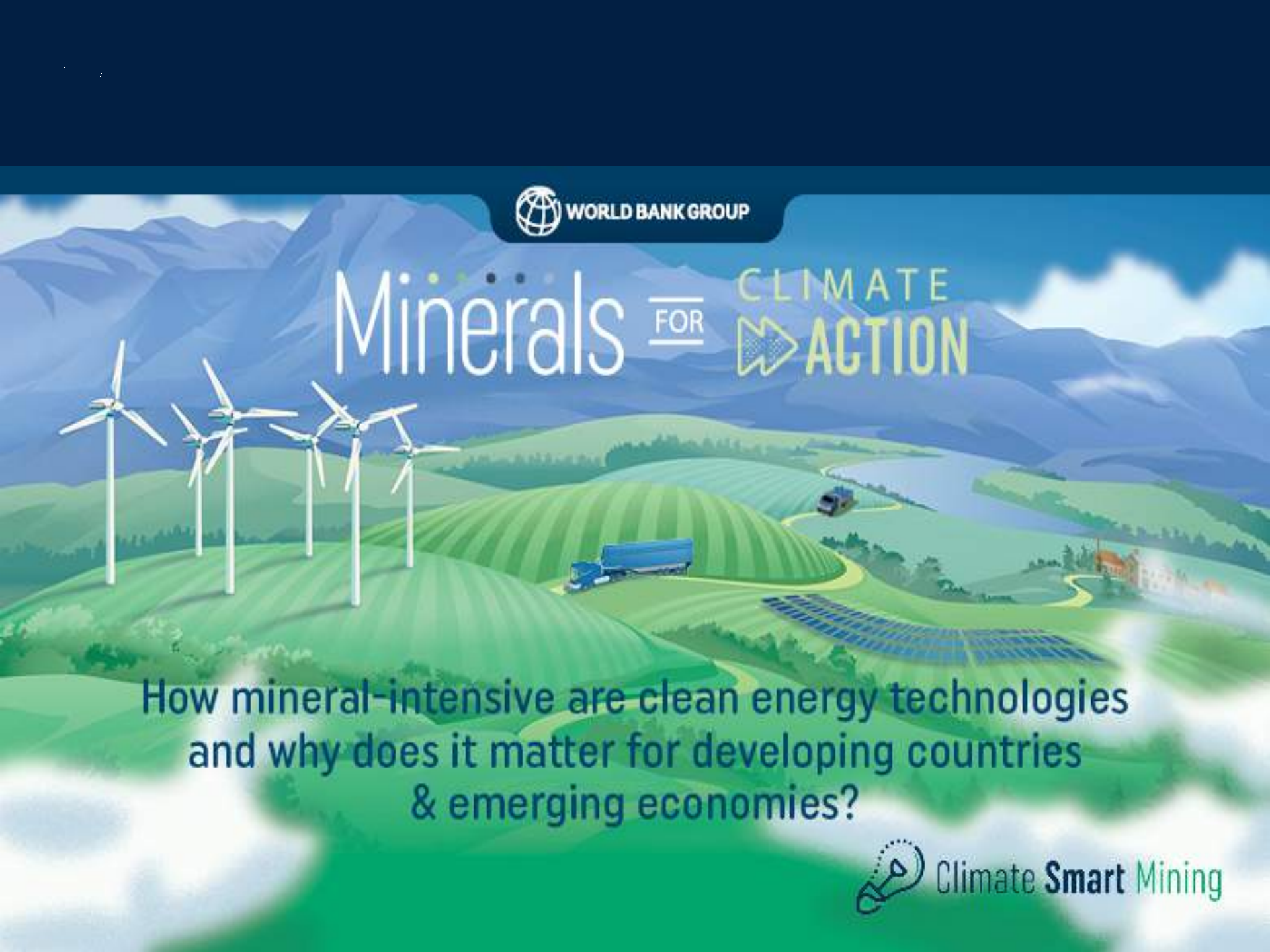
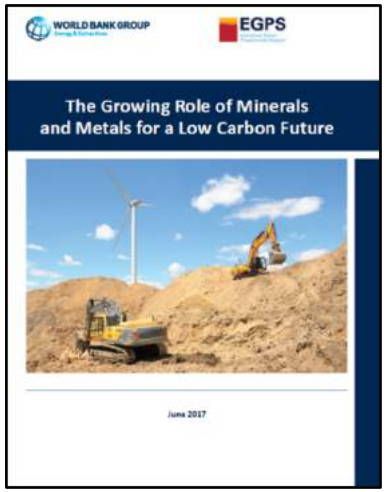
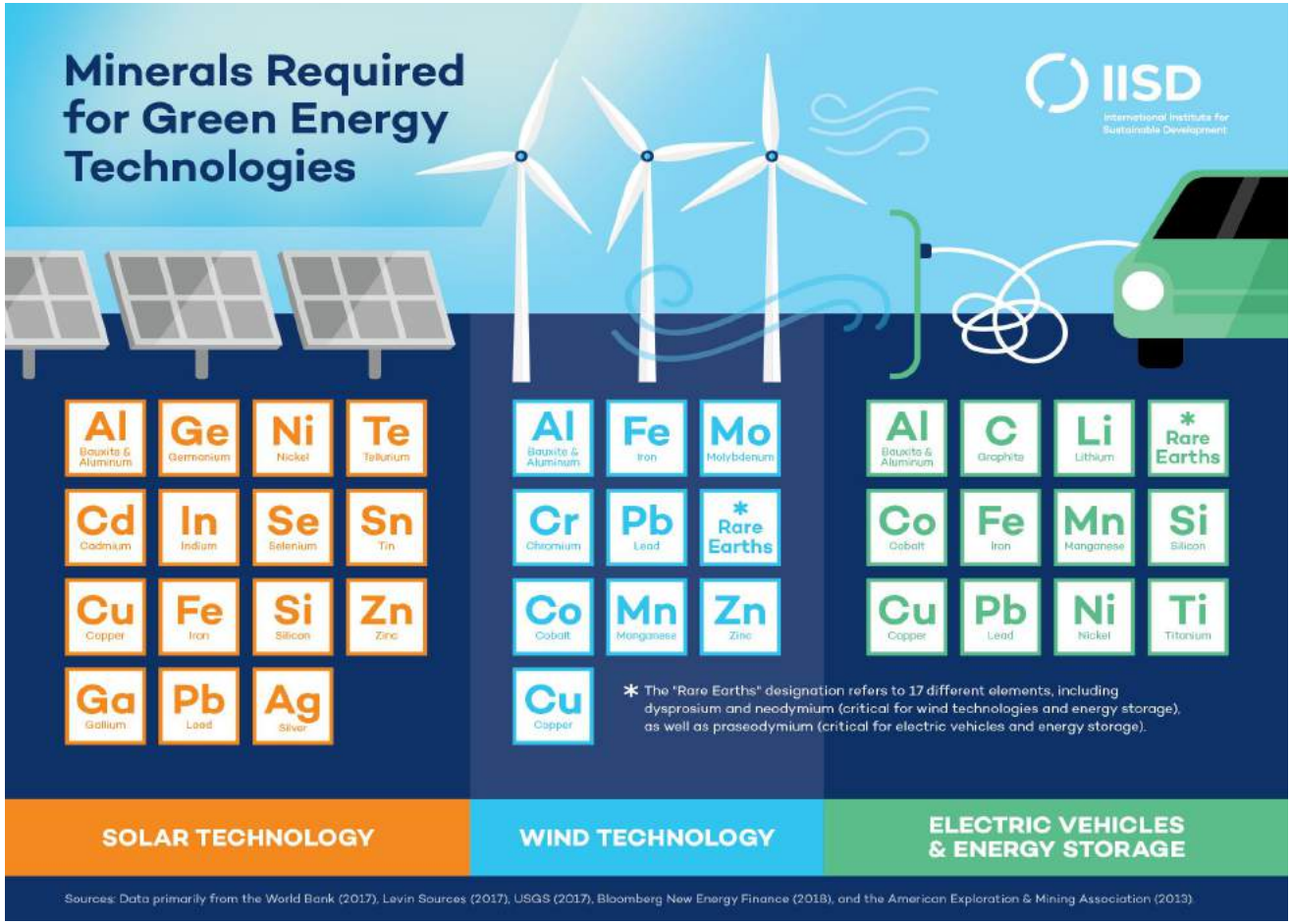

WORLD BANK GROUP
Minerals FOR CLIMATE ACTION
How mineral-intensive are clean energy technologies and why does it matter for developing countries & emerging economies?
Climate Smart Mining

I. CLIMATE ACTION METALS: AN UPDATE

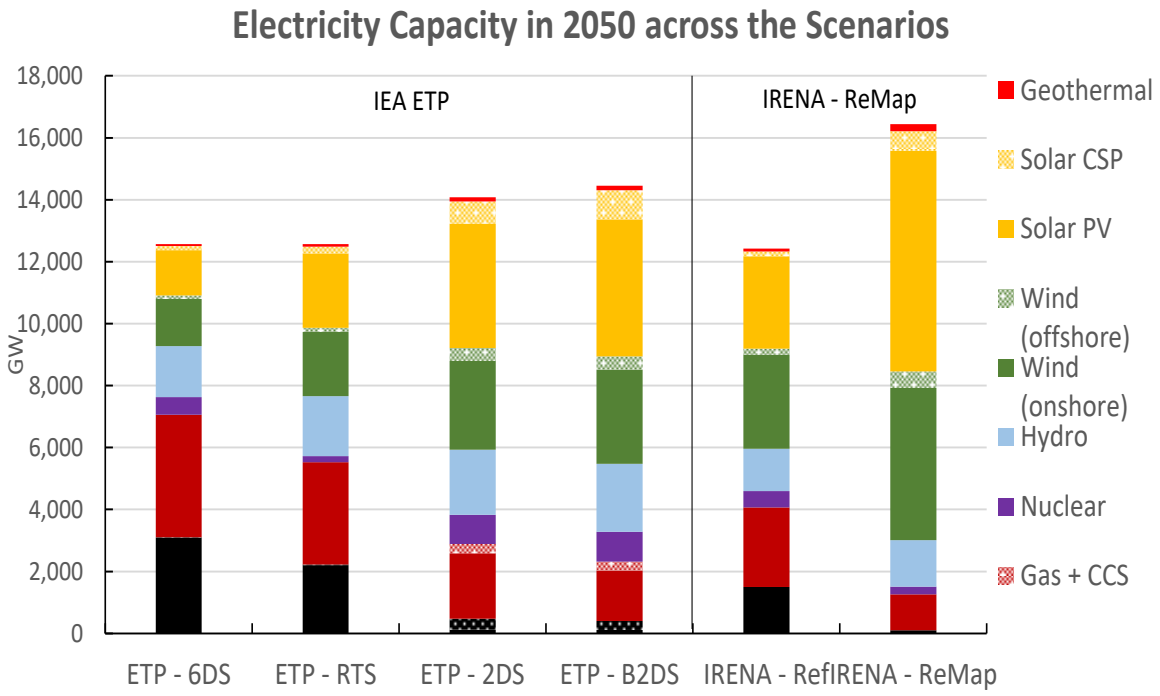
Where we started: The Growing Role of minerals and Metals for a Low-Carbon Future (2017)

In June 2017, the World Bank released the report '*The Growing Role Minerals and Metals for a Low Carbon Future*' and concluded that a **low-carbon future would be very *mineral intensive***.





Reaching the Paris Long Term Goal of 1.5 – 2C Will Require Increased Electrical Capacity



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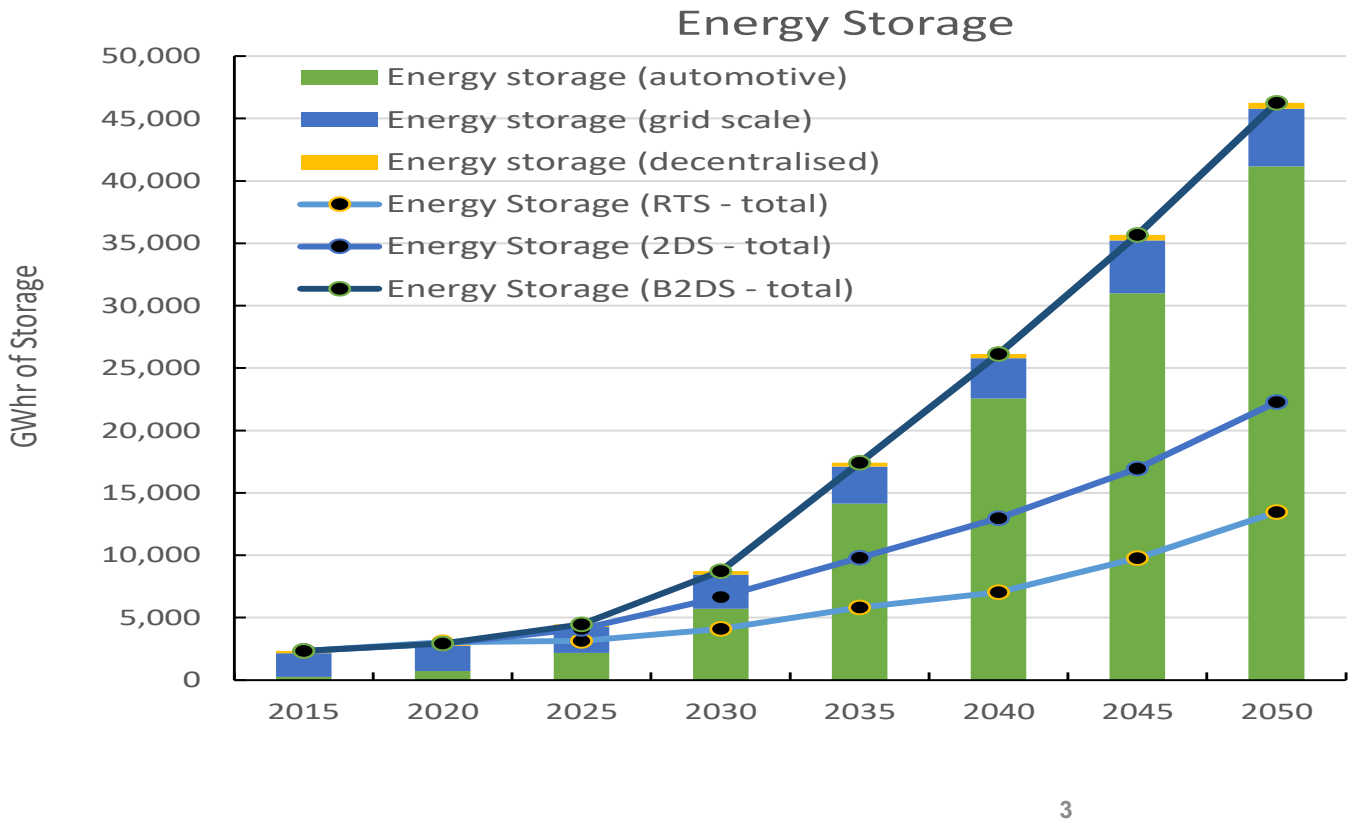
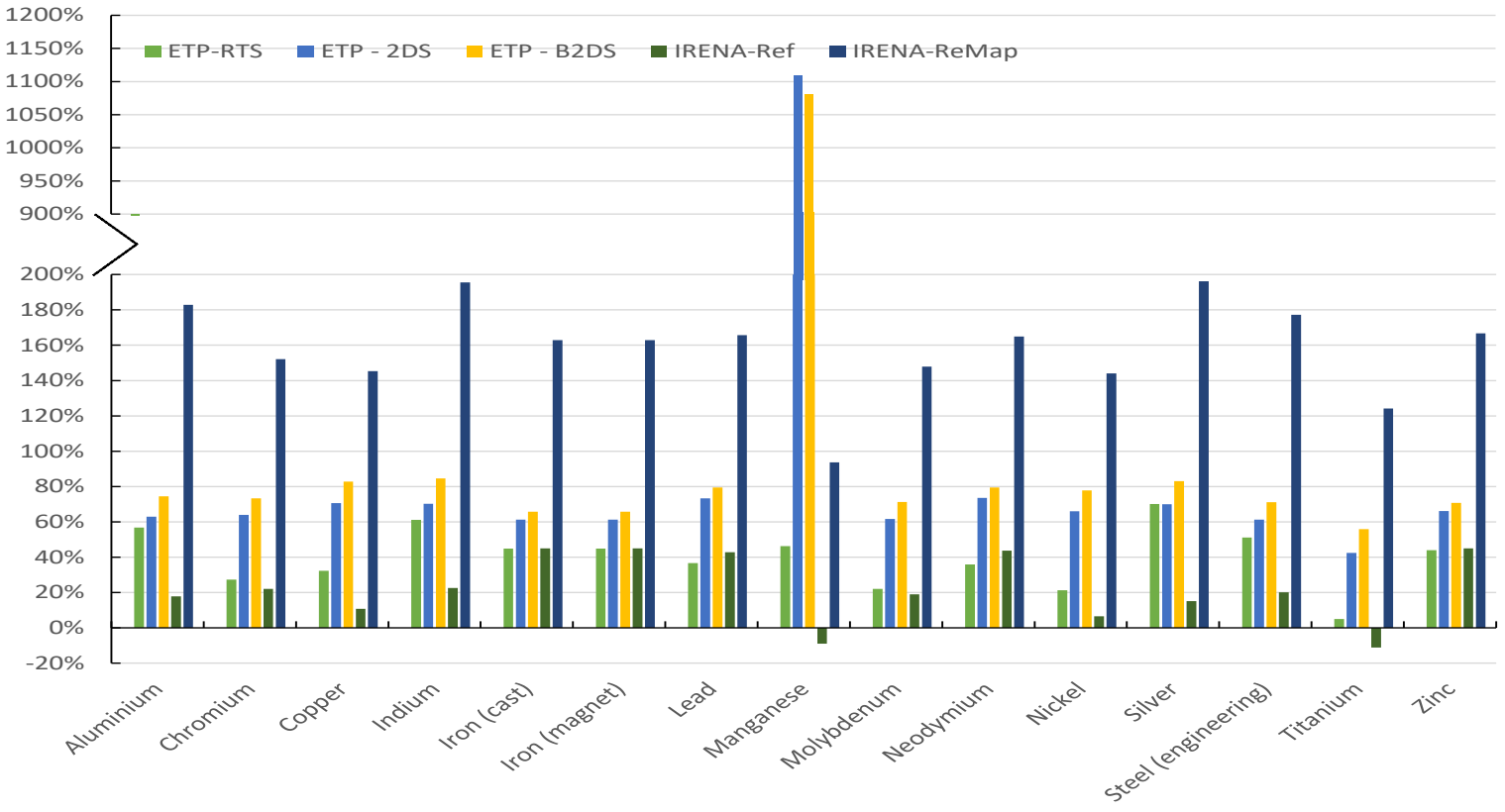
Reaching the Paris Long Term Goal of 1.5 – 2C Will Require Rapidly Growing Energy Storage Capacity



3

WITHOUT MINERALS AND METALS, THERE WOULD SIMPLY BE **NO LOW-CARBON FUTURE POSSIBLE**...

GREATER AMBITION IN GREENHOUSE GAS (GHG) REDUCTIONS LEADS TO GREATER DEMAND FOR A WIDE RANGE OF MINERALS AND METALS

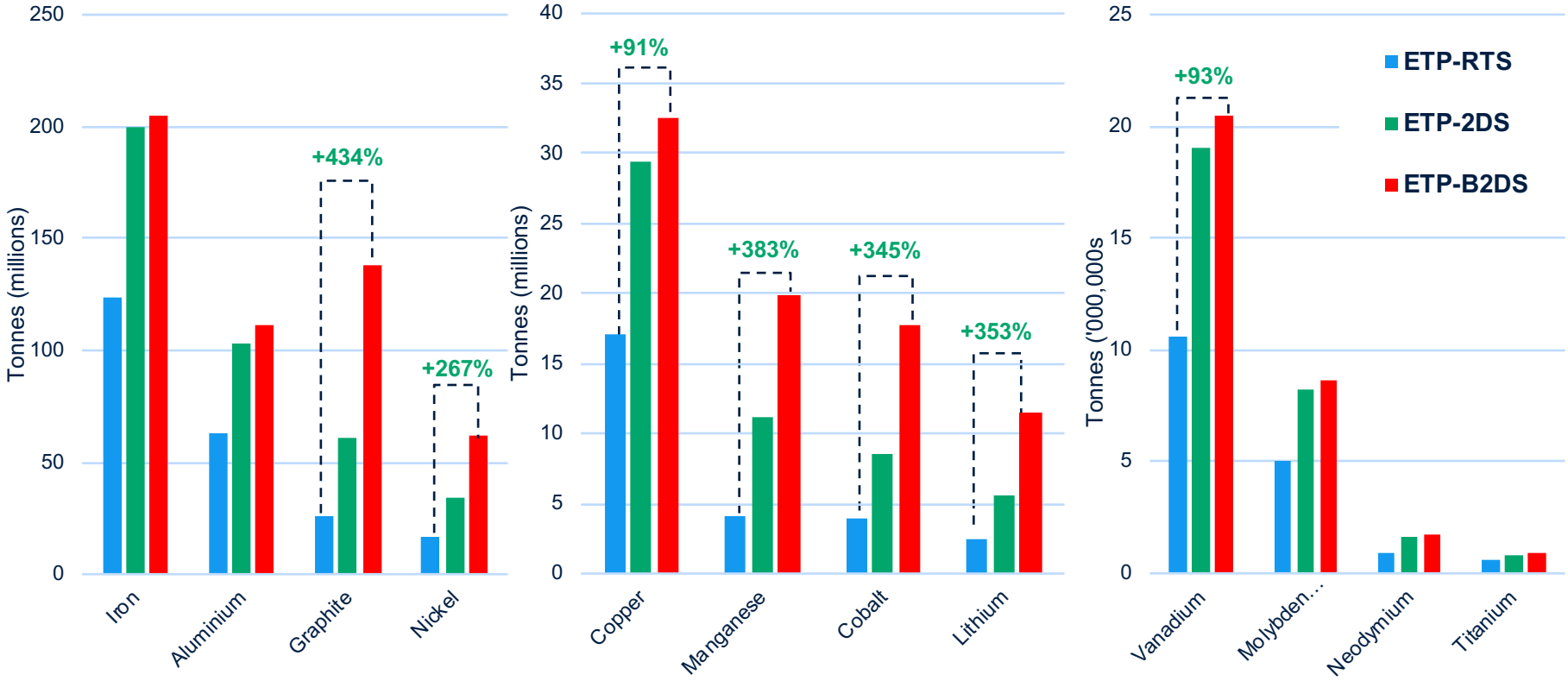


Source: IEA ETP 2017, IRENA

MINERALS FOR A LOW-CARBON FUTURE (3)

Data from the **IEA-ETP 2017** suggests the clean energy transition is still **very *mineral intensive***.

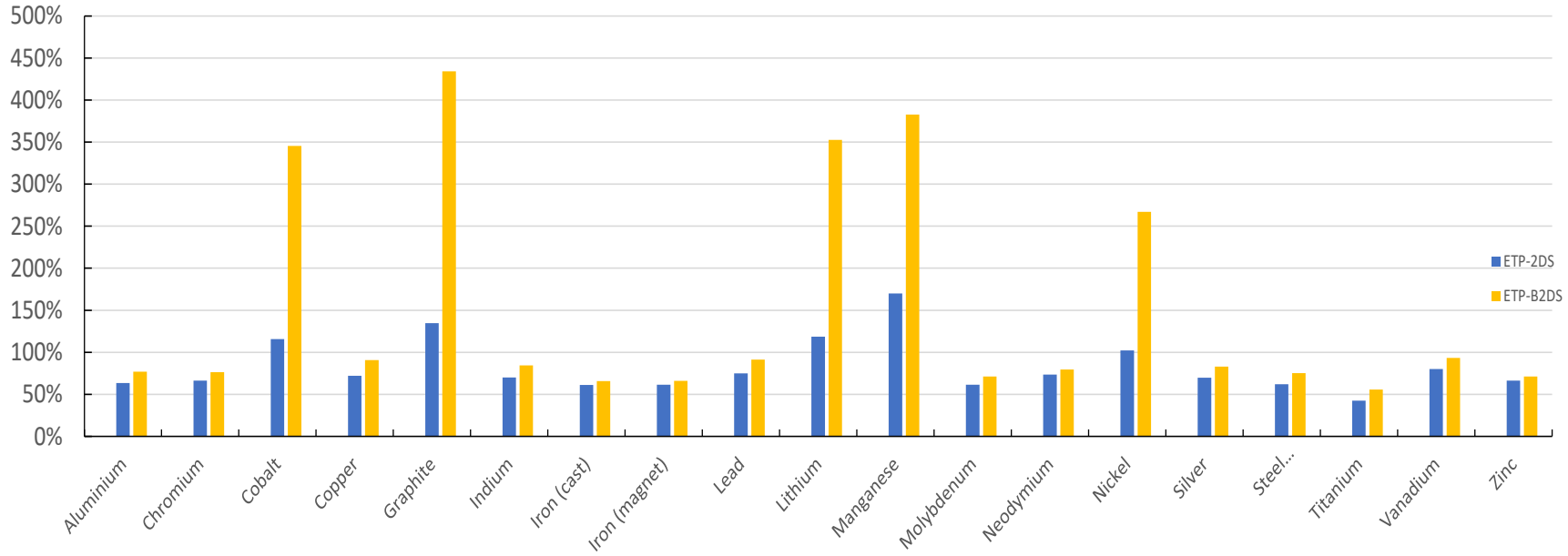
Total Mineral Demand from Power Generation Tech & Energy Storage to 2050 *(only)*



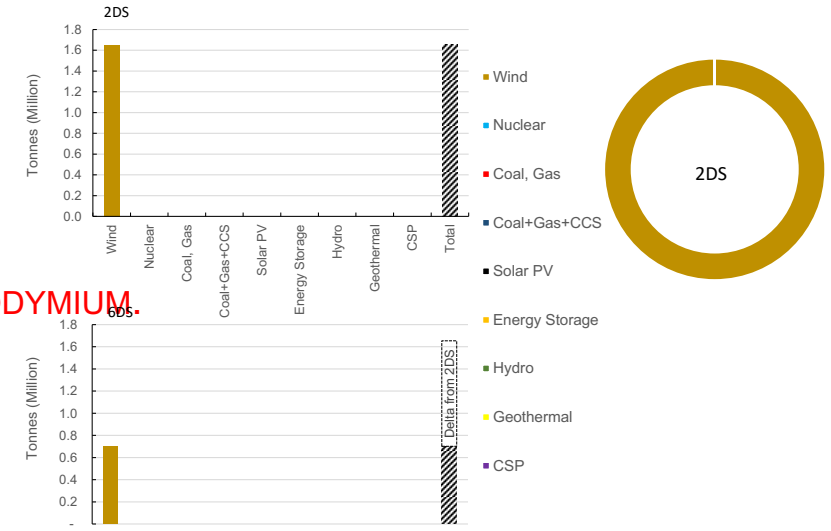
Source: International Energy Agency, Energy Technology Perspective (ETP) 2017, World Bank Analysis (preliminary results from Sep. 2018)

- ETP-RTS: Scenario based on existing Paris Agreement Commitments (2.6°C – 3.1°C)
- ETP-2DS: Scenario where there is at least a 50% chance of limiting the avg. global temperature increase to 2°C by 2100
- ETP-B2DS: Scenario where there is at least a 50% chance of limiting avg. future temperature increases to 1.75°C

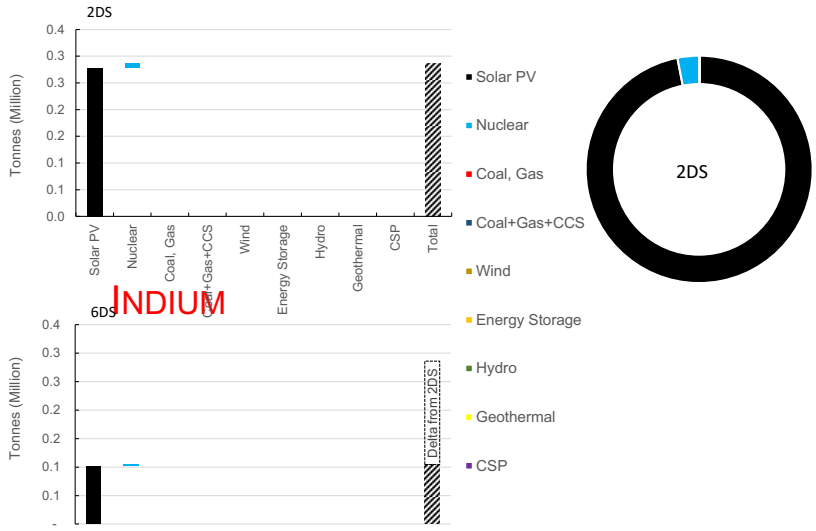
MINERALS AND METALS SPECIFICALLY INTENDED TO SUPPLY ENERGY STORAGE TECHNOLOGIES ARE LIKELY TO BE PARTICULARLY IMPACTED.



THE CHOICE OF PATHWAY TO A LOW-CARBON ECONOMY CAN DRAMATICALLY IMPACT WHICH MINERALS AND METALS EXPERIENCE THE GREATEST INCREASE IN DEMAND



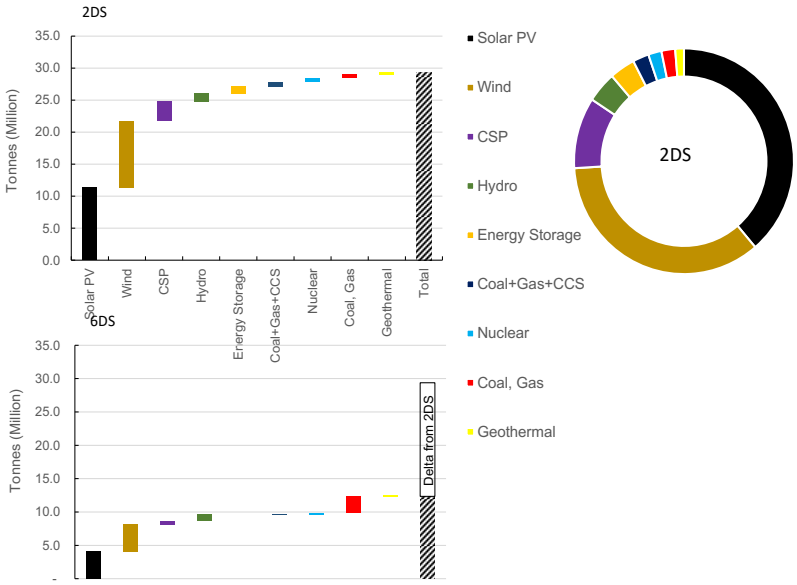
NEODYMIUM.



INDIUM

SOME METALS WILL BE REQUIRED FOR A WIDE RANGE OF CLEAN ENERGY TECHNOLOGIES, WHILE OTHERS ARE ONLY REQUIRED FOR ONE SPECIFIC (SUB) TECHNOLOGY

Copper.



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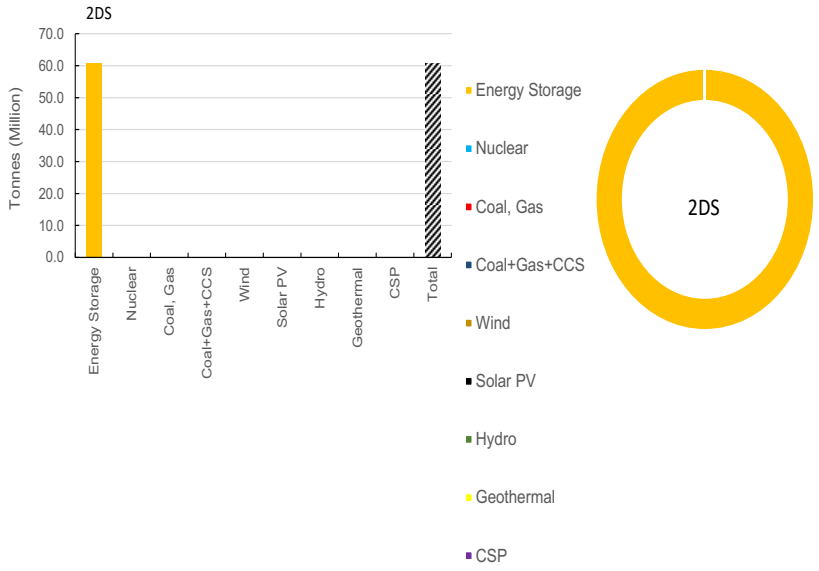
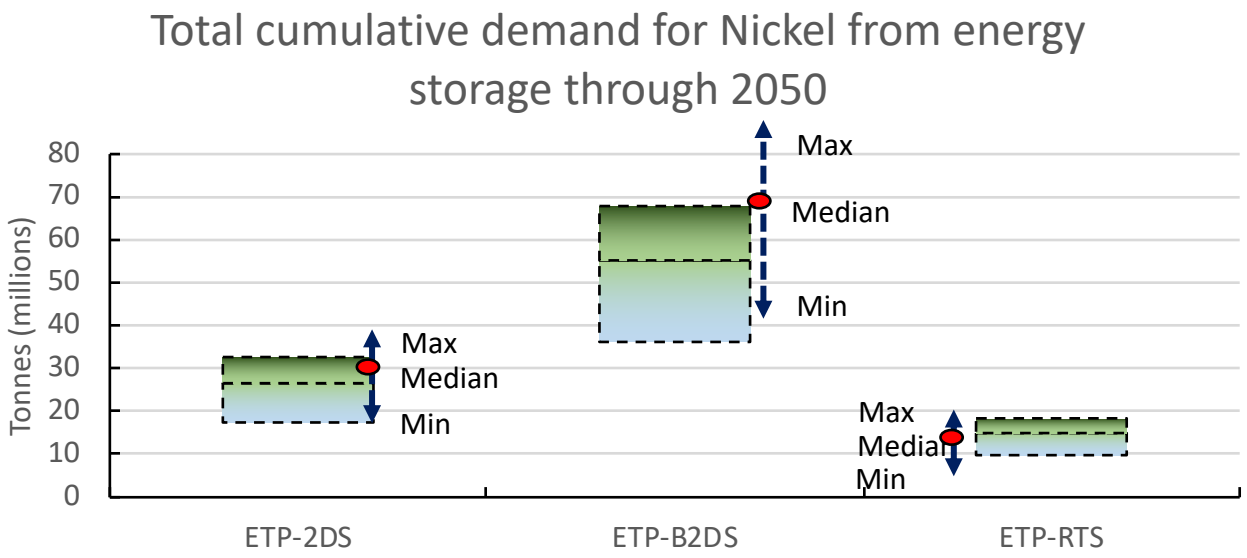


Uncertainty ranges are significant



Max - The maximum value is from Nickel Manganese Cobalt 111 batteries (NMC 111 - equal parts Nickel, Manganese and Cobalt).

Median - The median value comes from Nickel Manganese Cobalt 622 batteries (NMC622 - 6 parts Nickel, 2 parts manganese and 2 parts Cobalt) batteries.

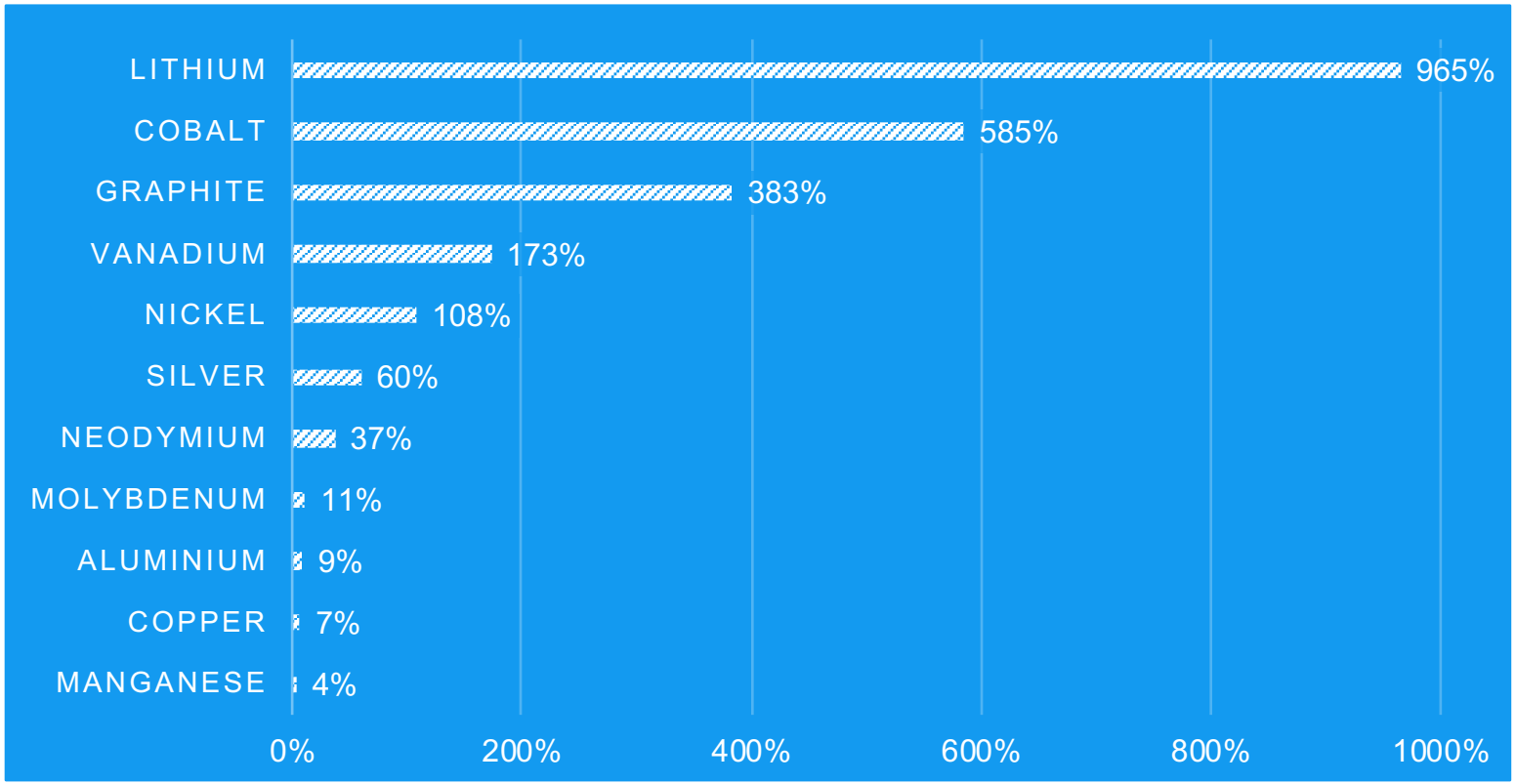
Min - All Lithium ion batteries are Lithium Iron Phosphate (No Cobalt)

MINERALS FOR A LOW-CARBON FUTURE

Under a **2-degree scenario (2DS)**, the overall mineral demand from **energy technologies** only is expected to be significant for **certain minerals and metals in 2050**.

Projected Annual Demand from Energy Technologies in 2050 (2DS)

(Percentage of 2017 Annual Production)



Source: International Energy Agency, Energy Technology Perspective (ETP) 2017, Deetman et all (2018), World Bank Analysis (2018)

- ETP-2DS: Scenario where there is at least a 50% chance of limiting the avg. global temperature increase to 2°C by 2100

WHERE WILL ALL THESE MINERALS COME FROM?

AND: How to address the (carbon) footprint of the industry?

The technology transition to a low carbon economy while materially intensive is of a magnitude smaller in GHG emissions when compared to continued combustion of coal and gas (Nuss and Eckleman – 2014)

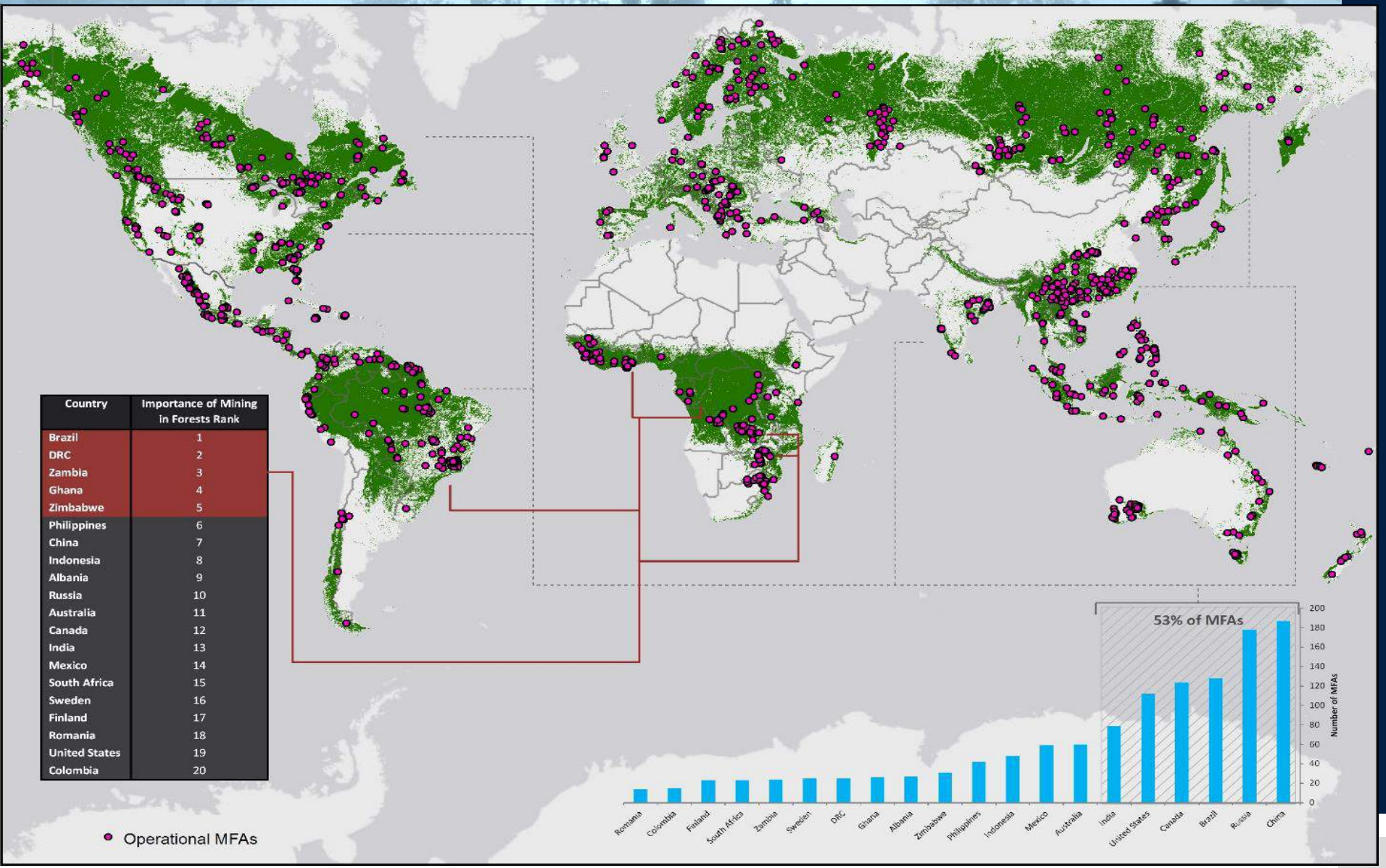
GWP of Climate Action Metals (Extraction & Processing)

Scenario	Generation	Storage	Total (Mt $C0^2$ eq)
IEA – RTS	15,533	657	16,191
IEA – 2DS	25,095	1,450	26,545
IEA – B2DS	26,575	3,011	**29,587**
IEA – 6DS	3,026	NA	

Cumulative Emissions of Coal and (Combustion)

Scenario	Coal	Gas	Coal and Gas (CO^2 Mt eq)
CIEA – RTS	421,130	140,815	561,945
IEA – 2DS	151,426	94,517	245,944
IEA – B2DS	123,351	91,887	**215,238**
IEA – 6DS	535,743	134,209	669,952

Example: increase of Mines in Forested Areas



Towards Climate Smart Mining

Key Points

- The **clean energy transition** will be significantly **more mineral intensive**
- **Technology choices matter**: need for a flexible approach (e.g. battery composition)
- **Need to increase recycling, but this will not be sufficient**
- Many minerals will come from **developing countries**
- **Footprint implications along the value chain** need to be factored into climate change *and* mineral development strategies of countries and companies
- This is **fundamentally changing** the mining sector
- No one can do this alone: Need for multi-Stakeholder **partnerships**
- **Policy Coherence!**

II. CLIMATE SMART MINING FACILITY

Climate Smart Mining

'Climate Smart Mining' (CSM) supports the sustainable extraction and processing of minerals and metals to secure supply for clean energy technologies by *minimizing* the climate and environmental footprint throughout the value chain of those materials by scaling up technical assistance and investments in mineral rich developing countries.

CSMF: OBJECTIVES

The Facility will be a *multi-year program* providing both technical assistance and advisory financing to support resource-rich client countries in developing their strategic mineral reserves while adopting CSM practices.

Climate Smart Mining FACILITY

Objectives

- Support research and adoption of innovative practices
- Leveraging resources to finance green and brownfield mining projects
- **De-risk investments for low carbon minerals** by creating an enabling environment for private sector investments in mineral-rich developing countries
- Assess opportunities for **mineral recycling operations** in developing countries

CSM Facility: Why?

The Climate Smart Mining Facility (CSMF) aligns with the need to address development challenges through a 'One WBG' approach using the Maximizing Finance for Development (MfD) Strategy.

1. The Opportunity → 2. The Challenge → 3. The WBG Solution

1. Opportunity: Minerals Essential for Green Future

- The clean energy transition is very mineral intensive
- Resource-rich developing countries can benefit from this new mineral demand
- However, low carbon minerals should be extracted and processed sustainably and responsibly

2. Challenge: Ensuring Mining & Developing Countries are Part of the Solution

- Investors largely prefer to operate in developed markets due to the favorable investment climate of those countries (e.g. Canada, Australia)
- Strong need to improve the sustainability, transparency & accountability of mineral supply chain
- Environmental degradation, conflict and human rights abuses in the mining sector of some developing countries pose significant reputational risks
- The perception from private investors is that developing countries are 'too risky'

3. Solution: WBG MfD – De-Risking Emerging Markets

- WBG is well positioned to support governments that want to benefit from the clean energy future
- WBG can leverage private sector capital to help client countries develop strategic mineral resources through 'climate smart mining' practices (MfD Strategy)
- WBG can integrate mining into its Climate Smart Action Plans
- WBG's strong network can bring together the public and private sectors, investors and CSOs

BUILDING BLOCKS OF 'CLIMATE-SMART MINING'

Strong Governance and Adequate Regulatory Framework

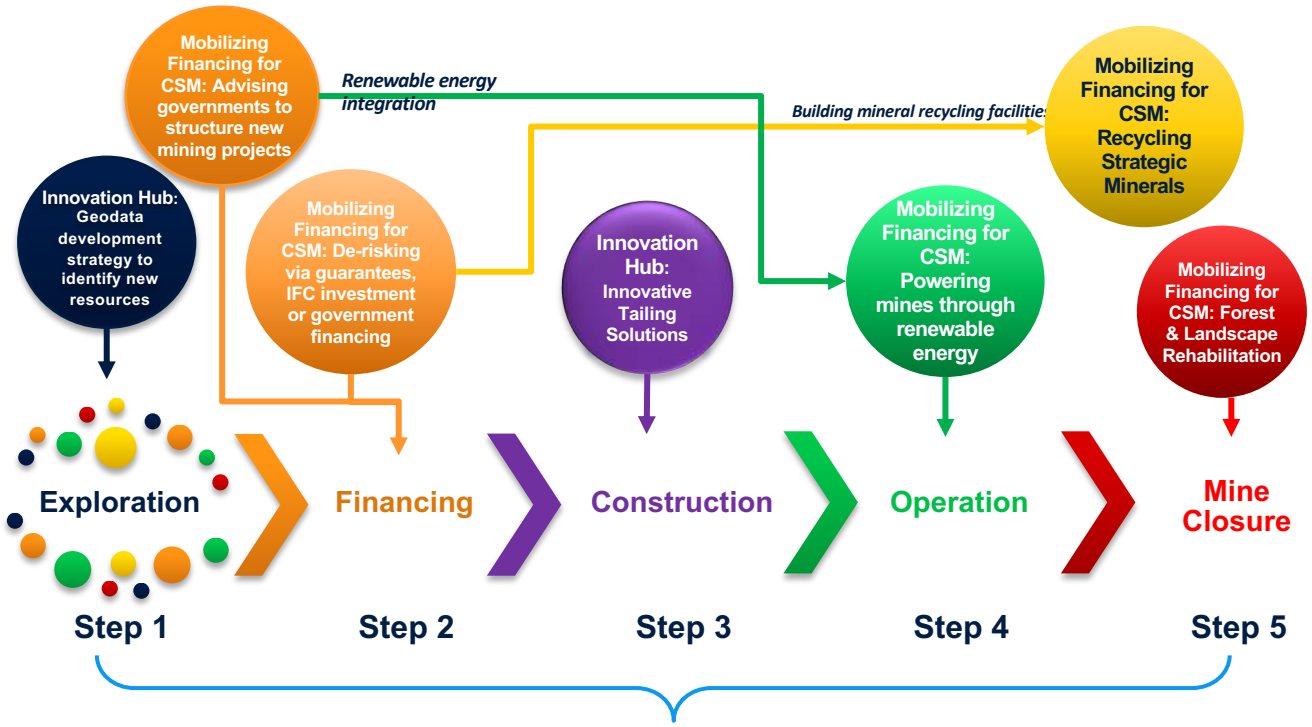
Climate Change Mitigation	Climate Change Adaptation	Reducing Material Impacts	Creating Market Opportunities
Integration of **Renewable Energy** in the Mining Sector	**Forest Smart Mining** within Landscape Management	Adoption of a '**Circular Economy**' for Strategic Minerals	**De-risking Investments** for Strategic Minerals
Innovation in Extractive Practices	**Resource Efficiency** in Mineral Value Chain (e.g. water)	**Recycling** of Strategic Minerals	Enabling **Carbon Markets**
Energy Efficiency in Mineral Value Chain	**Innovative Tailings** Solutions	Strategic **Mineral Supply Chain** Management	Robust **Geological Data Management**

World Bank Support to Decarbonize and Reduce Material Footprint of Mining Sector

Climate-Smart Mining

CSM Facility in the Mining Cycle

WB Value-Added to Mining Sector through Climate Smart Mining Facility

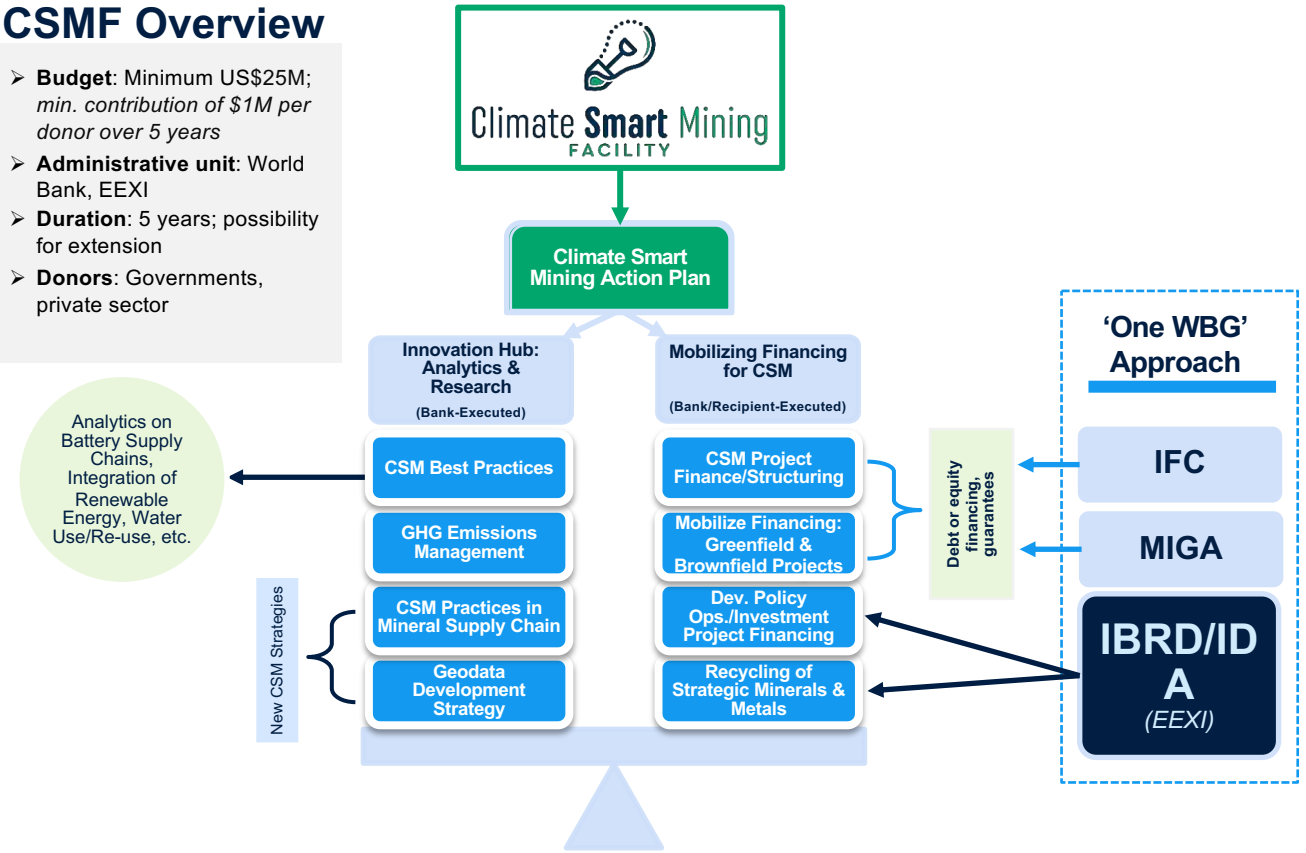


Analytical Themes: Strategic Mineral Supply Chain Management, Water and Forest Management, Best Practices for Mineral Recycling, Innovative Tailing Solutions

CLIMATE SMART MINING FACILITY STRUCTURE

CSMF Overview

- **Budget**: Minimum US$25M; *min. contribution of $1M per donor over 5 years*
- **Administrative unit**: World Bank, EEXI
- **Duration**: 5 years; possibility for extension
- **Donors**: Governments, private sector



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