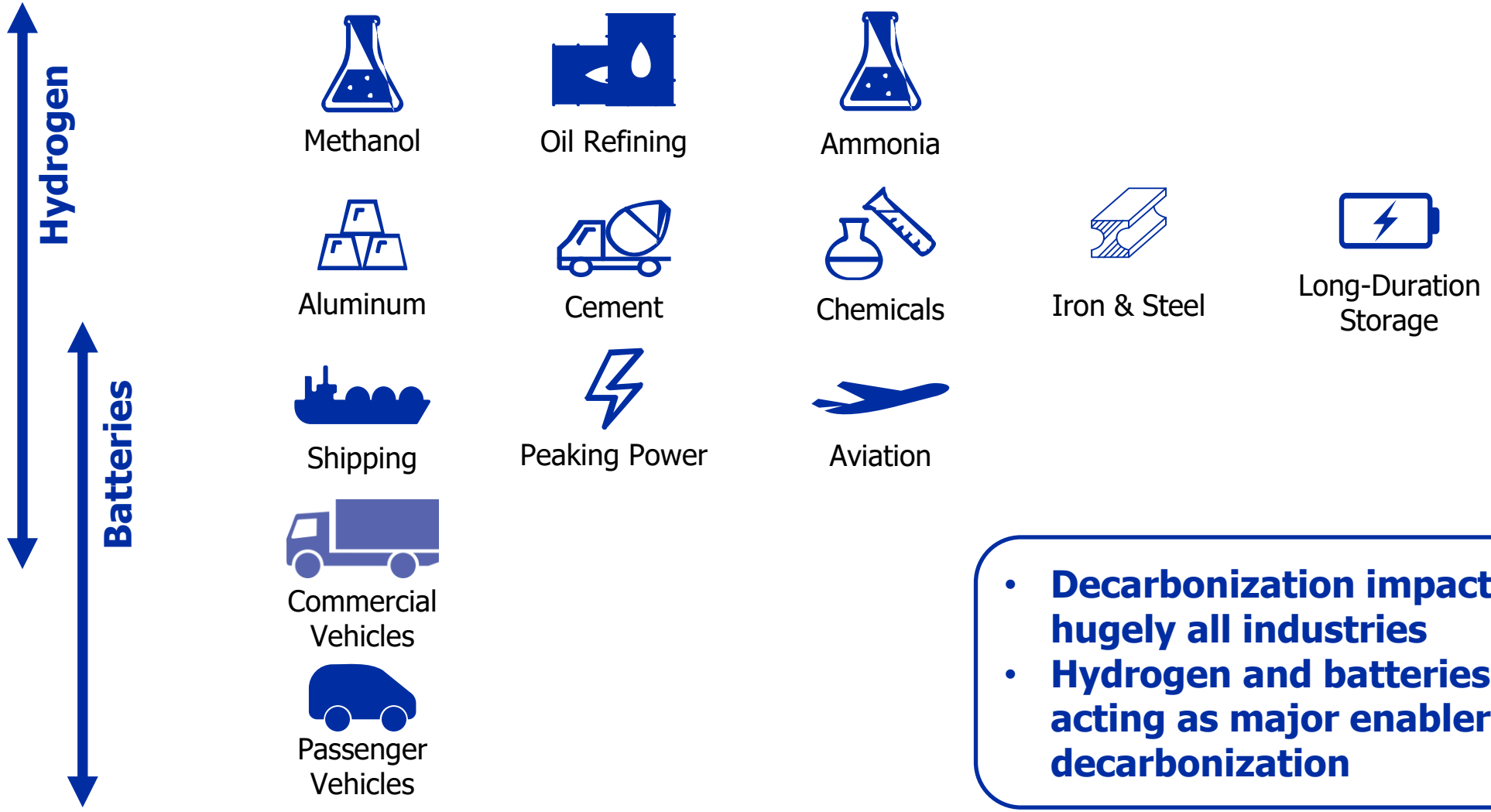
BUSINESS
FINLAND

Hydrogen and batteries – Dual Helix of decarbonization

Program introduction – 4.12.2023

Ilkka Homanen
Head of Hydrogen and Batteries

HYDROGEN AND BATTERIES – LANDSCAPE AND APPROACH



- **Decarbonization impacting hugely all industries**
- **Hydrogen and batteries are acting as major enablers in decarbonization**

Source: Frost & Sullivan

BUSINESS
FINLAND

Hydrogen and batteries – Dual Helix of decarbonization

Landscape hydrogen

LANDSCAPE HYRDOGEN – MARKETS

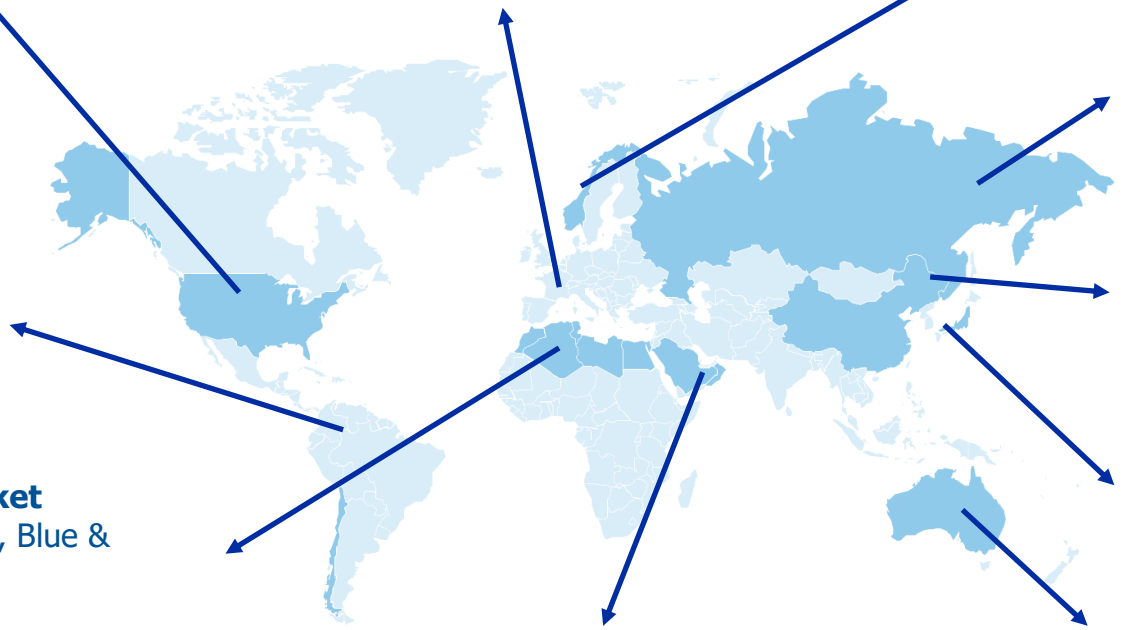
Most major global economies have developed hydrogen strategies

USA: Technology Expert & Investor
- Tremendous RES Potential
- Leads H2 technologies (Electrolysis & CCUS)
- Investment readiness
- Transport H2 via ships
- Potential to become exporter

Latin America: Growing Market
- Tremendous RES potential
- High H_2 production, storage & distribution costs
- Market potential for Green H_2
- Exporter of Green H_2 via ships

Northern Africa: Growing Market
- Tremendous potential for Green, Blue & Turquoise H_2
- High H_2 production, storage & distribution costs
- Exporter of Green H_2 & low-carbon ammonia via ships & pipelines
- Hub for transport of Green H_2 to Europe

EU: Largest Consumer & Producer
- Self-reliant supply of Green & Blue H_2
- Internal import & export through interconnections
- Leads H2 technologies (Electrolysis)



Gulf region: Growing Market
- Potential to become leading market for Green, Blue H_2
- Production & utilization of low-carbon ammonia
- Exporter of Green H_2 & low-carbon ammonia via ships

Norway: Green H_2 exporter
- Huge potential for Green & Blue H_2
- Production & utilization of low-carbon ammonia
- Transport within Europe by pipeline

Russia: Self-Consumption
- Has the potential to be a significant producer of blur hydrogen.
- Current political situation limits export potential.

China: Growing Market
- Potential to become leader in electrolyser & storage technologies
- Development of "Hydrogen Hubs" focused on H_2 development

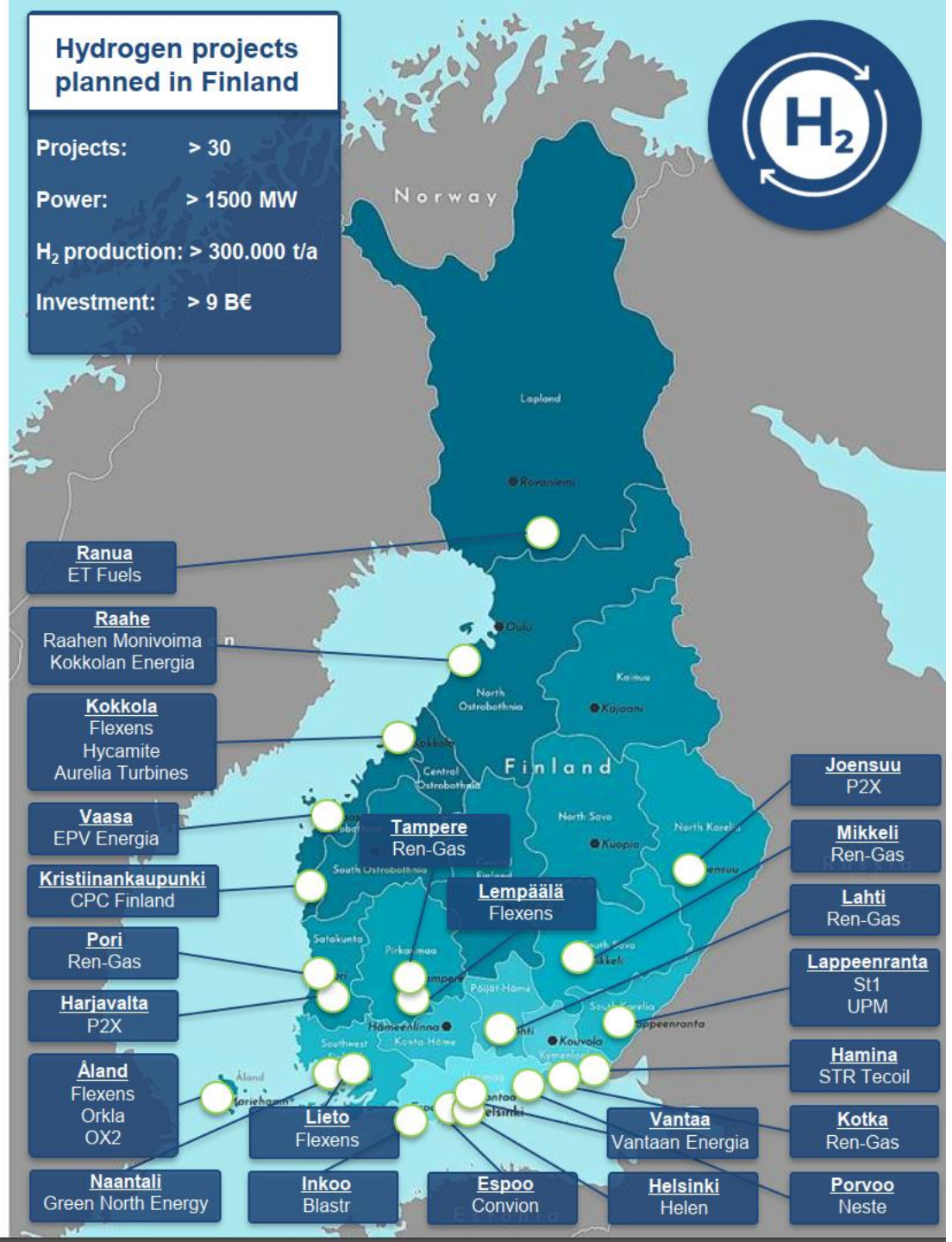
Japan & Korea: Leader in Fuel Cell Technologies
- Leading importer of H_2 & ammonia
- Utilization across industries

Australia: Accelerated growth in H_2 developments
- Potential to become leading exporter of Green & Blue H_2 & ammonia
- Utilization across industries
- Transport by ship

Source: Frost & Sullivan

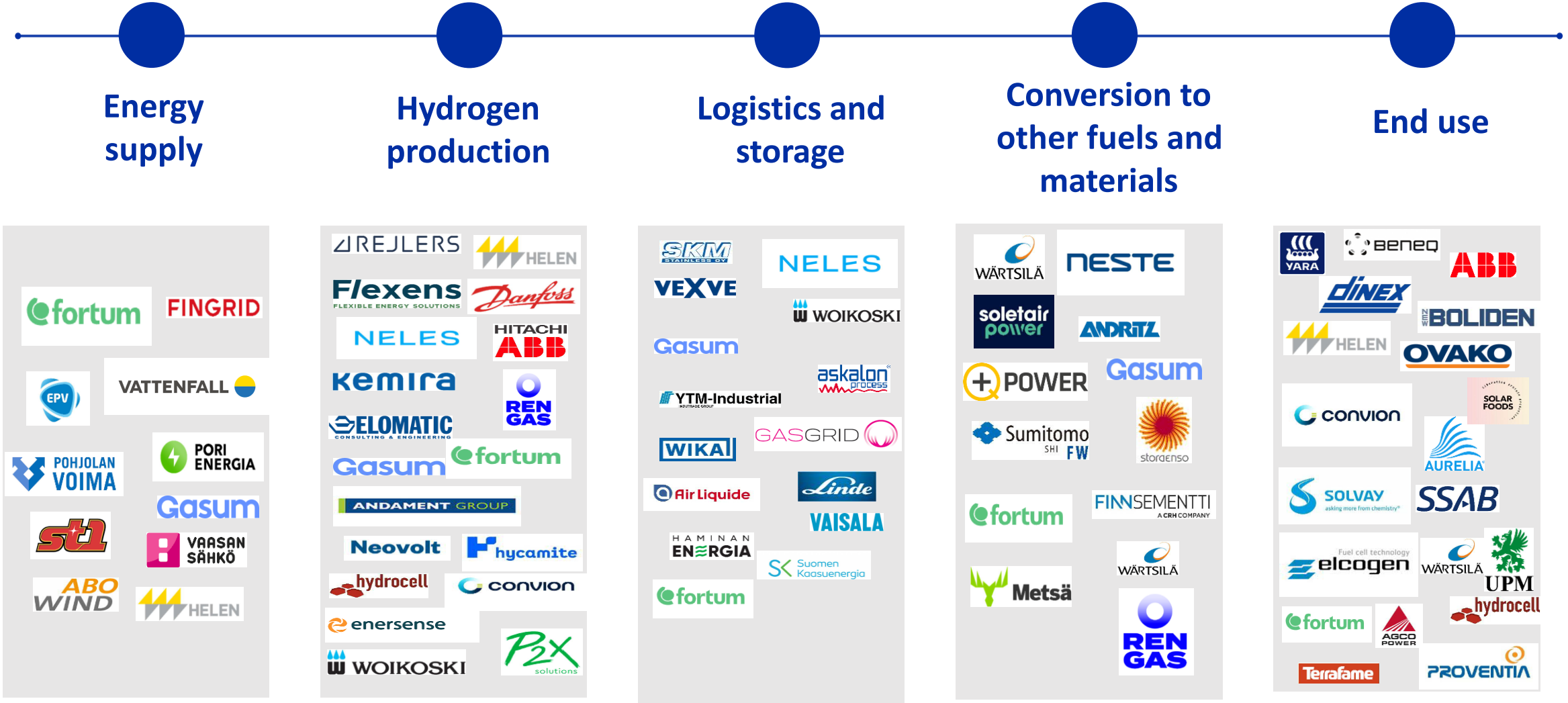
Hydrogen projects in Finland

- In year 2023 there are more than 30 hydrogen projects planned or already under construction in Finland
- First projects to be commissioned during year 2024
- Annual hydrogen production of planned projects will be more than 300.000 tonnes
- Most of the produced hydrogen will be refined into E-fuels or other products



H2cluster FINLAND

LANDSCAPE HYDROGEN – FINNISH COMPANIES VALUE CHAIN



BUSINESS
FINLAND

Hydrogen and batteries – Dual Helix of decarbonization

Landscape batteries

Cell production in Europe is growing: Selection of ongoing and planned lithium battery cell factories in Europe

EUROPEAN BATTERY ALLIANCE | EBA250

Update 23 August 2022

NORTHVOLT ETT
In operation, up to 60 GWh

FREYR
Announced, planned start 2023, up to 29 GWh

NORTHVOLT Labs
In operation, 0,5 GWh

Volvo Group
Announced, up to XX GWh

Beyonder
Announced, up to 10 GWh

MORROW
Announced, planned start 2021, up to 24 GWh

AMTE Power
announced, up to 2 GWh

Northvolt/ Volvo Cars
announced, planned start 2025, up to 50 GWh

ENVISION AESC,
In operation, 1,9 GWh

ENVISION AESC/Nissan
Announced, up to 25 GWh

BRITISHVOLT
Announced, planned start 2024, up to 30 GWh

NORTHVOLT DREI
Announced, planned start 2025, up to 60 GWh

EUROCELL
Announced, planned start 2025, up to 3 GWh

VERKOR/Renault
up to 50 GWh

ENVISION AESC/Renault
Announced, up to 24 GWh

ACC France (Total/Stellantis/Mercedes)
IPCEI project, Start 2023, up to 24 GWh

ACC Germany (Total/Stellantis/Mercedes)
IPCEI project, Start 2024, up to 24 GWh

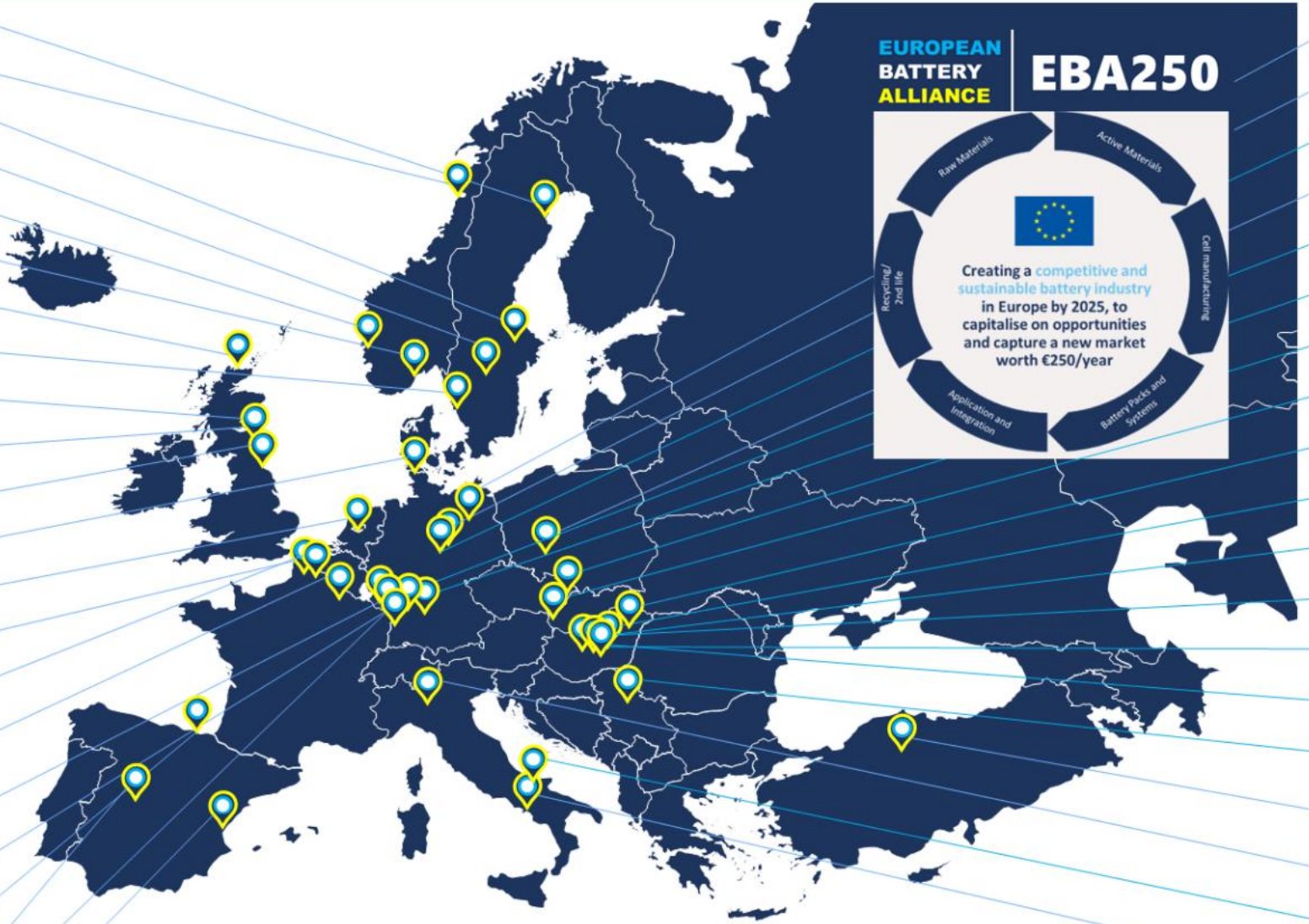
SVOLT
Planned start 2023, up to 24 GWh

Basquevolt, Spain
Announced, start 2025, up to 10 GWh

Acciona Energía/Envision
Announced, start 202X, up to 30 GWh

LECLANCHÉ/ENERIS
Small scale operation (0,3 GWh), up to 1 GWh

VW
Announced, up to 20 GWh



Source: EBA250 Observatory monitoring of public announcements on Li-Ion cell production capacity

TESLA
Start 2022, up to 150 GWh

CATL
Start 2022, up to 80 GWh

Volkswagen
Start 2022, up to 40 GWh

LG ES
In operation, 24 GWh, up to 67 GWh

CELLFORCE/Porsche
Announced, up to 1 GWh

VARTA
IPCEI project, Start 2021, up to 5 GWh

MES
Started 2020, up to 15 GWh

INOBAT
Announced, up to 2 GWh

EVE Energy, Debrecen, Hungary
Announced, start 2028, up to 30 GWh

SAMSUNG
Start 2018, up to 30 GWh

SK Innovation
In operation, 7,5 GWh

SK Innovation
In operation, 9,8 GWh

SK Innovation
Announced, start 2028, up to 30 GWh

CATL
Construction starting 2022, up to 100 GWh

ELEVEN ES
Announced, up to 16 GWh

SK Innovation/Ford Motor Company/Koç Holdings AS
Announced, start 2025, up to 30 GWh

ITALVOLT
Announced, up to 70 GWh

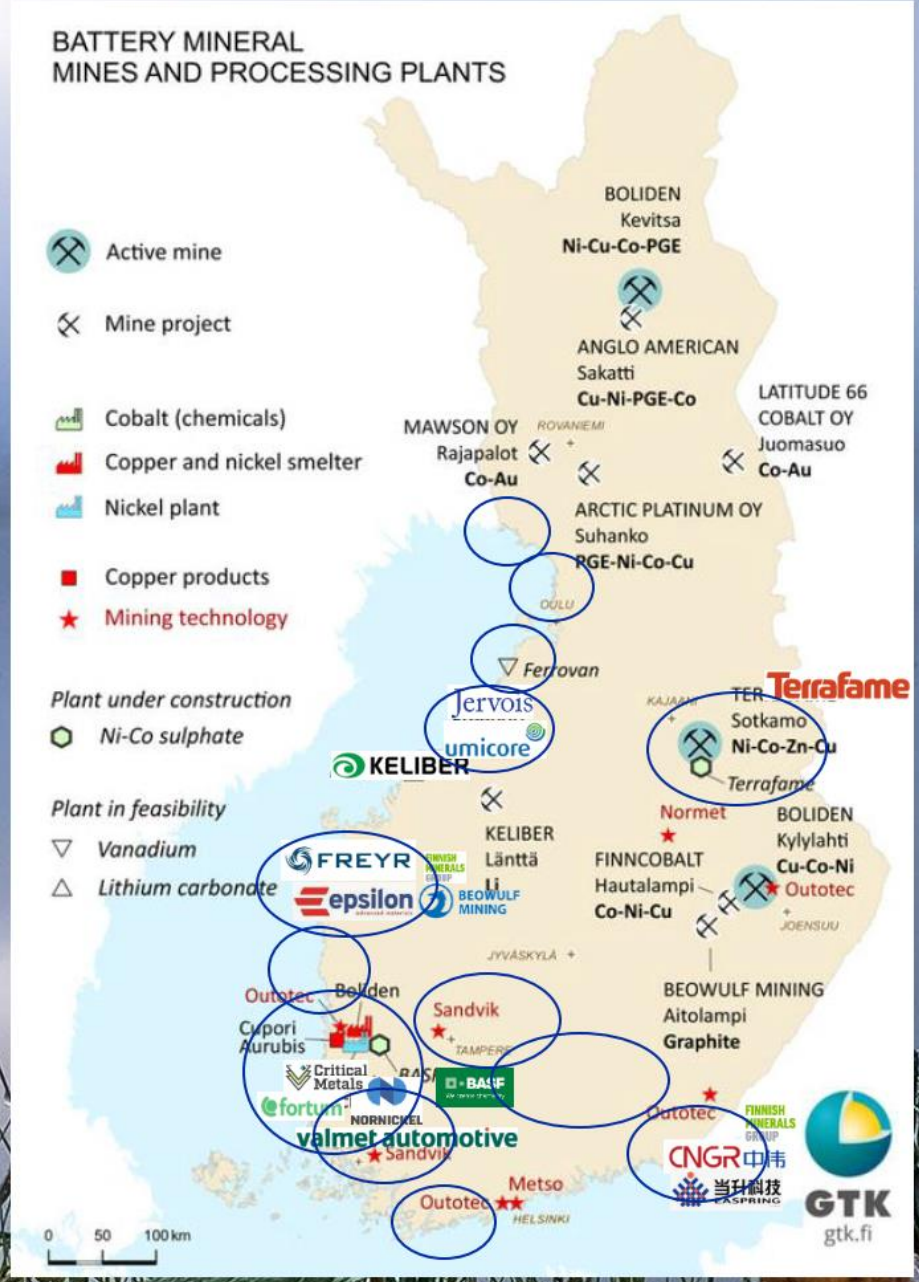
ACC Italy (Total/Stellantis/Mercedes)
Announced, up to 24 GWh

FAAM/FIB
IPCEI project, Production started small scale, up to 8 GWh

Volkswagen, Eastern Europe
Announced, location TBD, up to 10 GWh

FINLAND – ONLY EU COUNTRY WITH ALL KEY BATTERY MINERALS

SEVERAL INDUSTRIAL CLUSTERS / PARKS - Space, Power, People, Logistics



BATTERY KNOW-HOW AND MATERIALS, ELECTRIFICATION, DIGITALIZATION,

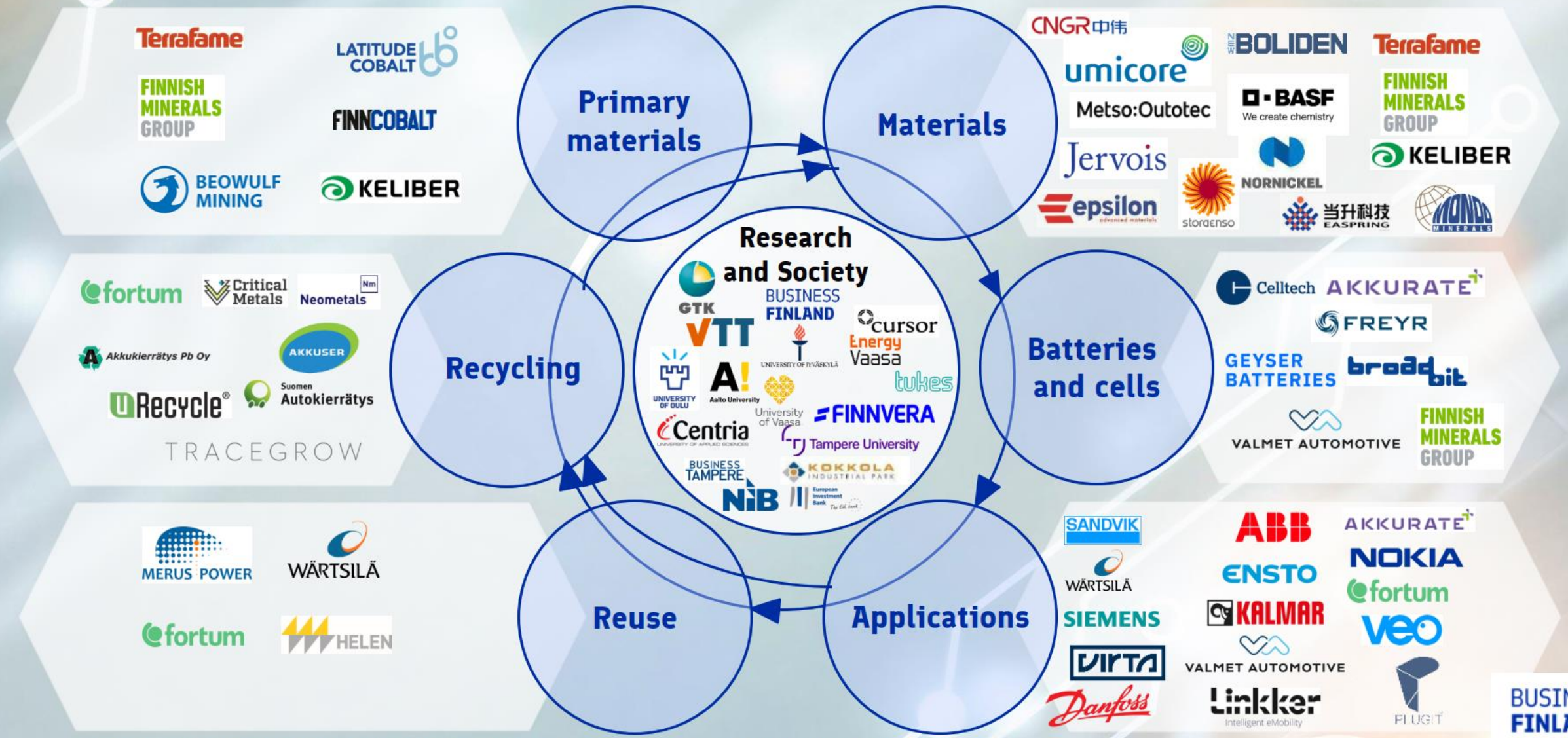
UNIQUE SUSTAINABLE CIRCULAR BATTERY ECOSYSTEM

Sample of companies

SUSTAINABLE CIRCULAR BATTERY INDUSTRY

FINLAND

SAMPLE OF COMPANIES INCLUDING OPERATING COMPANIES AND COMPANY PLANNING ANNOUNCEMENTS



https://www.businessfinland.fi/en/for-finnish-customers/services/programs/batteries-from-finland/

Ranking 2022 | Finland among the global top 4

November 1st, 2022

Finland #4

Figure 1: BNEF 2022 global lithium-ion battery supply chain ranking

Country	Raw Materials	Battery manufacturing	ESG	Industry, innovation and infrastructure	Downstream demand	Overall ranking
China	1	1	17	9	1	1
Canada	3	8	6	4	10	2
US	6	4	16	5	2	3
Finland	9	15	2	1	11	4
Norway	18	10	1	3	7	5
Germany	21	6	4	7	2	6
South Korea	17	2	10	6	5	6
Sweden	21	9	3	2	8	8
Japan	13	3	8	12	8	9
Australia	2	15	9	13	11	10
France	24	10	5	10	5	11
UK	26	15	7	8	4	12
Czechia	23	10	11	11	18	13
Poland	24	5	15	16	15	14
Hungary	26	6	13	14	20	15
Chile	7	18	14	23	19	16
Turkey	15	18	21	15	13	17
India	13	10	26	21	13	18
Vietnam	20	10	20	18	17	19
South Africa	8	18	19	17	26	20
Brazil	4	18	23	22	20	21
Indonesia	5	18	22	27	25	22
Argentina	11	18	12	19	26	23
Slovakia	26	18	18	25	24	24
Thailand	26	18	24	20	16	25
Philippines	10	18	29	28	22	26
Mexico	16	18	27	26	23	27
Morocco	19	18	25	24	28	28
DRC	11	18	30	29	30	29
Bolivia	26	18	28	30	28	30

Source: BloombergNEF. Note: "III" stands for infrastructure, innovation, and industry.

BUSINESS FINLAND

BUSINESS
FINLAND

Hydrogen and batteries – Dual Helix of decarbonization

Program contents

PROGRAM GOAL AND SUBGOALS

Driving Innovations through promotion of transformation, proactive activation of R&D&I community, helping in international R&D&I contacts to boost export and commercial results

Support **Investments** through export activities, Invest In co-op, financing facilitation, country to country partnerships to boost commercial results

To **catalyze** Finnish companies and stakeholders to capture **huge commercial opportunities** in long-term transitional growth in **hydrogen and battery industries**

Finland in the core of energy transition

Participation in **Policy Play** through EU and international structures and programs, EU regulatory influencing, industry policy

Impacting and reacting to **Behavioural change** through zero carbon showcasing and talent challenge activities

Economic growth

Competitiveness

Sustainability

Example activities

- Driving Innovations
  - Information on industry transformation
  - Information webinars in BF and EU funding
  - BF funding available on continuous basis
  - International funding
- Investments
  - Market information and market opportunities
  - International delegations
  - Match making events
  - International partnerships; projects and funding
- Policy play
  - Information webinars on EU regulation, R&D programs, subsidies
  - Information webinars on other international market policies
- Behavioural change
  - Talent challenge/attraction related events
  - Showcasing Finnish best examples both H&B

More concrete information 12.12.2023 in Ruoholahti:

Link to registration:
https://www.businessfinland.fi/en/whats-new/events/2023/opportunities-in-the-hydrogen--batteries-program

Contacts:

Ilkka.Homanen@businessfinland.fi
+358 44 5774430

Emilia.hyvatti@businessfinland.fi
+358 50 4349687