



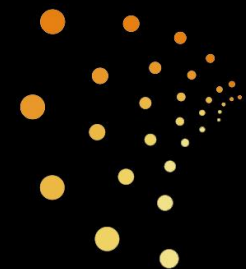
NOT INNOVATED HERE
LABORATORY OF CREATIVE DESTRUCTION

Kriittisten mineraalien saatavuuden varmistaminen myrkyisessä maailmassa

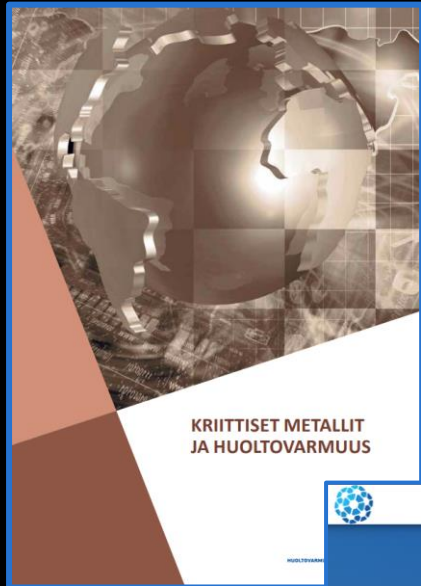
*Keski-Suomen kiertotalousmessut 2024
Jyväskylä 28.8.2024*

KTT Jarkko Vesa, toimitusjohtaja

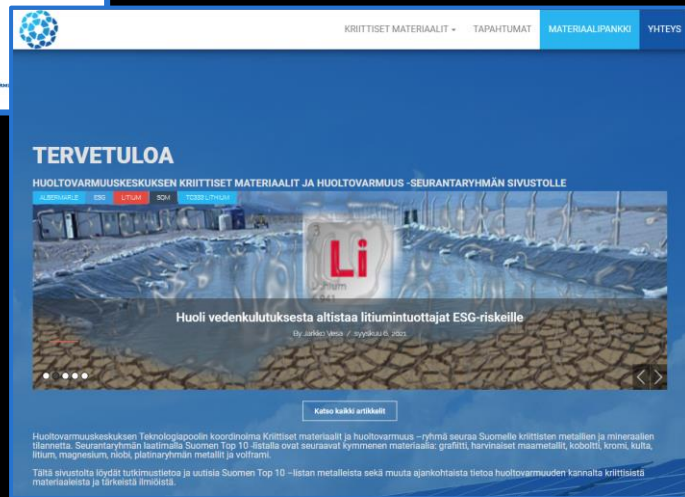
Not Innovated Here – Laboratory of Creative Destruction



Julkaisuja kriittisiin raaka-aineisiin liittyen



HVK 2017

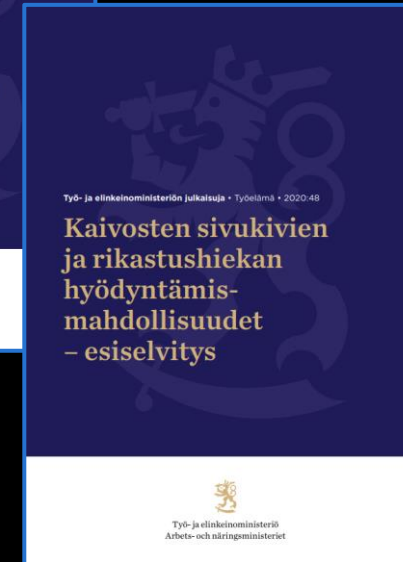


HVK 2018 – 2023 www.kriittisetmateriaalit.fi

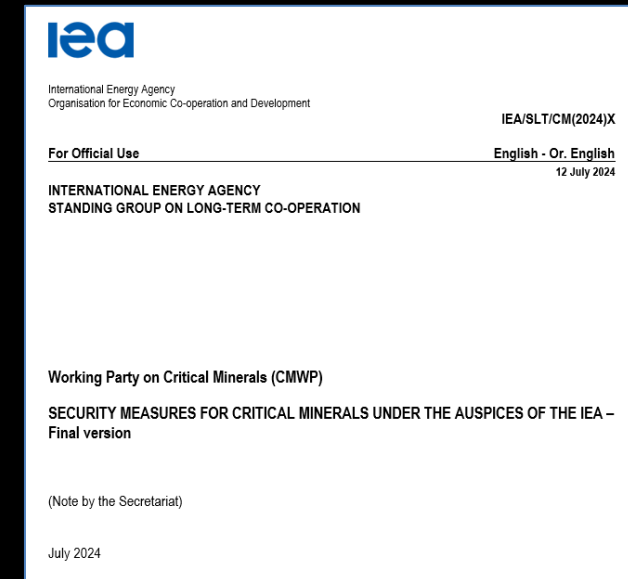
TEM 2021



TEM 2021



IEA 2024



Aiheeseen liittyvät avoimet LinkedIn-ryhmät

Kriittiset materiaalit
Kriittiset metallit ja mineraalit sekä puolijohteet ja elektronikkakomponentit.
Business Consulting and Services · 711 followers · 0-1 employees

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Kriittiset materiaalit
711 followers · 17h ·

Umicore mukaan USA:n energiaministeriön Critical Materials Innovation Hub (CMI Hub): "Umicore is proud to announce its partnership with the U.S. Department of Energy's Critical Materials Innovation Hub (CMI Hub). This collaboration m...see more

Umicore Joins Forces with the Department of Energy's Critical Materials Innovation Hub
umicore.com

Kriittiset materiaalit
711 followers · 2d ·

Antimonin hinta nousussa Kiinan ilmoitettua tällä viikolla ammuksissa käytettävän kriittisen raaka-aineen syyskuussa voimaan tulevista vientirajoituksista. kertoo Bloomberg (tilaajille). #kriittisetmateriaalit #antimoni #ammustuotanto #...see more

Show translation

China Adds Metal Used in Ammo to List of Restricted Exports
bloomberg.com

<https://www.linkedin.com/company/kriittiset-materiaalit/>
> 700 seuraajaa

Akkustrategia 2030

Tervetuloa seuraamaan Suomen akkuarvoketjun tapahtumia sekä akkuihin ja sähköautoihin liittyviä uutisia maailmalta!
Business Consulting and Services · 2K followers · 0-1 employees

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Akkustrategia 2030
1,917 followers · 15m ·

Viime aikoina sattuneiden sähköauto- ja akkutehdaspalojen jälkimainingeissa korealaiset laivarahtiyhtiöt ottavat käyttöön uusia rajoituksia sähköautojen kuljetuksiin. Osa yhtiöistä sallii litiumioniakkujen kuljetukset vain jäädytet...see more

Will HMM continue to transport EVs, batteries by sea?
koreatimes.co.kr

Akkustrategia 2030
1,917 followers · 6d · Edited ·

Kiina Norjan jalanjäljissä. Ladattavien autojen (new energy vehicles, NEV) osuus Kiinassa heinäkuussa myydyistä henkilöautoista nousi yli puoleen, kertoo China Passenger Car Association: "For the first time in China, new energy vehicle...see more

More than half of new cars sold in China are now electric or hybrid
cnbc.com

<https://www.linkedin.com/company/kansallinen-akkustrategia-2025/>
> 1900 seuraajaa

1.
Kriittisten mineraalien
myrskyisät markkinat

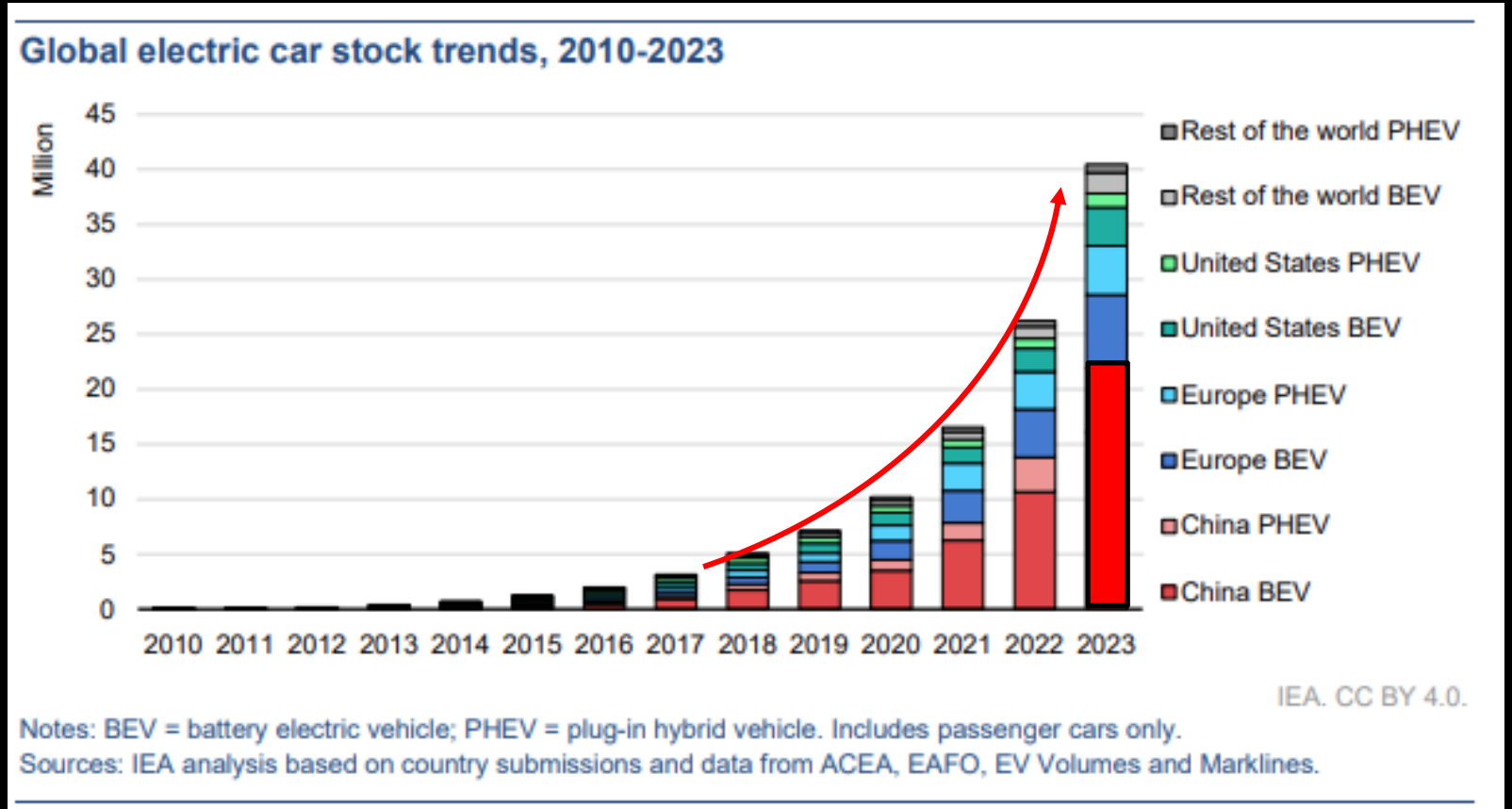
2.
Kierrätyksen ja
kiertotalouden
merkitys

3.
Yhteenveto ja
johtopäätökset



Sähköautomarkkinat mukavassa kasvussa

“In the NZE Scenario, EV sales rise rapidly, with demand for EV batteries up sevenfold by 2030”
IEA Batteries and Secure Energy Transitions report 2024

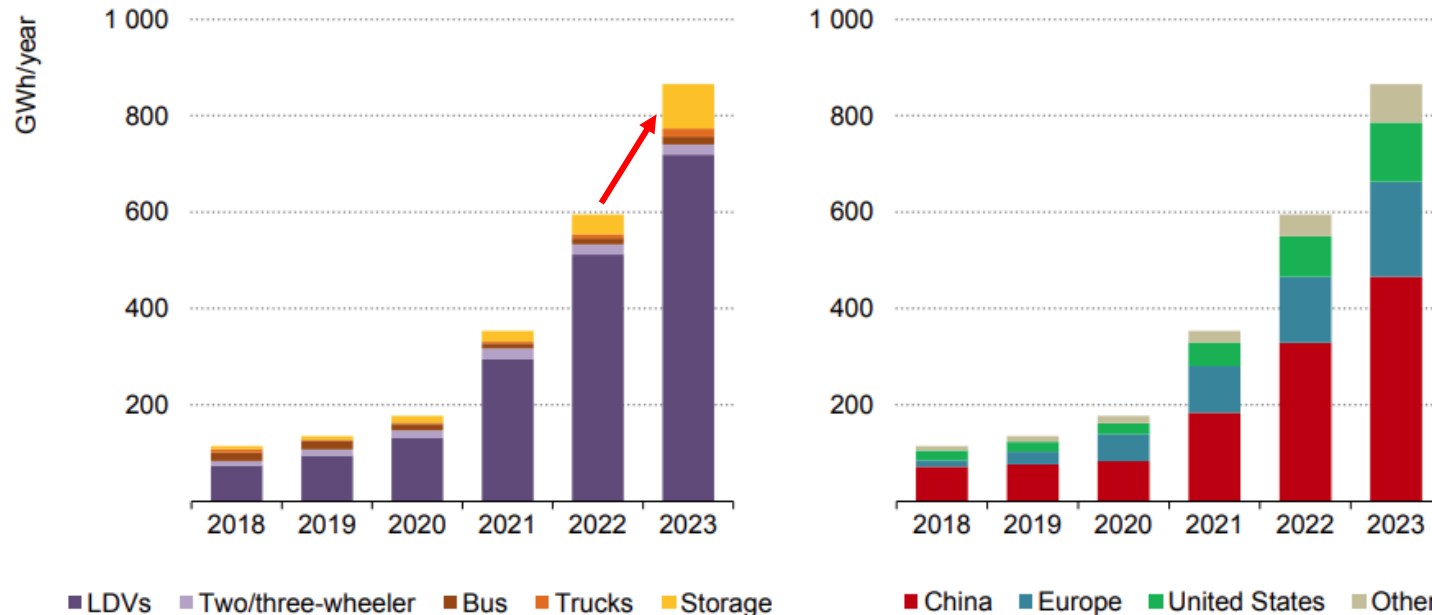


Lähde: IEA Global EV Outlook 2024

Energiavarastojen markkinat kovin kasvaja

Battery demand is dominated by electric cars, although storage is the fastest growing source of demand

EV and storage battery demand by mode and region, 2018-2023



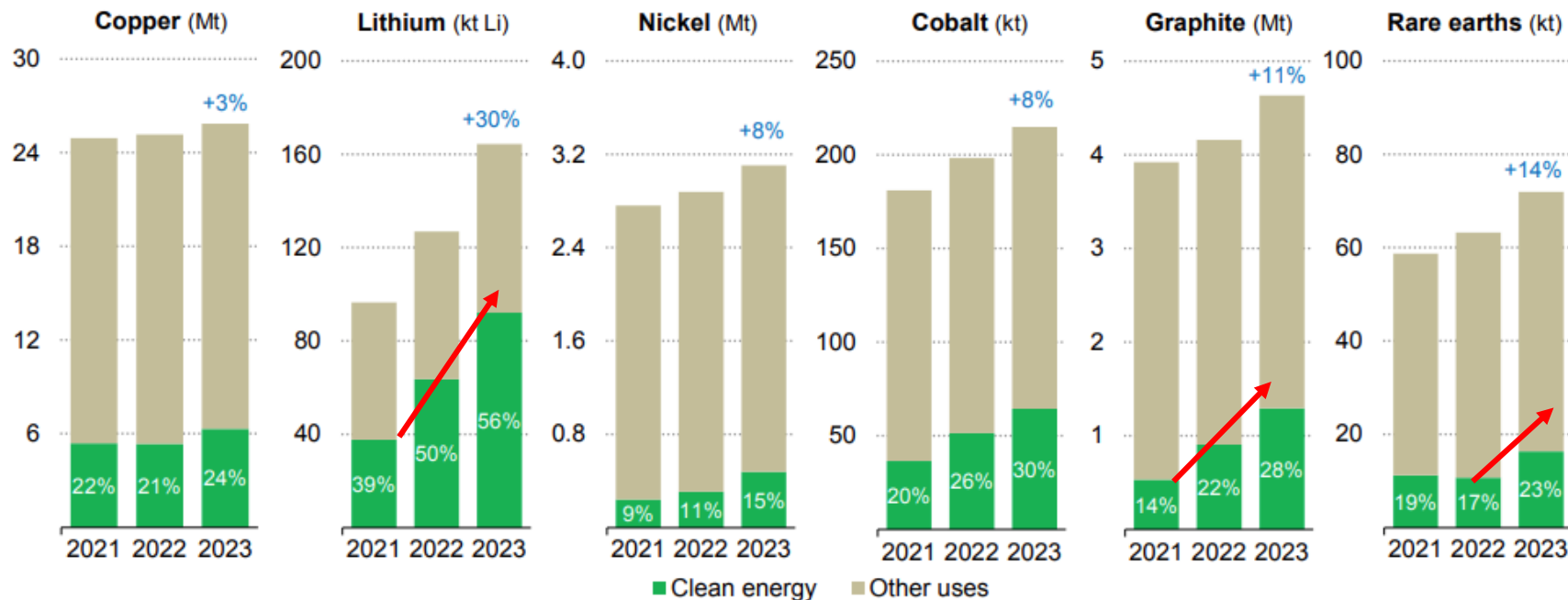
Note: LDVs = light-duty vehicles.
Source: IEA analysis based on EV Volumes.

IEA. CC BY 4.0.

Energiamurros vauhdittaa kysynnän kasvua

Demand for key energy transition minerals continued to grow strongly in 2023, propelled by the expansion of clean energy technologies

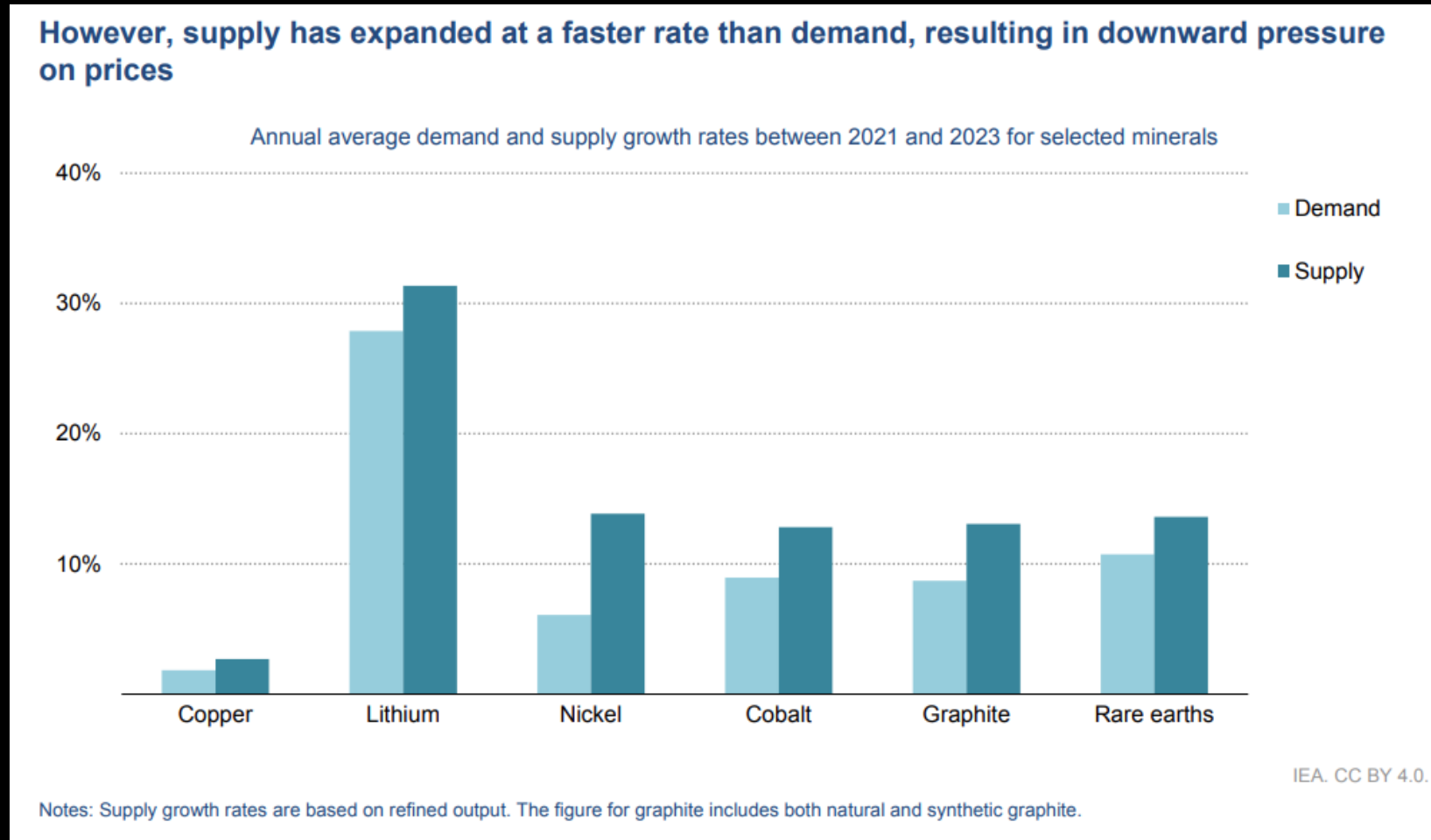
Demand outlook for selected minerals, 2021-2023



IEA. CC BY 4.0.

Lähde: IEA Global Critical Minerals Outlook 2024

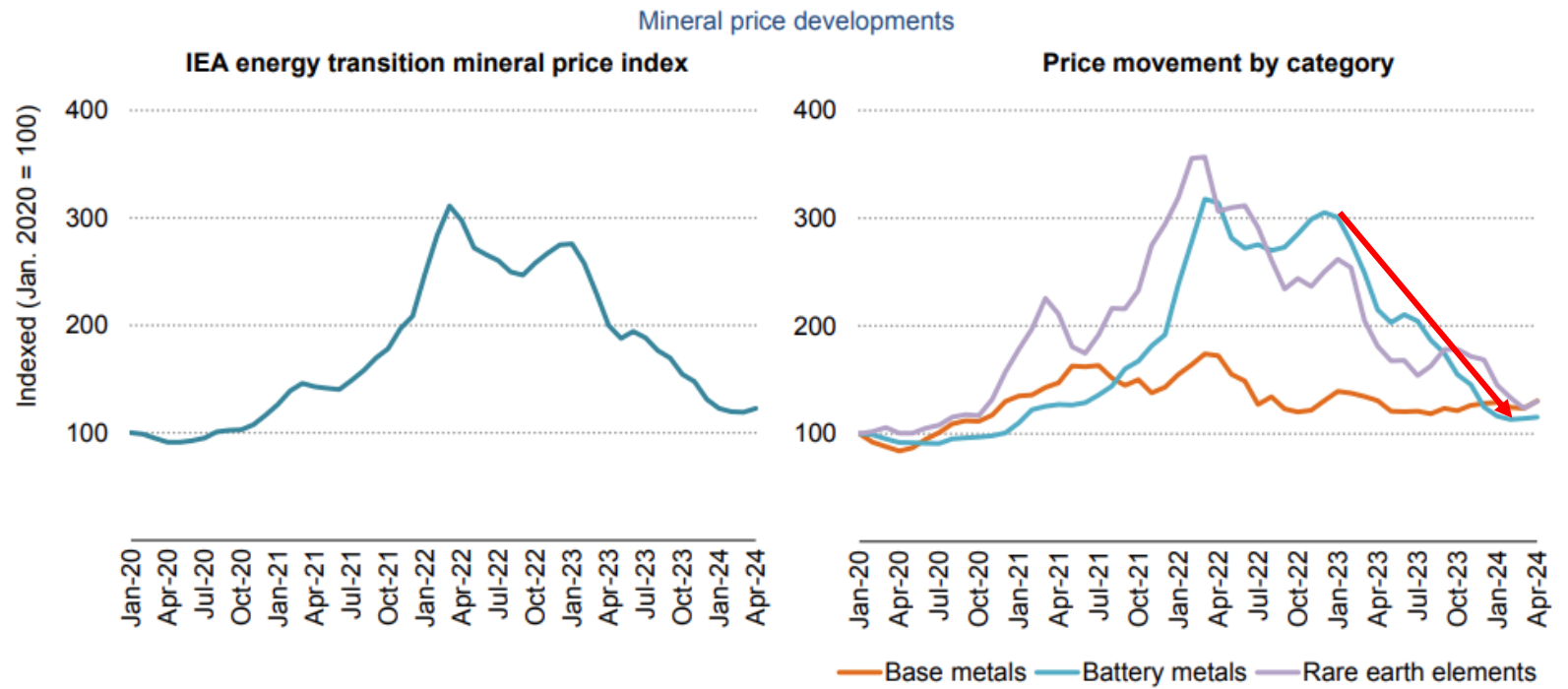
Tuotanto on kasvanut nopeammin kuin kysyntä



Lähde: IEA Global Critical Minerals Outlook 2024

Hinnat ovat palanneet vuoden 2020 tasolle

Prices for key minerals have returned to pre-pandemic levels



IEA. CC BY 4.0.

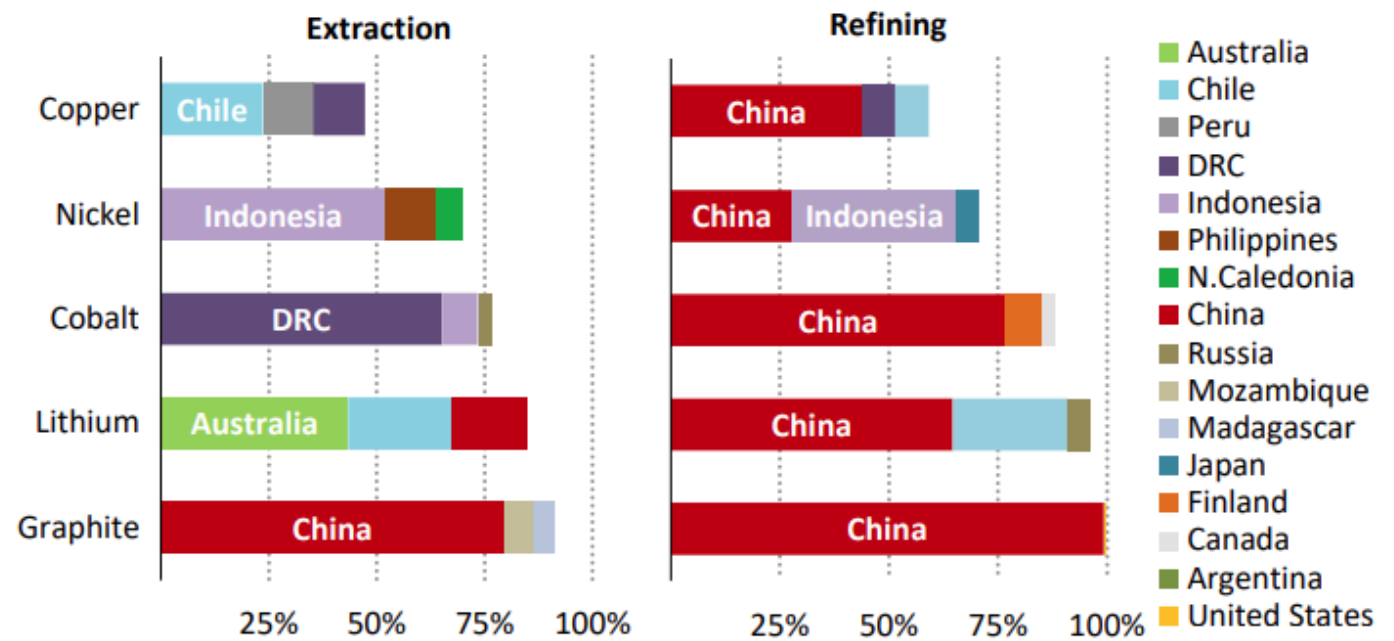
Notes: IEA Energy Transition Minerals price index is a basket price of copper, lithium, nickel, cobalt, graphite, manganese and neodymium. On the right-hand chart, base metals include iron, aluminium, zinc and copper. Battery metals include lithium, nickel, cobalt, graphite and manganese. Rare earth elements include neodymium, praseodymium, dysprosium and terbium.

Sources: IEA analysis based on Bloomberg and S&P Global.

Lähde: IEA Global Critical Minerals Outlook 2024

Kiina dominoi akkumetallien jalostusta

Figure 1.23 ▶ Share of the top-three countries in extraction and refining of critical minerals for batteries in 2023



IEA. CC BY 4.0.

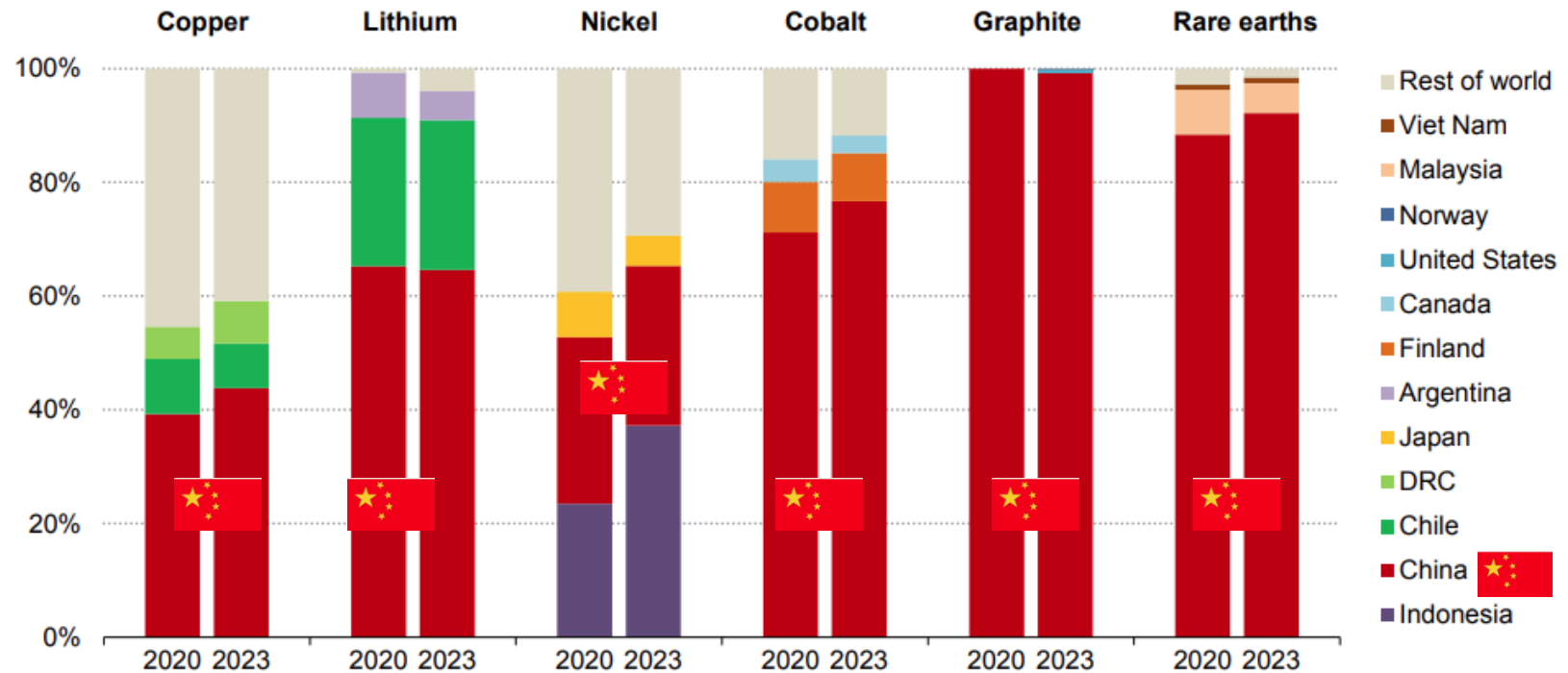
Extraction and refining of the global battery minerals supply chain are highly concentrated in geographical terms

Lähde: IEA Global Batteries and Secure Energy Transitions 2024

Maantieteellinen keskittyminen kasvaa

The level of geographical concentration for refined products has increased in recent years

Share of refined material production by country



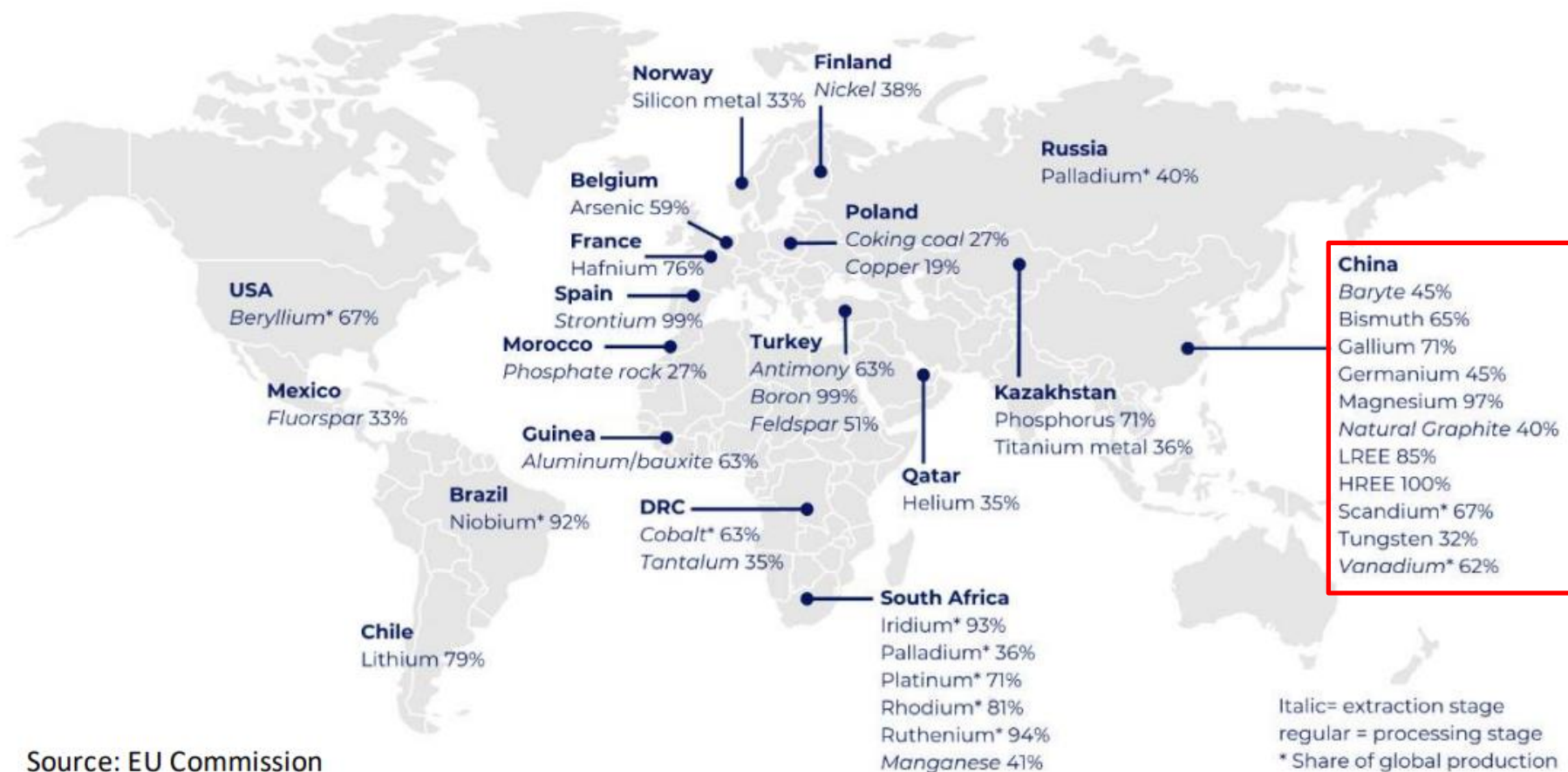
IEA. CC BY 4.0.

Note: Graphite is based on spherical graphite for battery grade. Rare earths are magnet rare earths only.

Lähde: IEA Global Critical Minerals Outlook 2024

EU on vahvasti mineraalien tuonnin varassa

Figure 1: Countries the EU imports critical raw materials from (2020)

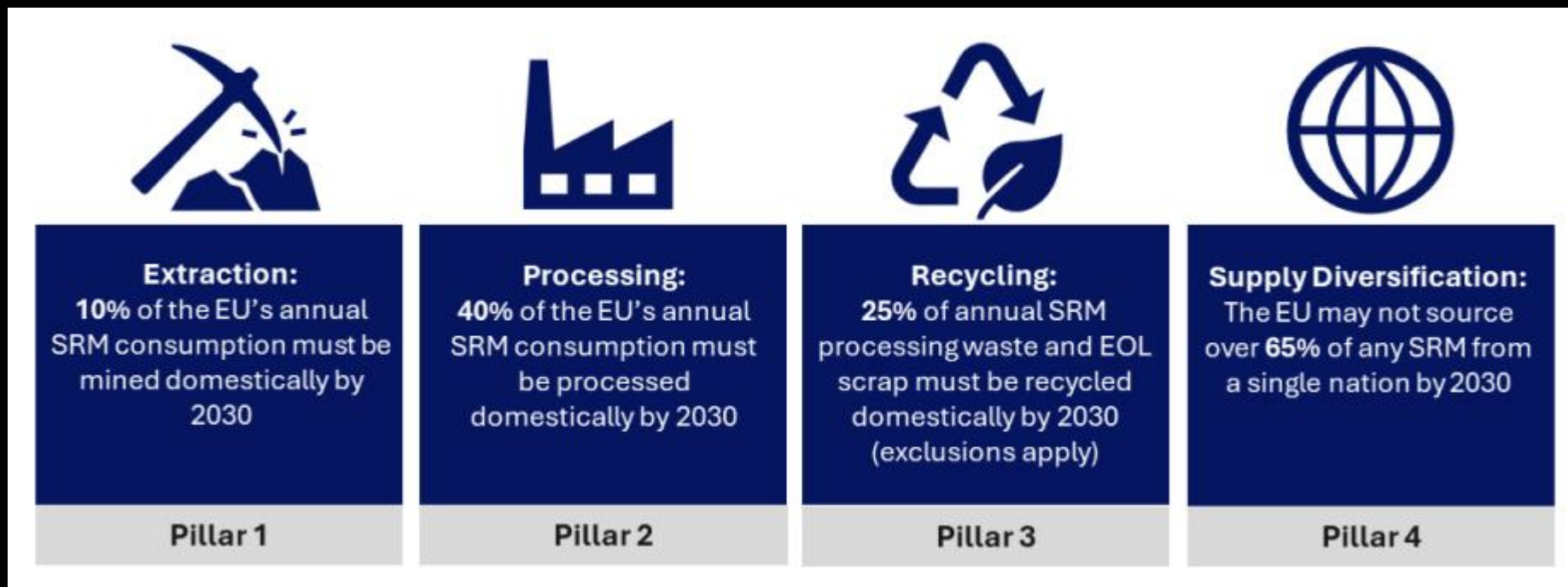


Kriittiset ja strategiset raaka-aineet (CRMA)

Antimony	Arsenic	Baryte	Bauxite	Beryllium	Bismuth
Boron Metallurgy Grade	Cobalt	Coking Coal	Copper	Feldspar	Fluorspar
Gallium	Germanium	Hafnium	Helium	Heavy * Rare Earth Elements	Light * Rare Earth Elements
Lithium Battery Grade	Magnesium Metal	Manganese Battery Grade	Natural Graphite Battery Grade	Nickel Battery Grade	Niobium
Phosphate Rock	Phosphorus	Platinum Group Metals	Scandium	Silicon Metal	Strontium
Tantalum	Titanium Metal	Tungsten	Vanadium	* Only Rare Earth Elements for magnets are considered strategic (Nd, Pr, Tb, Dy, Gd, Sm, and Ce)	

Lähde: EU-komission pohjalta Adamas Intelligence (2024)

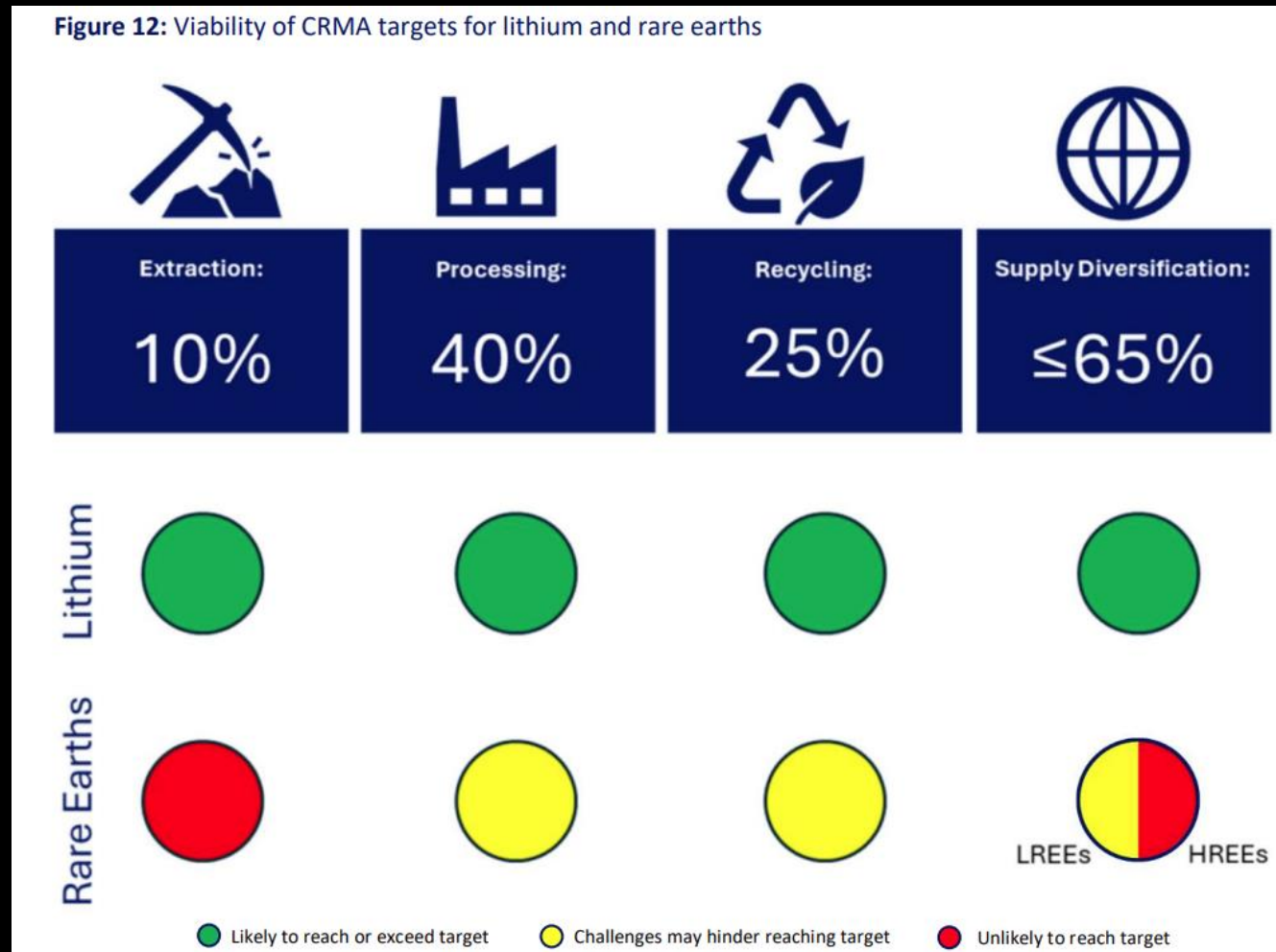
EU:n raaka-aineasetuksen 2030 tavoitteet



Lähde: EU-komission pohjalta Adamas Intelligence (2024)

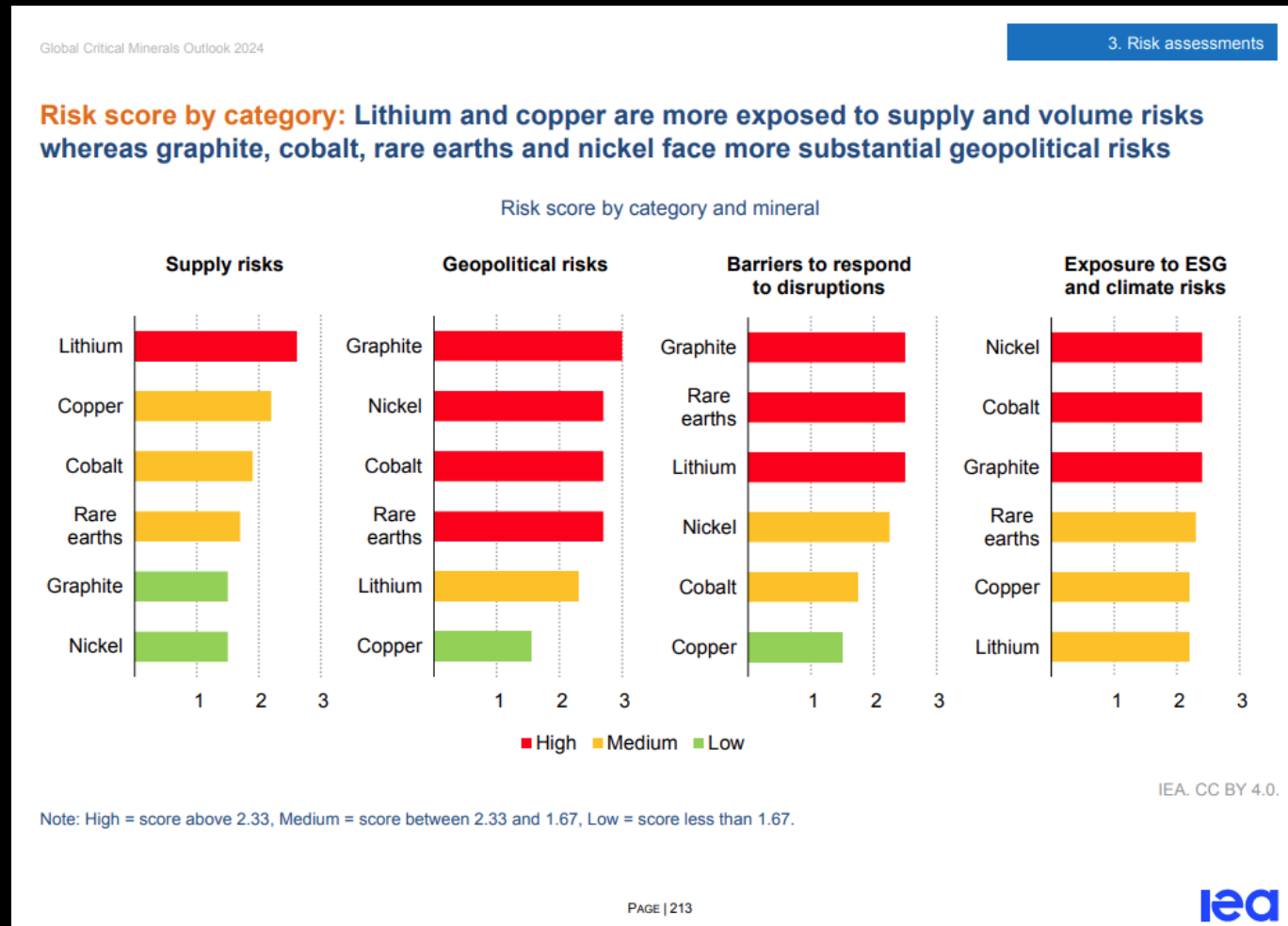
10% - 40% - 25% - 65%

Arvio mahdollisuuksista saavuttaa tavoitteet



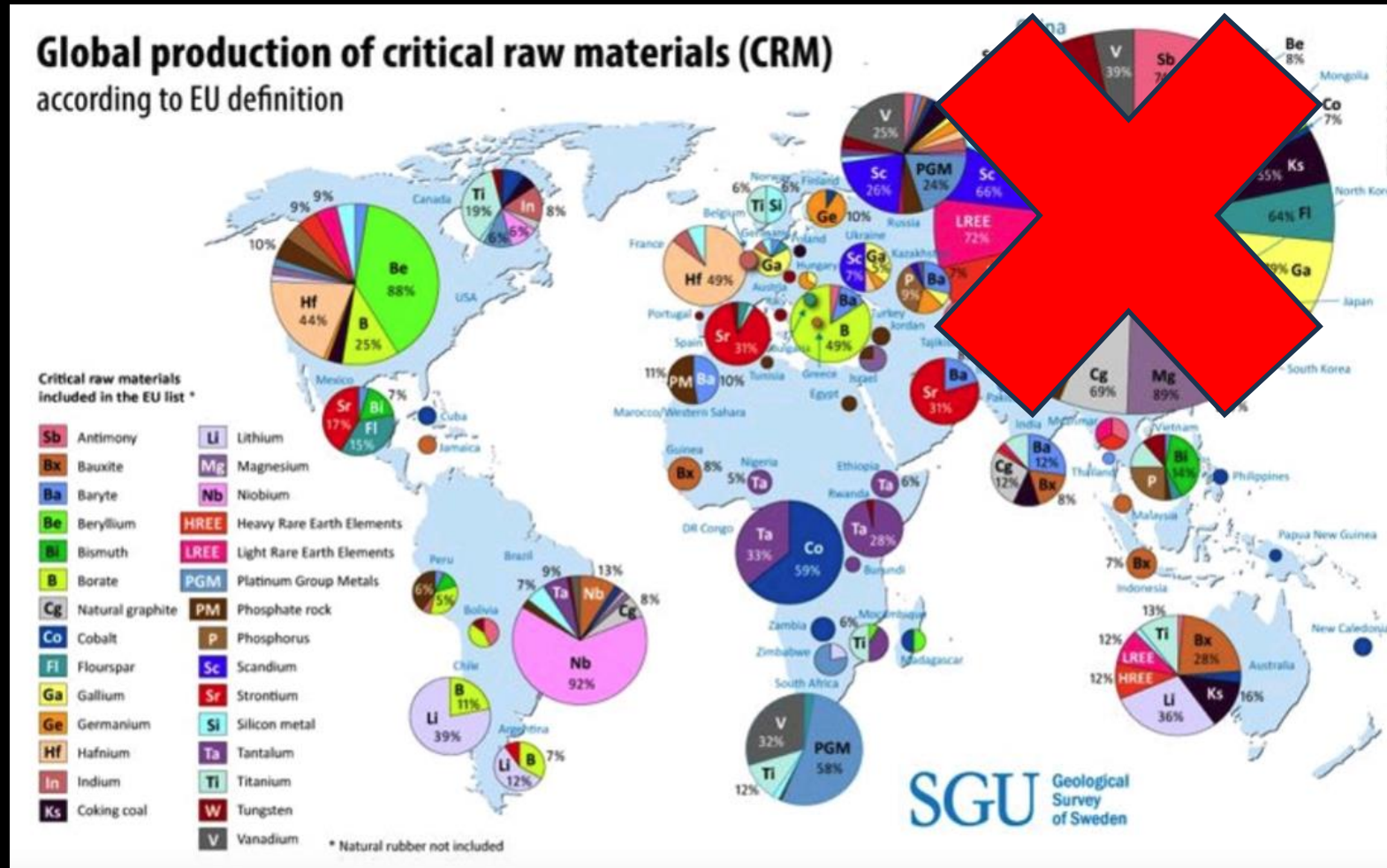
Lähde: EU-komission pohjalta Adamas Intelligence (2024)

Riskiarviot kriittisille mineraaleille



Lähde: IEA Global Critical Minerals Outlook 2024

Kanada, Australia, Afrikka, Etelä-Amerikka...



Lähde: SGU

Heräsikö länsi liian myöhään?



"Esimerkiksi eurooppalaisia ilmastotavoitteita ei saavuteta ilman Kiinassa tuotettua teknologiaa, Rydman arvioi. Niin suuri kiinalaisten markkinajohto vihreän siirtymän aloilla ministerin mukaan on." HS 11.8.2024

M maailman uusi talousjärjestys

VISUALIZING THE EXPANSION OF THE SHANGHAI COOPERATION ORGANIZATION

The Shanghai Cooperation Organization (SCO) is a Eurasian entity uniting political, economic, and security interests. It serves as a counterweight to Western influence in the region.



The Economist


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Leaders | Going global

Chinese companies are winning the global south

Their expansion abroad holds important lessons for Western incumbents



BBC

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In History Newsletter

China in Baltic navy drill with Russia

July 2017



Chinese Type 052D destroyers carry cruise missiles, anti-aircraft missiles and torpedoes.

Three Chinese warships are in the Baltic to start China's first naval exercises with Russia in the region.

Today, the SCO encompasses 42% of the global population and 32% of the global GDP.

SCO is the largest regional organization globally, encompassing 42% of the global population and 32% of the global GDP.

While BRICS mainly focus on economic cooperation, SCO focuses on regional security issues, like terrorism, ethnic separatism and religious extremism.

Russia and China have pledged to deepen their growing alliance and shared opposition to [what they describe](#) as the U.S.'s attempts to dominate the world order, with Moscow again seeking to boost trade with Beijing as it looks for new

PLUS

UUTISET

Uusi uhka idästä?

...telijoita ja tukee sotaa käyvää Venäjää. ...aiwanissa. Suurlähettiläs ei näe Suomen ...yhteistyölle esteitä.

Kreeta Karvala
Tänään klo 6:00

...nce again the
...the economy

Kiina esitellyt uusia vientirajoituksia

- On August 14, China announced the country's latest measures in the name of national security.
- **Antimony is critical** for armor-piercing ammunition, bullets, and precision weapons, including semiconductors.
- This is the latest restriction on graphite, germanium technologies, **raising** and **defense industries**.

Reuters


World Business Markets Sustainability Legal Breakingviews Technology

Commodities

Antimony prices gear up for new records on China export curbs

By Seher Dareen

August 15, 2024 7:45 PM GMT+3 · Updated 5 days ago



Workers transport soil containing rare earth elements for export at a port in Lianyungang. REUTERS/Stringer/File Photo [Purchase Licensing Rights](#)

Lähde: Reuters, 15 Aug 2024



Kiina kasvattaa varmuusvarastojaan

The Economist

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Finance & economics | China's reserves

Why is Xi Jinping building secret commodity stockpiles?

Vast new holdings of grain, natural gas and oil suggest trouble ahead



PHOTOGRAPH: GETTY IMAGES

Jul 23rd 2024

The Economist, 23 July 2024

Price of China's strategic germanium hits record high on possible state buying

By Reuters

July 18, 2024 12:45 PM GMT+3 · Updated 14 days ago



Zn 30 锌	26.9812	Silicon 14
Ga 31 镓	69.723	Ge 32 锗
In 49 铟	72.630	Sn 50 锡
Tl 81 铊		Pb 82 铅

BEIJING/SINGAPORE, July 18 (Reuters) - Prices of germanium, a strategic metal key to chipmaking, record high on Wednesday in top producer China, driven by speculation of possible state buying, industry sources said.

Reuters, 18 July 2024

China Plans Biggest Ever Cobalt Purchases For State Reserves

- Stockpiling agency could buy around 15,000 tons: sources
- Critical material is cheapest it has been in nearly five years



Cut cobalt cathodes. Photographer: Jasper Juinen/Bloomberg

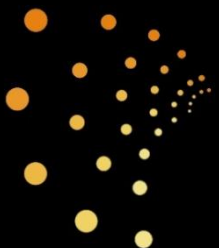
By Yvonne Yue Li, Alfred Cang, and Jack Farchy
23 May 2024 at 12:53 EEST

Bloomberg, 23 May 2024

1.
Kriittisten mineraalien
myrskyisät markkinat

2.
Kierrätyksen ja
kiertotalouden
merkitys

3.
Yhteenveto ja
johtopäätökset



Security Measures for Critical Minerals (IEA 2024)

Increase supply of CRMs

Stockpiling

Substitution

Offtake Agreements &
Production Reservations

Equity Investments

Incentives

Hedging, Futures
Contracts and Metal Bonds

Regulation

Trade or Export
Restrictions

Demand Pooling and
Matchmaking

Recycling

**Circular Economy
& Recycling**

Reduce demand of CRMs

Keinoja pienentää mineraalien kysyntää

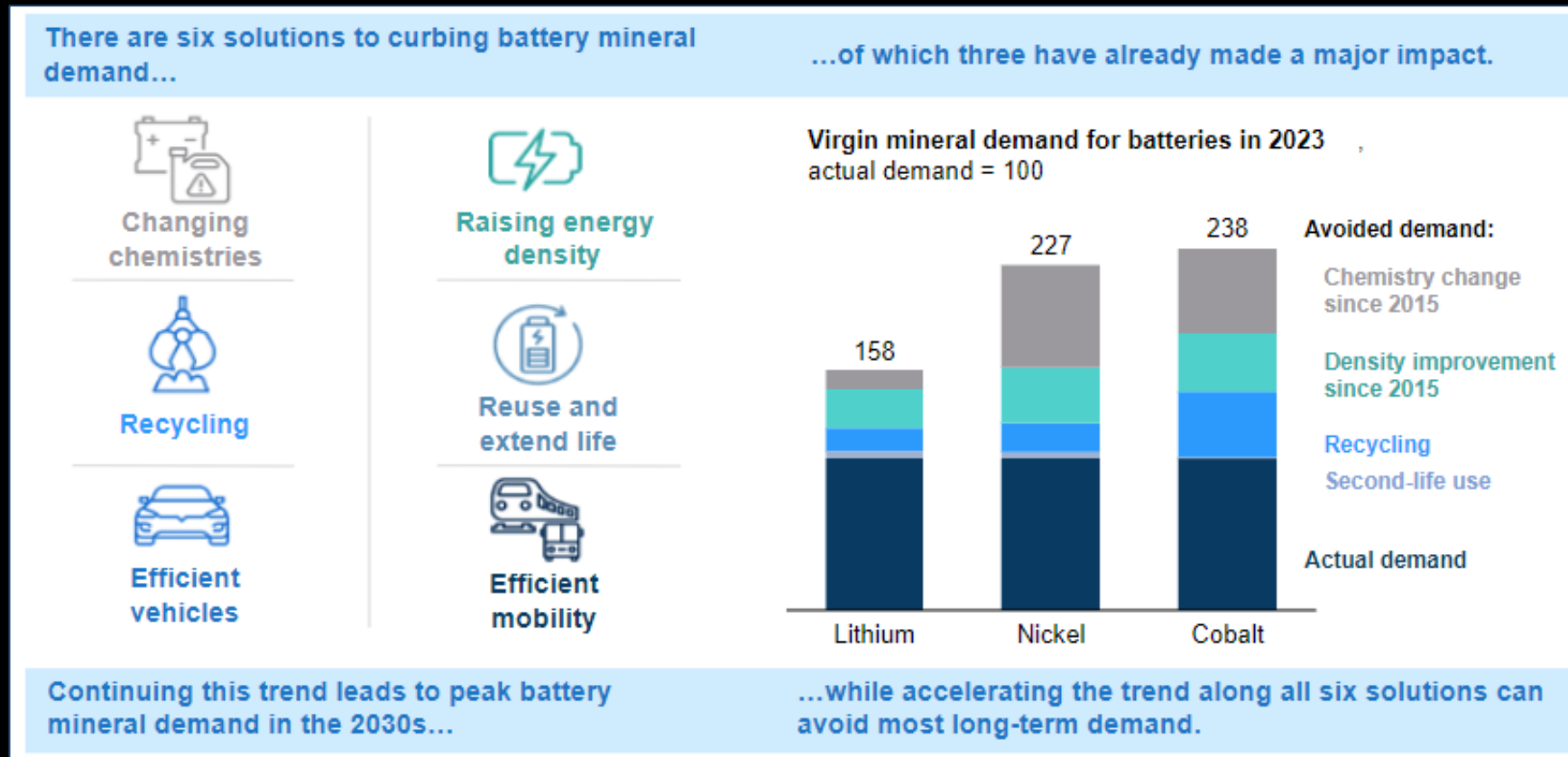
Materiaalitehokkuus
(Teknologiaateollisuus 2016)

Requirement
(1) Ability to re-manufacture
(2) Ability to re-use components
(3) Ability to re-use the product
(4) Durability
(5) Use of critical materials
(6) Use of recycled materials
(7) Recoverability (critical materials)
(8) Recyclability (critical materials)
(9) Repairability
(10) Upgradability

Policy area	Description	Examples	iea
Repair, refurbishment and remanufacturing	Extending product lifetimes, reducing the need for new production	<ul style="list-style-type: none"> Siemens Gamesa's lifetime extension programme for wind turbines 	
Recycling	Collecting, processing, and reusing materials that would otherwise be discarded as waste	<ul style="list-style-type: none"> Minimum recycled content requirements, extended producer responsibility regulations 	
Substitution	Replacing materials with renewable or more sustainable alternatives	<ul style="list-style-type: none"> Chemistry change for EV batteries Adoption of alternative battery technologies 	
Material efficiency	Designing products and processes to minimise material use, waste, and environmental impact	<ul style="list-style-type: none"> Iridium loading reduction in proton exchange membrane electrolyser manufacturing Reduced silicon use in solar PV 	
Product-as-a-Service	Business models that provide services instead of selling products	<ul style="list-style-type: none"> Vehicle-sharing schemes to increase utilisation of assets 	
Behavioural changes	Encouraging individuals to adopt more sustainable habits and practices such as reducing consumption	<ul style="list-style-type: none"> Opting for optimal size vehicles than larger cars Reducing private car journeys via public transport 	

Lähde: IEA Global Mineals Outlook 2024

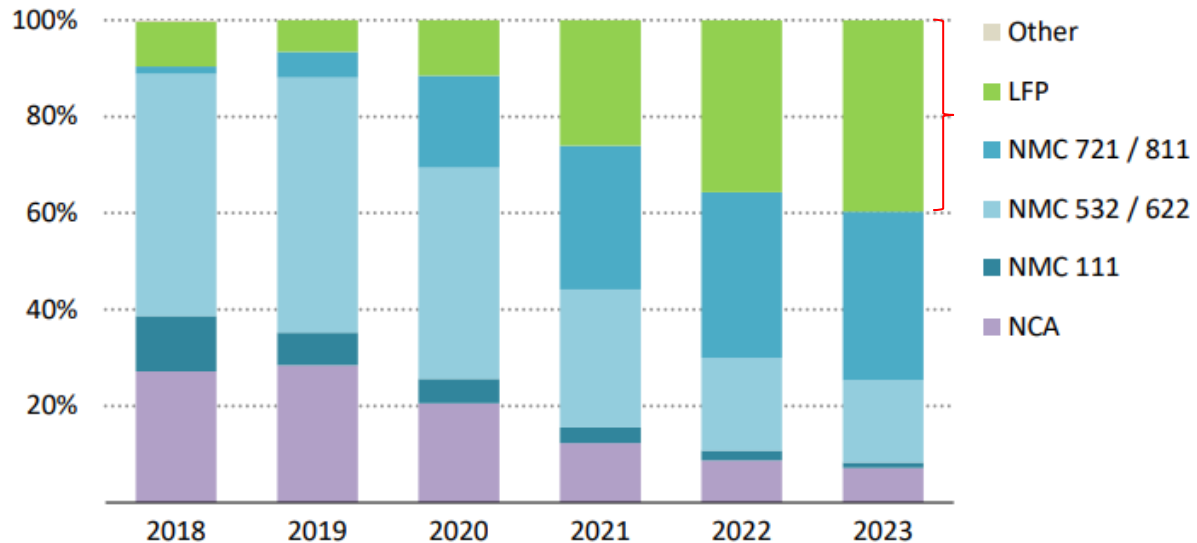
Akkujen mineraalitarpeen pienentäminen



Lähde: RMI, The Battery Mineral Loop – The path from extraction to circularity (2024)

LFP:n osuus kasvaa nopeasti sähköautoissa

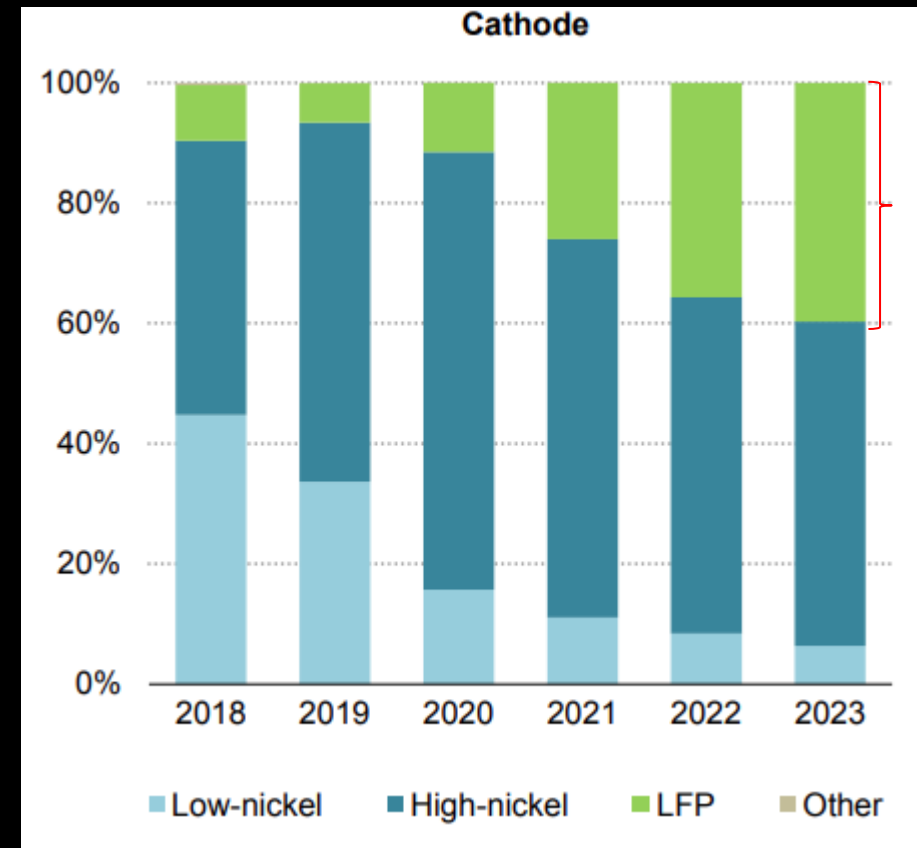
Figure 1.6 ▶ Battery cathode chemistry in electric car sales, 2018-2023



IEA. CC BY 4.0.

NMC remains the dominant cathode chemistry for electric cars, while the share of LFP batteries is increasing and reached its highest ever level in 2023

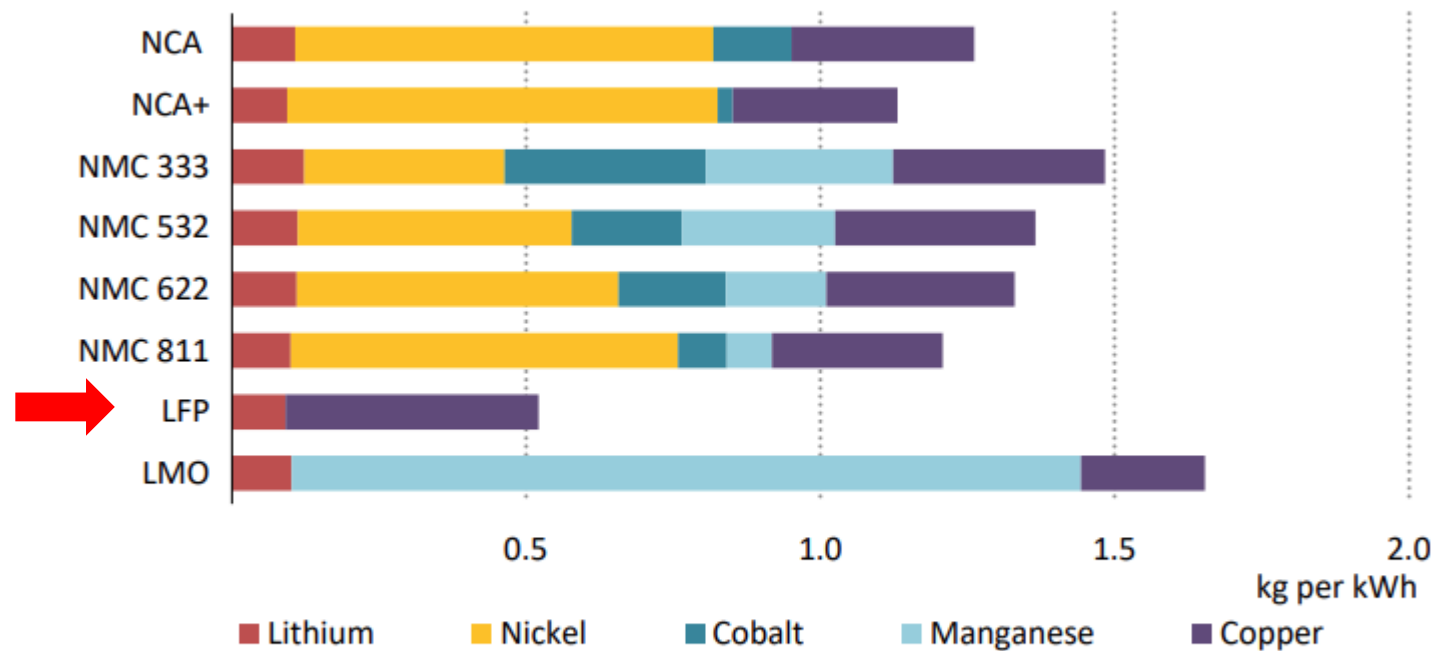
Lähde: IEA Global EV Outlook 2024



Lähde: IEA Global Critical Minerals Outlook 2024

LFP-akkujen “helpompi” koostumus

Figure 1.22 ▶ Mineral intensities by battery chemistry for lithium-ion battery cathodes used in EVs



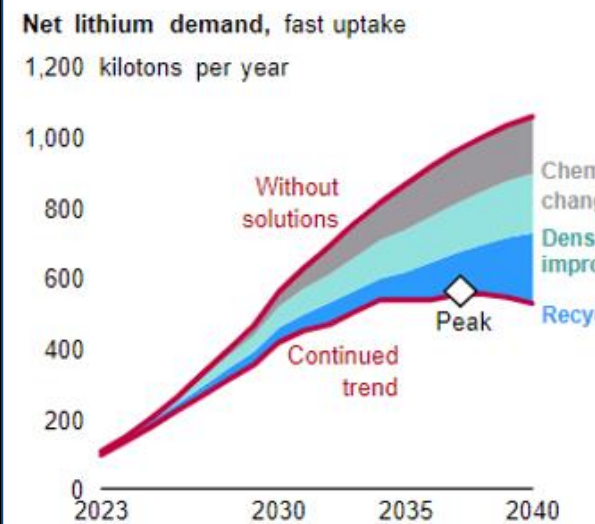
IEA. CC BY 4.0.

Critical mineral use such as nickel, cobalt and manganese varies significantly depending on the chemistry used in the cathodes of lithium-ion batteries

Lähde: IEA Global Batteries and Secure Energy Transitions (2024)

Uutta kaivostuotantoa ei enää tarvittaisi 2040

Continuing this trend leads to peak battery mineral demand in the 2030s...

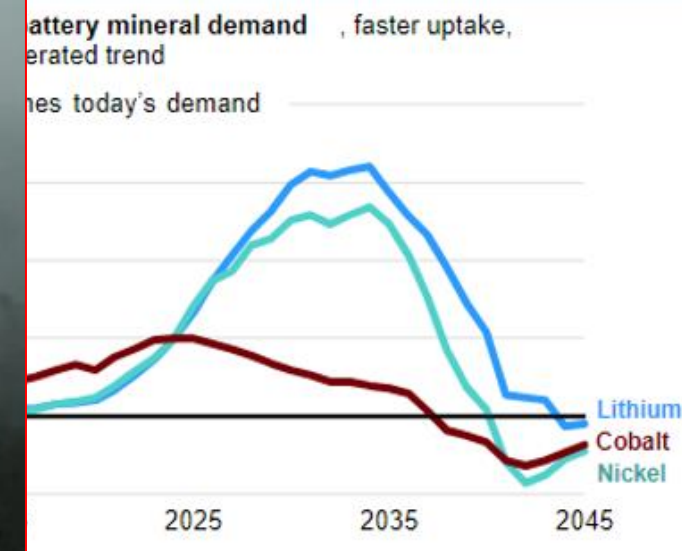


Lähde: RMI, The Battery Mineral Loop – The p

“By 2042, China will no longer need to mine new mineral materials because of its mature battery recycling market”

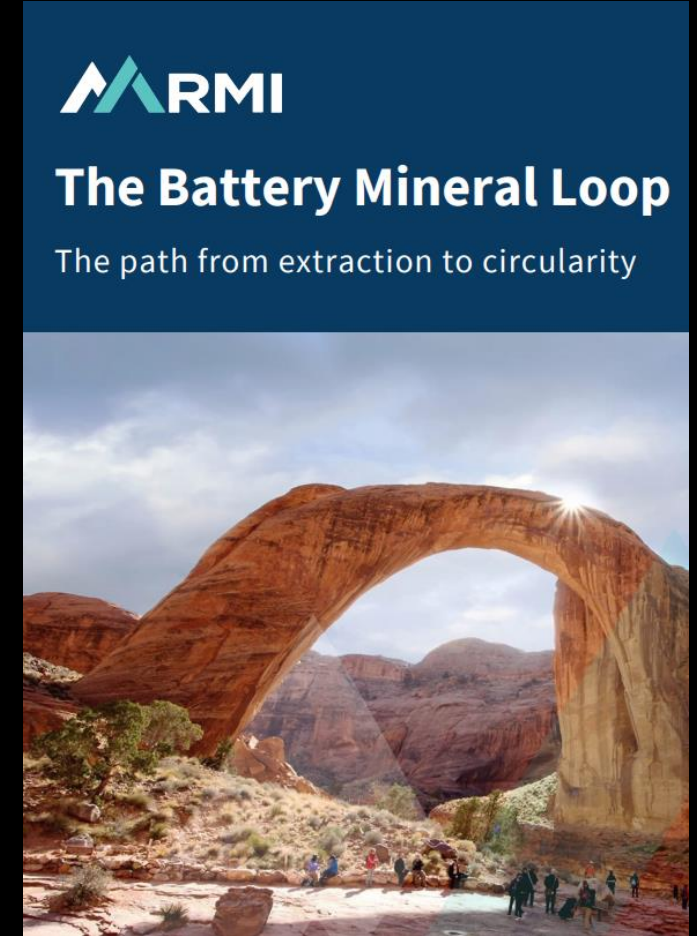
Robin Zeng - Founder & CEO of CATL

Zero battery mineral demand is achievable by 2050...



Kaivosinvestointeja tarvitaan

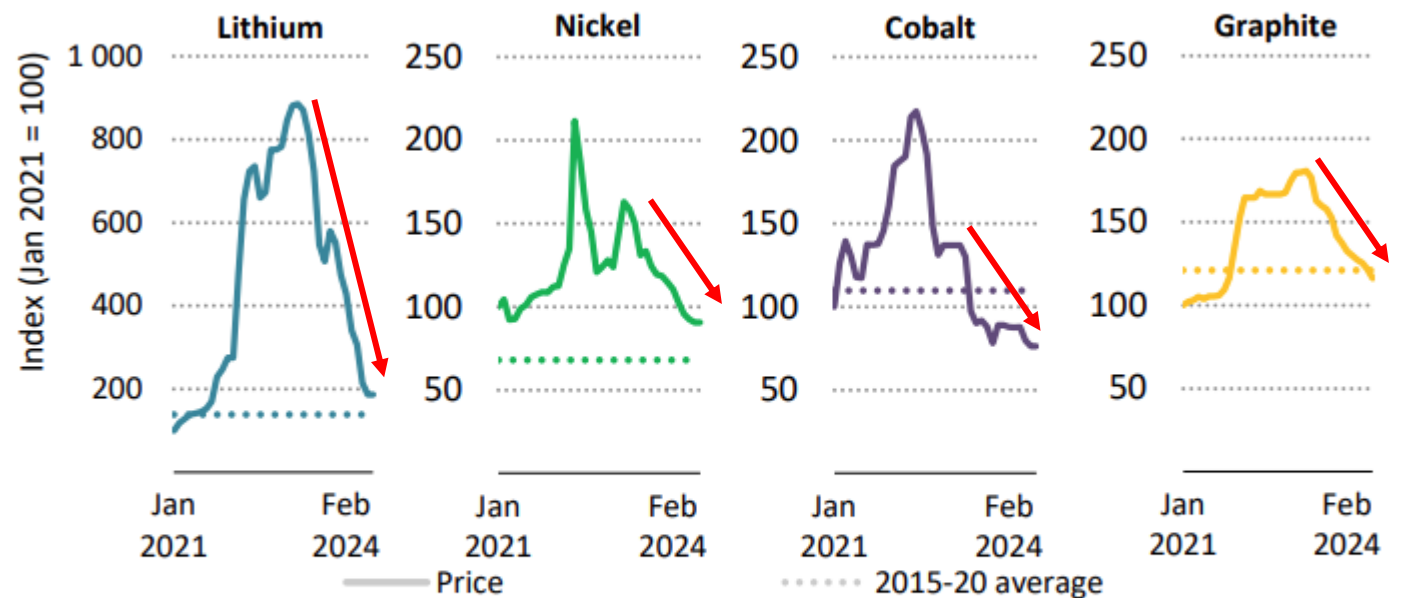
- **Akkujen kiertotalousvision** edellytyksenä on, että kaivosala jatkaa investointeja uusiin kaivoksiin siihen saakka, että kierrättäjät saavat metallien talteenoton talteen.
- Tässä on kuitenkin dilemma: jos kaivosten tuottamien mineraalien kysyntä hiipuu, ei kaivosalalla ole kannusteita investoida uusiin kaivoshankkeisiin.
- Tutkimuslaitos RMI ehdottaa, että maat tekisivät sopimuksia tuotannon ostamisesta (offtake) ja näin hankittu ylituotanto voitaisiin sijoittaa varmuusvarastoihin.
- Valtiot voisivat innostua jopa asettamaan sanktioita sähköautojen maastaviennille, koska silloin akkumineraalit karkaisivat muihin maihin.



Lähde: RMI (2024)

Akkumetallien hinnat putosivat rajusti v. 2023

Figure 1.24 ▶ Price developments for key battery minerals



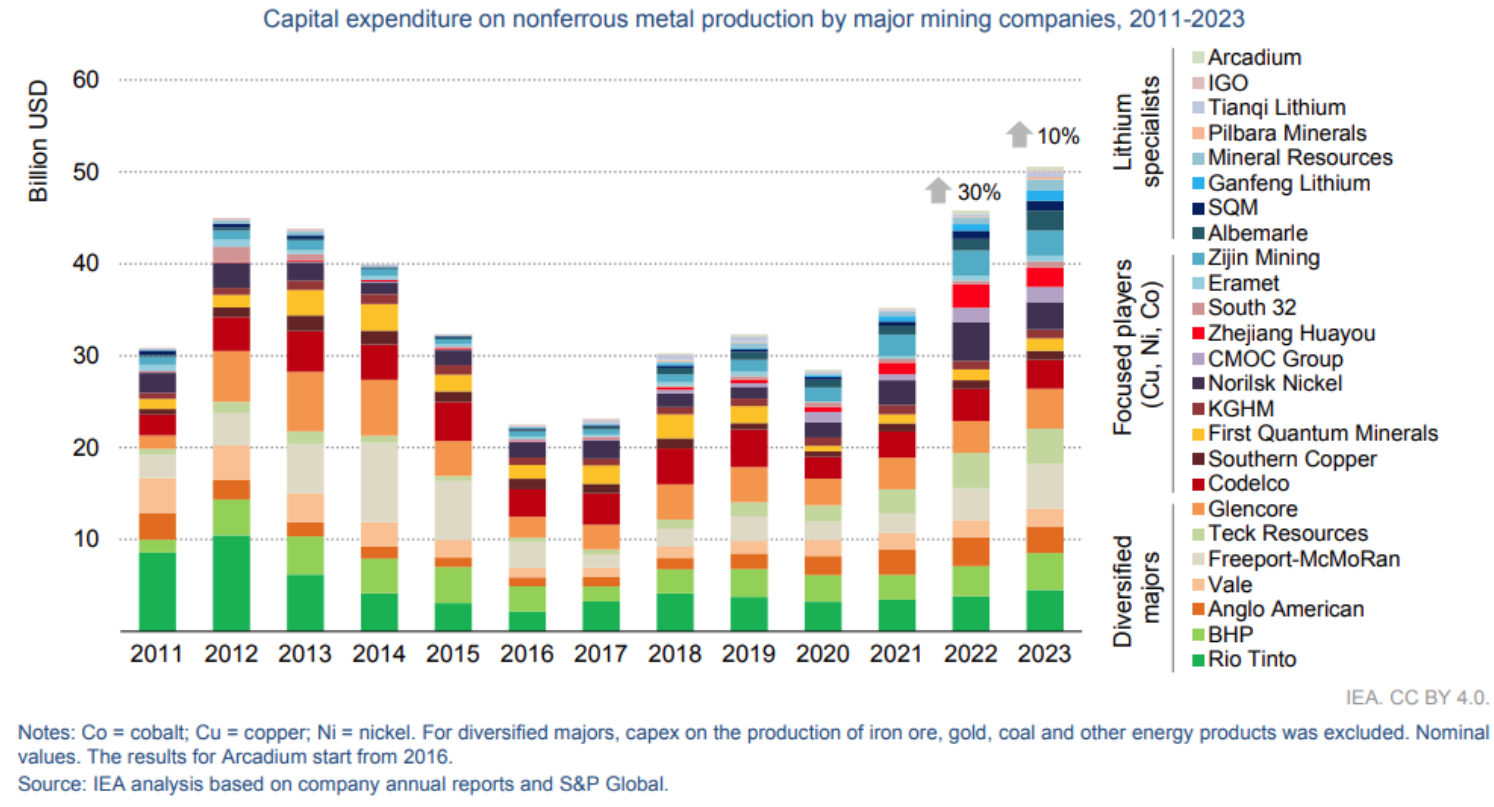
IEA. CC BY 4.0.

Lithium prices rose as much as nine times between 2021 and 2022 and prices of most battery minerals surged in 2021 and 2022 before plunging in 2023

Lähde: IEA Global Batteries and Secure Energy Transitions (2024)

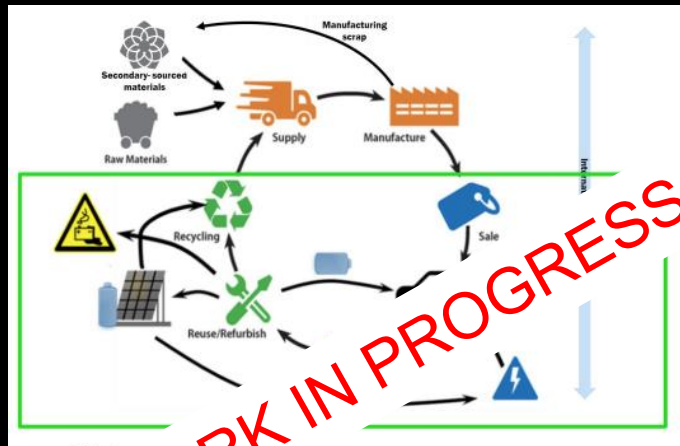
Kaivosinvestoinneissa vain niukkaa kasvua

Investment in critical mineral mining grew by 10% in 2023, a smaller increase than seen in 2022, as price declines placed pressure on producers' financial capacity



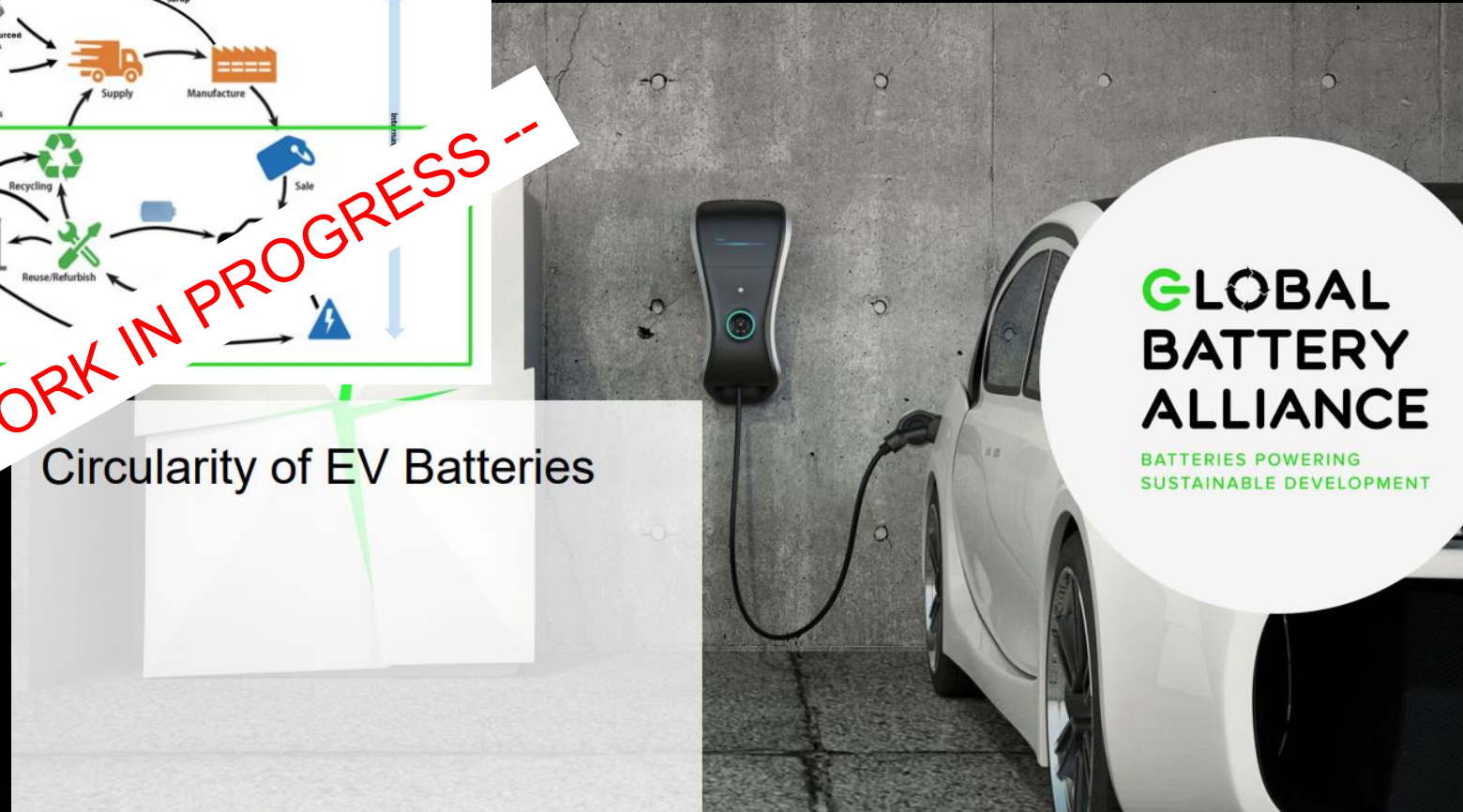
Lähde: IEA Global Critical Minerals Outlook 2024

Ajovoima-akkujen kierrätyksen koko kuva



-- WORK IN PROGRESS --

Circularity of EV Batteries



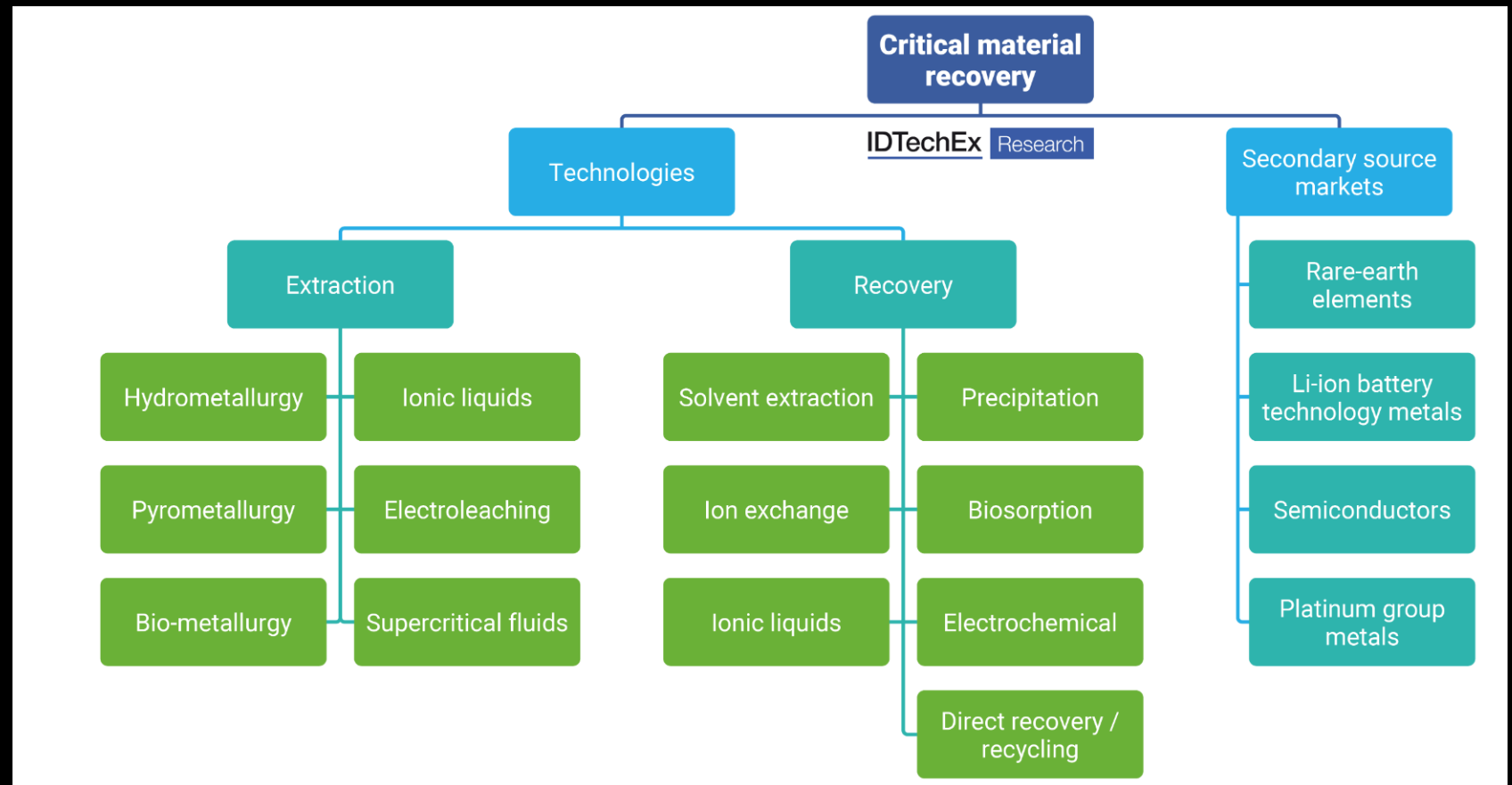
**GLOBAL
BATTERY
ALLIANCE**

BATTERIES POWERING
SUSTAINABLE DEVELOPMENT

Global Battery Alliance (GBA) – Critical Minerals and Circularity Advisory Group - forthcoming

Paljon erilaisia menetelmiä talteenottoon

”Critical material recovery technologies are largely ready to go, it is just a question of how easily they may be repurposed for secondary materials sources.”



Lähde: IDTechEX, "Critical Material Recovery 2025-2045: Technologies, Markets, Players (July 2024)"

SER-talteenottoa Jyväskylässä (kevät 2016)

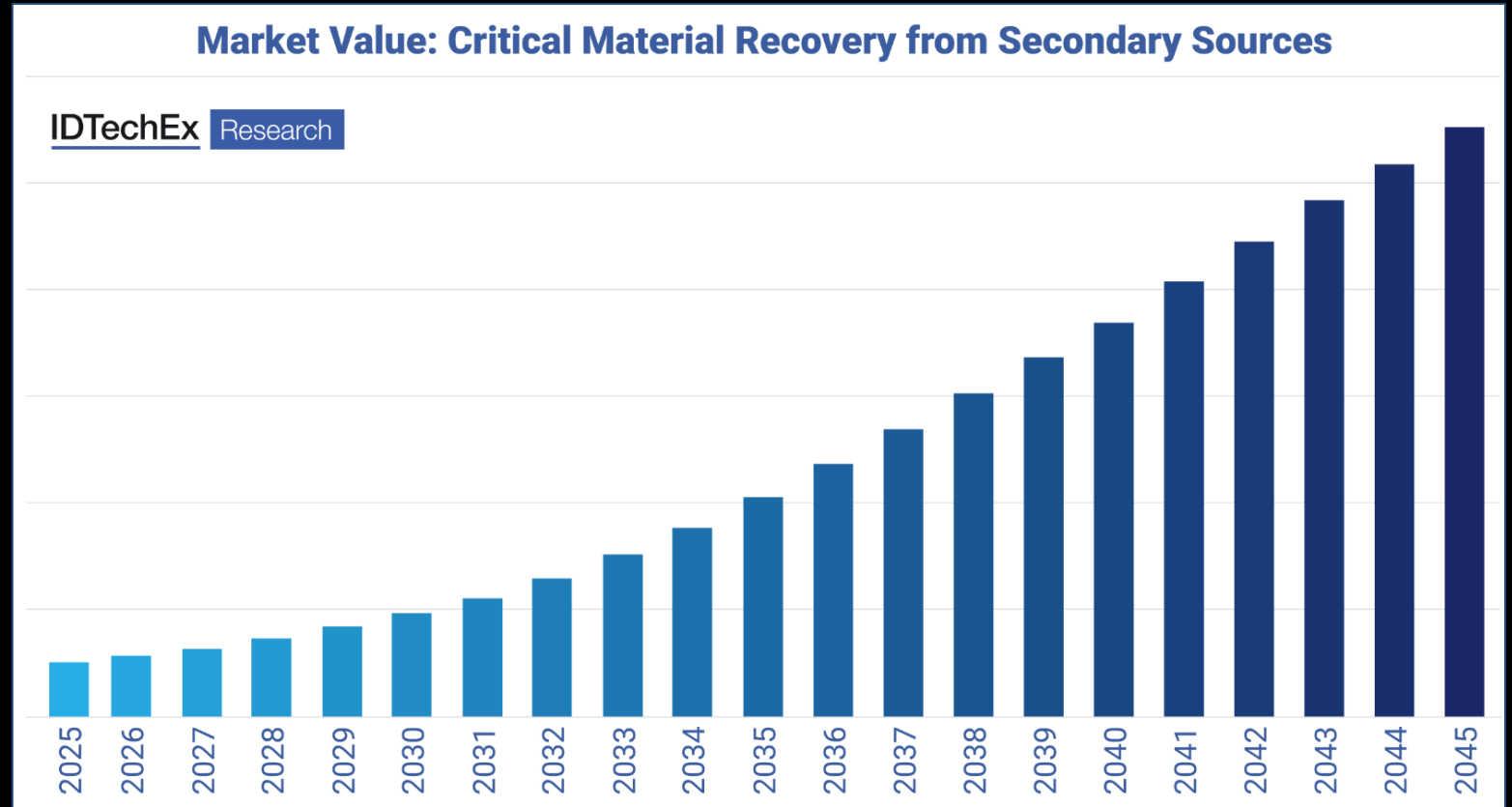


Metallien erotus



Kriittisten materiaalien talteenoton potentiaali

”As the volume of critical material containing equipment reaching end-of-life increases year-on-year, the secondary source stream for critical material recovery becomes ever more valuable.”

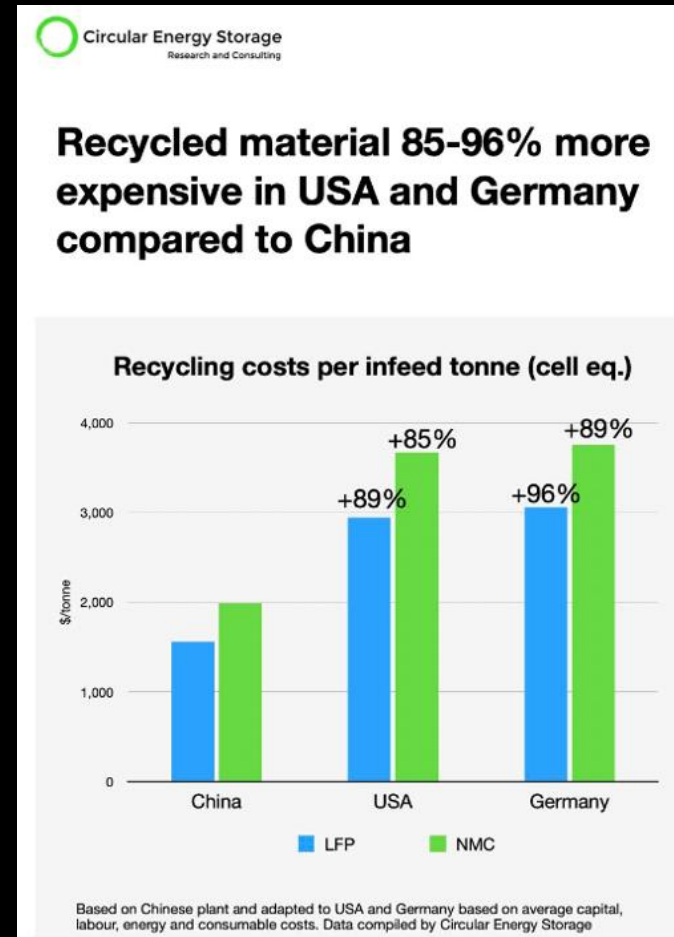


Lähde: IDTechEX, "Critical Material Recovery 2025-2045: Technologies, Markets, Players (July 2024)

Eurooppalaisen kierrätyksen kilpailukyky

”Costs for lithium-ion battery recycling in the US and Europe are set to become twice as high as current levels in China. That for materials claimed by policy makers to be strategic while being traded on a global market. Who will pay for that?”

Hans Eric Melin, CEO, Circular Energy Storage

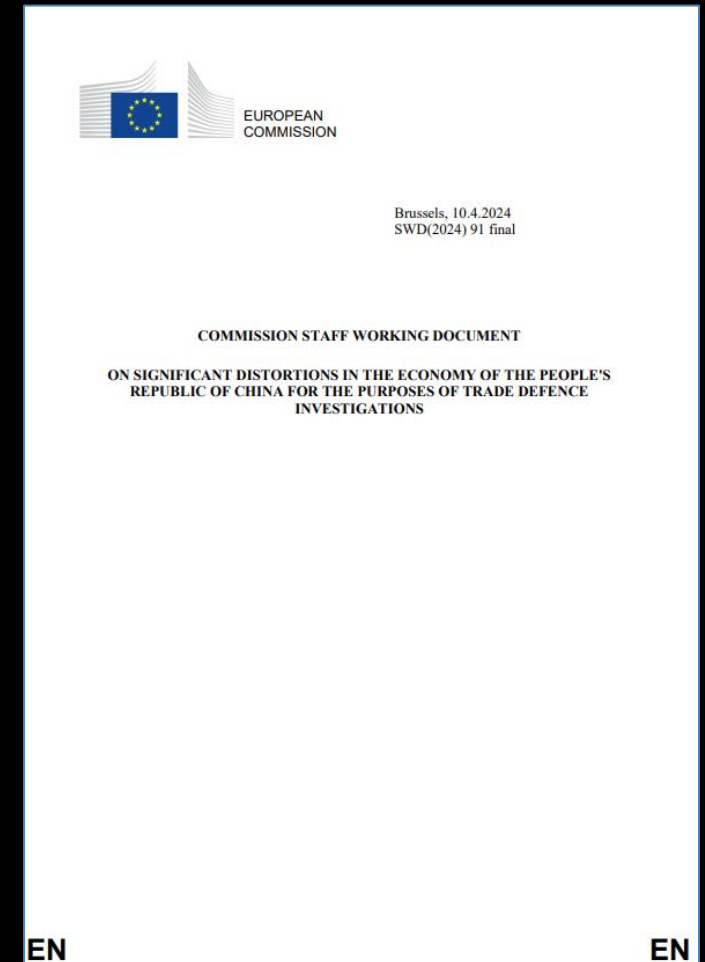


Kiina manipuloi raaka-aineiden hintoja

”China uses a broad range of instruments allowing it to **significantly influence the prices of raw materials**. By artificially increasing or decreasing the level of raw materials supply, or simply by centrally setting the prices, **the government can steer the prices upwards or downwards.**”

”**The dense web of plans** – including plans at the national, sectoral, provincial and municipal level – **regulates basically every aspect of the Chinese economy and sets specific targets**. In accordance with such plans, many key materials and other material inputs are to some extent regulated and are the targets of government intervention.”

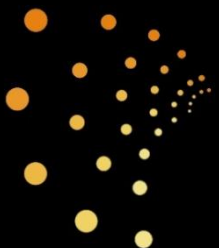
Lähde: European Commission, 10 April 2024



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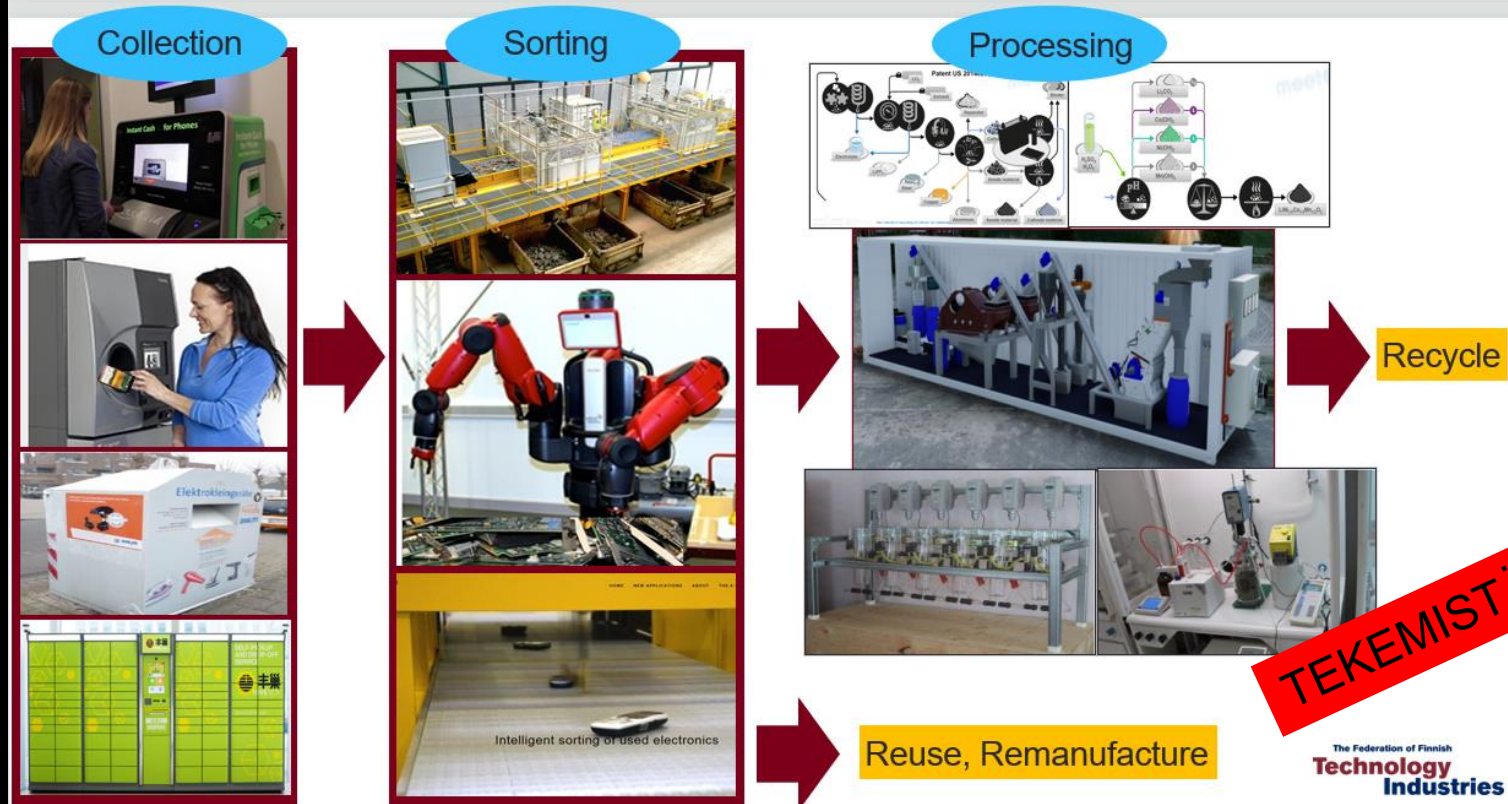
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kiertotalouden
merkitys

3.
Yhteenveto ja
johtopäätökset



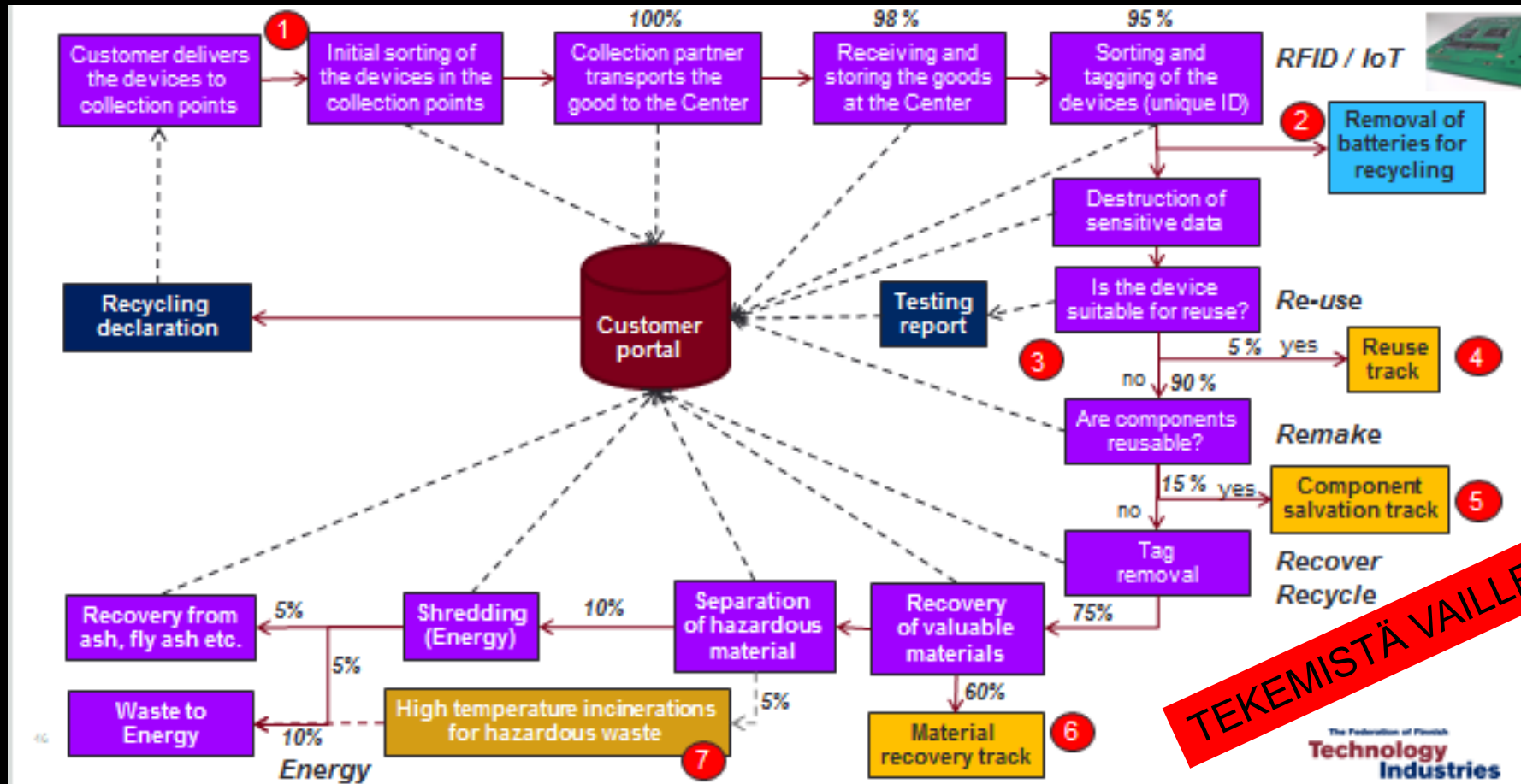
SER-demolaitoshanke (Teknologiategollisuus)

The objective: State-of-the-Art Recycling Center for e-Waste utilising the latest (Finnish) technology



Lähde: Teknologiategollisuus / Not Innovated Here 2015

Asetusten ja kiertotalouden mukainen prosessi

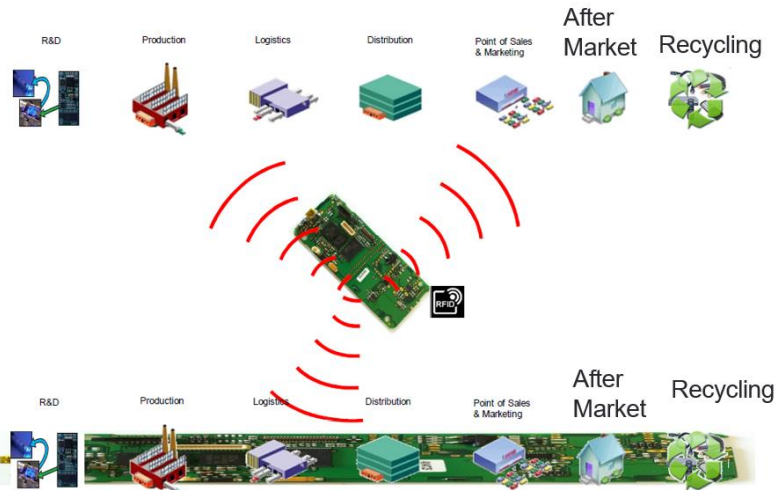


Lähde: Teknologiateollisuus / Not Innovated Here 2017

TEKEMISTÄ VAILLE VALMIS!

Digitaalinen tuotepassi / akkupassi (RFID)

RFID tag provides visibility through the whole lifecycle of the equipment



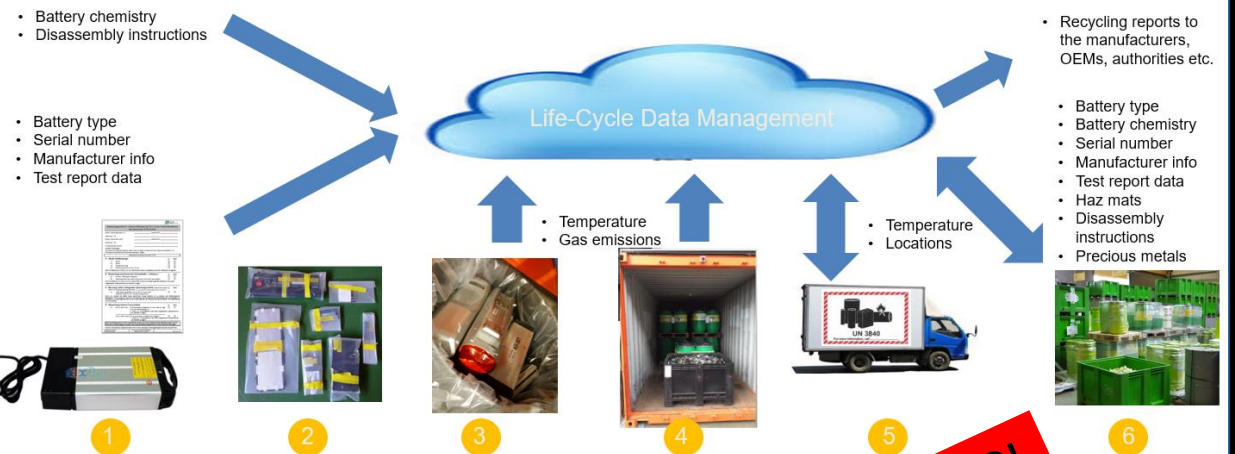
All Rights Reserved, Copyright: Murata Manufacturing Co., Ltd.

<http://www.slideshare.net/AlexanderMSchmoldt/rfid-pcb-tag-uhf-with-magicstrap-all-33-2013>

The Federation of Finnish Technology Industries

Lähde: Teknologiateollisuus / Not Innovated Here 2015

EV Battery Life Cycle Management



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Lähde: Not Innovated Here 2018

TEKEMISTÄ VAILLE VALMIS!

Johtopäätöksiä

1. Kiina pystyy manipuloimaan kriittisten mineraalien ja metallien markkinoita – ja on monesti osoittanut olevansa myös valmis näin toimimaan.
2. Länsimaiden strategiset virheet viimeisten 20-30 vuoden aikana ovat antaneet Kiinalle valttikortit raaka-aineissa ja uuden teollisen vallankumouksen teknologioissa.
3. Puhdas siirtymä vaatii huomattavan määrän mineraaleja ja metalleja. Uuden kaivostoiminnan käynnistäminen vie aikaa ja vaatii huomattavia investointeja. Siksi kierrätys ja kiertotalous ovat keskeisessä roolissa puhtaan siirtymän mahdollistajana.
4. Suuremmassa mittakaavassa kierrätys onnistuu vasta, kun kierrossa on riittävästi materiaalia. Siksi on tärkeää hyödyntää myös muut kiertotalouden mahdollisuudet.
5. Akkujen ja muiden energiamurroksen kannalta kriittisten teknologioiden kiertotalous ei ole mikään itsestäänselvyys, vaan se vaatii autovalmistajien, akkutuottajien, kaivosyhtiöiden ja julkisen sektorin tiivistä yhteistyötä seuraavan vuosikymmenen aikana.

KYSYMYKSIÄ?

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