





GREEN ENERGY MINERAL: KEY FACTS

# Titanium

<b>US CRITICAL MINERAL?</b> <b>YES</b>	
<b>MAIN USES IN GREEN ENERGY TECHNOLOGY</b>	<b>KEY DEVELOPMENT ISSUES IN MINING</b>
 Geothermal	 Environment  Conflict  Land tenure

## DEMAND PROJECTIONS

Titanium is a metal that is as strong as steel but weighs half as much, making it valuable for a variety of applications including aerospace, sporting goods, and medical equipment. However, 95% of titanium use stems not from its refined metal form but from titanium dioxide which is used as a pigment in paint, ink, plastics, and cosmetics (Titanium, n.d.). In renewables titanium metal is an important component of geothermal technologies since titanium is one of the few minerals that can survive extremely corrosive environments for more than a few years. Titanium also features in experimental energy storage and PV technologies. Titanium demand in renewables is projected to reach 3,440 tons per year by 2050, which represents no increase over 2018 global production levels (Hund et al., 2020).

## PRODUCTION/RESERVES



Source: OECD

Titanium’s main ores are rutile and ilmenite, which are considered mineral sands along with zirconium. **China** is the largest producer of ilmenite (2.3 million tons, or 30% of global supply), followed by **South Africa** (1 million tons) and **Australia** (800,000 tons). **Australia** is the world’s largest producer of rutile (200,000 tons in 2020, or 30% of global supply), followed by **Sierra Leone** (120,000 tons) and **South Africa** (100,000 tons). Rutile prices based on Australian trade data rose from \$740 per ton in 2016 to \$1,200 per ton in 2020. For ilmenite, prices rose from \$142 per ton to \$210 per ton in the same period.

## MINING IN USAID-PRESENCE COUNTRIES

**South Africa** is a top producer of both ilmenite and rutile, and **Sierra Leone** is a top producer of rutile. Other significant ilmenite producers are **Mozambique, Ukraine, Senegal, Madagascar, Kenya, India, Vietnam,** and **Brazil**. Other significant rutile producers are **Ukraine, Kenya, India, Senegal,** and **Mozambique**. Smaller or emerging mineral sand producers are located in **Sri Lanka, Burundi, Kazakhstan,** and **Malawi**.

## MAJOR INDUSTRIAL COMPANIES

**Rio Tinto** (Australia) owns the largest mineral sands producer in South Africa called Richard Bay Minerals as well as the ilmenite mine in south Madagascar. Australian **Iluka Resources** owns Sierra Rutile, the producer of most of Sierra Leone's rutile. **Kenmare Resources** (London-listed) is the main company operating in Mozambique. **Tronox** is an American chemical company that owns mines in South Africa and Australia as well as trading titanium-based products.

## ARTISANAL AND SMALL-SCALE MINING (ASM)

Sierra Leone has some artisanal mining of mineral sands, often as a byproduct of artisanal gold mining (EITI, 2021).

## ISSUES IN USAID-PRESENCE COUNTRIES

In South Africa, Rio Tinto's operations have been affected by violent protests by contractors in addition to shootings of employees, including the murder of its general manager in May 2021 (Mining.com, 2021). The issues which have led to the suspension of operations are different points in recent years appear to be linked to general insecurity and high unemployment in the province.

In Madagascar, Rio Tinto's mine has come under scrutiny for negative environmental impacts, namely the contamination of drinking water in surrounding communities by unsafe levels of lead and uranium concentrated due to extraction (Reid, 2019). While mineral sand mining is generally considered less destructive than open-pit mining and other minerals requiring chemical extraction, it is known to concentrate naturally occurring radioactive material. Rio Tinto has also been criticized for its handling of indigenous community land rights in its program of creating biodiversity offsets from its mining operation (Orengo, 2020).

## MINE DEVELOPMENT AND SUPPLY CHAIN DYNAMICS

Sierra Leone's rutile sector is uncertain as its main company suspended operations for six months in order to reduce costs and boost productivity (Iannucci, 2021). Companies like Iluka must determine based on costs as well as deposit characteristics the induce price at which a project begins to produce an adequate return. Investment decisions also take into account technical and socio-political risk.

Titanium metal is derived from titanium sponge which is produced in an energy-intensive and high-cost process. Most titanium sponge is produced in China (36%), Japan (25%) and Eastern Europe (34%) (ILUKA, 2013).

## ORGANIZATIONS AND INDUSTRY GROUPS

The **Zircon Association** (Zircon Industry Association, n.d.) members include the major rutile and ilmenite producers.