Charging Forward:

Explosive Global Growth in the Battery Industry – Opportunities and Challenges Ahead

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Significant technology and system development for the next 10 years in multiple market segments world-wide

Mobility Revolution

- Technology Innovations

Change in the Economy

- Energy Security
- Oil Independence
- Government Support

Portable Power

- Lithium-ion cell demand growing to $16Bn by 2018
- Requirements: dependable run time, fast charge, safe

Transportation

- EV market for lithium-ion batteries expanding to $30Bn by 2020; $175B 2025
- Requirements: Extended range, safe, affordable

Utility

- Lithium-ion batteries will be one technology with a clear and possibly astronomical growth trajectory estimating $30B by 2020 to $400B by 2030
- Requirements: Compact & modular, reliable, safe, affordable

Military

- Lithium-ion battery demand driven by growing need for transport, surveillance & communications
- Requirements: lightweight, safe, long-life, rugged, green

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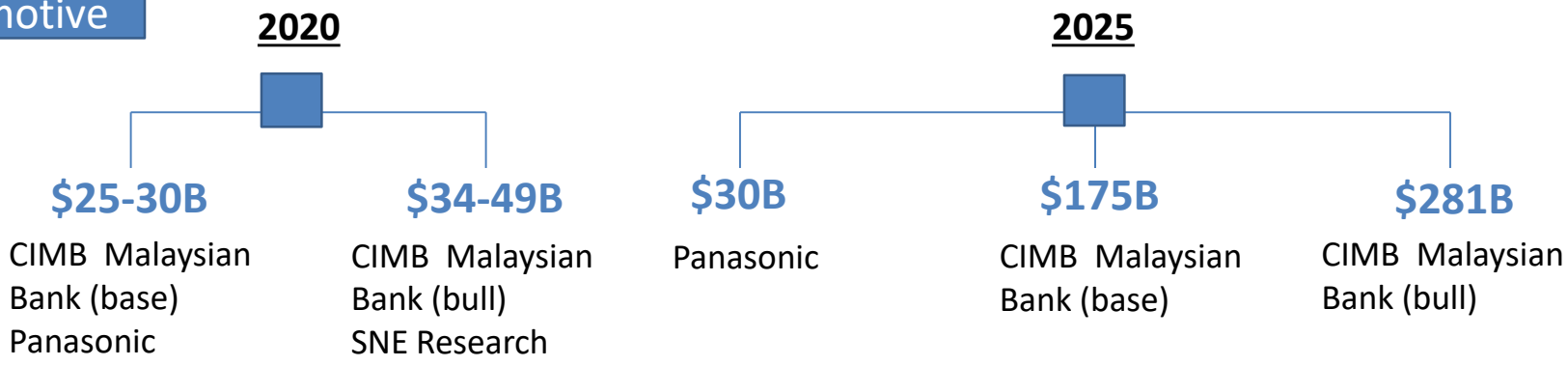
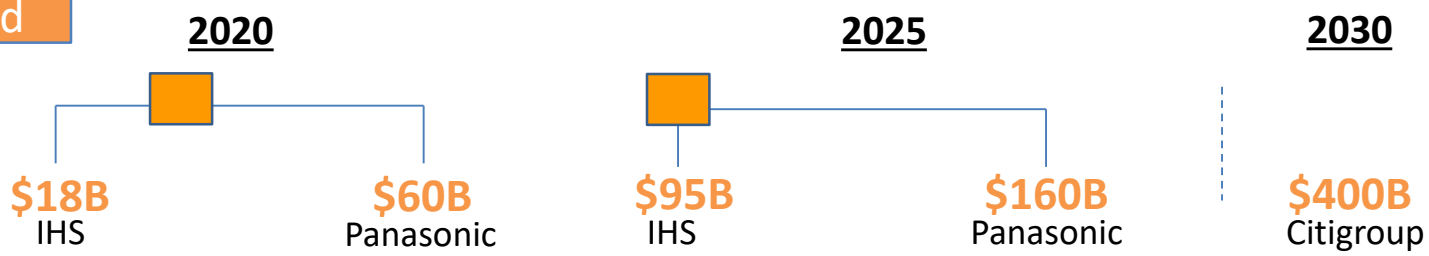
Market Forecasts – 3rd party

Marking Cadenza TAM assumptions (for auto and for grid)

Automotive



Utility Grid



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Sandia Study: *Expecting fail safe battery systems at high energy density and low cost to win in grid storage markets…..and that safety will enable the high performance/low cost paradigm*

2006 – US CPCS largest recall in history
4.1M Sanyo laptop batteries in Dell computers

Where are the lessons learned?

2015 – Recalling 500k Hoverboards

2016 – Samsung Galaxy S7… now with follow-on on Note7 … discontinued product lines

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The US national agenda involves energy security at the highest level, with innovation and time to market as levers

US energy policy and programs are diffuse through 50 states and federal government

DOE:

- To reduce U.S dependence on imported oil and increase national energy security
- To save money by cutting fuel costs for American families and businesses
- To protect US health and safety by mitigating the impact of energy production and use on climate change
- To spur innovation to build U.S. industry and jobs
- Battery Goals to be achieved by 2022:
  - $125/kWh
  - 400Wh/l energy density

DOD/Pentagon:

- Integrating plans for climate change risks across all of its operations, from war games and strategic military planning situations to a rethinking of the movement of supplies
- Predicting increased demand for military disaster responses as extreme weather creates more global humanitarian crises

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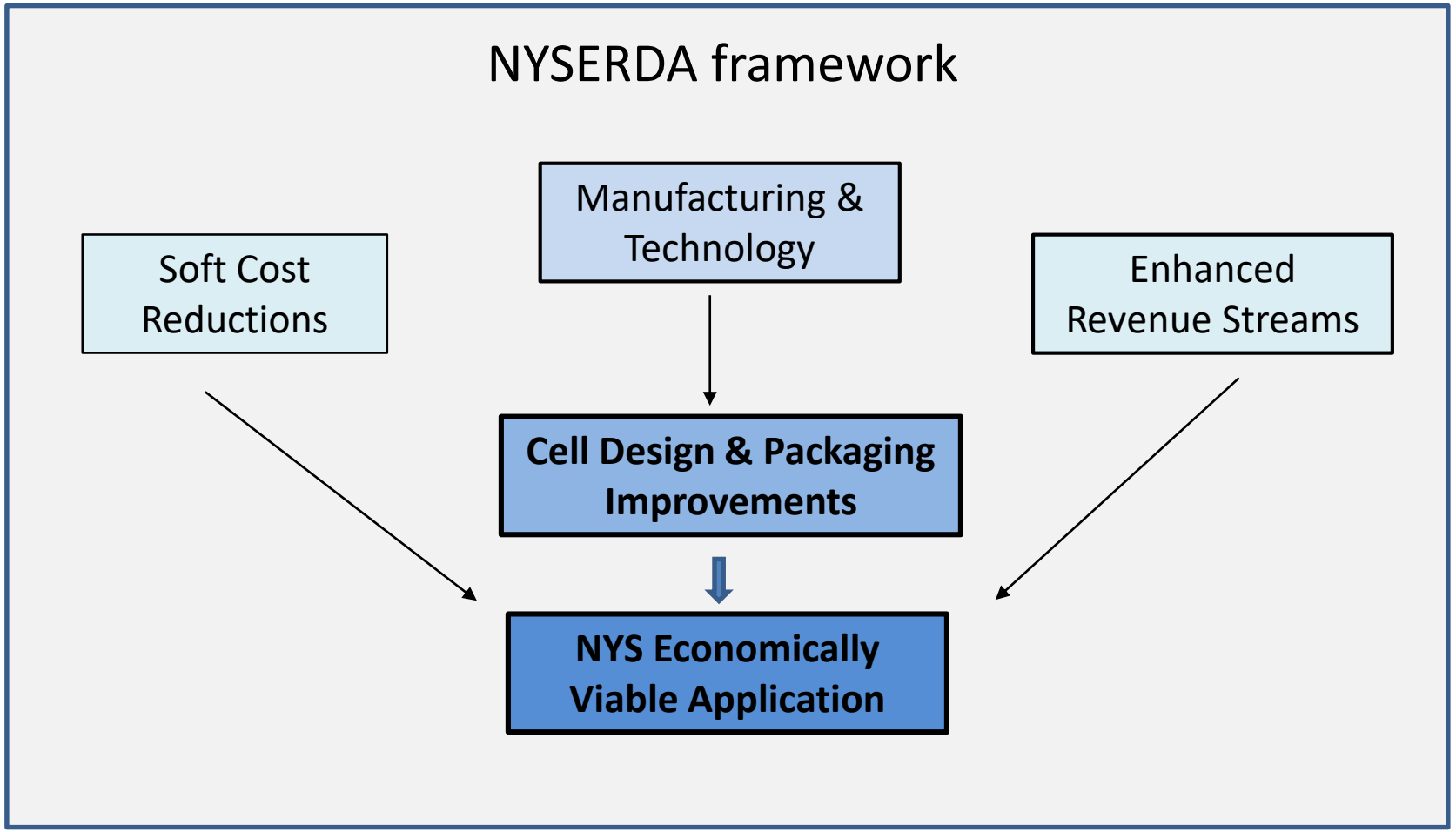
Cadenza is part of NYSERDA/New York State exploration of lower energy cost and increased electricity reliability



China is moving to energy self-sufficiency with renewables and nuclear while coal remains significant

- 2016 “war on pollution” eliminated 335 factories & 400,000+ high-emitting vehicles = 198 “Beijing blue sky days” (12 days in 2015)

- China will spend $360B by 2020
  - focus on wind and solar
  - creating 13+M new jobs

- In parallel, the electric drive revolution is taking place:

  2016: 507,000 xEV vehicles sold

  2017 goal: 800,000 xEV

  by 2025: 5,000,000 xEV will be deployed

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Fastest growing GHG emitter, India is looking at multiple solutions with energy storage at the core

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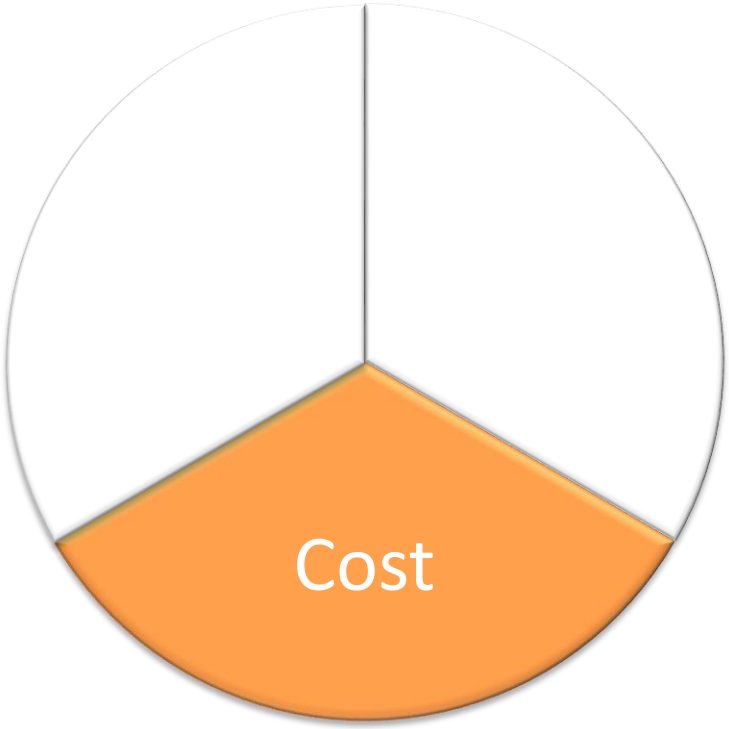
70% of Australian solarized homes need energy storage; prediction that ESS outstrips solar by 2025

Three unmet market needs for lithium-ion battery technology:

Costs need to beat current solutions
- prices at $350/kWh provides access to limited segments today
- but reaching $125/kWh delivers profitability across all markets



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Three unmet market needs for lithium-ion battery technology:

Safety means no fires propagating upon failure
– new standards require non-cascading structures (UL1973)

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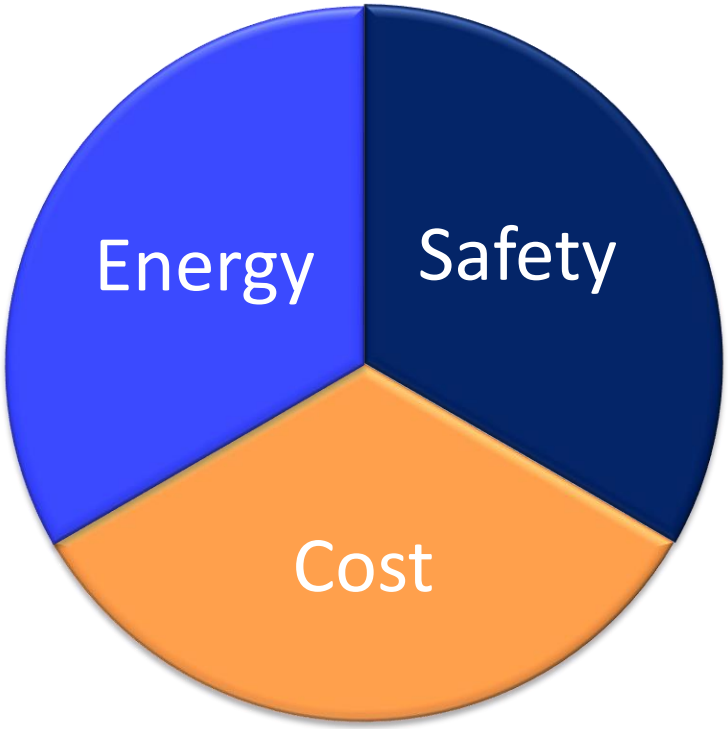
Three unmet market needs for lithium-ion battery technology:

Devices and systems are currently limited by energy density

- how much battery power can fit into a given space and how far does that get me -

- 300 Wh/L being competitive in large cells and
- 500Wh/L changes the paradigm



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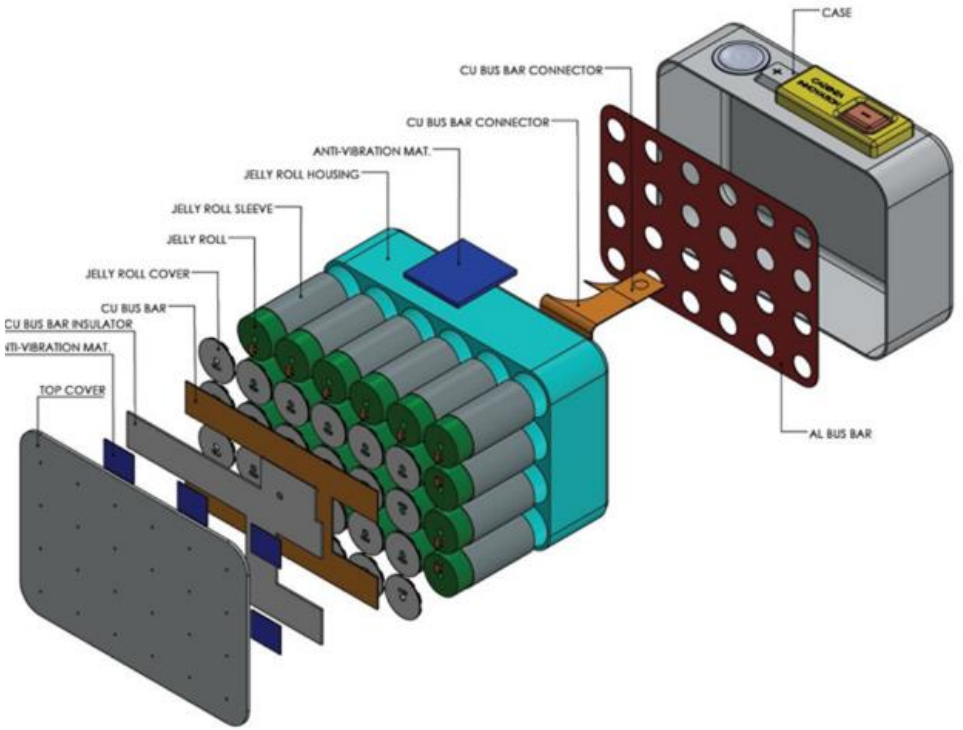
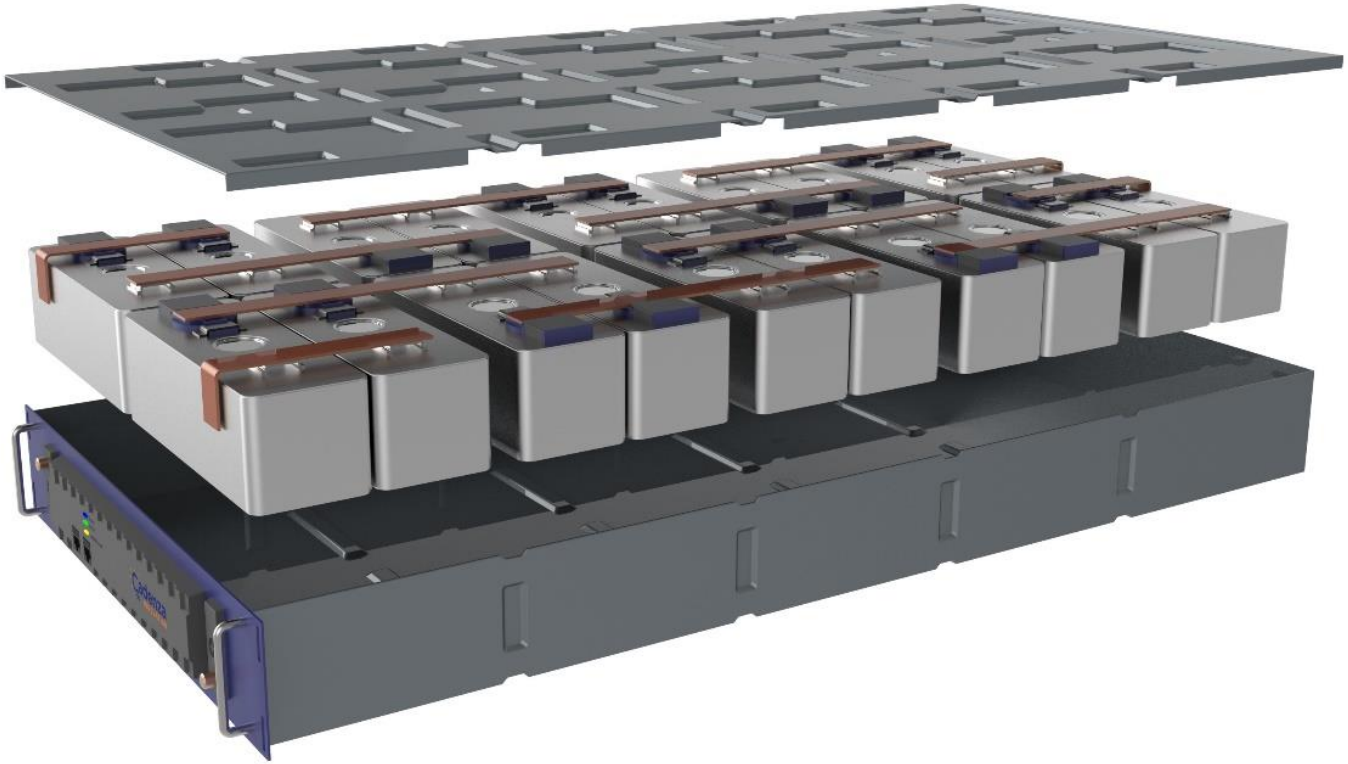
Current technology stage: completed platform entering into product demos and early commercialization 2017-18



2017 Cadenza Innovation EV Demo

Fiat 500e, 35kWh, 96 Cadenza Cells

2017-18: NYSERDA is betting on a technology solution: Cadenza cells optimized into grid modules for peak-shaving



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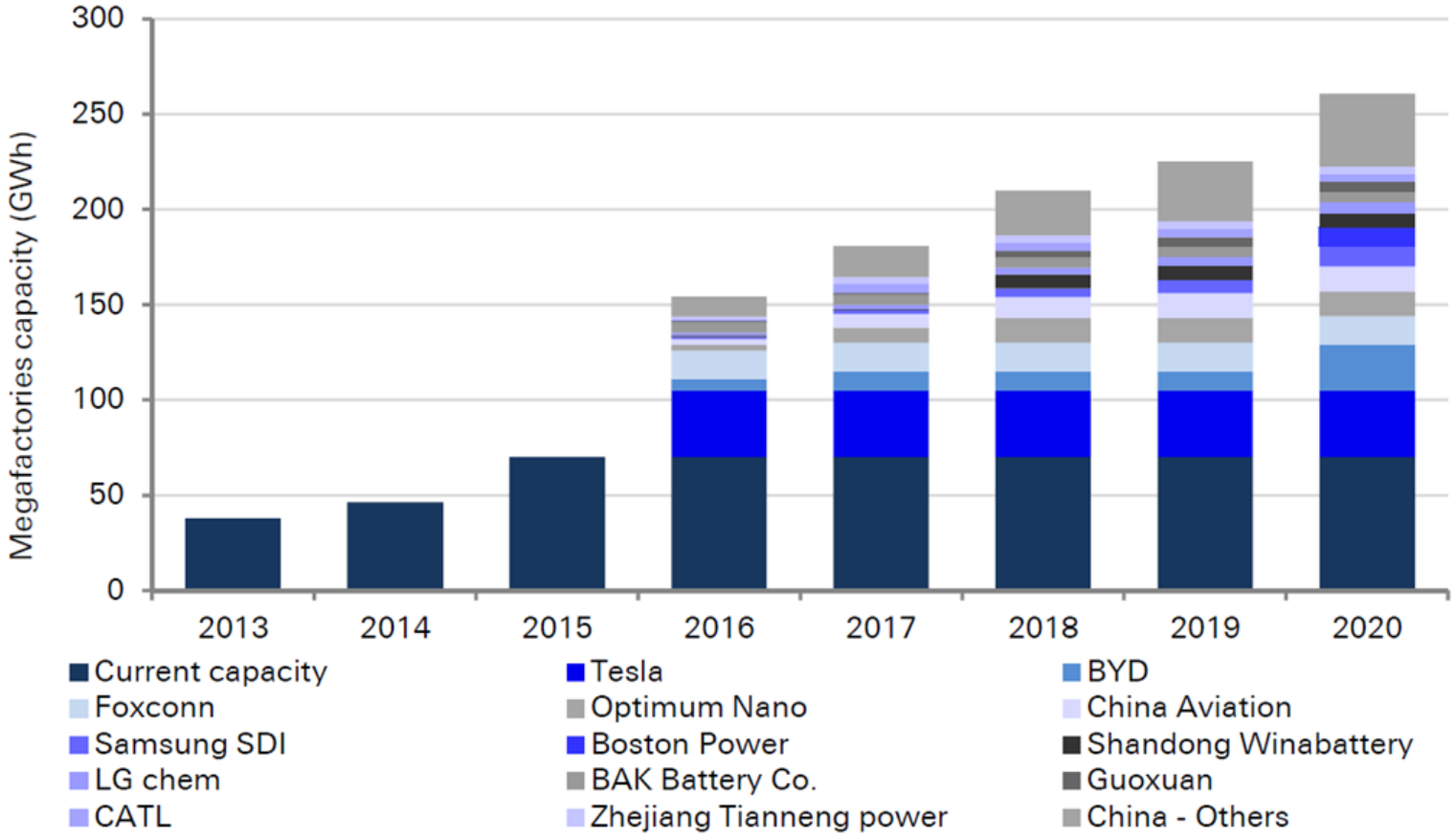
Battery Storage Rack Manufacturer	Large OEM1		Large OEM2		Cadenza DEMO	
Region	USA '17	Canada '17	USA '17	Canada '17	USA '17	USA '18
Rack Capacity	**137kWh**	**166kWh**	**56kWh**	**56kWh**	**190kWh**	**220kWh**

2020 forecasts indicate that China will expand 6x to manufacture more than 60% of global Li-ion batteries



Source: Deutsche Bank; BMI

Significant recent examples of capital deployment in energy storage indicate we are hitting the tipping point

Electric Vehicle Players

- Volkswagen will invest $3.7-billion in e-mobility and digitalization
- Ford is investing $4.5 billion to add 13 electrified vehicles
- Mercedes-Benz to electrify all model series through $7.8 billion R&D investment
- Apple offers $1.8 billion for McLaren Technology Group (EV knowledge)

Grid/Home Storage Initiatives

- Total purchased battery maker Saft for $1.1 billion
- GE invests “double-digit million-Euro sum” in storage firm Sonnen

Supply Chain Growth

- Albemarle, FMC, Sociedad Química y Minera and Tianqi Lithium (Lithium)
- Katanga, Lundin Mining, First Qvantum and Vale Inco (Cobalt)
- Syrah Resources opening world’s largest Graphite mine (Carbon)

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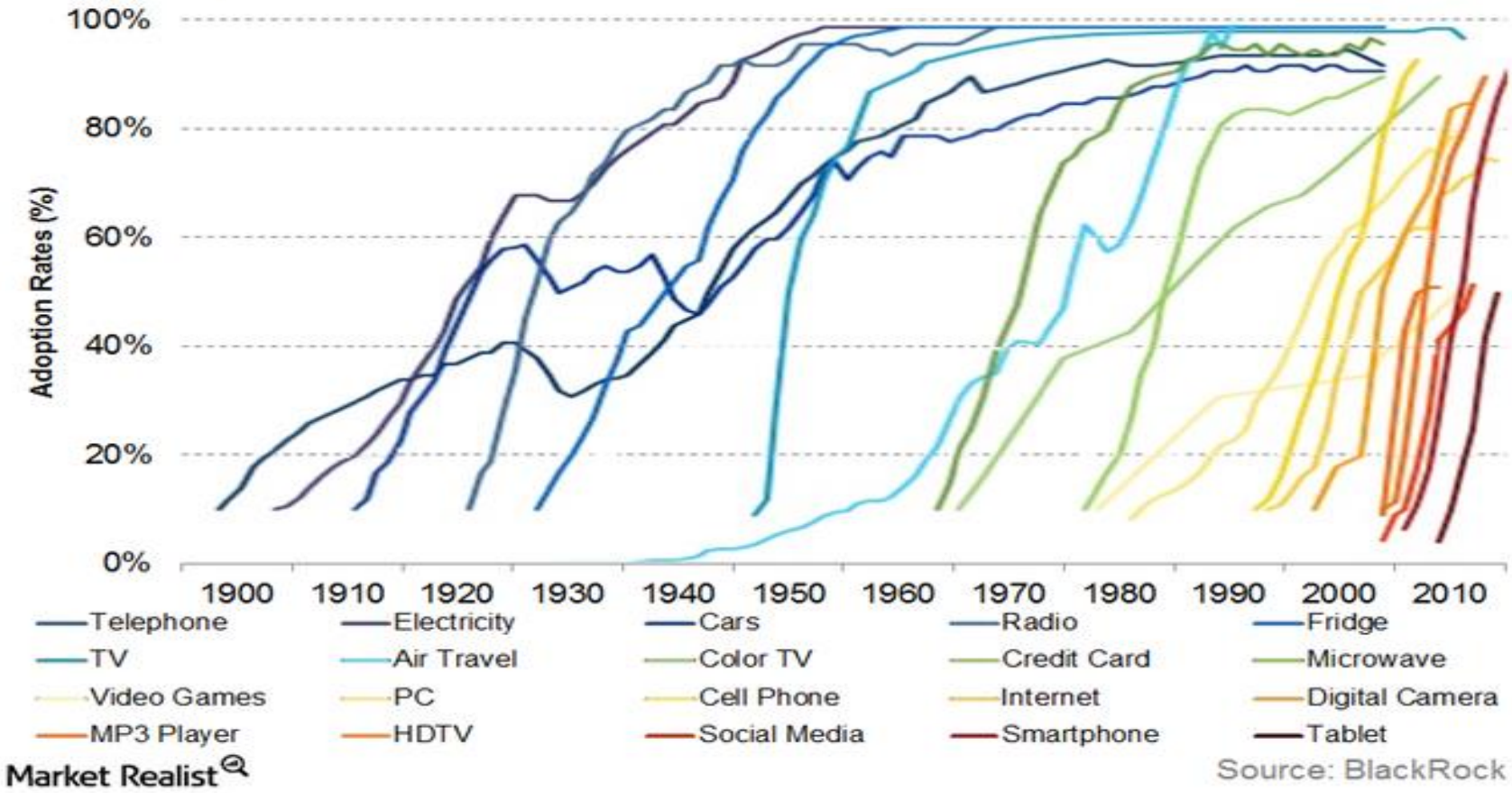
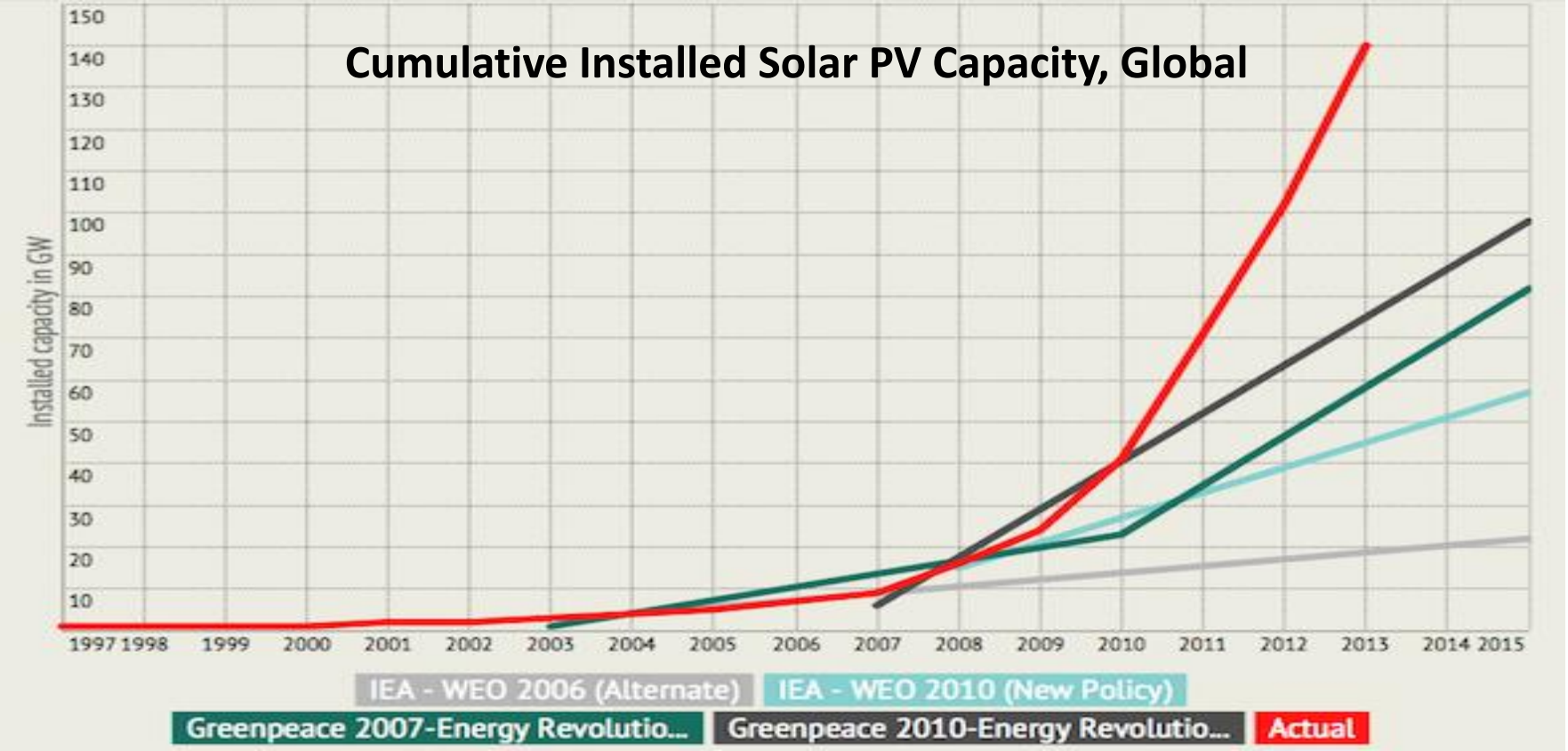
SYRAH RESOURCES

100+M tons

Already increasing technology adoption rates are projected to grow even faster driven by the large millennial generation

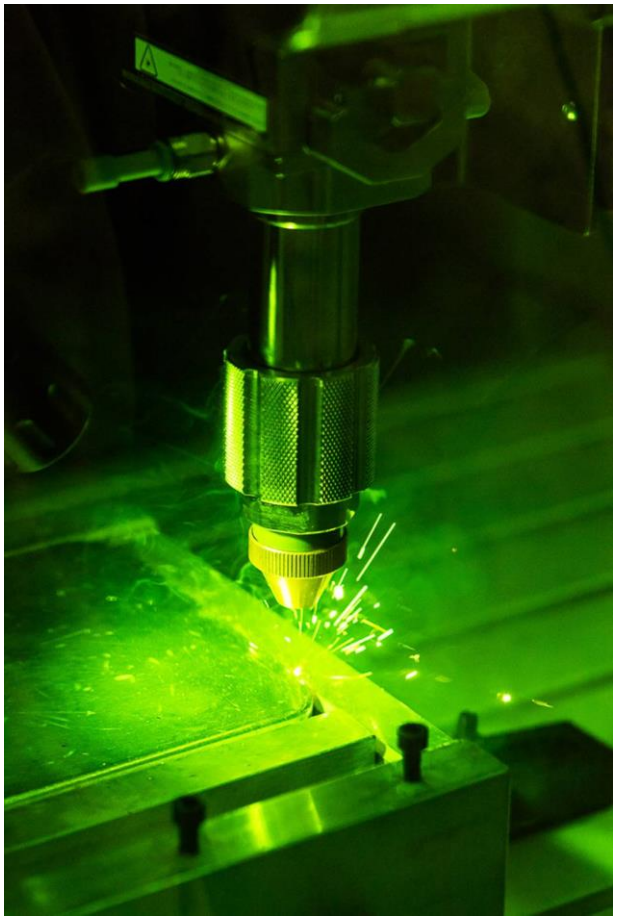


Solar PV boom underestimated by nearly all



source: International Energy Agency and IMF

Low cost, well defined safety, high energy density designed for end market in acceleration phase – lots of opportunity!



Lowest cost platform for EV, PHEV and grid storage

- Taking cost out of the traditional system in a simplified design
- Inventing and enabling low cost components and systems (with partners)
- Use of readily available and known components
- Launch new materials into known mass-production platforms

World-leading safe high energy density in large cell

- For Grid: smaller footprint, ease of operation
- For Auto: smaller, flatter, cells inside crash zone

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