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Alliance for Batteries Technology, Training and Skills
2019-2023

APPENDIX B: Workshop Notes and First Analysis

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Battery Cells Manufacturing – Job Roles & Skills

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Alliance for Batteries Technology, Training and Skills

Workshop Evaluation Template

Workshop name:

ALBATTS webinar on Battery Cells Manufacturing – Job Roles & Skills

Date and venue:

January 20th, 2021 10.00-11-30

Workshop purpose:

Identification of future job roles and skills; evaluation and verification of project progress/outputs

Organizer:

ALBATTS

Format:

Online webinar – parallel broadcast on Facebook
https://m.facebook.com/story.php?story_fbid=236935214475357&id=104780274397590&__tn__=%2AW-R

Location:

Webex, Facebook

Content:

- Introduction by Dr Björn Fagerström, Director CLC North, EIT Manufacturing.
- **ALBATTS introduction** by Dr Anders Norberg, ALBATTS Coordinator
- **Battery Market Growth Expectations** – Caspar Rawles, Benchmark Mineral Intelligence London, UK, Head of price Assessments
- **EC Policy Framework for Battery Production** Ivone Kaizeler, European Commission, DG GROW
- **New approach towards Li-ion battery mass manufacturing process**
  Ing. Vaclav Binar, CEO, Magna Energy Storage (HE3DA)
- **Challenges & opportunities in recruiting for the battery cell manufacturing ecosystem in the EU** Katarina Borstedt, Director of Growth, Northvolt

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Proposed schedule:

<agenda picture>

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Workshop Minutes

Dr Björn Fagerström, Director CLC EIT Manufacturing North welcomed participants and speakers to the webinar, told about EIT manufacturing and its interest in battery manufacturing. He explained the program with four presentations followed by a Q & A session. Questions can be submitted continuously through the chat function in Webex. Participants are asked to mute their microphones during presentations to minimize disturbances.

Dr Anders Norberg, ALBATTS Coordinator, presented the ALBATTS project and gave context to the webinar. ALBATTS are for both gathering data but also for dissemination and preparing for implementation of results further on. This workshop on battery cell manufacturing is the first and general one. Later on, we plan for workshops that go more into details, for example in different process phases of battery production (upstream downstream/battery assembly, formation) and thereby also try to get information on competency and skills needs from equipment manufacturers.

Caspar Rawles – Head of Price Assessment at Benchmark Mineral Intelligence London:

http://benchmarkminerals.com

10.00

Presentation: *State of the industry – The Battery Global Arms Race.* Rawles presented the company, a leading company in mineral intelligence. Caspar Rawles is mainly an expert on price and market assessments on battery raw materials, but also on the concept of "megafactories" for battery production. Other parts of the same consultancy form concentrate on forecasting, consultancy services and events. The benchmark comprises all from raw materials to cathodes and anodes to battery cells and battery packs for li-ion batteries. The operation is global.

12.21

Rawles made a capacity update comparing the situation globally 2015 (57GWh) with the situation in 2021. In 2021 there are 186 plants operating or under construction or planned to be in production, to produce 3.1TWh energy storage by 2030. Many different kinds of companies are going into investing in battery production, and varying strategies exist in different countries. Committed capital to these investments are by 2020 over $65 billion. A huge scale of investment.

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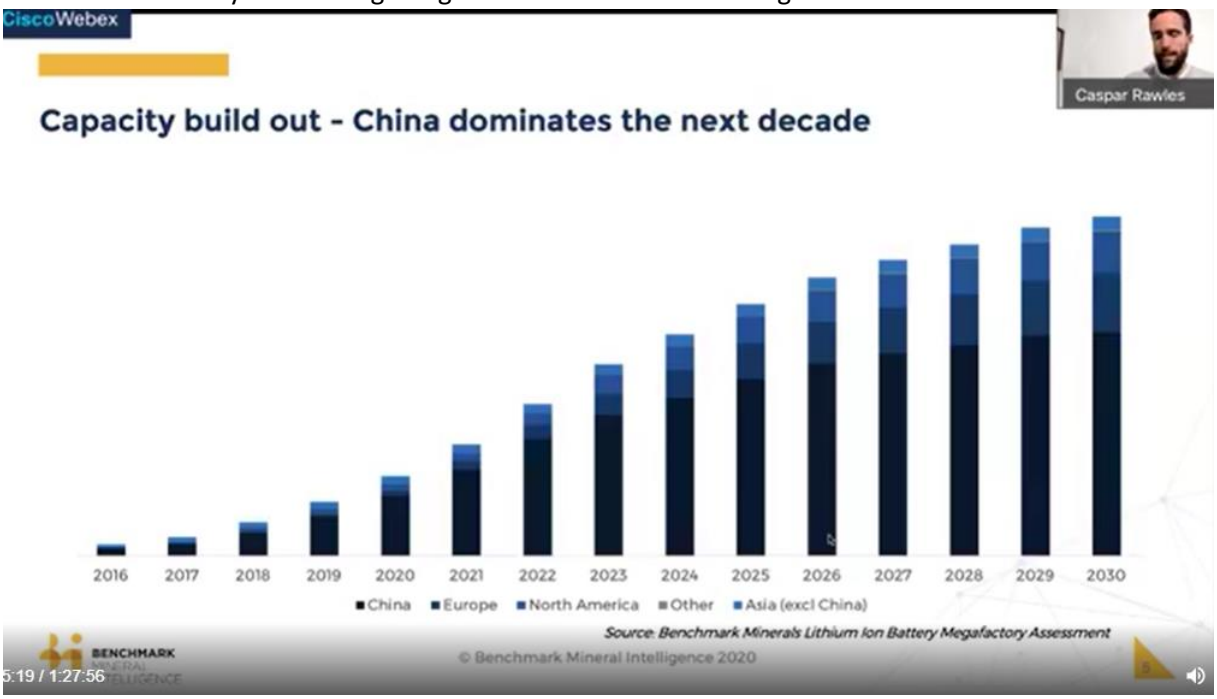
15.00 China is really dominating the growth of investments during next decade.



Plants outside China are generally larger, but there are so many more plants in China, about 100 of the 186. Many Chinese plants are focusing on cheaper electronics por tools instead, and not on the EV market.

16.00

The production capacity rises from 741.8 GWh globally per year in 2020 to 2.340,7 GWh in 2025 to 3.152.7GWh in 2020. The European share of global production grows from 6.8% in 2020 to 14,9% in 2025 to 17.6% in 2030. Chinas market share diminishes only slightly during the period, from 74.7% to 70.2 to 65.9% in 2030.

Interesting is that Rawles estimates that we do not need this capacity of 2,340GWh in 2025, but not all investments will become producing factories either. Consolidation is expected when competition grows.

17.00

Not all cells are created equal: EVs demand the best li-ion cells with the highest quality and lasting for at least 8 years under average driving conditions. That is called “Tier 1” batteries – the others are tier 2 and tier 3 for other uses, such as different qualities of stationary applications or electronics. Often also varying cell chemistries for different purposes are involved. Europe is focused on tier 1 batteries for EVs which will globally amount to 35% of capacity by 2030. In 2020 it is about 50% of produced batteries which are intended for the EV market. There can be a shortage of the right quality of cells further on. Possibly the producers of Tier 2 cells can adjust to fit into Tier 1 and the EV market.

19.00

European breakdown – big capacity plans. Germany, who did not have much battery production until recently, has now the biggest growth plans for battery production and the most ambitious state support. In Germany plants like SVOLT, Northvolt/VW, CATL and TESLA are building or planning battery plants. The contributions from Hungary (SK Innovation, Samsung), Poland (LG Chem), Sweden (Northvolt) and other (SAFT/PSA/Total, Envision, MES, VERKOR etc) will be considerably smaller.

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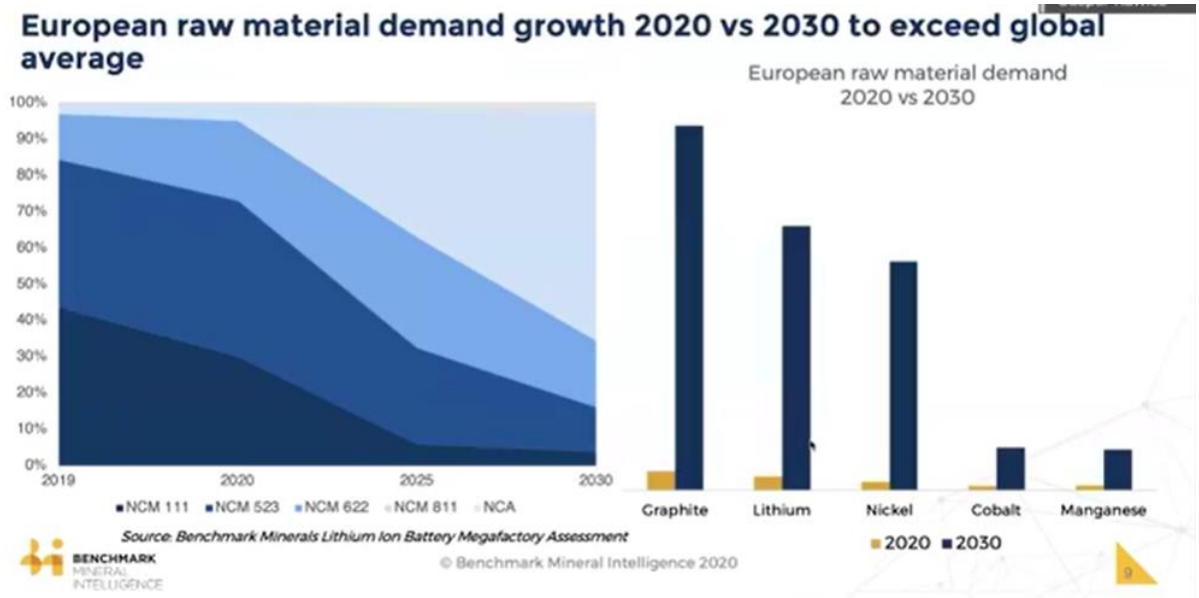
The average EU plant size 2030 will be about 32.6 GWh – while global average plants (dominated by China) will be on average size 16.9 GWh /year. This means that Europe will not supply electronics batteries, and that gigafactories will be a thing special in Europe.

21.00

European raw material demand 2030 is going to exceed global average. The critical is the raw material use for the cathode. No surprises, high nickel cathodes will be used, to lower cobalt use



The difference in demand in 2020 compared with 2030 is huge. Graphite and lithium x 18,9 each, nickel x 26,4, Cobalt x 9,7, manganese x 8.5. Much of this is already bound up in long-term contracts. European demand is going to exceed global average. Competition for raw materials will become a result.

23.40 *Does Europe need more cell capacity?*

Demand is exceeding capacity, but adjusted figures can show that capacity is enough, counting in that China still makes electronics batteries, some plants will have production problems, competition for EV battery shares and raw material will be hard, etc. It is critical that cathode and anode establishments are extremely limited in Europe and will probably continue to be if not big investments are made.

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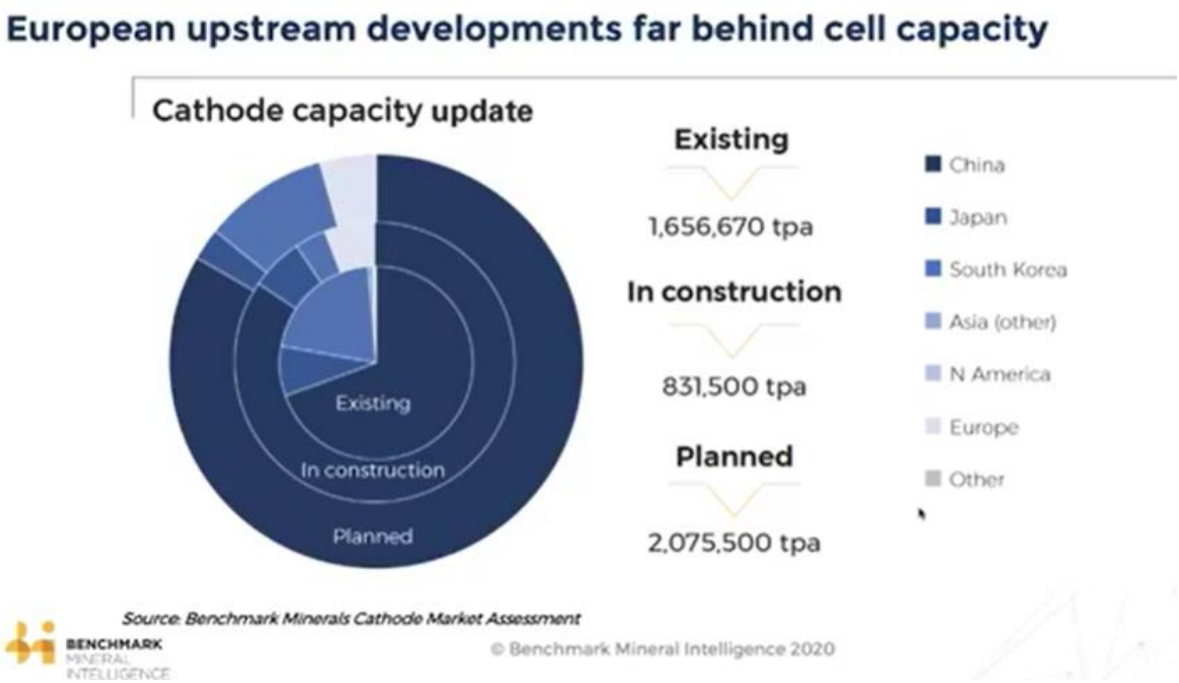

Summary is that

1) In Europe there are big commitments in new capacity because of stimulus and policy – the forecast is up 194% in only the last two years
2) Upstream production capacity is critical for Europe, as is raw material access. Investments are needed here as well.

Ivone Kaiseler, Policy advisor DG GROW: *European Battery Alliance fostering a strategic value chain*

EBA, European Battery Alliance, was launched in October 2017 by VP Maroš Šefčovič's

Battery Action Plan May 2018 aims "to establish a complete, competitive and sustainable battery value chain in the EU with spill over effects over upstream and downstream industries". Involved stakeholders were member states, industry, EC, European Investment Bank, InnoEnergy and other innovation actors.

31.30

The EBA covers all segments of the value chain. Cell manufacturing is very important and critical segments. EC also wants the cell component manufacturing to be located in Europe. There are new raw materials strategies in place to exploit resources in Europe that are not today exploited. The circular economy makes recycling important, but it is also important for the raw material supply.

34.00

Six key areas are identified by the EC together with member states. First area is Skills

1.12 .00 Ivone Kaiseler continues:

Sustainability proposed battery regulations – important part of battery plan

The European Green Deal – to become climate-neutral to 2050 is a context for battery production. The battery value chain is well placed to contribute to the green deal by

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- Protect human life, animals and plants by cutting pollution
- Help companies to become world leaders in clean products and technologies
- Help ensure a just and inclusive transition

1.14.29 EBA and the Green deal (EU Commission Dec 2019)

Green transition and battery action plan with 6 priorities

Resilient value chains

Legislation on sustainable batteries

Mentioning IPCEI (Important Projects of Common European Interest) 2019 (3.2 billion€ + private investment) and 2021 (2.9billion € + private investment)

The proposed battery regulations are also important – all batteries in the EU market should be produced with low environmental impact, be of high quality, using materials that have been obtained in full respect of social and ecological standards. They should be long lasting and safe, recyclable and recycled.

Upskilling and reskilling is very important, one of six points of the action plan.

39.40

Vaclav Binar HE3DA / Magna Energy Storage. **New approach towards Li-ion battery mass manufacturing process**

3D Technology, no binders, pressing into frames, no organics, ceramic separator for safety, 100% recyclable,

- New emerging technology focused on households and large-scale backup solutions
- Fully recyclable and non-flammable
- Ongoing R&D – more and more options for advanced research and new sectoral job roles
- New emerging market of installation companies and seek for electricians for connecting renewables with the batteries and grid
- Production scalability opens for more new workers – specific skills learned during the process
- New large project department for custom projects – high demand in custom projects for large corporate clients for specific usage in remote locations – both project managers and electricians working hand in hand with the technical department
- Creation of a new DC to DC architecture and AC to DC – Emerging project ideas for more efficient systems within the storage container, ev charging system, renewables and the grid
- Currently there are 50 employees. The company is seeking up to 250 employees once the production line is up and running at the first manufacturing facility.
- New workers will be educated and trained well for their job since it is a new technology.
- Mostly men within the manufacturing process. Women are working in the administrative and finance department. Currently the ratio is 75/25.

Company opened for attracting new employees to various positions in manufacturing department

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58.00

Katarina Borstedt, Director of Growth, Northvolt**: Challenges & opportunities in recruiting for the battery cell manufacturing ecosystem in the EU**

Northvolt is going from 30 to 3000 employees in a few years.

Katarina's job as Director of Growth is responsible for recruitment, focused on Northvolt Ett Skellefteå (the largest so far in Europe). Recently all permits for enlarging Northvolt Ett to 40GWh are granted. However, Northvolt is also together with VW building a factory in Salzgitter, Germany: Northvolt Zwei, hopefully running and producing 16 GWh yearly in 2023. This will be a pure downstream factory – the upstream active battery material will be produced in Skellefteå. In Skellefteå, all lines will be in production by 2025, first line starts producing in 2021. Right now, the upstream facility (Upstream 1) is in place, as well as one downstream battery assembly facility (Downstream 2) and a formation/ageing facility. At the moment equipment is being delivered and installed.

In the construction now about 1000 people work, and in 2021 also production will start while construction goes on with lines 1, 3,4, and 5, as well as construction of the recycling facility, ReVolt.

The ramp-up period and connected recruitment journey in Skellefteå started in 2020 with 50 production people hired – in 2021 it will grow to 500 and in 2023 1500 people on site. In 2025 it will be about 300 people working in Northvolt Ett, producing batteries for about 700 000 and 800 000 electric vehicles per year.

Nothvolt is searching for people in four main categories:

1) Management, administration, support
2) Engineers
3) Maintenance (about 150 people for the first production line)
4) Operations

The operators will be the majority of the people hired, operating machines along the production line.

As there is hard to find people with direct battery production experience in Sweden or even in Europe, Northvolt tries to find people with similar experience. For Skellefteå, there is also the situation that there are not enough people living there – people just must move to fill the factory.

Three important aspects for getting Northvolt Ett to ensure a successful growth in Skellefteå:

1) A good mix of experienced and unexperienced people. (About 50% of people will come directly from some kind of education).
2) Local hires vs relocation
3) Men vs women – 50% female workers are the target.

Right now, an adult education programme is ongoing, to bring potential workers to a stage where onboarding programmes in the factory can take over the training.

For this group, a level of technical understanding is critical. To understand a machine, to be able to do some troubleshooting, to be active as an operator. A strong data mindset is also needed. Also, a skill to fast understand information and instructions. A quality standard and mindset are central – much more so in this kind of industry than in some other kinds of industries. Cause and effect thinking!

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50% of employees will have to come from other parts of Sweden or from other countries. This kind of industry is well suited also for female workers. Not so much heavy lifting at all, etc.

Insight in /understanding of processes is clearly important as well.

For the recruitment of engineers, there is in Sweden, and in Europe very little background in battery manufacturing. The lack of practical experience from battery manufacturing in Europe is also a big problem.

The scale up period is a special challenge, as is also the very large-scale / high-volume of manufacturing.

Battery manufacturing in Europe is still a little of a mystery, a steep learning curve not only for battery plants but also for subcontractors and suppliers. “Lack of understanding from nearby industries on similarities in manufacturing flow” is also a problem.

Insight in materials is a needed kind of skill –a lack especially in the upstream production. This includes handling and safety in environments processing these materials.

We need to increase awareness on how different industries relate to one another, which process and production flow similarities there are to motivate a similarity in skills.

Q and A

36.38

What battery-relevant competence do you think will be needed in the future if you consider the European job market?

Reply by Northvolt Katarina Borstedt, Northvolt:

Northvolt experiences a big skills demand for battery production, but also a big lack as well of the building of large-scale production environments. Northvolt has a lot of PhDs but few that has done this in reality. There are also a lot of challenges to meet during ramp-up.

38.22

Rawles gets a question of ***How recycling is included in his calculations****?*

They are not, he says, but recycling is important. The big period for that will be at the end of the period, close to 2030.

What competence is needed for working with procurement in this industry?

Borstedt: Competencies in the automotive procurement, with quality demands etc, are directly applicable in the procurement for cell production.

1.21.30?

Implications for skills and competence development for HE3DA?

A difference between the ramp-up and the ordinary production?

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Generally, automotive-based skills are useful.

- Engineering capacities – not as great in Europe
- Similar to automotive production batteries
- R&D and production technicians and engineers
- Technical education needs to be improved in the Europe
- Training and education for new workers will be available as a “battery manufacturing processes”
- Brand name of HE3DA is highly popular
- Currently there are 10-15 CVs coming to our e-mail box every week.
- The factory is placed in highly technician region thanks to the history of coal mining and steel production and processing

What is the ratio between engineering, administration operations etc at Northvolt Ett?

Katarina Borstedt: Operations 75-80+% of the staff will be hired and working in operations, the rest is a mixture, mostly engineering.

How to attract new people to this sector?

Vaclav Binar, HE3DA: There has been many applications, people are already motivated to work in this sector. Attractive, “sexy” jobs. No big problems for HE3DA.

Katarina Borstedt: Interest is super high, but we need to direct it further.

The moderator thanks all presenters and participants

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Evaluation – Mapping to Topics of Intelligence

Stakeholders Identified:

Name	Specialization	Importance	Contacts/Links
Other industries	Existing skills	Transferable skills	Katarina Borstedt
Raw material producers	Raw material supply	Lack of raw material, minimal European sourcing	Prospecting, Mining and recycling companies
Upstream stakeholders, actors	Producing battery materials from raw materials	Lack of investment	Investors, EBA, battery plants, mining companies

Technologies Identified:

Name	Description	Comment	Links
Gigafactory production scale	Special for Europe? economies of scale battery production / vertical integration	Lack of knowledge how this really will work best	
Most technologies in practical production in Europe	Almost total lack of experience?		
Tiering system for battery quality/ purpose/ cell chemistry	A benchmark innovation / categorization. Tier 1 highest quality, longest battery life, preferred for EVs	Tier 2-3 for electronics, tools, some stationary apps. Tier 1 is the focus in Europe	
The Gigafactory concept	Economies of scale to bring price down but keep/increase quality	We do not know yet how it works best, a lot of trial and error in front of us. European plants are bigger than Chinese ones generally.	
The vertically integrated gigafactory	All from mine to car ideally, but in practise from raw materials to shippable batteries or -packs (in TESLA case: cars)	Many planned European gigafactories plan to not invest in upstream production, which can be a problem for effectiveness and pricing	
3D Cells (HE3DA)	New format – not cylindrical, not prismatic, not pouch		

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	but with 3D electrodes		
Ceramic separators	Nano material, very secure batteries to prevent shortcuts because of dendrites, etc		

Job Roles Identified:

Name	Value Chain	Comment	Links
Machine operators	Battery cell production	75% of people in a cell plant?	
Maintenance staff	Battery cell production	Big and important category, mixed engineers and workers	
Battery production engineers	Battery cell production	General engineers do not yet know how to apply their skills to battery production	
Area managers	Battery cell production	Way to organize a Gigafactory by segment/process phases	Northvolt job ads

Skills/Competence or Knowledge Identified:

Name	Job Roles	Comment	Links
Mechanical/technical understanding	Machine operator		
Active machine supervision	Machine operator		
Process understanding	Machine operator		
Data analysis	Machine operators, maintenance crew, engineers, battery quality engineers		
Understanding of related industries			
High volume manufacturing production (Gigafactory production)	All workers and management	Trial and error ahead of the present	
Practical battery manufacturing experience		Almost non-existent in Europe	

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Raw materials knowledge and handling safety		Not so much in otherwise relevant educations
Battery materials knowledge and handling safety		For all in upskilling and reskilling, different levels
Scaling up a plant from start to full production / economies of scale		Trial and error-based learning ahead
Understanding an industry 4.0 in giga-scale		Trial and error -based learning ahead
Work habits for clean- and dry rooms		
Troubleshooting at appropriate level for machine operators		
Preventive maintenance skills/knowledge of production equipment		
Understanding the optimal or workable staff mix when starting a battery factory	the mixes of 1) experienced workers / unexperienced, 2) local newly educated hires vs industry experienced and relocated hires, 3) gender's mix	

Drivers of Change Identified:

Name	Influence	Comment	Comment
Green deal	large	Until 2050	
Green deal + EBA battery action plan	large	now	
Coming battery regulations	large	Not yet settled, but will define a European battery quality for EVs mainly	
Chinese dominance to 2030 will continue even as Europe self-sources EV batteries	large	Global expansion of investment is huge, but Chinese dominance will only slightly decline	
Relations between skills and job roles in different industries	Relevant for easy up-/reskilling or direct transferability	Pharma? Chemical industry? Lab experiences? Food industry? Electronic circuit boards? Paper and pulp?	

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		Automotive?
Necessity of hiring experienced people outside region	Necessary,	but somewhat complex and expensive

Sector Attractiveness Factors Identified:

Name	Influence	Comment	Links
Attraction so far with limited jobs to offer	So far big		
Sexy?	?		
Clean	Quite big		
Not heavy – women welcome	Very useful for equality development		

Trainings/Courses and Education Identified:

Name	Focus	Type	Links
Adult education that connects to onboarding	Connects to onboarding	Adult education, Technician education	
Engineering courses with adapts experience to new area of battery production	Battery understanding	Courses for professionals, MOOCs, industry-based certifications	http://classcentral.com, http://skills4automotive.com http://battery.mba
Process understanding			

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