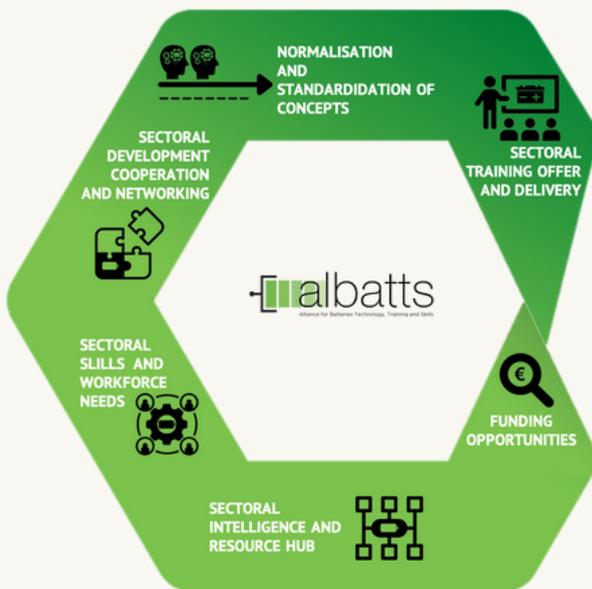


# SECTORAL SKILLS INTELLIGENCE & STRATEGY FOR THE EUROPEAN BATTERY SECTOR

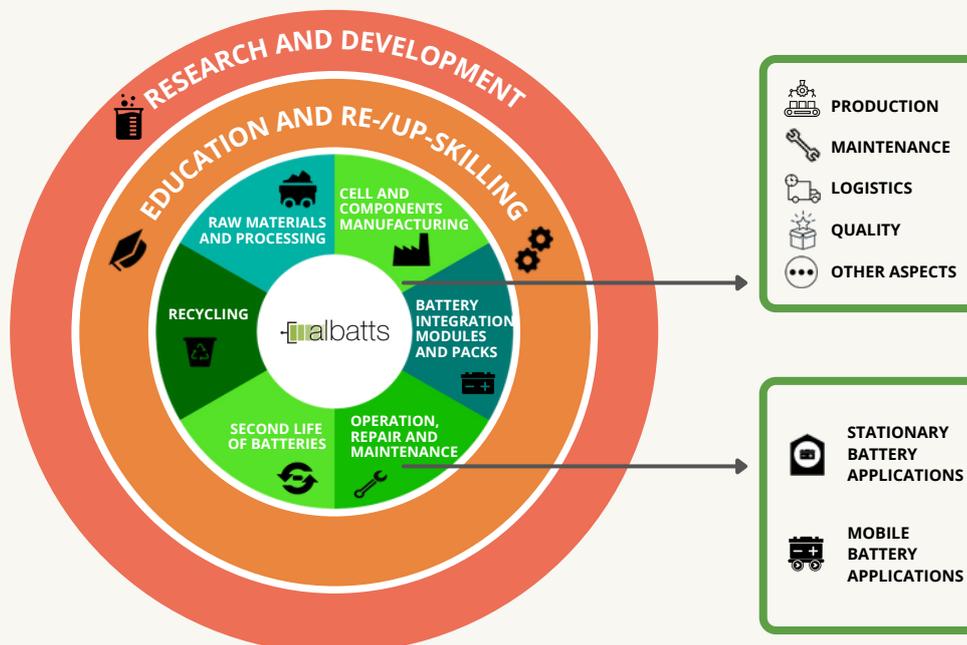
D3.6 – Sectoral Skills Intelligence and Strategy – Release 1

This is the first release of the sectoral skills intelligence and strategy covering the whole European battery value chain from raw materials to recycling of batteries in terms of skills needs, job roles needs and recommendations.



Readers will find designated actions needed in the sector to boost the overall re-/up-skilling activities as well as cooperation, information sharing and provision and many more.

The report also provides quantitative and qualitative overview of the skills and job roles needs per identified areas of interest consisting of the battery value chain steps as well as specific aspects of production, quality or safety tailored to the battery production or other processes that are happening within the European battery sector.





## RECYCLING

### OVERALL NEEDS

Overall focus on the skills/job roles needs for the whole value chain, example intelligence in **recycling**:

- **Biggest recruitment challenges**: engineers and researchers (first phase of the recycling facility set-up requires more white-collar workers, which levels more with the blue-collar as the plant is in the later stages of maturity)
- **Technology and processes**: chemical and physical recycling processes needs to be educated, this is joined with knowledge and skills of: (1) environmental management and circular economy; (2) battery design and design of components with the orientation on recycling at the end of the lifecycle; (3) battery materials, material science, chemistry and electrochemistry; (4) vehicle battery systems and systems overall; (5) material flow; (6) recycling processes, technologies, innovations and automation; and many more
- **Strategies for used battery collection**, methods and systems need to be developed

### JOB ROLES NEEDED





# RECYCLING

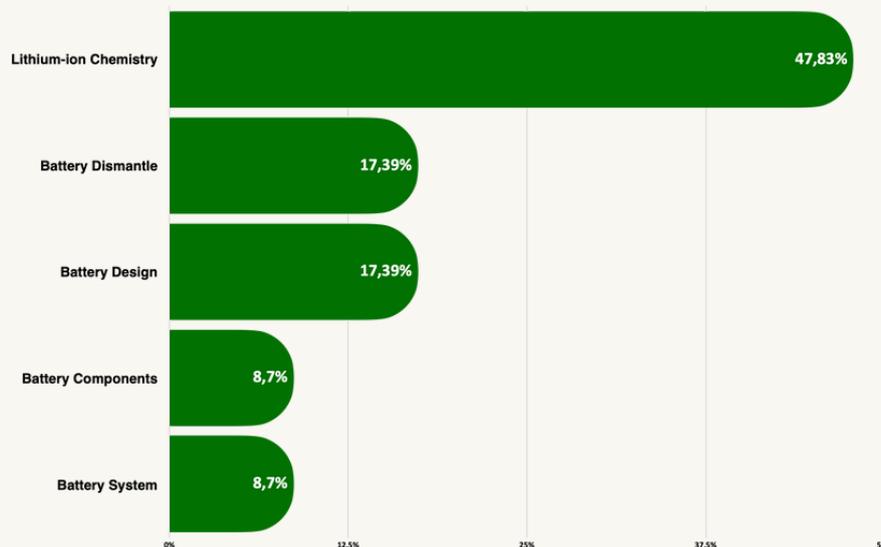
## ... JOB ROLES NEEDED

Observed Blue-collar workers are having expertise in **material handling, operation, machines** and **recycling**, among others.

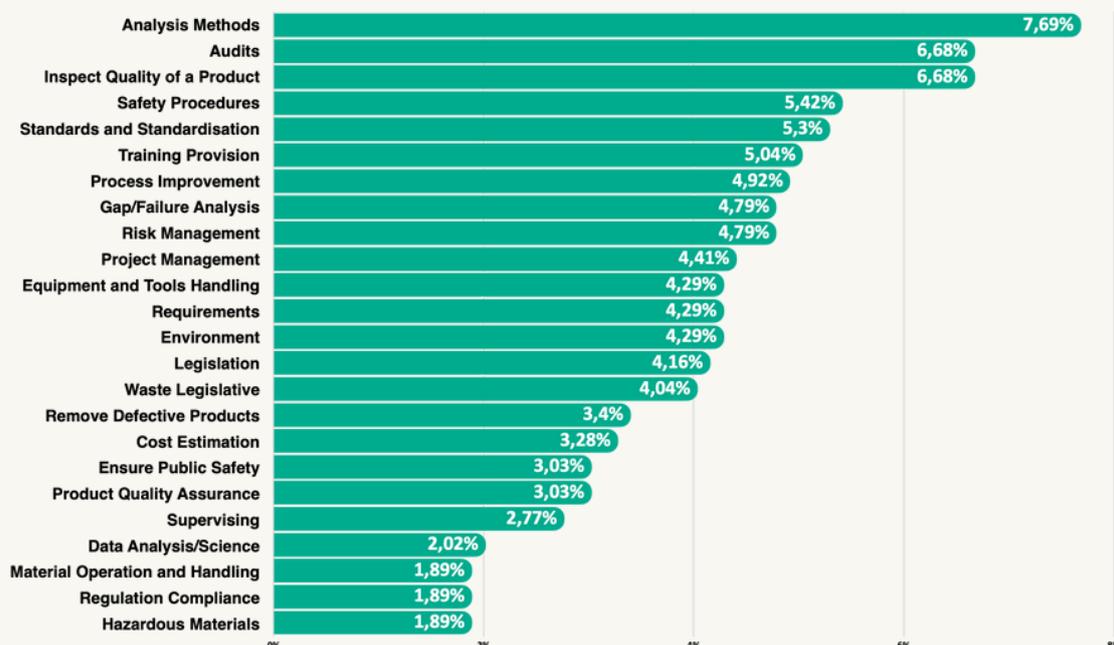
White-collar workers are having expertise in **audits, safety, quality** and **process engineering**, among others.

## NEEDED SKILLS / KNOWLEDGE

RECYCLING - SECTOR SPECIFIC COMPETENCE



RECYCLING - CROSS-SECTORAL SPECIFIC COMPETENCE

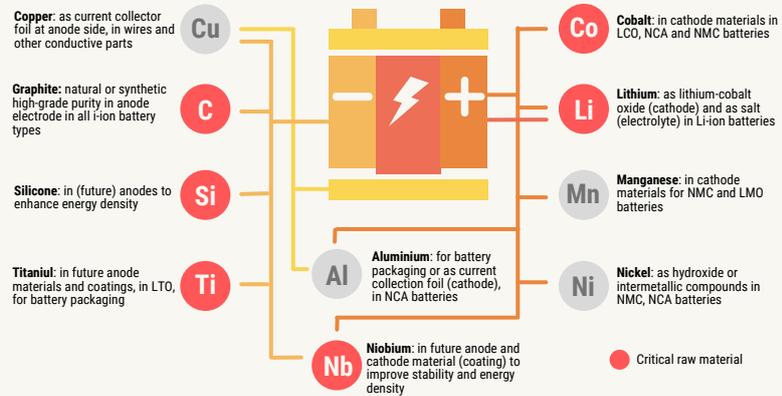




## RAW MATERIALS & PROCESSING

### OVERALL NEEDS

- Strengthening the awareness on the critical raw materials questions for Europe and connected emerging trends and issues;
- Development of new skills needs for mining and refining of raw materials relevant for the battery production (and relevant training material);
- Cooperation on the skills agenda and organisation of education events with relevant stakeholders within the sector.



Critical raw materials in Europe

### NEEDED JOB ROLES

BLUE-COLLAR

GENERAL



Blue-collar workers expertise domains: process and machine operation, material planning, calibration and instruments/equipment, among others.

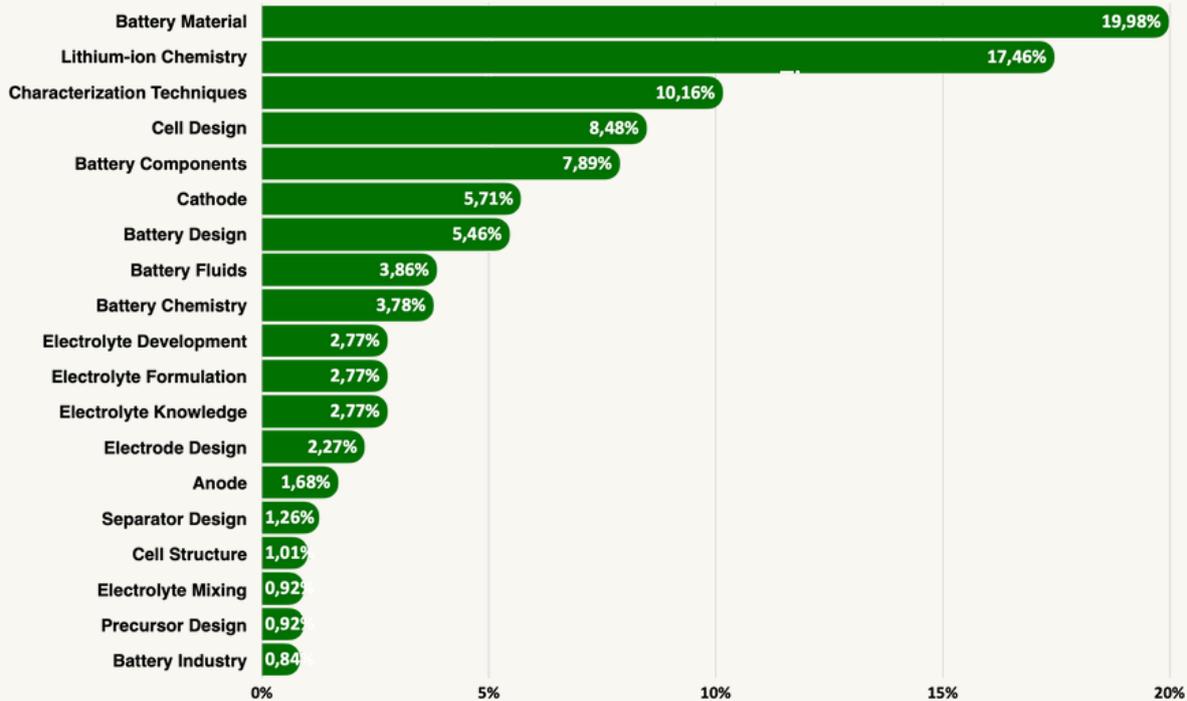
White-collar workers expertise domains: material engineering (electrode, cathode, electrolytes...), production control, inspection and quality, supply chain management, production, process and methodology improvement.



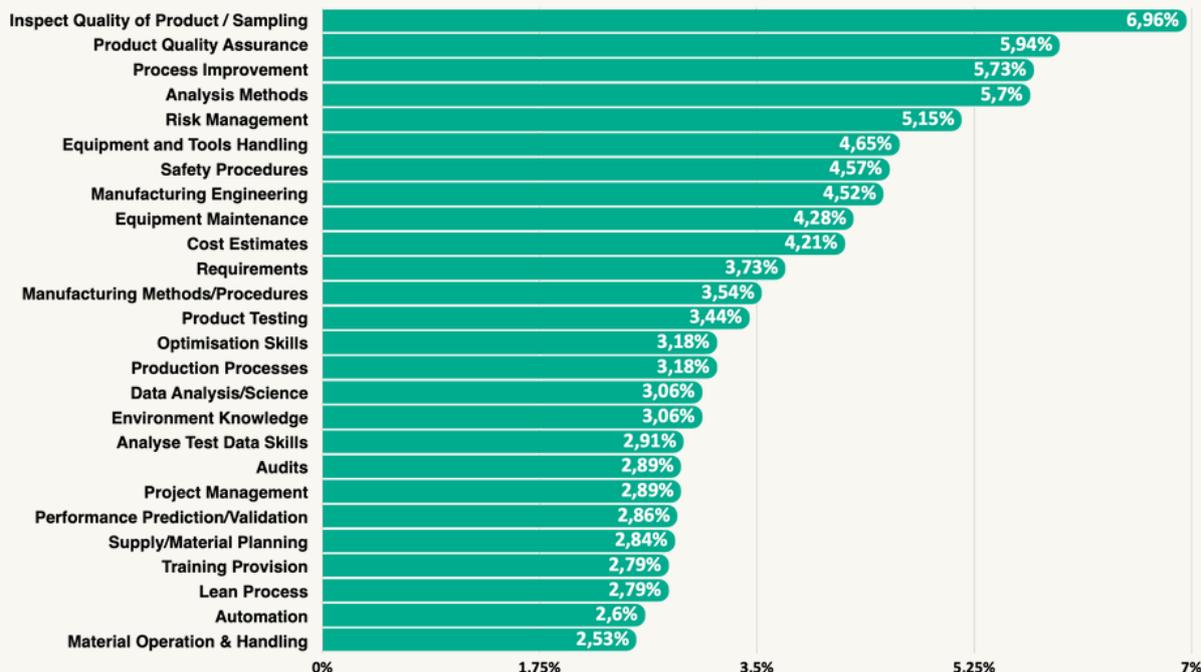
# RAW MATERIALS & PROCESSING

## NEEDED SKILLS / KNOWLEDGE

### RAW MATERIALS AND PROCESSING – SECTOR SPECIFIC COMPETENCE



### RAW MATERIALS AND PROCESSING – CROSS-SECTORAL SPECIFIC COMPETENCE





# CELL PRODUCTION & MAINTENANCE

## OVERALL NEEDS

### Production

- Understanding in the fields of **electrochemistry, electronics, mechanical engineering, process engineering, manufacturing technology, automation and digitalisation in manufacturing** (data analytics, maintenance and product process optimisation);
- In general, to speak and understand foreign languages, mainly English in working environment.

### Production Maintenance

- Apart from the general battery related education, strengthening the skills and competences to ensure understanding of **setting up the production, preparing related structures, commissioning the machines, chemical and mechanical assembly, automation** experience and **mechanical** understanding of the **automated systems** combined with **calibration** and **software**
- Strengthening the **IT** and **data analytics** skills to cover future needs
- **Dry and Clean rooms** maintenance
- **Predictive** and **preventive** maintenance
- **Diagnostics**

## NEEDED JOB ROLES





# CELL PRODUCTION & MAINTENANCE

## ...NEEDED JOB ROLES

WHITE-COLLAR

MANAGER OF BATTERY MAINTENANCE PRODUCTION MANAGER DOWNSTREAM PROCESS ENGINEER PRODUCT ENGINEER (ENERGY STORAGE)  
FORMATION MAINTENANCE ENGINEER CELL MODULE ELECTRICAL ENGINEER FIELD SERVICE ENGINEER (MICROGRIDS & BEES)  
ELECTRICAL ENGINEER/BATTERY SPECIALIST APPLICATION ENGINEER (PV ENERGY STORAGE) UPSTREAM PRODUCTION ENGINEER  
SENIOR CATHODE ENGINEER TEST AUTOMATION ENGINEER TOP CAP ENGINEER CELL DESIGN ENGINEER  
CELL MODULE MECHANICAL ENGINEER POWERTRAIN/BATTERY DEVELOPMENT SOFTWARE/MODELING ENGINEER LEAD EQUIPMENT ENGINEER  
CELL MATERIALS ENGINEERING TECHNICIAN MATERIAL ENGINEER - ELECTRODE JUNIOR INVENTORY TEAM SPECIALIST  
MATERIAL ENGINEER CATHODE CLEAN ROOM SPECIALIST MECHANICAL CELL DESIGN ENGINEER  
MANUFACTURING ENGINEER, LI-ION ENGINEER ENERGY ENGINEERING TECHNICIAN ELECTRICAL ENGINEER (PV) PRODUCTION CONTROL COORDINATOR  
MECHANICAL DESIGNER ENGINEER ELECTRICAL ENGINEER HYBRID VEHICLES AUTOMATION ENGINEER BATTERY ENGINEER  
CELL MECHANICAL ENGINEER ENGINEERING TECHNICIAN PRODUCTION ENGINEER MAINTENANCE ENGINEER  
MECHANICAL BATTERY DESIGN ENGINEER DEVELOPMENT ENGINEER - HIGH-VOLTAGE STORAGE COMPONENTS  
BATTERY DESIGN SENIOR CELL TEST ENGINEER SENIOR CELL DESIGN ENGINEER PROCESS & TEST ENGINEER - BATTERY TECHNOLOGY  
LEAN MANUFACTURING ENGINEER BATTERY REPAIR ENGINEER BATTERY MATERIALS ENGINEER SR. CELL MATERIAL ENGINEER - ELECTROLYTE  
BATTERY MATERIALS ENGINEER HIGH DENSITY ANODES CELL ENGINEER SENIOR ELECTRIC DISTRIBUTION SYSTEMS & CHARGING CONTROLS ENGINEER  
ENERGY STORAGE PRINCIPAL ENGINEER BATTERY SYSTEMS ENGINEER CELL MATERIAL ENGINEER  
ELECTRICAL ENGINEER - EV BATTERY DEV. CELL SIMULATION ENGINEER PRODUCTION MANAGER CELL ASSEMBLY  
PRODUCT MANAGER CELL ASSEMBLY BATTERY CELL DEVELOPER - ENERGY FUNCTIONS ENERGY ENGINEER ELECTRICAL ENGINEER (BMS)  
SENIOR BATTERY SYSTEMS ENGINEER - INNOVATION CELL MODULE SIMULATION ENGINEER PROCESS ENGINEER - BATTERY DISMANTLING  
CELL ASSEMBLY PROCESS ENGINEER APPLICATION ENGINEER SENIOR/STAFF BATTERY ENGINEER

Blue-collar workers expertise domains: battery assembly; quality; machine/process operation and maintenance.

White-collar workers expertise domains: production engineering; material engineering; testing; electrical engineering; maintenance engineering; mechanical engineering;

### BLUE-COLLAR

- **Up-stream** production – risks, envision safety issues and chemical behavior
- **Down-stream** production – machine understanding, 5S, troubleshooting
- Overall production system understanding
- Material handling, clean / dry room procedures, quality, sampling, material pressing, electrode process, fine mechanics, HMI (human machine interface)

### WHITE-COLLAR

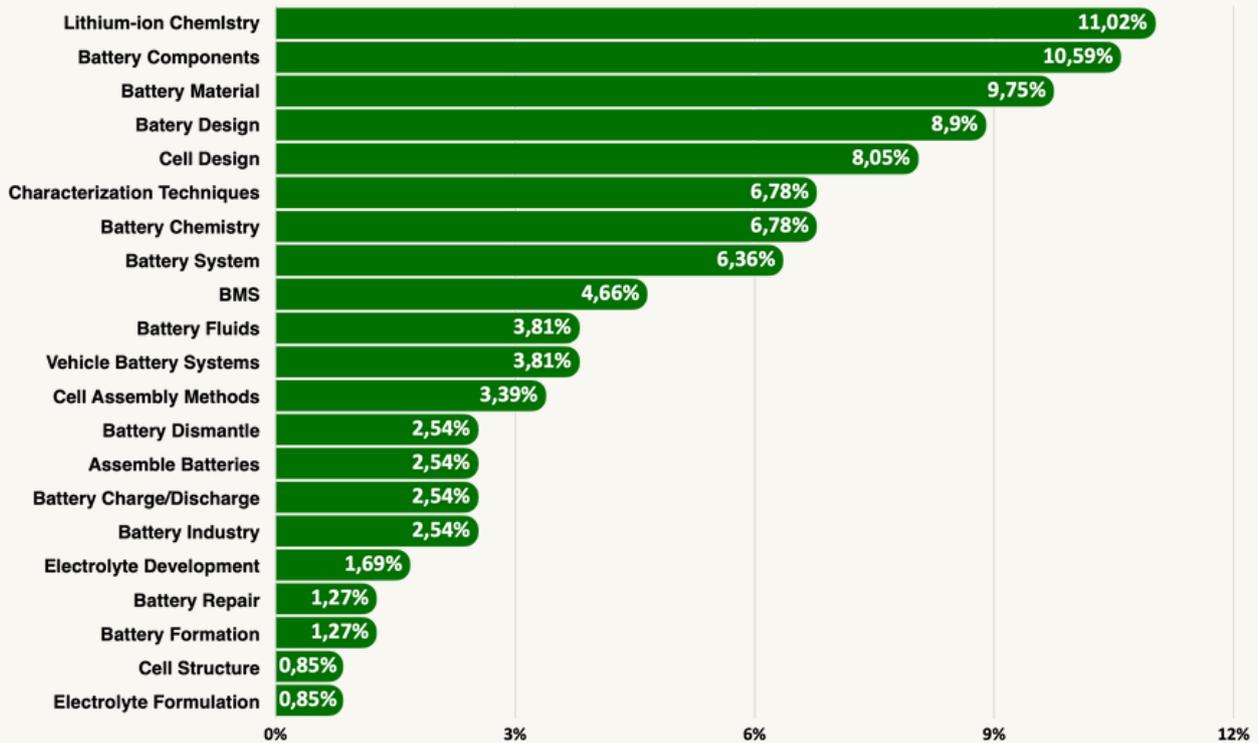
- Increasing competence in **production and material engineering, production planning, shift management, process engineering, cell design, machine learning and optimization, modelling and simulation;**
- Strengthening the focus on **large-scale manufacturing**, understanding of chemical processes, quality and risk/safety management;



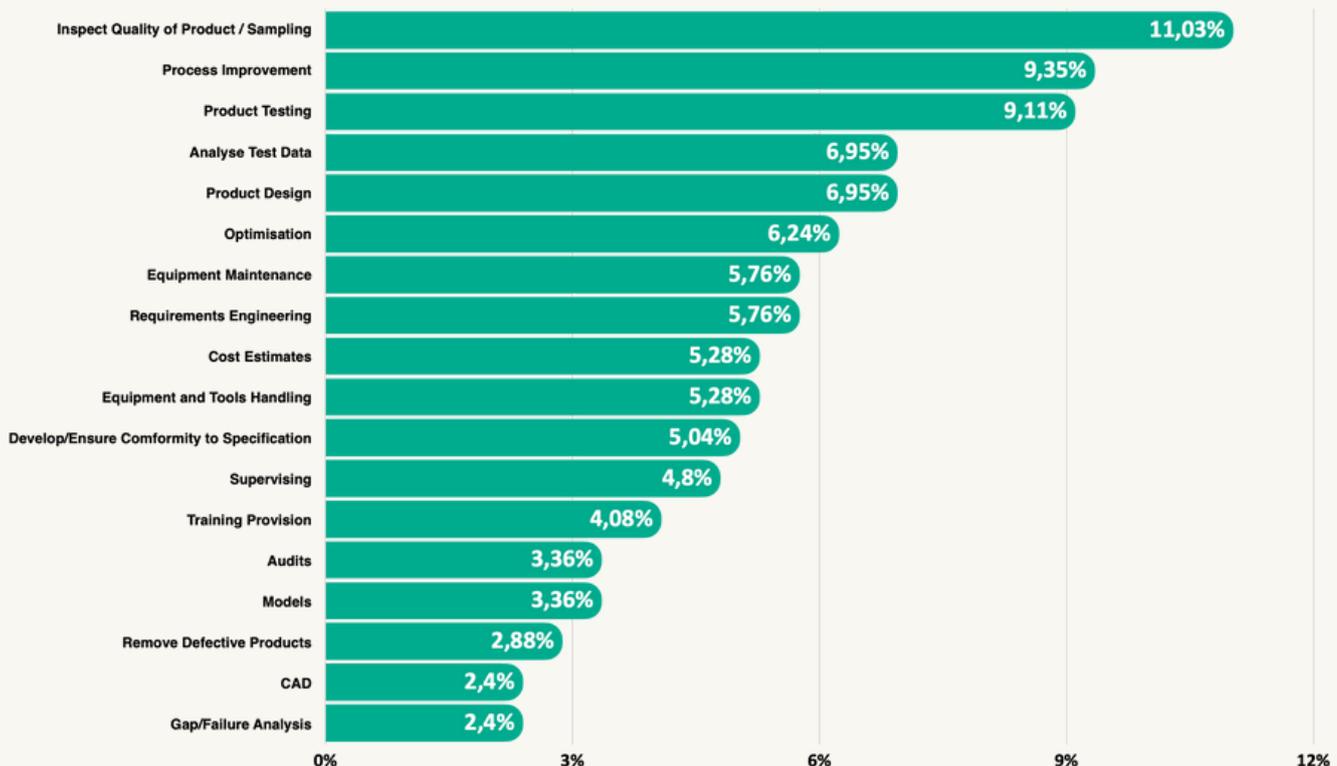
# CELL PRODUCTION & MAINTENANCE

## NEEDED SKILLS / KNOWLEDGE

### PRODUCTION AND MAINTENANCE - SECTOR SPECIFIC COMPETENCE



### PRODUCTION AND MAINTENANCE - CROSS-SECTORAL SPECIFIC COMPETENCE





## RESEARCH & DEVELOPMENT

### OVERALL NEEDS

- Overall cooperation on the research and development on the future issues and connection to the training and education needed to facilitate those needs
- Strengthening the competences in **electrochemistry**, particularly those related to the **characterisation, cell evaluation, validation, electrolyte development, thermal management, cell design, battery components, lithium-ion battery chemistry, battery design** and **battery material**.
- ALBATTs Provided report on the current state-of-the-art of alternative chemistries:
  - Future of the Li-Ion Batteries
  - Lithium-Sulphur Batteries
  - Sodium-Ion Batteries
  - Structural Batteries
  - Supercapacitors and Ultracapacitors
  - Fuel Cells

### NEEDED JOB ROLES

GENERAL

BATTERY RESEARCHER  
GENERAL R&D ROLES

WHITE-COLLAR

OPERATING MODEL AND CELL COST SPECIALIST PROJECT MANAGER CELL DEVELOPMENT  
CELL MECHANICAL ENGINEER  
CELL DESIGN ENGINEER ELECTROLYTE ENGINEER  
MECHANICAL BATTERY DESIGN ENGINEER CUSTOMER SUCCESS ENGINEER  
SENIOR BATTERY ENGINEER SENIOR/STAFF BATTERY ENGINEER HEAD OF BATTERY CELL R&D  
RESEARCH AND DEVELOPMENT BATTERY CHEMIST  
SENIOR CELL MATERIAL ENGINEER - ELECTROLYTE  
SENIOR SCIENTIST MATERIAL DESIGNER SENIOR BATTERY SYSTEMS ENGINEER - INNOVATION  
BATTERY SYSTEM ENGINEER MATERIAL ENGINEER CATHODE  
SOFTWARE/MODELING ENGINEER LEAD CELL ASSEMBLY PROCESS ENGINEER CONTROLS ENGINEER  
MANUFACTURING ENGINEER, LI-ION ENGINEER POST-DOCTORAL FELLOW  
PROCESS & TEST ENGINEER - BATTERY TECHNOLOGY SENIOR CELL DESIGN ENGINEER BATTERY ENGINEER  
LABORATORY & VALIDATION LABORATORY OPERATOR  
MECHANICAL CELL DESIGN ENGINEER SENIOR CATHODE ENGINEER

White-collar workers expertise: **material engineering, battery systems, manufacturing** and other.

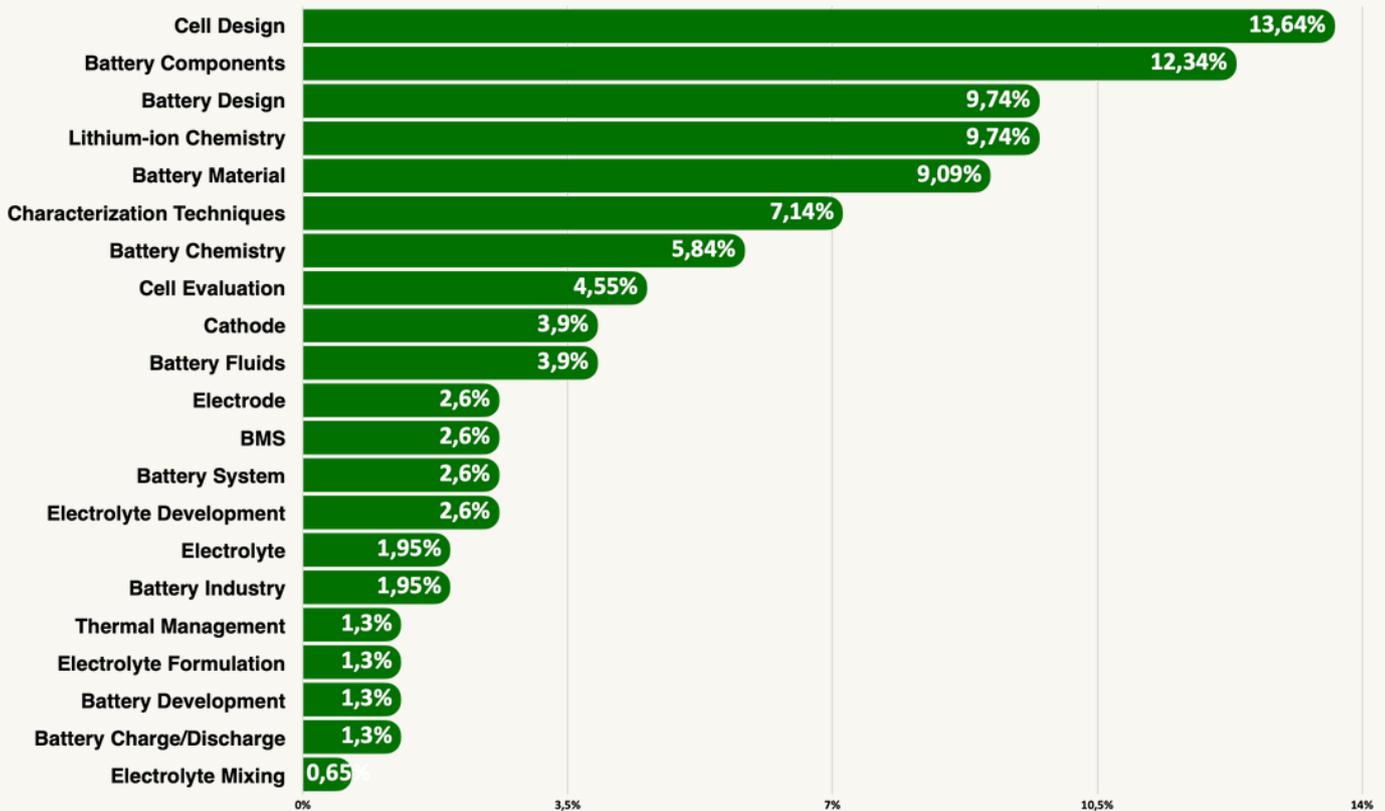
Generic job roles are **scientists** and **researchers**.



# RESEARCH & DEVELOPMENT

## NEEDED SKILLS / KNOWLEDGE

### RESEARCH AND DEVELOPMENT - SECTOR SPECIFIC COMPETENCE



### RESEARCH AND DEVELOPMENT - CROSS-SECTORAL SPECIFIC COMPETENCE

