ICBR 2021

Sustainable recycled battery raw materials by Fortum

Tero Holländer

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For a cleaner world

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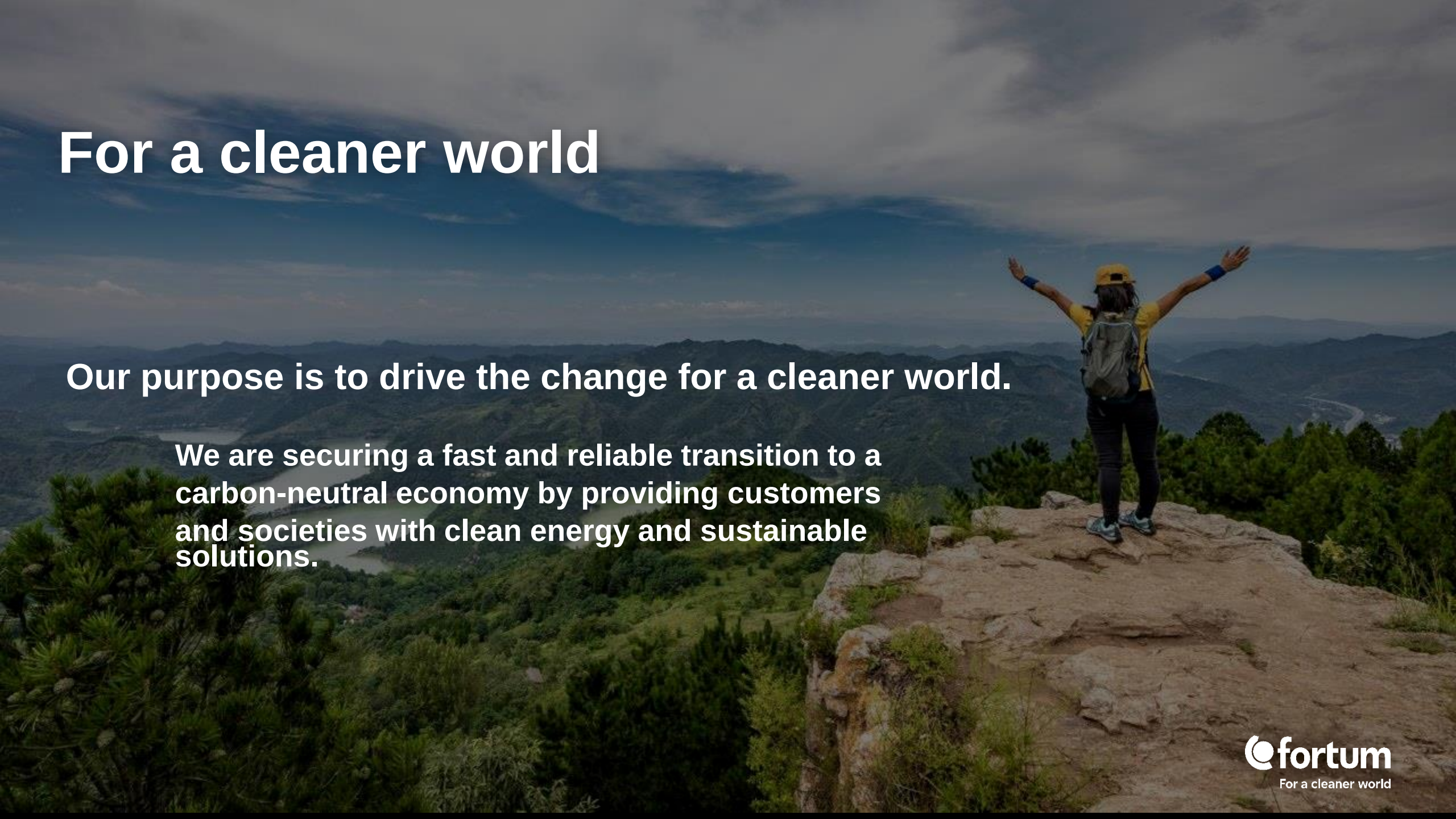

Our purpose is to drive the change for a cleaner world.

We are securing a fast and reliable transition to a carbon-neutral economy by providing customers and societies with clean energy and sustainable solutions.

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What we do?

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Fortum Group is a major European clean power and gas company with activities in more than

40 countries

19,000 experts worldwide

Revenue 49bn€

Operating profit 1,6bn€

3rd largest	3rd largest	4th largest	3rd largest
power generator in Europe and Russia	CO_2-free power generator in Europe	gas storage operator in Europe	nuclear generator in Europe

We provide our customers with **electricity, gas, heating** and **cooling** as well as **smart solutions to improve resource efficiency**.

Together with Uniper, we are the third largest producer of CO_2-free electricity in Europe with growing portfolio of wind and solar.

With approximately 19,000 professionals and a combined balance sheet of approximately EUR 58 billion, we have the scale, competence and resources to grow and to drive the energy transition forward.

Fortum's share is listed on Nasdaq Helsinki and Uniper's share on the Frankfurt Stock Exchange.

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Finland will be the hub for sustainable battery raw materials in Europe
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Finnish industry supports the creation of battery value chain

KELIBER

Starting operations for **lithium mining and g**oing to produce **battery-grade lithium chemicals**

umicore Freeport Cobalt

PCAM and the targest **cobalt refinery** outside of China

FREYR Renewable energy storage FINNISH MINERALS GROUP

Battery cell plant project

JM Johnson Matthey Inspiring science, enhancing life FINNISH MINERALS GROUP

30kt/a eLNO® integrated pCAM and CAM plant

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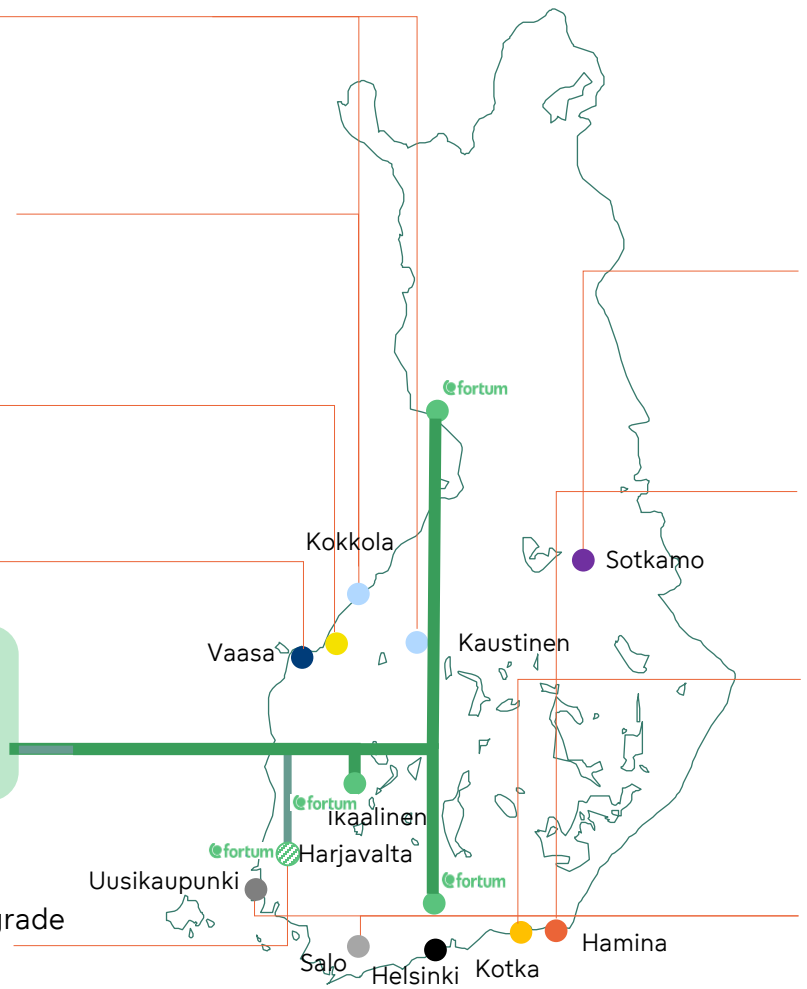
Fortum is building and expanding operations across **battery recycling value chain**

BASF We create chemistry NORNICKEL

BASF Harjavalta PCAM plant and Nornickel battery grade nickel and cobalt refinery



Terrafame

Nickel, zinc, cobalt and copper mines and battery grade nickel and cobalt sulphate production

CNGR中伟 FINNISH MINERALS GROUP

World's largest ternary (NCM) precursor manufacture and FMG are developing a pCAM plant in Hamina port

Undisclosed partner FINNISH MINERALS GROUP

Kotka CAM plant development project

valmet automotive

Premium vehicle + battery pack manufacturer focusing on e-mobility

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** Slide with courtecy of FMG*


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Fortum has a strong position in lithium-ion battery value chain

Our low-C02 recycling solution makes **OVER 80%** of the battery recyclable

We can achieve a recovery rate **UP TO 95%** of the critical metals in the active materials of battery's black mass

Investing to become a significant player on sustainable recycled battery chemicals

We offer

- end-of-life services for used EV and industrial sized batteries and for battery production waste and other industrial side streams
- Sustainable recycled chemicals for battery chemicals producers

Today our low CO2 recycling process consists of

- A mechanical processing plant in Ikaalinen, Finland
- An industrial pilot- scale hydrometallurgical recycling plant in Harjavalta, Finland

We are building

- a new state-of-the-art hydrometallurgical recycling facility in Harjavalta

Efficient and low CO_2 recycling process with high safety and high recovery rate

BATTERY PRODUCTION SCRAP

END-OF-LIFE BATTERIES

DISCHARGING → DISMANTLING → MECHANICAL PROCESSING → HYDROMETALLURGICAL PROCESSING

SECOND LIFE QUALIFICATION

PLASTIC AND METAL SCRAP COMMODITIES

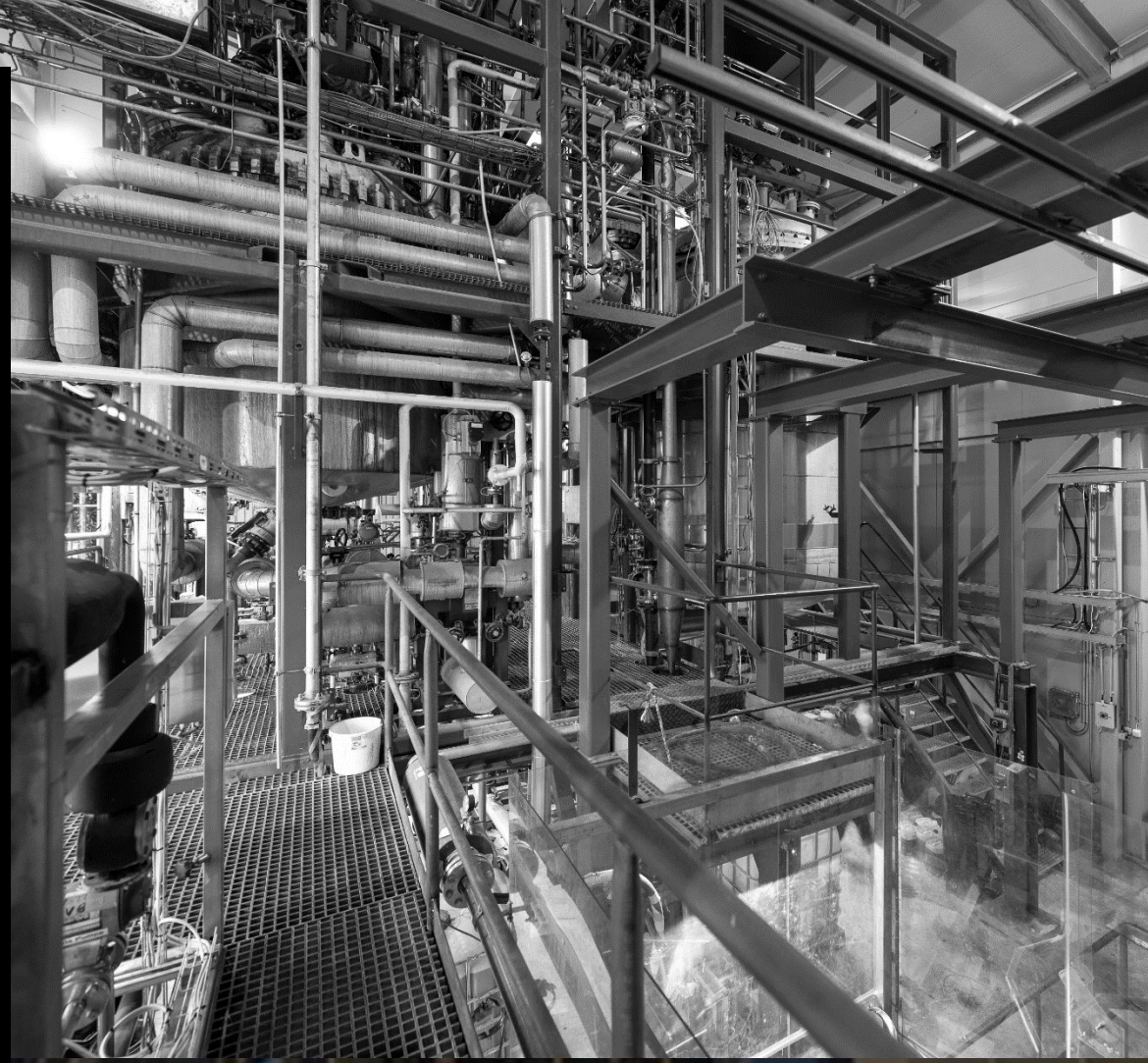
MECHANICALLY SEPARATED RAW MATERIALS E.G. COPPER, ALUMINIUM & PLASTIC FOILS

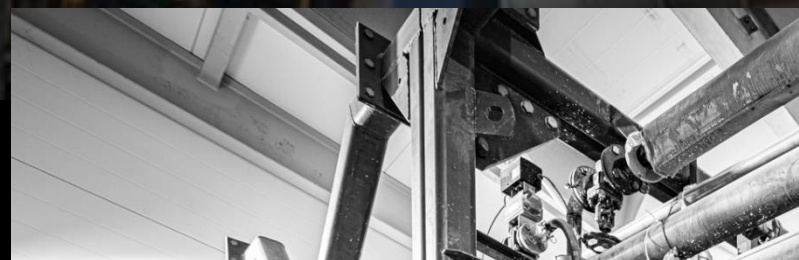
METAL INDUSTRY SIDESTREAMS

NI, CO, MN & LI BASED PRODUCTS

Battery black mass treatment in industrial scale

- We operate an innovative with low CO2 hydrometallurgical recycling facility located in Harjavalta, Finland
- In the hydrometallurgical process the ‘black mass’ from batteries is treated to
  - Nickel sulfate
  - Cobalt sulfate
  - Manganese sulfate
  - Patent pending for new Lithium recovery technology





Fortum Battery recycling principles

Always above Best Available Technologies (BAT)

Fortums multi-step recycling process focuses on following critical factors

1. Person safety
2. Environmental aspects and low CO2
3. Superior Efficiency
4. Transparency - all process steps in-house by Fortum

New EU-directive proposal from December 2020

New requirements of recycling rates

2025, recycling efficiency of 65 %

2030, recycling efficiency of 70 %

New requirements of recovered materials

- By 2026 materials recovery:
  - (a) 90 % for cobalt;
  - (b) 90 % for copper;
  - (d) 35 % for lithium;
  - (e) 90 % for nickel.
- By 2030 materials recovery:
  - (a) 95 % for cobalt;
  - (b) 95 % for copper;
  - (d) 70 % for lithium;
  - (e) 95 % for nickel.

New EU-directive proposal from December 2020

- Vehicle and industrial batteries will have to carry a ‘carbon footprint declaration

- Blending of recycled raw materials are required:

	Cobalt	Nickel
2030	12 %	4 %
2035	20 %	12 %

Thank you

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