QUALLION




Battery/Device Integration and Technologies that Address Patient Challenges

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Powering Life.

CAUTION

"The storage battery is, in my opinion, … a sensation, a mechanism for swindling the public by stock companies.

The storage battery is one of those peculiar things which appeals to the imagination, and no more perfect thing could be desired by stock swindlers than that very selfsame thing.

*... **Just as soon as a man gets working on the secondary battery it brings out his latent capacity for lying.***

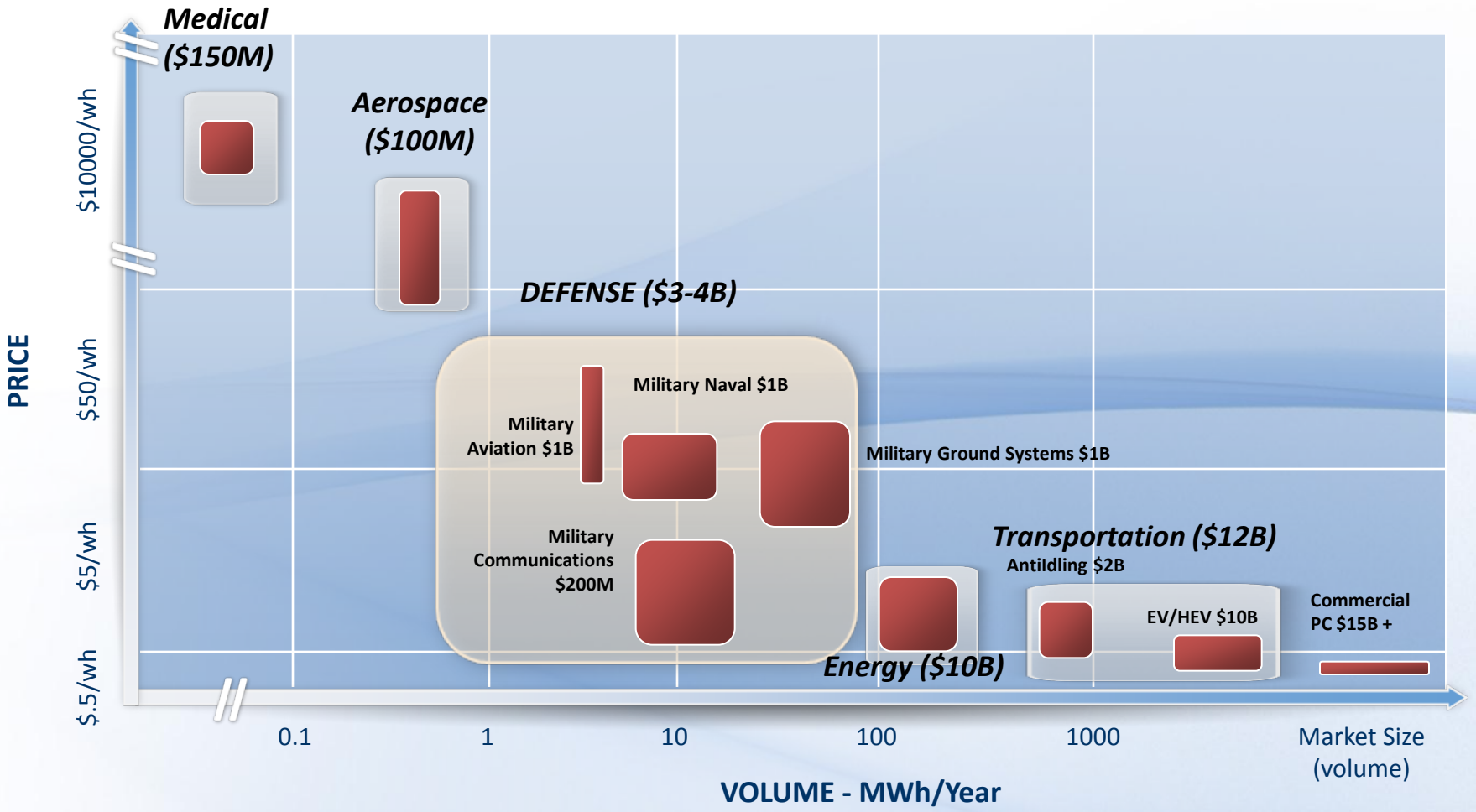
... Scientifically, storage is all right, but, commercially, as absolute a failure as one can imagine."

- Thomas Edison, February 1883

Company Information

- One of the **largest manufacturers** of lithium ion cells in the United States, based entirely in Southern California
- **Vertically integrated** manufacturer of materials, cells and batteries
- Unmatched **intellectual property** portfolio for increased battery safety, reliability and performance
- Strategic focus on **specialty applications** in medical, military, aerospace and markets
- Privately held. About 170 employees. Facilities in Sylmar, CA and Santa Clarita, CA

Overview of Battery Industry
Cost/Volume Ratio (Rechargeable Batteries)



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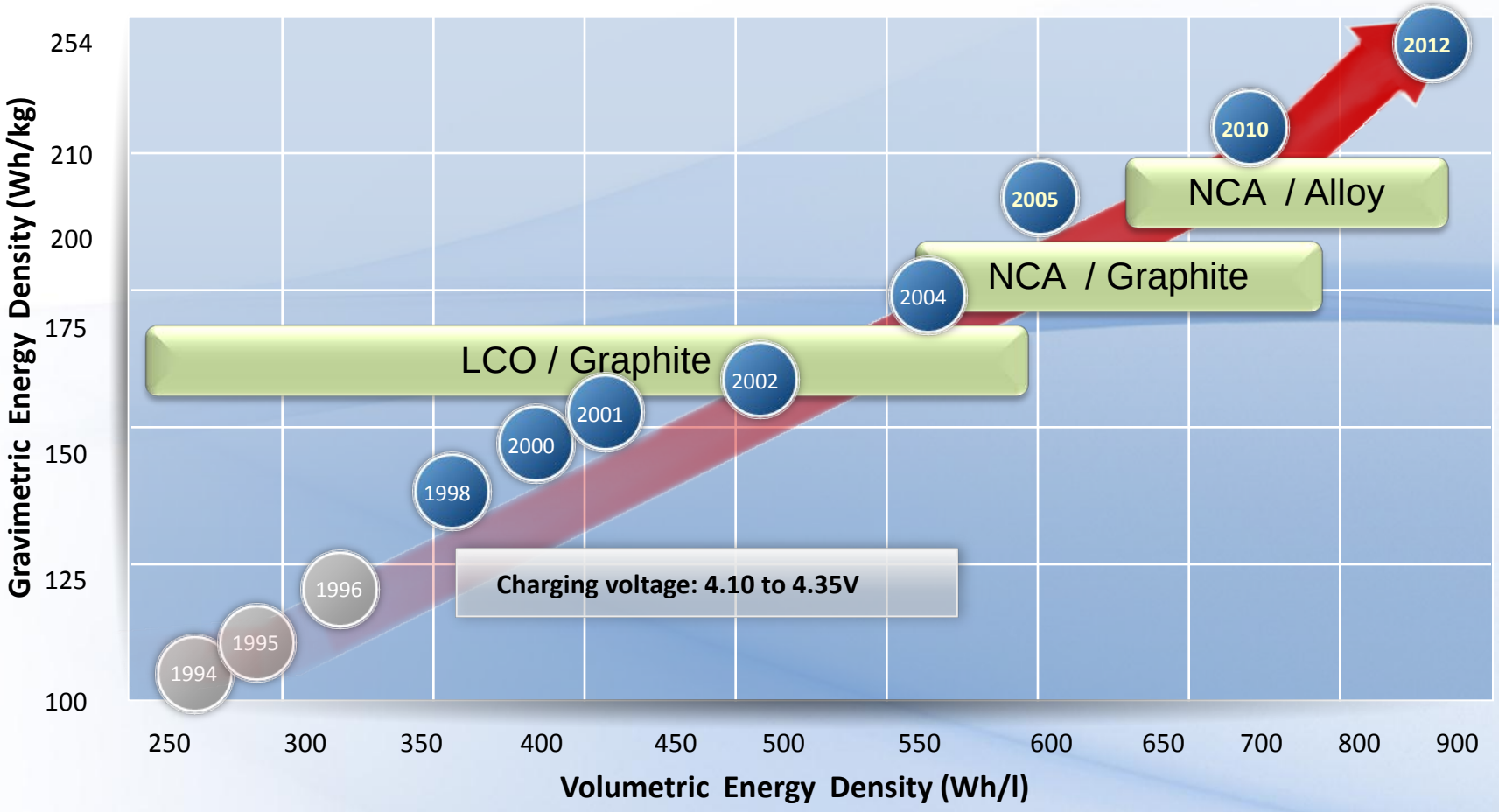
Li-ion Cells Show ~6-8% Increase in Specific Energy (Wh/kg) per Year

Lithium-ion density for 18650 Cells historically increases 6-8% per year



Implantable Cell Manufacturing

- Quallion has manufactured and delivered over 100,000 implantable Li Ion cells without a single safety incident and very consistent reliability.

- Full traceability by cell serial #
  - Materials by supplier lot through finished cell
  - Cell > Lot > Date > Operator > Operation > Materials
  - 100% testing of cells prior to shipment
  - Long term testing of retained samples from each lot

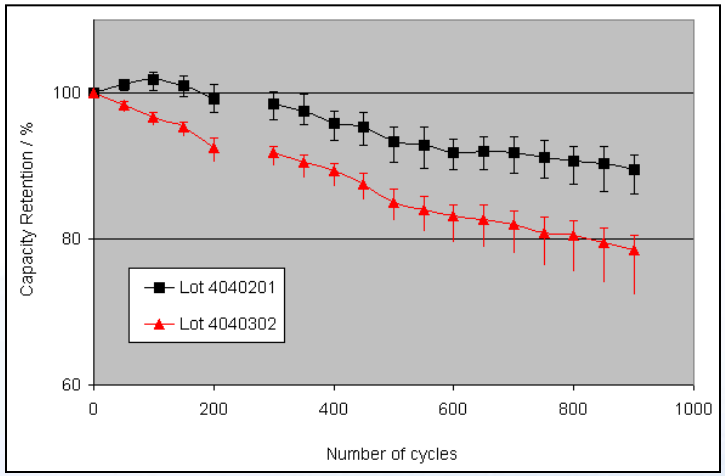
- In house production of key materials
  - Electrolyte
  - Cathode (LCO, NCA)
  - Anode (MCMB)

- Sampling multiple lots of key materials before procurement

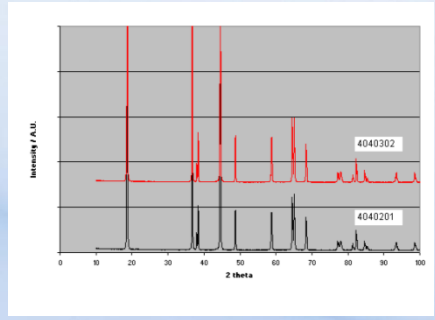
Is it worth it? ...Depends on application and requirements.

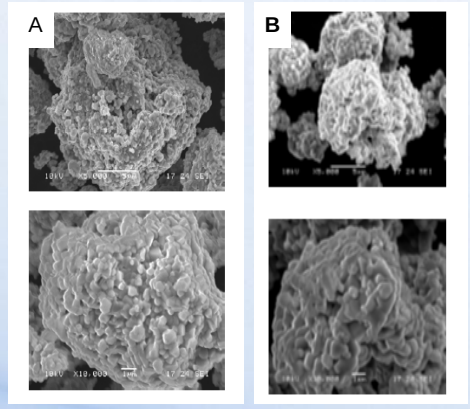
Supply Chain Quality Risks are Real

- 90% of world cell production is for consumer products, not for high reliability/high risk applications
- Broader industry goals may not align with needs of niche segments
- Variations in production lots of materials can be very difficult to ID
- Root cause can be in production process, a “trade secret”



10% difference in capacity between two seemingly identical lots





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Addressing Patient Challenges via Technology

"I need SURGERY to replace a dead battery?!"

Battery life is often the determining factor for device life

- ***Long life cell chemistry can extend battery life***

"I went on vacation, so I couldn't recharge my battery…"

Non-compliance can lead to dead "bricked" battery and require replacement

- ***Overdischarge tolerance via Zero-Volt technology can prevent permanent battery damage***

"My car tells me how much gas is in the tank, why can't my battery tell me how much juice is left?"

Imprecise/inaccurate measures of SOC and SOH are frustrating and wasteful

- ***Reference electrode and advanced modeling techniques can improve fidelity of estimates***

Device Maker Challenges

"Is this inexpensive foreign battery REALLY certified ?"

How to control against counterfeit product or fake certifications?

"I wish there was a standard battery!"

Can improved standardization reduce the costs of high quality batteries?

"Why do I have to buy 100 cells to get 50 good ones?"

Is it more cost effective to screen commercial cells or enforce tighter manufacturing controls to improve quality?

Lifecycle Assessment of Battery Cost

Improved batteries cost more upfront, but they may save money in the mid-term and long-term.

Indirect costs to consider:

- Surgery to replace battery, indirect risks of surgery (implantable)
- Costs of replacement batteries
- Staff time lost when battery dies unexpectedly
- Maintaining inventory of spares, recharging equipment, accessories
- Patient inconvenience

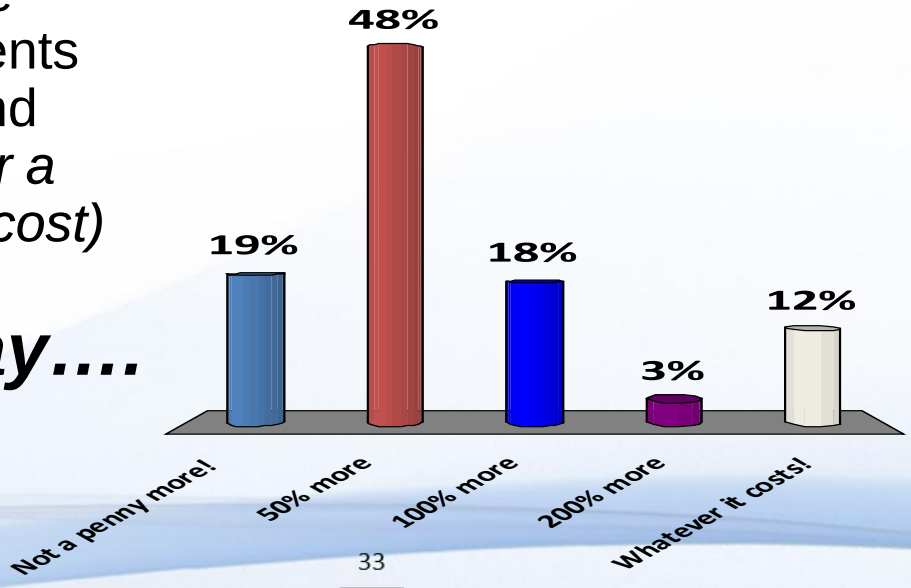
Who pays? Who benefits? How to bridge the gap?

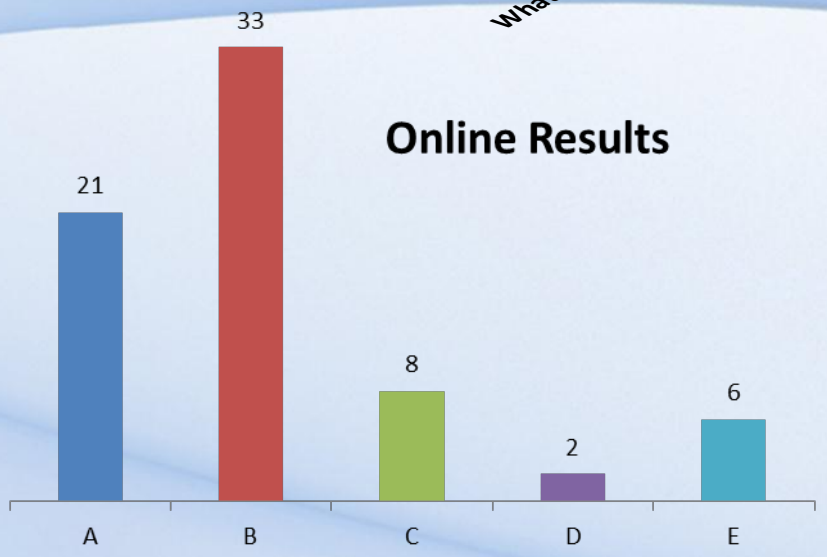
Question for the Audience

If better batteries are available, are device makers and ultimately patients willing to pay for the technology and reliability improvements? *(consider a battery costs 1-3% of total device cost)*

I would be willing to pay….

A. *Not a penny more!*
B. *50% more*
C. *100% more*
D. *200% more*
E. *Whatever it costs!*





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