

3. PROJECT RATIONALE

- 3.1 The coal stockyard is the gateway to the overseas markets for coal from the West Coast. Coal has been exported from Lyttelton since the 1970s and for many years the majority of coal produced on the West Coast has been exported rather than used domestically.
- 3.2 Approximately ninety-five percent of the coal exported is used in the making of steel which is shown schematically in **Figure 3.1**. Steel is an essential material, used in the construction of buildings, motor vehicles and appliances. Typically, developed economies use between approximately 0.3 and 1 tonne of steel per person per year.¹
- 3.3 The coal is used in steel making because of its high carbon content and is called metallurgical coal in the industry but is more commonly known as ‘coking coal.’

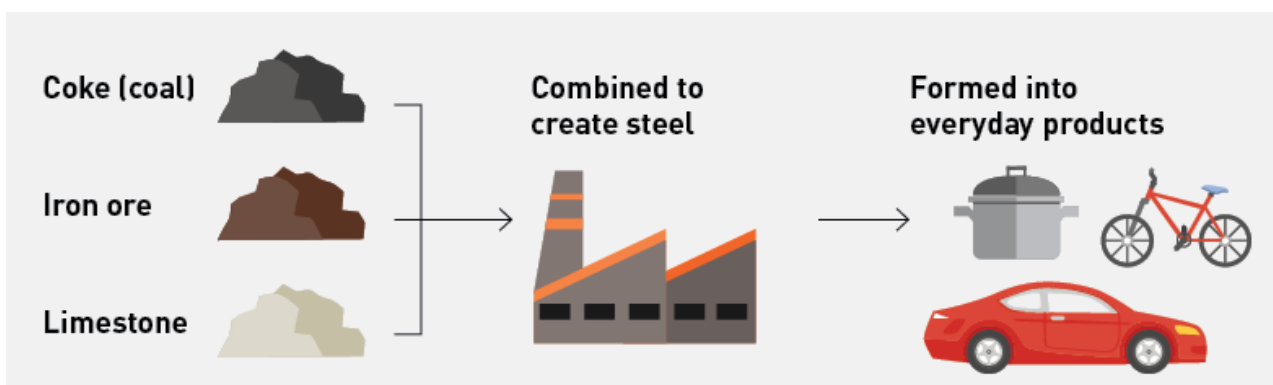


Figure 3.1: Key ingredients that are combined in a furnace to make steel.

- 3.4 The main raw materials needed in steel-making as shown in **Figure 3.1** are iron ore, coal, limestone as well as some recycled steel. To make new steel using a blast furnace, typically about 1,370 kg of iron ore, 780 kg of coking coal, 270 kg of limestone, and 125 kg of recycled steel is used to produce 1,000 kg of crude steel.²
- 3.5 The coal is ‘carbonised’ in a series of coke ovens where the coking coal is heated to 1,000-1,100°C in the absence of oxygen for 12-36 hours. During this process, by-products are removed, and coke is produced.

¹ 2020, World Steel in Figures, World Steel Association (page 29)

² World Steel Association, Fact Sheet – Steel and Raw Materials <https://www.worldsteel.org/about-steel/steel-facts.html>

- 3.6 The coke together with the iron and limestone are fed into a furnace to about 1,200°C which causes the coke to burn, producing carbon monoxide which reacts with the iron ore, and melts the iron. Finally, a tap hole at the bottom of the furnace is opened and molten iron and slag (impurities) are drained off.³ Approximately, 70% of total global steel is made this way.⁴ While other production methods are being examined it is expected coal will be needed to produce steel for some time yet.
- 3.7 The coal transiting at Lyttelton is shipped mostly to China, Japan, India and Australia. New Zealand coking coal is desirable for steel production due to its high carbon content, low ash content, very low phosphorus content and because the coal is mostly vitrinite.⁵
- 3.8 The remaining five percent of the coal exported is not suitable for steel production because it has been exposed to the weather with associated oxidation of the coal (called coal weathering). This coal is typically used in boilers to produce heat for manufacturing, industry, or electricity generation: otherwise known as thermal coal.

³ For further information on the integrated steelmaking route, based on the blast furnace and basic oxygen furnace, refer to <https://www.worldsteel.org/about-steel/steel-facts.html> and <https://www.worldcoal.org/coal-facts/coal-steel>

⁴ Most of the remaining 30% of steel produced is using an electric arc furnace that focuses on recycled steels and ‘sponge’ iron and electricity. Again, refer to <https://www.worldsteel.org/about-steel/steel-facts.html>

⁵ Vitrinite coal has a shiny appearance resembling glass (vitreous) and is useful because it acts to bind other (less vitreous) coal types together: known as a blend improver