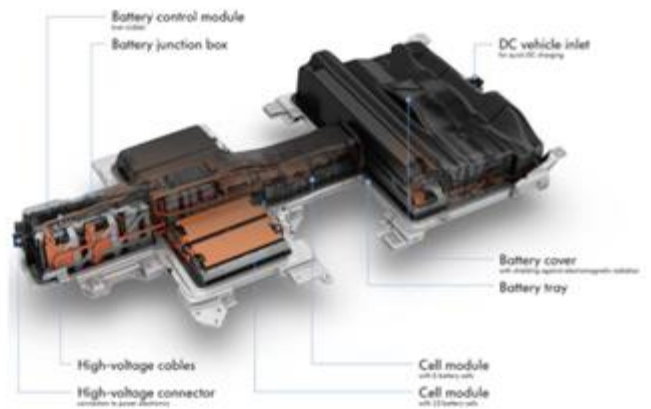

BatteriRetur
Contributing to a circular European battery industry
Fredrik Andresen

BatteriRetur

Close cooperation is key to evolve and create a circular system for HV batteries

BatteriRetur

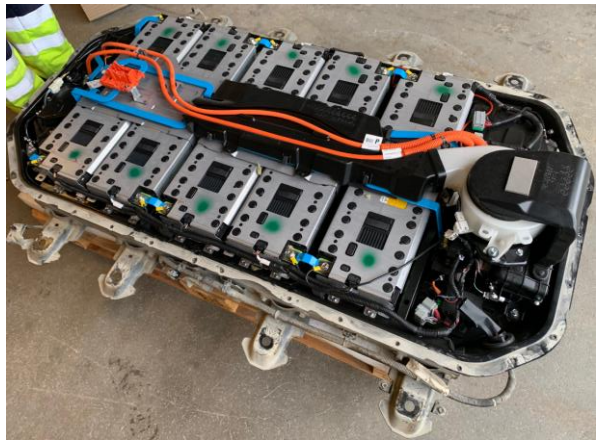
- Pilot project from 2012 on behalf of the European Car industry
  - Develop effective and safe solutions
    - Dismantling
    - Separation
    - Fire and energy safety
    - Development of manuals
    - Logistics
    - Recycling
  - Status
    - World leading
    - Reduced cost for recycling by 2/3
    - Developed unique knowledge and competence
    - Unique access to raw material
    - BIG international interest
    - Next project
      - Robotization of dismantling



Dismantling facility Sandefjord

Discharge and reuse of energy

- Many modules are too critical for transportation to recycling plants in Europe. These modules must be discharged 100% at our plant
- We discharge the modules down to 10% SOC before they are put on a “long term” discharging down to 0% SOC
- The energy is used to charge the Second Life storage system. This energy is used to support other parts of the plant
- For the future we see the need to discharge all batteries and modules so they can be shredded before recycling. It seems that this method will give the highest recycle rate for the rest products from the cells
- We are working on developing a fully automatic partially robotized discharging plant



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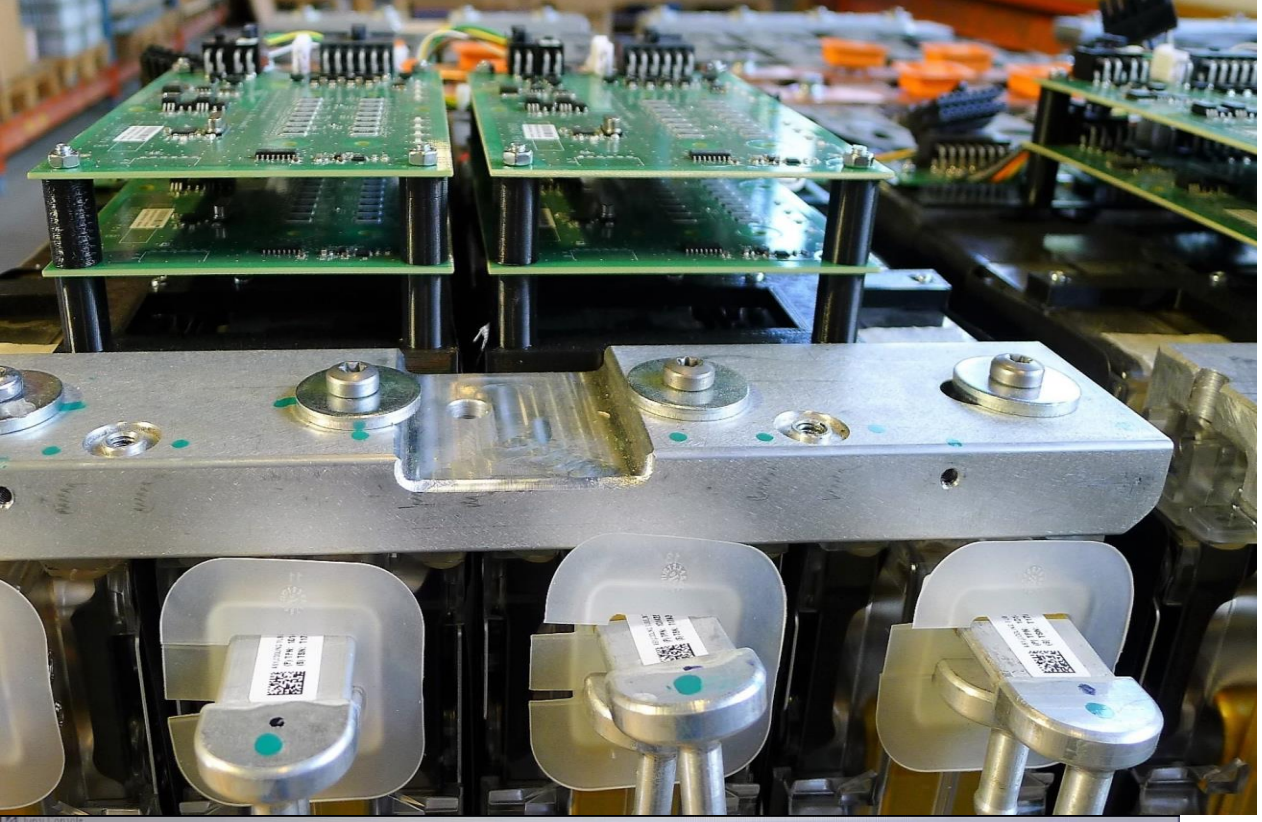
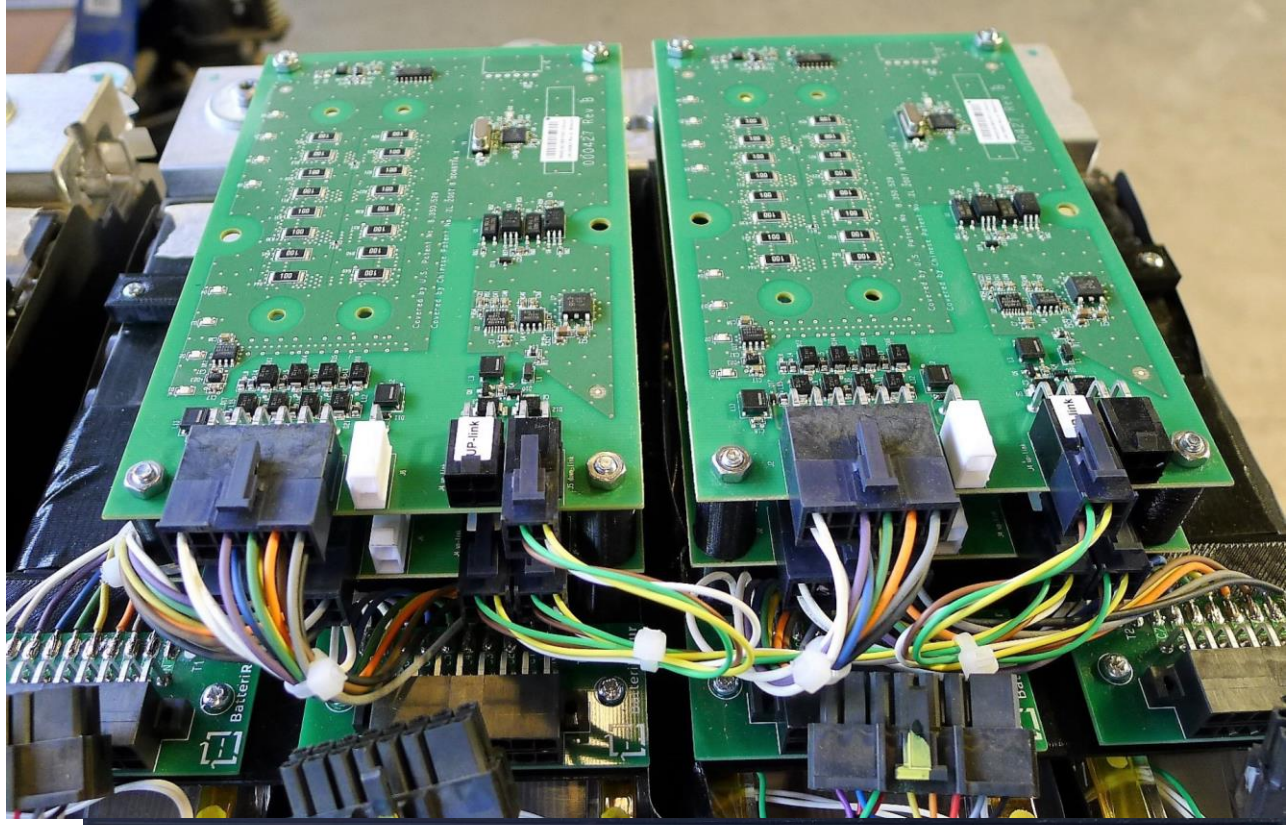
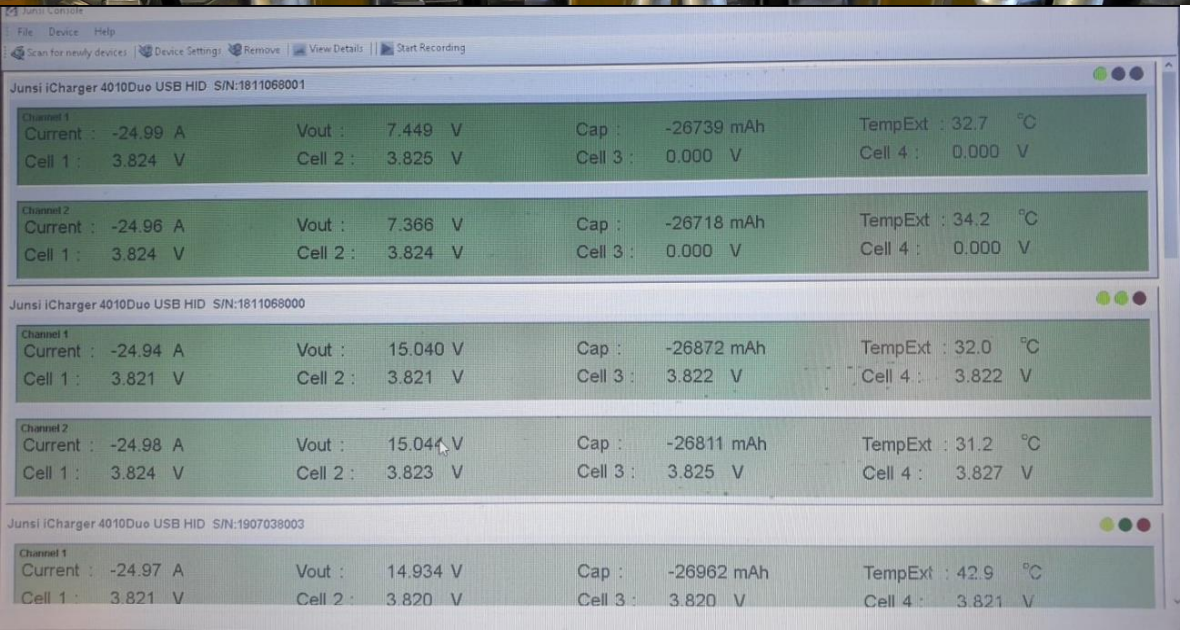
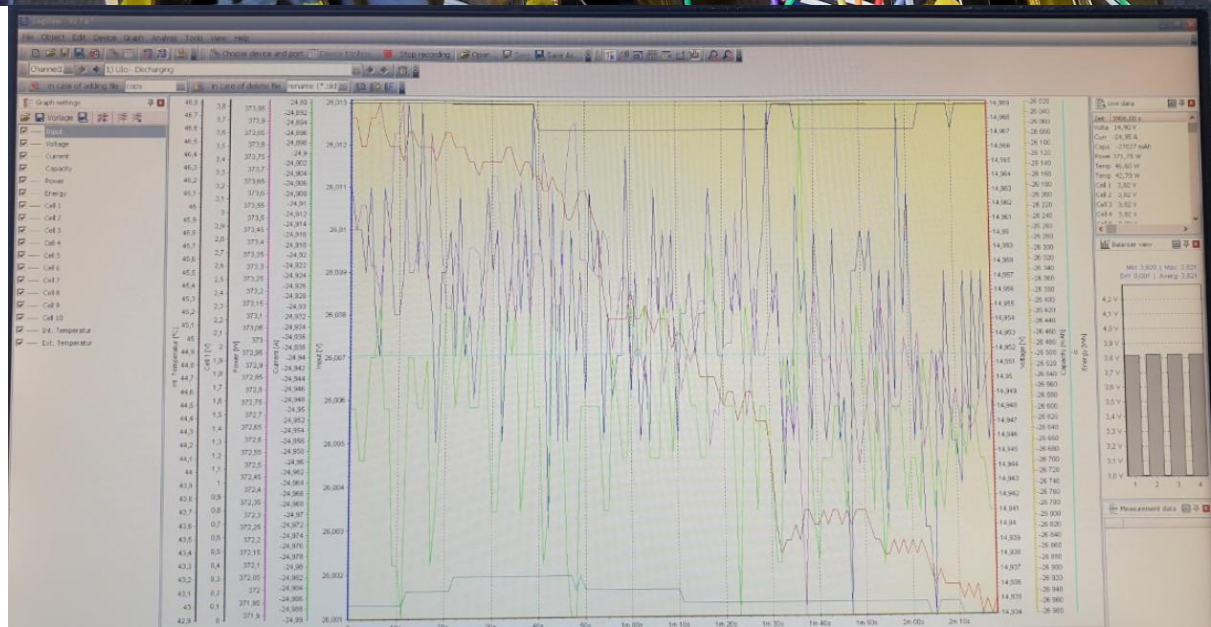
R&D and EV division unit in Sandefjord

- Several complete working stations for dismantling, analyzing, balancing and repair.
- Evaluation of EV batteries
- Analyzing of complete EV batteries, modules and cells with tailor made analyzing tools
- Batteriretur have developed tools to adapt to the OEM’s software

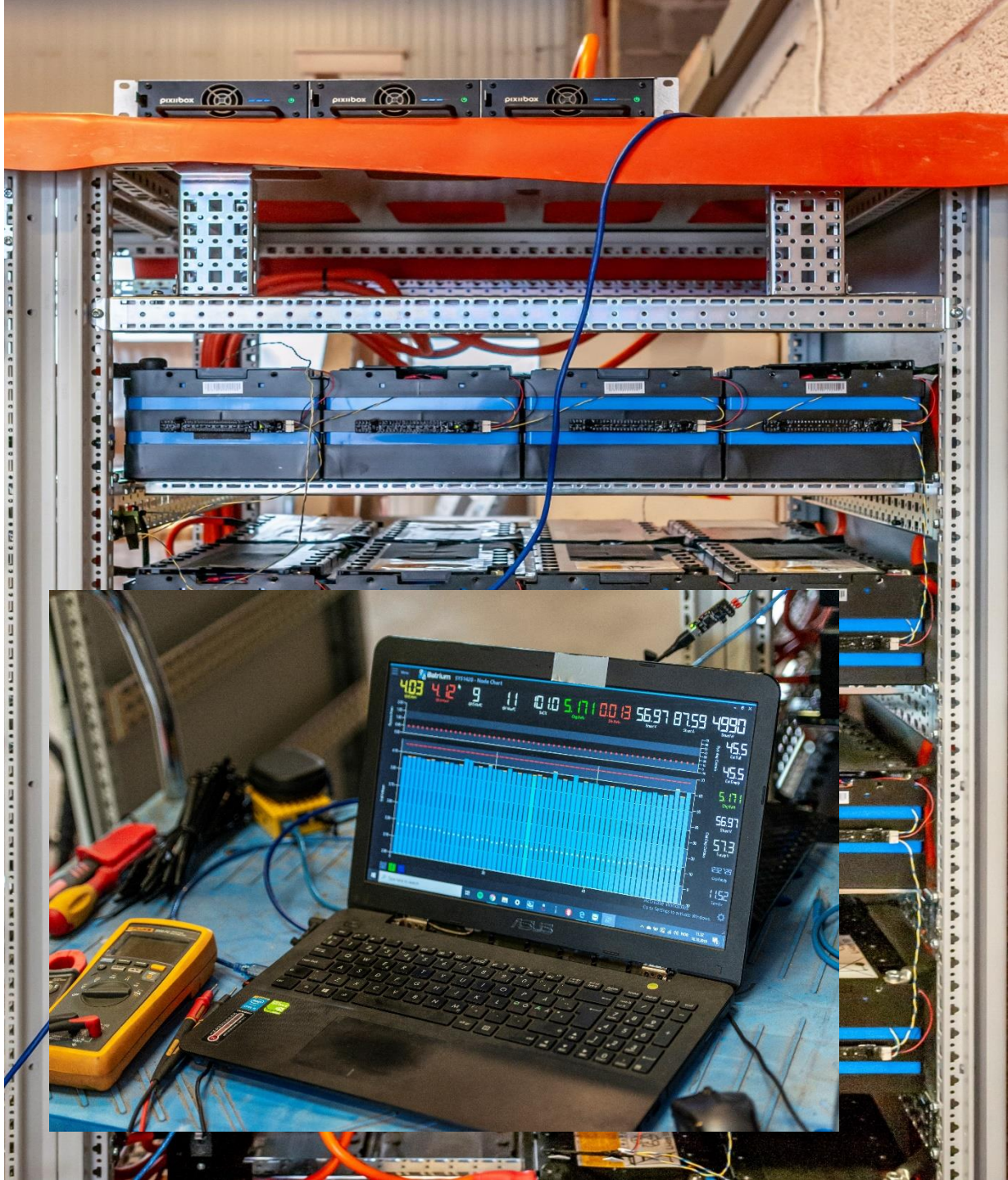





Junsi Console
File Device Help
Scan for newly devices Device Settings Remove View Details Start Recording
Junsi iCharger 4010Duo USB HID S/N:1811068001
Channel 1
Current : -24.99 A Vout : 7.449 V Cap : -26739 mAh TempExt : 32.7 °C
Cell 1 : 3.824 V Cell 2 : 3.825 V Cell 3 : 0.000 V Cell 4 : 0.000 V
Channel 2
Current : -24.96 A Vout : 7.366 V Cap : -26718 mAh TempExt : 34.2 °C
Cell 1 : 3.824 V Cell 2 : 3.824 V Cell 3 : 0.000 V Cell 4 : 0.000 V
Junsi iCharger 4010Duo USB HID S/N:1811068000
Channel 1
Current : -24.94 A Vout : 15.040 V Cap : -26872 mAh TempExt : 32.0 °C
Cell 1 : 3.821 V Cell 2 : 3.821 V Cell 3 : 3.822 V Cell 4 : 3.822 V
Channel 2
Current : -24.98 A Vout : 15.041 V Cap : -26811 mAh TempExt : 31.2 °C
Cell 1 : 3.824 V Cell 2 : 3.823 V Cell 3 : 3.825 V Cell 4 : 3.827 V
Junsi iCharger 4010Duo USB HID S/N:1907038003
Channel 1
Current : -24.97 A Vout : 14.934 V Cap : -26962 mAh TempExt : 42.9 °C
Cell 1 : 3.821 V Cell 2 : 3.820 V Cell 3 : 3.820 V Cell 4 : 3.821 V




DANGER
HIGH VOLTAGE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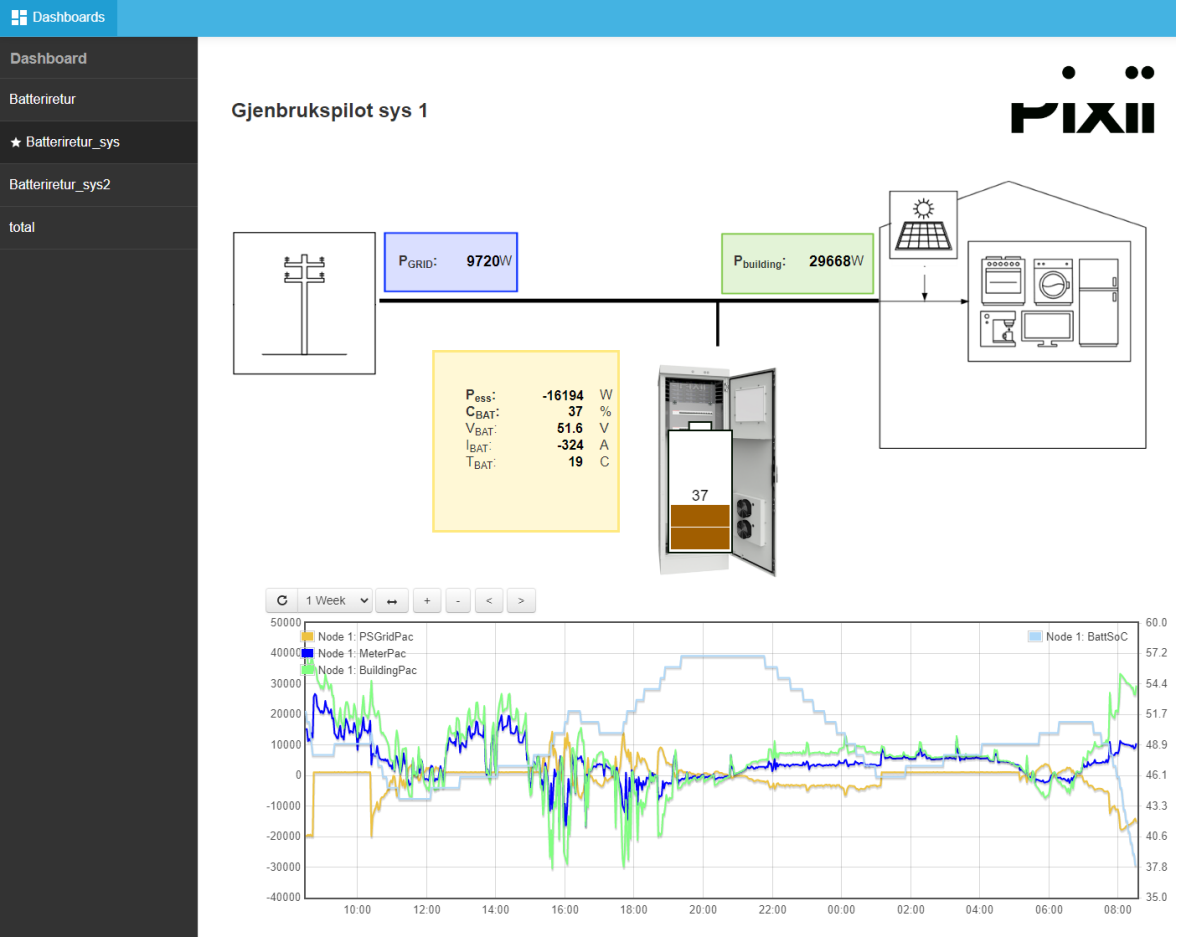

Live view

https://emoncms.org/dashboard/view/batteriretur-sys&apikey=9f104b4ae12741f0f0deec0bf5c137b1

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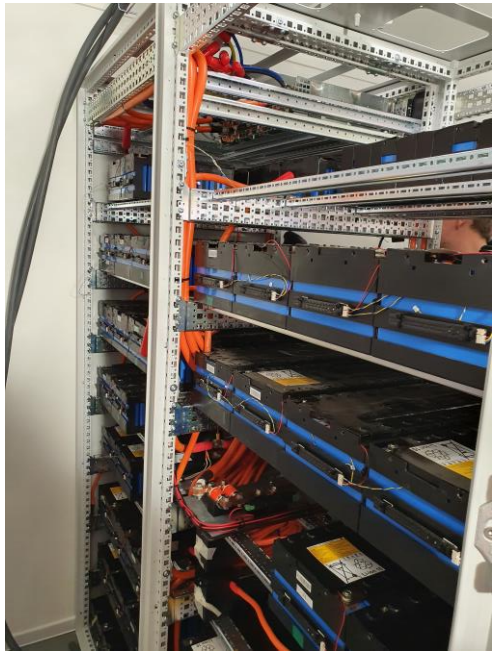

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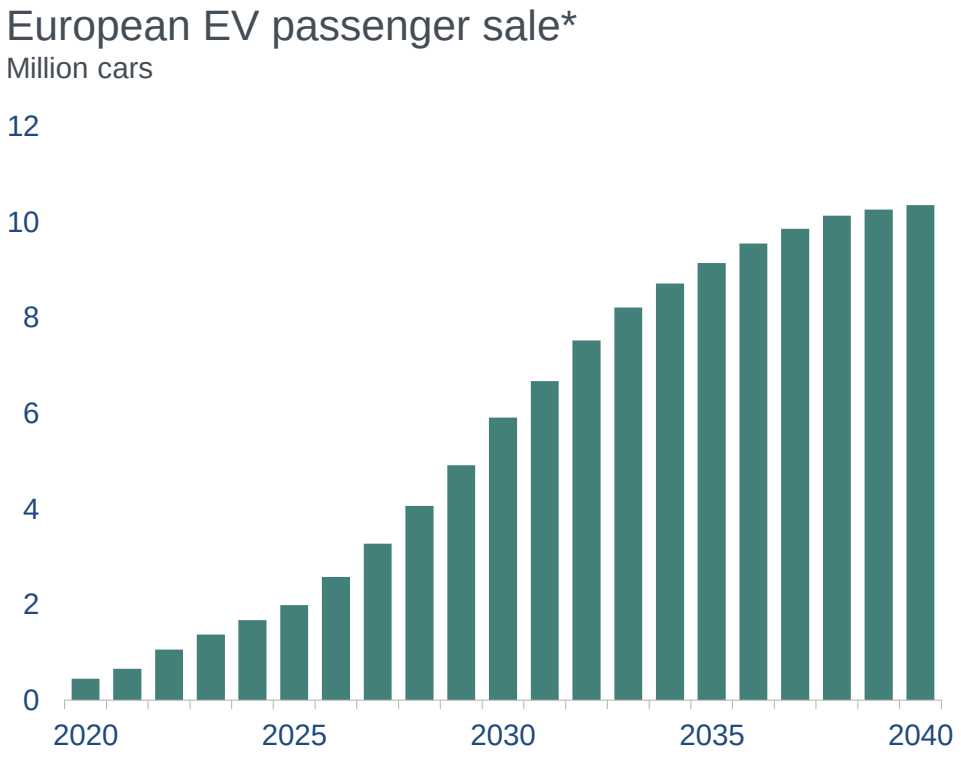
Battery industry in Europe is on the rise

Europe’s battery demand set to soar with rise of electric cars

80%

of European battery demand in 2030



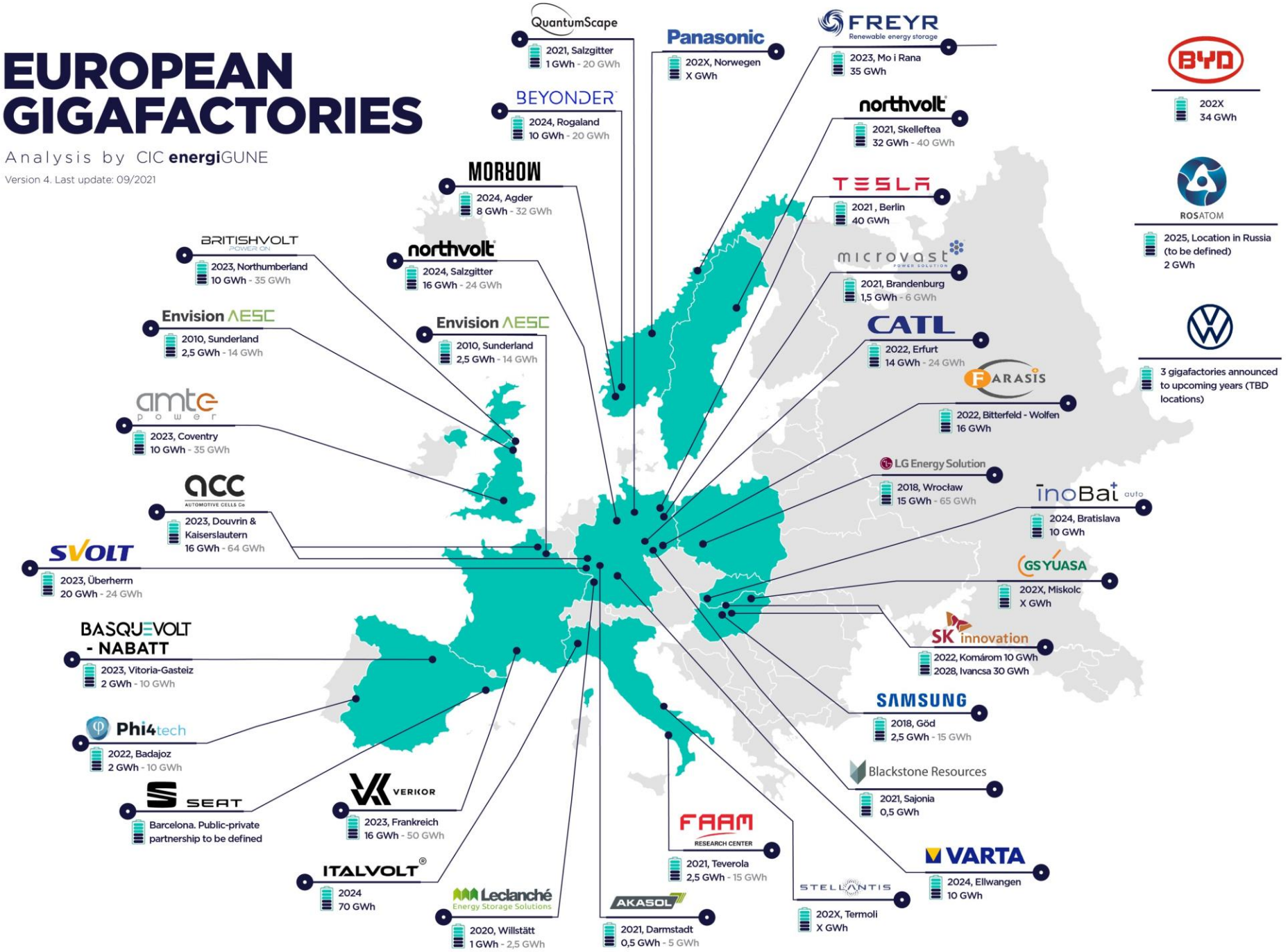
Assuming 35% EV share of new passenger sales in 2030
Source: BloombergNEF EVO-2020
Photo credit: iStockphoto

hydrovolt

EUROPEAN GIGAFACTORIES

Analysis by CIC energiGUNE

Version 4. Last update: 09/2021



Europe is ready to recycle the cars – but their batteries?

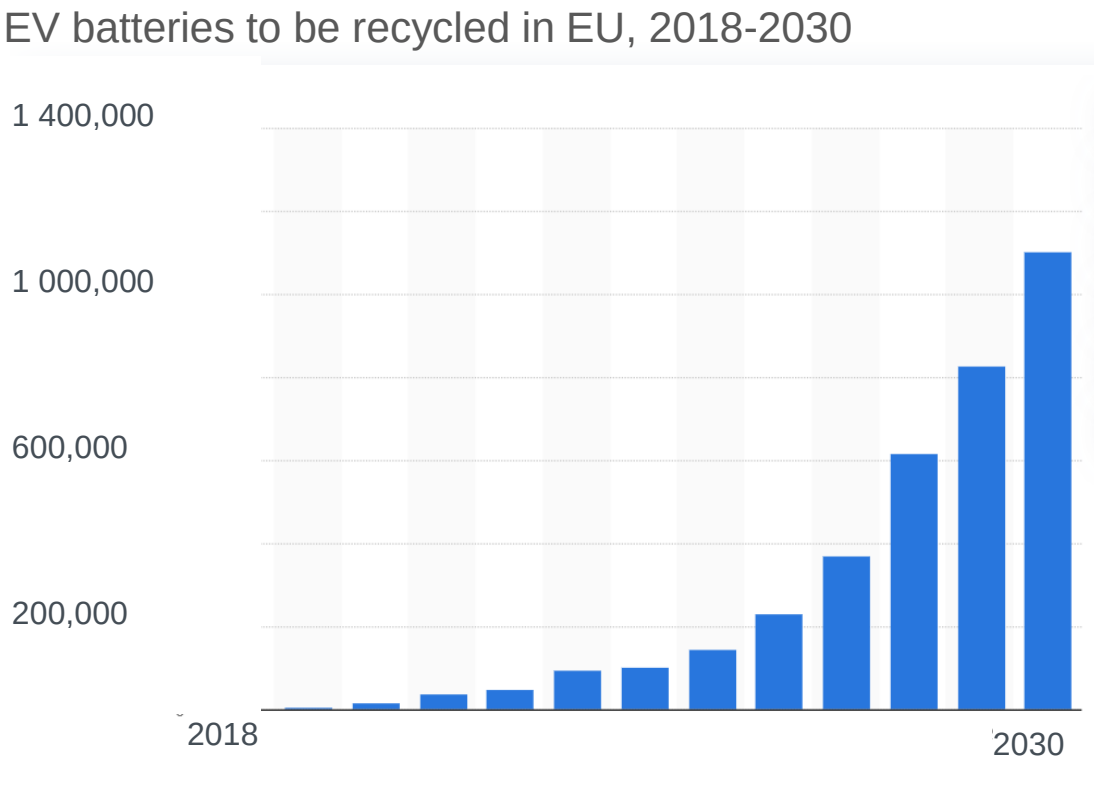
Considerable under-capacity of recycling in Europe today – urgent to establish and scale battery recycling

World #2

Europe set to become world's second-largest battery recycling market

>1 million

EV batteries available for recycling in Europe by 2030



Source: Statista Research Department, 2021

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Can we close the loop for HV batteries in Norway?


Hydro
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HydroVolt

A Hydro and Northvolt venture

– A 50/50 Hydro and Northvolt battery recycling company

– Pilot plant to test new technologies for recycling of car batteries, in Fredrikstad, Norway

– Initial capacity of 8.000 tons + battery modules per year

– 8 x the size of Norwegian market in 2020

Hydrovolt

Why Norway?

- Access to Norway’s advanced EV market. Hydrovolt’s location in Fredrikstad open the gate to the most advanced EV market in Europe
- The Port of Borg opens the doors to sourcing from the European markets
- Partnership with Batteriretur gives immediate access to supply of batteries
- Strongly supported from authoritites/government to build the new era of Norwegian industry


Air Liquide

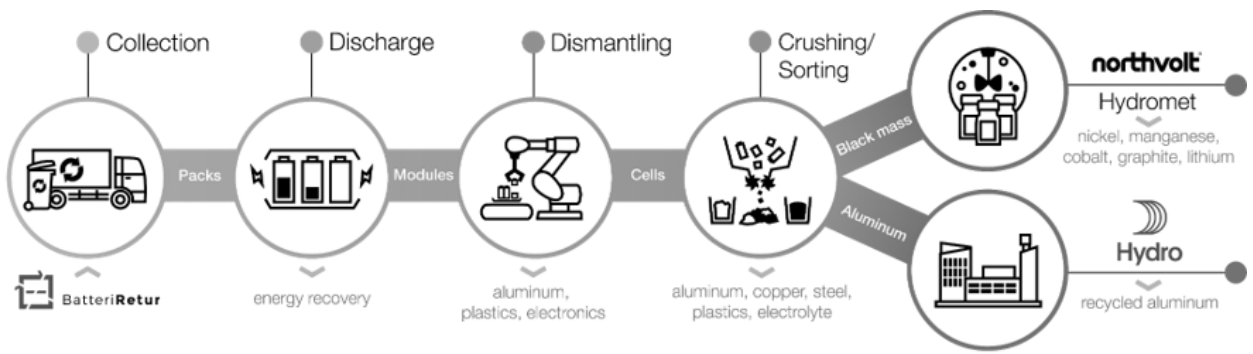

Air Liquide


30-09-2021 08:10:02

Panorama view inside building – November 17th

Hydrovolt process description in short

- **Collection:** Collection of batteries, including packaging, notification and storage. With a partner network.
- **Discharge:** Energy recovery through deep discharging to secure a safe process handling. Electric discharge of end-of-life packs and modules, including energy recovery used as support power for the plant. If need be, solution-discharge or roasting is used for added safety.
- **Dismantling:** Battery packs are dismantled down to at least the module level, robotically and/or manually. Dismantling allows for a.o. the following to be recovered for external recycling: steel casings, aluminium current collectors in the modules, copper bus bars and wiring, as well as plastics and other electronics.
- **Crushing/Sorting**: Cells and modules are crushed, and electrolyte solvent recovered. The crushed remaining material constituents are sorted depending on mechanical properties such as density, size and magneticity. Copper and aluminium are isolated for recycling. The remaining material, known as black mass, is then subjected to a hydrometallurgical process.
- **Hydrometallurgy:** Involves dissolving metals in a solution containing sulfuric acid. In a multistep process, impurities are removed and then nickel, manganese, cobalt and lithium are recovered. Specifications are set in such a way that the recovered materials can directly be reintroduced into the battery manufacturing. Hydromet with a preferred off taker.



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To achieve recycling goals and targets we need a clear legislation…

Legislation

Battery regulation gives boost for recycled content and to competition but still have some barriers to entry. It bases on 3 types of recycling targets: Recycling efficiency (RE), Material recovery targets (MRT) and Recycled content (RC) which all increase over time.

The deadline to achieve targets are in place but not rules on how to calculate recycling targets and how to report them.

Battery Regulation proposed:				
Minimum recycling efficiency	Total: 65%*	Cobalt: 90% Nickel: 90% Copper: 90% Lithium: 35%	Total: 70%* Cobalt: 95% Nickel: 95% Copper: 95% Lithium: 70%	
	2025	2026	2030	2035
Minimum recycled content in new cells			Cobalt: 12% Nickel: 4% Lithium: 4%	Cobalt: 20% Nickel: 12% Lithium: 10%

Barriers to entry and be clearified:

- Processing requirements when international shipping (within a year)
  - Capacity issues in Europe complicates the time frame
- All EV batteries to be collected
  - How to calculate the rates are still unclear
  - What is available for collection and how to measure?
- Reporting to authorities and suppliers
  - Rigid systems and avoid double reporting is important
- Permits and diverse safety regulations for storage and processing
  - Permitting time and bureaucracy
- Hazardous waste transport (ADR, etc.)
  - What is defined as hazardous waste varies greatly between countries
- Unusual market dynamics because of Extended producer responsibilities
  - Still a bit unclear on responsibilities

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Establishing green industrial jobs with a strong circular economy perspective are clearly in line with the Norwegian government policies and the global goals for the environment and development. In other words environmental focused industry and development of the global society walking hand in hand.

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#closingtheloop

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