Introduction à la prise de décision en contexte Anthropocène

Formation transverse

université de BORDEAUX

Sylvain LE BERRE

Chargé de recherche en science politique
à l'INRAE

Étude de cas :

Les industries extractives dans l'Anthropocène :
Décisions et matières premières souterraines

Impacts of mining

Harmful Impacts of Mining

43% of **world gold** production comes from **war zones**

Ecological impacts

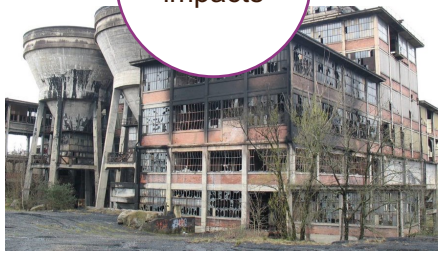
The UN's Global Resources Outlook (2019) estimates that **mining** and processing activities are responsible for **53%** of the **world's carbon emissions** and **20%** of the **health effects** of **air pollution**.

Political impacts

Social impacts

The mining regions structure an **economy** that is **enclosed and focused on the mine**: **when the mine closes, the whole region collapses** economically.

Economic impacts



In **Congo**, 20% of cobalt mines are **artisanal and illegal**.
More than **40,000 children work** in artisanal **cobalt mines in Congo**

Types of harmful impacts identified in the study

The study covers a wide range of mining-related impacts, including, among others, the following types:

- Abuses by security forces
- Air pollution
- Attacks on human and land rights defenders
- Bribery and corruption
- Child labour and forced labour
- Community fatalities and serious injuries
- Community health problems
- Damage to local livelihoods
- Destruction of cultural heritage
- Financial misconduct
- Forced displacement
- Loss of access to water
- Loss of wildlife
- Occupational diseases
- Rape, sexual assault and harassment
- Soil pollution
- Violations of Indigenous Peoples' rights
- Water pollution
- Worker fatalities and serious injuries

Source : Responsible Mining Foundation, Harmful Impacts of Mining Report, 2020

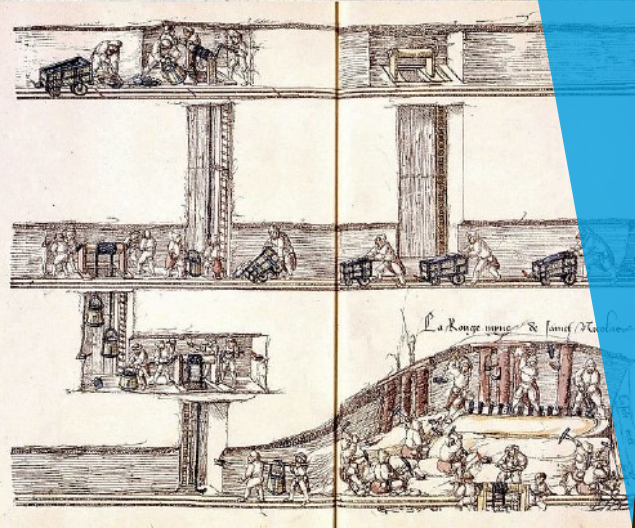
What is the dilemma ?

- **Mining is a key driver for social and ecological predation on the long run**
- **The entire economic and political structure of our contemporary societies that is based on the industrialization of nature and in particular of the subsoil's raw materials**
- **BUT all of our contemporary equipment, networks and infrastructures are made up of subsurface materials: ores, metals, stone, minerals, hydrocarbons...**

✓ **Anthropocene & Decision - Idea 1 : an industry that is both central and destructive**

We cannot do without the extraction of raw materials.
Change is, however, imperative.

= It is not only a question of "greening" an industry but to rethink their place in society and to regulate their production.



Introduction
Extractivism & Capitalism

Extractivism, what's that?

1. An asymmetric (geo)political and economic system

- to the **Western states** the surplus **value of extraction,** to the **colonized states the negative consequences** of extraction.
- Mining enclosures are socially and environmentally sacrificed areas.

2. A domination and commodification of the living and the earth

- The term **'extractivism'** also refers more broadly to an anthropological relationship of **domination, exploitation, commodification of nature** = **all "nature" must be a productive resource**

- **Nature** is only thought of as **a space to be exploited,** to make it **'productive',** following a triple logic:

- **Appropriation / Propertization**
- **Expulsion / Privatization**
- **Production / Commodification**
- **… and destruction**

3. A consubstantial & historical link between State, Extractivism, Capitalism

- **Political economy** associates the emergence of **modern societies, states and capitalism** with the ability of certain actors to **develop subsoil resources** (Malm 2016; Mitchell 2013).
- In the long run of history, the **modern state** has built its **sovereignty** through the appropriation of **mineral and metal resources**
- **Modern capitalism** has been **extractive** from the outset.

4. The speculative dynamic of the markets and the curse of natural resources

- **Extraction** is based on **technical and financial speculation.**
- The extractivist speculation reinforces **geopolitical asymmetries** and the **"natural resource curse".**

✓ **Anthropocene & Decision - Idea 2 : the interdependency between capitalism, State and extractivism**

Extractivism is consubstantial with the structuring of industrial capitalism
Extractivism is consubstantial with the structuring of modern States.

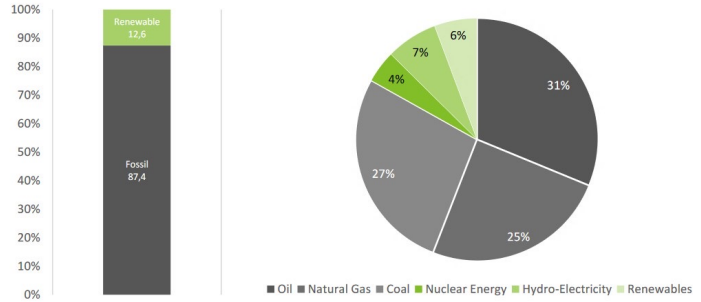
The mainstream solution: Transition & sustainable mining

Digital transition and decarbonization would mean climate mitigation

The "digital revolution" would automatically be eco-friendly

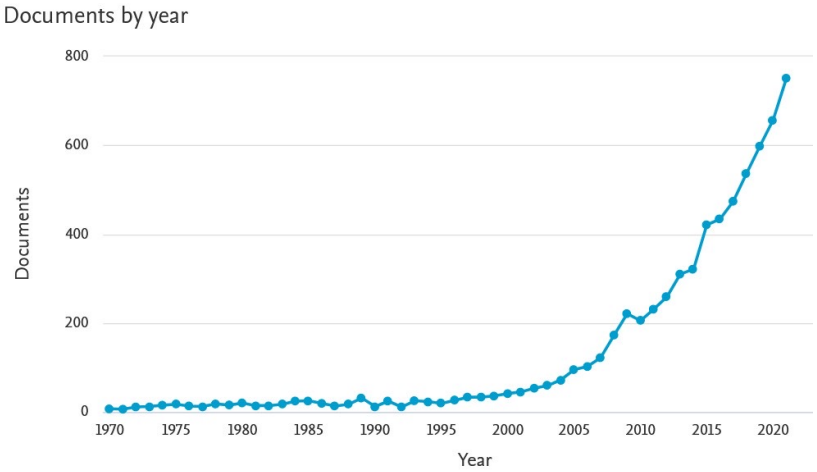
Transition would mean a green capitalism

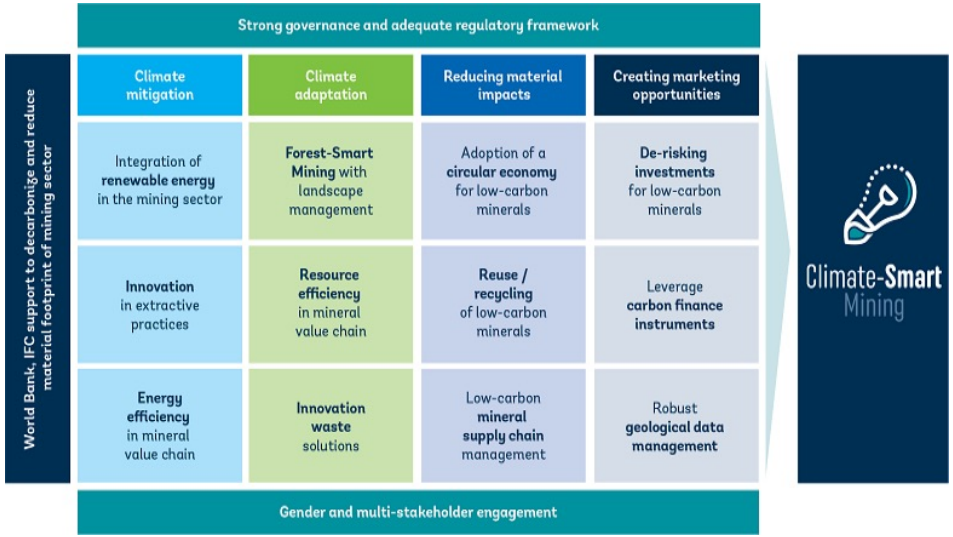
FIGURE 1: WORLD ENERGY CONSUMPTION

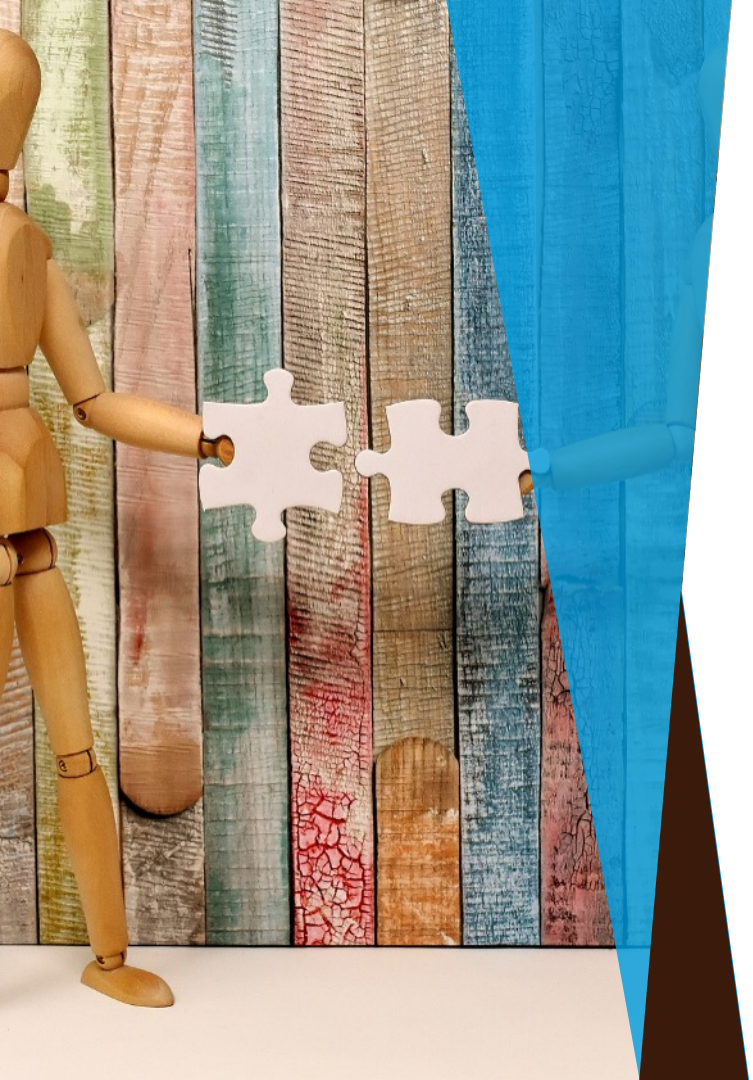


The green & climate-friendly mine

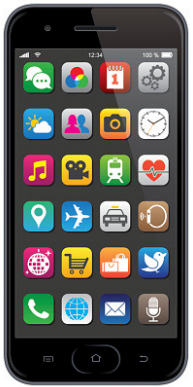
Increasing references to the environment and climate in R&D

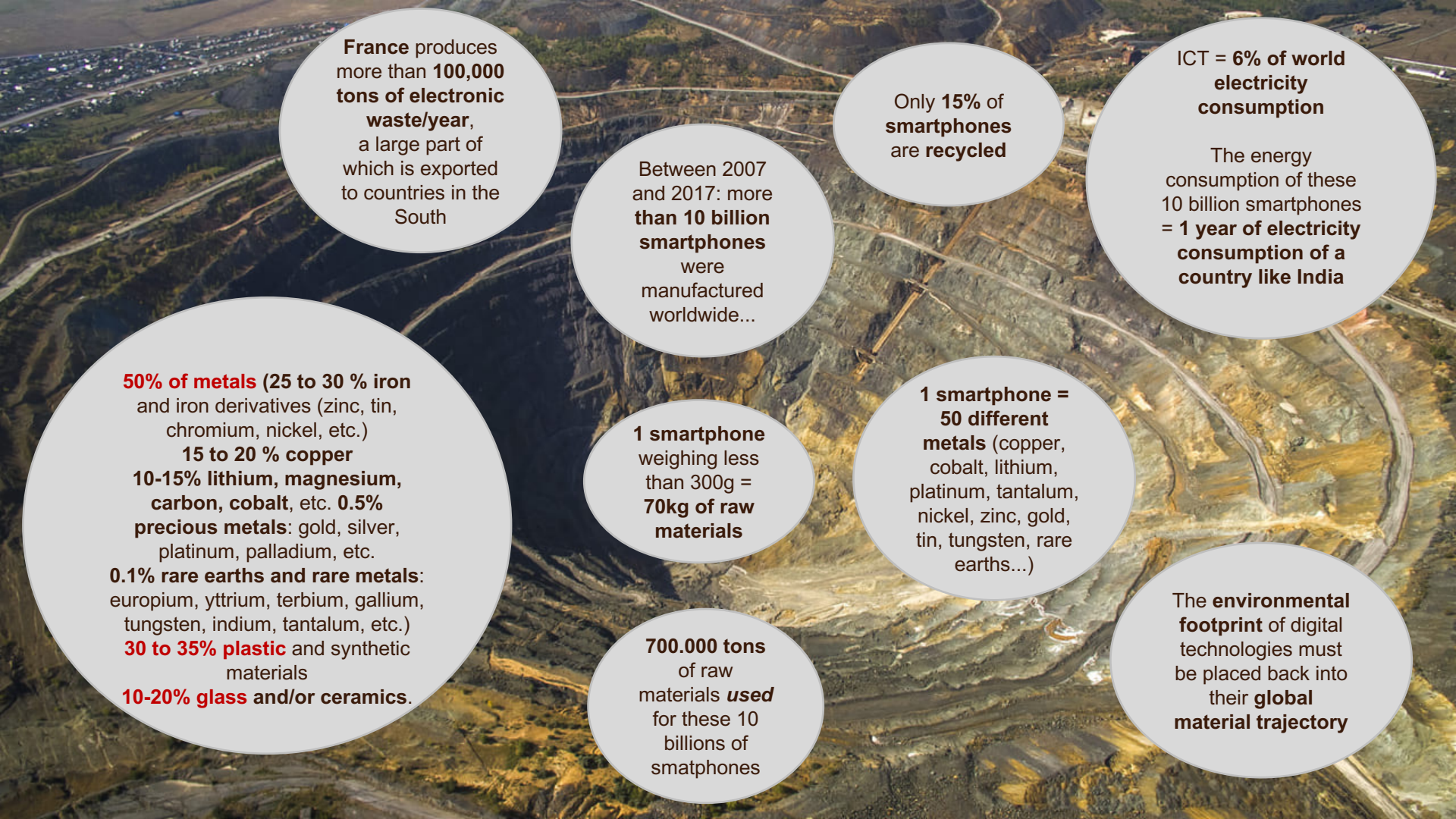






Open discussion – What is a smartphone made of?




France produces more than **100,000 tons of electronic waste/year**, a large part of which is exported to countries in the South
Between 2007 and 2017: more **than 10 billion smartphones** were manufactured worldwide...
Only **15%** of **smartphones** are **recycled**
ICT = **6% of world electricity consumption**
The energy consumption of these 10 billion smartphones = **1 year of electricity consumption of a country like India**
50% of metals (**25 to 30 % iron** and iron derivatives (zinc, tin, chromium, nickel, etc.)
15 to 20 % copper
10-15% lithium, magnesium, carbon, cobalt, etc. **0.5% precious metals**: gold, silver, platinum, palladium, etc.
0.1% rare earths and rare metals: europium, yttrium, terbium, gallium, tungsten, indium, tantalum, etc.)
30 to 35% plastic and synthetic materials
10-20% glass and/or ceramics.
1 smartphone weighing less than 300g = **70kg of raw materials**
1 smartphone = 50 different metals (copper, cobalt, lithium, platinum, tantalum, nickel, zinc, gold, tin, tungsten, rare earths...)
700.000 tons of raw materials ***used*** for these 10 billions of smatphones
The **environmental footprint** of digital technologies must be placed back into their **global material trajectory**

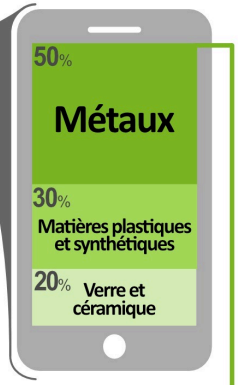
Focus

Poids moyen des matières nécessaires pour un smartphone

= 120 g Poids moyen d'un smartphone

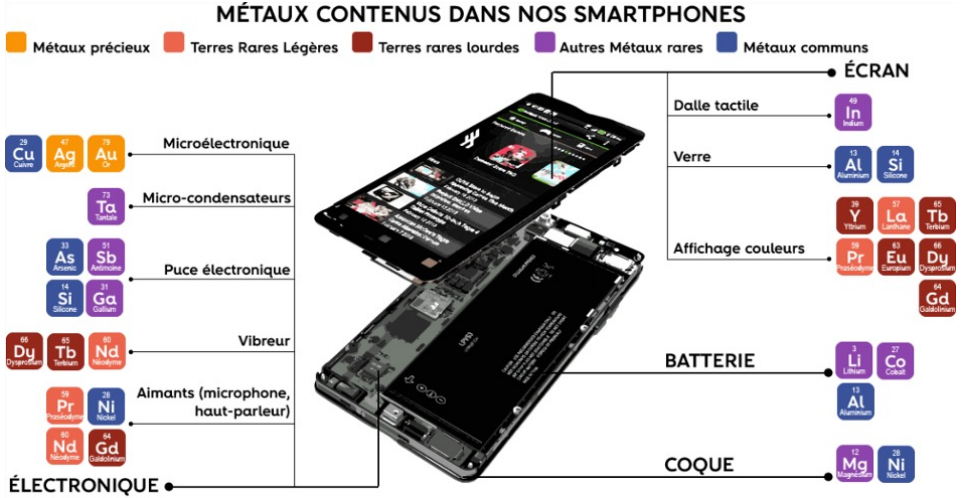
70 kg dont **2/3** environ pour l'extraction des matières premières

Composition d'un smartphone

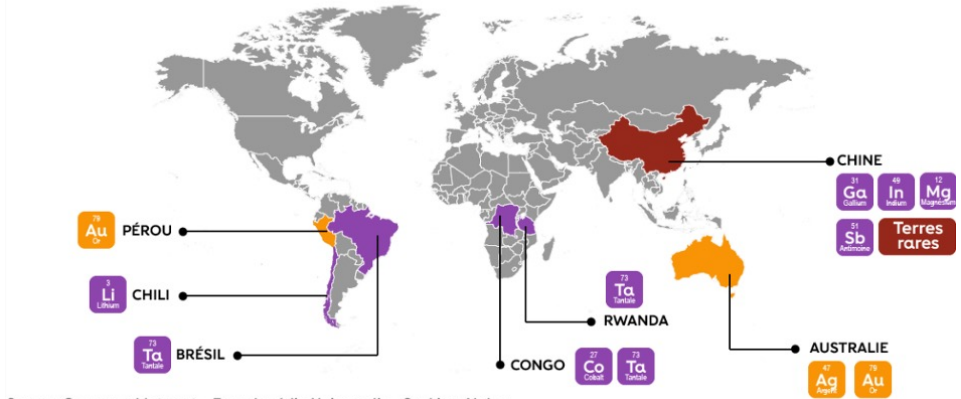


Cuivre
Fer
Aluminium
Cobalt
Étain
Zinc
Nickel
Lithium
Manganèse
Chrome
Argent
Baryum
Titane
Zirconium
Palladium
Or
Bismuth
Praséodyme
Néodyme
Magnésium
Antimoine
Strontium
Indium
Platine
Tantale
Bore
Tungstène
Europium
Terbium
Gallium
Yttrium
...

MÉTAUX CONTENUS DANS NOS SMARTPHONES



ORIGINE GÉOGRAPHIQUE DES COMPOSANTS



Source: Compound Interest - Encyclopédie Universalis - Seeking Alpha

Gold’s Footprint

- In 2017, a total of 3,300 tons of gold were produced globally.

- Gold, 1 ounce of gold (28 grams) = 100 tons of extracted materials

- 1 gram of refined gold is on average :
  - 2 grams of mercury
  - 2 grams of cyanide
  - 2500 liters of water
  - 5 liters of gazoil
  - 75 kg of CO_2
  - 1Kg of Sulphur
  - 1 ton of mining waste

- About 43% of production comes from war-torn countries

Lithium & Cobalt

It is widely used in electric batteries, known as lithium-ion batteries.

However, the extraction of lithium is one of the most water-consuming in regions where access to water can be a major issue, such as Australia, Chile, Argentina, Bolivia, Tibet and Afghanistan.

The extraction and processing of lithium is responsible for significant pollution of soil and water reserves.

Toxic chemicals such as hydrochloric acid can escape from evaporation ponds into the water supply: Research on lithium ecotoxicity in Nevada has found impacts on fish up to 240 km downstream of a lithium processing operation.

Historically used for medical imaging, radiotherapy and jewellery, the "blue metal" is an essential component for the lithium-ion batteries, which are used in the majority of mobile phones, electric cars, but also bicycles and electric scooters.

1 electric car = 5 to 9 kg of cobalt

1 computer = 30 g of cobalt

1 smartphone = 5 to 10 g of cobalt

About 136,000 tons produced in 2019.
Forecast 220,000 tons in 2030

Approximately 40,000 children (Unicef report, 2012) are reportedly working in Congolese cobalt mines.

The material footprint of the green economy

Dematerialization technologies actually have a considerable material cost throughout the value and commodity chain:

- **from extraction,**
- **to production,**
- **to consumption,**
- **to waste**

The mainstream Transition means Extractivism

Example of Rare earth elements :

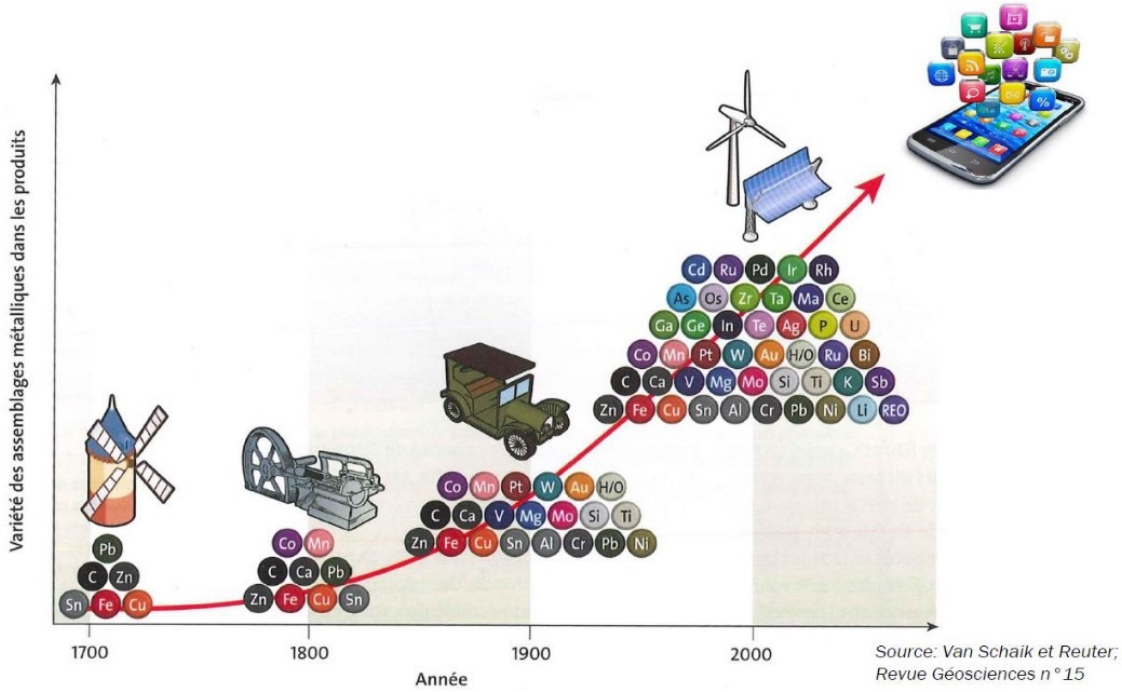
- **Our use has increased by 2.7% per year since 1970** (= a twofold increase every 20 years). **The estimated growth in our demand for rare earths is +6%/year** (+700%/year for dysprosium and +2500%/year for neodymium).

- **The boom of the green economy is expected to increase demand for metals tenfold by 2050. At this rate,** it is estimated that **in one human generation we will consume as much rare earth as the previous 2500 generations.** In other words, we will consume more in the next 30 years than in 70,000 past years.

- So much so that **the World Bank estimates** that **the green economy** (based on solar energy, wind turbines and batteries), which are supposed to decarbonize our energies, **could in fact consume "significantly more resources than traditional systems based on fossil fuels"** (World Bank Group report, 2020)

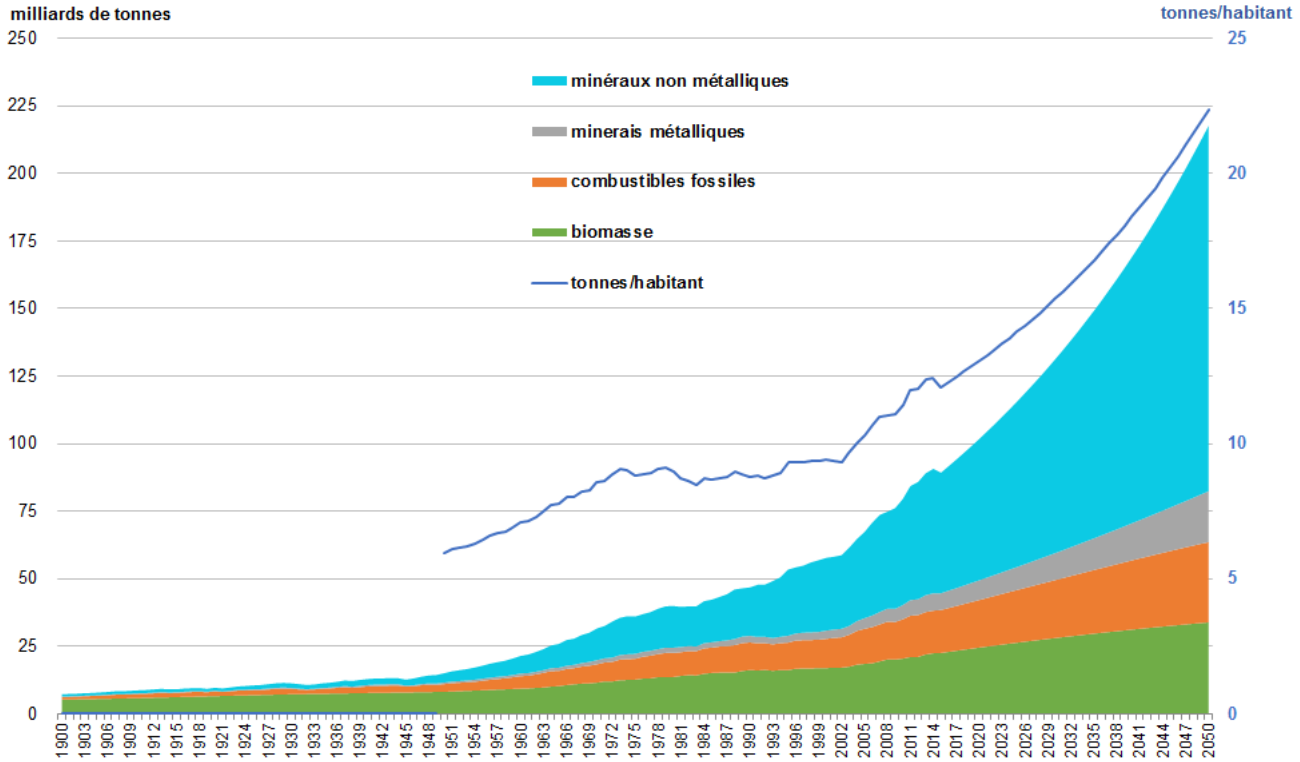
Innovation means extraction

Figure 1 – Illustration de l'augmentation du nombre de métaux utilisés selon l'évolution technologique



Source : Van Schaik et Reuter, revue Géosciences, *n° 15*

The myth of energy transition: they are rather successive accumulations



✓ Anthropocene & Decision - Idea 3 : The materiality of Transition

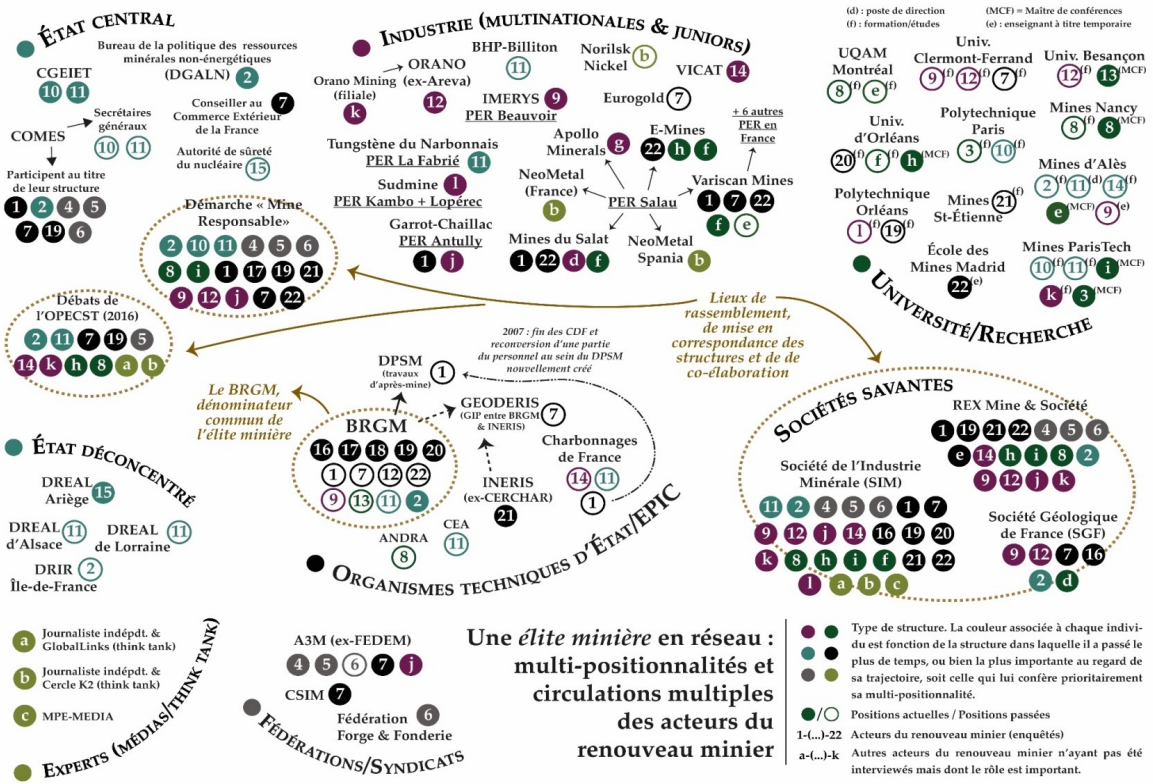
It is necessary to pay greater attention to the irreducible materiality of 'decarbonization' and 'digitalization' of our economy.

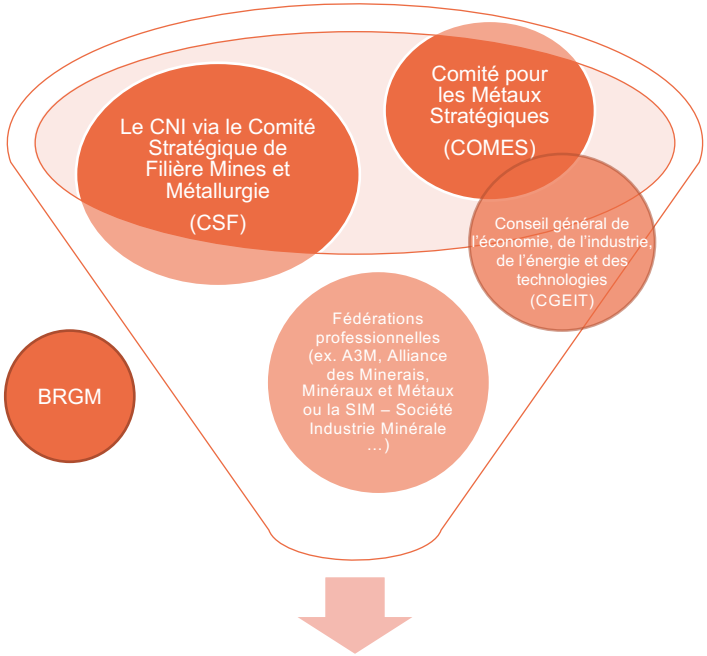
The Energy Transition is not an Ecological Transition
The Digitalization is not a Dematerialization

- **Decision-making in the Anthropocene should better consider the materiality of the economic and industrial choices**
- **Decision-making in the Anthropocene about raw materials priorities should take into account the scarcity of resources and the ecological vulnerability induced by their production**

The policy-making process for mining in France

L'élite minière (source: Pauline Massé, 2022)





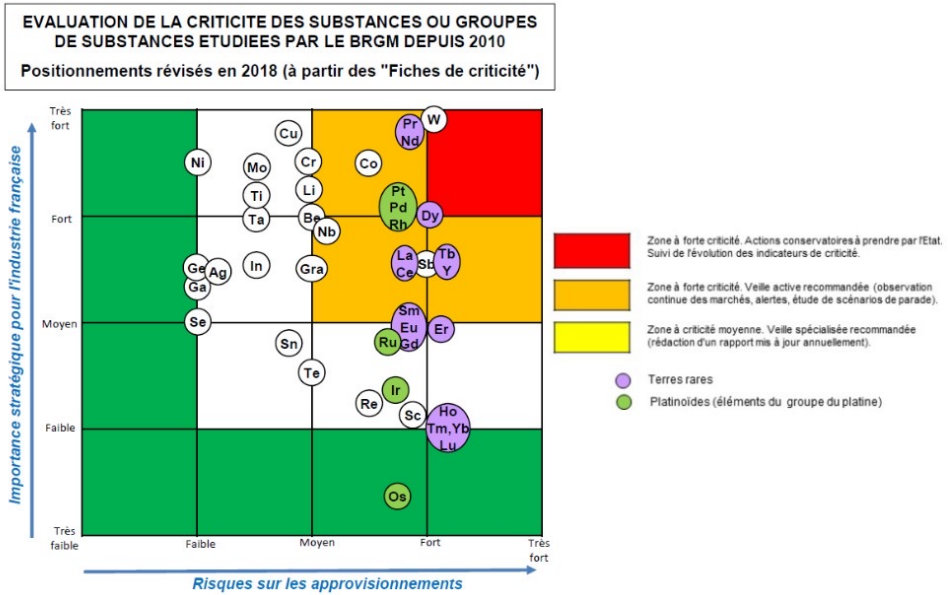
Vision stratégique

The mission of **COMES** is to assist the Minister of Economy (in charge of mining) in the formulation and implementation of **strategic metals policy**, with a view to strengthening the **security of supply** necessary for the **competitiveness** of the economy.

The **National Industry Council** (CNI) is a major tool in France's industrial strategy. It advises the public authorities on the challenges facing industry in France. The CNI is made up of 19 **Strategic sector committees (CSF)**, including the **Mines & Metallurgy CSF**.

The objective of a CSF is to establish a regular dialogue between the State, companies and employee representatives on all the key issues of French industrial sectors.
A CSF draws up a "**Contrat de Filière**" which lists the structuring projects for the sector, based on priority areas (ecological transition, innovation and digitalization, sovereignty and competitiveness, development of skills and the attractiveness of the industry) + a Roadmap for the sectors concerned (e.g. the "**Feuille de Route**" decarbonization for the Mines & Metallurgy CSF, in 2022).

Standard methodology on resource criticity

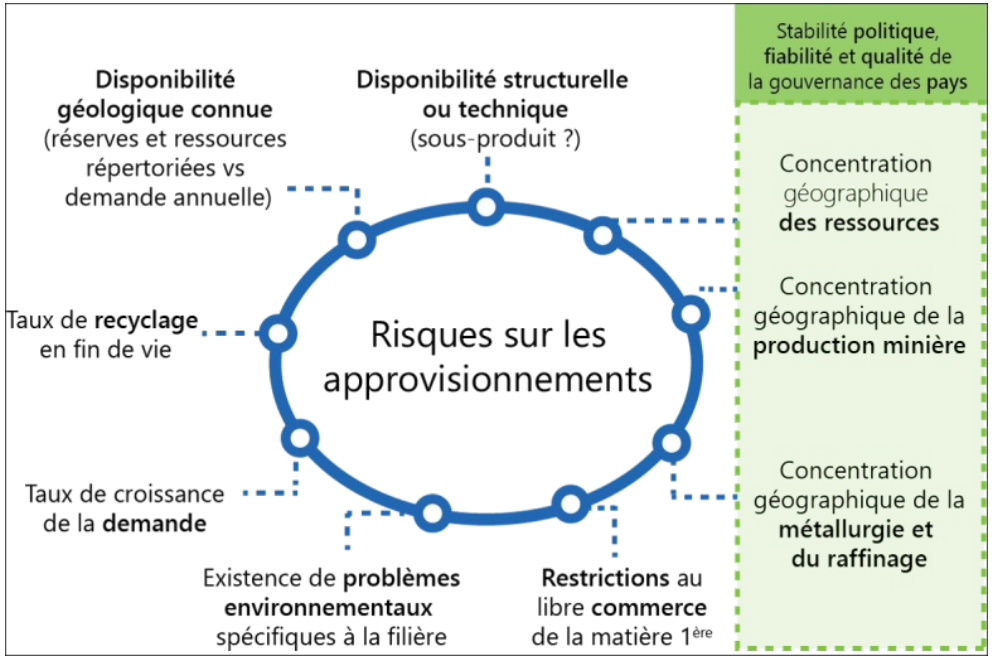


The criticity of a mineral substance is classically assessed along two axes:

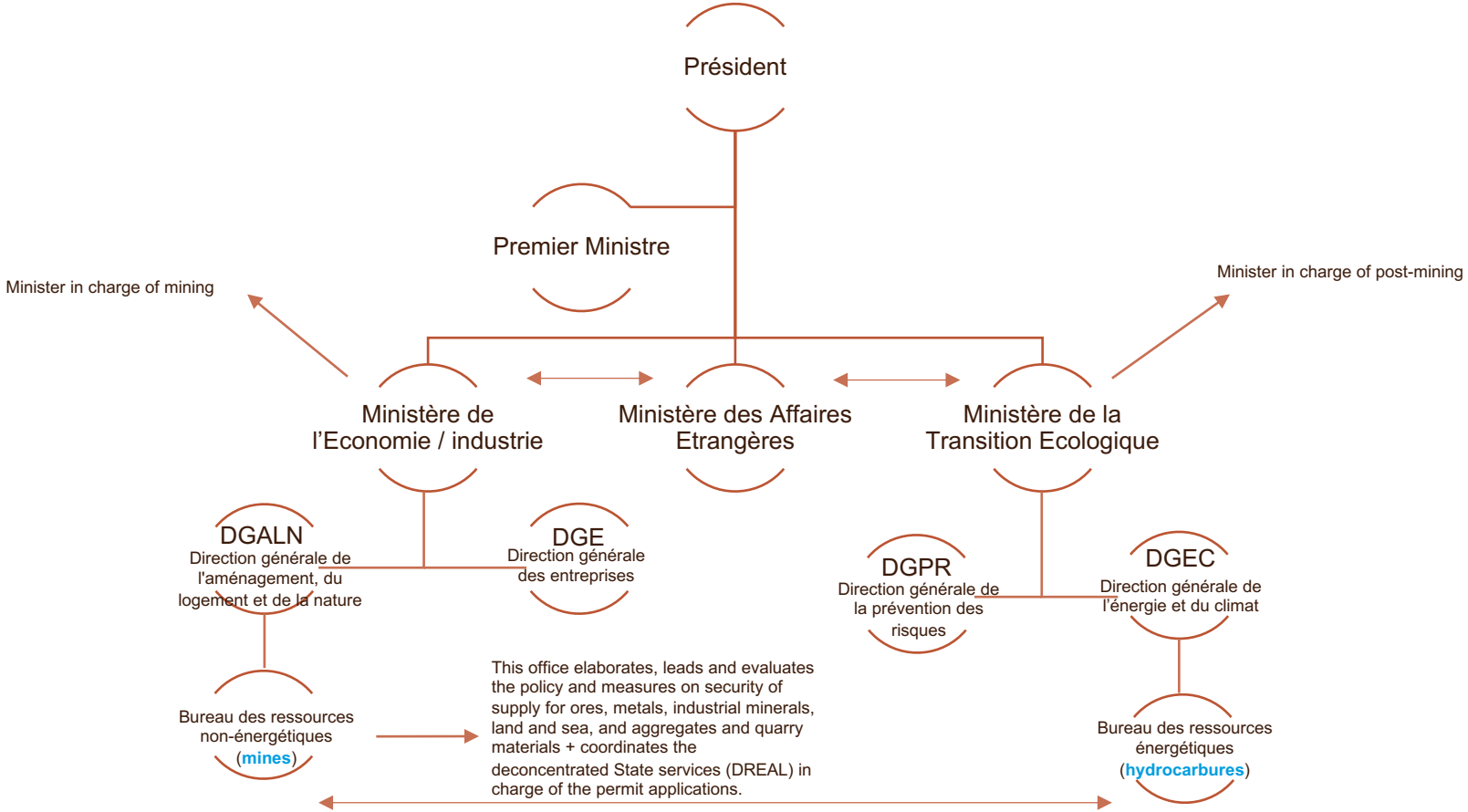
1. **Supply Risk** (SR): what are the risks to the sustainability and sufficiency of supplies?

2. **Economic Importance** (EI), reflecting the vulnerability of the economy to a possible shortage of supply - which would result in a surge in prices - or even a disruption in supply.

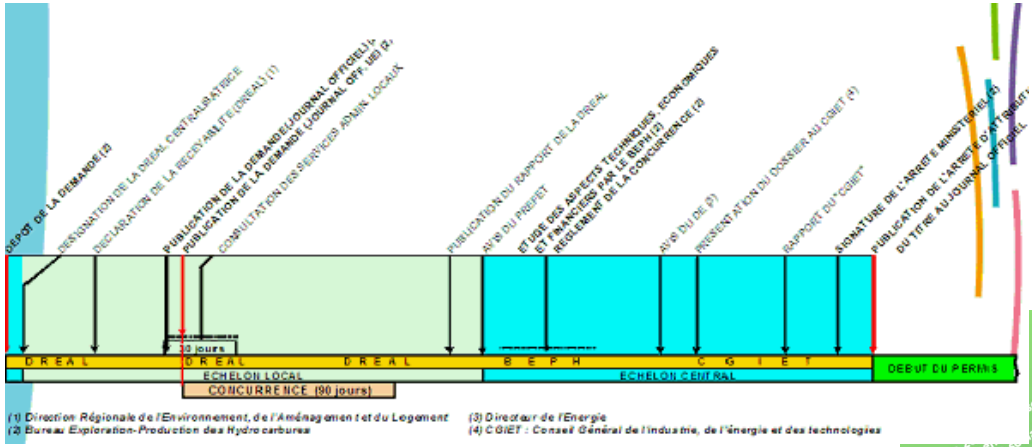
Additional methodology on resource criticity



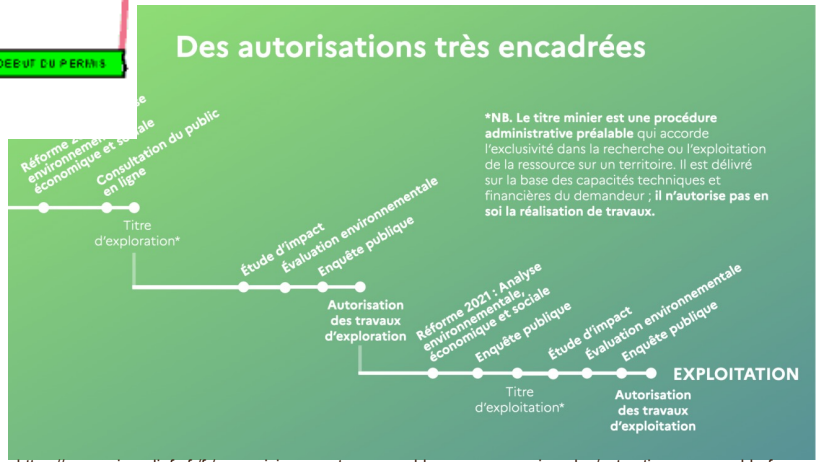
Source: BRGM


Président
Premier Ministre
Minister in charge of mining
Minister in charge of post-mining
Ministère de l'Economie / industrie
Ministère des Affaires Etrangères
Ministère de la Transition Ecologique
DGALN
Direction générale de l'aménagement, du logement et de la nature
DGE
Direction générale des entreprises
DGPR
Direction générale de la prévention des risques
DGEC
Direction générale de l'énergie et du climat
Bureau des ressources non-énergétiques (mines)
This office elaborates, leads and evaluates the policy and measures on security of supply for ores, metals, industrial minerals, land and sea, and aggregates and quarry materials + coordinates the deconcentrated State services (DREAL) in charge of the permit applications.
Bureau des ressources énergétiques (hydrocarbures)

The decision-making process for subsurface permits in France



(1) Direction Régionale de l'Environnement, de l'Aménagement et du Logement
(2) Bureau Exploration-Production des Hydrocarbures
(3) Directeur de l'Energie
(4) CGIET : Conseil Général de l'Industrie, de l'énergie et des technologies



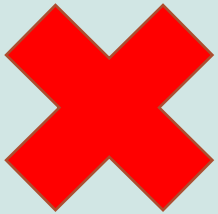
https://www.mineralinfo.fr/fr/approvisionement-responsable-ressources-minerales/extraction-responsable-france

What guidelines for decision-making regarding subsurface raw materials in the Anthropocene?

Potential strategic visions of raw materials industrial policy in the Anthropocene

Business as usual

- **Consumption** :
  support for growth & support for demand
- **Production :**
  Supporting the global extraction + the global production
- **Supply chain :**
  Global supply chains + waste chains



Transition

- **Consumption :**
  decarbonization, digitalization
- **Production :**
  Supporting the extraction of resources needed for "transition"
- **Supply chain :**
  Global supply chains + relocation
- Establish a more ambitious strategic vision on a European scale
- E.g. Sustainable Mining + Climate-Smart Mining

Regulation

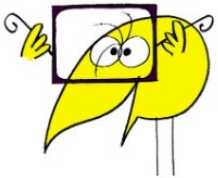
- **Consumption**:
  Moving towards sobriety
- **Production**:
  Regulate the extraction / supply + From obsolescence of products to more sustainability + ambitious circular economy plan
- **Supply chain:**
  Moving towards an Environmental Justice supply strategy + relocation
- weighting the criticity calculation with an increased ecological vulnerability calculation
- E.g. ending the outsourcing of socio-environmental predation, Support supply chains/manufacturers that meet the objectives of being "traceable", "ethical" and "green".

Degrowth

- **Consumption**:
  Moving towards sobriety and degrowth
- **Production** :
  Restricting extraction / supply + restricting access to resources to the most ecological companies + prohibit non-ecological products
- **Supply chain** :
  Implementing quotas + restricting more drastically supplies to green & ethical international partners + relocation
- weighting the criticity calculation with an increased ecological vulnerability calculation
- E.g. policies related to overfishing

Conclusion

Changing glasses & think outside the box



1. Metals, ores and minerals and biodiversity

Metals, ores and minerals are not only in the ground and the subsurface : they are everywhere

Metals, ores and minerals are considered in modern western ontology and epistemology as inert matter : but they are also part of the so-called "living" organisms: vegetation, animals…

2. Industrial capitalism and exploitation of nature

Western thought classically separates nature and culture, living and inert. This is the basis of the great domestication of nature for the industrial production of modern capitalism.

However, the Anthropocene leads us to reconsider this separation in favor of a greater ecological sensitivity and attention to the ecological continuum between nature and culture, human and non-human, living and inert.

✓ **Anthropocene & Decision - Idea 4 : the ecological continuum**

The Anthropocene leads us to **rethink the disconnection between humanity** and the **volumes of nature**

3. Consumer society and materiality

Our Western societies of overproduction and overconsumption systematically make their material part invisible.

Taking the ecological materiality of industry seriously means understanding the inseparability between product and waste, valorization and predation, consumption and pollution.

4. Materiality and predation of nature

Extractivist industrial capitalism is based on the externalization / relocation / invisibilization of the social, material and environmental cost of its predation towards the countries of the Global South.

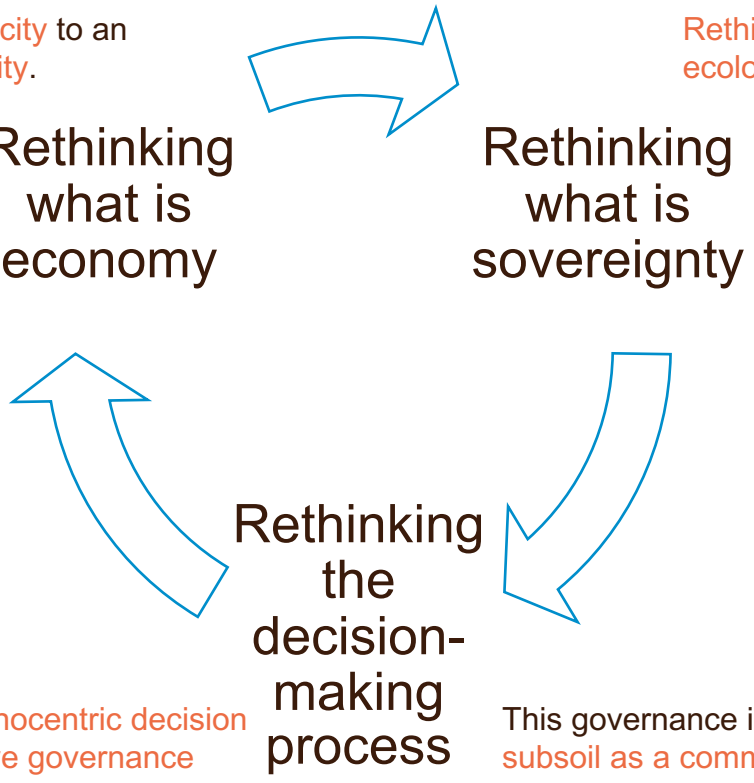
However, the Anthropocene leads us to pay more attention to the ecological materiality of our industries and societies

✓ **Anthropocene & Decision - Idea 5 : the interdependency livability - materiality**

The Anthropocene leads us **to rethink the disconnection between humanity and materiality**, and to consider the **ecological materiality** of our way of life : to take seriously **the interdependencies between human livability and biodiversity**, but also **between human livability and the ecological materiality** of the planet.

Moving from an economy of scarcity to an economy of ecological vulnerability.

Rethinking sovereignty in its ecological vulnerability



Moving from a top down and technocentric decision making process to a more inclusive governance

This governance implies a legal redefinition of the subsoil as a common good

Pour aller plus loin

Consultez la vidéo complémentaire

https://mediapod.u-bordeaux.fr/video/34540-etude-de-cas-4-lenjeu-des-matieres-premieres-du-sous-sol/

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