Aiming to become a leading solutions provider to the fast-growing battery industry

Nordea Battery Seminar
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7 April 2021

Aiming to become a leading solutions provider to the fast-growing battery industry

1. **A green transport revolution requires a green battery revolution**

2. **Elkem is uniquely positioned to supply specialised battery materials with a green footprint**

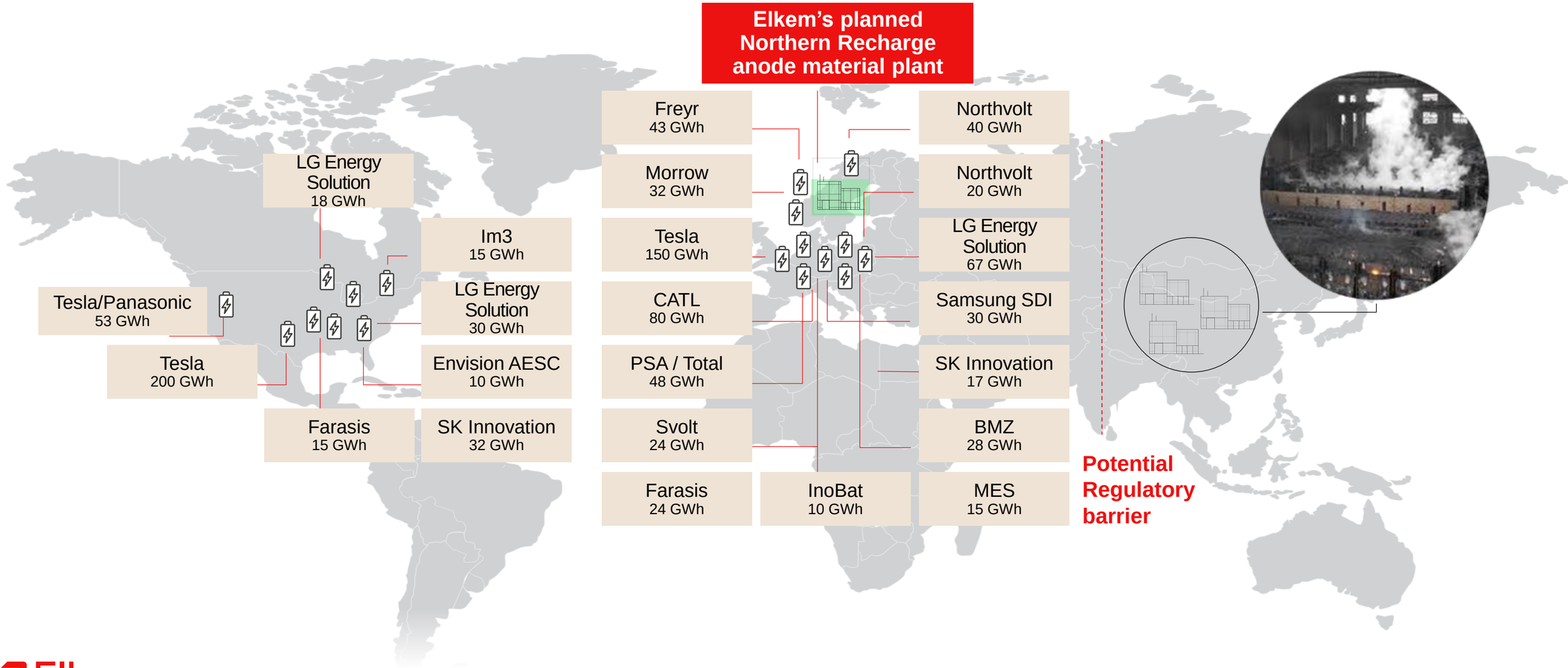
3. **Going from pilot to industrial production and aiming to become a leading solutions provider to the battery industry**

Elkem

High number of cell manufacturing projects in Europe and North America

…but production of critical anode materials is currently dominated by Asian players

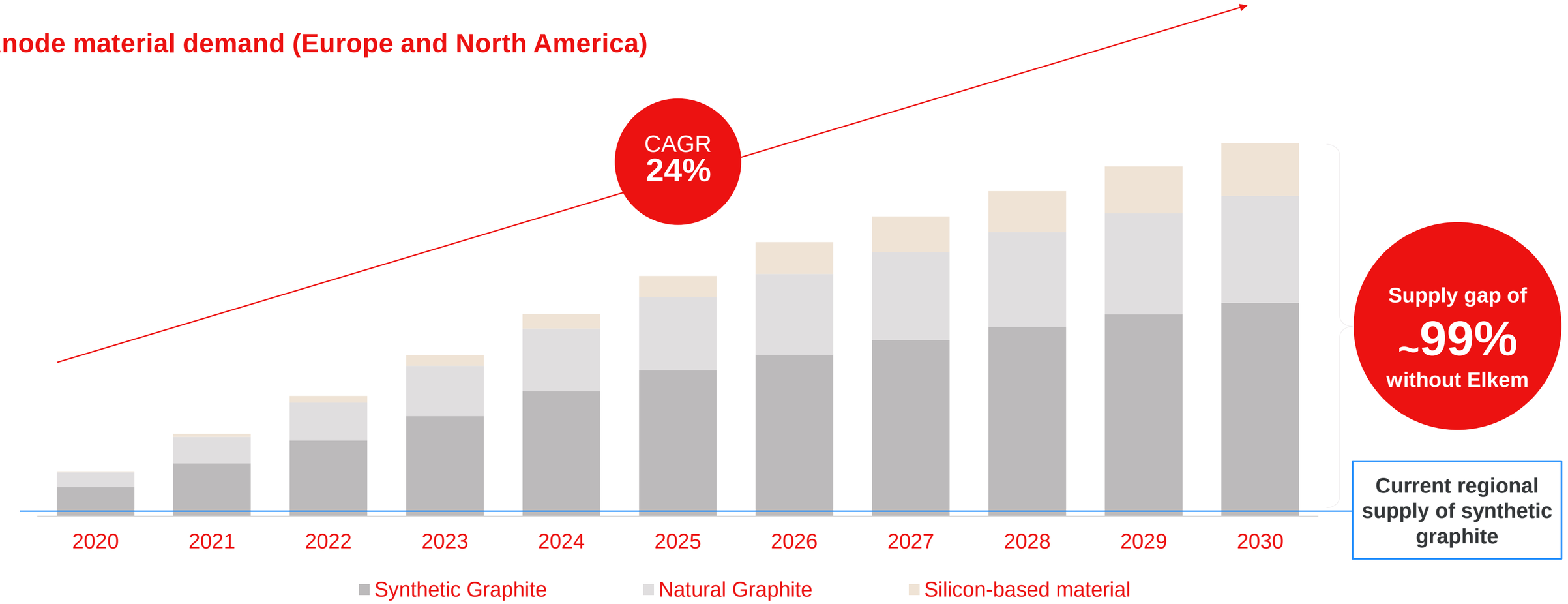
Gigafactory capacity (2030)
Europe ~ 610 Gwh
North America ~ 383 GWh
TOTAL ~ 1,000 GWh



Source: Benchmark Mineral Intelligence, Elkem intelligence.

This implies an increasing need for battery anode materials from reliable and sustainable suppliers

Anode material demand (Europe and North America)



Source: Benchmark Mineral Intelligence, Elkem analysis.

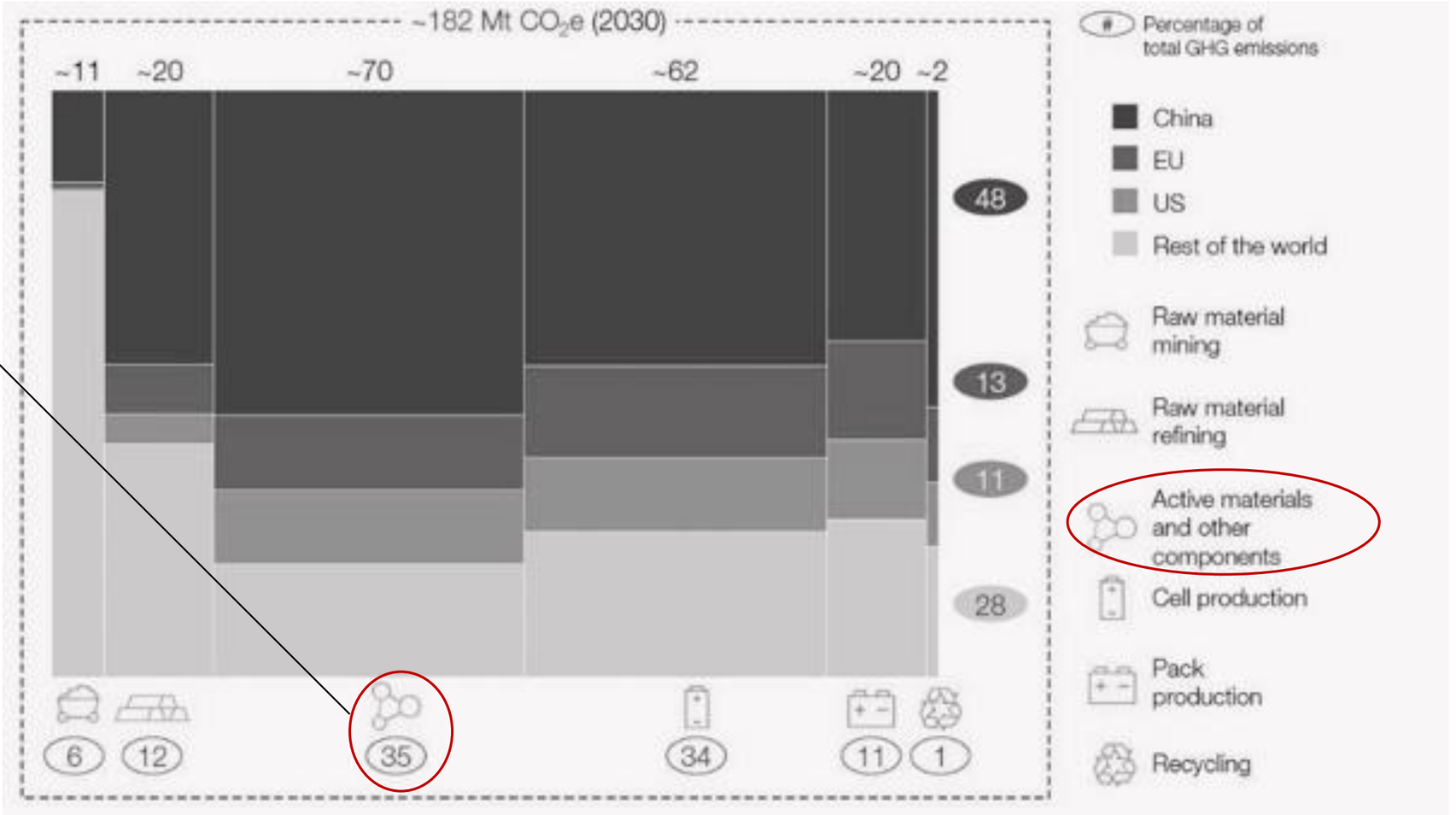
Today's battery production comes with a significant CO_2 footprint – active materials being a major contributor

Active materials and components

~ 35%

of battery GHG emissions

Greenhouse gas emissions by value chain step, Mt CO2e per annum (2030)



Source: World Economic Forum, Global Battery Alliance; McKinsey analysis

EU proposed regulations on sustainable batteries: Clear push for increased traceability, lower CO_2 footprint, more recycling

10 Dec 2020

EU proposal

2022

Producer responsible for **End-Of-Life collection**

2023

Traceability, performance, and durability documentation

2024

Carbon footprint documentation

2025

Recycling efficiency **65 %**

2026

Digital **battery passport**

2027

Max carbon footprint requirement

Recycled content documentation

2030

Recycled content requirement

Recycling efficiency **70 %**

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Source: Circular Energy Storage – Analysis of the new EU battery regulation

Automakers also increasingly focused on securing a more sustainable value chain

“We don’t want to compensate, we want to avoid. We don’t want to buy CO2 certificates from other companies, we don’t want to cause any emissions ourselves. Wherever energy cannot be saved, we use electricity from renewable sources”

Oliver Blume, chairman of the executive board of Porsche AG

COAL | ELECTRIC POWER | METALS — 11 Sep 2020 | 13:18 UTC — New York

VW aims to increase battery supply chain transparency

Swedish battery manufacturer Northvolt receives a $14 billion order from VW

Jonathan Shieber @jshieber / 1:30 PM GMT+1 • March 15, 2021

Tesla takes part in deal to take over controversial nickel mine in New Caledonia

Fred Lambert - Mar. 5th 2021 6:11 am ET @FredericLambert

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Source: Porsche, Tesla, Volkswagen, Northvolt

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1. **A green transport revolution requires a green battery revolution**

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Elkem

Elkem in brief

Elkem is one of the world's leading providers of advanced material solutions

Who we are

- A global team of 6,800 people, with >500 in R&D
- 29 production sites, R&D centres and offices worldwide
- Headquartered in Norway, hubs in France and China

What we do

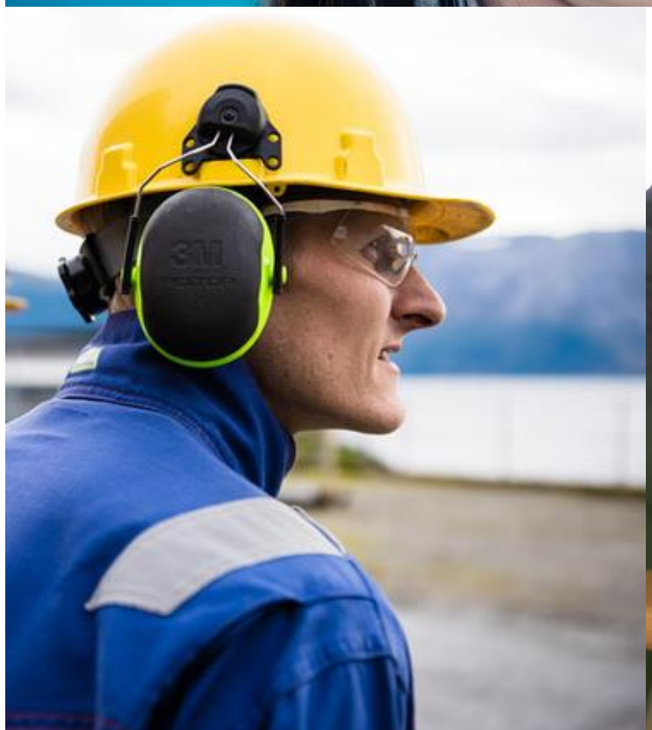
- We create and deliver advanced material solutions
- We offer specialties and standards from fully-integrated value chains
- Our divisions: Silicones, Silicon Products and Carbon Solutions

Our commitments

- Our purpose: Advanced material solutions shaping a better and more sustainable future
- Our strategy: Growth driven by operational excellence and increased specialisation

Our performance

- Track record of continuous improvement since 1904
- 2020: NOK 24.7 billion in revenues (USD 2.9 billion)
- 2020: Ecovadis "Gold" rating on sustainability, CDP "A" on climate



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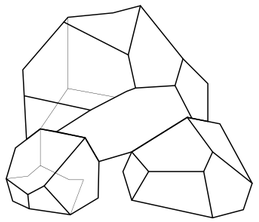
We are well-positioned in the battery value chain

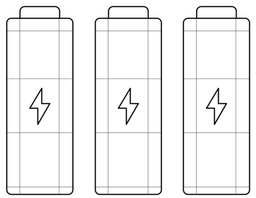
Elkem is a producer of **active anode materials**

Battery cell materials



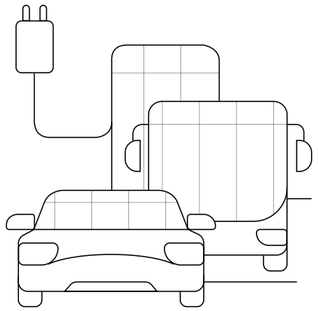
- *Synthetic graphite*
- *Silicon*

Cell manufacturing



Elkem is a supplier of **advanced silicone solutions for battery packs**

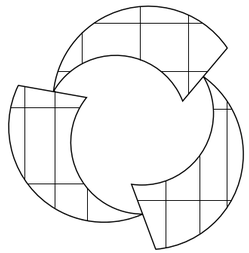
Battery modules and packs, vehicle integration



- *Thermal management*
- *Protection of electronics*
- *Cable protection*

Elkem is involved in **R&D projects with partners**

Recycling and second use



- *LIBRES program*
- *Others*

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Supporting a greener battery production

Renewable hydro power

Raw materials by land and sea

1 Elkem's Northern Recharge anode material plant

2 Battery cell manufacturing plant

3 Assembly of cells into battery modules and packs

10% Elkem anode graphite

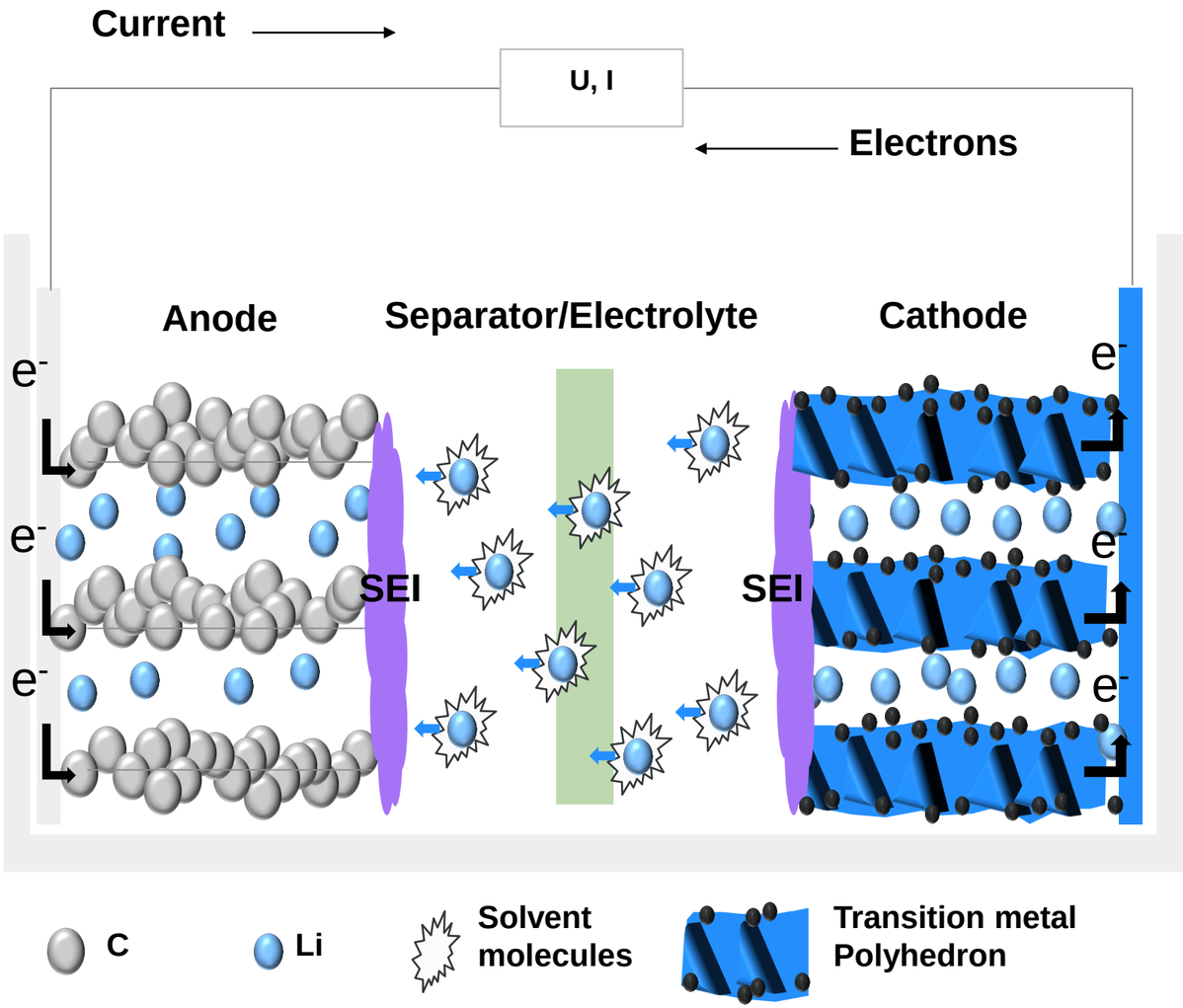
4 Integration of battery pack in vehicle

5 Recycling of anode graphite from battery

Anode graphite is a critical, advanced and highly engineered material

> *"Our cells should be called nickel-graphite, because primarily the cathode is nickel and the anode side is graphite"*
> ***Elon Musk, CEO of Tesla***

- **High energy density**
  - Graphite structure
  - Powder density
- **High charge speed**
  - Short diffusion path for Li-ions
  - Particle size and structure
  - Surface properties
- **Long lifetime/many cycles**
  - Graphite is an intercalation material (fundamentally different from silicon anodes) - this gives mechanical integrity
  - Surface forms stable Solid Electrolyte Interface (SEI)
- **Safety**
  - Controlled and limited degradation mechanisms
  - Limited swelling



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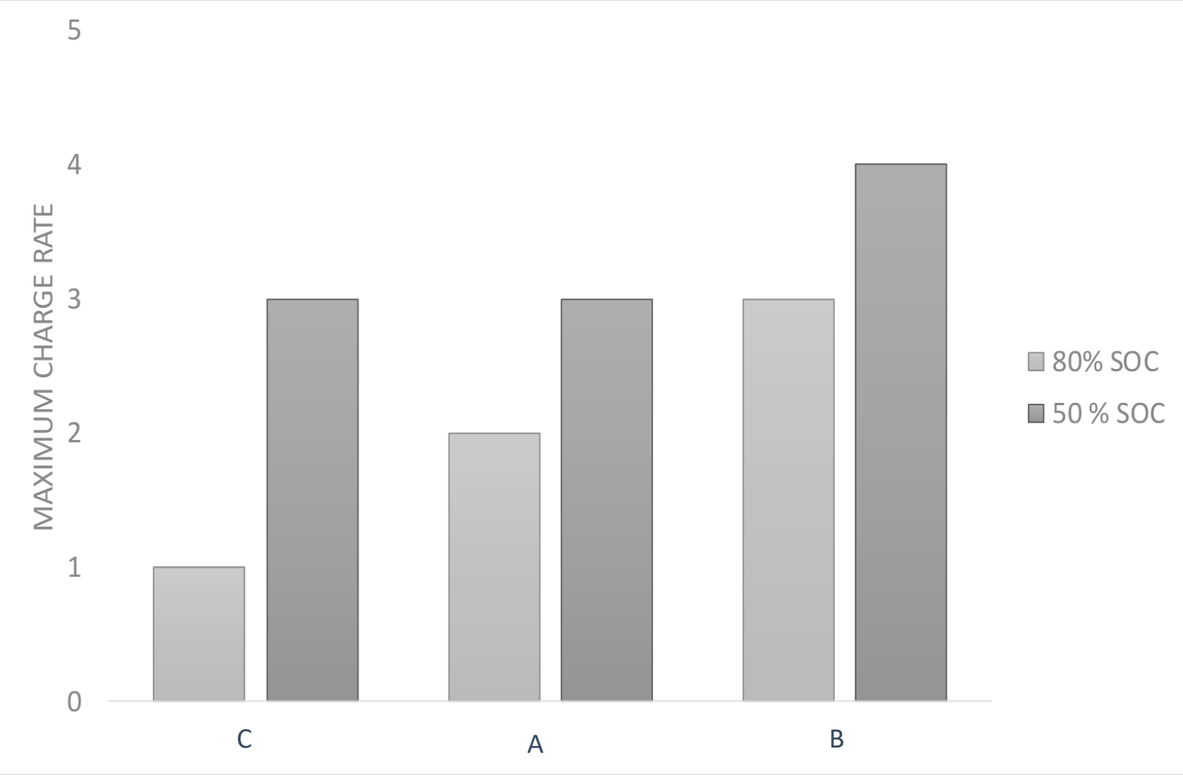
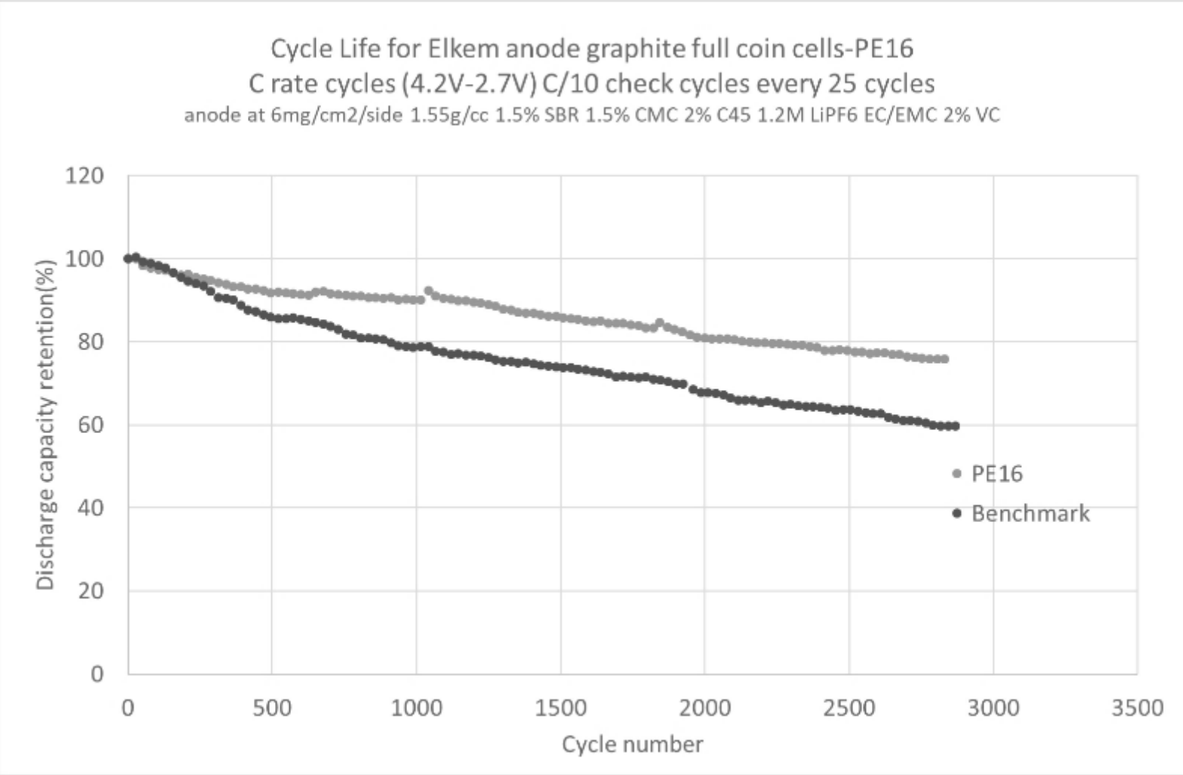
Elkem's active anode materials enable **fast charging** with **high energy density** and **long cycle life**

STRONG FAST-CHARGING CAPABILITIES



LONG CYCLE LIFE



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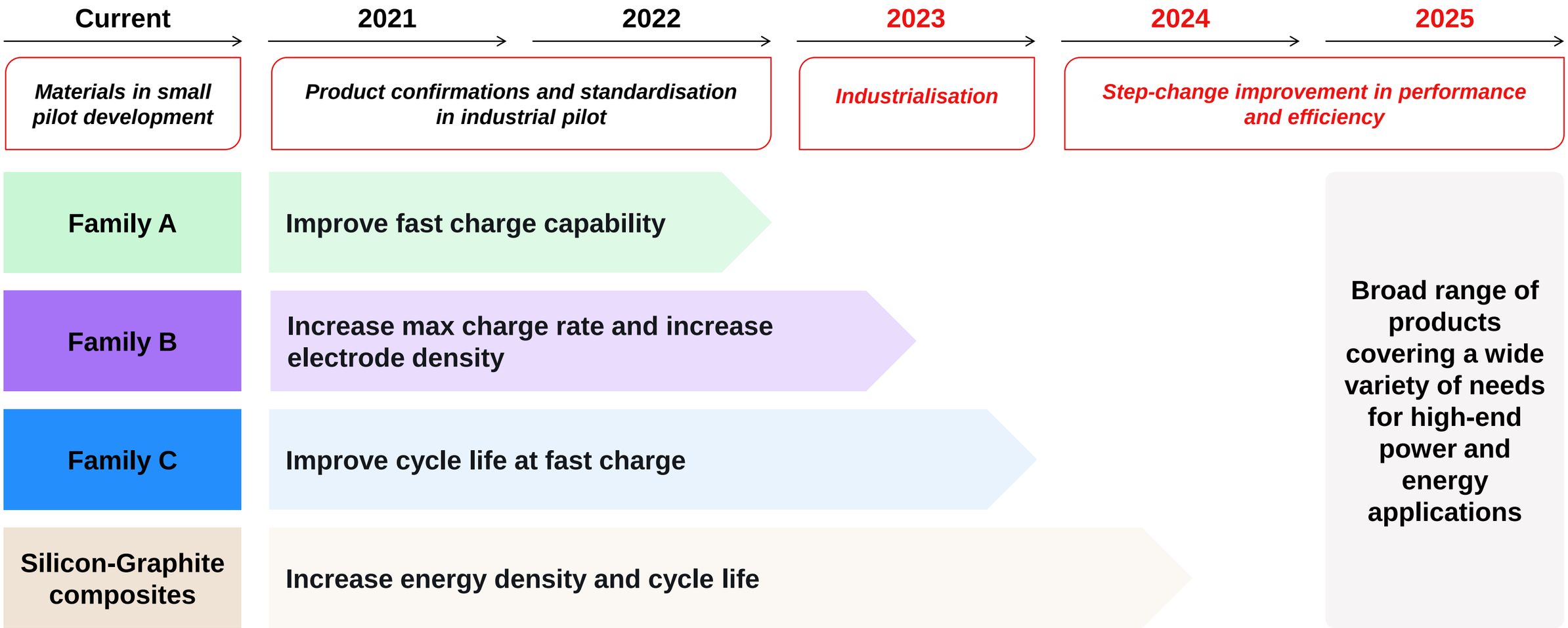
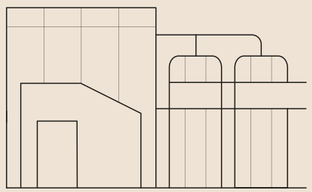
A clear roadmap for product families covering a wide variety of needs for high-end power and energy applications

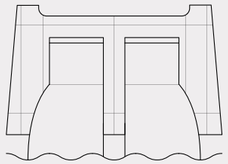


Elkem’s disruptive technology and access to clean hydropower enable **close to zero emissions**

Emission reductions vs market standard production process [1]

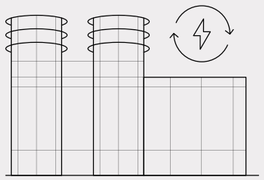


Acheson furnace process emissions

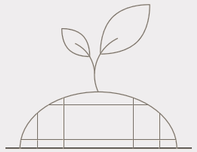


Clean hydro power

~ 90% reduction



Disruptive technology



Elkem greener processing

[1] Indirect CO2 emissions based on data from www.nve.no and www.iea.org

Silicon as capacity booster: Silgrain® powders for next generation LIB anodes

Silicon additions in the anode improve the energy density

- Technical challenges still to overcome to allow for larger additions and long cycle life

Silgrain® is a high purity silicon material with promising performance in battery anodes

- Existing large scale production capacity in Bremanger, Norway. Around 40,000 tons per year
- Sustainable production based on hydro-power

Strong focus on technology development together with customers and external research institutes

- Elkem has supplied advanced silicon solutions for 30+ years

Elkem is developing silicon-graphite composites for next generation anodes

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We are preparing to go from **pilot** to **industrial production**

	Pilot	Industrial pilot*	Industrial plant no. 1
			
Capacity	5 tons per year	200 tons per year	50,000 tons per year
Status	In full operation	In commissioning and start-up, In full operation from Q2 2021	In planning**. Phase 1 SOP: 2023 Phase 2 SOP: To be decided
Description	All process steps. Small size industrial equipment.	All process steps. Industrial scale equipment.	Modular design for rapid expansion
Location	Kristiansand, Norway	Kristiansand, Norway	Herøya Industrial Park, Norway

Elkem

*Project supported by Innovation Norway ** Project planning supported by ENOVA

Elkem’s Northern Recharge plant project, Herøya Industrial Park

Aiming to become a leading solutions provider to the fast-growing battery industry

- Positioning to become a leading supplier of advanced materials in a multi-billion USD market
- Leveraging our 100+ years of experience in large-scale high-temperature processes
- Offering a full range of materials and services with a dedicated and world-class team

Elkem aims to be a solutions provider to the battery industry, meeting today’s challenges and tomorrow’s opportunities

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Delivering your potential