

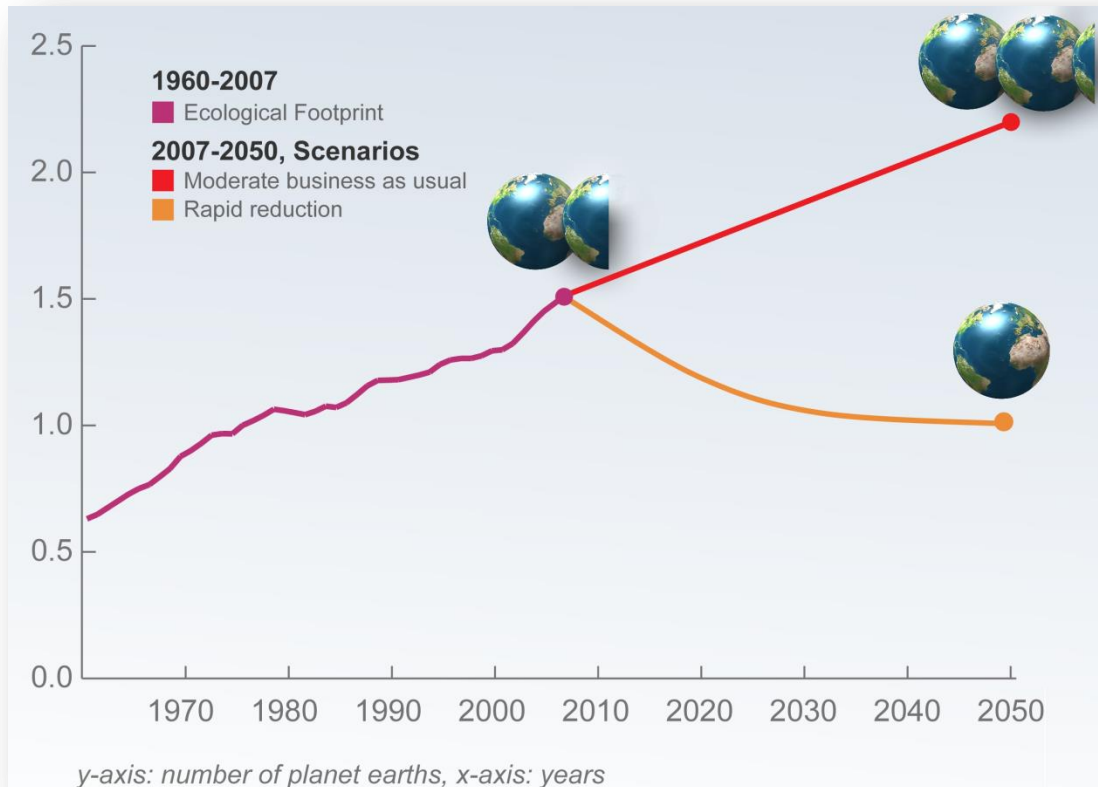
# Critical Raw Materials Innovation Network

E-MRS Spring Meeting May 2013,  
Dr. Pablo Tello (PNO Consultants)  
Symposium : F

Nanomaterials for energy conversion and storage

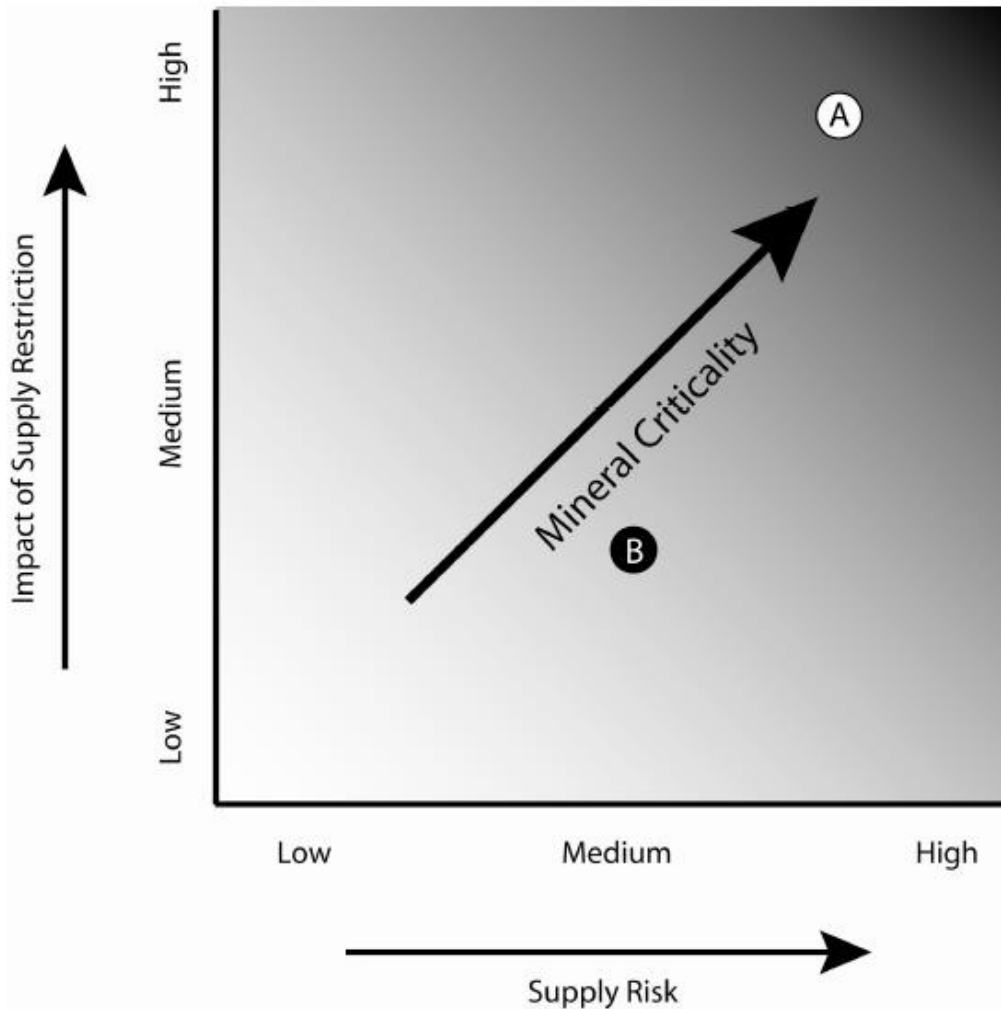


# Where we are and where will be with no action on energy and resource consumption rates



- ❑ Today humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste.
- ❑ Moderate UN scenarios suggest that if current population and consumption trends continue, by the 2030's, we will need the equivalent of two Earths to support us.

# Critical Raw Materials



- ❑ One of the most crucial resources we need are the so call Critical Raw Materials.
- ❑ Critical Raw Materials are those which are both essential in use and subject to the risk of supply restriction.

U.S. National Research Council, 2008. Minerals, Critical Minerals, and the U.S.Economy. Washington, D.C., National Academies Press

# Europe's energy-sustainable future depends on Critical Raw Materials



- Wind Turbines (permanent magnets).
- Electric Vehicles (permanent magnets & advanced batteries).
- Solar Cells (thin film semi conductors).
- Energy Efficient Lighting (LEDs).

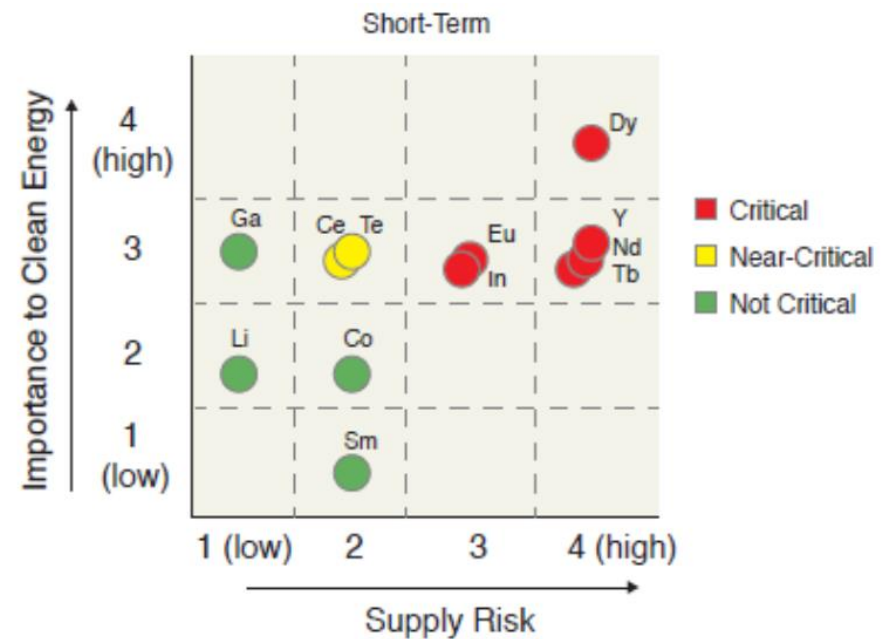


## Critical Materials Found in Clean Technologies

Technology	Component	Material
Wind	Generators	Neodymium
		Dysprosium
Vehicles	Motors	Neodymium
		Dysprosium
	Li-ion Batteries (PHEVs and EVs)	Lithium
		Cobalt
	NiMH Batteries (HEVs)	Rare Earths: Cerium, Lanthanum, Neodymium, Praseodymium
		Cobalt
PV Cells	Thin Film PV Panels General*	Tellurium
		Gallium
		Germanium
		Indium
		Selenium
		Silver
		Cadmium**
	CIGS Thin Films	Indium
		Gallium
	CdTe Thin Films	Tellurium
Lighting (Solid State and Fluorescent)	Phosphors	Rare Earths: Yttrium, Cerium, Lanthanum, Europium, Terbium
Fuel Cells*	Catalysts and Separators	Platinum, Palladium and other Platinum Group Metals, Yttrium

Sources: Table data extracted from Bauer, 2011 (20) and expanded upon with data from other sources per asterisks. \*APS/MRS, 2011 (2). \*\*Lifton, 2011 (10)

## Critical Materials found in Clean Energy Technologies





**...BUT their availability IS A FUNDAMENTAL PROBLEM...especially for EUROPE**

# EU Critical Raw Materials

## Critical Raw Materials at EU level EU Raw Materials Initiative, June 2010

- Antimony
- Beryllium
- Cobalt
- Fluorspar
- Gallium
- Germanium
- Graphite
- Indium
- Magnesium
- Niobium
- Platinum Group Metals  
(Pt, Pd, Ir, Rh, Ru, Os)
- Rare Earths  
(Y, Sc, La, Ce, Pr, Nd, Pm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu)
- Tantalum
- Tungsten



# CRM\_InnoNet

Critical Raw Materials Innovation Network  
Towards an integrated community driving  
innovation in the field of critical raw material  
**substitution** for the benefit of EU industry.

Alternative materials for certain applications;  
or  
Replacement those applications with an alternative technology not dependent on key raw materials.

# What is substitution?



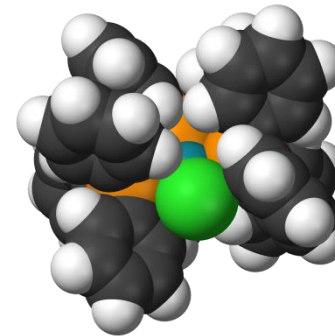
**Substance for Substance**



**Process for Process**



**Service for Product**

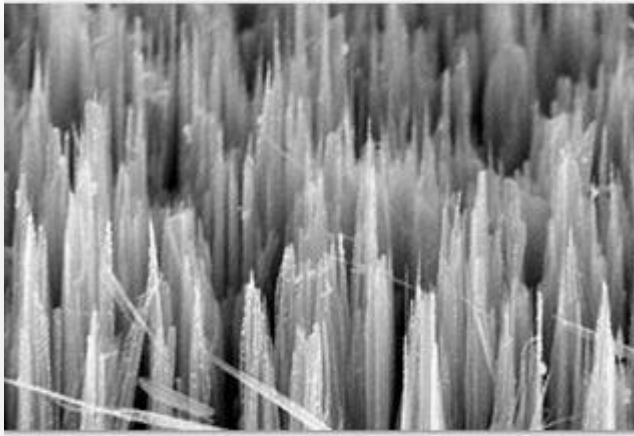


**New Technology for Substance**

# Substance for Substance

## Nexeon, UK

- Graphite used as anode in rechargeable batteries.
- Modified form of silicon matches graphite advantages with higher energy density



## Rio Tinto, US

- Antimony oxide used as smoke suppressant in PVC manufacture.
- Replace with Firebrake ZB (zinc borate).



# Substance for New Technology

## Nanoco, UK

- Rare earths in displays for ICT.
- Quantum dots in organic polymer LEDs.



## NEDO, Japan

- Rare earths used heavily in electric and hybrid vehicles (Prius uses 1 kg Nd)
- Developing a hybrid motor that is 'rare earth free'



# CRM\_InnoNet Consortium

**TNO** innovation  
for life

Knowledge  
Transfer  
Network  
Chemistry Innovation

**D'APPOLONIA**



RINA  
GROUP



**ASD** AeroSpace and Defence  
Industries Association of Europe

Knowledge  
Transfer  
Network  
Environmental  
Sustainability



**semi**



**feiQue**

**TU Delft** Delft  
University of  
Technology

**tecnalia** Inspiring  
Business

**SINTEF**

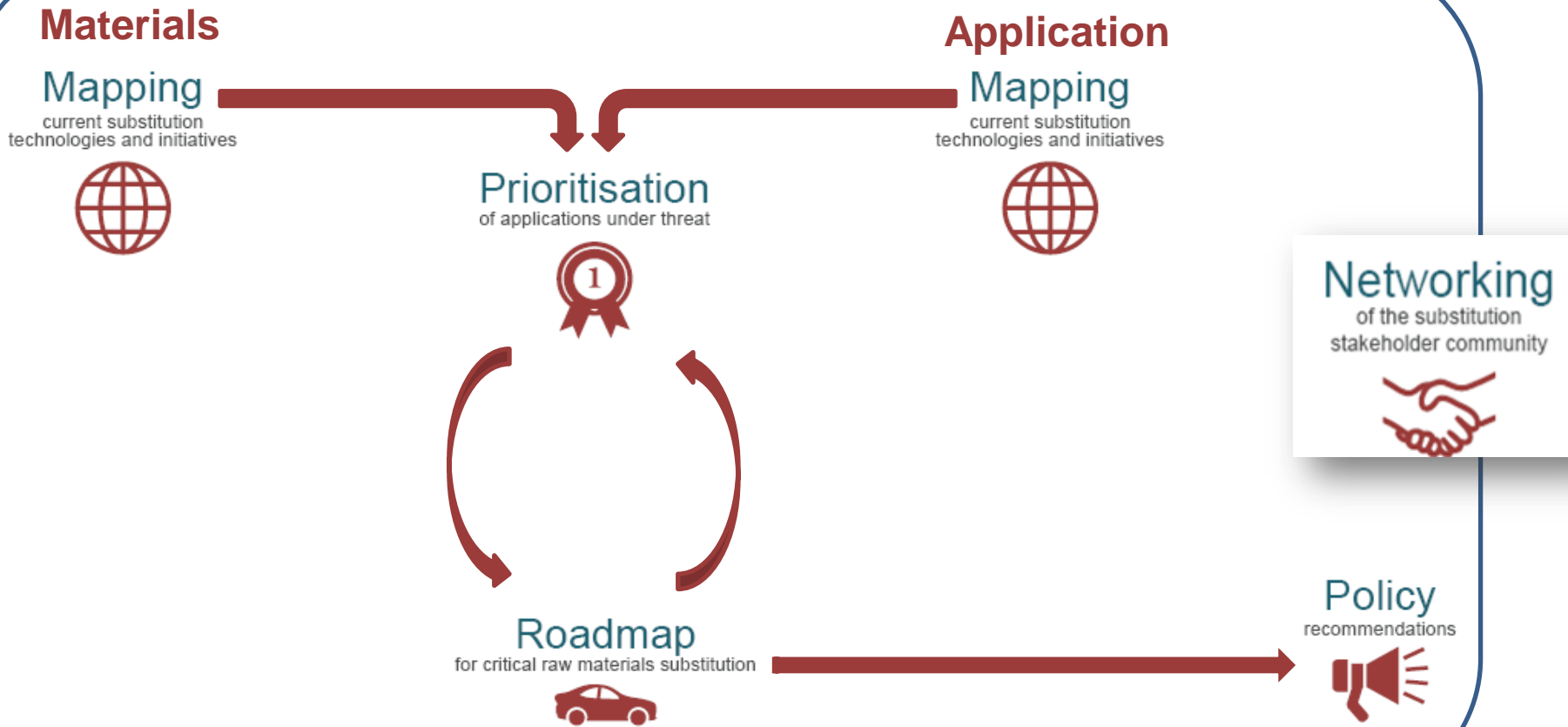
**swerea | MEFOS**

**Fraunhofer**  
ISI

# CRM\_InnoNet: Main Objectives



# CRM\_InnoNet: Project Structure



# CRM\_InnoNet Expected Impact

- **Generate** ideas for possible novel funding actions.
- **Prioritise** R&D needs in order to support the EU strategic approach.
- **Improve** coordination in R&I actions in the field of raw materials substitution.
- **Increase** efficiency and effectiveness of the EU research activities in this field.
- **Recommend** actions for policy-makers.
- **Create** one (or more) Innovation Network on substitution of Critical Raw Materials.



**Contribute** to the successful implementation of the **EU Raw Materials Initiative**

# Project Website



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[Project Summary](#) [Innovation Network](#) [News & Events](#) [Project Objectives](#) [Documents](#) [Partners](#)

## Related initiatives

### First project workshop date announced!

Register today to attend a workshop to launch the project stakeholder network on Monday 15th April 2013 in Brussels.

[Read more](#)



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CRM\_InnoNet (Critical Raw Materials Innovation Network) will drive innovation and influence policy in the field of **substitution** of critical raw materials for the benefit of EU industry.

CRM\_InnoNet is supported under the NMP (nanosciences, nanotechnologies, materials and new production technologies) theme of the European Commission 7th Framework Programme.

### News & Events

Innovation Network Workshop  
Mar 19, 2013, *Comments are off*

### Blog

Ongoing CRM\_InnoNet research from TU Delft in the Netherlands  
Mar 04, 2013, *0 Comment*

### From Twitter

RT @Dr\_Catj: Transport, Aerospace, ICT or Energy company? Worried about materials security? Innovation Network for CRM can help

# [www.criticalrawmaterials.eu](http://www.criticalrawmaterials.eu)

# CRM\_InnoNet Key Contacts

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Mapping  
current substitution  
technologies and initiatives



Materials mapping:

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Roadmap  
for critical raw materials substitution



Policy  
recommendations



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Networking  
of the substitution  
stakeholder community



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Thank you for your attention

Any questions?