

The European Commission's science and knowledge service

Joint Research Centre





Critical raw materials in strategic value chains

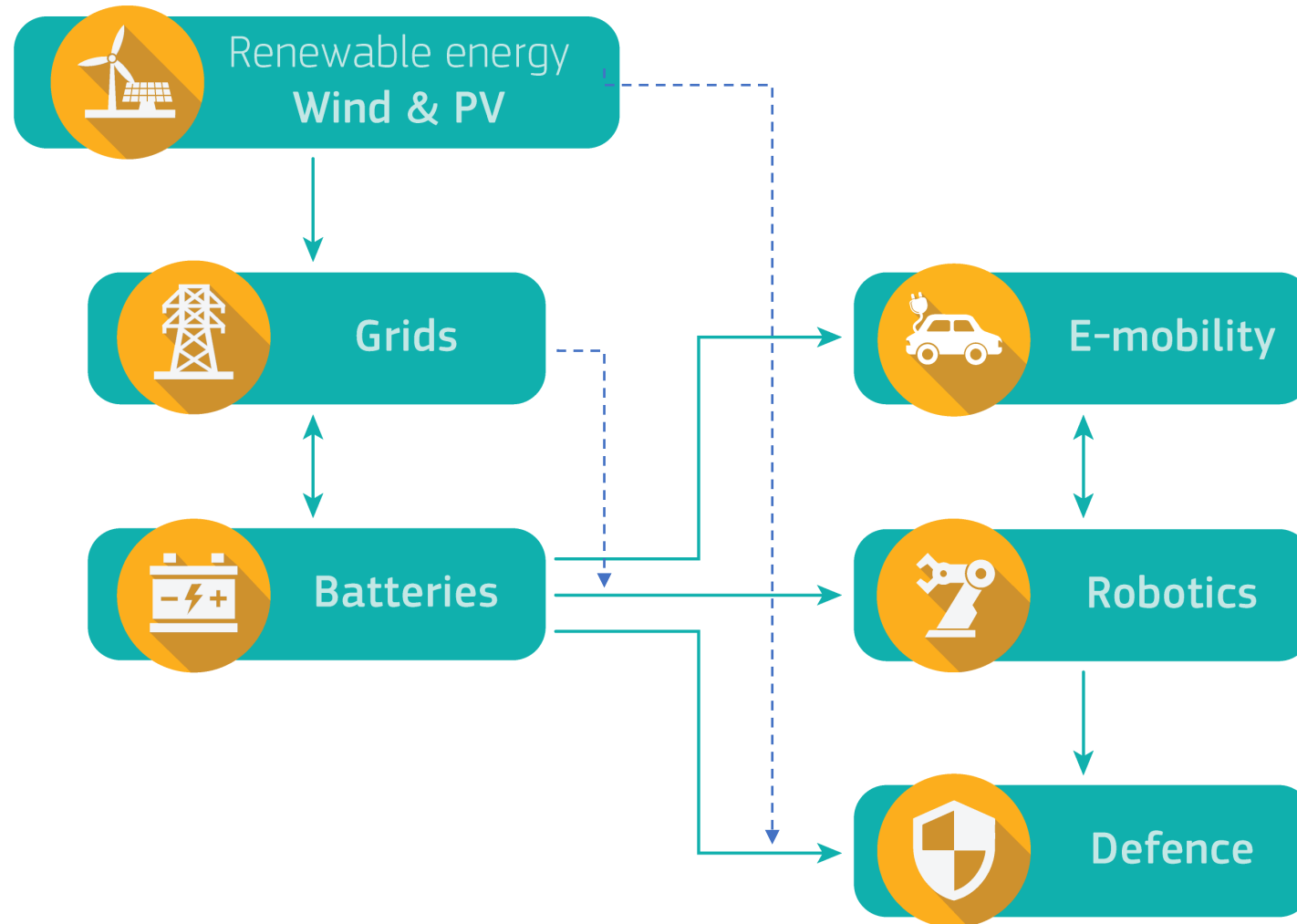
D. Blagoeva

Contributors: C. Pavel, P. Alves Dias

12 November 2018, Brussels

Strategic value chains

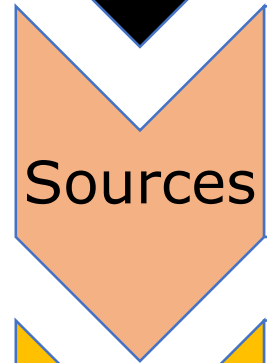
Target sectors / technologies



Analysis approach



- Supply chain steps identification



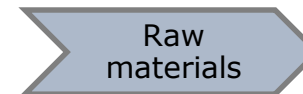
- Data source search and selection



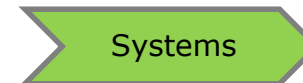
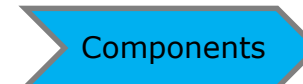
- Supply shares calculation along the value chain



Statistical sources (e.g. Statista, Europages, GWEC), market/consultancy reports, commercial (companies) websites, associations reports and web sites (World Steel Association, EWEA etc.), published JRC studies, CRM 2017, USGS etc.



Shares calculated based on the 3 main suppliers per material from **CRM 2017** (or USGS)



Shares calculated based on **sales, production capacity, revenues** or **number of companies**. HQ are used to allocate them to a specific country.

Raw Materials Information System (RMIS)

Raw materials

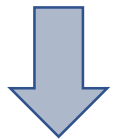
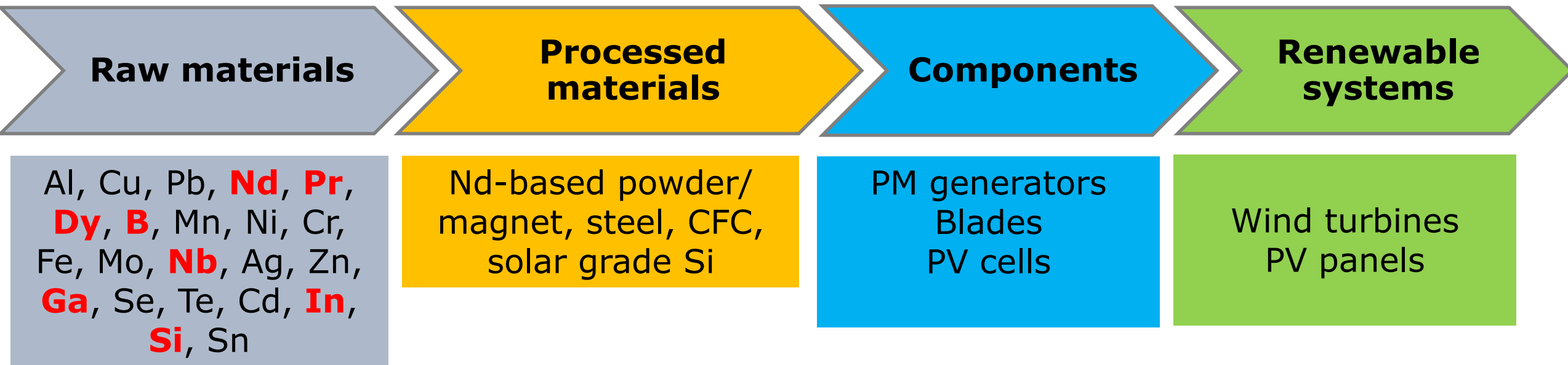
Processed materials

Components

Renewable systems



Renewable energy – Wind & PV value chain



**> 35% flagged
as CRMs
(2017 CRM list)**

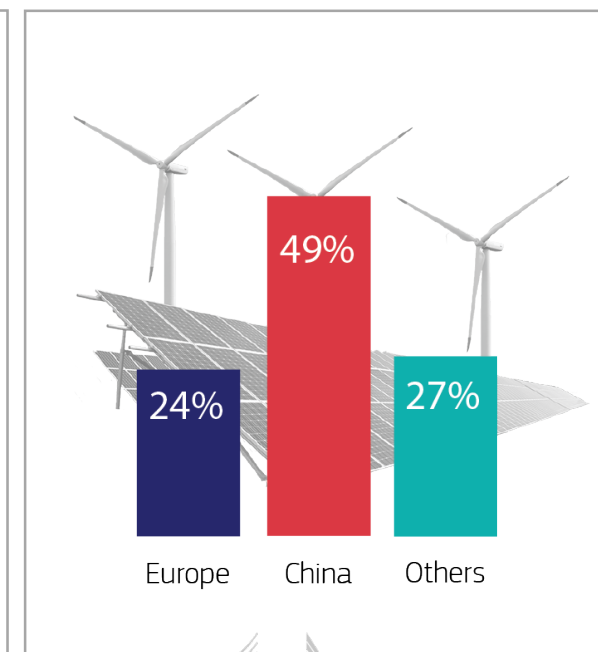
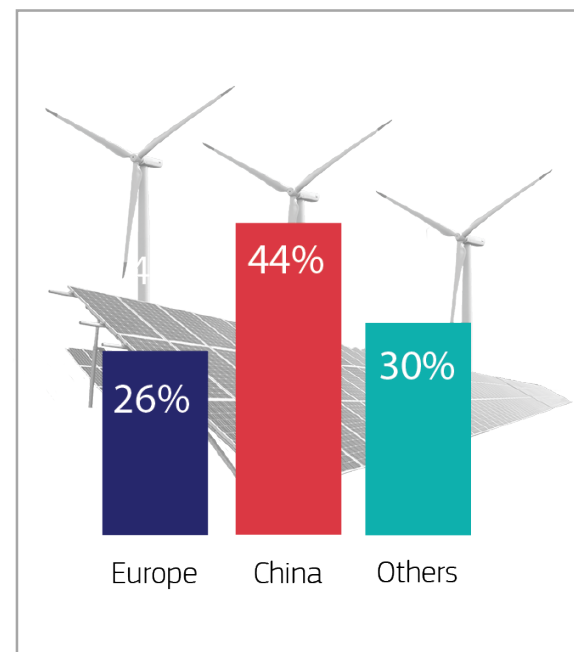
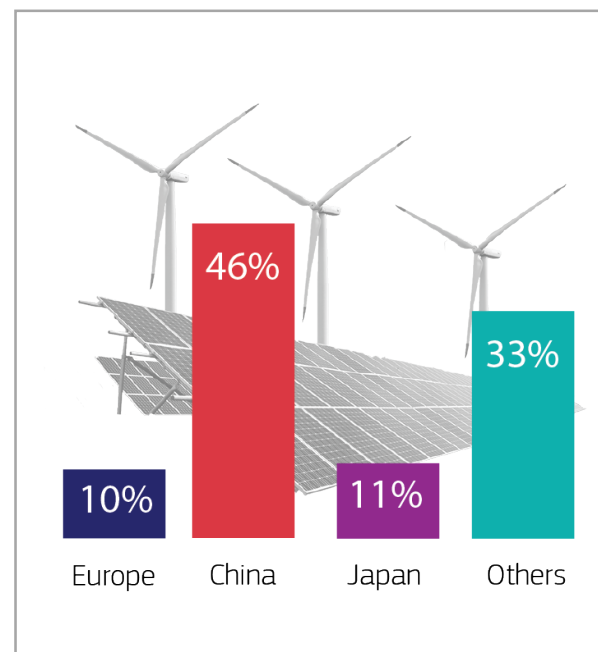
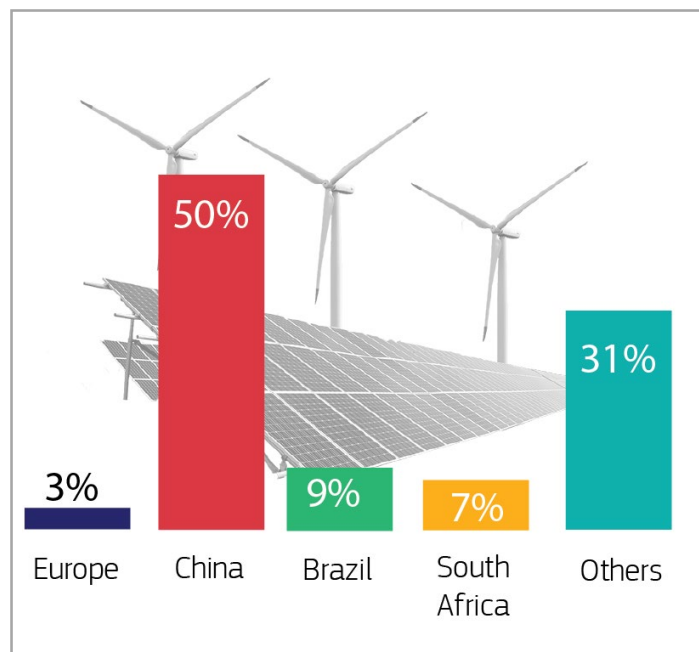
Wind & PV value chain – main results

Raw materials

Processed materials

Components

Renewable systems



Grids value chain

Raw materials

Cu, Al, Ni, Fe, **Si**

**Processed
materials/
sub-components**

Electric steel
Copper coils

Grid components

Cables
Transformers



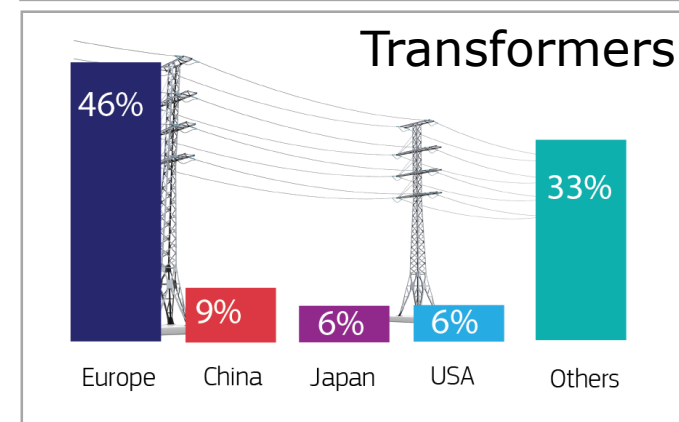
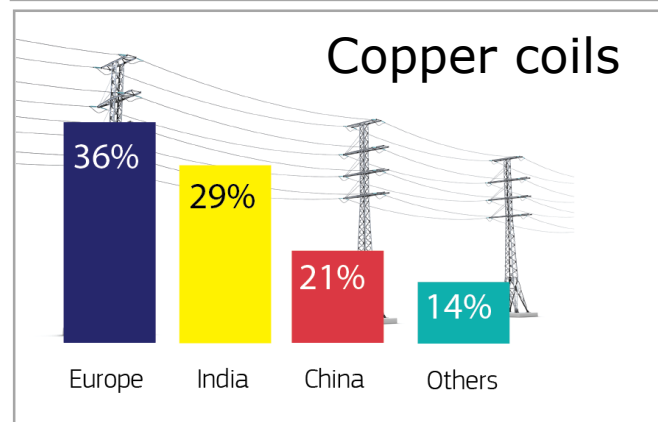
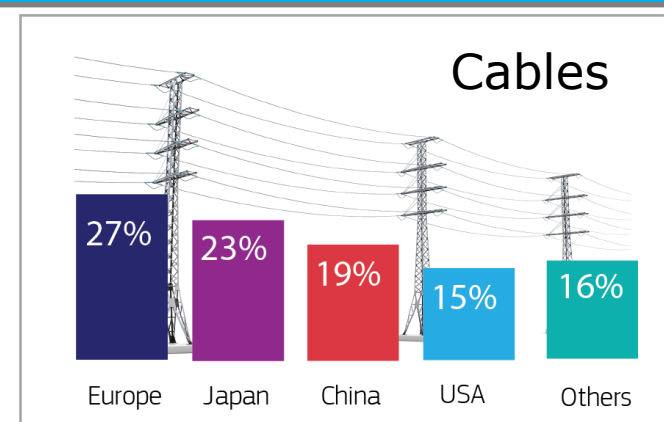
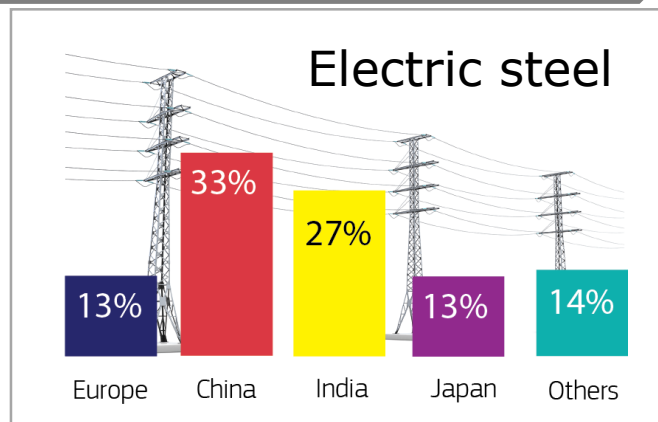
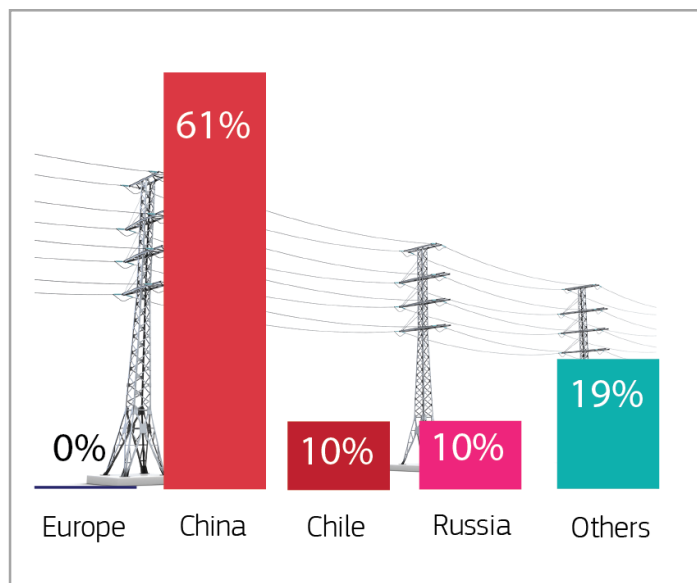
**1 flagged as
CRMs
(2017 CRM list)**

Grids value chain – main results

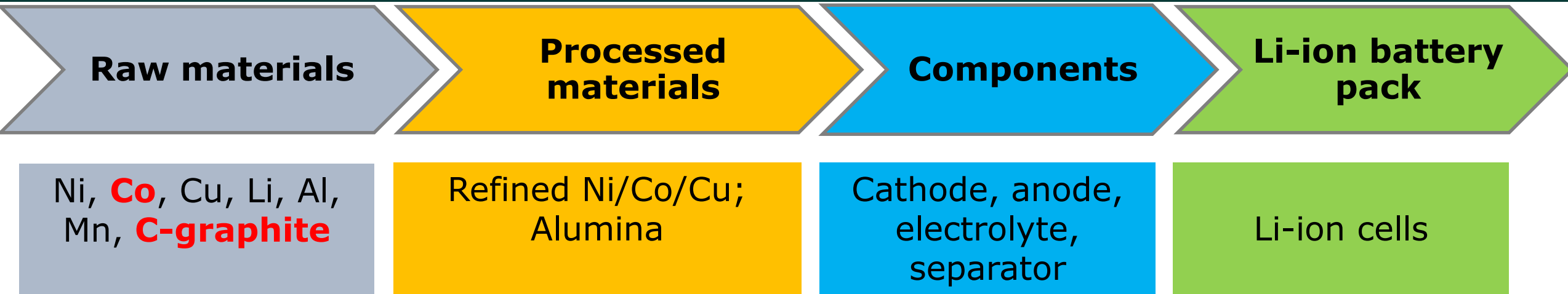
Raw materials

Processed materials/ sub-components

Grid components



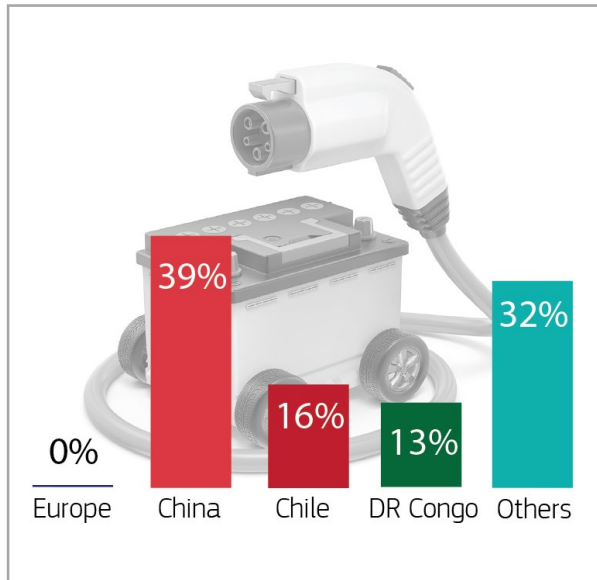
Li-ion batteries (LIB) value chain



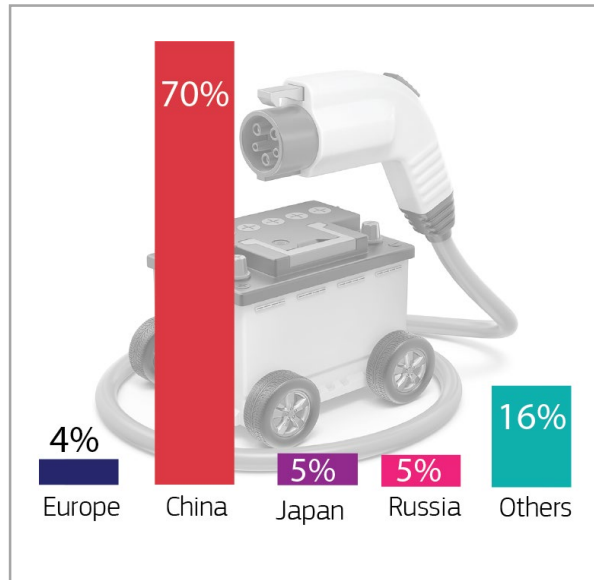
**2 flagged as
CRMs
(2017 CRM list)**

Li-ion batteries (LIB) - main results

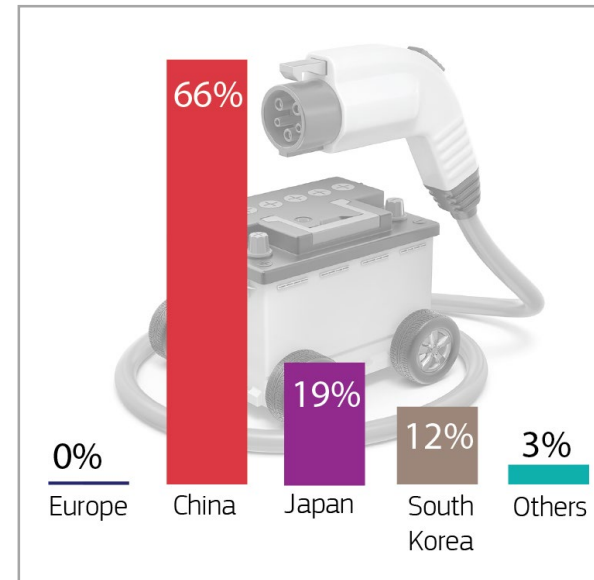
Raw materials



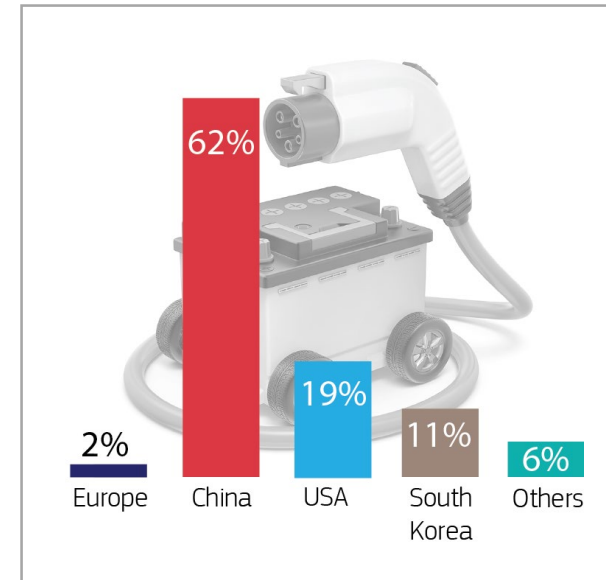
Processed materials



Components



Li-ion battery pack



Electric vehicles value chain

Raw materials

Ni, **Co**, Cu, Li, Al,
Mn, **C-graphite**,
Fe, Cr, Mo, **V**, **Si**,
Mg, **B**, **Nd**, **Pr**,
Dy

Processed materials

Refined
Ni/Co/Cu/Al/
alumina; carbon
based materials
(CFC); Nd-based
powders/magnets

Components

Li-ion battery;
Electric traction
motor

Electric vehicles

Electric cars
manufacturers

> 50% flagged as CRMs
(2017 CRM list)

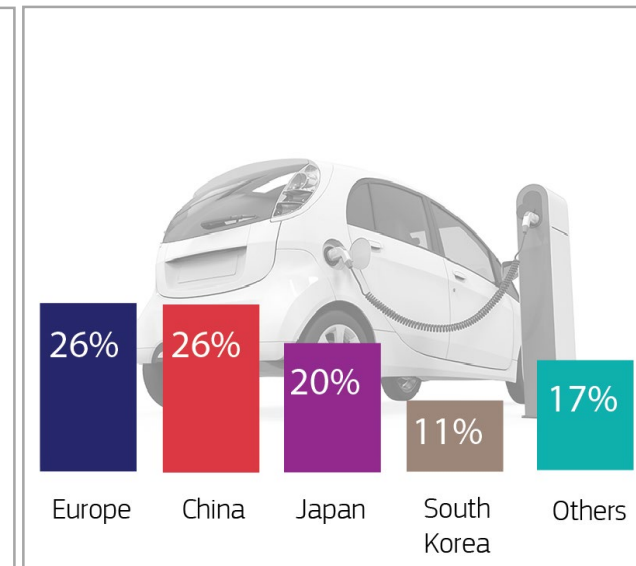
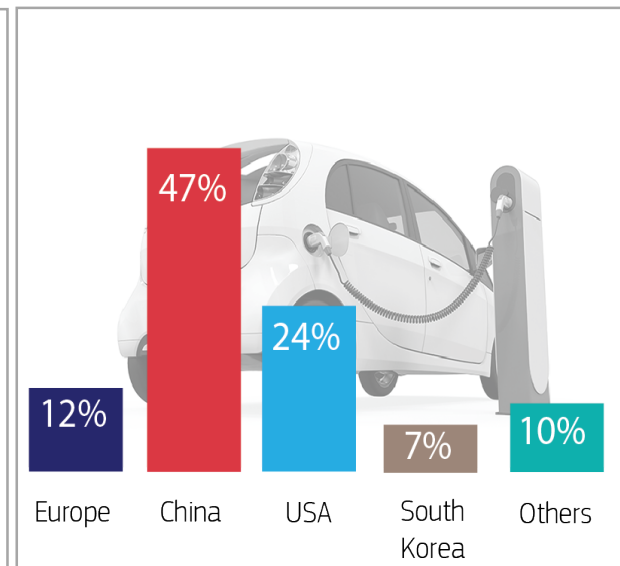
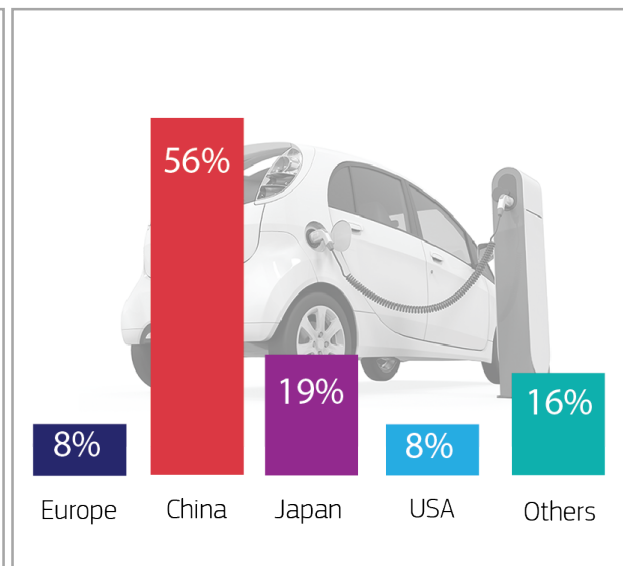
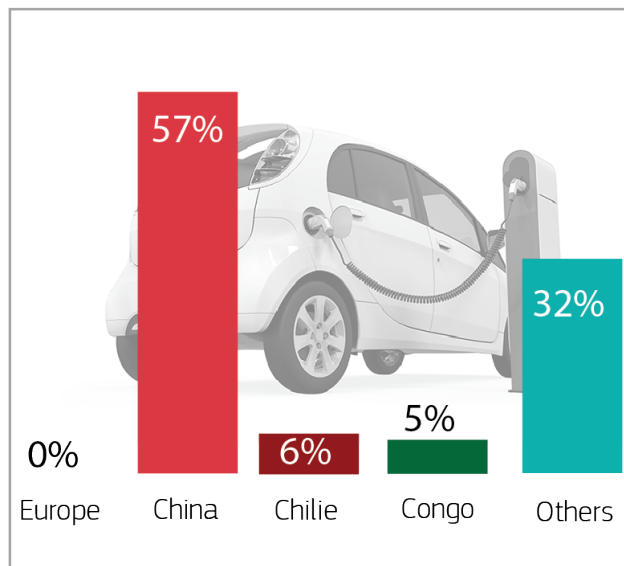
Electric vehicles – main results

Raw materials

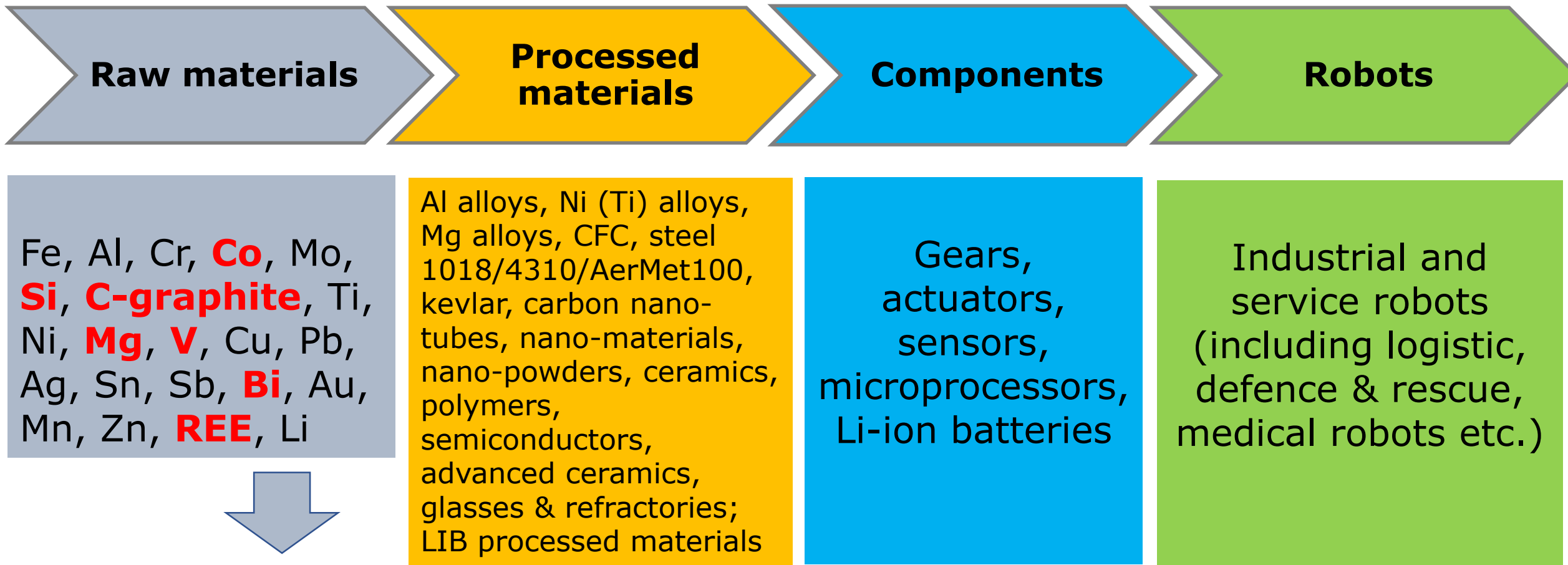
Processed materials

Components

Electric vehicles



Robotics value chain*



> 30% flagged as CRMs
(2017 CRM list)

* Ongoing study on materials for dual use applications.

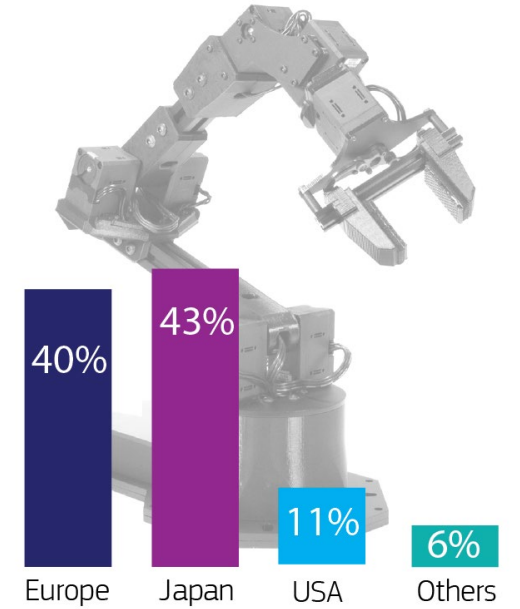
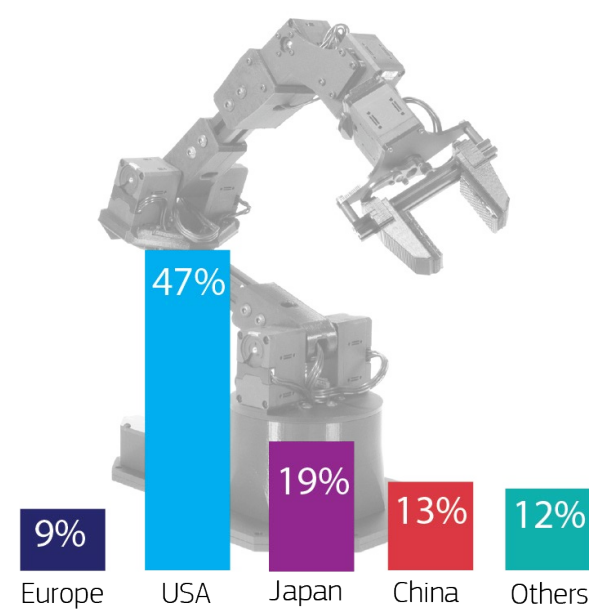
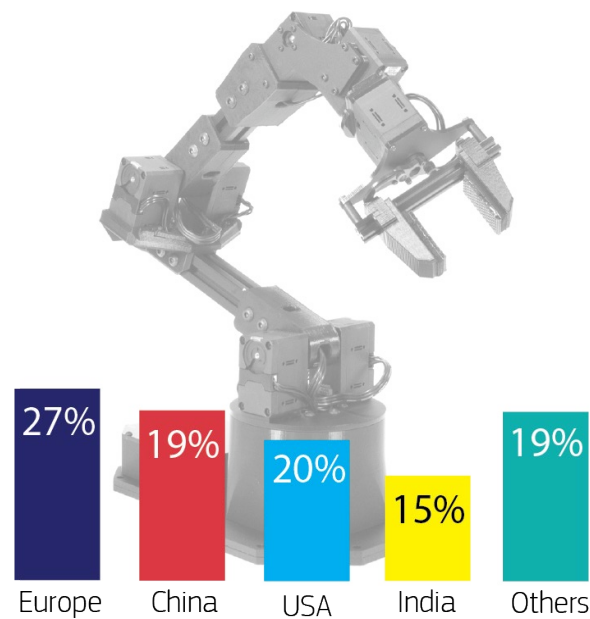
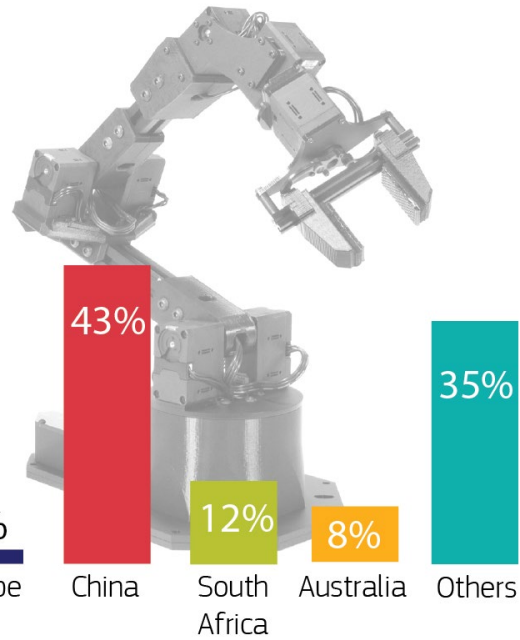
Robotics – main results*

Raw materials

Processed materials

Components

Robots

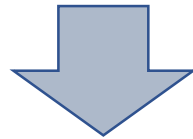


* Ongoing study on materials for dual use applications.

Defence value chain

Raw materials

Al, Cu, Pb, **Nb**, **W**, **Ba**, **Ga**, Li, **Rh**, **V**,
Be, **Ge**, **Mg**, **Ta**, Zn, Cd, **Hf**, Mn, Zr,
Cr, **In**, Mo, Sn, **Co**, Fe, Ni, Ti, **Dy**, **Nd**,
Pr, **Sm**, **Yt**, Au, **Pt**, Ag, **B**, Se



Processed materials

Al alloys, Co alloys, Ni alloys,
Ti alloys, special steels

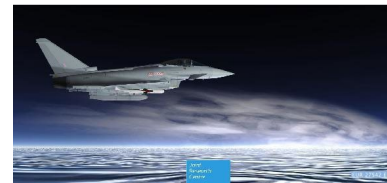


JRC SCIENCE FOR POLICY REPORT

Raw materials in the European
defence industry

Claudio C. Pavel
Evangelos Tzimas

2016



Air

Naval

Land

Space

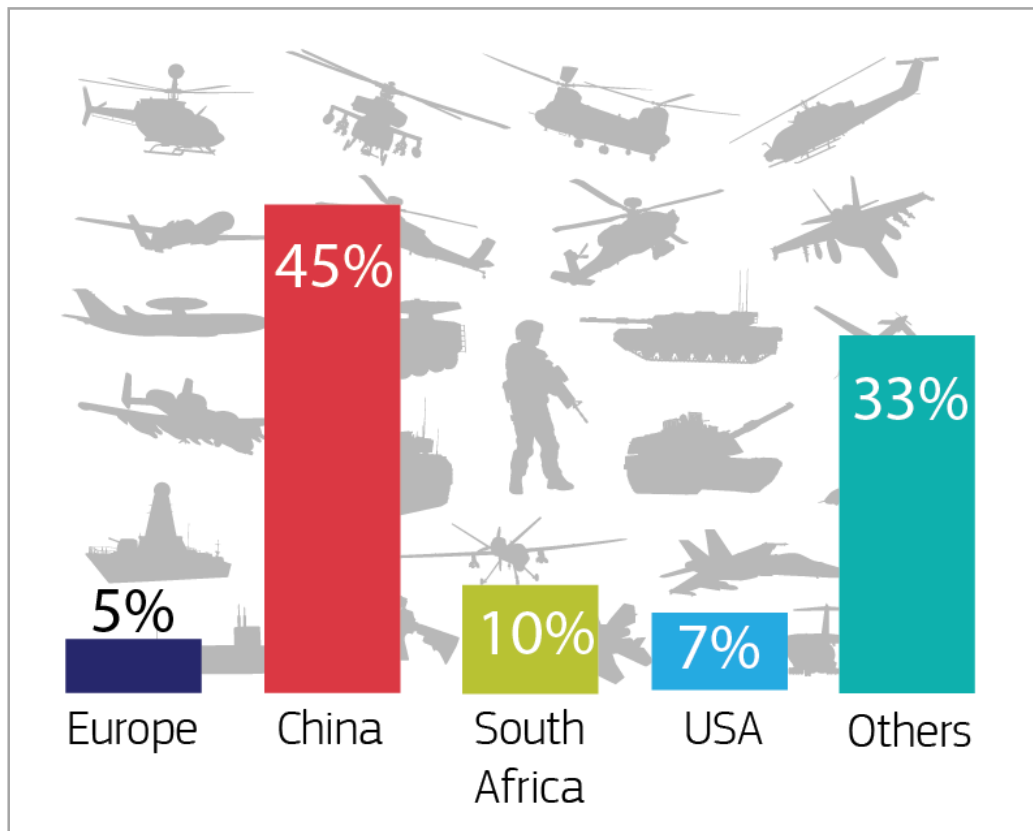
Electronics

Missiles

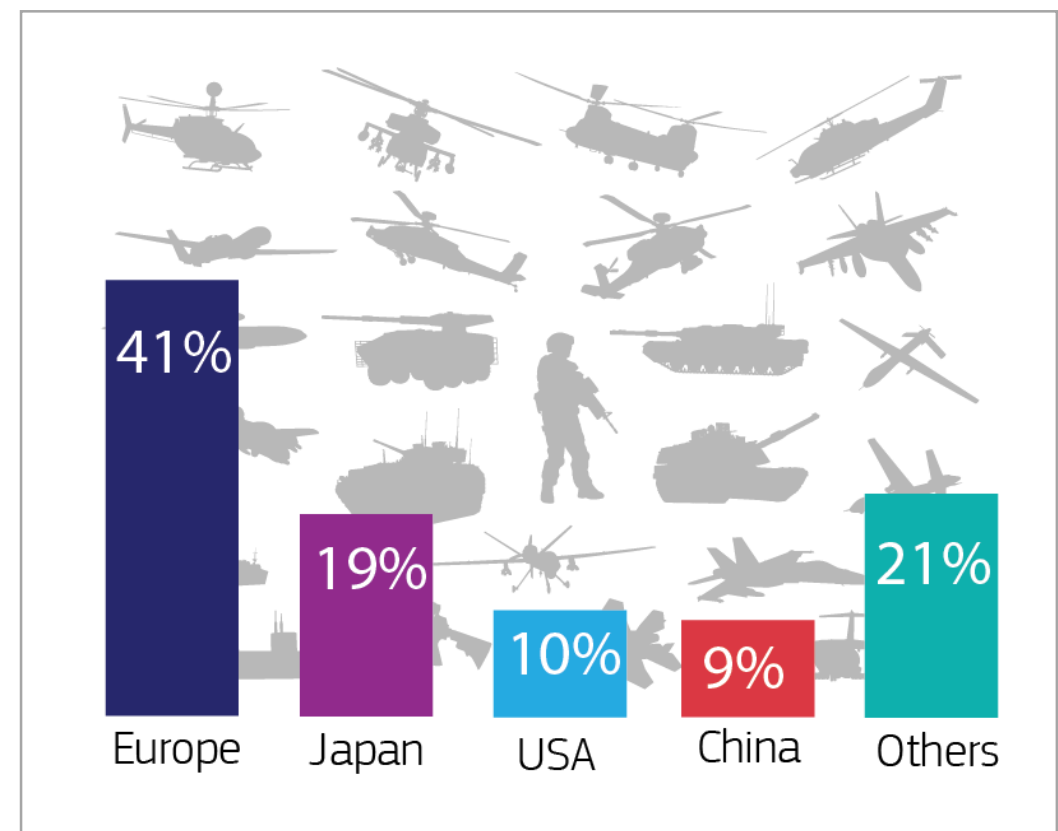
> 50% flagged as CRMs
(2017 CRM list)

Defence – main results

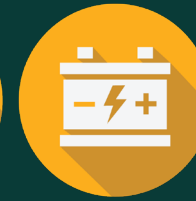
Raw materials



Processed materials



Critical Raw materials for



2017 CRMs (27)

Antimony	Fluorspar	LREEs	Phosphorus
Baryte	Gallium	Magnesium	Scandium
Beryllium	Germanium	Natural graphite	Silicon metal
Bismuth	Hafnium	Natural rubber	Tantalum
Borate	Helium	Niobium	Tungsten
Cobalt	HREEs	PGMs	Vanadium
Coking coal	Indium	Phosphate rock	

C, Co, Dy, Nd, Pr, Yt, other REE, W, Bi, Ga, Ge, Mg, Si, Pt, Ta, Nb, Hf, In, Rh, V, Be, Ba, Sm, B, Sb, Al, Cu, Pb, Li, Zn, Cd, Mn, Zr, Cr, Mo, Sn, Fe, Ni, Ti, Au, Ag, Se, Te, Sr

Critical Raw materials for



REE, Nd,
Pr, Dy



Co



Si



V



C-graphite



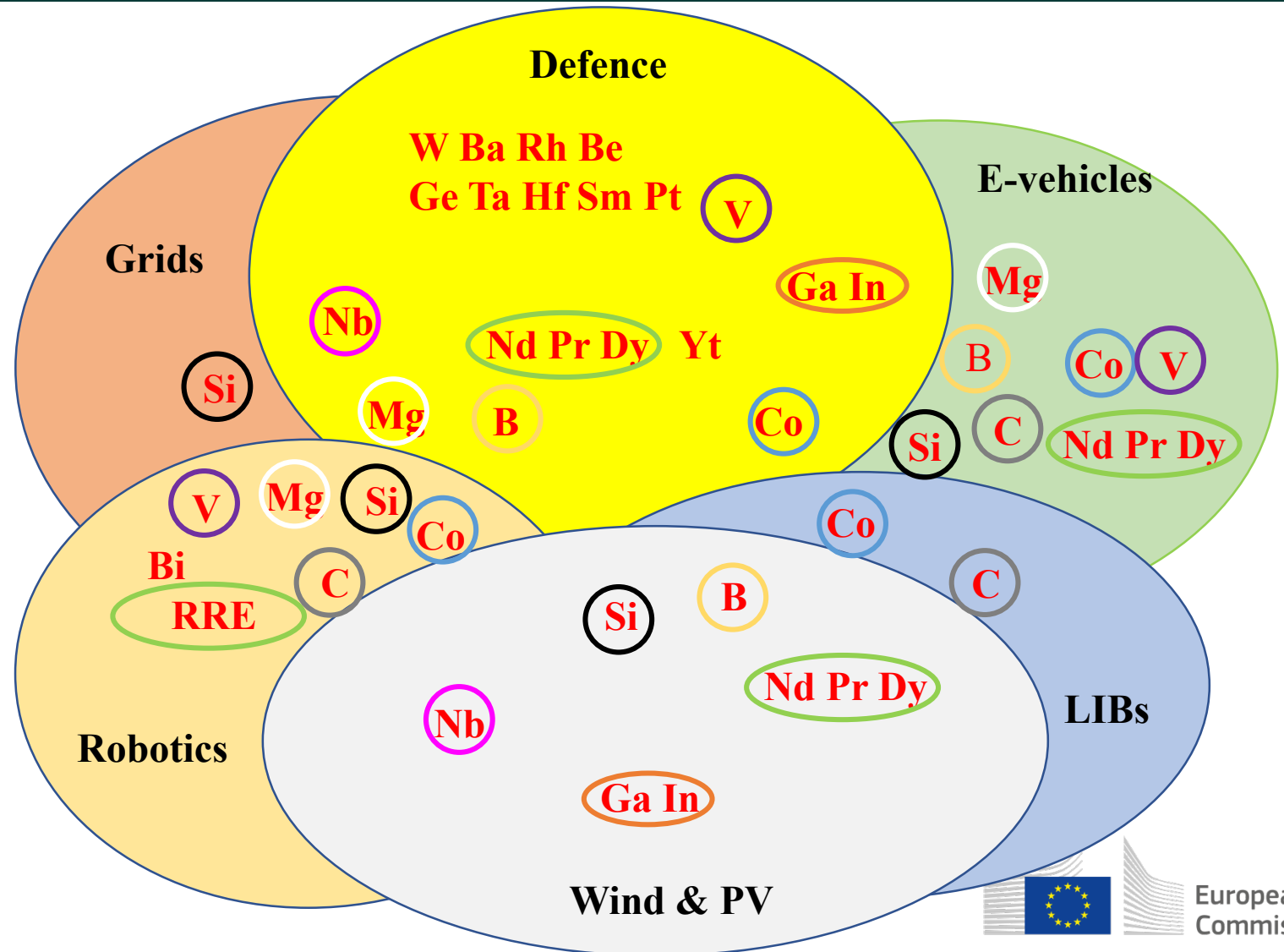
Mg



B



Ga, In, Nb



CONCLUSIONS (1)

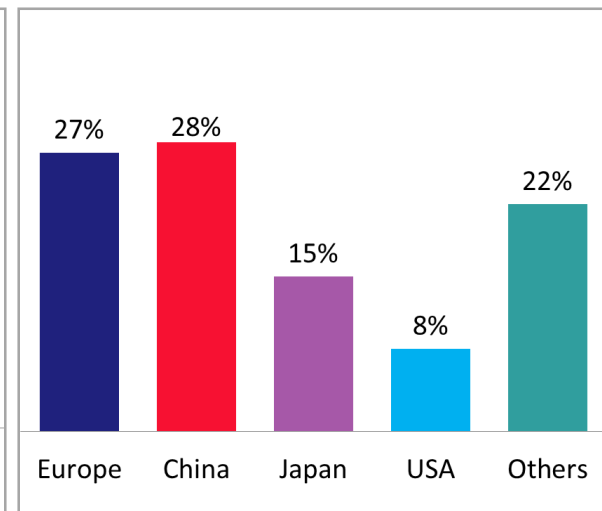
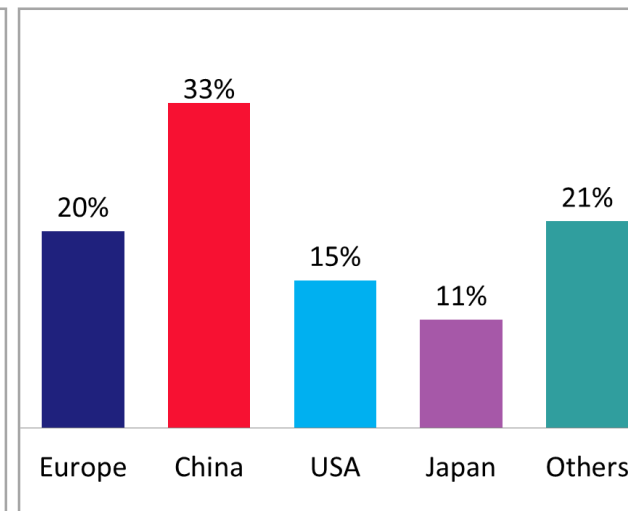
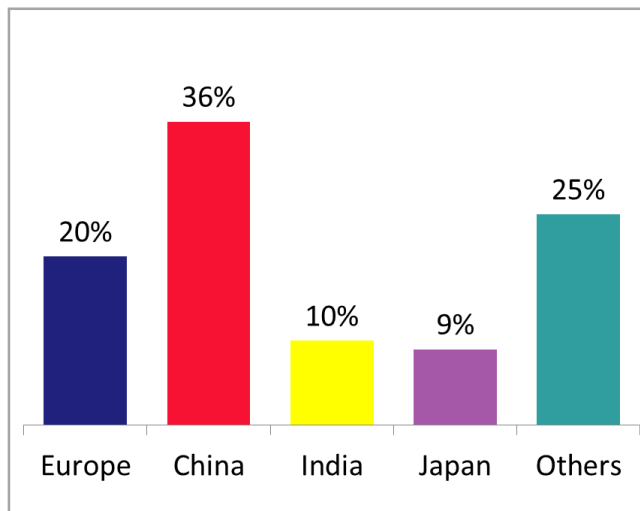
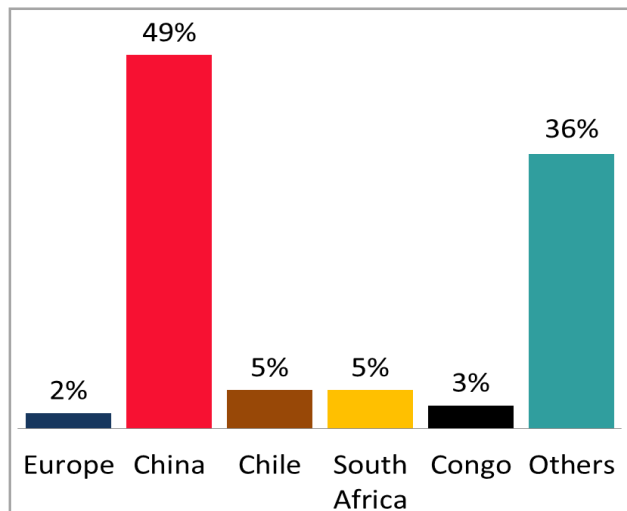


Raw materials

Processed materials

Components

Systems



- **China delivers around half of the RM** required in Wind and PV installations, LIBs, EVs, Grids, Robotics & Defence
- **China keeps its leading position** in all steps
- **Less dependency of Europe down the value chain***

**Higher uncertainties in the results going further down in the supply chain (indirect use of available data); necessity to estimate the companies' regional tangible and intangible assets, volumes, etc.*



CONCLUSIONS (2)

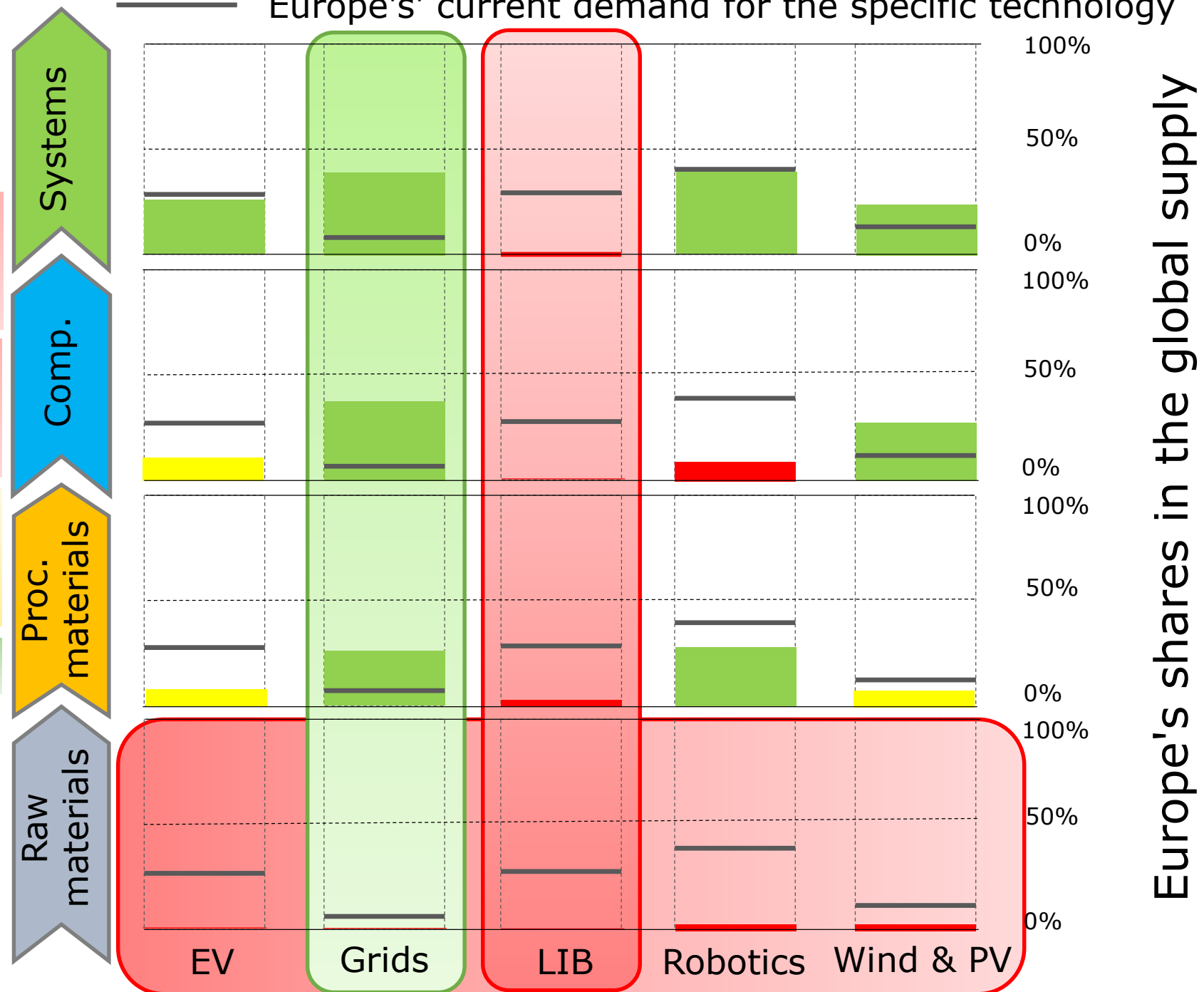
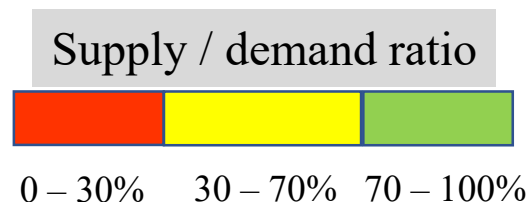


Europe* - vulnerable to supply of **RM** for all investigated technologies/sectors!

LIBs - most vulnerable technology: strong dependency along the whole supply chain!

Higher resilience of Europe **downstream** the supply chain!

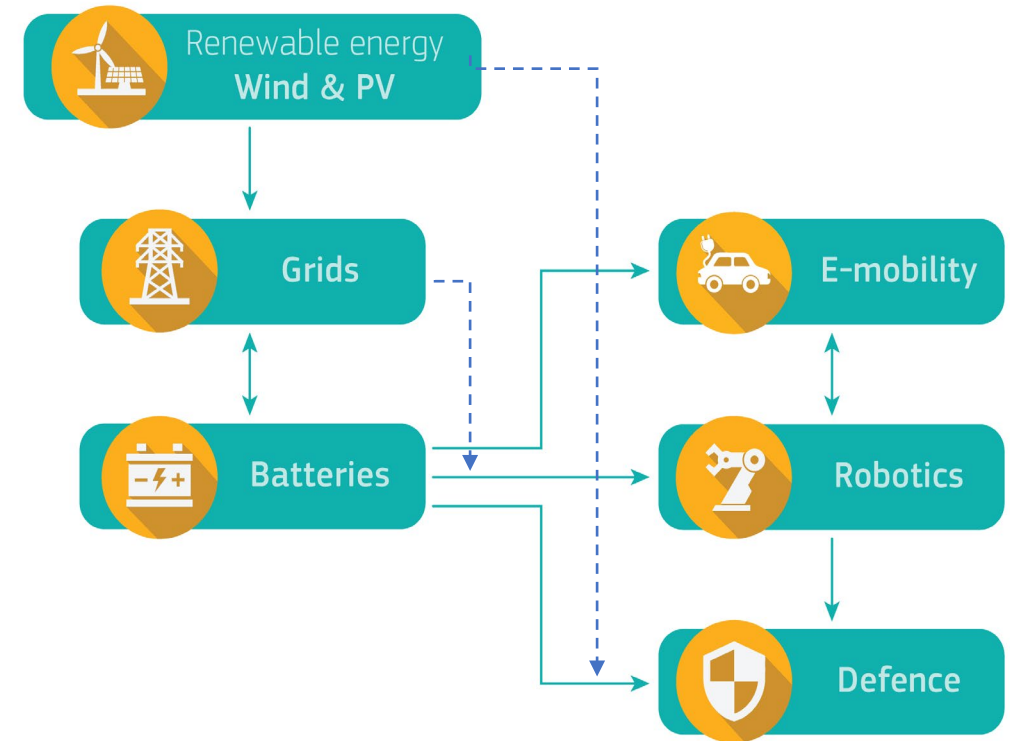
Best case for **Grids**!



* Cross-continent countries such as Russia and Turkey are not considered in the analysis as Europe.

Way forward

- **Strengthening collaboration with RM producers & diversifying the supply along the value chain;** e.g. > 35% of RM & > 20% downstream products delivered by very small suppliers
- Assuring more **secondary materials** supply – incentivising **recycling**
- **Substitution** as a mitigation measure to reduce dependency on certain CRMs
- Exploring better the **domestic potential** especially in view of **RM**



Thanks



Any questions?

You can find me at
Darina.Blagoeva@ec.europa.eu