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Alliance for Batteries Technology, Training and Skills
2019-2023

Workshop Evaluation

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Vessels of the future: Maritime Batteries - Job Roles and Skills

Co-funded by the Erasmus+ Programme of the European Union

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Workshop Evaluation

Workshop name:

Vessels of the future: Maritime Batteries - Job Roles and Skills

Date and venue:

19.01.2021 – Cisco Webex

Workshop purpose:

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

Organizer:

ALBATTS

Format:

Online Webinar

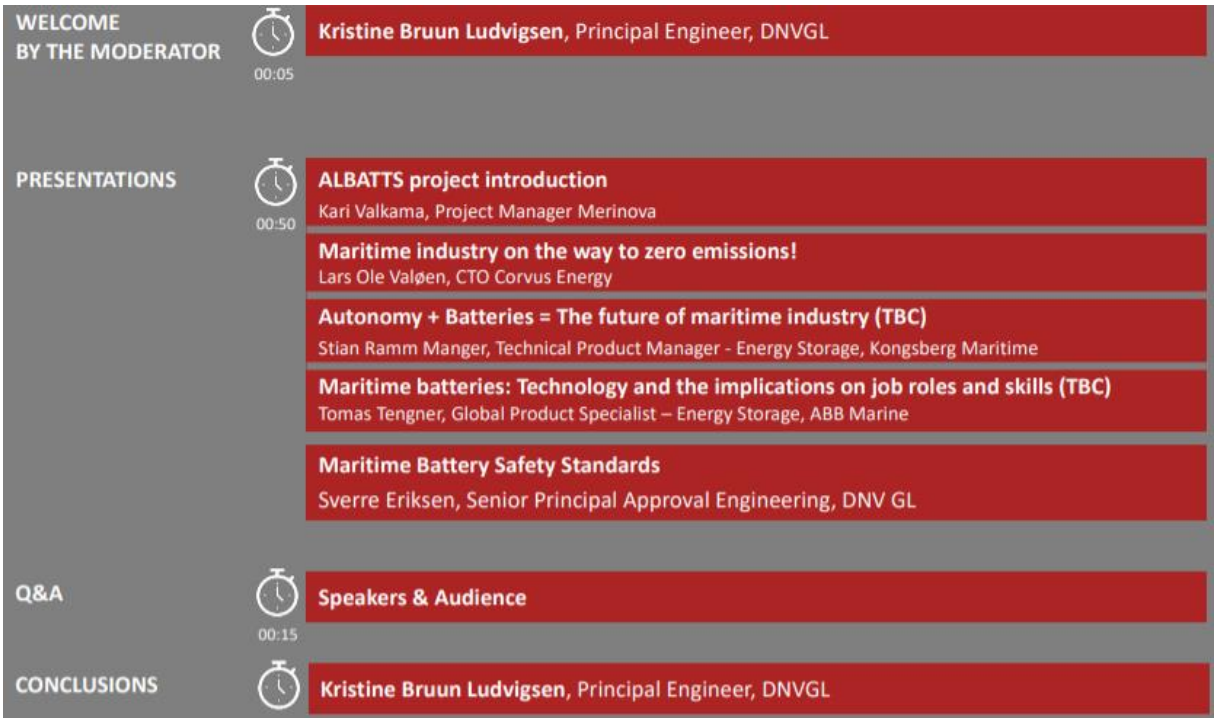
Location:

Webex

Content:

- About the ALBATTS Project
- Maritime industry on the way to zero emissions
- Autonomy & batteries: the future for Maritime industry
- Technology and the implication on job roles and skills
- Safety standards
- Q&A session

Schedule:



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Workshop Minutes

Kristine Bruun Ludvigsen (DNVGL)

Purpose and organization of the webinar

Electrified vessels can bring environmental benefits, better operational performance, more flexibility in operations

Kari Valkama (Merinova)

Presentation of ALBATTS project

First findings on skills and job roles from ALBATTS Desk research I. presented with regards to **operation, repair and maintenance** in the maritime **–** three types opf repairs – emergency repairs when operating offshore, repair in docks, service.

Lars Ole Valøen (Corvus)

His own career (25 years in the industry} a good example of new skills in the maritime / the change in the maritime industry – in the early years his skills (electrochemist) not relevant, today totally different situation.

Switch from batteries to batteries with continuous refill (fell cell) representing the big change in maritime

Not only environmental benefits of electrified vessels but also finding new solutions requiring less maintenance, economic models

Fully electric, hybrid vessels presented – significant CO2, NOx savings. According to a study, payback time for CO2 (taking into account also production of the batteries) can be 1,5 months, for NOx 10 days

Electrification thriving in certain vessel segments – cruise ships, car and passenger ferries, fishing vessels. Big ocean going vessels difficult to be electrified yet.

Batteries heavier and requiring more space than liquid fuels, but more energy efficient.

Battery modelling; electrochemical processes in the battery; system performance and impact of electrochemical processes; control over battery state of charge, lifetime and other properties; SOC; SOH; electrochemistry; usage patterns of batteries; batteries as an enabler for autonomy of the vessels, economic viability; **cooling** / heating systems; circuit shortage and safety precautions; servicing; less maintenance for batteries than other fuels/technologies; remote monitoring systems for batteries (information systems); IoT; cloud connections

Job Roles: engineering + R&D; technical sales; customer applications and customer service

Skills and knowledge trends: market understanding; adaptation and flexibility; learning ability; utilizing digital tools…

Travel requirements could lower with the batteries – sometimes can be handled from the home office; battery systems possibly virtually maintenance free;

Concluding remarks:

Maritime industry coming back to more environmentally friendly propulsion

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Huge impact of electrification of the industry expected - battery systems are virtually maintenance free, ideal for autonomous operation

Deep electrochemistry knowledge becoming key for R&D – model-building, digital twin construction

Computer & programming skills needed – moving from on-ship to over the air service

Stian Manger (Kongsberg Maritime) – energy storage and future

Company providing Energy storage systems (ESS) for vessels - battery hybrid solutions

Advantages - high energy density; space efficiency; optimization

ESS also enable alternative fuels usage LNG; Hydrogen; ammonia;

Different solutions for various vessels, applications: SAVe Energy, SAVe Power, SAVe power+

Operating modes

- Peak-shaving – helping the diesel engine – saves fuel, increases efficiency of the diesel engine
- Spinning reserve – one or battery packs as a backup in case of failure – the main business for the offshore supply vessels
- Zero emission – particularly interesting for short distances – e. g. a ferry crossing a fjord, cruise ship being require to run on zero emission at some point
- Blackout recovery
- Enhanced load sharing

Future for the electrified vessels – enabling autonomous shipping; reduced maintenance; alternative fuel enabler; every 3rd ship to have **energy storage according to a study.**

Geographical coverage – Norway and Europe leading the energy storage implementation in maritime – car/passenger ferries; offshore supply ships - importance for Europe to be less dependent on Asian suppliers of batteries

Cell production increase by electric vehicles demand -> as a result cost reduction on cell and module level also for maritime

Raw materials and sustainability focus is very important for EES manufacturers in Europe.

Skills set to be needed

ESS - Safety; electrical capability and limitation; mechanical design of rack and modules; cell topologies

Electrical skills – power electronics; electrical integration of ESS; external faults impact on energy storage

Software development – internal safety, battery management system, integration aspects

Deep chemical and production skills **not as important** for maritime as the market will be dominated and driven by mass production for EVs and EES

Tomas Tengner (ABB Marine & Ports) – products, systems and service and software

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ABB heavily involved in the battery value chain providing components, systems - incl. e. g. process automatization for gigafactories

“Electric, digital and connected” vision

Providing electric power distribution solutions in vessels – AC/on board DC grids, battery cells/fuel cells, propulsion unit

Providing propulsion, electric solutions, digital solutions services for vessels as well as port electrification, crane automatization

Addressing all vessels segments except from small leisure boats

Offering solutions for charging technology, onboard DC Grid, batteries and fuel cells

Growing interest in long haul transport

Digitalization of the vessels – enables remote diagnostics, cloud connection becomes important– future proof fleet

Batteries future enabler for automation, parking assistance, autonomous sailing etc. leading to unmanned ships with no personnel due to remote diagnostic/servicing possibilities

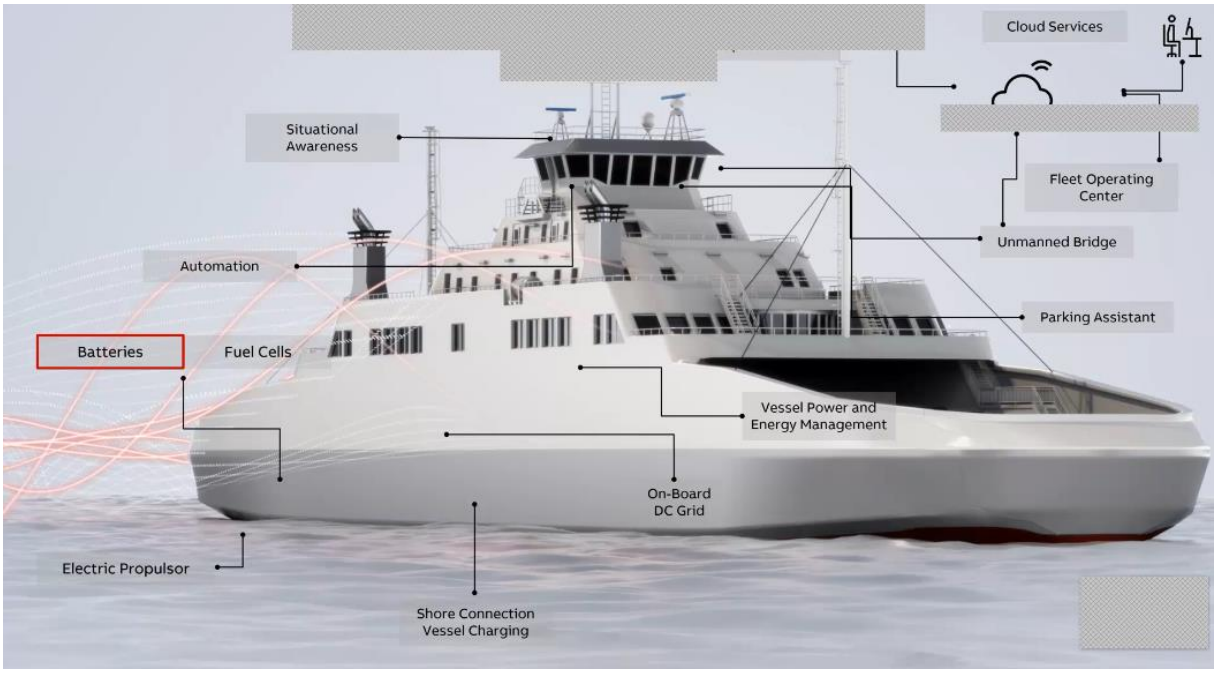

ABB are a system integrator, not making their own batteries – rely on their suppliers such as Corvus and other in this regard – need some electro-chemistry knowledge in-house, as well as other competencies (note: as described on the chart bellow)

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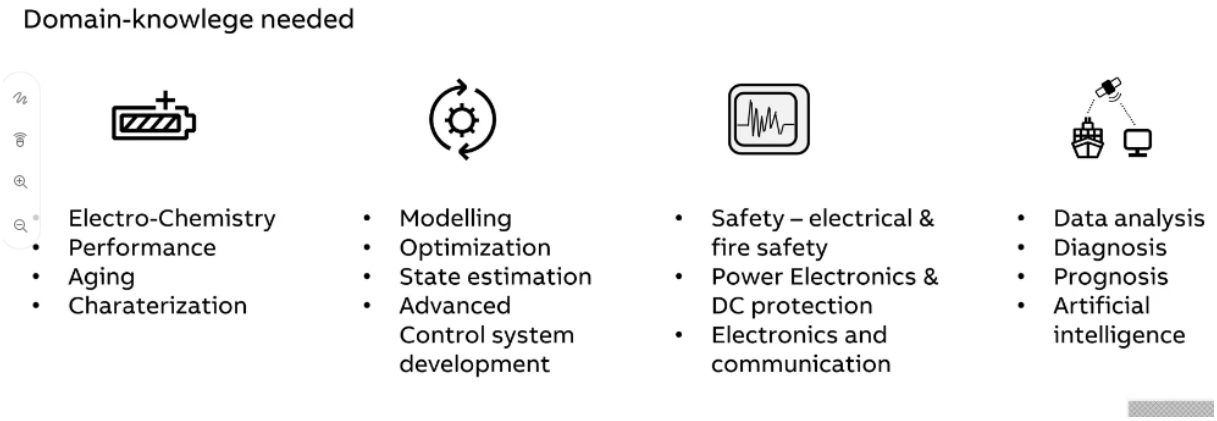

What did Tomas study himself: – thermodynamics; physics; chemistry; electrical engineering; energy systems engineering

General needs: more versatile workforce; broader competence needed

Sverre Eriksen – DNVGL

Company employs electrical engineers, fire experts; control system experts.

Classification of ships, certification, verification and testing against regulatory requirements, standards and recommended practices

Development of new rules, standards and recommended practices

Qualification of new technologies and operational concepts

Expert advisory on safety, technology, data management; efficiency, performance; and risk management

Organizations in maritime sector somehow addressing batteries in vessels - ISO/IEC /UN/IMO/CENELCE/ANSI/UL

Electrification of the vessels – it started in 2011 with offshore supply vessels "Viking lady" 1,5MWh battery from Corvus – first pilot

2015 – fully electric vessel pilot – since then it started to boom

Competences needed - Fire-safety engineers knowing how to extinguish lithium battery – nobody globally knew how to do it, electric engineers, experts on certification of battery, industrial design, people able to embed SW into systems

How to prohibit that a cell in a module in a thermal runaway does not put on fire other cells, module

Example of hybrid vessel "Color Line" with 5MWh battery – running on electricity in the ports and nearby, switching to diesel engine later on, charging in the port is ensured

Competences needed: Electricity, control systems, fire safety, chemistry

Safety is crucial – no chance to run away in case of a fire

Debate

Do solar panels have any relevance on ships at sea for re-supply of electricity?

- Other energy harvesting technologies might be viable

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Are there any synergies between maritime industry and automotive with respect to batteries (product / usage / recycling / second life ...) ?

- Production volumes in automotive, batteries can be used in maritime, focus of automotive into batteries is benefiting maritime, electrification of maritime is spearheading mainly because of policy of less taxation on EVs, batteries should be used constantly this is profitable long term.

Which battery relevant competences are missing now at the job market (if any) and which new competences do you think will be needed in the future?

- Deep competence in battery, battery technology, mathematics, chemistry with system overview of other fields
- System integration and up to date technology
- Battery experience and knowledge, academy is lagging behind industry, battle for people by all electrifying industries

Do you think that existing maritime machine engineers can be easily upskilled or reskilled to handle E-ships propulsion systems?

- Better understanding of electronics and control systems, young educated are better learners.

Questions from the audience <u>not answered</u> in the workshop

LIB and Fuel cells; which technology is more compatible in Maritime?

What training does a Mechanical Engineer, specialized on Product Development, need to move to battery industry?

Are ships, parallel or serial hybrid?

Fuel cells and lithium: Hand in hand with hybrid batteries – load variations

SW development skills

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Evaluation – Mapping to Topics of Intelligence

Stakeholders Identified:

Name	Specialization	Importance	Contacts/Links
ABB Marine & Ports	System integration	High	ABB.com
DNV.GL	Class Society	High	DNVGL.com
Kongsberg Maritime	System integration	High	Kongsberg.com

Technologies Identified:

Name	Description	Comment	Links
IoT	Industrial sensors and data		
Cloud connected batteries	Industrial IOT		
Monitoring systems	Industrial IOT		
Digital twins	Industrial IOT		
Battery hybrid solutions	Traditional & Fuel cells	LNG, Hydrogen, ammonia	
Peak shaving	Use-case		
Spinning reserve	Use-case		
Blackout recovery	Use-case		
Enhanced load sharing	Use-case		
Autonomous shipping	Trend	Electrification of vessels as an enabler	
Connected digital vision	Trend		
Modular systems	Scalability for maritime		
Cloud connection	Trend		

Job Roles Identified:

Name	Value Chain	Comment	Links
Engineering	All parts of value chain		
R&D	Innovation: new products and tech solutions		
Technical sales	Maritime is tailor-made solutions		
Customer applications	Maritime is solution selling		
Customer service	Troubleshooting and customer relationships		
Fire expert	Safety first		
Control system expert	Software and technology expertise		
Electrical engineer	Fundamental skills for maritime applications		
Expert advisors on safety	Safety first in maritime		

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Fire safety engineer	Safety first with tailor-made solutions		
Service Engineer	Both in-field and remote service. More and more condition based with monitoring applications.		

Skills/Competence or Knowledge Identified:

Name	Job Roles	Comment	Links
Battery modelling	Numerous		
Electrochemical processes in battery	Engineering		
Impact of electrochemical processes on system performance	Engineering		
SoC control	Engineering		
SoC, SoH management	Engineering		
Electrochemistry	Numerous		
Battery patterns	Engineering		
Cooling/heating systems	Engineering		
Battery safety	Numerous		
Servicing	Numerous		
Monitoring systems	Numerous		
IoT	Numerous		
Cloud	Numerous		
Market understanding	Numerous		
Learning ability	Numerous		
Utilize digital tools	Numerous		
Build models	Engineering		
Digital twin	Modelling and simulation		
Programming	Numerous		
Power electronics	Engineering		
Electrical integration	Numerous		
Fault management & identification	Engineering		
Electrical skills	Numerous		
Software development	Numerous		
Chemical skills	Engineering		
Production skills	Numerous		
Electrochemistry	Numerous		
Performance of batteries	Engineering		
Aging of battery	Engineering		
Characterization of battery	Engineering		
Optimization	Numerous		
Advanced control systems development	Engineering		
Safety: electrical, fire	Numerous		

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Power electronics and protection	Numerous
Electronics	Numerous
Communication	Numerous
Data analysis	Numerous
Diagnosis	Modelling and simulation
Prognosis	Modelling and simulation
Artificial intelligence	Numerous
Thermodynamics	Engineering
Physics	Numerous
Chemistry	Engineering
Electrical engineering	Engineering
Energy systems engineering	Engineering
Classification	Numerous
Certification	Numerous
Verification and testing	Numerous
Regulatory requirements	Numerous
Standards	Numerous
Regulations	Numerous
Data management	Numerous
Risk management	Numerous
Industrial design	Numerous
Embedded systems	Numerous
Electricity	Numerous
Control systems	Engineering
Fire safety	Numerous
System integration	Numerous
Electronics	Numerous
Control systems	Numerous
Autonomous control systems	Numerous

Drivers of Change Identified:

Name	Influence	Comment	Links
Shorter payback time for CO2, NOx	Maritime applications of batteries		
Batteries need less maintenance than traditional fuels	Favors batteries in application		
Less dependence on Asia	European battery strategy		
Europe leading in battery maritime	Technology innovation frontier is in Europe		
EV demand	Cost of batteries and production rise	Cell and module level	
Focus on Raw materials for Europe	Battery cell production in Europe		
Less taxation policy on EVs	Electrification of maritime		

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Academia is lacking behind industry	Skills gap must be closed
Autonomous control of vessels	Enabled by the electrification

Post-Workshop Survey

After the workshop, a satisfaction mini-survey was sent to the participants - 8 persons responded.

Overall, the participants were very satisfied with the webinar presentations and discussion.

What is your overall assessment of the event?		
Choice	**Answers**	**%**
1=Insufficient	0	0%
2	1	12,5%
3	0	0%
4	4	50%
5=Excelent	3	37,5%
Total	8	100%

The audience appreciated as interesting the presentations delivered by:

Which topic (presentation) did you find most interesting or useful?		
Choice	**Answer**	**%**
Corvus Energy	3	17,6%
Kongsberg Maritime	5	29,4%
ABB Marine & Ports	5	29,4%
DNVGL	4	23,5%
Total	17	100%

Almost all participants claim they gained knowledge and information from participation in the webinar.

Knowledge and information gained from participation at this event?		
Choice	**Answer**	**%**
Yes	5	62,5%
Somehow	3	37,5%
No	0	0%
Total	8	100%

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Written feedback:

- *How do you think the webinar could have been made more effective?*
  - "Little more time for each speaker
- *In your opinion, what are the battery relevant future jobs and skills needed in the battery production sector and why?*
  - Battery service, working with High voltage, Handling faulty battery.
- *Comments and suggestions (including activities or initiatives you think would be useful, for the future)*
  - Increasing awareness on Battery safety to all (End user, service person, Technical and non-technical management, etc.,)

Lessons learned and points to be improved:

- Increase the involvement of the audience
- Motivate more viewers to write feedback

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