New Technologies for the Energy and Circular Transition: the demand of Mineral Resources

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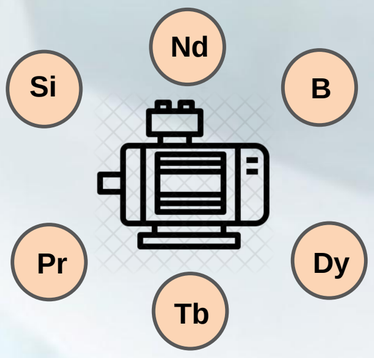
Energy and circular transitions are crucial to achieve sustainability goals and climate change targets in the upcoming decades. To enable such transitions towards sustainability, the development of technologies has a major role on contributing to mitigate greenhouse gases (GHG) emissions.

On the other hand, the development of these technologies require an increasing volume of raw materials also to build the infrastructure needed to develop renewable energies and digital strategies (IRP, 2020).

The so called Critical Raw Materials (CRMs), among the raw materials, are economically and strategically relevant for the economy and for these technologies but face comparatively high supply risks (European Commission, 2020b).

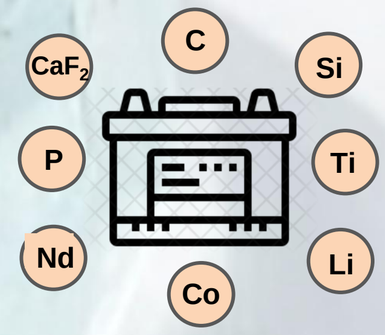
Key Sectors and Technologies for the transition

Transport



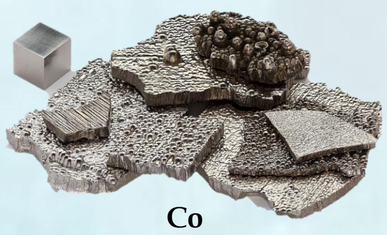
Electrical traction motor

Material	Sector	Technology	Total requirement 2018 (tonnes)	Future demand 2040 (tonnes)	Future demand factor	Reference
REEs	Transport	Traction	34630	834050	**x24**	Marscheider-Weildemann et al. (2021)
Lithium	Transport	Li-ion battery	7460	377300	**x51**	Marscheider-Weildemann et al. (2021)
				6100000**	x818	Michaux (2021)
Cobalt	Transport	Li-ion battery	12750	31100	**x24**	Marscheider-Weildemann et al. (2021)
				7900000**	x620	Michaux (2021)
Graphite	Transport	Li-ion battery	21900	101900	**x47**	Marscheider-Weildemann et al. (2021)
				62200000**	x2840	Michaux (2021)

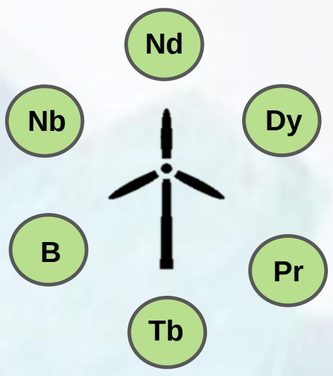


Li-ion batteries

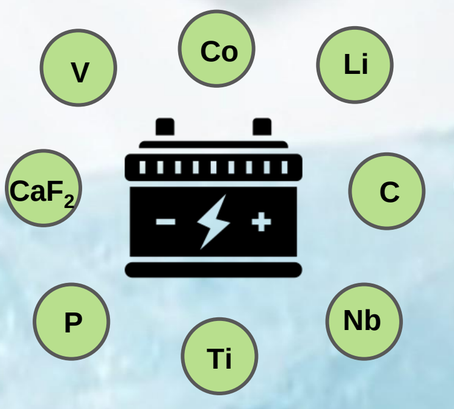
Adapted from Kleijn *et al* (2022). ** Estimated Demand for 2050.



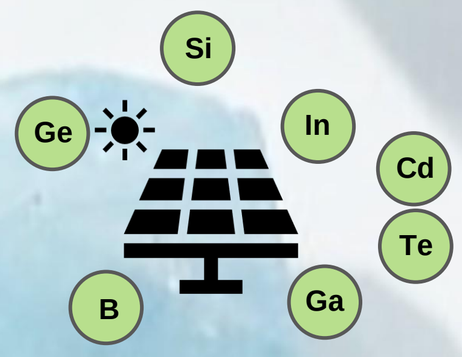
Co



Wind power



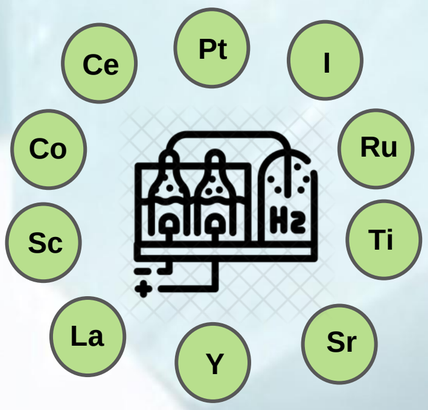
Energy storage



Solar photovoltaics

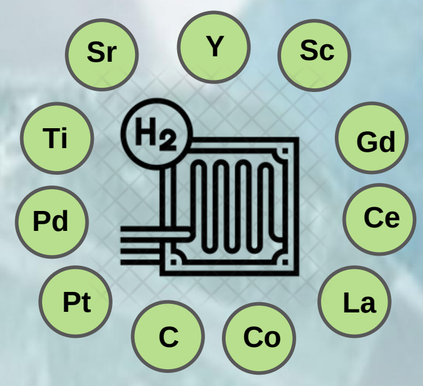
Li

Energy



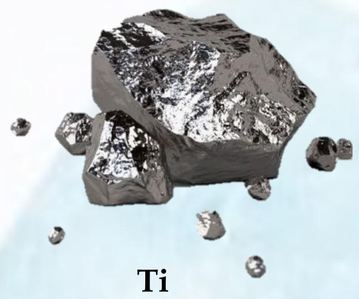
Hydrogen production

Material	Sector	Technology	Total requirement 2018 (tonnes)	Future demand 2040 (tonnes)	Future demand factor	Reference
REEs	Energy	Wind	2820	15890	**x6**	Marscheider-Weildemann et al. (2021)
		Solar PV	3168	17740	**x5**	
		Hydrogen	8E-01	3170	**x3000**	
Cobalt	Energy	Fuel cells	1	63	**x63**	Marscheider-Weildemann et al. (2021)
		Hydrogen	01	370	**x3700**	
Lithium	Energy	Li-ion battery	476	24083	**x51**	Marscheider-Weildemann et al. (2021)
Gallium	Energy	Solar PV	5	26	**x5**	Marscheider-Weildemann et al. (2021)
			5	50***	x10	IEA (2020a)
Indium	Energy	Solar PV	17	92	**x5**	Marscheider-Weildemann et al. (2021)
			17	170***	x10	IEA (2020a)
Platinum	Energy	Hydrogen	1E-02	40	**x4000**	Marscheider-Weildemann et al. (2021)
Scandium	Energy	Hydrogen	1E-02	24	**x2400**	Marscheider-Weildemann et al. (2021)
Titanium	Energy	Hydrogen	3.5	13600	**x3800**	Marscheider-Weildemann et al. (2021)

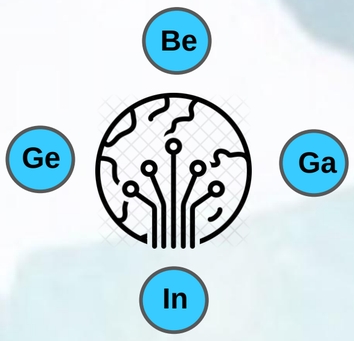


Fuel cells

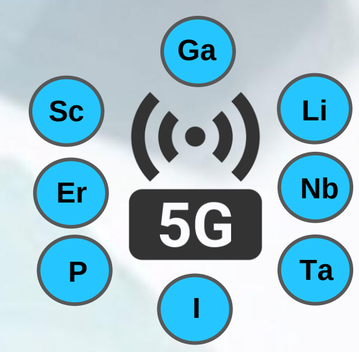
Adapted from Kleijn *et al* (2022). *** Values retrieved and rounded from the report´s figures.



Ti



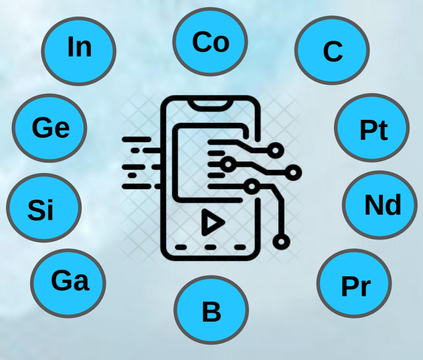
Photonics



5G/6G

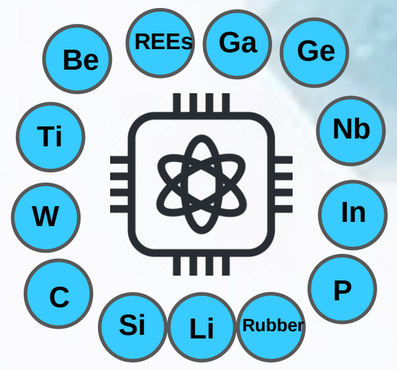
RREs

E & T



Digital technologies

Material	Sector	Technology	Total requirement 2018 (tonnes)	Future demand 2040 (tonnes)	Future demand factor	Reference
Gallium	E & T	Photonics	1	2	**x2**	Marscheider-Weildemann et al. (2021)
		5G/6G	77	122	**x2**	
Indium	E & T	Photonics	5	16	**x3**	Marscheider-Weildemann et al. (2021)
		5G/6G	5	16	**x3**	
Lithium	E & T	5G/6G	8	15	**x2**	Marscheider-Weildemann et al. (2021)
Tantalum	E & T	5G/6G	194	356	**x2**	Marscheider-Weildemann et al. (2021)



Quantum computing

Adapted from Kleijn *et al* (2022).