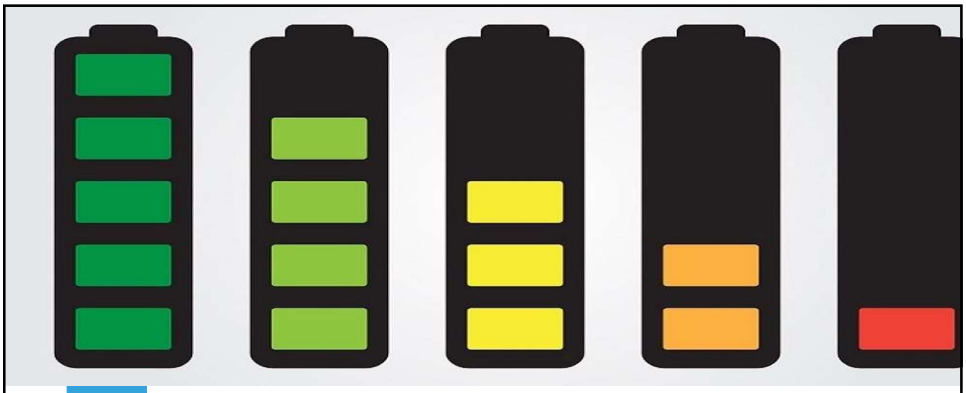

ECODESIGN OF BATTERIES AND FOLLOW-UP FEASIBILITY STUDY – WP 4 SUSTAINABLE SOURCING OF EV BATTERIES

Mette Rames (Viegand Maagøe) -presenting
Mette Rames, Kristian Madsen, Jan Viegand (Viegand Maagøe A/S) – mra@viegandmaagoe.dk
Matthias Pfaff, Denis Stijepic (Fraunhofer ISI)
November 5 2019

AGENDA OF PRESENTATION

- Aim of WP4
- Definition of sustainable sourcing
- Relevant raw materials
- Battery supply chain and risks
- Policy options
- Next steps: Solutions and their impact – data needs
- Discussion and questions

AIM OF WP4

- Identify and assess high risk raw materials used in batteries, with special focus on Cobalt
- Assess the future needs of raw materials
- Investigate if requirements can be set for sustainable sourcing of these materials
- Analyse the feasibility of applying regulatory principles in line with:
  - EU Timber regulation
  - The Conflict Minerals Regulation
  - The OECD Due Diligence Guidelines for Responsible Supply Chains of Minerals from Conflict Affected and High Risk Areas
- Analyse possible costs and benefits of regulatory measures

→ Stakeholder inputs necessary

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TASK 4: DEFINITION OF SUSTAINABLE SOURCING

- Triple bottom line: "Social, Environmental, Economic"
- This ensures to include ethical and legal aspects in the supply chain
- Focus areas for sustainable sourcing of materials for batteries:
  - Global production and share used for batteries, i.e. influence of batteries
  - EU Critical Raw Material index (economic importance and supply risk)
  - Political stability and avoidance of corruption in the supply chain
  - Local and global environmental protection
  - Human health and human rights
  - Working conditions
  - Avoidance of child labour and forced labour

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TASK 4: RELEVANT RAW MATERIALS FOR LI-ION BATTERIES - METHODOLOGY

Long-list of materials, based on BOMs from the preparatory study → Criteria for short-listing materials and data collection → Short-list of materials critical to regulate

RESULTS

- Li
- Ni
- Co
- Mn
- Al
- Fe
- Cu
- P
- C (graphite)

- World production
- End-use
- Forecasts and reserves
- Governance
- Environment, human health and working conditions
- Ciritical raw material rating

- Cobalt
- Lithium
- Nickel
- (Manganese)
- (Graphite)

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TASK 4: RELEVANT RAW MATERIALS AND THEIR SUPPLY CHAIN - DATA

	Lithium, Li*	Nickel, Ni	Manganese, Mn	Cobalt, Co	Graphite, natural, C
Global Annual production (metric ton)	76,000	2,212,000	17,366,000	134,000	1,088,000
EU 2020 demand for EV batteries (metric ton)	5,000	5,000	5,000	5,000	25,000
EU 2030 demand for EV batteries (metric ton)	90,000	210,000	105,000	60,000	550,000
Price (EUR/ton)	9,900€ 11,700€	15,400€	1,800€	32,500€	2,700€
All batteries share % (2019)	56%	6%	2%	49%	8%
EV battery share % (2019)	39%	3%	2%	9%	6%
Battery types	All	NMC, NCA	LMO, NMC	LCO, NMC, NCA	All
Political stability (% unstable sourcing)	9%	74%	70%	81%	97%
EU Economic importance**	2.4	4.8	6.1	5.7	2.9
EU Supply Risk**	1.0	0.3	0.9	1.6	2.9
Critical Raw Material (EU)**	Non-critical	Non-critical	Non-critical	Critical	Critical
CO2-emission (kgCO2/kg)	2 (brine) 27 (hard rock)	5.25-10	6	1.45-10	1-4.4
Environmental risk***	Low	Very high	High	Very high	Low
Working condition risk***	Low	Low	Moderate	Very high	Low
Human health risk***	Low	High	Moderate	Moderate	Moderate

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*Lithiumcarbonate and Lithiumhydroxide
** Based on EU critical raw material index 2017
***Based on evaulations from Drive sustainability report

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TASK 4: SUPPLY CHAIN MAPPING AND RISK IDENTIFICATION (ONGOING)

- For each of the shortlisted materials (Co, Li, Ni) the following is pin-pointed:
  - Step-by-step description of the supply chains
  - The technical processeses in each step
  - Geography of each step
  - When the materials are traded
- Identification of the critical steps of the supply chain:
  - Critical environmental impacts
  - Critical social impacts
  - Critical steps for transparency and traceability
- Has been made so far for Cobalt (in the discussion note)

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TASK 4: RISK IDENTIFICATION

	Cobalt	Lithium	Nickel
Environment	Water pollution Air pollution (dust)	GHG emissions Water depletion	Water pollution/toxic waste Acid rain
Human health	Respiratory disease Birth defects		Respiratory disease
Working conditions	Artisanal mining Child labour Lack of regulation		Lack of regulation Human rights risks

- Nature of risk
- Location of risk and supply chain step

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TASK 4: POLICY OPTIONS UNDER INVESTIGATION

- Identification of possible regulatory measures with inspiration from:
  - Voluntary vs mandatory requirements
  - Due diligence frameworks
  - Certification schemes
  - (see next slide)
- Inspiration from Conflict mineral regulation and voluntary schemes:
  - Due diligence is the prevailing form in all examples
  - OECD Due diligence guidelines as basis.
  - Due diligence performed by the battery manufacturer / importer / representative
  - It requires collaboration with the previous steps in the supply chain
  - Requires transparency of the supply chain and traceability of the materials

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TASK 4: RELEVANT REGULATION, STANDARDS AND VOLUNTARY SCHEMES

- OECD due diligence guidelines
  - Focusing on risk assessment
  - Focus on social aspects and human rights
  - 3rd party audit and annual reports
- Voluntary agreement: Principles on Security and Human Rights
  - International Council on Mining and Metals
- LME rules for listed brands
- Pilot Cobalt Refiner Supply Chain Due Diligence Standard
  - Responsible Minerals Initiative (RMI / CFSI), August 2018
- The Cobalt Industry Responsible Assessment Framework (CIRAF)
  - The cobalt institute
- Car manufacturers: Drive sustainability
  - A trend towards requirements for batteries and their materials
- ISO 14000 series (environmental responsibilities), OHSAS 18001 (Occupational Health and Safety)

- Conflict Minerals Regulation (expected 2021)
  - More or less direct adoption of OECD guidelines into regulation
  - The following metals and their minerals:
    - Tungsten
    - Gold
    - Tin
    - Tantalum
  - Not for final products containing these metals
- EU Timber regulation (995/2010)
  - Also due diligence-based

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TASK 4: POLICY OPTIONS

Policy options not finally defined yet, but considerations made regarding:

- OECD DDG to be used as basis for due diligence requirements
  - Risk based – intensity proportionate to risk, and includes 3rd party audits
  - Some aspects might not be fully covered, for example environmental issues and working conditions are not specifically mentioned as red flags
- Under investigation: include further standards or requirements on this, e.g. ISO 14000 series/ OHSAS 18001 (feasible for SMEs?)
  - Or other ways to increase focus on environment and occupational health.
- "Hard" requirements with specific limit values or the like
  - Could specific criteria be set for what is considered "acceptable" for the raw materials?
  - E.g. environmental criteria, working condition criteria, mining / production management criteria.
- A combination of the above

TASK 4: NEXT STEPS: SOLUTIONS AND THEIR IMPACTS

- Assessment of the impact of the regulatory measures will be the last step of the study
  - Administrative Costs for manufacturers and national authorities
    - Internal costs for due diligence system
    - Costs for 3rd party audits
    - Market surveillance costs
  - Additional costs for end users (car owners)
  - Effect on material prices and supply security
  - Positive effect of avoiding the targeted risks in the supply chain
  - Positive effect of good reputation in the market / cost of bad reputation

SUSTAINABILITY OF BATTERY MATERIALS BECOMES A PUBLIC FOCUS

The high human cost of cobalt mining

Jan 7, 2019 · 0

CNN

Congo, child labour and your electric car

Informal workers produce almost a third of the country's cobalt. Can mining groups address the problem?

Cobalt: the dark side of a clean future

An estimated 35,000 children work in perilous conditions to extract cobalt from the ground in the Democratic Republic of Congo. So what will the impact be on these exploited workers from rapid advances in electric cars, which are heavily reliant on this conflict mineral?

BY JAMES GORDON – JUNE 4, 2019

[13] https://www.ft.com/content/c6909812-9ce4-11e9-9c06-a4640c9feebb
https://www.raconteur.net/business-innovation/cobalt-mining-human-rights
https://www.miningreview.com/top-stories/human-cost-cobalt-mining/

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TASK 4: DISCUSSION

- Inputs from stakeholders imperative for realistic outcome of the analysis
- Any comments or inputs relevant to the subject are welcome
- Questions also given in the end of the discussion note (section 6)

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TASK 4: RELEVANT RAW MATERIALS AND THEIR SUPPLY CHAIN - QUESTIONS

- Inputs regarding the short listed materials?
  - Comments on the materials short-listed in general – should it include manganese and natural graphite?
  - Comments or insights on the data gathered (section 3 of discussion note)
  - How near-future technology development might change the importance of the chosen materials for batteries?
- Inputs regarding the identified risks
  - Will be specified more for each material as the study moves forward, but if anything is missing, we will be happy for inputs
  - How are these risks tackled today, and what is done to mitigate them? (e.g. spraying in open pit mine to prevent dust)

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TASK 4: RELEVANT RAW MATERIALS AND THEIR SUPPLY CHAIN - QUESTIONS

- How many battery suppliers already perform due diligence, in line with the OECD guidelines?
  - For which materials is due diligence performed?
- How many companies already comply with ISO standards, e.g. 14001?
- What are the costs for performing due diligence, or implement a new management standard?
  - Internal / external
  - Material prices

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TASK 4: BACK-UP SLIDES

- Additional slides with further elaboration of data and methods

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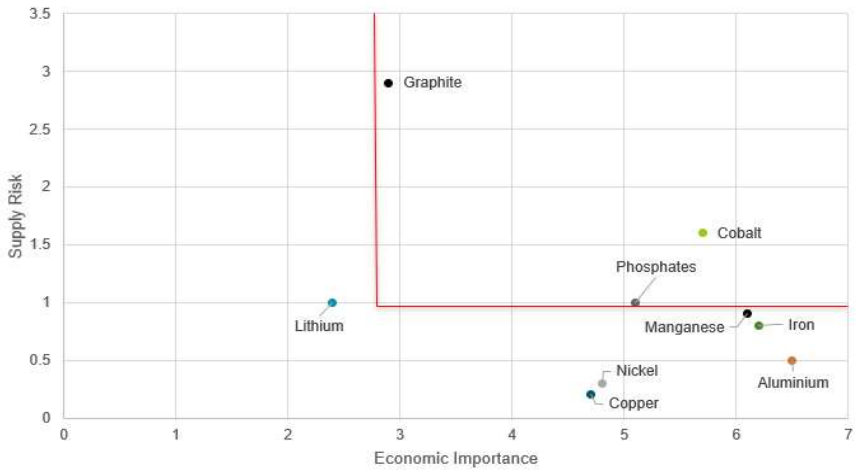
CRITICAL RAW MATERIAL INDEX (2017)



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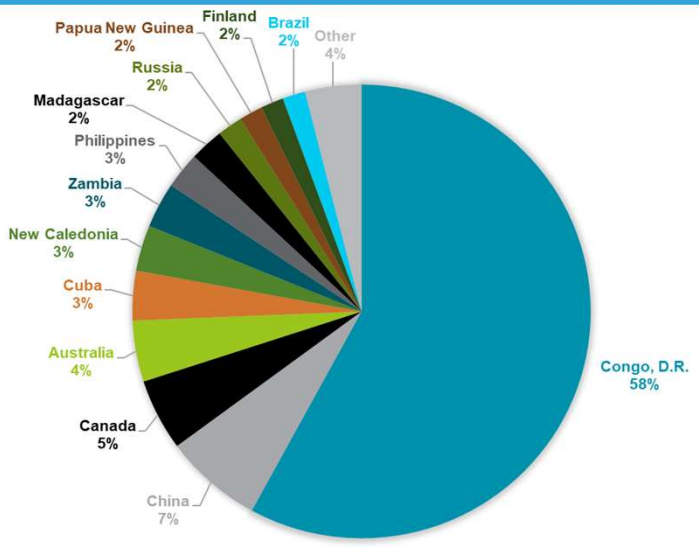
WORLD PRODUCTION OF COBALT



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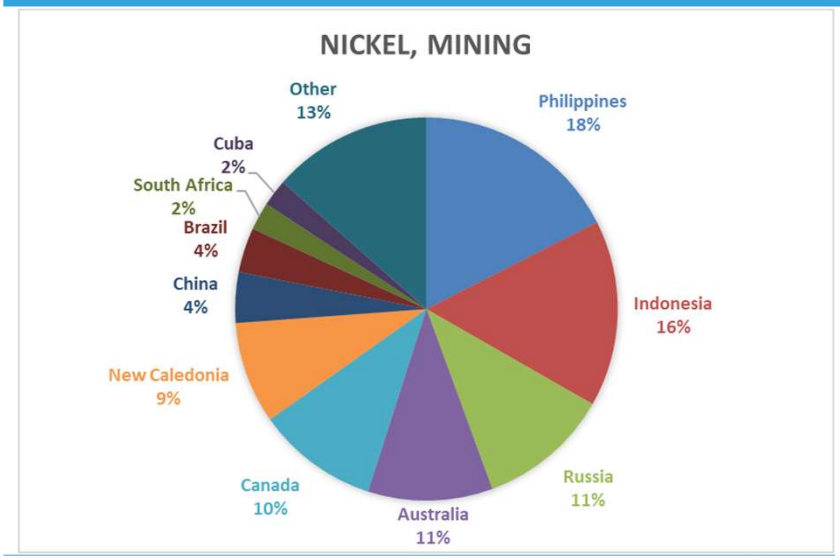
WORLD PRODUCTION OF NICKEL



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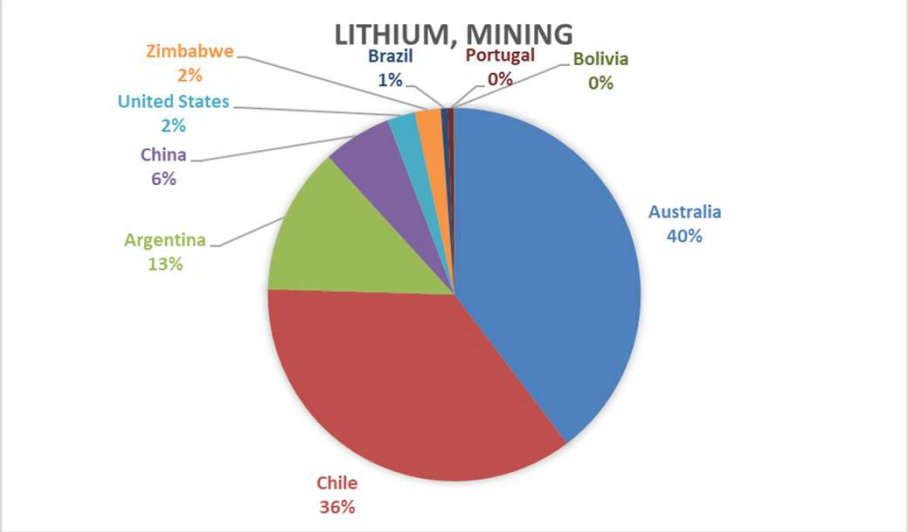
WORLD PRODUCTION OF LITHIUM



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POLITICAL STABILITY

Methodology

- Based on the World Bank governance score between -2.5 and +2.5, on different indicators.
- The indicator used for this assessment is 'Political Stability and Absence of Violence/Terrorism'. The lower the number the more unstable the country.
- Classes of political stability used are: Estimates ≤ -1.25: extremely unstable; ≤ 0 to -1.25: unstable; > 0 to +1.25: fair; ≥ +1.25: stable.
- This assessment only covers the sourcing countries where the metal has been mined – it does not include countries where the metal has been refined or further processed.
- https://info.worldbank.org/governance/wgi/Home/Reports

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ENVIRONMENT, HUMAN HEALTH AND WORKING CONDITIONS

Methodology

- Based on a study on material sourcing produced by Drive Sustainability https://drivesustainability.org/wp-content/uploads/2018/07/Material-Change_VF.pdf

Drive sustainability categories	Our categories
Artisanal and small-scale mining (ASM)	Working conditions
Child labour and forced labour	Working conditions
Incidences of overlap with areas of conservation importance	Environment
Potential of acid discharge to the environment	Environment
Potential for harm from hazardous materials and chemicals	Human Health
Preconditions for radioactive materials in ore/tailings	Human Health

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