European Commission

Critical minerals: the EU perspective

Critical minerals for the clean energy and high technology industries 2012 and beyond – the EU perspective
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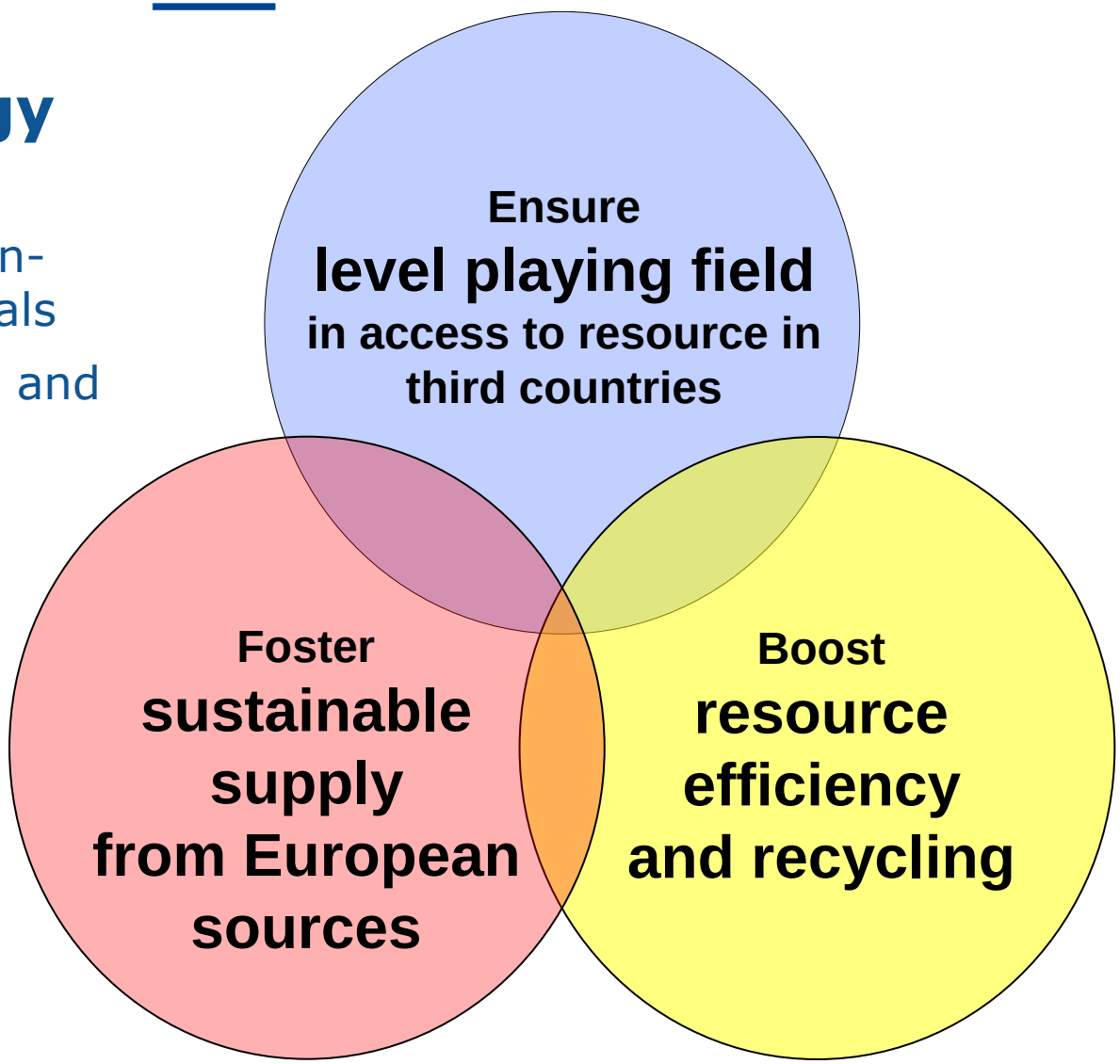
Structure

- **2010 EC report on critical raw materials**
- **Awareness raising**
- **Policy tool**
  - Research projects
  - International co-operation
  - Innovation Partnership
- **Follow up analysis and revision**
  - JRC report on critical metals
  - Revision of list of critical raw materials

EU Raw Materials Initiative

Integrated strategy

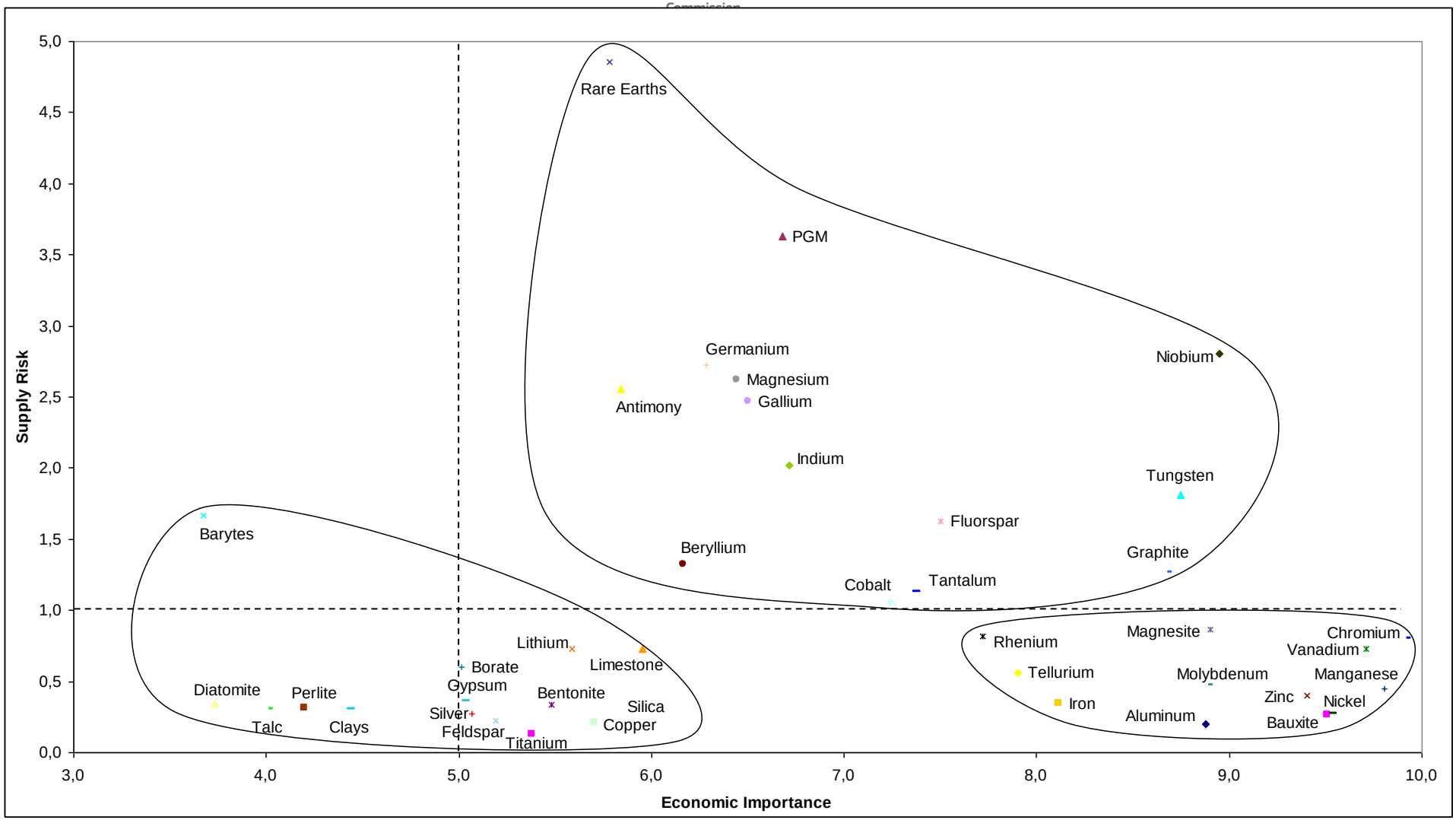
- based on three pillars
- area of non-energy, non-agricultural raw materials
- connecting EU external and internal policies
- launched Nov. 2008
- reinforced Feb. 2011



Approach

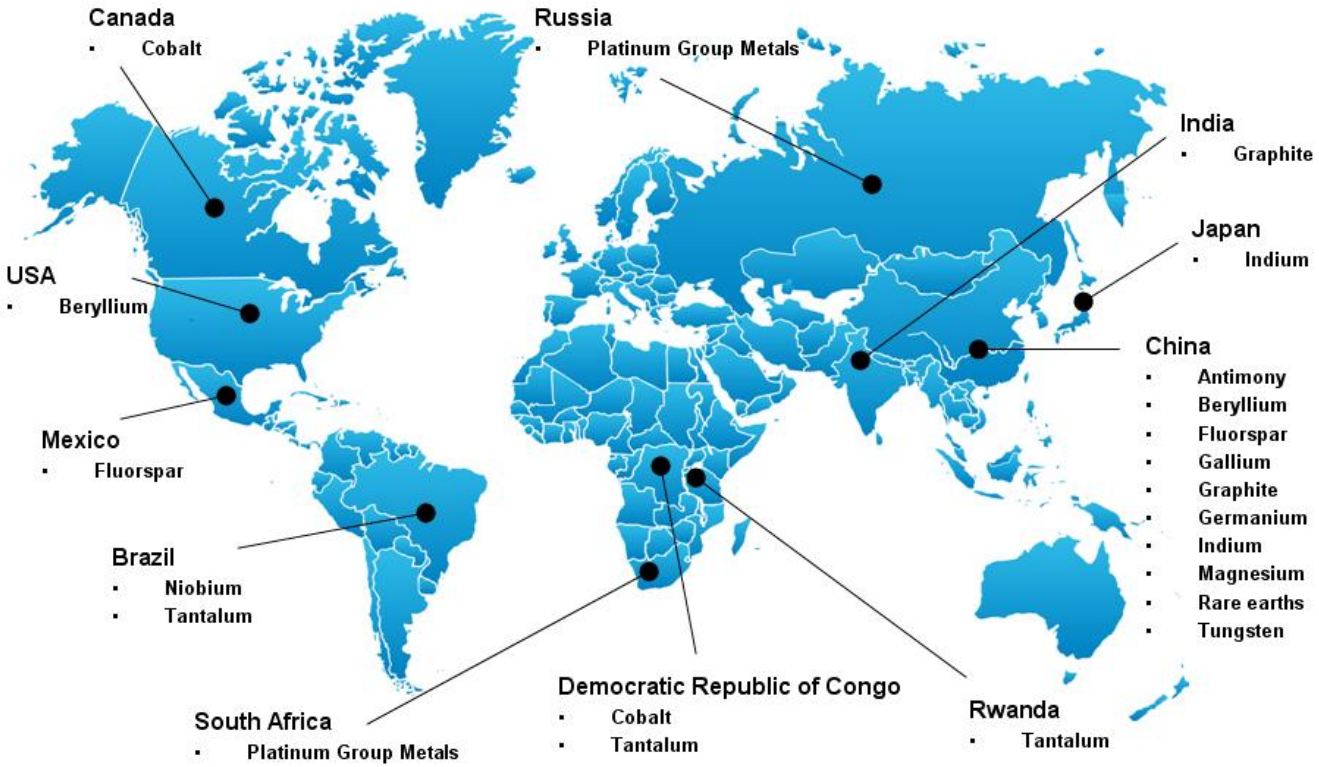
- **41 raw materials analysed**
- **Time horizon: 10 years**
- **Pragmatic, transparent approach**
- **Key indicators**
  - economic importance
  - supply risks
  - environmental country risks

Outcome


Supply Risk
Economic Importance
5,0
4,5
4,0
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0,0
3,0
4,0
5,0
6,0
7,0
8,0
9,0
10,0
Rare Earths
PGM
Germanium
Magnesium
Gallium
Antimony
Niobium
Indium
Tungsten
Fluorspar
Beryllium
Graphite
Cobalt
Tantalum
Barytes
Lithium
Borate
Limestone
Gypsum
Bentonite
Silica
Silver
Copper
Feldspar
Titanium
Diatomite
Perlite
Talc
Clays
Rhenium
Magnesite
Chromium
Vanadium
Tellurium
Molybdenum
Manganese
Zinc
Nickel
Iron
Aluminum
Bauxite

Critical raw materials

Production concentration of critical raw mineral materials



Emerging technologies

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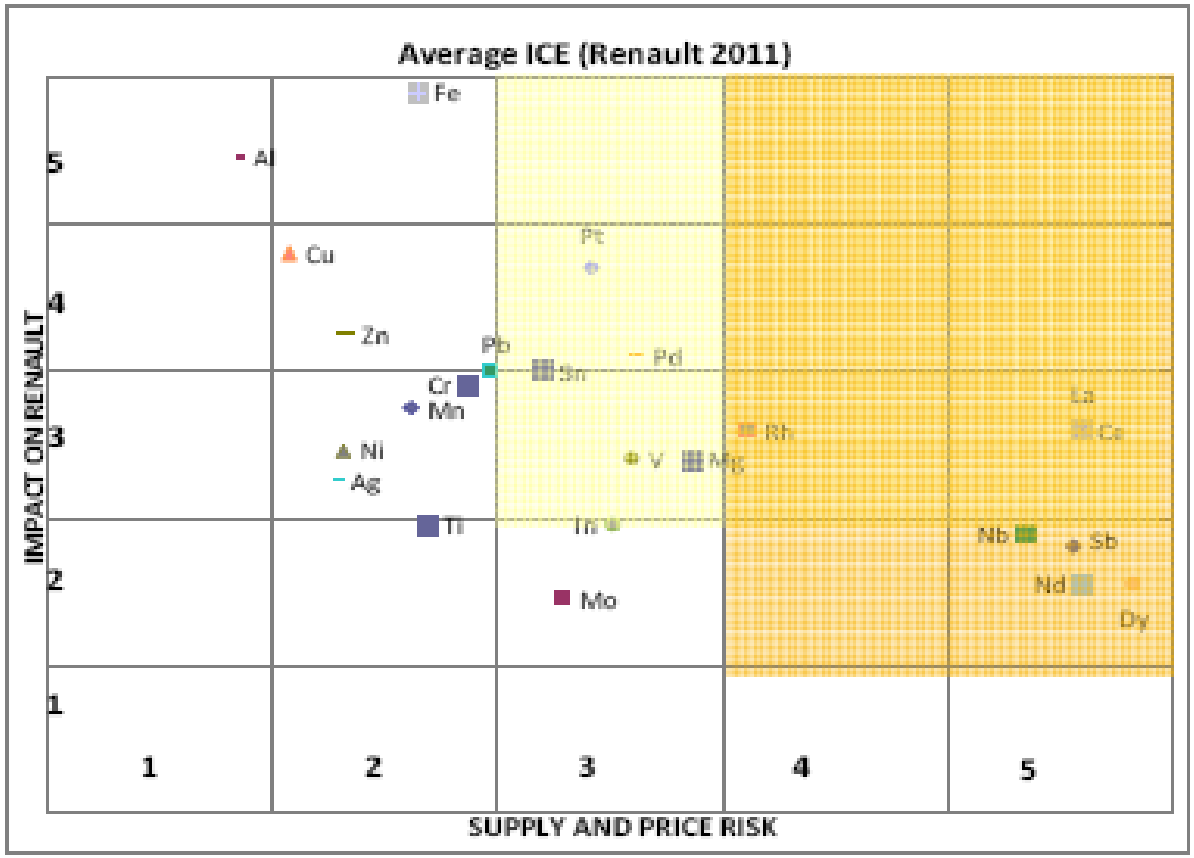
Raw material	Production 2006 (t)	Demand emerging tech. 2006 (t)	Demand emerging tech. 2030 (t)	Demand/prod 2006	Demand/prod 2030
Gallium	**152**	**28**	**603**	**0.18**	**3.97**
Indium	**581**	**234**	**1.911**	**0.40**	**3.29**
Germanium	**100**	**28**	**220**	**0.28**	**2.20**
Neodymium	**16.800**	**4.000**	**27.900**	**0.23**	**1.66**
Platinum	**255**	**very small**	**345**	**0**	**1.35**
Tantalum	**1.384**	**551**	**1.410**	**0.40**	**1.02**
Silver	**19.051**	**5.342**	**15.823**	**0.28**	**0.83**
Cobalt	**62.279**	**12.820**	**26.860**	**0.21**	**0.43**
Palladium	**267**	**23**	**77**	**0.09**	**0.29**
Titanium	**7.211.000**	**15.397**	**58.148**	**0.08**	**0.29**
Copper	**15.093.000**	**1.410.000**	**3.696.070**	**0.09**	**0.24**

Awareness-raising



With courtesy by Mr Schulz (Renault)

Policy tool

- **Monitor issues of critical raw materials to identify priority actions**

- **Policy actions not limited to critical raw materials exclusively**

Promote RTD and innovation

2008 2009 2010 2011 2012 2013 2014 2015 2016

One Geology Europe

ProMine

ExPerl

ImpactMin

EO-MINERS

EuroGeoSource

Data capture and analysis for Exploration.

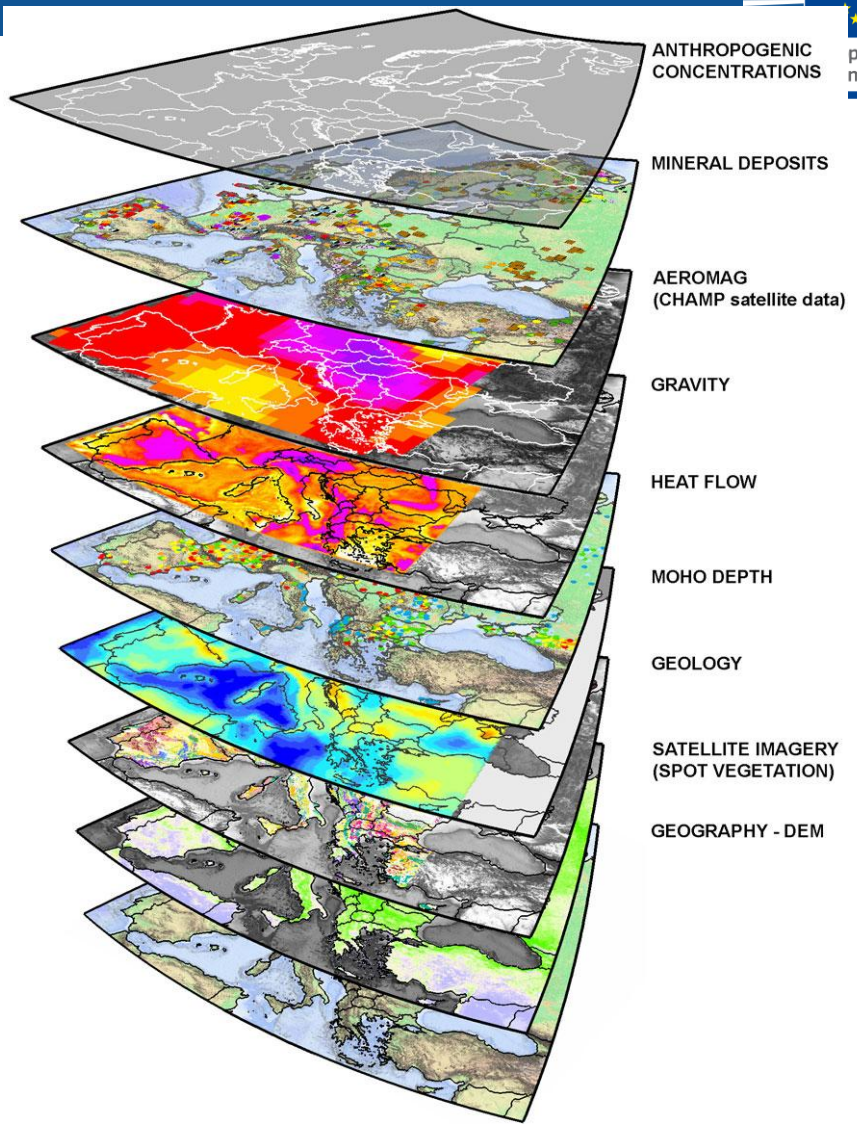
I²Mine

ERA-MIN

"Horizon 2020"

Exploration, extraction, processing, recycling and substitution

Case #1: ProMine



Assessments and homogenising multi-layer information system within the ProMine-Project building a basis for 3D and 4D modelling.

- **2009-2013**
- **Budget: € 17 million**
- **27 partners from 11 Member States**
- **Aims to improve the EU's knowledge base for actual and future deposits**
- **Develop first ever pan-European GIS-based mineral resources database and detailed 4D computer modelling system**

Case #2: substitution

Projects under FP7

Project	Title	Total budget	Max EC contribution
REFREEPER MAG	RARE EARTH FREE PERMANENT MAGNETS	5,207,885	3,841,400
FREECATS	Doped carbon nanostructures as metal-free catalysts	5,068,694	3,955,619
Next-Gen-Cat	Development of NEXT GENeration cost efficient automotive CATalysts	5,615,292	3,938,298
TOTAL		**15,918,538**	**11,735,316**

International cooperation

- **In December 2010 in the context of the Transatlantic Economic Council (TEC), the US and EU agreed to work together in the area of innovation and access to critical raw materials**

- **In November 2011 the TEC launched a joint work plan around various topics:**
  - ✓ Trade co-operation
  - ✓ Raw Materials Data, Flows and Information Sharing
  - ✓ Resource Efficiency and Recycling
  - ✓ Research and Development on Raw Material Substitution and Reduction
  - ✓ Waste Shipment

EIP – novel concept

European Innovation Partnership on Raw Materials
COM(2012) 82 final - 29 February 2012

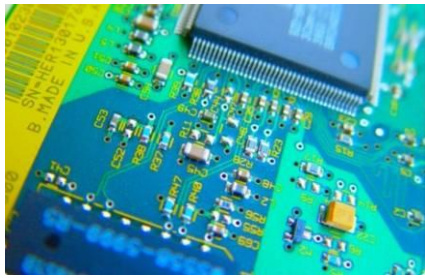
Objectives:

- Reduce **import dependency**
- Provide **alternatives in supply**
- Push **Europe to the forefront** in raw materials sectors
- Mitigate negative **environmental impacts**

Key components

- **Technology-focused policy areas**
  - WP1 - Exploration, extraction, processing, recycling …
  - WP2 - Substitution, alternative functionalities and materials

- **Non Technology policy areas**
  - WP3 - Improving Europe's **raw materials** regulatory framework conditions, knowledge base and infrastructure
    - ► e.g. data interoperability and availability
  - WP4 - Improving Europe's **recycling** regulatory framework conditions and excellence
    - ► e.g. public procurement, private initiatives



- **WP5 - International cooperation**
  - Promoting appropriate international cooperation
    - ► various policy issues possible e.g. geology, research, trade, competitiveness and investment conditions

2020 targets

- **EU standardised instruments for the survey of resources/reserves and 3-D geological map**
- **dynamic modeling of trends: link demand and supply with reserves and complete LCA**
- **Up to 10 innovative pilot actions, e.g. demonstration pilot plants → exploration, mining, processing, collecting and recycling**
- **Substitutes for at least 3 applications of critical raw materials**
- **Network of Research, Education and Training Centres on sustainable raw materials management**
- **Pro-active strategy of EU at bilateral and multilateral level**

Way forward EIP

NB: If Council conclusions in December 2012

- **First steps foreseen: setting HLSG, Sherpa group and operational groups**

  => call for expression of interest

- **HLSG to prepare Strategic Implementation Plan (SIP), for adoption ~ Sept. 2013**

- **Communication on SIP, late 2013**

  => SIP implementation to start

Follow up analysis

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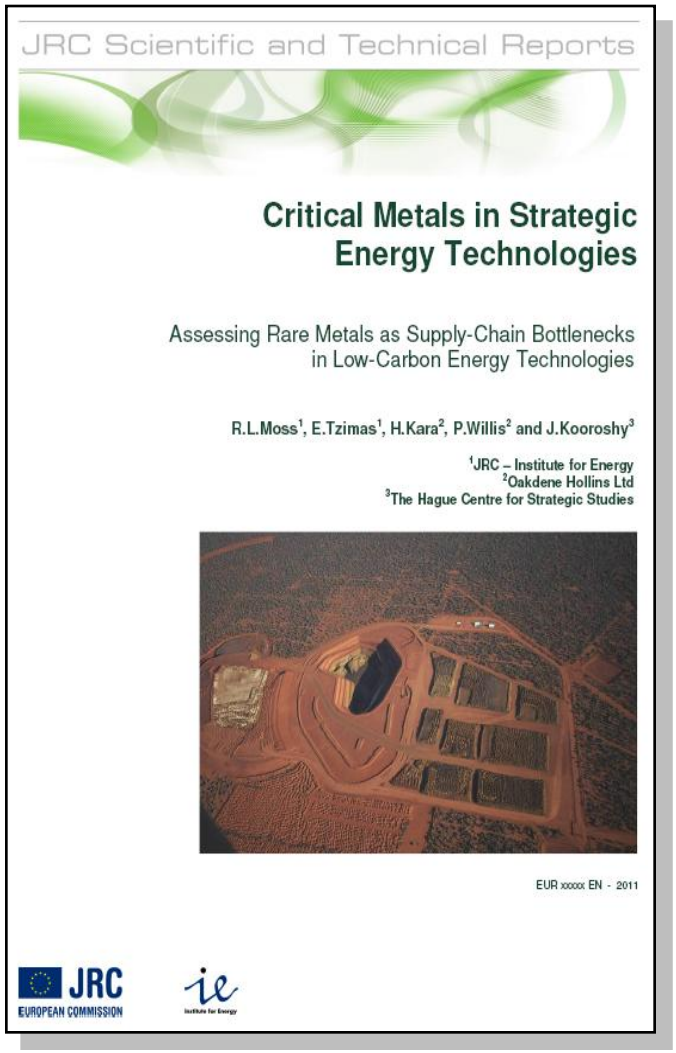
THE JRC-IET STUDY (2010-11)

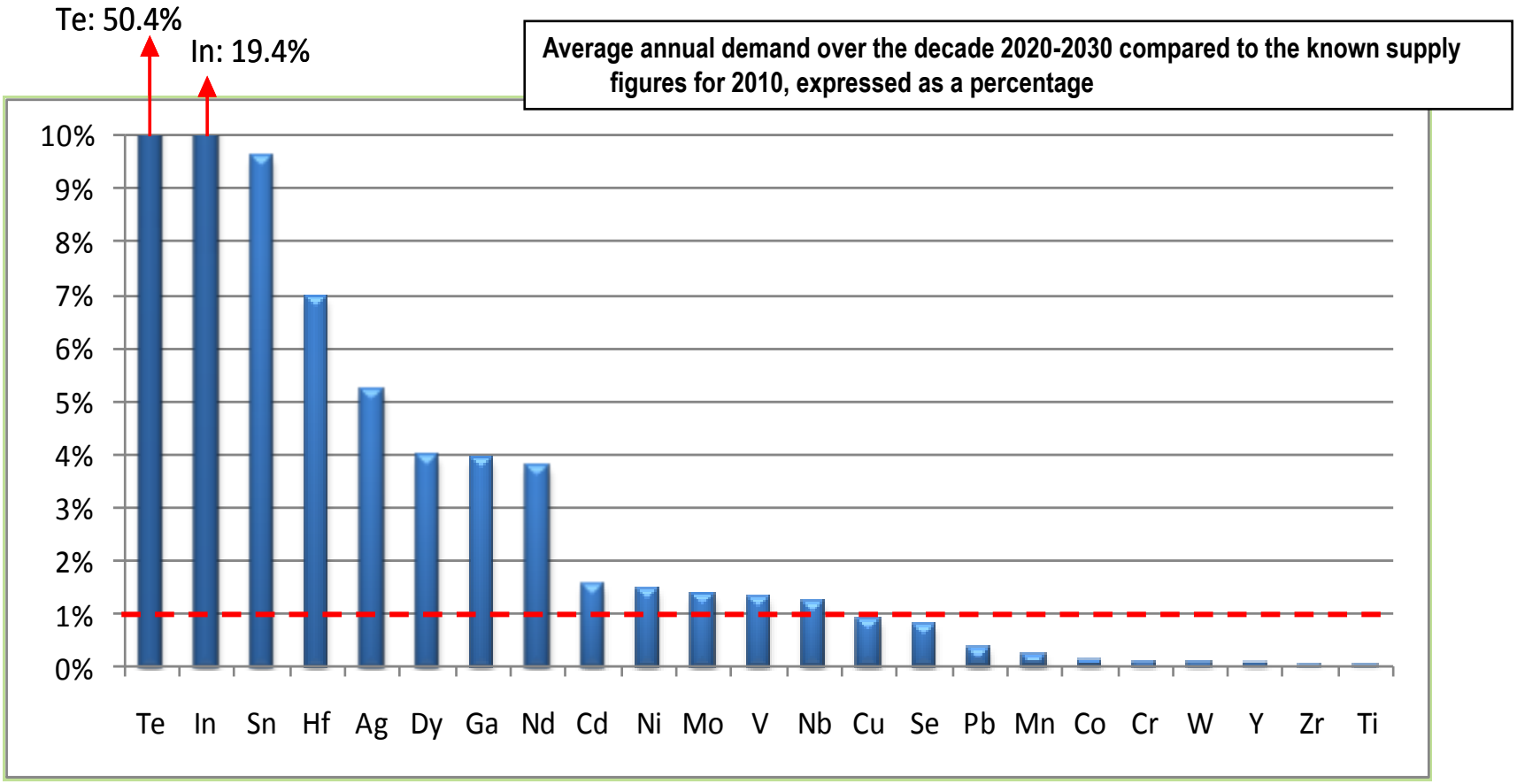
- Identify rare metal requirements for the high-priority low-carbon technologies of SET-Plan, namely: wind, solar, bio-energy, CCS, nuclear and electricity grids

- Examine the impact of rare metal supply and its disruption on the deployment of these technologies based on technology penetration scenarios

- Explore possible strategies to prevent or mitigate the negative impacts of rare metal supply and its restrictions on the SET-Plan goals



Results of significance screening

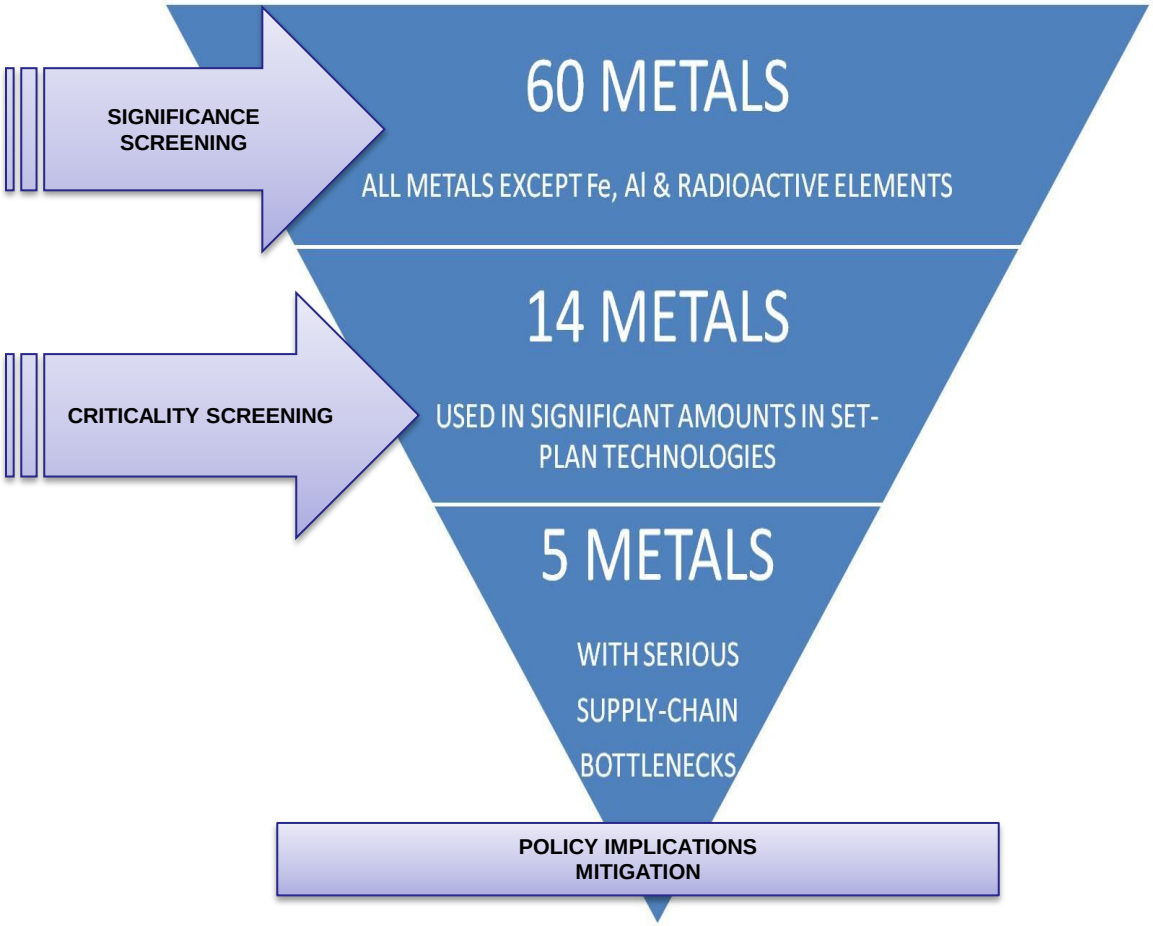


Results of geopolitical screening

Metal	Market Factors		Political Factors		Overall risk
	Likelihood of rapid demand growth	Limitations to expanding production capacity	Concentration of supply	Political risk	
Dysprosium	High	High	High	High	High
Neodymium	High	Medium	High	High	
Tellurium	High	High	Low	Medium	
Gallium	High	Medium	Medium	Medium	
Indium	Medium	High	Medium	Medium	
Niobium	High	Low	High	Medium	Medium
Vanadium	High	Low	Medium	High	
Tin	Low	Medium	Medium	High	
Selenium	Medium	Medium	Medium	Low	
Silver	Low	Medium	Low	High	Low
Molybdenum	Medium	Low	Medium	Medium	
Hafnium	Low	Medium	Medium	Low	
Nickel	Medium	Low	Low	Medium	
Cadmium	Low	Low	Low	Medium	

Due to market and geo-political factors, five metals represent a high risk: neodymium, dysprosium, indium, tellurium and gallium

Summary of results



PV uses three bottleneck metals: tellurium, indium and gallium, at 45, 30 and 2% maximum resp. of 2010 supply

Wind uses two bottleneck metals: neodymium and dysprosium at around 4% maximum of 2010 world supply

Conclusions of JRC report

- There are five metals (Dy, Nd, Te, Ga and In) for which the screening finds high risks for supply-chain bottlenecks.
- Existence of technology options implies that there are no unavoidable bottlenecks that could affect the implementation of the SET-Plan as a whole.
- Mitigation – EU-mine production; re-use, re-cycling, waste reduction and substitution
- Strong (EU) policy support – being addressed, for example, by the EU's Raw Materials Initiative and the EIP
- Recommend that similar study be carried out to identify metal requirements and bottlenecks in other green technologies (e.g. electric vehicles, fuels cells, hydrogen etc)

Revising the list of critical raw materials

- ✓ **Update list of critical raw materials at least every 3 years**
- ✓ **Technical work to start in September 2012**
  - o Expanded scope
  - o Fine-tuning methodology
- ✓ **Work to be completed by September 2013**
- ✓ **Adoption of new list by Commission end 2013**

References

•EU raw materials webpage:
http://ec.europa.eu/enterprise/policies/raw-materials

•EU 2010 Report on critical raw materials:
http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm

•European Innovation Partnership on raw materials
http://ec.europa.eu/enterprise/policies/raw-materials/innovation-partnership/index_en.htm

•2011 JRC report on critical metals and energy technologies:
http://setis.ec.europa.eu/newsroom/library/setis-presentations/jrc-report-on-critical-metals-in-strategic-energy-technologies