

Alliance for **Batteries Technology, Training and Skills**

2019-2023

Skills for boosting 'greenovation'...in the European Battery sector

Dr Anders Norberg, Skellefteå municipality, Sweden
Coordinator ERASMUS+ ALBATTTS

Dr Jakub Stolfa, Technical University of Ostrava,
Czech Republic

President, Automotive Skills Alliance, ASA



What is the European Battery Sector?

How is the battery sector a “greenovation”?

What job roles and skills are needed and how can we train for them?

Strategy / policy issues and recommendations



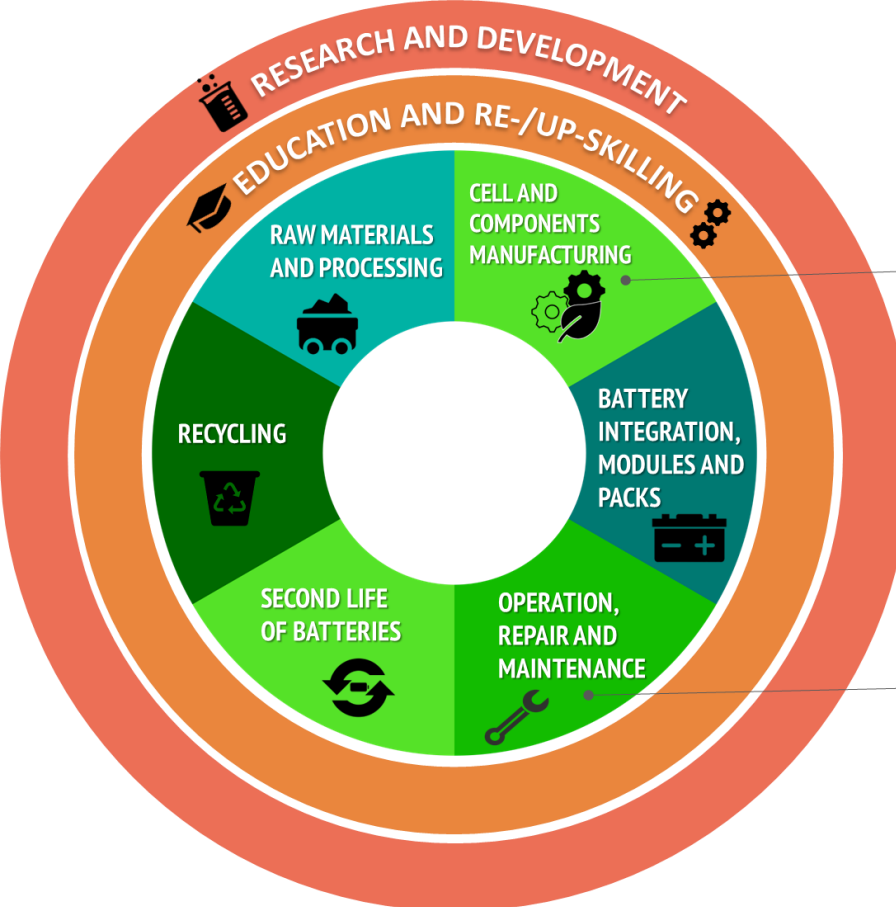
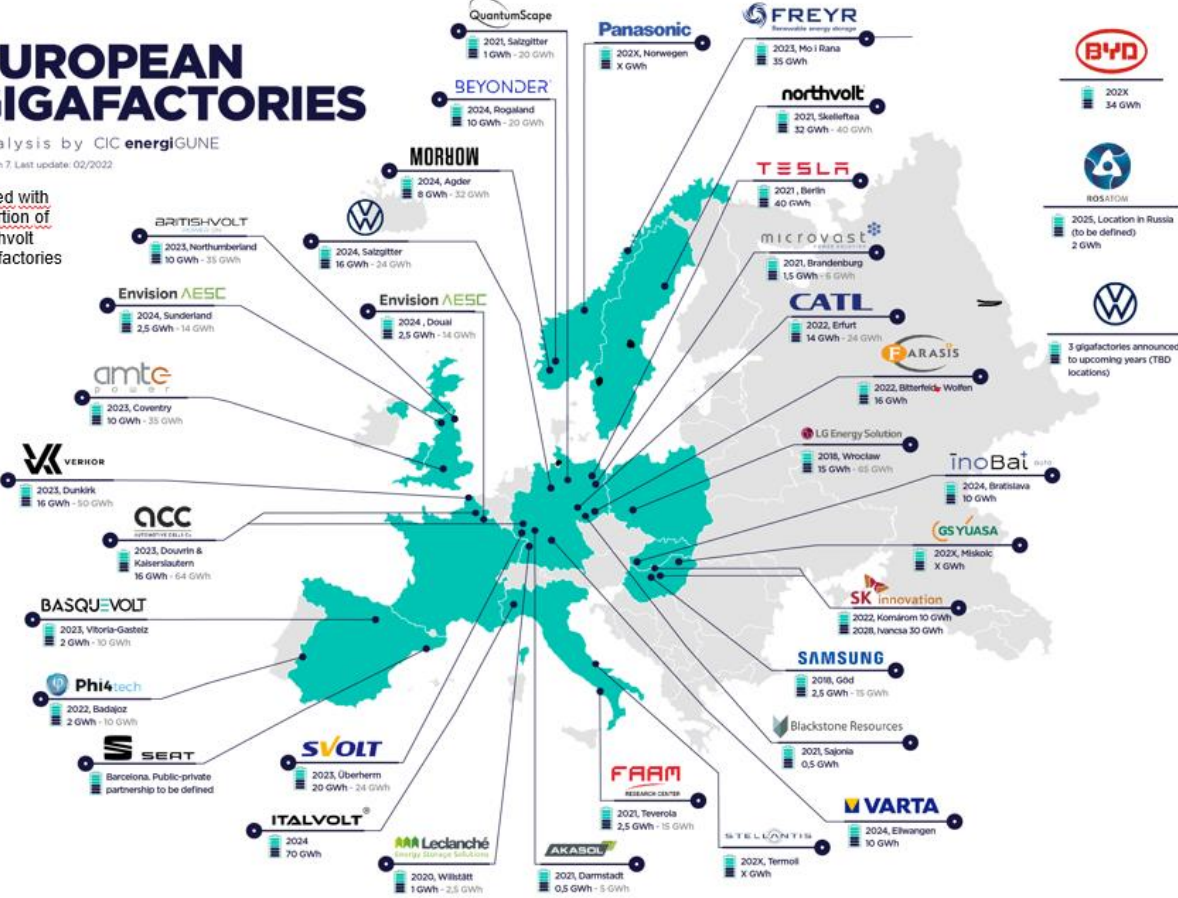
European Battery Sector



EUROPEAN GIGAFACTORIES

Analysis by CIC energigUNE
Version 7. Last update: 02/2022

Edited with insertion of Northvolt gigafactories



- PRODUCTION
- MAINTENANCE
- LOGISTICS
- QUALITY
- OTHER ASPECTS

- STATIONARY BATTERY APPLICATIONS
- MOBILE BATTERY APPLICATIONS

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

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

BATTERY CELL MANUFACTURERS

MODULE AND PACK MANUFACTURERS

Battery projects as of July 2022

Published by: **BATTERY-NEWS.DE**

NW: 125 GWh + X	SE: 110 GWh + X	LV: X GWh	DE: 493.6 GWh + X
MORHØV 2024, Agder Up to 33 GWh	northvolt 2025	Anodox Energy Systems	CALB 202X, Germany
Blackstone Resources 2024, Döbeln			

Battery system manufacturing

Published by: **BATTERY-NEWS.DE**

SE:	LV:	FI:	DE:
Anodox	VALMET AUTOMOTIVE	VALMET AUTOMOTIVE	VALMET AUTOMOTIVE

EQUIPMENT SUPPLIERS

ACTIVE MATERIAL SUPPLIERS

Battery equipment

Poland: PFEIFFER, VACUUM

Sweden: PFEIFFER, VACUUM

Finland: PFEIFFER, VACUUM

Germany: PFEIFFER, VACUUM

Battery active materials (extract) as of June 2022

Published by: **BATTERY-NEWS.DE**

NW: 172,000t	Vianode	NIKKELVERK	SE: 40,000t	2025, Borlänge
2025, Mo i Rana 30,000t	2023, Porsgrunn 50,000t	2021, Kristiansand 92,000t	northvolt	Up to 40,000* Cathode
LFP	Graphite	Nickel sulfate	FI: 71,000t	
			TRANSFORM	

RECYCLING COMPANIES

BATTERY TEST CENTERS

LIB recycling projects EU: July 2022*

Published by: **BATTERY-NEWS.DE**

Corresponds to 100,000 t/a of installed and planned capacity

$\Sigma = \text{Installed } 118,750 \text{ t/a} + X$

Norway	Netherlands	Great Britain	Belgium	France	Spain	Italy	Switzerland	Hungary
NIKKELVERK Installed, Kristiansand 7,000 t/a	TES Installed, Rotterdam 14,000 t/a	GLENCORE 202X, X 10,000 t/a	Aurubis 2025/26, Olen X t/a	TES Installed, Grenoble 2,200 t/a	enova Installed, Cubillos del Sil 8,000 t/a	ITALVOLT 202X, Scarmagno X t/a	BATREC Installed, Wimmis 500 t/a	librec
Hydrovolt Installed, Fredrikstad 12,000 t/a		CIGAMINE 202X, X X t/a	ABEE 2023, X 1,000 t/a	VEOLIA EDI 2023, Dieuze 5,000 t/a			KYBURZ Installed, Freienstein 100 t/a	Sungie Installed, 25,000 t
MORHØV 2024, Agder Up to 33 GWh		ecobat Installed, Darlaston X t/a	RENAULT 2023, Amneville 4,000 t/a	SUEZ 2024, X X t/a			ROYAL 2020, Le 3,600 t/a	

Authors: Natalia Soldan, Gerrit Bockey, Janis Vismenkötter, Christian Offermanns & Dr. Heiner Helmes (IPEM RWTH Aachen University)

Battery testing as of July 2022

Published by: **BATTERY-NEWS.DE**

Norway	Netherlands	Great Britain	France	Spain	Sweden	Poland	Finland	Germany
IFE Halden	DEKRA Arnhem	UTAC Bedford	FEV Saint Quentin en Yvelines	cidetec Tolosa	intertek Stockholm	Warsaw	VALMET AUTOMOTIVE Uusikaupunki	TÜVRheinland Aachen
	SGS Spijkenisse	intertek Leatherhead	SERMA Bordeaux, Chambéry, Grenoble, Le Cheylas	SERMA Valladolid	SCANIA Södertälje			BI BATTERIE INGENIEURE Aachen
	DNV Enschede	MIRA Nuneaton						MOOSER Ludwigsburg
								kiwa Kaufbeuren
								Fraunhofer Freiburg
								FEV Sandersdorf-Brehna
								SGS München
								TESTLAB Blomberg
								intertek Kaufbeuren
								VDE Offenbach
								SRG Plattling
								voltaVision Bochum, Nürtingen, Unterschleißheim
								TWAI München
								BU Karlsruhe
								AVL Graz
								NETEC Betzigau
								VALMET AUTOMOTIVE Bad Friedrichshall, Weihenbronn
								Aschaffenburg
								GL Hartberg

Authors: Niklas Kjaesler & Dr. Heiner Helmes (IPEM RWTH Aachen University)

Source: www.battery-atlas.eu; abstract, no claim of completeness

Source: www.battery-atlas.eu; abstract, no claim of completeness



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

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

How “green”?



High-energy-density batteries (as Li-Ion)
Produced in huge-scale “**gigafactories**” with Industry 4.0 methods with...
...problematic **raw materials** (Li, Ni, Co, etc)
...a huge **energy** demand
...the need of a lot(!) of **skilled workers**, with very varying skills ($\approx 80+$ % blue-collar)

The EU aims to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions.
A part of the European Green Deal / Paris declaration commitment
Battery use aims at...
fossil-free transport (electromobility)
fossil-free electrical grids

European battery production aims at a much lower environmental footprint than Asian-made batteries ($\approx 30\%$ of), with strategies as local renewable energy supply, sustainable supply lines, recycling, etc

Recruitment argument for a battery gigafactory: “Come work with us and save the world”

The sector affects directly around 3-4 million European jobs, and 800 000 workers need up-/reskilling by 2025 (EU Vice President Maroš Šefčovič, March 2021)



What is **ALBATTIS**?



⚡ **20 Partners in 4-year**
(2019-2023)
Erasmus+ co-
funded project

⚡ Blueprint for
Sectoral
Cooperation on
Skills in Battery and
Electromobility
sector



ALBATTIS Tackles Two Main Questions



1

WHAT IS ONGOING IN THE BATTERY SECTOR AND HOW DOES IT AFFECT JOB ROLES & SKILLS?

SECTORAL INTELLIGENCE

- Gathering **skills needs**
- Detailed description of **skills and job roles**
- Covering the **whole value-chain**
- Covering both **higher education and VET**

2

HOW CAN WE ADDRESS CURRENT CHALLENGES?

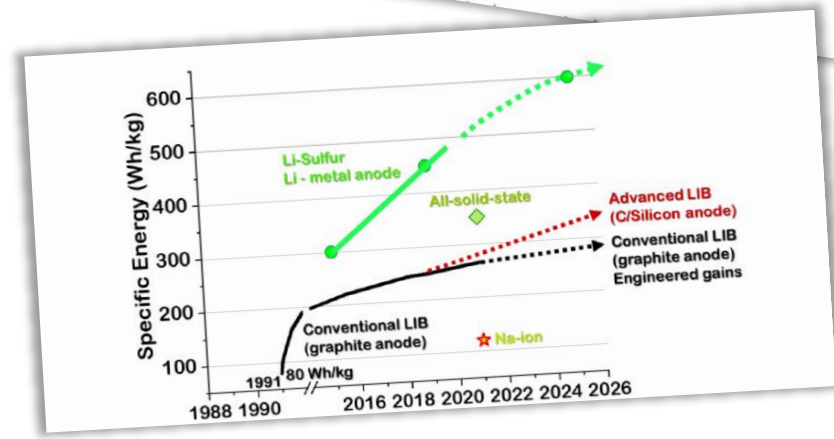
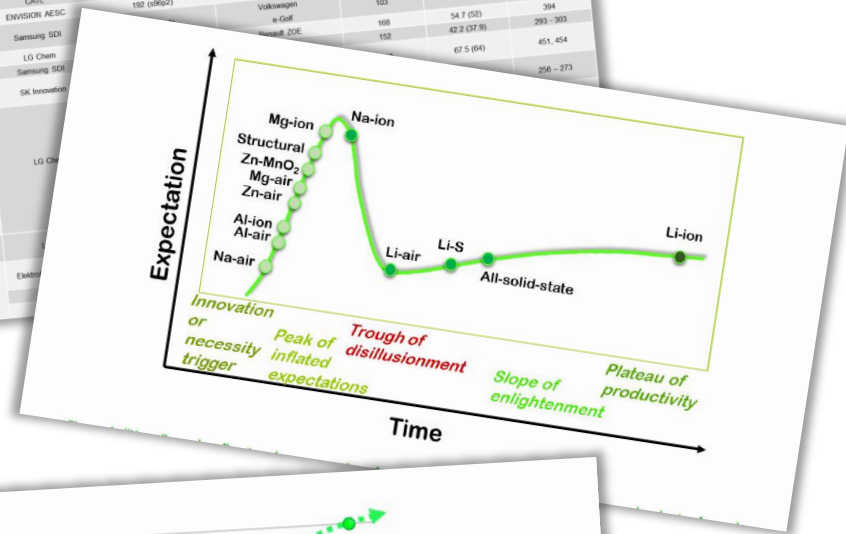
EDUCATION & TRAINING

- **FOCUSING ON** Vocational Education and Training, **initial training (IVET) and re-skilling and up-skilling of workforce (CVET)**

Reports



Cathode type	Ratio (R) or Cell designation (S)	Manufacturer	No. of cells (series, parallel)	EV Model	Specific Energy (Wh/kg)	Energy (usable) (kWh)	Range, combined (WLTP, relevant) (km)
Lithium Nickel Cobalt Aluminium oxide (NCA)	18000 (S)	Panasonic	8256 (x10x40)	Tesla Model S	162	102.4 (98.4)	503, 487
	2170 (S)	Panasonic	4416 (x10x40)	Tesla Model X	168	80.5 (78)	530
Lithium Manganese Oxide (LMO)		Yusaka	80	Citroen Zero (LEV50 battery)	107	14.5	150
		Nissan	298	Nissan Leaf e+	140	56 (46)	385
Lithium Nickel-Manganese Cobalt oxide (NMC)		CATL	216 (x10x2)	Peugeot e-208 Opel Corsa-e	130	39.5 (36)	349, 336
		ENVISION AESC	192 (x6x2)	Nissan Leaf	103	35.8 (32)	270
		Samsung SDI		Volkswagen e-Golf	168	54.7 (52)	293, 303
		LG Chem		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
		Samsung SDI		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
		SK Innovation		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
		LG Chem		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
		LG Chem		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
		LG Chem		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
		LG Chem		Volkswagen e-Golf	152	42.2 (37.9)	265, 273
Lithium Cobalt Oxide (LCO)		EMVI					
Lithium Iron Phosphate (LFP)							

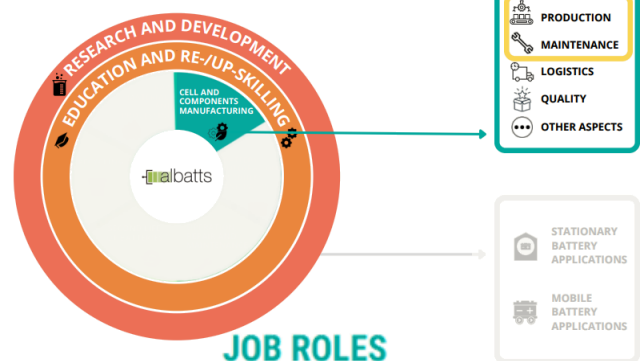


Webinars + Survey



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

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Cell and Components Manufacturing – Production and Maintenance



BLUE-COLLAR

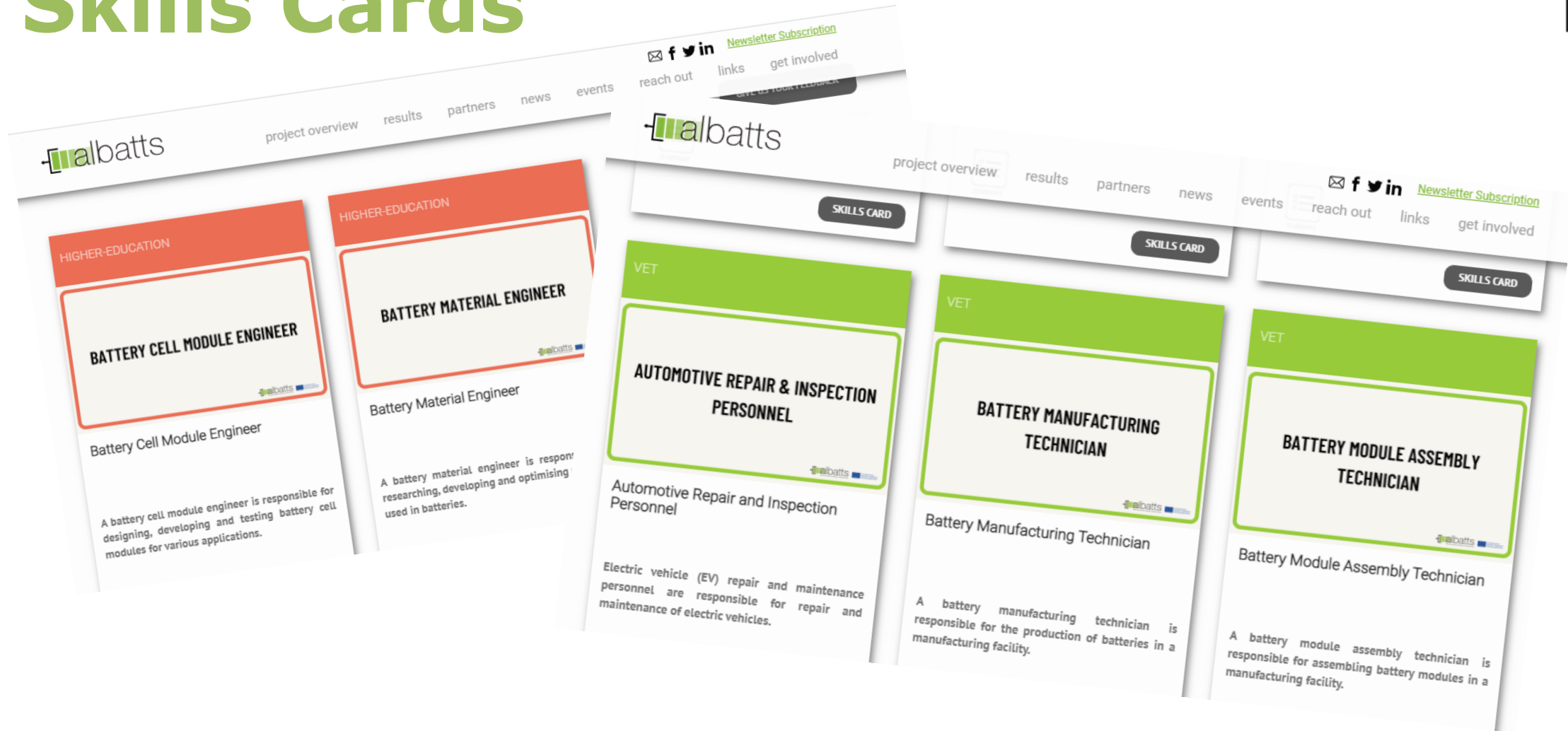
TECHNICAL ASSEMBLY WORKER
 ELECTROMECHANICAL EQUIPMENT ASSEMBLER CMM LAB TECHNICIAN

BATTERY TECHNICIAN OPERATOR
 MAINTENANCE TECHNICIAN SHIFT LEAD
 LITHIUM MAINTENANCE TECHNICIAN
 CALIBRATION TECHNICIAN
 CELL ASSEMBLY TECHNICIAN
 ELECTRICAL TECHNICIAN MECHANICAL DRAFTER MACHINE OPERATOR
 AUTOMATION/PROCESS OPERATOR
 TEAM ASSEMBLER INSTRUMENT TECHNICIAN
 PRODUCTION ASSEMBLY OPERATOR BATTERY PRODUCTION TECHNICIAN
 COMPUTER-CONTROLLED MACHINE TOOL OPERATOR MATERIAL PLANNER
 GENERAL-MACHINIST

WHITE-COLLAR

BATTERY CELL SIMULATION ENGINEER
 DEVELOPMENT ENGINEER HIGH-VOLTAGE STORAGE COMPONENTS BATTERY MATERIALS ENGINEER HIGH-DENSITY ANODES
 CELL SIMULATION ENGINEER SR. BATTERY CELL ENGINEER MAINTENANCE ENGINEER
 ELECTROCHEMISTRY LEAD-BATTERY MATERIALS SR. ELECTRONICS ENGINEER TECHNICIAN
 FORMATION MAINTENANCE MANAGER CONTROLS ENGINEER CELL TEST ENGINEER
 MECHANICAL CELL DESIGN ENGINEER ELECTRICAL ENGINEER
 BATTERY MECHANICAL ENGINEER SENIOR CELL DESIGN ENGINEER
 LITHIUM ION CELL BATTERY SYSTEM ENGINEER
 CELL ASSEMBLY PROCESS ENGINEER MANUFACTURING ENGINEER
 EQUIPMENT ENGINEER
 MECHANICAL ENGINEER PRODUCTION ENGINEER
 MECHANICAL BATTERY DESIGN ENGINEER
 SENIOR/STAFF BATTERY ENGINEER ELECTRO-MECHANICAL ENGINEER
 PRINCIPAL MECHANICAL DESIGNER TOP CAP ENGINEER CELL DESIGN ENGINEER
 CELL MECHANICAL ENGINEER DESIGN ENGINEER-BATTERY TECHNOLOGY
 MECHANICAL DESIGN ENGINEER MANUFACTURING ENGINEER, LI-ION ENGINEER
 PRODUCT MANAGER CELL ASSEMBLY ENERGY STORAGE PRINCIPAL ENGINEER
 PRODUCTION MANAGER DOWNSTREAM PRODUCTION MANAGER CELL ASSEMBLY
 AUTOMATION ENGINEER SENIOR ENGINEER-BATTERY MODELLING & ANALYSIS
 ELECTRICAL DESIGN ENGINEER SENIOR BATTERY MECHANICAL ENGINEER

Skills Cards



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

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

EDUCATION / TRAINING BLUEPRINT



ALBATS TRAINING FRAMEWORK FOR BATTERY INDUSTRY

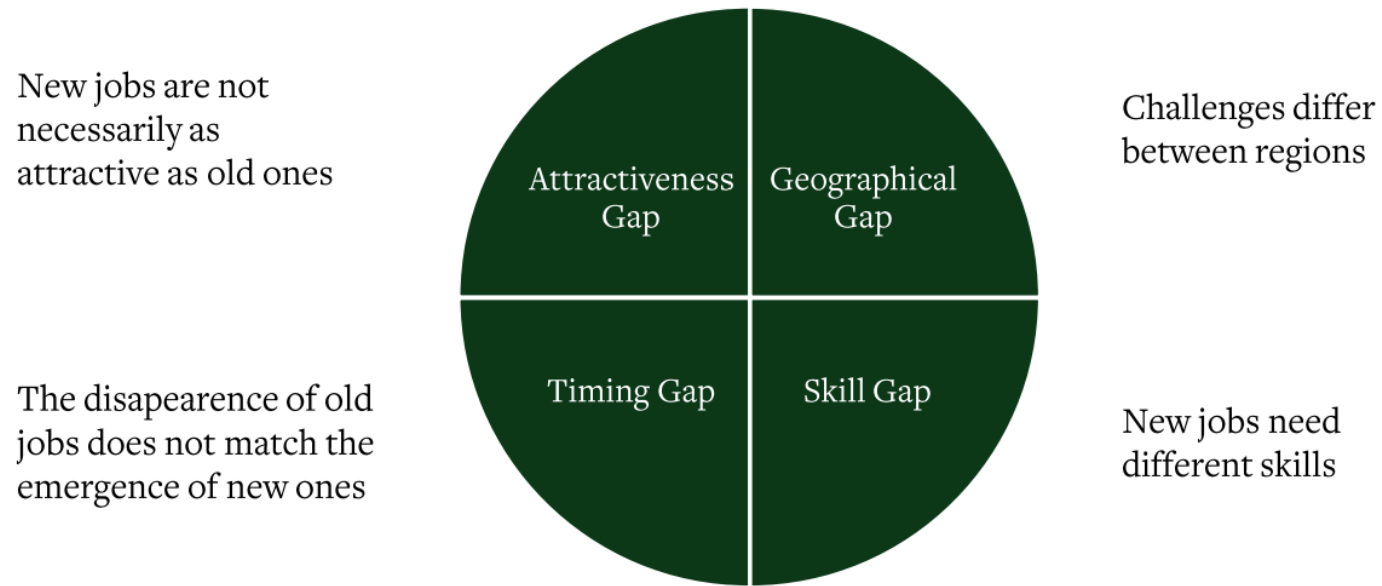


FORMAL QUALIFICATIONS AT EU LEVEL
THROUGH FLEXIBLE AND INCLUSIVE SOLUTIONS
FOR BOTH INITIAL AND CONTINUOUS EDUCATION & TRAINING

Challenges & Opportunities in Upskilling/Reskilling



It is necessary to close the four gaps of a Just Transition!



Twitter: #EU4JT

Source: Just Transition in the European Car Industry - <https://justtransition.eu/publications>



Supported by:



based on a decision of the German Bundestag

Alarm! Public education development is too slow!



...by different reasons in VET and Academia:

- Universities have freedom to create new courses – but only based on own research, which means long lead times.
- VET can initiate new programmes and packages faster, but it must often build on national (or approved) curricula to be funded, and these are not always in place.

**Support FLEXIBILITY & COLLABORATION
=> SPEED UP REACTION TO THE CHANGES**



Recommendations /Vocational Education!

EU-level:

- Skills agenda roll-out over Europe
- Funding for labs, on- and offline

Regional/National level:

- Green skills in curriculum!
- Flexible curricula – easy to update and adapt
- Force education providers to cooperate!
- English language learning!

VET provider level:

- Cooperate – universities - industry, - other VET providers!
- Be proactive! Don't wait!

Industry /Working life:

- Communicate with VET providers!
- Offer on-site experience for teachers and trainers!

Hypothesis – LLMs (as ChatGPT) and Skills...

- **...can or will bring Higher Education and VET closer to each other?**
- **...less focus** on evaluating memory & personal understanding of X (constructivism)
- **...increased focus** on application, on evaluation on skills, built on knowledge:
 - What can you create, recreate, adapt?
 - What process can you master in practice?
 - What can you manage / what can you do?
 - What actual problems can you solve?(Constructionism)

Let's all
focus more
on skills!

Battery Training Offer & Skills Collaborations – (as ALBATTs is soon finalized)



An initiative of the European Commission

Large-scale
European Partnership
In Mobility-Transport-
Automotive Ecosystem



AUTOMOTIVE
SKILLS
ALLIANCE




InnoEnergy
SKILLS INSTITUTE

<https://pact-for-skills.ec.europa.eu/>

<https://automotive-skills-alliance.eu/>


<https://www.innoenergy.com/skillsinstitute/>





Learning
Platform



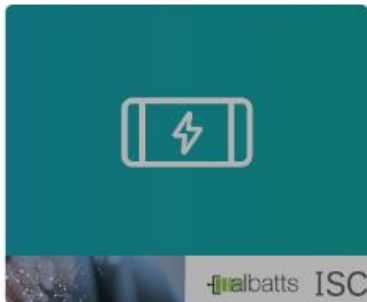

<https://learn.skills-framework.eu/>



Examples:

COURSES

All General Production Maintenance Engineering R&D Battery Sector

 <p>Integration Process</p> <p>ALBATTs</p> <p>ALBATTs - Integration Process</p>	 <p>Manufacturing Process</p> <p>ALBATTs</p> <p>ALBATTs - Manufacturing Processes</p>	 <p>Battery Systems Engineer</p> <p>ALBATTs ISC</p>	 <p>Raw Materials Mining and Refin</p> <p>ALBATTs</p> <p>ALBATTs - Raw Materials, Mining and Refining</p>
--	---	---	---



Thank you!



FOLLOW US / GET INVOLVED



info@project-albatts.eu



<https://www.project-albatts.eu>



@ALBATTs – Alliance for Batteries Technology, Training and Skills



@ALBATTs1



@Project ALBATTs

JOIN OUR NETWORK THROUGH OUR WEBSITE AND GET FIRST-HAND INFORMATION ABOUT OUR WORK & BATTERY SECTOR SKILLS AGENDA!



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

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.