Securing Critical Materials for Critical Sectors

Irina Patrahau
HCSS
May 27th, 2021

iea

Press release

Clean energy demand for critical minerals set to soar as the world pursues net zero goals

5 May 2021

In the most comprehensive global study yet, IEA shows need for government action to ensure reliable, sustainable supplies of elements vital fo EVs, power grids, wind turbines and other key technologies

Supplies of critical minerals essential for key clean energy technologies like electric vehicles and wind turbines need to pick up sharply over the coming decades to meet the world's climate goals, creating potential energy security

ABN·AMRO

Group Economics | 11 May 2021

Energy Transition Monitor - Critical Metals

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No easy road to greening road transportation

- **There are three options for greening road transportation, namely full or partial electrificatio more efficient fuel combustion and the rollout of fuel cell infrastructure.**
- **Every option will lead to the scarcity of some metals and a geopolitical dependency**
- **But a combination of these options would ease the scarcity and criticality of these metals**
- **We think demand and prices will rise substantially for lithium, some rare earth metals and platinum group metals**

1. Introduction

Greening road mobility has been on most governments' minds for a long while e.g. in the form of fuel efficiency standards for vehicles. Now the shift is to move away from combustion engines. Transportation (shipping, aviation ar road transport) accounts for more than a quarter of global energy-related carbon emissions. Road travel accounts fo roughly three-quarters of the transport emissions.

The Hague Centre for Strategic Studies

ENERGY.GOV

Department of Energy

DOE Awards $19 Million for Initiatives to Produce Rare Earth Elements and Critical Minerals

APRIL 29, 2021

European Raw Materials Alliance contributes to Europe's industrial resilience

European Alliance for a more resilient and greener Europe

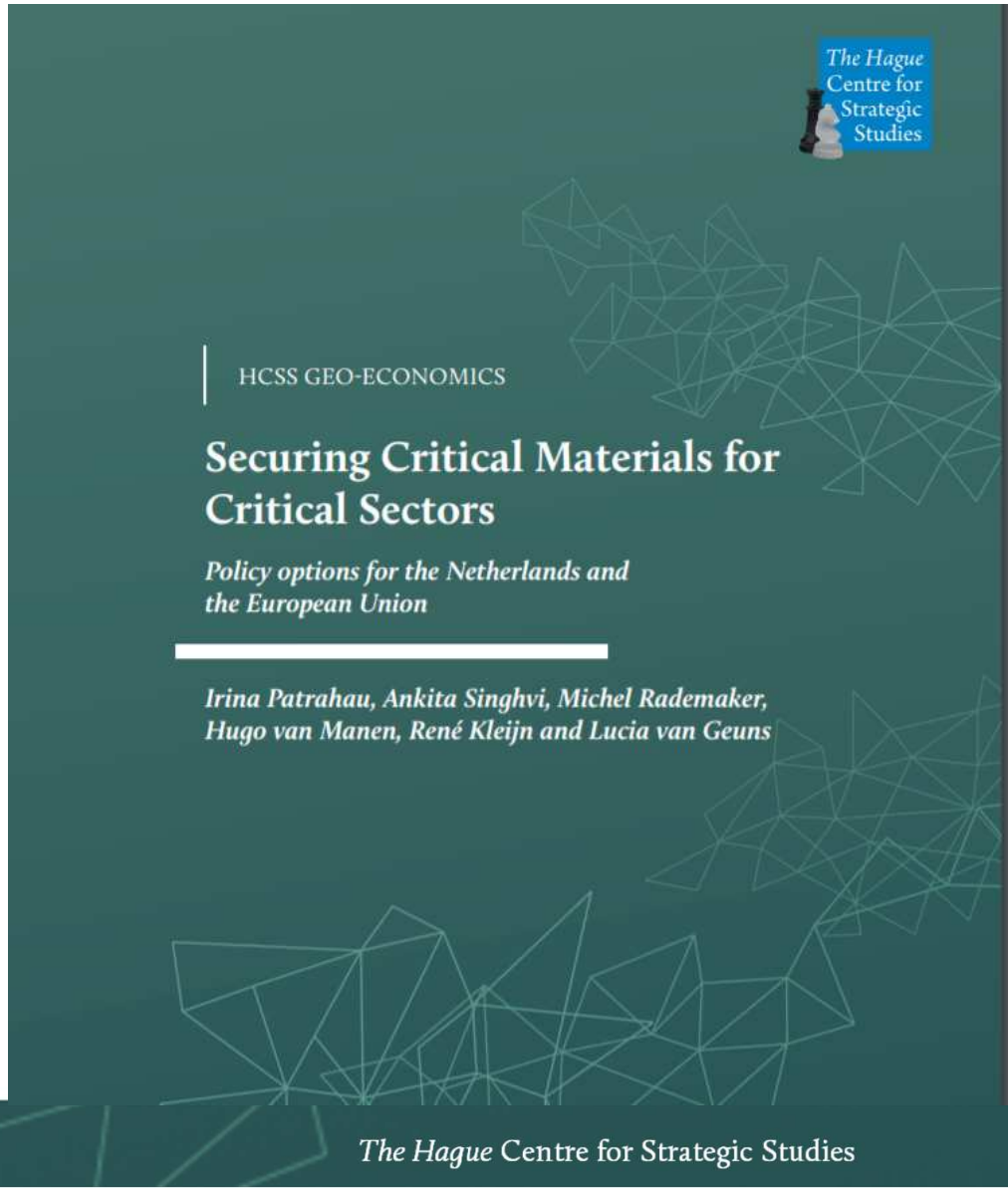
On 23 February 2021, President von der Leyen, in the opening speech at the EU Industry Days 2021, highlighted the importance of the European Raw Materials Alliance (ERMA) to build Europe's resilience, reduce dependency on third countries, improve resource efficiency and circularity to ensure Europe's ambition for a green and digital future.

Today's presentation is based on the HCSS report, published in 2020:

"Securing Critical Materials for Critical Sectors:

Policy options for the Netherlands and the European Union"

Available at **www.hcss.nl**



Contents

- What are critical raw materials?
- Why are they important?
- Where do we get the critical raw materials from?
- Strategies to secure supplies
- Geopolitical issues + policy options for the EU and NL
- Key take-aways

What are critical raw materials?

Concept of critical raw materials (CRM) first introduced by the EU in 2011.

CRM are economically and strategically important minerals for the European economy, but have a high risk associated with their supply

due to high import dependence and lack of substitutes.

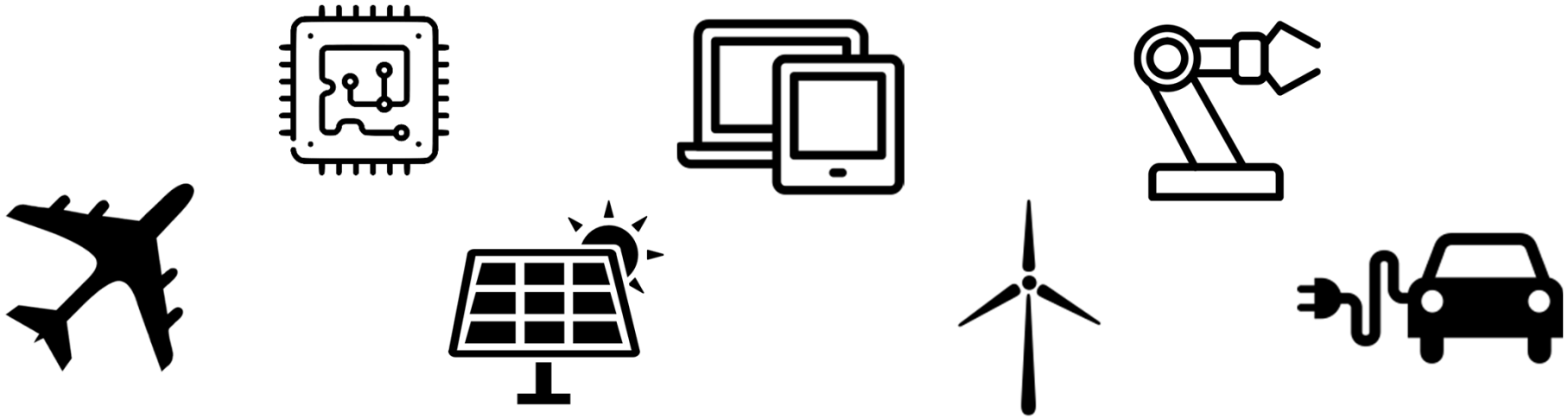
The 2020 CRM list

Antimony	Hafnium	Phosphorus
Baryte	Heavy Rare Earth Elements	Scandium
Beryllium	Light Rare Earth Elements	Silicon metal
Bismuth	Indium	Tantalum
Borate	Magnesium	Tungsten
Cobalt	Natural graphite	Vanadium
Coking Coal	Natural rubber	**Bauxite**
Fluorspar	Niobium	**Lithium**
Gallium	Platinum Group Metals	**Titanium**
Germanium	Phosphate rock	**Strontium**

In bold: new compared to the 2017 CRM list.

Source: European Commission, 2020.

What are critical raw materials used for?

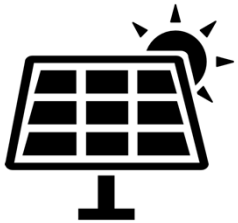


Consumer electronics, environmental technologies, electric transport, aerospace, defense, robotics

Energy and transport in the Netherlands

Today: 4,7 GW wind energy
By 2030: 18,9 GW wind energy

Permanent magnet REEs: 90% global production in China, some Western Australia and other countries



Today: 2,4 GW of solar PV
By 2030: 19.5 GW of solar PV

Gallium (85% China), Germanium (67% China), Indium (57% China), Silicon (61% China)

Today: ± 200,000 electric cars
By 2030: ±2 million electric cars

Li-ion battery: Lithium (44% Chile), Cobalt (64% Congo), natural graphite (China)

Source: Klimaatakkoord, 2019; European Commission, 2020

Ambitions for future decades

2050:

- Climate neutrality
- Strategic autonomy
- Global competitiveness

2049:

- "Chinese dream" - Industrial and technological leadership

2060:

- Climate neutrality

Surge in demand for critical raw materials

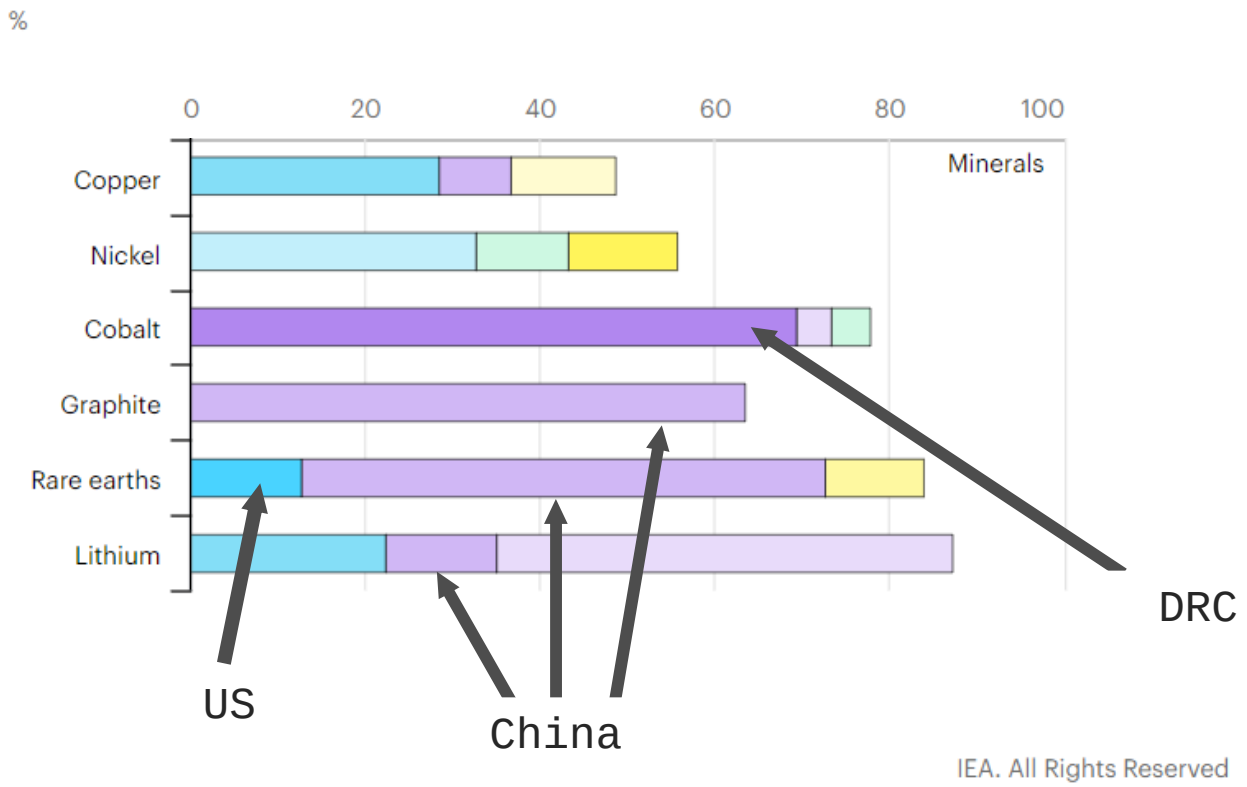
China’s dominant position

The most important CRM mining areas

Source: DW, 2021

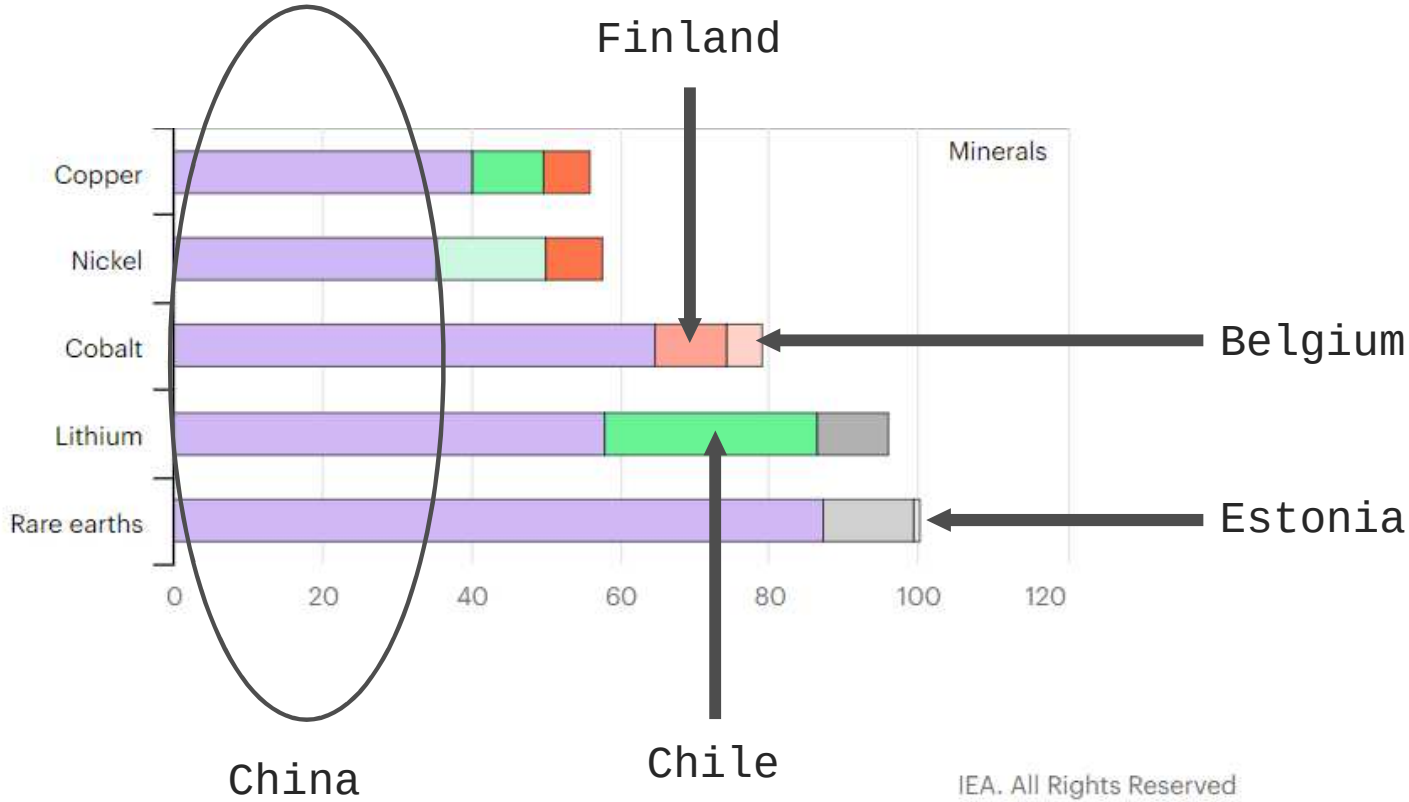
- For a long time, China has been active in securing a dominant position regarding CRM.
- China is the main source of EU imports of both CRM and components for climate-related technologies.

Share of top three producing countries in extraction of selected minerals, 2019



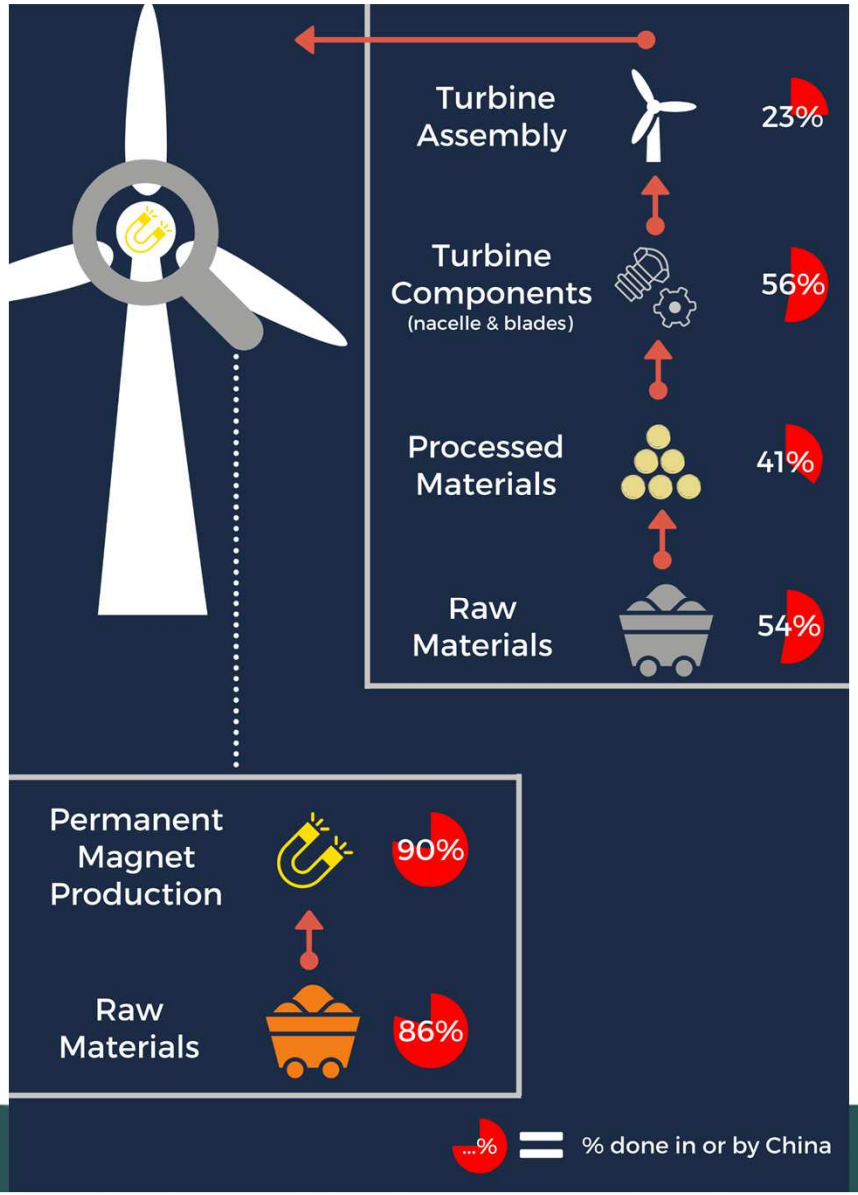
Source: IEA, 2021.

Share of top three producing countries in total processing of selected minerals, 2019

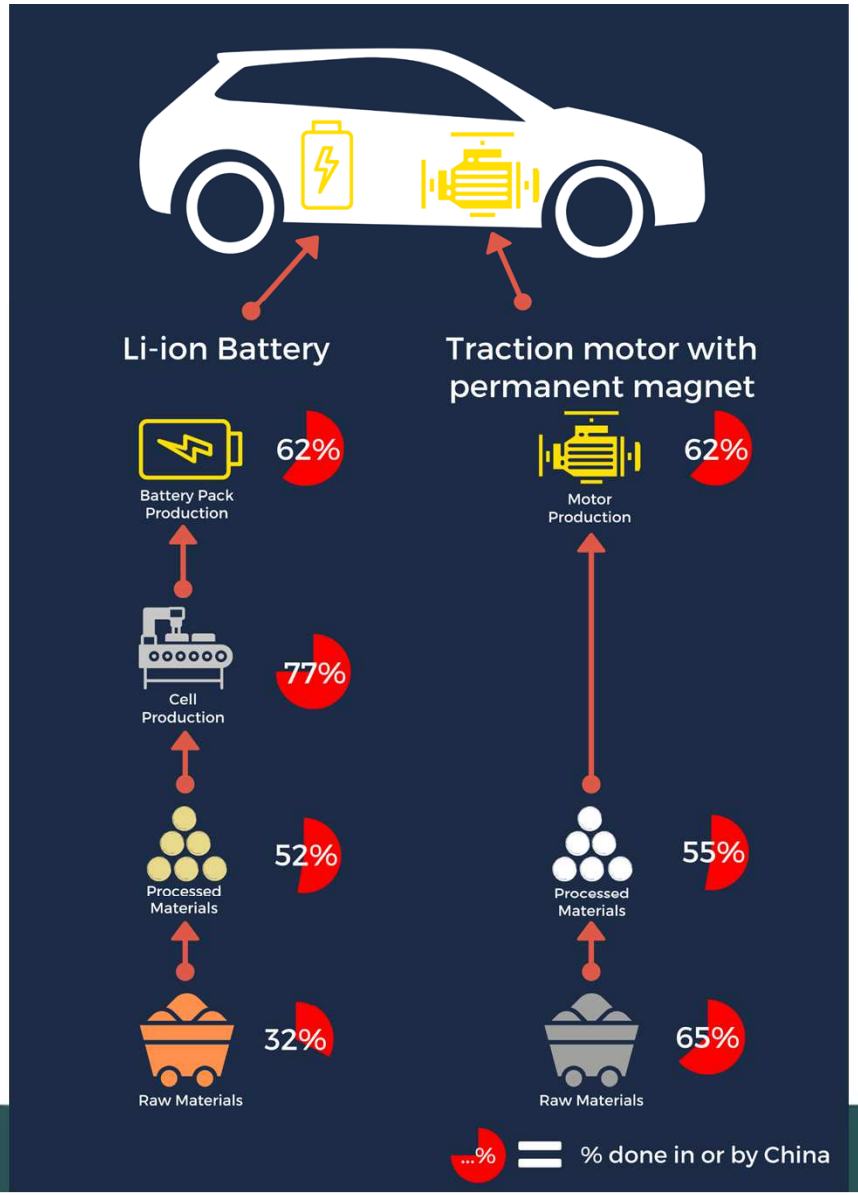


Source: IEA, 2021.

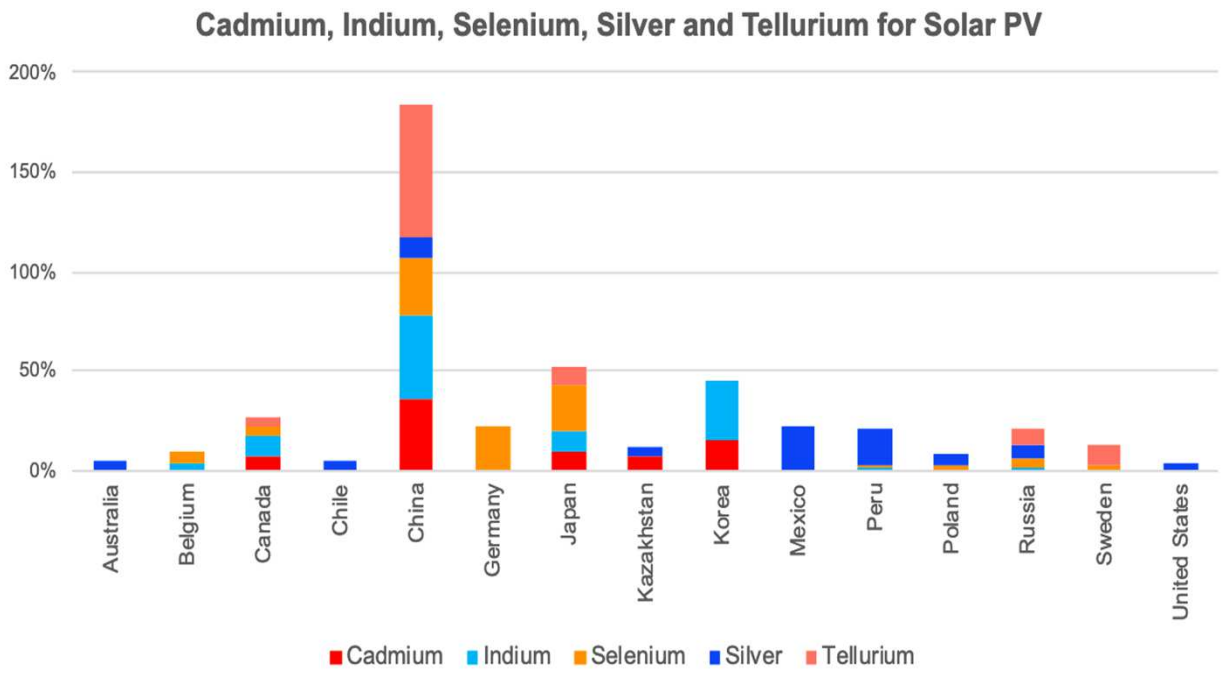
Wind energy


Turbine Assembly
23%
Turbine Components
(nacelle & blades)
56%
Processed Materials
41%
Raw Materials
54%
Permanent Magnet Production
90%
Raw Materials
86%
...%
% done in or by China

Electric transport



Photovoltaic solar power



Share of production of metals for PV by country Source: Dominish et al., 2019.

Strategies

Technical and political approaches employed by countries / companies in order to secure supply of materials

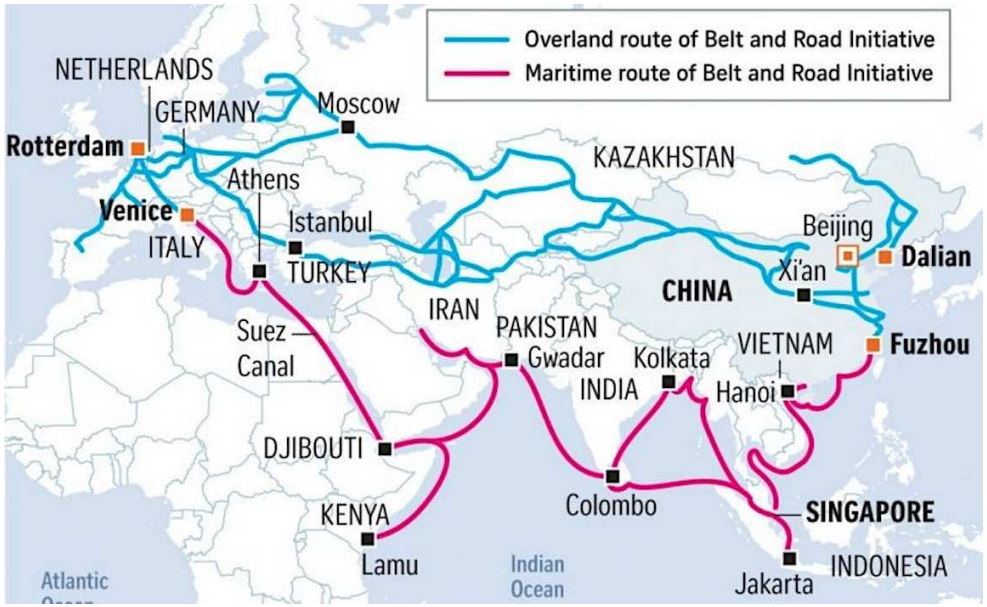
- Vertical integration
- Standard-setting
- Resource diplomacy
- Stockpiling
- Diversification of supply
- Industrial alliances
- Restrictions
- Circular economy
- R&D

Vertical integration

- Strategy applied by China in many sectors, including rare earth elements and lithium companies.

- The entire Chinese REE industry is dominated by the six integrated enterprises.
  - Once they integrated, these companies were assigned 90% of total national production quotas, thus controlling 22 of 23 mines and 54 of 59 smelting facilities by June 2016.

- The Belt and Road Initiative (BRI) is the most significant integration of international logistical networks.



Source: Indo-Pacific News, 2020.

Stockpiling

LONDON METAL EXCHANGE

LME
An HKEX Company

- In 2011, the Chinese government commissioned a public-private strategic stockpile of REEs, and in 2016 a commercial one.

- In 2012, Hong Kong Exchange & Clearing (HKEX) purchased London Metal Exchange (LME), the most relevant trading platform for metals, accounting for 80% of world trade.
  - Paid 180 times higher than the platform's annual revenues and had China Development Bank as its biggest sponsor.

- The lack of stock transparency of the LME has come to be known as "shadow warehousing", which is one of the reasons why the institution has tried to reform its system.

Restrictions

- The Chinese government has been imposing restrictions in their domestic CRM sector since the 1990s.
  - Restrictions on foreign investments, export and production quotas for REE
- Most notable case: export quotas leading to a surge in global REE prices between 2010-2011
  - The EU, US, Japan reported China to the WTO, which found the restrictions illegal under trade rules
- Now, domestic companies control the entire REE supply chain, while foreign ones are disadvantaged in their activity

Standard setting

- Decentralized system in which private organizations and industrial actors are in charge of standards
- Overall, EU representation dominates international standards organizations
- Highly active in responsible mining and transparency initiatives

- Heavy state involvement in domestic standardization organizations
- Chinese representatives supported by government
- National strategy to become influential in international standards organizations
- Membership in strategic and leadership positions in organizations
- Absent from normative organizations

1. Difficult to diversify supply

- China holds a near-monopolistic position in several stages of supply chains
- It is challenging for the Netherlands/EU to start new mining explorations due to high financial investment, need for long-term planning, and social acceptance
- For international mines (e.g., Australia, Russia), it is difficult to meet environmental standards, which prevents large-scale refining of rare earth metals outside China (amongst other reasons).

Strategies such as investing in **R&D, establishing alliances, stockpiling, resource nationalism or support for circular economy** are relevant interventions.

2. Competing demand as global ambitions rise

- China's own increasing domestic consumption needed to achieve its development goals decreases the international supply of CRMs
- Demand for materials such as graphite, cobalt, and lithium is expected to increase by as much as 500% of 2018's total production by 2050 as a result of clean energy initiatives alone

In order to mitigate the consequent supply risks to the Netherlands, a combination of **resource diplomacy, diversification of suppliers, R&D and support for circular economy strategies** should be applied.

3. Resource nationalism as a barrier

- In the upstream sector in China, licensing mechanisms exclude companies from the Netherlands/EU from investing in alternative mines and facilities, as well as other existing operations
- Export tax alleviation for Chinese domestic upstream producers encourages technology development in China rather than raw material exports, creating an uneven playing field for EU producers

In order to mitigate the consequent supply risks, a multi-strategy approach will be necessary: **industrial alliances within the EU, resource diplomacy, campaigning, standard-setting and support for circular economy**.

4. Foreign strategic investments

- China secures and expands its future supply of technology through the use of FDI and mergers & acquisitions as tools to increase control over the NL/EU internal market and establish dominance in supply and value chains
- It invests in foreign mines and infrastructure to increase its supply security and consequently hinders diversification attempts of the NL/EU:
- In Africa, Chinese investors increased their control over mining operations from 10 in 2011 to at least 24 in 2018

In response, the NL/EU could place **licensing restrictions, increase standard setting efforts and increase diplomatic ties regarding resources within the EU.**

5. Dynamic geopolitical landscape

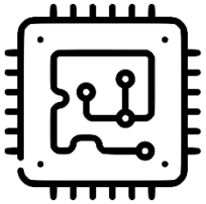
- Export restrictions in the form of taxes, quotas and minimum export prices influence global price and availability of supply
- Standard-setting privileges some countries to achieve market dominance through first-mover advantage
- Opaque trade relations, political instability and demand uncertainty depress investments in new facilities

In response, **resource diplomacy, standard setting and diversification of suppliers** increase security of supply.

Sector-specific strategies

R&D, standard-setting and circular economy strategies are important to creating a strong market for secondary raw materials in NL/EU, thereby reducing dependency on imports.

Encouraging diversification of suppliers, increased R&D (continuous collaboration between material scientists and industry, as well as learning from best practices abroad) and standard setting.



Greater ‘digital sovereignty’ can be achieved using strategies such as: restricting access to domestic markets, stronger resource diplomacy and R&D (a particular advantage for NL’s chipmaking)

Key take-aways

1. Develop a long-term national strategy

   that reflects the needs of industrial actors; prioritize policy coherence.

2. Support technical expertise

   within relevant ministries in the Netherlands to encourage dialogue with industry.

3. Encourage European and national alliances

   in which market players and research institutes collaborate in problem-solving.

Thank you for your attention!

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