

Critical materials in the value chain of electrolysers for electrolysis of water

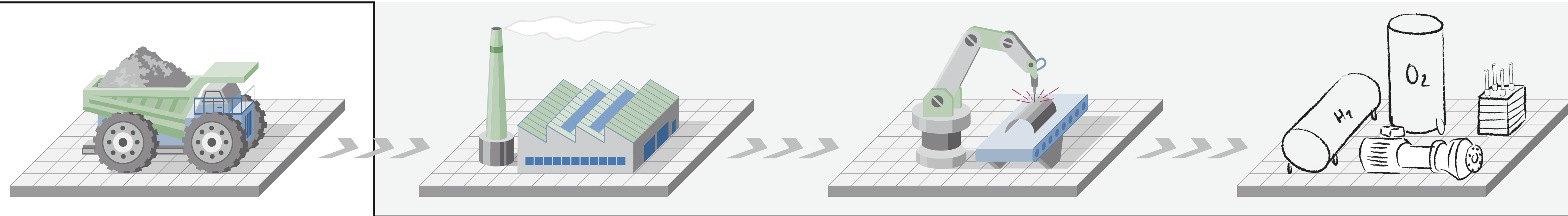


Step 1: (Critical) raw materials¹

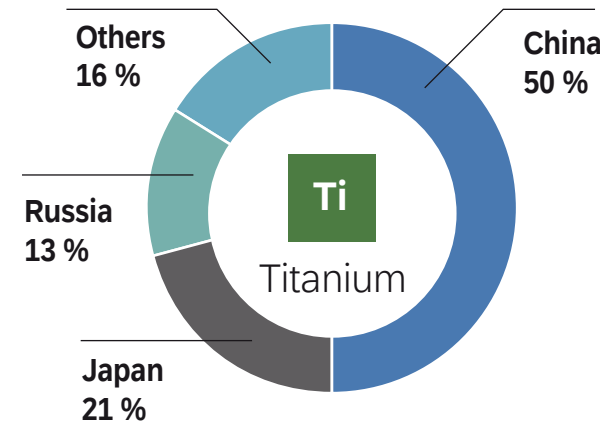
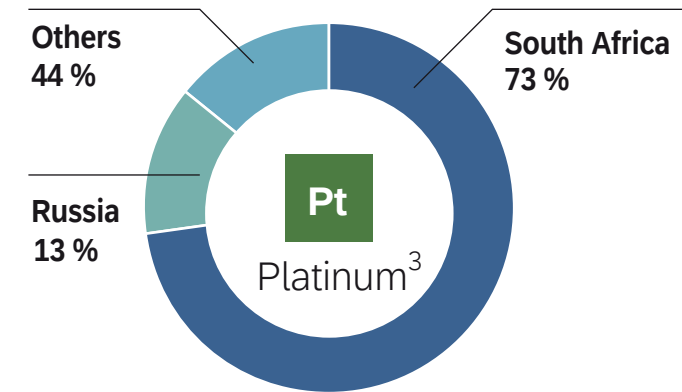
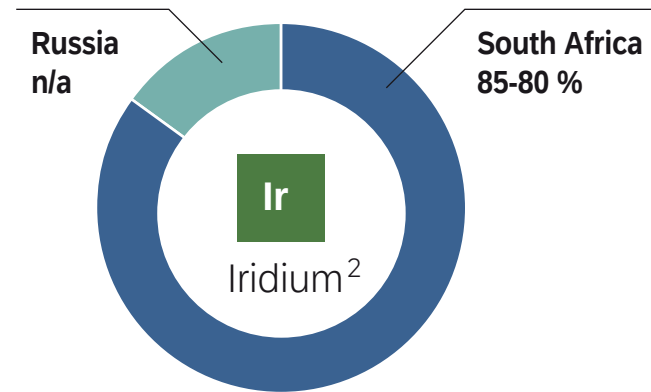
Step 2: Processes materials

Step 3: Components

Step 4: Assemblies



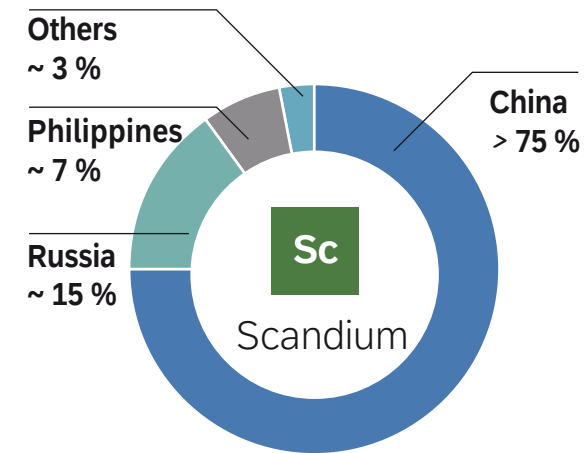
PEMEL



Ni
Nickel⁴

Gr Cr
Ni Al

SOEL



Gd Gadolinium

Prv Perovskite materials like lanthanum-strontium-cobalt-ferrite (LSCF), lanthanum-strontium-cobaltite (LSC) or lanthanum-strontium-manganite (LSM)

Y Yttrium is obtained from ion adsorption clays (IAT) and the mineral xenotim

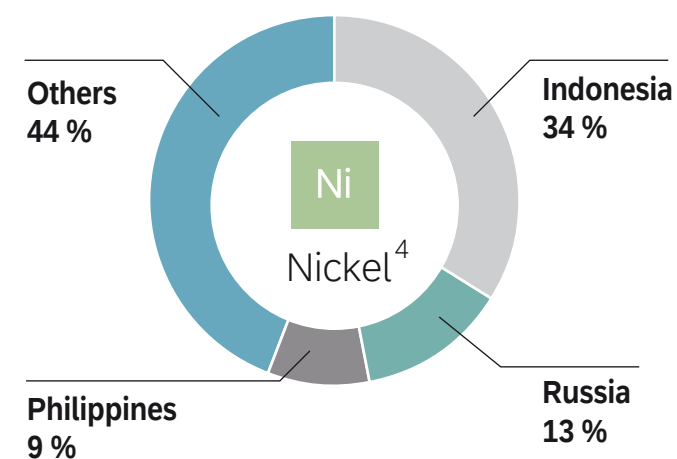
Xenotim
- Australia
- Malaysia, Indonesia and Thailand

IAT comes from
- China
- Myanmar
- Currently developing IAT production in Chile, Brazil, Uganda und Madagascar.

Ni
Nickel⁴

La Sr Co Fe
Mn Zr Zr
Stainless steel
Borosilicate glass

AEL



ZrO₂

- Critical Raw Material according to DERA
- strategic raw materials
- Other materials

Critical raw materials are characterized by the following:

- a high dependency on a few producers, each of which has very high market power
- low production (in some cases) and uncertainty whether it can be scaled up
- fluctuations in price development (for most)
- rising demand in the future
- markets are not transparent in terms of information (for most).
- significant environmental and social risks in the supply chain such as the disrespect of human rights in the production of the raw materials or the violation of environmental laws or the lack there of in certain producing countries.

¹ Critical raw materials are commonly defined as those raw materials that are economically and strategically important for an economy but have a high-risk associated with their supply.

² By-product of platinum- and palladium, see below

³ especially for iridium production

⁴ Nickel does not meet the critical raw material thresholds of the EU but is categorized as a strategic raw material in line with the Critical Raw Materials Act of the EU.