

# Energy Initiatives & Their Impact on Public Safety

*Innovation to Adoption*  
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# From One Revolution to Another Over 125 years...

Then...



Columbian  
Exposition (1894)  
Electricity Building



Now...



Residential



Commercial Outdoor



High-Rise Rooftop

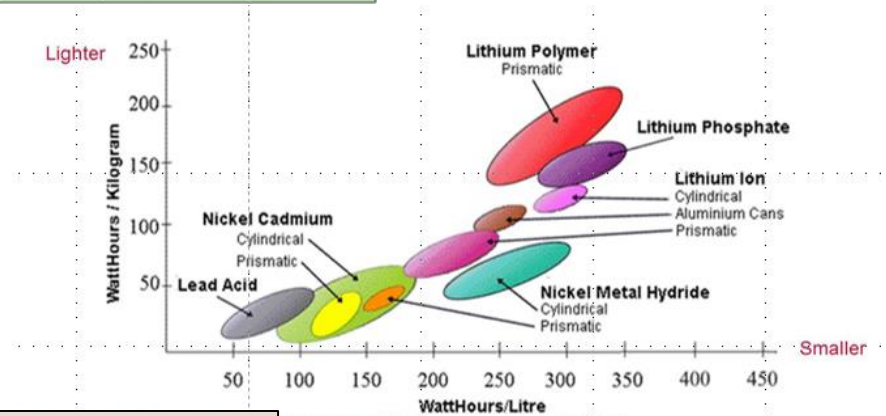
**... safety is the constraint for mass adoption**



# Drivers for Energy Storage

## 1. Advances in Battery Technology

Battery Type	Cost \$ per Wh	Wh/kg	Joules/kg	Wh/liter
Lead-acid	\$0.17	41	146,000	100
Alkaline long-life	\$0.19	110	400,000	320
Carbon-zinc	\$0.31	36	130,000	92
NiMH	\$0.99	95	340,000	300
NiCad	\$1.50	39	140,000	140
Lithium-ion	\$0.47	128	460,000	230



... there is a future in batteries



# Drivers for Energy Storage

2. Policy: Twenty nine states in the USA have mandates or targets for energy storage as part of their renewable energy solution



NY is the leader in coordinating energy storage mandate.

**... renewal sources of energy get competitive with energy storage**



# Safety is the Key to Adoption



**Standards**



**Hazard Based Safety Engineering**

Systematic approach for analyzing product hazards, and developing test methods and requirements to mitigate them.



# Synergy between Model Codes, Standards and Regulations



## Model Codes

**NEC:** National Electric Code (NFPA 70)

**NFPA 855:** Standard for the Installation of Stationary Energy Storage Systems

**ICC:** The International Fire Code, International Residential Code



## Battery Safety Testing and Certification

**UL 1642:** Lithium Batteries

**UL 1973:** Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications

**UL 9540A:** Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

**UL 9540:** Energy Storage Systems and Equipment



## Regulations, Permitting, Training

**State and Local Regulations  
Insurance  
Fire Service**



# Challenges

## Research

- Making battery technology cells inherently safe
  - Electro-chemistry, solid electrolytes, STOBA

## Engineering

- Integrating fire mitigation in energy storage units to control thermal runaway propagation
  - Detection, control, suppression

## Education

- Communications across stakeholder groups
  - Regulators, manufacturers, insurance, building owners, fire service



# Thank You

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