Zinc Technologies for Grid Scale Energy Storage

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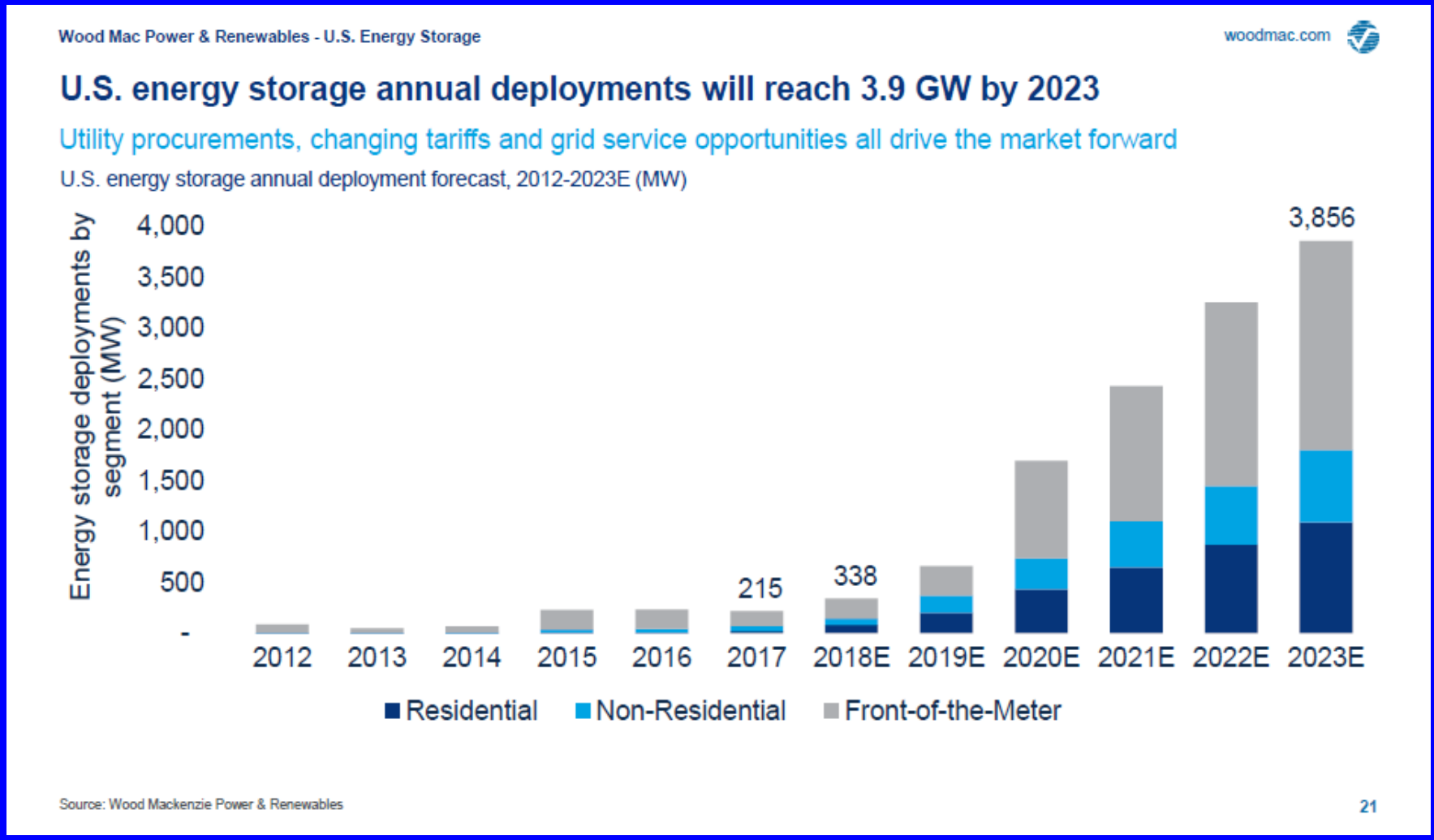
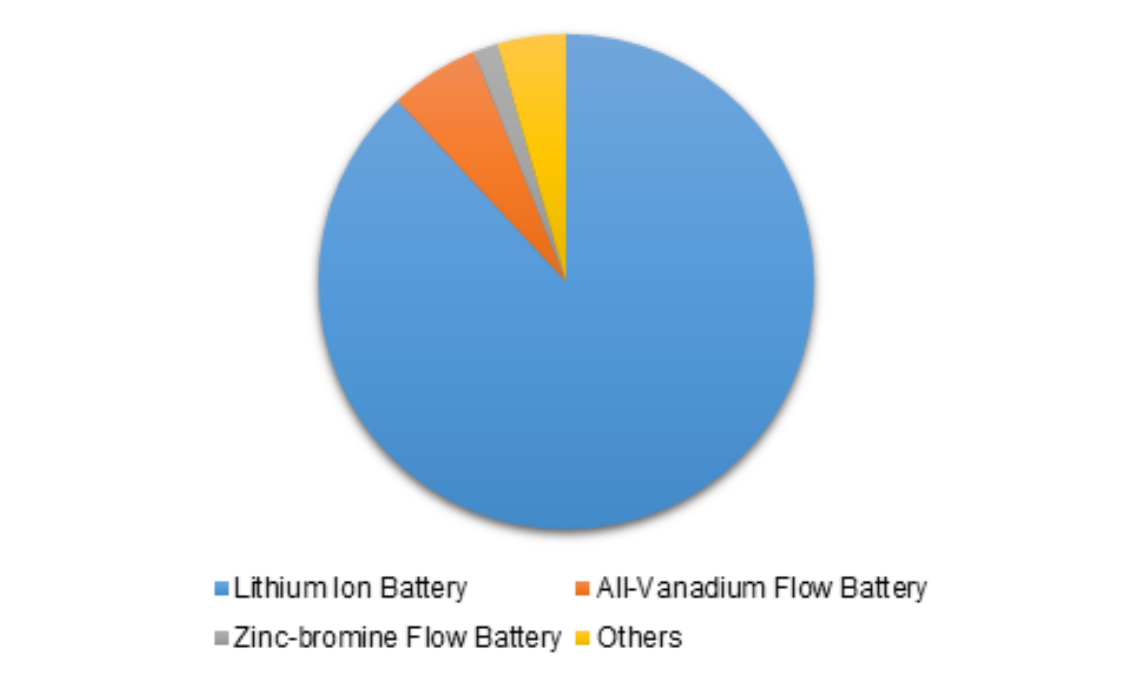
Energy Storage has become a Resounding Success!



And yet!



Lithium Technologies dominate the Market

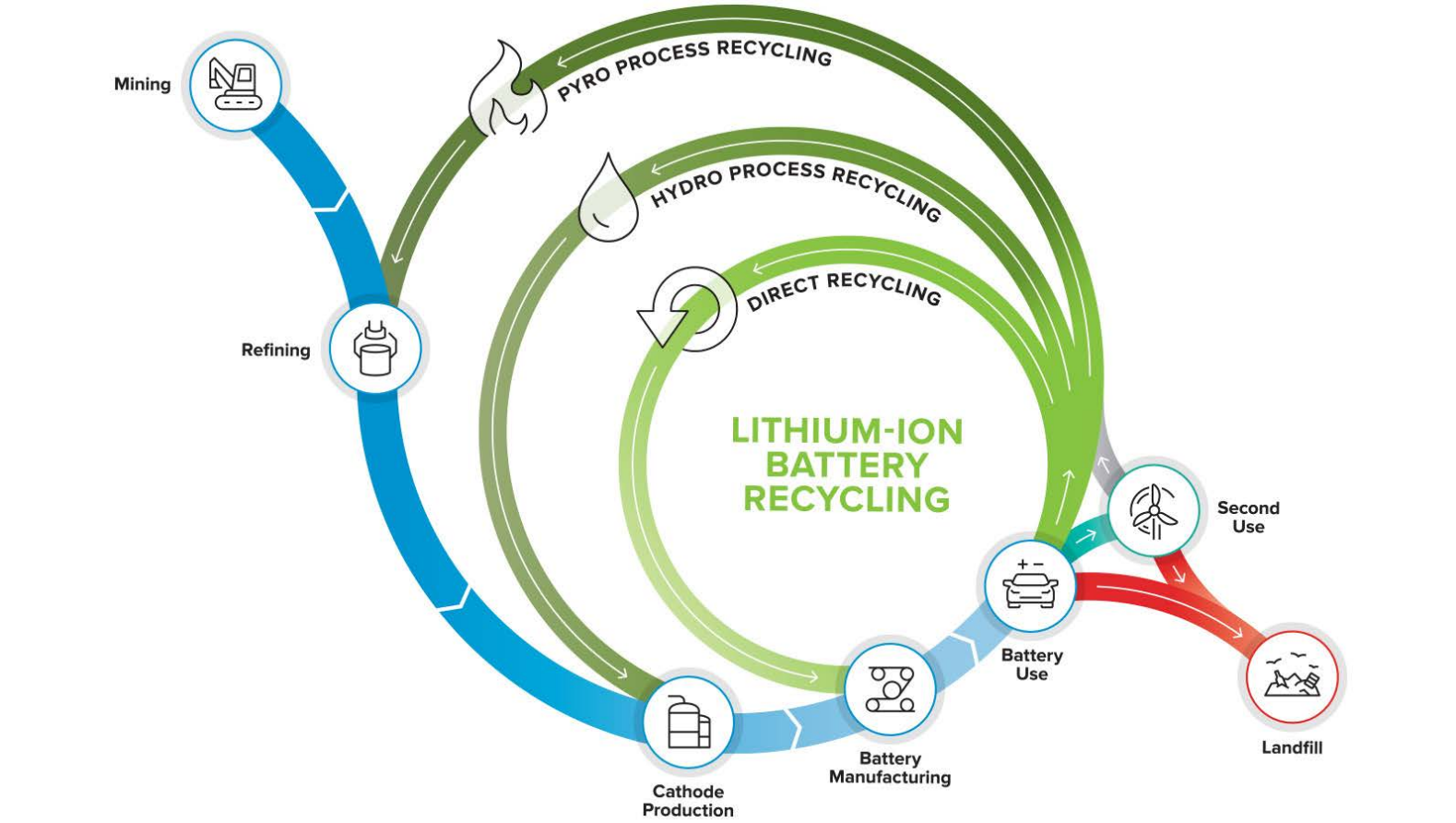
Incumbent Lithium Ion Technology:

Ecological and Sociological Issues

Safety, Reliability,

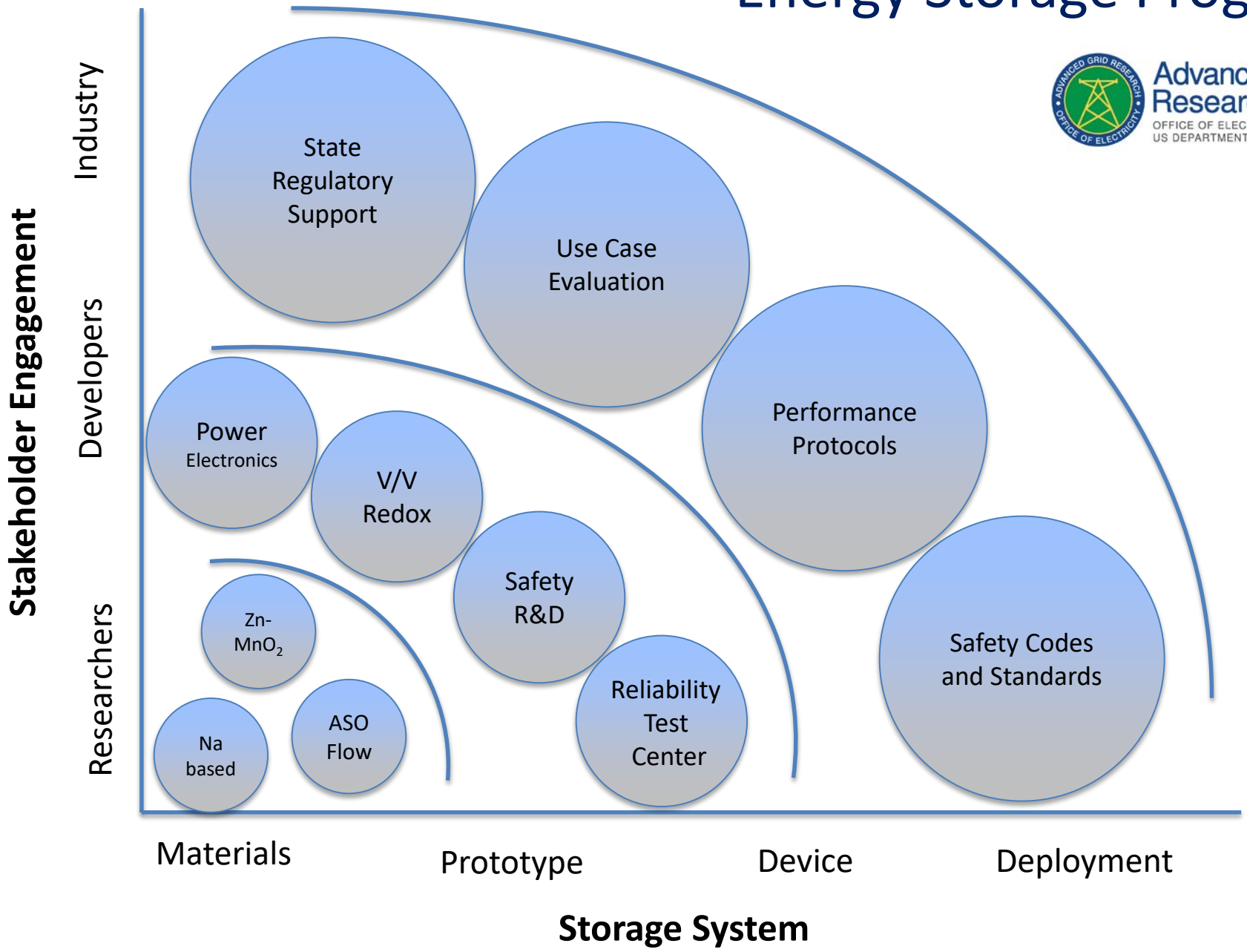
Re-Use, Recycling, Disposal

Recycling Lithium Batteries?



Argonne

Energy Storage Program



EPA - American Chemical Society Green Chemistry Award

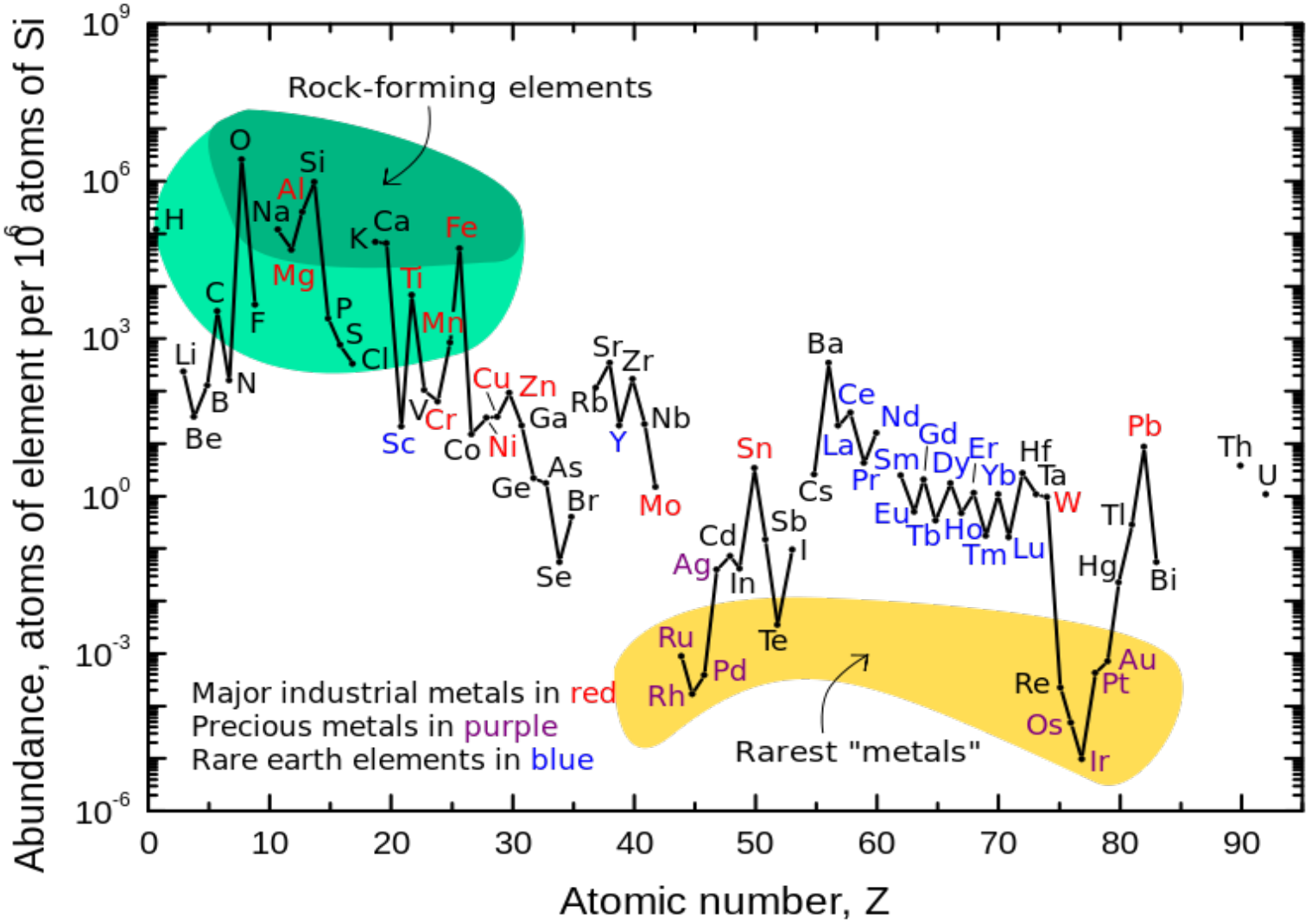
2017 – V/V Redox

2019 – Zn-MnO_2

Zinc Batteries have:

Low Material Cost
Easily Recycled
No Strategic Vulnerability
Fire Safe, Low Toxicity

Show Considerable Promise and are well worth Research Investment!



We want low Cost !

Iron	$ 529
Zinc	$ 2,636
Aluminium	$ 2,104
Lead	$ 2,284
Copper	$ 6,320
Nickel	$14,115
Tin	$19,770
Vanadium	$29,000

Country	Tons
China	5,000,000
Australia	1,500,000
Peru	1,300,000
India	820,000
United States	700,000
Mexico	700,000

Zinc Batteries:

Zinc Manganese Oxide
Zinc Bromine
Zinc Air
Nickel Zinc
Zinc Silver

Cost Goals for Focus Technologies

Manufactured at scale

Li-ion Batteries (cells only)	$100/kWh
V/V Flow Batteries (stack+PE)	$300/kWh
Zinc Manganese Oxide (Zn-MnO_2) 2 Electron System	$ 50/kWh
Low Temperature Na / Na-ion based Batteries	$ 60/kWh
Aqueous Soluble Organic (ASO) Redox Flow Batteries (stack+PE)	$125/kWh
Advanced Lead Acid	$ 35/kWh

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