

U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

Emerging Energy Storage Markets Panel DOE Introduction

Energy Storage Grand Challenge Summit

August 9, 2024

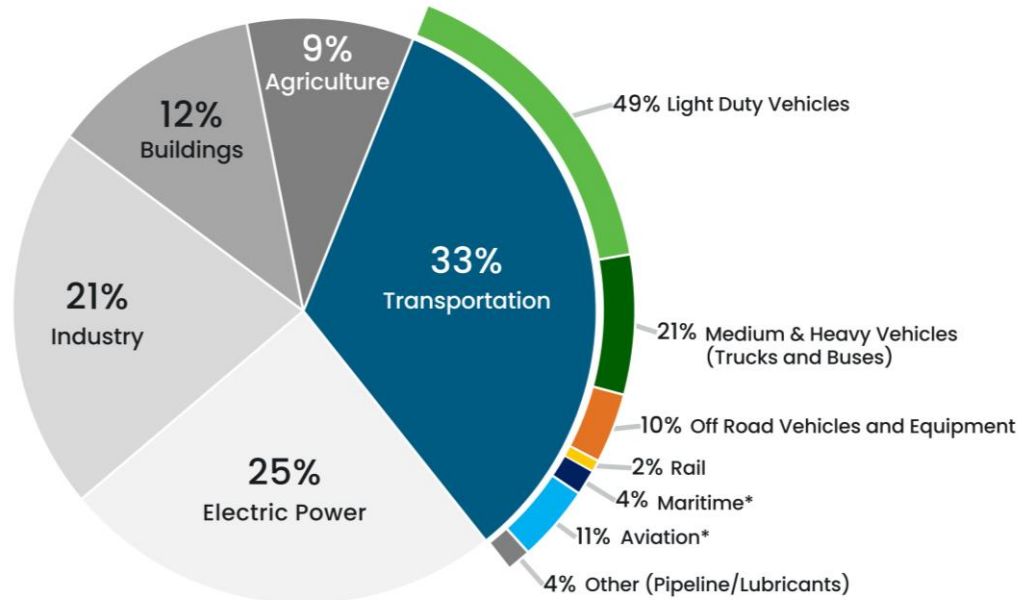
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Economy-wide Decarbonization by 2050

2022 U.S. GHG Emissions



*Aviation and marine include emissions from international aviation and maritime transport. Military excluded except for domestic aviation.

Based on 2024 EPA data, dated 05/21/2024

- Transportation is the largest source of GHG emissions
 - 51% of transportation GHG emissions come from areas outside of LDVs
- The Biden administration has set a goal of net-zero carbon emissions economy wide by 2050
- Interagency Collaborations
 - Federal Consortium for Advanced Batteries (FCAB)
 - Joint Office of Energy and Transportation (JOET)



Survey from 21st Century Truck Partnership (21CTP) HD Truck Battery Meeting

- What breakthrough(s) or change(s) in operations would expedite Class 8 long haul electrification?

Change	Frequency (60 responses)
Fast charge (e.g., “3C fast charging that does not impact battery life with EVSE availability”)	15
Battery swapping	11
Charger availability (e.g., “High-power (MW) charging”)	8
Low-cost battery chemistry	8
Energy density (e.g., “Cell-to-pack battery architecture for max volumetric energy density,” “Leap in cell chemistry”)	7
Shorter routes/logistics	6
Batteries in trailer/cargo space	5
Cycle life improvement (e.g., “More than 10000 cycle battery”)	3
Charging	2
Wireless charging	2
Cell serviceability	1



ARPA-E: Pioneering Railroad, Oceanic and Plane Electrification with 1K energy storage systems (PROPEL-1K)



Aviation: enable regional flight on aircraft transporting up to 100 people.



Railways: enable cross-country travel in U.S. with fewer stops and reduced infrastructure needed for charging/refueling.



Maritime: enable the electrification of all ships that operate exclusively in U.S. territorial waters.

	Category A (Aviation)	Category B (Railways & Maritime)
Gravimetric Energy Density	$\geq 1000 \text{ Wh/kg}$	
Volumetric Energy Density	$\geq 1000 \text{ Wh/L}$	
Peak Power Capability	$\geq 1.5 \text{ kW/kg}$ (3 minutes)	$\geq 0.25 \text{ kW/kg}$ (15 minutes)
Continuous Power Capability	$\geq 0.5 \text{ kW/kg}$	$\geq 0.10 \text{ kW/kg}$
Levelized Cost of Storage	$\leq \$0.30/\text{kWh}$	$\leq \$0.20/\text{kWh}$
System Voltage	$\geq 1000 \text{ V}$	$\geq 350 \text{ V}$



Marine

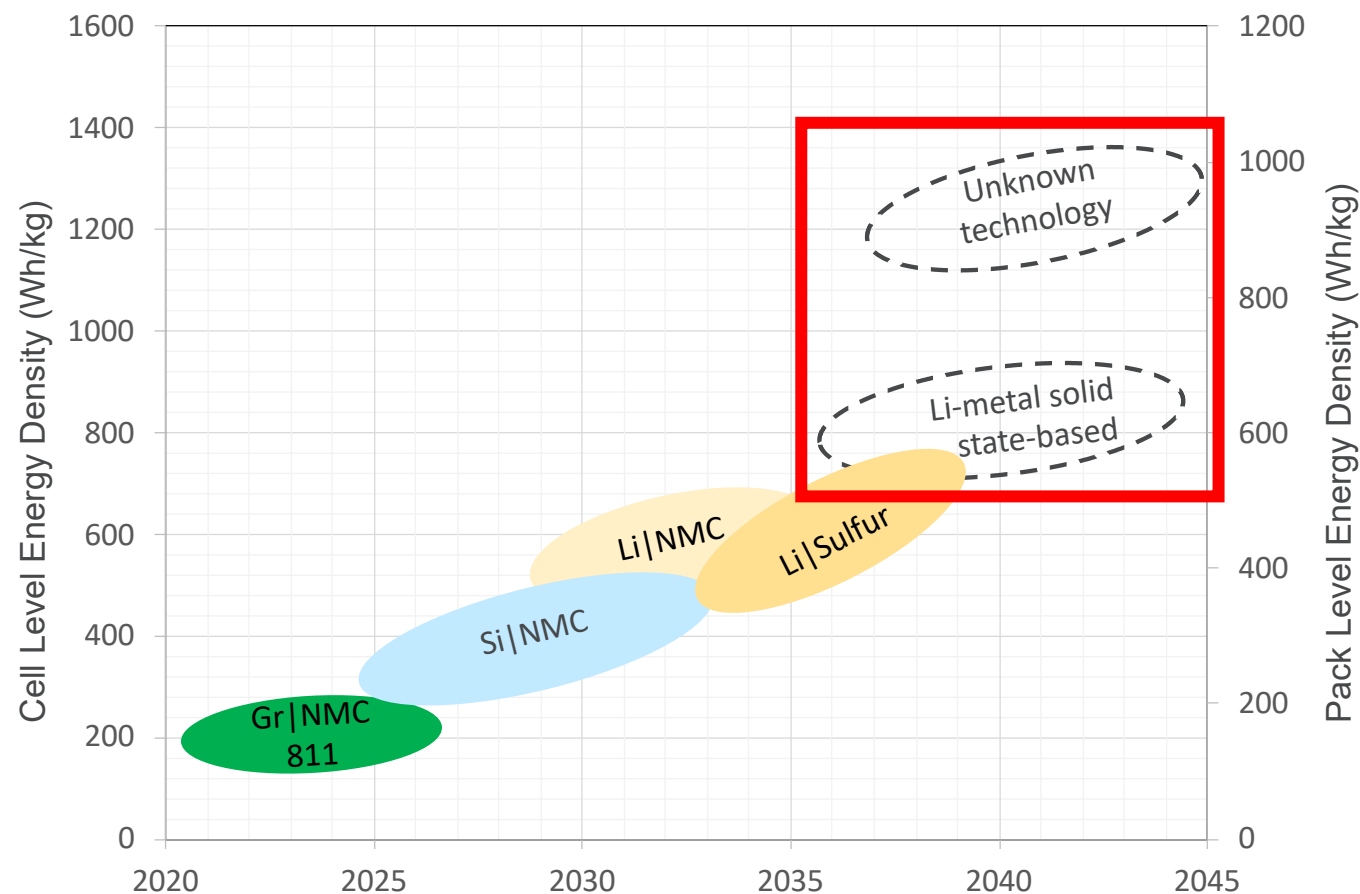
- Water Power Technologies Office and PNNL
- *RV Resilience* plug in hybrid marine research facility
 - Diesel engines (cruising) and electric motors (low speed)
 - Battery mode runs silent for **zero emissions** and **no intrusive sound for wildlife**





Battery Technology Improvement Roadmap for Aviation

- Electric Vertical Take-off and Landing (EVTOL)
 - <7 passengers, 50 miles
- Commuter e-aircraft
 - 9-19 passengers, 300 miles
- 737 Class short-haul e-aircraft and hybrid aircraft
 - 100 passengers, 700 miles



VTO-NASA Workshop April 2023

FY24 Vehicle Technologies Office Batteries FOA (DE-FOA-0003383)

- FOA Amount: **\$42,950,000**
- **Topic 1 Improved 12 Volt Lead Acid Batteries for Safety-Critical Electric Vehicle Applications** - improving the service life and performance requirements to meet critical safety features while reducing cost (**\$10 million**).
- **Topic 2 Develop Vehicle or Structural Level Strategies to Reduce the Likelihood of the Cascading Effects of Electric Vehicle Fires** - university-led teams conducting research at the cell, pack, and vehicle level (**\$3.9 million**).
- **Topic 3 Battery Electrode, Cell, and Pack Manufacturing Cost Reduction** - developing improved manufacturing technologies for EV battery electrodes, cells, and packs (**\$12.5 million**).
- **Topic 4 Silicon-Based Anodes for Lithium-Ion Batteries** - researching, fabricating, and testing lithium battery cells implementing silicon electrodes with a commercially available cathode technology (**\$12.5 million**).
- **Topic 5 High Energy Density Conversion Cathodes** - developing high energy density battery cells containing metal chalcogenide, oxide, or halide cathodes (**\$4.05 million**).



Submission Deadline for Concept Papers:	September 9, 2024, 5:00 p.m. ET
Submission Deadline for Full Applications:	October 30, 2024, 5:00 p.m. ET
Expected Date for EERE Selection Notifications:	March 2025
Expected Timeframe for Award Negotiations:	March-June 2025

Thank You

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