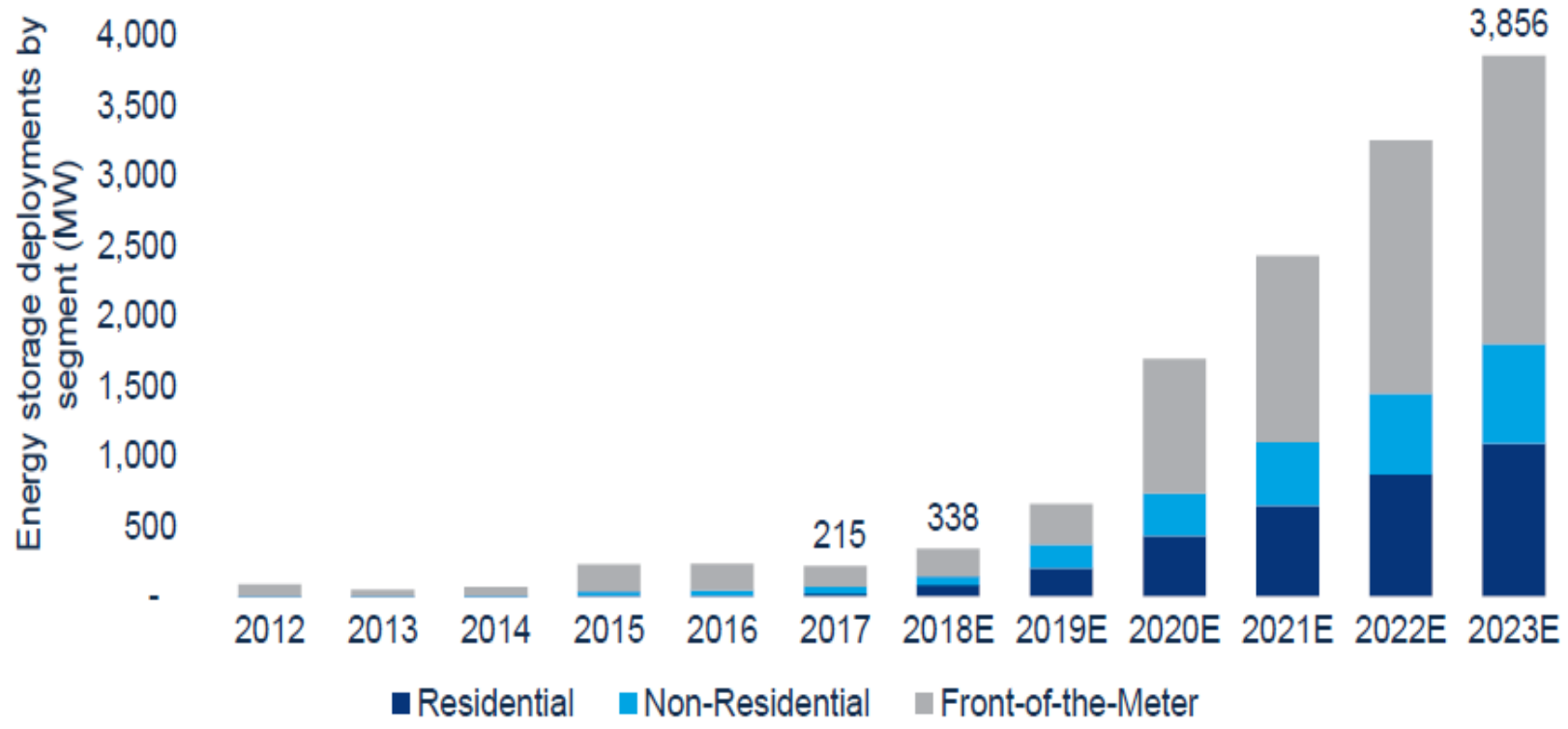
Gridscale Energy Storage: Is there a better Technology?

IMRE GYUK, DIRECTOR,
ENERGY STORAGE RESEARCH, DOE-OE

U.S. energy storage annual deployments will reach 3.9 GW by 2023

Utility procurements, changing tariffs and grid service opportunities all drive the market forward

U.S. energy storage annual deployment forecast, 2012-2023E (MW)

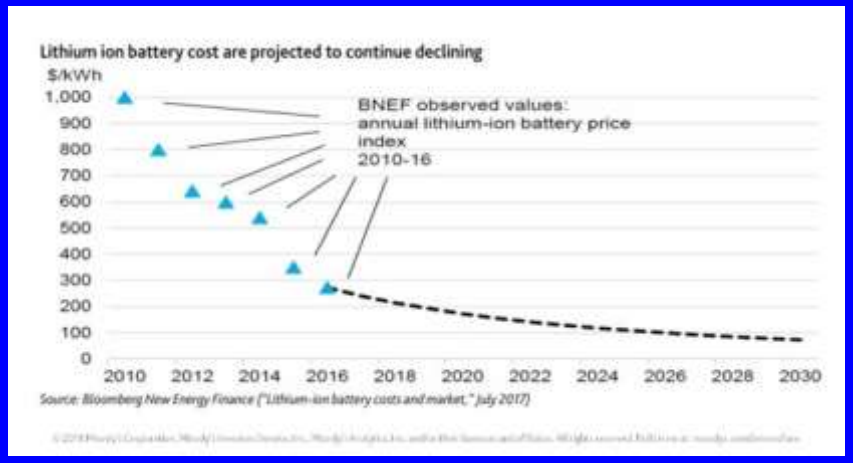


Source: Wood Mackenzie Power & Renewables

Li-ion Batteries?

Low cost, market ready
Tie-in with EV development

Cycle life <<20years
Safety Concerns.
No Recycling!
No U.S. Manufacture



Obstacles and Impediments to Sustainability:

Safety, Reliability,

Ecological and Sociological Issues,

Re-Use, Recycling, Disposal

27 MW in 2017!

Co Mining in Africa!

A Stream of Trash!

Safety is Essential!!

Statistics needed:

- Casualties?
- Damage to Property?

How much would Liability Insurance be?
Or is it a no-go?

Can the Technology be improved? E.g. seatbelts
Should the Technology be replaced? E.g. H_2 airships

Safety should not be a Patch but part of Design!

Reliability is also Essential!!

Energy Storage is introduced to make the Grid more reliable!

Predictable Capacity Fade → reduced Cycle Life
Catastrophic Failure → costly Outage
Inherent or Fixable?

Maintenance Cost or LCOE? Valuation?
Do we go for Cheap Replacement or Durability?

Reliability should be part of the Design!

Ecological and Sociological Issues.

Cheap for whom?
Who will pay?
Who will benefit?

What is the Total Carbon Footprint?
Are you ripping off your children? (Global Warming)
Are you ripping off less developed countries?

Is the Technology Sustainable?

Re-Use, Recycling, Disposal

EV Batteries retain ~80% Capacity

- Reuse for Stationary Application?
- or the Trash-heap?

But:

Ownership? Collection? Transport? Warranty?

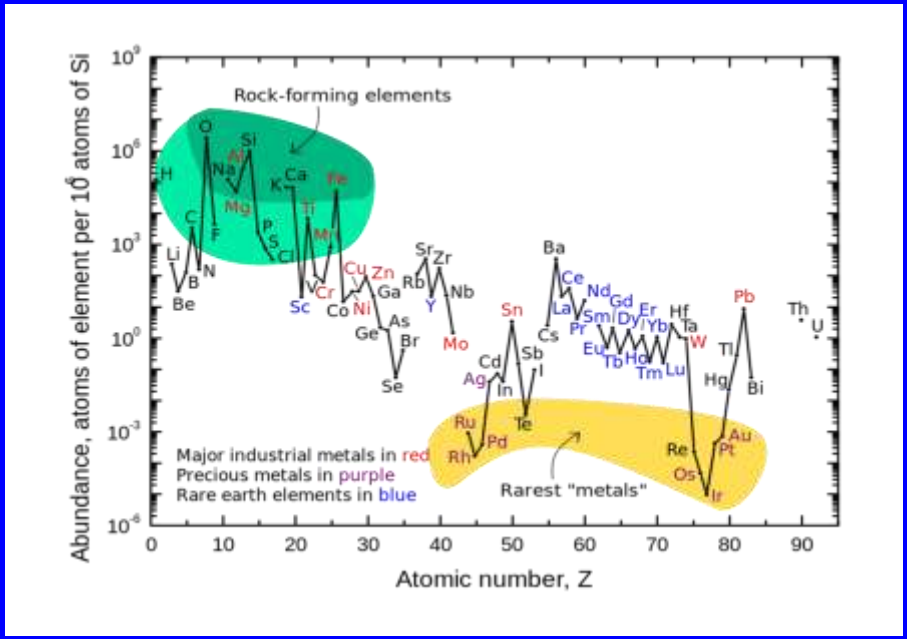
Recycling – is it commercially feasible

Or does Entropy win again?

The Midden is not an Answer!

We must design for the Waste Stream!!

To develop Safe, Inexpensive,
and Environmentaly Benign Batteries
We must look towards Earth-Abundant Materials

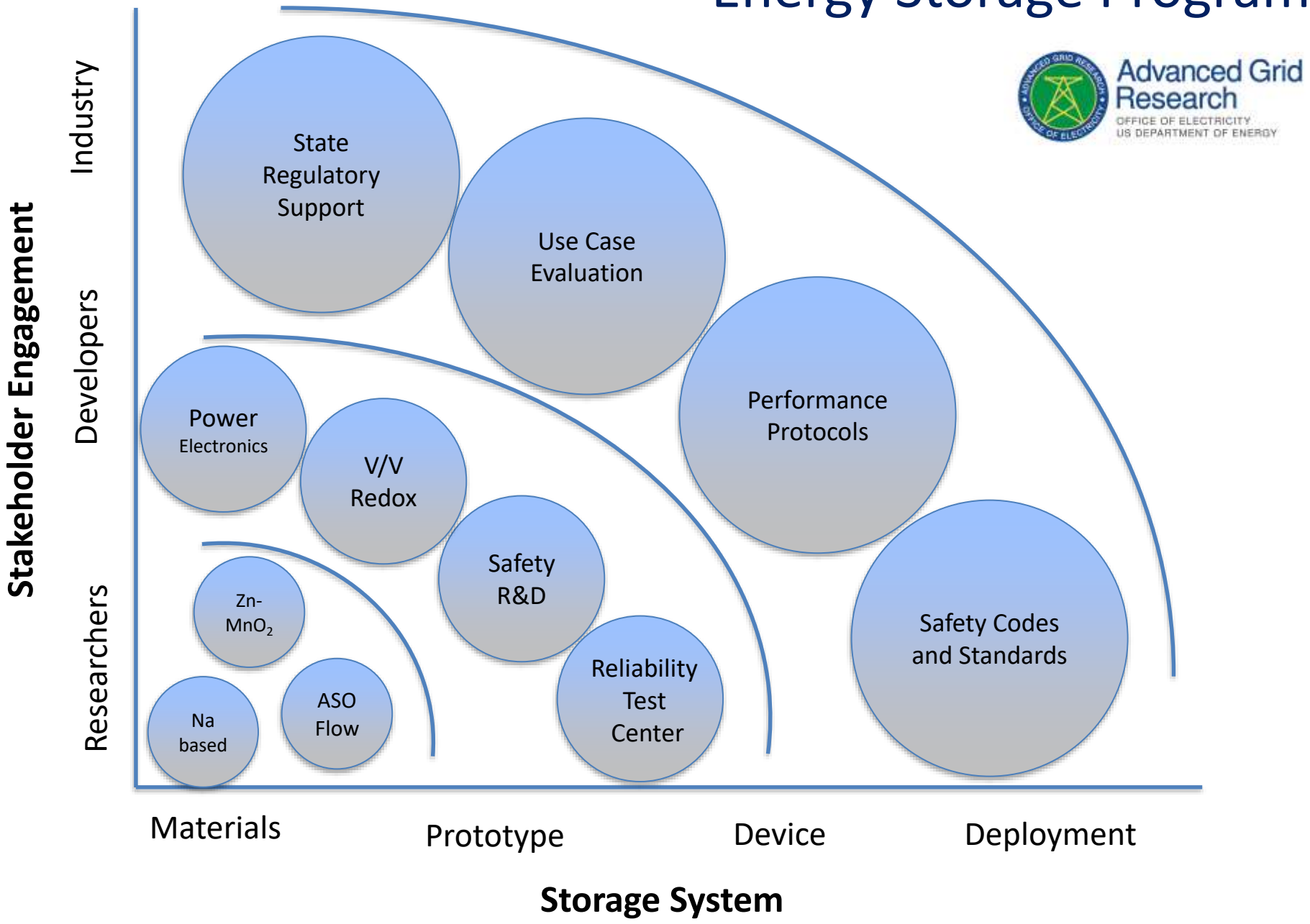


Cost Goals for Focus Technologies

Manufactured at scale

Li-ion Batteries (cells)	$250/kWh
V/V Flow Batteries (stack+PE)	$300/kWh
Zinc Manganese Oxide (Zn-MnO_2) 2 Electron System	$ 50/kWh
Low Temperature Na-NaI based Batteries	$ 60/kWh
Aqueous Soluble Organic (ASO) Redox Flow Batteries (stack+PE)	$125/kWh
Advanced Lead Acid	$ 35/kWh

Energy Storage Program



New Technology Solutions will cut Costs, increase Safety and Reliability.

Re-Use, Recycling, Disposal Issues will be Resolved.

But, can new Technologies Prevail in the Marketplace??