

NEW SKILLS

TRAINING

OVERVIEW OF THE SKILLS AND COMPETENCE NEEDS OF THE EUROPEAN BATTERY SECTOR

Alliance for Batteries Technology, Training and Skills

Dr. Jakub Stolfa, ASA / VSB-TUO / ALBATTTS WP Leader, js@skills-alliance.eu

SKILLS TRANSITION IN THE BATTERY INDUSTRY: TRAINING PEOPLE FROM OTHER INDUSTRIES;
9th February 2023; online





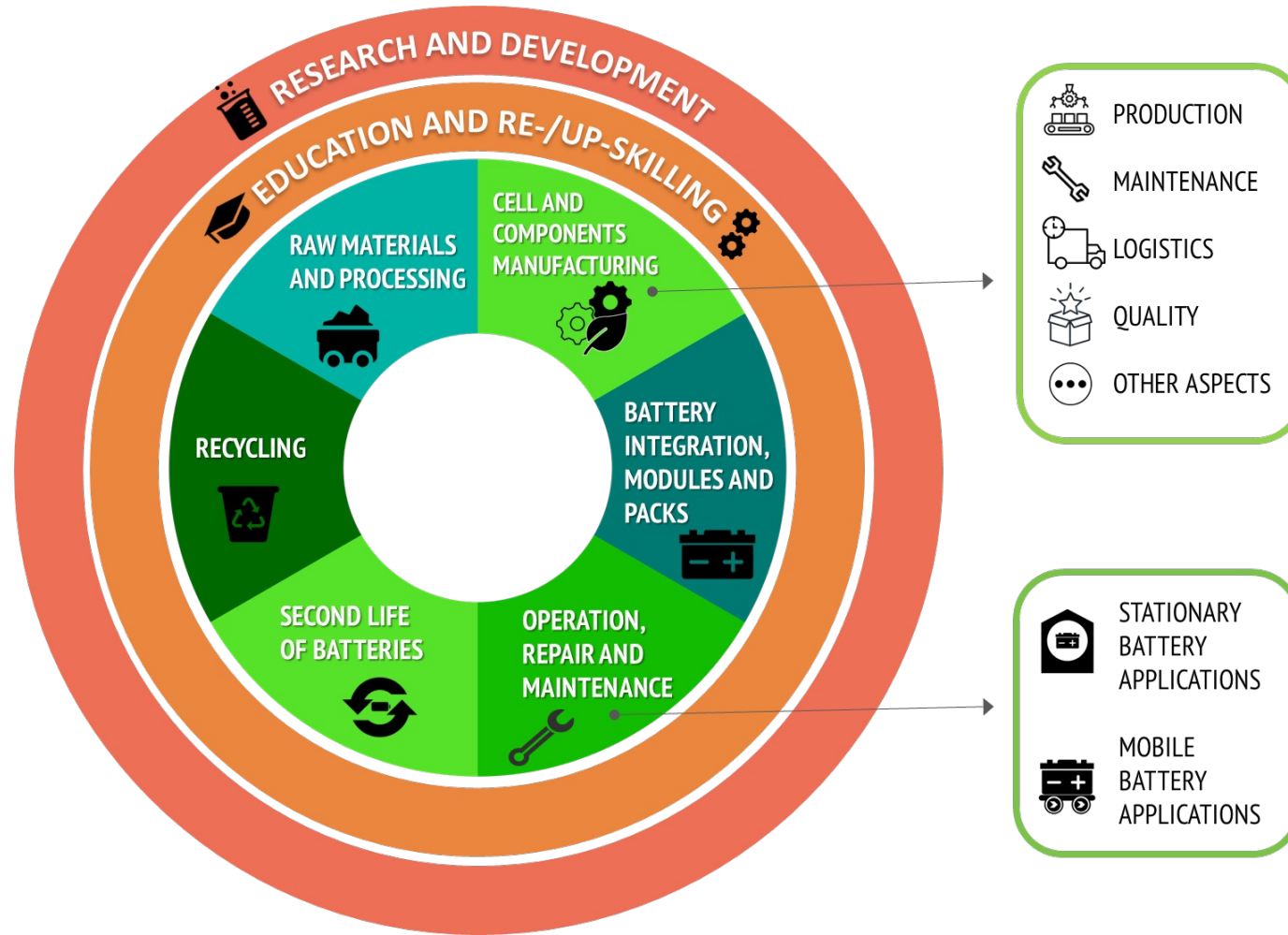
What is the European Battery Sector?



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 Value-Chain



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.

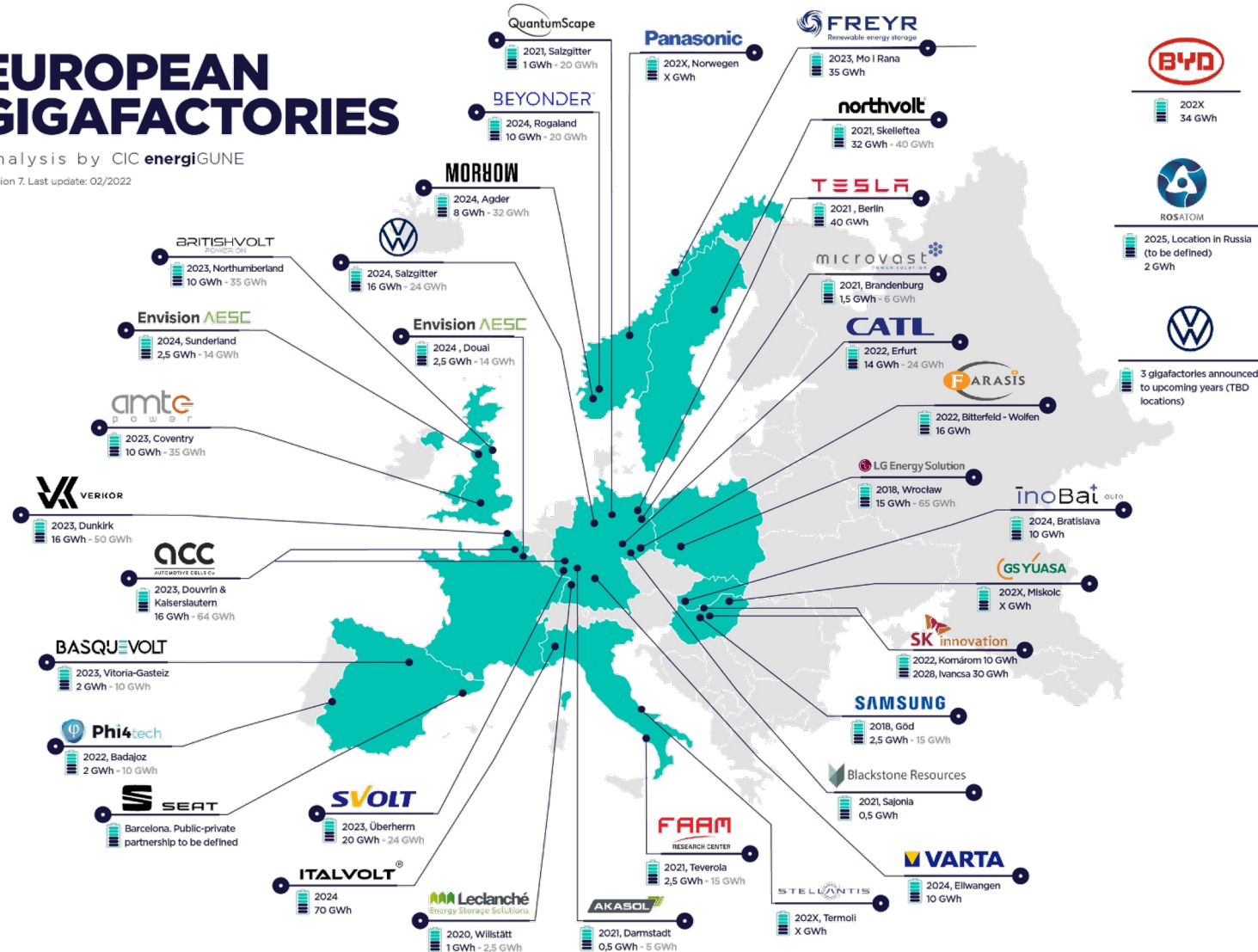
Battery Production in Europe



EUROPEAN GIGAFACTORIES

Analysis by CIC energigUNE

Version 7. Last update: 02/2022



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.

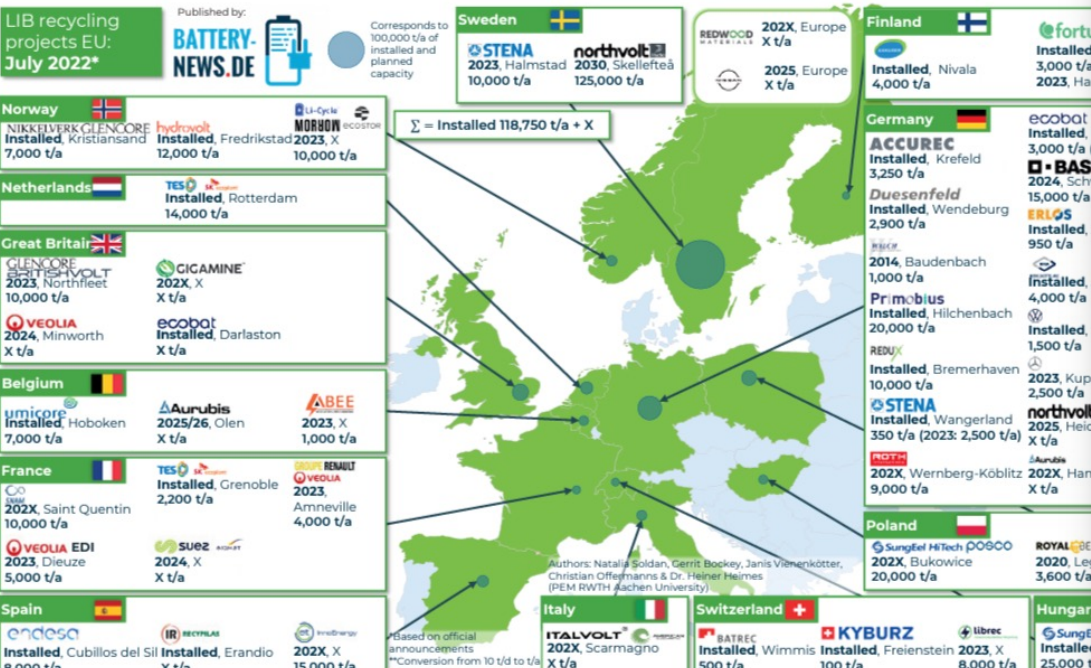
BATTERY CELL MANUFACTURERS

Battery projects as of July 2022	Published by: BATTERY-NEWS.DE	NW: 125 GWh + X MORHOF 2024, Agder Up to 33 GWh	SE: 110 GWh + X northvolt 2025	LV: X GWh Anodox Energy Systems	DE: 493.6 GWh + X CALB 202X, Germany Blackstone Resources 2024, Döbeln
----------------------------------	-------------------------------	---	-----------------------------------	------------------------------------	--

EQUIPMENT SUPPLIERS

Battery equipment	Poland	Sweden	Finland	Germany	PFEIFFER VACUUM
-------------------	--------	--------	---------	---------	-----------------

RECYCLING COMPANIES



Check Battery-atlas.eu and coming ALBATTS reports

MODULE AND PACK MANUFACTURERS

Battery system manufacturing	Published by: BATTERY-NEWS.DE	SE: Anodox	LV: VALMET AUTOMOTIVE	FI: VALMET AUTOMOTIVE	DE: VALMET AUTOMOTIVE
------------------------------	-------------------------------	------------	-----------------------	-----------------------	-----------------------

ACTIVE MATERIAL SUPPLIERS

Battery active materials (extract) as of June 2022	Published by: BATTERY-NEWS.DE	NW: 172,000t 2025, Mo i Rana 30,000t LFP FREYR	Vianode 2023, Porsgrunn 50,000t Graphite	NIKKELVERK 2021, Kristiansand 92,000t Nickel sulfate	SE: 40,000t 2025, Borlänge Up to 40,000t* Cathode	FI: 71,000t BASF
--	-------------------------------	---	--	--	---	---------------------

BATTERY TEST CENTERS



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.

Battery Sector – Overview



- ⚡ Highly **emerging and rising** sector in Europe
- ⚡ **Electromobility** is pushing the **European battery sector**



Battery Sector – Overview



- ⚡ Highly **emerging and rising** sector in Europe
- ⚡ **Electromobility** is pushing the **European battery sector**

- ⚡ This needs to be supported by the **workforce with the right skills**
- ⚡ **Change of needed skills/competences or knowledge during the individuals' career – the change is constant.**



Battery Sector – Overview



- ⚡ Highly **emerging and rising** sector in Europe
- ⚡ **Electromobility** is pushing the **European battery sector**

- ⚡ This needs to be supported by the **workforce with the right skills**
- ⚡ **Change of needed skills/competences or knowledge** during the **individuals' career – the change is constant**.

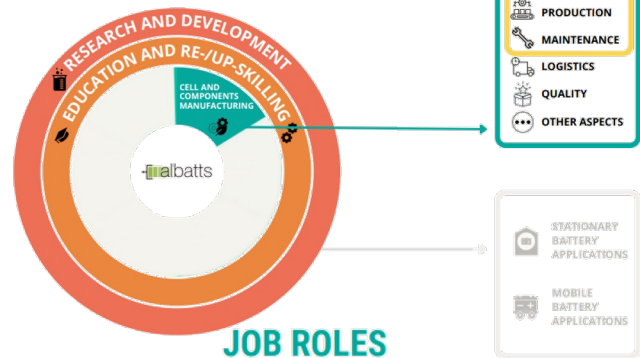
- ⚡ **High demand for workers**
- ⚡ It is important to see **which competence is possible to transfer** from one **job** to another or even from one **industry** to the other





What skills and job roles are needed?





Cell and Components Manufacturing – Production and Maintenance



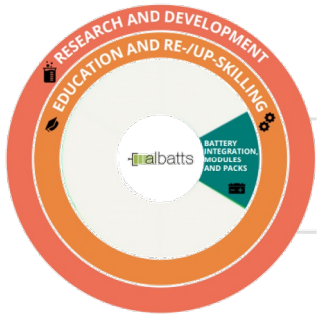
BLUE-COLLAR

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





JOB ROLES



Battery Integration, Modules and Packs

BLUE-COLLAR

FACILITY TECHNICIAN SERVICE TECHNICIAN
CLEANING TECHNICIAN **PLANNER**
MAINTENANCE TECHNICIAN
MACHINE OPERATOR **BESS TECHNICIAN**
OPERATOR **SR. QUALITY TECHNICIAN**
SHIFT LEAD **CELL ASSEMBLY TECHNICIAN**
ELECTRONIC MOTOR BENCH TEST TECHNICIAN
BATTERY TEST TECHNICIAN
CELL INSPECTION TECHNICIAN RELIABILITY TECHNICIAN

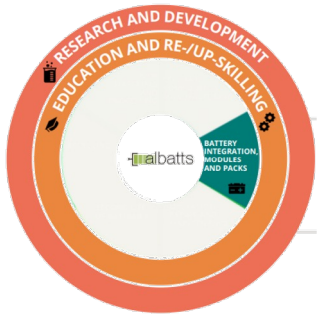
WHITE-COLLAR

ELECTRO-MECHANICAL ENGINEER EV PROJECT MANAGER
MECHANICAL CELL DESIGN ENGINEER **BATTERY SYSTEM & TECHNOLOGY ENGINEER**
MECHANICAL SUPERVISOR PROJECT ENGINEER-CONTROLS ELECTRONICS FOR MOBILITY
HIGH-VOLTAGE BATTERY DRE SENIOR INTEGRATION ENGINEER SYSTEM ENGINEER
LITHIUM ION CELL BATTERY SYSTEM ENGINEER MECHANICAL BATTERY DESIGN ENGINEER
MECHANICAL ENGINEER PRODUCTION BLOCK MANAGER PRODUCTION ENGINEER
SENIOR ENGINEER-BATTERY MODELLING & ANALYSIS APPLICATION ENGINEER
CELL TEST ENGINEER **ELECTRIC ENGINEER-FIRMWARE MANAGER**
PRODUCTION MANAGER CELL ASSEMBLY **BATTERY SYSTEM ENGINEER**
MOBILE HYDRAULICS-APPLICATION ENGINEER
ELECTRICAL VEHICLE ENGINEER-CHARGING **BATTERY SYSTEMS MANAGER**
BATTERY TECHNICAL LEAD **DESIGN ENGINEER-BATTERY TECHNOLOGY**
MAINTENANCE ENGINEER **PRODUCTION MANAGER DOWNSTREAM**
SENIOR SYSTEM DESIGN ENGINEER SOFTWARE/MODELLING ENGINEER LEAD
PRODUCTION ENGINEER MANUFACTURING ENGINEER FORMATION MAINTENANCE MANAGER
CONTROLS ENGINEER ELECTROMOBILITY PROJECT LEADER POWER DISTRIBUTION ENGINEER
ELECTRICAL SYSTEM ENGINEER SR. ELECTRONICS ENGINEERING TECHNICIAN



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

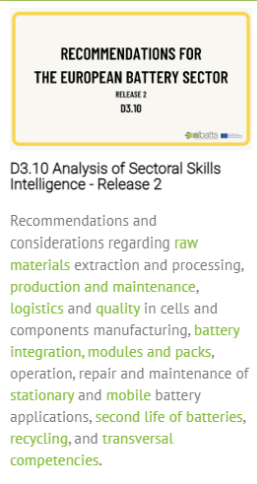
The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Battery Integration, Modules and Packs

JOB ROLES

All the steps and more info is available on the [ALBATTs project website](#).



MACHINE OPERATOR
SR. QUALITY TECHNICIAN
SHIFT LEAD
ELECTRONIC MOTOR BENCH TEST TECHNICIAN
CELL INSPECTION TECHNICIAN
BATTERY TEST TECHNICIAN
RELIABILITY TECHNICIAN

WHITE-COLLAR

ELECTRO-MECHANICAL ENGINEER
MECHANICAL CELL DESIGN ENGINEER
CELL SUPERVISOR
BATTERY DRE
BATTERY SYSTEM ENGINEER
ENGINEER
BATTERY MODELLING & ANALYSIS
T ENGINEER
AGER CELL ASSEMBLY
HYDRAULICS-APPLICATION ENGINEER
ELECTRICAL VEHICLE ENGINEER-CHARGING
BATTERY TECHNICAL LEAD
MAINTENANCE ENGINEER
SENIOR SYSTEM DESIGN ENGINEER
PRODUCTION ENGINEER
CONTROLS ENGINEER
EV PROJECT MANAGER
BATTERY SYSTEM & TECHNOLOGY ENGINEER
PROJECT ENGINEER-CONTROLS
ELECTRONICS FOR MOBILITY
SYSTEM ENGINEER
MECHANICAL BATTERY DESIGN ENGINEER
PRODUCTION BLOCK MANAGER
PRODUCTION ENGINEER
APPLICATION ENGINEER
ELECTRIC ENGINEER-FIRMWARE MANAGER
BATTERY SYSTEM ENGINEER
BATTERY SYSTEMS MANAGER
DESIGN ENGINEER-BATTERY TECHNOLOGY
PRODUCTION MANAGER
DOWNSTREAM
SOFTWARE/MODELLING ENGINEER LEAD
FORMATION MAINTENANCE MANAGER
ELECTROMOBILITY PROJECT LEADER
POWER DISTRIBUTION ENGINEER
ELECTRICAL SYSTEM ENGINEER
SR. ELECTRONICS ENGINEERING TECHNICIAN



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.



Where to attract and retrain the workforce for the battery sector?



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.

Workforce for the Battery Sector



Initial Education

- ⚡ **Create and integrate new curricula to VET and HE**
- ⚡ Approx 85% of required skills and job roles will be on VET level

Continuous Education

- ⚡ **Upskill and reskill existing workforce** from other descending sectors
- ⚡ Need for **new training courses, new ways of training courses delivery** (training on the work, VR, etc.) and offer (to be able to react flexibly)





Where to attract and retrain the workforce for the battery sector?

...challenges & opportunities...



Challenges & Opportunities (1)



According to CLEPA, up to **500,000 jobs in Europe will be lost by 2040 in parts of the automotive value chain, mainly within ICE suppliers.** This is the reduction of **84 % of the current jobs in the ICE value chain;**

CLEPA. 2021. „Electric Vehicle Transition Impact Assessment Report 2020 - 2040“. Transition Impact Study. European Association of Automotive suppliers. <https://clepa.eu/strategy-transition-impact-study/>.



Challenges & Opportunities (1)



According to CLEPA, up to **500,000 jobs in Europe will be lost by 2040 in parts of the automotive value chain**, mainly within **ICE suppliers**. This is the reduction of **84 % of the current jobs in the ICE value chain**;

CLEPA. 2021. „Electric Vehicle Transition Impact Assessment Report 2020 - 2040“. Transition Impact Study. European Association of Automotive suppliers. <https://clepa.eu/strategy-transition-impact-study/>.

The loss of jobs will be **partially compensated** by the **BEV powertrain production** that is expected to create **226,000 jobs**;

Mobility Ecosystem is rising, number of jobs will be rising – e.g., **e-bikes sector, battery sector**, etc.



Challenges & Opportunities (2)

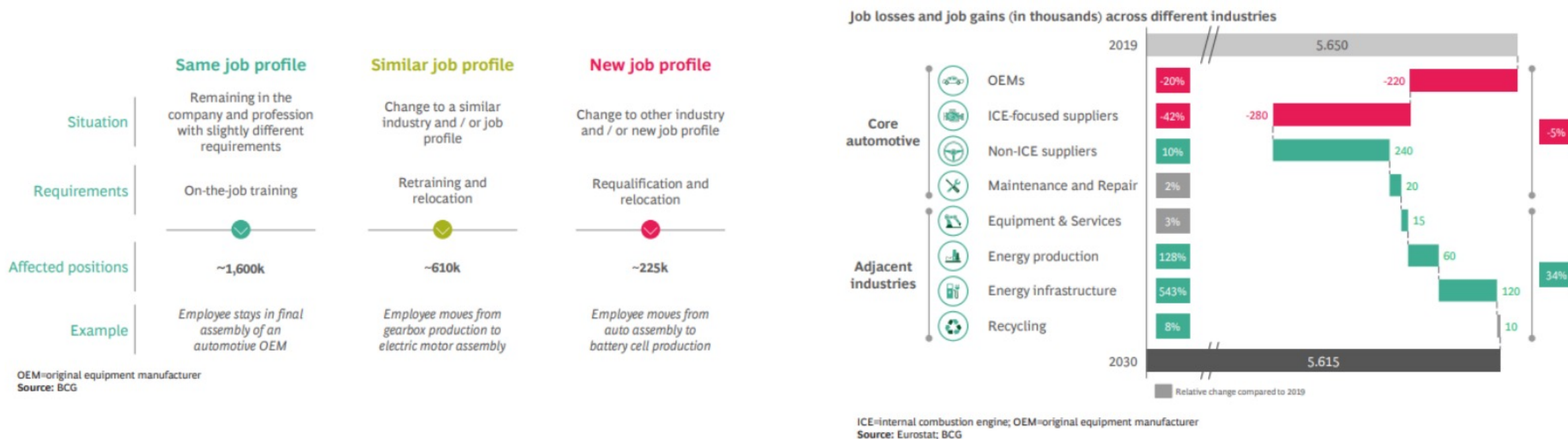


According to Boston Consulting Group, up to **2.4 million jobs** will require partly high retraining in this transition by 2030

While **1.6 million persons** need re-skilling within the same job profile,
610,000 persons have to change their job profiles slightly.

In comparison, just **225,000 persons** need radical retraining into different job profiles and industries.

Kuhlmann, Kristian, Daniel Küpper, Marc Schmidt, Konstantin Wree, Rainer Strack, und Philipp Kolo. 2021. „Is E-Mobility a Green Boost for European Automotive Jobs?“ Boston Consulting Group.
<https://www.bcg.com/ise-mobility-a-green-boost-for-european-automotive-job>



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.

Challenges & Opportunities (3)



Sectors supporting the battery sector e.g.:

Mining: Extracting of raw materials – lithium, cobalt, nickel, manganese

Manufacturing: line operators, quality control technicians, production supervisors

Chemical industry: work with electrolytes and cathode materials

Engineering: Electrical and material engineers

Information technology: Battery management system, artificial intelligence

Energy: workers with expertise in renewable energy, energy storage, and grid integration



Challenges & Opportunities (4)



Industries that have **similar skill sets** that might be **transferable** to the battery sector, e.g.:

Manufacturing experience: Workforce familiar with volume production processes and techniques. Pharmaceutical; chemical; automotive; industry with the ultra-clean environment; pulp and paper production industry; etc.

Supply chain and logistics experience: Battery sector requires coordination of a complex supply chain

Sales and Marketing: Increasing need for workers with sales and marketing skills to promote and sell batteries

IT industry: Includes skills as data analysis, automation and robotics.

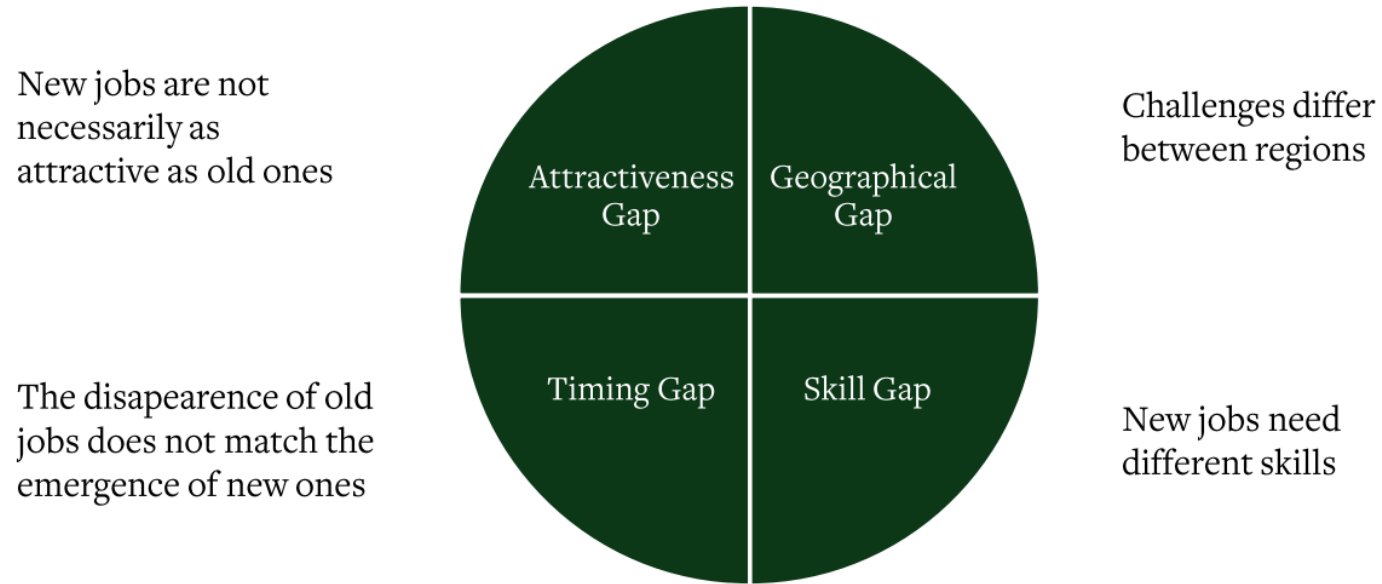
Project management: large-scale, complex projects to be managed



Challenges & Opportunities (5)



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



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.



Do have any relevant education and training courses?



Battery Training Courses (selection)



- ⚡ Need for urgent and continuous training courses offer and update



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.

Do you want to know more?



Is your **region** or **city** working or planning to start activities in the battery value chain?

Are you already or looking for a **career** within the development, production or handling of energy storage?

CHECK WEBSITE RESULTS PAGE OR CONTACT US!

**SECTORAL SKILLS STRATEGY
FOR THE EUROPEAN BATTERY SECTOR**
RELEASE 1
D3.6



D3.6 Analysis of Sectoral
Intelligence - Release 1

**RECOMMENDATIONS FOR THE
EUROPEAN BATTERY SECTOR**
RELEASE 1
D3.6



D3.6 Analysis of Sectoral
Intelligence - Release 1

**INTELLIGENCE IN
BATTERY MANUFACTURING
AND BATTERY TECHNOLOGY**
RELEASE 2
D3.7



D3.7 Desk Research & Data Analysis
- Release 2



info@project-albatts.eu



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.



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 STAKEHOLDERS' DATABASE THROUGH OUR WEBSITE AND GET FIRST-HAND INFORMATION ABOUT OUR WORK!



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.

Electromobility

ALBATTIS Skills Transition | 2023

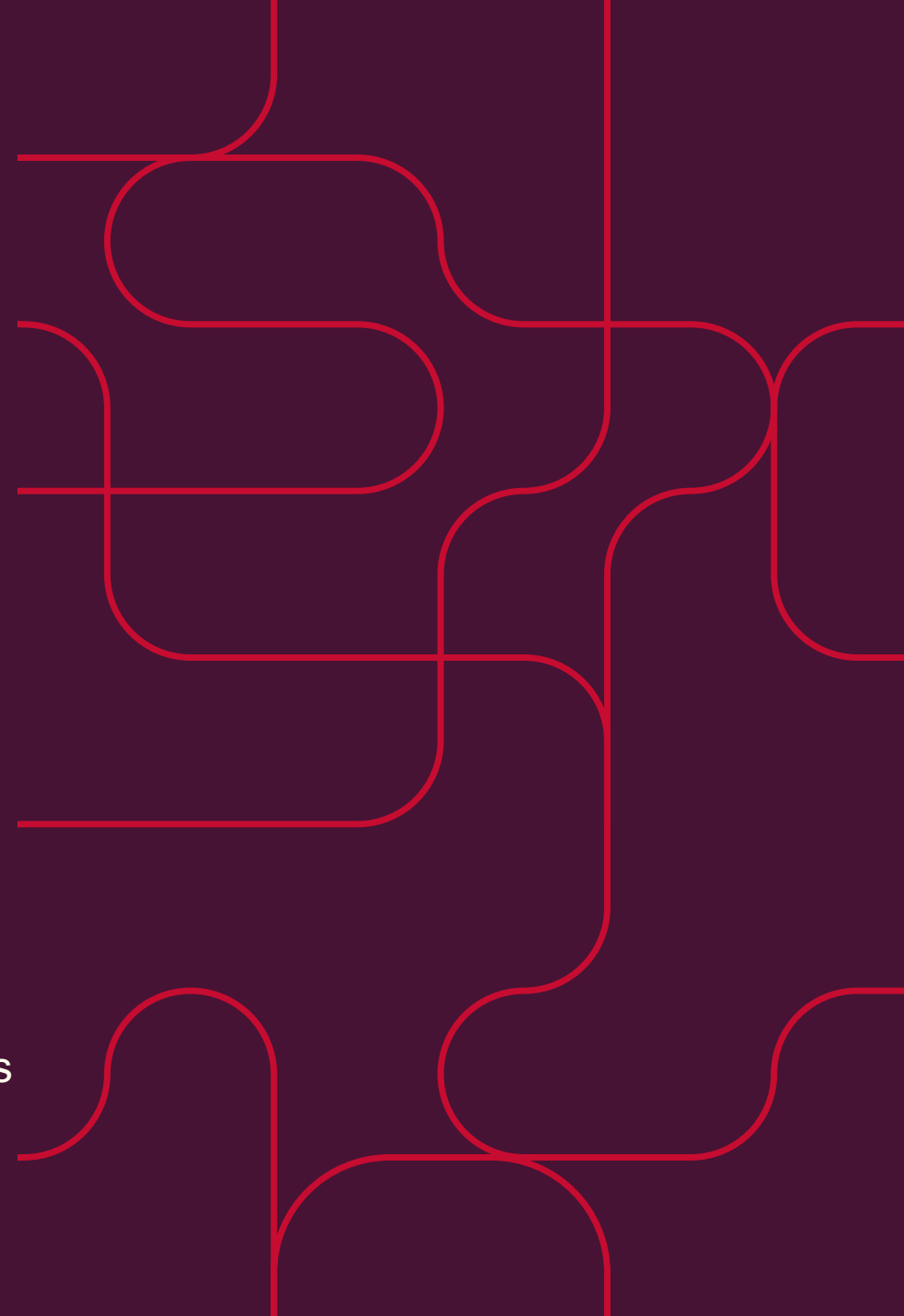
CONTACT

Fredrik Hannerz

MSc, Senior Change Manager: Lean Production and Financial Risks

+46708581970

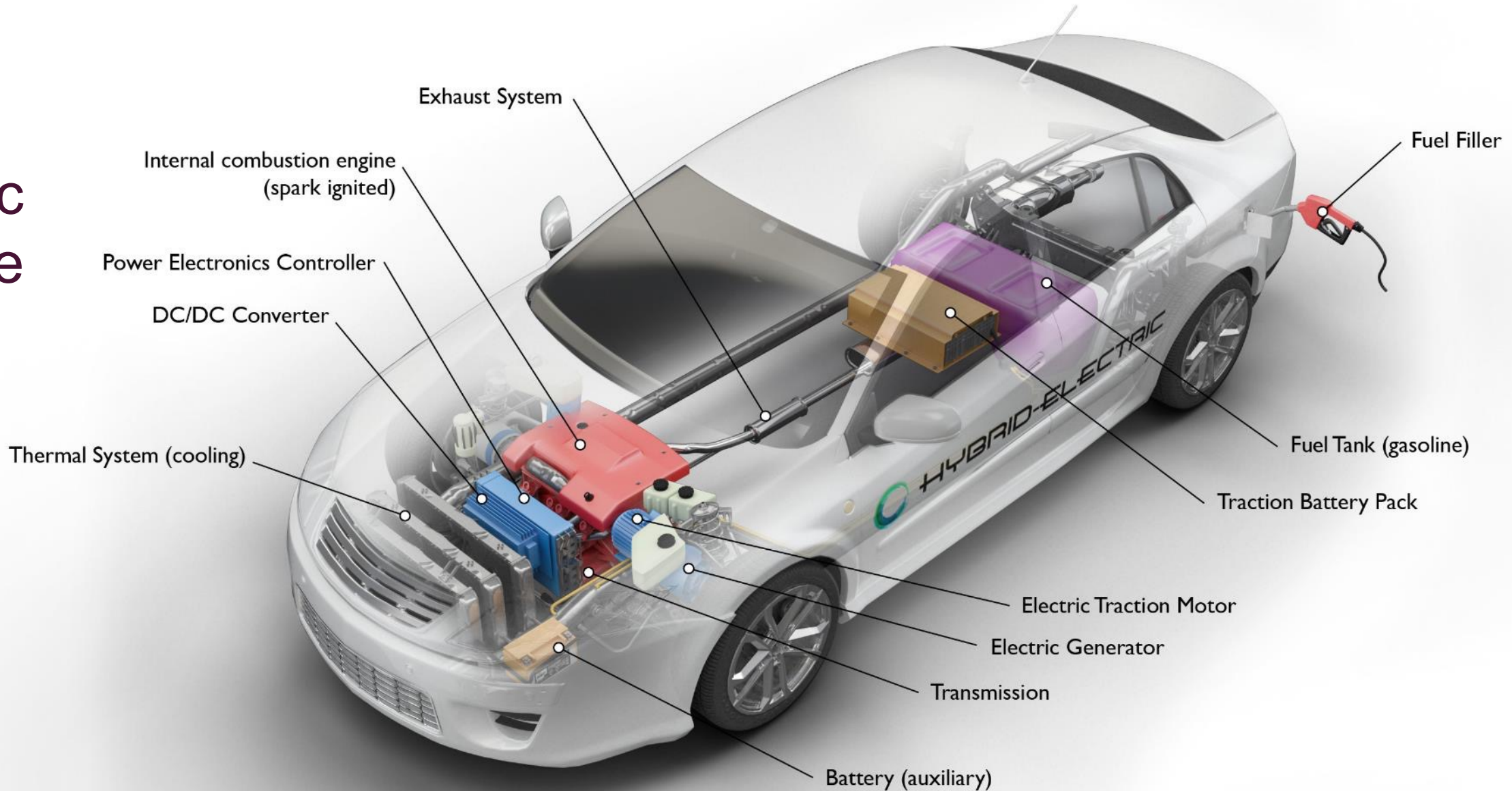
fredrik.hannerz@gtc.com



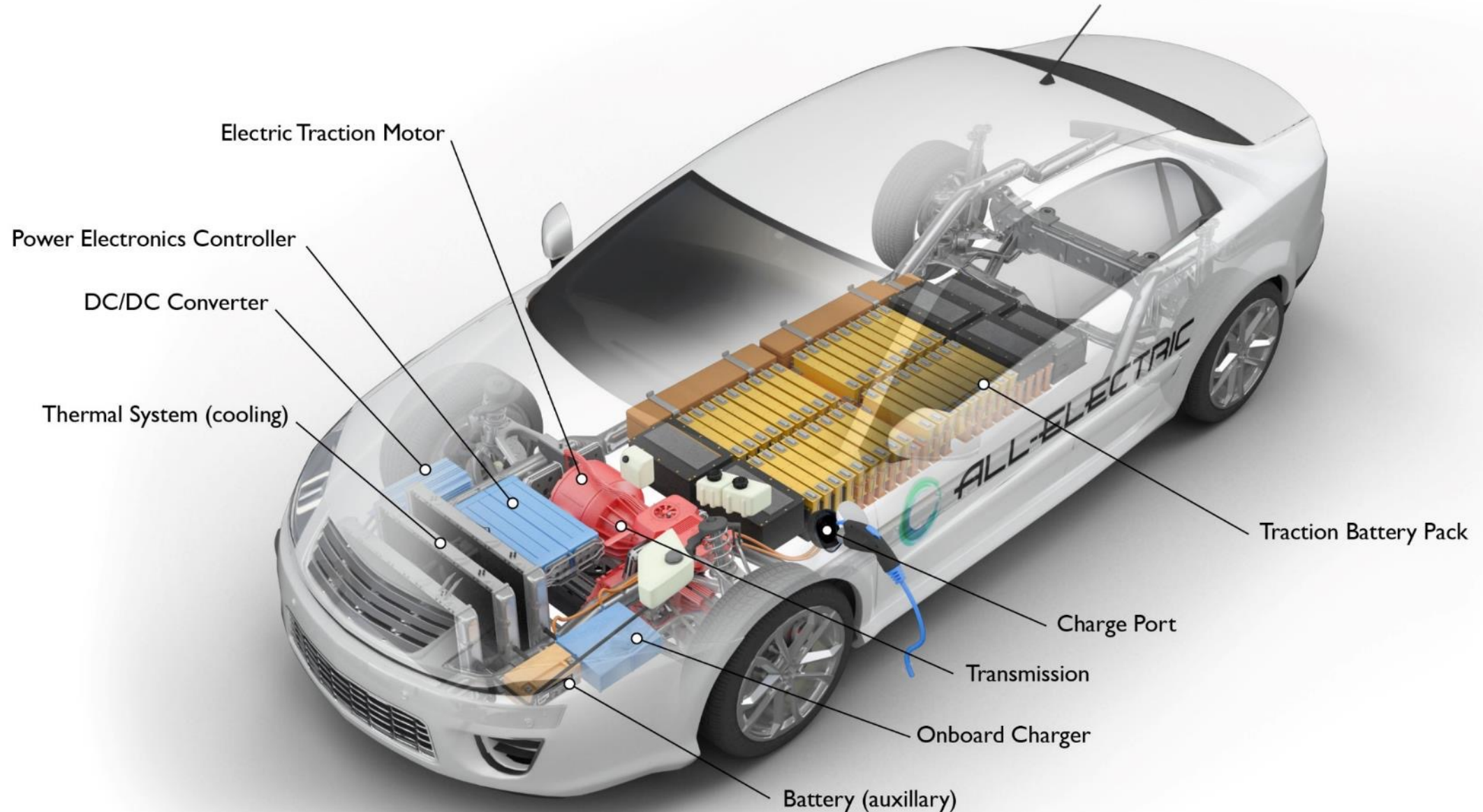
EV Architecture



HEV Hybrid Electric Vehicle



BEV Battery Electric Vehicle



Our suite of E-mobility Courses: Strategy and Tactics

To target the key questions regarding the transformation of our society and the automotive industry

- What is happening?
- Why is it happening?
- When is it happening?
- Where is it happening?
- Who does it effect?
- How will it happen?

... and the most relevant question of all "What's in it for me?"

Our suite of E-mobility Courses: Operations (7 days/56 Hours)

- Awareness EV (4h of theory / 32 Participants)
 - Environment, Market development, Total cost of ownership, Technology, ...
- Battery system overview (8h of theory and practice / 16 Ps)
 - Battery technology, Electric safety, Battery Management, Usage, Durability, ...
- Li-Ion battery system (16h of theory and practice / 16 Ps)
 - Cell formats, Physical chemistry, Supply chain, System design, Production, ...
- EV charging and power supply (12h of theory and practice / 16 Ps)
 - Modes, Behaviour, Infrastructure, Business Model, Power Components, ...
- Electrical machines and transmission (16h of theory and practice / 16 Ps)
 - Drives Overview, Hybrid Powertrain Topologies, Circuit Theory, ...

Most in-demand course package, by the employees, in Volvo Cars training offers.

Experience: 1000+ participating VCC engineers during the last 45 months!

Project Findings: Thoughts on Change Management

- We know that our way of life over the past 100 years is no longer sustainable. We have an urgent need to change our behavior and the work it performs.
 1. If what you're doing is working, do more of it
 2. If it doesn't work; change the way you do it.
 3. If the result still is not satisfactory, then you know that too →2.
- The best definition of an idiot is a person who does things the same way and waits for the outcome to change on their own.
- Basic knowledge of economics and budget management are useful prerequisites for change management

Project Findings: Thoughts on Engineering

- The curiosity about people's needs, how they: feel, think and do things - is the necessary working material needed to bring about change. The creative outcome is innovations that lead to modified behaviors.
- Just look around! A good chance is that most of what you see is artificial, or merely "reworked nature". All natural raw materials refined into products and services, which make it possible to do things in new ways.
- Engineers are the profession that specialize in realizing ideas for tools and methods - thoughts and intentions that materialize.

Project Findings: Thoughts on Education

- The ultimate goal is to share a world of concepts and a 'language', to be able to exchange experiences.
- Only reskilling and upskilling can provide the workforce a rapidly expanding electrification market requires.
- It takes courage to challenge one's own self-image.
- Heading towards an uncertain future, we know that curiosity and creativity always pays off. The people who have those abilities, see what needs to be done - instead of just following outdated orders that does not produce the desired outcome.

Business Intelligence and Legitimacy

[GTC Electromobility Reference Library](#)



The product of almost four years of exchange between
our coaches/teachers and 1000+ participants at Volvo
Car Corporation

GTC Electromobility courses for VCC

- ☐ 1: Awareness Electromobility
- ☐ 2: Battery System Overwiev
- ☐ 3: Li-Ion Battery System
- ☐ 4: HV Charging and Power Supply
- ☐ 5: Electrical Machines and Transmission



[GTC Electromobility](#)
[Full Range of Courses](#)

Project Findings: Thoughts on Engineering

- Our biological species is at least 300,000 years old. That ancient hardware has been updated by cultural reprogramming, to perform completely novel tasks - by supplying new tools and methods.
- For the last 10,000 years, the population of Sweden has grown from 10,000 hunters and gatherers to 10,000,000 modern Swedes. A cultural evolution has increased the production of survivability 1,000 times! It is equally hopeful and terrifying at the same time.
- Progress is an inescapable part of our cultural "DNA".
- 'The best way to predict your future is to create it' – Abraham Lincon

Hi, I'm Tore!

**Training coordinator,
VUX Skellefteå.**



Reno 2019

**Make people believe
it's really going to
happen.**



**Don't be blinded
by the new
establishment.**

Coordination

Factor 3.0

Our city has become a growing centre for the European battery industry with the increasing need for battery-skilled employees.

Automation Operator Program

Based on a draft from Northvolt.

20 week program launched in October 2020

Half of the education are core courses. Technical English, digitization, working environment, laws and regulations, group dynamics, ergonomics, chemistry safety, CPR, soft skills, forklift certificates.

Technical part. Mechanical training, pneumatics, electrical pneumatics, production technology, maintenance, trouble shooting.

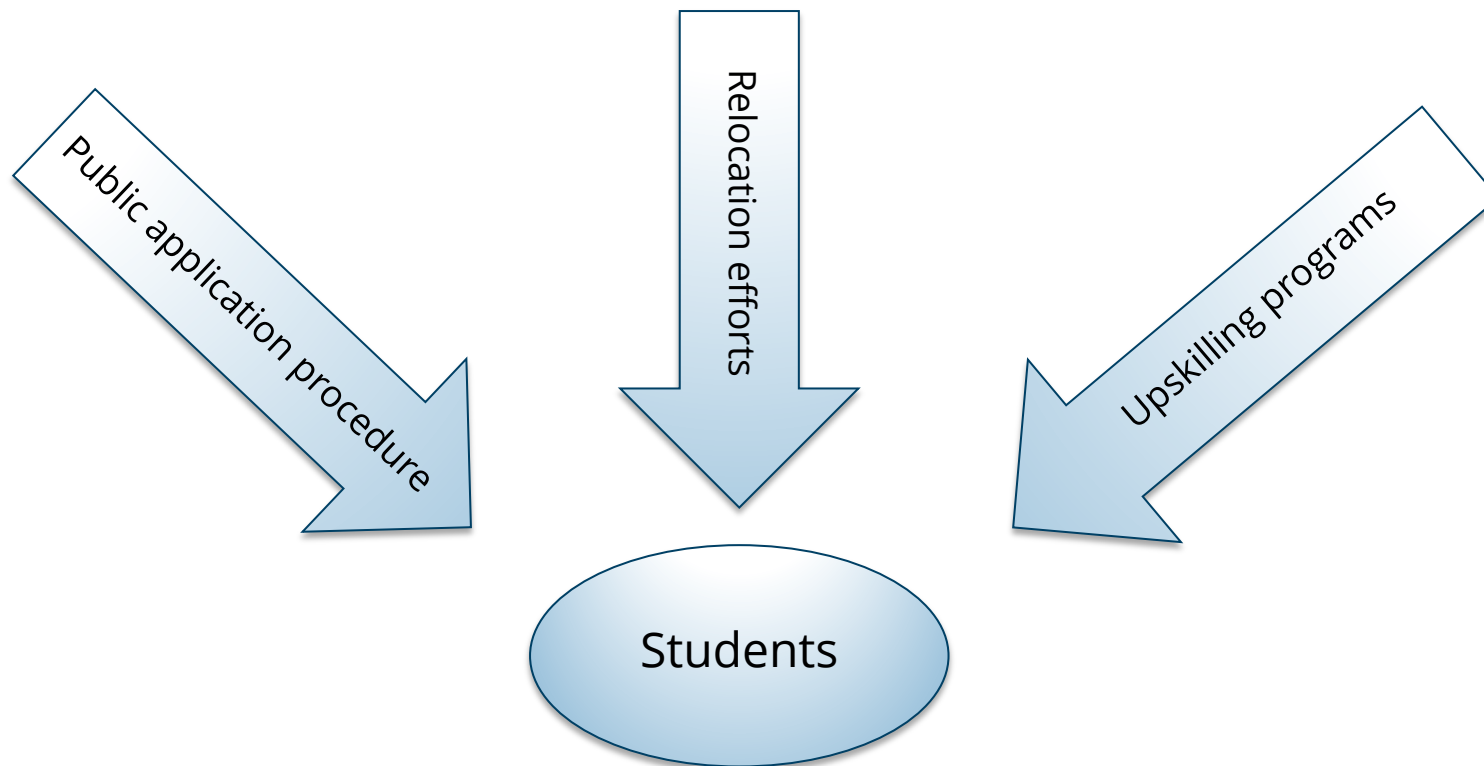
Recruitment program in collaboration with Northvolt.

530 applicants since October 2020, more than 200 trained operators. 55% are women. About 70% goes to Northvolt.

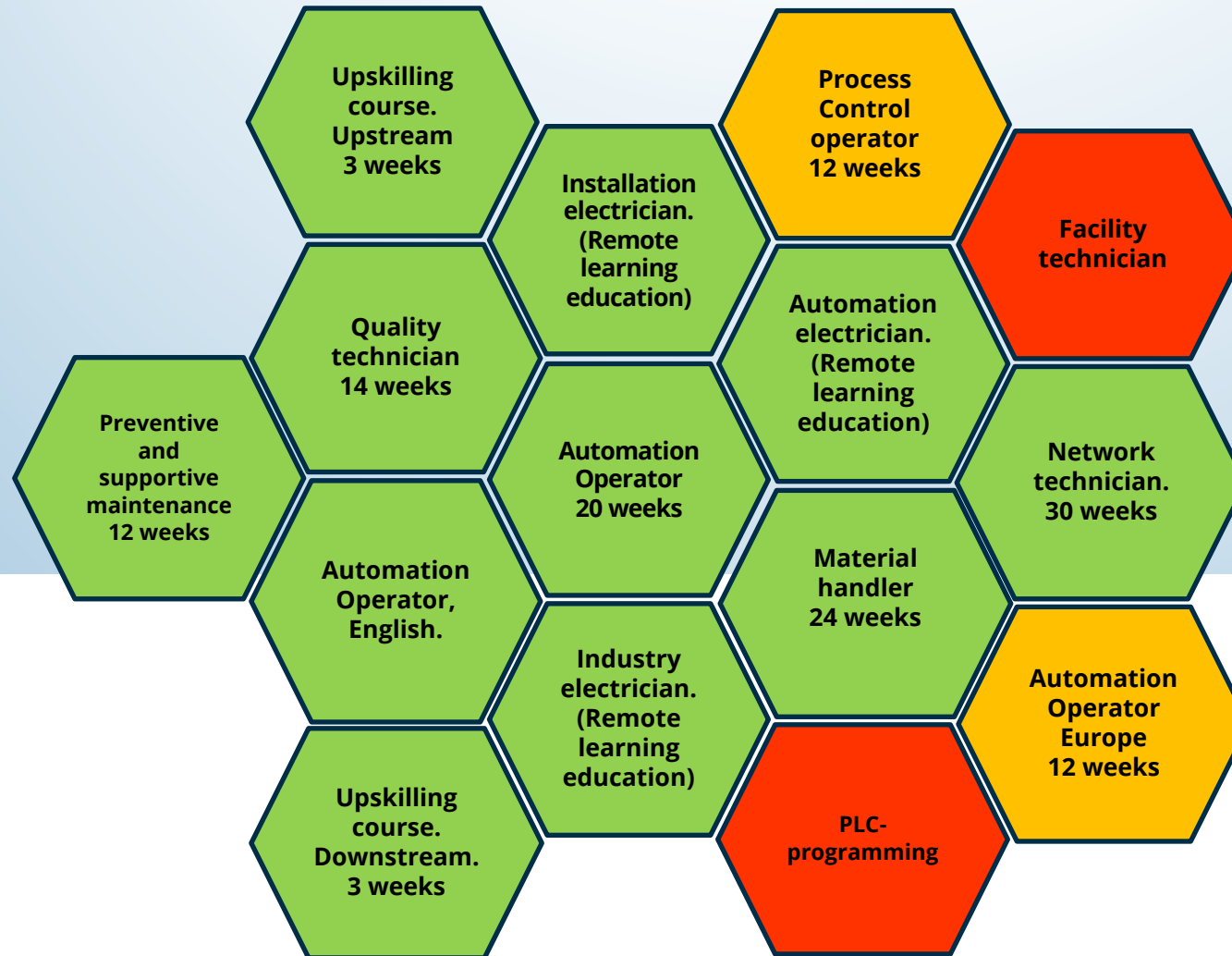


**Skellefteå
kommun**

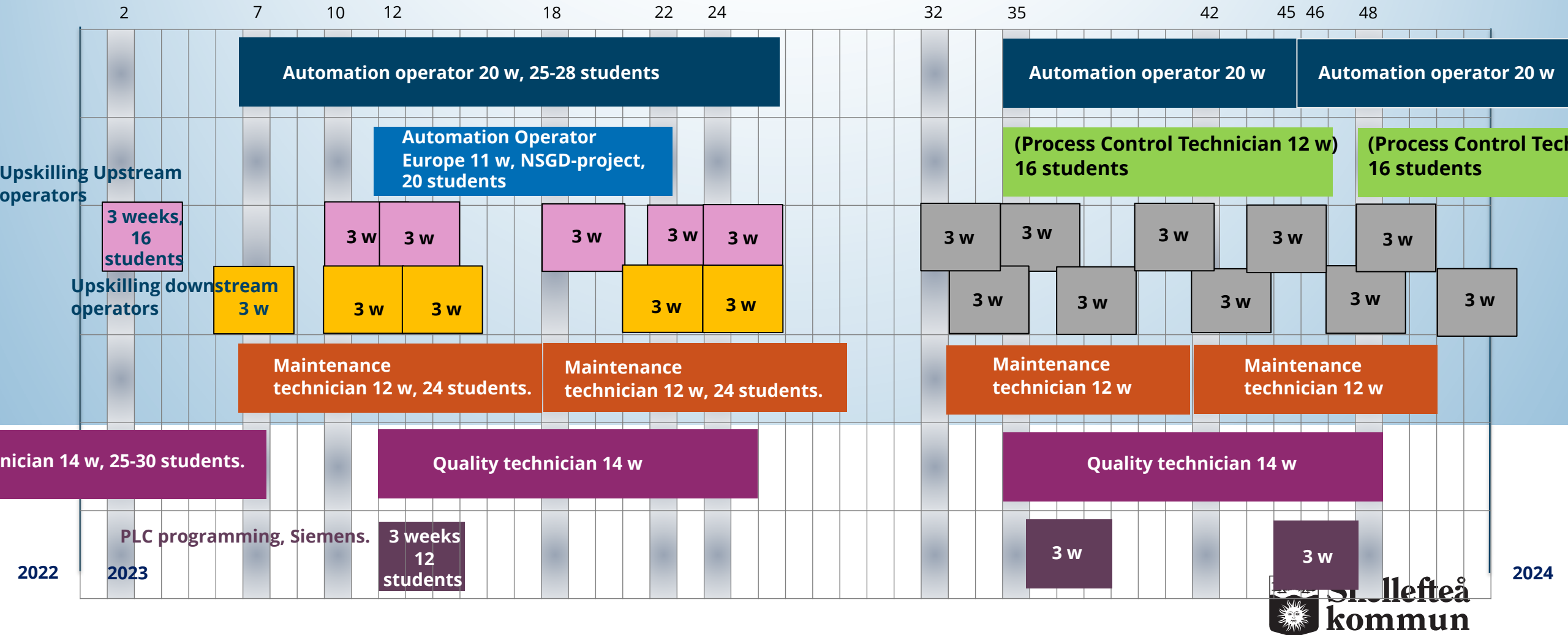
Changed conditions



Education Map, EQF 4-level.



Automation educations Vux 2023, EQF 4



Approximate number of trained for 2023 is 600-650, divided into seven different roles.



All scenes are filmed in our training facilities at VUX in Skellefteå.



**Skellefteå
kommun**

Thank you for your time.

tore.karlsson@skelleftea.se

+46706814292