

Making “Beyond Lithium” a Reality: Fostering Innovation in Long-Duration Grid Storage

David M. Hart
Senior Fellow, ITIF

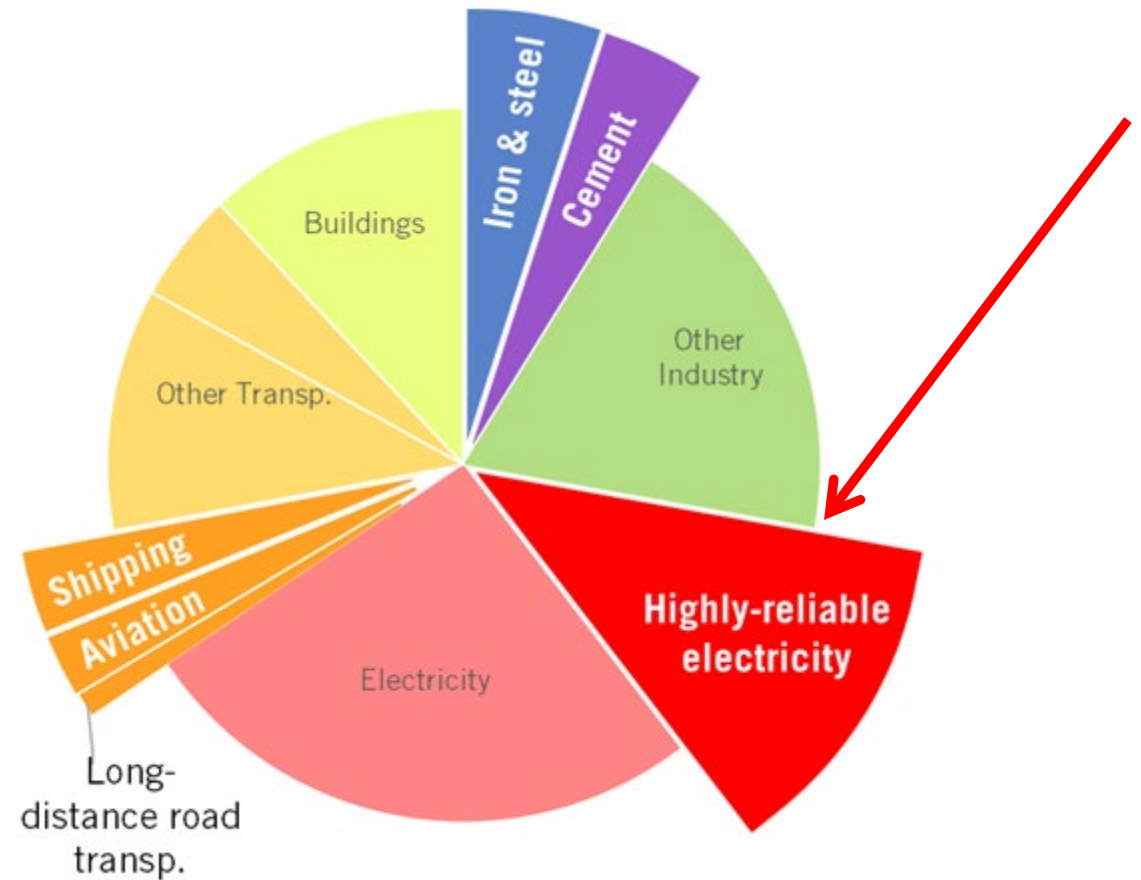
November 28, 2018

Join the Conversation: #ITIFenergy

@ProfDavidHart

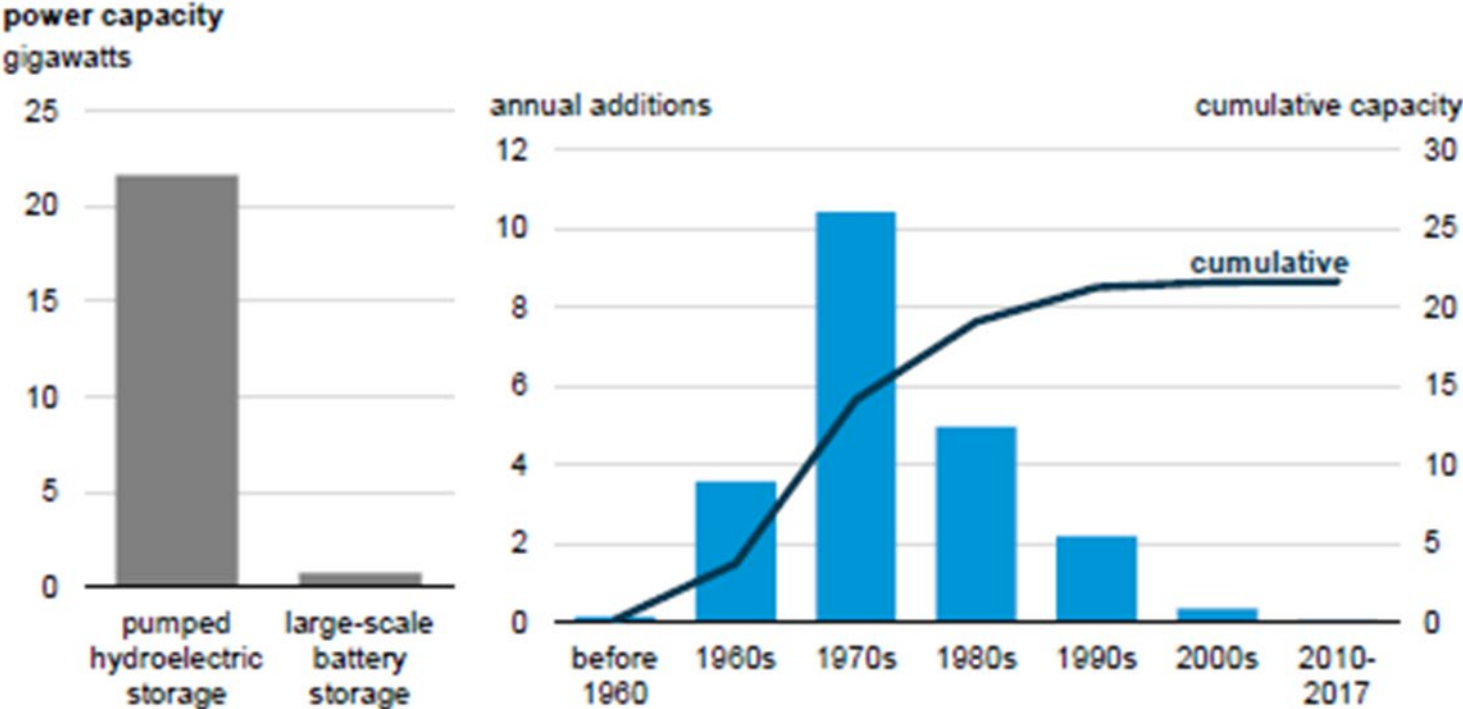
Highly Reliable Electricity: The Biggest Hard Slice

- One increasingly likely 2050 scenario:
 - Variable renewables: rapid growth
 - Hydro: stalled
 - Nuclear: stalled
 - CCUS: stalled
 - Long-duration storage: required



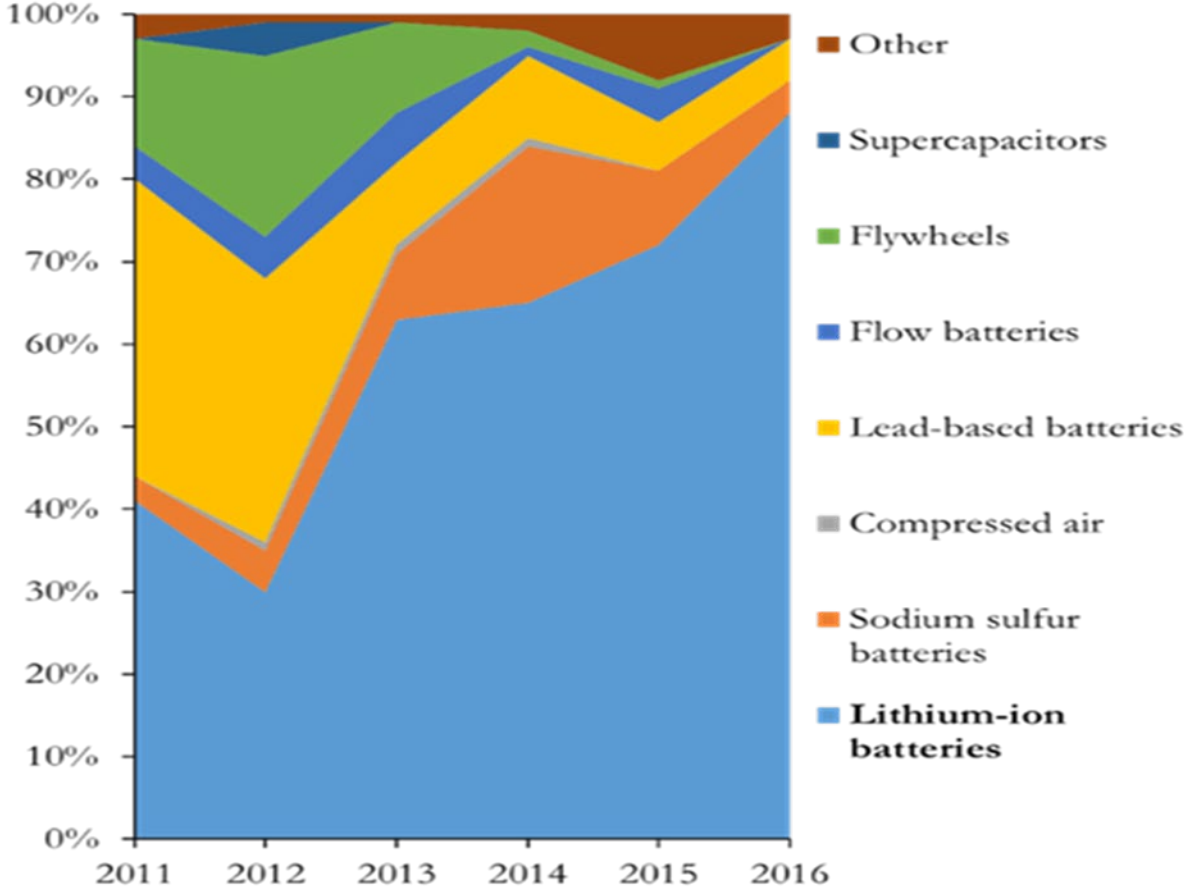
Pumped Hydro: Stalled

Figure 15. U.S. Hydroelectric Pumped Storage Capacity (1960–2017)



Source: U.S. Energy Information Administration, Form EIA-860M, *Preliminary Monthly Electric Generator Inventory*

Global Grid-scale Energy Storage Capacity by Technology (excluding pumped hydro)



Source: International Energy Agency

Lock-In: The QWERTY Question (April 2018 MITEI paper)



Tesla South Australia project
(Source: Electrek 1/14/18)



The “Baseload Challenge” for Energy Storage

- Marco Ferrara et al.:
 - 100+ hours duration
 - <\$20/kWh
- Paul Albertus (ARPA-E):
 - 8-100 hours duration
 - \$5-30/kWh

“We expect peaker gas (i.e. open cycle gas turbines and gas reciprocating engines) to grow by almost a factor of four by 2050.”

BNEF New Energy Outlook 2018

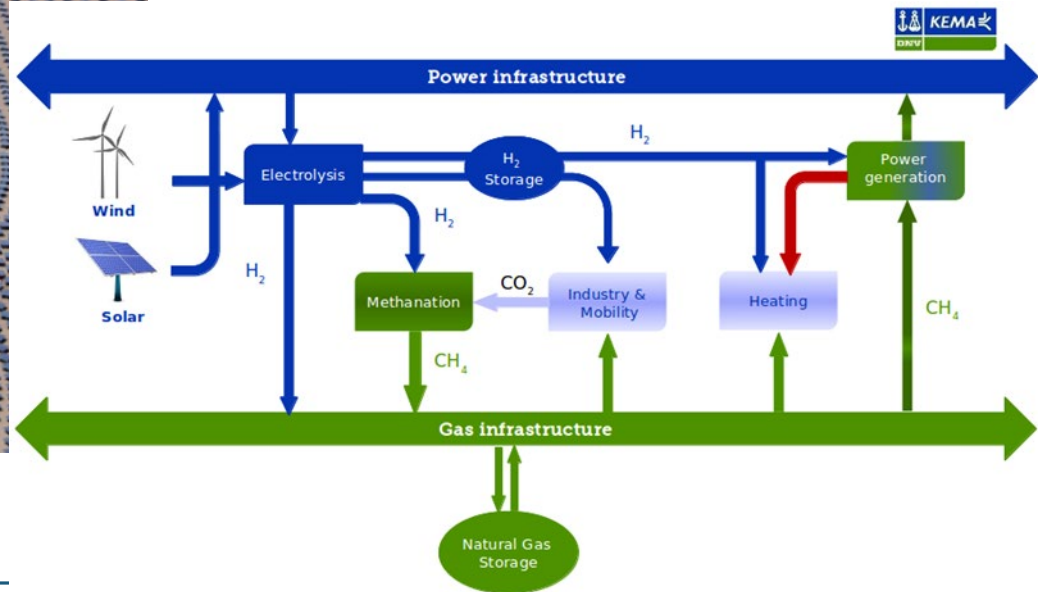
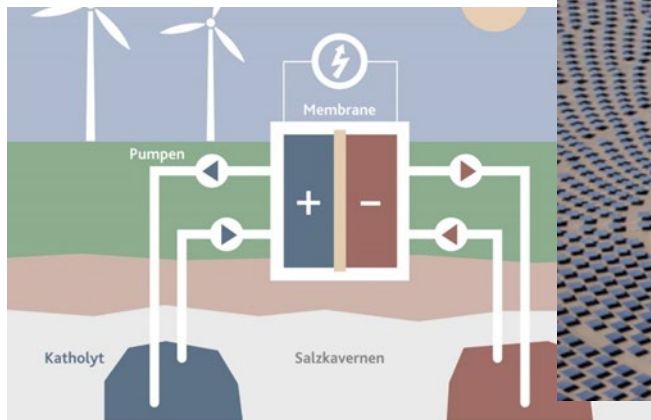
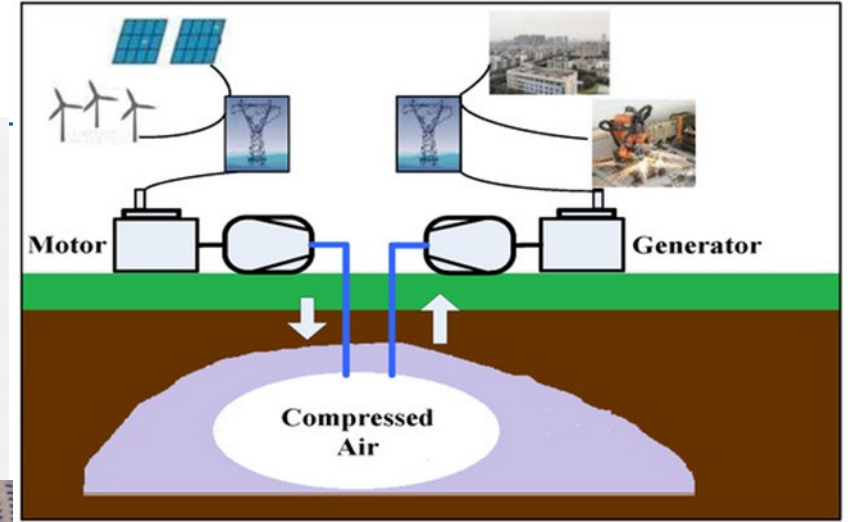
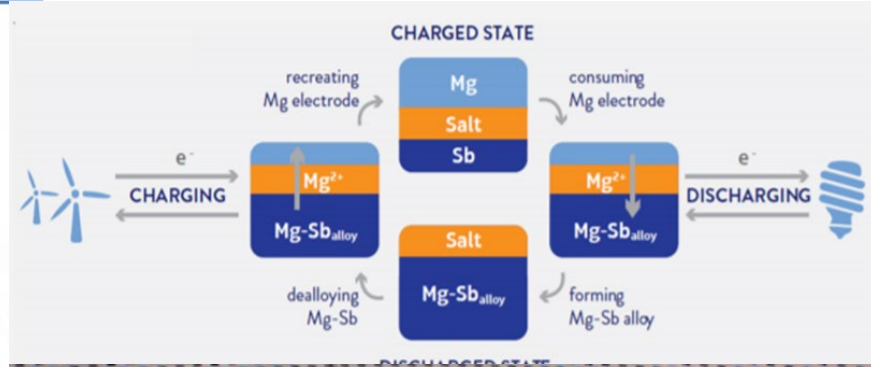
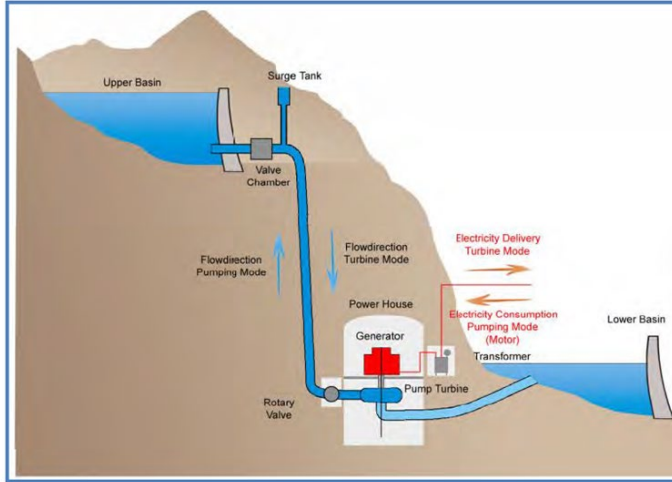
Limits of Lithium-Ion Batteries

- Unit costs
- Materials availability
- Safety
- Durability

“A consensus has now formed that lithium-ion batteries will not be able to satisfy the energy storage requirements of the long-term future and new battery technologies are urgently needed.”

Nature Energy (volume 1, 2016)

(Some) Technology Options



Federal Leadership on Long-Duration Grid Storage

- Set high-profile goals (“StorageShot”)
- Sustain basic research on scientific fundamentals
- Support applied R&D across a diverse technology portfolio
- Lead a new international challenge within Mission Innovation
- Create demo pathways with DOE, DOD, states & private sector
- Explore new valuation & business models for existing pumped hydro
- Simplify licensing for new pumped hydro
- Expand collaborative planning for the fully decarbonized grid

Thank You!

David M. Hart, Senior Fellow | dhart@itif.org | [@ProfDavidHart](https://twitter.com/ProfDavidHart)