The BMS Alliance Webinar
Data Access & Harmonization

Unlock BMS potential to electrify mobility

20 March 2025

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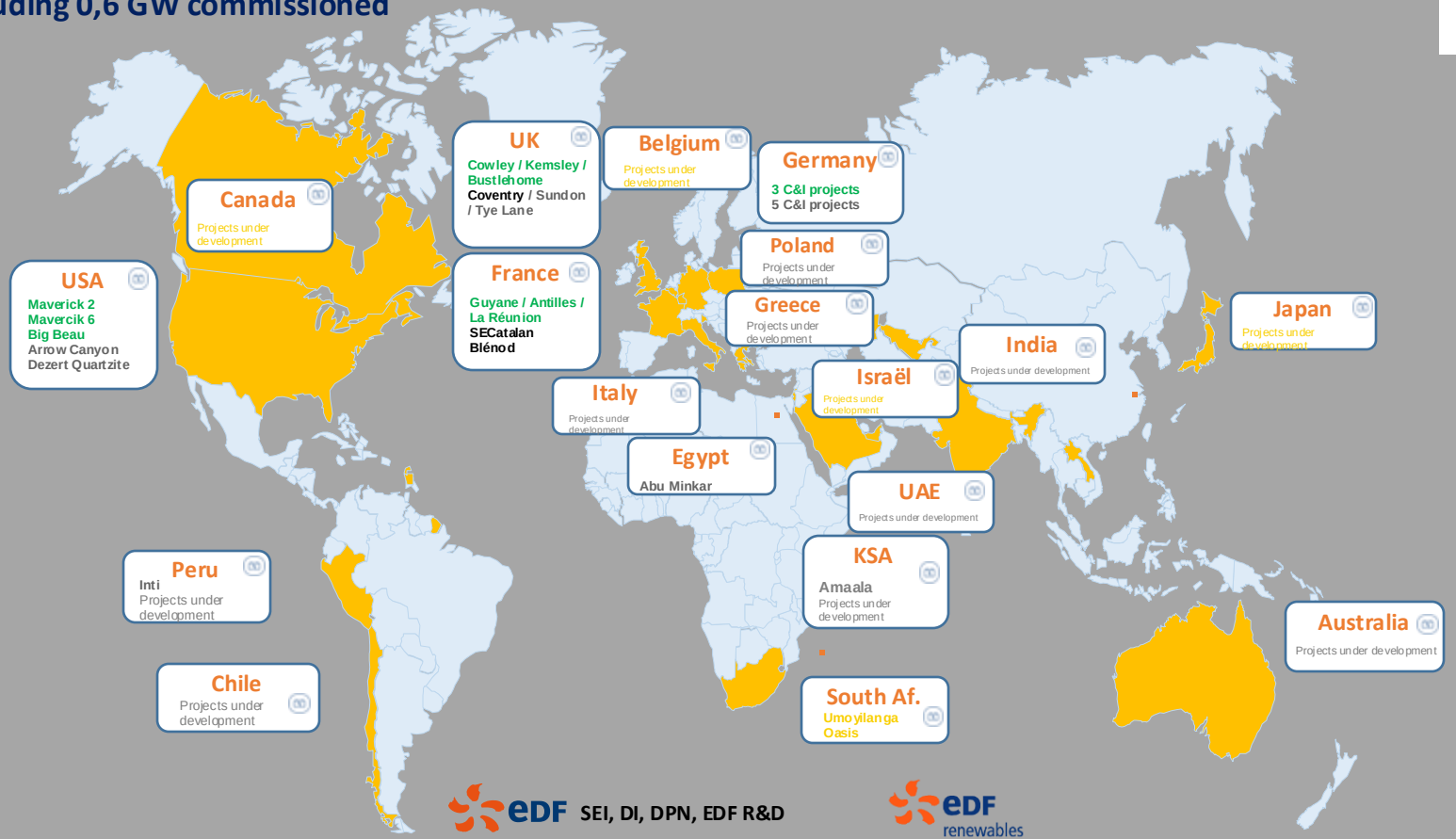
EDF battery activities, a global footprint

➔ 1,8 GW secured projects (~ 5 GWh)
➔ including 0,6 GW commissioned



And also the energy for e-mobility with Izivia (charge), DREEV (V1G, V2G), Izy (B2B, B2C chargers), Neot (e-bus)

Monitoring as a key point to optimize services and lifespan

Edwards & Sanborn BESS (California Terra-Gen)
3 300 MWh - 875 MWp solar
~ 12 000 racks / 700 containers
~ 13 millions cells

And EDF R&D to support each step and subject

Project support

- Technological support
- Economic optimization
- System specification and dimensioning
- Piloting laws
- Monitoring and Root cause analysis

Modelling

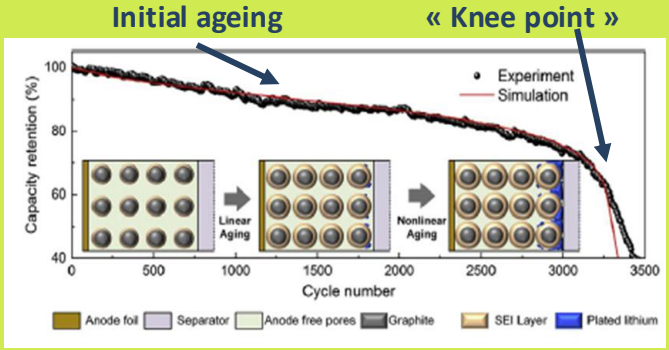
- Ageing, end of life
- Safety
- Cost
- Lifecycle analysis, carbon footprint

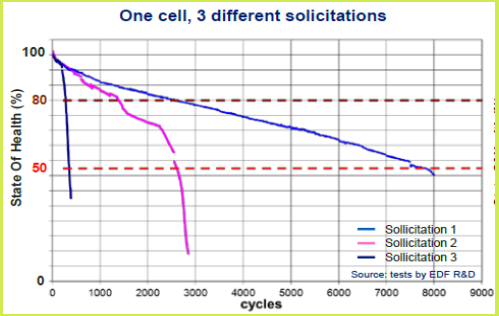
Tests

- 6 laboratories at EDF Lab Les Renardières with >300 test channels from cell to complete BESS
- Performance, accelerated ageing tests
- Abusive testing – thermal runaway
- Post-mortem analysis

Prospective

- Cost of storage
- Battery technology roadmap
- Breakthrough innovation detection and analysis

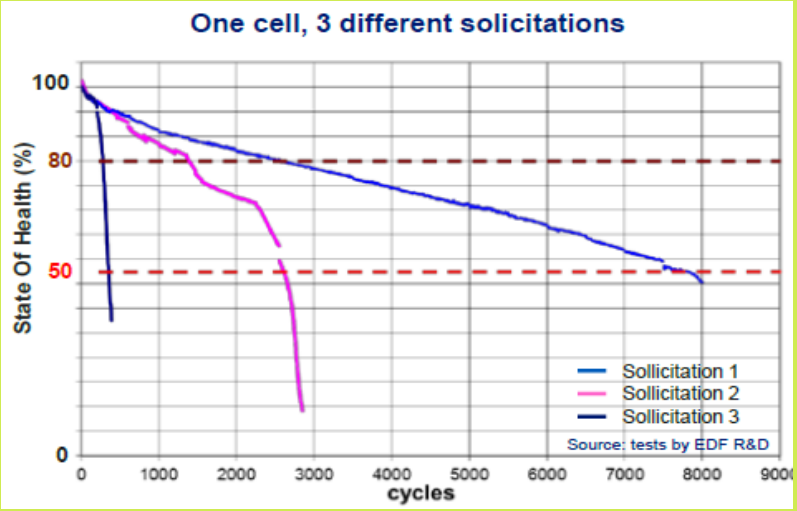




Tesla megapack , Victoria, Australia 2021

Ageing battery and SOH warranty

Batteries performances decrease naturally because of 2 phenomenon:
cycling
and also **storage**
Each contribution depends on temperature, current and state of charge



Typical manufacturer warranty : **70 %** of initial capacity after **8 years** or **160 000 km**...But how this capacity is defined ?

Nos véhicules Renault E-Tech 100% électrique intègrent des batteries qui sont garanties 8 ans ou 160 000 km (au 1er des 2 termes échu). A noter qu'il existe une dégradation naturelle comme tout appareil électronique équipé d'une batterie. Sur nos nouveaux modèles, la batterie est garantie pour maintenir à minima 70% de sa capacité initiale sur la période de garantie.

Votre véhicule électrique ou hybride rechargeable bénéficie d'une garantie étendue sur sa batterie de traction : 8 ans ou 160 000 km, avec une capacité minimale de 70 %. Pendant toute cette durée, les

Model 3 Propulsion Model 3 Grande Autonomie, Propulsion Model Y Propulsion	8 ans ou 160 000 km, au premier terme échu, avec une rétention minimale de 70 % de la capacité de la batterie au cours de la période de garantie.

No standardization or regulation of SOH exists today

…. Public actors are working for the decarbonation

Global technical regulations of UN : **No conclusion**

19. Early agreement was reached that the UN GTR should not seek to dictate the algorithm used by the manufacturer in determination of on-board battery health metrics, but instead provide a means to ensure the accuracy of any values through in-use verification. Two metrics were created, named the state of certified energy (SOCE) and the state of certified range (SOCR), which would form the basis for assessment within the UN GTR.

20. Early agreement was also reached that the UN GTR would not seek to create new test methods for assessment of vehicle range and battery energy, but instead rely upon the test procedures already employed within a Contracting Party for those purposes.

European union: **regulation in progress**

European regulation introduces a battery passport (2023/1542) but does not specify how to calculate the SOH or in which unit it should be expressed (Ah, kWh). This battery passport is still not defined (no certainty on the parameters). No formal obligation to know the SOH of a battery at the end of its life.

(huge) Impact of battery ageing on residual EV value while battery is 40 % of total EV value

Numerama: « *Certaines [marques] auraient même des pratiques de reprogrammation des systèmes de management des batteries (BMS) pour masquer les pertes d'autonomie. D'autres constructeurs font payer le test SOH pour décourager le client de le faire. Certains constructeurs n'ont pas l'air de vouloir se montrer transparent sur le sujet.* »

La perte de valeur des voitures électriques, un gros problème pour le leasing

L'Automobile Magazine 13/08/2024

Leasing model behind Europe's EV drive at risk of breakdown

Reuters

By Nick Carey

August 13, 2024 7:03 AM GMT+2 · Updated 3 months ago

Le loueur Hertz n'en finit pas de réduire sa flotte électrique

Auto Infos Distribution 06/05/2024

Uncertainty on the residual value is against the EV market growth

An accuracy estimation of SOH is needed !

And EDF R&D involved in EP : Batmax, Big Leap, Next BMS and… **Energetic**

To develop and embed low-cost sensors which provide new physical information to the BMS

To design a hardware abstraction layer platform

To develop multiphysics modelling tools to continuously assess the SoX and RUL of Li-battery

To develop AI based models for explainable SoX prediction

To design an innovative, connected and smart DT based BMS

To make recommendations for future standard for predictive maintenance in the Cloud

To demonstrate and validate the ENERGETIC innovative smart DT based BMS

To facilitate the uptake and exploitation of ENERGETIC results by the academic community

What data access can allow for stationary and mobility applications ?

Monitoring

- The system needs to be monitored to ensure the service to user
- To predict maintenance
- To allow AI optimization
- To follow safety criteria
- To allow BMS to become updatable, real time and custom battery steering

Value estimation

- Estimate the potential and value, as example for a leased electric car or for a second life application

Energetic contributions

- Develop new sensors
- Perform ageing tests for AI training and validate the learnings
- Produce a POC composed with a BMS and a real battery

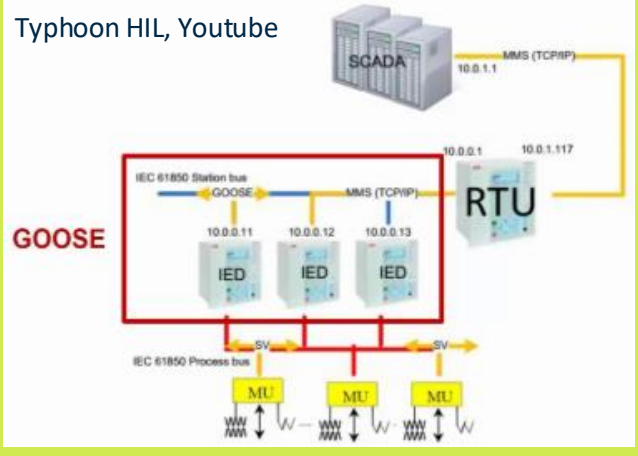
12 li-ion cells tests, Energetic project
EDF R&D

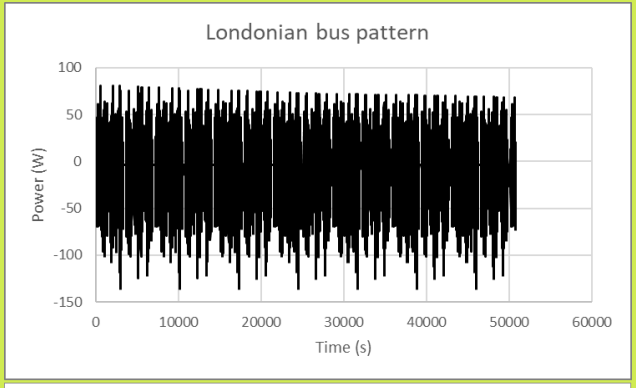
Why the harmonization is a key point ?

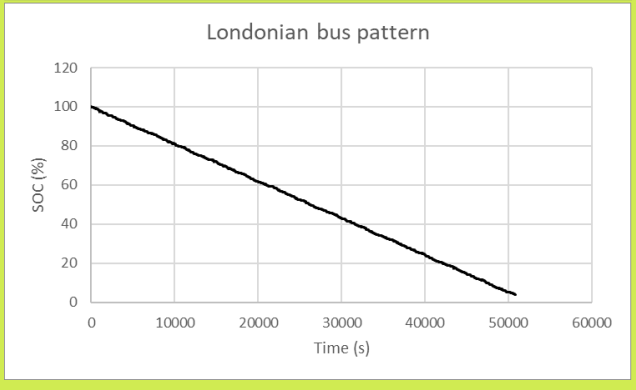
Data volumetry

- The volumetry is huge, more than To per day for a project
- The data must be compressed, stocked and sorted by system
- Example, turning tags, IEC 61850

Typhoon HIL, Youtube







1 li-ion cell for 14 hours (50 800 points)
Forsee Power, Energetic

Best analysis

- Anticipate maintenance operations
- Optimize availability and safety
- Introduce new tests methods (ICA)

What is the situation today ?

Monitoring

- Actually operating for stationary application. Easy because the data is produced by owner but data volumetry is still a challenge
- Adventure is beginning in mobility because often, data producer ≠ car owner (RGPD)

Value estimation based on SOH

- Not easy because BMS actually doesn't measure SOH => Not accurate estimation
- > 3.5 points of SOH (measure VS BMS SOH) => several years of lifespan uncertainty

Panorama

- For mobility applications, mainly by vehicule manufacturer
- For car fleets, with OBD port
- For stationary, owner solution

Age (year)	Distance (km)	Total capacity measured	BMS Energy	Delta
2,46	15 386	94,5%	96,8%	2,3 pts
2,40	11 475	94,6%	97,3%	2,75 pts
1,81	31 521	87,5%	91,0%	3,50 pts

Comparison on 3 EV cars (≠) measured and BMS SOH (SOH capacity VS SOH energy, delta is underestimated) EDF R&D

What have to be done ?

- European Battery Passport will communicate only SOH and SOC, it's not enough
- Raw data as time, current, voltage must be available to allow AI actors for training
- Define the way to measure the SOH
- Improve people trust to help used EV market to grow
- In Energetic, work in synergy with researchers, start up and industry to develop and integrate AI in BMS to improve safety, lifespan, tracability and trust in the e-mobility

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