

## PS3: MATERIALS EFFICIENCY FOR PORTABLE ENERGY STORAGE

### A: KEY SECTOR TRENDS

1. One Portable Energy Storage Technology has emerged : Lithium Ion , as of now in Liquid State, and Solid State as of 2025
2. The initial Portable Energy Storage Market of the smartphones is now mature and all growth will come from EVs.
3. This a complex topic both inside the cell, with 4 key components that interact with each other in order to ensure efficiency and safety at cost, and outside the cell with the challenges of access to critical materials and recycling
4. Market growth supports incredible technology evolution:
  - lower cobalt content for cathodes
  - move from graphite to silicium or lithium for anodes
  - more efficient separators thanks to coatings
  - new electrolyte salts
  - .... and ultimately solid state.
5. What still needs to be understood, estimated and measured:
  - the pace of adoption of new technologies (whether cathodes, anodes, separators or electrolytes)
  - the key drivers (necessary regulations?) towards recycling or reuse at the end of life
  - the impact of all these trends on using critical materials smarter, less and longer.

### B: MATERIALS EFFICIENCY SOLUTIONS & GOALS

1. «Practical solutions» for the roadmap towards « Smarter, Less and Longer» have emerged from the discussion:

Smarter:

- higher usage rate of cars (Renault example of Zoe shared system in Madrid)
- improved battery performance to weight (Renault cooperation with Enevate)
- regionalization of supply chains (JX and Umicore)

Less:

- reduced usage of critical materials (BASF example of high nickel cathode with reduced cobalt, Arkema example of cathode production by extrusion)
- new and thinner design of battery components (Sepion)
- recycling the metals along the battery life (Umicore and JX)

Longer:

- Number of Cycles (Arkema additives and electrolytes for long cycling)
- Range (Arkema and Sepion)
- Second life: reuse of batteries whether for same or different usage (all)

2. Goals of Materials Efficiency shared by co-chairs and speakers

- Smarter in 2030 (new batteries) : 80% charge in 15 minutes - currently 80% in roughly 30 minutes
- Smarter and Less in 2035 (new batteries ) : Energy density at cell level of >1000 Wh/L or >350 Wh/kg specific energy - currently 700 Wh/L and 250 Wh/kg are best-in-class
- Less and Longer in 2035 (used batteries): collect and recycle or reuse 80% of used EV batteries - currently 5%

### SPEAKERS

Thierry Le Henaff - CEO Arkema (France) - Co-chair  
 Shigeru Oi - CEO JX Nippon Mining & Metals (Japan) - Co-chair  
 An Steegen - CTO Umicore (Belgium)  
 Gilles Normand - Senior VP Electric Vehicles Renault (France)  
 Michael Baier - Senior Vice President Battery Materials BASF (Germany)  
 Peter Frischmann - CEO Sepion (USA) - WMF Award Coup de Coeur 2017

**Moderator** : Victoire de Margerie, Vice Chairman World Materials Forum