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ENERGY ECONOMICS

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Coesione
Sociale nella
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Clean energy technologies and critical raw materials

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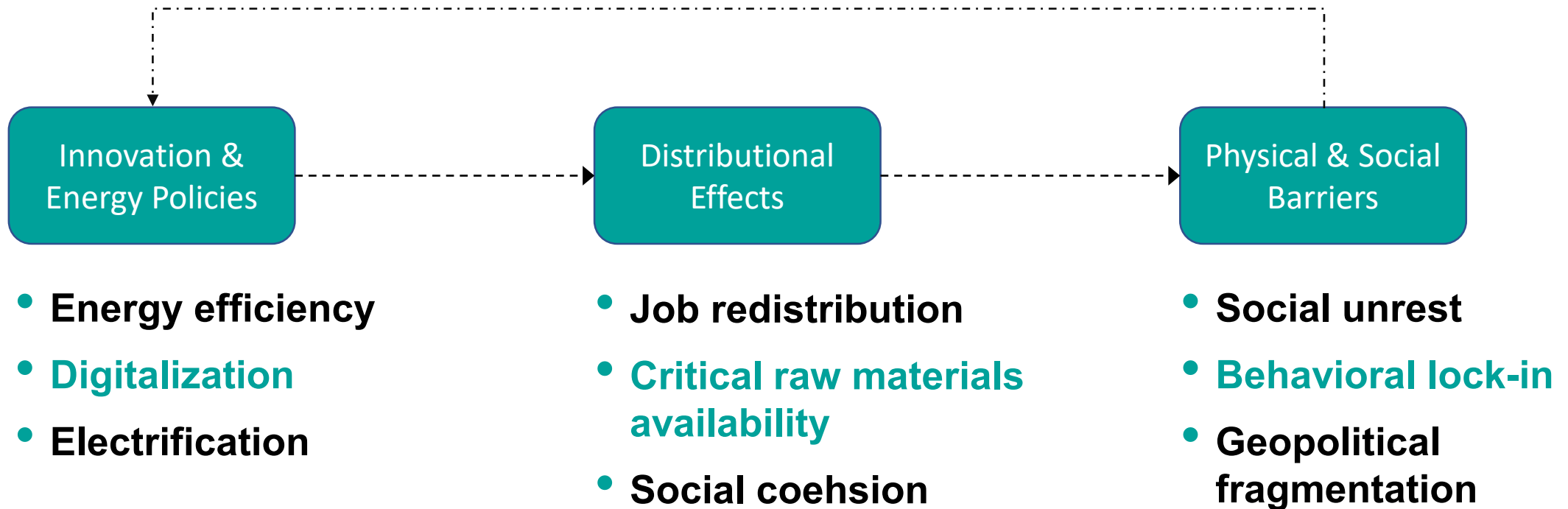
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A narrow window

- European Green Deal requires an enormous effort in decarbonization pathways through electrification, energy efficiency and radical transformation of the production structure
- European institutions share the vision that our economic and social prosperity cannot be achieved without promoting industry
- How to increase competitiveness, jobs and social cohesion without compromising the ecological transition is a major challenge for Europe
- The 2021 Strategic Foresight Report (EC, 2021) forecasts an unprecedented increase in demand for the key materials necessary to a successful twin transition
- The analysis also reveals the EU's heavy dependence on a very limited number of suppliers for all the strategic technologies in several stages of their supply chains
- On the top of this, the twin transition will produce a large redistribution in the labour market with the necessity to reskill the workers and renew education programmes

Physical and social barriers to the twin transition



The mineral intensity of green innovation

Green technologies carry intensive mineral demands (more than fossil fuel counterparts)

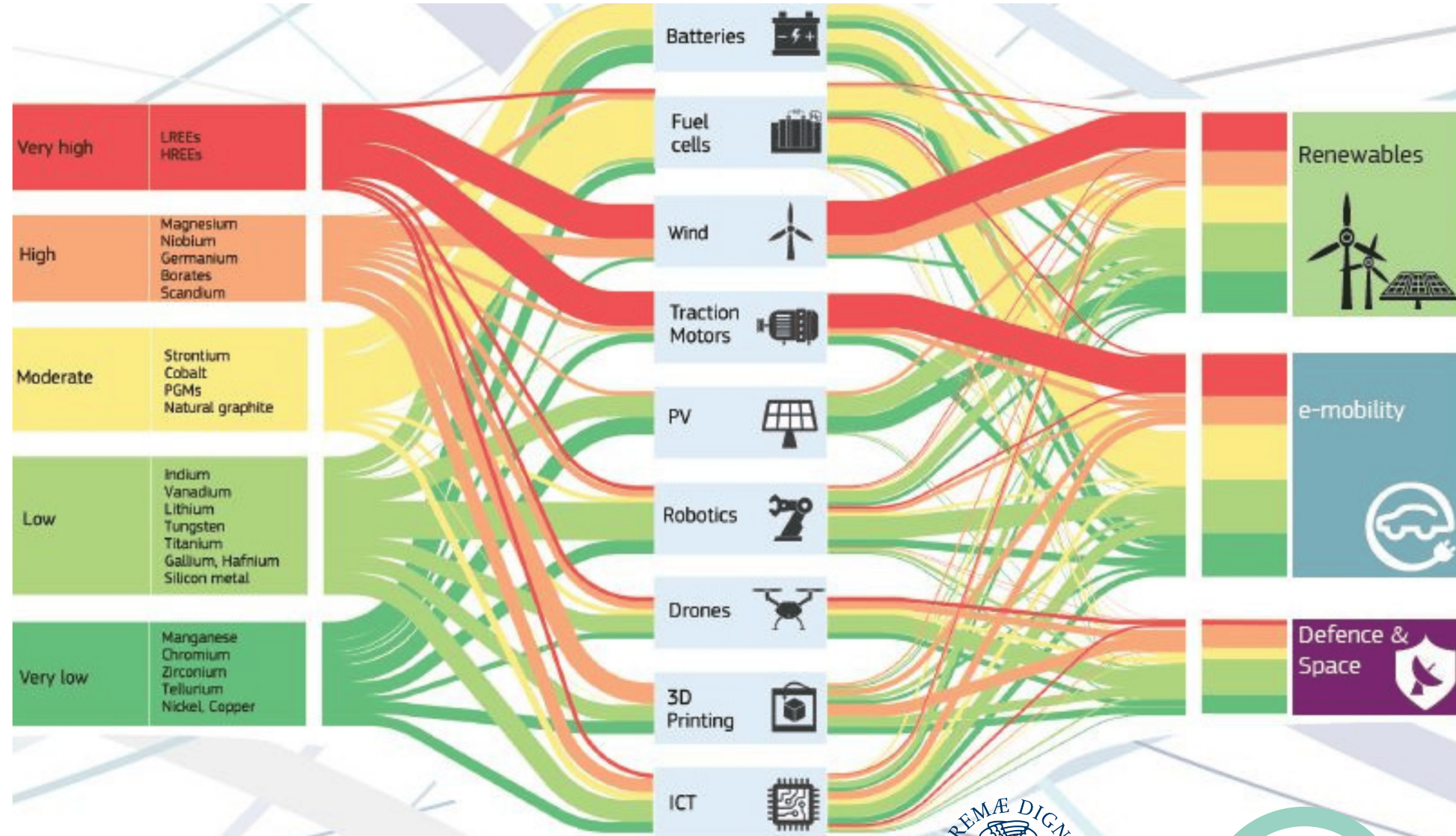
- Batteries powering electric vehicles is forecasted to drive up **demand for lithium 11 times by 2030** and 17 times by 2050
- Electric car requires **x6 times** the mineral inputs of a conventional car
- Onshore wind plant requires **x9 times** more mineral resources than a gas-fired power plant

The increase of primary and secondary production opens new issues.

	Copper	Cobalt	Nickel	Lithium	REEs	Chromium	Zinc	PGMs	Aluminium*
Solar PV	●	○	○	○	○	○	○	○	●
Wind	●	○	●	○	●	●	●	○	●
Hydro	○	○	○	○	○	○	○	○	○
CSP	○	○	●	○	○	●	○	○	●
Bioenergy	●	○	○	○	○	○	○	○	○
Geothermal	○	○	●	○	○	●	○	○	○
Nuclear	○	○	○	○	○	○	○	○	○
Electricity networks	●	○	○	○	○	○	○	○	●
EVs and battery storage	●	●	●	●	●	○	○	○	●
Hydrogen	○	○	●	○	○	○	○	●	○

Source: IEA 2021.

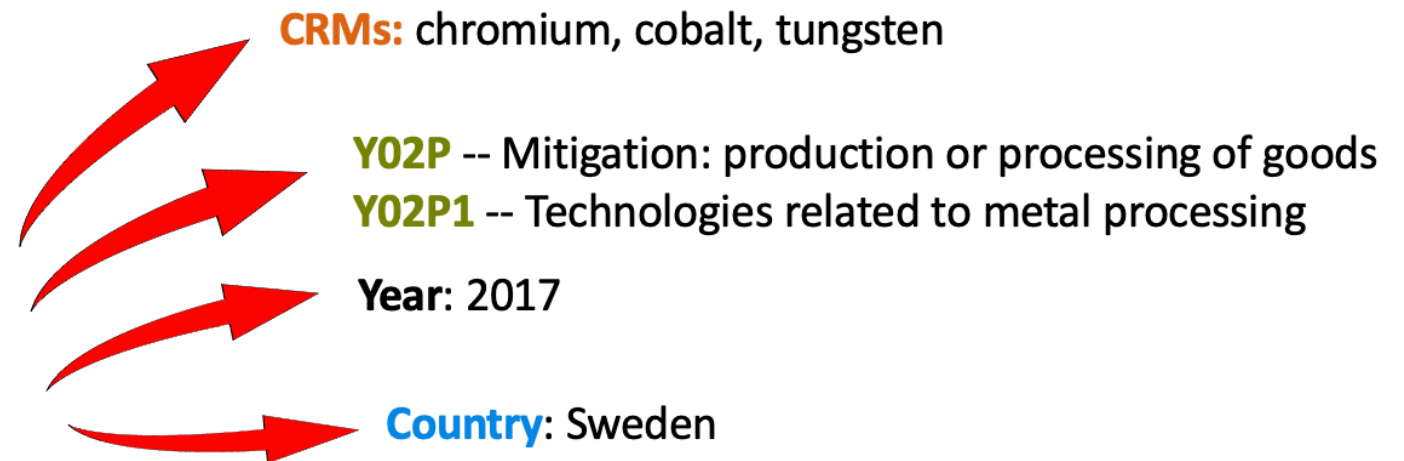
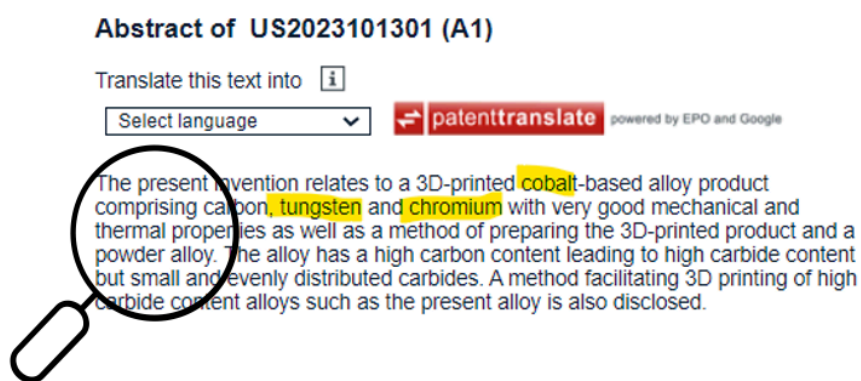
The mineral intensity of green innovation



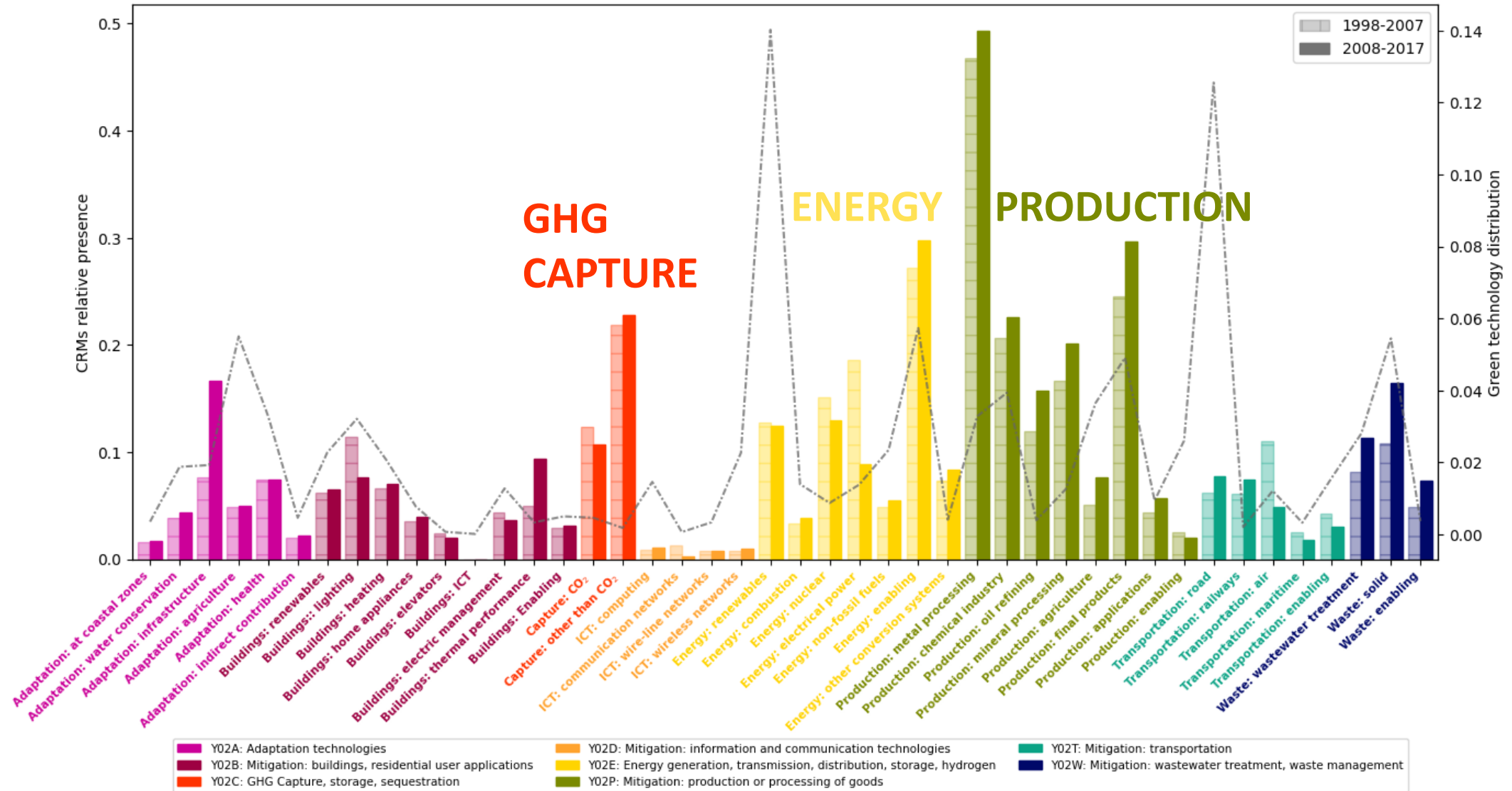
Source: EC, 2021

The direction of innovation

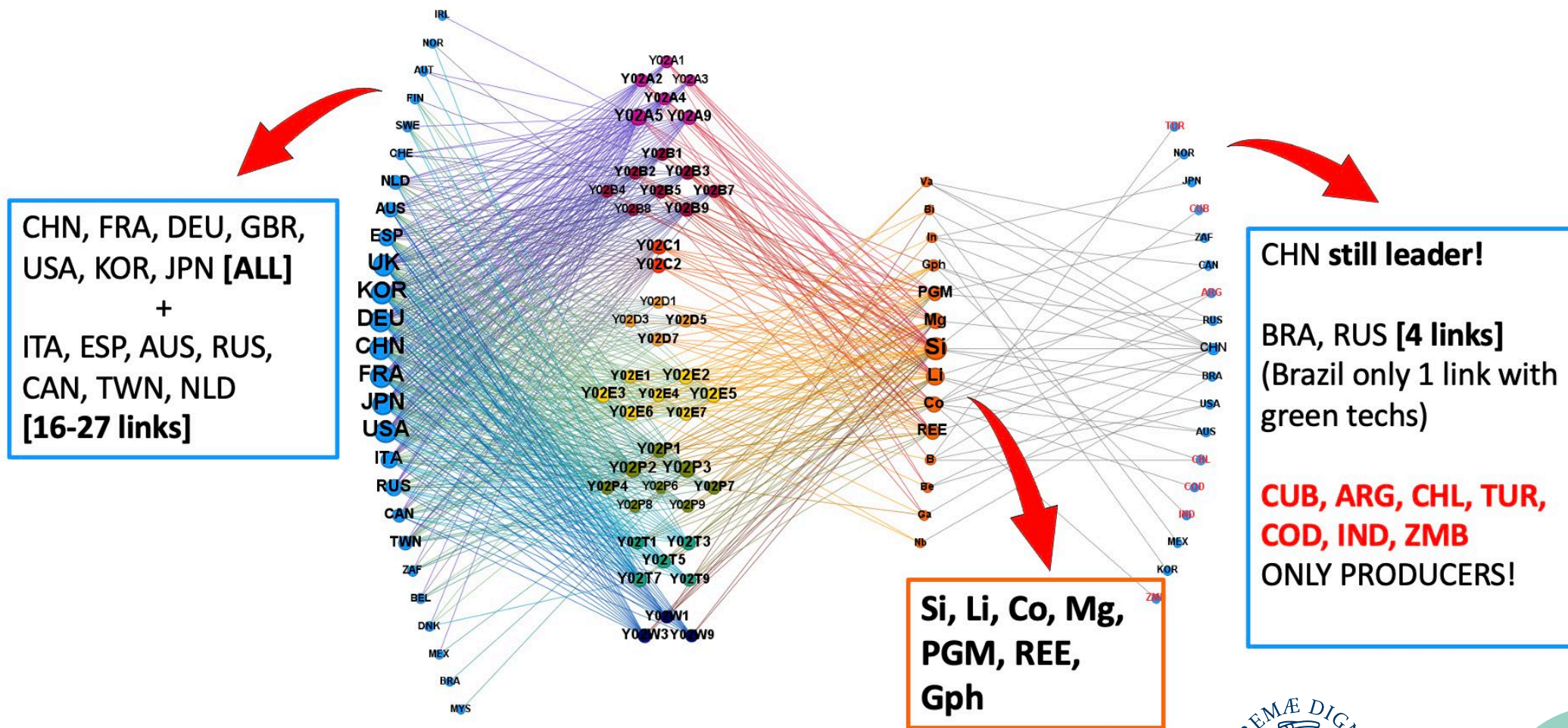
- Mapping Critical Raw Materials in Green Technologies.
- **Francesco De Cunzo** (in collaboration with Davide Consoli, François Perruchas and Angelica Sbardella) develops an empirical analysis of the relationship between CRMs and clean technologies + focus on the producer vs innovative countries
- Method: Text mining in green patent abstracts + CRMs production [data 1998-2017]



Which green technologies rely more intensively on CRMs

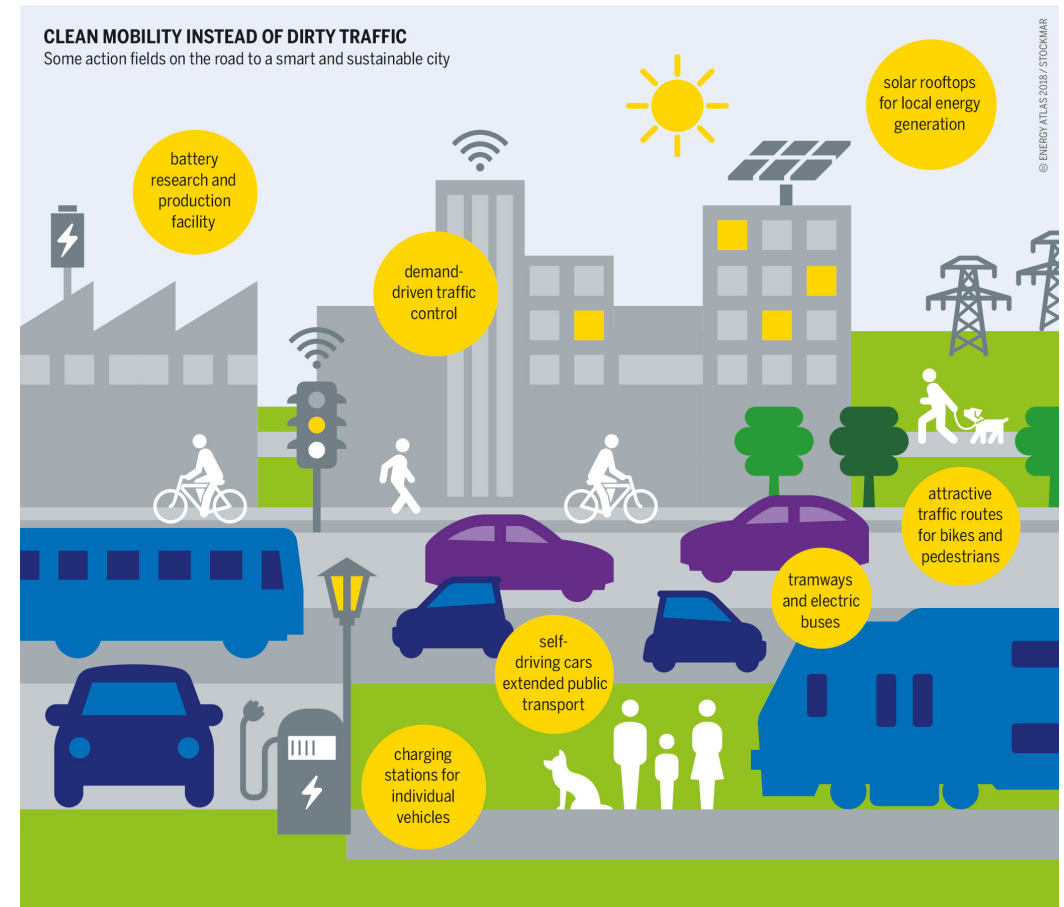


Which countries are more exposed to green technology-driven demand for CRMs?



From the automotive sector to sustainable mobility

- Automotive is anticipating the transition
- It increases competition inside the EU Single Market (es. Gigafactories)
- It does not seem capable to re-absorb the employment of the sector (IMF, 2023)
- The **private car model** is not compatible with the supply of CRMs but also decarbonization targets
- But cars are a tool to meet our mobility need. Mobility can be differently organized, changing the system from the supply chain to the consumption patterns



Source: Bartz/Stockmar, CC BY-SA 4.0

Exit from the **technological** bubble

- The faith in innovation can reduce the effectiveness of our new worldviews
- We are at risk of entering a paved terrain that does not produce the promise prosperity
- The decline of Europe needs political decisions based on a holistic and systemic view where social innovations are crucial as well as technical ones
- Otherwise the achievement of SDGs and their coherence is strongly threatened





**Coesione Sociale
nella Transizione Ecologica**

The Project

Policies aimed at tackling climate change can raise social and distributional issues, which may become an obstacle to the low-carbon transition. The Ecohesion project explores the relationship between climate and energy policies, structural change in the economy, and redistributive mechanisms. Taking a multidisciplinary systemic approach, Ecohesion aims to facilitate policymaking and support learning through advanced training courses and participatory processes.

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