes into buildings and infrastructure, with the other half used in a wide variety of products, including vehicles, machinery, appliances and furniture (see Figure 2-1).

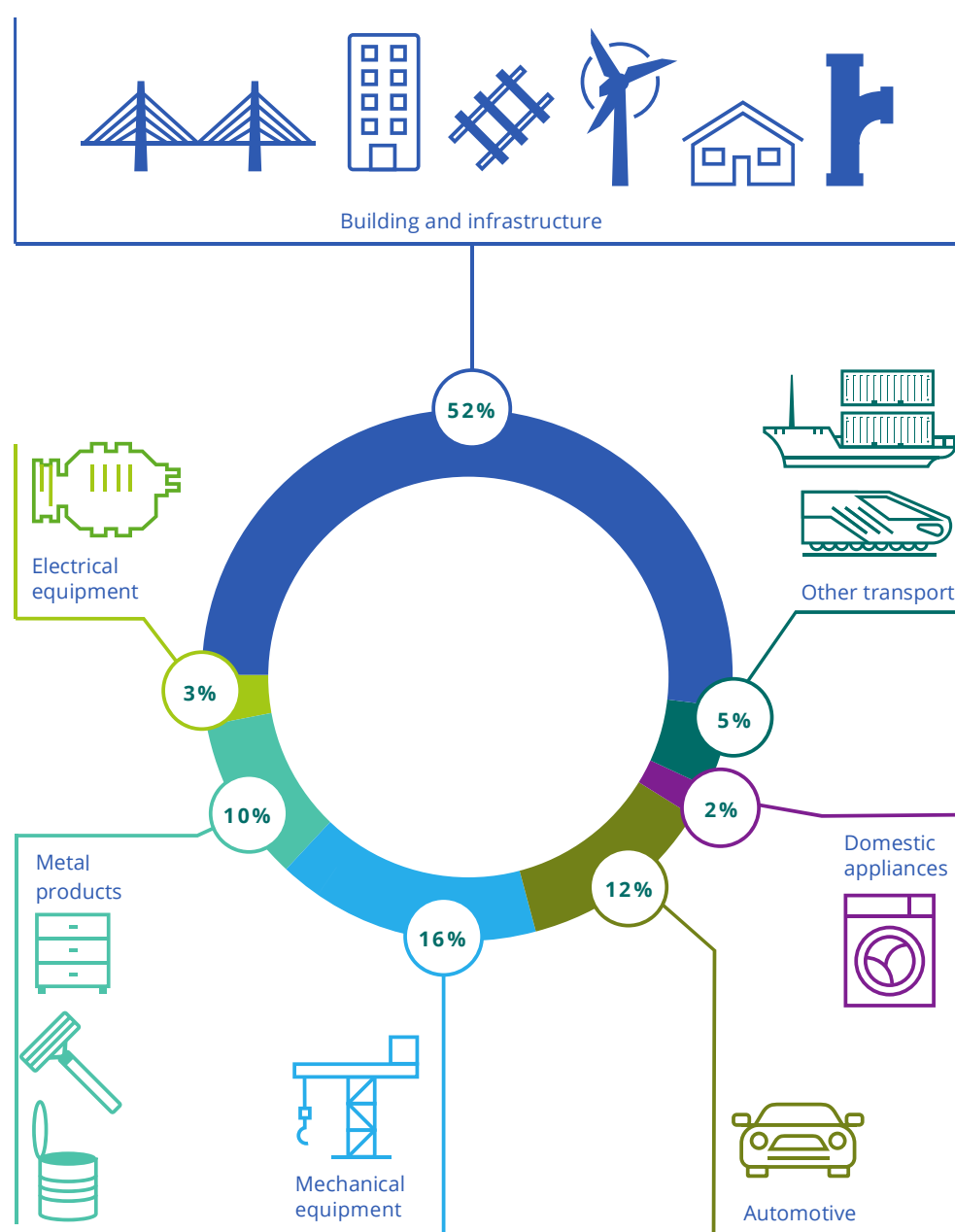


Figure 2-1: Uses of steel (worldsteel, 2025)

Steel offers resilience in earthquakes, making it an important construction material in seismically active countries like New Zealand. Steel's ductility enables it to absorb and dissipate seismic energy by bending without breaking.

Steel is also an important contributor to the circular economy. It is infinitely recyclable (provided that impurities are controlled) and there has been a thriving market for iron and steel scrap ever since the dawn of the Iron Age over 3,000 years ago.

2.2. Composition of steel

Steel is an alloy of iron and carbon. There are many classes of steel, some of which include additional alloying elements. Common examples include mild steel (with a carbon content of 0.05–0.30%) and stainless steel (with a chromium content of at least 11%).

Iron is the most important raw material for steelmaking, comprising 99% of mild steels and over 60% of even the highest alloyed steels. The source of iron may be a primary resource (i.e., manufactured iron from ore) or a secondary resource (i.e., steel scrap).

The only other essential alloying element in steelmaking is carbon, which adds strength and hardness, while also allowing the ductility of the finished steel to be controlled. While critical for steelmaking, the carbon content in steel is $\leq 2\%$ by definition (Sumec Metal, 2025).

Other important alloying elements – and their beneficial properties – include:

- Manganese (Mn) for hardness, ductility and wear resistance, while also acting as a desulfuriser and deoxidiser in manufacturing.
- Chromium (Cr) for corrosion resistance (especially in stainless steels) and strength.
- Nickel (Ni) for toughness and corrosion resistance.
- Molybdenum (Mo) for high-temperature strength, hardenability and creep resistance.
- Vanadium (V) for strength and wear resistance.
- Silicon (Si) for strength, hardenability, and corrosion resistance, while also acting as a deoxidiser in manufacturing.

2.3. Types of steel

Following the World Steel Association's (worldsteel's) definitions, e.g. (worldsteel, 2024):

- **Liquid steel:** molten steel that is poured from a furnace, prior to casting.
- **Crude steel:** steel in its first usable form – typically a solid. Examples include ingots and semi-finished products (billets, blooms and slabs). Liquid steel used for castings is also included.
- **Long products:** products with a cross-section that is significantly smaller than their length. Examples include bars, rods, sections and railway tracks. Long products are typically manufactured from steel billet.
- **Flat products:** products that are wide and thin, often stored as either coils or rectangular plates. Examples include plate, hot rolled coil, sheet and strip. Flat products are typically manufactured from steel slabs or blooms.
- **Tubular products:** hollow sections. Examples include seamless tubes and pipes (produced from billets or long steel bars) and welded tubes and pipes (produced by welding sheet or plate).

2.4. How steel is made

Globally, there are two dominant production routes used to manufacture steel:

1. **The BF-BOF route**, making up 70% of global production in 2023 (worldsteel, 2025). Iron is manufactured from iron ore in a Blast Furnace (BF) and then converted to steel in a Basic Oxygen Furnace (BOF). While this is the main method for manufacturing steel from virgin materials, BF-BOF steel still contains some recycled content as steel scrap is added to the BOF to help regulate the temperature of the furnace.
2. **The EAF route**, making up 29% of global production in 2023 (worldsteel, 2025). Steel is manufactured in an Electric Arc Furnace (EAF) from steel scrap, often with an addition of primary iron. Where primary iron is used, it is typically manufactured via the Direct Reduced Iron (DRI) route and commonly abbreviated as DRI-EAF.

2.5. Steel production in Aotearoa New Zealand

For most of its history, Aotearoa New Zealand has relied on imported steel. New Zealand does not have notable hard rock deposits of iron ore. However, it does have significant deposits of iron-rich sand on the west coast of the North Island (Brathwaite, et al., 2017).

The potential of New Zealand's titanomagnetite ironsands for ironmaking was recognised by early European settlers in the 1800s; however, its titanium content and small particle size meant that it clogged conventional blast furnaces (Williams, 1906; Engineering New Zealand, 2026). By the early 1900s, efforts to produce iron and steel domestically had shifted to limonite ore (ibid.). In 1920, the Onkakā Iron and Steel Company was established, producing iron from limonite from 1924 until the plant's closure (for economic reasons) in 1935 (Engineering New Zealand, 2026).

The 1960s saw renewed interest in domestic steelmaking. Pacific Steel Limited installed an EAF and rolling mills in Ōtāhuhu, Auckland and began full-scale production of long steel products from recycled steel scrap in 1964 (Archives New Zealand, 1965). In 1966, New Zealand Steel Limited started construction of a steel mill at Glenbrook, around 60 km south of central Auckland (NZ Steel, 2026; Templeton, 2009). The mill is sited near to the ironsand deposits at Waikato North Head, but it initially imported steel coil for galvanising while its ironmaking and steelmaking stages were developed and installed. Installation of the ironmaking phase (direct reduced iron produced in rotary kilns with electric melters) and steelmaking (initially using EAFs) was completed by late 1969, with commercial production taking place in early 1970 (Auckland Libraries, 2026). This made New Zealand Steel one of the first commercial users of direct reduction technology in the world, following Hylsa in Monterrey, Mexico in 1957 (Hylsa, 1997) and the first commercial Midrex plant in Portland, Oregon in 1969 (Kopfle & Griscom, 2019).

The 1980s saw considerable expansion of New Zealand Steel into the country's only fully integrated steelworks. The EAFs were replaced by an oxygen-blowing furnace (Klöckner Oxygen Blown Maxhütte, or KOBM) and the production line expanded to include a continuous slab caster, a hot strip mill and a cold strip mill (NZ Steel, 2026). Unlike a conventional BOF, which blows oxygen from the top only, a KOBM furnace blows oxygen from both the top and bottom, making it better able to handle the high titanium and vanadium content found in New Zealand ironsand.

When both New Zealand Steel and Pacific Steel were operating at their full capacities, New Zealand produced up to 900,000 tonnes of crude steel per annum (Figure 2-2): ~650,000 tonnes from New Zealand Steel (all from ironsand) and ~250,000 tonnes from Pacific Steel (all from steel scrap). That changed in 2014 when New Zealand Steel's parent BlueScope Steel purchased Pacific Steel from Fletcher Building, decommissioning Pacific Steel's aging EAF in 2015 and instead supplying the plant from a new billet caster installed at New Zealand Steel in Glenbrook. This reduced domestic crude steel production capacity to approximately 650,000 tonnes per year from 2016.

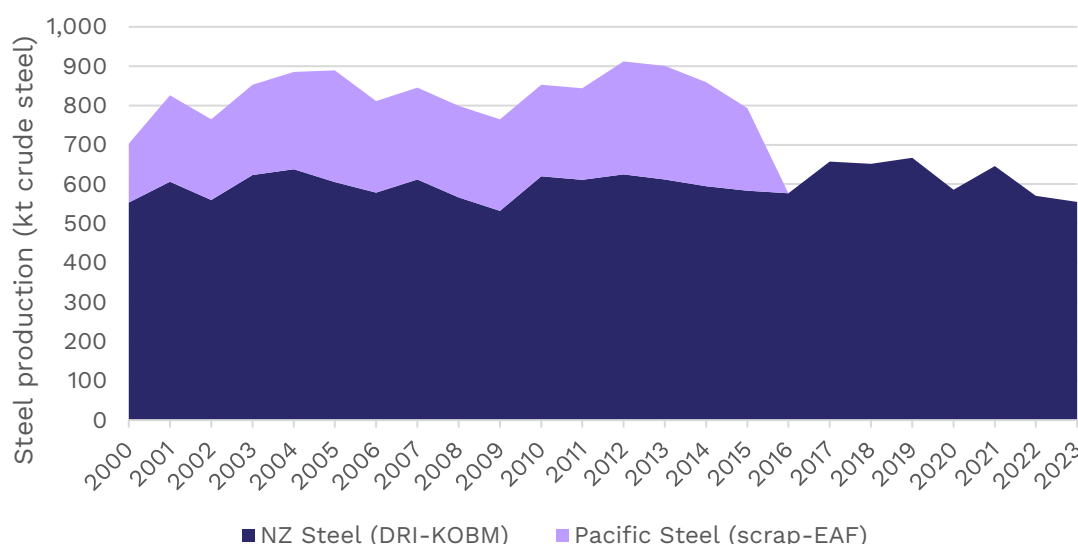


Figure 2-2: Crude steel production in New Zealand 2000–2023
[data sources: (worldsteel, 2010; 2018; 2024)]

A further change is taking place in 2026, with New Zealand Steel's oxygen-blowing furnace being decommissioned and replaced by an EAF. This allows New Zealand Steel to replace approximately half of its iron feed with around 300,000 tonnes of steel scrap – similar to the amount of scrap used by Pacific Steel when their EAF was operational.

2.6. Steel consumption in Aotearoa New Zealand

Most of the steel consumed in New Zealand arrives as part of the products we import from overseas, including vehicles, appliances and furniture. In the baseline year (c. 2020, considering the years 2018–2022), New Zealand consumed approximately 1,700 kt of finished steel products, of which roughly 900 kt were embedded in products (Figure 2-3). The remaining 800 kt was made up of ~580 kt of domestically manufactured finished steel products and ~220 kt (net) of imported finished steel products. (The mass of finished steel differs from the mass of crude steel because it accounts for manufacturing losses.) The large dip in steel consumption in 2009 was caused by the Global Financial Crisis.

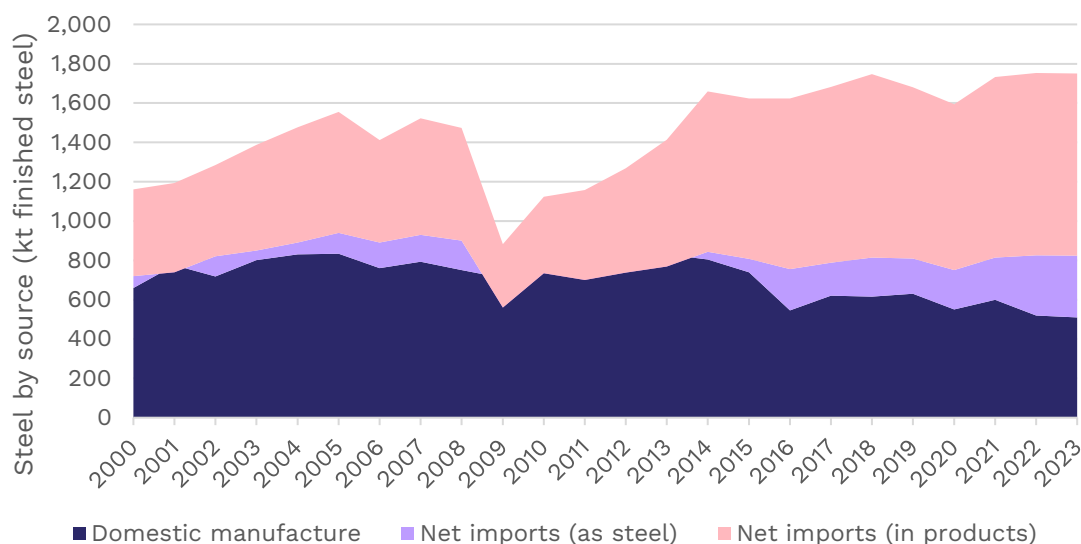


Figure 2-3: Steel manufacture and trade (finished steel)
 [data sources: (worldsteel, 2013; 2018; 2024); steel in products interpolated for 2020-2023]

2.7. The carbon footprint of steel

The carbon footprint of crude steel in 2024 was 2.18 kg CO₂e/kg (worldsteel, 2026a). This is a weighted average of global production, with primary steel (via the BF-BOF route) having a carbon footprint of 2.66 kg CO₂e/kg (ibid.) and secondary steel (via the scrap-EAF route) having a carbon footprint of 0.71 kg CO₂e/kg (ibid.). Finished products have a higher carbon footprint due to additional processing steps, with most having a carbon footprint less than 4 kg CO₂e/kg.

Steel in New Zealand had a different baseline carbon footprint due to the very different nature of domestic steelmaking. This is illustrated in section 5.2.

3. The life cycle of steel

The life cycle of primary steel products starts with the extraction of iron ore from the Earth's crust. This ore is converted first into metallic iron and then to steel. The crude steel is cast into a large shape, typically a billet, bloom or slab. Billets and blooms are manufactured into long products (e.g., bars), while slabs are manufactured into flat products (e.g., sheets). These bulk products are then further manufactured into finished products, such as coated steel cladding. These steel products are then typically incorporated into other assets, such as buildings, bridges, cars and home appliances.

The life of steel in use depends heavily on the application. Steel cans used as packaging typically have a short life measured in months or years. On the other hand, steel in buildings or infrastructure typically lasts many decades if properly protected from corrosion. Once a steel asset reaches its end of life, the steel within it can either be reused directly, or recycled into new steel products. Within New Zealand, around 85% of all steel is recovered for recycling or reuse (Soo, et al., 2021).

The life cycle of secondary (recycled) steel starts with steel scrap. This scrap is remelted in a furnace to make new steel products, eliminating the need for primary iron from iron ore. However, while certain products can be made from 100% scrap, there will always be a need for some virgin iron to help balance out impurities introduced through recycling.

The life cycle of steel is commonly broken down into five stages, which are further broken down into modules. This terminology comes from European standards EN 15978 (CEN, 2011; 2026) and EN 15804 (CEN, 2021) and international standard ISO 21930 (ISO, 2017).

These life cycle stages/modules relate to the life cycle of the building or infrastructure asset where the steel is used, not the life cycle of the steel itself. Steel can be reused and recycled many times and steel members can outlast the structure of which they are a part.

The stages and modules are:

- **Product stage (modules A1-A3):** Raw material is either extracted from the Earth's crust (as iron ore) or recovered (as steel scrap) (module A1). It is then transported to a manufacturing site (module A2) and manufactured into a finished product (module A3).
- **Construction process stage (modules A4-A5):** Steel is transported to the construction site (module A4) and then fixed into place (module A5).
- **Use stage (modules B1-B7):** Maintenance of steel products (modules B2 to B3) and replacement of any steel products that fail (modules B4 to B5). Direct emissions (B1) and energy/water-related emissions (B6 and B7) are not relevant to steel products.
- **End-of-life stage (modules C1-C4):** Decommissioning the building/infrastructure asset (module C1), transport of materials to off-site recovery (module C2), recovery for reuse and recycling (module C3) and disposal of what cannot be recycled (module C4).
- **Future product life cycles (module D):** Reuse and recycling offset the need for virgin iron/steel production for future buildings, infrastructure or other products.

3.1. Iron ore extraction

There are several naturally occurring minerals high in iron (Ramanaidou & Wells, 2014):

- Magnetite (Fe_3O_4 , with 72% Fe)
- Hematite (Fe_2O_3 , with 70% Fe)
- Goethite ($\text{FeO}(\text{OH})$, with 63% Fe)
- Limonite ($\text{FeO}(\text{OH}) \cdot n(\text{H}_2\text{O})$, with 55% Fe)
- Siderite (FeCO_3 , with 48% Fe).

Magnetite and hematite are the minerals primarily used to manufacture metallic iron due to their relatively high iron content and ease of processing in conventional furnaces.

Today's commercial iron ores have high iron content relative to other metal ores, with 60-66% iron content common in the ore body (see Table 3-1).

The major suppliers of iron ore are Australia (38%), primarily from the Pilbara region, and Brazil (17%), primarily from the states of Pará and Minas Gerais (see Table 3-1). The Carajás Mine in Pará, Brazil is the world's largest iron ore mine and also produces some of the highest-grade ore, with iron content of nearly 66% (Mining Technology, 2020).

Table 3-1: Largest producers of iron ore in 2023, from (Tuck, 2024)

Country	Production (kt)	Iron content (kt)	Share of production	Iron content
Australia	960,000	590,000	38%	61%
Brazil	440,000	280,000	17%	64%
China	280,000	170,000	11%	61%
India	270,000	170,000	11%	63%
Russia	88,000	58,000	3%	66%
Iran	77,000	50,000	3%	65%
Canada	70,000	42,000	3%	60%
South Africa	61,000	39,000	2%	64%
Kazakhstan	53,000	8,800	2%	17%
United States	44,000	28,000	2%	64%
Sweden	38,000	27,000	1%	71%
Ukraine	36,000	22,000	1%	61%
Peru	19,000	13,000	1%	68%
Chile	18,000	11,000	1%	61%
Turkey	17,000	10,000	1%	59%
Mauritania	13,000	8,100	1%	62%
Mexico	12,000	7,600	0%	63%
Other countries	48,000	27,000	2%	56%
Total	2,544,000	1,561,500	100%	61%

While Aotearoa New Zealand does not have significant deposits of hard rock iron ores, we do have significant black sand (ironsand) on the west coast of the North Island. This black sand is titanomagnetite. It covers nearly 800 km of coastline and is the result of the erosion of an estimated 39 Gt of volcanic material (Brathwaite, et al., 2017), making it a significant reserve. After concentration, ironsand contains around 79% iron oxides (magnetite and hematite), together with smaller amounts of titanium dioxide (TiO_2), vanadium(III) oxide (V_2O_3), magnesium oxide (MgO), manganese(II) oxide (MnO), alumina (Al_2O_3) and silica (SiO_2) (Brathwaite, et al., 2017). This gives it an iron content of around 55-57%, which is low compared to ore bodies elsewhere in the world (see Table 3-1).

Iron ore is typically mined in open pits (due to their comparatively low cost), though it can also be mined underground. The process is similar to hard rock quarrying, with explosives used to fracture the rock and excavators used to load the ore into haul trucks before it can be crushed and screened (Farjana, et al., 2019). Lower grade magnetite ores (which are naturally magnetic) may also be magnetically separated to increase iron concentration. Low-grade fines can be sintered or pelletised to create hardened pellets that can then be used in blast furnaces. In New Zealand, ironsand is extracted from deposits (typically beaches) using excavators, with magnetic separation to concentrate the iron. Iron ore mining relies primarily on diesel (for heavy vehicles) and electricity (for crushing, grading, screening, magnetic separation and conveying). It contributes only a very small share of the total carbon footprint of a steel product.

3.2. Ironmaking

As of 2026, most of the world's iron ore is converted to primary iron using one of two methods:

1. The blast furnace (BF), a liquid phase process using a vertical shaft furnace.
2. Direct reduced iron (DRI) using either the MIDREX or ENERGIRON process, both solid-state processes using a vertical shaft furnace.

Many novel types of DRI are also currently being developed to try to reduce the GHG emissions from ironmaking, as described in section 3.2.2.

3.2.1. Blast furnace (BF)

The blast furnace is the dominant method for ironmaking globally (worldsteel, 2025). It uses iron ore, coking coal and limestone to produce pig iron (see Figure 3-1). The furnace gets its name from the high-pressure “blast” of hot air and oxygen that is forced into the lower part of the furnace to combust coke and drive the chemical reduction of iron ore (iron oxide) to liquid iron (also known as hot metal).

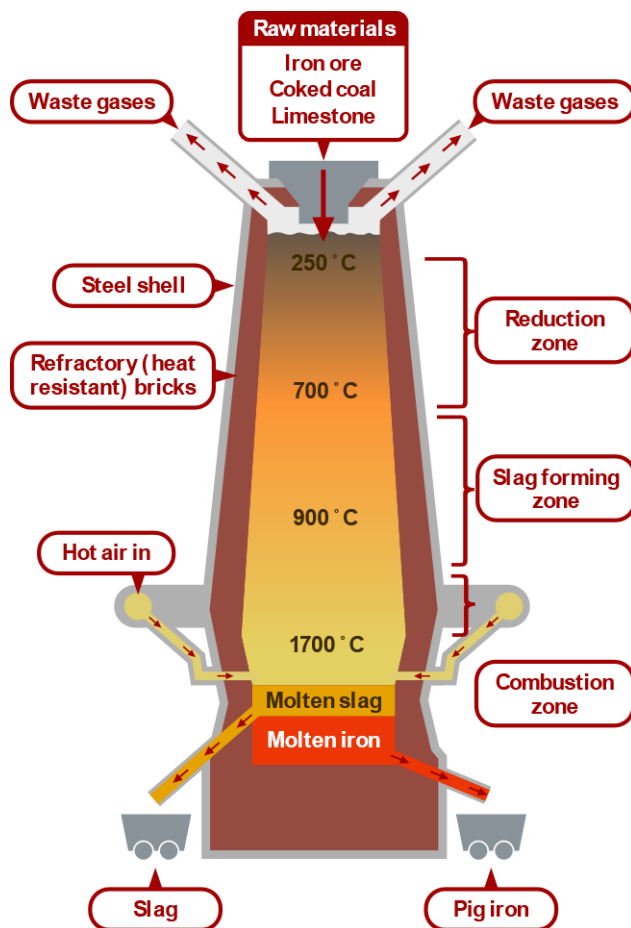


Figure 3-1: Blast furnace (Brunning, 2025)

A blast furnace is a type of vertical shaft furnace where input material is fed in the top and descends to the bottom under the force of gravity. The temperature inside the furnace gets hotter closer to the bottom, with solid material entering at the top and molten iron and slag tapped off the bottom.

Blast furnaces can be tuned to manage a wide range of iron ore types, including those with relatively low iron content (~60%). Limestone is added as a flux, reacting with impurities like silica and alumina (collectively known as gangue) to form slag. More impurities means more limestone and more slag – the process becomes less efficient, but it still works. This is significant because many DRI processes (e.g., MIDREX) require high-grade ore with a purity of at least 67% (Nicholas & Basirat, 2022). And there is only a limited supply of iron ore of this quality available globally – currently making up only 4% of global supply (ibid.).

Pig iron from a blast furnace is typically fed into a basic oxygen furnace to produce steel, creating the BF-BOF process that collectively accounted for 70% of all steel production in 2023 (worldsteel, 2025). The offgases from the chemical reactions in the blast furnace are typically combusted to help provide heat and power for integrated steelworks.

3.2.2. Direct reduced iron (DRI)

DRI is the collective term for a range of different technologies that reduce iron ore to metallic iron in a solid state (i.e., without melting it). These technologies typically produce sponge iron, a material covered in tiny holes that looks and behaves like a sponge. Sponge iron is then typically fed into an EAF to produce steel.

Current DRI technologies include:

- **Gas DRI:** This is the most common type currently on the market. The main furnace technologies are MIDREX and ENERGIRON, which use a vertical shaft furnace and syngas (a mixture of hydrogen and carbon monoxide, typically produced from reformed natural gas) to reduce iron ore pellets to sponge iron (Figure 3-2).
- **Hydrogen DRI:** Like gas DRI, but uses pure hydrogen instead of syngas, resulting in only water vapour (and no carbon dioxide) in the exhaust gas. This technology is currently in its infancy, with only small-scale plants in operation as of early 2026. In Europe, hydrogen DRI is being explored in Sweden, Germany, Finland, Spain and France (Burfurd, et al., 2025). Well-known examples are the HYBRIT (European Commission, 2022) and Stegra (2026) projects in Sweden, though Stegra faced significant financial hurdles in 2025 (Vikström & Connolly, 2025). China also has several small-scale plants that were starting to scale up production as of 2025 (Kaufman, 2025). Most of these plants use variants of MIDREX and ENERGIRON gas DRI. As with any hydrogen-based technology, the potential to reduce GHG emissions depends on the “greenness” of the hydrogen, with the lowest GHG variant being hydrogen produced by electrolysis of water using 100% renewable electricity.
- **Coal DRI:** Uses conventional thermal coal (not metallurgical/coking coal) in rotary kilns to reduce iron ore. Currently in use in India and New Zealand, but the most GHG intensive form of DRI due to the use of coal as the reducing agent.

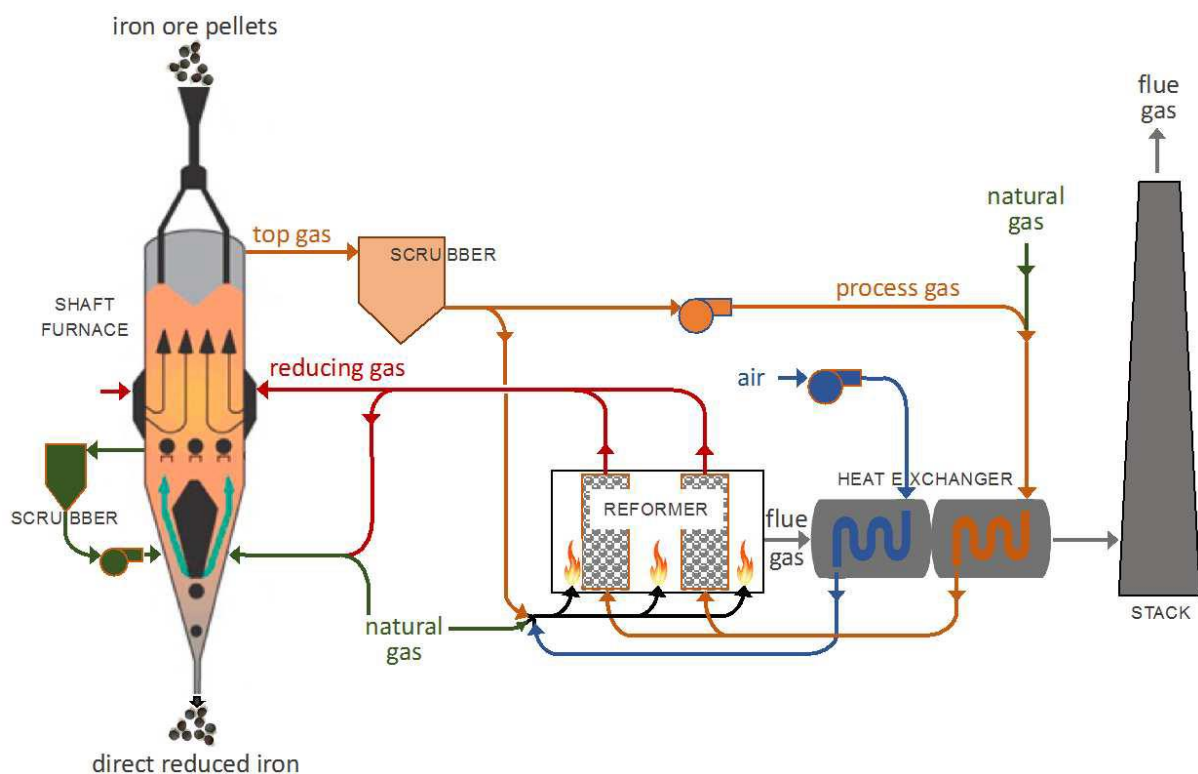


Figure 3-2: DRI from natural gas using the MIDREX process (Hamadeh, et al., 2018)

Most DRI processes use high quality iron ores, with iron content of 67% or above (Nicholas & Basirat, 2022). This is because DRI does not remove impurities and EAFs are not designed to handle large volumes of slag. When low-grade ores are used in an EAF, the furnace also needs to melt the impurities, slowing processing times and requiring more electricity and lime (ibid.).

One solution to this problem is to use an intermediate smelter between ironmaking (DRI) and steelmaking (either EAF or BOF) (Fleischanderl & Wimmer, 2023; Mendoza, et al., 2026). The smelter takes the reduced iron from the DRI process, melts it and removes impurities as slag, producing a high-quality liquid iron (like that from a BF) that can then be fed into an EAF. This process has been used at New Zealand Steel since the 1980s, where their rotary kilns produce reduced iron that is fed into smelters (called “Melters” at NZ Steel) and then into their oxygen-blowing furnace (called a “KOBM” at NZ Steel). Globally, Hismelt and Hlsarna are the most well-developed of this technology type (Burfurd, et al., 2025).

Other solutions exist, though most are still in early stages of development. Most of these technologies are designed explicitly to deal with lower grade iron ores and/or iron fines (rather than lumpy or pelletised ores). Conventional MIDREX and ENERGIRON processes use vertical shaft furnaces, which – like blast furnaces – require their feedstock to be lumpy or pelletised and do not work with powdered ores (Burfurd, et al., 2025).

Examples of novel DRI technologies include:

- **Fluidised bed reactors:** These reactors use powdered iron ore or ironsand as their feedstock and use pressurised gas to make the powder behave as if it were a fluid. Examples include HYFOR (Primetals, 2026), Circored, Finored and HyREX (Burfurd, et al., 2025). Where the reductant gas in the fluidised bed is green hydrogen, these reactors produce iron with very low GHG emissions. In New Zealand, Victoria University of Wellington has successfully trialled hydrogen DRI using a fluidised bed reactor starting from New Zealand ironsand (Prabowo, et al., 2019). This technology is now being commercialised by CullBeck.
- **Flash smelting:** Flash smelting rapidly reacts powdered iron ore with a reductant gas in a heated vessel. Hydrogen is used as a reductant gas, as in all other forms of hydrogen DRI. However, unlike other types of DRI, the hydrogen is used as a reductant only, not combusted or used as a fuel. All heat is supplied by the heated vessel. The best-known example is Calix’s ZESTY process where the vessel is electrically heated (Calix, 2024). This has two advantages: (1) it reduces hydrogen demand, and (2) it allows the process to start up and shut down rapidly – an important feature when powered from renewable electricity (ibid.).
- **Iron electrolysis:** Electrolysis is an electrochemical process, making it very different to all other technologies described above. Iron ore is either dissolved in a chemical bath to create an electrolyte solution or melted to create molten oxide salts. A direct current is then applied to split the oxygen off the iron oxides. Companies developing electrolysis processes include Boston Metal, Helios, Electra, Element Zero and Fortescue Metals Group (Burfurd, et al., 2025). The GHG emissions of the process depends on the chemical solution used, the operating temperature and the source of energy used to produce the chemicals and thermal energy. Molten oxide electrolysis operates at temperatures of around 1600°C (West, 2020), requiring significant thermal energy. However, low-temperature processes also exist.

Possible pathways for low GHG emissions ironmaking and steelmaking technologies are shown below in Figure 3-3.

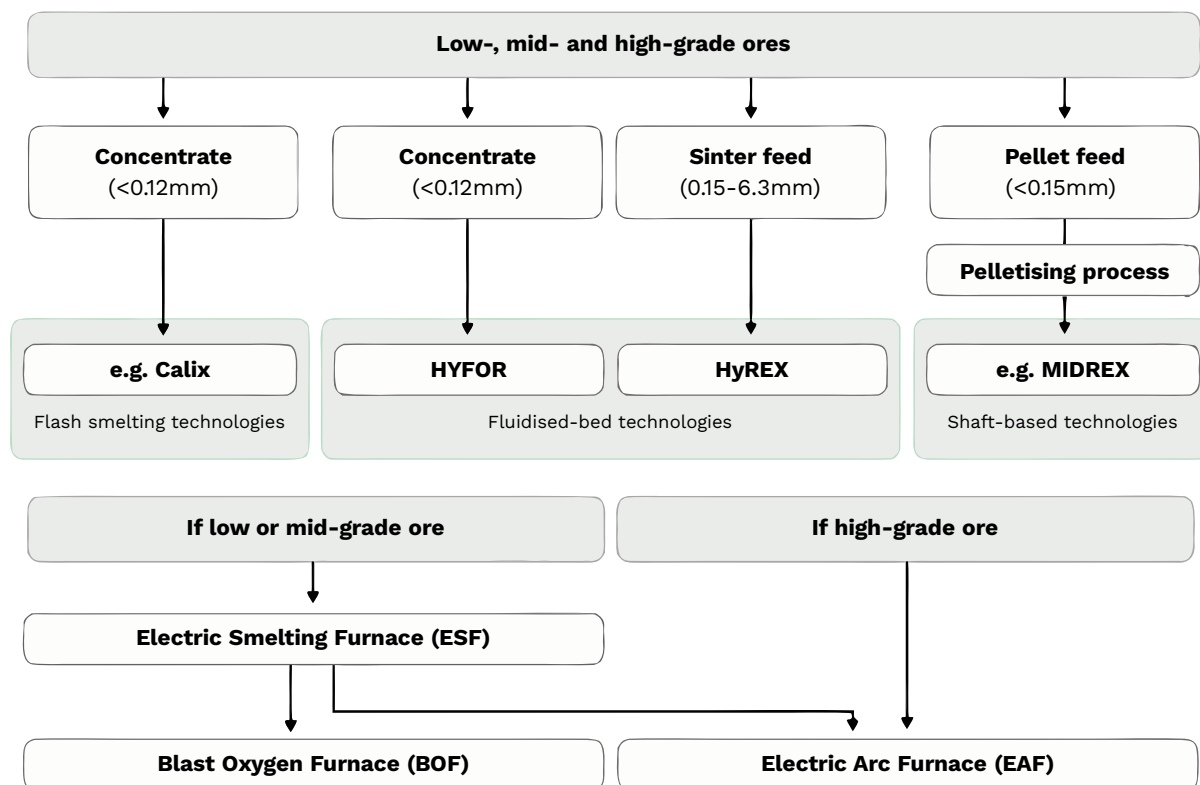


Figure 3-3: Low-GHG ironmaking and steelmaking pathways available for different ore grades (Burford, et al., 2025, after Primetals Technologies, 2024)

3.3. Steelmaking

As of 2026, most of the world's steel is manufactured using one of two methods (worldsteel, 2025):

1. The basic oxygen furnace (BOF), which takes liquid iron as an input and uses solid steel scrap as a cooling agent. Most BOF steel comes from primary iron, making it primary steel.
2. The electric arc furnace (EAF), which may use any combination of steel scrap and primary iron. Most EAF steel comes from steel scrap, making it secondary steel.

3.3.1. Basic oxygen furnace

A basic oxygen furnace is a vessel used to convert molten iron to molten steel. The BOF is first charged with molten iron, usually from a blast furnace, along with steel scrap and lime/dolomite. The steel scrap is added as a cooling agent to control the temperature inside the vessel. The lime/dolomite removes impurities. A lance is then lowered into the furnace from the top and oxygen is blown at high speed over the surface of the molten metal. The oxygen reacts with the carbon and other impurities in the molten metal, forming gases (like carbon monoxide and carbon dioxide) and solids (like SiO_2) that form a protective slag over the melt. These oxidation reactions are exothermic, keeping the metal in a molten state. During this process, carbon is reduced from around 4% to around 0.5% (ArcelorMittal, 2026). The waste gases are captured and combusted for heat and power generation. Depending on the grade of steel required, other alloying elements may be added. Once the steel is ready, it is tapped from the vessel into a ladle ready for casting. The slag is also tapped off.

3.3.2. Electric arc furnace

An electric arc furnace is a vessel used to convert recycled steel scrap – and often some primary iron – to molten steel. The EAF is first charged with solid steel scrap, along with lime/dolomite and carbon additives. The steel scrap serves as the primary iron source to eliminate the need for liquid pig iron. The lime/dolomite removes impurities. Graphite electrodes are then lowered into the furnace from the top and high-voltage electric current is discharged, forming intense arcs through the scrap. The electrical energy, along with supplemental oxy-fuel burners, generates high temperatures that melt the metal from within. Carbon reacts with oxygen and impurities in the charge, forming gases (like carbon monoxide) and slag, which forms a protective layer over the melt. It is an energy-intensive process that operates primarily on electrical power rather than exothermic chemical heat. During this process, carbon levels and trace impurities are continuously adjusted to meet target specifications. The offgases are captured and treated through dust collection systems to recover energy and filter particulates. Depending on the grade of steel required, other alloying elements may also be added. Once the steel is ready, it is tapped from the vessel into a ladle ready for secondary refining or casting. The slag is also tapped off.

3.3.3. Crude steel production

After the primary melting vessel (BF/BOF or EAF), hot metal is tapped into a secondary refining vessel, often a ladle metallurgy furnace (LMF). The LMF adds alloying elements such as ferromanganese and ferrosilicon to create the desired alloy composition.

From the LMF, the hot metal is either set to a billet caster (for long products), a slab caster (for flat products) or a bloom caster (for structural sections and rail tracks). Billet, slabs and blooms are the final stage of crude steel production and the start of steel product manufacturing.

3.3.4. Steel product manufacturing

The crude steel then follows one of several different pathways to be made into a finished product, as illustrated in Figure 3-4.

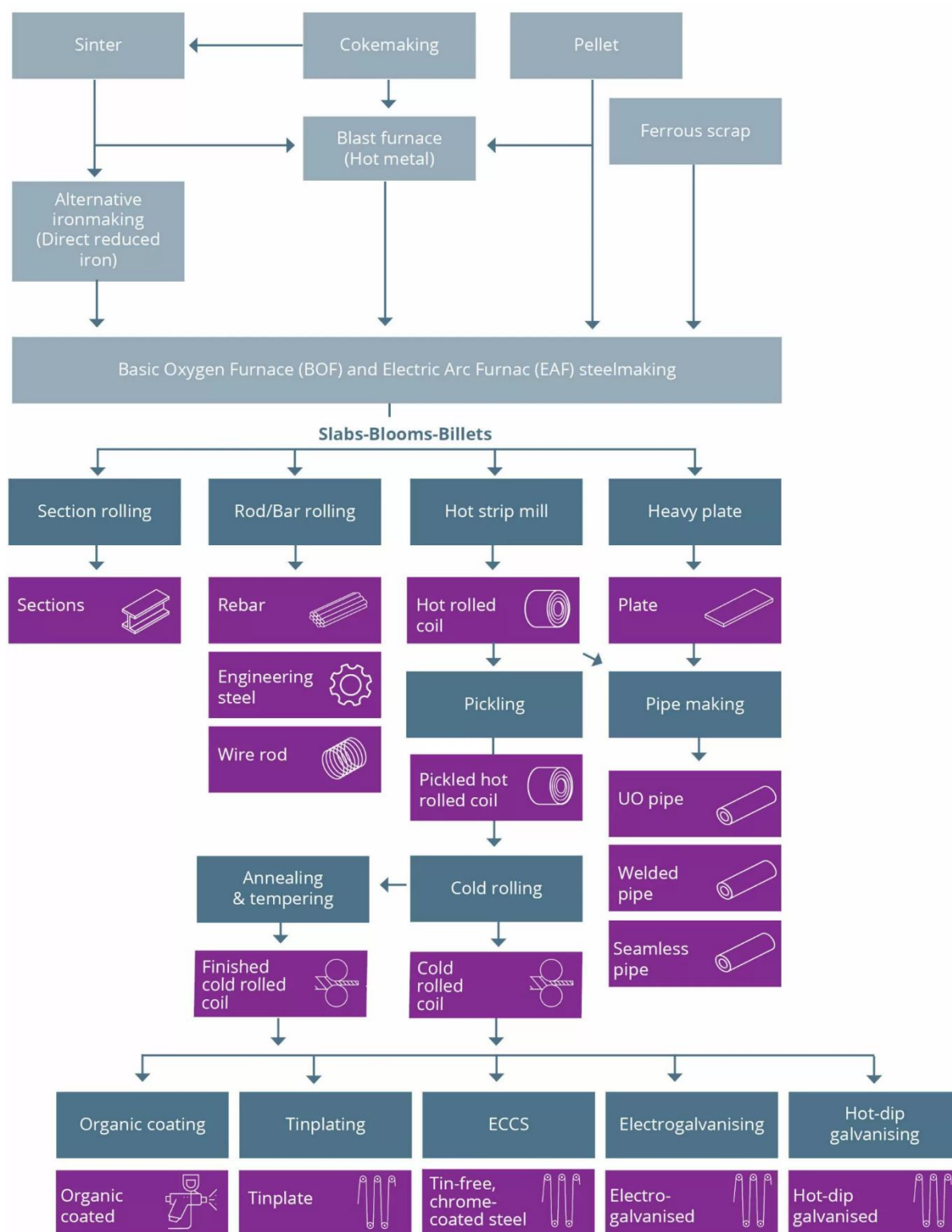


Figure 3-4: Steel product manufacturing overview (worldsteel, 2026b)

4. Method

This project started in March 2025 and led to the launch of the roadmap on 21 April 2026.

The process followed was:

- Desktop research to help establish a baseline and identify key levers for decarbonisation within the iron and steel industry.
- Workshops with industry to further elaborate the baseline, agree on the key levers available and agree on the level of decarbonisation possible decade by decade to 2050.
- Detailed modelling of the baseline and decarbonisation trajectories.
- Drafting the decarbonisation pathway and roadmap.
- Working with industry to refine and agree the content of the roadmap.
- Peer review of the modelling and roadmap.

4.1. Desktop research

This roadmap builds on work done by others, notably the International Energy Agency's "Iron and steel technology roadmap" (IEA, 2020), Mission Possible Partnership's "Making net-zero, 1.5°C-aligned steel possible" (MPP, 2022) and worldsteel's extensive data.

Infographics from MPP (Figure 4-1, Figure 4-2 and Figure 4-3) were used to help guide conversations in the workshops described in the next section.

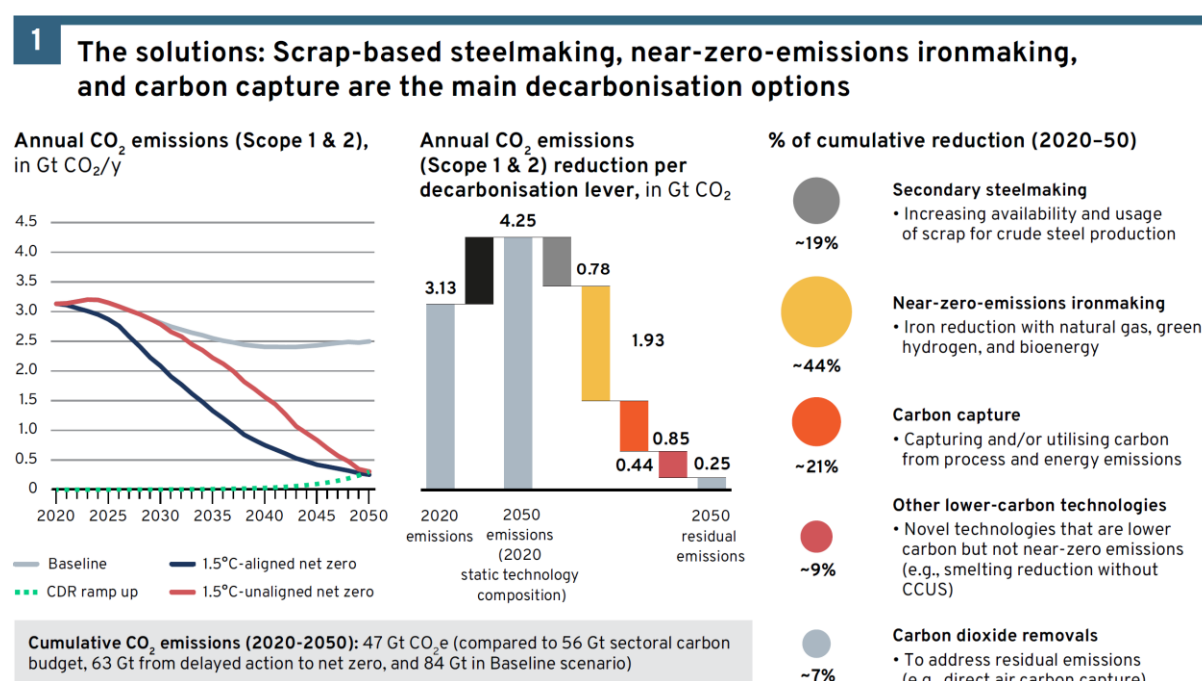
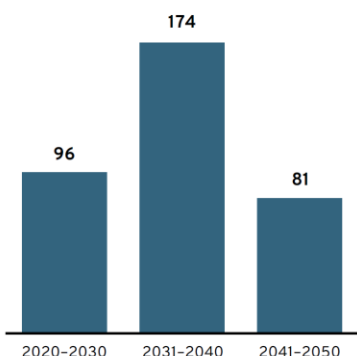


Figure 4-1: MPP's decarbonisation pathway (MPP, 2022)

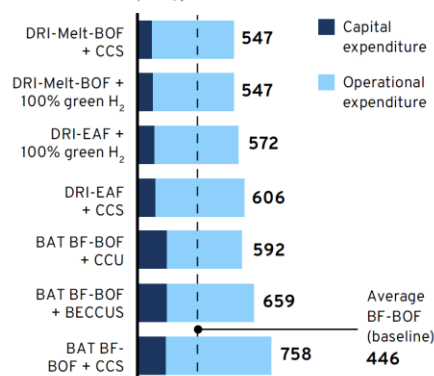
2 What it will take

Additional investments to get to net zero, additional annual capital investments (compared to a Baseline scenario), \$ billion

90%+ of investments required for supporting energy and carbon infrastructure



Additional production costs to get to net zero, levelised cost of steel in 2050, in \$/tonne of crude steel*



Despite higher production costs, impact on the cost of final consumer goods will be manageable (<3%).

* Assumes a greenfield plant with a production capacity of 2.5 Mt/y operating at 80% utilisation.

Resource requirements, share of annual global demand by 2050

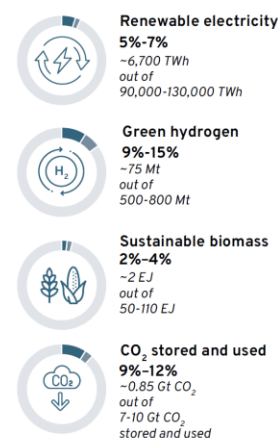


Figure 4-2: MPP's analysis of the investment required to reach net-zero GHG steel (MPP, 2022)

3 Key milestones

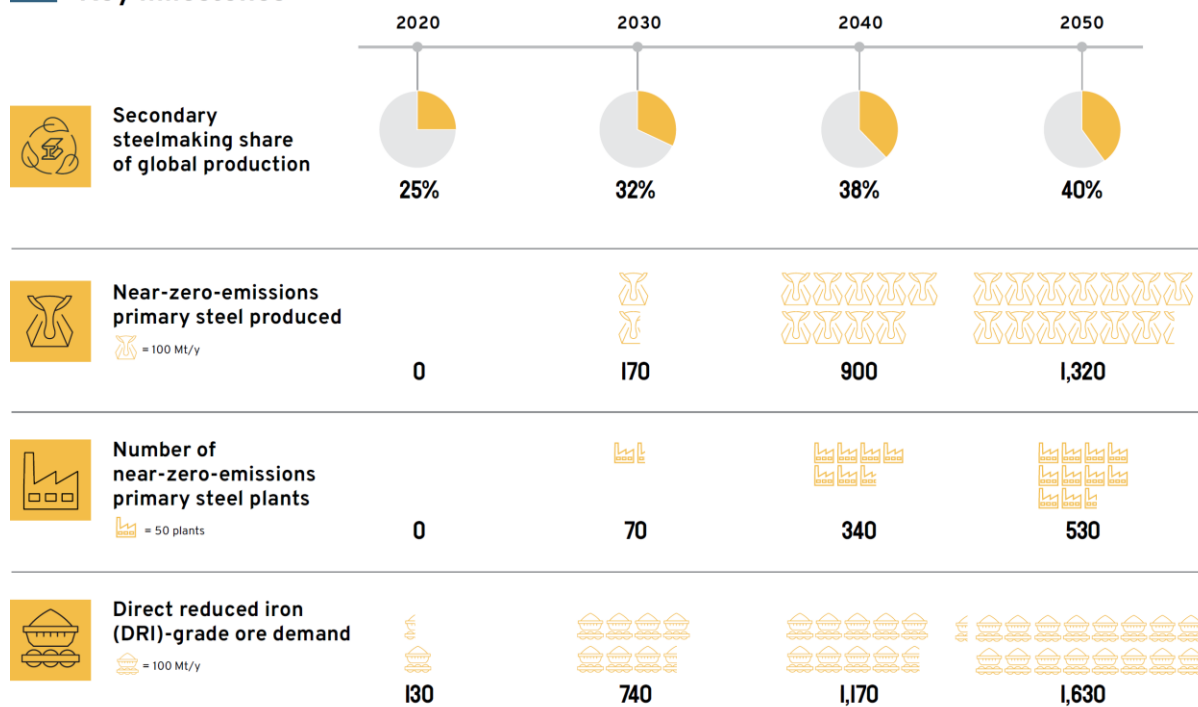


Figure 4-3: MPP's key milestones by decade from 2020 to 2050 (MPP, 2022)

4.2. Workshops

Workshops were held to:

- present initial research
- seek feedback on calculated steel flows for the baseline year
- assess the feasibility of different emissions reduction strategies.

Eight workshops were run in June and July 2025, grouped by different types of organisations in the steel value chain:

- importers of unprocessed steel products and structural steel
- domestically produced steel
- reinforcing steel producers
- roll-formed steel and light steel framing
- semi-finished steel products
- stainless steel
- end users (specifiers, architects, engineers and academics)
- steel recyclers.

Most workshops were run in person at HERA House in Manukau, Auckland. The domestic steelmaking workshop was run at New Zealand Steel in Glenbrook, Auckland. The workshops for stainless steel, end users and recyclers were all run online.

Targeted follow-ups were conducted to fill data gaps and refine modelling assumptions.

An important comment raised in several workshops was that New Zealand imports a significant share of its steel yet is buying at low volumes by global standards. While importers can set GHG intensity targets, they can't meaningfully influence decarbonisation technology choices as they don't have enough buying power. As a result, there is no need for importers to try to "pick a winner" among decarbonisation technologies. They can simply work with any manufacturer who is able to meet their GHG, price, quality and reliability requirements.

4.3. Modelling

The modelling approach was goal-oriented: the aim was to achieve direct and energy-related emissions reductions of over 90% by 2050 from a 2020 baseline, without the use of carbon offsets. A backcasting approach was used, starting from the desired state (i.e., >90% reduction in GHG emissions by 2050) and working backwards to determine the steps necessary to achieve that state.

The modelling assumes that, for the roadmap to be economically sustainable, emissions reductions must be achieved through lower emissions per tonne of steel and reduced material demand per item, not through reduced economic activity. As such, the modelling assumes that steel demand would grow in line with population growth if no interventions were made. Background data used in the model are presented in Annex A.

Modelling was done in Microsoft Excel based on life cycle inventory (LCI) data for each process stage. The LCI data can be found in Annex C. This approach was used to allow energy mixes to be adjusted over time.

Two different system boundaries were applied:

- **Direct and electricity-related emissions** from ironmaking, steelmaking and steel fabrication. These are the emissions the steel industry most directly influences and this approach best aligns with other decarbonisation roadmaps globally.
- **A full life cycle view**, including indirect emissions like raw material extraction, coatings, transport and end-of-life processing. This approach was designed to align with the scope of Environmental Product Declarations (EPDs).

The life cycle emissions system boundary includes modules A1-A5 and C1-C4 but excludes modules B1-B7 and D. Modules B1-B7 are excluded because they are (a) highly context-specific and (b) expected to be relatively small at the national scale. Module D is excluded because it represents an avoided impact (i.e., a credit), which is already captured at the national scale in modules A1-A3 through the increased use of steel scrap in EAFs.

A summary of the inclusions and exclusions in each case is presented in Table 4-1.

Table 4-1: Comparison of the two system boundaries used in this study

Emissions source	Direct and electricity-related	Life cycle
Direct and electricity-related emissions from ironmaking, steel recycling, steelmaking and steel fabrication	✓	✓
The electricity required to produce green hydrogen and pure gases (e.g., oxygen and nitrogen)	✓	✓
Production of upstream raw materials (e.g., iron ore and coal)	✗	✓
Production of alloying elements	✗	✓
Production of coatings (metals, paints)	✗	✓
Transport at all stages (upstream raw materials, finished products and scrap)	✗	✓
Demolition/deconstruction of buildings and infrastructure assets to recover steel scrap	✗	✓
Manufacture of capital goods	✗	✓ (electricity only)
Maintenance of steel in use	✗	✗
Indirect emissions due to downstream use of sold products (e.g., steel in vehicles)	✗	✗
Impacts related to employees, e.g., employee commuting and business travel	✗	✗

4.4. Roadmap drafting and review

The first draft of the roadmap was completed in early October 2025. It was then iterated with the project steering group before being distributed to all participants from the workshops for feedback in November and December 2025. A revised version was prepared in February 2026 to account for this feedback. This was then peer reviewed by Jill Cooper in February 2026, revised and reviewed again in April 2026 prior to publication. Graphic design took place in March and April 2026. Peer review only took place on the roadmap and underlying calculations and not on this supporting technical report.

5. Defining a baseline

The baseline year is designed to reflect typical material flows around the year 2020, excluding the disruption caused by the Covid-19 pandemic. It was calculated as an average of the calendar years 2018, 2019, 2021 and 2022.

The carbon footprint in the baseline year was calculated as follows:

1. Determine steel flows in the reference year
2. Calculate emissions per type of steel flow in the reference year
3. Multiply and sum to calculate base year emissions

5.1. Determine steel flows in the reference year

thinkstep-anz initially calculated steel product flows for all major steel product categories where steel is the main material (e.g., a steel beam) rather than a component part (e.g., a refrigerator that contains steel). The initial table was compiled from bottom-up estimates of material flows (Dixon & Vickers, 2022), import/export statistics (using harmonised trade statistics at the HS10 level from Stats NZ) and estimates for domestic production. The table was refined and updated through the workshops, resulting in Table 5-1.

Table 5-1: Steel flows in the baseline year, by end use (approximate)

Steel use	Mass (kt)
Heavy structural	150
Light structural	40
Reinforcing	200
Roofing and cladding	150
Hollow sections, pipes & tubes	50
Fasteners	30
Fencing wire	30
Cables & chains	10
Scaffolding	10
Rail track	5
Oil & gas	20
Manufacturing	75
Miscellaneous	10
Stainless steel	20
Total	800

These steel product flows were then recategorised by the type of steel product they are manufactured from and scaled to “apparent steel use (finished steel products)” for New Zealand of 816 kt from worldsteel. This is calculated as the average of 815 kt in 2018, 810 kt in 2019, 815 kt in 2021 and 825 kt in 2022 (worldsteel, 2024). This analysis is presented in Table 5-2.

Table 5-2: Steel flows in the baseline year, by type of steel (approximate)

Steel product	Mass (kt)
Sections, hot rolled	129
Sections, welded	16
Sections, hollow, small	42
Sections, hollow, large	33
Plate	30
Sheet, galvanised	97
Sheet, coated	153
Long, reinforcing	204
Long, other	10
Wire	41
Fasteners	31
Cast	11
Stainless steel	20
Total	816

5.2. Calculate emissions per type of steel in the reference year

Emission factors were calculated independently for crude steel (Table 5-3) and for finished steel (excluding crude steel; see Table 5-4) in the baseline year. The two were summed to calculate finished steel emission factors (Table 5-5). In these tables “Scope 1” refers to direct emissions, “Scope 2” refers to electricity-related emissions and “Scope 3” refers to upstream emissions, such as mining and transportation.

All emissions in Table 5-4 were calculated from the LCI data in Annex C.

Totals in these tables may not sum due to rounding.

Table 5-3: Emission factors per kg of crude steel in the baseline year

Steelmaking technology	Scope 1 (kg CO ₂ e/kg)	Scope 2 (kg CO ₂ e/kg)	Scope 3 (kg CO ₂ e/kg)	Scope 1-3 (kg CO ₂ e/kg)	Description	Source
NZ-DRI(C)-KOBM	3.22	0.10	0.31	3.63	Ironmaking and steelmaking in New Zealand. DRI with carbon (from coal) as a reductant. Steelmaking using an oxygen-blowing furnace (KOBM). This was the process in place at NZ Steel until late 2026.	Calculated from LCI based on public data
NZ-DRI(C)/Scrap-EAF	1.65	0.16	0.24	2.05	Ironmaking and steelmaking in New Zealand. Iron sources: DRI with carbon (from coal) as a reductant + scrap steel. Steelmaking using an EAF. This is the process being installed at NZ Steel in 2026.	Calculated from LCI based on public data
NZ-DRI(H₂)/Scrap-EAF	0.06	0.35	0.28	0.69	Ironmaking and steelmaking in New Zealand. Iron sources: DRI with green hydrogen (from renewable electricity) as a reductant + scrap steel. Steelmaking using an EAF. This is one possible future process for NZ Steel, though various other options exist.	Calculated from LCI based on public data
Imp-BF-BOF	1.20	1.00	0.46	2.66	Ironmaking and steelmaking offshore and imported into New Zealand. Ironmaking using the BF route. Steelmaking using the BOF route. No CCUS.	Scope 1 & 2 and electricity from IEA (2020). Iron and Steel Technology Roadmap. International Energy Agency. Scope 3 from worldsteel (2026). Sustainability Indicators Report 2025. World Steel Association.

Steelmaking technology	Scope 1 (kg CO ₂ e/kg)	Scope 2 (kg CO ₂ e/kg)	Scope 3 (kg CO ₂ e/kg)	Scope 1-3 (kg CO ₂ e/kg)	Description	Source
Imp-Scrap-EAF	0.04	0.26	0.41	0.71	Ironmaking and steelmaking offshore and imported into New Zealand. Iron comes predominantly from scrap (>70%). Steelmaking using an EAF. "Mini mill" technology.	Scope 1 & 2 and electricity from IEA (2020). Iron and Steel Technology Roadmap. International Energy Agency. Scope 3 from worldsteel (2026). Sustainability Indicators Report 2025. World Steel Association.
Imp-DRI(C)-EAF	1.00	0.40	0.26	1.66	Ironmaking and steelmaking offshore and imported into New Zealand. Iron comes predominantly from DRI (>70%) using carbon (from natural gas or coal) as a reductant, with some steel scrap (<30%). Steelmaking using an EAF.	Scope 1 & 2 and electricity from IEA (2020). Iron and Steel Technology Roadmap. International Energy Agency. Scope 3 from worldsteel (2026). Sustainability Indicators Report 2025. World Steel Association.
Imp-DRI(H₂)-EAF	0.04	1.64	0.47	2.14	Ironmaking and steelmaking offshore and imported into New Zealand. Iron comes predominantly from DRI (>70%) using hydrogen (from the grid, not all of which is renewable) as a reductant, with some steel scrap (<30%). Steelmaking using an EAF.	Electricity from Bhaskar, A., Assadi, M., Nikpey Somehsaraei, H. (2020). Decarbonization of the Iron and Steel Industry with Direct Reduction of Iron Ore with Green Hydrogen. Energies 13, 758. Other emissions assumed to be the same as the Scrap-EAF.

Table 5-4: Emission factor uplift (excluding crude steel) per kg of finished steel in the baseline year (calculated from LCI)

Product	Region	Abbreviation	Main supply (base year)	Scope 1 (kg CO ₂ e/kg)	Scope 2 (kg CO ₂ e/kg)	Scope 3 (kg CO ₂ e/kg)	Scope 1-3 (kg CO ₂ e/kg)
Sections, hot rolled	GLO	SHR-GLO	EAF	0.087	0.071	0.026	0.184
Sections, welded	NZ	SW-NZ	KOBM	0.100	0.037	0.037	0.175
Sections, welded	GLO	SW-GLO	BOF	0.100	0.075	0.038	0.213
Sections, hollow, small	GLO	SHS-GLO	BOF	0.086	0.272	0.058	0.417
Sections, hollow, large	GLO	SHL-GLO	BOF	0.089	0.139	0.037	0.265
Plate	NZ	P-NZ	KOBM	0.085	0.013	0.021	0.120
Plate	GLO	P-GLO	BOF	0.085	0.049	0.022	0.156
Sheet, galvanised	NZ	SG-NZ	KOBM	0.122	0.090	0.232	0.444
Sheet, galvanised	GLO	SG-GLO	BOF	0.122	0.335	0.239	0.696
Sheet, coated	NZ	SC-NZ-Gas	KOBM	0.298	0.113	0.565	0.976
Sheet, coated	NZ	SC-NZ-Elec	KOBM	0.137	0.181	0.580	0.898
Sheet, coated	GLO	SC-GLO-Gas	BOF	0.298	0.407	0.572	1.277
Sheet, coated	GLO	SC-GLO-Elec	BOF	0.137	0.656	0.593	1.386
Long, reinforcing	NZ	LR-NZ	KOBM	0.081	0.012	0.024	0.117
Long, reinforcing	GLO	LR-GLO	EAF	0.081	0.044	0.025	0.150
Long, other	GLO	LO-GLO	EAF	0.081	0.044	0.025	0.150
Wire	NZ	LW-NZ	KOBM	0.081	0.024	0.030	0.135
Wire	GLO	LW-GLO	EAF	0.081	0.088	0.032	0.201
Fasteners	GLO	F-GLO	EAF	0.163	0.176	0.060	0.398
Cast	GLO	C-GLO	BOF	0.108	0.095	0.193	0.397
Stainless steel	GLO	SSt-GLO	EAF	0.000	0.044	2.797	2.841

Table 5-5 presents the calculated emission factors from cradle to gate (for modules A1-A3, or scopes 1-3). Where possible, these calculated emission factors have been compared to relevant EPDs/LCAs in the market to sense-check them. The emission factors are not expected to match exactly since they were calculated from the bottom-up to allow decarbonisation to be modelled out to 2050.

Table 5-5: Calculated emission factors in the baseline year compared to reference values

Finished product	Main feed (base year)	Region	Product abbr.	Scope 1-3 (kg CO ₂ e/kg)	EPD (kg CO ₂ e/kg)	Dif.	EPD source
Sections, hot rolled	EAF	GLO	IEAFS-SHR-GLO	0.951	0.934	1.8%	Tung Ho (2021). Environmental Product Declaration: Hot Rolled Structural Sections. EPD 4789597922.102.1. UL Environment.
Sections, hot rolled	EAF	GLO	IEAFC-SHR-GLO	1.978			
Sections, hot rolled	EAF	GLO	IEAFH-SHR-GLO	2.501			
Sections, welded	KOBM	NZ	NZKOBM-SW-NZ	4.221			
Sections, welded	KOBM	NZ	NZEAFS-SW-NZ	2.461			
Sections, welded	KOBM	NZ	NZEAFH-SW-NZ	0.939			
Sections, welded	BOF	GLO	IBOF-SW-GLO	3.175	2.840	11.8%	BlueScope Steel (2020). Steel – Welded Beams and Columns Environmental Product Declaration. S-P-00559 v2.0. EPD Australasia.
Sections, welded	BOF	GLO	IEAFC-SW-GLO	2.061			
Sections, welded	BOF	GLO	IEAFH-SW-GLO	2.600			
Sections, hollow, small	BOF	GLO	IBOF-SHS-GLO	3.266			
Sections, hollow, small	BOF	GLO	IEAFC-SHS-GLO	2.195	2.510	-12.5%	NZGBC (2024). NZGBC Embodied Carbon Methodology v2.0. Auckland: New Zealand Green Building Council.

Finished product	Main feed (base year)	Region	Product abbr.	Scope 1-3 (kg CO ₂ e/kg)	EPD (kg CO ₂ e/kg)	Dif.	EPD source
Sections, hollow, small	BOF	GLO	IEAFH-SHS-GLO	2.714			
Sections, hollow, large	BOF	GLO	IBOF-SHL-GLO	3.198	3.020	5.9%	NZGBC (2024). NZGBC Embodied Carbon Methodology v2.0. Auckland: New Zealand Green Building Council.
Sections, hollow, large	BOF	GLO	IEAFC-SHL-GLO	2.095			
Sections, hollow, large	BOF	GLO	IEAFH-SHL-GLO	2.629			
Plate	KOBM	NZ	NZKOBM-P-NZ	3.974			
Plate	KOBM	NZ	NZEAFC-P-NZ	2.297	2.060	11.5%	New Zealand Steel (2025). Plate Steel Environmental Product Declaration. EPD-IES-0022708:001. EPD Australasia.
Plate	KOBM	NZ	NZEAFC-P-NZ	0.848			
Plate	BOF	GLO	IBOF-P-GLO	2.977	2.540	17.2%	BlueScope Steel (2026). XLERPLATE® steel EPD. EPD-IES-0000558:003. EPD Australasia.
Plate	BOF	GLO	IEAFC-P-GLO	1.917			
Plate	BOF	GLO	IEAFH-P-GLO	2.430			
Sheet, galvanised	KOBM	NZ	NZKOBM-SG-NZ	4.204			
Sheet, galvanised	KOBM	NZ	NZEAFC-SG-NZ	2.569			
Sheet, galvanised	KOBM	NZ	NZEAFC-SG-NZ	1.155			
Sheet, galvanised	BOF	GLO	IBOF-SG-GLO	3.448			
Sheet, galvanised	BOF	GLO	IEAFC-SG-GLO	2.413			
Sheet, galvanised	BOF	GLO	IEAFH-SG-GLO	2.914			

Finished product	Main feed (base year)	Region	Product abbr.	Scope 1-3 (kg CO ₂ e/kg)	EPD (kg CO ₂ e/kg)	Dif.	EPD source
Sheet, coated	KOBM	NZ	NZKOBM-SC-NZ-Gas	4.679	4.239	10.4%	New Zealand Steel (2025). Environmental Product Declaration for COLORSTEEL MAXAM® 0.4mm. EPD-IES-0022699:001. EPD Australasia.
Sheet, coated	KOBM	NZ	NZEAFC-SC-NZ-Gas	3.068			
Sheet, coated	KOBM	NZ	NZEAFH-SC-NZ-Gas	1.676			
Sheet, coated	KOBM	NZ	NZKOBM-SC-NZ-Elec	4.602			
Sheet, coated	KOBM	NZ	NZEAFC-SC-NZ-Elec	2.991			
Sheet, coated	KOBM	NZ	NZEAFH-SC-NZ-Elec	1.598			
Sheet, coated	BOF	GLO	IBOF-SC-GLO-Gas	3.988	3.606	10.6%	BlueScope Steel (2023). COLORBOND® steel for roofing and walling EPD. S-P-00999 v2.0. EPD Australasia.
Sheet, coated	BOF	GLO	IEAFC-SC-GLO-Gas	2.969			
Sheet, coated	BOF	GLO	IEAFH-SC-GLO-Gas	3.462			
Sheet, coated	BOF	GLO	IBOF-SC-GLO-Elec	4.097			
Sheet, coated	BOF	GLO	IEAFC-SC-GLO-Elec	3.078			
Sheet, coated	BOF	GLO	IEAFH-SC-GLO-Elec	3.571			
Long, reinforcing	KOBM	NZ	NZKOBM-LR-NZ	3.896	3.950	-1.4%	Pacific Steel (2024). Environmental Product Declaration – Reinforcing Bar, Coil and Wire. S-P-01002 v2.0. EPD Australasia.
Long, reinforcing	KOBM	NZ	NZEAFC-LR-NZ	2.252	1.890	19.2%	Pacific Steel (2025). Reinforcing Bar Environmental Product Declaration. EPD-IES-0022721:001. EPD Australasia.
Long, reinforcing	KOBM	NZ	NZEAFH-LR-NZ	0.831			
Long, reinforcing	EAF	GLO	IEAFS-LR-GLO	0.888			

Finished product	Main feed (base year)	Region	Product abbr.	Scope 1-3 (kg CO ₂ e/kg)	EPD (kg CO ₂ e/kg)	Dif.	EPD source
Long, reinforcing	EAF	GLO	IEAFC-LR-GLO	1.876			
Long, reinforcing	EAF	GLO	IEAFH-LR-GLO	2.380			
Long, other	EAF	GLO	IEAFS-LO-GLO	0.888			
Long, other	EAF	GLO	IEAFC-LO-GLO	1.876			
Long, other	EAF	GLO	IEAFH-LO-GLO	2.380			
Wire	KOBM	NZ	NZKOBM-LW-NZ	3.987	4.090	-2.5%	Pacific Steel (2024). Environmental Product Declaration – Reinforcing Bar, Coil and Wire. S-P-01002 v2.0. EPD Australasia.
Wire	KOBM	NZ	NZEAFC-LW-NZ	2.311			
Wire	KOBM	NZ	NZEAFC-LW-NZ	0.863			
Wire	EAF	GLO	IEAFS-LW-GLO	0.954			
Wire	EAF	GLO	IEAFC-LW-GLO	1.961			
Wire	EAF	GLO	IEAFH-LW-GLO	2.474			
Fasteners	EAF	GLO	IEAFS-F-GLO	1.201			
Fasteners	EAF	GLO	IEAFC-F-GLO	2.274			
Fasteners	EAF	GLO	IEAFH-F-GLO	2.821			
Cast	BOF	GLO	IBOF-C-GLO	3.855			
Cast	BOF	GLO	IEAFC-C-GLO	2.555			
Cast	BOF	GLO	IEAFH-C-GLO	3.184			
Stainless steel	EAF	GLO	IEAFS-SSt-GLO	3.551			

5.3. Calculate base year emissions

Total direct and energy-related GHG emissions in 2020 were 2,125 kt CO₂e at the national level. Total whole-life GHG emissions (excluding the use stage) were 2,740 kt CO₂e. These values are presented unrounded to align with later sections (see chapter 7).

6. Strategies to reduce GHG emissions

Table 6-1 presents the strategies to reduce GHG emissions considered within the roadmap. These strategies include both demand-side measures to reduce steel use per person and supply-side measures to reduce emissions per kilogram of steel.

Uptake rates for each strategy are presented in Annex B.

Table 6-1: Strategies to reduce GHG emissions

Strategy	Description
Adaptive reuse	Extending the life of existing assets The lowest emissions steel is the steel we do not need to produce. Adaptive reuse extends the life of buildings and infrastructure, avoiding the need for new virgin steel. This includes repurposing existing structures, upgrading assets rather than replacing them, and designing today's buildings so they can be reused in future.
Design & construction	Using steel more efficiently Optimising structural design reduces the amount of steel required without compromising safety or performance. This includes early peer review, digital modelling, better coordination between designers and contractors, and moving beyond routine over-specification. Efficiency in fabrication and construction further reduces material use and waste.
Renewable energy	Decarbonising electricity and hydrogen supply EAFs rely on electricity. Ironmaking pathways such as DRI can use hydrogen instead of coal or natural gas. As New Zealand and global electricity systems increase renewable generation, and as green hydrogen becomes available at scale, the emissions intensity of steel production declines.
Steelmaking	Expanding scrap-based EAF production Shifting from BF-BOF routes to scrap-based EAF steelmaking reduces direct and electricity-related emissions and supports a more circular economy. This includes maximising the use of domestically recovered steel scrap and sourcing lower emissions EAF steel from international suppliers.
Ironmaking	Reducing emissions from ironmaking Ironmaking is the most emissions-intensive step in producing virgin steel. Emissions can be reduced through hydrogen-based DRI, novel technologies such as low temperature electrolysis and metallothermic reduction, or retrofitting carbon capture, utilisation and storage (CCUS) to existing blast furnaces where feasible.

7. Results and interpretation

7.1. Direct and electricity-related GHG emissions

Three waterfall diagrams are used to show where savings are anticipated by 2030, 2040 and 2050. All diagrams show an initial increase in steel emissions on the left side – these are the emissions under a business-as-usual scenario assuming 2020 emission factors but multiplying by increased steel demand due to increased population.

The headline findings are:

- Figure 7-1 shows reductions in GHG emissions primarily due to improvements in steelmaking, namely increased use of EAF technology.
- Figure 7-2 shows other measures starting to become noticeable: adaptive reuse, design & construction and renewable energy.
- Figure 7-3 further reinforces the trends in the 2030s but adds significant decarbonisation in the ironmaking stage – technology that is not expected to be commercially viable until the 2040s.

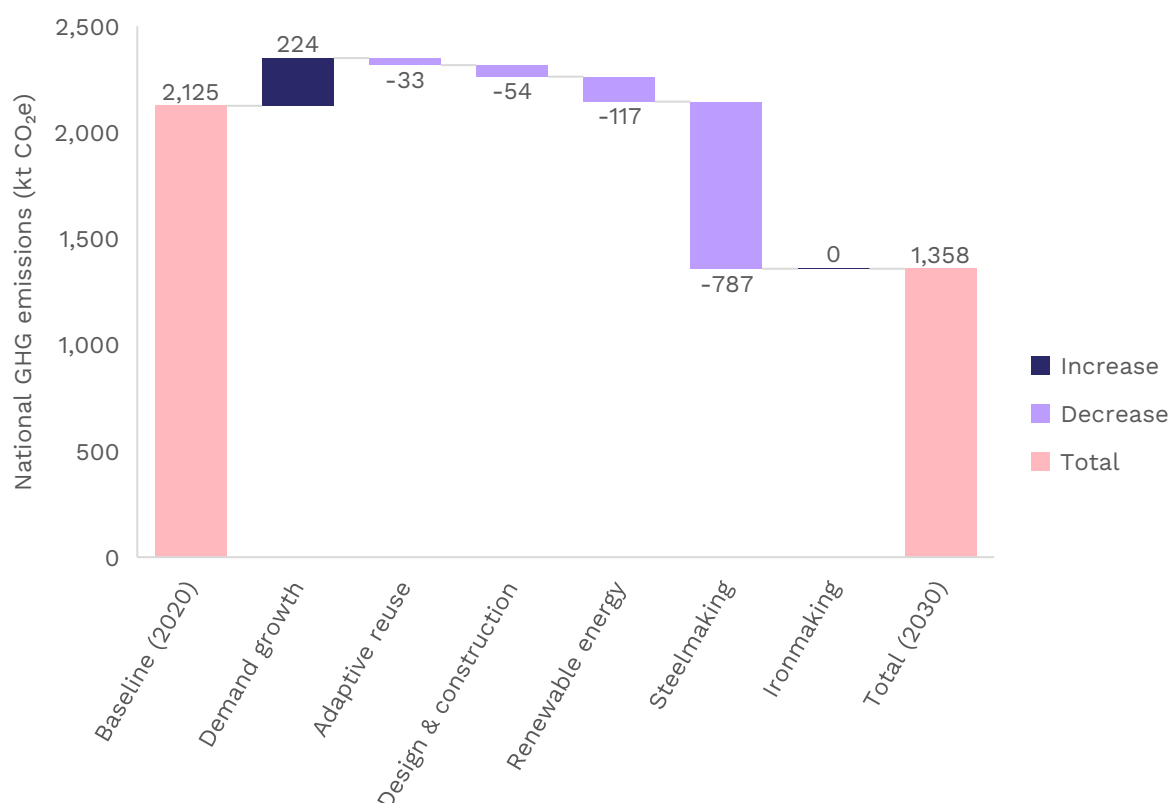


Figure 7-1: Waterfall chart from 2020 to 2030

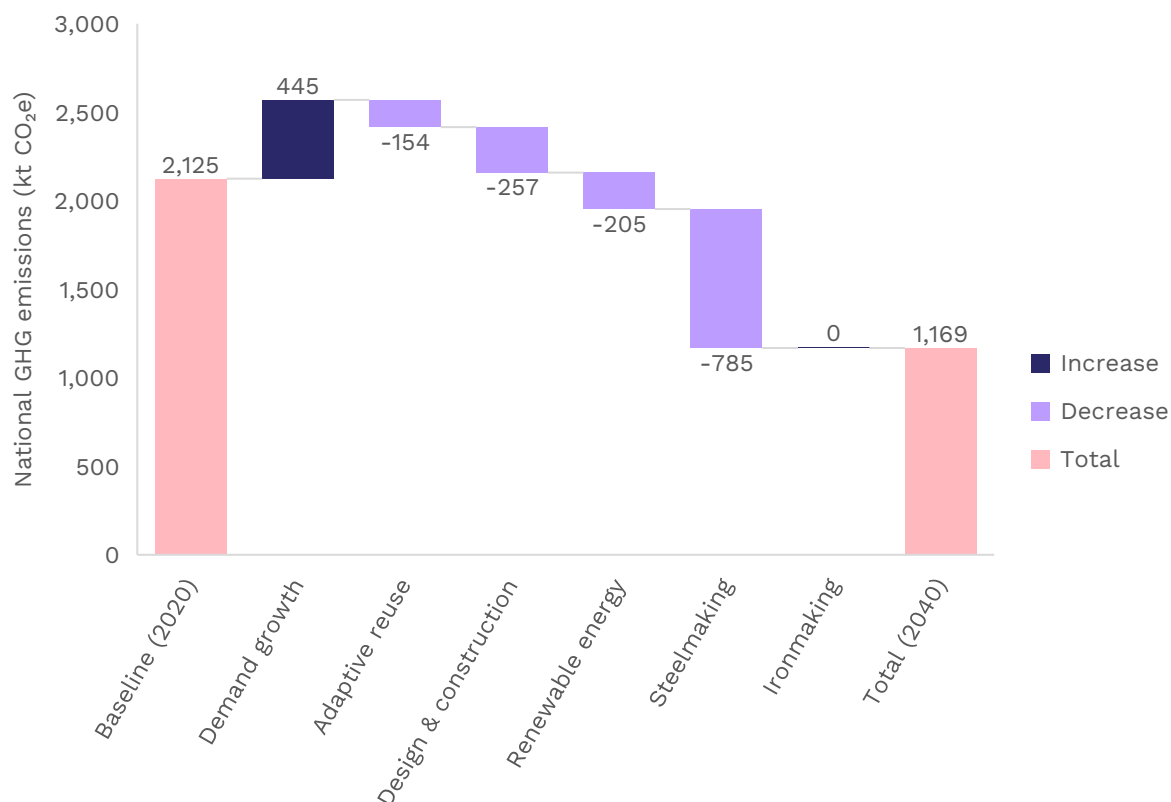


Figure 7-2: Waterfall chart from 2020 to 2040

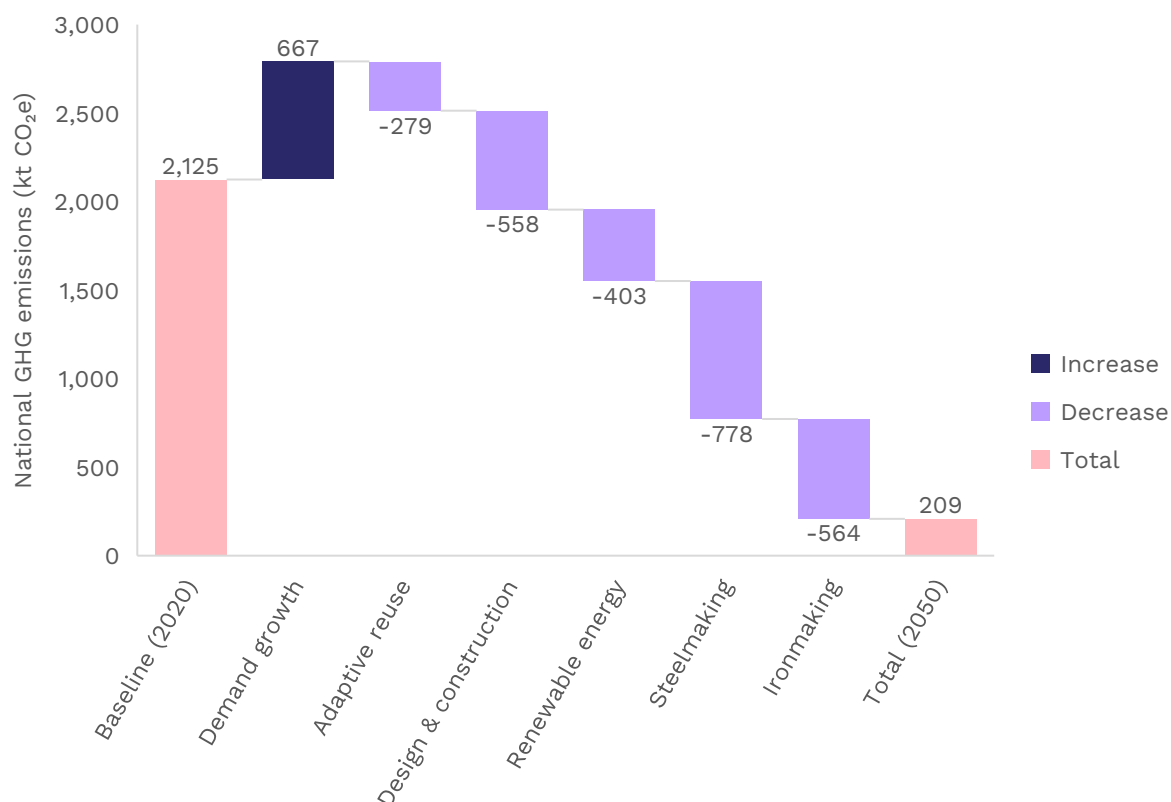


Figure 7-3: Waterfall chart from 2020 to 2050

7.2. Life cycle GHG emissions

Figure 7-4 and Table 7-1 present country-wide GHG emissions from steel over its life cycle (excluding the use stage) in decade-by-decade steps from 2020 to 2050. While indirect product-related emissions initially start as only a component of total emissions in 2020 (18%), they become the dominant source of emissions by 2050 (58%). These indirect emissions include coating metals (zinc, aluminium, magnesium), paints and upstream impacts (mining and transport). These emissions are assumed not to decarbonise within the calculations in this roadmap, which represents a conservative (i.e., worst-case) assumption. However, it emphasises the point that no industry can decarbonise in isolation – all industries must work together.

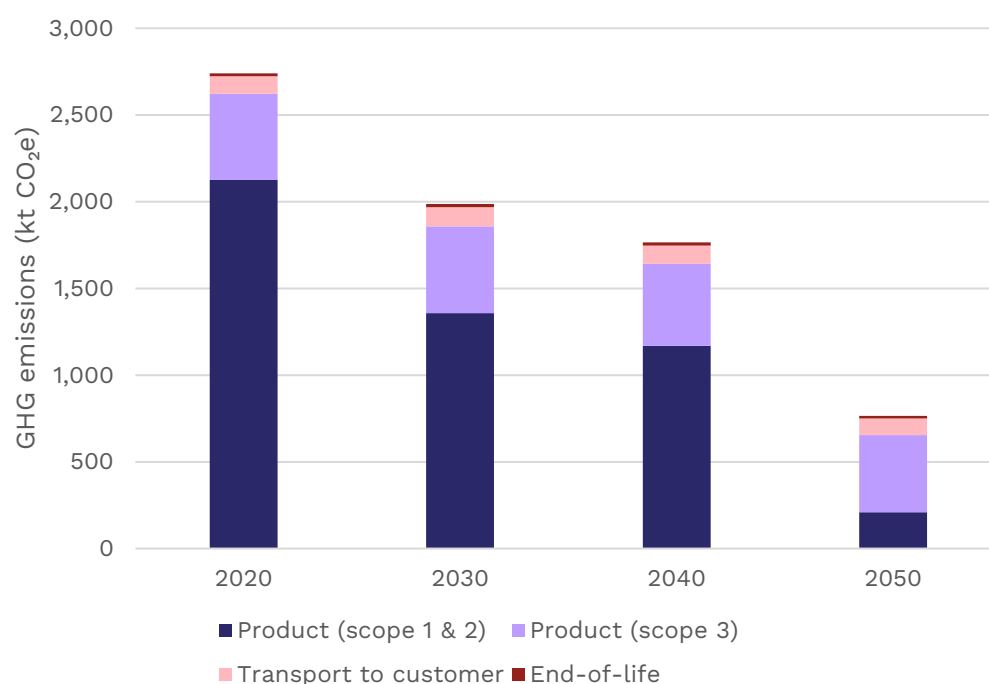


Figure 7-4: Life cycle GHG emissions

Table 7-1: Life cycle GHG emissions (kt CO₂e)

Life cycle stage	2020	2030	2040	2050
Product (scope 1 & 2)	2,125	1,358	1,169	209
Product (scope 3)	497	499	472	445
Transport to customer	101	111	106	96
End-of-life	17	18	17	16
Total	2,740	1,986	1,765	765

7.3. Assessing data quality

This study presents an industry-wide analysis of steel consumed in New Zealand. It was calculated primarily using from generic/secondary data. As such, it does not have the same level of data quality that would be achievable for a company-specific LCA or EPD where primary data would be available.

Specifically:

- **Activity data:** Country-level steel flows come from worldsteel and align with bottom-up calculations done by thinkstep-anz. Steel breakdowns were validated through the industry workshops. Data quality is considered acceptable for the aim of the study.
- **Emission factors:**
 - EFs for imported crude steel come from worldsteel and are considered representative of current steelmaking technology.
 - EFs for domestically manufactured steel, downstream steel processing and fabrication were based on LCIs created for this study and have lower data quality. However, the results were validated against EPDs and found to be reasonably well aligned. These EFs are considered acceptable for the aim of this study.
 - EFs for background data like electricity and transport come primarily from New Zealand government sources, as well as the International Energy Agency and the Australian Government. These EFs are the same as would be used for company-specific assessments and are good quality.

7.4. Limitations

This study relies on secondary data which inherently contains some uncertainty. While a limitation, this is considered acceptable for the aim of this study which seeks to represent industry-wide opportunities for decarbonisation. This study is not intended to be an accurate representation of any specific manufacturer, but rather than average on the New Zealand market through time.

Excluded from the system boundary, but not considered limitations, are:

- Production of capital goods.
- Personnel-related emissions.
- Corporate activities, such as marketing, R&D, business travel and insurance.
- Production (and any potential air emissions) related refractories and other consumables (oils, rags, etc.).
- Production of packaging for inbound materials and consumables.

The above approach is in line with the system boundary and typical cut-off rules allowed under EN 15804+A2:2019 and ISO 21930:2017, the European and international standards for preparing EPDs of construction products.

8. Conclusions

The steel industry in New Zealand has set the following decarbonisation targets:

- | | |
|----------------|---|
| By 2030 | Reduce direct and electricity-related emissions from steel used in New Zealand by more than 30% compared with 2020. |
| By 2050 | Reduce these emissions by more than 90%. |

Achieving this level of reduction within 25 years will be challenging and requires coordinated action across the entire steel value chain.

The biggest gains in the 2020s will come from proven technologies and smarter demand. By late 2026, direct emissions from steel consumed in New Zealand are forecast to fall by around 25% compared with 2020 levels. This is driven by:

- commissioning the new EAF at Glenbrook
- increasing use of recycled steel
- sourcing more steel from lower-emissions EAF production overseas.

The 2030s are the critical transition decade. By 2040, the steel industry must be firmly on track to achieve more than 90% emissions reduction by 2050. During this period, the focus shifts to scaling emerging technologies and accelerating system-wide change.

On the supply side, this includes:

- accelerating the global shift from basic oxygen furnace (BOF) production to EAF
- rapidly expanding renewable electricity generation
- switching fuel in DRI plants, from coal/gas to green hydrogen
- narrowing the cost gap between conventional and low-emissions steel.

On the demand side, this includes:

- making adaptive reuse the default option where feasible, including reuse of existing assets and designing new assets so they can be adapted in the future
- embedding carbon considerations alongside cost, quality and timeline in early design decisions
- continuing to optimise structural design to reduce material use.

By 2050, near-zero emissions steel must be the norm.

On the supply side, steel used in New Zealand buildings and infrastructure must come from facilities operating with minimal GHG emissions. This may include:

- scrap-based EAFs powered by renewable electricity
- EAFs supplied with green hydrogen-based iron
- conventional blast furnaces retrofitted with carbon capture, utilisation and storage.

On the demand side, this roadmap assumes:

- a 20% reduction in steel use in new construction through better design
- a 10% reduction in demand through greater adaptive reuse.

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Glossary

Basic oxygen furnace (BOF): A steelmaking furnace that converts carbon-rich molten pig iron (usually from a blast furnace) into steel by blowing pure oxygen through it. The oxygen removes impurities via oxidation, a process which generates heat and keeps the iron in a molten state. Solid steel scrap is added as a cooling agent to maintain the optimal temperature.

Blast furnace (BF): An ironmaking furnace that uses coking coal and limestone to convert iron ore to pig iron and slag.

Carbon capture, utilisation and storage (CCUS): Technologies that capture carbon dioxide emissions from industrial processes and either store them permanently underground or use them in other applications.

Consumption-based approach: An accounting approach that attributes emissions to the country where materials are used, regardless of where they are produced.

Direct and electricity-related emissions: Greenhouse gas emissions from ironmaking, crude steel production, recycling and fabrication, including emissions from fuels used on site and purchased electricity.

Direct reduced iron (DRI): Iron produced from iron ore below its melting point using a reducing gas which contains elemental carbon (produced from natural gas or coal) and/or hydrogen. Most DRI plants produce sponge iron, so called because of its porous, spongy appearance. Sponge iron can be compacted to form hot briquetted iron. DRI is an established technology but either requires high grade iron ores or an extra smelting step.

Electric arc furnace (EAF): A steelmaking furnace that produces steel primarily from steel scrap. Heat is generated from an electric arc formed between electrodes and the steel. Primary iron (typically DRI) and other alloying elements are often added to control the chemical composition of the finished steel.

Environmental product declaration (EPD): A standardised document that reports the environmental impacts of a product across its life cycle, based on international standards.

Indirect life cycle emissions: Greenhouse gas emissions that occur outside direct steelmaking processes, including raw material extraction, alloy production, coatings, transport and end-of-life processing.

Greenhouse gas (GHG): A gas that absorbs and re-emits infrared radiation (heat), thereby trapping heat in the Earth's atmosphere and contributing to the greenhouse effect and climate change. Carbon dioxide (CO₂) is the main greenhouse gas produced by the steel industry.

Green hydrogen: Hydrogen produced using renewable electricity, typically through electrolysis of water, with little or no associated greenhouse gas emissions.

Klöckner Oxygen Blown Maxhütte (KOBM): a steelmaking furnace that blows oxygen from both the top and bottom, making it better able to handle the high titanium and vanadium content found in New Zealand ironsand.

Net-zero GHG emissions: A state where greenhouse gas emissions are reduced as close to zero as possible, with any remaining emissions balanced by permanent greenhouse gas removals.

Recycled steel: Steel manufactured primarily from steel scrap. Also known as 'secondary' steel.

Steel scrap: Recovered steel from manufacturing offcuts or end-of-life products and buildings, used as a raw material in electric arc furnace steelmaking.

Virgin iron / virgin steel: Iron or steel manufactured primarily from iron ore. Also known as 'primary', or 'unrecycled' iron and steel.

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Legal interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Annex A Background data

A.1. Population forecast

Table Annex A-1: New Zealand population forecast

Year	Population	Pop. rel. 2020
2020	5,069,900	100%
2021	5,084,000	100%
2022	5,081,800	100%
2023	5,183,000	102%
2024	5,286,600	104%
2025	5,322,400	105%
2026	5,388,000	106%
2027	5,441,000	107%
2028	5,495,000	108%
2029	5,549,400	109%
2030	5,603,800	111%
2031	5,658,200	112%
2032	5,712,600	113%
2033	5,767,000	114%
2034	5,819,400	115%
2035	5,871,800	116%
2036	5,924,200	117%
2037	5,976,600	118%
2038	6,029,000	119%
2039	6,080,000	120%
2040	6,131,000	121%
2041	6,182,000	122%
2042	6,233,000	123%
2043	6,284,000	124%
2044	6,333,200	125%
2045	6,382,400	126%
2046	6,431,600	127%
2047	6,480,800	128%
2048	6,530,000	129%
2049	6,607,826	130%
2050	6,661,378	131%

Source of forecast: StatsNZ "National population projections", 2024 base year.
Source of historic data: StatsNZ "Estimated Resident Population", Table DPE059AA.

A.2. Transport distances

Table Annex A-2: Transport from Auckland to other regions

Region	Pop,	Pop. %	Truck NI (km)	Truck SI (km)	Ship (km)	Truck (km)
Northland region	194,007	4%	270			270
Auckland region	1,656,486	33%	30			30
Waikato region	498,771	10%	110			110
Bay of Plenty region	334,140	7%	270			270
Gisborne region	51,135	1%	480			480
Hawke's Bay region	175,074	4%	420			420
Taranaki region	126,015	3%	390			390
Manawatū-Whanganui region	251,412	5%	430			430
Wellington region	520,971	10%	630			630
Tasman region	57,807	1%	630	164	64	794
Nelson region	52,584	1%	630	139	64	769
Marlborough region	49,431	1%	630	48	64	678
West Coast region	33,390	1%	630	392	64	1,022
Canterbury region	651,027	13%	630	488	64	1,118
Otago region	240,900	5%	630	720	64	1,350
Southland region	100,143	2%	630	995	64	1,625
Total	4,993,293		316	125	15	441

Source: Population by region from Stats NZ (2024). 2023 Census. Statistics New Zealand.
Source: Distances from Google Maps.

A.3. Emission factors: baseline

This section includes emission factors for the baseline year only. Reductions in GHG emissions over time are only modelled for selected EFs – primarily those related to electricity.

Table Annex A-3: Emission factors for the baseline year

Direction	Flow	Region	Unit	Scope 1 (kg CO ₂ e)	Scope 2 (kg CO ₂ e)	Scope 3 (kg CO ₂ e)	Scope 1-3 (kg CO ₂ e)	Source
Output	Carbon dioxide, fossil, gas	GLO	kg	1.000			1.000	IPCC AR6 GWP100
Output	Methane, fossil, gas	GLO	kg	30.000			30.000	IPCC AR6 GWP100
Input	Electricity, medium voltage	GLO	MJ		0.122	0.019	0.142	Scope 1&2 emissions from IEA. (2021). Iron and Steel Technology Roadmap. International Energy Agency. Scope 3 emissions based on data for Australia from DCCEEW (2025). National Greenhouse Accounts Factors 2025. Department of Climate Change, Energy, the Environment and Water, Australian Government.
Input	Electricity, medium voltage	NZ	MJ		0.033	0.017	0.050	Reference scenario from BRANZ (2020). "New Zealand Low Voltage Electricity Supply - Future Environmental Impacts 2020-2050".
Input	Thermal energy from natural gas	GLO	MJ	0.054		0.009	0.064	Scope 1 from MfE (2025). Measuring Emissions: A guide for organisations – 2025. New Zealand Ministry for the Environment. Scope 3 from "Natural gas (50% mineral blend)" in "WTT- fuels" from UK Government GHG Conversion Factors for Company Reporting 2025.
Input	Aluminium, primary	GLO	kg			11.300	11.300	OCA→OCA→GCC scenario from IAI (2022). 2019 Life Cycle Inventory Survey: Global Summary. International Aluminium Institute.
Input	Bentonite, crushed	GLO	kg			0.005	0.005	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.

Direction	Flow	Region	Unit	Scope 1 (kg CO ₂ e)	Scope 2 (kg CO ₂ e)	Scope 3 (kg CO ₂ e)	Scope 1-3 (kg CO ₂ e)	Source
Input	Coal, coking	GLO	kg			0.293	0.293	Direct emissions based on limestone mining. Methane emissions from global coking coal production from https://www.iea.org/reports/global-methane-tracker-2022/estimating-methane-emissions . "In 2021, it is estimated that the global steel industry used about 2.3 billion tonnes of iron ore, 1.1 billion tonnes of metallurgical coal and 680 million tonnes (Mt) of recycled steel to produce 1.95 billion tonnes of crude steel." from https://worldsteel.org/wp-content/uploads/Fact-sheet-raw-materials-2023.pdf . The ETS Default Emission Factor is much lower for "Coal mined from surface mining" (0.024 tCO ₂ e/t coal) and higher for "Bituminous coal mined from underground mining" (0.514 tCO ₂ e/t coal).
Input	Coal, pulverised BF injection	GLO	kg			0.044	0.044	Direct emissions based on limestone mining. Methane emissions from "Coal mined from surface mining" from Table 3, Schedule 2, Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (as at 1 January 2026).
Input	Coal, thermal	GLO	kg			0.044	0.044	Direct emissions based on limestone mining. Methane emissions from "Coal mined from surface mining" from Table 3, Schedule 2, Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (as at 1 January 2026).

Direction	Flow	Region	Unit	Scope 1 (kg CO ₂ e)	Scope 2 (kg CO ₂ e)	Scope 3 (kg CO ₂ e)	Scope 1-3 (kg CO ₂ e)	Source
Input	Coking coal	GLO	kg			0.044	0.044	Direct emissions based on limestone mining. Methane emissions from "Coal mined from surface mining" from Table 3, Schedule 2, Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (as at 1 January 2026).
Input	Dolomite, crushed	GLO	kg			0.005	0.005	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Electrode, graphite	GLO	kg			2.652	2.652	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Ferromanganese (FeMn) (77% Mn)	GLO	kg			5.903	5.903	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Ferrosilicon (FeSi) (75% Si)	GLO	kg			11.435	11.435	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Iron ore	GLO	kg			0.020	0.020	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Limestone, crushed	GLO	kg			0.005	0.005	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Magnesium, primary	GLO	kg			28.000	28.000	Ehrenberger (2020). Carbon Footprint of Magnesium Production and its Use in Transport Applications. DLR. URL: https://cdn.ymaws.com/www.intlmag.org/resource/resmgr/sustainability/LCA-update-summary-2020-Oct-.pdf

Direction	Flow	Region	Unit	Scope 1 (kg CO ₂ e)	Scope 2 (kg CO ₂ e)	Scope 3 (kg CO ₂ e)	Scope 1-3 (kg CO ₂ e)	Source
Input	Natural gas	GLO	kg			0.446	0.446	"Natural gas (50% mineral blend)" in "WTT-fuels" from UK Government GHG Conversion Factors for Company Reporting 2025
Input	Paint, acrylic	GLO	kg			2.151	2.151	Dulux Wash&Wear® Low Sheen Vivid White at a spreading rate of 0.172 kg/m ² . Dulux (2017). Environmental Product Declaration for Wall Paints. EPD S-P-00859 of the International EPD System.
Input	Sand, moulding	GLO	kg			0.259	0.259	Sphera data, from worldsteel (2021). Life cycle inventory (LCI) study: 2020 release. World Steel Association.
Input	Silicon, primary	GLO	kg			12.000	12.000	Hoover, H., Bell, R., Rippey, K. (2024). Emerging Technologies for Decarbonizing Silicon Production. Journal of Sustainable Metallurgy, 10, pp. 1921–1932.
Input	Steel scrap	GLO	kg			0.181	0.181	Assume 60% post-consumer + 40% post-industrial
Input	Steel scrap, post-consumer	GLO	kg			0.000	0.000	Post-consumer scrap is allocated zero emissions
Input	Steel scrap, post-industrial	GLO	kg			0.302	0.302	NZ Steel (2025). Plate Steel: Environmental Product Declaration. EPD-IES-0022708:001. International EPD System.
Input	Zinc, primary	GLO	kg			3.500	3.500	IZA (2023). Zinc environmental profile. Life cycle assessment: 2023 update based on 2021 industry data. International Zinc Association. URL: https://www.zinc.org/wp-content/uploads/sites/30/2023/09/IZA-3890-EnvironmentalProfile.-R3-v1.pdf

Direction	Flow	Region	Unit	Scope 1 (kg CO ₂ e)	Scope 2 (kg CO ₂ e)	Scope 3 (kg CO ₂ e)	Scope 1-3 (kg CO ₂ e)	Source
Input	Ship, bulk carrier	GLO	tkm			0.004	0.004	Direct emissions from MfE (2025). Measuring Emissions: A guide for organisations – 2025. New Zealand Ministry for the Environment. Indirect emissions from UK Government GHG Conversion Factors for Company Reporting 2025.
Input	Ship, container	GLO	tkm			0.020	0.020	Direct emissions from MfE (2025). Measuring Emissions: A guide for organisations – 2025. New Zealand Ministry for the Environment. Indirect emissions from UK Government GHG Conversion Factors for Company Reporting 2025.
Input	Train, diesel	GLO	tkm			0.035	0.035	Direct emissions from MfE (2025). Measuring Emissions: A guide for organisations – 2025. New Zealand Ministry for the Environment. Indirect emissions from UK Government GHG Conversion Factors for Company Reporting 2025.
Input	Truck, heavy	GLO	tkm			0.130	0.130	Direct emissions from MfE (2025). Measuring Emissions: A guide for organisations – 2025. New Zealand Ministry for the Environment. Indirect emissions from UK Government GHG Conversion Factors for Company Reporting 2025.
Input	Truck, urban	GLO	tkm			0.481	0.481	Direct emissions from MfE (2025). Measuring Emissions: A guide for organisations – 2025. New Zealand Ministry for the Environment. Indirect emissions from UK Government GHG Conversion Factors for Company Reporting 2025.

A.4. Emission factors: electricity grid decarbonisation

Table Annex A-4: Emission factors for electricity over time

Year	Electricity NZ	Electricity NZ S1	Electricity NZ S3	Electricity GLO	Electricity GLO S1	Electricity GLO S3
2020	0.180	0.119	0.062	0.510	0.440	0.070
2030	0.133	0.053	0.080	0.312	0.242	0.070
2040	0.088	0.037	0.051	0.074	0.004	0.070
2050	0.088	0.040	0.049	0.070	0.000	0.070

Source NZ: Reference scenario from BRANZ (2020). "New Zealand Low Voltage Electricity Supply - Future Environmental Impacts 2020-2050".

Source GLO Scope 1: IEA (2020-2025). World Energy Outlook 2020-2025. International Energy Agency. Forecasts follow the net-zero scenarios.

Source GLO Scope 3: DCCEEW (2025). National Greenhouse Accounts Factors 2025. Department of Climate Change, Energy, the Environment and Water, Australian Government.

Annex B Uptake rates

Table Annex B-1: Uptake of demand-side strategies

Year	Adaptive reuse	Design & construction
2020	0.0%	0.0%
2030	1.4%	2.3%
2040	6.0%	10.0%
2050	10.0%	20.0%

Table Annex B-2: Uptake rates for major iron/steel-making technologies, by type, 2020-2050

Supply region	NZ-made steel, initially DRI-KOBM route				Imported steel, initially BF-BOF route				Imported steel, initially scrap-EAF route			
	NZ	NZ	NZ	NZ	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO
Base case	KOBM	KOBM	KOBM	KOBM	BOF	BOF	BOF	BOF	EAF	EAF	EAF	EAF
Replacement	NZKOBM	NZEAFC	NZEAFH	Total	IBOF	IEAFC	IEAFH	Total	IEAFS	IEAFC	IEAFH	Total
Year	KOBM-NZKOBM	KOBM-NZEAFC	KOBM-NZEAFH	KOBM-Total	BOF-IBOF	BOF-IEAFC	BOF-IEAFH	BOF-Total	EAF-IEAFS	EAF-IEAFC	EAF-IEAFH	EAF-Total
2020	100%			100%	100%			100%	100%			100%
2030		100%		100%	100%			100%	100%			100%
2040		100%		100%	80%	20%		100%	100%			100%
2050			100%	100%	0%	20%	80%	100%	100%			100%

All transitions are indicative. Transition timing is not exact. Neither New Zealand Steel nor steel importers have committed to specific decarbonisation trajectories beyond 2026. However, values are needed to generate the roadmap to 2050.

Unit processes

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Reheat furnace	Input	Mass, cut off	Steel, mild, slab	Scope 1	1.01	kg		Calculated	1	1.01	kg
Reheat furnace	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	1.5	MJ	GLO	Estimate. NZ Steel	1	1.5	MJ
Reheat furnace	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.01	kWh	GLO	Estimate	3.6	0.036	MJ
Reheat furnace	Output	Mass, product	Steel, mild, slab, reheated		1	kg	GLO	As defined	1	1	kg
Reheat furnace	Output	Mass, waste	Mill scale	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Reheat furnace	Check		Mass balance		0.0	%			1	0	%
Hot rolling	Input	Mass, internal	Steel, mild, slab, reheated		1.02	kg		Calculated	1	1.02	kg
Hot rolling	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.1	kWh	GLO	Estimate	3.6	0.36	MJ
Hot rolling	Input	Energy, internal	Compressed air, 7 bar		0.2	m ³	GLO	Estimate	8.3	1.66	kg
Hot rolling	Output	Mass, product	Steel, mild, hot rolled coil		1	kg	GLO	As defined	1	1	kg
Hot rolling	Output	Mass, co-product	Steel scrap	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Hot rolling	Output	Mass, waste	Mill scale	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Hot rolling	Check		Mass balance		0.0	%			1	0	%
Cold rolling	Input	Mass, internal	Steel, mild, hot rolled coil		1.01	kg		Calculated	1	1.01	kg
Cold rolling	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.15	kWh	GLO	Estimate	3.6	0.54	MJ
Cold rolling	Input	Energy, internal	Compressed air, 7 bar		0.1	m ³	GLO	Estimate	8.3	0.83	kg
Cold rolling	Output	Mass, product	Steel, mild, cold rolled coil		1	kg	GLO	As defined	1	1	kg
Cold rolling	Output	Mass, co-product	Steel scrap	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Cold rolling	Check		Mass balance		0.0	%			1	0	%
Metal coating line (AZM)	Input	Mass, internal	Steel, mild, cold rolled coil		0.965119238	kg		Calculated	1	0.965119238	kg
Metal coating line (AZM)	Input	Mass, purchased	Aluminium, primary	Scope 3	0.025879949	kg	GLO	NZ Steel (2025). En	1	0.025879949	kg
Metal coating line (AZM)	Input	Mass, purchased	Zinc, primary	Scope 3	0.019271648	kg	GLO	NZ Steel (2025). En	1	0.019271648	kg
Metal coating line (AZM)	Input	Mass, purchased	Magnesium, primary	Scope 3	0.000470265	kg	GLO	NZ Steel (2025). En	1	0.000470265	kg
Metal coating line (AZM)	Input	Mass, purchased	Silicon, primary	Scope 3	0.001410795	kg	GLO	NZ Steel (2025). En	1	0.001410795	kg
Metal coating line (AZM)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.1	kWh	GLO	Estimate	3.6	0.36	MJ
Metal coating line (AZM)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	1	MJ	GLO	Estimate	1	1	MJ
Metal coating line (AZM)	Input	Energy, internal	Compressed air, 7 bar		0.5	m ³	GLO	Estimate	8.3	4.15	kg
Metal coating line (AZM)	Output	Mass, product	Steel, mild, sheet, AZM-coated 0.4mm BMT		1	kg	GLO	As defined	1	1	kg
Metal coating line (AZM)	Output	Mass, co-product	Steel scrap	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Metal coating line (AZM)	Output	Mass, waste	Dross	Scope 1	0.002	kg	GLO	Estimate	1	0.002	kg
Metal coating line (AZM)	Check		Mass balance		0.0	%			1	0.01500951	%

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Paint line (AZM, gas)	Input	Mass, internal	Steel, mild, sheet, AZM-coated 0.4mm BMT		0.994993307	kg		Calculated based on	1	0.994993307	kg
Paint line (AZM, gas)	Input	Mass, purchased	Paint, acrylic	Scope 3	0.029770145	kg	GLO	Assume paint is 50%	1	0.029770145	kg
Paint line (AZM, gas)	Input	Mass, elementary	Oxygen, gas	Scope 1	0.047036829	kg	GLO	Calculated. Assume	1	0.047036829	kg
Paint line (AZM, gas)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	2	MJ	GLO	Estimate	1	2	MJ
Paint line (AZM, gas)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.05	kWh	GLO	Estimate	3.6	0.18	MJ
Paint line (AZM, gas)	Input	Energy, internal	Compressed air, 7 bar		0.2	m ³	GLO	Estimate	8.3	1.66	kg
Paint line (AZM, gas)	Output	Mass, product	Steel, mild, sheet, AZM/paint-coated 0.4mm BMT (gas)		1	kg	GLO	As defined	1	1	kg
Paint line (AZM, gas)	Output	Mass, co-product	Steel scrap	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Paint line (AZM, gas)	Output	Mass, elementary	Carbon dioxide, fossil, gas	Scope 1	0.049269589	kg	GLO	Calculated. Assume	1	0.049269589	kg
Paint line (AZM, gas)	Output	Mass, elementary	Water vapour	Scope 1	0.012622541	kg	GLO	Calculated. Assume	1	0.012622541	kg
Paint line (AZM, gas)	Check		Mass balance		0.0	%			1	-0.008568979	%
Paint line (AZM, electric)	Input	Mass, internal	Steel, mild, sheet, AZM-coated 0.4mm BMT		0.994993307	kg		Calculated	1	0.994993307	kg
Paint line (AZM, electric)	Input	Mass, purchased	Paint, acrylic	Scope 3	0.029770145	kg	GLO	Assume paint is 50%	1	0.029770145	kg
Paint line (AZM, electric)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.605555556	kWh	GLO	Estimate. Assume a	3.6	2.18	MJ
Paint line (AZM, electric)	Input	Energy, internal	Compressed air, 7 bar		0.2	m ³	GLO	Estimate	8.3	1.66	kg
Paint line (AZM, electric)	Output	Mass, product	Steel, mild, sheet, AZM/paint-coated 0.4mm BMT (electric)		1	kg	GLO	As defined	1	1	kg
Paint line (AZM, electric)	Output	Mass, co-product	Steel scrap	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Paint line (AZM, electric)	Output	Mass, elementary	Water vapour	Scope 1	0.014885072	kg	GLO	Calculated. Assume	1	0.014885072	kg
Paint line (AZM, electric)	Check		Mass balance		0.0	%			1	-0.011866731	%

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Galvanising (0.75mm BMT Z275)	Input	Mass, internal	Steel, mild, cold rolled coil		0.974872708	kg		Calculated	1	0.974872708	kg
Galvanising (0.75mm BMT Z275)	Input	Mass, purchased	Zinc, primary	Scope 3	0.045535456	kg	GLO	Calculated for Z275	1	0.045535456	kg
Galvanising (0.75mm BMT Z275)	Input	Mass, elementary	Water, freshwater	Scope 1	2	kg	GLO	Estimate	1	2	kg
Galvanising (0.75mm BMT Z275)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.05	kWh	GLO	Estimate	3.6	0.18	MJ
Galvanising (0.75mm BMT Z275)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	0.7	MJ	GLO	Estimate	1	0.7	MJ
Galvanising (0.75mm BMT Z275)	Input	Energy, internal	Compressed air, 7 bar		0.5	m ³	GLO	Estimate	8.3	4.15	kg
Galvanising (0.75mm BMT Z275)	Output	Mass, product	Steel, mild, sheet, galvanised, 0.75mm BMT Z275		1	kg	GLO	As defined	1	1	kg
Galvanising (0.75mm BMT Z275)	Output	Mass, co-product	Steel scrap	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Galvanising (0.75mm BMT Z275)	Output	Mass, waste	Zinc dross / ash / skimmings	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Galvanising (0.75mm BMT Z275)	Output	Mass, waste	Wastewater	Scope 3	2	kg	GLO	Estimate	1	2	kg
Galvanising (0.75mm BMT Z275)	Check		Mass balance		0.0	%			1	0.01351534	%
Rollforming (cladding, NZ gas)	Input	Mass, internal	Steel, mild, sheet, AZM/paint-coated 0.4mm BMT (gas)		1.02	kg	NZ	Calculated	1	1.02	kg
Rollforming (cladding, NZ)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.02	kWh	NZ	Estimate	3.6	0.072	MJ
Rollforming (cladding, NZ)	Input	Energy, internal	Compressed air, 7 bar		0.05	m ³	NZ	Estimate	8.3	0.415	kg
Rollforming (cladding, NZ gas)	Output	Mass, product	Steel, cladding, profiled, AZM/paint-coated 0.4mm BMT (NZ gas)		1	kg	NZ	As defined	1	1	kg
Rollforming (cladding, NZ)	Output	Mass, co-product	Steel scrap		0.02	kg	NZ	Estimate	1	0.02	kg
Rollforming (cladding, NZ)	Check		Mass balance		0.0	%			1	0	%

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Rollforming (cladding, NZ electric)	Input	Mass, internal	Steel, mild, sheet, AZM/paint-coated 0.4mm BMT (electric)		1.02	kg	NZ	Calculated	1	1.02	kg
Rollforming (cladding, NZ electric)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.02	kWh	NZ	Estimate	3.6	0.072	MJ
Rollforming (cladding, NZ electric)	Input	Energy, internal	Compressed air, 7 bar		0.05	m ³	NZ	Estimate	8.3	0.415	kg
Rollforming (cladding, NZ electric)	Output	Mass, product	Steel, cladding, profiled, AZM/paint-coated 0.4mm BMT (NZ electric)		1	kg	NZ	As defined	1	1	kg
Rollforming (cladding, NZ electric)	Output	Mass, co-product	Steel scrap		0.02	kg	NZ	Estimate	1	0.02	kg
Rollforming (cladding, NZ electric)	Check		Mass balance		0.0	%			1	0	%
Rollforming (cladding, GLO gas)	Input	Mass, internal	Steel, mild, sheet, AZM/paint-coated 0.4mm BMT (gas)		1.02	kg	GLO	Calculated	1	1.02	kg
Rollforming (cladding, GLO gas)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.02	kWh	NZ	Estimate	3.6	0.072	MJ
Rollforming (cladding, GLO gas)	Input	Energy, internal	Compressed air, 7 bar		0.05	m ³	NZ	Estimate	8.3	0.415	kg
Rollforming (cladding, GLO gas)	Output	Mass, product	Steel, cladding, profiled, AZM/paint-coated 0.4mm BMT (GLO gas)		1	kg	NZ	As defined	1	1	kg
Rollforming (cladding, GLO gas)	Output	Mass, co-product	Steel scrap		0.02	kg	NZ	Estimate	1	0.02	kg
Rollforming (cladding, GLO gas)	Check		Mass balance		0.0	%			1	0	%
Rollforming (cladding, GLO electric)	Input	Mass, internal	Steel, mild, sheet, AZM/paint-coated 0.4mm BMT (electric)		1.02	kg	GLO	Calculated	1	1.02	kg
Rollforming (cladding, GLO electric)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.02	kWh	NZ	Estimate	3.6	0.072	MJ
Rollforming (cladding, GLO electric)	Input	Energy, internal	Compressed air, 7 bar		0.05	m ³	NZ	Estimate	8.3	0.415	kg
Rollforming (cladding, GLO electric)	Output	Mass, product	Steel, cladding, profiled, AZM/paint-coated 0.4mm BMT (NZ electric)		1	kg	NZ	As defined	1	1	kg
Rollforming (cladding, GLO electric)	Output	Mass, co-product	Steel scrap		0.02	kg	NZ	Estimate	1	0.02	kg
Rollforming (cladding, GLO electric)	Check		Mass balance		0.0	%			1	0	%

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Rollforming (light steel framing, NZ)	Input	Mass, internal	Steel, mild, sheet, galvanised, 0.75mm BMT Z275		1.02	kg	NZ	Calculated	1	1.02	kg
Rollforming (light steel framing, NZ)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.02	kWh	NZ	Estimate	3.6	0.072	MJ
Rollforming (light steel framing, NZ)	Input	Energy, internal	Compressed air, 7 bar		0.05	m ³	NZ	Estimate	8.3	0.415	kg
Rollforming (light steel framing, NZ)	Output	Mass, product	Steel, framing, galvanised, 0.75mm BMT Z275 (NZ)		1	kg	NZ	As defined	1	1	kg
Rollforming (light steel framing, NZ)	Output	Mass, co-product	Steel scrap		0.02	kg	NZ	Estimate	1	0.02	kg
Rollforming (light steel framing, NZ)	Check		Mass balance		0.0	%			1	0	%
Rollforming (light steel framing, GLO)	Input	Mass, internal	Steel, mild, sheet, galvanised, 0.75mm BMT Z275		1.02	kg	GLO	Calculated	1	1.02	kg
Rollforming (light steel framing, GLO)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.02	kWh	GLO	Estimate	3.6	0.072	MJ
Rollforming (light steel framing, GLO)	Input	Energy, internal	Compressed air, 7 bar		0.05	m ³	GLO	Estimate	8.3	0.415	kg
Rollforming (light steel framing, GLO)	Output	Mass, product	Steel, framing, galvanised, 0.75mm BMT Z275 (GLO)	Scope 1	1	kg	GLO	As defined	1	1	kg
Rollforming (light steel framing, GLO)	Output	Mass, co-product	Steel scrap	Scope 1	0.02	kg	GLO	Estimate	1	0.02	kg
Rollforming (light steel framing, GLO)	Check		Mass balance		0.0	%			1	0	%
Plate rolling and cutting (NZ)	Input	Mass, internal	Steel, mild, slab, reheated		1.05	kg	NZ	Calculated	1	1.05	kg
Plate rolling and cutting (NZ)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.1	kWh	NZ	Estimate	3.6	0.36	MJ
Plate rolling and cutting (NZ)	Output	Mass, product	Steel, mild, plate (NZ)	Scope 1	1	kg	NZ	As defined	1	1	kg
Plate rolling and cutting (NZ)	Output	Mass, co-product	Steel scrap	Scope 1	0.04	kg	NZ	Estimate	1	0.04	kg
Plate rolling and cutting (NZ)	Output	Mass, waste	Mill scale	Scope 1	0.01	kg	NZ	Estimate	1	0.01	kg
Plate rolling and cutting (NZ)	Check		Mass balance		0.0	%			1	0	%

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Plate rolling and cutting (GLO)	Input	Mass, internal	Steel, mild, slab, reheated			1.05 kg	GLO	Calculated	1	1.05 kg	
Plate rolling and cutting (GLO)	Input	Energy, purchased	Electricity, medium voltage	Scope 2		0.1 kWh	GLO	Estimate	3.6	0.36 MJ	
Plate rolling and cutting (GLO)	Output	Mass, product	Steel, mild, plate (GLO)	Scope 1		1 kg	GLO	As defined	1	1 kg	
Plate rolling and cutting (GLO)	Output	Mass, co-product	Steel scrap	Scope 1		0.04 kg	GLO	Estimate	1	0.04 kg	
Plate rolling and cutting (GLO)	Output	Mass, waste	Mill scale	Scope 1		0.01 kg	GLO	Estimate	1	0.01 kg	
Plate rolling and cutting (GLO)	Check		Mass balance			0.0 %			1	0 %	
Hot rolled sections	Input	Mass, internal	Steel, mild, slab, reheated			1.07 kg	GLO	Calculated	1	1.07 kg	
Hot rolled sections	Input	Energy, purchased	Electricity, medium voltage	Scope 2		0.15 kWh	GLO	Estimate	3.6	0.54 MJ	
Hot rolled sections	Output	Mass, product	Steel, mild, section, hot rolled	Scope 1		1 kg	GLO	As defined	1	1 kg	
Hot rolled sections	Output	Mass, co-product	Steel scrap	Scope 1		0.06 kg	GLO	Estimate	1	0.06 kg	
Hot rolled sections	Output	Mass, waste	Mill scale	Scope 1		0.01 kg	GLO	Estimate	1	0.01 kg	
Hot rolled sections	Check		Mass balance			0.0 %			1	0 %	
Reinforcing bar (NZ)	Input	Mass, cut off	Steel, mild, billet	Scope 1		1.04 kg	NZ	Calculated	1	1.04 kg	
Reinforcing bar (NZ)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1		1.5 MJ	NZ	Estimate. NZ Steel	1	1.5 MJ	
Reinforcing bar (NZ)	Input	Energy, purchased	Electricity, medium voltage	Scope 2		0.1 kWh	NZ	Estimate	3.6	0.36 MJ	
Reinforcing bar (NZ)	Output	Mass, product	Steel, mild, bar (NZ)			1 kg	NZ	As defined	1	1 kg	
Reinforcing bar (NZ)	Output	Mass, co-product	Steel scrap	Scope 1		0.03 kg	NZ	Estimate	1	0.03 kg	
Reinforcing bar (NZ)	Output	Mass, waste	Mill scale	Scope 1		0.01 kg	NZ	Estimate	1	0.01 kg	
Reinforcing bar (NZ)	Check		Mass balance			0.0 %			1	0 %	
Reinforcing bar (GLO)	Input	Mass, cut off	Steel, mild, billet	Scope 1		1.04 kg	GLO	Calculated	1	1.04 kg	
Reinforcing bar (GLO)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1		1.5 MJ	GLO	Estimate. NZ Steel	1	1.5 MJ	
Reinforcing bar (GLO)	Input	Energy, purchased	Electricity, medium voltage	Scope 2		0.1 kWh	GLO	Estimate	3.6	0.36 MJ	
Reinforcing bar (GLO)	Output	Mass, product	Steel, mild, bar (GLO)			1 kg	GLO	As defined	1	1 kg	
Reinforcing bar (GLO)	Output	Mass, co-product	Steel scrap	Scope 1		0.03 kg	GLO	Estimate	1	0.03 kg	
Reinforcing bar (GLO)	Output	Mass, waste	Mill scale	Scope 1		0.01 kg	GLO	Estimate	1	0.01 kg	
Reinforcing bar (GLO)	Check		Mass balance			0.0 %			1	0 %	
Wire(NZ)	Input	Mass, cut off	Steel, mild, billet	Scope 1		1.06 kg	NZ	Calculated	1	1.06 kg	
Wire(NZ)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1		1.5 MJ	NZ	Estimate. NZ Steel	1	1.5 MJ	
Wire(NZ)	Input	Energy, purchased	Electricity, medium voltage	Scope 2		0.2 kWh	NZ	Estimate	3.6	0.72 MJ	
Wire(NZ)	Output	Mass, product	Steel, mild, wire (NZ)			1 kg	NZ	As defined	1	1 kg	
Wire(NZ)	Output	Mass, co-product	Steel scrap	Scope 1		0.05 kg	NZ	Estimate	1	0.05 kg	
Wire(NZ)	Output	Mass, waste	Mill scale	Scope 1		0.01 kg	NZ	Estimate	1	0.01 kg	
Wire(NZ)	Check		Mass balance			0.0 %			1	0 %	

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Wire (GLO)	Input	Mass, cut off	Steel, mild, billet	Scope 1	1.06	kg	GLO	Calculated	1	1.06	kg
Wire (GLO)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	1.5	MJ	GLO	Estimate. NZ Steel	1	1.5	MJ
Wire (GLO)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.2	kWh	GLO	Estimate	3.6	0.72	MJ
Wire (GLO)	Output	Mass, product	Steel, mild, wire (GLO)		1	kg	GLO	As defined	1	1	kg
Wire (GLO)	Output	Mass, co-product	Steel scrap	Scope 1	0.05	kg	GLO	Estimate	1	0.05	kg
Wire (GLO)	Output	Mass, waste	Mill scale	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Wire (GLO)	Check		Mass balance		0.0	%			1	0	%
Fasteners	Input	Mass, cut off	Steel, mild, billet	Scope 1	1.13	kg	GLO	Calculated	1	1.13	kg
Fasteners	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	3	MJ	GLO	Estimate. Reheat +	1	3	MJ
Fasteners	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.4	kWh	GLO	Estimate	3.6	1.44	MJ
Fasteners	Output	Mass, product	Steel, mild, fasteners		1	kg	GLO	As defined	1	1	kg
Fasteners	Output	Mass, co-product	Steel scrap	Scope 1	0.12	kg	GLO	Estimate	1	0.12	kg
Fasteners	Output	Mass, waste	Mill scale	Scope 1	0.01	kg	GLO	Estimate	1	0.01	kg
Fasteners	Check		Mass balance		0.0	%			1	0	%
Hollow sections, welded, small (ERW)	Input	Mass, internal	Steel, mild, hot rolled coil		1.04	kg	GLO	Calculated	1	1.04	kg
Hollow sections, welded, small (ERW)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.4	kWh	GLO	Estimate, including	3.6	1.44	MJ
Hollow sections, welded, small (ERW)	Output	Mass, product	Steel, mild, hollow section, small, welded		1	kg	GLO	As defined	1	1	kg
Hollow sections, welded, small (ERW)	Output	Mass, co-product	Steel scrap	Scope 1	0.04	kg	GLO	Estimate	1	0.04	kg
Hollow sections, welded, small (ERW)	Check		Mass balance		0.0	%			1	0	%
Hollow sections, welded, large (LSAW)	Input	Mass, internal	Steel, mild, plate (GLO)		1.04	kg		Calculated	1	1.04	kg
Hollow sections, welded, large (LSAW)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.2	kWh	GLO	Estimate	3.6	0.72	MJ
Hollow sections, welded, large (LSAW)	Output	Mass, product	Steel, mild, hollow section, small, welded		1	kg	GLO	As defined	1	1	kg
Hollow sections, welded, large (LSAW)	Output	Mass, co-product	Steel scrap	Scope 1	0.04	kg	GLO	Estimate	1	0.04	kg
Hollow sections, welded, large (LSAW)	Check		Mass balance		0.0	%			1	0	%

Process	Direction	Type	Flow	Scope	Value	Unit	Region	Source	Conv.	Conv. Value	Conv. Unit
Welded structural sections (NZ)	Input	Mass, internal	Steel, mild, plate (NZ)	Scope 1	1.05	kg		Calculated	1	1.05	kg
Welded structural sections (NZ)	Input	Mass, purchased	Oxygen, liquid		0.03	kg	NZ	Oxygen or acetylene	1	0.03	kg
Welded structural sections (NZ)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	0.2	MJ	NZ	Estimate for thick p	1	0.2	MJ
Welded structural sections (NZ)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.2	kWh	NZ	Estimate	3.6	0.72	MJ
Welded structural sections (NZ)	Output	Mass, product	Steel, mild, section, welded (NZ)		1	kg	NZ	As defined	1	1	kg
Welded structural sections (NZ)	Output	Mass, co-product	Steel scrap	Scope 1	0.05	kg	NZ	Estimate	1	0.05	kg
Welded structural sections (NZ)	Output	Mass, elementary	Oxygen gas	Scope 1	0.03	kg	NZ	Estimate	1	0.03	kg
Welded structural sections (NZ)	Check		Mass balance		0.0	%			1	0	%
Welded structural sections (GLO)	Input	Mass, internal	Steel, mild, plate (GLO)	Scope 1	1.05	kg		Calculated	1	1.05	kg
Welded structural sections (GLO)	Input	Mass, purchased	Oxygen, liquid		0.03	kg	NZ	Oxygen or acetylene	1	0.03	kg
Welded structural sections (GLO)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	0.2	MJ	NZ	Estimate for thick p	1	0.2	MJ
Welded structural sections (GLO)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.2	kWh	NZ	Estimate	3.6	0.72	MJ
Welded structural sections (GLO)	Output	Mass, product	Steel, mild, section, welded (NZ)		1	kg	NZ	As defined	1	1	kg
Welded structural sections (GLO)	Output	Mass, co-product	Steel scrap	Scope 1	0.05	kg	NZ	Estimate	1	0.05	kg
Welded structural sections (GLO)	Output	Mass, elementary	Oxygen gas	Scope 1	0.03	kg	NZ	Estimate	1	0.03	kg
Welded structural sections (GLO)	Check		Mass balance		0.0	%			1	0	%
Shaped casting (GLO)	Input	Mass, cut off	Steel, mild, billet	Scope 1	1.3	kg		Calculated	1	1.3	kg
Shaped casting (GLO)	Input	Mass, purchased	Sand, moulding	Scope 3	0.3	kg	NZ	Moulding sand	1	0.3	kg
Shaped casting (GLO)	Input	Energy, purchased	Thermal energy from natural gas	Scope 1	2	MJ	NZ	Estimate	1	2	MJ
Shaped casting (GLO)	Input	Energy, purchased	Electricity, medium voltage	Scope 2	0.8	kWh	NZ	Estimate	3.6	2.88	MJ
Shaped casting (GLO)	Output	Mass, product	Steel, mild, casting (shaped)		1	kg	NZ	As defined	1	1	kg
Shaped casting (GLO)	Output	Mass, co-product	Steel scrap	Scope 1	0.3	kg	NZ	Estimate	1	0.3	kg
Shaped casting (GLO)	Output	Mass, waste	Waste sand	Scope 1	0.3	kg	NZ	Estimate	1	0.3	kg
Shaped casting (GLO)	Check		Mass balance		0.0	%			1	0	%

Annex D Detailed direct emissions

Table Annex D-1: Direct and energy-related emissions, by product type, by decade

Product group	Product type	Reg.	Base steel	Crude steel	Finishing	Code	2020	2030	2040	2050
Sections	Hot rolled	GLO	EAF	IEAFS	SHR-GLO	IEAFS-SHR-GLO	62	47	23	21
		GLO	EAF	IEAFC	SHR-GLO	IEAFC-SHR-GLO	0	0	0	0
		GLO	EAF	IEAFH	SHR-GLO	IEAFH-SHR-GLO	0	0	0	0
	Welded	NZ	KOBM	NZKOBM	SW-NZ	NZKOBM-SW-NZ	31	0	0	0
		NZ	KOBM	NZEAFC	SW-NZ	NZEAFC-SW-NZ	0	18	17	0
		NZ	KOBM	NZEAFC	SW-NZ	NZEAFC-SW-NZ	0	0	0	2
		GLO	BOF	IBOF	SW-GLO	IBOF-SW-GLO	21	22	16	0
		GLO	BOF	IEAFC	SW-GLO	IEAFC-SW-GLO	0	0	2	2
		GLO	BOF	IEAFH	SW-GLO	IEAFH-SW-GLO	0	0	0	1
		GLO	BOF	IBOF	SHS-GLO	IBOF-SHS-GLO	114	113	80	0
	Hollow (small)	GLO	BOF	IEAFC	SHS-GLO	IEAFC-SHS-GLO	0	0	10	9
		GLO	BOF	IEAFH	SHS-GLO	IEAFH-SHS-GLO	0	0	0	4
		GLO	BOF	IBOF	SHL-GLO	IBOF-SHL-GLO	87	88	64	0
	Hollow (large)	GLO	BOF	IEAFC	SHL-GLO	IEAFC-SHL-GLO	0	0	8	8
		GLO	BOF	IEAFH	SHL-GLO	IEAFH-SHL-GLO	0	0	0	3
		GLO	BOF	IEAFH	SHL-GLO	IEAFH-SHL-GLO	0	0	0	3
Flat products	Plate	NZ	KOBM	NZKOBM	P-NZ	NZKOBM-P-NZ	54	0	0	0
		NZ	KOBM	NZEAFC	P-NZ	NZEAFC-P-NZ	0	30	28	0
		NZ	KOBM	NZEAFC	P-NZ	NZEAFC-P-NZ	0	0	0	4
		GLO	BOF	IBOF	P-GLO	IBOF-P-GLO	36	38	28	0
		GLO	BOF	IEAFC	P-GLO	IEAFC-P-GLO	0	0	4	3
		GLO	BOF	IEAFH	P-GLO	IEAFH-P-GLO	0	0	0	1

Product group	Product type	Reg.	Base steel	Crude steel	Finishing	Code	2020	2030	2040	2050
	Sheet (galvanised)	NZ	KOBM	NZKOBM	SG-NZ	NZKOBM-SG-NZ	283	0	0	0
		NZ	KOBM	NZEAFC	SG-NZ	NZEAFC-SG-NZ	0	160	150	0
		NZ	KOBM	NZEAFC	SG-NZ	NZEAFC-SG-NZ	0	0	0	24
		GLO	BOF	IBOF	SG-GLO	IBOF-SG-GLO	53	52	36	0
		GLO	BOF	IEAFC	SG-GLO	IEAFC-SG-GLO	0	0	5	4
		GLO	BOF	IEAFH	SG-GLO	IEAFH-SG-GLO	0	0	0	2
	Sheet (coated)	NZ	KOBM	NZKOBM	SC-NZ-Gas	NZKOBM-SC-NZ-Gas	552	0	0	0
		NZ	KOBM	NZEAFC	SC-NZ-Gas	NZEAFC-SC-NZ-Gas	0	240	0	0
		NZ	KOBM	NZEAFC	SC-NZ-Gas	NZEAFC-SC-NZ-Gas	0	0	0	0
		NZ	KOBM	NZKOBM	SC-NZ-Elec	NZKOBM-SC-NZ-Elec	0	0	0	0
		NZ	KOBM	NZEAFC	SC-NZ-Elec	NZEAFC-SC-NZ-Elec	0	80	284	0
		NZ	KOBM	NZEAFC	SC-NZ-Elec	NZEAFC-SC-NZ-Elec	0	0	0	50
		GLO	BOF	IBOF	SC-GLO-Gas	IBOF-SC-GLO-Gas	23	22	0	0
		GLO	BOF	IEAFC	SC-GLO-Gas	IEAFC-SC-GLO-Gas	0	0	0	0
		GLO	BOF	IEAFH	SC-GLO-Gas	IEAFH-SC-GLO-Gas	0	0	0	0
		GLO	BOF	IBOF	SC-GLO-Elec	IBOF-SC-GLO-Elec	0	0	14	0
		GLO	BOF	IEAFC	SC-GLO-Elec	IEAFC-SC-GLO-Elec	0	0	2	2
		GLO	BOF	IEAFH	SC-GLO-Elec	IEAFH-SC-GLO-Elec	0	0	0	1
Long products	Reinforcing	NZ	KOBM	NZKOBM	LR-NZ	NZKOBM-LR-NZ	652	0	0	0
		NZ	KOBM	NZEAFC	LR-NZ	NZEAFC-LR-NZ	0	367	345	0

Product group	Product type	Reg.	Base steel	Crude steel	Finishing	Code	2020	2030	2040	2050
		NZ	KOBM	NZEAFH	LR-NZ	NZEAFH-LR-NZ	0	0	0	45
		GLO	EAFC	IEAFS	LR-GLO	IEAFS-LR-GLO	9	7	3	3
		GLO	EAFC	IEAFH	LR-GLO	IEAFH-LR-GLO	0	0	0	0
		GLO	EAFC	IEAFH	LR-GLO	IEAFH-LR-GLO	0	0	0	0
	Other long	GLO	EAFC	IEAFS	LO-GLO	IEAFS-LO-GLO	2	2	1	1
		GLO	EAFC	IEAFH	LO-GLO	IEAFH-LO-GLO	0	0	0	0
		GLO	EAFC	IEAFH	LO-GLO	IEAFH-LO-GLO	0	0	0	0
	Wire	NZ	KOBM	NZKOBM	LW-NZ	NZKOBM-LW-NZ	74	0	0	0
		NZ	KOBM	NZEAFH	LW-NZ	NZEAFH-LW-NZ	0	0	0	0
		NZ	KOBM	NZEAFH	LW-NZ	NZEAFH-LW-NZ	0	0	0	0
		GLO	EAFC	IEAFS	LW-GLO	IEAFS-LW-GLO	10	15	7	6
		GLO	EAFC	IEAFH	LW-GLO	IEAFH-LW-GLO	0	0	0	0
		GLO	EAFC	IEAFH	LW-GLO	IEAFH-LW-GLO	0	0	0	0
Fasteners	Fasteners	GLO	EAFC	IEAFS	F-GLO	IEAFS-F-GLO	21	16	8	7
		GLO	EAFC	IEAFH	F-GLO	IEAFH-F-GLO	0	0	0	0
		GLO	EAFC	IEAFH	F-GLO	IEAFH-F-GLO	0	0	0	0
Castings	Castings	GLO	BOF	IBOF	C-GLO	IBOF-C-GLO	34	35	26	0
		GLO	BOF	IEAFH	C-GLO	IEAFH-C-GLO	0	0	0	2
		GLO	BOF	IEAFH	C-GLO	IEAFH-C-GLO	0	0	0	2
Stainless steel	Stainless steel	GLO	EAFC	IEAFS	SSt-GLO	IEAFS-SSt-GLO	7	5	2	2
Total							2,125	1,358	1,169	209

Annex E Detailed life cycle results

Table Annex E-1: Life cycle emissions for module A1-A3 only, by product type, by decade

Product group	Product type	Reg.	Base steel	Crude steel	Finishing	Code	2020	2030	2040	2050
Sections	Hot rolled	GLO	EAF	IEAFS	SHR-GLO	IEAFS-SHR-GLO	122	111	84	76
		GLO	EAF	IEAFC	SHR-GLO	IEAFC-SHR-GLO	0	0	0	0
		GLO	EAF	IEAFH	SHR-GLO	IEAFH-SHR-GLO	0	0	0	0
	Welded	NZ	KOBM	NZKOBM	SW-NZ	NZKOBM-SW-NZ	34	0	0	0
		NZ	KOBM	NZEAFC	SW-NZ	NZEAFC-SW-NZ	0	20	19	0
		NZ	KOBM	NZEAFC	SW-NZ	NZEAFC-SW-NZ	0	0	0	5
		GLO	BOF	IBOF	SW-GLO	IBOF-SW-GLO	26	27	20	0
		GLO	BOF	IEAFC	SW-GLO	IEAFC-SW-GLO	0	0	3	2
		GLO	BOF	IEAFH	SW-GLO	IEAFH-SW-GLO	0	0	0	4
		GLO	BOF	IBOF	SHS-GLO	IBOF-SHS-GLO	137	138	99	0
	Hollow (small)	GLO	BOF	IEAFC	SHS-GLO	IEAFC-SHS-GLO	0	0	13	12
		GLO	BOF	IEAFH	SHS-GLO	IEAFH-SHS-GLO	0	0	0	21
		GLO	BOF	IBOF	SHL-GLO	IBOF-SHL-GLO	104	107	79	0
	Hollow (large)	GLO	BOF	IEAFC	SHL-GLO	IEAFC-SHL-GLO	0	0	11	10
		GLO	BOF	IEAFH	SHL-GLO	IEAFH-SHL-GLO	0	0	0	16
		GLO	BOF	IEAFH	SHL-GLO	IEAFH-SHL-GLO	0	0	0	16
Flat products	Plate	NZ	KOBM	NZKOBM	P-NZ	NZKOBM-P-NZ	59	0	0	0
		NZ	KOBM	NZEAFC	P-NZ	NZEAFC-P-NZ	0	35	33	0
		NZ	KOBM	NZEAFC	P-NZ	NZEAFC-P-NZ	0	0	0	8
		GLO	BOF	IBOF	P-GLO	IBOF-P-GLO	44	46	34	0
		GLO	BOF	IEAFC	P-GLO	IEAFC-P-GLO	0	0	5	4
		GLO	BOF	IEAFH	P-GLO	IEAFH-P-GLO	0	0	0	7

Product group	Product type	Reg.	Base steel	Crude steel	Finishing	Code	2020	2030	2040	2050
	Sheet (galvanised)	NZ	KOBM	NZKOBM	SG-NZ	NZKOBM-SG-NZ	326	0	0	0
		NZ	KOBM	NZEAFC	SG-NZ	NZEAFC-SG-NZ	0	200	188	0
		NZ	KOBM	NZEAFC	SG-NZ	NZEAFC-SG-NZ	0	0	0	61
		GLO	BOF	IBOF	SG-GLO	IBOF-SG-GLO	67	67	48	0
		GLO	BOF	IEAFC	SG-GLO	IEAFC-SG-GLO	0	0	7	6
		GLO	BOF	IEAFH	SG-GLO	IEAFH-SG-GLO	0	0	0	13
	Sheet (coated)	NZ	KOBM	NZKOBM	SC-NZ-Gas	NZKOBM-SC-NZ-Gas	680	0	0	0
		NZ	KOBM	NZEAFC	SC-NZ-Gas	NZEAFC-SC-NZ-Gas	0	332	0	0
		NZ	KOBM	NZEAFC	SC-NZ-Gas	NZEAFC-SC-NZ-Gas	0	0	0	0
		NZ	KOBM	NZKOBM	SC-NZ-Elec	NZKOBM-SC-NZ-Elec	0	0	0	0
		NZ	KOBM	NZEAFC	SC-NZ-Elec	NZEAFC-SC-NZ-Elec	0	114	407	0
		NZ	KOBM	NZEAFC	SC-NZ-Elec	NZEAFC-SC-NZ-Elec	0	0	0	166
		GLO	BOF	IBOF	SC-GLO-Gas	IBOF-SC-GLO-Gas	31	31	0	0
		GLO	BOF	IEAFC	SC-GLO-Gas	IEAFC-SC-GLO-Gas	0	0	0	0
		GLO	BOF	IEAFH	SC-GLO-Gas	IEAFH-SC-GLO-Gas	0	0	0	0
		GLO	BOF	IBOF	SC-GLO-Elec	IBOF-SC-GLO-Elec	0	0	21	0
		GLO	BOF	IEAFC	SC-GLO-Elec	IEAFC-SC-GLO-Elec	0	0	3	3
		GLO	BOF	IEAFH	SC-GLO-Elec	IEAFH-SC-GLO-Elec	0	0	0	7
Long products	Reinforcing	NZ	KOBM	NZKOBM	LR-NZ	NZKOBM-LR-NZ	716	0	0	0
		NZ	KOBM	NZEAFC	LR-NZ	NZEAFC-LR-NZ	0	421	397	0

Product group	Product type	Reg.	Base steel	Crude steel	Finishing	Code	2020	2030	2040	2050
		NZ	KOBM	NZEAFH	LR-NZ	NZEAFH-LR-NZ	0	0	0	98
		GLO	EAFC	IEAFS	LR-GLO	IEAFS-LR-GLO	18	17	13	12
		GLO	EAFC	IEAFH	LR-GLO	IEAFH-LR-GLO	0	0	0	0
		GLO	EAFC	IEAFH	LR-GLO	IEAFH-LR-GLO	0	0	0	0
	Other long	GLO	EAFC	IEAFS	LO-GLO	IEAFS-LO-GLO	5	4	3	3
		GLO	EAFC	IEAFH	LO-GLO	IEAFH-LO-GLO	0	0	0	0
		GLO	EAFC	IEAFH	LO-GLO	IEAFH-LO-GLO	0	0	0	0
	Wire	NZ	KOBM	NZKOBM	LW-NZ	NZKOBM-LW-NZ	81	0	0	0
		NZ	KOBM	NZEAFH	LW-NZ	NZEAFH-LW-NZ	0	0	0	0
		NZ	KOBM	NZEAFH	LW-NZ	NZEAFH-LW-NZ	0	0	0	0
		GLO	EAFC	IEAFS	LW-GLO	IEAFS-LW-GLO	19	35	26	24
		GLO	EAFC	IEAFH	LW-GLO	IEAFH-LW-GLO	0	0	0	0
		GLO	EAFC	IEAFH	LW-GLO	IEAFH-LW-GLO	0	0	0	0
Fasteners	Fasteners	GLO	EAFC	IEAFS	F-GLO	IEAFS-F-GLO	37	33	24	22
		GLO	EAFC	IEAFH	F-GLO	IEAFH-F-GLO	0	0	0	0
		GLO	EAFC	IEAFH	F-GLO	IEAFH-F-GLO	0	0	0	0
Castings	Castings	GLO	BOF	IBOF	C-GLO	IBOF-C-GLO	43	45	33	0
		GLO	BOF	IEAFH	C-GLO	IEAFH-C-GLO	0	0	5	4
		GLO	BOF	IEAFH	C-GLO	IEAFH-C-GLO	0	0	0	8
Stainless steel	Stainless steel	GLO	EAFC	IEAFS	SSt-GLO	IEAFS-SSt-GLO	72	75	68	62
Total							2,622	1,857	1,642	654

About thinkstep-anz

We're an independent and award winning sustainability firm with offices in Australia and Aotearoa New Zealand – and a global reach.

Our team works with you to put sustainability at the heart of your business, to set you up to succeed and inspire you to keep achieving more.

We focus on what matters and use data to understand organisations and their impact. We provide practical resources and ideas that move you ahead.

We create value for organisations like yours, bringing our technical expertise and business know-how to help you tell your story. It's what we've been doing since 2006.

Our services cover:



LCA and EPD services

Measure environmental impacts to support informed decision-making.

- Life cycle assessment (LCA)
- Environmental product declarations (EPD)
- Product carbon footprinting
- Critical review



Carbon footprint services

Calculate your carbon footprint, develop net zero strategies and targets.

- Carbon footprint: Scope 1 & 2
- Scope 3
- Carbon reduction strategy
- Net zero targets



Circular economy services

Identify opportunities to improve resource efficiency and reduce waste.

- Material Circularity Indicator
- Circular economy workshops
- Circular economy strategy
- Circularity declaration



Sustainability strategy

Turn sustainability priorities into practical roadmaps and targets.

- Materiality assessment
- Double materiality
- Sustainability strategy
- ESG policies



ESG and climate reporting

Prepare reports and disclosures supported by robust data and practical implementation.

- Climate related disclosures
- Disclosurekit
- GRI and sustainability reports
- Greenwashing risk review



Communications and design services

We turn complex data into graphics, summary reports and presentations.

- Sustainability reports
- Summary reports
- Board presentations
- Case studies
- Infographics



Software, data and tools

- LCA calculators
- LCA software
- Material Circularity Indicator
- Spend based emission factors
- Residual grid mix factors
- LCA data
- Carbon reporting software



Upskilling and training

- LCA training
- Carbon workshops
- Supplier workshops
- Training for industry associations
- Tailored in-house workshops
- Greenwash risk training



Succeed sustainably

www.thinkstep-anz.com

We don't just talk
about sustainability
– we practise it too



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