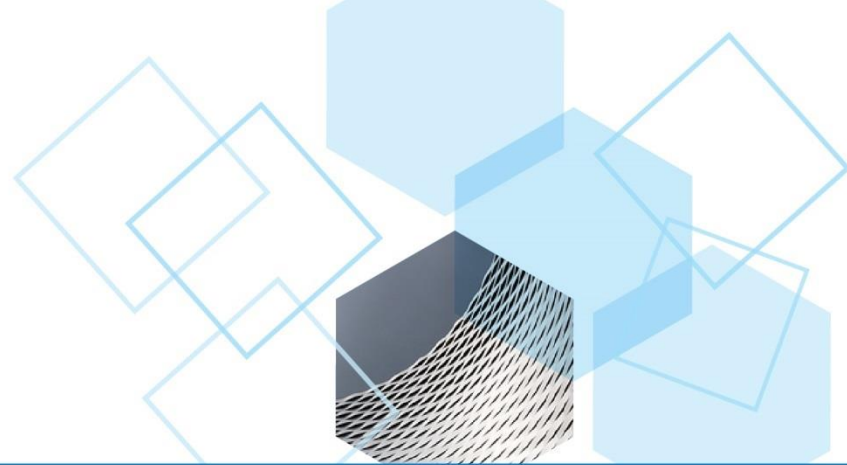


WORKING DRAFT

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Wrap up of session 1

Access to rare minerals resources & feed stock



Workshop reviews
24 June 2015

A growing global economies requires more resources

40% The number of resource-driven countries has increased by almost since 1995

81 countries driven by resources in 2011 accounting for 26 percent of global GDP

90% of resources investment has historically been in upper-middle-income and high-income countries

50%+ improvement in resource-sector competitiveness possible through joint government and industry action

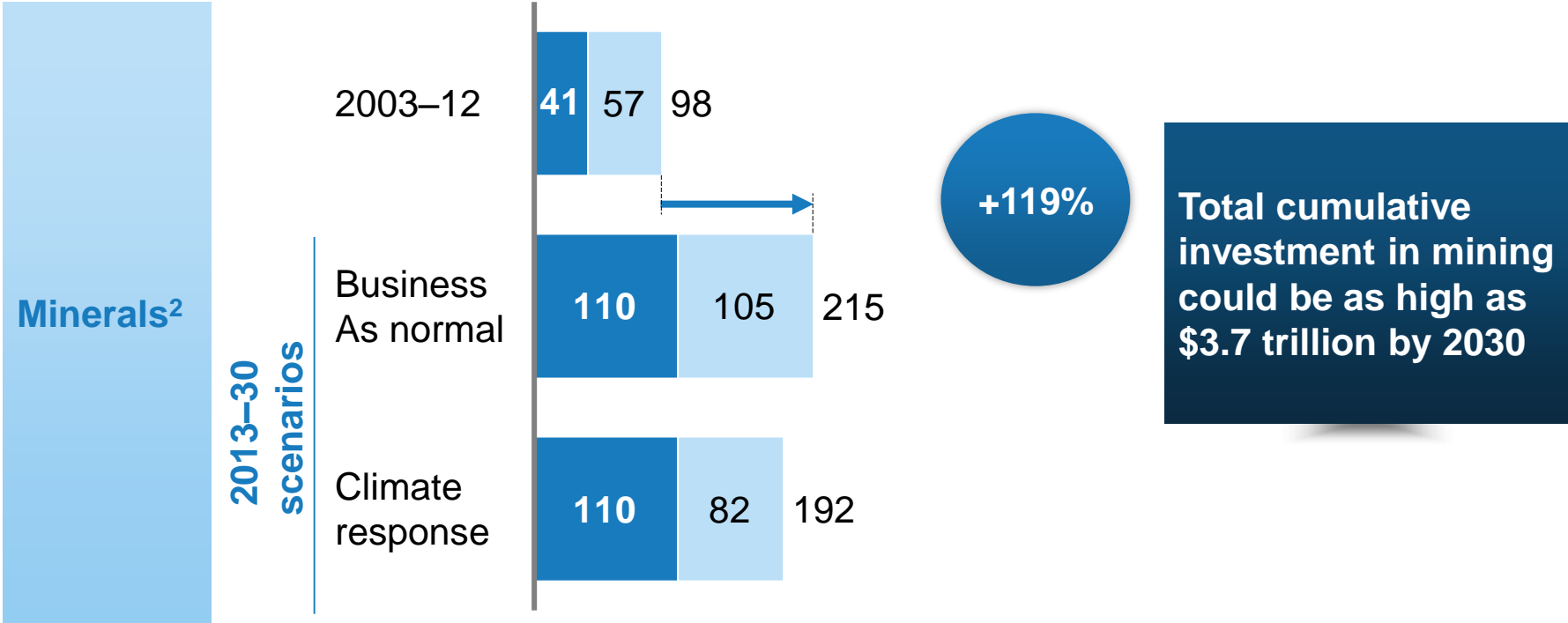
1 Up from 58 generating only 18 percent of world GDP in 1995

Investment in minerals may need to increase at more than double historical rates to meet new demand and replace existing supply

■ Replacement capital expenditure ■ Growth capital expenditure

Annual investment requirements¹

2012 \$ billion, annual






1 See the appendix for further details on the methodology.

2 Includes iron ore, coal, copper, and an estimate for other mineral resources.

NOTE: Numbers may not sum due to rounding.

SOURCE: McKinsey Energy Insights; McKinsey Basic Materials Institute; Wood Mackenzie; Rystad Energy; IHS Global Insight; World Bank; McKinsey Global Institute analysis






In paving the pathway forward and ensuring sustainable development, the key topics have been discussed

Workshop	Access to rare minerals resources & feed stock	Why is this important
1	Rare raw materials issues 	<ul style="list-style-type: none">▪ Meeting additional requirements in growing humanity accounting for the rising middle class in a resource constrained world
2	Policies for the XXIst century 	<ul style="list-style-type: none">▪ Provide opportunities to all stakeholders from an intra and inter-generational equity perspective▪ Develop global resource governance based on resource efficiency, transparency and accountability
3	Better access to R&D 	<ul style="list-style-type: none">▪ Develop the necessary tools and mechanisms to support a sustainable industry meeting increasing global challenges





Innovation and advanced technologies are key to overcome industry supply issues

Company/Institution	Speaker	Key outcomes
	Shunichi Miyanaga	<ul style="list-style-type: none"> ▪ Innovation across the whole supply chain through international collaboration and technology exchanges is needed ▪ Sustainable mining practices and advanced mining technology should be shared through “global open innovation network”
	Prof. Thomas Graedel	<p>»</p> <ul style="list-style-type: none"> ▪ By-product rare metals score high in long-term criticality ▪ By-products should be mined irrespective of current demand requirements and stored for long-term accessibility
	Prof. Pär Weihed	<p>»</p> <ul style="list-style-type: none"> ▪ Success in mining encompasses; 1. Cash cost and lean production, 2. Automation and systemic integration, 3. Technological advances 4. Economic extraction of by-products ▪ Thinking smart and mining efficiently will drive sustainability
	Prof. Frédéric Villieras	<p>»</p> <ul style="list-style-type: none"> ▪ Addressing complex ores and the processing thereof leads to diversification of supply sources of metals and the minimisation of environmental impacts of mining and metallurgical activities
	Philippe Bideau	<p>»</p> <ul style="list-style-type: none"> ▪ Productivity has decline ~30% over the last decade ▪ There are 4 levers to drive change: 1. Effective management operating systems, 2. Focus on innovation, 3. Operations excellence, 4. Capability building ▪ Multiple advanced mining technologies are reaching commercialization

Collaboration between all stakeholders is needed for successful policy

Company/Institution	Speaker	Key outcomes
	Alan Davies	<ul style="list-style-type: none"> ▪ Policy fundamentals should include; 1. Free trade, 2. Encourage exploration, 3. Anti-bribery and corruption, 4. Environment al and social progress, 5. Global principles fit for purpose at local level
	Dierk Paskert	<ul style="list-style-type: none"> ▪ Biggest issue in accessing materials is cyclicalitiy in the industry ▪ Downstream players to give upstream guidance as to future supply requirements
	Vincent Laflèche	<ul style="list-style-type: none"> ▪ Shift from current linear behaviour to a circular based concept applying the 4R principle; resources use reduction, re-manufacture, Re-use components , recycling
	Henryk Karas	<ul style="list-style-type: none"> ▪ Solving the problems of deep underground mining on shore and off shore can give Europe technological leadership in the resource-efficient production
	Moyo Kamgaing	<ul style="list-style-type: none"> ▪ Stable democratic environments are is vital in fostering a sustainable mining industry ▪ African governments could further develop a collaborative approach

Life cycle analysis is key to process optimisation

Company/Institution	Speaker	Key outcomes
 voestalpine ONE STEP AHEAD.	Wolfgang Eder	<ul style="list-style-type: none"> ▪ Life-cycle and material flow analysis are keys to process optimisation ▪ Common labs shared between universities and industry, bringing together scientists from a wide range of disciplines bear great potential to speed up innovation
 Universiteit Leiden	Prof. Arnold Tukker	<ul style="list-style-type: none"> ▪ Taxing materials and waste generation rather than labour, developing open innovation centres could play an important role to help overcoming the hurdles
 RawMaterials	Prof. Jens Gutzmer	<ul style="list-style-type: none"> ▪ The European Council and the European Parliament launch the Knowledge and Innovation Community (KIC) ▪ The objective is to boost the transition in overcoming the “valley of death” of innovation; separating research and innovation from the market
Tech Transfer and Licensing, France	Dr Florence Ghrenassia	<ul style="list-style-type: none"> ▪ Consistently re-visit and challenge existing knowledge and ways of thinking ▪ Cross skills can be used to stimulate innovations
 ARKEMA	Christian Collette	<ul style="list-style-type: none"> ▪ Lead times in innovation can be very long ▪ Innovation needs to be based on life-cycle and on “resources nexus” thinking, understanding the linkages between raw materials, energy and water uses to compare different possible process routes

What you said should happen next...



“ “ *Gather as a group consisting of multiple stakeholders to identify and define the global landscape for key minerals is needed before definitive next steps can be agreed*
- Delegate 1

” ”

“ “ *Private companies, countries and institutions need to develop economic activities ... acting as the necessary catalyst to close capability gaps*

- Delegate 2 ” ”



Thank you to our faculty for their valuable input in driving engaging discussions

Thanks!

