German Mineral Resources Agency
Federal Institute for Geosciences and Natural Resources

Demand of mineral raw materials for future technologies for the German industry

German Day

Mining INDABA 2018

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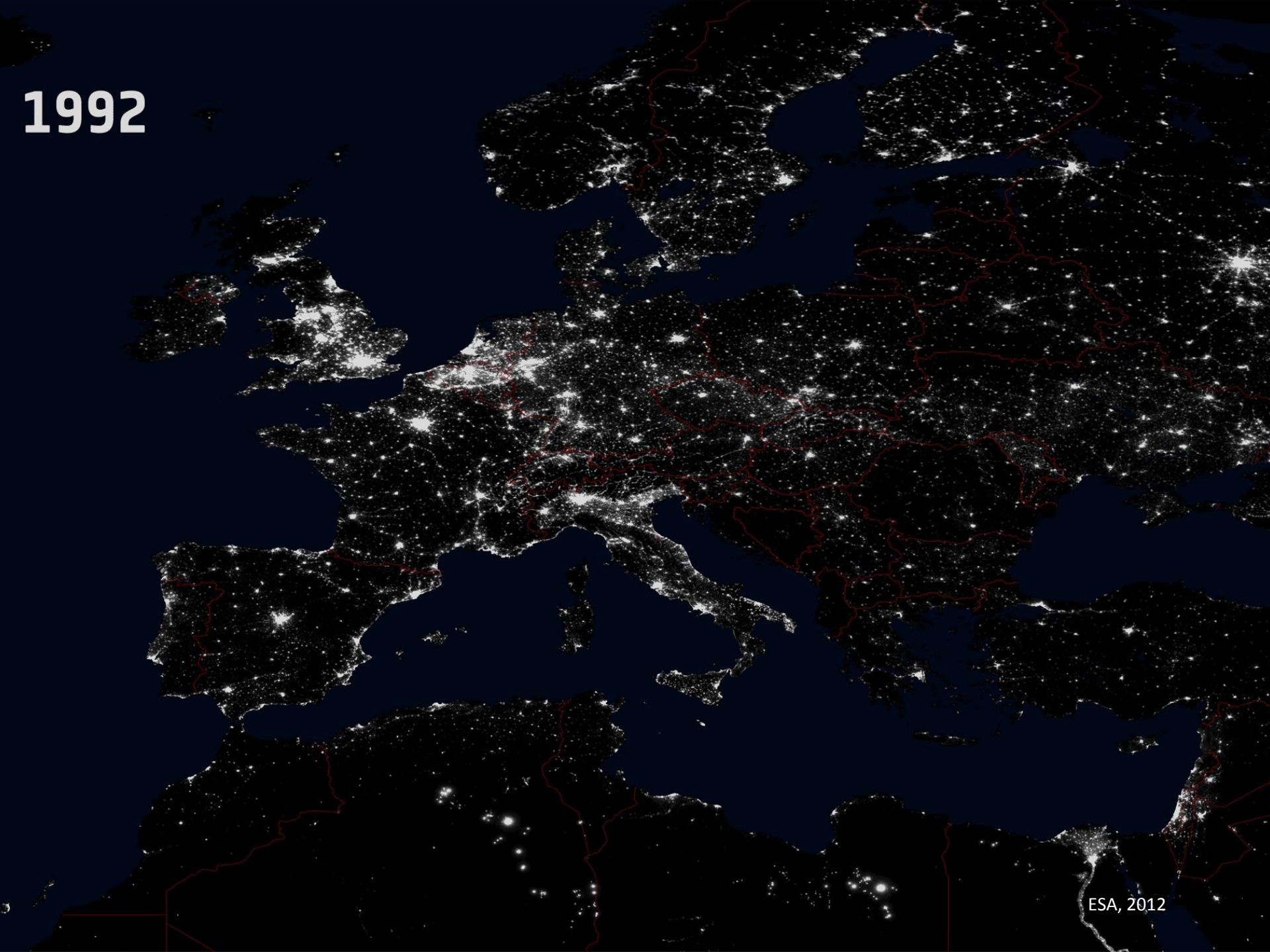
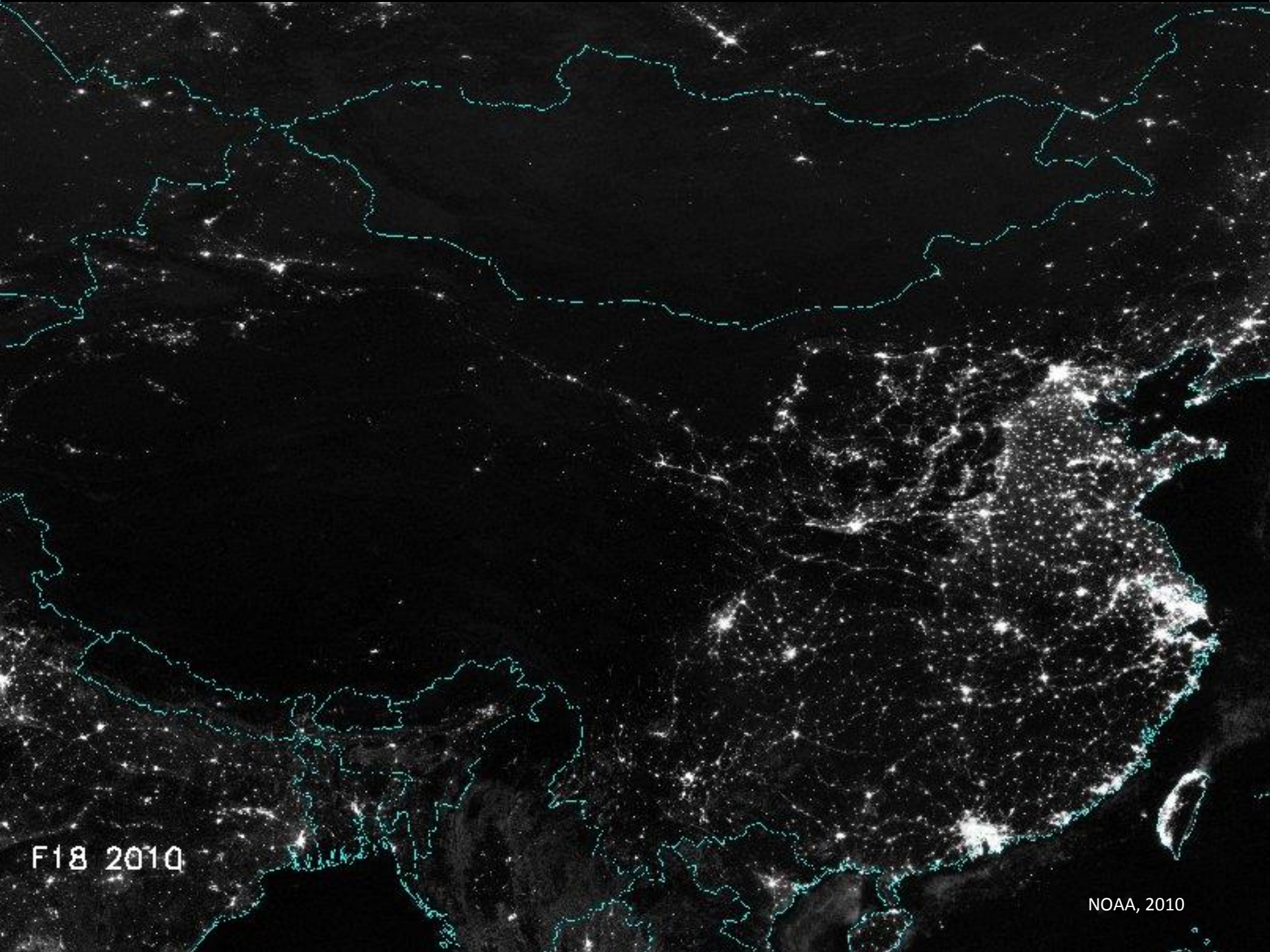
NASA, 2012


NASA, fotolia.com


1992
ESA, 2012



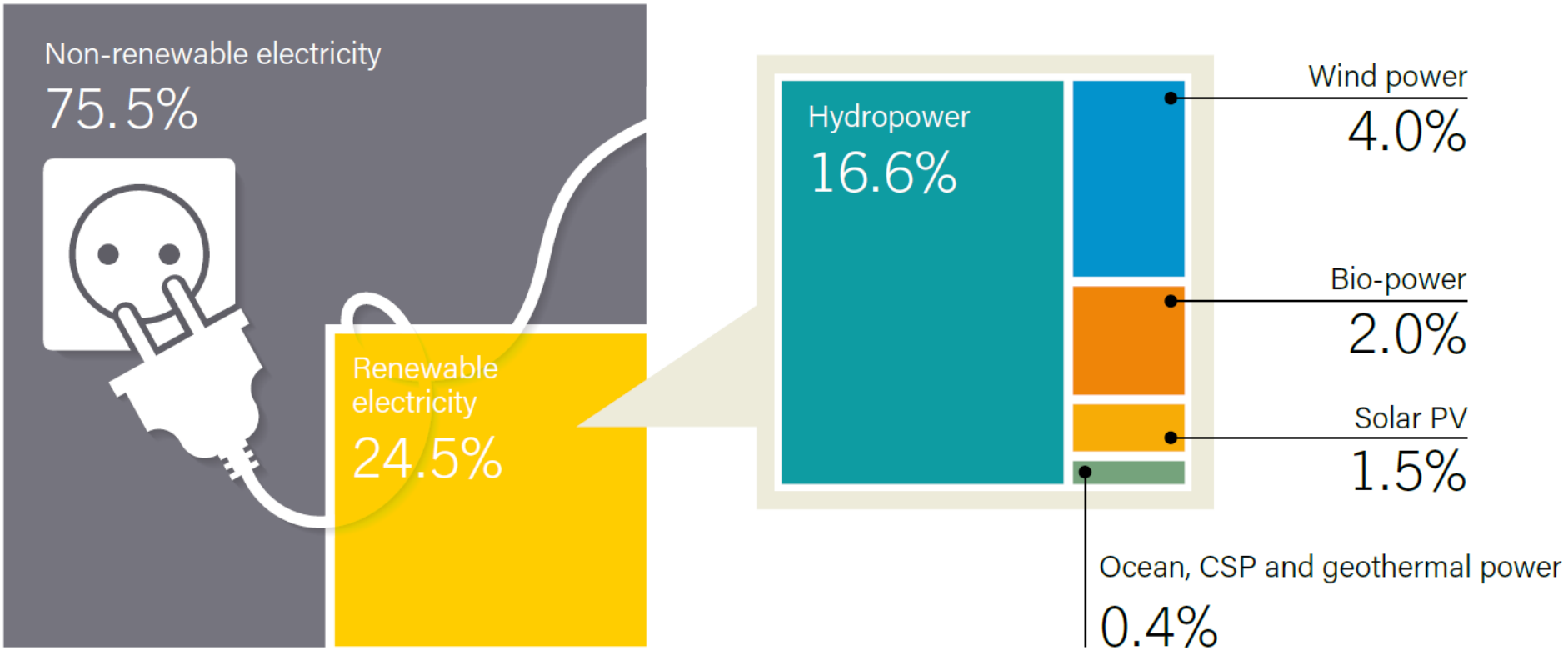
NOAA, 2010

NASA, fotolia.com

NASA, 2012

Renewable energy

Share of renewable energy of global power production by the end of 2016

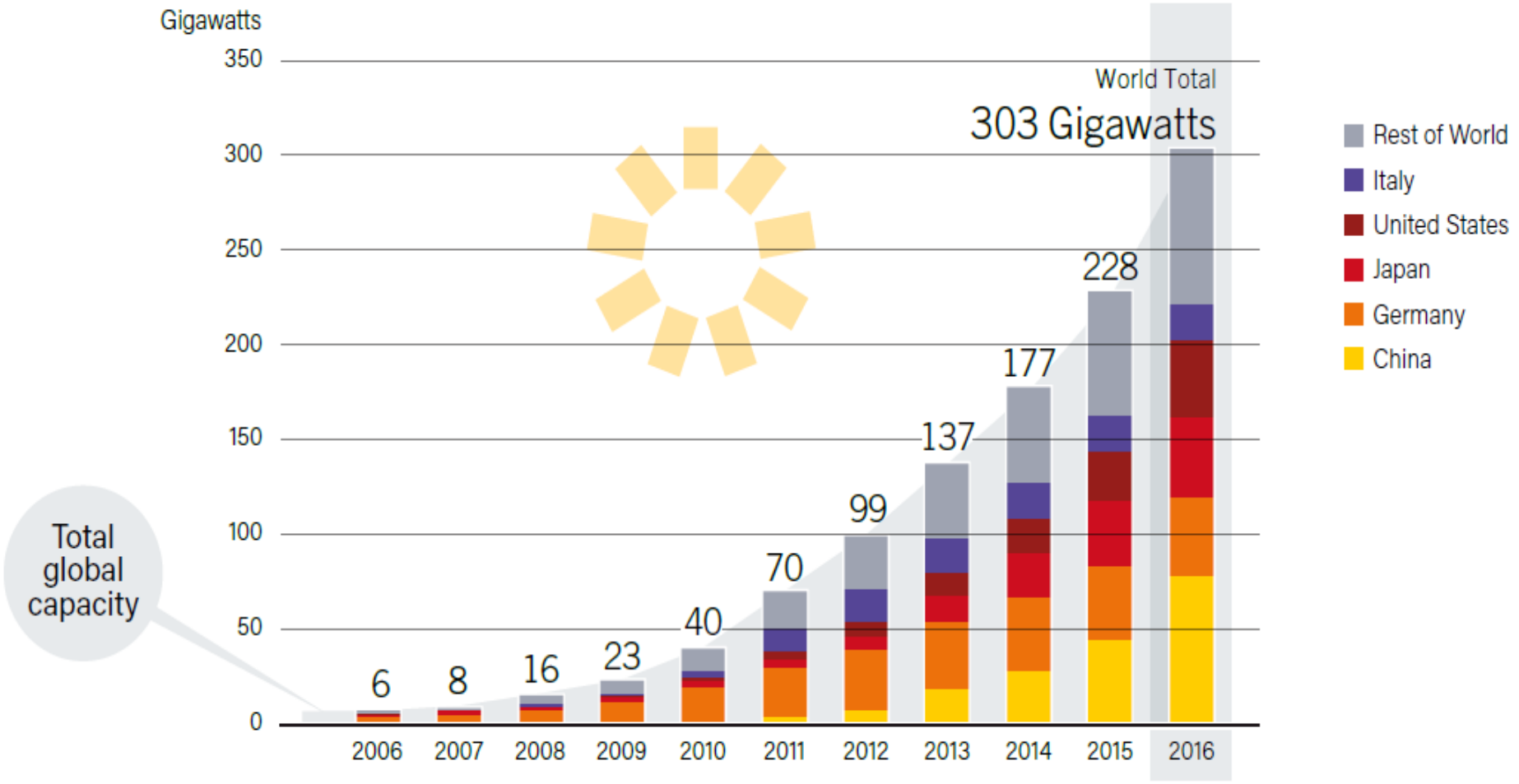


Quelle: REN21

Solar power

- Thin film cells of amorphous and crystall. Silicium
- Galliumarsenide cells (GaAs)
- Cadmiumtelluride cells (CdTe)
- CIS cells (Cu-In-Diselenide; Cu-In-Ga-Diselenide)

Globally installed solar photovoltaic electric power capacity, 2006-2016



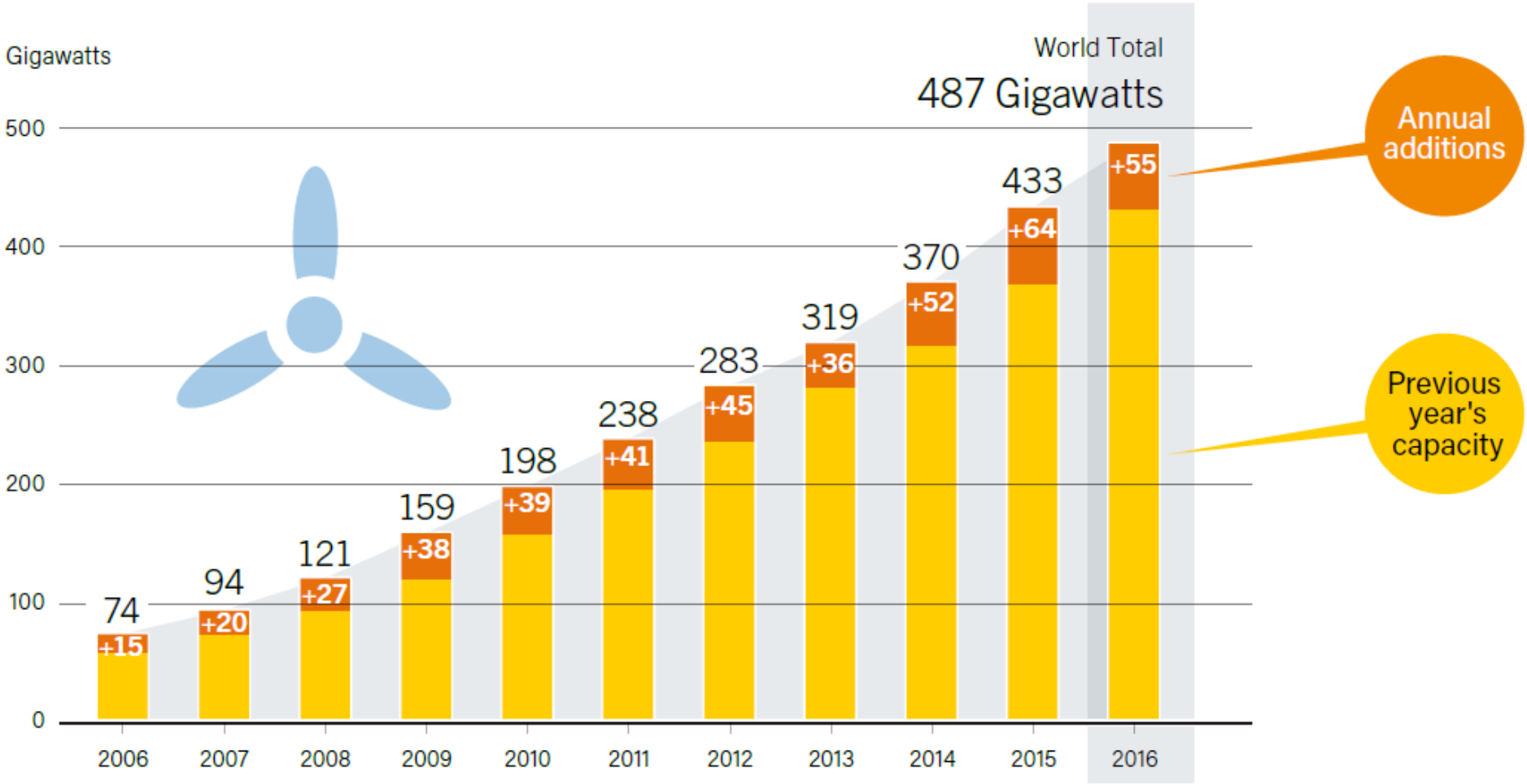
Source: REN21

Wind power

Nd, Dy, B


Fotolia.com

Globally installed wind electric power capacity, 2006-2016



Source: REN21

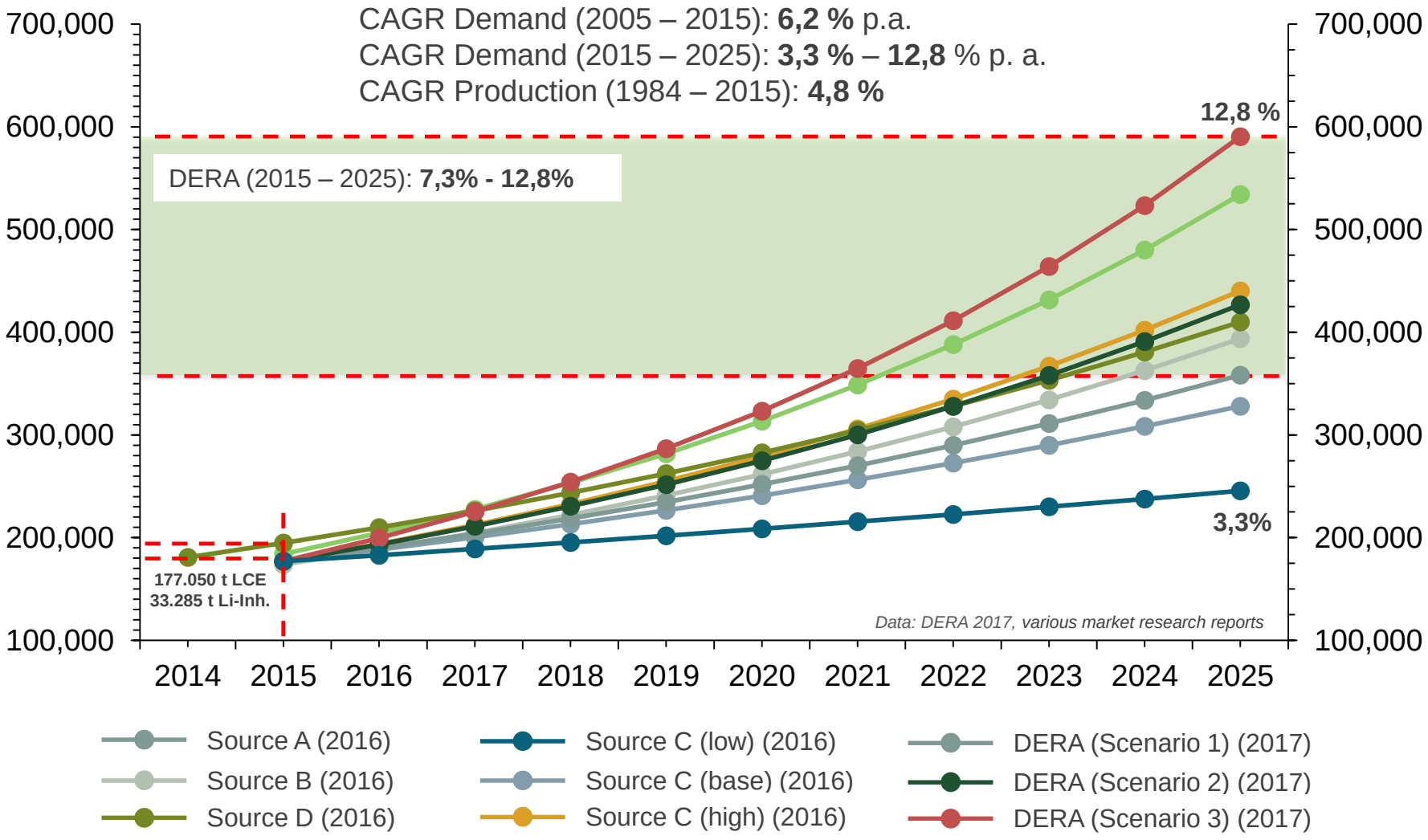
Mineral raw materials for renewable energy technologies	Category	Global production/ consumption 2013/2014	Estimated additional demand for renewable energy technologies (without EVs)	Szenario	Comment
Copper	Refined production	22,470,000*	~4,000,000 - 5,000,000*5	2030	Renewable Energy power supply
Aluminium	Refined production	53,290,000	n.d.	n.d.	Global economic growth and infrastructure extension, +40,000,000*2 to 2026
Silicon	Refined production	2,410,000	n.d.	n.d.	Thick layer and thin film solar PV
Indium	Refined production	834	198-218*3	2035	Thin film solar PV
Selenium	Refined production	3,700	173-240*3	2035	Thin film solar PV
Cadmium	Refined production	25,283	174-190*3	2035	Thin film solar PV
Gallium	Refined production	250*6	25-26*3	2035	Thin film solar PV
Tellurium	Refined production	450 to 550*6	198-218*3	2035	Thin film solar PV
Neodymium/praseo-dymium oxide	Consumption	28,900*5	4,000 to 18,000*3	2035*	Permanent magnets for wind turbines
Dysprosium/terbium oxide	Consumption	2,000*5	200 to 1,200*3	2035	Permanent magnets for wind turbines
Lithium (Li-content)	Mine production	31,801	5,000*4	2025	Stationary energy storage systems
Cobalt	Refined production	98,000	n.d.	n.d.	Stationary energy storage systems

Electro mobility

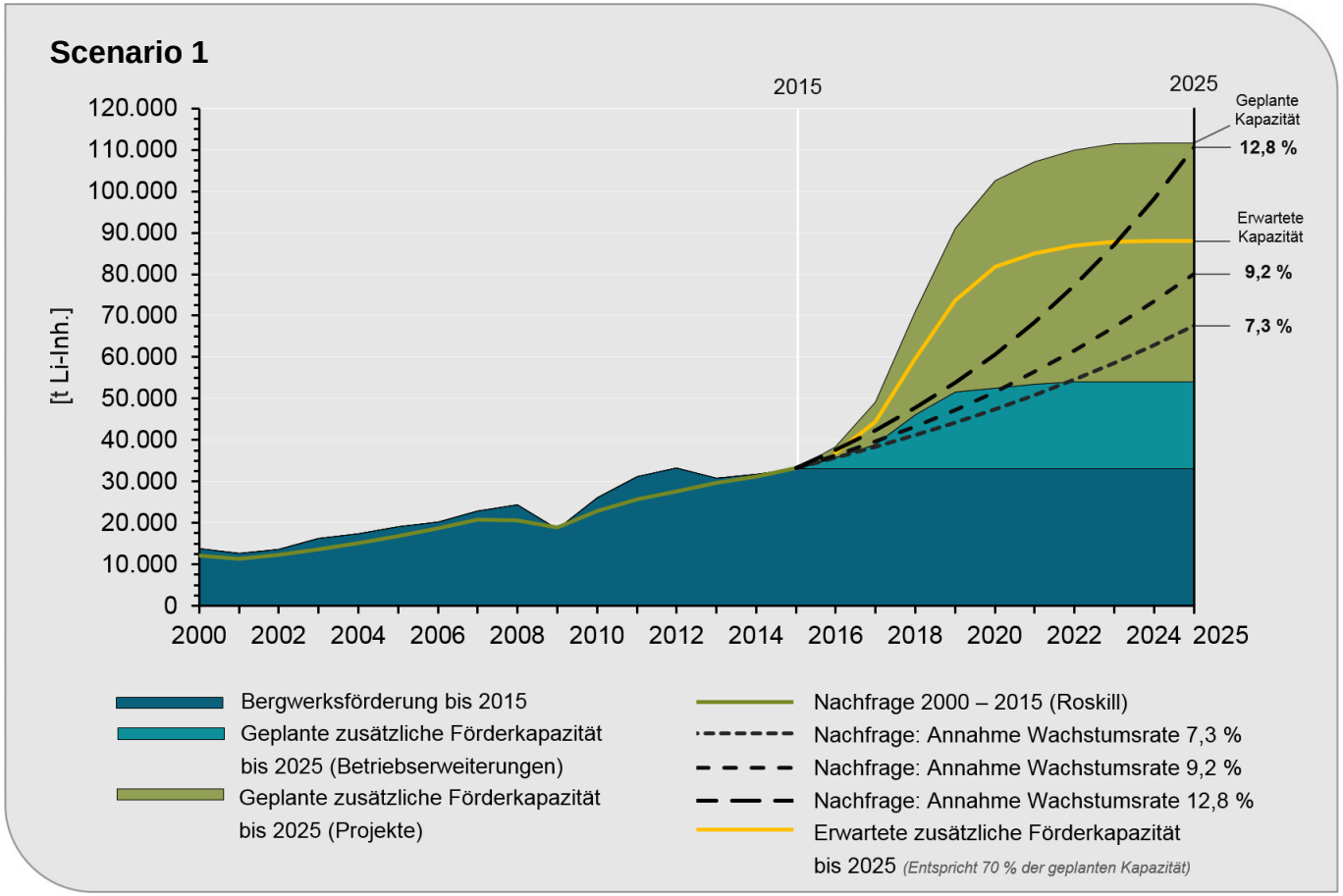
Li, Co, Ni, Mn, Graphite

Fotolia.com

Lithium Demand (Scenarios 2015 – 2025)

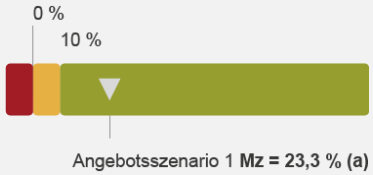


Supply/Demand Scenario to 2025 – Scenario 1

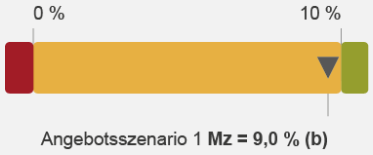


Demand CAGR → 2025

- 7,3 %: Surplus 20.500 t



- 9,2 %: Surplus 7.850 t



- 12,8 %: Deficit -22.700 t


Energy Efficiency, LEDs
REE, Ga, In
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Industry 4.0 - Digitalisation Germanium

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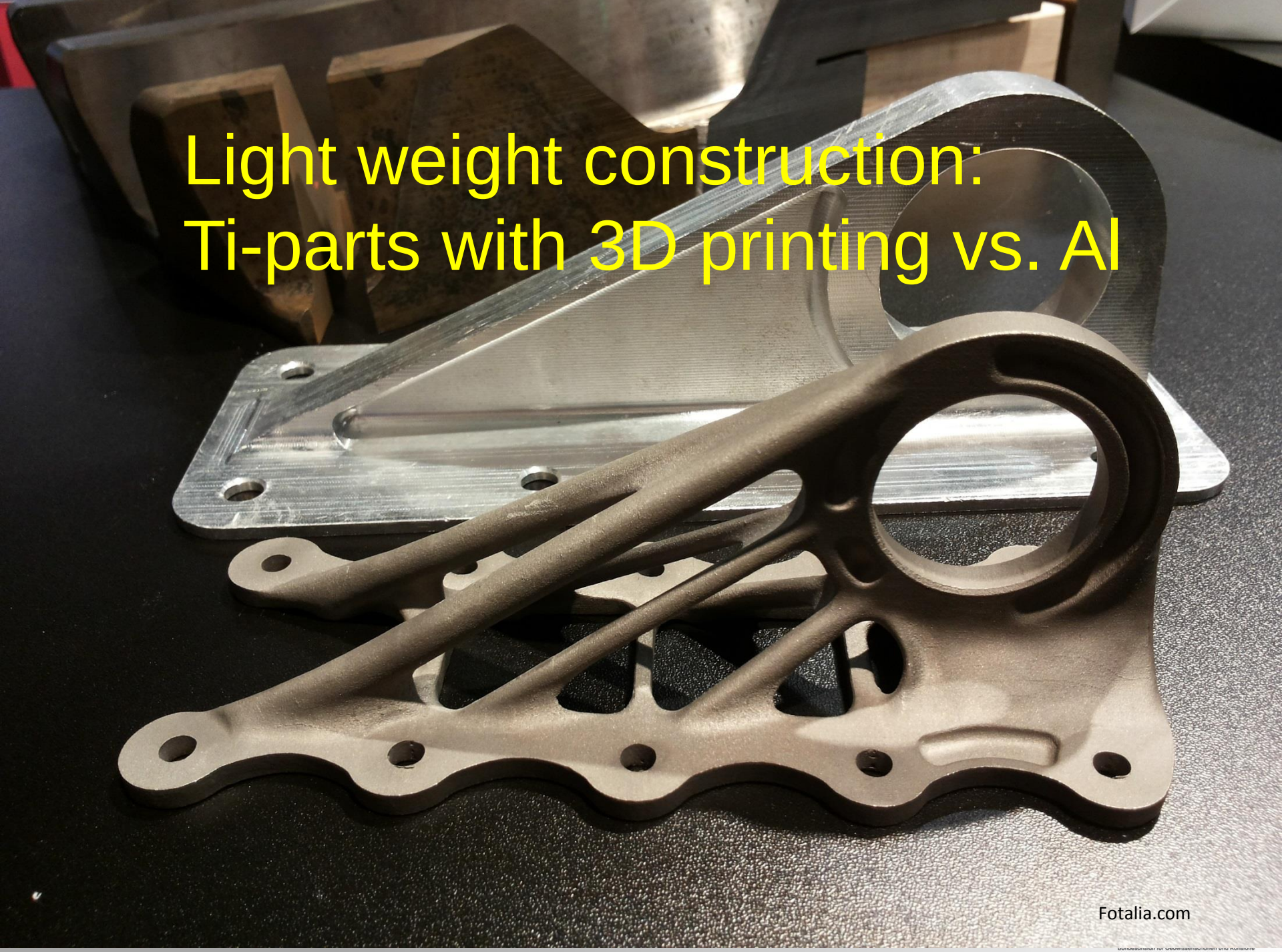
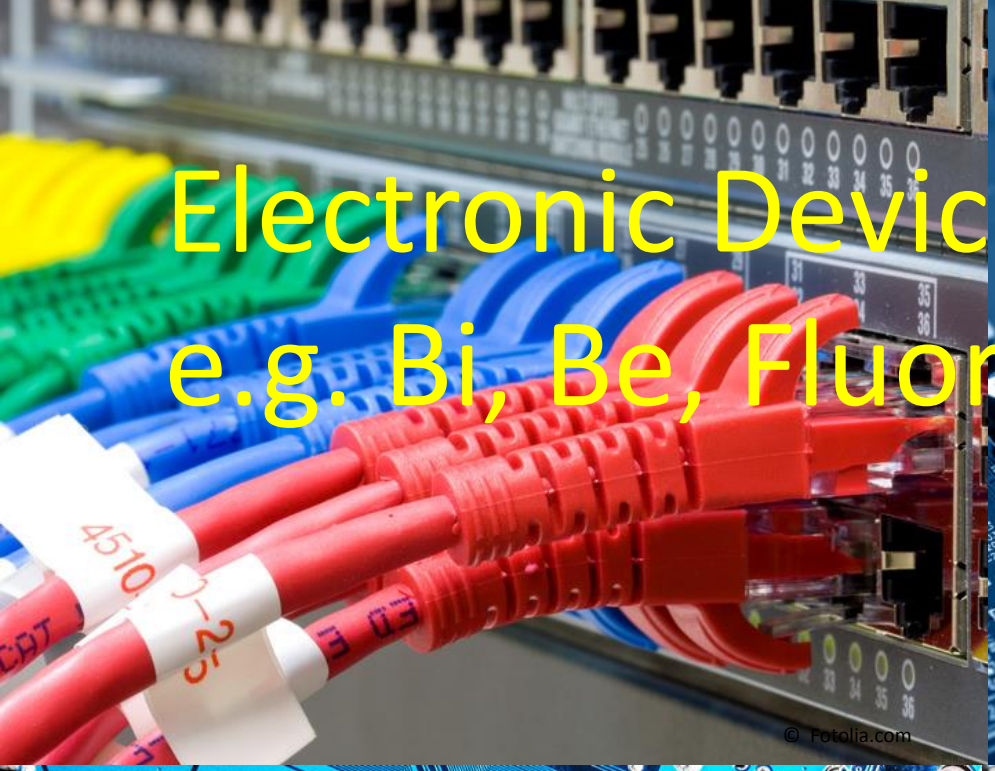
Aerospace industry

Fotalia.com


Light weight construction:
Ti-parts with 3D printing vs. Al
Fotalia.com

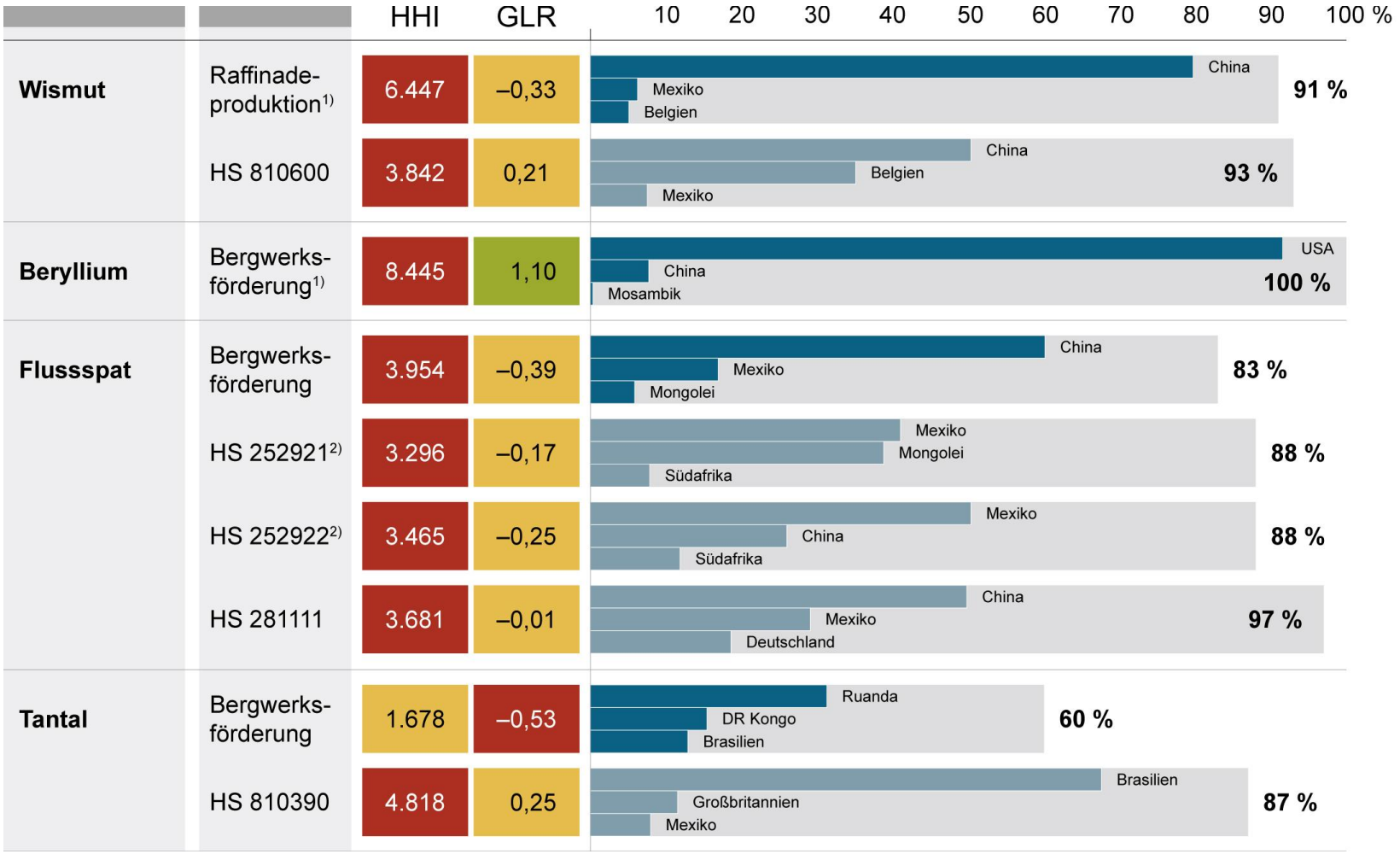

Super alloys:
Ni, Co, Cr, Mo, Nb,
W, Ta, Ti, Re
Fotalia.com

Electronic Devices
e.g. Bi, Be, Fluorspar, Ta



Electronic Industry: Global concentration of Bismuth, Beryllium, Fluorspar, Tantalum supply

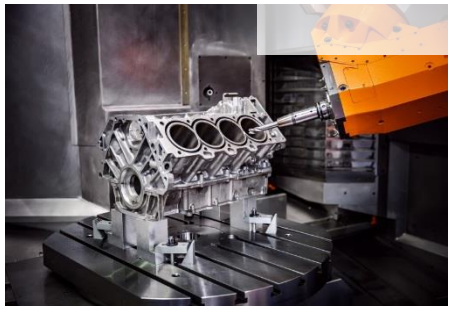
- Raw materials for the electronic industry

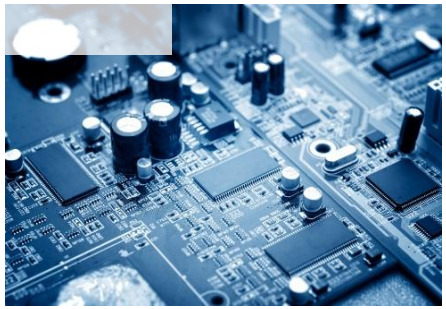












Thank you for your attention

Bildquellen: Fotolia.com