BATTERIES FOR ENGINEERING APPLICATIONS

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TOPICS

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1. INTRODUCTION (terminology, battery construction and operation characteristics)
2. BATTERY TECHNOLOGIES (lead acid, Ni-MH, lithium ion, zebra, metal-air)
3. APPLICATIONS (Portability, renewal sources, Smart Grid, sizing and testing batteries, safety concerns)
4. NEXT GENERATION (battery challenges, new technologies, the future of energy storage)

Battery Challenges

1. High Energy and Power densities
2. Safety
3. Environment concerns
4. Recyclability
5. Costs
6. Materials availability

Battery Challenges

1. High Energy and Power densities

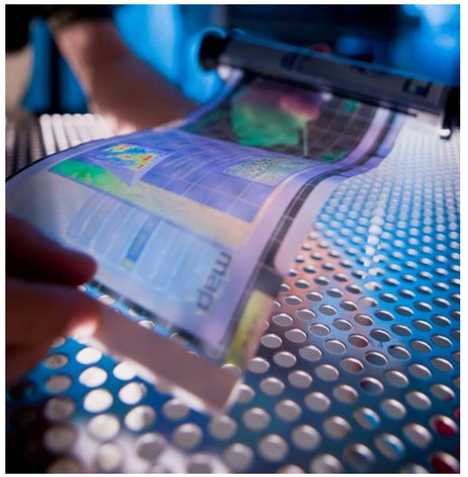
Every year new batteries are announced (more powerful, with higher cycle life, calendar life, with fast recharging characteristics, cheaper, …..)

Battery Challenges

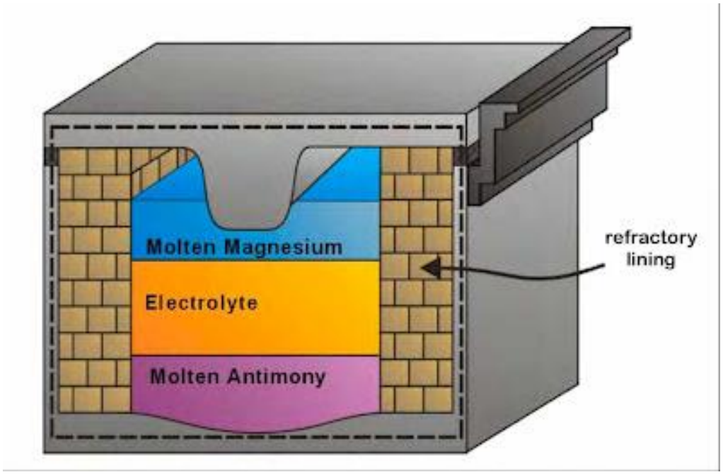
1. High Energy and Power densities

GM and Envia Systems, announced batteries for electric vehicles with 450 km autonomy

AIST Tsukuba



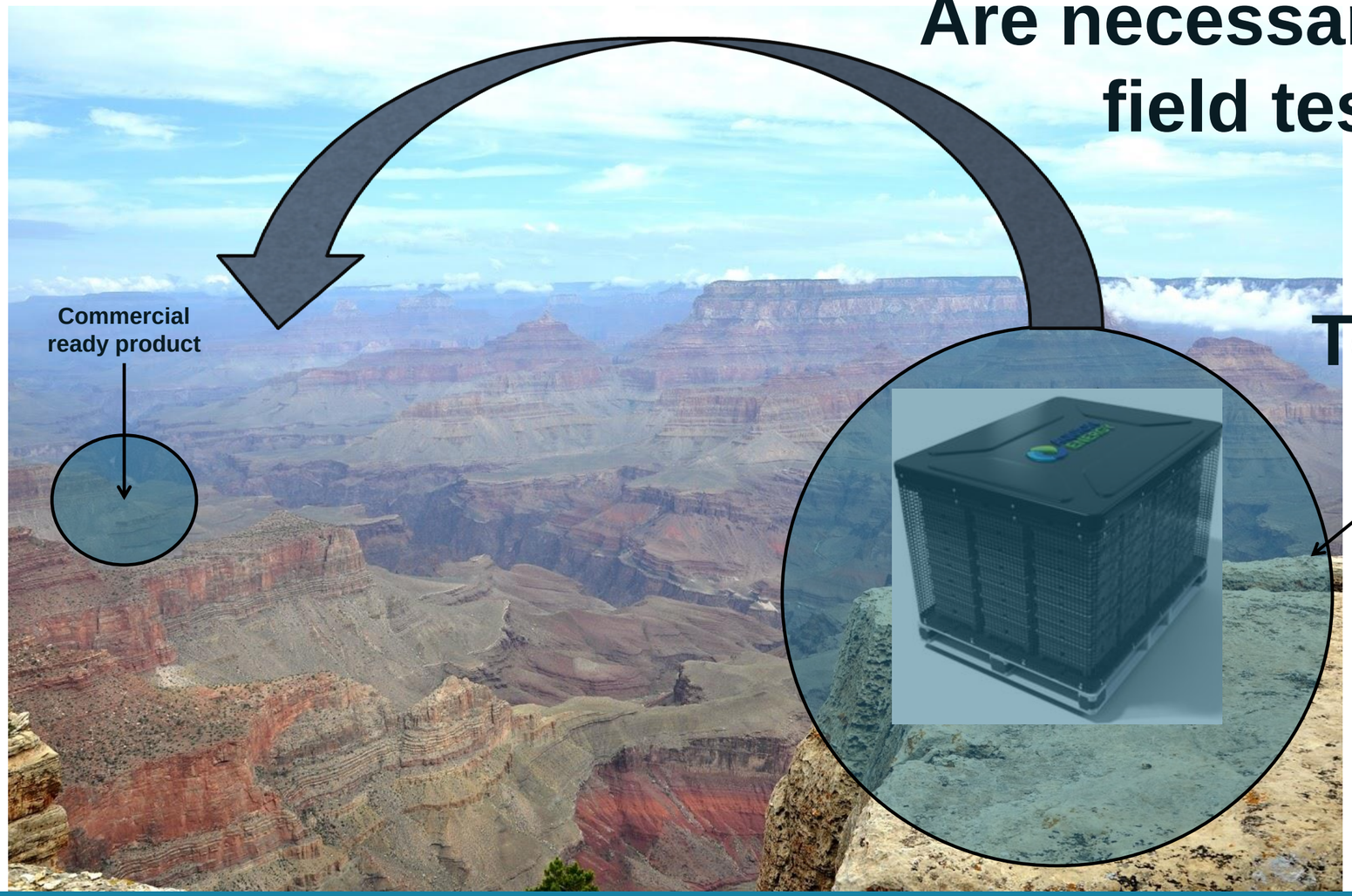
Liquid metal battery (MIT)



But from laboratory to commercial ready product….. Is like…

Battery Challenges

1. High Energy and Power densities



Battery Challenges

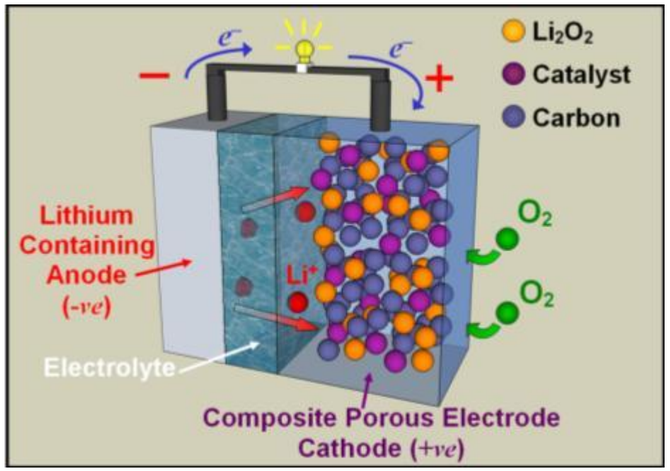
2. Safety

Dynamite = 4 Mj/kg = 1100 Wh / kg

TNT = 5 Mj/kg = 1390 Wh / kg

Metal-air batteries = 3000 – 6000 Wh /kg

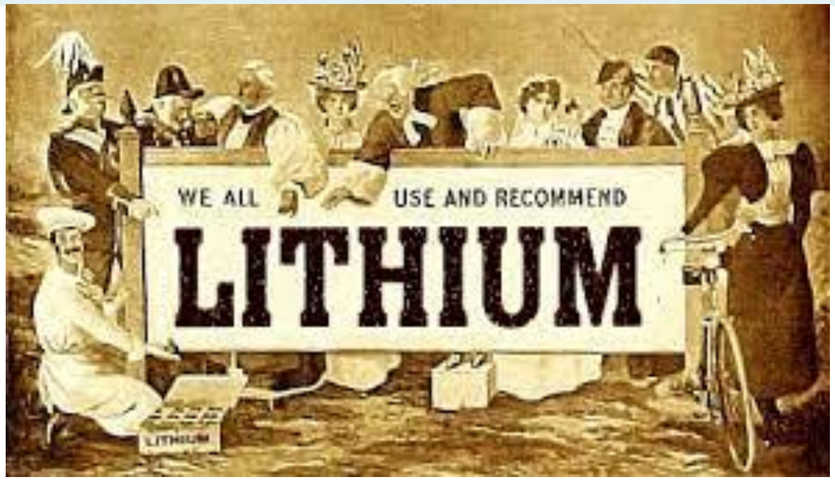
Stair (St. Andrews air) Technology



Battery Challenges

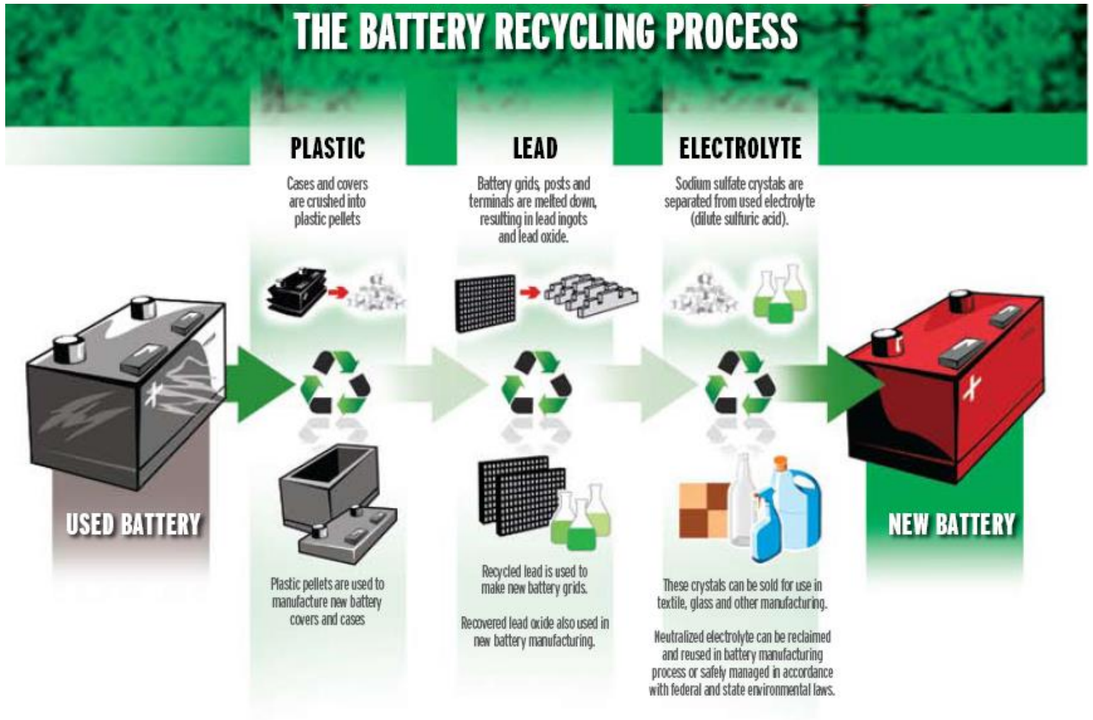
3. Environment concerns

New battery technologies must use environmentally friendly materials



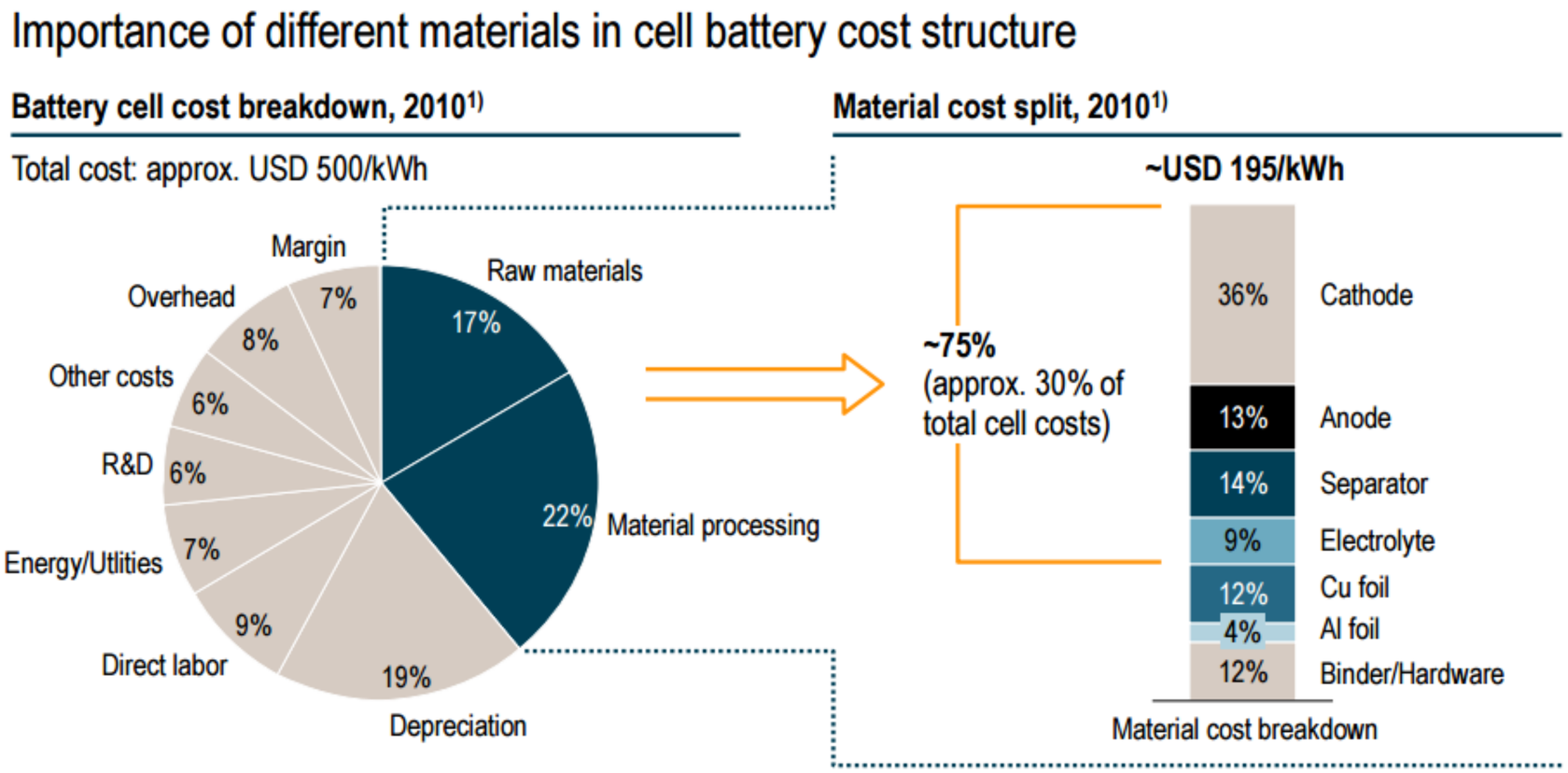
Battery Challenges

4. Recyclability



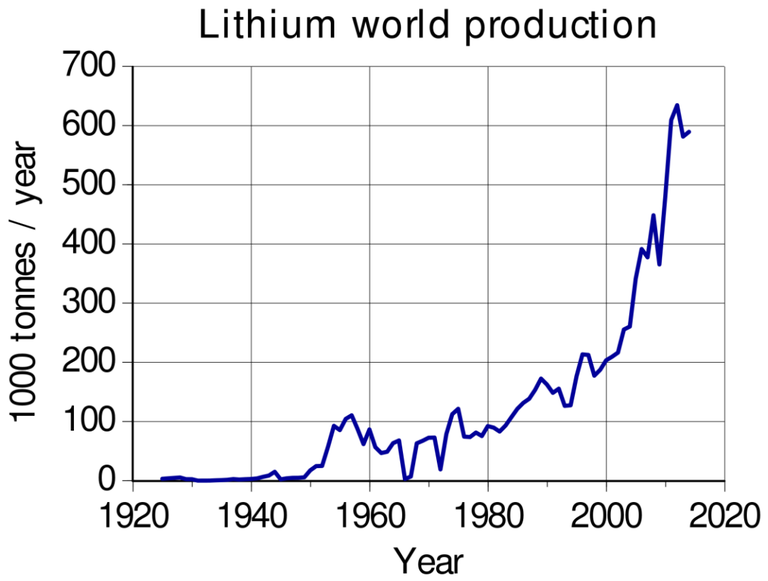
Battery Challenges

5. Cost issues



Battery Challenges

6. Materials availability



Battery New Technologies

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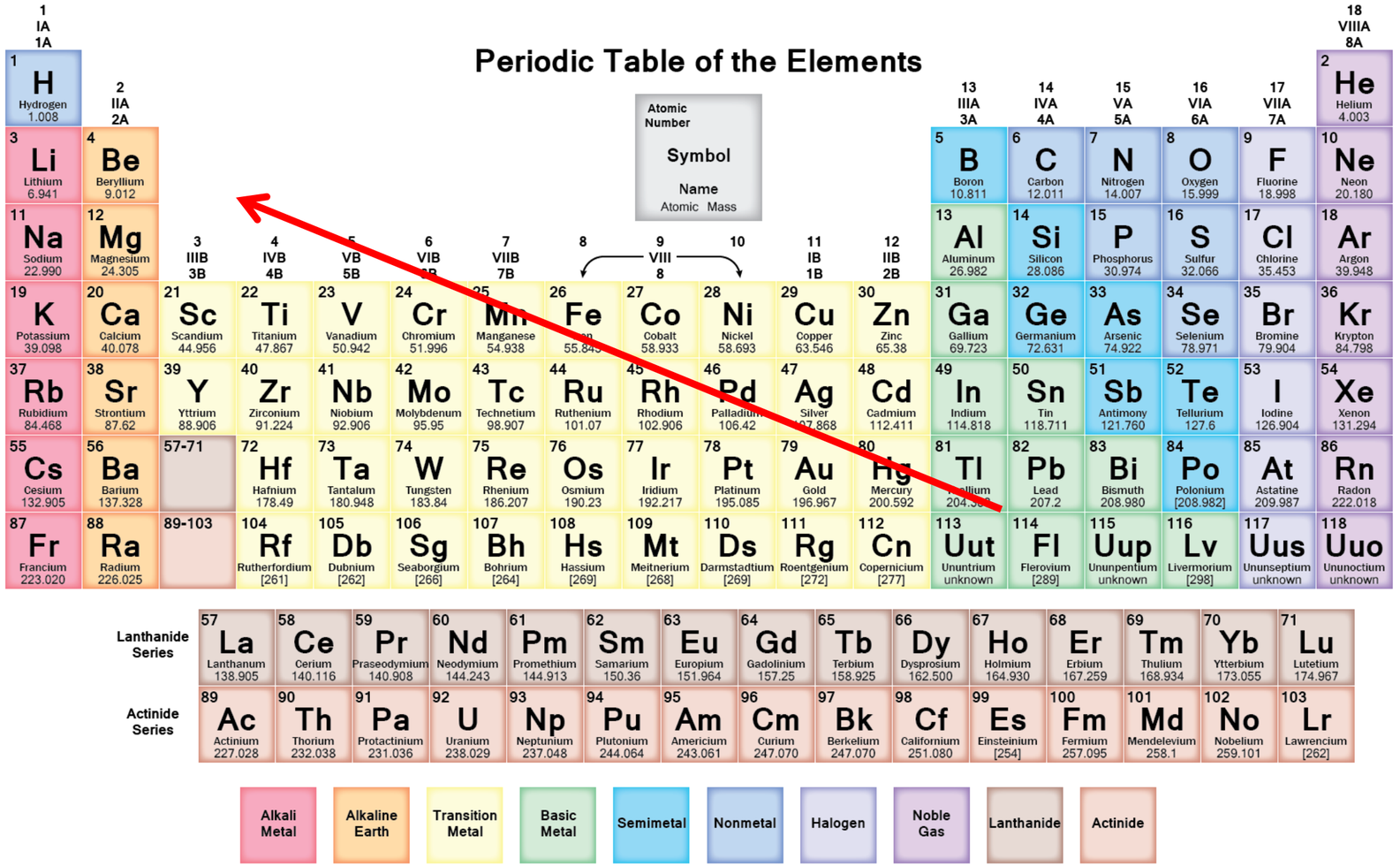
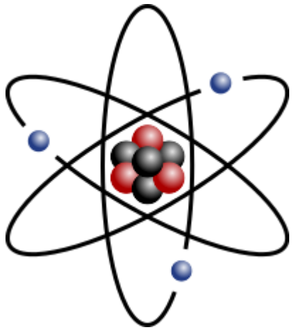
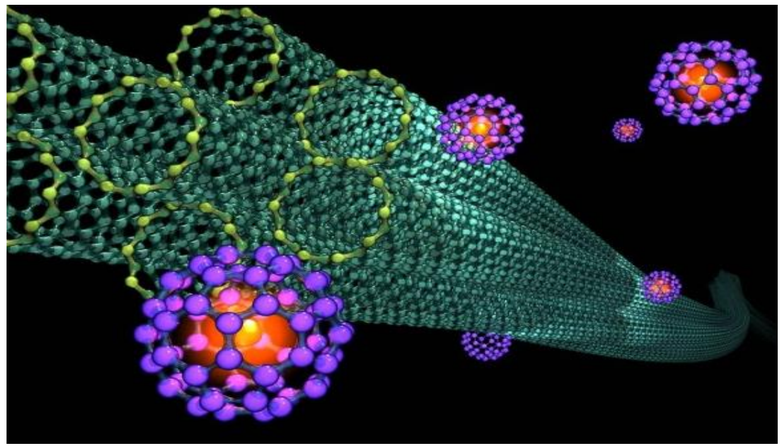


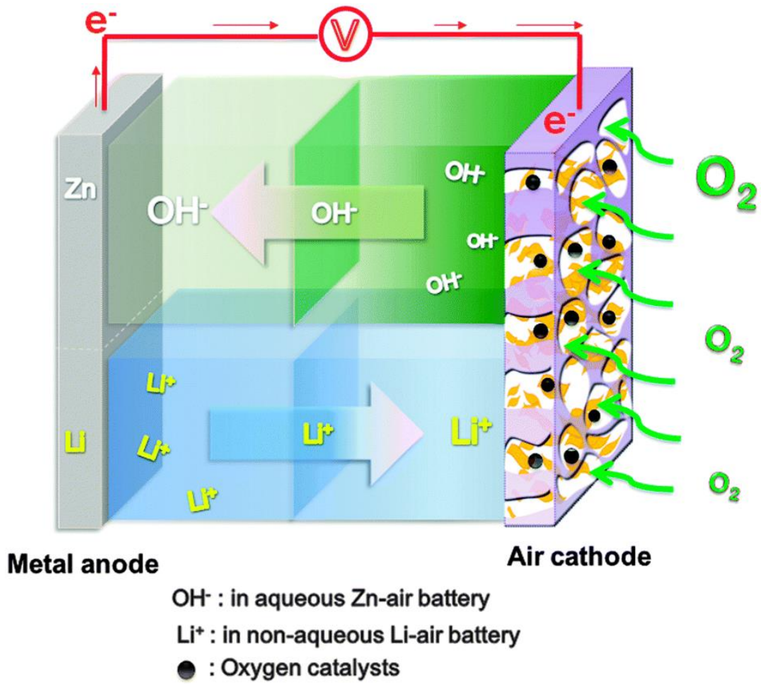


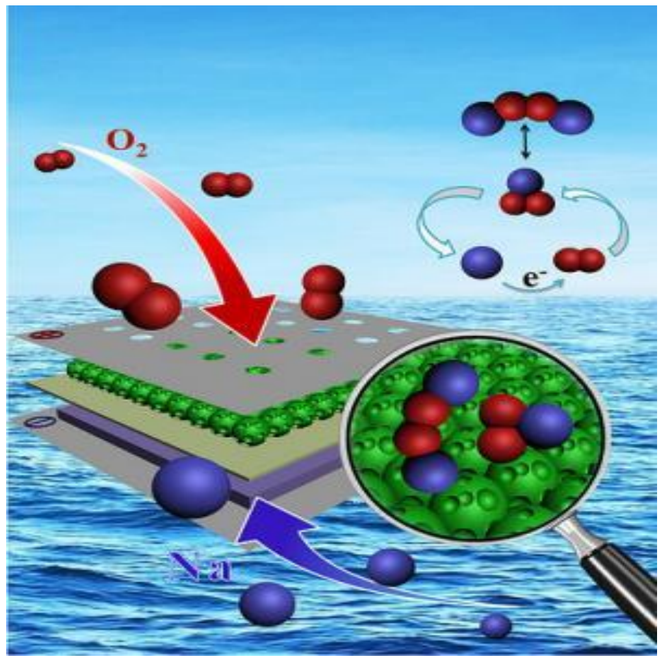
No new elements…more technology!



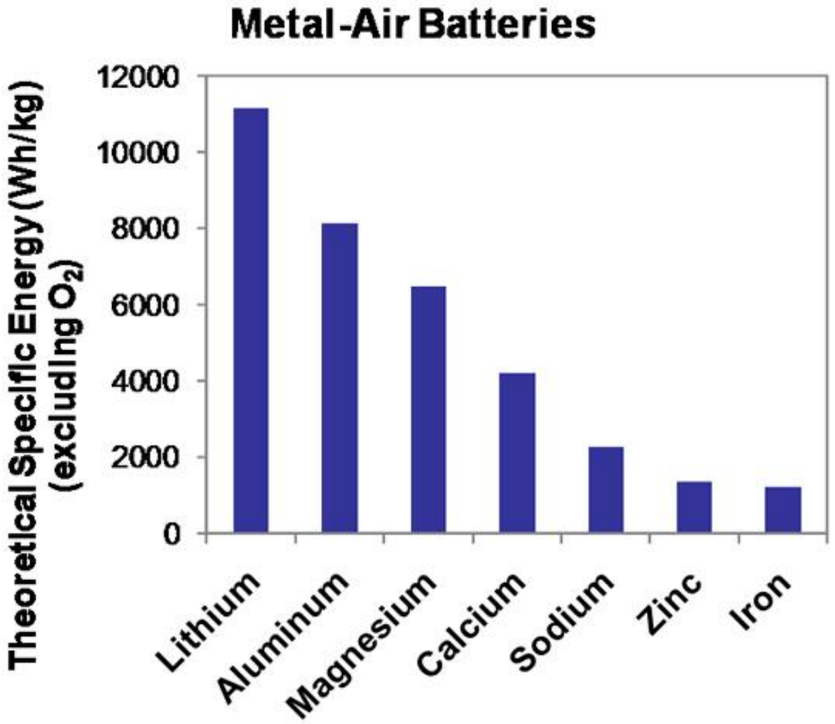
Battery New Technologies

Metal air batteries:
Anode – metal oxidation
Cathode – oxygen reduction





Na-Ar

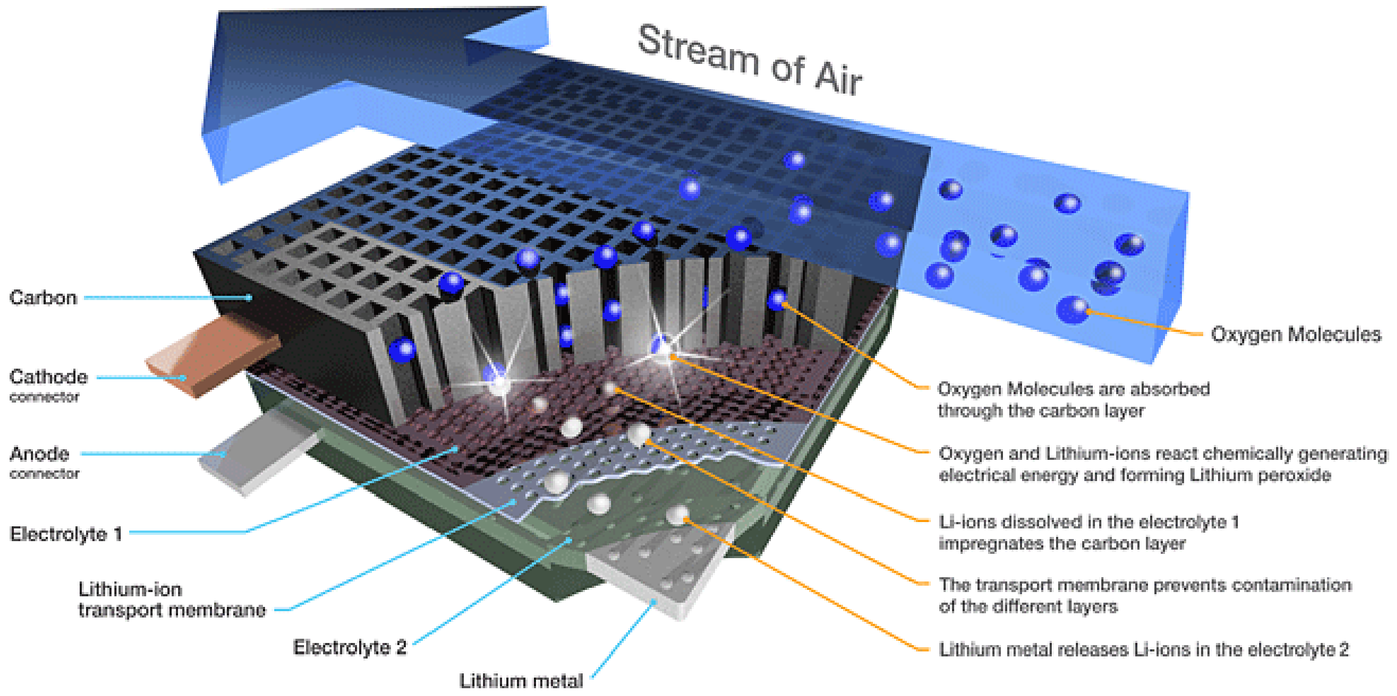


Battery New Technologies

Metal-air batteries

Battery 500

The Battery 500 technology is an open system using common air as a reagent which upon recharge releases oxygen back into the environment.



Battery New Technologies

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Super caps

Ultra batteries

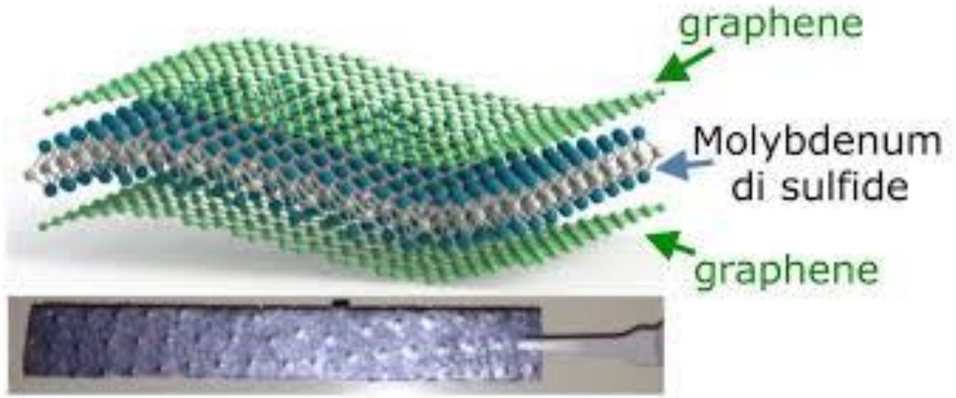
Other technologies…

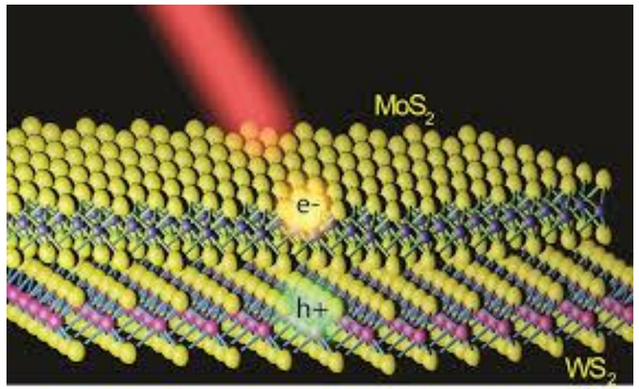
Fuel Cells

Flow batteries

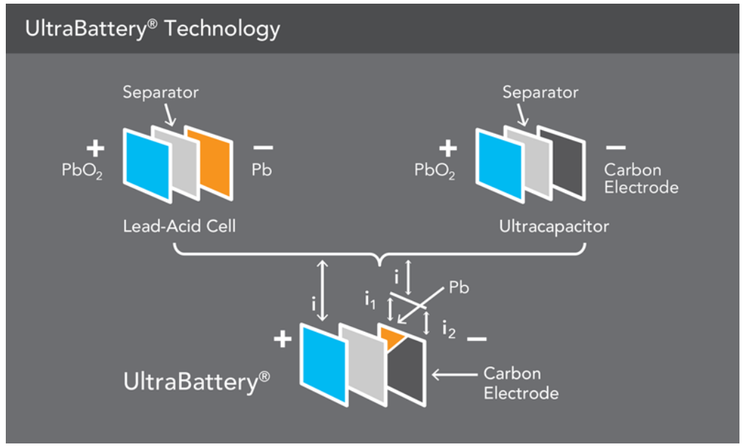
Battery New Technologies

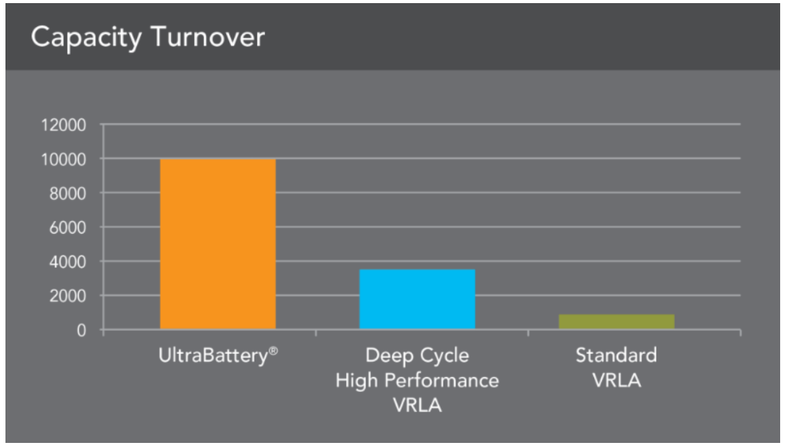
Supercapacitors





Ultra batteries





Battery New Technologies

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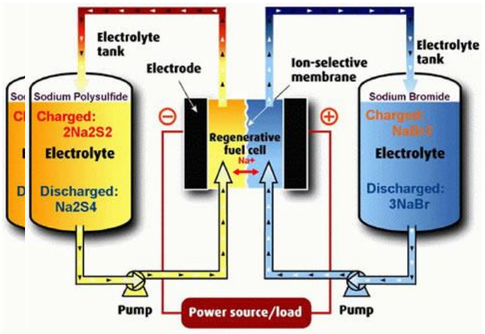
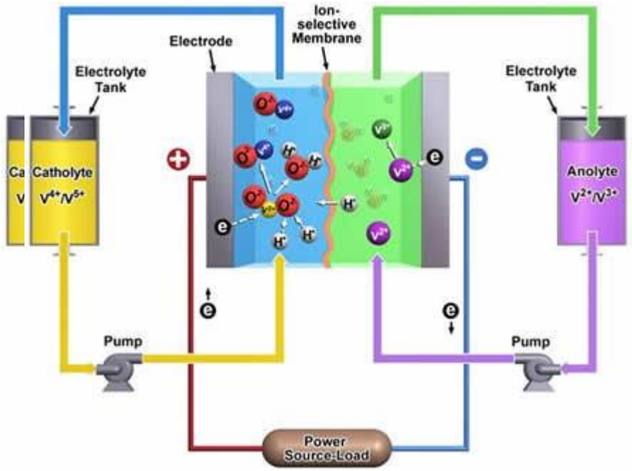
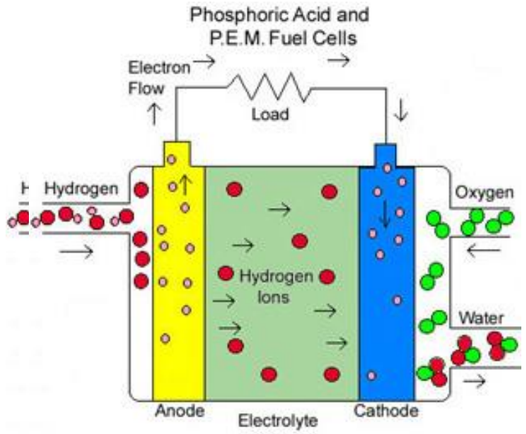
Flow Batteries





Fuel Cells



Conclusions

< 10 years

10-30 years

>30 years

Present technologies

Lithium ion
Supercapacitors

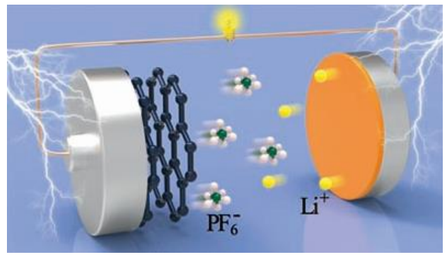
New technologies

Nanotechnology

Metal-air
Flow batteries
Ultra batteries

Hydrogen

Fuel Cells
Other technologies
$H_2 - O_2$



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THANK YOU