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Alliance for Batteries Technology, Training and Skills

2019-2023

Analysis of Future Needs

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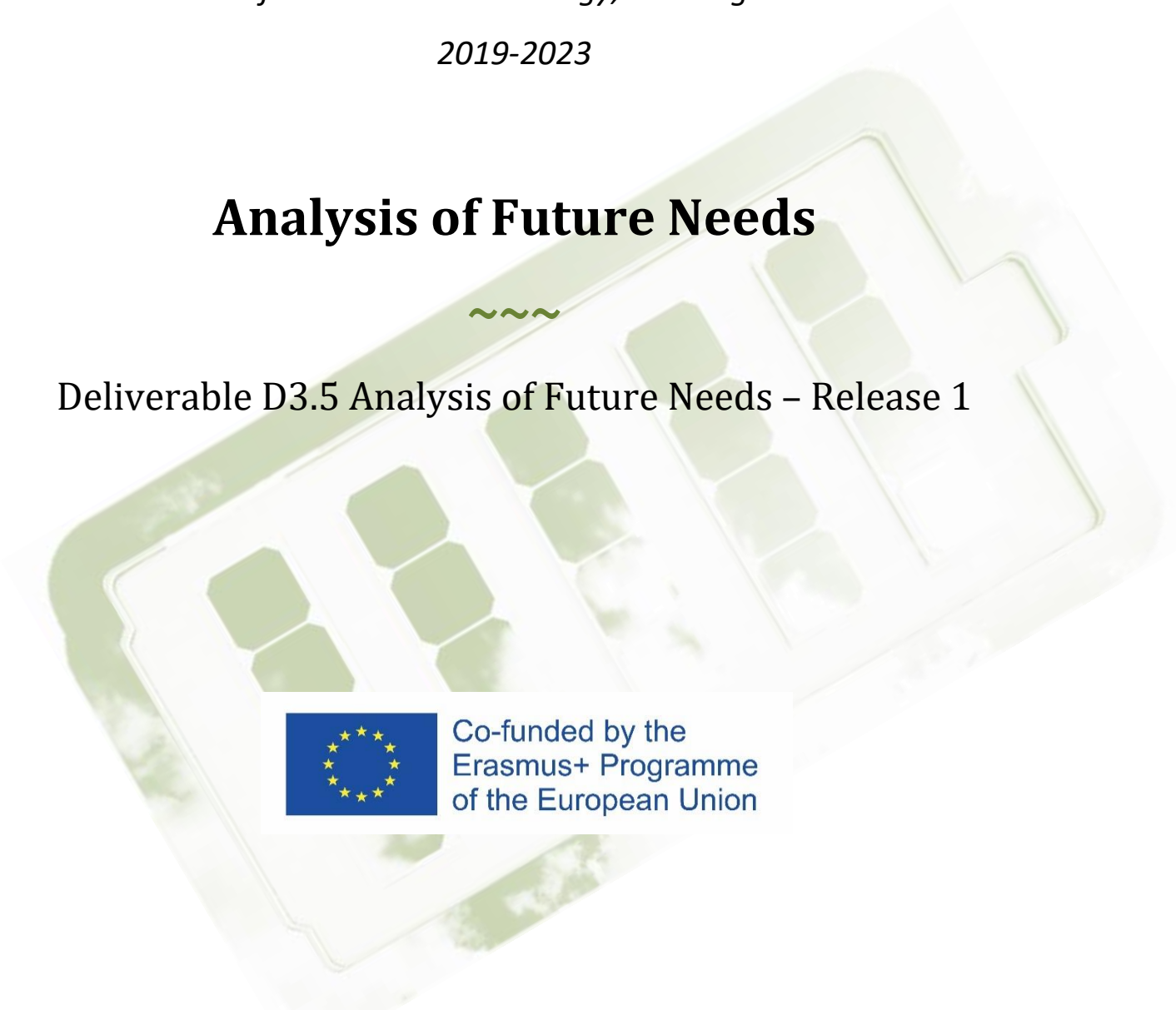
Deliverable D3.5 Analysis of Future Needs – Release 1



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Executive Summary

Workshops, as one of the skills needs gathering techniques, were used to discuss the EU battery sector needs with participants and speakers - sectoral stakeholders. The focus of the workshops, that were organised by the project ALBATTS consortium, was to gather skills needs and have a debate on the sector development in four workshop events with the following themes: (1) electronic vehicles manufacturing and battery integration – future qualifications needed; (2) stationary energy storage in grids and telecom applications: safety and future job roles and skills; (3) battery cell manufacturing – job roles and skills; and (4) vessels of the future: maritime batteries – job roles and skills.

This analysis provides the results summarised by: trends, drivers of change, and innovations; job roles, skills/competences and knowledge; and education, training offer, re- and up-skilling delivery for each workshop event if information was available.

To support the results and extend the intelligence an additional activity was held by project ALBATTS partners with the goal to analyse past and ongoing events related to the battery sector. Each event report or other material was analysed according to the same methodology as the ALBATTS workshops.

Our findings are summarised in the last section and categorised by: mobile applications; battery manufacturing; stationary applications and safety; competence, training, and education; and provides the key messages and needs of the EU battery sector according to the workshop data and analysis.

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Introduction

This document describes the main findings on sectoral intelligence gathered from workshops that were held during the month of January 2021 and organised by project ALBATTS members. Overall, 4 workshop events (automotive, stationary, battery manufacturing, and maritime) were organised with the main goal of identifying trends in battery technology and applications, and to gather sectoral intelligence regarding emerging job roles, skills/competences, and knowledge requirements. A comprehensive summary of the events can be found in section 1 – each event description features a homogenous structure which allows further extraction of information and definition of needs and conclusions at the end of the document. The event description contains the following topics:

- trends, drivers of change, and innovations;
- job roles, skills/competences, and knowledge;
- education, training offer, re- and up-skilling delivery;
- key messages and needs.

To further enhance the sectoral intelligence gathering in a context of sectoral needs 6 other battery related events and articles were analysed using the same methodology as mentioned above. For the list of analysed event reports and documents see [1, 2, 4, 7, 8, 9].

The last section of the document summarises the key messages and needs that arose from the workshops and the analysed documents covering 4 thematic areas: mobile applications of batteries; stationary applications of batteries and safety; battery manufacturing; and competence, training, and education.

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List of Abbreviations

5G	…	Fifth generation technology standard for broadband cellular networks
ACEA	…	European Automobile Manufacturers' Association
ALBATTS	…	Alliance for Batteries Technology, Training and Skills
CO_2	…	Carbon Dioxide
CO_2	…	Carbon Dioxide
CTIF	…	International Technical Committee for the Prevention and Extinction of Fire
DG GROW	…	European Commission DG Internal Market, Industry, Entrepreneurship and SMEs
DRIVES	…	Project on Development and Research on Innovative Vocational Education Skills
EAP	…	Electrically Acquainted Person
EBA250	…	European Battery Alliance
EEP	…	Electrically Educated Person
ESS	…	Energy Storage System
EU	…	European Union
EV	…	Electronic Vehicle
GWh	…	Gigawatt hour
HVE	…	High-Voltage Expert
HVT	…	High-Voltage Technician
ICE	…	Internal Combustion Engine
Industry 4.0	…	The Fourth Industrial Revolution
IoT	…	Internet of Things
IPCEI	…	Important Projects of Common European Interest
IT	…	Information Technology
MOOC	…	Massive Open Online Courses
R&D	…	Research and Development
S1	…	Electrician Qualification Level
S2	…	Electrician Qualification Level
S3	…	Electrician Qualification Level
SPOC	…	Small Private Online Course
VET	…	Vocational Education and Training
VNEb	…	High-Voltage Battery Expert
VSB-TUO	…	Technical University of Ostrava

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1 ALBATTS Workshops - Sectoral Intelligence Gathered

This section contains a (1) comprehensive summary of drivers of change, factors, strategic recommendations for the sector, innovations, and key technologies; (2) job roles, skills/competences, and knowledge; (3) education and training offering, delivery methods and approach to the re-skilling and up-skilling followed by (4) overall key messages and needs that were identified during the project ALBATTS workshops held in the beginning of 2021.

1.1 AUTOMOTIVE WORKSHOP

The automotive workshop was held on 27th of January 2021 and gave an overview on battery plug-in hybrid vehicle manufacturing and a discussion on how the batteries are integrated into a vehicle with the focus on current and future needed job roles and skills. Speakers included James Copping (EU Commission – DG GROW), Dr. Jakub Stolfa (VSB-TUO), Dr. Petr Dolejsi (ACEA), Dr. Oliver Fischer (Daimler AG), Stanislav Hackl (SKODA-AUTO) and Sara Hermansson (Northvolt AB). More information on this event can be found on the project website[3] or in the dedicated, more in-depth deliverables[5].

1.1.1 Trends, Drivers of Change, and Innovations

The decarbonization of the European economy is the crucial environmental objective of the European Union towards year 2050, with CO_2 emissions from passenger cars and vans scheduled to be lowered by 37,5% from 2030 and possibly further reduced due to the Green Deal revision and the incoming emission standards for passenger cars – Euro 7 (legal framework consisting of series of directives and emission standards for passenger cars). The fulfilment of this objective is nowadays seen as possible via the replacement of fossil fuels and fossil fuel-based sources of energy with alternative, carbon-free, technologies and fuels. Electricity and the electric propulsion are considered to be the most appropriate tools to accomplish these goals. Other carbon-free technologies are still lagging in comparison to the electric solution in terms of cost, efficiency, and safety.

As a result of the coronavirus pandemic, the European automotive industry has suffered EU-wide production losses amounting to 3.6 million vehicles during the first half of 2020. The pandemic, on the other hand, led to the acceleration of the shift towards the digitalization and digital economy.

Batteries, as the centerpiece of the entire electrification paradigm, need special attention and focus. Given that the core materials are still scarce compared to the projected demand and

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the battery manufacturing infrastructure is still insufficient, development in the battery sector is critical for the EU recovery and the future competitiveness of its economy. Intelligent strategic steps taken today are going to be the foundation of an entire economic ecosystem soon.

Therefore, the European Commission stepped in with various initiatives meant to improve the performance of the European battery industry and the development of the battery value chain. Back in 2017, when battery manufacturing was almost absent in the EU, the Battery Alliance was founded with the main goal of having solid battery manufacturing in Europe.

The European Commission recently approved, under EU State aid rules, a second Important Project of Common European Interest ("IPCEI") to support research and innovation in the battery value chain. The project, called "European Battery Innovation" was jointly prepared and notified by 12 European countries (Austria, Belgium, Croatia, Finland, France, Germany, Greece, Italy, Poland, Slovakia, Spain, and Sweden) and will provide up to €2.9 billion funding in the coming years. The public funding is expected to unlock additional €9 billion in private investments, i.e., more than three times the public support. The project complements the first IPCEI in the battery value chain that the Commission approved in December 2019.

The emerging battery industry will need to be provided suitably qualified people in sufficient numbers and the efforts thereto are important: The Skills Agenda was released in 2020. There are enormous challenges to be dealt with:

- #1 short-term challenge - to find enough skilled employees to meet the growth of the companies at the moment;
- #2 long-term challenge – to secure the education and training infrastructure for qualified staff.

Besides the adaptation of the workforce, 2 other major issues must be solved in order to pave the way for the electric mobility:

- The lack of recharging infrastructure;
- The unsustainability of the supportive measures.

Once the regulatory and legislative issues are dealt with, there are still aspects concerning the technology involved in the batteries, battery manufacturing and the electric vehicles themselves. First concern is the safety of the battery during use as well as during the

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maintenance and repair works. This is the main objective of the trainings carried out by some of the major players in the industry. (Skoda Auto as an example)

As one of the main gains of electrification is decarbonization, and battery manufacturing is an energy intensive process, it is extremely important for stakeholders (especially for battery and vehicle manufacturers) to have a very low carbon footprint associated with the production cycle and to be able to prove it.

According to the workshop presentations and the debate in the panel, there are a couple of technologies that are bound to bring a difference to the sector:

- The massive electrification within the Mercedes – Benz company (the entire line-up will be electrified) – to achieve sustainability within and beyond regulations, especially CO_2 neutrality, and to ensure the leadership in electric drive through the electrification of all segments;
- The digitalization enhancement will also play an important role in the battery ecosystem where accurate traceability will be required for almost the entire lifecycle of the battery, from raw materials to recycling (according to information provided by Mercedes- Benz and Northvolt at the workshop)

1.1.2 Job Roles, Skills/Competences and Knowledge

Although job losses are expected in both car manufacturing and car repair, there will be a need for extra jobs to handle the new technology coming to the market, especially for the core element of the EV – the battery. Currently, all areas related to the EV battery are impacted by a staff shortage: manufacturing, maintenance, repair, repurposing and recycling. The most stringent and urgent need for skilled labor, though, is in the battery manufacturing area, as the demand for electric vehicles is on the rise.

The list of competences/skills and knowledges that were identified during the workshop:

- Types of competences required for digital transformation: Technical - analytics, infrastructure, risk, and security; Enabling – communication, leadership, ways of working; Transformational – change, customer experience, innovation
- Upskilling in the transformation combining competencies from vehicle, software, and components – Mercedes-Benz;

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- Electric engineers, electricians, car electricians and car electronics experts are still sought after and missing even though some manufacturers took the issue upon themselves such as Skoda Auto through Skoda Academy
- Engine engineers, despite their solid qualifications, are difficult to reskill for the automotive industry that is slowly moving away from Internal Combustion Engines (ICE).
- Chemical engineers, according to Northvolt, could be easily reskilled to work in a battery factory or in a battery recycling facility
- Paper production specialists are easy to upskill for the new automotive industry paradigm in terms of process management and maintenance (Northvolt).

1.1.3 Education, Training Offer, Re- and Up- Skilling Delivery

As the need of skilled technicians and specialists is quite urgent, **Daimler** went the extra mile by advising VET providers on the necessary mind sets, competencies and skills or even setting up its own qualifications such as the "**Electric Specialist**" with a modular design for basic qualification.

Skoda's training scheme is based on a European standard (EN-50110) and consists of 3 competence levels covering all the works that may be carried out by a vehicle manufacturer – assembly, maintenance, and repair.

Special rules, identification of risks, qualifications needed, and training programs reflect European standards on 3 levels:

Table 1 SKODA AUTO - Example Courses

Level 1 - Electrically Acquainted Person – EAP	OHS Training
Level 2 – Electrically Educated Person – EEP	Course no. 1-14-208
Level 2 – High –Voltage Technician – HVT	Course no. 1-14-208
Level 3 - High - Voltage Battery Expert – VNEb	Course no. 1-09-001
Level 3 – High – Voltage Expert – HVE	Course no. 1-09-001

Skoda has established a **Secondary vocational school of engineering** that has already prepared over 1000 students in 15 new professions related to the electric drive.

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To be better adapted to future evolutions, the automotive industry, and especially propulsion technologies, Skoda has also set cooperation with universities and has enabled internships.

1.2 STATIONARY APPLICATIONS OF BATTERIES WORKSHOP

Stationary workshop was held on 26th of January 2021 and was intended to provide a discussion of the future needs in skills and competence related to stationary battery energy storage through selected speakers and interaction with audience with the focus on areas such as: grid and telecom applications and battery safety. Speakers were – Johan Söderbom (EIT InnoEnergy), Kari Valkama (MERINOVA), Mikko Saastamoinen, Karolina Neurman (Tukes), Dr. Ismael Miranda (Efacec) and Jussi Havela (Telia Towers). More information on this event can be found on the project website[3] or in the dedicated, more in-depth deliverables[6].

1.2.1 Trends, Drivers of Change, and Innovations

Increasing use of batteries and consequently growing risk of disastrous situations involving battery fires acts as a driver of change for firefighters and rescue service capabilities. Due to the challenging procedure of extinguishing battery fires and the high risk of re-ignition, firefighters need to master new methods and techniques e.g., use of fire blankets and submerging the vehicle into a water tank. The CTIF commission for extrication & new technology is responsible for assessing these problems.

CTIF is an international fire & rescue association which has several different commissions. Sharing information, testing, and training is essential for providing future firefighters with skills and competences to manage various battery fire scenarios.

As an example of new applied techniques, a fire blanket is a new rapid extinguishing method, which blocks and isolates any fires including even lithium battery fire. Fire blankets are maintenance free. The development and research take place in Europe, France and Finland. This method is new, and training will be needed. Another technique is to use water tanks. Burning electric vehicles are submerged into a tank, which European rescue departments have purchased for that application.

The ISO 17840 standard – project includes alternative propulsion identification of EV storage technology which is very important in case of fire or accident. There are different stickers on fire and rescue trucks, heavy duty vehicles and buses that help to identify the propulsion type. Some countries went further in this implementation than others. Energy storage systems are not covered well by EU legislation. There are installation standards such as

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HD 60364 - *Low-voltage electric installations* and EN 50110-1 - *Operation of electrical installations*. Additionally, the standard in which safe working methods are provided is IEC 60364 - *Electrical Installations for Buildings*. There are several standards for ESS. For example, there is a standard from America, NFPA 855, "*Standard for the Installation of Energy Storage Systems*", which is considered as good.

The European Parliament and the Council have recently proposed a draft regulation concerning batteries and waste batteries. Safety requirements for stationary battery energy storage system are provided in chapter II (Article 12 together with Annex V). This proposal would repeal Directive 2006/66/EC and the amending Regulation (EU) No.2019/1020.

Fire safety is also important with energy storage systems. Stopping thermal propagation between cells and eliminating a possible risk of gas explosion is critical if fire occurs. Automatic fire suppression systems are applied, and they are using either water, which has an effective cooling power, or inert gasses.

Integration of renewable and continuous decarbonization, growing electrification and new market designs and business models are boosting the development and integration of energy storage. The EU Green Deal and other European regulations are starting to recognize energy storage with a key role to achieve the sustainability goals for energy.

The lithium-ion battery cell chemistry is and will be the leading technology for stationary battery storage due to the falling costs triggered by the EV revolution. Higher integration of renewables sources (mainly wind and solar) needs an attached energy storage to be able to provide flexibility. High energy and power density are required to cater to the needs of the installation. Companies and organizations will differentiate and innovate through software and algorithm optimization.

Europe is growing and evolving while the US and Australia are the main markets of ancillary services. Energy storage and battery energy storage can decrease costs in upgrading the transport and distribution infrastructure. Storage can be closer to the end-user with customer energy management services, by reducing the cost of electricity. Off-grid can be applied in both geographical and electrical islands, for Europe or more remote places, such as in some countries in Africa and in other developing countries.

The development and deployment of new technologies such as 5G cellular networks with their increased energy needs are further increasing the demand for energy storage solutions. 5G is

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a major driver of change since that technology is substantially increasing the power consumption in telecom networks and it needs new solutions. Telecom business is heavily regulated by authorities. The base stations towers have certain back up requirements timewise; depending on how many customers the current base station is serving, it needs to be in service 3, 6, or even 12 hours. Stationary batteries provide this backup power if a power blackout occurs.

1.2.2 Job Roles, Skills/Competences and Knowledge

As explained in the previous chapter – safety related aspects with batteries from firefighters extinguishing a fire to electricians and maintenance staff installing and servicing them have implications on the skills and competences. For example, the rising number of electric vehicles in traffic has led to an increase in accidents involving battery fires. Extinguishing a battery fire needs new techniques and tools which both require firefighters to adopt new skills and competences. The increasing application of energy storage solutions in on and off grid applications as well as with 5G telecom base stations will emphasize the need to be able to work with them, for example to install and maintain them.

1.2.2.1 Job Roles

Considering **the whole battery value chain** there is a variety of job roles from various maintenance and engineering roles to information technology not forgetting positions in sales and administration. We identified such job roles as electricians with a variety of qualification levels (S1, S2 and S3) and electrical work supervisors. Additionally, we identified such roles as data analysts and experts on artificial intelligence, sales personnel, and economists.

With regards to **cell and module manufacturing** the identified job roles include positions such as chemists, any manufacturing related roles, thermal engineers, electrochemical technicians and engineers, product designers, electrical engineers, digital control software developers and software engineers.

The system integration related roles partly include similar job role titles as identified with manufacturing. They are for example algorithm developers, software engineers, product designers, thermal engineers, communication operators and developers, automation

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engineers, product designers, power electronics engineers, digital control engineer and asset managers.

The **2nd life and recycling** related identified job roles are chemists, algorithm developers, software engineers, product designers and digital control engineers.

We also identified **operation and maintenance** related job roles as follows: asset managers, electrical engineers, power electronics engineers and management consultants.

Finally, in terms of responding to **battery related accidents and fires,** fire and rescue personnel play an essential role.

1.2.2.2 Skills and Competences

Considering **the whole battery value chain** safety, regarding both the personnel/users and the environment, is important in virtually all the discussed stages of the value chain here. Consequently, it is important to have, for example, the following skills: safety for the (1) electrical equipment expert (electrical hazards); (2) contamination control of batteries (safety and environmental professionals); (3) product safety (test engineers/regulatory consultants); (4) safe working methods (risk assessment consultants); and (5) extinguishing a battery fire (fire and rescue personnel). Safety also goes hand in hand with skills in electrical works (electricians) that are needed almost throughout the value chain. Various testing (testing experts) is also needed throughout the value chain. A variety of training (educators) of staff is required in every stage of the value chain and sharing information. Information management is an important competence in general. Additionally, it is important to understand legislation and standards (Consultants) in every stage of the value chain. Any company/organization operating in the battery sector needs to understand the market and the circumstances in which it operates and thus the ability to conduct market surveillance (business developer/sales department/inspector) is also needed.

In terms of **cell and module manufacturing,** for example, the following skills and competences are important: (1) chemistry (chemists/chemical engineers); (2) electrochemistry;

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(3) modelling tools (simulation Engineers); (4) thermal simulation (simulation engineers); (5) investigation of things (R&D); and (6) software development (IT developers).

The system integration involves skills and competences such as, for example, modelling tools, thermal simulation and power electronics, systems (electrical engineers) and software development (IT developers).

The 2nd life and recycling essential skills and competences include, for example, chemistry, electrochemistry, and software development.

The operation and maintenance related skills and competences include electrical works (electricians), power electronics and systems (electrical engineers), and service and maintenance (maintenance leaders and operators).

1.2.3 Education, Training Offer, Re- and Up- Skilling Delivery

With regards to the education and training there we identified the following:

- risk mitigation database;
- master thesis done in collaboration with energy storage companies: Solving company's issue + developing student's skills and competences related to energy storage;
- master's degree targeting battery storage: Development of specific skills related to battery storage;
- modelling of batteries: Creating, developing, and improving models for batteries and battery systems;
- strategic thinking: Develop methodologies for storage business and storage development;
- safety and regulations: Increase knowledge in safety issues and current development regulations;
- software development and algorithms for battery storage: Software & algorithms used to improve the functionalities of energy storage;
- battery Firefighting: Methods and protocols for battery fire prevention and mitigation;

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1.3 BATTERY MANUFACTURING WORKSHOP

A Battery manufacturing workshop was held on the 20th of January 2021 on battery cell manufacturing process. Current and future needs in job roles, skills, and competence were discussed with professionals from the EU market, followed by a conversation on education, skills, market expectations, political initiatives, and current global players in the battery market. Speakers were: Dr. Björn Fagerström (EIT Manufacturing), Dr. Anders Norberg (Skelleftea municipality), Caspar Rawles (Benchmark Mineral Intelligence London), Ivone Kaizeler (DG GROW), Vaclav Binar (Magna Energy Storage), and Katarina Borstedt (Northvolt AB). More information on this event can be found on the project website[3] or in the dedicated – more in-depth deliverables[6].

1.3.1 Trends, Drivers of Change, and Innovations

One of the most important driving factors in battery manufacturing is the shift towards a clean and environmentally sustainable economy supported by high-quality products, mainly batteries and battery architecture in the automotive sector supplied by European-made battery cells and packs. In 2017 the European Battery Alliance (EBA250) launched its commitment to creating up to 250 GWh of battery production capacity within the European region by 2025. The original vision progressively changes into real data, processes, and manufacturing projects currently appear in many parts of Europe.

Next to the EBA250, there is the new European Green Deal created by the European Commission, which supports projects with state aid and low interest loans from the European Bank. Another successful strategical movement was the creation of the Strategy Action Plan consisting of 6 key areas within the whole battery value chain. Based on the multiple meetings with the largest and key European companies and players at the EBA floor, the summary generated a real action plan which maps the whole circle from the raw materials being processed, and batteries manufactured up to the recycling process and back to the first step of the value chain.

Until now there has been, and over the next decade there will be, a Chinese dominance in the battery market, even though the European market is expecting a rapid growth. One of the key factors to establishing a great position within the global battery race is to have a high-quality batteries produced locally. Imported batteries are hard to regulate and control and therefore, upcoming battery regulations represent an unprecedented move towards high-quality output and market control achievement.

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With the quality control strategy movement by the European Commission and other regulatory entities, it is certain that the primary demand for batteries will come from the automotive sector. From the technological perspective, it is the largest transformation of technology for the automotive sector since the beginning of the car era. As the quality level of European cars is the highest among other competitors, the same quality system of Tier 1 products will be applicable for the battery sector and supply quality control.

And behind a high-quality product lies a unique technology and an economy of scale which is the crucial breakthrough in the recent push for EVs, due to an abrupt drop in battery production costs. It is a fundamental purpose of the Gigafactory concept first promoted by Tesla Inc. For now, there is a lack of knowledge and proof of concept that the quality and quantity are on the same level or higher. Nevertheless, the demand for EVs in the market is substantially higher than the current supply and opportunities are greater than ever before within the battery market itself.

The great attractiveness of the battery manufacturing sector comes from its novelty, its new possibilities, and of course the sector receives a great push forward by the European legislative movement and financial aids prepared for new projects aiming to satisfy the massive demand for top quality batteries designed for the EV market.

1.3.2 Job Roles, Skills/Competences and Knowledge

Requirements for the automotive sector and battery manufacturing sector share similarities. As an example, we have discovered from our guest speakers currently building and launching battery manufacturing plants, that the most required job for machine operators, which is a similar demand for an automated line in modern car manufacturing halls. Another similar, but also very important job role is the maintenance staff within the battery cell production facility composed of engineers and workers.

The job role of machine operator is then structured into various micromanagement operations, namely:

- mechanical or technical operators;
- active machine supervision;
- process managers;

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- data analytics.

Furthermore, other similar operators are being sought for in the rest of the battery value chain. As for the automated lines, there is a lack of skills in the combination of knowledge from electricians, engineers, and programmers. Those who master such skills during their employment in the battery manufacturing facility will be the next educators for new incoming employees.

1.3.3 Education, Training Offer, Re- and Up- Skilling Delivery

The guest speakers, especially Northvolt's Director of growth, Katarina Boerstedt, explained two known courses and training towards more incoming skilled employees. Those courses, such as MOOCs, and industry-based certifications, are for a certain type of professionals, sought after by employers. The generated skills are meant for a better understanding of the working environment of the battery cell manufacturing facility. More educational courses are widely offered within the automotive sector. As it was discussed during the workshop, there is a lot to learn from this stable and precisely functioning working environment with highly developed key educational areas as well as working processes.

There is also a potential problem for Gigafactories as per their physical location in remote areas with shortage of new and qualified employees. As NorthVolt stated for their Swedish first factory in Skelleftea (around 770 km north of Stockholm), there is an urgent need for thousands of workers. The company together with the municipality and private housing companies are already organizing a massive build-up of new living area to accommodate new employees and their families. Mr. Binar from Czech battery company HE3DA claims that the location close to a large city (Ostrava) has experienced a surplus of job requests just by the company e-mail. Both company representatives agree there is an urgent need for high skilled workers due to the sophisticated nature of the battery manufacturing process and other related job roles along the assembly line.

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1.4 MARITIME WORKSHOP

The maritime workshop was held on 19th of January 2021 with a focus on the specifics of maritime applications of batteries, and the provision of understanding of current and future skills and competences. Speakers includedKristine Bruun Ludvigsen (DNVGL), Kari Valkama (MERINOVA), Lars Ole Valøen (Corvus Energy), Stian Ramm Manger (Kongsberg), Tomas Tengnér (ABB Marine & Ports), Sverre Eriksen (DNVGL). More information on this event can be found on the project website[3] or in the dedicated, more in-depth deliverables[5].

1.4.1 Trends, Drivers of Change, and Innovations

The maritime industry is fundamentally adopting new innovations and following EU regulations to reduce CO_2 emissions. This will require zero emission or hybrid ship solutions with proper design and strong energy infrastructure (grid regulations, capacity upgrades or funding models). Digitalisation is one of the main drivers of electrification in the maritime industry with the need for available and cost-efficient technologies such as cloud-based data storage and other cloud solutions. Industrial IoT devices and sensors used for the data driven approach, and the use of digital tools for troubleshooting and guidance are being implemented This also brings along the concept of connected vessels – connected batteries and the whole ecosystem. Cyber security becomes more important with this concept as well as a strong internet and satellite connection.

1.4.2 Job Roles, Skills/Competences and Knowledge

Job roles for maritime applications of batteries follow similar a hierarchy to other application fields. Job roles that are important according to the trends are data scientists, test engineers, software developers, and cloud solutions and cybersecurity experts and engineers. Other job roles include production and manufacturing engineers, battery modelling experts, factory operators or application engineers. The servicing and safety of the battery systems that are in use is also very important as well as logistics and overall corporate infrastructure related job roles.

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2 Relevant Findings – Ongoing Events, Webinars and Workshops

This section consolidates the results of the analysed battery related events and documents – summary of trends, drivers of change and innovation; important future job roles, skills, and knowledge; as well as education and training offer, and its delivery.

2.1 TRENDS, DRIVERS OF CHANGE, AND INNOVATION

According to the **Fraunhofer** report, the decarbonisation of the sector and investment into modest large-scale production (with the importance of automation and control of production processes, reduction of scrap and energy consumption), circular economy with a focus on the sustainability of batteries is needed. As the demand for batteries is rising (demand is expected to be dominated by electromobility) it is important to satisfy customer needs. It is not practical to transport batteries from Asia, and therefore battery production hotspots need to be developed in the EU and other nearby areas in the world. Furthermore, this is a question of European control over its car manufacturing sector and consequently its own battery production. There is a clear European interest in controlling the quality of the batteries, the work conditions in the whole supply chain and the type of energy used for battery production. With the aforementioned demand comes the upscaling of production which leads to lower number of jobs per GWh. Solid-state batteries, alternative chemistries and mobility of the people should be taken into consideration.

When it comes to the drivers of change in the automotive industry, there are huge investments in the EV revolution (Daimler, Volkswagen, or Ford). Energy intensive manufacturing and recharging of EVs will require renewable sources of energy to reduce their environmental impact. Many cities and countries have announced the phasing out of conventional vehicles (equipped with ICEs), hence why the market share of EVs is increasing – due to this increase, customer requirements will have to be satisfied: (1) fast charging solutions and charging infrastructure availability; (2) alternative battery exchanging and swapping; (3) longer range of EVs.

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2.2 JOB ROLES, SKILLS/COMPETENCES AND KNOWLEDGE

A wide range of job roles will be needed ranging from machinery and equipment supply experts to Research & Development. It is important to focus on a wide range of domains and disciplines such as chemistry and materials science, manufacturing, or computer science. When it comes to battery manufacturing, the main topics for the future are the manufacturing processes; quality control; automation; industry 4.0; safety; circular economy; digitalisation (concerning machine learning and artificial intelligence); second life of batteries and recycling. Soft and transversal skills are important as well: communication, troubleshooting.

For mobile applications and EV manufacturing, the following engineering job roles should be considered as important: chemical engineers; materials engineers; electrical engineers; electronics engineers; mechanical engineers; industrial engineers; software engineers.

2.3 EDUCATION, TRAINING OFFER, RE- AND UP-SKILLING DELIVERY

The re-skilling of staff working in the industries where jobs are disappearing will be important, both for avoiding unemployment, and because they may have attractive and transferable skills needed in the battery and electromobility value chain. Additional skills of digitalisation and automation are needed, as well as processes, production, and design of competitive and sustainable products. Staff with academic education and on professional and vocational level will be needed as well. It is also important to mobilise the future workforce – internships, apprenticeships, and prioritization of cross-cutting skills, on-board training, MOOCs, and SPOCs as well as lifelong learning. Other delivery methods of training could be in-house training, education on the job, online training, pairing entry-level engineers with senior engineers until the entry-level engineer reaches professional autonomy.

Other interesting practices in re-skilling and up-skilling could be (1) the establishment of centres of excellence to provide future generations of engineers and scientists with knowledge and skills in advanced technologies; (2) the recruitment of workforce in battery manufacturing related sectors that can quickly acquire the technical background knowledge; (3) investment into new expert developments which will pay off in the future due to the positive perspective of the battery sector; (4) the acquisition of start-up companies as an alternative to classic recruitment; (5) the validation of prior learning, and adaptive learning technology.

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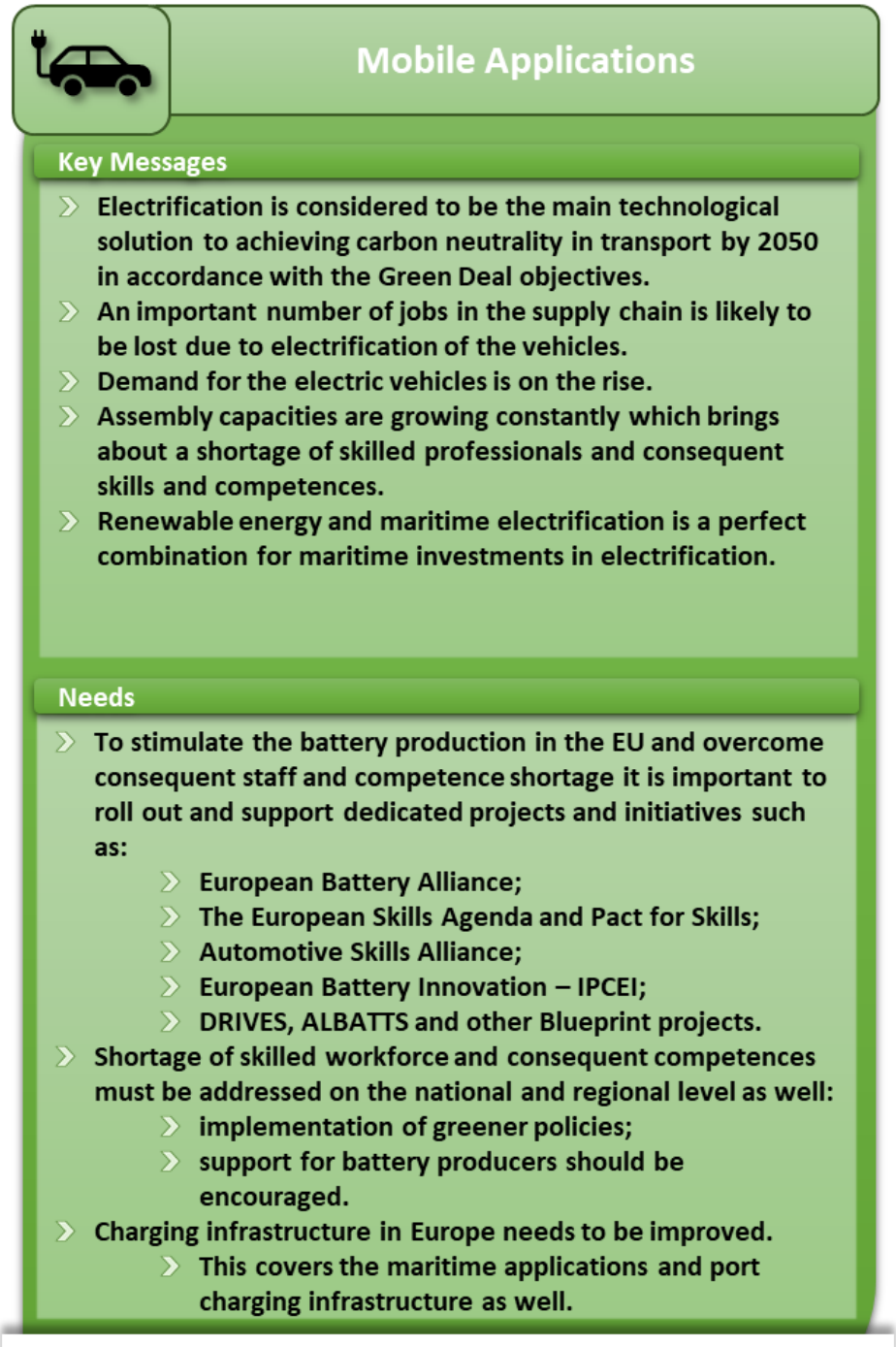
3 Key Messages and Needs - Summary

This section provides the evaluation of key messages and needs for the battery sector in a structured way. Each key message or need is categorised by areas of sectoral intelligence or by application sector/domain, namely: (1) mobile applications; (2) stationary applications and safety; (3) battery manufacturing; and (4) competence, training, and education. Information contained within will be valuable for the development of the roadmap for the EU battery sector.



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Stationary Applications and Safety

Key Messages

- EU initiatives and update of regulations, namely on the environmental and energy fields, are an incentive to the development of the energy storage business and its integration.
- New business models are boosting the sector development, namely integration of renewables, electrification and new market design and new technologies such as 5G cellular networks and IoT devices.
- Lithium-ion is and will be the leading technology for stationary battery storage due to the decreasing production costs.

Needs

- A wide range of competence is needed from a variety of fields and domains.
- Battery safety needs development and should be prioritized:
  - New technologies and techniques are needed as well as competences.
  - Safe product development and guidance on legislation and standards should be improved.
- Cooperation across different fields of knowledge is critical to develop sustainable businesses in energy storage domain.
- Update of the regulation concerning the batteries and waste batteries is needed.

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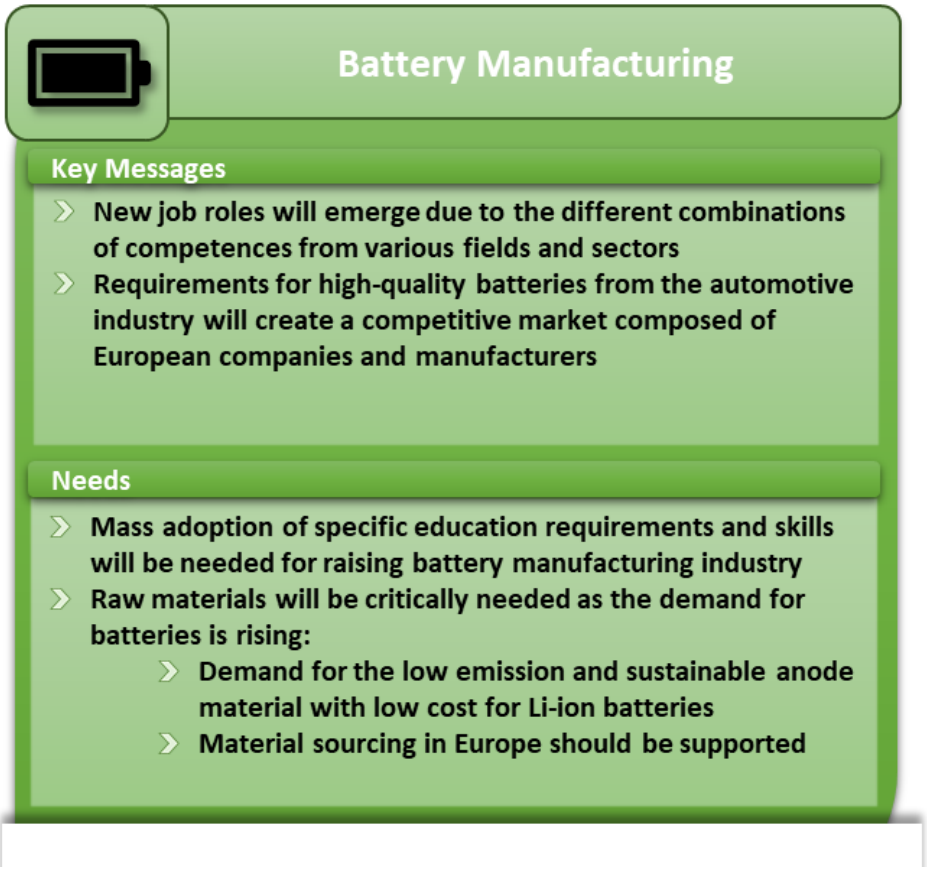

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Competence, Training, and Education

Key Messages

- Sharing of information is crucial for the development of competence needs in the EU battery ecosystem.

Needs

- Experts in the battery field should be mobilized.
- Interdisciplinary education programmes for VET and Higher Education should be rolled out.
  - This requires adaptation of curricula overall as well as adaptation to digital skills and competences.
- Academia, VET and industry should cooperate via standardized approach on:
  - apprenticeships programmes;
  - internships;
  - projects.
- Attractiveness of the sector should be fostered.
- Clear roadmap for re-skilling and up-skilling towards new needs should be developer.
- Re-skilling and up-skilling instruments should be implemented and used, such as:
  - onboarding in factories;
  - digital and specific seminars for industry;
  - standardized online courses;
  - training of trainers;
  - access to learning infrastructure for SME's and other target groups;
  - centeres of excellence.

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References

1 Automobilwoche. (2021, May 12). Supercharger Talentmanagement | Automobilwoche.de. https://www.automobilwoche.de/article/20210318/BCONLINE/210319931/supercharger-talentmanagement.

2 Davis, S. (2018, October 5). The EV Revolution Will Require More Engineers. Power Electronics. https://www.powerelectronics.com/markets/automotive/article/21864240/the-ev-revolution-will-require-more-engineers.

3 Events. Project ALBATTS. https://www.project-albatts.eu/en/listnewsevents

4 Executive Agency for Small and Medium sized Enterprises., EY., & Fondazione Brodolini. (2020). Blueprint for sectoral cooperation on skills: towards a common vision on addressing SMEs skills needs in the automotive sector: strengthening the development of upskilling and reskilling strategies: final report. Publications Office. https://doi.org/10.2826/962616

5 Project ALBATTS. (2021). (tech.). D5.3 Future Needs Definition for sub-sector IMBA - Release 1. Retrieved from https://www.project-albatts.eu/Media/Publications/12/Publications_12_20210226_11248.pdf

6 Project ALBATTS. (2021). (tech.). D4.3 Future Needs Definition for sub-sector ISIBA - Release 1. Retrieved from Publications_16_20210226_153326.pdf (project-albatts.eu)

7 RECHARGE. (2020). New EU Batteries Regulation: Delivering on the Strategic Action Plan on Batteries. Retrieved from https://www.avere.org/wp-content/uploads/2021/03/CRM4EV-webinar-Claude-Chanson-RECHARGE.pdf

8 TALGA GROUP LTD (ASX:TLG). (2020). BUILDING AND SCALING ANODE SUPPLY FOR EUROPEAN BATTERIES. Retrieved from https://www.talgagroup.com/irm/PDF/04667eb9-ada7-49d8-bf1b-f81d1a0bb0e7/PresentationatBenchmarkWeek2020BatteryMegafactoriesEurope

9 Thielmann, A., Neef, C., Hettesheimer, T., Ahlbrecht, K., Ebert, S. (2021). (rep.). Future Experts Needs in the Battery Sector. EIT RawMaterials; Fraunhofer. Retrieved from https://eitrawmaterials.eu/wp-content/uploads/2021/03/EIT-RawMaterials-Fraunhofer-Report-Battery-Expert-Needs-March-2021.pdf

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