

# THE ROAD TO 0 EMISSIONS



The voice of European vehicle dealers and repairers

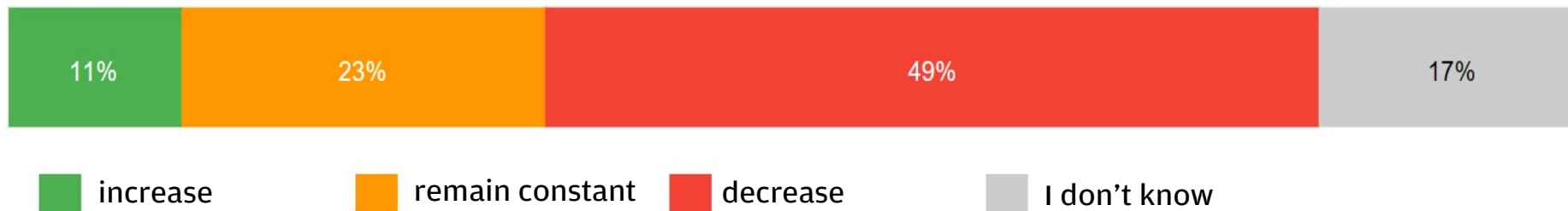
**ROUTE**  
**2030**

“It will take  
more time”



# Which **impact** will electrification have on your company?

Revenue will...



# New skills

- Knowledge of electric vehicle **specifications**
- **Diagnosis** of defects in the vehicle
- Maintenance and repair of **electrical** systems
- Knowledge of **services** and accessories for electric vehicles





# Bodywork



- Mild steel
- High strength steel
- Very high strength steel
- Extra high strength steel
- Ultra high strength steel
- Aluminium

# Lifelong learning

“The rapid succession of evolutions means the staff needs to retrain at a faster pace.

This requires an **open mindset** and the desire to keep learning”



Message from EC Commissioner Timmermans during CECRA's conference  
on Europe's Automotive Mobility conference – 20 & 21/09/2021 @ Evian

“The automotive industry has an important role to play in  
the transition to a climate neutral future.

Emissions need to be brought down and we need to accelerate the efforts.  
It will have a serious impact on the supply chain for components of combustion  
engines, on car dealers and repairers. A transition plan is therefore needed.

Regarding the social agenda, the industry shall share their thoughts and  
ideas on how workers can swift jobs.

By 2035, we need to be firmly on track for 0 emission road transport.

He counts on the whole automotive industry  
to help the European Commission to get a transition that will be  
bold but that **will leave no one behind.**”

# THE ROAD TO 0 EMISSIONS



The voice of European vehicle dealers and repairers

**ROUTE**  
**2030**





# **TRANSITION TO HIGH VOLTAGE VEHICLES**

## **THE REQUIREMENT FOR LARGE SCALE SAFE HANDS-ON TRAINING**

**DANIEL BROWN SEPT 2021**

## Challenges

### Challenges to the automotive repair sector:

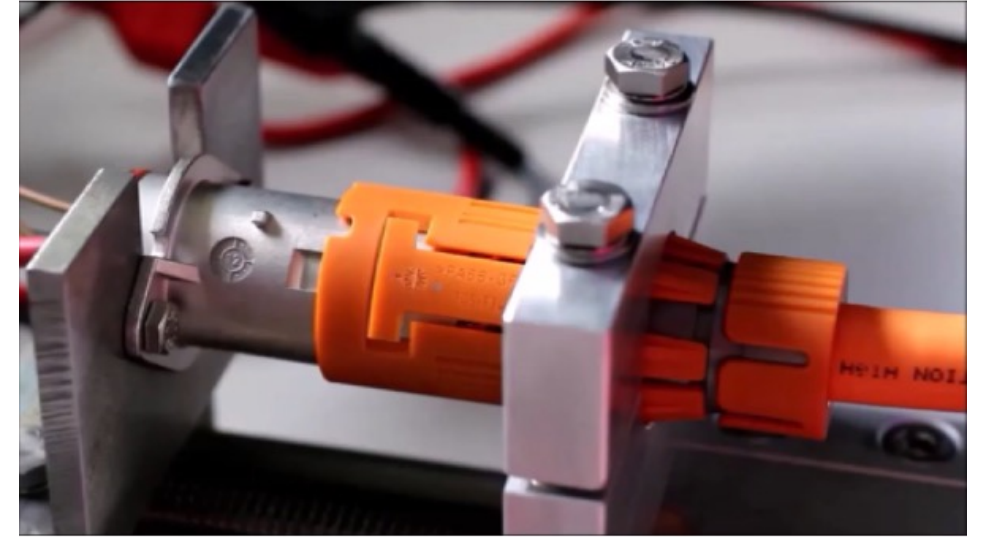
1. Safety knowledge requirements
2. Technical knowledge and competencies
3. How to/should we standardise and qualify training?



As of August 2021, the IMI estimate that only 6.5% of UK automotive technicians are qualified to work on high voltage vehicles!

## Safety

- Understand dangers of live high voltage
- Correct PPE and appropriate tools
- Follow isolation procedures and verify voltage free state





## Safety

Need to be aware of unsafe work procedures and develop a culture of safety







# Official WorldSkills HV Trainer







## SkillsUSA First National HV Skills Station 2018

- Introduction to the topic of Hybrid and Electric vehicles
- System identification and shut down procedure (fully documented)
- Plan to expand to more difficult tasks as topic becomes established

### Results

- < 50% participants had any HV experience
- Very poor knowledge of PPE and specialised tools (even when provided)
- Many participants triggered “critical” events due to poor knowledge and experience

## Technical

- Completely new technology for technicians
- Skills and knowledge gaps



- High voltage batteries
- Inverters
- 3 phase motors
- DC/DC converters
- Insulation testing
- Potential equalisation

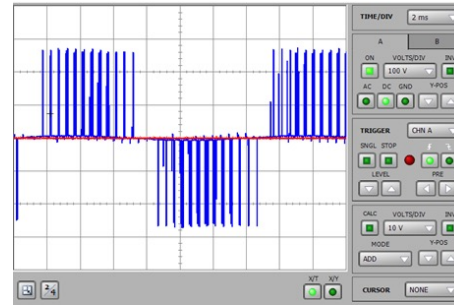
Diagnose and repair requires high level knowledge!



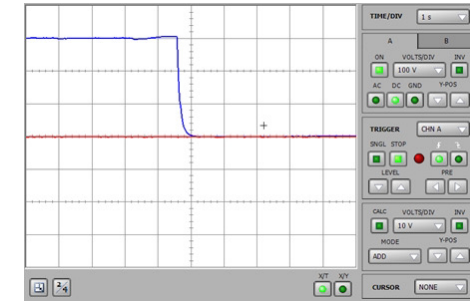
# Real Measurements and Hands On Tasks

Plus:

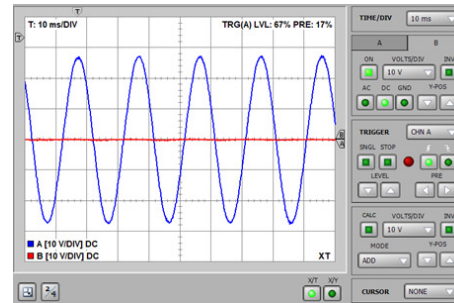
- Insulation testing
- Isolation procedures with LIVE – DEAD – LIVE testing
- And much, much more



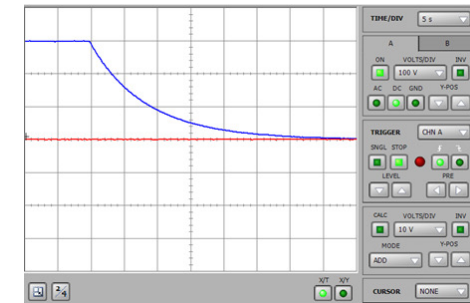
Digital 3 phase motor signals



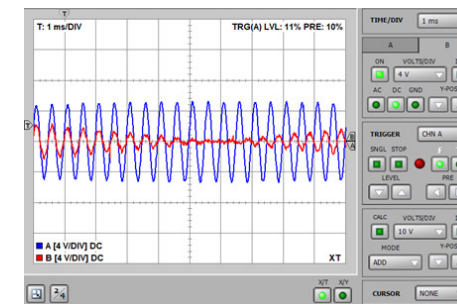
Active discharging



Analog 3 phase motor signals



Passive discharging



Resolver signal



## High voltage battery



### Lithium based high voltage batteries:

- Dangerous goods – difficult to transport to repair centres
- Often very well sealed – cover is often destroyed when opening
- Very high energy – reluctance to insert faults that technicians are required to learn to develop diagnostic skills

**HV batteries always contain high voltage, even when “Shut down”!**

# HV BATTERY TRAINER

Intended for next level,  
diagnostic technicians

Make the technology  
accessible and  
understandable

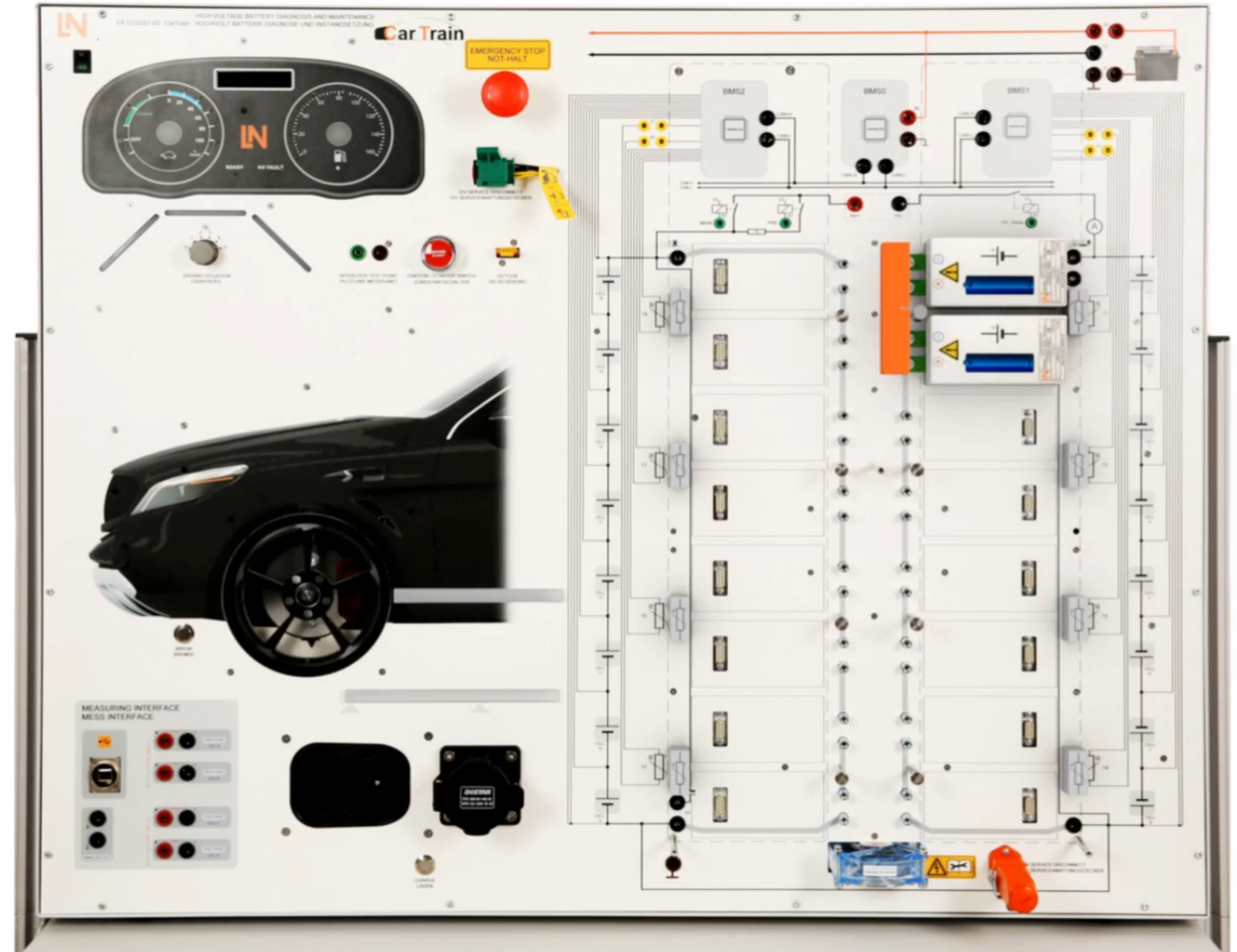




## Real HV Battery



HV battery with the high visibility and the highest safety standards



## Qualifications



**INSTITUTE  
OF THE MOTOR  
INDUSTRY**

1. Level 1 Non Technican staff -  
Awareness training
2. Level 2 Technician - Isolate HV vehicles
3. Level 3/4 Technician - Work on High  
Voltage Battery







**First responders, police, tow truck and crash repair:**

- **When is a vehicle safe? How to achieve this?**
- **What can be touched and what must be avoided?**
- **Non technical, awareness training**

# European Skills Agenda in the Automotive Ecosystem

Alliance for Batteries Technology, Training and Skills  
2019-2023

**Dr. Jakub Stofa,**  
VSB-TUO, ALBATTS Project WP Supervisor, DRIVES Project Coordinator & Automotive Skills Alliance Leader

**ALBATTS Workshops: Servicing of electric vehicles: Future qualifications needed, 29<sup>th</sup> September 2021**



# Automotive Skills Agenda

## The road until now



# Automotive Skills Agenda - Background



- ⚡ **Automotive ecosystem** is facing **unprecedented transformation**
- ⚡ Caused by, e.g.
  - ⚡ Long-term shift towards **zero-emission, digital mobility, new mobility concepts, or carbon neutrality** by 2050
  - ⚡ Short-term **COVID impact**
- ⚡ Impact to the workforce – **cca. 15 million people employed** in European automotive value-chain
  - ⚡ **Jobs endangered VS. struggle to attract and recruit qualified people for new and emerging jobs**

**Sustainable, massive and pragmatic approach towards education and training (up-/re-skilling) in the ecosystem is needed more than ever before**

# Automotive Skills Agenda – Initiatives



- ⚡ **High Level Group GEAR 2030 (2015 - 2017) - Final report** on automotive competitiveness and sustainability
- ⚡ New Skills Agenda for Europe (2016) with action **The Blueprint for Sectoral Cooperation on Skills**



**Automotive Sector**  
**Ongoing (2018 - 2021)**



**Batteries Sector**  
**Ongoing (2019 - 2023)**

- ⚡ European Skills Agenda (2020) with action **Pact for Skills (launched November 2020)**



**AUTOMOTIVE**  
**SKILLS**  
**ALLIANCE**



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# Automotive Skills Agenda

## DRIVES Blueprint Project

Development and Research on Innovative  
Vocational Education Skills



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# Automotive Skills Agenda –



- ⚡ 24 full project partners from 11 European Countries, including ACEA, CLEPA, ETRMA
- ⚡ Main results so far:
  - ⚡ Strategy and Roadmap including also Sectoral Analysis of Skills Demand and Offer
  - ⚡ DRIVES Job Roles and DRIVES Learn Platform (MOOCs, Blended learning, Trainer interaction courses) to offer directly to companies and also to education and training providers to their courses
    - ⚡ **Courses are open now, register for free at:** <https://learn.drives-compass.eu/>



# Automotive Skills Agenda –



- ⚡ **DRIVES Framework** – initial version of **EU-wide database of reference job roles and training courses** provided across Europe and possibility of digital badges for skills recognition

- ⚡ **Harmonisation of the job roles definitions** (“electronic version of the competence matrix”)
- ⚡ **Overview of courses** (paid/free, online/onsite, etc.)
- ⚡ **Individual Learning Account** (progress, digital badges)
- ⚡ See at: <https://drives-compass.eu/home>

- ⚡ **All DRIVES project results and activities at: [www.project-drives.eu](http://www.project-drives.eu)**





# Automotive Skills Agenda



**AUTOMOTIVE  
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# Automotive Skills Agenda –



**AUTOMOTIVE  
SKILLS  
ALLIANCE**



- ⚡ **Sustainable collaboration on skills agenda** topics in the **Automotive Ecosystem**
- ⚡ ASA is also partnership of European Skills Agenda, **Pact for Skills in Automotive Ecosystem**
- ⚡ The ASA mission is to bring together different kind of stakeholders involved in the Automotive ecosystem and to ensure continuous, pragmatic and **sustainable cooperation on the skills agenda** in the ecosystem. Including Massive workforce **upskilling and reskilling across the automotive ecosystem**
- ⚡ **Get involved** in Working Groups (e.g. **Repair and Maintenance WG led by CECRA**), or webinars, pilot projects in the regions, or further collaborations: [info@skills-alliance.eu](mailto:info@skills-alliance.eu)
- ⚡ See more at: [www.automotive-skills-alliance.eu](http://www.automotive-skills-alliance.eu)



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# Automotive Skills Agenda

## albatts Blueprint Project

Alliance for Batteries Technology, Training and Skills



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# What is **ALBATTs**?



- ⚡ **20 Partners in 4-year** (2019-2023)  
Erasmus+ funded project
- ⚡ **Blueprint for Sectoral Cooperation on Skills in Battery sector**
- ⚡ **Focus on demand and supply sides of competences in the battery value chain**







# ALBATTIS

## Sectoral Intelligence

**Q1: What is going on?**



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# ALBATTIS Desk Research

- ⚡ Desk research provide screening of the latest information relevant for skills agenda in Battery Sector
- ⚡ Desk Research starts by 2020 and will be hold till 2023





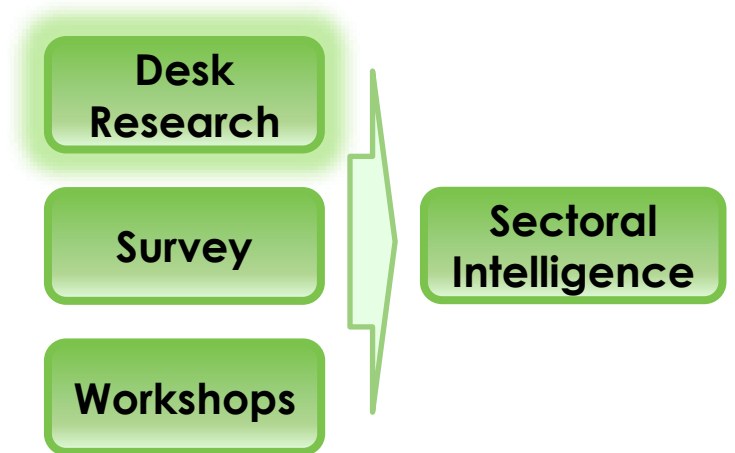
# ALBATTIS Desk Research

## Release I

- ⚡ [Overall Battery Sector](#) – Mobile and Stationary Applications (Nov 20)
- ⚡ [Stationary Battery Applications](#) Sub-sector (Aug 20)
- ⚡ [Mobile Battery Applications](#) Sub-sector (Aug 20)

## Release II

- ⚡ Overall Battery Sector – RnD and Battery Manufacturing (Nov 21)
- ⚡ [Research and Development Report](#) (Aug 21)
- ⚡ [Battery Manufacturing Report](#) – “Gigafactories” (Aug 21)



# ALBATTTS Online Survey

- ⚡ Online Survey is focused on detailed analysis of skills and job roles needed in the sector
- ⚡ [Survey results](#) for sub-sector Stationary and Industrial Battery Applications (Feb 21)
- ⚡ [Survey results](#) for sub-sector Mobile Battery Applications (Feb 21)
- [Survey Results](#) for Overall Battery Sector – (May 21)
  - + semi-formal interviews

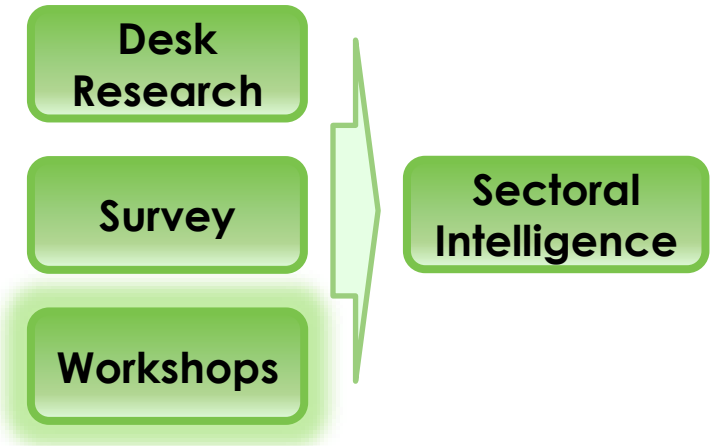






# ALBATTIS Workshop Series

- ⚡ Brings stakeholders together to participate on the skills intelligence updates and consult on the latest inputs
- ⚡ Workshop Series starts by 2021 and will be hold till 2023





# Workshop Series

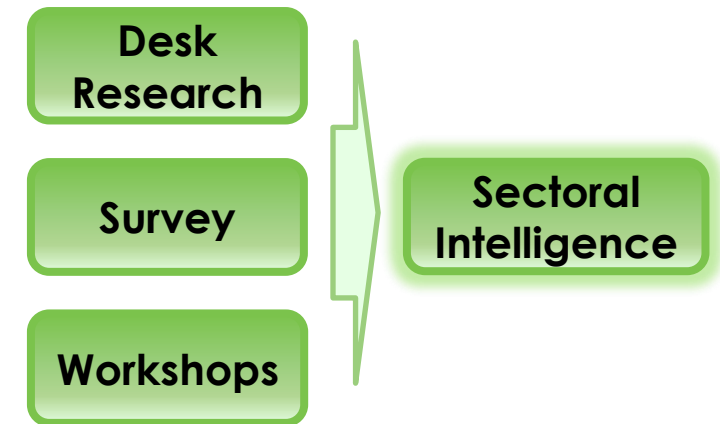
- ⚡ [Workshop Results – Stationary Battery Applications and Safety](#) (Feb 21)
- ⚡ [Workshop Results – Mobiles and Maritime Battery Applications](#) (Feb 21)
- [Workshop Results](#) – Overall Results (May 21)





# Sectoral Intelligence - Roadmap

- [Sectoral Intelligence](#) for Mobile Battery Applications (Aug 21)
- [Sectoral Intelligence](#) for Stationary Battery Application (Aug 21)
- Sectoral Intelligence for Overall Sector (Nov 21)





# ALBATTIS

## Education and Training

**Q2: How can we address the education and training needs?**



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# ALBATTs will...

- Analyse new job roles/skills
- Suggest learning objectives
- Develop course plans
- Develop learning material
- Try out adaptive learning
- Pilot-test innovative courses
- Train-the-trainer guidelines
- Network!
- Use European instruments
- Implement results



To get involved with the **albatts** stakeholders group:

Stakeholder registration [here](#)

LinkedIn Group - European Battery Skills Agenda [here](#)



Follow us on:

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

LinkedIn: [LinkedIn](#)

Facebook: [Facebook](#)

Twitter: [Twitter \(@ALBATT1\)](#)

Mail: [info@project-albatts.eu](mailto:info@project-albatts.eu)

# Thank you

**Presenter**

**Dr. Jakub Stolfa**

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[https://twitter.com/jakub\\_stolfa](https://twitter.com/jakub_stolfa)



Polish Chamber of Electromobility  
Development Association





# About us



## Mission

We believe in real electromobility. We create and carry out activities based on the knowledge of the greatest specialists in the industry. We initiate and implement processes allowing for proper development of zero-emission transport. We show how the future will look like.



## Organization

We are a non-governmental organization. Our activities are based primarily on knowledge and experience. We operate locally for the benefit of the entire community. We are building the future on the foundation of new technologies.



## Knowledge and experience

For years we have been associated with the electromobility market. Founders of PIRE built the European EV market since 2009. Now we transfer our knowledge, experience and together build real electromobility. We organize conferences, trainings, webinars – We teach, explain and advise.



# Sector skills council for Automotive and Electromobility

## NATIONWIDE ENVIRONMENTAL CONSULTATION

*„Prospects for the development of the labor market in the context of electromobility in Poland and Europe”*

### GENERAL RECOMMENDATIONS:

- extensions of current vocational qualifications, e.g. - electric vehicle mechanic with elements of electromobility are necessary
- including the new profession in the ministerial list and creating a core curriculum the profession of Electromobility Technician should be separated and developed at the level of Technical Secondary School,
- support of industry and business experience in the automotive sector,
- systematization of required licenses for the broadly understood industry (up to 1 kV)
- vocational education vs. short forms of education (courses) - also at the engineering level



Sektorowa Rada  
ds. Kompetencji  
Motoryzacja i Elektromobilność



PARP  
Grupa PFR



POLSKA IZBA MOTORYZACJI



ZWIĄZEK PRACODAWCÓW  
MOTORYZACJI I ARTYKUŁÓW  
PRZEMYSŁOWYCH



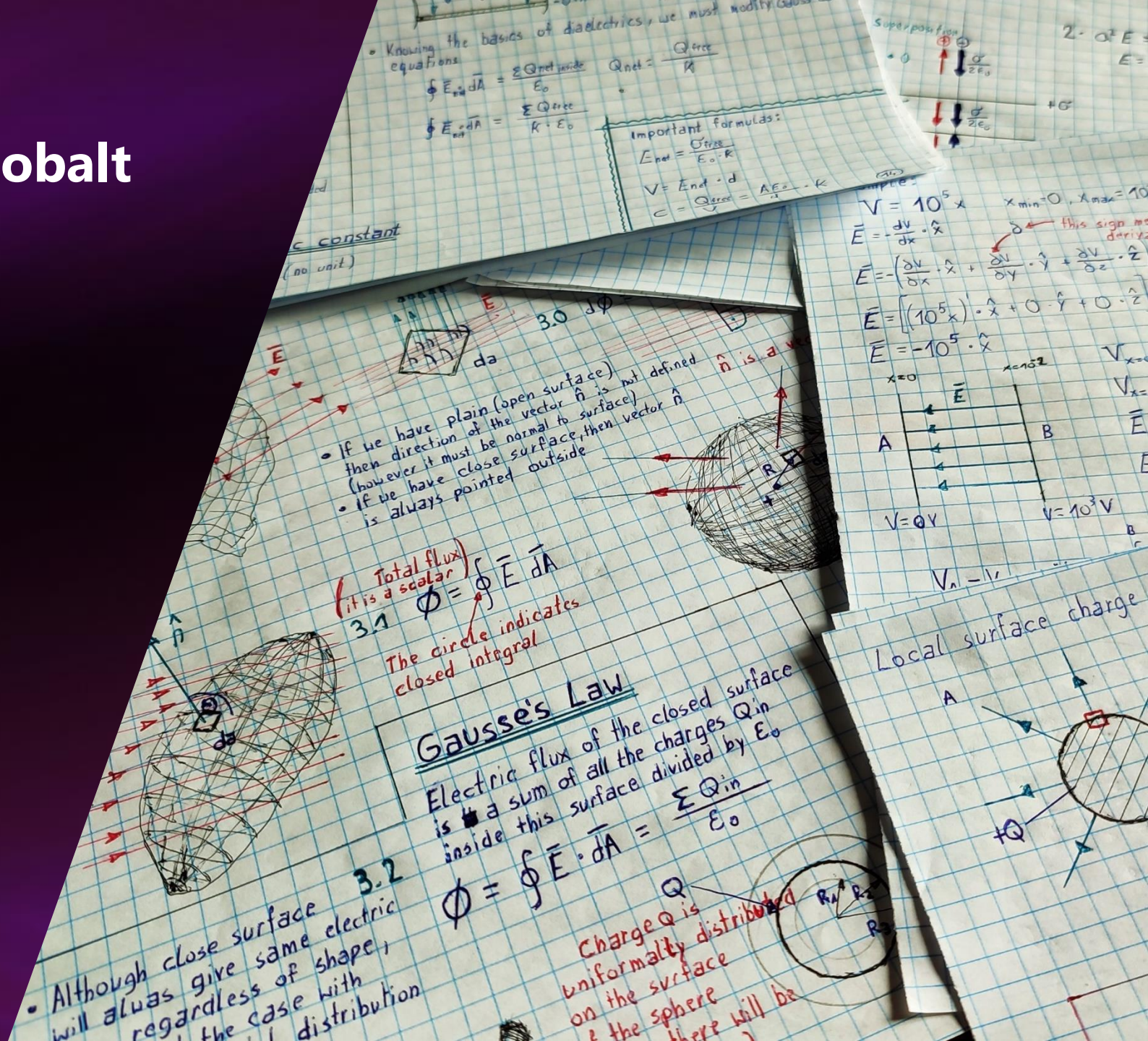


# Knowledge rarer than cobalt



KNOWLEDGE HUB

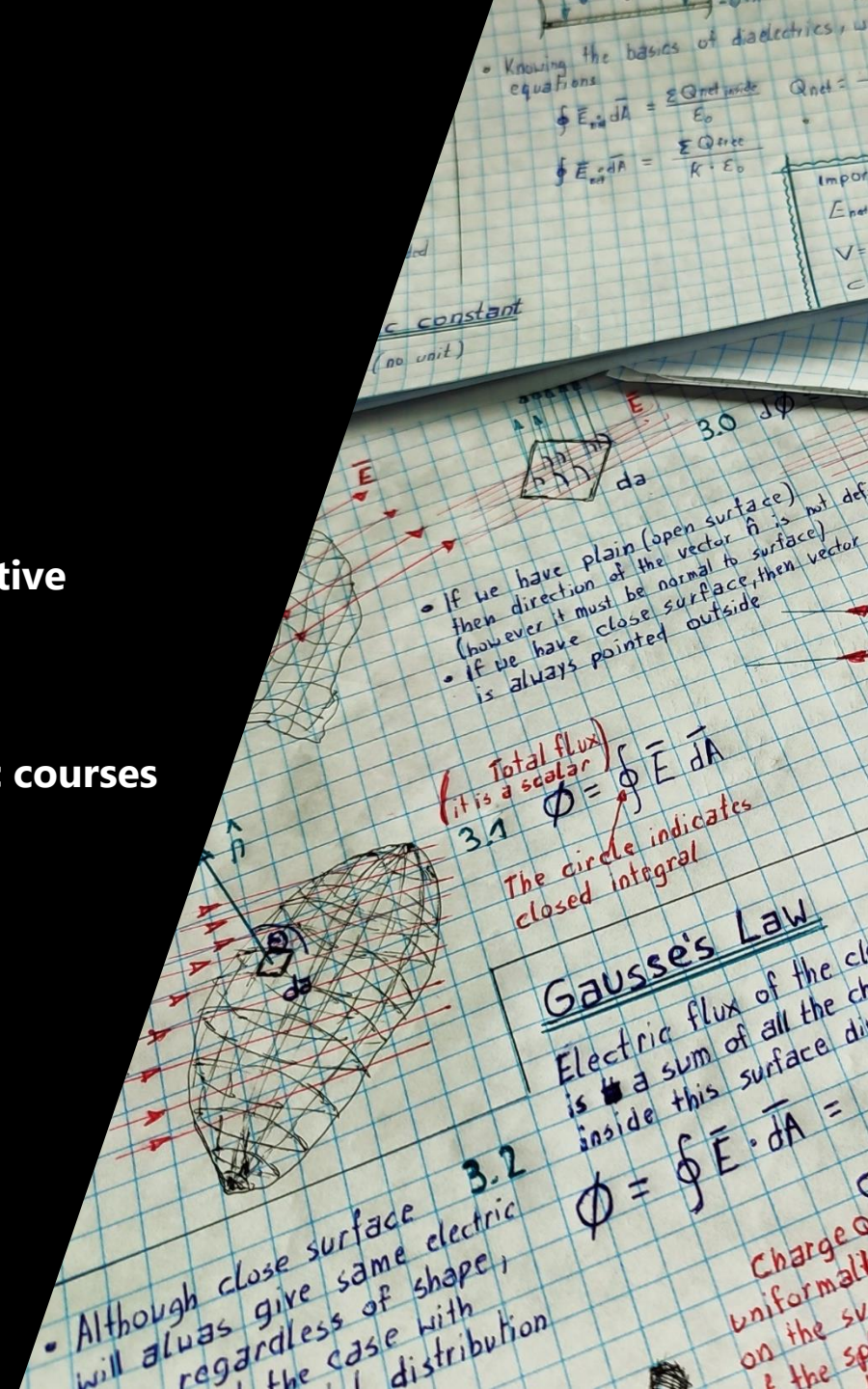
Polska Izba Rozwoju  
Elektromobilności





## Key points

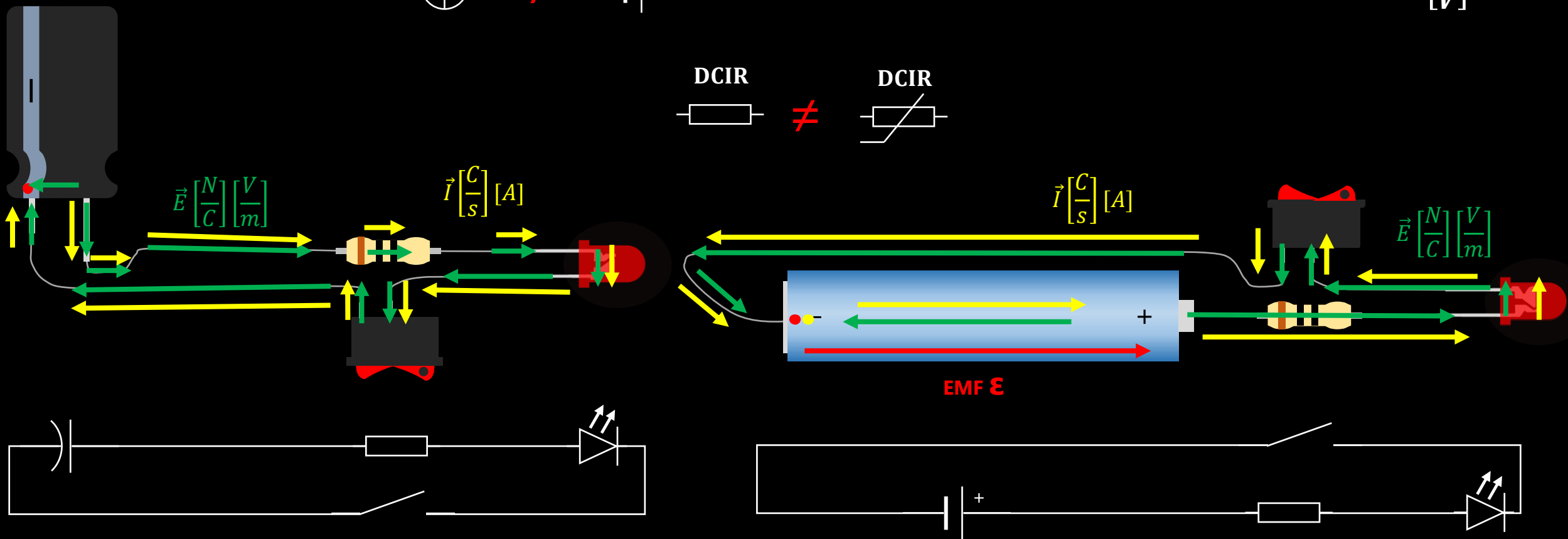
- Electromobility combines multiple fields:
  - Mechanics
  - Electronics
  - Energy
  - Electrochemistry
  - Programming...
- Electromagnetism which is essential for electromobility is rather counterintuitive
- Batteries are very complex devices, which are poorly understood
- The industry is in a hurry and doesn't have time for studying all the academic courses
- The real challenge is to transfer academic-level knowledge in a clear way.



## Example 1 – understanding electromotive force

- In our school times we all used battery as a source of energy
- In the common understanding battery is no different than other DC sources
- Misconceptions are costly...

$$\text{Battery symbol} \neq \text{Capacitor symbol} \quad \text{Capacity [Ah] [C]} \neq \text{Capacitance [F]} \left[ \frac{C}{V} \right]$$





## Example 2 – What is the voltage of my battery?

IEC 61960-4:2020

### Phase 1

Discharge to 0% SOC  
Current: 0,2 C

Technical discharging

### Phase 2

Charging to 100% SOC  
Current: defined in the product's specification

Setting up the test

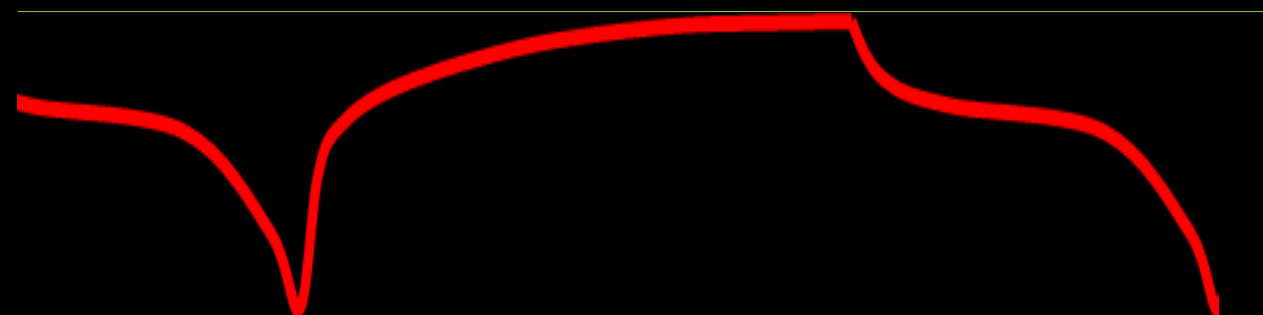
### Phase 3

Discharge to 0% SOC  
Current: 0,2 C

Testing phase

4,20 V

3,00 V



$$P_{cell} = U * I [W]$$

$$E_{cell} = P * \Delta t = U * I * \Delta t [Wh]$$

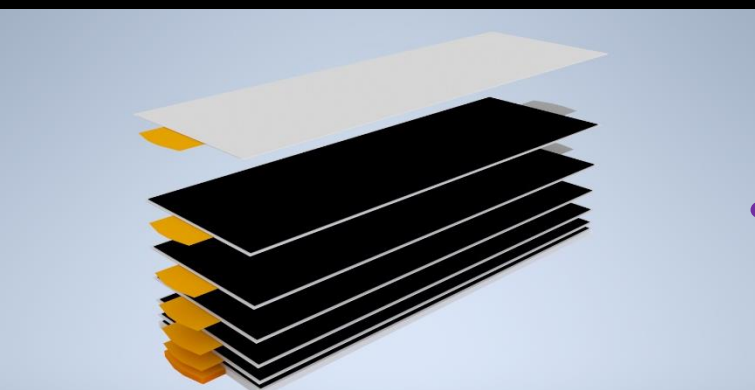
$$Capacity_{cell} = I * \Delta t [Ah]$$

$$U_n = \frac{E_{cell} [V * A * h]}{Capacity_{cell} [A * h]} = [V]$$

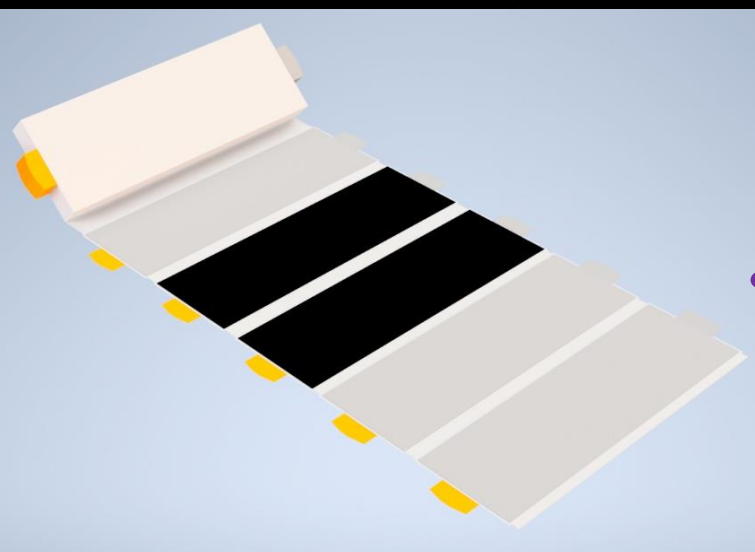
## Example 3 – Why are there so many different kinds of batteries?



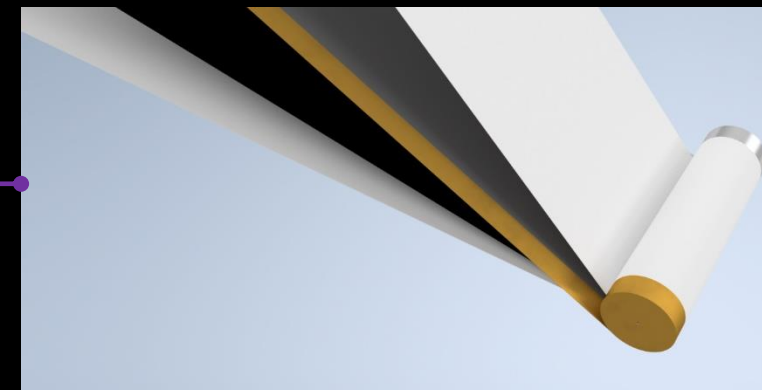
Lamination and stacking



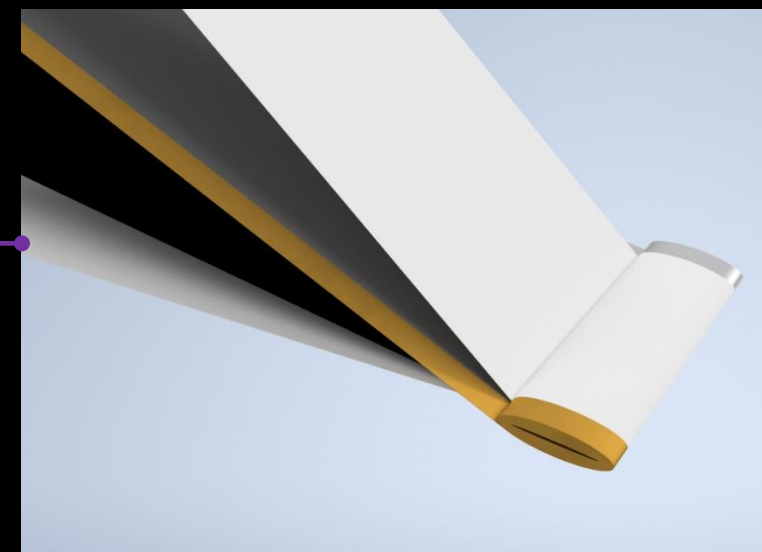
Lamination and folding



Winding



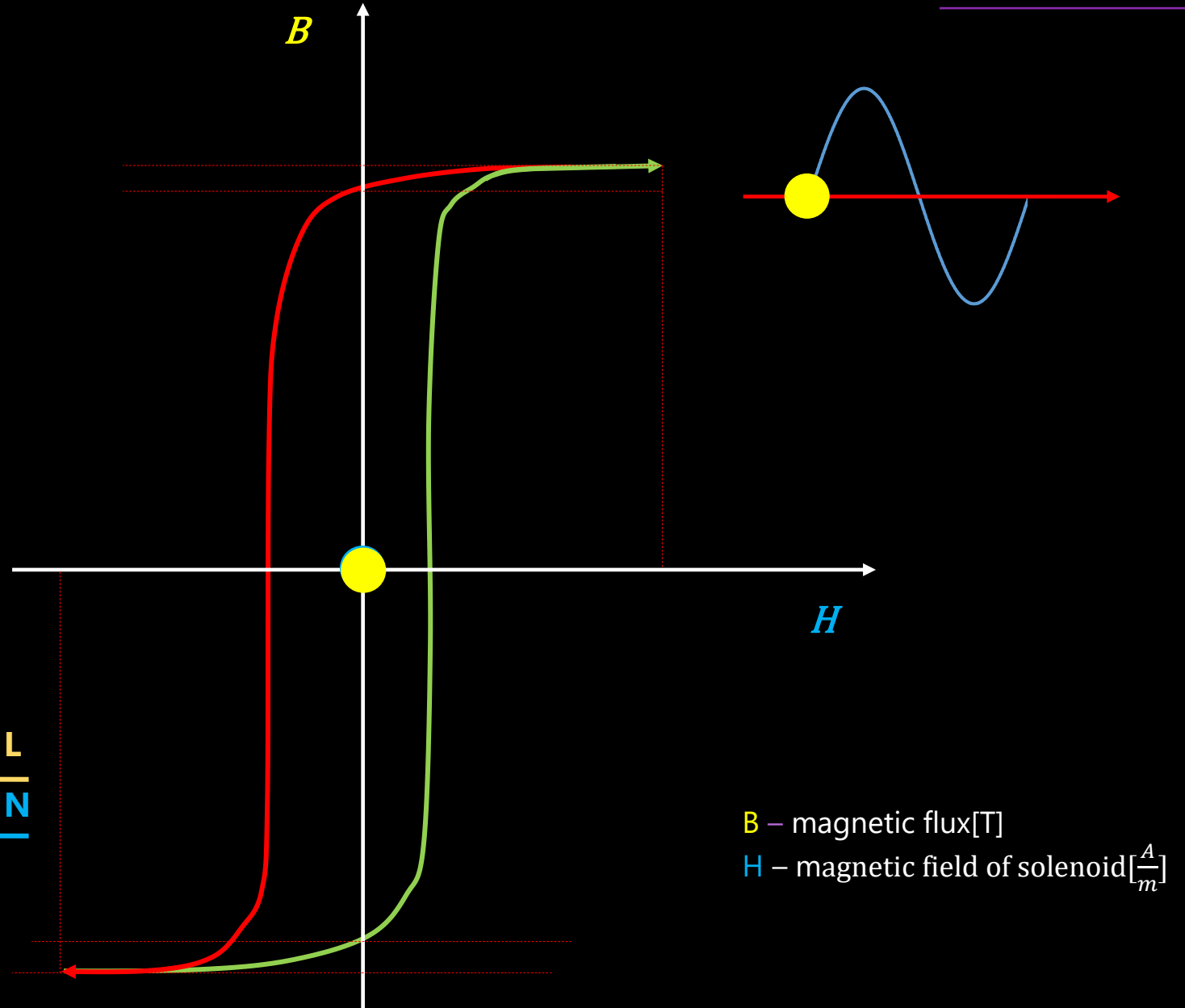
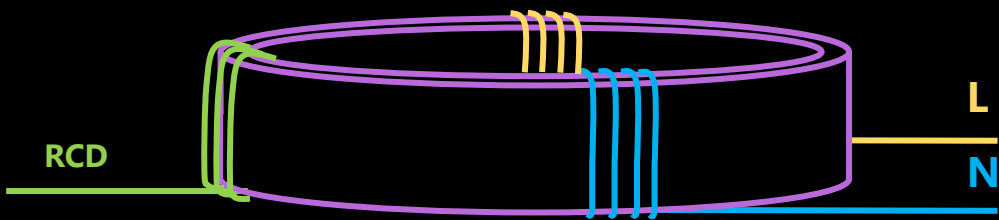
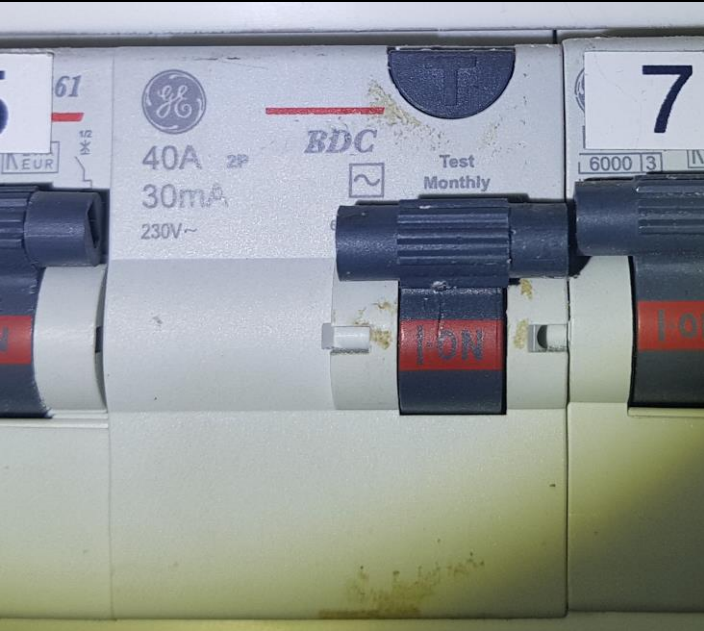
Winding



## Example 4 – Can I touch my car while charging?

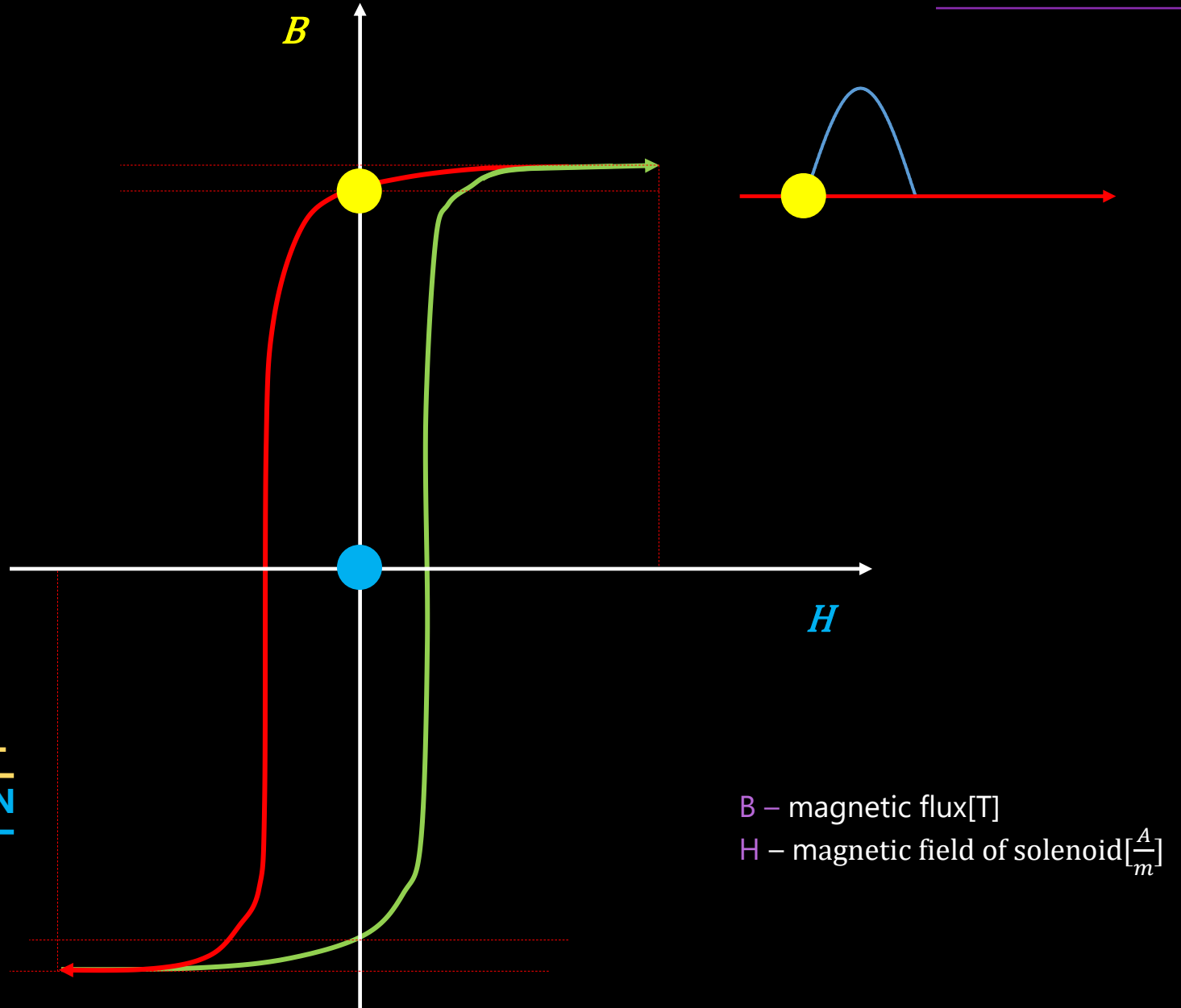
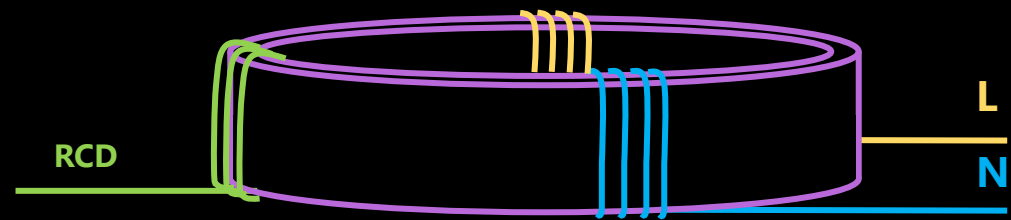
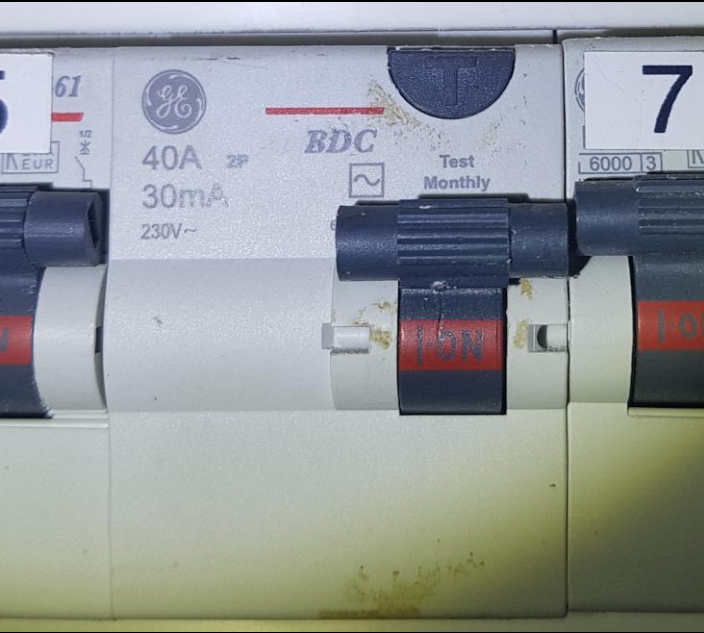


## Example 4 – Do you know how your RCD works? AC RCD and AC current





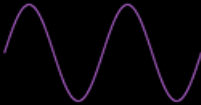


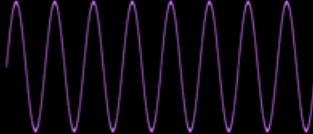
## Example 4 – Do you know how your RCD works? AC RCD and AC pulsating current





Example 4 – Do you know how your RCD works?

Residual current characteristics

	Residual current characteristics				
	AC 50 Hz	AC 50 Hz Pusating current	DC	50 Hz < AC < 1kHz	3 kA/20μs
RCD types					Temporary current spikes
AC	protected	NOT protected	<6 mA	NOT protected	Turn off
A	protected	protected	<6 mA	NOT protected	Turn off
AKV	protected	protected	<6 mA	NOT protected	Stay on
F	protected	protected	<10 mA	protected	Stay on
B	protected	protected	protected	protected	Stay on
EV	protected	protected	<6 mA	protected	Stay on

## All the knowledge must be sorted out...

- PIRE KH has listed all the required skills
- We systemized the data and created first in Europe full qualification guideline
- 6 modules:
  - Branches of electromobility, including market and industry
  - EV categorisation, design and operation
  - Electromagnetism and electronics fundamentals
  - Batteries
  - Hydrogen
  - Other related topics
- 35 teaching effects
- 195 verification criterias

Name of the module:	04. Knowledge of the battery industry and calculation of the basic characteristics.
Teaching effects Student:	Verification criteria Student:
a) Presents basic concepts required in the battery industry	<ul style="list-style-type: none"> <li>Lists and explains basic concepts required for description of the redox reaction: ionic bond, anion, cation, oxygen number, reduction, oxidation, reducing agent, oxidant, half-cell, anode and cathode</li> <li>Explains concept of the galvanic series of metals</li> <li>Explains concept of intercalation</li> <li>Writes and draw schematics of the primary and secondary cells</li> <li>Writes reactions of the galvanic cell of the given chemistry</li> <li>Calculates EMF based on the standard potential of the half-cells</li> </ul>
b) Describes the most important characteristics of the cell	<ul style="list-style-type: none"> <li>Lists and explains the basic concepts describing the cell: Electromotive force (EMF), cell capacity, open circuit voltage (OCV), closed circuit voltage (CCV), internal resistance (DCIR), energy and power density (weight and volumetric)</li> <li>Explains the term C-rate</li> <li>Lists and explains the terms used to describe the charging process of a cell: state of charge (SoC), depth of discharge (DoD), state of health (SoH), cutoff current</li> <li>Explains the meaning of the acronyms: EMF, OCV, CCV, DCIR, SoC, DoD and SoH, and provides their English meaning</li> </ul>
c) Describes the structure and operation of a lithium-ion cell and battery	<ul style="list-style-type: none"> <li>Explains the terms: cell, battery, module, package</li> <li>Lists and characterizes the components of the cell: electrodes - anode and cathode (divided into active material and conductive foil), separator, electrolyte</li> <li>Describes the difference between type batteries: stacked, prismatic and cylindrical</li> <li>Recognizes the markings of cylindrical cells, eg 18650, 21700, 4680</li> </ul>



# Thank you

Rafał Biszcz – Director of the PIRE Knowledge Hub

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You can find us on:



KNOWLEDGE HUB

Polska Izba Rozwoju  
Elektromobilności

