albatts

Alliance for Batteries Technology, Training and Skills

2019-2023

ALBATTS Workshops:

Battery Relevant Job Roles & Skills - Impact of Technological and Legislative Trends

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Deliverable D5.6 - Future Needs Definition for sub-sector IMBA - Release 2

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Author(s):	AIA, APIA, Corvus, VSB TUO		
Responsible Project Partner:	AIA (Czech Automotive Industry Association)	Contributing Project Partners:	AIA, Merinova, ACEA, APIA, Corvus, EFACEC, EUPPY, HE3DA, Northvolt, SKEA, SPIN360, VSB-TUO

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EXECUTIVE SUMMARY

Altogether **four online workshops and three interviews** focusing on job roles and skills were organised by the ALBATTS partnership in the second series of events between September and December 2022. The topics of the webinars were the following:

- **Servicing of Electric Vehicles (webinar)**
- **Impact of the New EU Battery Regulation Proposal (webinar)**
- **Autonomous Operation and Virtual Reality in Maritime Applications (webinar)**
- *Building a Gigafactory (interview)*
- *Impact of the "Battery Passport" (interview)*
- *Battery Energy Storage Enabling Sustainable Islands (interview)*
- *Recycling Electric Vehicles' Batteries (webinar).*

While this Work package 5[1] report describes outputs collected during the above-listed webinars **marked in green colour**, a similar report is created by Work package 4[2] covering the remaining webinar and interviews topics.

With respect to the EU goal of becoming a climate-neutral continent by 2050, the transport and mobility sector must also contribute. In addition, new legislation has been proposed by the European Commission to decrease CO2 emissions from vehicles, which will translate into an increasing number of EV registrations. The topic of **EV servicing** was therefore chosen to discuss current and future competencies and qualifications of personnel needed by **the repair and maintenance sector.**

Missing knowledge and skills in the car repair segment mentioned by speakers were **electricity** and **high voltage batteries, insulation testing, potential equalisation, ICT knowledge and EV diagnostics (interpretation of fault codes), MMLV repair, electric propulsion, inverters, DC/DC converters, ADAS, connectivity or cybersecurity**.

[1] The ALBATTS project Work Package 5 - Intelligence in Mobile Battery Applications (IMBA)
[2] The ALBATTS project Work Package 4 - Intelligence in Stationary and Industrial Battery Applications (ISIBA)

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Prediction of **pack deviations** (remote monitoring of the state of health of the battery) and **preventive repair**, **traceability** of the battery pack **during the lifetime**, **handling and transportation of damaged packs, end-of-life vehicles,** and **recycling** are areas to play a significant role in the future. Apart from knowledge of electric vehicle specifications and diagnosis of defects, **occupational safety** issues linked to the high voltage come into place. In Belgium or Germany, for instance, they work with four qualification levels of personnel, where each level comprises certain qualifications and tasks the worker can perform.

Investment in special tools and equipment, including personal protective equipment, is essential. It is instrumental to use **practical examples within the training** – e. g. opening of the battery pack, using **virtual reality,** etc. **Lifelong learning** is essential. Besides instructions for repair, information for **first responders/emergency** is also created.

The EU legislation tackles not only vehicles but also EV batteries. The currently negotiated proposal for a **Regulation on batteries**[3] will set demanding requirements in areas like sustainability, safety and labelling, recycled content, electrochemical performance and durability, carbon footprint, due diligence in the supply chain, restriction of hazardous substances, collection, treatment, and recycling of waste batteries. This will have implications also for the jobs and skills.

As new battery factories in Europe will demand thousands of workers, requalifications and relocations will be necessary. More **development and testing engineers**, **electronics engineers, material scientists, electrochemical and chemical engineers,** or **software developers** will be needed. Some skills can be converted from job roles related to conventional vehicles - like assembly; some jobs become obsolete; some will need intensive re-training. Competences related to **quality control and applying standards**, **certification activities, processes of compliance, testing, inspection** will be highly relevant as well.

[3] *Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries… (COM/2020/798)*

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Repurposing and remanufacturing of EV batteries will require **specific skills** in authorised workshops. Rules on **carbon footprint** will require competencies and professions like **emissions modelling and simulation**, **climate scientists**, as well as **lawyers** and **accountants**. The electronic exchange system and "battery passport" will necessitate **monitoring and sharing information**. Due diligence, including responsible sourcing of raw materials, will impact the employment of **procurement departments**. **The use of batteries in the grid** allows creating new tools and business services, triggering communication platforms with security and **personal data protection challenges**.

This development will require **IT, digital skills (installers and support), programmers, application developers, service security experts, cybersecurity experts, data scientists (forecasting tools)**, knowledge of **mathematical formulas, battery,** and **system optimisation**. **STEM education** and the sector's attractiveness will be key to ensuring a sufficient number of workers. Electromobility means interaction and merging of mobility and energy industries – even more discussion between the areas will be vital.

The development of innovation and technology is rapid and advanced in the **maritime sector**, where **battery technology is a key driver**. In addition, the industry is at the forefront in **autonomous operations**, which drive the use of **Virtual Reality** and **advanced simulation technology**.

Knowledge of **digital twins** and **virtual prototyping,** enabling data-driven decision-making and understanding of complex data, is crucial. Competencies in **automation, IT and cyber security, computer science, testing, big data processing,** and **user interface** will be needed. **Gaming technology** used in virtual prototyping and simulation creates many opportunities.

Computer engineers, 3D artists, and **developers** have become increasingly important. New jobs are emerging in **remote operations (certified operators). Ship engineers** will need knowledge about **alternative fuels**, like ammonia or electric energy. **Safety awareness** and **emergency response**, also concerning these new propulsions, **will be essential.**

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All information about the events with speakers' bios, presentations, and recordings can be found on the project ALBATTS website.[4]

[4] https://www.project-albatts.eu/en/listnewsevents

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LIST OF ABBREVIATIONS

AC	…	Alternate current
AC RMS	…	Root mean square alternate current
ADAS	…	Advanced driver-assistance systems
BC	…	Battery centre
BEV	…	Battery electric vehicle
BMS	…	Battery management system
CO2	…	Carbon dioxide
DC	…	Direct current
DCIR	…	Direct current internal resistant
EMF	…	Electromotive force
EPR	…	Extended producer responsibility
EV	…	Electric vehicle
FCEV	…	Fuel cell electric vehicle
HV	…	High voltage
ICE	…	Internal combustion engine
ICT	…	Information and communication technologies
IEC	…	International Electrotechnical Commission
IMBA	…	Intelligence in Mobile Battery Applications
IPR	…	Intellectual property rights
ISM Code	…	The International Safety Management Code
ISPS Code	…	International Ship and Port Facility Security Code
MMLV	…	Multi-material lightweight vehicle
OCV	…	Open-circuit voltage
OECD	…	Organisation for Economic Co-operation and Development
OEM	…	Original equipment manufacturer
PEFCR2	…	Product Environmental Footprint Category Rules Guidance 2
PPE	…	Personal protective equipment
SOLAS	…	International Convention for the Safety of Life at Sea
STEM edu	…	Science, technology, engineering, math education
SW	…	Software

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TMS	…	Temperature management system
UN	…	United Nations
VR	…	Virtual reality

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1 INTRODUCTION

The organisation of workshops is specified as Task 5.4 Future Needs Definition in the ALBATTS project application. Within this task, altogether three reports are expected: the first report (named Delivery 5.3 or shortly D5.3 in the project application) was published in February 2021, focusing on job roles and skills relevant to battery applications in the automotive and maritime sector. This is the second report (D5.6). The third one (D5.9) is due in February 2023.

The workshop activities **build on previous tasks** carried out by the ALBATTS project, extend the sectoral intelligence gathered within the project, and **serve as an input** for deliverables of the ALBATTS project Work package 3 - Sectoral Intelligence, where the findings will be elaborated in more detail, and Work package 6 – Training and Education. The latter mentioned work package will use data from the report to address its main task, which is to propose updates of the curricula, introduces training, etc., to reflect the future skills needs relevant to the emerging battery eco-system.

Organisation of webinars

Due to the synergies, the organisation was coordinated in **joint meetings** of relevant partners of Work Package 5 (WP5 – Intelligence in Mobile Battery Applications, IMBA) and Work Package 4 (WP4 – Intelligence in Stationary and Industrial Battery Applications, ISIBA). These weekly meetings led by project partner EFACEC dealt with overall coordination and ensured a consistent approach to the organisation of the workshops.

To deal with daily issues and specifics of the individual webinars, several **working meetings** were organised and led by partners responsible for the individual workshops.

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2 SERVICING OF ELECTRIC VEHICLES

The decision to focus on battery application in the automotive sector was taken by the project partners involved. Reasons include the **growing number** of electric vehicles on the European roads and the emerging lack of personnel qualified with their servicing and maintenance.

Know-how and contacts of some of the WP5 partners who are associations of entities in the automotive industry (APIA, AIA, ACEA) also played a role. The webinar was organised, including rehearsals etc., by a small **organisation team** led by APIA, where EUPPY, AIA, Merinova, ACEA and other project partners also participated.

The webinar **"Servicing of Electric Vehicles: Future Qualifications Needed"** was held on **September 29th, 2021,** from 10.00 to 11.30 CET. The webinar aimed to provide a useful and valuable overview of the **actual and future needs** in servicing and maintenance operations for electric vehicles (EV) in terms of skills, competencies, and job roles, focusing on the needs and offers of training, the views of car manufacturers, repairers, and training providers.

Agenda

Figure 1: Webinar agenda

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Altogether 162 registration requests came from 33 countries (16 from outside the EU). The top origin of registrations was India, Portugal and Austria. 44% of registrations came from the industry sector and 39% from the education sector.

The webinar was attended through the Cisco Webex platform by **80 participants**. It also was live-streamed to Facebook. In addition, presentations and the video from the workshop have been available on the ALBATTS website, thus enabling an even wider reach to the stakeholders.

Moderator and speakers

Figure 2: Biographies of the moderator and the speakers

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Rafał Biszcz is the Director of the PIRE Knowledge Hub, where he has bulit an organization focused on acquiring and systematizing the technical knowledge concerning all aspects of electromobility. Rafał started his electromobility journey in 2018, when when he had built the Defect Engineering team in the newly constructed LG battery plant in Wroclaw. He also has over 100 hours consulting experience within various projects connected with electromobility – mainly within the scope of the batteries.

Daniel Brown is the manager of the Lucas-Nülle Academy (Germany) and is an automotive industry and training and assessment expert with over 20 years' experience spanning across two continents. Founding manager of the completely new LN Academy and responsible for its conception and strategy, he developed the world's first hybrid or electric vehicle skill station currently being used at Worldskills international (Kazan), SkillsUSA and Worldskills Germany. Also, he developed the curriculum used in US automotive programs to cover the ASE L3 certification for hybrid and electric vehicle technician certification. He specialises in electric and hybrid vehicle training for various countries, the different training standards used, and building strategic partnerships for Lucas-Nülle with education partners and certificate awarding organisations from around the world.

Sjoerd Zijlstra is experienced in Training with a demonstrated history of working in the professional training & coaching industry. Skilled in Hands-on Training, Coaching, Continuous Improvement, Business Development, and Automotive Engineering. He is the Director of Studies and Training Development at EDUCAM Belgium (a knowledge and training centre for the automotive industry)

Hanna Persson has been working for Volvo Cars for ten years. Her role is Product Owner for Volvo Cars three regional battery centres and she is managing the HV battery roadmap for Volvo Cars Service Business and EPIC's related to batteries. She is also leading and balancing the HW and SW battery requirements for serviceability and battery exchange for all car and battery platforms within Volvo Cars. She is also the technical expert in the method development of battery repair and battery refurbish in the Battery centre. Prior to this she has been leading the Battery 2nd life strategy and pilot project as well as developed refurbish methods for Volvo first generation of PHEV batteries. For this development work she won the Volvo Cars Technology Award in Sustainability in 2020.

Krzysztof Burda is a co-founder and CEO of the Polish Chamber of E-mobility Development Association. He is a practitioner in the electromobility industry, with a focus on the development of charging infrastructure for electric vehicles. He is a co-creator of the *E-mobility now!* program, which involves building real electromobility in local government units, through a number of bottom-up activities (including education, infrastructure, promotion, information) aimed at creating appropriate conditions for the development of electromobility that will be future-proof and suitable for a growing market. He has participated in many congresses, conferences, and working groups aimed at developing the right conditions for electromobility in Poland.

Figure 3: Biographies of the speakers

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Moderator

James Copping (DG GROW, European Commission)

Key messages:

- Green Deal – EU target of climate neutrality by 2050 – transport sectors' emissions also in focus
- EU Sustainable Mobility Strategy – proposed 90% emission reduction from transport by 2050, predicted at least 30 million EVs on EU roads as a target
- "Fit for 55" package – measures to achieve 55% emission reduction by 2030 – incl. tightening of CO2 emissions from vehicles and measures concerning alternative fuels infrastructure
- Support to the EU battery sector – European Battery Alliance – **70 major projects, 60 bn. EUR of public and private investments at the moment, expected to reach 250 bn. EUR by 2025, InnoEnergy estimates this will lead to 3 – 4 million jobs, at least 800 thousand current workers** will need to be re-trained – motivation to support ALBATTS in partnership with DRIVES and the Automotive Skills Alliance
- Key principle – the whole battery value chain to be supported
- The rapidly increasing number of EV registrations means a lot of qualified EV servicing personnel will be needed.

Speakers

Jakub Stolfa (the Technical University of Ostrava, DRIVES coordinator, ALBATTS Work Package leader, Automotive Skills Alliance representative)

Key messages:

- Changes in the automotive sector – **decarbonisation, digitalisation, new mobility concepts, the impact of Covid-19**
- DRIVES project – new skills in the automotive sector – results: **sectoral skills strategy** available on the website (https://www.project-drives.eu/en/home)
- ALBATTS project – new skills relevant to the **battery value chain** (https://www.project-albatts.eu/en/home)
- **Automotive Skills Alliance** – based (not exclusively) on DRIVES and ALBATTS. Within the Alliance, EV servicing topics are being dealt with in a **working group** led

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by CECRA

- Education providers are invited to register their **courses in DRIVES**, while webinar participants are invited to register for the courses.

Figure 4: Illustration from the presentation of Jakub Stolfa

Bernard Lycke (European Council for Motor Trades and Repairers – **CECRA)**

Key messages:

- Some member companies fear their revenues will decrease
- New skills envisaged – **knowledge of electric vehicle specifications, diagnosis of defects in the electric vehicles, maintenance and repair of electrical systems, knowledge of services and accessories to electric vehicles**
- **Safety issues** – some works on vehicles using new materials are potentially dangerous to people and infrastructure – also relevant to battery electric vehicles and hydrogen
- **Lifelong learning** is essential – an open mind is a key prerequisite
- Training is needed particularly for battery-electric vehicles but also for **hydrogen** vehicles. Servicing training is essential to ensure future mobility and social inclusion.

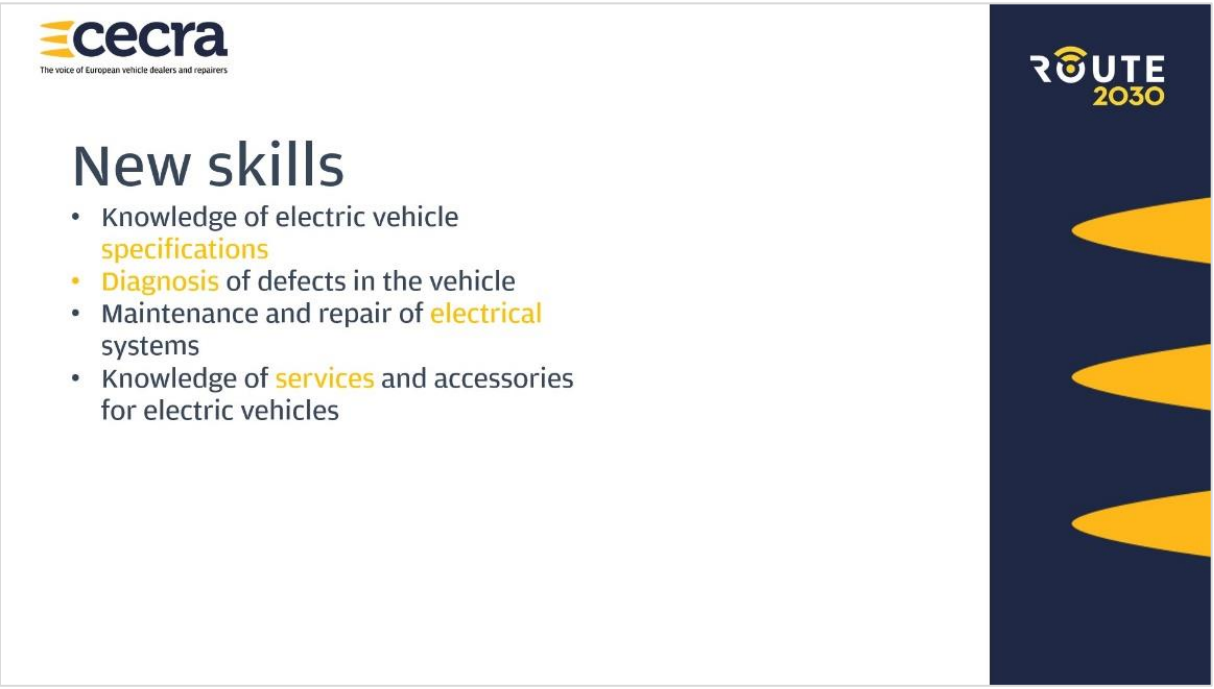

Figure 5: Illustration from the presentation of Bernard Lycke

Sjoerd Zijlstra (EDUCAM Belgium)

Key messages

- There has been a lack of **electrical competence** in garages for some time already, and this will very much increase in the future with electric vehicles
- Missing skills in the car repair segment identified – **electricity, diagnostics (ICT knowledge), MMLV repair, BEV, hydrogen, ADAS, connectivity**
- Different levels of EV servicing qualifications developed in Belgium started ten years ago using examples from other countries since the **topic was not dealt with on the EU level.** The key topic is safety, being dealt with on different levels:
  - Level 1 – **Aware** (employees especially need to know, be trained) – workers who do not touch the HV (high voltage) system but **still need to be aware.** This includes also servicing personnel that changes tyres and does wheel alignment as they work close to the battery pack. An example was given of personnel who were not aware they worked on an EV. When doing the wheel alignment, they took out the battery pack bottom cover, considering it a typical plastic cover underneath the car, making thus the battery pack lose

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- Level 2 – **Qualified** – disconnecting the HV system
- Level 3 – **Specialised** – situations where it is not possible to take the electrical risk away by disconnecting the HV system – e. g. working inside the battery pack. It is crucial to follow exactly manufacturer procedures very precisely. Procedures for working on HV systems were re-developed last year in a workshop with servicing managers of all the car brands present in Belgium, including minimum requirements everybody shall have: **safety, risk awareness/mitigation/analysis, technical competencies, knowledge of basic electricity, practice for opening the battery pack, including tools being used for working in the battery pack.**
- Level 4 – **Expert** – this level is being developed now in Belgium – sometimes the car or the battery pack is in a situation when there is no procedure yet – experts develop the procedures for others. This is also being done for hydrogen.

- Practical examples are used within the training – e. g. opening of the battery pack, **VR (virtual reality) training** they developed is being used for some situations (e.g. working on the battery pack)
- Some situations are **unpredictable** – reactions of people to different situations are part of the training.

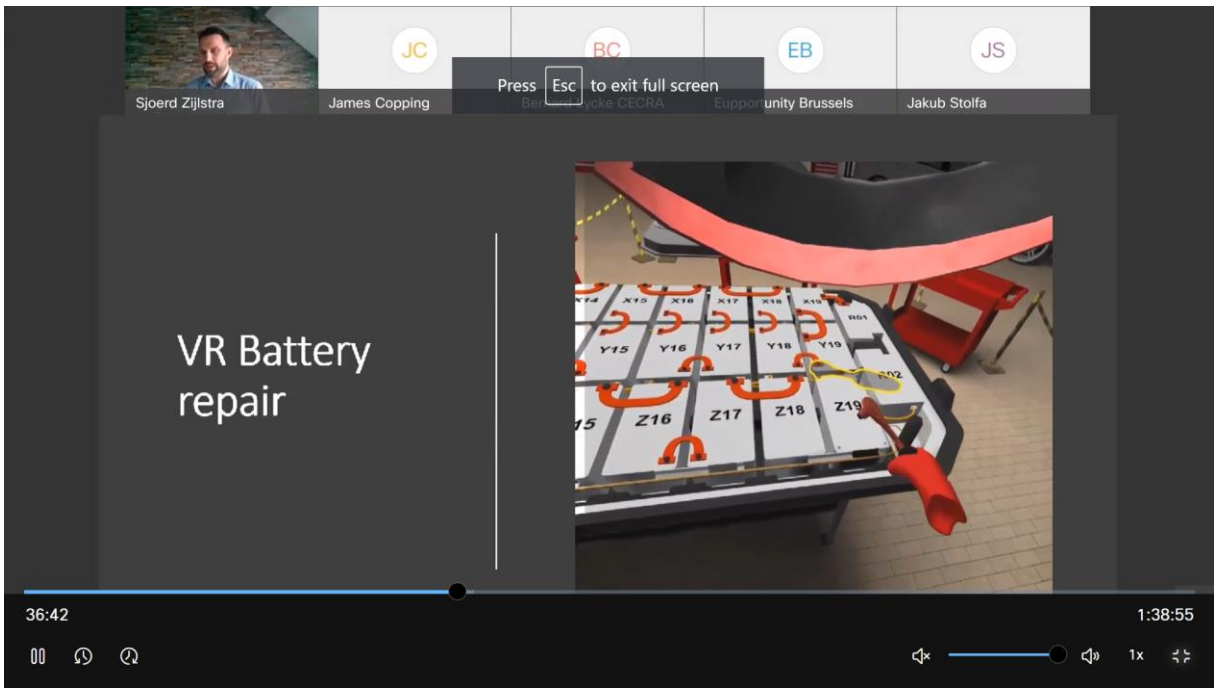

Figure 6: Illustration from the presentation of Sjoerd Zijlstra

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Hanna Persson (Volvo)

Key messages:

- Among the main challenges related to EVs are **cell failure rate, compatibility of new chemistries and cells, spare parts supply, prediction of pack deviations and preventive repair, traceability of the battery pack during the lifetime, transportation of damaged packs, end-of-life vehicles, recycling**
- Battery **remote monitoring** to predict a failure – a system is being developed to understand and follow battery State of Health on individual and fleet level
- Main challenges for service workshops and battery centres – **safety, battery diagnostics, education of workshop technicians, investments for dealers in special tools and equipment, documentation, traceability of battery – after repair in the BC, the pack changes its battery pack ID, handling of all battery variants, information for first responders/emergency**
- Competences needed in service workshops and battery centres – **how to handle a battery with isolation faults, electric order of cells/modules, disassembly/assembly of high voltage systems, disconnection of the battery from the vehicle, interpretation of fault codes, and understanding what to repair, drainage of damaged battery pack/module.**

Figure 7: Illustration from the presentation of Hana Persson

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Krzystof Burda (Polish Chamber of E-mobility Development Association)

Key messages:

- The chamber dealt with new competencies within the Sectoral Skills Council for Automotive and Electromobility (schools, universities, industry) in June 2021
- The most important recommendation was to include a **new profession** in the Polish national ministerial list, create a core curriculum of the profession **Electromobility Technician** on the technical secondary school level, a course for engineers at the university level, and to establish **short forms of education** to upskill/reskill the current workers in the automotive sector
- Education shall provide courses with new skills needed for **car servicing, charging infrastructure, IT sector – knowledge of programmes such as Python, C++, Java skills, cybersecurity, autonomous vehicles.**

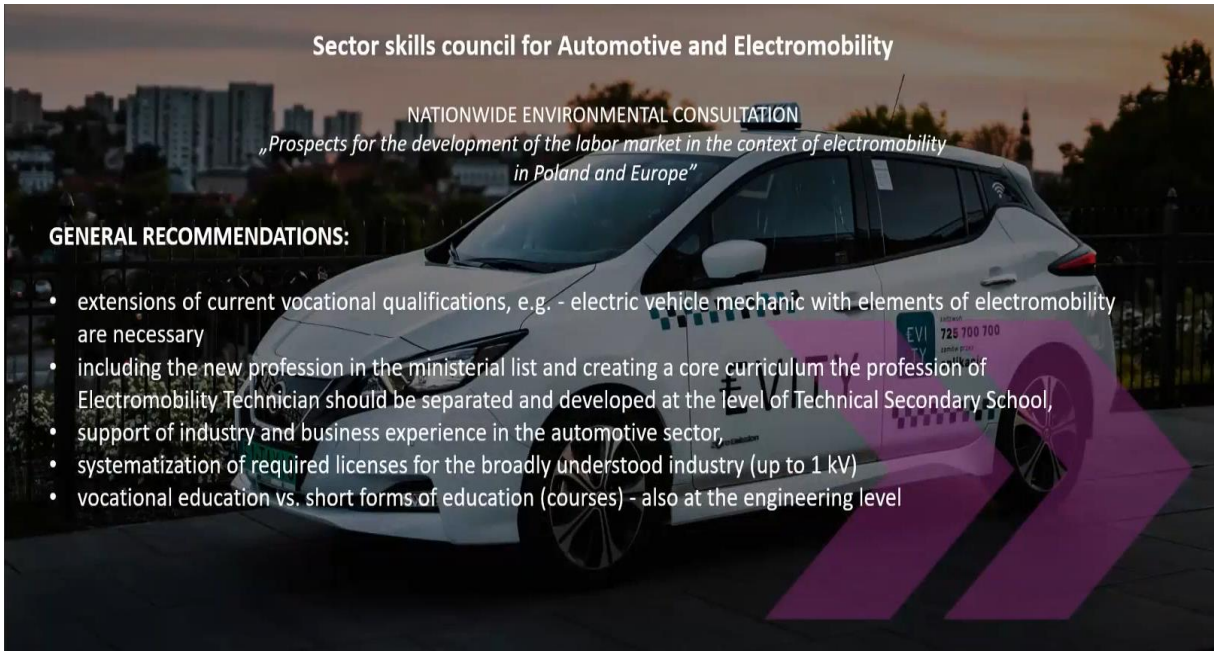

Figure 8: Illustration from the presentation of Krzystof Burda

Rafael Biszcz (Polish Chamber of E-mobility Development Association)

Key messages:

- A combination of competencies in the following fields is essential for e-mobility: **mechanics, electronics, energy, electrochemistry, programming**

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- The industry is hustling, having no time to do the training. Transfer of knowledge from the academy to the industry needs to be done in a comprehensible way.
- Different **variants of batteries** make the situation more complex
- PIRE knowledge hub provides **training guidelines** for all EV relevant skills
- It is essential to start with the basic **HV skills,** and then more expert levels can follow.

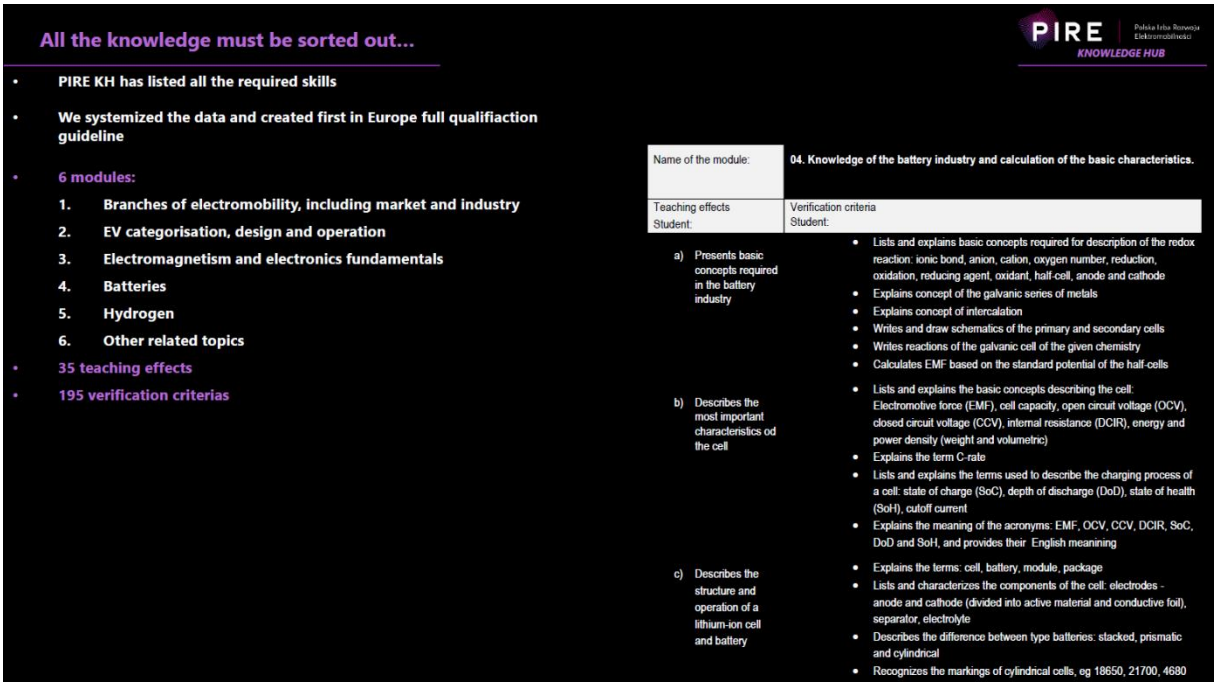

Figure 9: Illustration from the presentation of Rafael Biszcz

Daniel Brown (Lucas-Nülle Academy, Germany)

Key messages:

- Challenges to EV servicing – **Safety knowledge requirements, technical knowledge, and competencies, how to standardise the training**
- According to an IMI survey, only 6,5% of UK service technicians have some basic qualifications to deal with high-voltage vehicles
- Safety – important is to understand the dangers of high voltage, the use of Personal Protective Equipment (PPE – gloves, (helmets with) glasses, full-length clothes, measuring equipment), following insulation and voltage-free status check procedures

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- Creating a **culture of safety** incl. warnings for third persons, awareness of unsafe procedures
- The work various **WorkSkills associations** – HV skills were the topic of the event SkillsUSA First National HV Skills Station 2018 – findings: more than 50% of the participants had no HV experience, poor knowledge of PPE or specialised tools
- There is a knowledge gap in the following areas: **high voltage batteries, inverters, 3phase motors, DC/DC converters, insulation testing, potential equalisation**
- Lithium-ion HV batteries – transport is difficult – dealerships shall be ready for the repair to **avoid unnecessary transport**. In addition, the battery pack is often well-sealed – batteries can be destroyed when opening the cover
- Training:
  - Level 1 – **Awareness training**
  - Level 2 – **Isolate HV vehicles**
  - Level 3/4 – **Working on HV battery**
  - **First responders** – receive a special training

Figure 10: Illustration from the presentation of Daniel Brown

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Debate & questions

This section consolidates the debate section of the workshop:

- **On-board diagnostics** are expected to play an even more important role in the future
- The maintenance of EVs is expected to be simpler than that of ICEs. However, **diagnostics in the battery pack** and of the HV parts will get much more complex
- **Electromagnetic training** should be provided understandably also outside the university level – e. g. at the lower technician level
- **EU-wide qualification standards** for EV servicing qualifications shall be developed
- Servicing of **hydrogen** vehicles shall be addressed as well.

Chat box discussion (selection)

Q: What is the setup cost for training Battery technicians?

A: The **basic equipment needed for the battery analysis**:

1. Measurement tools (scale, ruler, calliper, micrometer, thickness meter)

2. Good quality multimeter (you should be able to set up voltage when checking for short circuit)

3. Oscilloscope with differential probes

4. Microscope to look for defects

5. Cyclers

The most important:

6. Glovebox with the ability to reach 1% humidity

Basic list everybody must use and of course more

+ PPE with insulated tools and equipment.

Q: Is **Predictive Analytics** required before servicing/maintenance to ease maintenance services?

A: Predictive analytics is quite challenging at the moment, as the vehicle manufacturers are not keen to share their BMS internal data. You cannot get much information via OBD. However, the data analysis will be crucial in the future, as there is only a limited number of

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sensors inside the battery pack. Therefore, we must analyse the data very carefully to predict failure.

The only data which we have are:

1. Module temperature (in Chevy Bolt, there are only 6 sensors for 10 modules!)
2. Cell group voltage
3. Cell group current
4. Cooling liquid temperature (if there is TMS)

IEC voltage range	AC RMS voltage (V)	DC voltage (V)	Defining risk
High voltage	> 1 000	> 1 500	Electrical arcing
Low voltage	50 to 1 000	120 to 1 500	Electrical shock
Extra-low voltage	< 50	< 120	Low risk

Automotive Engineering is a bit different - High voltage is considered 60V DC or 30V AC

Augmented reality is indeed a good academic tool, but there is no doubt that teaching with real elements is inevitable.

Q: How to consider that a **battery is defective**?

A: Before the cells leave the cell plant, there are many indicators.

The most reliable is OCV tracking for self-discharge, capacity testing, and DCIR.

Errichten von Niederspannungsanlagen/Establishments of low voltage devices – **the relevant norm:** E DIN-IEC 60364-4-43 VDE 0100-430:2017-05

The industry needs some **regulation** and especially now with EVs being widely utilised

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Batteries are complex. Technicians know about Ohm's and Kirschoffs laws, but not many people realize what **EMF or internal resistance is**.

Ex-post satisfaction survey

After the workshop, a **satisfaction survey** was sent to the registered participants. The

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response rate was 19%, with 15 people answering. Overall, the participants were **very satisfied** with the workshop.

What is your **overall assessment** of the event**?**		
Choice	Answers	%
1=Insufficient	1	6.7%
2	0	
3	0	
4	5	33.3%
5=Excellent	9	60%
Total	15	100 %

In the opinion of the survey participants, **the most relevant** future jobs and skills needed in the battery production sector are:

In your opinion, what are the battery relevant **future jobs and skills** needed in the battery production sector?
Deep technical understanding
Safety skills
High qualification and additional skills (digital) for R&D
Deeper electrochemical understanding

Most of the participants (87%) answered that they **gained** knowledge and information from the workshop

Knowledge and information gained from participation at this event?		
Choice	Answer	%
Yes	13	86.7%
Somehow	2	13.3%
No	0	
Total	15	100 %

Recommendations for the organisation of future webinars

- **Timing/number of speakers** need to be adjusted to ensure each speaker has enough time for the presentation and the seminar does not need to be extended
- More information related to **challenges** that occur within OEM EV/FCEV

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- Matching future qualifications with actual competencies in the **VET system**
- Create regional **collaborative networks** where car garage/brands/VET centres design a roadmap to develop new jobs and competences.

Key findings and next steps

- The **trends** identified within the workshop include a rapid growth of the electrification of the vehicle fleet causing an increasing need to provide training at **different levels.** This training must range from basic training of EV users or even the general public to expert knowledge needed in the service shops when doing battery diagnostics or particularly when working inside the vehicle batteries packs.
- It seems that knowledge at different levels is **scattered** among various actors, and **centralisation** of the information sources, training opportunities and **standardisation** of training is high in demand
- Training relevant to **hydrogen** vehicles should not be forgotten
- Several actual and future job roles and skills, training tools, and relevant recommendations were **identified** within the webinar. **These will be elaborated in detail and extended by additional data in the upcoming Work package 3 report due in May 2022.**

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3 IMPACT OF THE NEW EU BATTERY REGULATION PROPOSAL

The webinar **"New EU Regulatory Proposal: Implications for the Job roles & Skills "**was organised to learn about implications of the currently negotiated legislative *Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries… (COM/2020/798)* for the automotive value chain and energy sector and the job roles and skills needed for the future.

The webinar was held on **October 22nd, 2021,** from 11.00 to 12.30 CET. It was organised, including rehearsals etc., by a small **organisation team** led by ACEA, where AIA, EUPPY, EFACEC, Merinova and other project partners participated.

Altogether 98 persons registered for the webinar, and out of these, **52 participated**. Others could watch via Facebook. Registration requests came from **21 countries** (5 from outside the EU). The top origin of registrations was the Czech Republic, Germany, Belgium, Portugal, Finland and Sweden. **55%** of the registrations were from the industry sector and **20%** from the education sector. Presentations and the video from the workshop have been available on the ALBATTS website, thus enabling an even wider reach to the stakeholders.

Agenda

Figure 11: Webinar agenda

Moderator and speakers

Zdenek Petzl represents Czech Automotive Industry Association since 2016. In his role as Executive Director he actively defends the interests of its member companies and he participates in the creation of programs and policies supporting the automotive industry. Previously, he worked at the Ministry of Foreign Affairs as a senior lawyer in the office of government representative for the Czech Republic before the EU Court of Justice and as Legal Advisor to the Internal Market Ambassador at the Permanent Representation of the Czech Republic to the EU.

Kari Valkama is a project manager at the Technology Centre Merinova in Finland. Merinova is a key member of the energy cluster in the Vaasa region. Its cutting-edge expertise is in energy technology, business development and operational conditions. Technology Centre Merinova is involved in various projects, programs and services both regionally, nationally and globally. Kari holds a degree in Business Administration. He has years of experience in working with business and general development related tasks in SME companies in metal and cleantech industries.

Amélie Sophie Salau joined ACEA in August 2020 as Environmental Policy Director.
She is on a secondment for Volkswagen.
She worked over 15 years for the Volkswagen group in different areas.
She is a political scientist by education.

Figure 12: Biographies of the moderator and the speakers

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Simon Godwin is the Delegate for European Government Affairs of BorgWarner Inc., a global automotive supplier that delivers innovative and sustainable mobility solutions for the vehicle market. In this role, he collaborates with other companies and stakeholders to advocate for regulations that encourage lower emissions and higher efficiency while supporting a competitive industry and affordability for consumers. He is also the Chairman of the Impact Assessment Institute, which scrutinises evidence for policy making in a broad range of sectors. Previously he was the Director of EUCAR, the automobile manufacturers' research association, and Senior Manager at Daimler AG. He also spent three years as an internal auditor at a Merchant bank in the City of London. Simon gained his Bachelor's and Master's degrees in Physics from Oxford University and his Ph.D. in Mechanical Engineering from Imperial College, London.

Michelangelo Aveta is the Advisor for Electromobility and Energy Efficiency at Eurelectric, the sector association representing the European electricity industry. With members in over 30 European countries, Eurelectric speaks for more than 3,500 companies in power generation, distribution, and supply.

Before joining the association in 2021, Michelangelo worked in Brussels for three years as a public affairs consultant advising associations and corporations from the automotive and transport sector. Michelangelo holds a bachelor's degree in Political Science and a master's degree in International Relations from the LUISS Guido Carli University in Rome, and a master's degree in European Political and Governance Studies from the College of Europe in Bruges.

Michiel Verbeeck works in the Consumer Centricity department of Elia Group where he follows up different technologies that could help society to make the transition to a more consumer centric system. Previously he worked in consultancy and did some implementations of demand side management solutions.

Figure 13: Biographies of the speakers

Moderator

Zdeněk Petzl (Czech Automotive Industry Association, ALBATTS WP5 leader)

Key messages:

- Brief description of the legislative proposal:
  - date of publication by the EC (December 2020)
  - main **areas it covers** (sustainability, safety and labelling, requirements on recycled content, electrochemical performance and durability, carbon footprint, due diligence in the supply chain, restriction of hazardous substances, collection, treatment and recycling of waste batteries or creation of an electronic record - a so-called "battery passport")
  - **types of batteries** it applies to (portable, classical automotive, electric vehicle and industrial batteries)

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Speakers

Kari Valkama (Merinova, ALBATTS WP4 leader)

- Presentation of the **ALBATTS project**
- The purpose of the project is to help to make Europe a **competitive player** in the battery eco-system by defining relevant jobs and skills needed by the sector and enabling the education sector to provide **education and training** for the future employees and specialists needed by the battery sector (incl. recommendations for **curricula changes** or developing **pilot courses**).

Amélie Sophie Salau (ACEA)

Key messages:

- Short information on ACEA – European Automobile Manufacturers' Association - and EU automotive industry representing **12.7 million workers** in the European auto industry (directly and indirectly), accounting for **6.6% of all EU jobs**, and investing €62 billion in R&D per year, which means automotive is Europe's most significant private contributor to innovation, accounting for 33% of the EU total
- The automotive industry is undergoing a massive transformation
- Electric vehicles are gradually accepted by customers. BEVs and PHEVs represented almost **14%** of newly registered passenger cars in 1. Q 2021 – requires **changes in dealerships and repair shops,** authorised personnel working on EVs needs to be able to work on **high voltage**; this is also relevant to **rescue teams**
- As for the proposal for the Regulation, battery and vehicle need to be perceived as one product. Batteries cannot be treated separately; it is highly relevant for EV battery performance and durability parameters, activities are taken at UNECE level; workers in OEMs will need **skills to deep dive** into the parameters required by the regulation
- Implication for jobs and skills in the automotive sector, as **OEMs also become producers** of batteries
- More **development and testing engineers** are needed, also **software developers** or **chemical engineers** – that means a holistic approach to cars
- Recycled content requirement – not reasonable from the perspective of

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technological development or development of the market with recycled materials

- Repurposing and remanufacturing of EV batteries – **authorised operators must perform repair, reuse, remanufacturing and repurposing in authorised workshops** as specific skills are crucial; **data collection and sharing** is carried out already under dismantling information
- Electronic exchange system and "battery passport" will require **monitoring and sharing of information** - assessment of existing tools (like Dismantling Information System) as well and real needs of stakeholders is essential
- Due diligence, including responsible sourcing of raw materials – impact on employment of **procurement departments**; need to avoid overlaps in legislation and administrative burden.

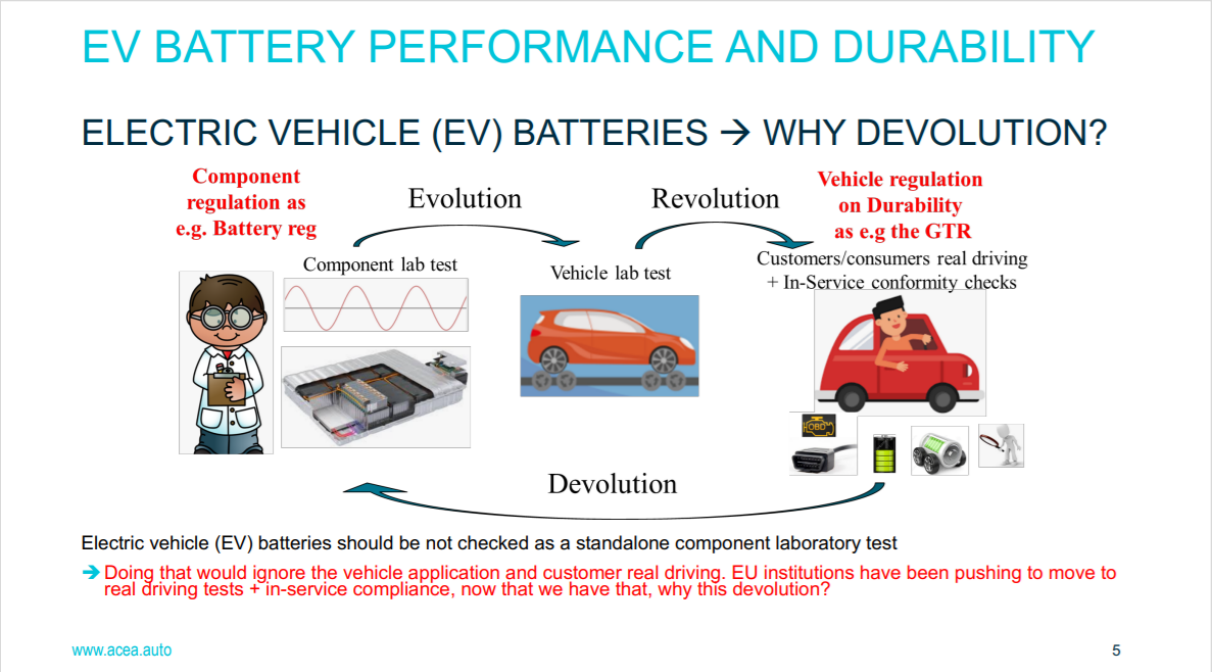

Figure 14: Illustration from the presentation of Amélie Sophie Salau

Simon Godwin (BorgWarner, CLEPA)

Key messages:

- Short presentation of CLEPA – European Association of Automotive Suppliers – representing **5 million jobs** in the EU
- Presentation of BorgWarner and its activities, 50% related to vehicle electrification

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by 2030

- The industry will need more **electrochemical engineers, electronics engineers, material scientists and chemical engineers, SW engineers**; some skills can be converted from job roles related to conventional vehicles - like assembly; some jobs become obsolete, some will need intensive re-training; **STEM education** and attractiveness of the sector will be key to ensure sufficient number of workers
- Recycled content requirement – company targets per year instead of requirement per battery would enable better planning and less burden for companies; could be contradictory to high purity needs, lack of recycled materials on the market (would limit the growth of European production) or hinder second life of batteries; **skills implication**: recycling technologies will become one of the primary activities of the sector – **materials and chemicals scientists** and **technicians** will be in great demand
- A grandfather clause is necessary to avoid retroactive application to replacement batteries and spare parts; otherwise, it would lead to the situation where skilled resources will be deployed in designing replacements for low volume legacy products instead of high-value new products
- Restriction of hazardous substances – should not duplicate REACH and other legislation already in place; **chemical engineers** will be highly demanded
- Requirements like those on carbon footprint will require competencies like emissions modelling and simulation, **climate scientists**, as well as **lawyers** and **accountants**
- It is necessary to avoid duplication in durability and performance requirements, align to UNECE standards; **engineers** and **physicists** will be needed

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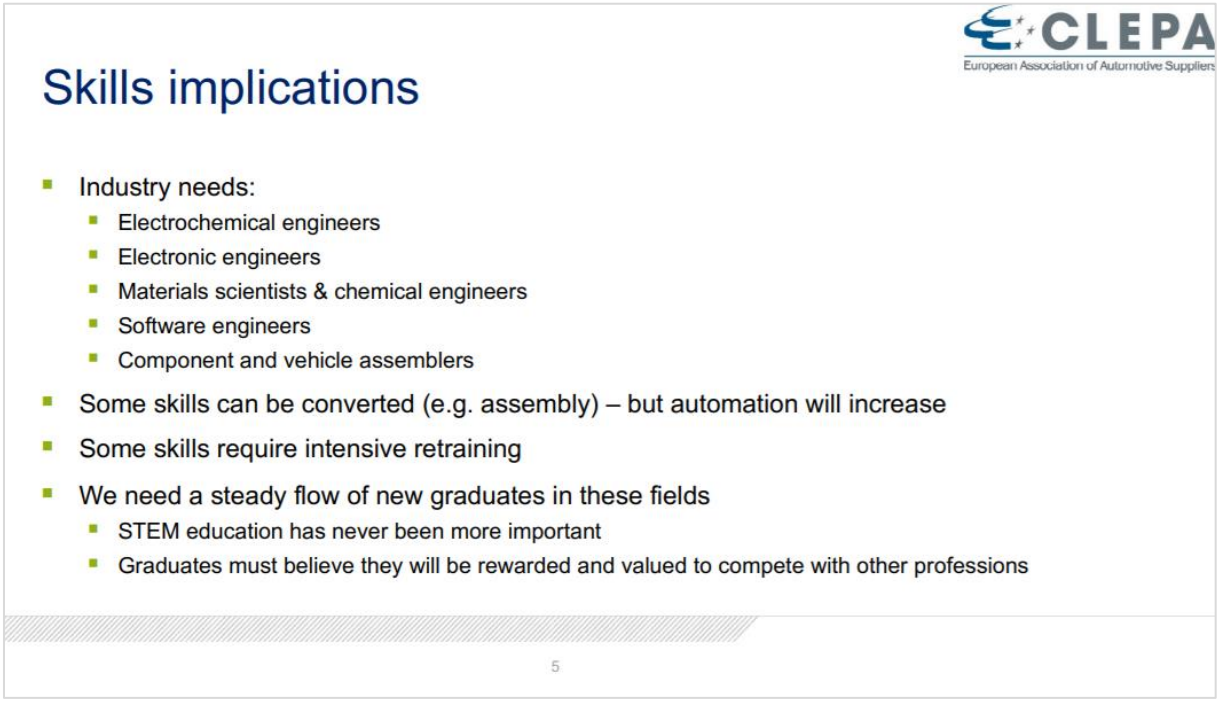

Figure 15: Illustration from the presentation of Simon Godwin

Michelangelo Aveta (EURELECTRIC)

Key messages:

- Electromobility means interaction and **merging of mobility and energy** industries – more discussion between the sectors are needed, e. g. launching of Platform for electromobility (https://www.platformelectromobility.eu/)
- The size of transition is immense – labour demand in the battery sector will increase, and **requalification and relocations** will be necessary
- Carbon footprint declaration should be based on PEFCR2 currently under revision. Provisions should apply per battery model, manufacturing plant, raw materials extraction processes and supply chain configurations; not feasible for all industrial batteries
- Due diligence – should also cover the sectors competing with electric transport; link to UN and OECD guidelines and principles needed
- "Battery passport" – needs to be designed in a way so it encourages a data-sharing economy while ensuring confidentiality
- Repurposing and remanufacturing – access to BMS data needs to be clarified concerning safety and IPR protection

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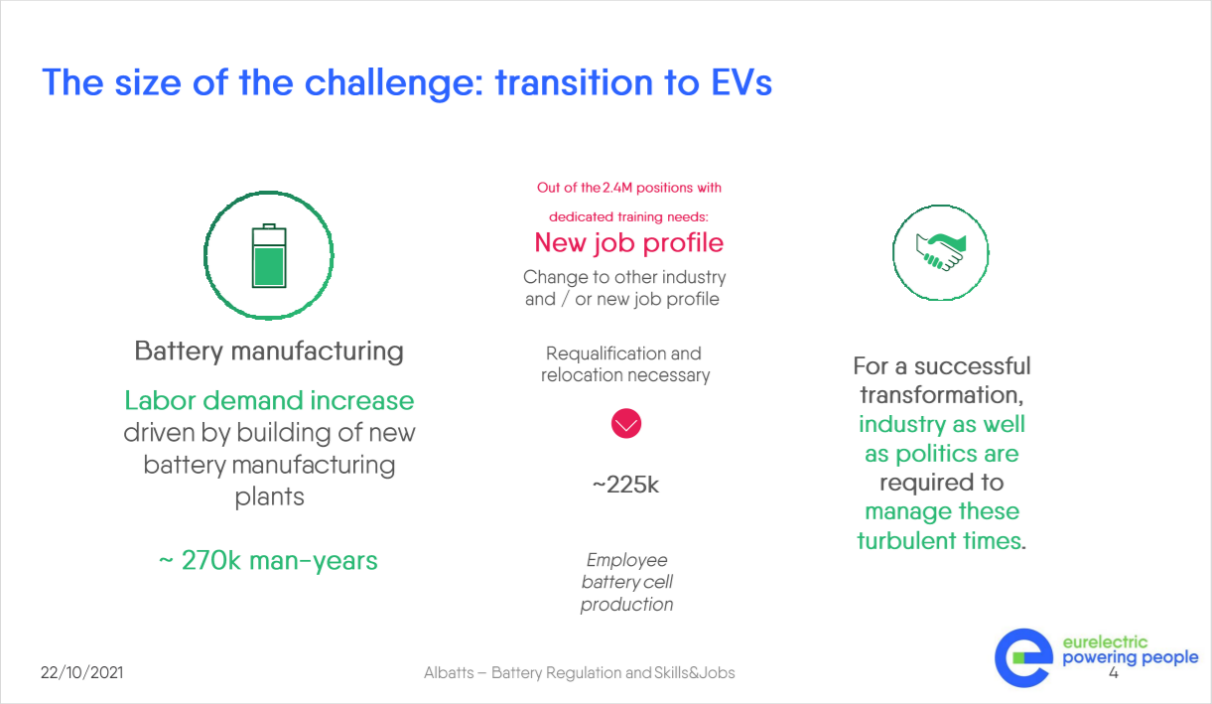

Figure 16: Illustration from the presentation of Michelangelo Aveta

Michiel Verbeeck (ELIA Group)

Key messages:

- Short presentation of ELIA Group – TSO, balancing the grid, operating in Belgium and Germany
- Highlighting the importance of batteries to the energy sector
- Batteries will empower consumers, can lower their carbon footprint
- Allows creating new tools and business services, triggering communication platforms, with security and personal data protection challenges – will require **IT, digital skills (installers and support), programmers, service security experts, cybersecurity experts, data scientists** (forecasting tools)
- According to consumer preferences, different settings are created (lower price, green electricity, increase the use of self-consumption etc.) – this will require **mathematical formulas, battery, and system optimisation.**

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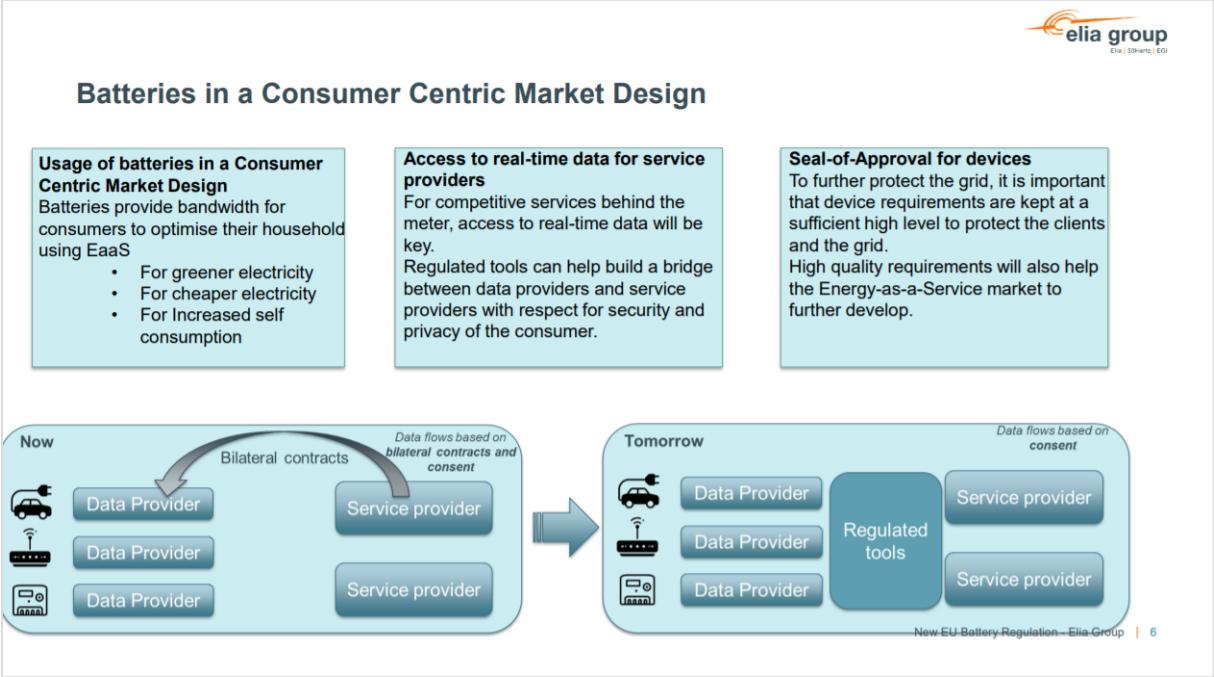

Figure 17: Illustration from the presentation of Michiel Verbeeck

Debate & questions incl. chat box (selection)

Q: OEMs becoming battery producers – what measures are planned to prepare employees?

A: Many OEMs organise **in-house capacity** building, not only for blue-collar, but also for white collars jobs, inviting teachers from universities to help with **lifelong learning.**

Q: What about suppliers, cooperation with the education sector etc.?

A: **Internships**, cooperation in changing curricula taking place.

Q: Data, carbon footprint declaration, battery passport, etc. – which skills does it require?

A: The passport will work as an enabler – **digital and IT skills** will be required; **certification activities, processes of compliance, testing, inspection** will take place; interaction and cooperation with other sectors, like extraction and mining, is necessary.

Q: Forecast - how will the market look, and what skills will it require?

A: Many **digital skills, automatisation and forecasting tools, applications development, consumer protection/personal data**-related jobs.

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Ex-post satisfaction survey

After the workshop, a satisfaction survey was sent to the participants. 5 responses have been received. Overall, the participants were **very satisfied** with the workshop.

What is your **overall assessment** of the event?		
Choice	Answers	%
1=Insufficient	0	
2	0	
3	0	
4	2	40%
5=Excellent	3	60%
Total	5	100 %

In the participants' opinion, the most relevant **future jobs and skills** needed in the battery production sector are:

In your opinion, what are the battery relevant **future jobs and skills** needed in the battery production sector and why?
Competences related to quality control and applying standards
Safety = one of the most important features of a battery for a motor vehicle
Chemical engineers
System engineers
Manufacturing specialists/technicians
Embedded SW engineers
Software architects (incl. SCADA-focused)
Digital skills

All the respondents answered that they learned a lot from the workshop.

Recommendations for the organisation of future webinars

- The number of speakers seemed to be optimal to allow some time for discussion; the presentation time of each speaker needs to be kept as much as possible according to the plan.

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- More **interaction** between the speakers was recommended.
- Stressing even more to the speakers the **focus on job roles and skills.** However, it is quite understandable that this is a challenging task for many reasons. One of them is that the regulation is still being changed within the legislative process and it is still unclear which provisions will be finally there.

Key findings and next steps

- The webinar showed that the new EU battery regulation, while still being discussed within EU institutions, will have important implications for the emerging European battery eco-system and its competitiveness. Its provisions will strongly influence the sector and it can be expected that one of the results will be **"greener" batteries** than those produced outside the EU
- More interactions and **cooperation among different sectors** (mobility and energy, but also inside the battery value chain) will be crucial to creating an efficient eco-system in Europe
- **Requalifications** (both in-house and external, also in cooperation with education institutions) and relocations will be necessary to feed the newly established battery manufacturing plants in Europe
- **Implications on job roles and skills will be elaborated in detail and extended by additional data in the upcoming Work package 3 report due in May 2022.**

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4 AUTONOMOUS OPERATION AND VIRTUAL REALITY IN MARITIME APPLICATIONS

The webinar **"Autonomous operations and Virtual Reality in Maritime. Job Roles & Skills"** was organised so that the participants can get inspired by technology innovation and trends in the maritime sector, which has **relevance** also for other **innovative industries,** including the **emerging battery sector** and the future job roles and skills needed there.

The webinar was held on **November 7th, 2021,** from 13.00 – 14.30 CET. The main organiser was Corvus Energy with the support of some other project partners such as AIA and EUPPY.

Altogether 98 persons registered for the webinar, while **46 participated** in the Cisco Webex platform. On top of those 19 participants watched the event via Facebook live streaming. Registration requests came from 28 countries (11 from outside the EU), the top origin of registrations was Norway, the United Kingdom, and the Czech Republic. 53% of registrations were from the industry sector and 20% from the education sector. Presentations and the video from the workshop have been available on the ALBATTS website, thus enabling an even wider reach to the stakeholders.

Agenda

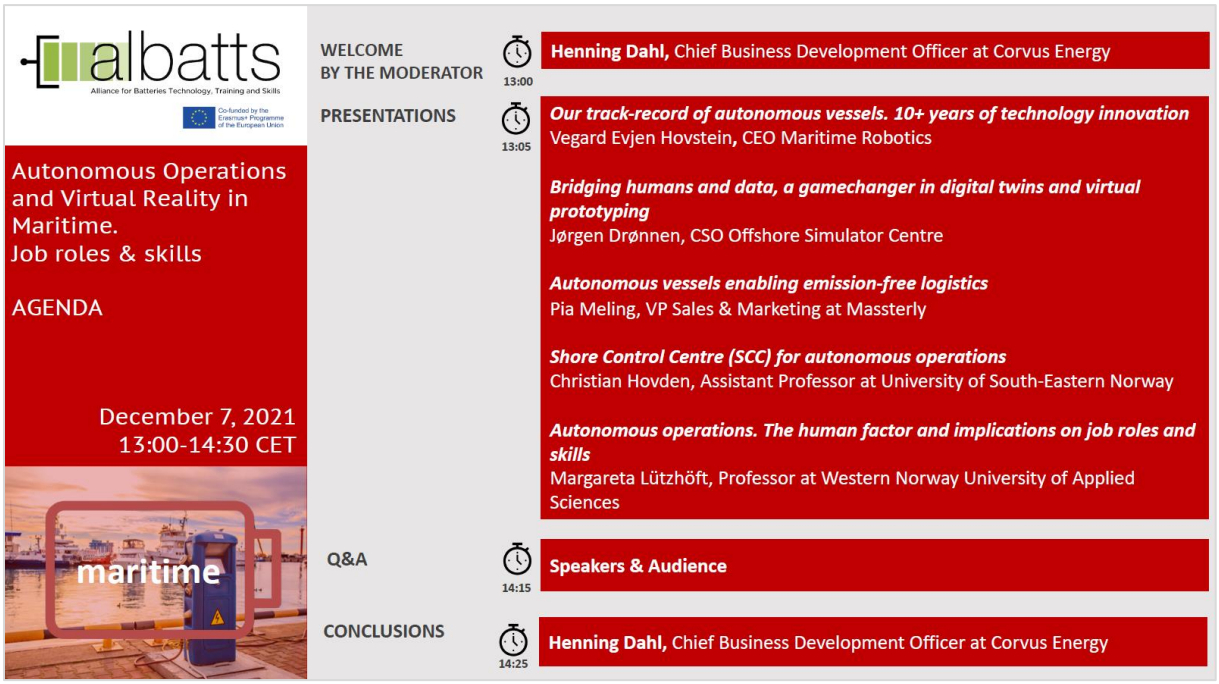

Figure 18: Webinar agenda

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Speakers

Vegard Evjen Hovstein is Founder & CEO at Maritime Robotics. He holds a M.Sc. Degree in Control Engineering and Flight Control Systems from the Norwegian University for Technology and Science. He founded Maritime Robotics back in 2005, that is 16 years in unmanned & autonomous vessels for the Maritime industry. Their systems operate unmanned both in the air and on the surface. Products allow for collection of data ranging from aerial to subsea. Vegard is a true autonomous pioneer!

Jørgen Drønnen is the Chief Sales Officer at Offshore Simulator Centre in Aalesund, Norway. Jørgen has a Bachelor with First Class Honor's Degree in Product Design from Teesside University, UK. Furthermore 2 single years of Computer Science Studies and a single year study of International Marketing. Jørgen has over 13 years of experience in understanding simulated environments and processes and along the way Creating World class simulator design. He has been at the Offshore Simulator Centre for more than 10 years.

Pia Meling is Vice President of Massterly (a Kongsberg Wilhelmsen joint venture). Massterly is the world's first company set up to operate zero emission, autonomous vessels. Their aim is to enable a shift in transport from road to sea; through cost-effective, safe, and environmentally friendly logistics. Pia has broad management experience from shipping and the maritime industry. She serves on the Boards of TECO 2030 ASA, Dolittle AS and Westport AS and she is a member of the Ocean portfolio board in The Research Council of Norway. Meling holds an MBA from the Norwegian School of Economics.

Christian Hovden is an Assistant Professor at the University of South-Eastern Norway. He holds a Masters degree in Process Control. He is the Automation Discipline Lead at the University, specialising in Electrical Power, Automation and Robotics. He is also the Project Manager for Markom2020 on Shore Control Centres and Operator Competence, and likewise the Project Manager for the Autonomous Sea drones project.

Margareta Lützhöft is a Professor in the Maritime Safety Research Program at the Western Norway University of Applied Sciences. She holds a MSc in Computer Science from the University of Skövde, and a PhD in Human-Machine Interaction from the Linköping University, Sweden. The MarSafe program includes projects like Safety management and autonomy in the maritime sector, IT education for seafarers, and the human element in autonomous shipping.

Figure 19: Biographies of the speakers

Moderator

Henning Dahl (Corvus Energy, ALBATTS project partner)

Key messages:

- The Maritime industry is at the forefront of autonomous operations. We read much about self-driving cars, but traditionally these are small scale pilots. In maritime, autonomous operations have a **longer history,** and the projects are larger
- Innovation and technology development is rapid and advanced in maritime. **Battery technology** is a key driver for the industry
- Autonomous operations drive the use of **Virtual Reality** and **advanced simulation technology** to train **new skills** and **competencies** for new job roles in the maritime industry.

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Speakers

Vegard Evjen Hovstein (Maritime Robotics)

Key messages:

- Autonomous vessels enable acquiring massive amounts of data, developing of new business models
- Autonomous and electric work well together
- Technology development in stages:
  - Remotely operated
  - Automatic
  - Constrained autonomy
  - Autonomous
- The key challenge for Maritime Robotics as a company: is our future within Data Acquisition or Transportation? This choice of strategy will have a significant impact on future **skills and competence** requirements. The transportation market is larger but more competitive.

Jørgen Drønnen (Offshore Simulator Centre)

Key messages:

- Bridging humans and data, a gamechanger in **digital twins** and **virtual prototyping**
- Why use Digital Twins?
  - Not only 3D models – so much more
  - Rapidly simulate and test operations, functions, assets, etc. regardless of complexity
  - Vessels/rigs/assets into the simulator in weeks, not months
  - Specific objects modelled in days, not weeks
  - Enables discussion, redesign and perform new testing
  - Improve data-driven decision-making
  - Integrate sensors into physical assets or monitor log files and other sources to collect data
  - Understand complex data: Insight and common understanding
- **Linking humans to machines** will change the world
  - Simulation (digital twin) is the bridge between humans and complex "big" data

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(machines)

- Graphical Digital Twin
  - Taking real-world sensor data and using simulator visuals
  - Enables augmented features to convey key information
- Talent / skills
  - **Automation**
  - **Computer Science**
  - **User interface**
- From our developers:
  - **Gaming technology** used in **virtual prototyping** and simulation creates many opportunities
  - In the world of gaming, one can try and fail, reset, and load from a checkpoint. This transfers directly to simulation scenarios and training sessions
  - **Computer engineers** and **Unity developers** become increasingly important as we move into autonomous operations and controlling scenarios and processes in a simulation environment require fast development and technical know-how.

Pia Meling (Massterly)

Key messages:

- Massterly is Kongsberg and Wilhelmsen's joint effort to develop the autonomous maritime market
- They shall deliver environmentally friendly logistics enabling the shift from road to the sea
- Autonomy is the means, not the target
  - Lower operational cost
  - Improved safety and efficiency
  - Zero / low emission vessels
- **Electricity + autonomy**
  - Reduced CO2 emissions. Zero-emission solution
  - Reduced transit speed. Reduced speed reduces energy consumption

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- **Reduced maintenance**. Fewer moving parts and simpler to maintain
- Electric power increases response and manoeuvring capabilities
- Reduced fuel cost. Electricity is cheaper than diesel

- Clearing the road towards autonomy by joint efforts
  - Different autonomy levels
    - Decision support
    - Automatic
    - Periodically unmanned
    - Unmanned
    - Fully autonomous
  - Under discussion
    - Captain's role
    - Crew & competence in Remote Operations Centre
    - Compliance with SOLAS, ISM Code and ISPS Code
    - Flag state regulations, local rules and permits
    - Legal aspects and division of responsibilities
    - Insurance
- We are creating **new jobs** in the **Remote Operations Centre**
- Future needs for **skills & competence** in Maritime
  - Competent shore-based crew for the **energy transition** (new fuels)
  - Innovation and **diversity in thinking**
  - Learning from other industries.

Christian Hovden (University of South-Eastern Norway)

Key messages and important questions:

- Massterly Remote Operations Center - Certified Operators
- The operator is monitoring the port operation of loading and discharging the ASKO sea drone and the connection and **charging of batteries**
- These are, of course, relevant operations for the officer responsible for cargo handling
- But how about more of the supply chain. Can the operator also monitor the port

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for intruders?

- Is it possible to give the operator assignments outside of pure navigation and vessel operation?
- Will this affect the operator's ability to ensure the same level of safety as on a manned vessel?

Margareta Lützhöft (Western Norway University)

Key messages:

- Shipping is a sociotechnical system
  - Autonomy, high automation, smart ships. Autonomy does not mean unmanned
- Top future skills for the maritime industry (HUMANE, 2020):
  - **IT and Cyber security**
  - **Tool handling**
  - **Seamanship**
  - **Safety awareness**
  - **Well-trained & multi-skilled**
  - **Communication**
  - **Emergency response**
- What to expect?
  - Adaptation
  - Life-long learning
  - Eco-system of skills
  - Ability to find the information (or a person)
  - Cybersecurity awareness
  - Environmental awareness
- New technology and **competence** in maritime
  - Be multidisciplinary
  - Keep humans at the centre
  - Changes in crew/staff, tasks, technology, and responsibilities
  - Look at sociotechnical systems
    - Example: Green Shipping Program considers the traffic system for future

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coastal ferries, not individual ships

- Maritime safety - Human-centred operations, design, technology, and education
- Digitalisation - **smart ships, high automation, autonomy**
- Green shipping - **batteries, wind, hydrogen.**

Moderators' conclusions:

- The technology **transformation** in the maritime industry requires long term investments in new skills and competence
- The maritime industry will require a vast effort in training and **re-training** of a global maritime workforce
- Young gamers and **gaming technology** will be attractive to the industry going forward
- Zero-emission technology is the key **enabler** for this drive of change. **Battery technology** is the most mature zero-emission technology available.

Recommendations for the organisation of future webinars

- Even though the webinar's focus was intentionally shifted outside the core of the battery industry to get some inspiration from trends in other industries, the next webinars might need to be **more focused** on battery relevant topics.

Key findings and next steps

- Trends in the maritime industry (**virtual reality, advanced simulation technology, inspiration from the gaming industry, digital twins**) provide some hints also about the future direction of e. g. battery applications in other transport modes such as road vehicles, trains, or planes
- **Autonomous operations** (in combination with electric propulsion) can improve not only carbon footprint and safety (can operate in risky areas) and reduce operational and maintenance costs, but also help solve the lack of professionals in

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some professions, like seafarers

- **Implications of the trends on job roles and skills will be elaborated in detail and extended by additional data in the upcoming Work package 3 report due in May 2022.**

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