

World Scenario Series

The Future Availability of Natural Resources A New Paradigm for Global Resource Availability

#1 Supply does not depend merely on blophysical availability

#2 Demand depends more on economic growth than population growth

#3 Polltical, economic, and social interconnections are critical but often underestimated #4 Distributional Issues are underap preclated and can lead to systemic risks #5 Tight feedback loops connect resource availability to climate and environmental change

Systems Thinking

WHAT HAS PRIORITY?

Fragmented paradigms

Stakeholders tend to view the future availability of natural resources through the lens of one of four divergent paradigms:

#1 Focus on threats of material exhaustion

#2 Focus on rising costs

#3 Focus on abundance

#4 Focus on social justice

The resulting picture of the future availability of natural resources is:

Critically important to stakeholders: Despite exhortations by some to decouple economic growth from the increasing use of resources, the world's current economic systems require reliable access to natural resources to deliver populations with even a minimal quality of life. Shortages in critical inputs could cause significant damage to economic and social systems, leading to geopolitical conflict, political instability and social unrest. Such effects are unevenly distributed; as with global food markets in recent years, high and volatile commodity prices can create existential concerns for low-income families, contribute to political instability and influence trends such as global migration.

Contested due to polarization: Over this century's first decade, a flurry of academic papers, statements from civil society, advice from investors and alarming media reports have resulted in an increasing polarization of viewpoints on the matter, with stakeholders' perspectives sharply divided as either bearish or bullish on future resource availability. The result has been a muddled picture favouring antagonism and reasons linked to personal opinion, rather than a common understanding and collaborative solutions to the world's resource challenge.

Complex to understand: Natural resource availability is the function of the supply and demand of resources that are discovered, developed, processed, distributed and consumed in intricate value chains, a significant portion of which are global. Though these value chains seem to operate as markets for most end consumers, they all suffer from distortions at different points, thanks to monopolistic structures, constrained supply routes and government intervention (subsidies, taxation). Further, while nearly all natural-resource value chains are subject to physical interference from weather, climate and political instability, pricing on global markets is sensitive to the actions of traders and investors uninterested in physical delivery, and is thus exposed to the prevailing views on global economic growth.

Uncertain in its predictions. This complexity leads to significant uncertainty on future demand and supply of different resources, which are subject to consumer price sensitivity and myriad possible issues linked to supply. Surprises are also numerous on the upside, as abundant rainfall, technological breakthroughs and new discoveries can quickly cause a shift from scarcity to abundance. While almost all predictions of resource availability and prices use the recent past as a guide, both are highly volatile and have proved impossible to predict reliably over the medium and long term.

WE ARE NOW APPROACHING EARTH LIMITED SCALES

So looking to the past is NOT and using a traditional view are not helpful:

Economic growth and the technological have accelerated the use of many natural resources and some fear the world will soon run out of key resources:

What does economics have to say about the answer to this question?

Economic Corrections History

In 16th-century England, fear arose that the supply of wood – widely used for energy – would soon be exhausted.

 Higher wood prices, however, encouraged conservation and led to the development of coal which dissipated the crisis.

In 1850 world would soon run out of whale oil, the primary source of artificial light.

- Whale oil prices rose sharply -> less light
- By 1890, the development of kerosene from coal provided a much more energy efficient alternative to whale oil

Why have forecasts been wrong?

When resources are allocated by markets, increased scarcity leads to higher prices.

Higher prices strengthen the incentive for ...

- users to reduce their consumption,
- <u>suppliers</u> to search for ways to expand future supply
- both producers and users to search for substitutes.

All of these adjustments will increase future supply relative to demand and make it highly unlikely that the resource will be *actually* depleted.

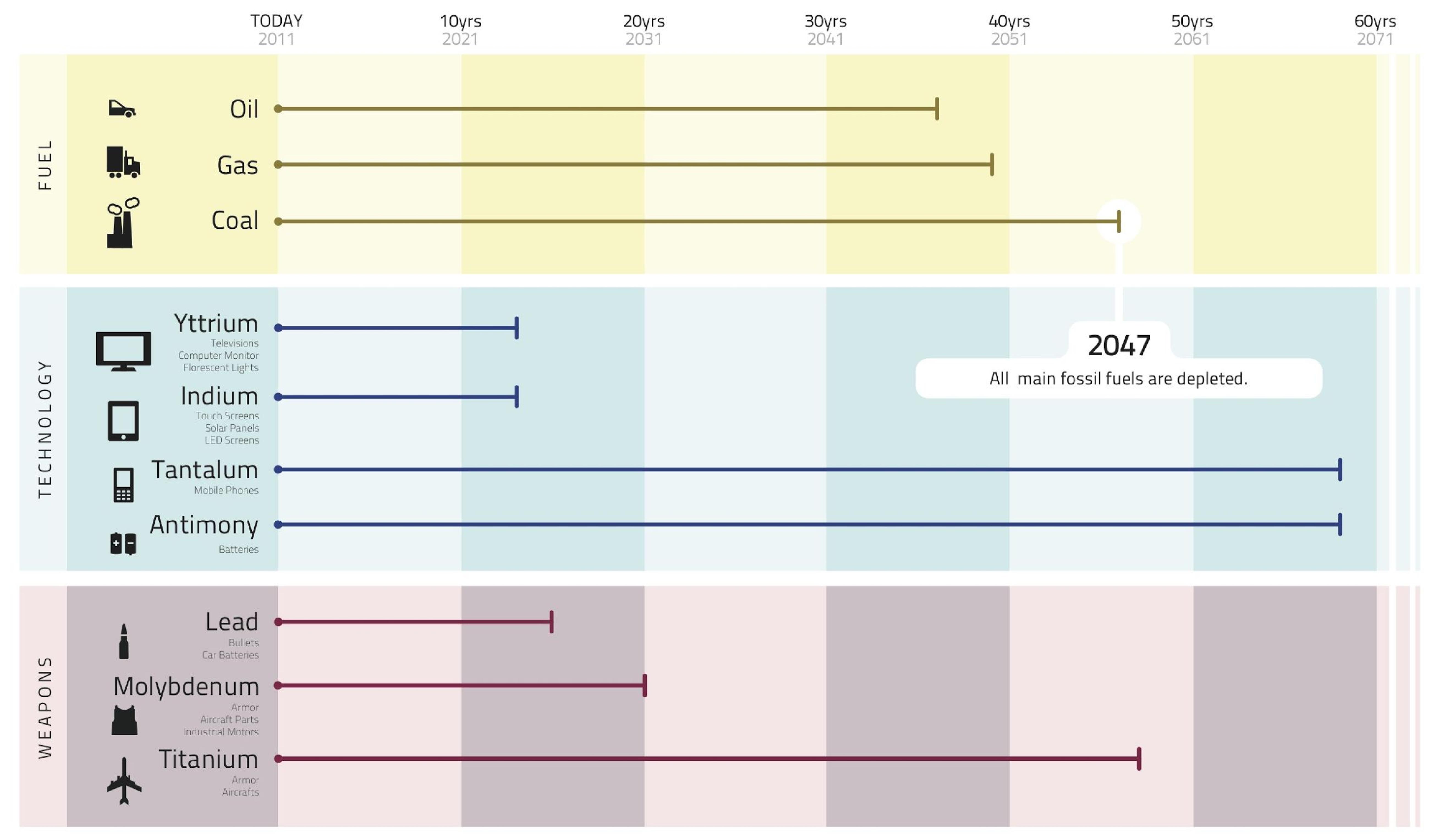
The sky is falling problem

After people switched to petroleum, dire predictions about petroleum oil depletion soon arose.

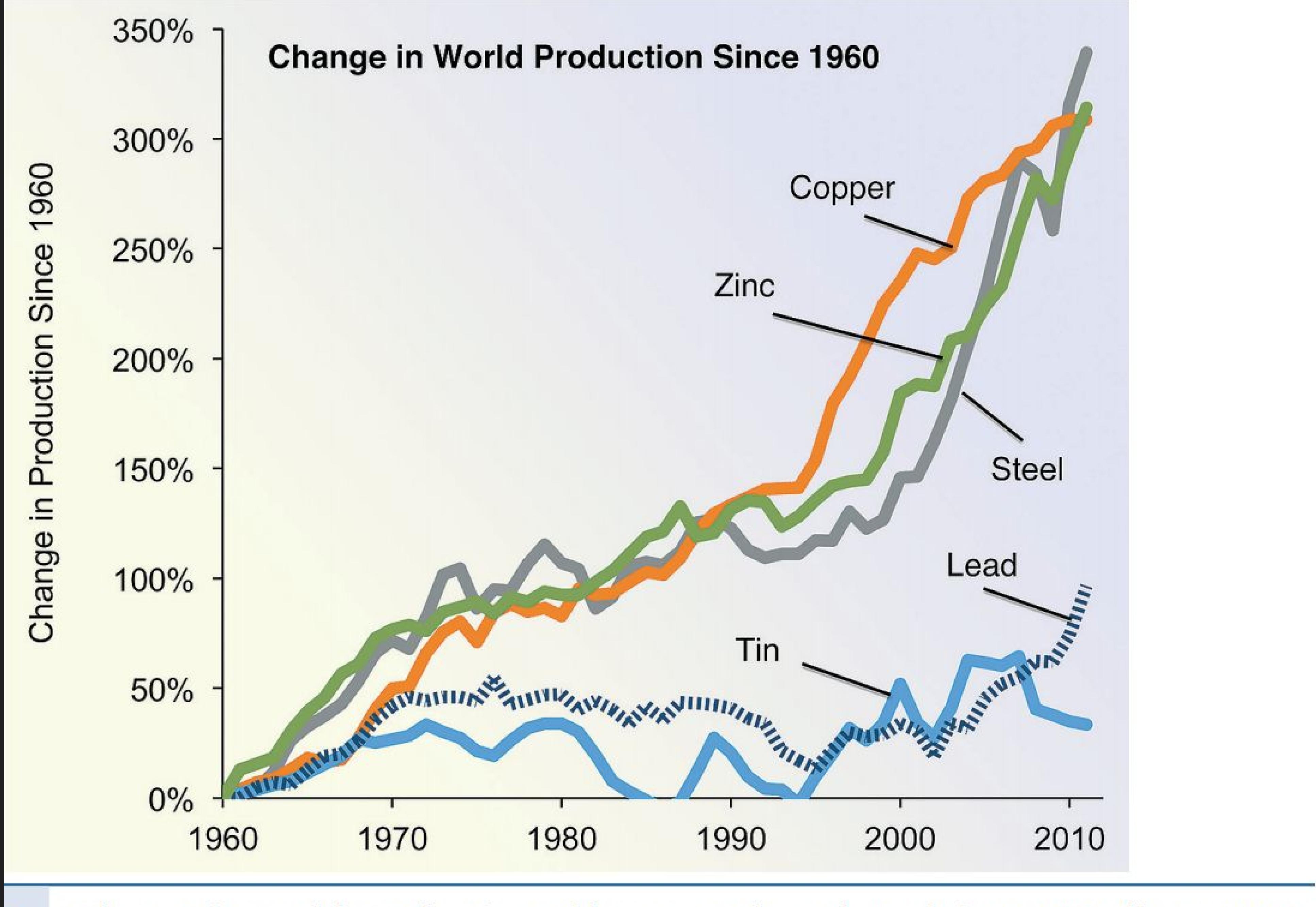
- In 1914 the Bureau of Mines reported the U.S. supply of oil was 6 million barrels -- less than 2 years of U.S. production.
- In 1926 the Federal Oil Conservation Board announced that oil would be depleted in the U.S. within 7 years.
- In 1939, the Interior Department predicted petroleum supplies in this nation would run out within 20 years.
- In the 1972 report "The Limits of Growth," the authors used large computer models to project that the world would run out of several key minerals in the 1980s and 1990s.

End of the Line

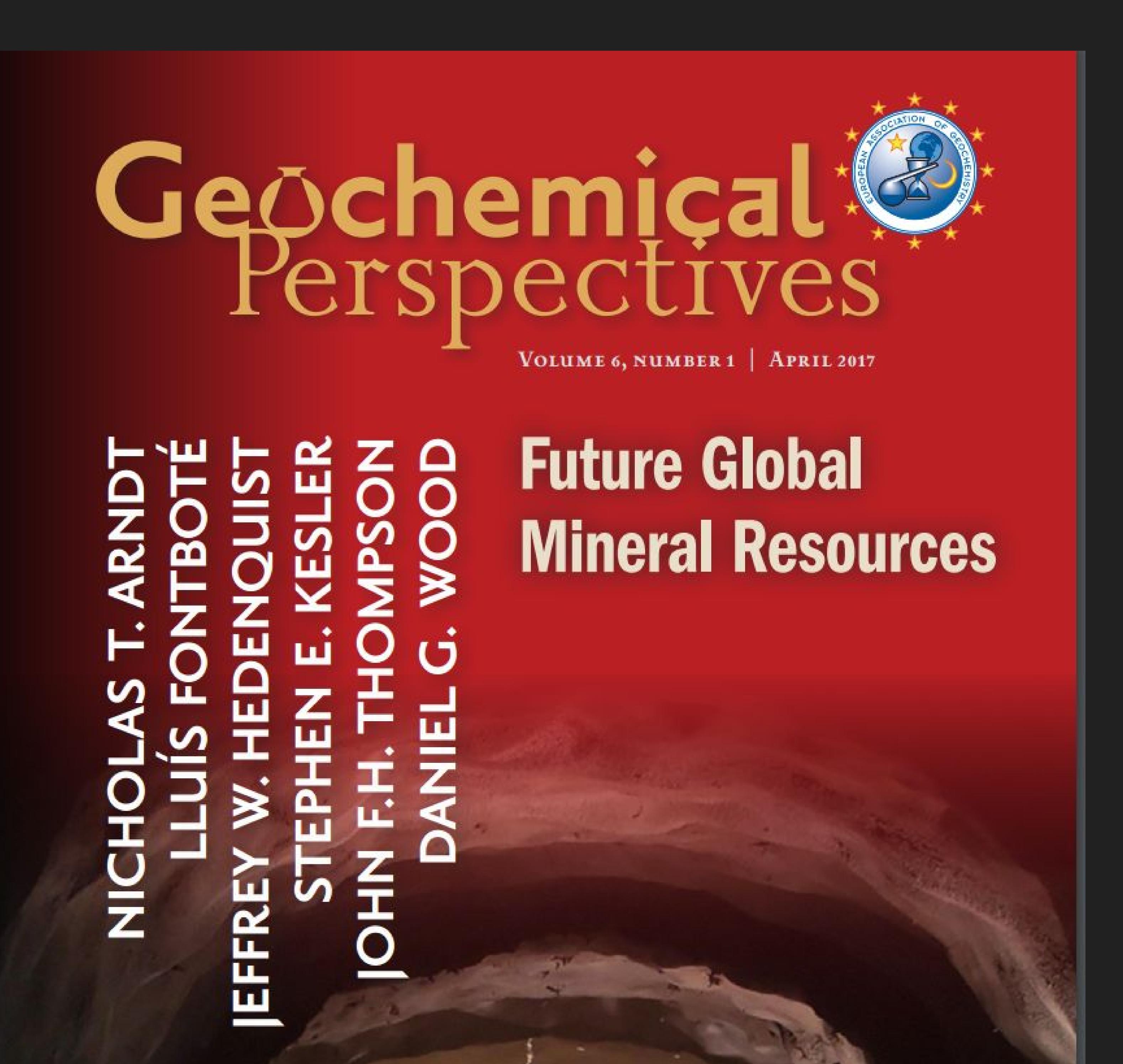
When Will Our Natural Resources Run Out? (If Production Continues to Grow at Current Rates)

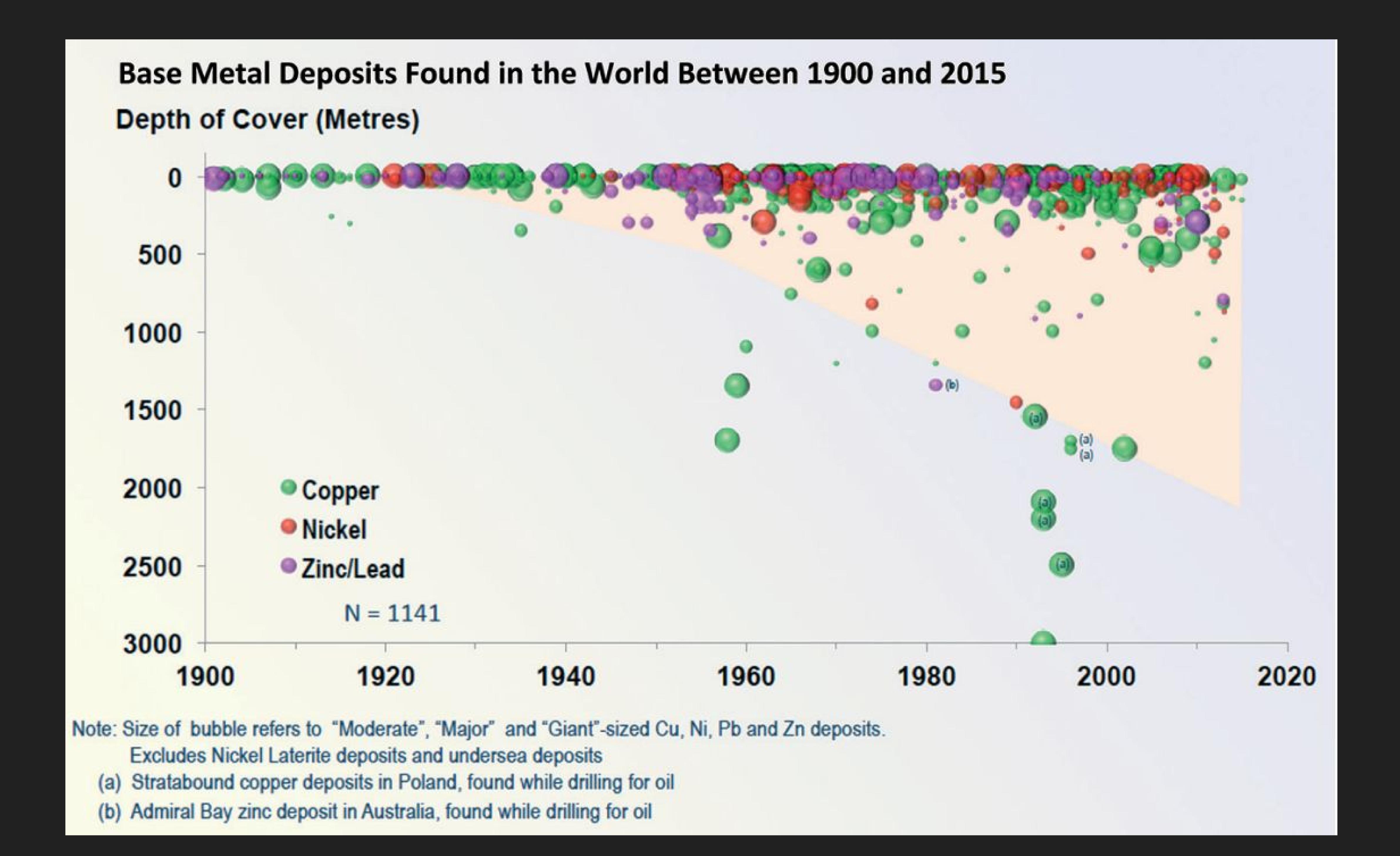


Sources (minerals): US Geological Survey, Adroit Resources, World Bureau of Metal Statistics, International Copper Study Group, World Gold Council, Minormetals.com, Roskill Nicke | Report, Cordell et al (2009), Smil (2000), Silver Institute, World Nuclear Association, International Lead and Zinc Study Group, Source (fossil fuels): BP Statistical Review of World Energy 2010.



Change in world production of base metals and steel since 1960 (from USGS,





Higher prices strengthen the incentive for ...

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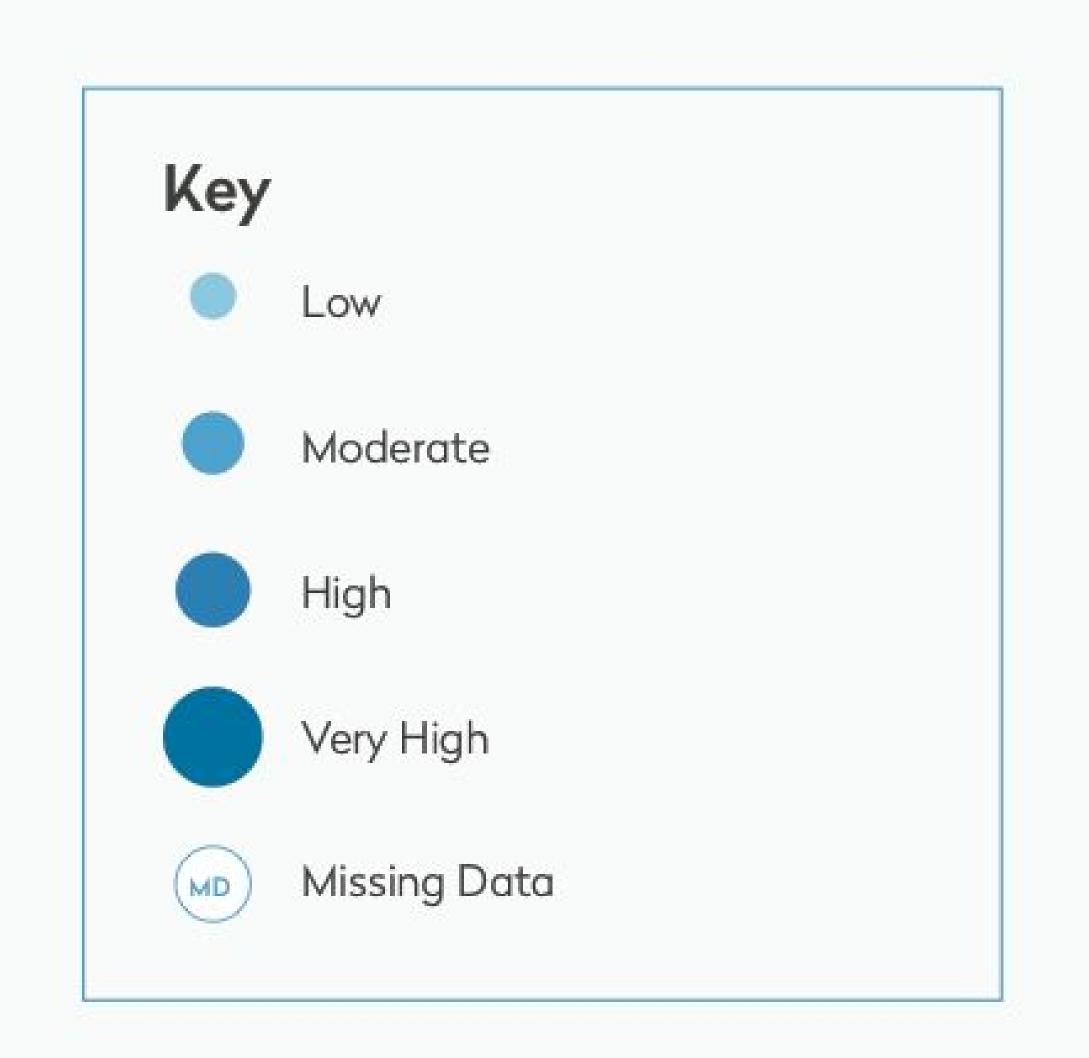
Fine, but substitutes have to EXIST at scale!!!

We are rapidly losing surplus!

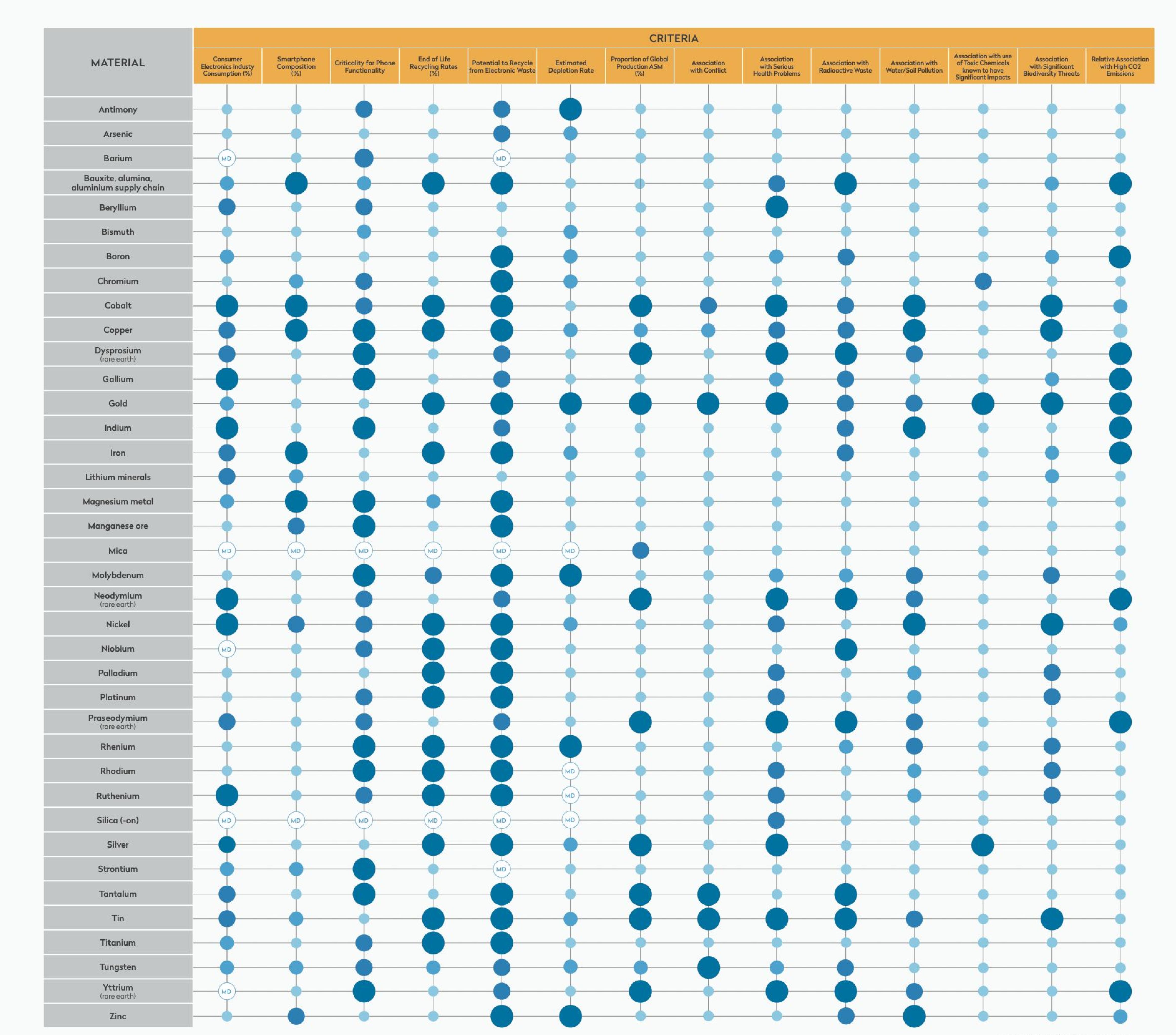
FAIRPHONE

Why should you care about the materials in your phone?

To understand the sustainability and responsibility issues associated with the smartphone supply chain, we collaborated with The Dragonfly Initiative to examine 38 of the materials used in mobile phones. The chart below shows how each material's supply chain scores on selected material, social and environmental aspects. We're using this information to prioritise which supply chains to engage first, and determine where our involvement can deliver the greatest impact.









Updated on 31 January 20

The Real Threat Matrix

Material exhaustion and crash – the threat of using up physical resources

Rising costs – the pressure caused by rising prices and costs of resources

Long-term abundance – the concerns about resource availability are irrational and overblown

Social injustice – distributional challenges and the risks that arise from uneven and unfair access to natural resources

"Nature is the basis of our well-being and our prosperity – but we are using up way too much of the Earth's finite resources. WWF's *Living Planet Report* shows clearly that humanity's demands exceed our planet's capacity to sustain us – simply put, we are asking for more than we have available."

Jim Leape, Director-General, WWF International (2006-2014)

Buffers protect us, but as said before, we are running out of this protection!

Assumptions and arguments

- The biosphere has a finite supply of material resources, but demand for them grows exponentially,
 leading inevitably to unprecedented shortages.
 - Inherent physical and economic needs of life and development mean little room exists to substitute with new types of resources.
 - Development and adoption of new technologies to increase resource supply will be too slow to close the gap between supply and demand.
 - Society cannot simply ignore the exhaustion of resources, as many have an inherent value beyond their commodity price.

"We are sleepwalking towards an avoidable age of crisis. One in seven people on the planet go hungry every day despite the fact that the world is capable of feeding everyone."

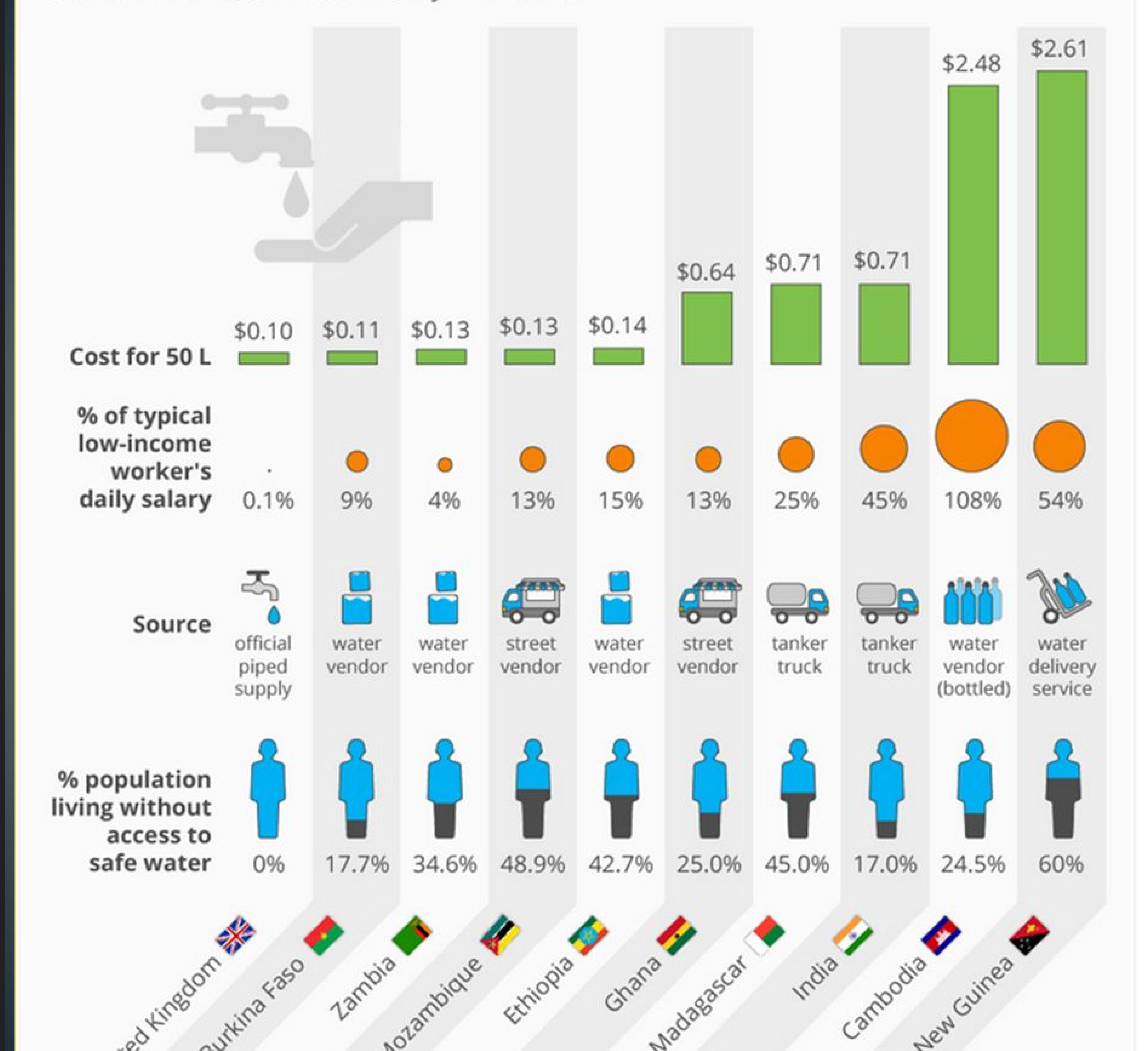
Dame Barbara Stocking, Chief Executive, Oxfam (2001-2013)

Assumption and argume

- Social justice and sustainable development are core ethical issues that markets are unable to address, given their proven inability to distribute goods fairly.
- The costs of negative environmental and social externalities are disproportionately borne by those least able to afford them, which is also deeply unfair.
- As a matter of ethics and values, those lucky enough to control access to resources should invest a significant portion of them to ensure that those deprived of resources are still able to experience their benefits.
- The trend towards a more educated, connected and aware global population will increase the visibility of unfair resource distribution and create pressures towards making it fairer.

The State of the World's Water in 2016

Safe water is a scarce commodity worldwide



THIS IS GLOBAL INEQUITY

Following Trump Victory and Brexit *** 2 improbable things – 8 WEC predictions about the year 2030

- 0 1. All products become services; no one owns anything -> UNLIKELY
- 2. There is a global price on Carbon -> Likely
- 0 3. US dominance is over -> already true
- 0 4. Medical transformed via nano robots and 3D printing of organs; not much need for hospitals ->

- o 5. We are eating much less meat -> Likely
- 0 6. Refugee movement will accelerate and countries need to be prepared for populations on the move -> Definitely
- 07. Traditional "Western" values under attack ->
- O Humans will be on Mars -> maybe





















The Future is obviously Uncertain

O But your generation has to have a different value system and different practices form the past in order to produce a more holistic view of the world that allows for reduced consumption and better partnership with nature

O But those are just words – real action is required!