

Materiais e sustentabilidade

Setores estratégicos para a UE



Renewables



Photovoltaics



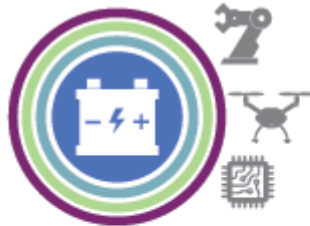
Wind Generators



Robotics



e-mobility



Batteries



Traction Motors



Fuel Cells



Defence &
Space



Drones (UAV)



3D Printing



ICT



used by sector



used by other technology (icon)

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Li-ion battery technology is rapidly being deployed for both e-mobility and energy storage for intermittent electricity generation. The technology is increasingly relevant for defence applications;



Fuel cells (FCs) are an important energy conversion technology, which together with hydrogen as fuel, will offer a high potential for decarbonisation of the energy system and e-mobility in the future, although large-scale deployment has not yet taken place;



Wind energy is already one of the most cost-effective renewable energy technologies for climate-change mitigation and will remain a growing sector in the EU industrial base;



Electric traction motors are central components in e-vehicles. Permanent magnet motors containing rare earth elements are particularly efficient and attractive for current and future e-mobility applications.



Photovoltaic (PV) technology together with wind energy will lead in the transformation of the global electricity sector; PV panels are also relevant for space applications;



Robotics is an emerging technology with an increasing role in future manufacturing, including defence and aerospace, as well as energy technologies and automotive applications;



Drones (Unmanned aerial vehicles or UAV) are increasingly deployed for both civil and various defence applications;



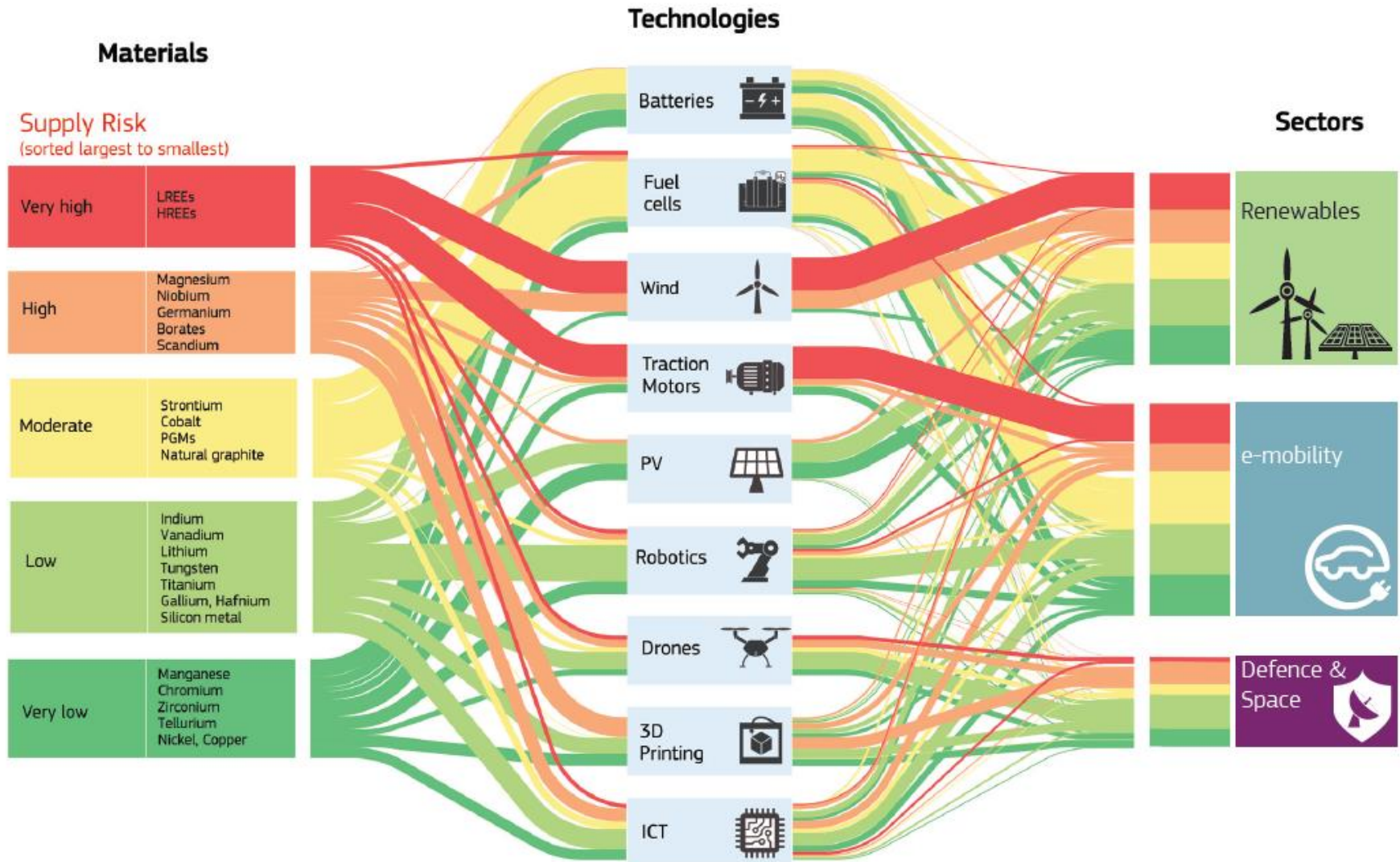
3D Printing (3DP, Additive manufacturing or AM) will rapidly reshape traditional supply chains and replace conventional manufacturing, in particular in defence and aerospace. It will lead to a significant shift in the amount and types of raw materials and processed materials consumed;



Digital technologies sustain the enormous digital sector enabling all technologies evaluated in this study.

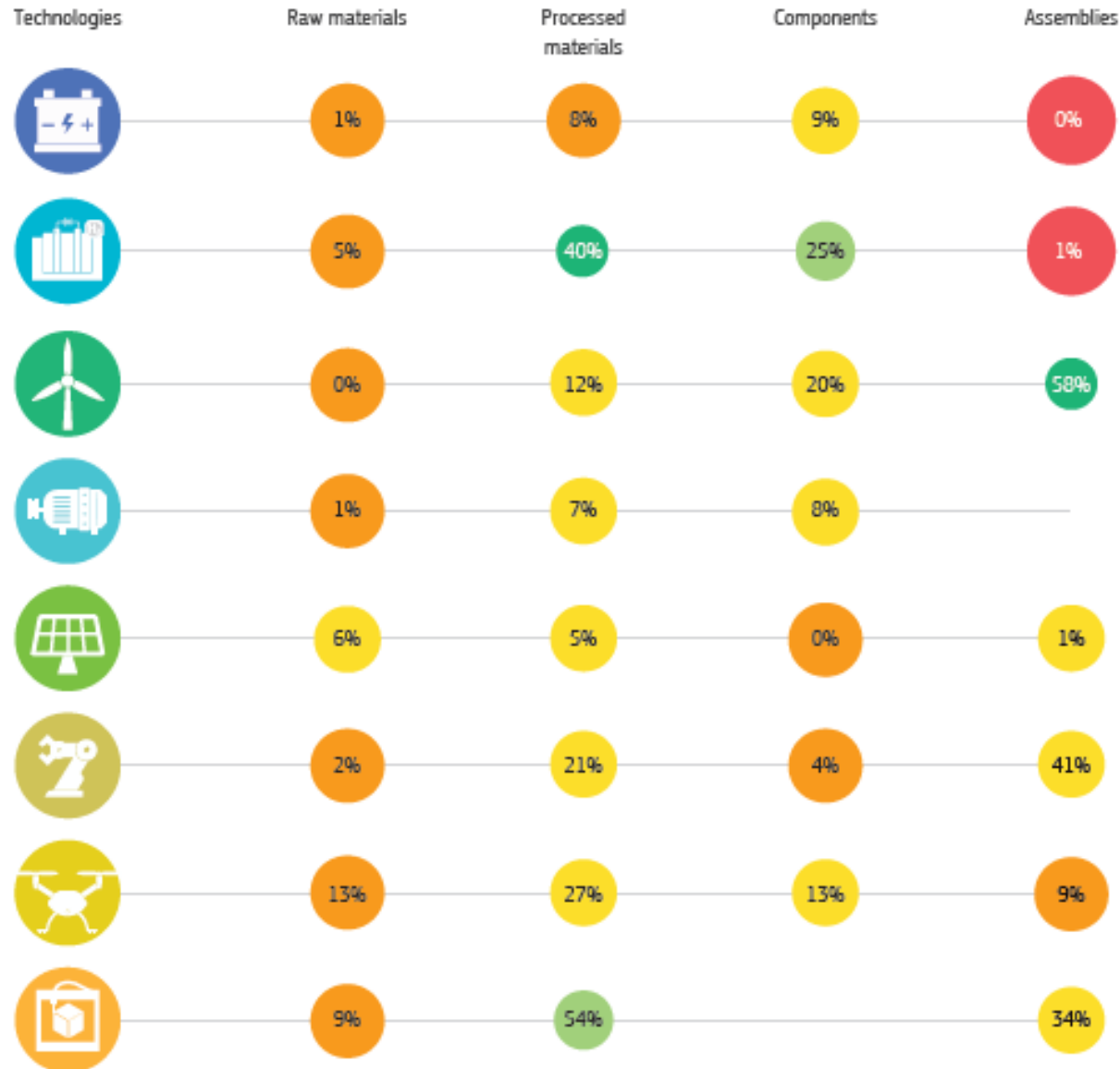
Materiais e sustentabilidade

Setores estratégicos para a UE



Materiais e sustentabilidade

Estrangulamentos

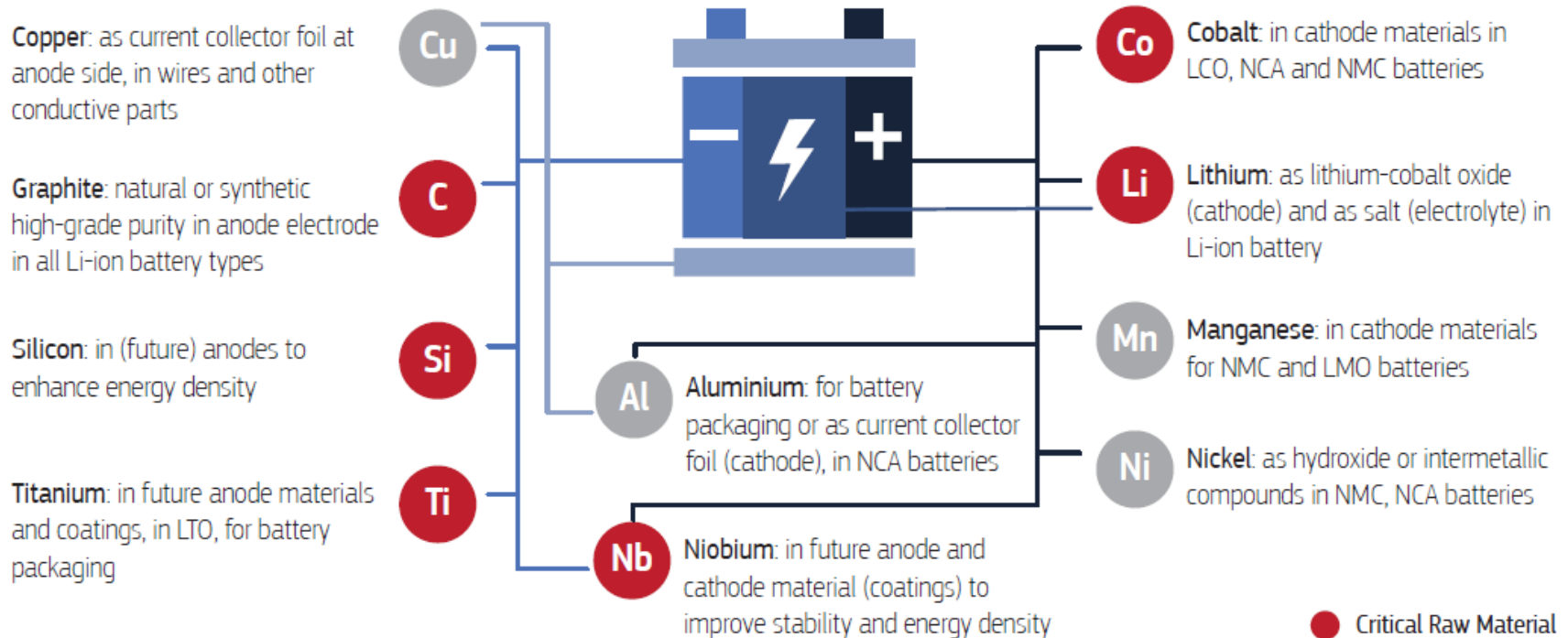


Materiais e sustentabilidade

Materiais críticos e não críticos

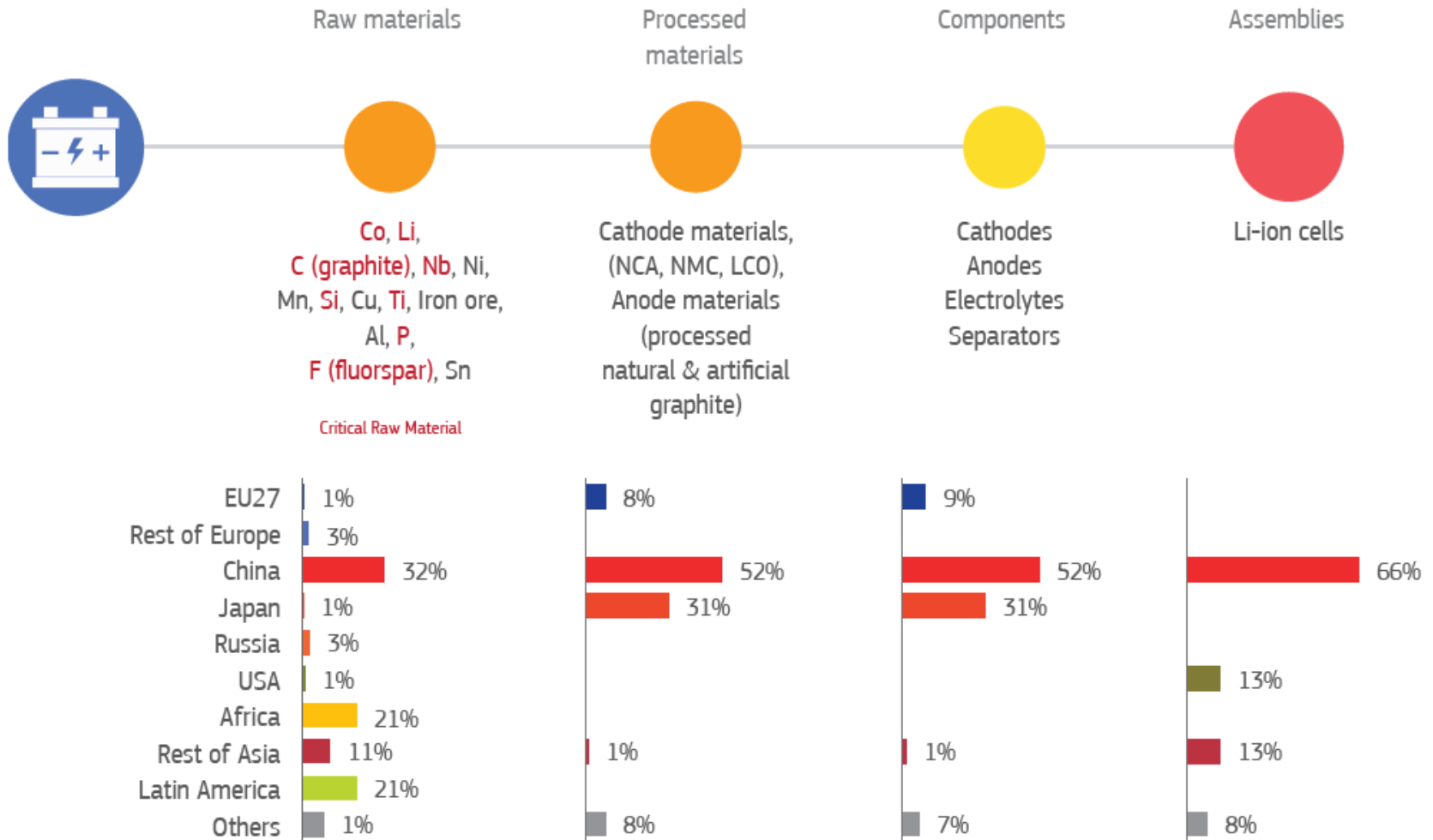
Supply Risk	Material									
●	LREEs	●	●	●			●	●		●
●	HREEs		●	●	●		●	●		
●	Magnesium		●				●	●	●	●
●	Niobium	●		●				●	●	
●	Germanium					●		●		●
●	Borates		●	●	●	●	●	●	●	●
●	Scandium							●	●	
●	Strontium		●				●	●		
●	Cobalt	●	●	●			●	●	●	●
●	PGMs		●				●	●		●
●	Natural graphite	●	●				●	●		●
●	Indium					●	●	●		
●	Vanadium		●				●	●	●	●
●	Lithium	●	●				●	●		
●	Tungsten						●	●	●	
●	Titanium	●	●				●	●	●	●
●	Gallium					●	●	●		●
●	Silicon metal	●	●		●	●	●	●	●	●
●	Hafnium							●	●	
●	Manganese	●	●	●			●	●	●	●
●	Chromium		●	●			●	●	●	●
●	Zirconium		●				●	●	●	●
●	Silver		●			●	●	●		●
●	Tellurium					●	●	●		●
●	Nickel	●	●			●	●	●	●	
●	Copper	●	●	●	●	●	●	●	●	●

Baterias de lítio: elementos críticos



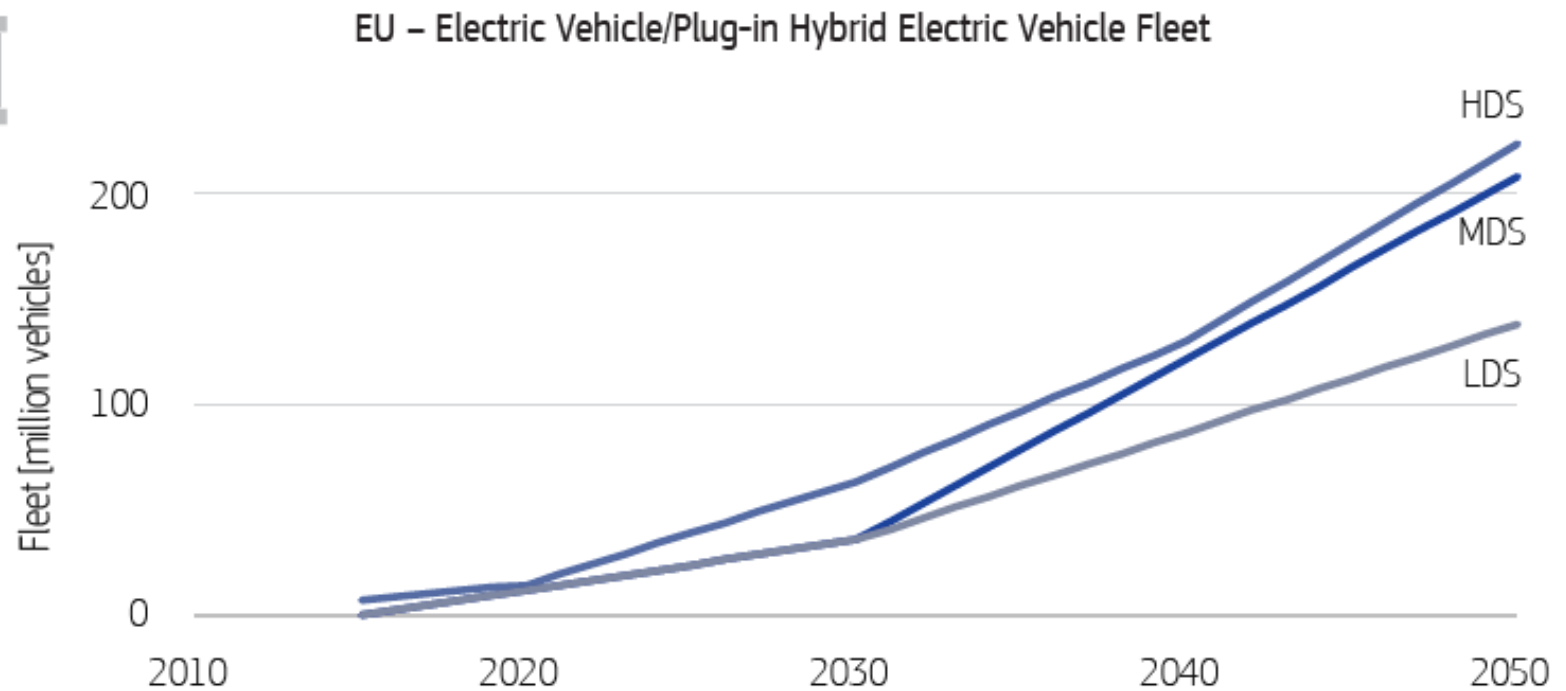
Materiais e sustentabilidade

Baterias de lítio: riscos de estrangulamento



Baterias de lítio: perspectivas de procura

Mobilidade elétrica



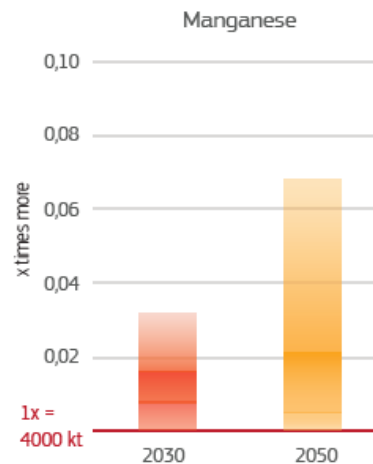
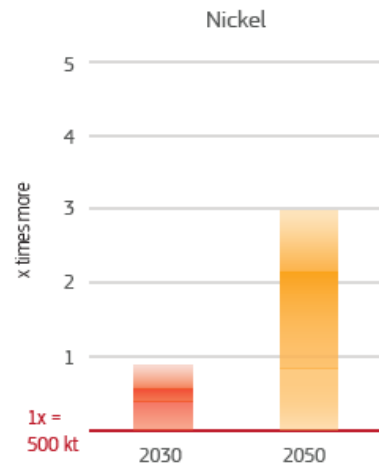
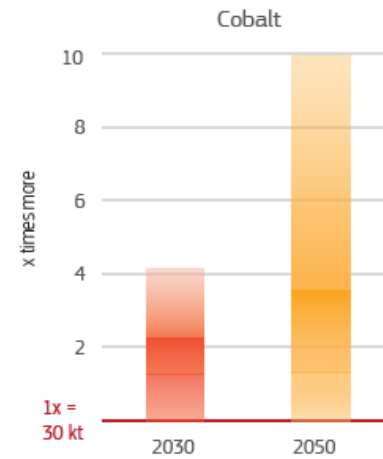
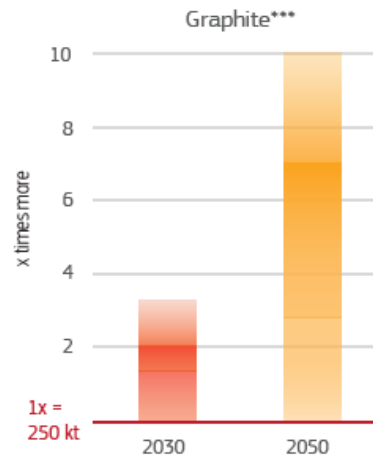
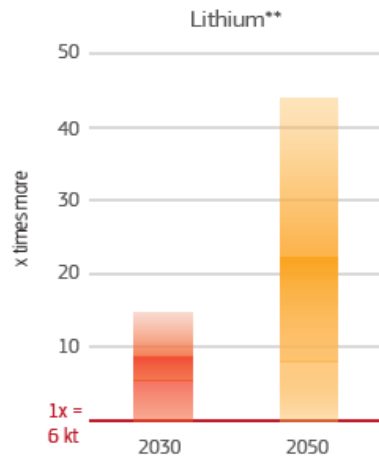
Materiais e sustentabilidade

Baterias de lítio: perspectivas de procura

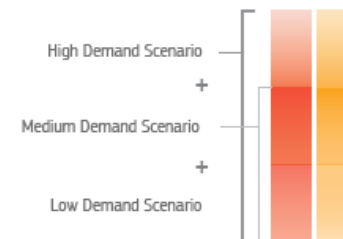
Mobilidade elétrica



Additional material consumption for batteries in **e-mobility only** in 2030/2050 compared to current EU consumption* of the material in **all applications**

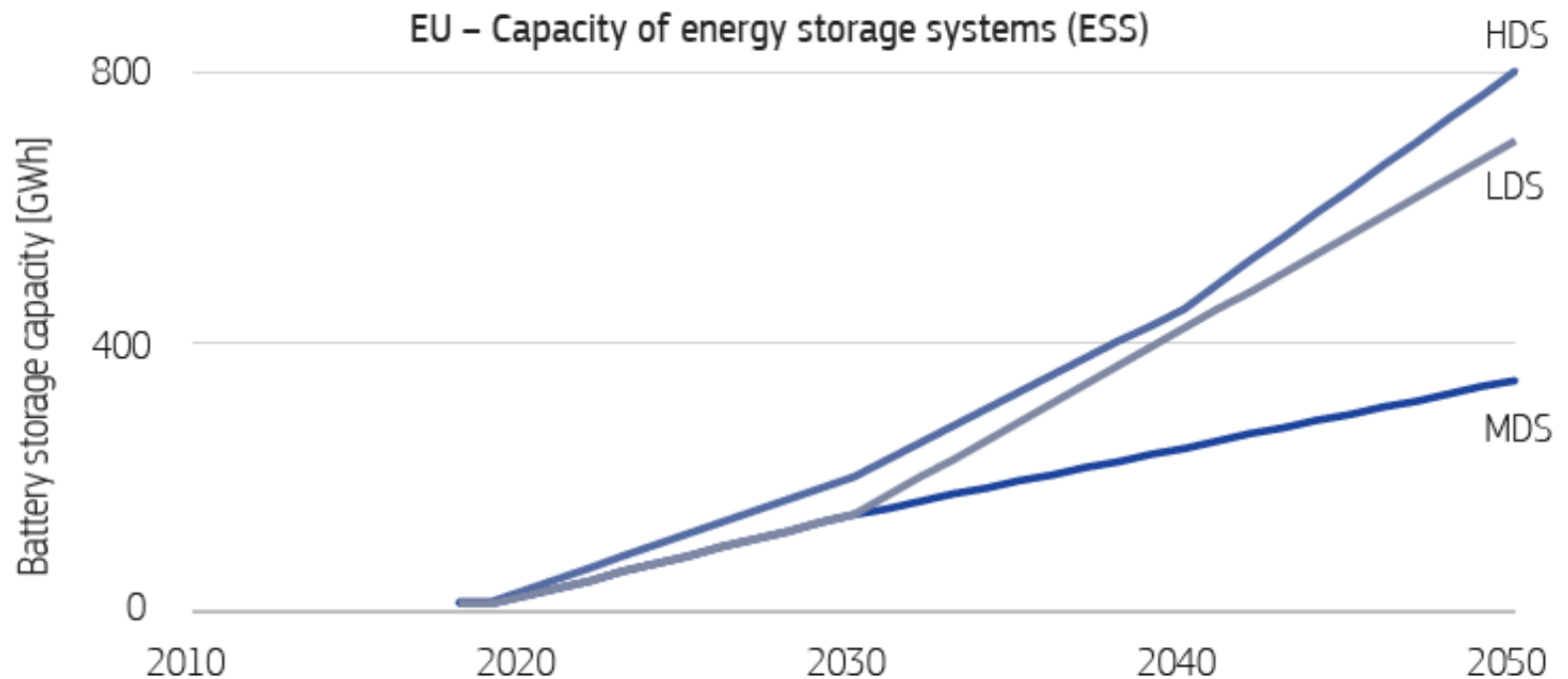


* See the methodological notes in Annex 1 and all data in Annex 2
** of refined supply (Stage II) instead of ore supply (Stage I)
*** increase in demand of all graphite in relation to natural graphite



Baterias de lítio: perspectivas de procura

Mobilidade elétrica

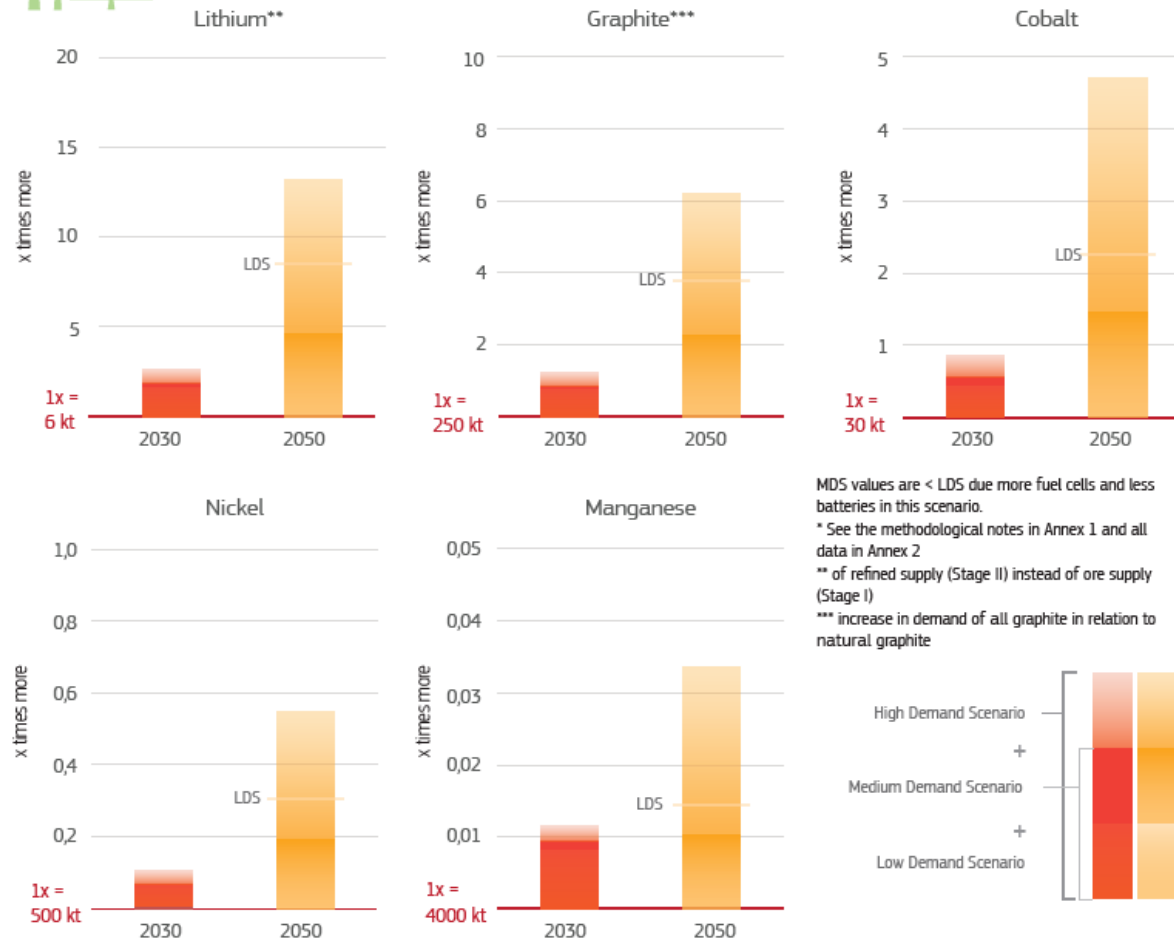


Baterias de lítio: perspectivas de procura

Sistemas de armazenamento de energia



Additional material consumption for batteries in **renewables only** in 2030/2050 compared to current EU consumption* of the material in **all applications**



Turbinas eólicas: elementos críticos

Iron: as cast iron or in steel composition for tower, nacelle, rotor and foundation; in NdFeB permanent magnets

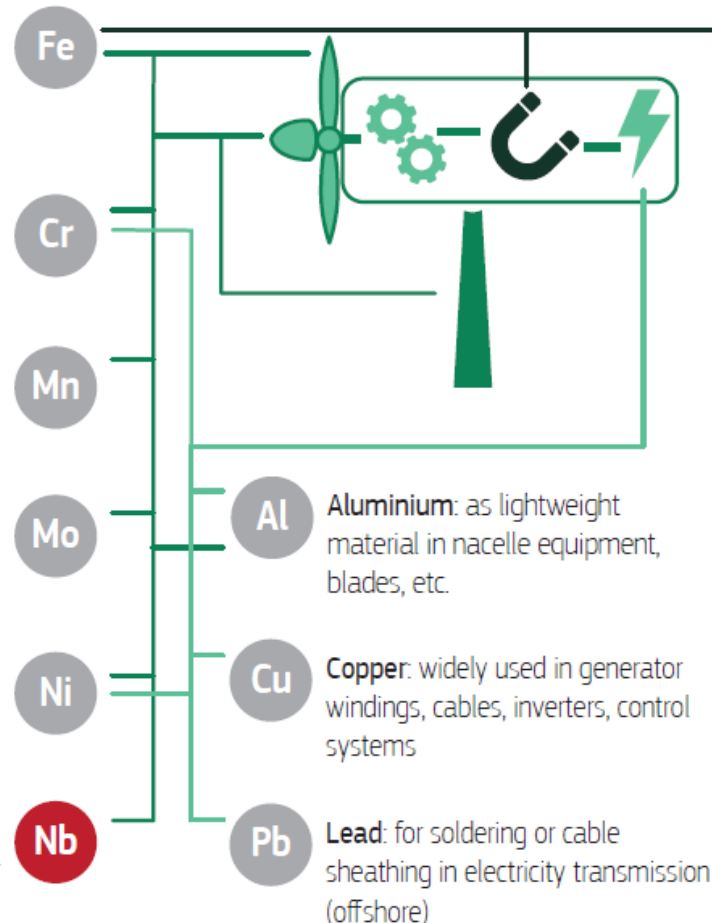
Chromium: essential for stainless steel and other alloys in rotor and blades

Manganese: essential for steel production used for many parts of a turbine

Molybdenum: in stainless steel composition for many components of the turbine

Nickel: in alloys and stainless steel for different components of the turbine

Niobium: a microalloying element in high strength structural steel for towers of a turbine



B Boron: in composition of neodymium–iron–boron (NdFeB) magnets or as lubricant

Dy Dysprosium: important additive of neodymium–iron–boron (NdFeB) permanent magnets

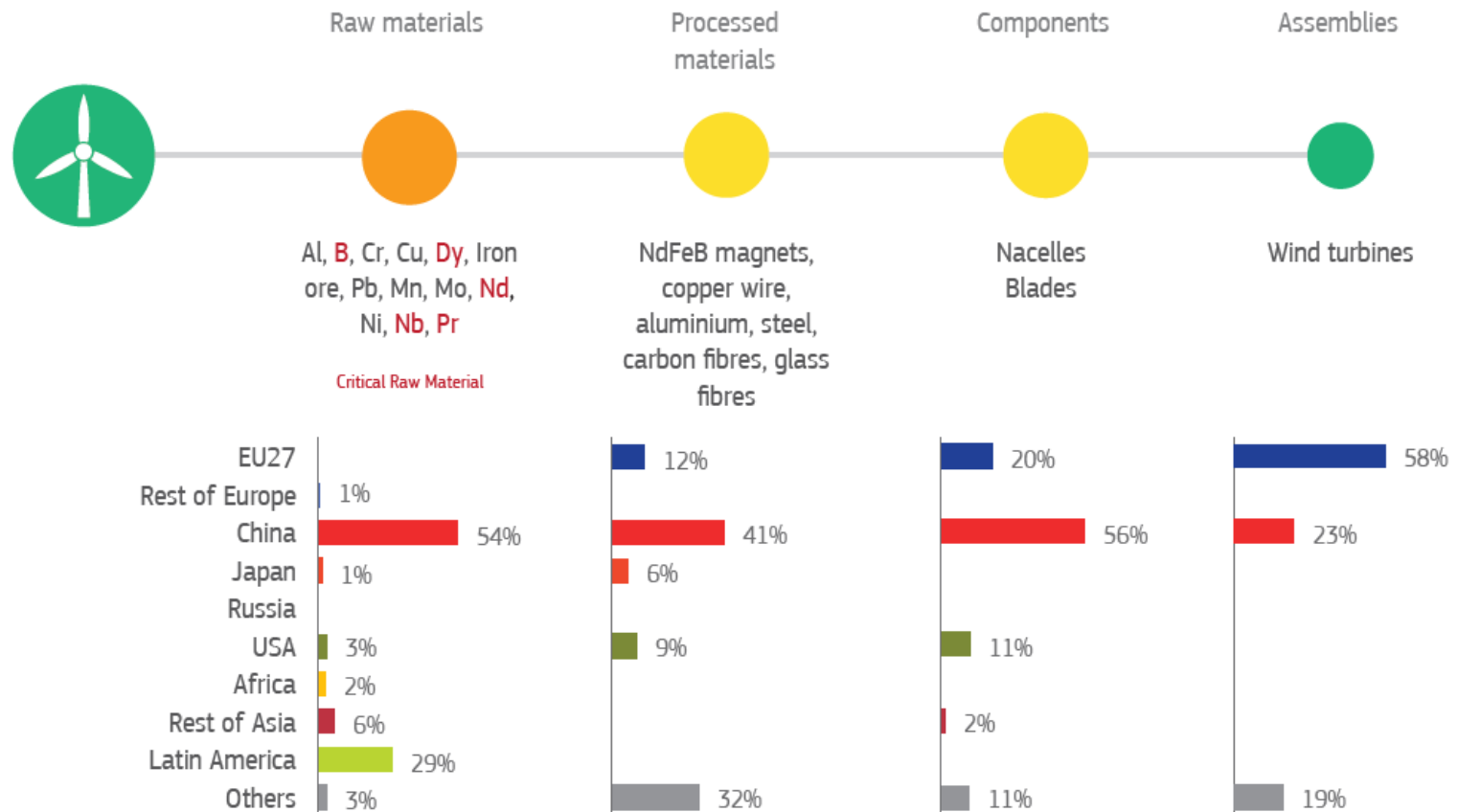
Nd Neodymium: in NdFeB permanent magnets for electricity generation

Pr Praseodymium: together with neodymium in permanent magnets

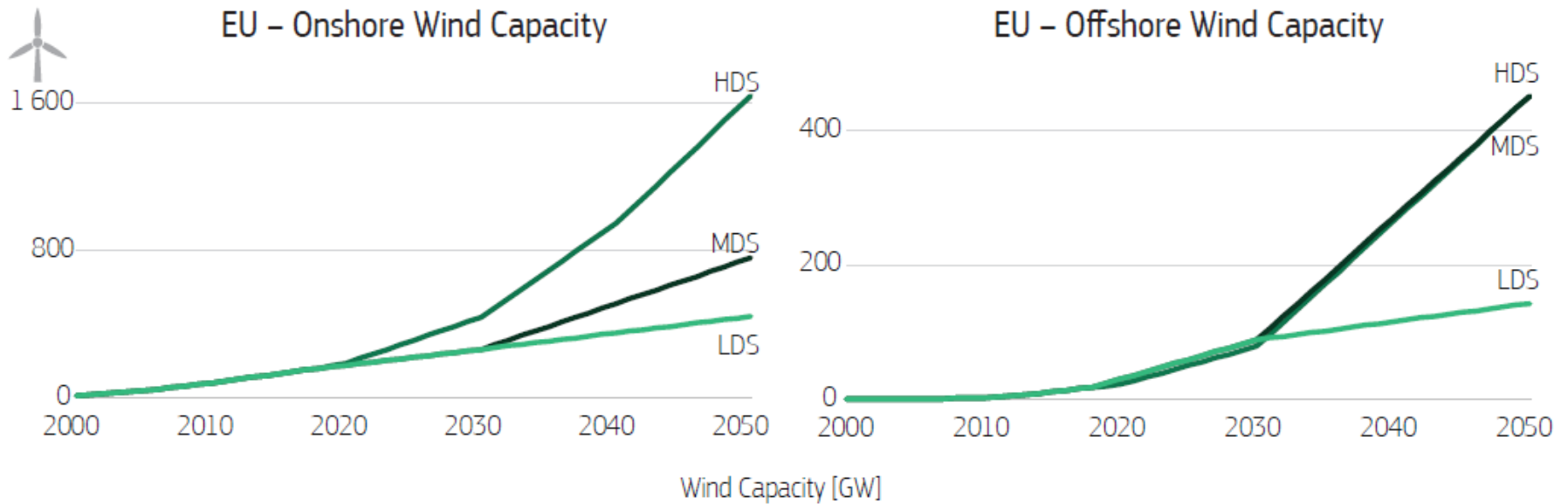
● Critical Raw Material

Materiais e sustentabilidade

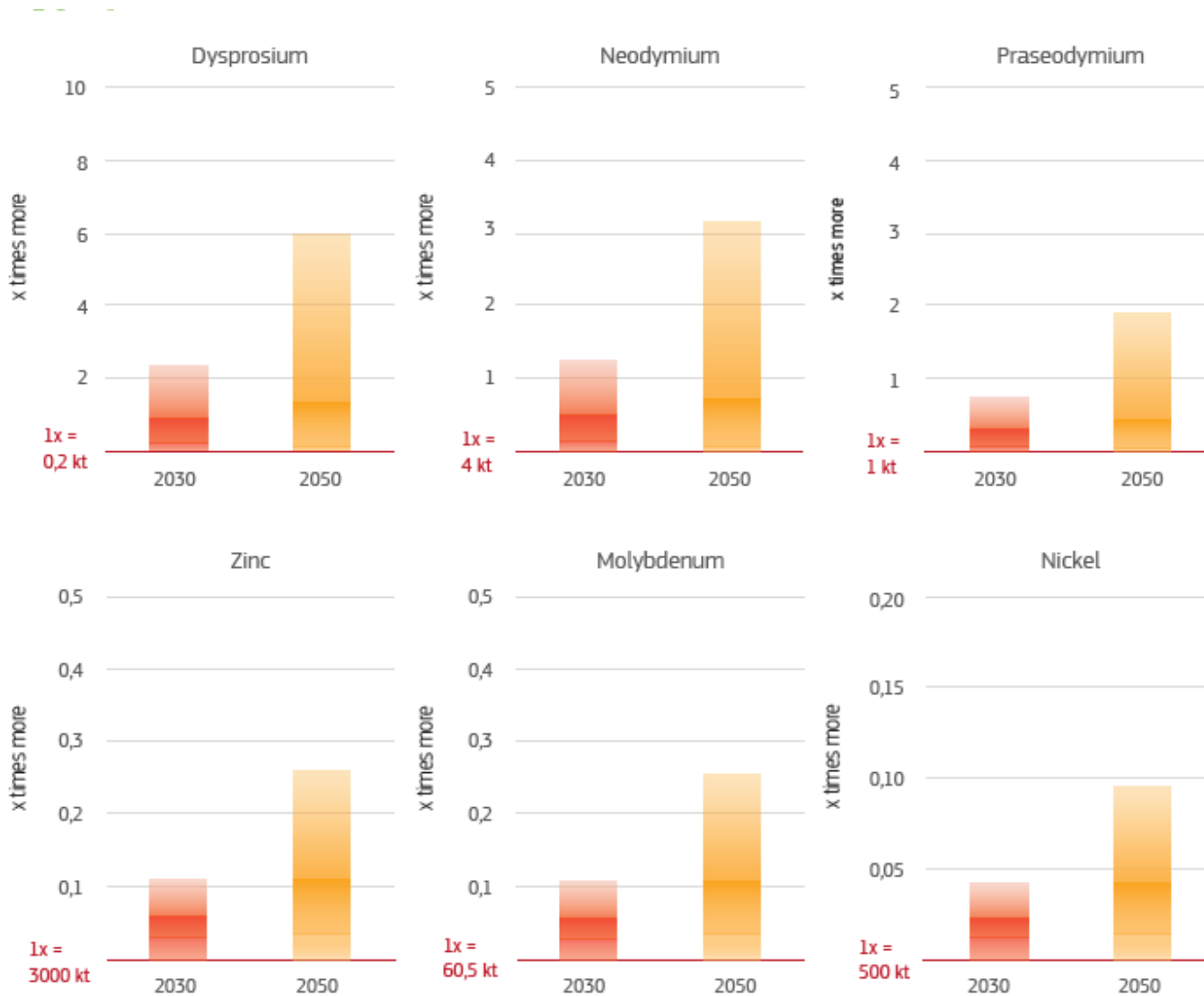
Turbinas eólicas: riscos de estrangulamento



Turbinas eólicas: perspectivas de procura



Turbinas eólicas: perspectivas de procura



Painéis fotovoltaicos: elementos críticos

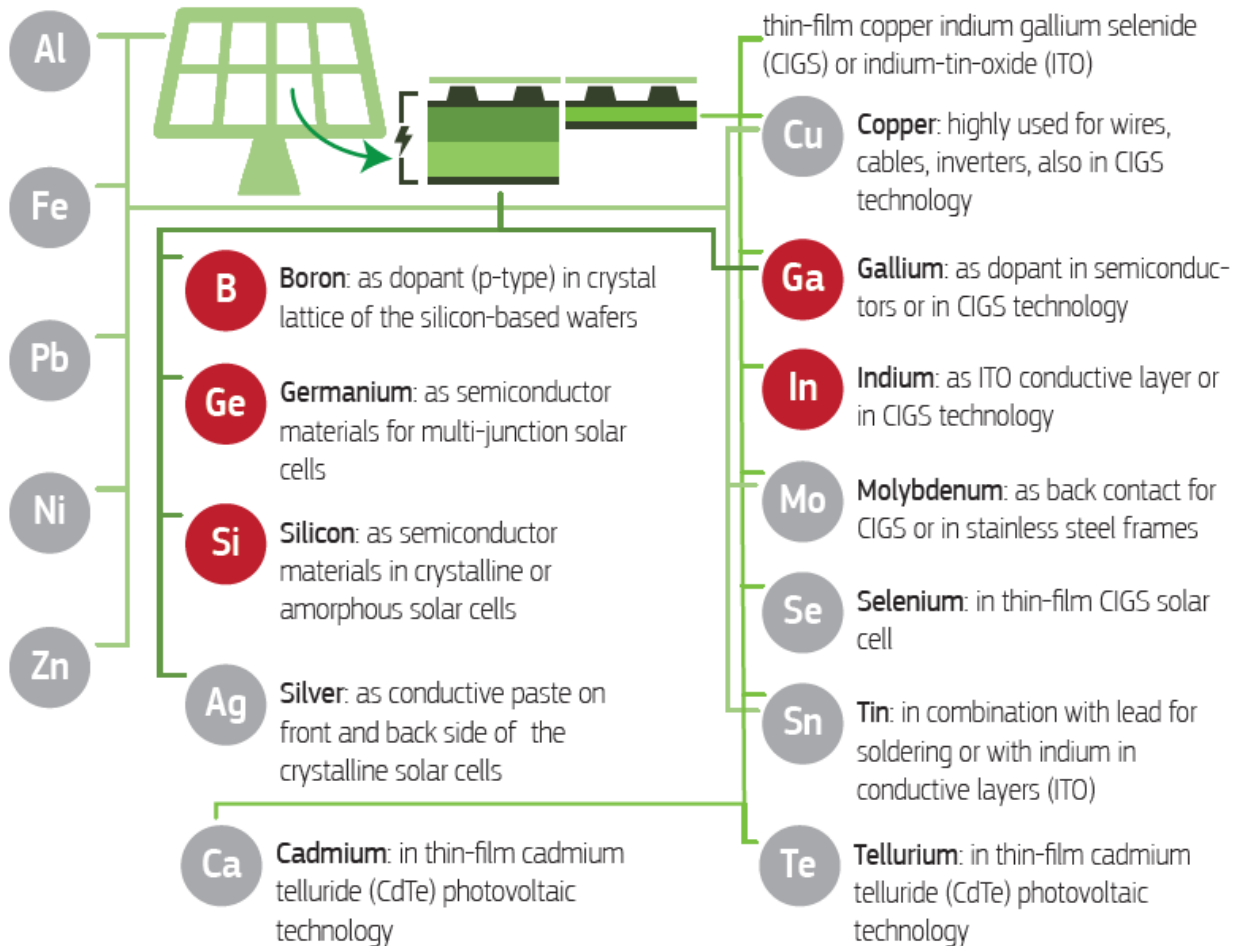
Aluminium: in panel frames and inverters or in alloys for construction and support

Iron: in steel alloys for different parts and in fixing systems of PV installations

Lead: in alloys with tin (Sn) as solder for electric circuits and interconnectors

Nickel: in electroplating or in stainless steel frames, fasteners and connectors

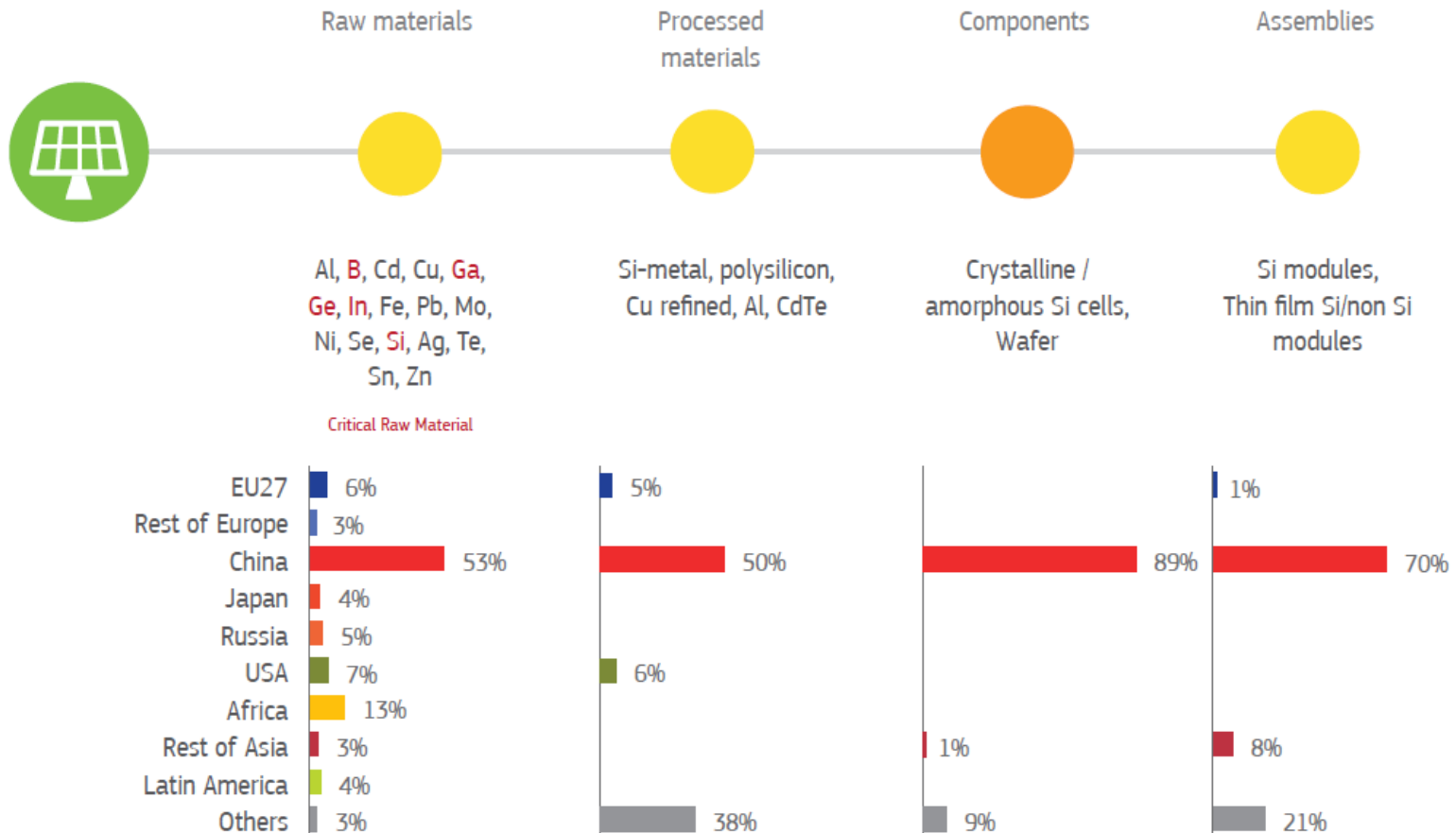
Zinc: as transparent conductive oxide in the front contact of solar cells



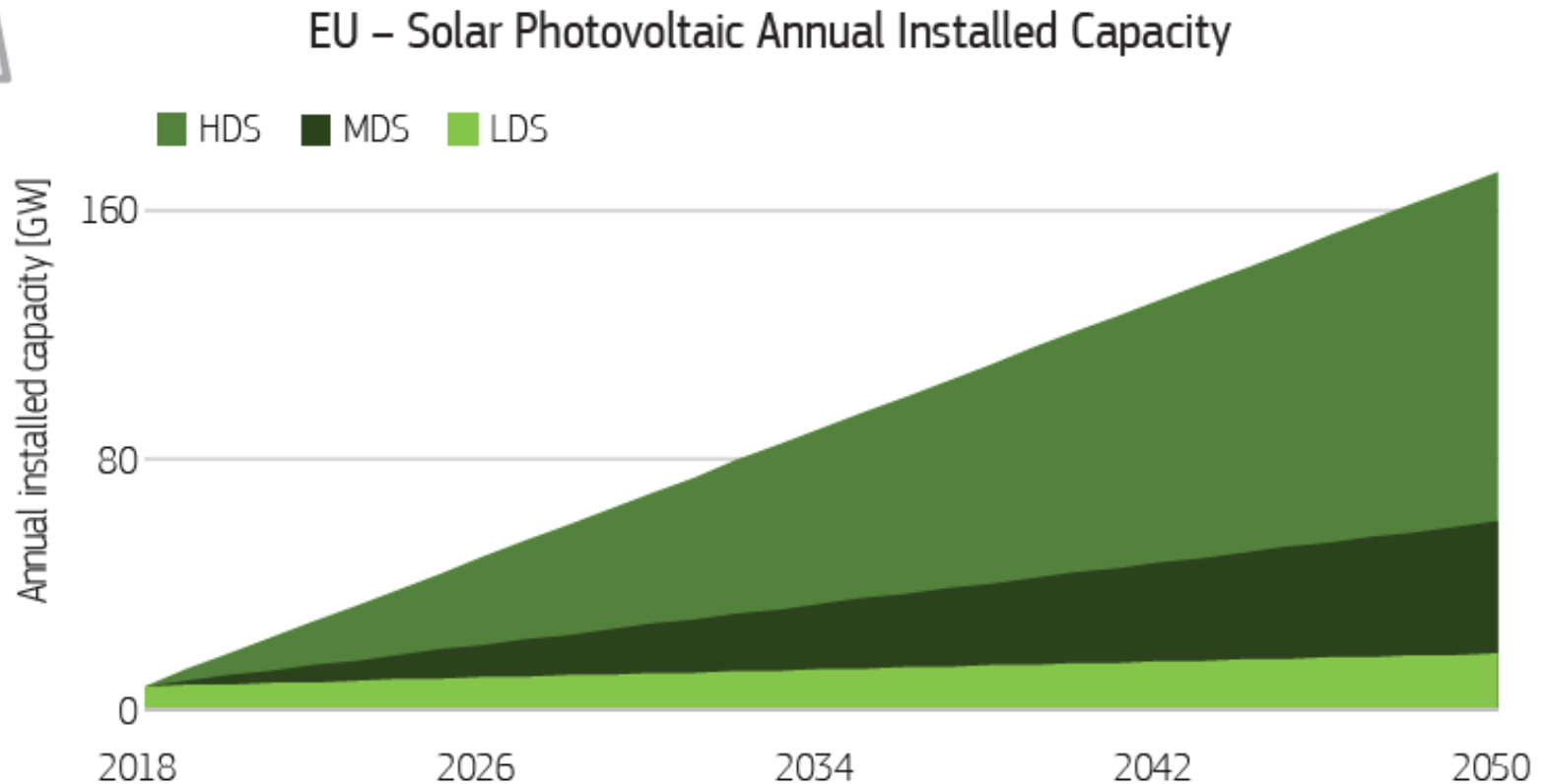
● Critical Raw Material

Materiais e sustentabilidade

Painéis fotovoltaicos: riscos de estrangulamento



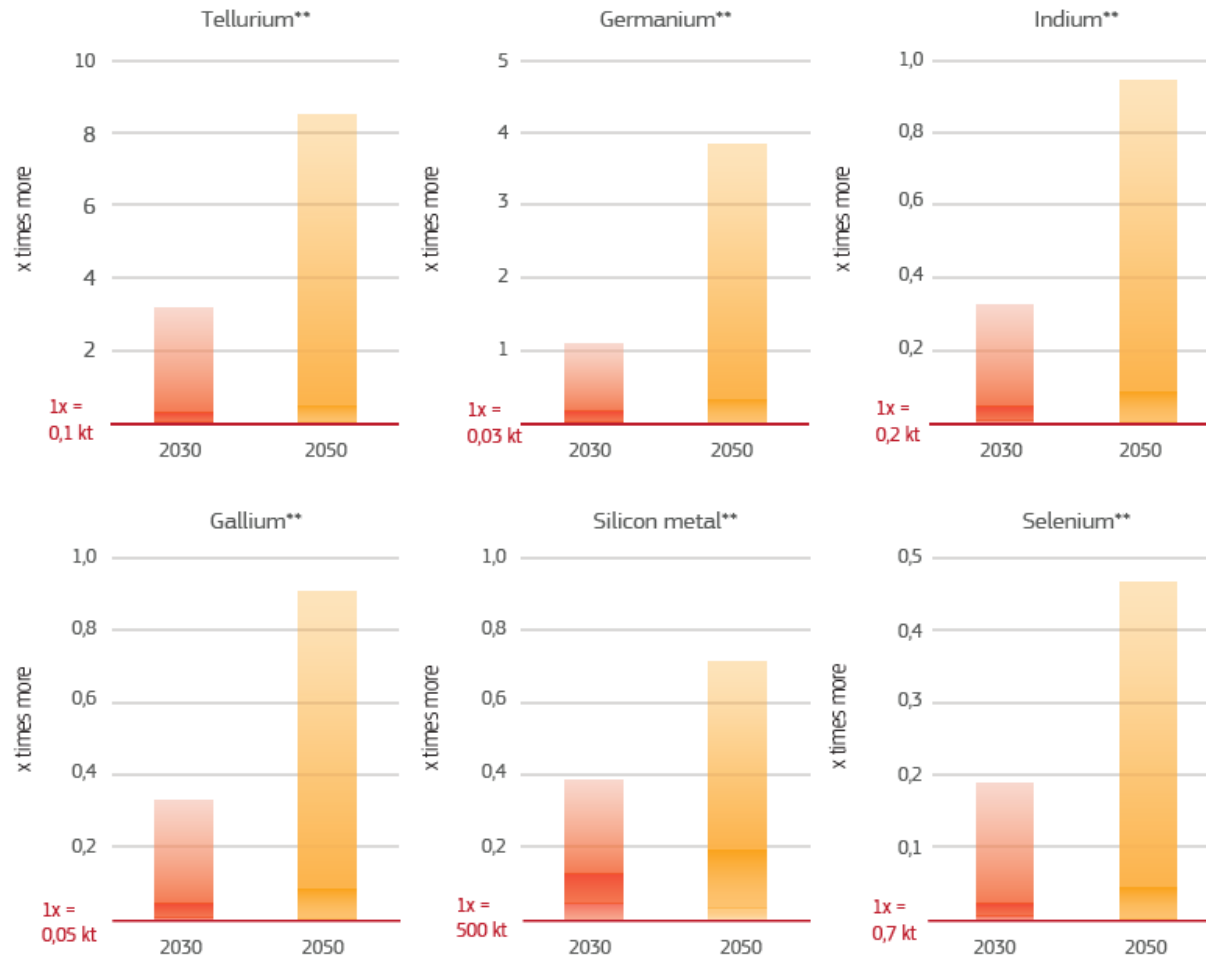
Painéis fotovoltaicos: perspectivas de procura



Painéis fotovoltaicos: elementos críticos



Additional material consumption for photovoltaics in **renewables only** in 2030/2050 compared to current EU consumption* of the material in **all applications**



Materiais e sustentabilidade

Robótica: elementos críticos

Beryllium: in alloys, electro-optical systems and robotic surgical devices

Gallium: for communication, electro-optical and power systems

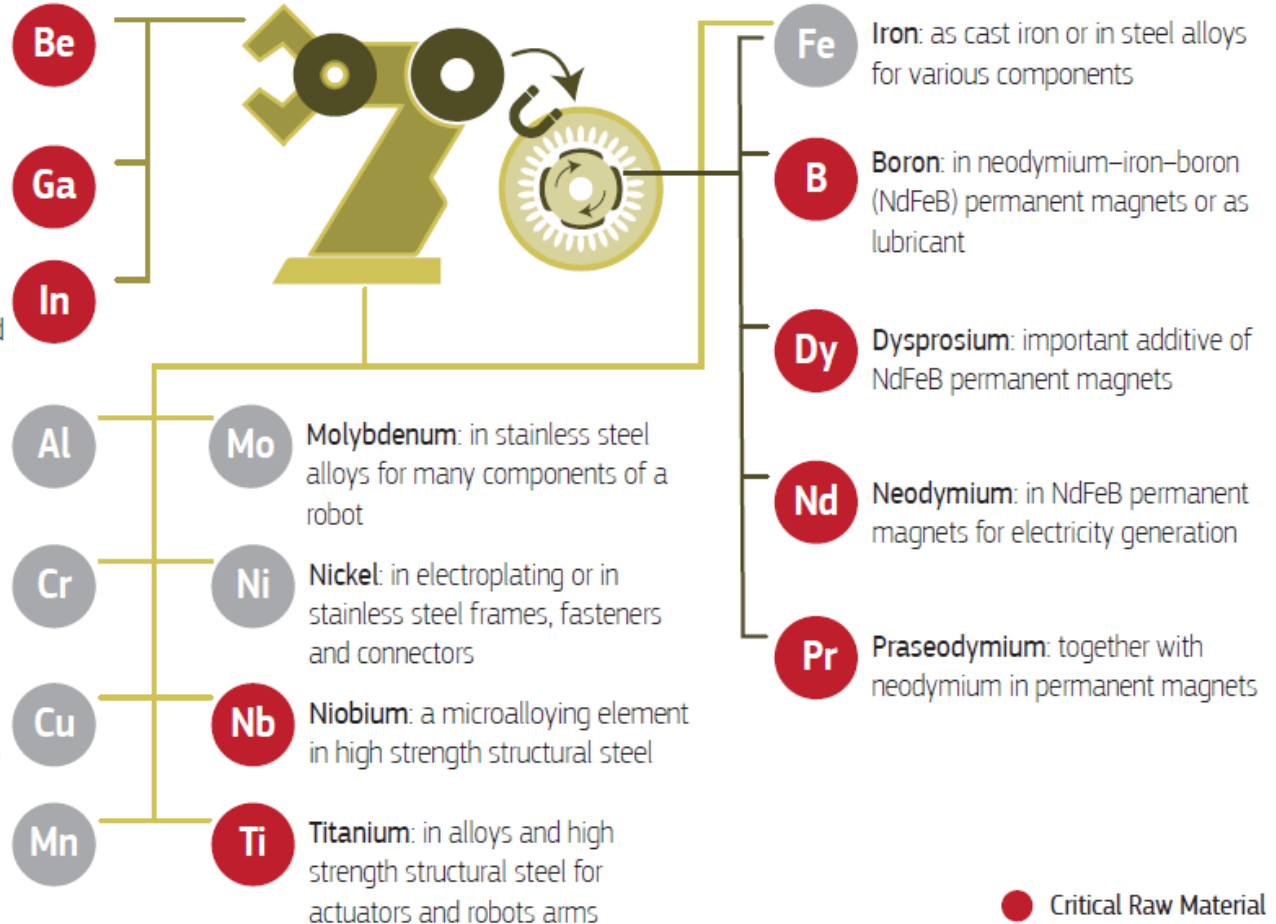
Indium: in compounds for electro-optical systems, sensors and stretcher skin

Aluminium: as lightweight and high-performance alloy in various components

Chromium: essential for stainless steel and other alloys in robots

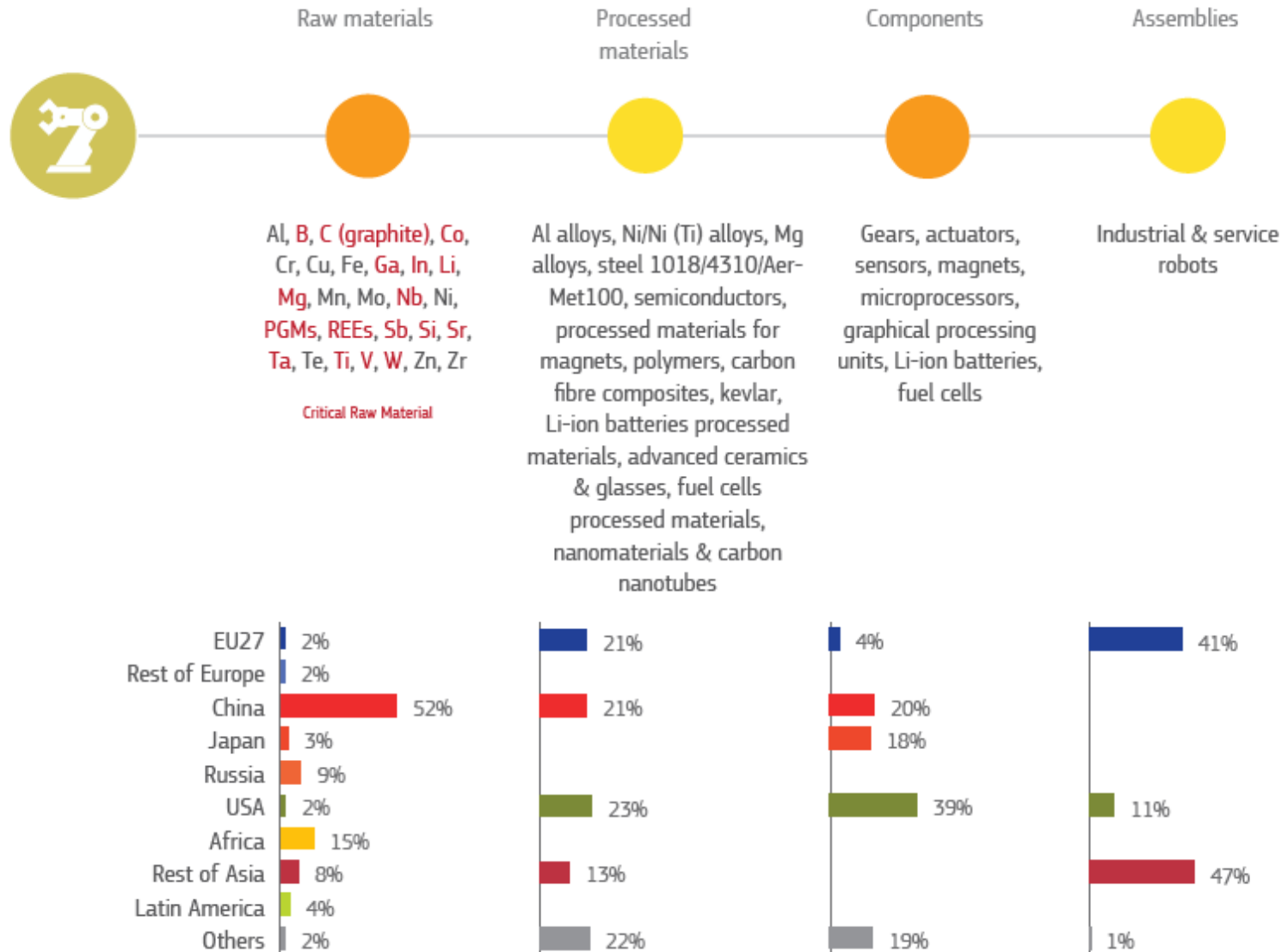
Copper: widely used in wire or axles, or in corrosion resistant alloys

Manganese: essential in steel alloys used for many parts of a robot



Materiais e sustentabilidade

Robótica: riscos de estrangulamento

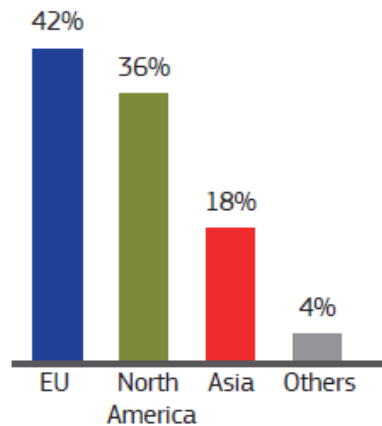


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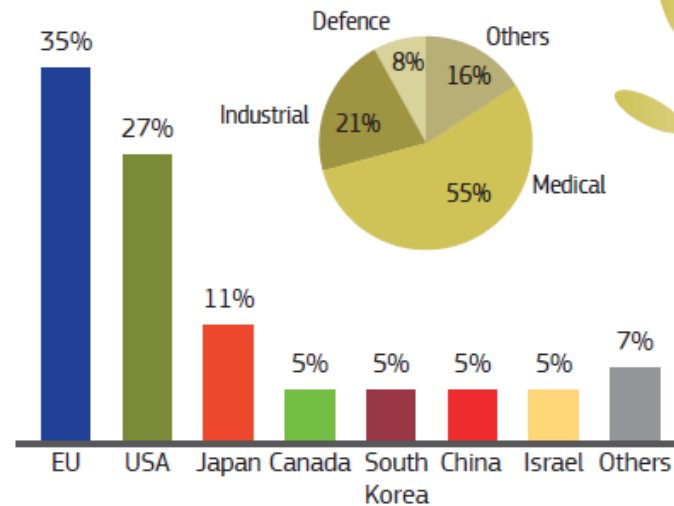
Robótica: taxa de produção por país



Service Robots



Exoskeletons



Manufatura aditiva: elementos críticos

Aluminium: main alloy family used in 3DP for aerospace, light and stiff, cabins interiors

Iron: main alloy family of stainless steels in structural and engine parts

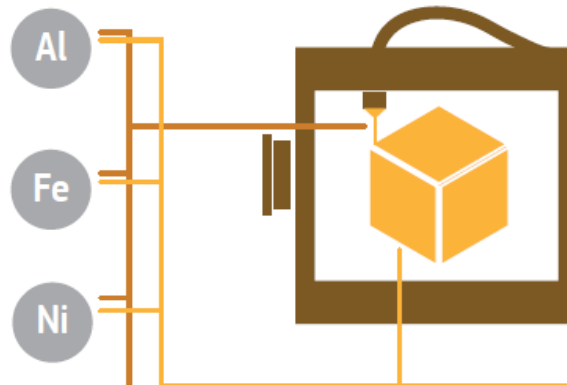
Nickel: for Ni and Ni-Ti alloys (Hastelloy series), ductile and corrosion resistant, in turbine and engine parts

Titanium: main alloys family, lighter than Al-Mg alloys, high strength, for aerospace and medical

Magnesium: in high-performance Al-Mg alloys

Chromium: corrosion resistant in CoCr alloys, gas-turbines, engines, dental and medical

Cobalt: in various super-alloys, CoCr, in gas-turbines, engine, dental and medical



Al

Fe

Ni

Ti

Mg

Cr

Co

Cu

Hf

Mn

Mo

Nb

Sc

Si

W

V

Zr

Niobium: in super-alloys, Ti-Al-Nb alloys, in engines, blades, valves, rotors

Scandium: for lightweight - high strength non-structural parts and fittings

Silicon: as alloying element in light-weight Al-Mg alloys

Tungsten: in various heat resistant super-alloys, in stainless and hardens tool steels, turbine blades and vanes

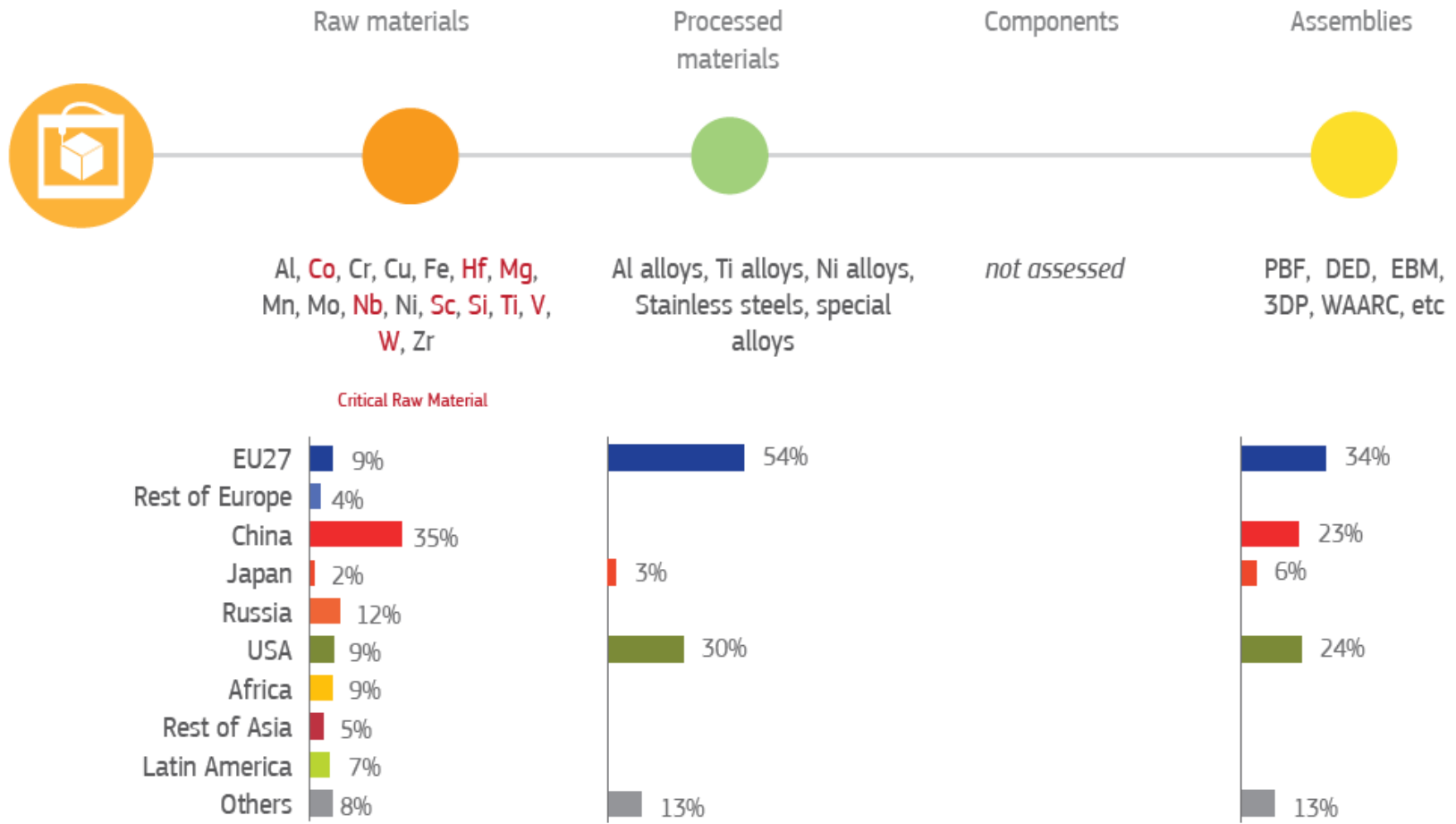
Vanadium: alloying element in various Ti-Al alloys

Zirconium: element in Ti-alloys, in Bulk Metallic Glass, sprockets, springs, gears, sensors

● Critical Raw Material

Materiais e sustentabilidade

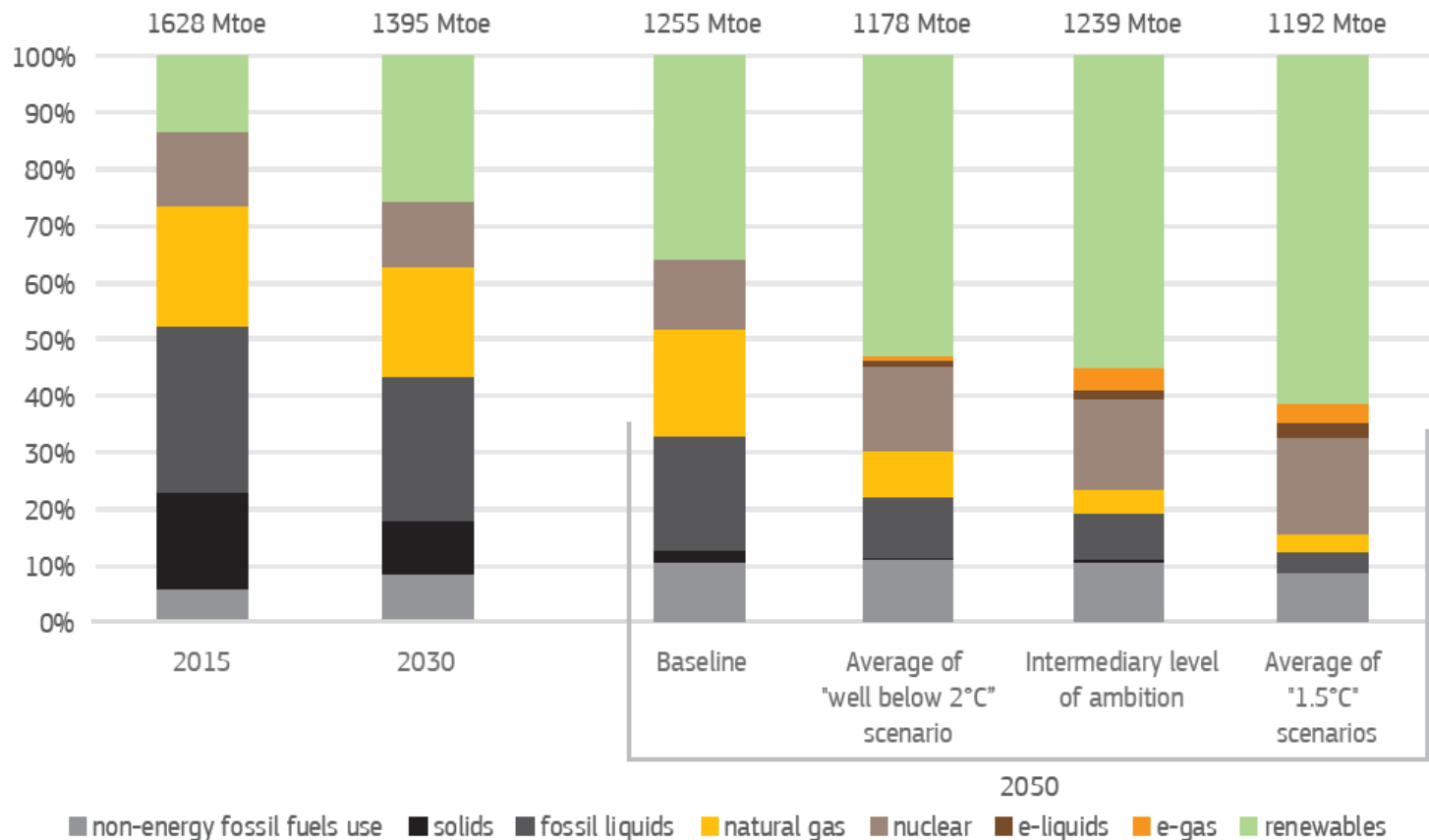
Manufatura aditiva: riscos de estrangulamento



Materiais e sustentabilidade

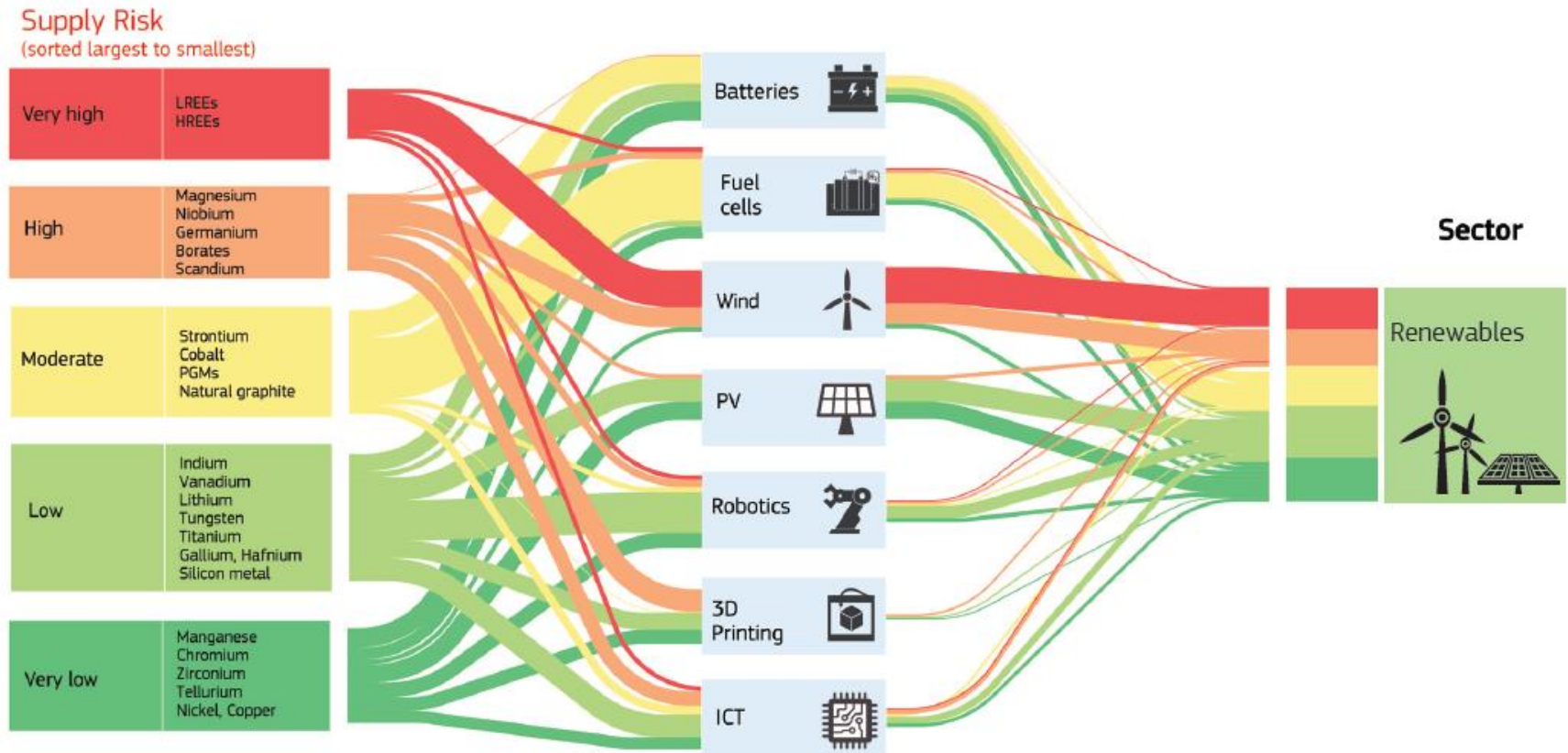
Energias renováveis – desafios

A transição para uma sociedade de baixo carbono dependerá da implementação em larga escala de tecnologias renováveis. Até 2025, pretende-se que mais de 80% da eletricidade produzida na EU seja proveniente de fontes renováveis.



Materiais e sustentabilidade

Energias renováveis – desafios



Energias renováveis – desafios

Figure 48. List of critical and non-critical raw materials used for renewables ranked by their 2020 supply risk

