

FULL REPORT

The Nordic Battery Value Chain

- Step 2: The feasibility of a joint Nordic value proposition to attract investments and partnerships within the battery value chain

An assignment from the Swedish Energy Agency

Delivered by Business Sweden

Published on August 26th, 2021



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- Preface
- Executive summary
- **A new industry in Europe**
- **An emerging value chain in the Nordics**
 - Developments
 - Preconditions
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 - Overall
 - Per step of the value chain
- **Nordic joint business promotion**
- **A value proposition for FDI and partnerships**
 - Summary
 - Value proposition evaluation
- Appendix



This report is a second step in the overall ambition to evaluate a joint Nordic approach to strengthen the high potential emerging battery industry

Background

- The Swedish Energy Agency and Business Sweden believe that the Nordics have an advantageous momentum to realize the potential of a new basic industry, take position for sustainability and thereby have a critical impact on accelerating the green transition. There is an emerging Nordic battery industry in Sweden, Finland and Norway, with the business and employment potential to become a new basis industry.
- In the Nordics, the Nordic Council of Ministers has set out its vision - to become the most sustainable and integrated region in the world by 2030. In April 2021 Innovation Norway, Business Finland and Business Sweden signed a Letter of Intent for Nordic Collaboration in Trade Promotion. The ambition is to work closely together in carefully selected initiatives where the value of acting as one united force is undisputable. Battery and health technology are two ongoing initiatives
- In, December 2020, the Swedish Energy Agency and Business Sweden joined forces to evaluate how to support the emerging Nordic Battery Ecosystem.
 - The overall goal is to support the development of a sustainable, circular, profitable and competitive Nordic battery industry.
 - This is the second report launched during 2021

March 2021

- 1
- The Nordic Battery Value Chain: an inventory of actors active in the battery value chain in Denmark, Finland, Iceland, Sweden and Norway
 - Overall criteria of foreign investors

August 2021

- 2
- Interviews with industry representatives
 - Understanding the need to complete the value chain in the Nordics
 - Understand the viability of a joint Nordic Value Proposition for positioning & FDI
 - Suggestion of next steps

Objective of the report

- To understanding the need to complete the value chain in the Nordics
- To understand the feasibility of a joint Nordic Value Proposition attracting foreign direct investments and partnerships

Methodology

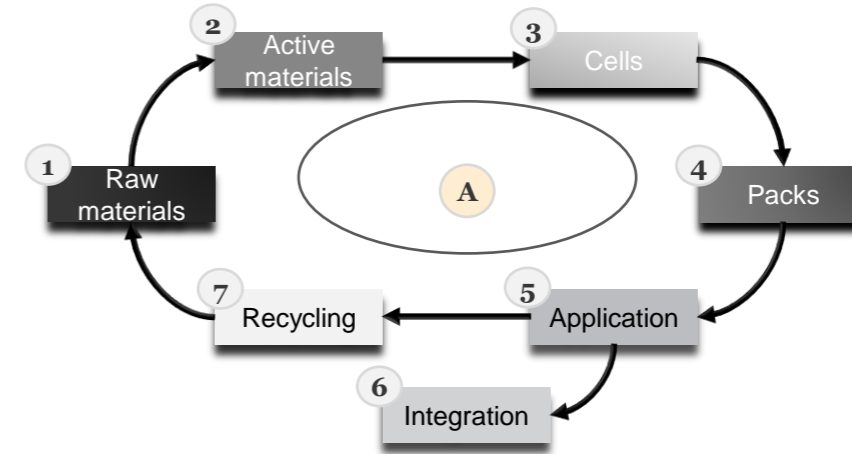
- The report is based on
 - in-depth interviews with representatives from leading players within all parts of the value chain in Sweden, Finland and Norway. About 10 interviews per country
 - additional interviews from step 1 for deepened understanding of foreign investor need
 - market research for a comparative analysis of competing regions within Europe focusing on Central Europe (Germany / France) and Eastern Europe (Hungary / Poland)
- The methodology for how to identify a competitive value proposition is based on three theoretical frameworks (see explanation in appendix)
 - *Effective Inward Investment Value Proposition* (by Nick Smillie, Clarity Business Strategies Ltd., 2018) focusing on foreign investments to geographical regions
 - *Value Proposition Design* (by Alexander, Yves, Gregory, Smith, Trish, 2014) focusing on positioning the value proposition around what the customer values and needs.
 - Overall *Business Sweden* methodology for Investment Promotion

The report focuses on the full lithium-ion battery value chain in the Nordic countries Sweden, Finland and Norway

Report preconditions

- Audience and application
 - The report is publicly available targeted towards collaboration partners to the industry still new to the battery industry as well as to market experts. The aim of the report is to be used for discussions with and within the battery ecosystem in the Nordics
- Focus
 - The focus of the report is to have a dialogue with industry representatives to seize their opinions and needs ahead
 - The report focuses on the value chain for lithium-ion batteries but touches on developments in R&D and innovative solutions for other technologies. The report work has been carried out from a market perspective. There are several application areas for lithium-ion batteries, e.g. transport as passenger electric vehicles (hereinafter EV, heavy vehicles, trains, airplanes and the maritime industry; energy storage in the grid as well as construction or forestry machinery. The battery industry is changing rapidly, and the report highlights the market until the end of June 2021
- Limitations
 - The reports focuses on Finland, Norway and Sweden in line with the actual set, or ambitions to set, national strategies for the establishment of a battery industry. As there are no such overall ambitions today in Denmark or Iceland these countries have not been included.
 - The report objective does not include analysis of size of potential for each country considering employment, turnover or trade nor analysis of the concrete size of the competence gap in numbers
 - The value chain is a simplified version of reality to fit the scope of the assignment. The value chain can be analyzed both deeper and in more detailed steps.
 - The initial comparative analysis of the value proposition is not a deep full-weighted analysis but serves as an initial overview

The steps of the battery value chain



- 1 Critical raw materials used in lithium-ion production; steel (sleeve), aluminum and copper (conductors), graphite (anode material) and manganese, lithium, cobalt, nickel, aluminum and iron (cathode material)
- 2 Production of anodes, cathodes and electrolyte for usage in lithium-ion cells
- 3 Production of lithium-ion battery cells
- 4 Production of the packs for lithium-ion cells with including Battery Management System (BMS)
- 5 Vehicles and other machinery using lithium-ion batteries in order to function
- 6 Energy storage including charging stations for EV, other grid solutions and battery storage units for the energy networks
- 7 Recycling of the materials of the lithium-ion and/or re-usage of the cell
- A Academia, Official organizations, Networks

The report findings and analysis are based on 26 interviews with leading players in Sweden, Finland and Norway

Interviewees from Sweden, Finland and Norway*

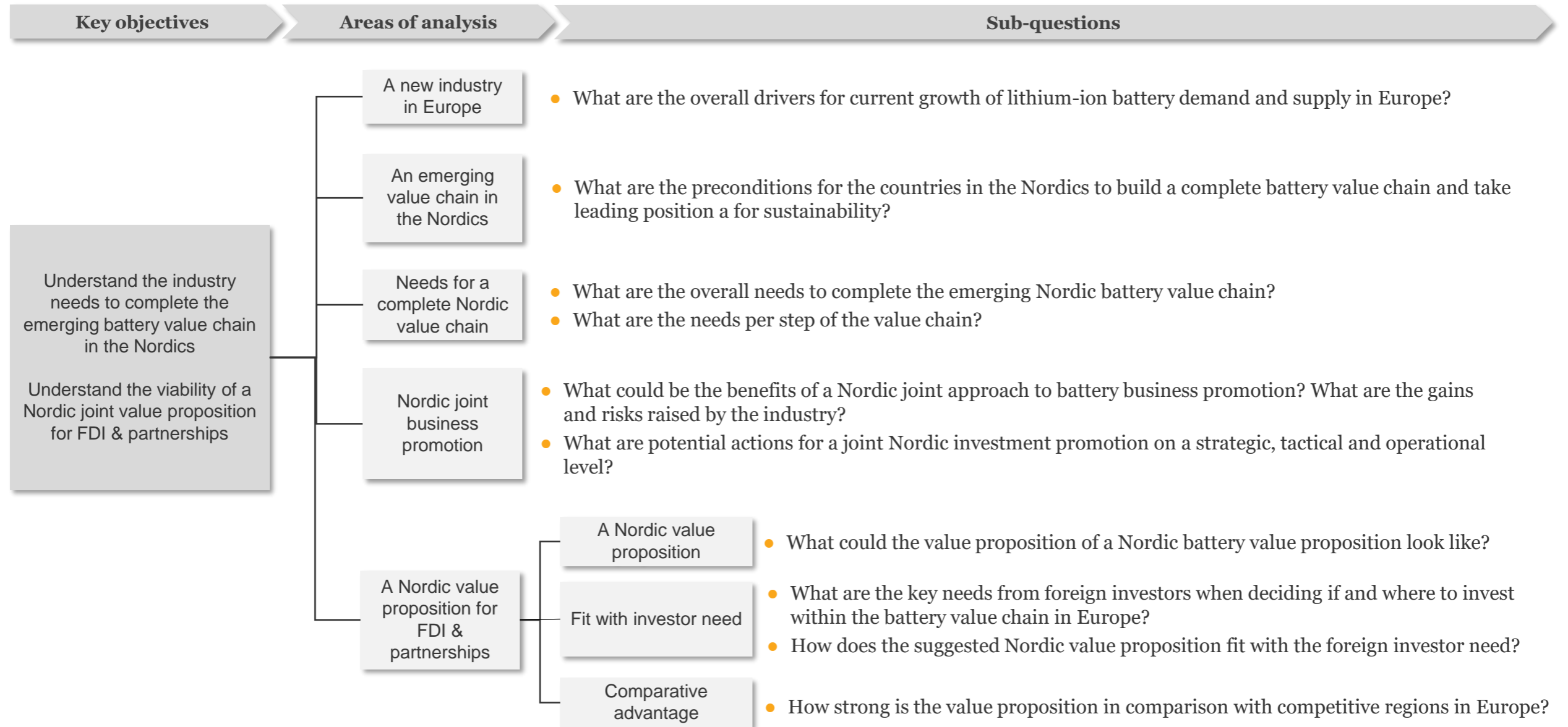


- About the interviews
 - The 26 interviews were conducted throughout April – June in 2021.
 - The information from the specific interviews is confidential. No information in the report can be tracked to a specific company.
 - Business Sweden take full responsibility for the compilation of the information from the interviews. Although confidential, individual opinions are from the interviewees and not from Business Sweden
- Acknowledgements
 - The Swedish Energy Agency and Business Sweden would like to express our gratitude to all interviewees as well as to Business Finland and Innovation Norway for dialogue and support throughout the work with this report



*Excluding additional interviewees wishing to stay confidential

The key objectives are broken down into three areas of analysis with ten defined sub-questions answered throughout the report



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This report is a second step in the overall ambition to evaluate a joint Nordic approach to strengthen the emerging battery industry in the Nordic region

Background	<ul style="list-style-type: none"> • In, December 2020, the Swedish Energy Agency and Business Sweden joined forces to evaluate how to support the emerging Nordic Battery Ecosystem • The overall goal is to support the development of a sustainable, circular, profitable and competitive Nordic battery industry • The reports focuses on the Nordic countries who have set, or with ambitions to set, national strategies for the establishment of a battery industry. • This is the second report launched during 2021
Objective of the report	<ul style="list-style-type: none"> • To understand the gaps that need to be filled in order to build up a competitive battery industry in the Nordic region • To understand the feasibility of a joint Nordic value proposition for attracting foreign direct investments and partnerships
Methodology	<ul style="list-style-type: none"> • The report is based on <ul style="list-style-type: none"> – In-depth interviews with leading players within all parts of the value chain in Sweden, Finland and Norway – Market research for a comparative analysis of competing regions within Europe
Appreciation	<ul style="list-style-type: none"> • Our gratitude to all interviewees as well as to Business Finland and Innovation Norway for dialogue and support
Next steps	<ul style="list-style-type: none"> • To discuss the report findings with the Nordic industry

Interviewees from Sweden, Finland and Norway*

*Excluding additional interviewees wishing to stay confidential

There is a great potential for the Nordic countries to develop a strong position in the rising European battery market – but the window of opportunity is narrowing



Key takeaways

European battery industry is developing fast

- Electric vehicles drive and accelerating growth of European battery market
- Vast investments into Europe bring competence and capital
- Ongoing race among emerging European battery hubs to secure investments
- Heavy EU investments for an EU clean energy transition towards carbon neutrality by 2050

The Nordic region has a favorable momentum

- The battery industry is being developed throughout the region
- The Nordic countries have complementary strengths in every step of the battery value chain
- The region has advantages in clean, affordable energy and a strong manufacturing industry

Some gaps need to be filled to build a competitive industry

- There is an overall need to speed up the development and strengthen market position
- Competence and critical components are required
- Foreign direct investments are needed to fill the gaps

By joining forces, the region can take a strong position

- The region needs to move fast in order to take a stronger position
- Joint promotion activities to get attention is desired by the industry
- A joint value proposition would improve the attractiveness towards foreign investors

“The value chain needs to become circular [...] and **batteries need to be obtained close by**. You do not want to be under China's restrictions. Covid has proved that the supply chain must be European.”

[Finnish company]

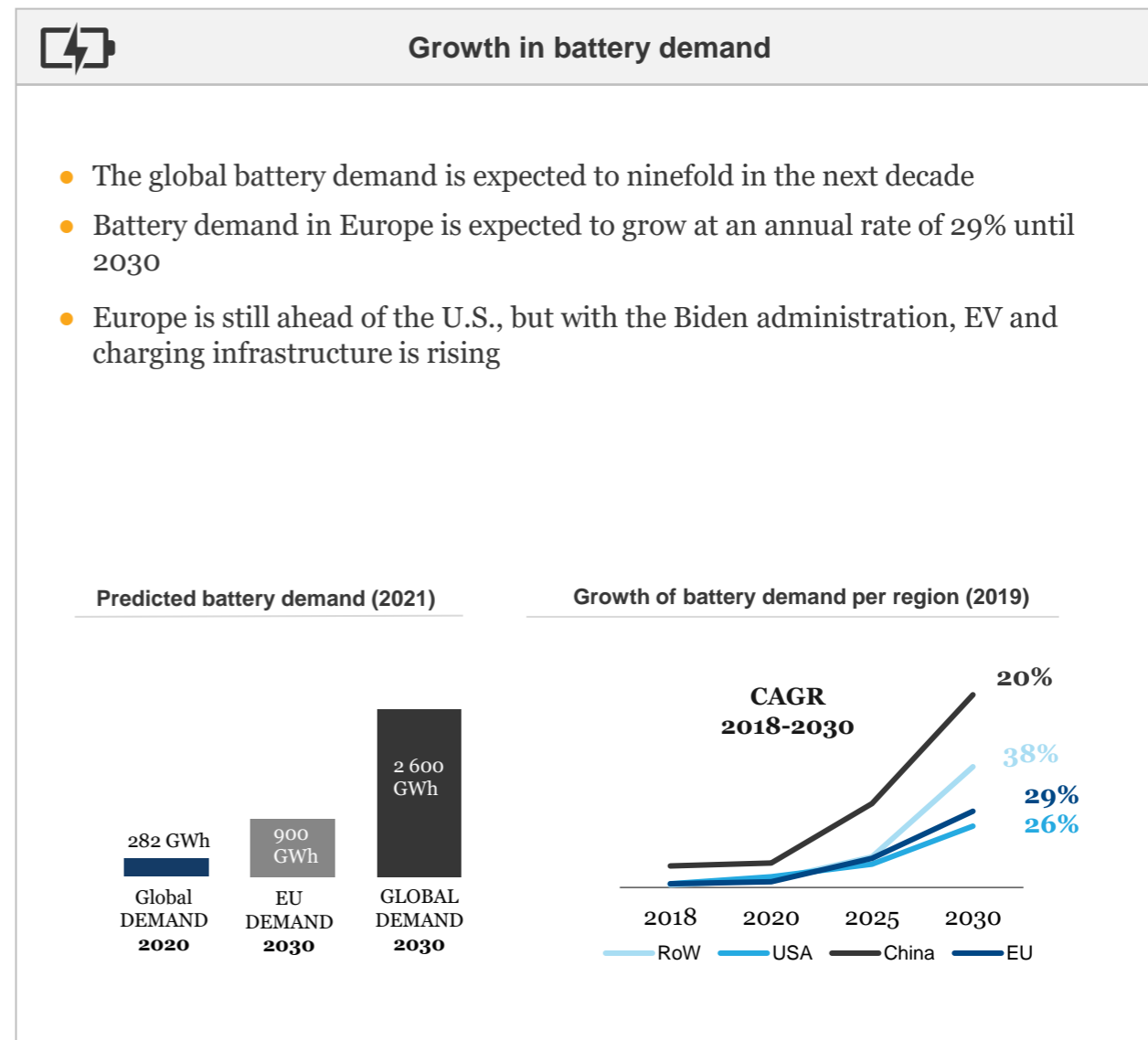
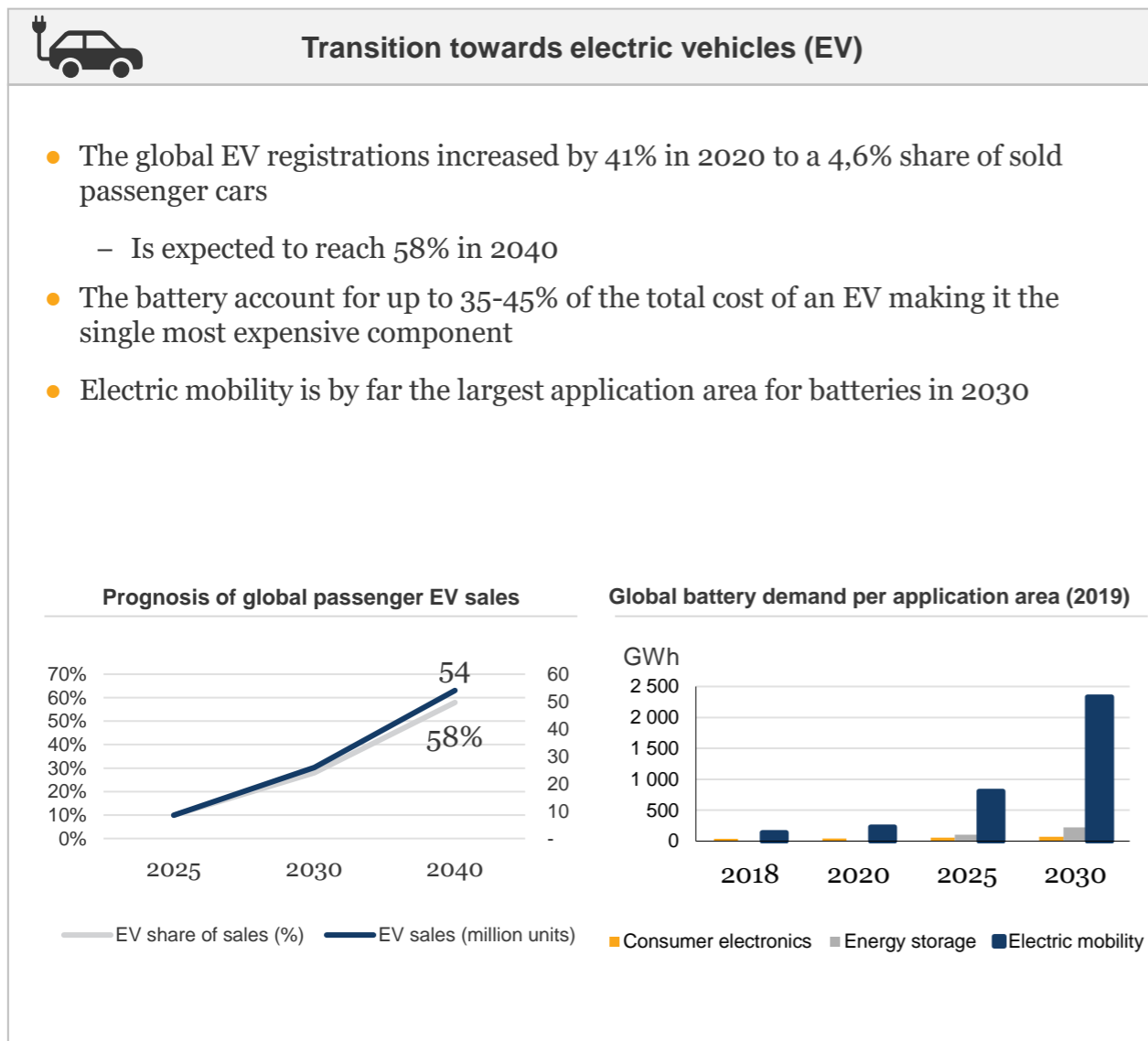
“Nordic batteries have **the chance to become the Rolls-Royce of batteries**. We have the preconditions for high quality sustainable batteries and integration with digital services.”

[Norwegian company]

“We need to take decisions and invest now **in order to take this position for sustainability at all**. It takes 3-4 years to establish a battery cell factory, and 10 years to set up mining. **We need to act NOW.**”

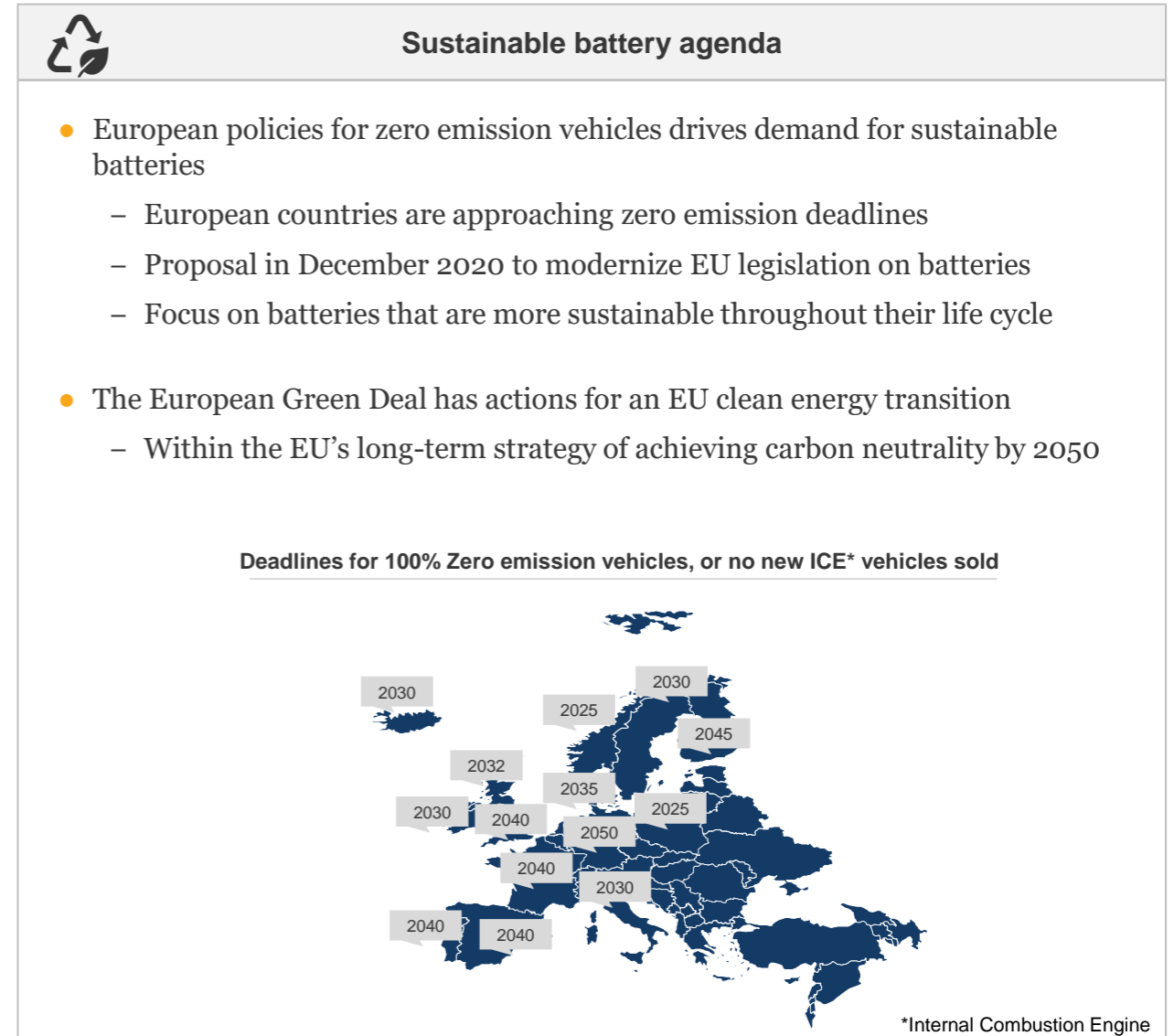
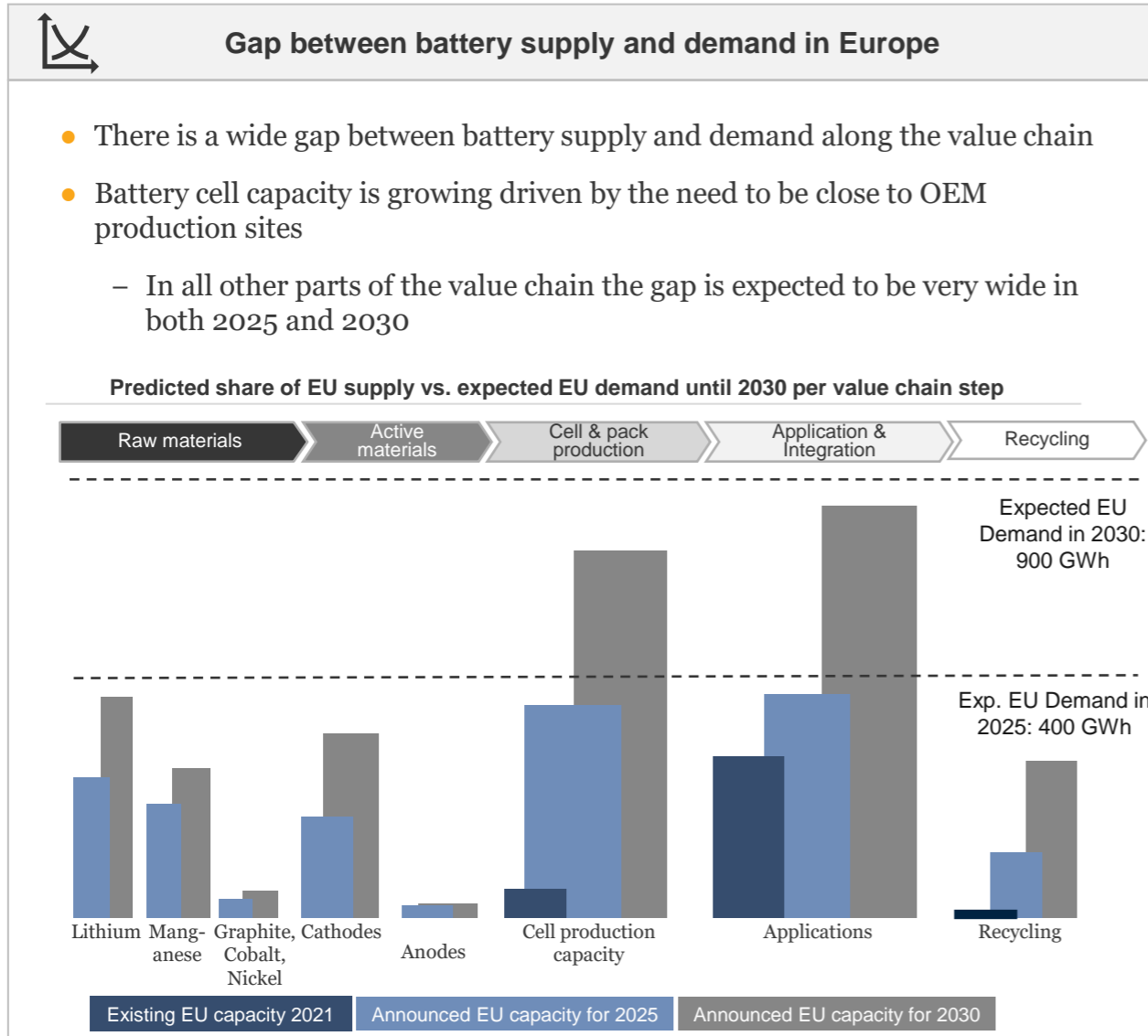
[Swedish company]

The transition towards electrical vehicles will accelerate the demand for batteries in Europe in the next decade



Source: World Economic Forum - A Vision for a Sustainable Battery Value Chain in 2030, McKinsey analysis 2020, BloombergNEF Electric Vehicle Outlook 2020, European Battery Alliance

There is a wide gap between current production capacity and future demand - EU regulations for a green battery life cycle are setting the market conditions



Source: European Battery Alliance, Innovation Norway and Eyde Cluster: The Nordic Battery Scene, part 2, National governments

Europe is mobilizing to build up competitive battery value chains – the arena is expected to be set within 3-4 years



European battery production build-up

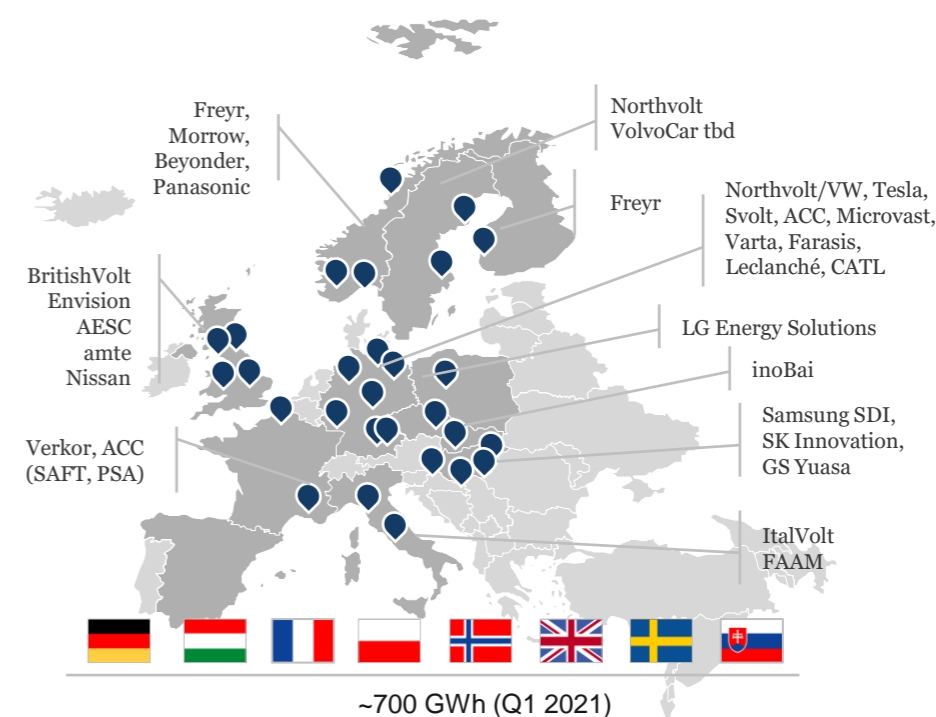
- Proximity of strategic components are crucial for European OEMs
 - Today, China, South Korea, Japan and Taiwan represent about 80-95% of the global battery production capacity
- The European share of the global battery production is expected to grow from 6% in 2020 to 16% in 2030
- Investments are happening at high speed – primarily by Asian and North American industry actors

Bloomberg NEF ranking (planned capacity)

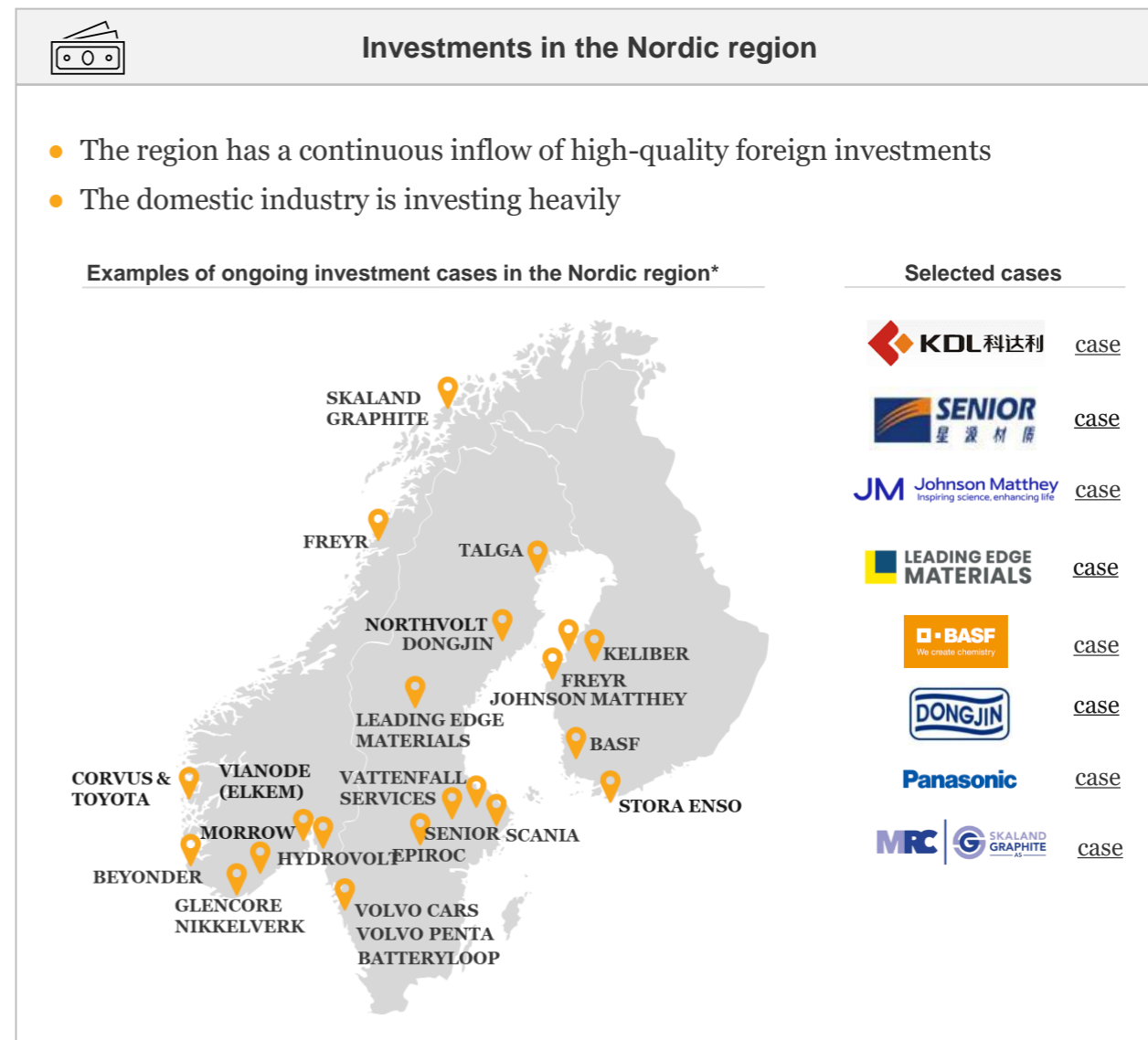
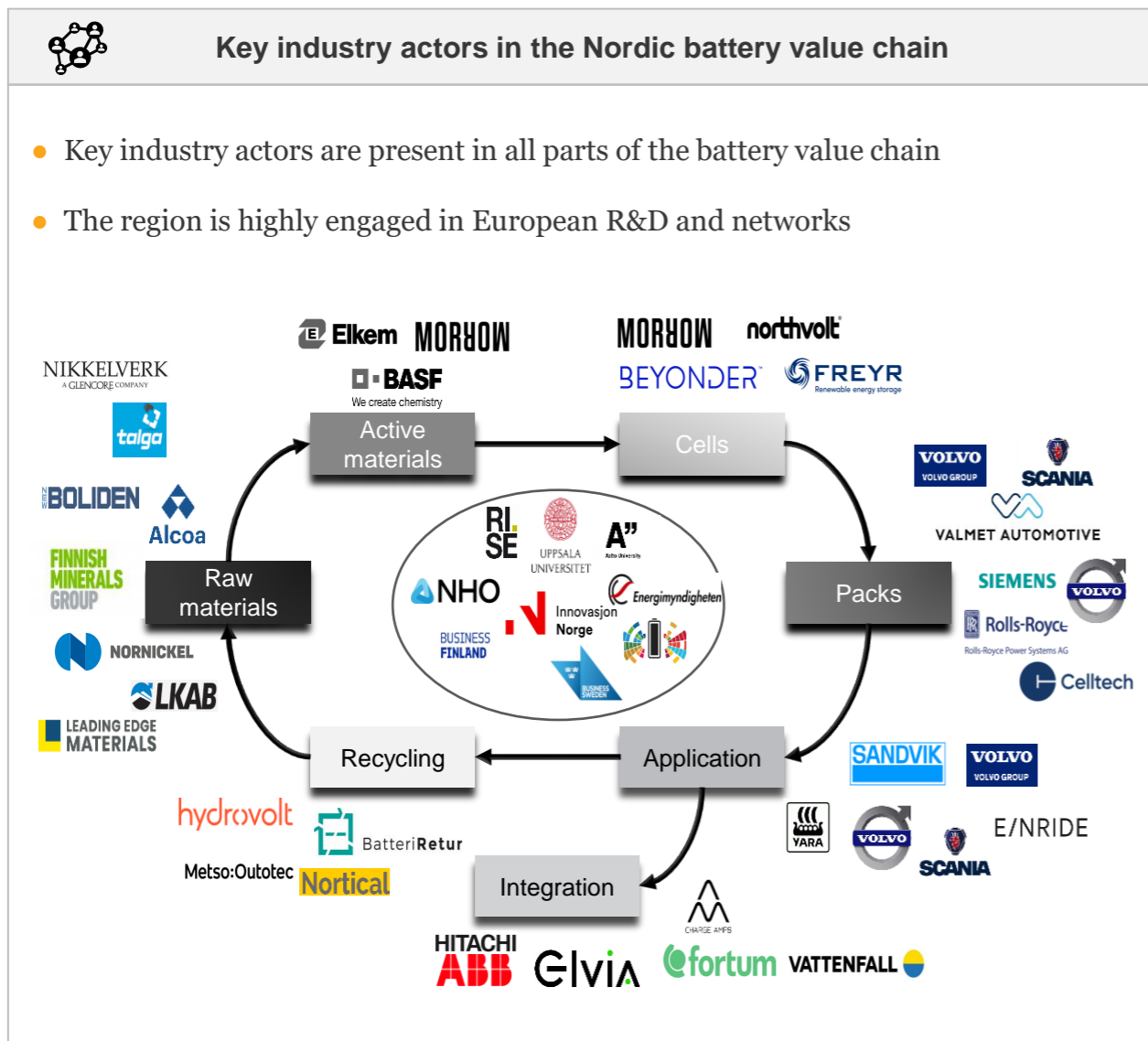
	Sweden	Finland	France	Germany	Hungary	Poland
BNEF ranking 2020	10	8	8	4	12	12
Raw mat.	22	11	17	17	22	22
Cell & component	13	13	13	6	6	5
Environment	3	5	1	12	8	11
Regulations	1	3	9	2	14	13
Demand	8	13	5	2	15	14

*Excl Norway, the index is based on activities in 2020 only

Announced Gigafactory investments in Europe



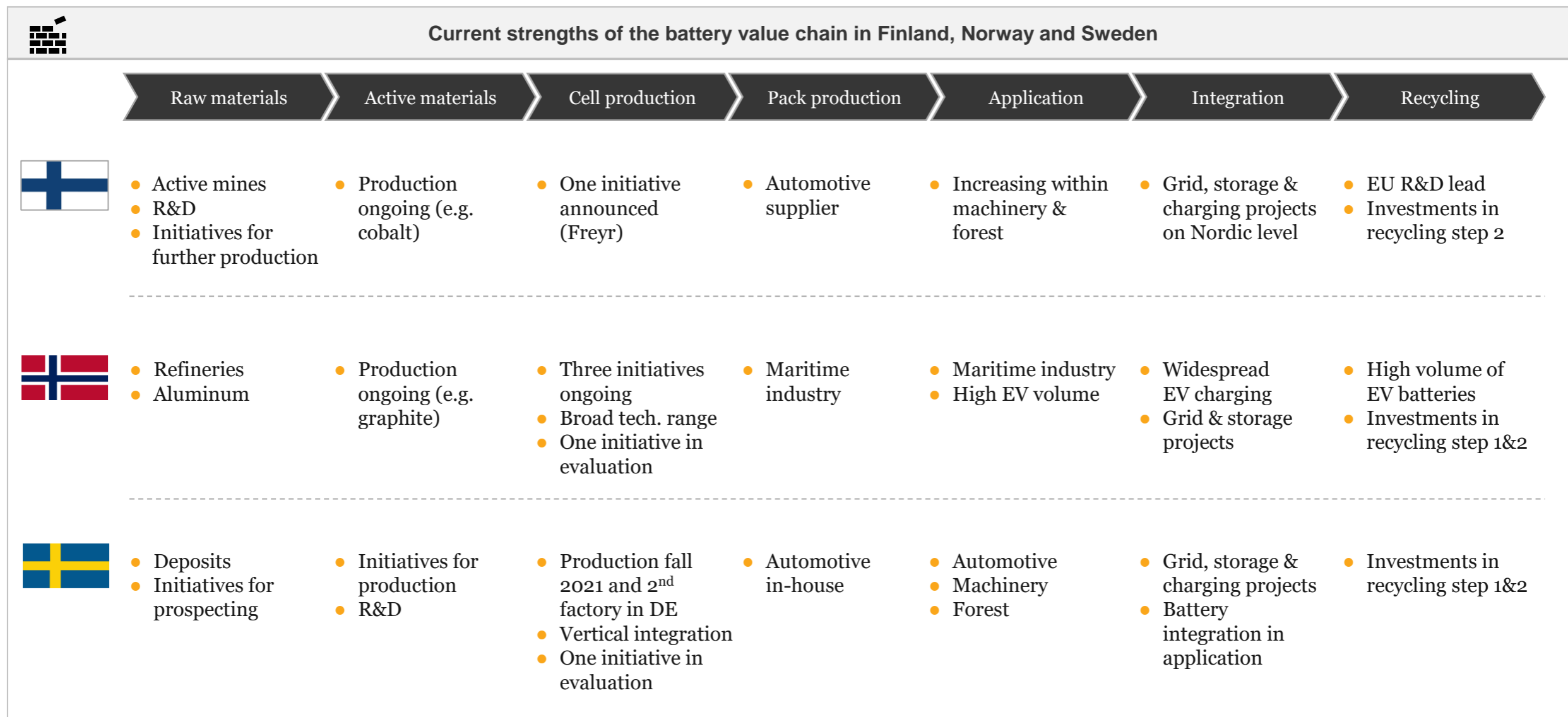
The Nordic region has a favorable momentum with key actors in all parts of the value chain and a continuous inflow of foreign investments



*Foreign and domestic investments

Source: Business Sweden interviews and analysis, Business Sweden report "the Nordic battery value chain" January 2021, company homepages

Finland, Norway and Sweden have complementary strengths in every step of the battery value chain



The Nordic region has the basis for a cost efficient and sustainable battery industry

Industry prerequisites for operational expenses in the Nordic region	
Green and affordable energy	<ul style="list-style-type: none"> High share of renewable energy in the energy mix Among the lowest energy prices in Europe with a low carbon footprint
Stable energy supply and cold climate	<ul style="list-style-type: none"> Robust grid network with great redundancy and integrated electricity markets Six months cold climate reducing the need for cooling
Productive workforce	<ul style="list-style-type: none"> Deep knowledge in industrial processes, manufacturing and focus on R&D Educated population and high productivity
Connected logistics	<ul style="list-style-type: none"> Well-connected with regional and continental industries Geographical distance reduced by digital communication and efficient logistics
Position for sustainability	<ul style="list-style-type: none"> High national demands and level of investments in sustainable production processes Production site in the Nordics create positive brand awareness for sustainability
Supply of materials	<ul style="list-style-type: none"> Rich deposits of raw material for batteries High sustainability of produced battery materials

“ The battery industry is **extremely competitive**, global and driven by regulations. All clients throughout the value chain have a focus on price and regulations. The Nordics **offers preconditions for efficient OPEX to a high level of sustainability.** ”
[Swedish company]

“ The Nordic **cold climate is an attractive add-on** for the energy mix and low electricity costs. ”
[Finnish company]

“ The Nordics offer clean energy, sourcing of raw materials and a strong industry converting the materials to end-products. All of this is sustainable and at low energy prices. **This makes the Nordics unbeatable!** ”
[Norwegian company]

The industry highlight engagements in setting EU regulations, as well as to reduce risk and attract FDI to strengthen the value chain

Highlighted industry needs to successful build-up a strong battery industry				
Market prerequisites	Regulations for sustainability <ul style="list-style-type: none"> Supportive EU regulatory for batteries and battery waste demanding full life cycle sustainability 	Competence lift <ul style="list-style-type: none"> Investments in R&D initiatives Education on all levels to reduce the competence gap long term 	Access to raw materials <ul style="list-style-type: none"> Transparency and speed in national regulations and processes for mining Public debate on options for responsible mining 	Investments in infrastructure <ul style="list-style-type: none"> Charging infrastructure Improvements in energy supply, storage and digital grids
	Value chain supply & demand	Lowered first-mover risk <ul style="list-style-type: none"> Capital, grants and guarantees to reduce first mover risks Clear incentives for FDI 	Connected ecosystem <ul style="list-style-type: none"> Alliances with OEMs for orders and future innovations Collaboration between regional leaders and digital innovators 	Accelerated market position <ul style="list-style-type: none"> Broad official and industry support A strong global brand with clear value proposition
<p>“ Regulations on EU level are crucial for the future market requirements. We can not miss such an opportunity, so we need to be engaged in the process. ”</p> <p>[Finnish company]</p>		<p>“ We have a good storyline regarding a green battery value chain, but our voices have not been heard – marketing efforts are needed. ”</p> <p>[Swedish company]</p>		<p>“ If the Nordic position for sustainability was more known, we might finally be able to get paid for all the investments we have done to have high quality along the full production line. ”</p> <p>[Norwegian company]</p>

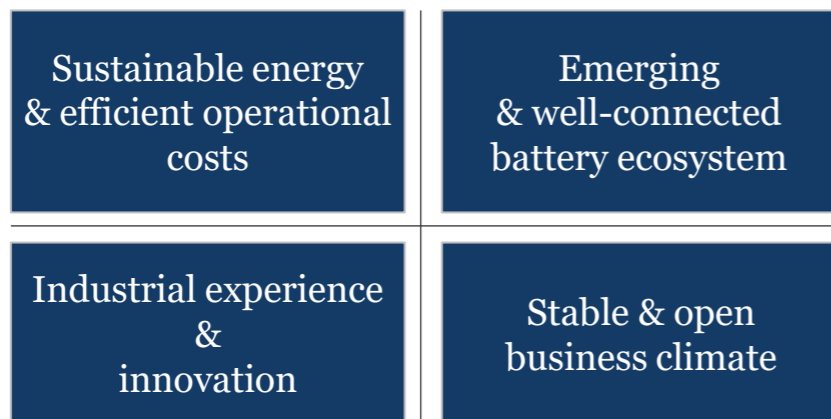
A jointly developed value proposition would improve the attractiveness towards foreign investors



A suggested Nordic value proposition...

- As the Nordic countries share similarities and offer comparative strengths, a combined value proposition would strengthen each country
- The value proposition is aimed to attract foreign direct investments as well as strategic partnerships with OEMs and R&D centers
- The suggested Nordic value proposition centers around four pillars:

Suggested Nordic value proposition for batteries



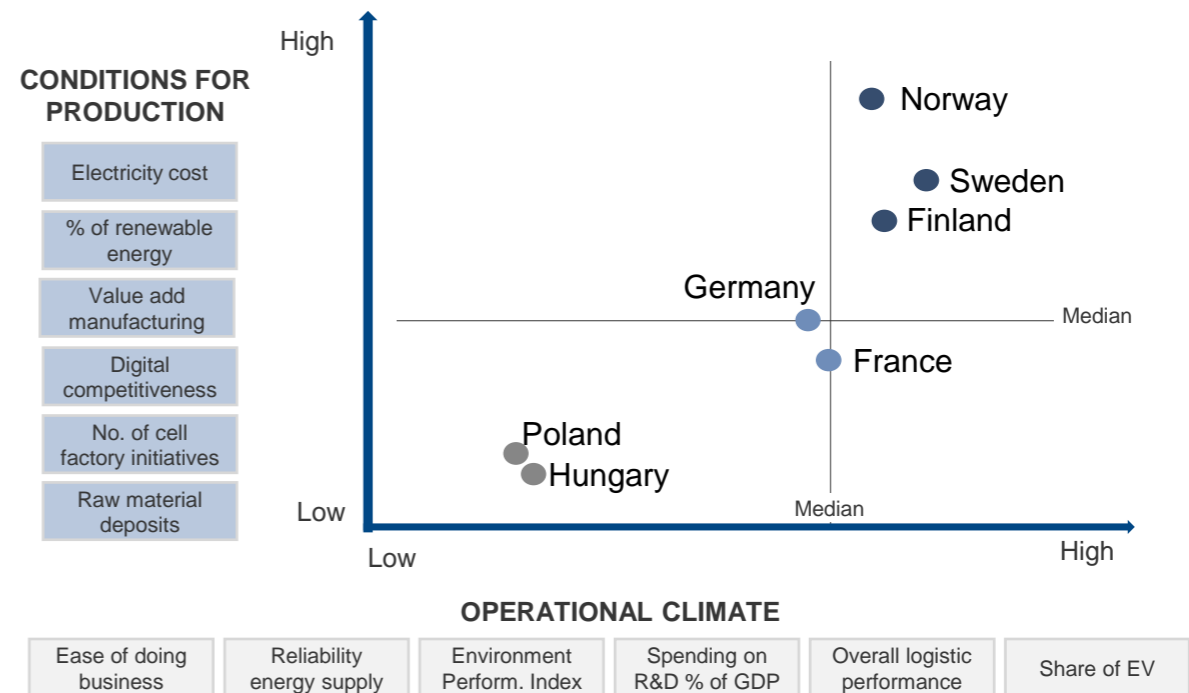
“ We must have a **clear, to the point narrative** highlighting our strengths for sustainability, profitability and strong industry tradition ”
 [Norwegian company]



...is strong compared to other European investment destinations


- An initial European comparison indicates a strong Nordic position*
 - Deeper analysis over time with future estimates needed

Business Sweden's Market Selection Analysis of the suggested value proposition



*Based on latest data available for one specific year. Parameters weighted. Comparison only among stated countries.
 Source: Business Sweden interviews and analysis, Business Sweden Market Selection Analysis

By joining forces, the Nordics can accelerate the development of a strong position in the rising European battery market

 Recommended actions to accelerate the Nordic battery industry		
Develop a joint Nordic value proposition to attract FDI	<ul style="list-style-type: none"> • Develop a joint Nordic value proposition to attract foreign direct investments for experience, competence and competitiveness • Manage potential collaboration barriers by securing speed and efficiency, and focus on business value 	<p>“ For example: recycling is still an open field, more so than other value chain steps, where the Nordic countries have preconditions for high value add. Regulations will set the conditions.”</p> <p>[Finnish company]</p> <p>“ Together in the Nordics we could lift the level of R&D substantially. We need test centers like the ones in the UK and Germany.”</p> <p>[Norwegian company]</p> <p>“ We need vast investments throughout the entire value chain. Foreign investments and competence are decisive as we accelerate our own capabilities and technology.”</p> <p>[Swedish company]</p>
Positioning and creation of global alliances	<ul style="list-style-type: none"> • Take a global position with a strong common sustainability and profitability narrative • Initiate joint marketing activities, e.g setting up alliances and enabling networking platforms 	
Extend Nordic collaboration	<ul style="list-style-type: none"> • Set up a Nordic communication platform for exchange of experiences and recruitment needs • Collaborate as joint Nordic R&D test centers • Develop a common agenda for long-term competency development at all levels 	
Acknowledge the impact of upcoming EU regulations	<ul style="list-style-type: none"> • Create awareness of the importance of the ongoing developments of the EU regulations on Nordic governmental level <ul style="list-style-type: none"> – Including regulations on the battery life cycle, battery waste and transportation of battery materials 	

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The transition towards EV drives an immense global growth of battery demand

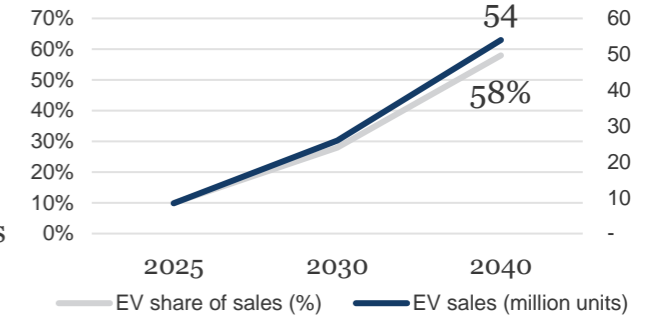
- The EU is expected to experience the strongest growth globally



Transition towards EV

- Globally, transport is responsible for 24% of direct CO2 emissions alone. The ongoing transition to an electrified and sustainable society has a new generation of conscious consumer demand
- The global EV registrations increased by 41% in 2020, even though overall global car sales decrease with 16%. Registrations of electric bus and truck also increased to a global stock of 600 000 and 31 000 respectively
- The global EV share of sold passenger cars grew with 3 million cars in 2020 (4,6% sales share) and is expected to increase from 7% in 2025 to 58% in 2040

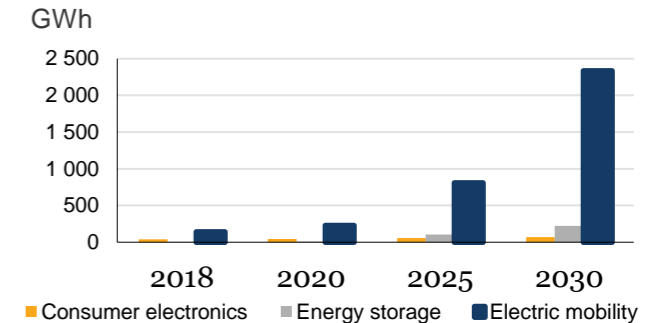
Prognosis of global passenger vehicle sales



EV growth drives battery demand

- Electrification drives a vast demand for batteries.
- The battery is a strategic component of a car. It account for up to 35-45% of the total cost of an EV making it the single most expensive component
- Global battery demand is growing from 300 GWh in 2020 to a forecasted 2 600 GWh in 2030
- The automotive industry is the primary contributor to this increasing demand.

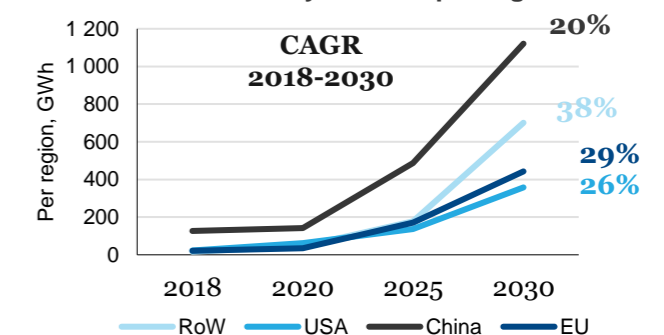
Global battery demand per application area



EU strongest predicted growth

- 2020 was the first year that Europe overhauled China as the world's largest market for EV
- Future battery demand in European market is expected to grow faster than US and China.
- Europe is still ahead of the U.S., but with the Biden administration, electric vehicles and charging infrastructure is rising.

Growth of battery demand per region



Europe has a wide gap between current production capacity and future demand

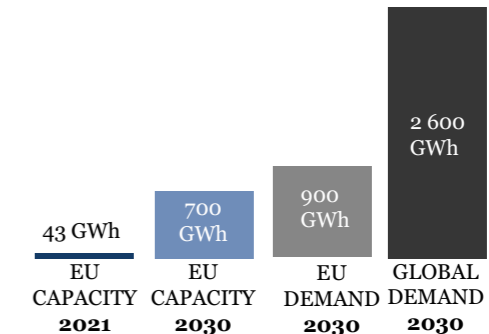
- EU regulations for a green battery life cycle is setting the market conditions



Wide gap between European battery supply and demand

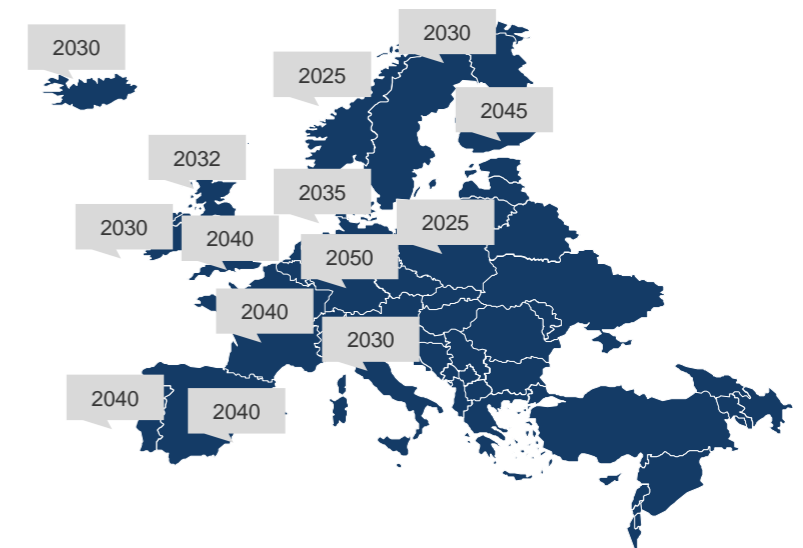
- **There is a forecasted gap of 200 GWh between EU battery demand and supply in 2030**
 - The predicted supply sums up the current investments in Gigafactories in Europe
- **The gap between global demand and EU capacity is forecasted to 1 900 GWh in 2030**
 - Estimates as of spring 2021
- As demand continue to rise along innovations, energy battery storage possibilities and continued electrification the potential for supply is currently immense

Predicted battery demand and capacity (2021)



EU regulations set future market conditions

- **The European Green Deal has actions for a EU clean energy transition**
 - Decarbonising the EU's energy system is critical to reach the 2030 climate objectives and the EU's long-term strategy of achieving carbon neutrality by 2050
 - 3 key principles: 1) ensuring a secure and affordable EU energy supply 2) developing a fully integrated, interconnected and digitalised EU energy market 3) prioritising energy efficiency, improving the energy performance of our buildings and developing a power sector based largely on renewable sources
- **European policies for zero emission vehicles drives demand for sustainable batteries**
 - Batteries that are more sustainable throughout their life cycle are key for the goals of the European Green Deal
 - Proposal in December 2020 on modernization of EU legislation on batteries as an action within the Circular Economy Action Plan



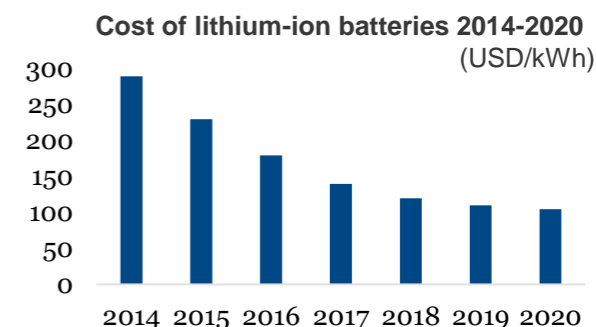
Source: "Accelerating change", Business Sweden 2019, Batteries Europe, BloombergNEF "Batteries For Electric Cars Speed Toward a Tipping Point", December 2020. Batteries Europe "Strategic Research Agenda for batteries 2020", Business Sweden

Proximity of actors within a value chain and on site in Europe will be crucial for competitiveness



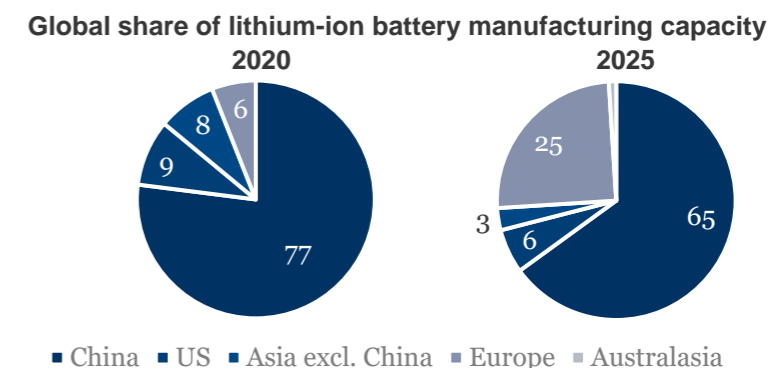
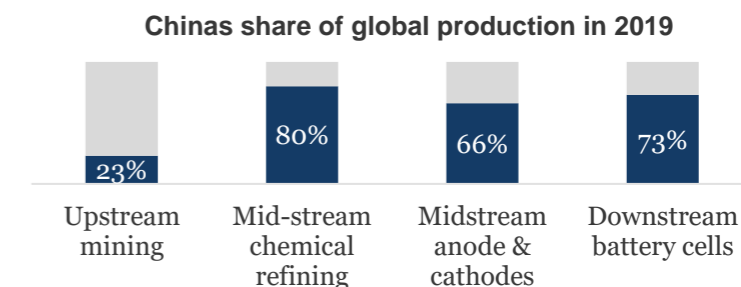
Battery production in Europe key for competitiveness

- **Proximity of strategic components are crucial for OEMs**
 - The automotive industry demand just-in-time deliveries from sub-suppliers demanding geographical proximity of key deliveries. The Covid-19 pandemic has among others highlighted the importance of proximity to supply chains for continuance
- **Economies of scale is crucial for producing competitive batteries**
 - The battery prices per kWh are declining



There is an expansion of global investors into Europe

- **Currently, Asian players dominate the battery industry**
 - China, South Korea, Japan and Taiwan represent about 80-95% of the production capacity in several parts of the battery value chain today
 - The 5 largest companies accounting for 75% of global battery production are from Asia
- **Europe is investing now to keep automotive competitiveness**
 - Immediate action is required in terms of scale and speed for Europe to take a position for a competitive automotive industry
- **Europe is predicted to increase its share of manufacturing capacity from 6% in 2020 to 25% in 2025**
 - Key drivers for the European market is expected to be regulations and access to sustainable sources battery materials



There is an expansion of global investors into Europe and investments are made in large scale, with speed and offer crucial capabilities for the ecosystem



There is an expansion of global investors into Europe

- **Currently, Asian players dominate the battery industry**
 - China, South Korea, Japan and Taiwan represent about 80-95% of the production capacity in several parts of the battery value chain today
 - The 5 largest companies accounting for 75% of global battery production are from Asia.
- **Foremost Asian investors, but also North American, are expanding into Europe**
 - In line with increasing battery demand in Europe and request for local production

Geographical change of the global battery production sites

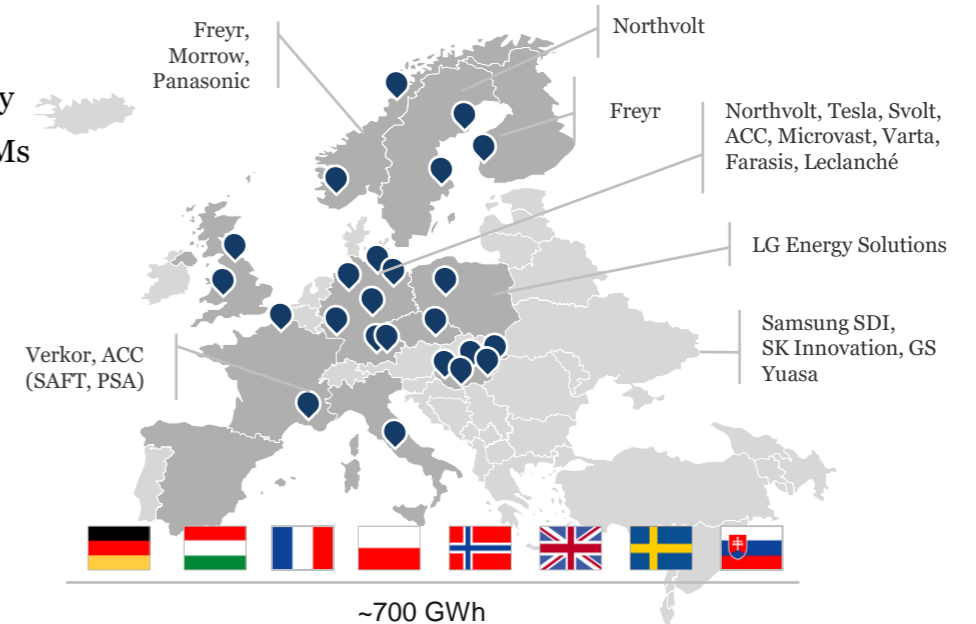


Speed and alliances crucial for battery productions

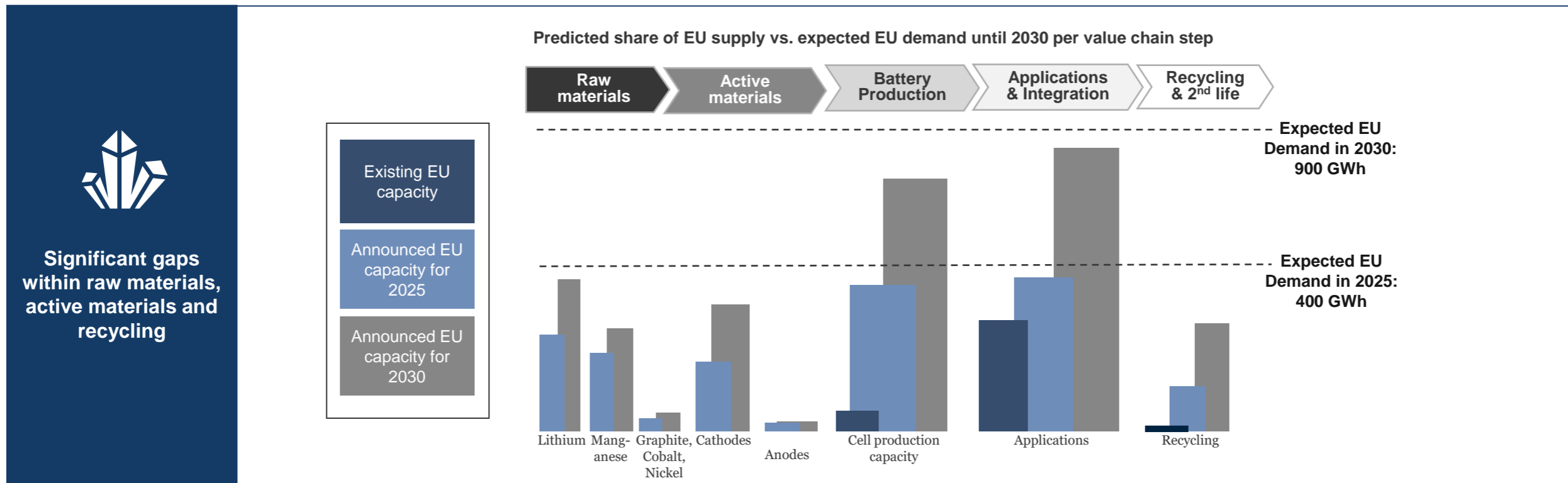
- **Speed for investment decisions and alliances crucial**
 - Within the coming 3-4 years there will be significant activity in order to build up the European battery value chain.
 - To reach front runner advantages and be part of creating the new industry
 - Strategic partnerships are crucial both for the cell factories as for the OEMs
- **Investments within cell factories are immense**
 - Very capital intense investments with estimates of investment cost of ~1 billion SEK per GWh
- **The cell factories are spread all over Europe**
- **The investors offer crucial capabilities to the receiving country**
 - Experience and competence of the full battery value chain
 - Skilled personnel
 - Capital for the large investments and global value chains for business

Announced Gigafactory investments in Europe

Excl. latest announcements from e.g. VolvoCar, VW and Nissan



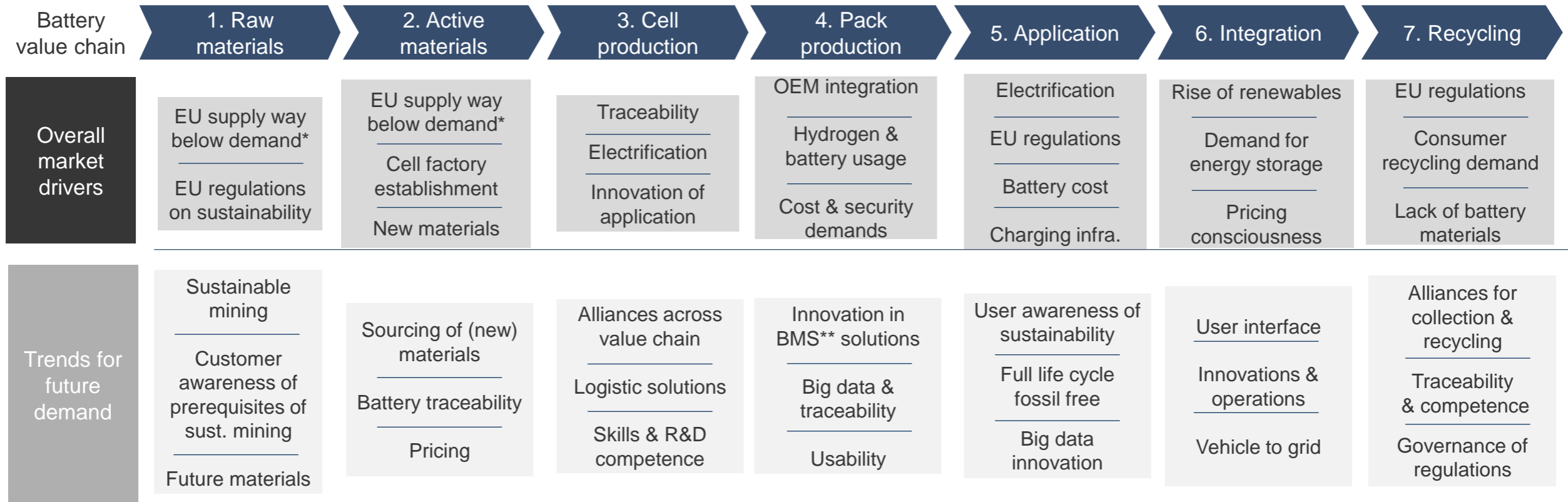
There is a wide gap between EU demand and supply which creates opportunities within especially raw materials, active materials and recycling



- Opportunities to reduce raw material supply risks**
- **Increase supply of lithium and cobalt**
 - Large estimated increased need of raw material: lithium - up to 18 times by 2030 and 60 times by 2050 ; cobalt - up to 5 times by 2030 and 15 times more by 2050
 - **Increase recycling efficiency and volume of copper, nickel and cobalt**
 - Currently volume of recovered metals used in battery manufacturing is low. In the new EU regulatory framework for batteries the recycling efficiencies are estimated at around 9% for cobalt and nickel, and 80 % for copper
 - **New sourcing of battery materials, e.g. slag piles**

Source: New EU regulatory framework for batteries (europa.eu), European Battery Alliance, Business Sweden interviews and analysis

Market drivers and trends on a value-chain level stipulate future opportunities for digitalization, traceability and new materials



*Estimates from the European Battery Alliance comparing supply and demand 2025 and 2030

**BMS = Battery Management Systems

Source: Business Sweden interviews – see chapter “Needs for a complete Nordic value chain” for details

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A prosperous hotbed with investments, engagements for sustainability, R&D and emerging alliances and networks

1

Strong emerging battery ecosystem

- Several concrete cell manufacturing initiatives for different appliances and technologies
- The battery value chain is based on traditional strong Nordic industries with MNEs in the global lead, e.g. maritime industry, construction equipment, automotive, transport, forest and manufacturing
- Raw material resources, mining excellence, future material R&D as well as clean processes
- Early investments in recycling collection and refineries as well as R&D for future materials
- Strong complementary characteristics of the Nordics enabling full coverage of the value chain

2

Active region with investment inflows and R&D spend (already)

- Inflows of investments and interest from foreign stakeholders
- Potential new location of battery cell production is driving investments for complementary value chain steps
- Established proof of concept and clear strategy for several battery value chain steps and their companies in the Nordics
- Innovative region focused on R&D and companies investing in own progress

3

Engagement in strategy, key alliances & networks

- All the Nordic countries has set strategies or are on the verge of developing a strategy that involves goals, plans and ambitions for the upcoming years for their battery value chains
- High level of engagement on European-level within all aspects of batteries, e.g., high engagement in EBA and Batt4EU
- Nordic battery ecosystem has strong bonds and alliances with leading OEMs in Europe

“ To establish a complete sustainable Nordic battery value chain within a new industry with long-term business opportunities is a chance we can not let slip away! We must **think big as small countries**. ”

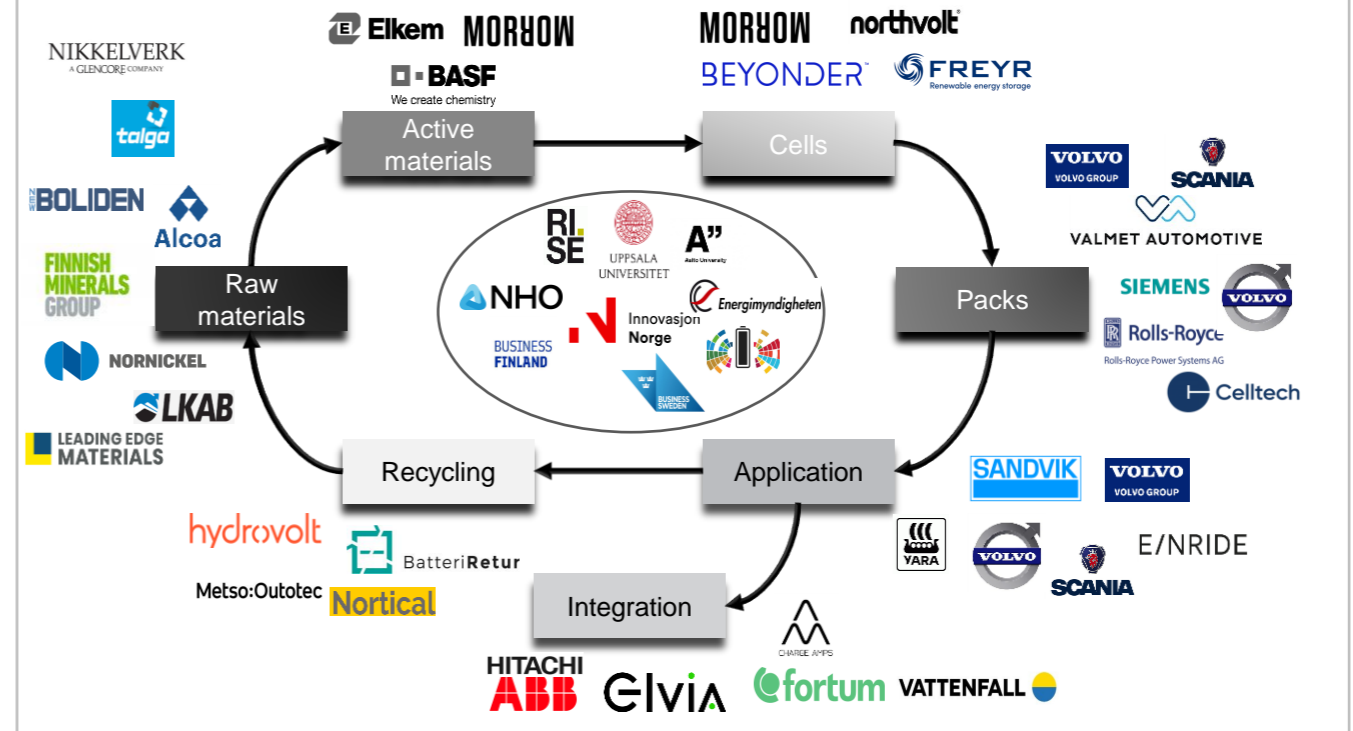
[Norwegian company]

The Nordics have a strong momentum to complete a value chain with strong alliances and collaborations

Strengths of Nordic value chain momentum*

1. Raw materials	Rich deposits of minerals Production ongoing (FI)
2. Active materials	FDI & initial investments Process industry competence
3. Cell production	Cell initiatives attracting FDI Initial alliances for order stock
4. Pack production	Strong maritime suppliers OEM in-house development
5. Application	Strong traditional industries invest increasingly in electrification OEM & maritime in lead
6. Integration	Joint Nordic grid investments Initial ESS projects Growing charging infra.
7. Recycling	Investments in capacity Strong R&D Significant EV volume (NO)

The Nordic Value Chain

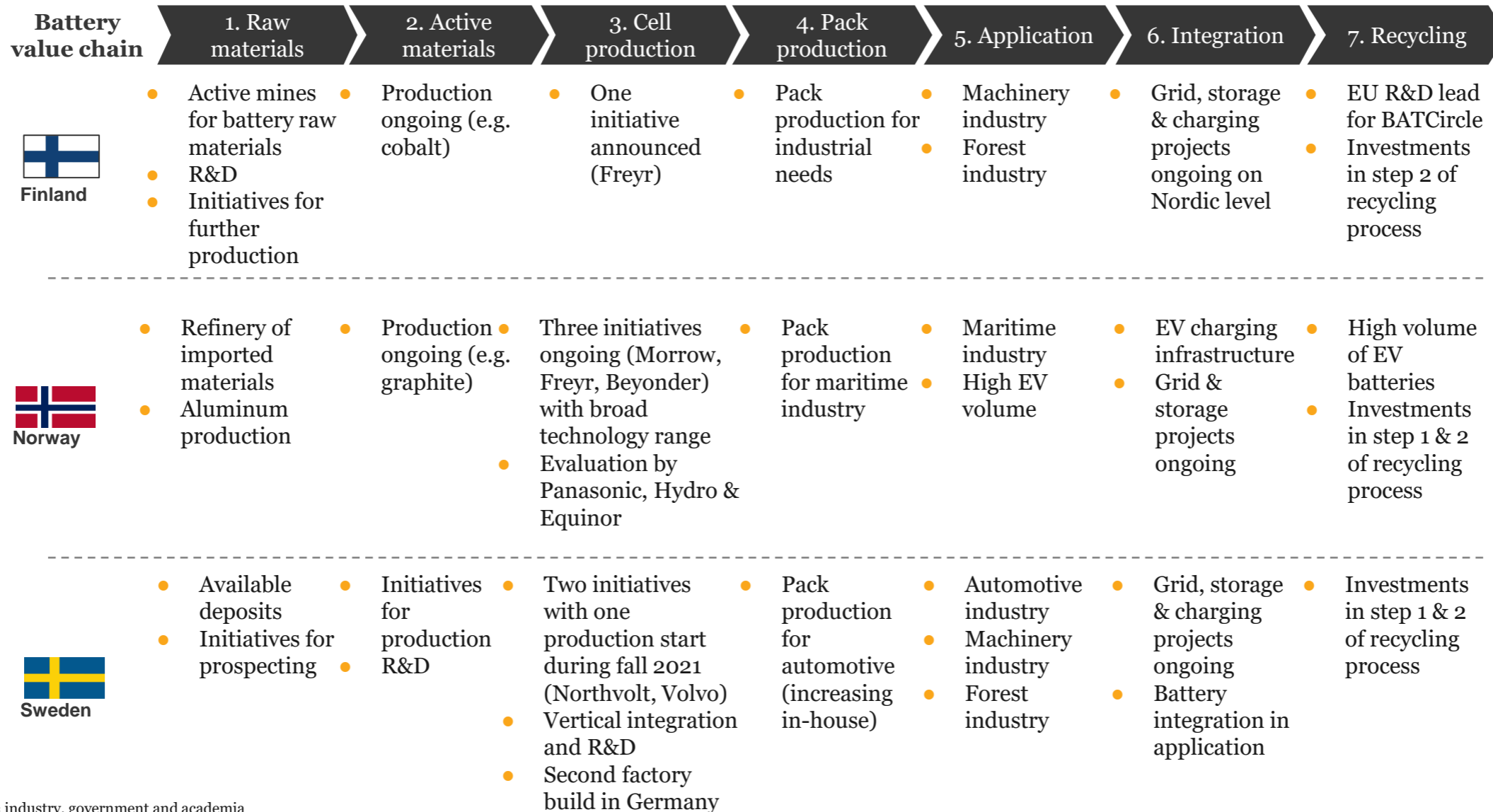


Alliances (examples)

- The European Battery Alliance (EBA)
- BATTERY 2030+
- EuBatIn
- ETIP
- Batt4EU
- European Raw Material
- BATCircle

*See chapter "Needs for a complete Nordic value chain" for details
Source: Business Sweden interviews

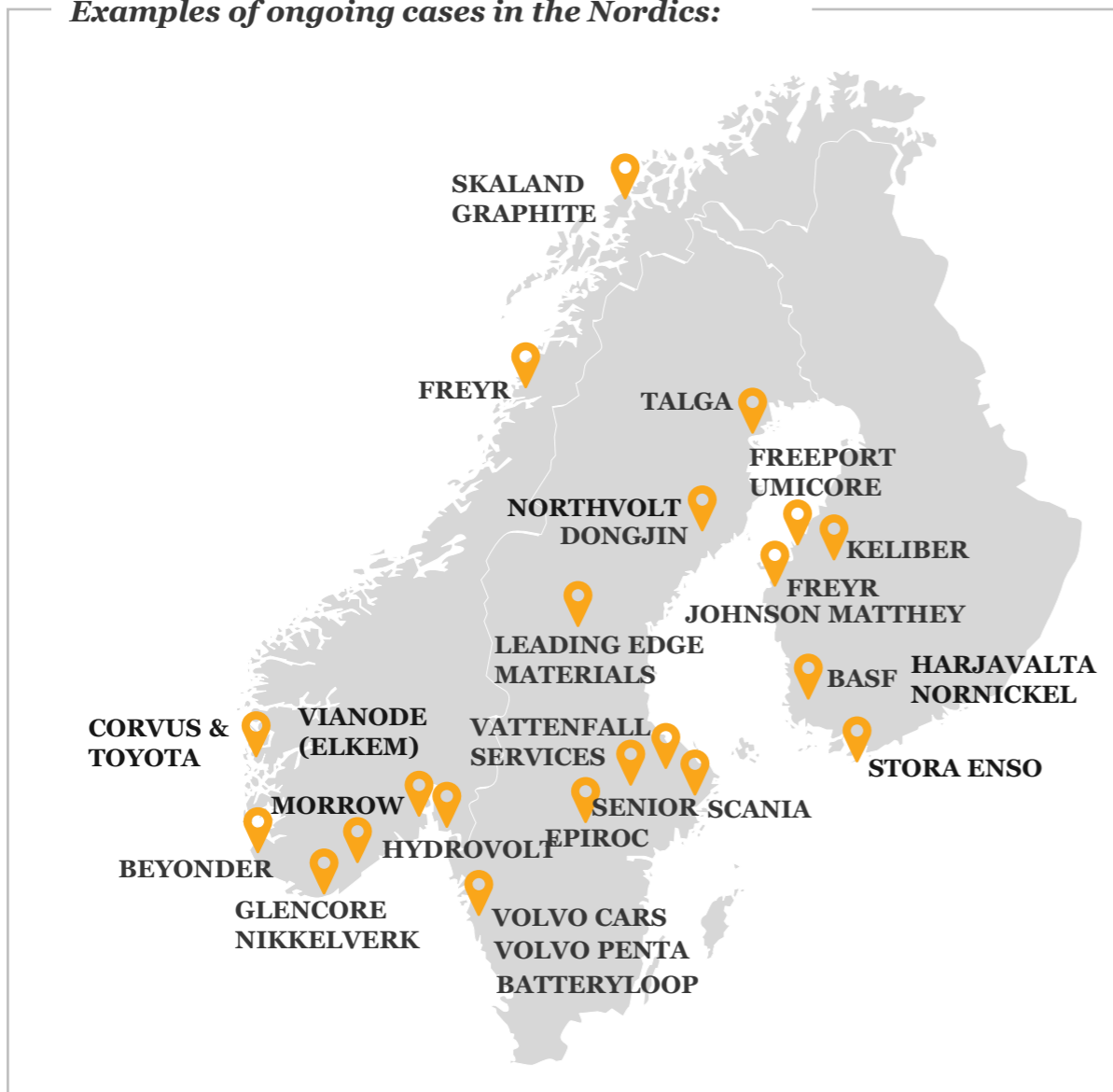
The emerging battery value chains in Sweden, Finland and Norway are complementary creating a stronger business case together



* Triple helix = industry, government and academia
 Source: Business Sweden interviews

The Nordics are already experiencing key investments in all steps of the battery value chain

Examples of ongoing cases in the Nordics:



Highlighted Investments in the Nordics

KDL 科达利 case	Production of casings in Skellefteå	LEADING EDGE MATERIALS case	Prospecting for graphite in Woxna	Panasonic case	MoU with Equinor & Hydro to explore new cell factory
SENIOR case	Production of separator film Eskilstuna	BASF case	Production of cathode materials in Harjavalta	MRC SKALAND GRAPHITE case	Flake graphite mine in Skaland & ju for anode materials
Johnson Matthey case	Production of cathode material in Vaasa	DONGJIN case	Production of active materials in Skellefteå		

- Sweden is the only country with a near-time production-start of battery cells, but the value chain is already preparing for an increased demand and future ramp-up not only in Sweden but in other potential locations in the Nordics contributing to inflow of investments for building a battery ecosystem
- Application owners are and want to invest in conversion and pack-production facilities, driving demand, which is increasing the inflow to raw-materials, active materials and cell production related investments
- The inflow of investments needs to continue to increase in the future in order to continuing the build-up of the battery eco-system across the Nordics so the current and future demand of battery cells can me met, this also implies new ways to meeting demand, like recycling and efficiency increase batteries

*All cases can be found in Appendix

Examples of cases strengthening the battery value chain Raw materials

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

LEADING EDGE

- Canadian Leading Edge Materials intend to resume operations at the mine in Woxna, near Edsbyn, which has been down since 2001
- The company hopes to be able to supply graphite to Europe's battery cell manufacturers.



»»» **Re-opening of a mine in an area with mining tradition to supply cell-production**

KELIBER

- The Finnish-owned mining company Keliber plans to open a lithium mine and a smelter to produce lithium hydroxide
- The start of operations was planned for 2020 but have been postponed (tentatively 2024) and have the ambition to supply the battery industry



»»» **Lithium focused mining in Finland with focus on batteries**

GLENCORE NIKKELVERK

- Refined nickel, copper and cobalt are produced by British-Swiss Glencore Nickel Works in Kristiansand
- The ambition is to increase the sustainability of battery production and increase the green tech with their materials



»»» **Alternative materials for batteries to increase the sustainability of the cells**

TALGA

- Australian Talga is the 100% owner of the Vittangi graphite project anode battery production. Permit applications for the graphite mine was filed in May 2020.
- Talga, Mitsui and LKAB have signed a non-binding Letter of Intent (LOI), with the intent to jointly develop the Talga project to realisation, after delivery of a Detailed Feasibility Study in 2021.



»»» **First case of potential battery material extraction in Sweden**

HARJAVALTA NORRNICKEL

- Harjavalta Norrnickel is a Finish nickel refinery powered by renewable energy
- The factory recycles over 80-90% of its waste generated at the plant
- Plan to increase production due to European market demand for battery raw material



»»» **One of the most sustainable producers of nickel and cobalt metals to the EV industry**

STORA ENSO

- Stora Enso aims to meet the demand of the global battery market by developing renewable alternatives for the automotive industry
- A pilot plant that will produce renewable bio-based carbon is currently being built at Sunila Mill in Finland.



»»» **New innovative material solutions**

Examples of cases strengthening the battery value chain

Active materials

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

DONGJIN

- Dongjin Sweden AB is a subsidiary of Dongjin Semichem Co Ltd in Korea, which has signed an agreement with Northvolt to supply the material called Carbon Nanotube Slurry (CNT)
- The facility will be located next to Northvolt production facility and employ up to 3000 + 3000 for subcontracting



Supplier to Northvolt to move production of active material to Skellefteå

JOHNSON MATTHEY

- Johnson Matthey and state investor Finnish Minerals Group have agreed to build a plant to produce cathode materials used in electric vehicle batteries
- Will produce eLNO – is nickel rich advanced cathode materials



Supply of sustainable cathode materials based on Nickel

SKALAND GRAPHITE

- Australian Mineral Commodities (MRC) finalised its acquisition of Skaland Graphite during 2019
- Long-term plans to produce graphite products for use in battery anodes. Skaland is considered to be world's highest grade flake graphite operation



Grade flakes to enable smaller and more dense anodes for lithium-ion batteries

BASF

- BASF has chosen Harjavalta Finland as their first location for battery materials production serving the European automotive industry starting late 2020
- The plant will be constructed adjacent to the nickel and cobalt refinery



The strong public and green party support for its sustainable refinery was decisive

FREEPORT UMICORE

- Umicore completed the acquisition of the cobalt refining and cathode precursor activities in Kokkola, Finland during 2019
- The Kokkola refinery is Europe's largest cobalt refinery. Umicore plans to serve the European operations of its battery cell and automotive customers with this plant



Umicore to expand its battery mineral value chain by acquisitions in Finland

VIANODE (ELKEM)

- In 2021 Elkem established the company Vianode as a wholly owned subsidiary of Elkem to develop and produce sustainable active anode materials
- Vianode has already received NOK 10 million in financial support from Enova, the Norwegian government body



Planning the potential large-scale battery materials plant in Norway

Examples of cases strengthening the battery value chain

Cell production

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

NORTHVOLT

- Northvolt has received groundbreaking investments and is expected to start production from 2021 in Skellefteå Norway
- Northvolt has already an extensive order stock and is to supply application owners such as Volkswagen and Volvo Group



»»» **First large-scale lithium-ion battery cell producer in the Nordics**

MORROW

- Morrow Industries announced that they will build a plant for production of battery cells to the automotive and marine industry
- The first factory is planned to begin construction in 2023 and will be in Arendal in southern Norway



»»» **Morrow to build a 32GWh plant to supply sustainable battery cells**

FREYR

- FREYR is developing an initial pilot plant, a scalable and modulated fast track plant, a 32 GWh gigabyte plant lithium-ion battery cells
- Production of the gig factory is scheduled to begin in early 2021 and be up and running in 2023



»»» **Large scale production of lithium-ion is to start in Norway during 2023**

VOLVO & NORTHVOLT

- Volvo Car Group established a joint venture with leading Northvolt to develop and produce sustainable batteries
- The JV intends to enable battery cells production and vehicle integration technologies, specifically developed for use in Volvo and Polestar cars



»»» **Nordic alliance to boost the next-generation Volvo pure electric vehicles**

BEYONDER

- Norwegian Beyonder focuses on a hybrid battery for industry based on sawdust
- Beyonder's goal is a full-scale battery factory, preferably located in Rogaland with start of construction in 2023



»»» **Sustainable cells based on sawdust, with high power, fast charging and long lifetime**

PANASONIC, HYDRO & EQIONOR

- Panasonic, Equinor and Hydro signed a Memorandum of Understanding (MoU) in 2020
- The companies invited municipalities in Norway in December 2020 to notify interest in hosting a possible battery plant; as of March 2021 the project has a list of some 20 proposed site locations



»»» **Large established players to form alliances in order to penetrate the Nordics**

Examples of cases strengthening the battery value chain Pack production

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

SCANIA

- With the rapid expansion of Scania's electrified range of trucks, buses and engines, the company plans to invest just over SEK 1 billion in a battery assembly plant in Södertälje next year
- The facility 18,000 sqm will begin construction in 2021 with the goal of starting production in 2023



»»» Scania to set up its own battery pack production for customization

CELLTECH

- Celltech produces simple primary alkaline battery packs to highly advanced Lithium battery systems with cloud based online monitoring and management
- Cell tech is to invest in a new factory that will focus on battery systems for industrial vehicles and include an Engineering & Development Centre



»»» New battery pack focus on industrial vehicles have its base in Finland

SIEMENS

- Siemens places its automated pack-production facility in Trondheim as of 2019 to primarily supply the maritime cluster
- Siemens points to the political support for low-emission solutions as crucial for the establishment



»»» Pack production focused on maritime established in Norway

EPIROC

- Epiroc has a fully electric underground vehicle fleet with next generation loaders, mining trucks, drilling rigs, production drilling and rock reinforcement
- Epiroc manufactures its own packs for their vehicles and will order cells from Northvolt



»»» Epiroc to supply the sustainable mining equipment in the Nordics and globally

VALMET AUTOMOTIVE

- In 2019, Valmet Automotive expanded its operations with a new factory for battery packs in the municipality of Salo
- In 2020 the company decided to double the capacity of the Salo-plant and expand the plant in Uusikaupunki for production of battery packs



»»» Aggressive increase of pack production in Finland

CORVUS & TOYOTA

- Corvus Energy is set to start development and production of sustainable, large scale maritime-certified hydrogen fuel cell systems
- Toyota is onboard as key partner and supplier of mass-produced fuel cell technology



»»» Increasing dual partnerships for hydrogen and batteries for maritime

- 1. Raw materials
- 2. Active materials
- 3. Cell production
- 4. Pack production
- 5. Application**
- 6. Integration
- 7. Recycling
- 8. Academia, organizations

Examples of cases strengthening the battery value chain Application

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

VOLVO CARS

- Volvo Cars aims for sales by 2025 to consist of 50% of fully electric vehicles. Volvo Cars expects to produce one million electric cars by 2025.
- Volvo Cars has launched the Polestar brand for a series of all-electric passenger cars. The first model Polestar 2 was launched in 2020



Göteborg

»»» **Volvo Cars has a strong conversion agenda during upcoming years**

RUTER

- Ruter, the public transport authority for Oslo and Akershus counties in Norway, placed an order of 109 electrical buses
- This will imply that already by 2022 a 40% of the buses in Oslo will be electrical with the total amount of 265 electrical buses in the Norwegian capital



Oslo

»»» **Ruter, an early adopter of electrical busses are converting with sustainability in mind**

VOLVO PENTA

- Volvo Penta has issued a clear statement of intent with the news in 2018 that by 2021 it will provide electrified power solutions for both its land and sea-based business segments
- And in 2021 Volvo Penta became majority shareholder of Norwegian marine battery and electric driveline solutions supplier ZEM AS



Göteborg

»»» **Maritime battery acceleration in the Nordics accomplished by acquisitions**

SCANIA

- In 2020, Scania launched its first electric truck with plans to expand its fleet
- The company believes that sustainable and emission-free transport is an increasing requirement for transport companies in the future



Södertälje

»»» **Scania is driving electrification of heavy vehicles in the Nordics**

Examples of cases strengthening the battery value chain Integration

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

CHARGEAMPS



- Founded in 2012 in Sweden ChargeAmps started providing cables for charging. In 2015 first charging station was launched
- ChargeAmps currently provides a large portfolio of charging stations for EV and for different customer segments both for private and public use

Integration solutions in Sweden are deeply rooted and exists in several forms

VIRTA



- The company Virta is established by 18 Finnish electricity companies to offer a nationwide network of charging stations for electric vehicles.
- The portfolio includes charging stations for households, real estate, workplaces and commercial places.

National alliances in the Nordics to boost integration

TIBBER



- Tibber is a company enabling a solution to the peak-load problematics
- For example, smart charging with Tibber's service enables the electric car to charge when the electricity price is at its lowest. All you need to do, is tell the app at which time your car needs to be fully charged and ready for you to drive

Digital solution to reduce electricity cost and peak load problematics in the Nordics

VATTENFALL SERVICES



- Innovation project where a battery warehouse is being built in the Gränby area, northern Uppsala. It will be the largest in the Nordic region and occupies about half a football pitch
- The plant started operations in 2020 and will begin their pilot testing in the winter of 2020/2021.

How a batteries can help in balancing the electricity network

FORTUM (digital)



- Charging networks for electric cars in Finland, Sweden and Norway as well energy storage solutions to both compensate for frequency fluctuations in the electricity grid and to control energy consumption.
- Through its Charge & Drive service, Fortum focuses on charging infrastructure in parking lots and in public areas. Including 24 hours a day around service (customer service and payment solutions)

Fortum has developed a service for charging infrastructure as well as infrastructure

VW & V2G

- Volkswagen putting efforts into vehicle to grid compatibility on its vehicles enabling their EVs to charge wireless
- At the beginning of January 2022, every electric car from the Volkswagen Group that uses the MEB electrical platform — including cars from Audi, Skoda, and Seat-Cupra — will be able to charge from the electrical grid and return electricity to the grid on demand

V2G to be a potential charging option for one of the largest application owners

Case highlighted in interviews as it strongly influencing market development

Examples of cases strengthening the battery value chain Recycling

These investments were highlighted in several interviews as examples of how local and foreign business believe in the potential for profitable and long-term business in the Nordics. Most interviewees highlighted that as the battery industry is extremely competitive each investment is a proof of the value proposition of the Nordic region.

BATTERYLOOP

- BatteryLoop was founded by Stena Recycling in 2017 builds energy storage systems from batteries and ensures the recovery and recycling of batteries that are no longer in use
- The product portfolio includes storage and charging systems for electrical vehicles and maritime applications



Göteborg

»»» Development of a recycling hub in the west-coast of Sweden to spark research

FORTUM

- Finnish Fortum recycles cobalt, lithium, manganese and nickel for recycling in new batteries through a so-called hydrometallurgical recycling process
- Fortum believes that they should be able to recycle over 80% of today's batteries. Fortum has strengthened its position through acquisition of Crisolteq, which recycles lithium-ion batteries based in Harjavalta



Harjavalta

»»» Finnish Fortum have a high ambition to establish efficient recycling in the Nordics

HYDROVOLT

- Hydro and Northvolt are building a recycling plant in Norway
- The plant will have the capacity to process more than 8,000 tonnes of modules from car batteries each year, with the possibility to expand. Operations are planned to start in late 2021



Fredrikstad

»»» Hydro and Northvolt have invested 120m NOK in a joint venture to enhance recycling

NORTHVOLT

- Northvolt plans to establish a complete ecosystem for battery recycling
- Northvolt has together with Chalmers University of Technology developed its own solution at Northvolt Labs which is currently in pilot. A full-scale recycling facility will be built at Northvolt One to secure Northvolt's own target of 50% recycled material in new cells by 2030



Skellefteå

»»» Cell producers in the Nordics to establish recycling and have high demands of re-use

BATMAN

- BATMAN is a user-driven innovation project led by the Eyde cluster in Norway
- The project deals with restoration of batteries, reuse and recycling. Focused on developing a dynamic and strategic tool based on material flow analysis to reuse the materials in the battery value chain



Oslo

»»» Government, academia and private companies active in the value chain to boost recycling through the BATMAN project

Examples of cases strengthening the battery value chain Academia

These institutes were highlighted in several interviews as examples of critical for R&D and innovation as well as collaborations and alliances across borders. The German and UK cases are highlighted as critical examples of competing regions within Europe with the string urge from the industry to find something similar on a Nordic level.

ÅNGSTRÖM

- At Uppsala University in Sweden is the home to the largest research group in batteries in the Nordics Ångström Advanced Battery Centre. The research covers most aspects of lithium batteries and fuel cell chemistry
- The angstrom laboratory leads among other things Battery 2030+



Sweden, the home of the most prominent battery research centers in Europe

AALTO UNIVERSITY

- Aalto University's School of Chemical Engineering offers studies in e.g. new battery raw materials and manufacturing methods
- The BATCircle 2.0 consortium consists of six research organizations and 15 companies is lead by Aalto University



Finland's deep knowledge in materials and mining contributing to a leading position in battery materials and recycling research

AGDER UNIVERSITY

- The University of Agder (UiA) is starting a five-year project with business and industry partners to build up expertise in the field of battery technology
- The goal is to become one of the leading tech environments in Norway, and that Southern Norway will live up to its new nickname as the "battery coast"



Agder University to put effort in to battery specific research and development

UKBIC

- UK Battery Industrialisation Centre (UKBIC) is a £130 million pioneering concept in the race to develop battery technology for the transition to a greener future. UKBIC is a key part of the Faraday Battery Challenge (FBC), a Government programme to fast track the development of cost-effective, high-performance, durable, safe, low-weight and recyclable batteries
- The facility wants to provide the missing link between battery technology, which has proved promising at laboratory or prototype scale, and successful mass production. Based in Coventry, the publicly-funded battery product development facility invites manufacturers, entrepreneurs, researchers and educators, and can be accessed by any organization with existing or new battery technology – if that technology will bring green jobs and prosperity to the UK.

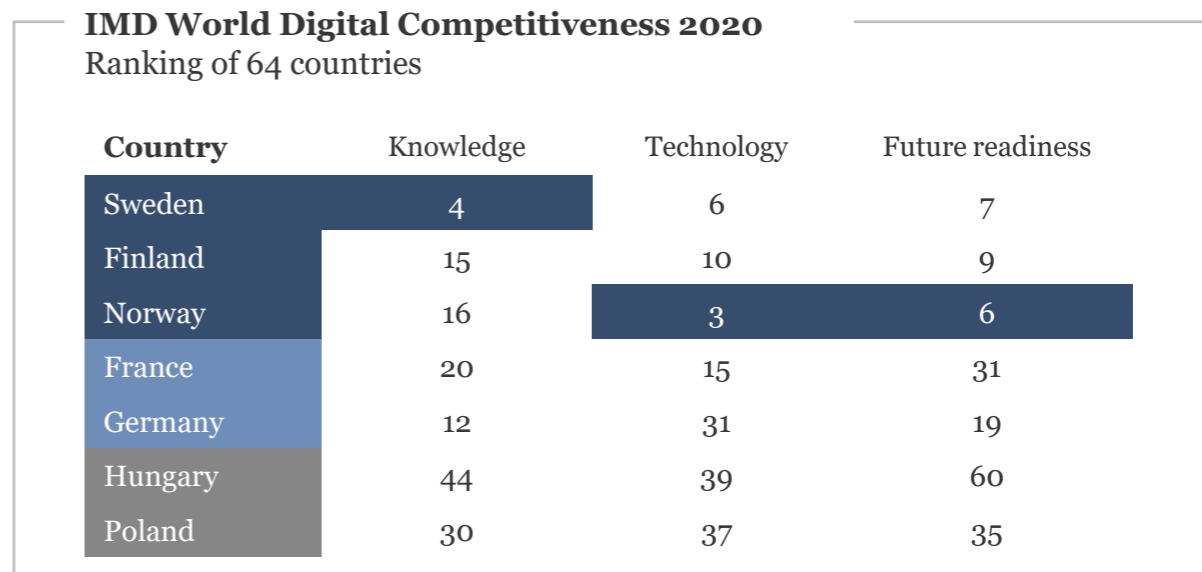
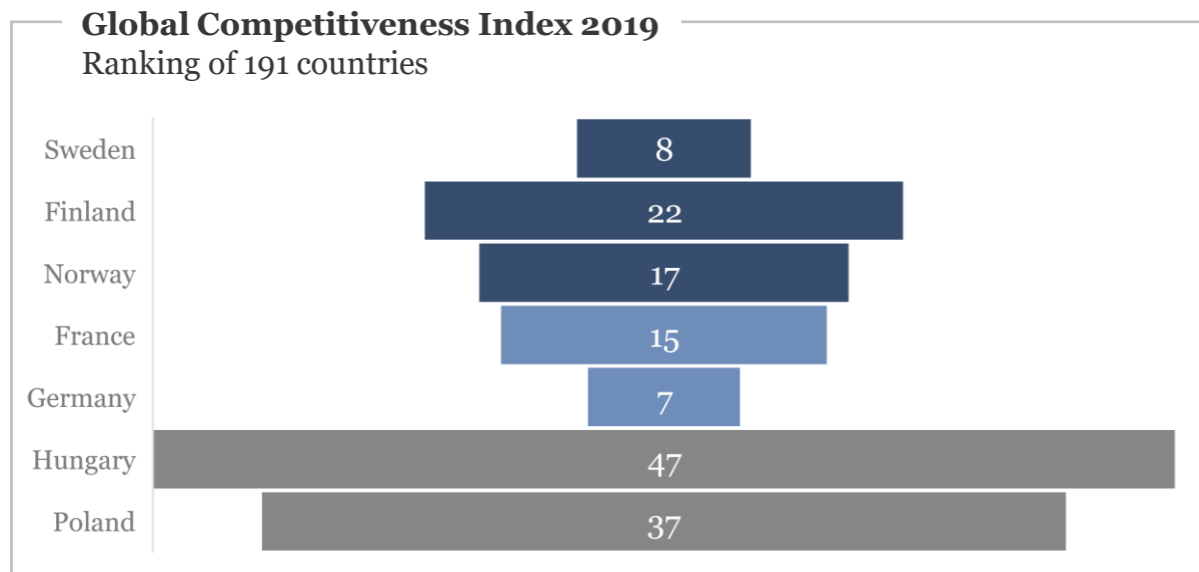
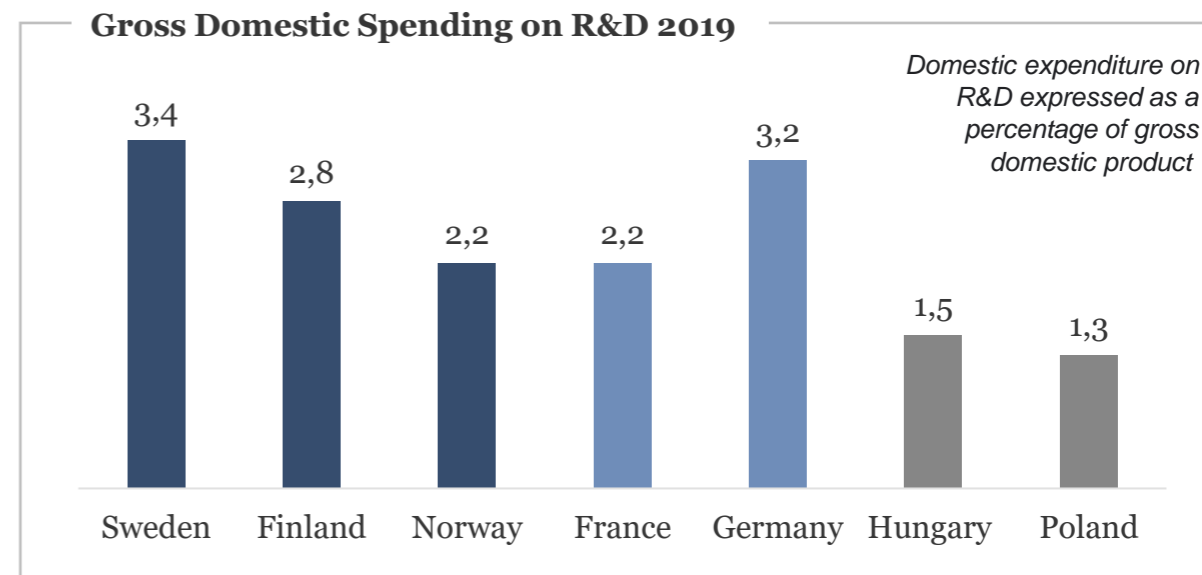
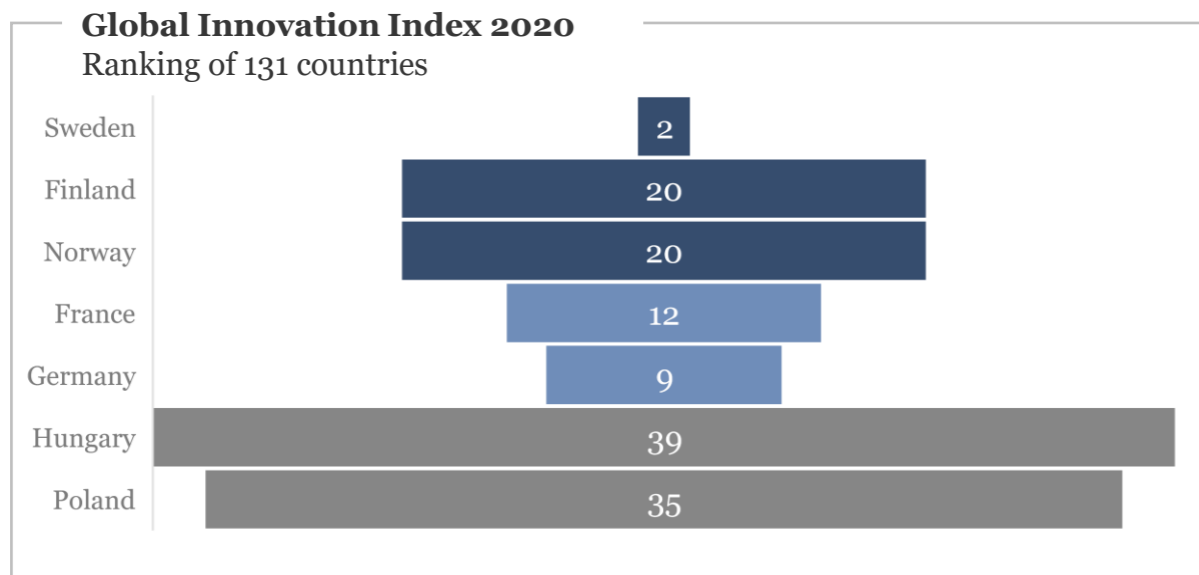
A link between R&D, academia and innovations to scale production and mass exposure

FRAUENHOFER

- The Battery Alliance is concerned with both primary and secondary (rechargeable) systems, from small-scale applications such as button cells to large stationary systems such as redox-flow batteries
- Electrical energy storage devices in vehicles must meet a particularly wide range of (sometimes contradictory) requirements, regarding for example their cost, energy and power density, cycle stability, temperature range and safety. In order to adapt lithium ion batteries for use in vehicles, optimization is needed in a variety of areas. The institutes of the Fraunhofer-Gesellschaft will use it's competence in these particular areas to develop a new generation of batteries

Proactive approach to tackle the energy storage dilemma

The Nordics are leaders in innovation and competitiveness indexes, invest in R&D on levels as France & Germany and are in leaders for digital competitiveness



Source: Global Innovation Index 2020, Global Competitiveness report 2019, OECD Gross Domestic Spending on R&D 2019, Digital Competitiveness Ranking 2020



In January 2021 Finland published its national battery strategy

The Finnish battery strategy in short

- In January 2021, the Ministry of Economic Affairs and Employment published its national battery strategy. The strategy presents ways for Finland to develop into a **competitive, competent, and sustainable** part of the international battery industry
- The vision consists of **six building blocks**:
 1. The Finnish battery cluster masters **responsible production and optimal use** of batteries and battery systems
 2. The Finnish battery cluster is a **valued member** of the European and international battery ecosystem
 3. In the selected focus areas, the Finnish battery cluster is a **leading technology and competence centre for materials, battery systems, and heavy machinery and electrification** of traffic
 4. For leading international players in the field of batteries and electrification, Finland offers an attractive **business and innovation platform**
 5. Finland accumulates **skills and talent** to renew the industry in a manner that companies can act as forerunners who bring new skills, technology, and services to the industry
 6. The innovations developed by the Finnish battery and electrification cluster **speeds up the transition** towards an electrified society
- The report recognizes that the emerging new battery industry is one of the biggest opportunities for Finland moving forward. The country wants to be part of the creative destruction in the global battery race.



The vision of Finland's battery strategy is that by 2025, the country's **battery** cluster will be a pioneer, producing skills, innovations, sustainable economic growth, wellbeing and jobs in **Finland**. At the same time, **Finland** is strongly involved in the international development.

“ *In 2025, the Finnish Battery and Electrification sector will be a forerunner that provides skills, innovation, sustainable economic growth, well-being and new jobs for Finland.* ”

— Finland National Battery Strategy 2025

“ *The battery strategy is one of the most important strategies for Finnish future growth* ”

[Finnish company]

Businesses are urging for the potential of batteries and need for national strategy

The Norwegian context

- There is currently no national battery strategy in Norway but initiatives are driven by the industry. In 2020 NHO - Confederation of Norwegian Enterprise in collaboration with 15 industry partners launched the report on the green electric value chain looking at how we can speed up export-oriented value creation within electrification. In May 2021 NHO and LO launched another report along with 18 partners concerning industrial investment in batteries in Norway
- The green electric value chain report lists the following goals for Norway:
 - **2020-2025:** Norway starts building their activity along the value chain through national competitive advantage, financing and collaboration with foreign stakeholders. Establishes cell production as a catalyst for increased activity in other parts of the value chain. Strengthens R&D competence and capacity to ensure national technological ownership and value creation
 - **2025-2030:** Norway scales up green, competitive battery cell production (32 GWh). Norwegian players in raw material processing, component production and composition strengthen their customer base. New industrial activity in recycling is established. Targeted investment in competence building leads to more active technology development along the value chain
 - **2030-2040:** Norwegian players increase their market share in battery-specific materials. Norwegian battery cell production has a capacity of more than 100 GWh, and large-scale component production has been established. Norwegian players have an established position in specific markets for battery composition. Significant competence building and technology development to take strong positions towards 2050
- Overall, there is an industry desire to create a national battery strategy and position the battery actors towards the European network.



NHO, LO and 18 partners are united on the report for Industrial investment in batteries in Norway. This shows how batteries can be the next Norwegian industrial adventure.

“Batteries can be a big industry, but it is urgent to land the competitive framework conditions and secure investments. Additionally, we must think holistically and long-term about the industry, and ensure competence building, research and the necessary infrastructure. That is why we need the government to establish an offensive battery strategy with ambitions for the entire value chain.”

– Ole Erik Almlid, Managing Director in NHO



There is a suggestion for a national strategy and promotion plan with a strong belief in the potential of the battery industry to become a new basis industry

The Fossil Free Sweden Battery Strategy Launch

- In December 2020, **Fossil Free Sweden launched a strategy for a sustainable battery value chain in Sweden.** It was developed in collaboration with EIT InnoEnergy as well as the business community, civil society, and academia. Participants included Chalmers, Uppsala University, Business Sweden, Volvo Cars, Scania, Ferroamp, RISE, Volvo, Northvolt, Epiroc, and Husqvarna. The strategy **highlights a list of demands for national policy within five areas:**

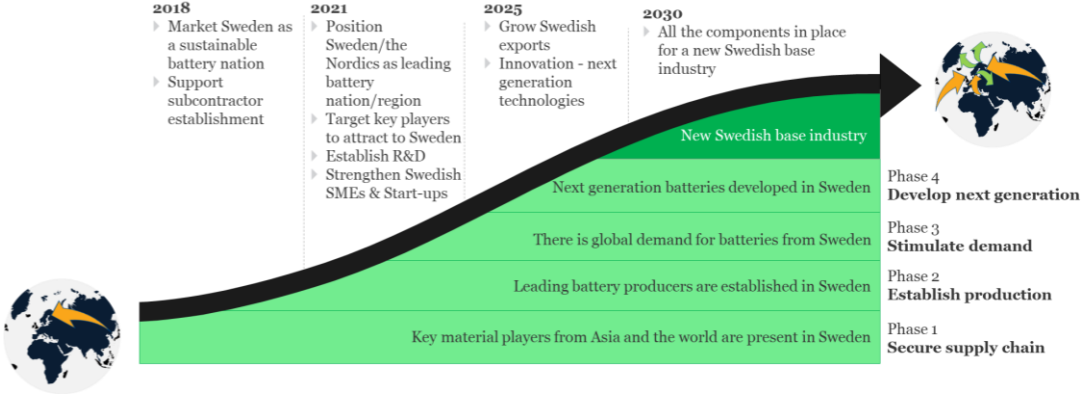
- Sustainable batteries for a fossil-free energy and transport system:** Stimulate demand for and use of sustainable batteries
- Sustainable battery production,** a new industry for Sweden: Create conditions for the development of a sustainable battery value chain in Sweden
- Recovery and extraction of materials** for a sustainable and circular battery industry: Create conditions to enable the mining industry and the recycling industry to contribute sustainably produced raw materials
- Skills development** for a charged future: Invest in research, innovation, and education for skills development
- Collaboration and dialogue** for growth and export: Implement and follow-up the action proposals through broad collaboration throughout the battery value chain

- The Government has commissioned the Swedish Energy Agency, the Swedish Environmental Protection Agency, and SGU develop a collaboration of authorities to support the development of a sustainable, competitive, and resource-efficient battery value chain in Sweden with low greenhouse gas emissions, and zero spread hazardous substances. The purpose of the assignment is to facilitate for increased electrification needed to meet the climate goals

“ The development of sustainable battery production is not only important for achieving climate goals, but also enables the emergence of a competitive industry that creates growth and jobs throughout the battery value chain

Fossil Free Sweden ”

Business Sweden suggestion for a 10-year promotion plan



- Together with the battery industry Business Sweden recommends a 10-year battery program to support the creation of a sustainable battery value chain in Sweden
- Focus 2021: Position the Nordics/Sweden as leading battery region/nation. Target key players to attract to collaborate with or invest in Nordics/Sweden, establish R&D and Strengthen SMEs & Start-ups

Source: Regeringskansliet, "Sverige deltar i europeiskt storprojekt för hållbar batteritillverkning", April 2020, Invest in Norrbotten, Norran, Fossilfree Sweden: Strategy for a Sustainable Battery Value Chain

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The Nordic region is well positioned for establishing a competitive and sustainable battery value chain

1. Green energy at low costs

- Renewables corner stone in energy mix. Lower CO₂-emission from production
- Attractive pricing - the Nordics has among the lowest energy prices in Europe, and they are predicted to stay that way for the foreseeable future

2. Stable energy supply and cold climate

- Excellent grid systems - robust grid network with great redundancy. Mission critical is business as usual.
- One of the worlds most integrated electricity markets
- Six months cold climate reduce need for cooling. Valued by e.g. data centers

3. Productive workforce

- Deep knowledge in industrial processes, manufacturing and great focus on R&D
- Educated population and high productivity

4. Connected logistics

- Well-connected with regional and continental industries
- Geographical distance reduced by digital communication, frequent travels & efficient logistics

5. Profitable image of sustainability

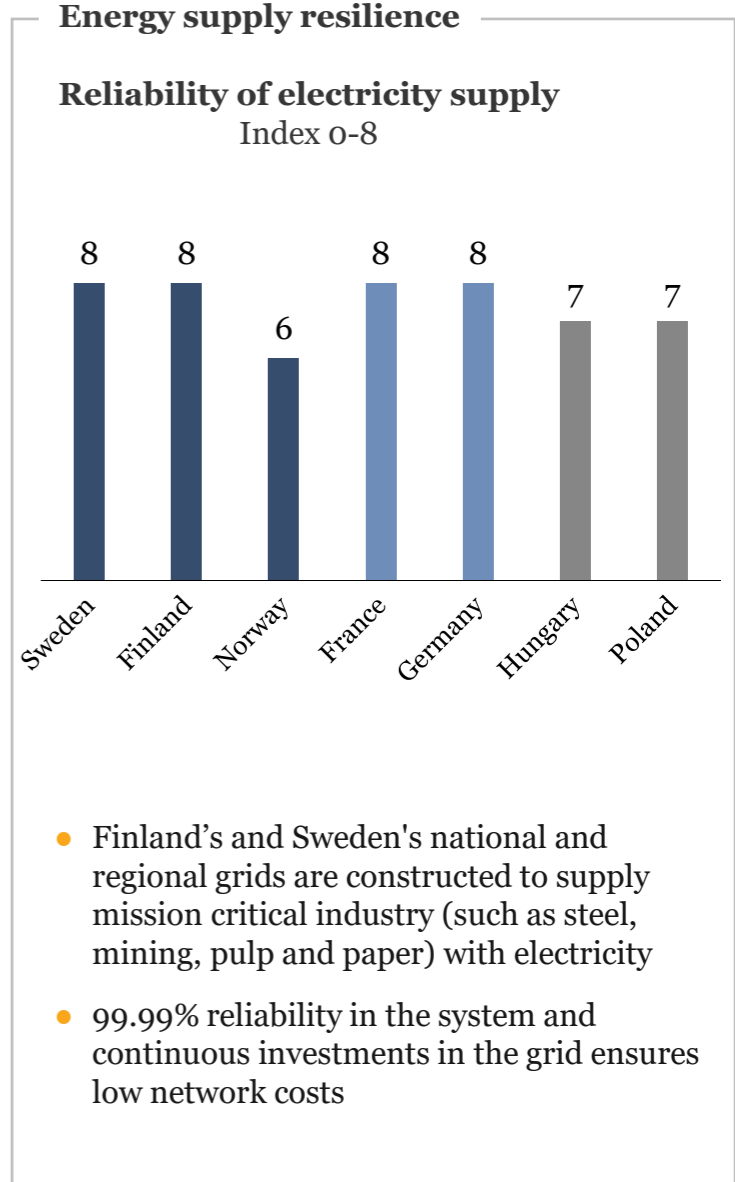
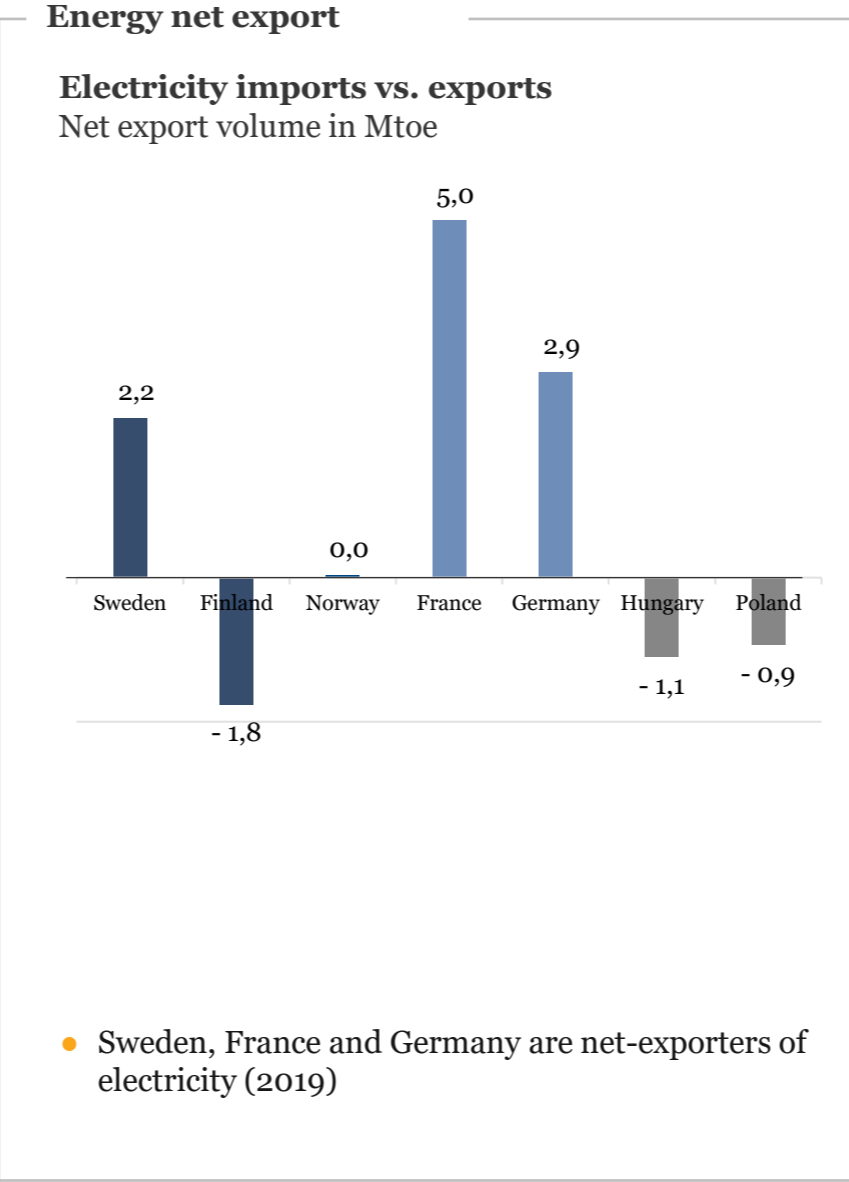
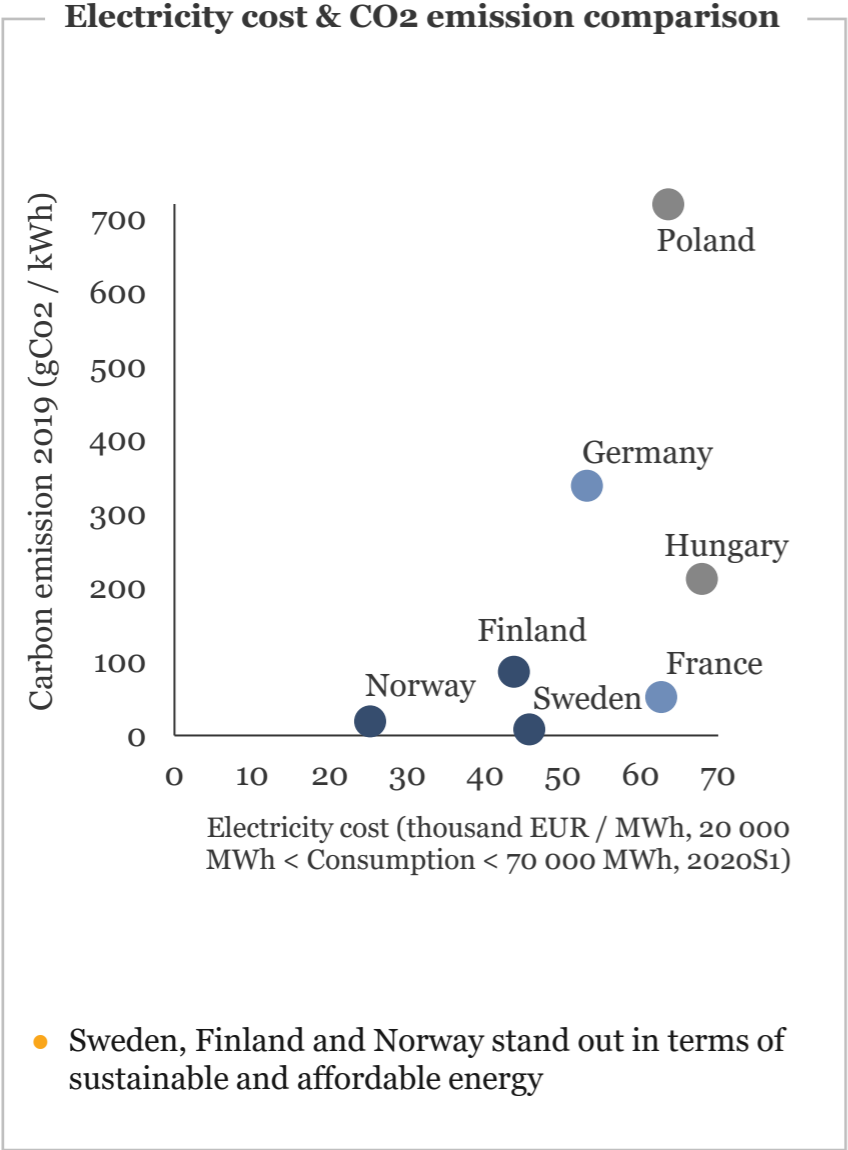
- Production site in the Nordics create positive brand awareness for sustainability
- High national demands on as well as high level of investments in sustainable and clean production processes

6. Abundant deposits of raw material

- Abundant deposits of raw material for batteries
- Ability supply responsible and sustainable mined raw materials

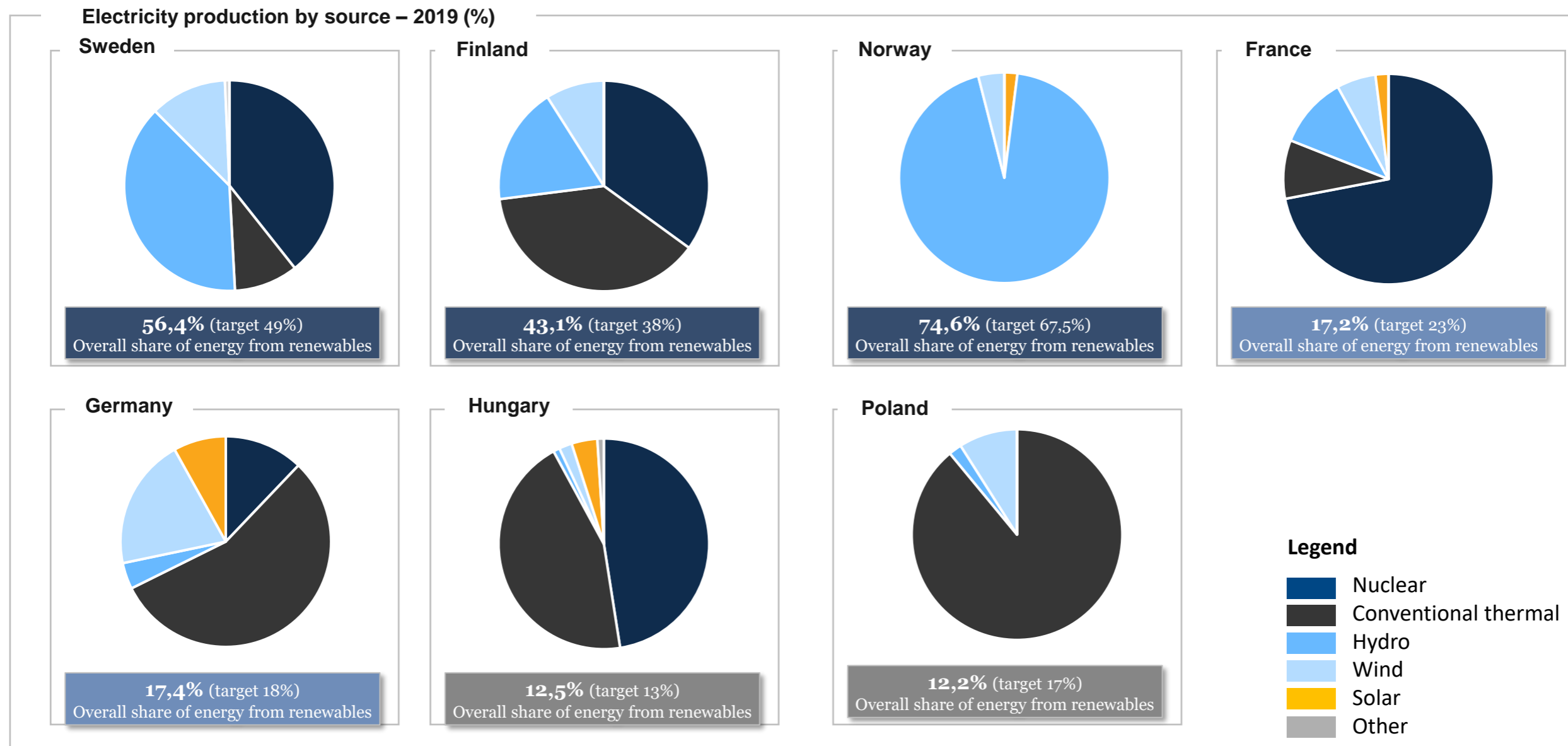
“
We need to invest long-term in the battery industry in the Nordics now. **We have a window of opportunity as we have competitive advantages from our clean energy, an emerging industry and a high-quality reputation.** We have competence, business mind-set and the opportunity. We have competitive investments going on throughout the value chain”

Sweden, France and Germany are all energy net-exporters and have high reliable energy supply while Norway stands out on the overall energy dependence rate



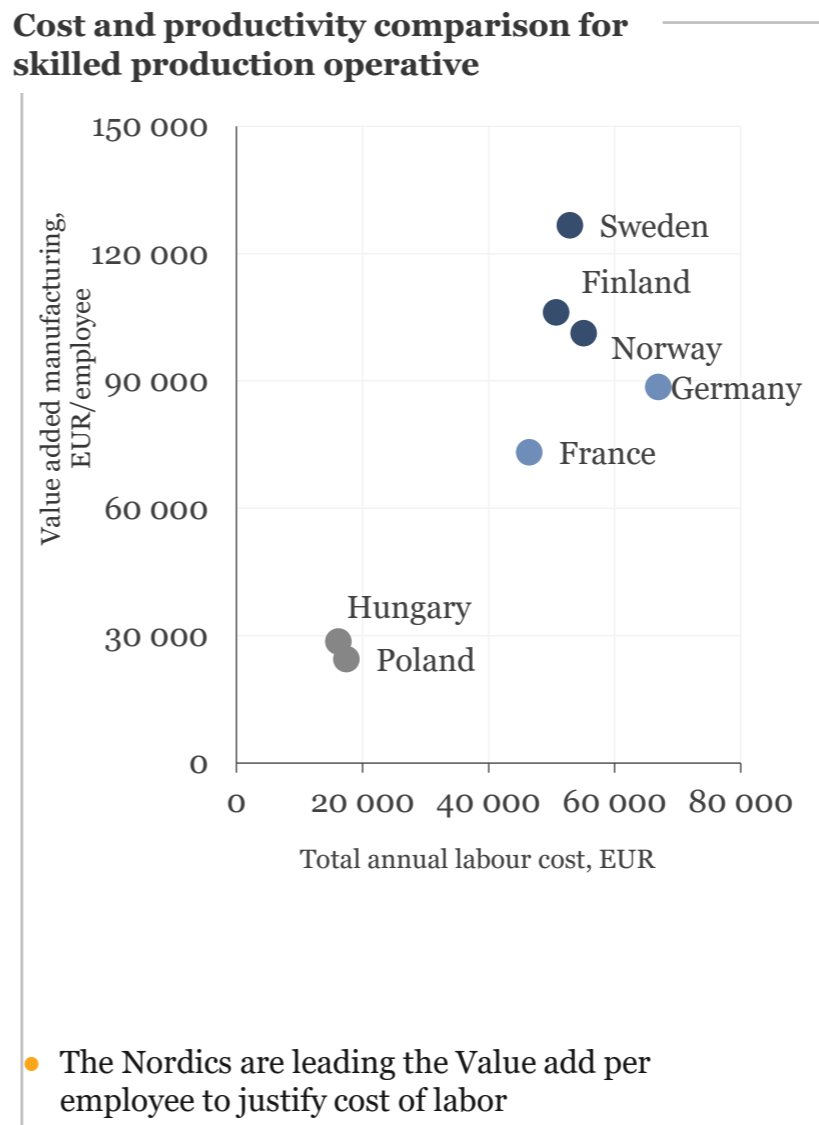
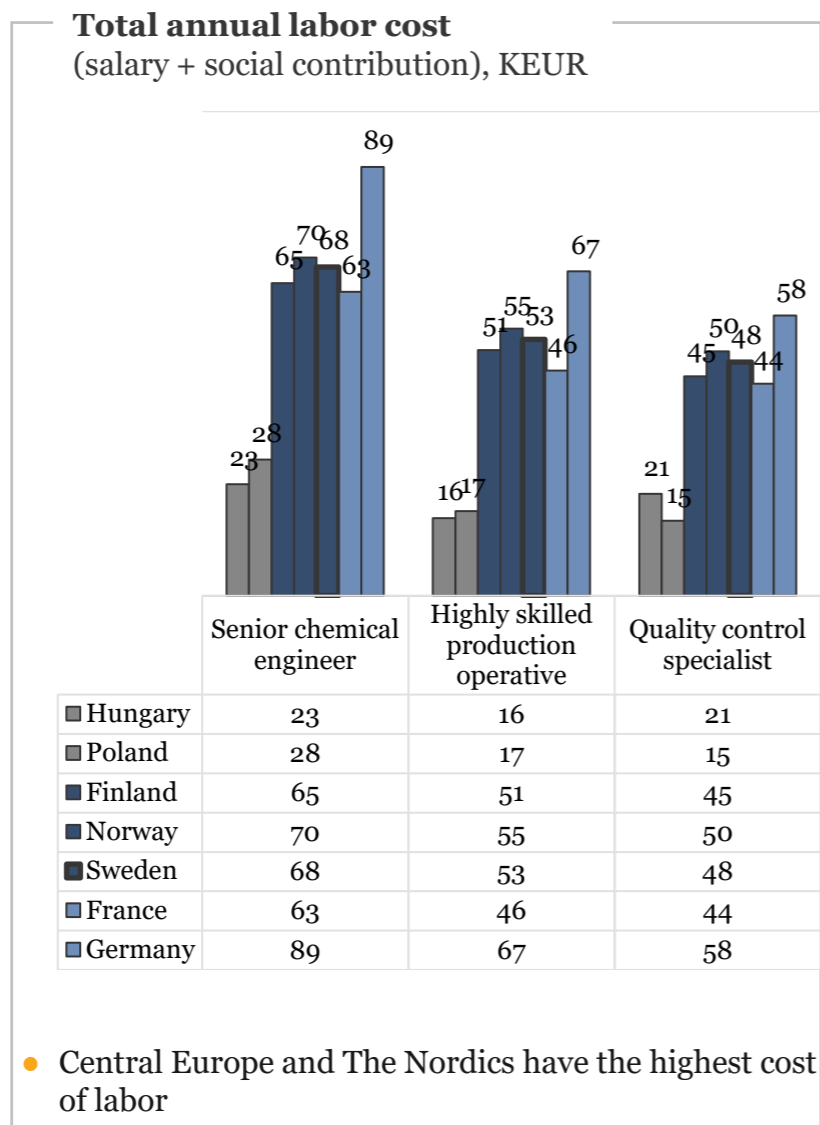
SOURCE: FM GLOBAL RESILIENCE INDEX 2021, IF METALL, SVERIGES INGENJÖRER 2021, EUROSTAT
 Source: IEA 2019, Eurostat 2019

The Nordics have a decisive higher level of renewable energy in the electricity mix and are all exceeding the EU targets for the overall renewable energy share



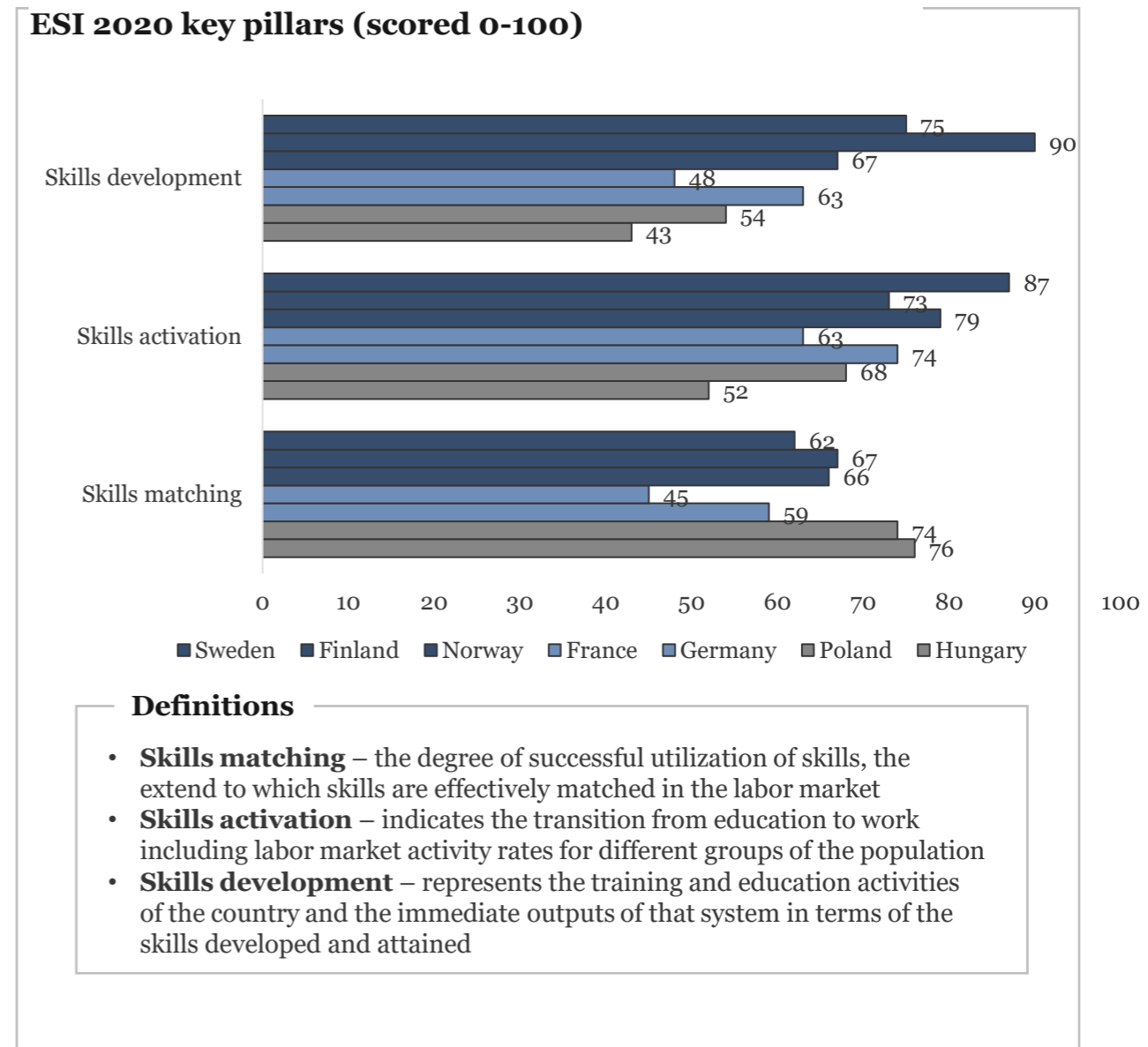
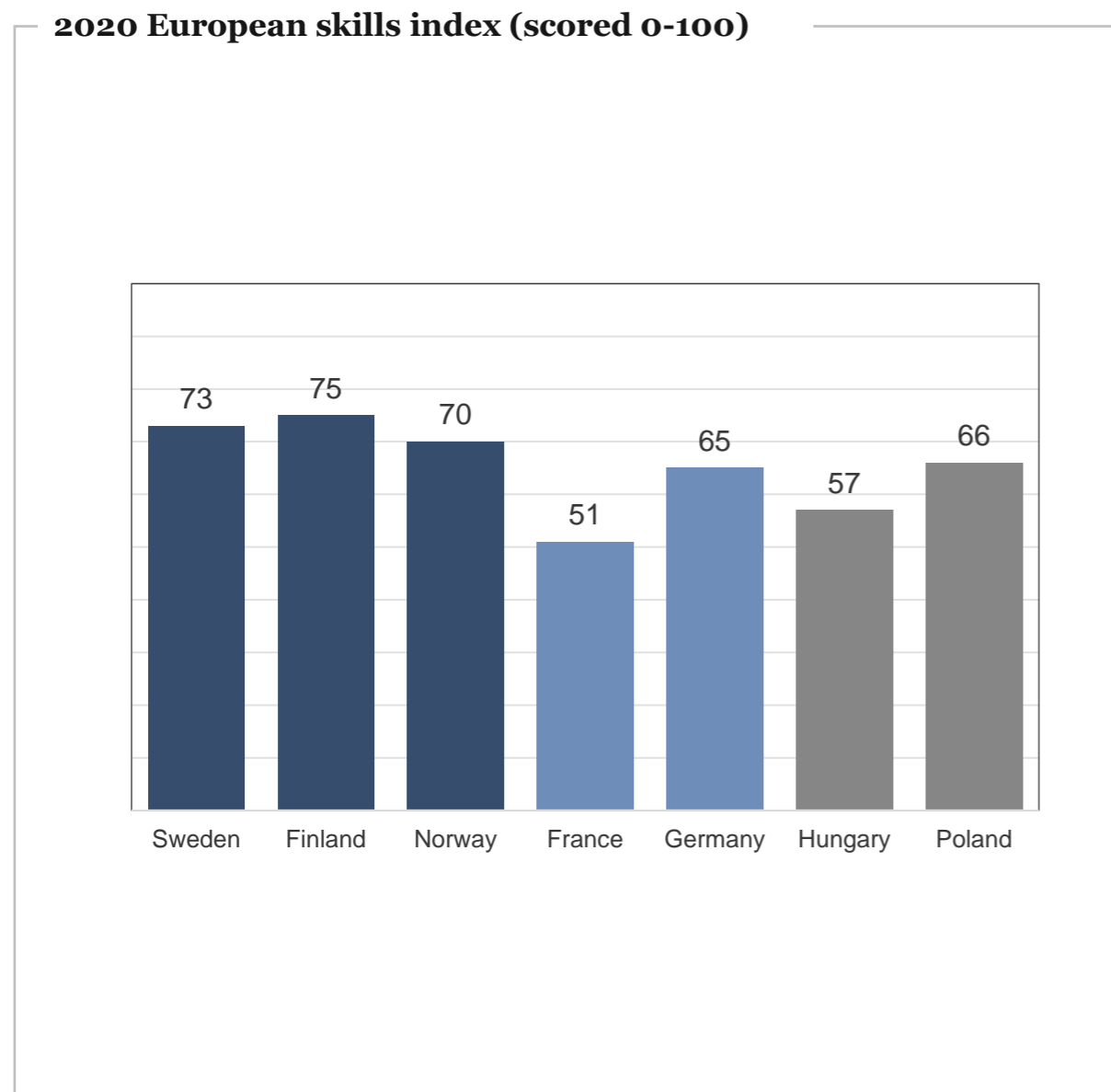
Conventional thermal includes coal, oil, natural gas, biomass and waste
 Source: Eurostat, International Energy Agency, 2021, latest data used

The Nordics provide the most affordable energy in combination with the highest value add per employee in manufacturing



Source: European Environment Agency 2019, Eurostat, Nordpool electricity exchange 2020, World Bank Doing Business 2020

The Nordics are among the top in 2020 European Skills Index which positions the region well in terms of availability and composition of competent workforce



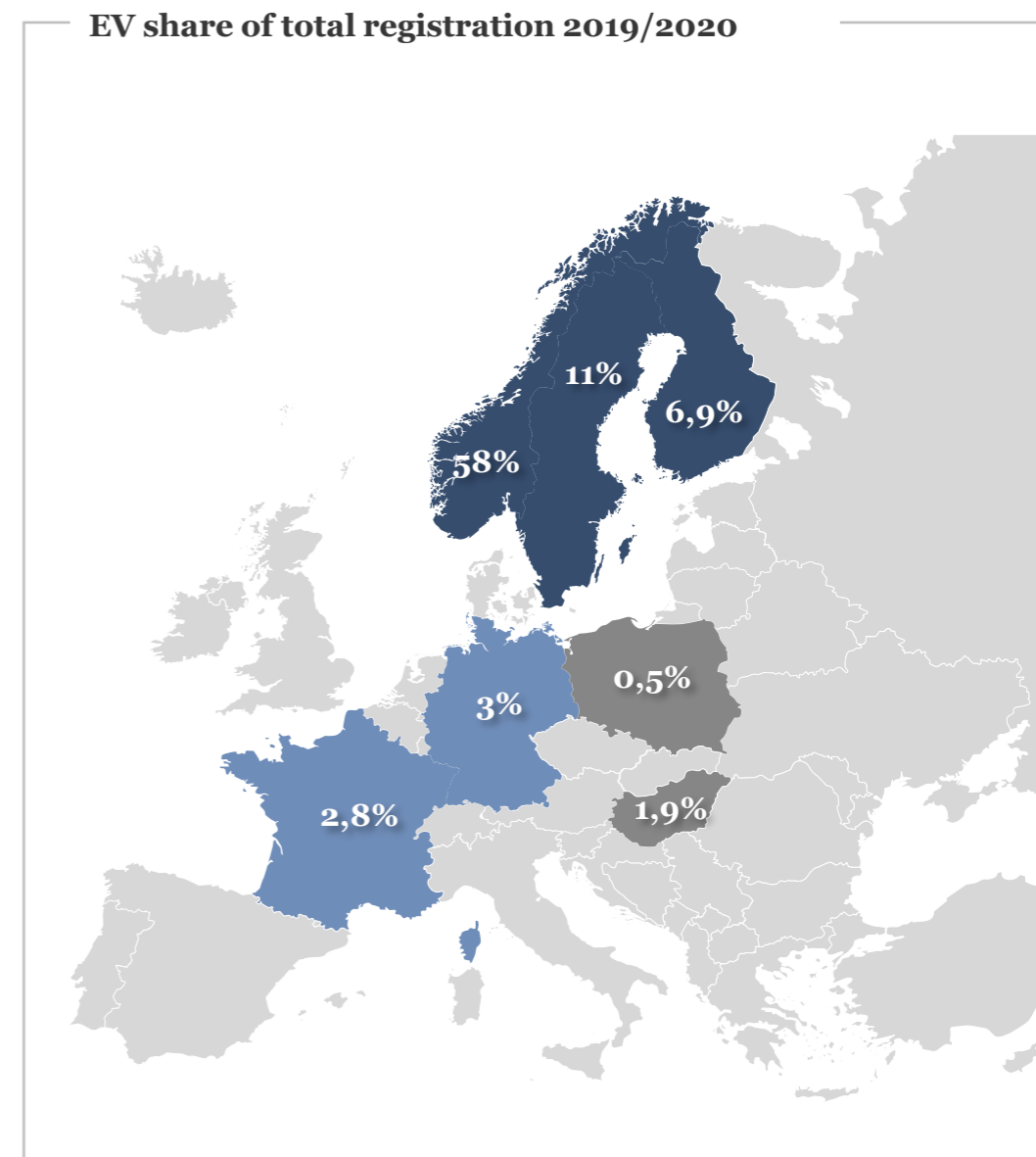
Source: CEDEFOP, Extracted April 2021, www.cedefop.europa.eu

Germany and Sweden with a developed infrastructure for marine, road and rail traffic on top in global logistics ranking

Logistics

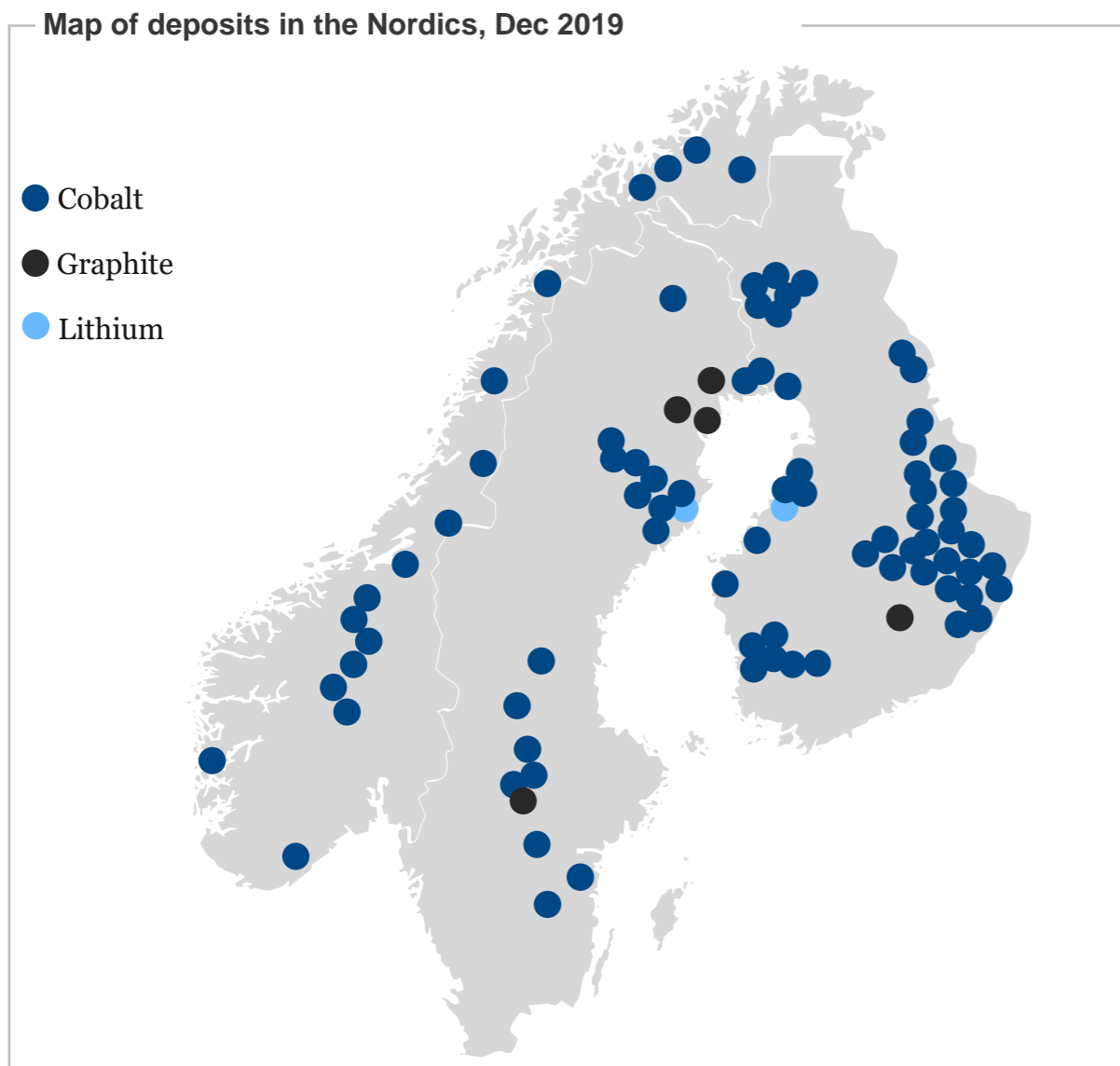
	Sweden	Norway	Finland	Poland	Hungary	France	Germany
Logistics Performance Index – global ranking	2	21	10	28	31	16	1
PORTS: Number of medium or large size ports	11	10	8	6	1	22	24
ROAD: Number of European A class highways	14	6	5	8	9	25	27
RAIL: Railway Performance Index: Tier 1 (best) – Tier 3 (worst)	Tier 1	Tier 2	Tier 1	Tier 3	Tier 3	Tier 1	Tier 1
Share of electrified railway tracks	75%	61%	56%	62%	40,5%	58%	No data

Central Europe, especially Germany is leading in terms of logistical prerequisites for establishing production followed by the Nordics



Source: fDi Benchmark from the Financial Times Ltd 2020, Eurostat, fDi Intelligence from the Financial Times based on Economist Intelligence Unit, IF Metall, Sveriges Ingenjörer

The Nordics have unique deposits of raw materials for battery production



- The Cobalt, Lithium and Graphite deposit map visualize the geographical placement of deposits of battery materials in the Nordics
- The Nordics all have rich findings of foremost cobalt and graphite, with some lithium
- The prerequisites are large and there is great potential to partially supply the producers of cells with local, sustainable raw material from the Nordics
- In order to start mining each deposit needs to there is a set of activities and rules to be conducted prior to getting the green light to start mining. This processes is of different lead-times and rules between the different Nordic countries

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Critical overall needs to improve market preconditions are risk-reducing-capital, access to raw materials, impact on EU regulations and investments for demand

Overall need	Critical needs for market conditions	
Supportive regulations for sustainability	Engagement in setting EU regulations	<ul style="list-style-type: none"> The proposed EU Batteries Regulations would change prerequisites and could be a game changer for the Nordics. The industry urge for Nordic engagements to secure supportive prerequisites for green batteries Key aspects : 1) difference between regulation or directive 2) regulation governance model 3) level of regulation vs. industry possibilities 4) regulations vs. global competition
Lead innovation & secure supply of skilled workforce	Strengthen & support R&D and education	<ul style="list-style-type: none"> R&D throughout the full value chain & for new materials & grid solutions (e.g. V2G). Competence for complete battery design. Test center for diagnostics and pilot centers, e.g. UKBIC & Fraunhofer. Support initiatives. Joint R&D and talent attraction. Solve the competence gap. Most needed: operators. Education needed on all levels. Fast track education. Enable border mobility skill exchange for incoming FDI
Access to raw materials through activated additional mining	Fast permit processes Public awareness	<ul style="list-style-type: none"> The rich deposits of battery materials offers an opportunity for battery materials from sustainable mining. Granted access for mining is needed. A battery-fast-track is called for Clear, fast & transparent permit processes are crucial for mining prospecting an onward The potential for mining is connected to public opinion. A The industry are interested in a public dialogue with reflections on the social and environmental aspects of options for sourcing battery materials. Sustainable mined battery materials from the Nordics could make a difference on a global market with immense demand
Investments in infrastructure to secure demand / energy supply	Charging infrastructure Investments for energy supply	<ul style="list-style-type: none"> Crucial to grasp potential of electrification and increase demand. Speed charging, affordable charging & geographical coverage Investments needed to enable development of energy storage solutions. Increased energy demand need supply. Digital & effective grid crucial.

“
If we want to get the industry **up and running quickly**, we need to find ways to subsidize investments. Permitting and approval **processes must be made faster and smoother**. ”
[Swedish company]

“
The proposed EU Batteries Regulations would change prerequisites and could be a game changer for the Nordics. We must engage to e.g. make sure “regulations” do not change to “directive”. The difference is immense for the Nordic potential for supplying sustainable batteries. ”
[Finnish company]

Critical overall needs to secure supply and demand partnerships: strong market position, connected ecosystem, further FDI and investment in R&D and competence

Overall need	Critical needs for value chain supply & demand	
Lower first-mover risk & start operations	<ul style="list-style-type: none"> Capital, grants & guarantees Clarity in FDI incentives 	<ul style="list-style-type: none"> First mover investments are more risky and less profitable, but these investments are crucial set off the industry, e.g. factories for cell production and active minerals Need for investment capital, grants, guarantees and shared risk Difference in content and level of incentives among European markets result in a lack of clarity when FDI investors seek to lower risk Need for evaluation of possibilities, Europe comparison & clarity of offer to investors
Competence & capital to build up a new industry	Establishments of further FDI	<ul style="list-style-type: none"> As the battery industry is new competence and experience is lacking within Europe. Therefore it is also key to make it easier for FDI investors to initially bring skills Scale & speed investments for sustainability to build the Nordic ecosystem & create alliances. Further investments are proof concept making the region additional attractive. Cell factories crucial to close the value chain
Be connected with leading allied & networks	<ul style="list-style-type: none"> Alliances with OEMs Nordic & digital networks 	<ul style="list-style-type: none"> Need to better understand foreign clients and build strong alliances for business ventures, e.g. attracting significant flows of recycled materials Places to meet, exchange experiences, solve competence issues, meet suppliers and customers, increase network and be acquainted are asked for Need to connect digital & battery. The Nordics has a digital edge for e.g. interfaces, technology, business models and big data; all of which with potential around batteries
Accelerate market position for sustainability	<ul style="list-style-type: none"> High ambitions, broad official support Strong global brand with clear value proposition 	<ul style="list-style-type: none"> A high national ambition underlines seriousness & creates trust. National strategies emphasize support and commitment for investors and partners and lower risks Increase awareness of preconditions for life cycle environmental & social sustainability of e.g. carbon footprint of EV charging. Industry is extremely fast & competitive There is a window of opportunity to take position for sustainability now as other regions increase renewable energy share & are close to market.

“ We need to think big. We need vast investments throughout the whole value chain. **Foreign investments and competence are decisive** as we accelerate our own capabilities and technology. **We must work with the best to be the best!** ”

[Norwegian company]

“ We need a Nordic joint the **LIFT for R&D** in order to **fundamentally strengthen** Nordic value chain. At the same time we must recognize the high quality capabilities we also already have and build upon that. ”

[Finnish company]

“ Education is extremely important; there should be an increased collaboration between universities; skilled labor is currently imported. ”

[Swedish company]

Source: Business Sweden interviews

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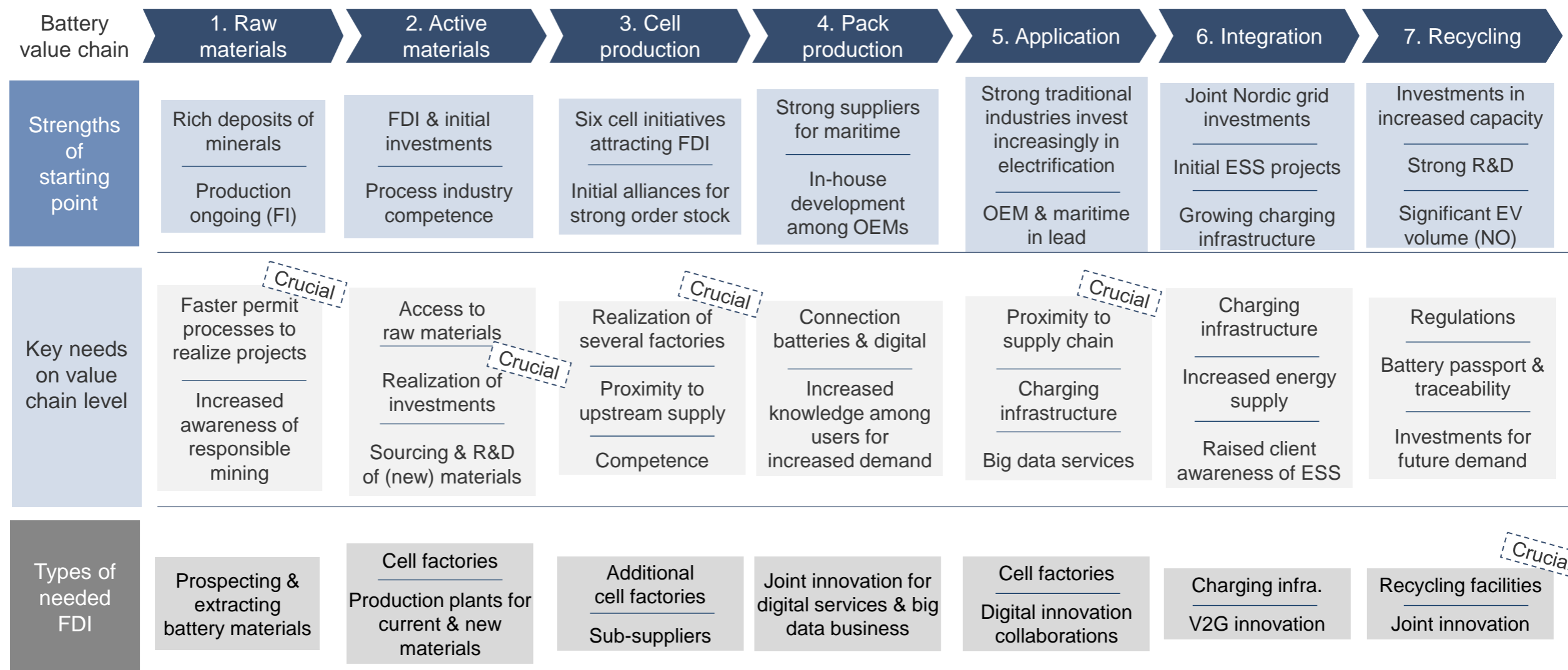
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Needs on a value chain level to leverage the strong starting point - the realization of current investments and attraction of additional FDI is crucial



- 1. Raw materials
- 2. Active materials
- 3. Cell production
- 4. Pack production
- 5. Application
- 6. Integration
- 7. Recycling
- A. Academia, organizations

Faster processes, increased awareness of responsible mining and an active EU engagement would benefit the potential for ongoing mining projects in 2025

Market drivers

Overall drivers for development	<ul style="list-style-type: none"> ● EU supply of the battery materials lithium, cobalt, nickel and graphite will be way beneath EU and global demand both in 2025 and 2030 ● EU regulations on sustainability & life cycle analysis
Customer demand	<ul style="list-style-type: none"> ● Available raw materials produced as sustainably as possible (environmental and social sustainability) ● Sourcing within the EU ● Production energy source increasingly important ● Closeness to production of cells and active materials (often located near cell producers as well)

Trends & opportunities	<ul style="list-style-type: none"> ● Further develop sustainable mining <ul style="list-style-type: none"> – Mining with electrical machinery, remote mining and overall low emission per operation – Partnerships for fossil-free mining – Be active on EU regulation level to influence future demand ● Awareness of responsible mining <ul style="list-style-type: none"> – Increase recognition of current prerequisites for battery production among the public and end-customers of e.g. EV to influence demand for sustainability – Triple-helix collaborations to support an open public opinion ● R&D for future materials <ul style="list-style-type: none"> – Collaborations for research of future battery materials along with reopening mines for currently demanded battery materials.
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How to reach a complete battery value chain

The current Nordic situation
<ul style="list-style-type: none"> ● There is a strong mining sector with focus on sustainability, especially in Finland and Sweden <ul style="list-style-type: none"> – Increasing fossil-free and fully electrified mining operations – High-skilled workforce, global leading companies and long tradition for mining ● Rich availability of raw materials needed for battery production, e.g. lithium, cobalt, graphite ● Power supply from clean energy with further investments in e.g. wind power ● Ongoing cases for permits to initiate further mining. Public debate concerning mining in the own backyard

Needs to establish a complete Nordic battery value chain
<ul style="list-style-type: none"> ● Access to raw materials <ul style="list-style-type: none"> – Faster and more transparent processes for permits. Battery fast track – Transparent and long-term regulations and fast decision times for sustainable mining – Attract foreign investments in the sector. Support high CAPEX risk ● Preferable EU regulations <ul style="list-style-type: none"> – Active engagement in the development of EU regulations ● Public, official and business commitment for sustainable mining <ul style="list-style-type: none"> – Active public debate about responsible mining for production sites as well as EV consumer demand ● Marketing of sustainable raw materials from the Nordics

Source: Business Sweden interviews
 For investment cases & definition of value chain step: see appendix

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Additional cell production facilities in the Nordics are key to grasp the immense opportunity of high EU demand and advantageous Nordic production sites

	Market drivers	How to reach a complete battery value chain
Overall drivers for development	<ul style="list-style-type: none"> ● EU supply of the active materials is expected to stay way beneath EU demand both in 2025 and 2030. ● Establishment of cell factories and new innovations drive demand 	<p style="text-align: center;">The current Nordic situation</p> <ul style="list-style-type: none"> ● Refineries active in Finland for e.g. cobalt ● Domestic and foreign investments in all countries as snowball effects from cell production projects ● High skills in process industry and establishments of leading chemical companies in all countries ● Companies focusing on active materials are e.g. Altris, Northvolt and Dongjin in Sweden, Freeport Cobalt (Umicore), Terrafame and Metso Outotec in Finland and investments by e.g. Norsk Hydro, ELKEM and Glencore in Norway
Customer demand	<ul style="list-style-type: none"> ● High-quality and safe materials sourced close by (dangerous goods for transportation) ● Social and environmental sustainability for production will increase. Potential EU (or other) regulations can boost demand. Proximity to cell manufacturing is and will be decisive 	
Trends & opportunities	<ul style="list-style-type: none"> ● New materials & sources <ul style="list-style-type: none"> – Cheaper & efficient cathode material. Replacement of materials, e.g. silicon for graphite, graphene for graphite – Extraction of rare earth elements out of slag stockpiles – Competence in cleaning materials ● Traceability <ul style="list-style-type: none"> – Blockchain technique for traceability throughout the value chain to ensure the greenest batteries – Requirements regarding chemical safety are updated in order to identify (potential) risks in advance ● Pricing <ul style="list-style-type: none"> – High willingness to pay now but expect cost cuts. <ul style="list-style-type: none"> ➔ Increased demand of attractive production for costs & sustainability 	<p style="text-align: center;">Needs to establish a complete Nordic battery value chain</p> <ul style="list-style-type: none"> ● Several established companies with operations for active materials <ul style="list-style-type: none"> – Crucial to attract and establish active cell production – Offer easy transition and support – Expected snowball effect on active material companies as cell production is established ● Available competence, especially in the chemistry-related area <ul style="list-style-type: none"> – Educate domestic & attract foreign on all levels – Make it easy for investors to bring own personnel – Make use of high competence in e.g. chemistry and metallurgical industries – Market the competencies for broad knowledge of it ● Availability of subcontractors ● Investments in R&D for new materials & efficient production processes

Source: Business Sweden interviews
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Crucial to support the first cell production cases and to engage in EU regulations for sustainable batteries to achieve the potential of a Nordic battery industry

Market drivers

Overall drivers for development	<ul style="list-style-type: none"> ● Traceability and big data. Smart batteries and need for control. Decarbonization / electrification. Charging infrastructure. Innovations of application. ● EU regulations. FDI to to Europe. Business models.
Customer demand	<ul style="list-style-type: none"> ● Cost efficiency, cost reductions, volumes with short lead times. Demand for sustainability grows with regulations and user demand, but cost still decisive ● Proximity to the OEM's is key as the operate with just in time deliveries.. Alliances decisive in order to design cells aligned with specific client need
Trends & opportunities	<ul style="list-style-type: none"> ● Alliances <ul style="list-style-type: none"> – A lot of capital available and high interest to get in profitable business – Strong alliances to secure raw materials & orders – Alliances to enable re-use & recycling to produce at affordable prices ● Logistics & materials <ul style="list-style-type: none"> – Logistics: speed and scale pre-requisite for clients – Estimations that 75% of cell production costs can be linked to material utilization and logistics. Opportunity in increasing negotiation power ● Skills & R&D <ul style="list-style-type: none"> – Make use of the high attention for and investments in cell production facilities and the following competence attraction to develop Nordic competence – Nordic knowledge sharing and R&D exchange

How to reach a complete battery value chain

The current Nordic situation
<ul style="list-style-type: none"> ● The Nordic countries currently (Q2-2021) have six cases for battery cell production, all with strong footholds in the Nordic culture but with different financing models and battery techniques <ul style="list-style-type: none"> – Developments have been driven by Northvolt, which is currently completing the final preparations for the start of their new factory production in Skellefteå. – There are currently three concrete projects to produce battery cells in Norway: FREYR, Morrow and Beyond. – In December 2020, the possibility for another producer was announced through the collaboration and MoU between Panasonic, Equinor and Hydro
Needs to establish a complete Nordic battery value chain
<ul style="list-style-type: none"> ● Need a handful established cell producing factories with segmented focus <ul style="list-style-type: none"> – Crucial to support current first mover investment cases for cell production to at all realize the potential of a battery industry – Estimates: investment cost of ~1 billion SEK per GWh – Attract and establish further active cell production facilities ● Proximity to large scale value chain. <ul style="list-style-type: none"> – Attract strong sub-suppliers to avoid dependence on outside-Europe suppliers ● Batteries acknowledge as a high-potential new basis industry ● New clusters <ul style="list-style-type: none"> – networks, education centers, test centers and R&D for the battery industry – Create Nordic platforms to build skill excellency ● Increased demand for sustainable batteries <ul style="list-style-type: none"> – EU regulations as well as awareness of prerequisites of sustainability throughout the battery life cycle

Source: Business Sweden interviews
For investment cases & definition of value chain step: see appendix

Great opportunity to create a vibrant connection of batteries & digital services as big data and BMS enable changed user experiences & business models

Market drivers

Overall drivers for development

- Pack further integrated in OEM production. Maritime need for hydrogen and battery hybrid. Reduced cost of battery packs. Efficiency & security increases demand for software and BMS

Customer demand

- Production must be close to client, low cost with just in time delivery. Maritime: custom design
- Dual maritime need of battery / hydrogen.
- Reliability, safety and digitalization. No risk for endangering credibility and brand value.
- Performance as for combusting engine applications

Trends & opportunities

- **Battery Management systems**
 - Creation of packs and modules that enables the best possible fit to the application. Control re-charging by redirecting the recovered energy.
 - BMS preferably near customers
- **Big data**
 - High investment in development where the key is BMS, battery passport and performance.
 - User experience and demands are key. Batteries no longer commodity.
 - OEM's invest in big data for new business models
- **Usability of battery packs and modules**
 - Increased application in-house production of packs increases need of systems and knowhow of how the batteries are to be used
 - Marine increased focus on their special needs.
 - Nordic knowledge sharing and R&D exchange

How to reach a complete battery value chain

The current Nordic situation

- The Nordics has a wide range of applications within the automotive, maritime, forest, mining and construction machinery industry. Expected growth of pack production facilities. Increased Investments in BMS software. The maritime industry still sources from pack producers
 - In Sweden, companies like Epiroc, Scania, Volvo AB and Volvo Cars have their in-house production
 - In Finland, there is Valmet Automotive, which in 2020 decided to double the capacity in Salo and expand the plant in Uusikaupunki to produce battery packs.
 - Norway has two well-established companies within maritime industry: Corvus Energy and Siemens

Needs to establish a complete Nordic battery value chain

- **Connection of digital & batteries**
 - Realize potential of commercializing battery data
 - Create ecosystem for digital solutions for battery data applications for user experience, security control and performance excellence
- **Investments in R&D and innovations for user experience**
- **Strategic alliances**
 - With application MNEs for digital solutions and business models based on big data
- **Continuous investments in battery security and performance**

Source: Business Sweden interviews
 For investment cases & definition of value chain step: see appendix

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- 8. Academia, organizations

Increase of demand, user competence, digital innovation, charging infrastructure & proximity to supply chain would accelerate the strong application industry

	Market drivers	How to reach a complete battery value chain
Overall drivers for development	<ul style="list-style-type: none"> ● Decarbonization and electrification trends continue. Regulations and incentives for EV / against CO2 emission (e.g.. EU CO2 in 2025). ● Lower cost of batteries and EVs. Available charging 	<p style="text-align: center;">The current Nordic situation</p> <ul style="list-style-type: none"> ● There are several application owners in the Nordics with an aggressive fleet conversion agenda during upcoming years. High demand for EV, maritime, the forest and the mining industry ● Automotive industry influencing the global agenda, e.g., Scania, Volvo Group and Volvo AB. During 2021 Volvo Car Group communicated their joint venture with leading Swedish battery company Northvolt ● Heavy machinery & maritime applications industry e.g., Wärtsilä, TankTwo and VEO. ● World leader in electrification of vessels and the use of EV with 54% of new sales 2020. Strong investments in electrification. In maritime global lead.
Customer demand	<ul style="list-style-type: none"> ● Affordability for consumers as well as efficient reach and capacity of battery 	
Trends & opportunities	<ul style="list-style-type: none"> ● User awareness <ul style="list-style-type: none"> – B2B user competence of possibilities of a battery e.g. influence of charging times on fleet size – B2C user awareness of preconditions for life cycle sustainability – Energy storage possibilities ● Fossil free <ul style="list-style-type: none"> – Continued investment in fossil-free fuels in all areas of applications – Engage in European alliances to increase network, market and long-term demand – Sustainability in full value chain ● Innovation & big data <ul style="list-style-type: none"> – Invest in digital services for user experience, battery performance, battery life-time & security – Evaluate big data opportunities and new business models, e.g. battery-as-a-service 	<p style="text-align: center;">Needs to establish a complete Nordic battery value chain</p> <ul style="list-style-type: none"> ● Established battery cell production facilities as proximity to sourcing is crucial. <ul style="list-style-type: none"> – Close collaboration for transparency in production. Supply-chain within Europe ● Investments in broad electrification <ul style="list-style-type: none"> – Increased charging infra. (also in remote areas) – Competitive offer of alternative transport ● Increased demand e.g. through <ul style="list-style-type: none"> – public incentives rules for public procurement – increase user awareness of life cycle sustainability and – increased user competence of application areas of batteries ● Strategic alliances within the Nordics for sustainable & competitive offerings ● Prerequisites for recycling <ul style="list-style-type: none"> – e.g. who is responsible and how the Co2-footprint of applications will be measured – Engagement in EU regulations

Source: Business Sweden interviews
 For investment cases & definition of value chain step: see appendix

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With large-scale investments and clear legislation, the opportunities with e.g. V2G, increased charging and energy storage solutions will boost integration

	Market drivers	How to reach a complete battery value chain
Overall drivers for development	<ul style="list-style-type: none"> Increased demand, regulations and innovations for charging and storage. Growth of renewable energy, consciousness of energy pricing and peak-load problems. Broad decarbonization. User interface 	<p style="text-align: center;">The current Nordic situation</p> <ul style="list-style-type: none"> Integration is a prerequisite for the demand of EV's and the Nordics are top tier in charging-solutions. A long-term opportunity for EES. Strong expansion of public charging stations in Norway and Sweden. Investments for smart roads in esp. Sweden. Innovative storage and charging solutions The Nordic TSOs (DK, FI, NO & SE) plan to invest more than EUR 15 billion until 2028 in the grid for transmission power, reduce bottlenecks & renewable energy (official plan of 2019). Pilot projects for peak-load problem running, e.g. the first Nordic solar power plant for electric storage and a charging station for EV in Finland. Projects for vehicle-to-grid (V2G) integration incl. maritime sector.
Customer demand	<ul style="list-style-type: none"> Grid connection for all types of vehicles, storage and maritime transport will increase e.g. so the vehicle can be used to access all desired routes and areas Charging infrastructure is a must for increased demand in electric applications 	
Trends & opportunities	<ul style="list-style-type: none"> User interface <ul style="list-style-type: none"> Value add from digital services that use interface big data Software-based business and models depending on battery data Digital communication in the grid Operations & innovation <ul style="list-style-type: none"> Energy storage will change energy operations => automation solutions Digitalized grid & new possible solutions (V2G) Solutions for how to value the effect of the electricity market more Application & innovation <ul style="list-style-type: none"> Replacement of black power (diesel generators). Implications & possibilities of local restrictions Vehicles to grid including power supply and management 	
		<p style="text-align: center;">Needs to establish a complete Nordic battery value chain</p> <ul style="list-style-type: none"> Expansion of the charging infrastructure <ul style="list-style-type: none"> Key for e.g. logistics Charging must be affordable Incentives to build charging solutions in rural areas Increased volume of renewables <ul style="list-style-type: none"> Investments for increased energy supply in digital grids in place Breakthrough of large-scale energy storage & V2G <ul style="list-style-type: none"> Increase awareness of prerequisites of sustainability in the battery life cycle (carbon footprint of charging of EVs) Incentives for investments Increase EES demand by education of B2B customers Clearer legislation for the electricity market, energy generation and storage

Source: Business Sweden interviews
 For investment cases & definition of value chain step: see appendix

Regulations and governance, standards and smart batteries as well as early investments in facilities are key before recycling volume picks up around 2027

	Market drivers	How to reach a complete battery value chain
Overall drivers for development	<ul style="list-style-type: none"> Regulations demanding sustainability and life cycle analysis. The EU <i>End of Life Vehicles Directive</i>. Consumer recycling demand. Lack of materials from sustainable sources. Awareness of current sources 	<p>The current Nordic situation</p> <ul style="list-style-type: none"> The Nordics countries have recognized recycling as a critical part of the battery value chain with an abundance of initiatives for ramping up and enhancing the recyclability of batteries and their materials as well as the possibility of re-usage (e.g. storage units). The larger market for recycling will come in 2027-30 <ul style="list-style-type: none"> Swedish project from e.g. Northvolt and Stena Recycling (Batteryloop Technologies) In 2018 the European Commission called on Finland to coordinate research on battery recycling in Europe. The main Finnish initiative is BATCircle. Norway will be first in line with a critical mass for profitable battery recycling. Initiatives are e.g. BATMAN and joint venture HydroVolt. Preparations for larger market around 2027-30
Customer demand	<ul style="list-style-type: none"> Black mass* facilities close to clients Clean materials sufficient for production Cost efficient processes 	
Trends & opportunities	<ul style="list-style-type: none"> Alliances for collection & recycling <ul style="list-style-type: none"> European network for collection, disassemble and transport of batteries and black mass Business alliances for recycling processes & R&D Competence in cleaning for recycle Traceability & competence <ul style="list-style-type: none"> Traceability could become a game changer for the Nordics as digital knowledge is needed and it would be preferable for sustainable production Competence & innovations for 2nd-life usage Governance of regulations <ul style="list-style-type: none"> Alliances for EU dialogue about governance of regulations to enable profitable recycling and not unbalanced competition 6 million end-of-life vehicles are disposed of in the EU each year. Another 3.4 to 4.7 million deregistered vehicles are unaccounted for 	<p>Needs to establish a complete Nordic battery value chain</p> <ul style="list-style-type: none"> Clear EU regulations and governance Clear standards to ease recycling process <ul style="list-style-type: none"> E.g. standards for production. Would enable automation Recycling solutions to re-used materials for new cell production Strong R&D in place with Nordic collaborations Ecosystem for smart batteries and traceability <ul style="list-style-type: none"> Smart batteries with data and traceability to know the battery content before de-charge Regulations for transport <ul style="list-style-type: none"> of black mass from e.g. Eastern Europe close to refineries in e.g. the Nordics

Source: Business Sweden interviews
 For investment cases & definition of value chain step: see appendix

*Black mass is the output from the mechanical initial part of the recycling process of a battery. The black mass is transported to facilities caring for the second step: the chemical cleaning of black mass for raw materials for battery active materials

- 1. Raw materials
- 2. Active materials
- 3. Cell production
- 4. Pack production
- 5. Application
- 6. Integration
- 7. Recycling
- A. Academia, organizations**

Engaging in EU dialogue, taking position and investing in competence on all levels would strengthen the emerging battery ecosystem in each country

	Market drivers	How to reach a complete battery value chain
Overall drivers for development	<ul style="list-style-type: none"> ● Immense competition for investments in the battery value chain and crucial lack of competence ● EU commitment to full life cycle sustainability as well as overall public and private investments in the European battery R&D 	<p style="text-align: center;">The current Nordic situation</p> <ul style="list-style-type: none"> ● Strong national R&D centers and high engagement in EU projects. ● Lack of educated chemical engineers and active material experts. Lack of operational experienced labor – for larger scale production ● R&D initiatives generally coordinated through Batteriers Sweden (BASE), Uppsala University, BATCircle, Aalto University, SINTEF and Agder University or NTNU
Trends & opportunities	<ul style="list-style-type: none"> ● Competence & R&D <ul style="list-style-type: none"> – Triple helix R&D collaborations cross-border – Nordic joint R&D center (test, pilot) – Educating customers along the value chain in possibilities with batteries – Automation and digitalization handling big data ● Promotion for position <ul style="list-style-type: none"> – Marketing with value proposition & cases of investments and success – Position in the EU & connection with North America – Create and engage in ecosystem platform to increase network ● Financing & regulations <ul style="list-style-type: none"> – Not only soft funding. Possibilities for support from official credit and financing institutions – Supporting programs and incentives 	<p style="text-align: center;">Needs to establish a complete Nordic battery value chain</p> <ul style="list-style-type: none"> ● National strategies and strong official industry support <ul style="list-style-type: none"> – High ambitious position for long-term position ● Investment promotion activities for FDI <ul style="list-style-type: none"> – Clear and competitive value offering of the Nordic countries that is well-known – A simple joint message ● R&D and education system for batteries with easy labor movement <ul style="list-style-type: none"> – Close the competence gap with education on all levels and easy labor movement & interest in living in the Nordics – R&D throughout the full value chain. Competence for complete battery design. Test center for diagnostics and pilot centers ● Engage on highest level in the EU <ul style="list-style-type: none"> – for active dialogue about regulations along value chain ● Public procurement focusing on zero-emission and preferably strengthening the Nordics

Source: Business Sweden interviews
 For investment cases & definition of value chain step: see appendix

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The interviewees see benefits of a joint Nordic approach by focusing on industry profitability and sustainability with a strong R&D agenda

Benefits with a Nordic approach according to interviewees

- Many regulatory decisions with a high impact on future demand are taken on an EU level. A joint Nordic engagement could set ambitions higher, **enabling the positioning of a strong sustainable Nordic business case to impact future market prerequisites**
- An **investment in one country is a win for all** – it is a proof of concept of the profitable and sustainable business model in the Nordics
- Today, public awareness of the preconditions of battery production is low. The marketing and the positioning of a Nordic context could **strengthen the narrative of the Nordic preconditions for a green battery value chain**
 - In addition, today's lack of demand for sustainable batteries could be impacted
- To be profitable in business and successful in R&D, volume is key – something a **Nordic approach** would enable. A larger market could also be **more interesting when attracting capital, workforce and business partners as well as researchers and students**
 - Fraunhofer Battery Alliance and UKBIC are examples of German and British role models

Challenges with a Nordic approach according to interviewees

- The regulatory hurdle of 10% customs on Norwegian batteries is a **trade barrier**
- While sourcing within the Nordics is a great possibility, but on the extreme competitive battery market, **goods and services are always sold or bought at the best price**
- **The battery industry is driven by references.** Due to the confidentiality needs in the value chain for some industries, success cases for marketing purposes could be hard to showcase
- **Public and private capital is a constant need** for R&D projects to start but also as scale is critical for production throughout the entire value chain

Conclusions

- **All interviewees are positive to a joint Nordic engagement** in developments of regulations as they are critical for future market prerequisites
- Further, a joint Nordic approach is seen as advantageous if it is **efficient and driven by business needs by focusing on profitability, sustainability and with a strong R&D agenda**

By joining forces, the Nordics can accelerate the development of a strong position in the rising European battery market

Develop a joint Nordic value proposition to attract FDI	<ul style="list-style-type: none"> ● Develop a joint Nordic value proposition to attract foreign direct investments for experience, competence and competitiveness ● Manage potential collaboration barriers by securing speed and efficiency, and focus on business value
Positioning and creation of global alliances	<ul style="list-style-type: none"> ● Take a global position with a strong common sustainability and profitability narrative ● Initiate joint marketing activities, e.g setting up alliances and enabling networking platforms
Extend Nordic collaboration	<ul style="list-style-type: none"> ● Set up a Nordic communication platform for exchange of experiences and recruitment needs ● Collaborate as joint Nordic R&D test centers ● Develop a common agenda for long-term competency development at all levels
Acknowledge the impact of upcoming EU regulations	<ul style="list-style-type: none"> ● Create awareness of the importance of the ongoing developments of the EU regulations on Nordic governmental level <ul style="list-style-type: none"> – Including regulations on the battery life cycle, battery waste and transportation of battery materials

“
If we want to get the industry up and running quickly, we need to find ways to subsidize investments. Permitting and approval processes must be made faster and smoother. There must be access to skilled staff and we must make it easier to come and work here.
 ”

[Finnish company]

“
Together we could decisively invest in the need for R&D and education in the Nordics and together invest for future demand in an industry so many of us strongly believe in.
 ”

[Norwegian company]

“
We need educated work force within energy storage and network operators. If customers do not understand the potential in batteries, they will not invest. This is costly for individual companies.
 ”

[Swedish company]

There is a possibility for joint actions for trade & invest promotion with actions on strategic, tactical and operational level

		Strategic <i>Overall direction and resource allocation</i>	Tactic <i>Break down strategic in actionable areas</i>	Operational <i>Short term objectives to solve tactic</i>		
Promotion for position	Nordic brand	<ul style="list-style-type: none"> Decision go/no go of Nordic approach Set strategic ambition until 2025 with key areas of collaboration Invite a triple-helix industry advisory group to continuously stay close to business need Assign budget for resources Have a model for roles & responsibilities created Have a follow-up communication plan set Have a framework for collaboration vs. healthy competition defined Have a framework for confidentiality set 	<ul style="list-style-type: none"> Assign resources for internal and external (marketing) operations Agree on level, geography and overall thematic of joint engagement Set key milestone platforms and objectives for position within given time frame 	<ul style="list-style-type: none"> In-depth value proposition with concrete statistical data over 5-10yrs Create active working groups for setting an operational plan Follow-up and adjust as needed 		
	Invest promotion				<ul style="list-style-type: none"> Identify and engage partnerships Define concept, time plan & objective 	<ul style="list-style-type: none"> Reach out jointly to key targets in set geography Build upon existing platforms
	Take position now					
Ecosystem network	Nordic network		<ul style="list-style-type: none"> Engage with industry and academia to be concrete about needs and targets Assign resources to define the value proposition 	<ul style="list-style-type: none"> Reach out to high-level academia and innovation centers Reach out to set targets abroad for educations on all levels 		
	Connect digital				<ul style="list-style-type: none"> Team up with industry & assign resources to define the value proposition, needs and targets 	<ul style="list-style-type: none"> Concrete global customer dialogues for increasing competence
	Enable alliances					
R&D and education	R&D and talent					
	Education					
Public & customer awareness	Full life cycle sustainability					

* For e.g. Co2 emissions of electricity, electrocity costs, labor cost development, shipment cost benchmark
 Source: Business Sweden analysis

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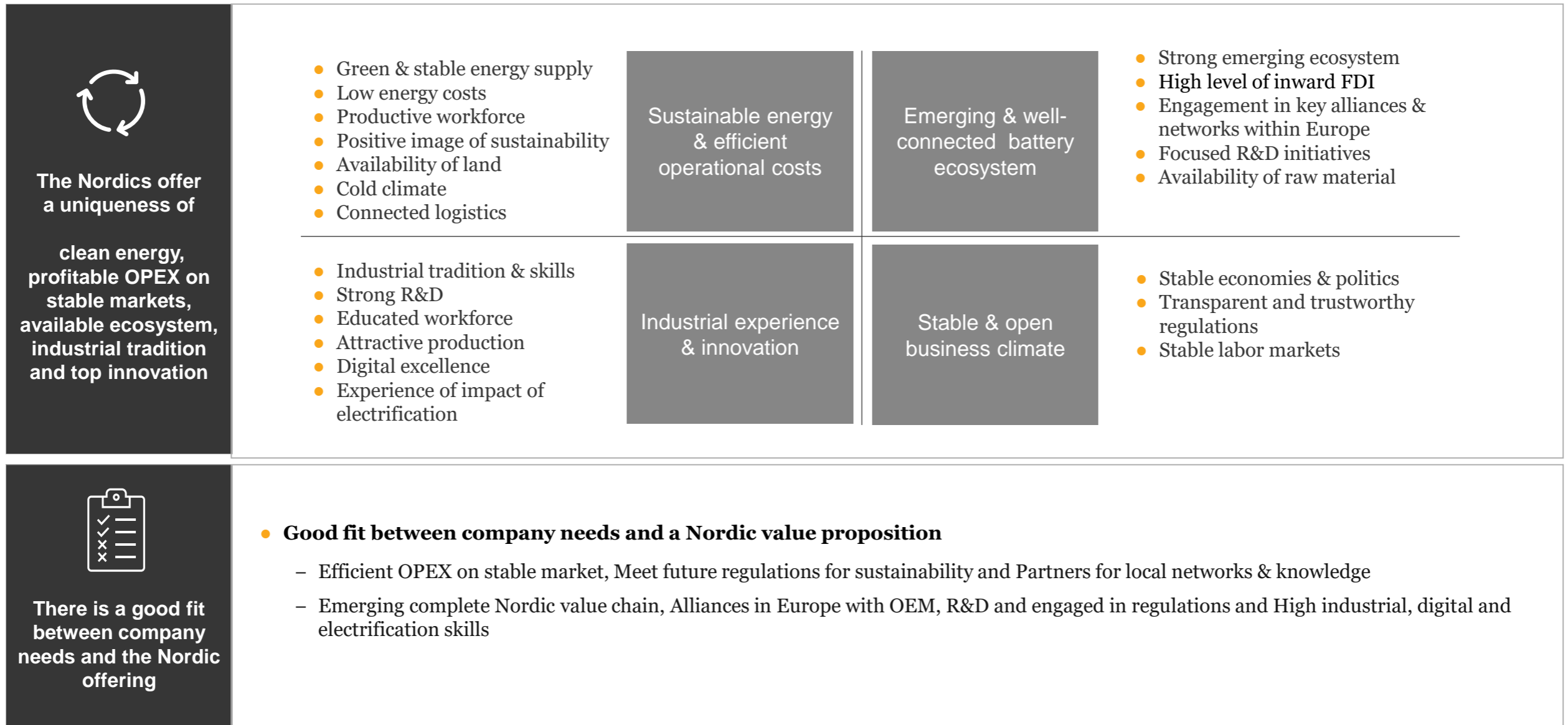
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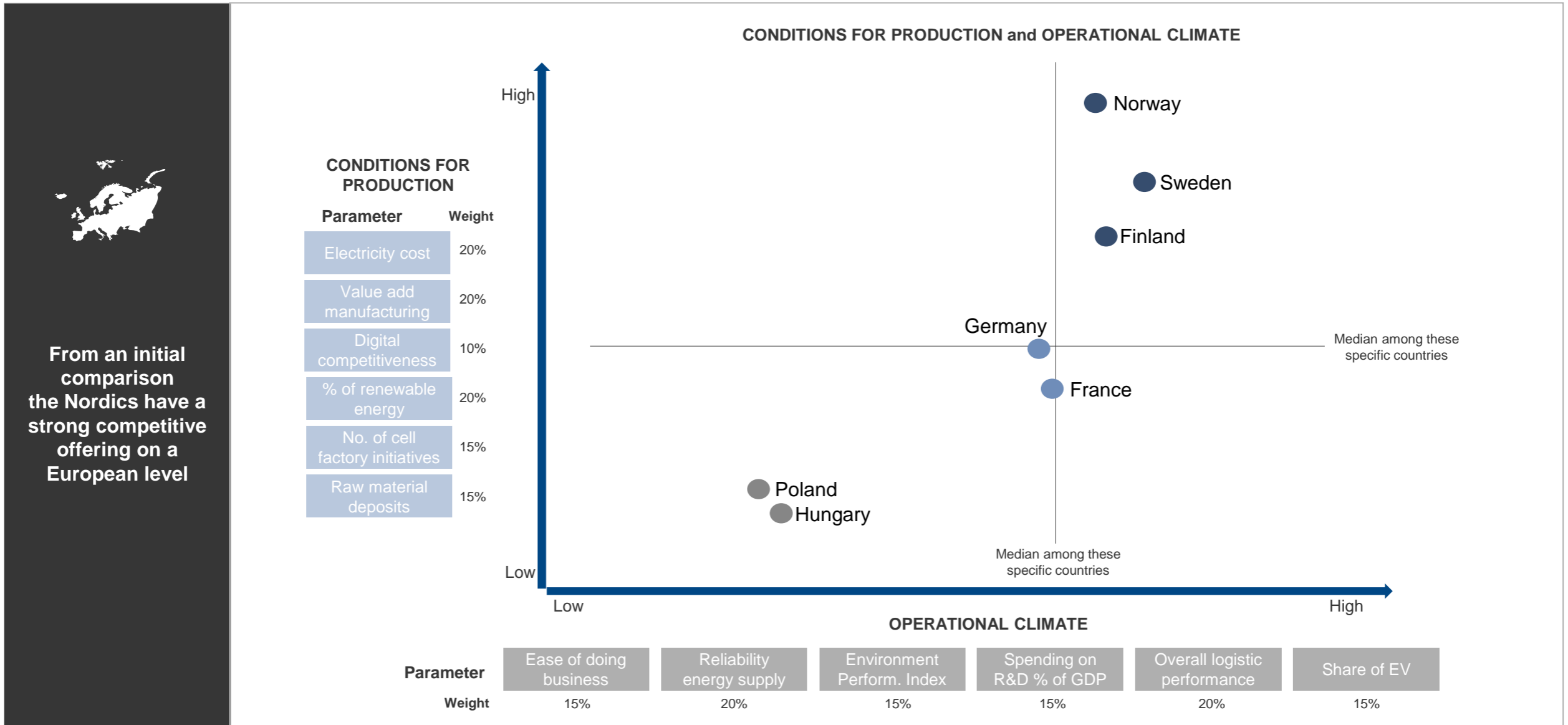


The Nordic edge with the combination of sustainability and profitability is competitive and attractive for investors targeting Europe



*Based on latest data available for one specific year.
 Source: Business Sweden interviews and analysis

The Nordics have a strong competitive offering on a European level with competitive conditions for production as well as operational climate



From an initial comparison the Nordics have a strong competitive offering on a European level

Source: Business Sweden analysis

Interviewees highlight that some aspects need to be developed in order to further strengthen the Nordic value proposition



From an initial comparison the Nordics have a strong competitive offering on a European level

Well-founded value proposition

- Common narrative well-founded in all Nordic countries engaged in batteries
- Aggregate OPEX data over time
- Clarity about CAPEX incentives
- Clear message per target group
- *N.b. acknowledge competition between Nordic countries*

Strong marketing efforts

- Short and clear joint message
- Meet false prejudgments
- Highlight investments in place
- Position for sustainability & profitability
- Reach out to investors, OEMs, key stakeholders along the value chain and to innovation initiatives
- Serve as a story towards students and researchers

Strengthen the offering

- Take actions corresponding with industry needs as for example stated in this report
- Make sure to work close to investor need and alliance partner expectations
- Engage on official high level

Market engagements

- Set targets for market engagements and arenas where the joint value proposition can be promoted
- Set action plan for using marketing material and joint narrative to strengthen the market position and brand of the Nordics
- Set and engage with key stakeholders

“ We must have a clear to the point narrative highlighting our strengths for sustainability, profitability and strong industry tradition ”

[Finnish company]

“ We have a good storyline regarding a green battery value chain, but our voices have not been heard – marketing efforts are needed ”

[Norwegian company]

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The Nordic value proposition - why integrate with the Nordics to realize your ambitions within the battery ecosystem? (1:2)



Sustainable energy & efficient operational costs

Green energy at low costs

- Renewables corner stone in energy mix. Lower CO₂-emission from production
- Attractive pricing - the Nordics has among the lowest energy prices in Europe, and they are predicted to stay that way for the foreseeable future

Stable energy supply and cold climate

- Excellent grid systems - robust grid network with great redundancy. Mission critical is business as usual.
- One of the worlds most integrated electricity markets
- Six months cold climate reduce need for cooling. Valued by e.g. data centers

Productive workforce

- Educated population and high productivity

Connected logistics

- Well connected with regional and continental industries
- Geographical distance reduced by digital communication, frequent travels & efficient logistics

Availability of land

- Sufficient land with competitive pricing for large investments
- Transparent processes and trustworthy long-term decision making

Profitable image of sustainability

- Production site in the Nordics create positive brand awareness for sustainability
- High national demands on as well as high level of investments in sustainable and clean production processes

* European Economic Area

Source: Business Sweden interviews



Emerging battery ecosystem & strong EU engagement

Strong emerging battery ecosystem

- Several concrete cell manufacturing initiatives for different appliances and technologies in Sweden and Norway
- The battery value chain is based on traditional strong Nordic industries with MNEs in the global lead, e.g. maritime industry, construction equipment, automotive, transport, forest and manufacturing
- Raw material resources, mining excellence, future material R&D as well as clean processes and increasing active materials investments
- Early investments in recycling collection and refineries as well as R&D for future materials

EU engagements in R&D

- Deep engagements in European collaborations for R&D within batteries

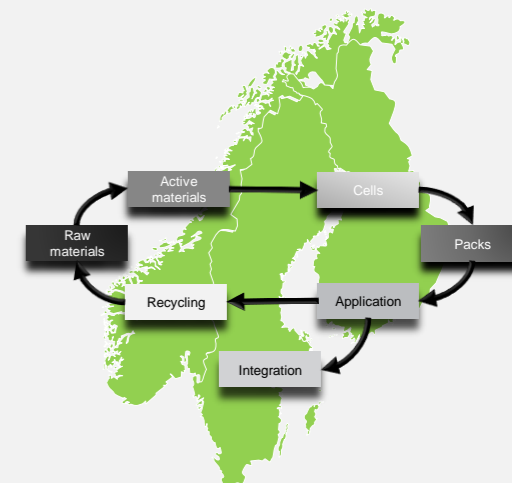
Availability of raw materials and land

- Rich deposits of battery raw materials
- Innovations for alternative battery materials

Engagement in key alliances & networks

- High level of engagement on European-level within all aspects of batteries, e.g. high engagement in EBA and Batt4EU
- Nordic battery ecosystem has strong bonds and alliances with leading OEMs in Europe

High level of inward foreign direct investments



Quotes from foreign investors in the Nordic battery industry

“ Levels of initial capital expenses are an important issue to discuss, but transparent processes, stable decisions and the long-term operational expenses levels are key for future return on investment and successful business. ”

[Swedish company]

“ Investors has stated that the Nordics is expensive. In retrospect they however concluded it to be very expensive to educate cheap labor. The Nordics offer high educated workforce, clean energy at low prices and close connection to key European stakeholders. ”

[Finnish company]

The Nordic value proposition - why integrate with the Nordics to realize your ambitions within the battery ecosystem? (2:2)



Industrial experience & innovation

Industrial tradition & skills

- Entrepreneurial and industrial culture from global connected MNEs as well as Start-Ups
- High competence of automation & digitalization
- Existing high-level of competence and experience valuable for the battery industry within e.g. metallurgy, mining, process and chemical industry and power integration
- Tradition in developing and managing multinational enterprises

Close connection to Europe

- Closely connected for trade, investments, networks and collaborations. Closeness through ports, road, train, air and digital communication
- Geographical situated within the EU (Sweden, Finland) and the EEA* (Norway)
- Deep knowledge of EU regulations as well as engagement of development of the same

Educated and international workforce

- High level of English language knowledge and workforce experience from foreign markets

Excellence in digital technologies

- Tradition of globally successful companies for digital services and cross-industry innovations
- Long entrepreneurial, creative tradition for new business models and innovation.

Experience of impact of electrification

- High level of a new generation of prosumers and flexumers with broad awareness of & demand for sustainability. Hotspot for testing new digital and sustainable innovations
- Institutional knowledge of the impact of a highly electrified society on e.g. consumer behavior, regulative effects and solutions for challenges

High ranked and connected R&D

- High rated R&D as well as high level of investments in R&D
- Well-known established R&D centers in each countries, all with a close partnership with the industry and foreign research



Stable & open business climate

Business climate profitable for business

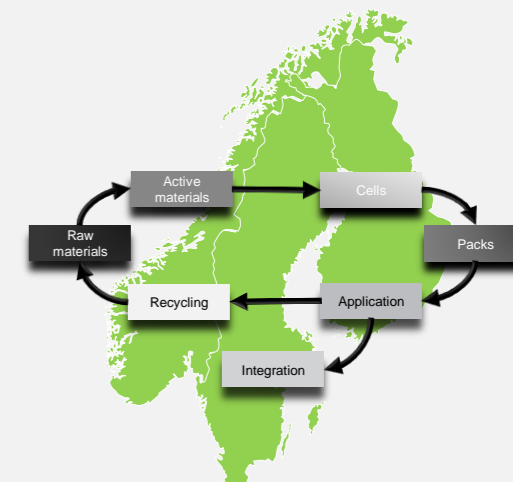
- Low corruption – high transparency

Stable and open societies

- Stable economies with high level focus on sustainability
- A culture of trust - Autonomous authorities with high integrity and low corruption. Permitting processes in the Nordics are known for their high standards and legal certainty.
- Short decision ways
Culture of cooperation - the Nordics has excellent functioning labor markets with very good cooperation and respect between businesses, unions and authorities.

Transparent and trustworthy regulations

- Transparent permitting - Authorities want to help companies obtain permits rather than working against them. Once a permit is given, it cannot be revoked without a valid reason.
- Regulations for sustainability
- Labor market stability and tradition of pragmatic negotiations
- Labor laws applied



Quotes from foreign investors in the Nordic battery industry

“ The Nordics offer clean energy, sourcing of raw materials and a strong industry converting the materials to end-products. All of this is sustainable and at low energy prices. This makes the Nordics unbeatable! ”

[Norwegian company]

Crucial investor needs are to meet future EU regulations, efficiency for long term operational expenses, speed to market, proximity to clients and a skilled workforce

Cost efficiency

- Profitable return on investment by cost efficiency for materials, processes and battery performance
- Preferable long term operational expenses for electricity, labor and logistics
- Customer demands must be reached in a cost-efficient manner
- Incentives are important for the calculations of capital investment size long-term than operational expenses (opex is key in comparison to initial capex)
- Rather not many separate low costs adds up to high total cost
- Stable local prices

Proximity to ecosystem

- Grasp current business opportunity in Europe
- Closeness to end-user
- Well-developed & cost-effective logistic network, both within the specific country and to the rest of Europe
- Positive proximity for communication and to over bridge possible cultural differences
- Closeness to active networks to become fully integrated

Speed & local official support

- Decision and approval times crucial to get operations up as fast as possible
- Easy and clear point of contacts with official network and easy administration for investments. Short time to market.
- Commitment of Government with clear and fast communication about incentives. Capital is not only money but also gestures
- Public opinion, stable labor markets & politics
- Transparent regulations with trustworthy governance to avoid changes of prerequisites

Established networks

- Previous investments and established networks simplify establishment and lower risk
- Proof-of-concept in the region increase familiarity and interest for investing.
- Investments of global players within own network

Skills supply and R&D

- Access to relevant workforce competence & labor on all levels, e.g. operators for larger manufacturing activities
- Support with bringing own skills (e.g. regulations, housing)
- Opportunities for R&D cooperation for e.g. future batteries, new materials, digital services, user interface

Local regulations & partnerships

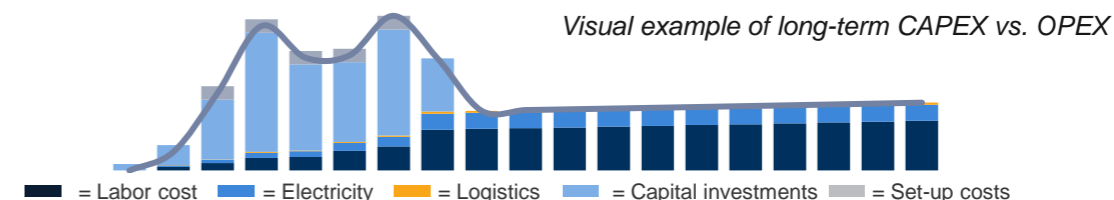
- Meet future EU regulations for sustainability as Life Circle Assessment and e.g. green energy
- Transparent long-term regulations for lower risk of sizeable investments
- Local European production to lower emissions
- Local partners familiar with market, regulations and culture



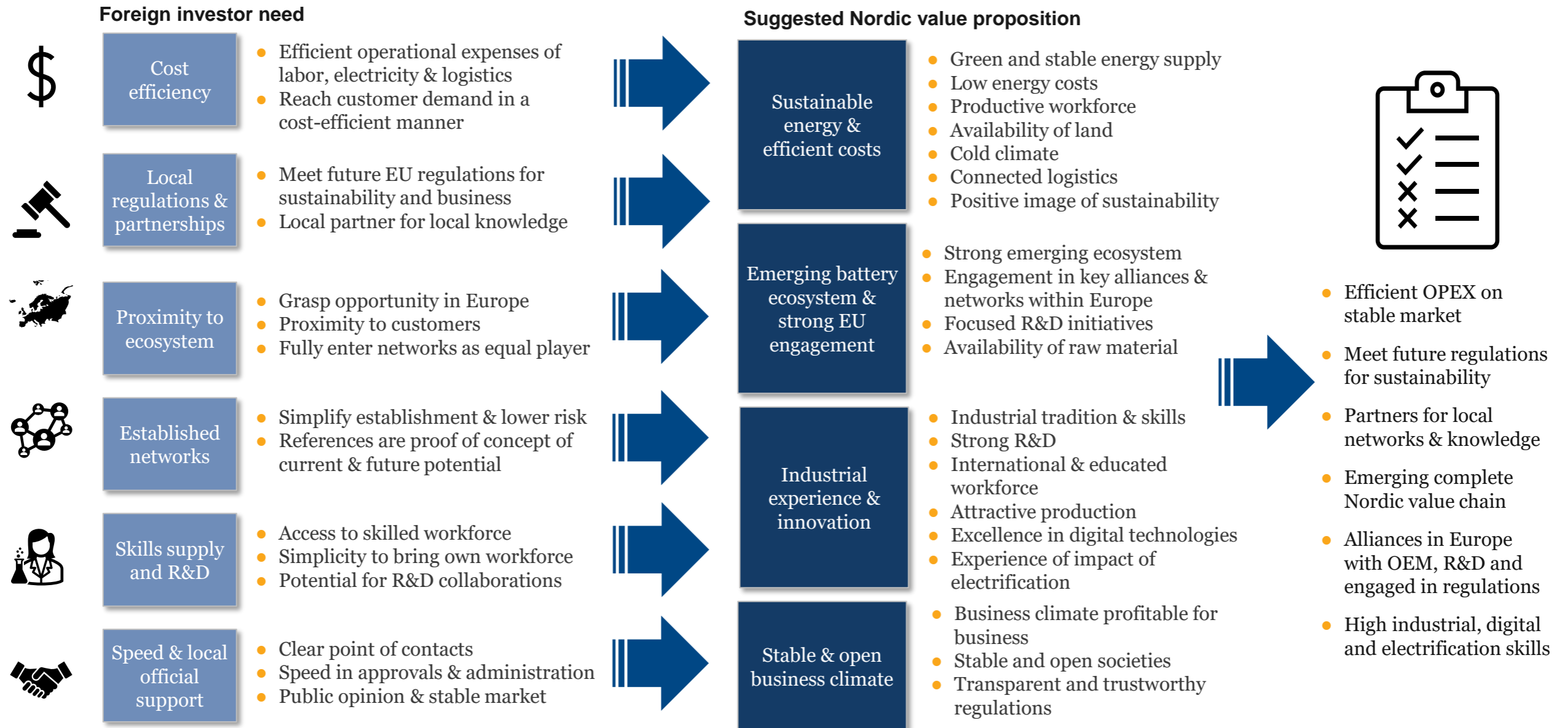
Overall foreign investor demand



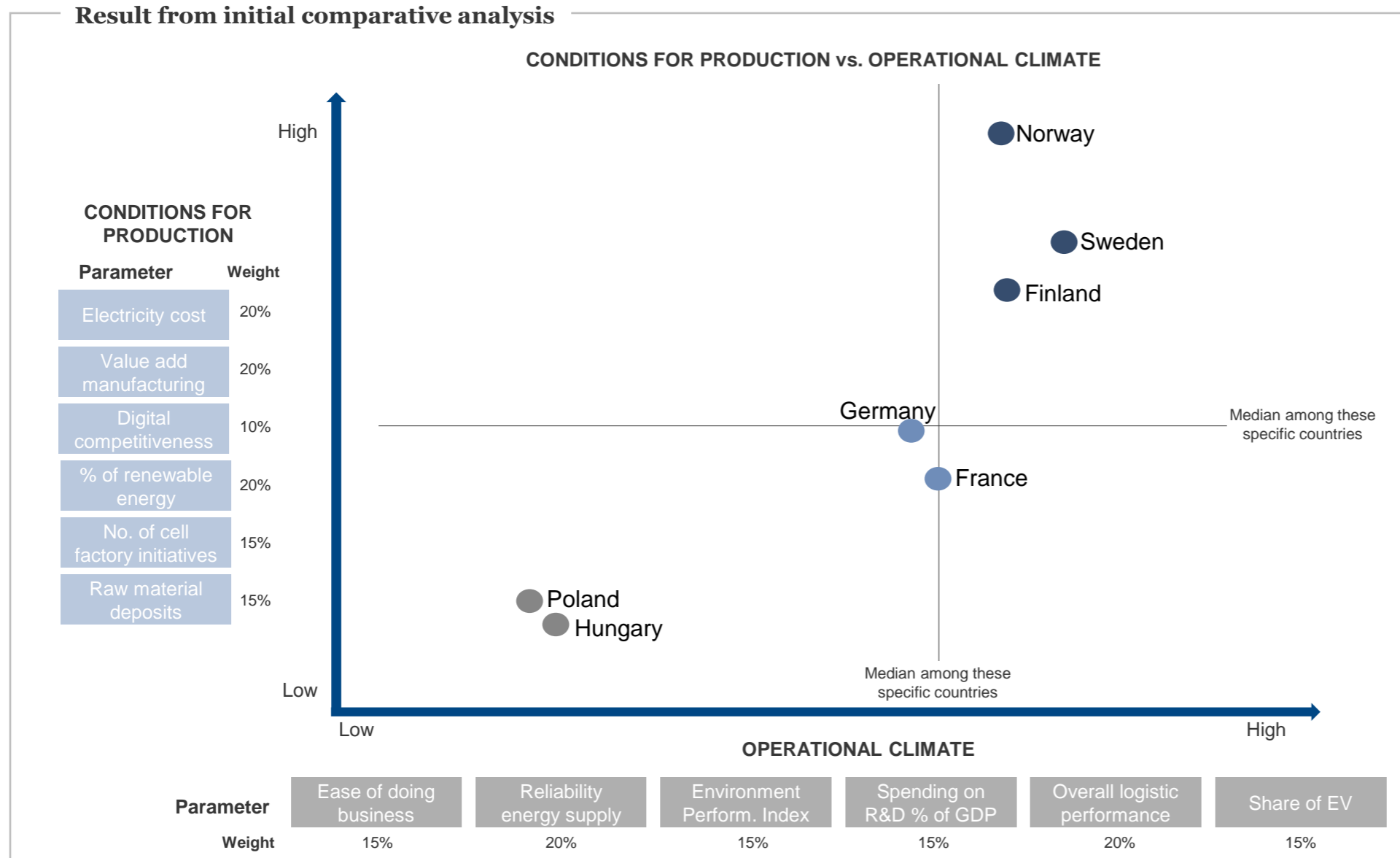
Initial CAPEX are nowadays almost less important than the long-term OPEX for green enough power when qualifying for the future standards.



There is a good initial fit between company needs and a Nordic value proposition



In an initial comparative analysis, the Nordic countries have a competitive advantage towards other European investment destinations



Countries for comparison

- Germany and France** are attractive markets for foreign investors within batteries due to their strong local application OEMs as well as strong markets for EV demand
- Hungary and Poland** are highly interesting markets for foreign investors as they have a tradition of FDI into electronics as well as low labor costs and proximity to automotive factories

Germany and France are leading hubs for car manufacturing

- Both countries invest heavily in battery production for strategic reasons



Germany

- The German government has made domestic battery production a priority. There are several strategies aimed at stimulating development of the German battery value chain. Germany is coordinating the second European-wide “IPCEI”-project on batteries. It has previously been common for German automotive manufacturers to source battery cells from Asian suppliers like LG Chem or CATL. Several gigafactories are currently being built or are planned to be built in Germany coming years e.g.: Tesla, start 2021, up to 150 GWh, CATL, start 2022, up to 80 GWh and Northvolt Zwei, start 2021, up to 20 GWh. According to BNEF’s worldwide Lithium-ion battery supply chain ranking in 2020, Germany placed 4th and is expected to place 6th in 2025
- Many German automotive manufacturers are joining forces with foreign (often Asian) battery cell manufacturers, either in joint R&D projects or in strategic partnerships to increase access to cells needed in the electrification of the automotive industry. Many foreign battery cell manufacturers are choosing Germany for their European entry due to closeness to the leading players within applications e.g. Daimler, BMW and BOSCH, making it logistically efficient
- As production of battery cells increase, actors are looking to expand their recycling capacities in order to close the material loop and thus reduce the production-and-environmental costs



France

- France’s industrial policy targets to develop and industrialize new generations of cells and battery modules for electric vehicles and a dedicated Battery strategy is in progress and will be finished by 2022. The French government is heavily invested in promoting the battery cell production. They are investing 846 Million EUR in the ACC initiative by SAFT and PSA Group. It will construct two production plants by 2030 (one in France). Verkor is planning to start working on a battery factory in France in 2023 with an output of 16 GWh and plans to ramp-up to 50 GWh. The French market is characterized by large companies within applications such as Stellantis/PSA Group, Renault, Iveco & Alstom making France an interesting market for investors. According to BNEF’s worldwide Lithium-ion battery supply chain ranking in 2020, France placed 8th and is expected to place 10th in 2025
- Battery initiatives are mainly driven by "heavyweight" industry players that consolidate expertise. This can be confirmed when reviewing the value chain where French actors within energies, chemicals and the automotive industry cover several steps. France also has a strong research culture with academics, institutions and innovation clusters working with battery research. E.g., CEA Liten that generate spin-off products, services and firms. Future opportunities in the French value chain can be identified within raw materials, but also within integration. A nationwide (charging) infrastructure needs to be developed to support the applications step and to reach their national targets

Source: BloombergNEF, European Battery Alliance, Germany Trade & Invest, Invest in France, Business Sweden interviews

Poland and Hungary attract investors for their low labor costs production capacities

– Both markets have a reputation of advantageous incentives for investments



Poland

- Batteries are the number one of Polish export commodity and Poland is seen as one of the main suppliers in Europe of car components and parts for the global automotive players. There is not only production of finished battery cells, but also their components - separators, cables or electrolytes taking place. LG Energy Solution invests heavily in the battery factory in Kobierzyce. SK Innovations, Nara Battery Engineering, Foosung and Enchem, are additionally investing in the production of lithium-ion batteries in Poland. According to BNEF's worldwide Lithium-ion battery supply chain ranking in 2020, Poland placed 12th and is expected to place 13th in 2025
- Lower labor costs than in Western Europe and an attractive geographic location, i.e., the proximity of many European automotive factories, makes Poland an attractive market for investors. Public financial support for investors is available; the Polish government announced the allocation of up to EUR 3.1 billion for this purpose in 2019. There are opportunities to reduce the carbon footprint of Polish factories. Opportunities to be an attractive place for the battery production sector in the long term by ensuring good regulations and attractive conditions for investments within battery recycling in order to guarantee producers access to raw materials for the production of new battery cells

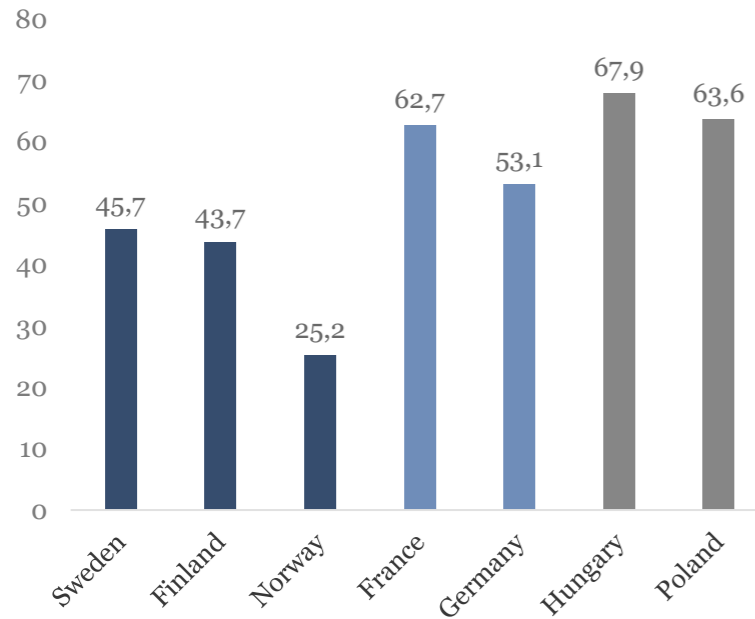
Hungary

- The Hungarian Ministry of Innovation and Technology is in cooperation with EIT InnoEnergy developing a national strategy for the Hungarian battery industry. Hungary's strengths lies within battery manufacturing and the country has the second biggest battery production capacity in Europe. Players like SK Innovation, Samsung SDI and GS Yuasa are present on the market. Since 2016 FDI in battery production reached EUR 5,29 Billion. SK Innovation and INOBAT have both announced plans to build up to 30 GWh gigafactories in the coming years in Hungary. According to BNEF's worldwide Lithium-ion battery supply chain ranking in 2020, Hungary placed 12th and is expected to place 15th in 2025
- Electrification and greening the transport sector drives the development of the battery value chain. Opportunities for domestic suppliers are seen within battery manufacturing. Recycling of batteries are seen as a priority on the Hungarian market: development of battery analytics technologies, development of digital technologies for sharing battery data ("battery passport"), development of battery design to facilitate disassembly and automated module replacement, exploration of recycling opportunities, development of innovative recycling technologies, development of technologies to recover raw materials from spent batteries and development of practices for the drop-off, collection and logistics of used batteries

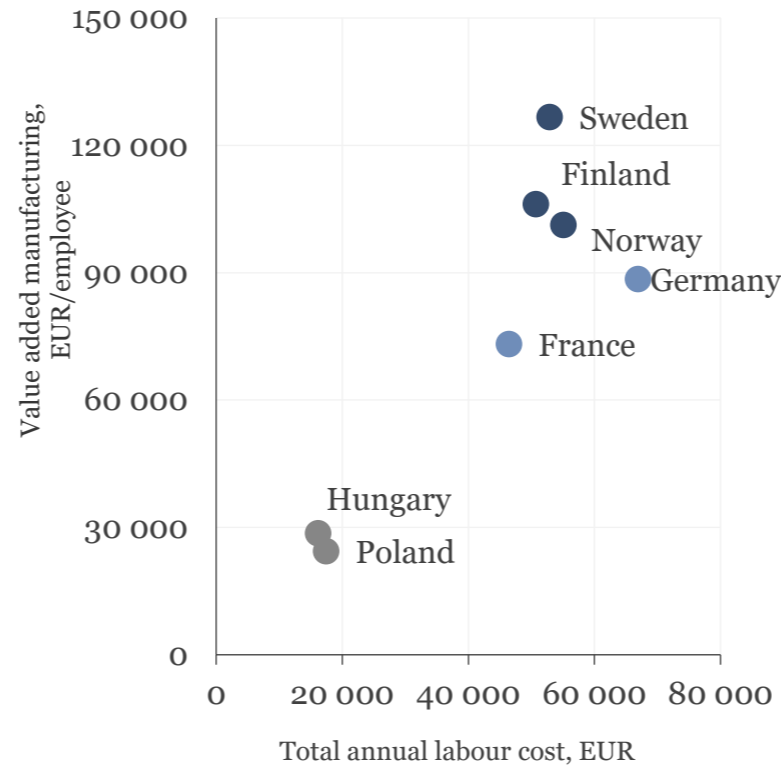
Criteria for Conditions for production 1(2)

Electricity cost & CO2 emission comparison

Electricity cost (thousand EUR / MWh, 20 000 MWh < Consumption < 70 000 MWh, 2020S1)



Cost and productivity comparison for skilled production operative



IMD World Digital Competitiveness 2020 Ranking of 64 countries

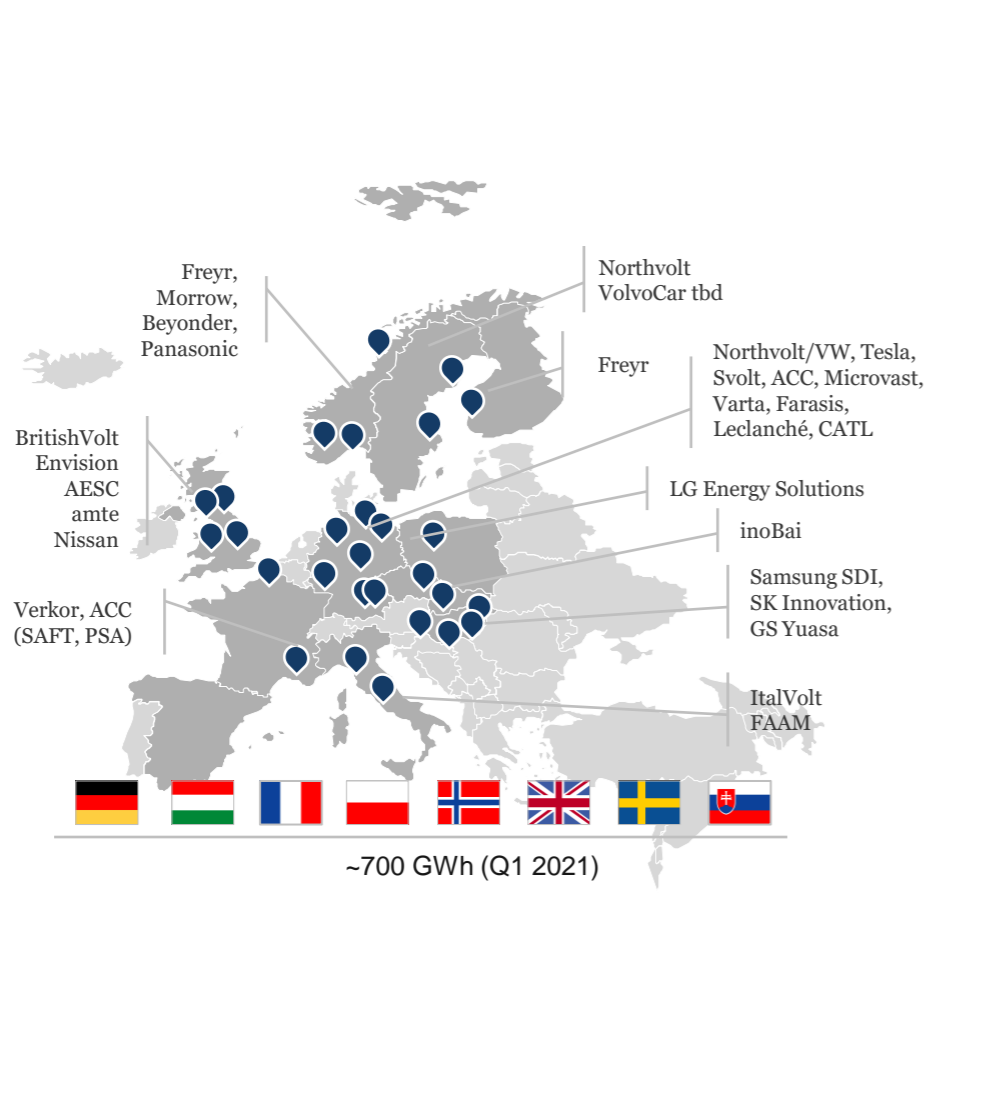
Country	Future readiness
Sweden	7
Finland	9
Norway	6
France	31
Germany	19
Hungary	60
Poland	35

For share of renewable energy in energy mix

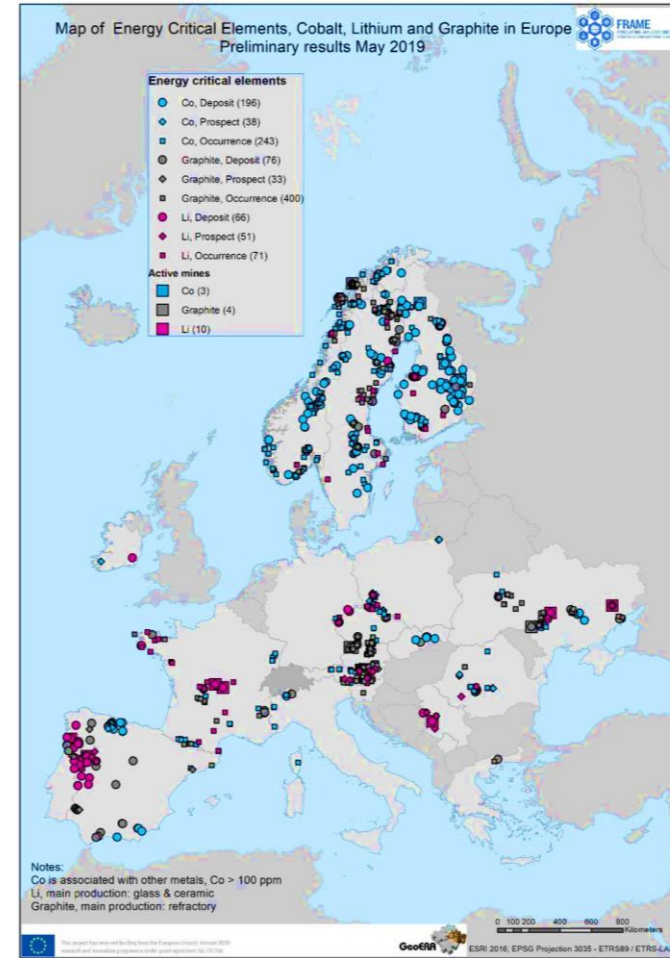
● See page 46

Criteria for Conditions for production 2(2)

Announced Gigafactory investments in Europe

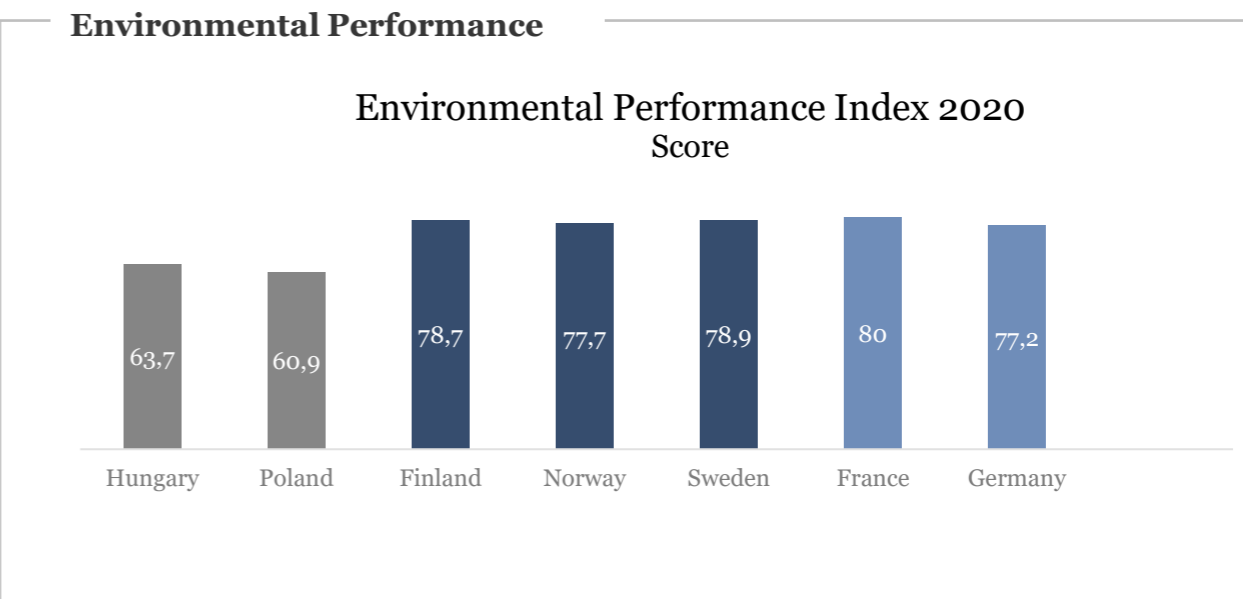
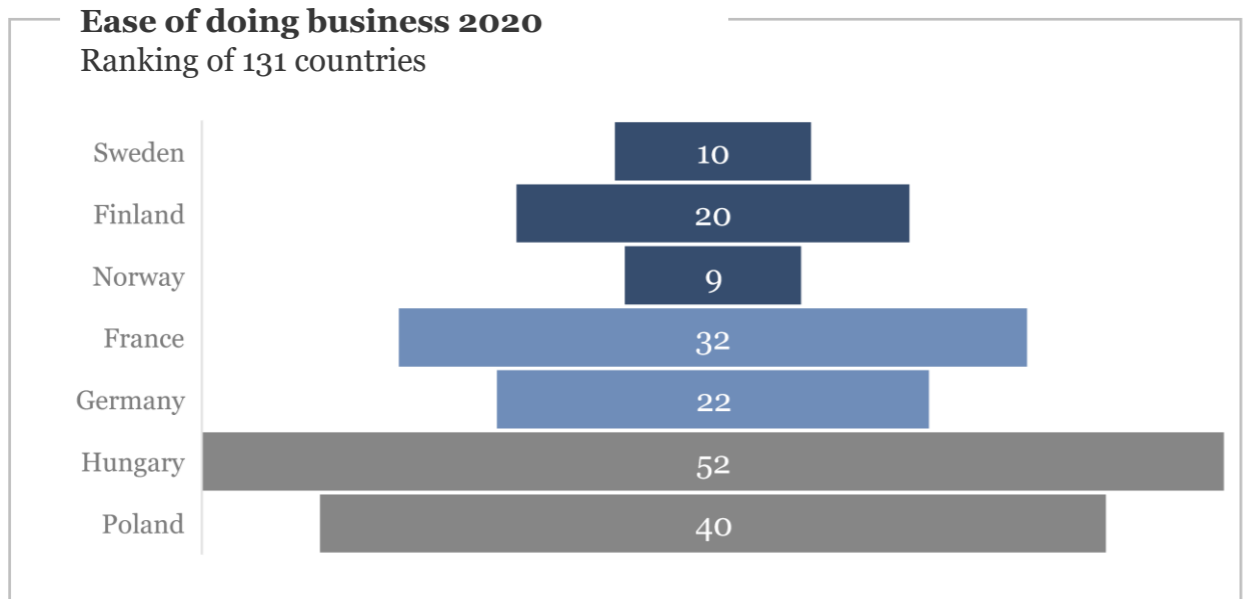


Map of energy critical elements in Europe, Dec 2019



- The Cobalt – Lithium and Graphite deposit map visualize the geographical placement of rich findings of battery materials in Europe
- The Nordics all have rich findings of foremost cobalt and graphite, with some lithium
- France has some lithium deposits
- In Poland there are deposits on the border to Czech Republic

Criteria for Operational climate



Energy supply resilience

- See page 45

Gross Domestic Spending on R&D 2019

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Logistics Performance index 2018

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EV share of total registration 2019/2020

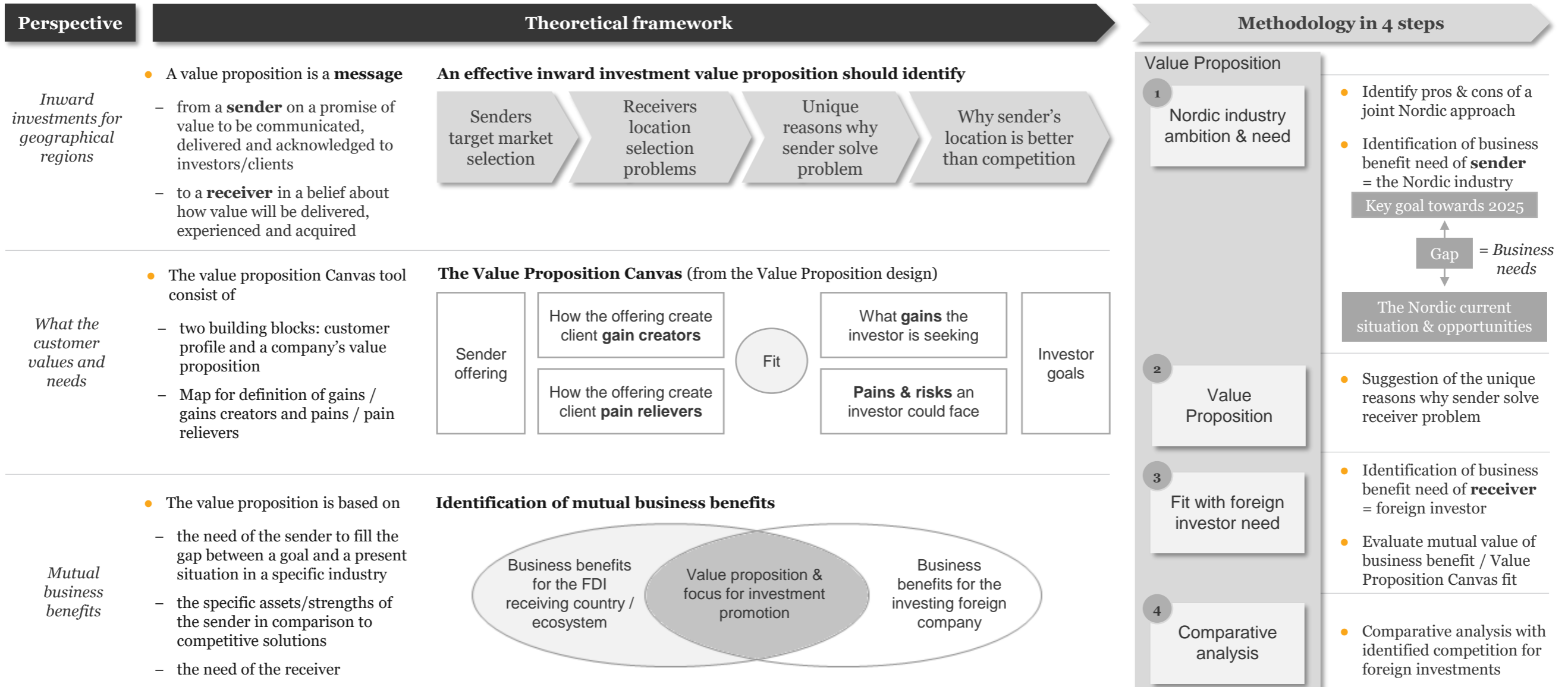
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Agenda

- Preface
 - Executive summary
 - **A new industry in Europe**
 - **An emerging value chain in the Nordics**
 - Developments
 - Preconditions
 - **Needs for a complete Nordic value chain**
 - Overall
 - Per step of the value chain
 - **Nordic joint business promotion**
 - **A value proposition for FDI and partnerships**
 - Summary
 - Value proposition evaluation
- Appendix

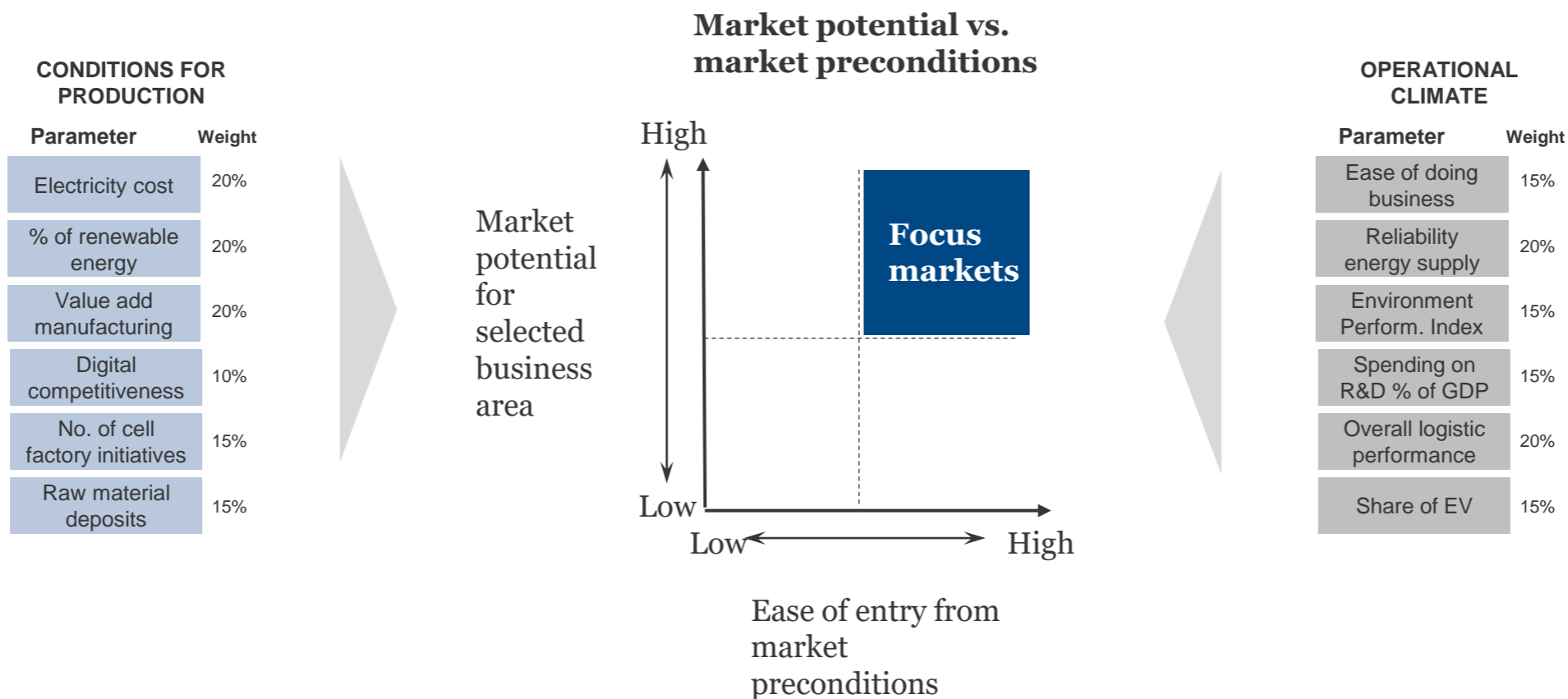


The four-step-methodology to identify a competitive value proposition is based on three theoretical frameworks



Source: Effective Inward Investment Value Proposition (by N. Smillie, Clarity Business Strategies Ltd., 2018), Value Proposition Design (by P. Yves, O. Alexander, B. Gregory, A. Smith, P. Trish, 2014), Business Sweden

The Business Sweden Market Selection Analysis model assessing selected market relatively each other





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