



## **WMF GENESIS**

# **CRITICAL MATERIALS**

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IRCE, May 15th 2019

# Facing A World Challenge

## 3 megatrends: booming of the middle class, urbanization, electrification of power trains

- Passenger aircrafts: 34 000 by 2036, 40% replacement and 60% growth
- Electric vehicles: 54% of new car sales in 2040
- Smartphones: 1,9 billion units in 2018, 10 fold the number of 2009

**Resources of our planet under incredible pressure** with temporary or long term bottlenecks

**Difficult situations on waste management and landfill disposal**

**ONE PLANET NOT TWO !**

# Promoting A Global Answer

Why	Decouple economic growth and materials consumption while creating value for our industries
What	Change mindsets and behaviors in order to <b>use materials smarter, less and longer</b>
Who	<b>Industry Leaders</b> (MNCs, SMEs and Start Ups) <b>Political leaders</b> (International organizations, Nations and Big Cities) <b>Key Opinion Leaders</b> (Academia, NGOs, Experts and Media).
How	<b>Speak with facts and figures</b> <b>Use collective intelligence to design actionable recommendations</b> <b>Use networking to speed up implementation</b>

## Done

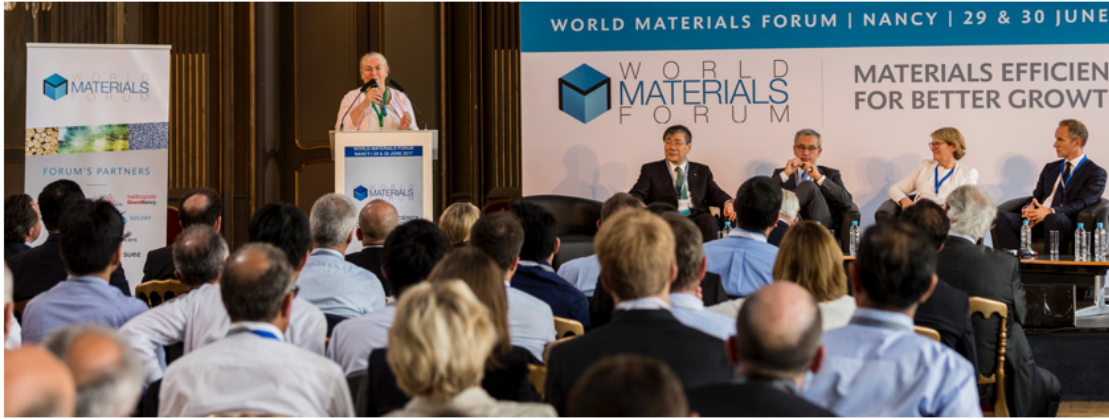
**4 editions since 2015 and 1000 participants from 30 countries:**

- 60 CEOS & 280 Comex of MNCs
- 130 CEOs of Start-ups
- 170 Public Institutions
- 260 Academia & experts

## The outcome

- Since 2015: the WMF Criticality Assessment – a yearly survey on critical materials future supply/ demand
- Since 2016: the WMF “Smarter, Less and Longer” toolkit
- Since 2017: the WMF Start Up Challenge
- Since 2018: the WMF Monthly Newsletter
- Already in 2019: World Materials Connect
- Throughout: numerous field projects in materials science, supply chain and digital technologies





# Getting The Big Picture On Critical Materials

**Idea = Target the right priorities** for industrial companies to choose which materials/countries they want to buy from/invest in & for political entities to select the materials/countries in which to prioritize their actions/regulations

## Thorough yet simple decision making tool based on 6 components impacting the balance supply/demand:

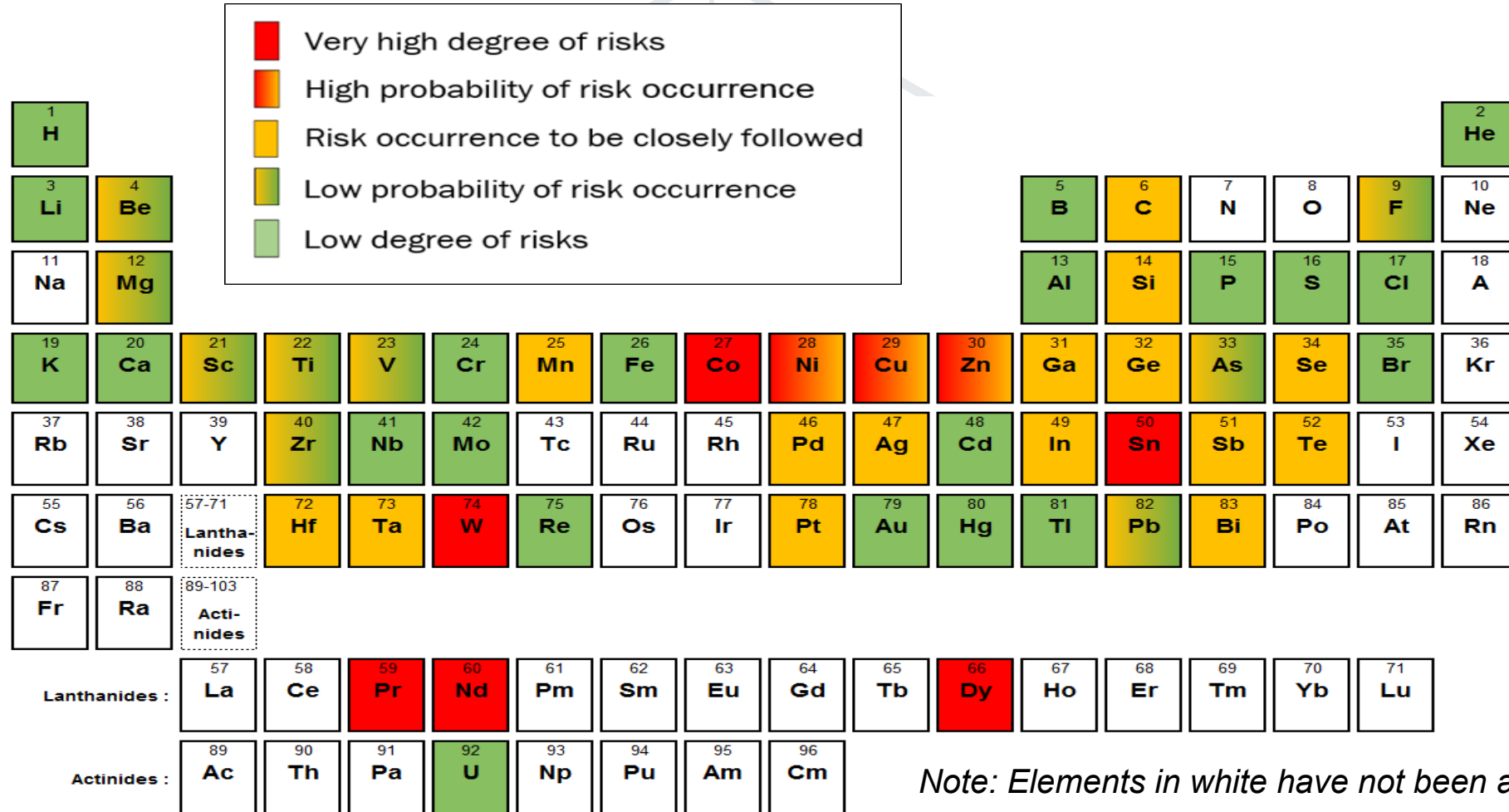
- Years of known USGS reserves
- Uncertainty of supply
- Political exposure
- Qualitative assessment of recycling
- Uncertainty of demand
- Vulnerability on core applications

## Opportunity to identify and track progress on solutions

- New mines/capacities
- Substitution by less critical materials
- Scrap reduction throughout the supply chain for existing products
- Design of new and lower weight products
- Collecting, sorting and recycling schemes



# WMF Criticality assessment by BRGM, CRU & McKinsey (as of June 2018)



## Top critical = cobalt

### Very high risk

- 70 years of reserves will decline to 25 years in 10 years time if no new reserves are identified
  - **Supply deficit in 2027 is forecasted to be greater than 30%**
  - **At least 60% of mine supply comes from the Democratic Republic of Congo**
    - High recycling rate is needed and we are not there yet
- **More than 60% of demand growth comes from electrification of car power trains**
  - No real “safe” alternative yet in battery applications

### Solutions progress

New mid size mines are being developed in Australia and Canada

BASF – DOE project to develop cathodes without cobalt

SAMSUNG Project to recycle smartphones and recover cobalt

EV bodies lightweighting and EV batteries energy efficiency projects altogether



# The trio of « really » rare earth: Pr, Nd and Dy

## The status

- Only 3 of 16 rare earth are « red »: Pr, Nd and Dy
  - At least 90% of mine supply comes from China
  - Less than 1% recycling (Solvay stopped in 2016)
- Europe and US have stopped most of their mining and refining capacities

## Solutions progress

Developing capacities in Australia (Lynas, MountWeld), restarting Mountain Pass in the US

Samsung has planned a 1, 4 billion \$ R&D budget to find alternatives to rare earth on the 2013-2022 period

Tesla induction motors (same for BMW) or swith reluctance engines used in mining do not require the use of rare earth

Start ups such as Ajelis (France) or Momentum Technologies (Texas) develop lower cost recycling technologies

Fraunhofer demonstrated minus 80% in new permanent magnets + recycle/reuse permanet magnets at 96% capacity

**Overall improvement... even on very critical materials such as cobalt or the “famous” 3 very rare earth (Dy, Ne and Pr)**

**Reasons for improvement are: new capacities in democratic countries, better alignment of interest of all actors along the supply chain ... Fraser Index improvement nearly everywhere.**

**Questions remain on the stability of geopolitical situation – Trump tweets – and on the feasibility of recycling for the very critical materials**

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**THANK YOU  
FOR YOUR ATTENTION**

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