

THE NEXT STEP OF RECYCLING

-

SECOND-LIFE STORAGE SOLUTIONS

SNAM SOCIETE NOUVELLE D'AFFINAGE DES METAUX

RECYCLING OF END-OF-LIFE
BATTERIES

THE REGULATORY FRAME

The Directive 2006/66/EC of 6th September 2006 regulates the manufacturing and disposal of batteries in the EU with the aim of improving the environmental performance of batteries and accumulators

Collective vs individual system

The collection and recycling of waste batteries can be organized either through an individual or a collective scheme. The latter takes over for producers and importers most of their duties under the Producer Responsibility Scheme, while the individual scheme is of their sole responsibility (take back and recycling)

Collection rate

Waste battery collection rate targets are specified in Article 10 of the Directive, with minimum targets of 45% of battery sales from 2016 on

Recycling efficiency

The directive 2006/66/EC specifies the minimum recycling efficiency for Nickel Metal Hydride and Lithium Rechargeable batteries to 50%



THE RECYCLING INDUSTRY IN EUROPE

OVERVIEW OF KEY PLAYERS



umicore

ACCUREC
RECYCLING GMBH

Nickelhütte Aue GmbH

INSTALLED CAPACITIES

SNAM – Target 5.000 tn/year – Actual 1.000 tn/year

Umicore – Target 7.000 tn/year – Actual < 500 tn/year

Accurec – Target 5.000 tn/year – Actual <1.000 tn/year

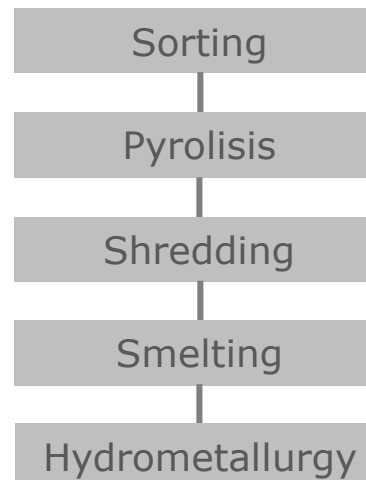
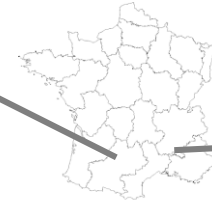
NHA – Target 7.000 tn/year – Actual 1.500 tn/year (estimation)

Actual EU proven capacity around 5.000 tn/year vs available waste > 25.000 tn/year



PRESENTATION AND RECYCLING PROCESS

Founded in Lyon in 1977
Awarded ISO 14001 certification
Yearly turnover 15 M€
2 sites operating in France
Recycling of NiCd, NiMH, NiNa, alkaline and Li-Ion



RECYCLED PRODUCTS

Processed waste



Ni

Co

Mn

Cu

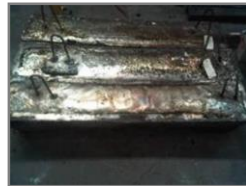
Al

Zn

Fe

Plastics

Secondary raw materials



Final applications





PHENIX BATTERIES

SECOND LIFE STORAGE SOLUTIONS
FROM ELECTRIFIED VEHICLES

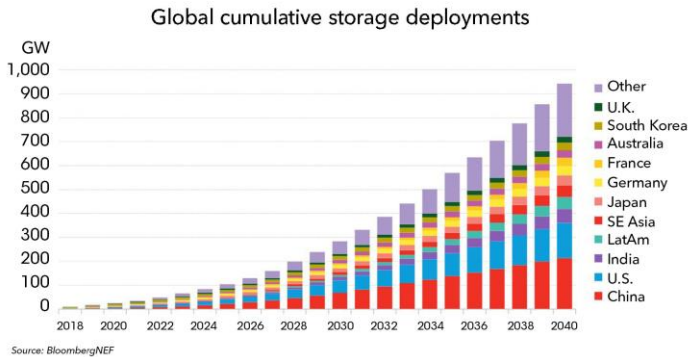
INTRODUCTION

EV MARKET

First half 2021, 2.6 million electric vehicles (EV & PHEV) were sold worldwide, up 160%

This represents more than 500.000 tons of batteries

ENERGY STORAGE

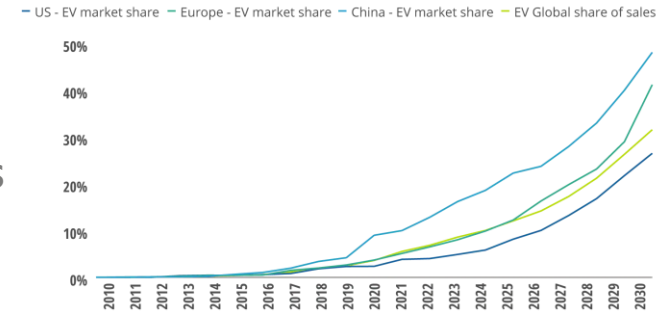


ECONOMICAL INPUT

Price lost 89% from 2010-2020, trend 2025 <\$100/kWh

2021 average battery pack price hits \$137/kWh

Outlook for EV market share by major region

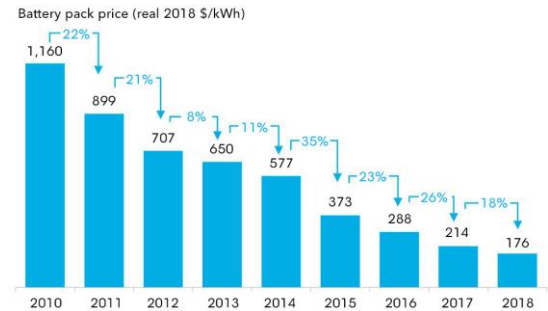


Source: Deloitte analysis

Global EES market estimated to grow to a cumulative 942GW/2,857GWh by 2040

Batteries for stationary storage estimated to make up 7% of total battery demand in 2040

Lithium-ion battery price survey results: volume-weighted average



Source: BloombergNEF



SECOND LIFE

OVERVIEW OF PAST AND ACTUAL INITIATIVES IN THE EU

Nissan/Eaton



Nissan 2nd life Amsterdam Arena

3 MWh

Daimler



*Daimler 2nd life battery plants
in Lünen and Elverlingsen*

21 MWh

BMW



BMW battery farm in Leipzig

15 MWh

Audi



Audi BSU on Berlin EUREF Campus

2 MWh

All these initiatives
are based on single-
brand and fully
integrated original
packs

Renault



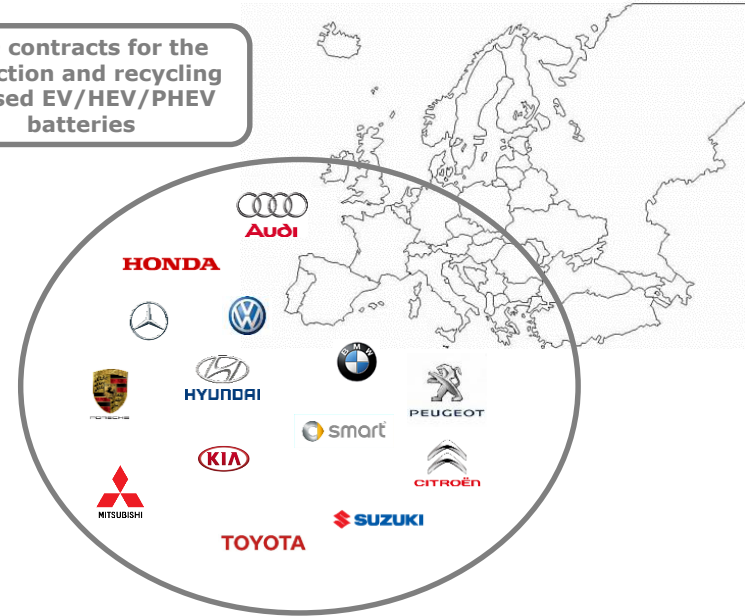
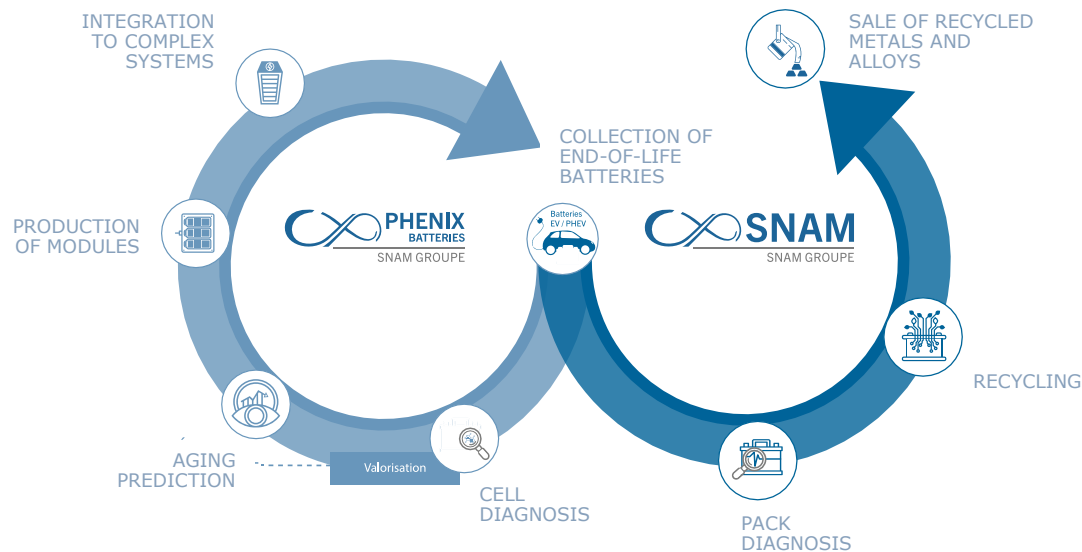
Renault Advanced Battery Storage

60 MWh

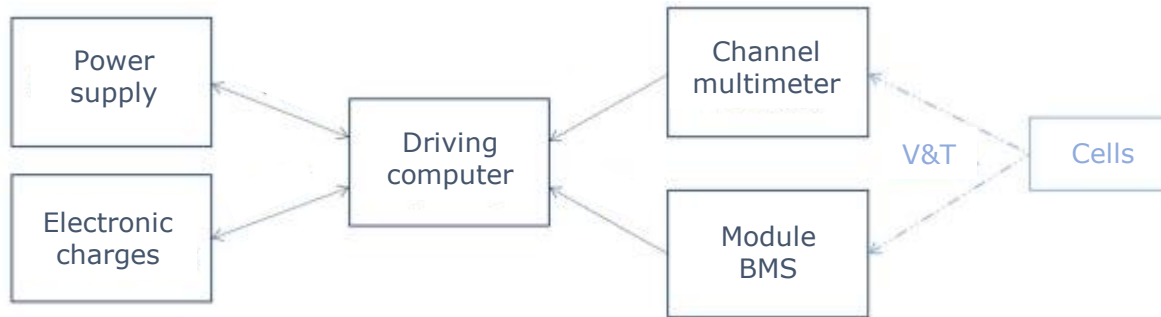
PHENIX BATTERIES : CONCEPT

Unlike OEMs, Phenix Batteries focuses on a multi-brand supply of batteries and builds new packs with a new BMS design

YTD contracts for the collection and recycling of used EV/HEV/PHEV batteries



PHENIX BATTERIES : R&D

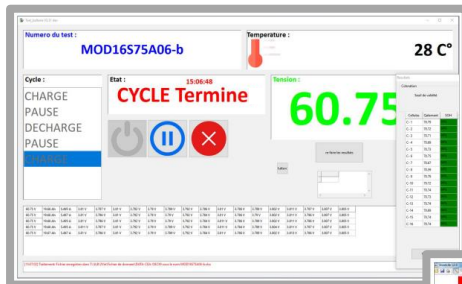


INPUT

- SOH (diagnosis)
- Usage profile
- Usage temperature
- DOD

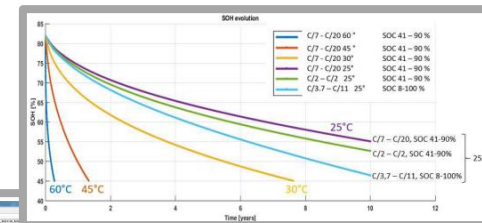
OUTPUT

- SOH evolution
- Mix cycling/aging
- Expected lifespan
- Cycles/year/kWh

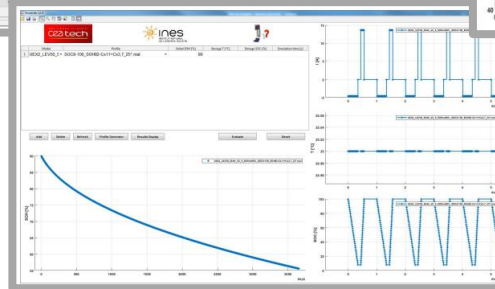


Diagnosis software

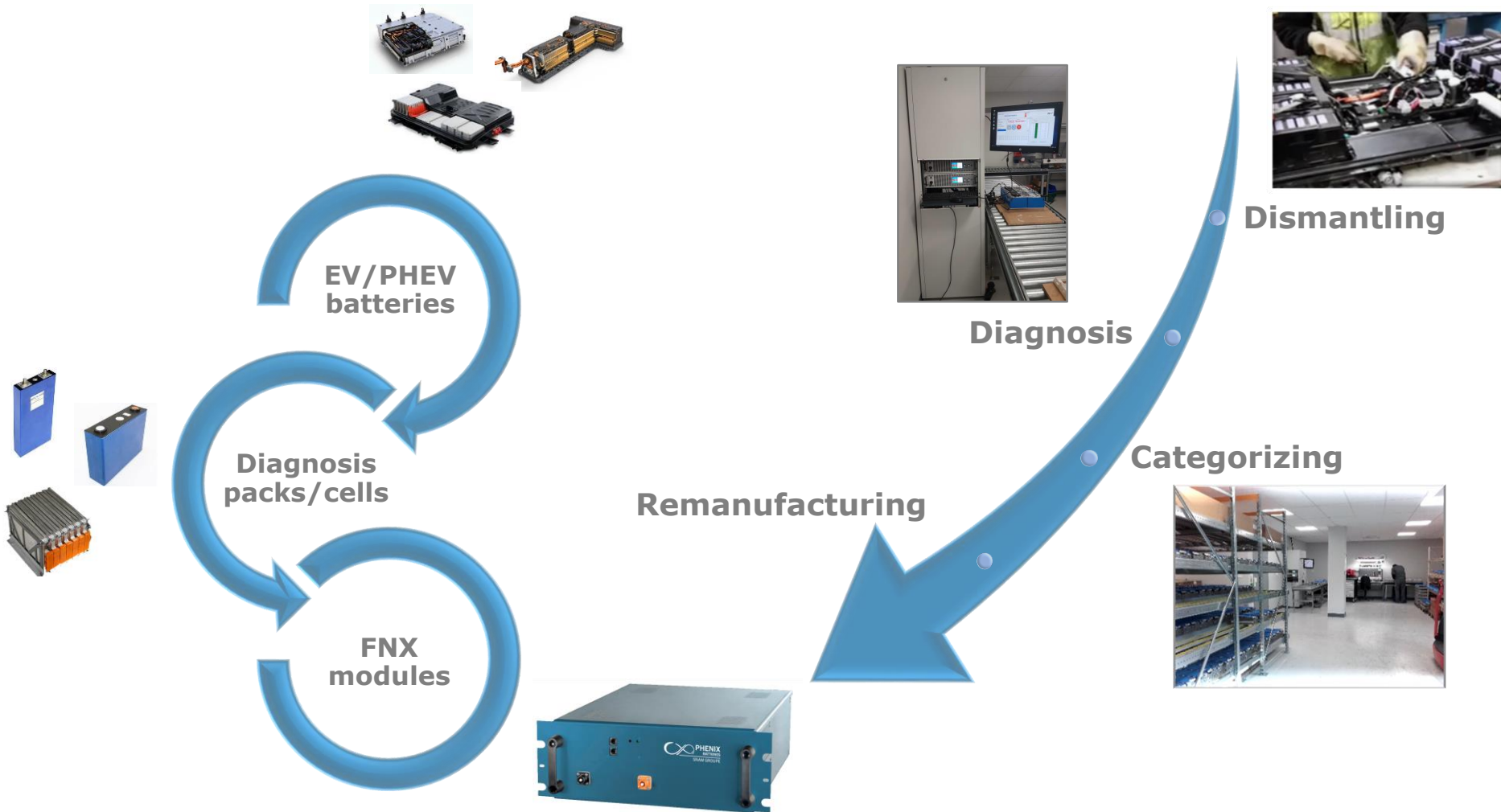
Aging prediction



Lifespan & warranty



PHENIX BATTERIES : PROCESS



PHENIX BATTERIES : PRODUCT



FNX MP14



Nominal voltage 48V
Up to 10 modules parallel
1 BMS per module
1 external EMS

FNX MS14



...



Nominal voltage 400-700V
7-12 modules serial
1 PCM per module
1 Master BMS per string
Up to 10 strings parallel
1 external EMS

- Nominal energy 2,5-3,5 kWh
- Lithium NMC
- Dimensions rack 19" 4U
- Warranty 10 years / 3.650 cycles
- CE / CEM / UN 38.3 certified
- End-of-life recycling included



PHENIX BATTERIES : MARKETS



Industrial

Retailers/factories
Isolated sites
Private network
Off grid

Stationary

Solar power plants
Wind energy
Cogeneration



Residential

Individual
Collective
Remote sites



Energy

Grid service
Primary/secondary reserve
Power supply & UPS



PHENIX BATTERIES : INSTALLATIONS



Stationary
PV/Wind (Belgium)
216 kWh/600V



Energy
Truck service (Belgium)
84 kWh/400V



Industrial
Retailer (France)
42 kWh/48V



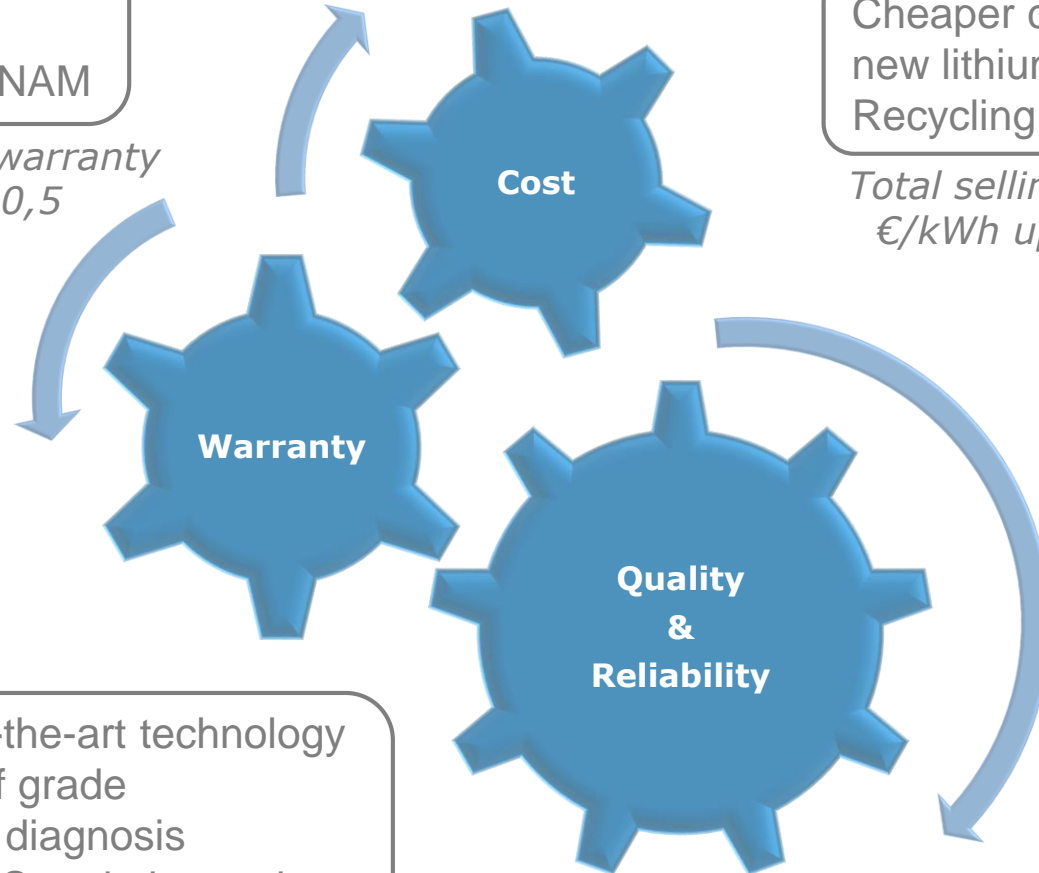
Residential
Collective (France)
738 kWh/48V



PHENIX BATTERIES : ECONOMICAL ASPECTS

Reliable prediction
Free substitution in case
of proven defect
EPR taken over by SNAM

*10 years / 3.650 cycles warranty
DOD 85% - C-rate 0,5*



Cheaper compared to
new lithium batteries
Recycling charge included

*Total selling price 180-350
€/kWh upon application*

State-of-the-art technology
EV proof grade
Reliable diagnosis
New BMS and electronics
Made in France

FUTURE AND OUTLOOK



Cooperation with Sirea, expert in conversion,
monitoring and energy efficiency systems
Turnkey solutions (cabinets and containers)



New factory designed for 10 MWh/year
to 40 MWh/year by 2025
3,5 MWh EV cells in stock for production



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