GRID-SCALE ENERGY STORAGE: STATE OF THE MARKET

BLOOMBERG NEW ENERGY FINANCE SUMMIT 2011

SHU SUN

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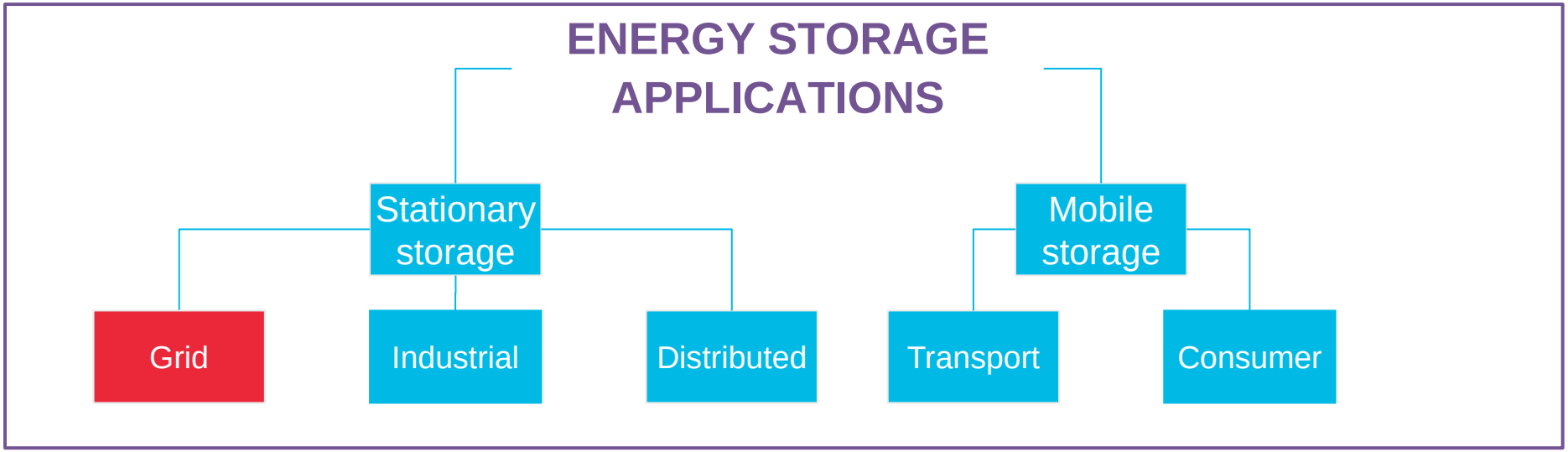
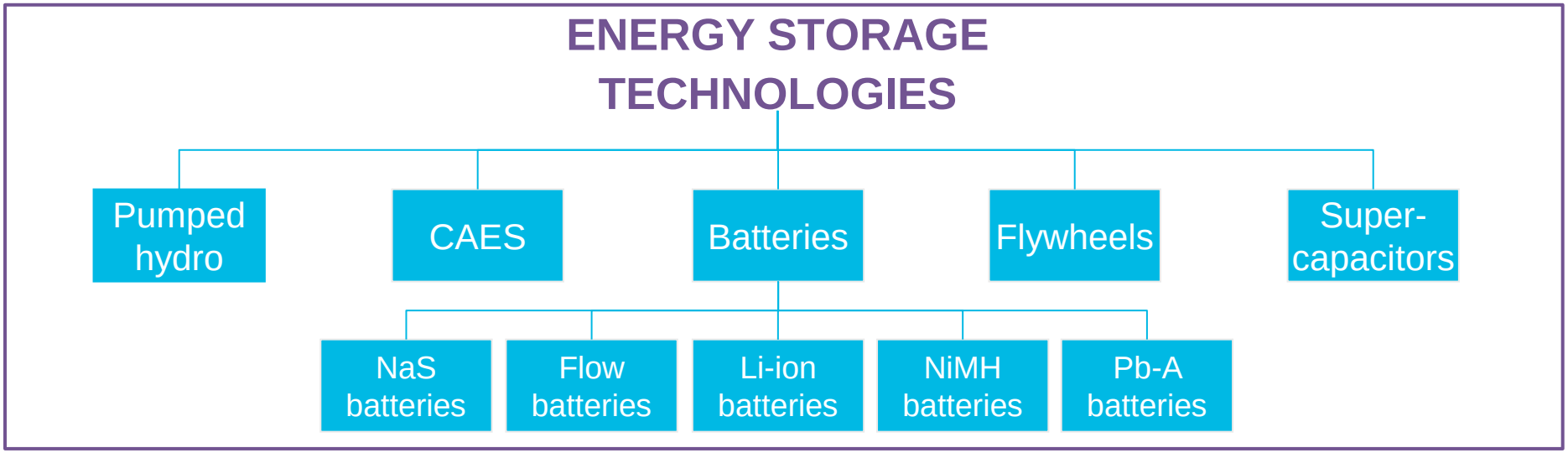
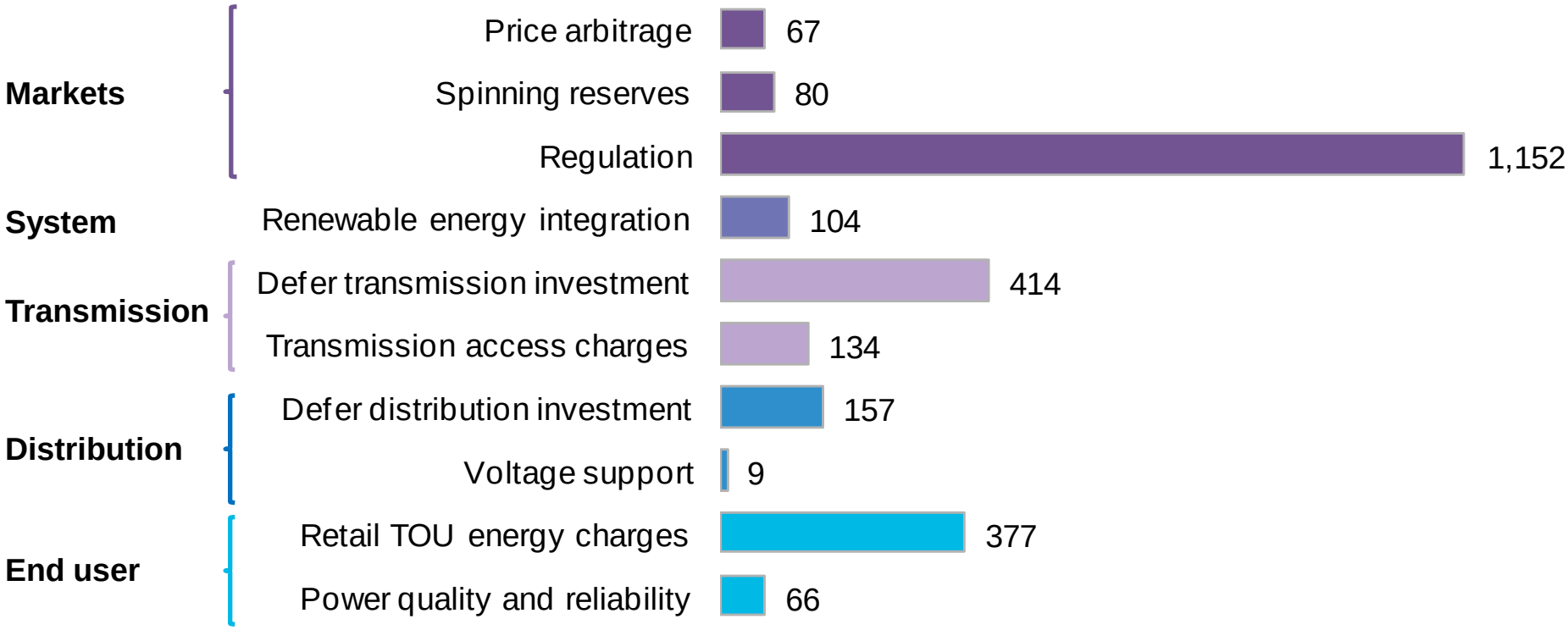
ENERGY STORAGE: TECHNOLOGIES AND APPLICATIONS





BENEFITS OF STORAGE IN GRID APPLICATIONS

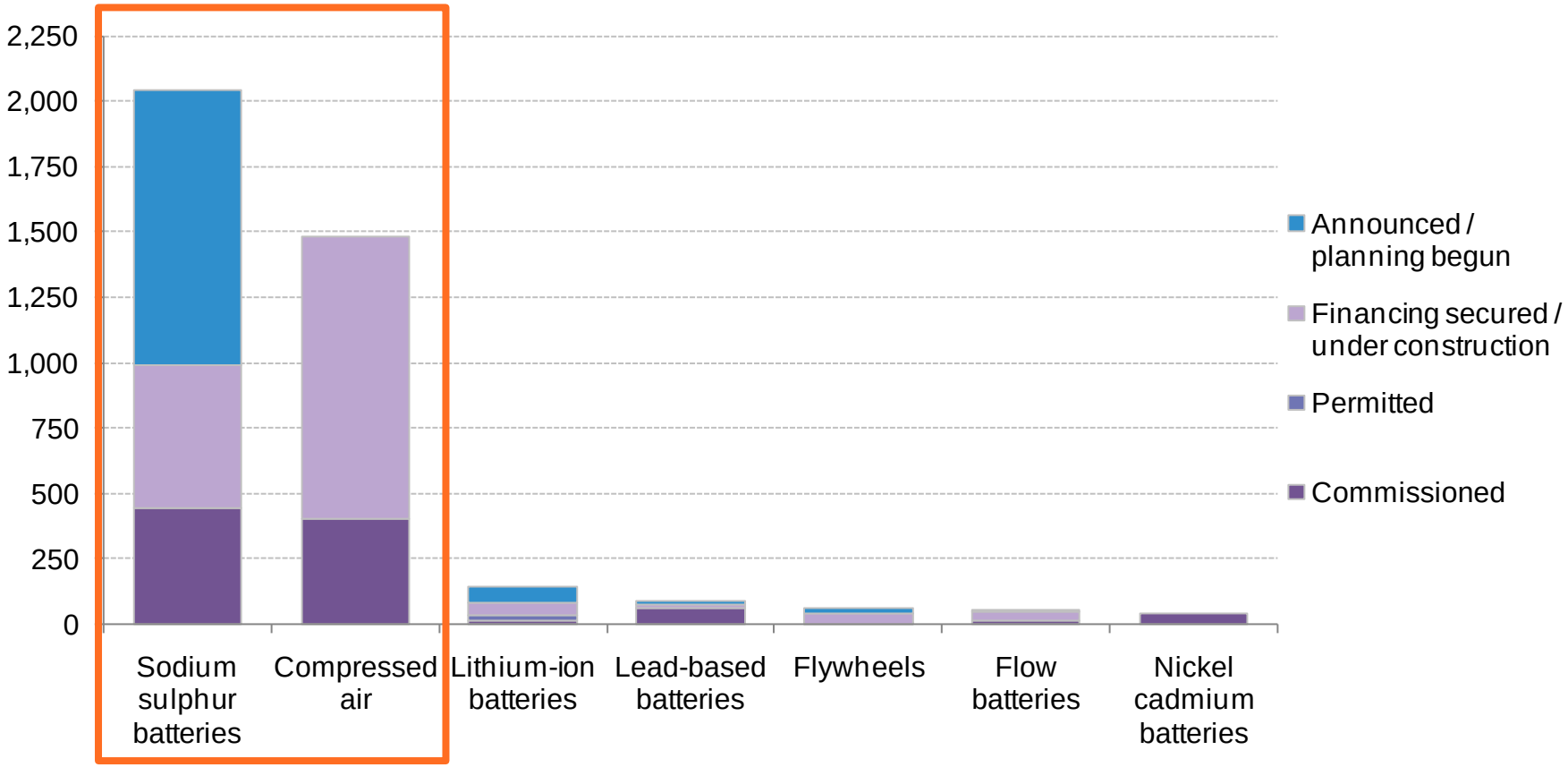
Lifetime benefits of energy storage at different stages of value chain ($/kWh of storage capacity)



Note: Benefits are modeled using a battery configuration of 1MW, 2MWh, with 15-year life-time and a 10% discount rate.

Source: EPRI, Bloomberg New Energy Finance

ENERGY STORAGE PROJECTS WORLDWIDE (MW)



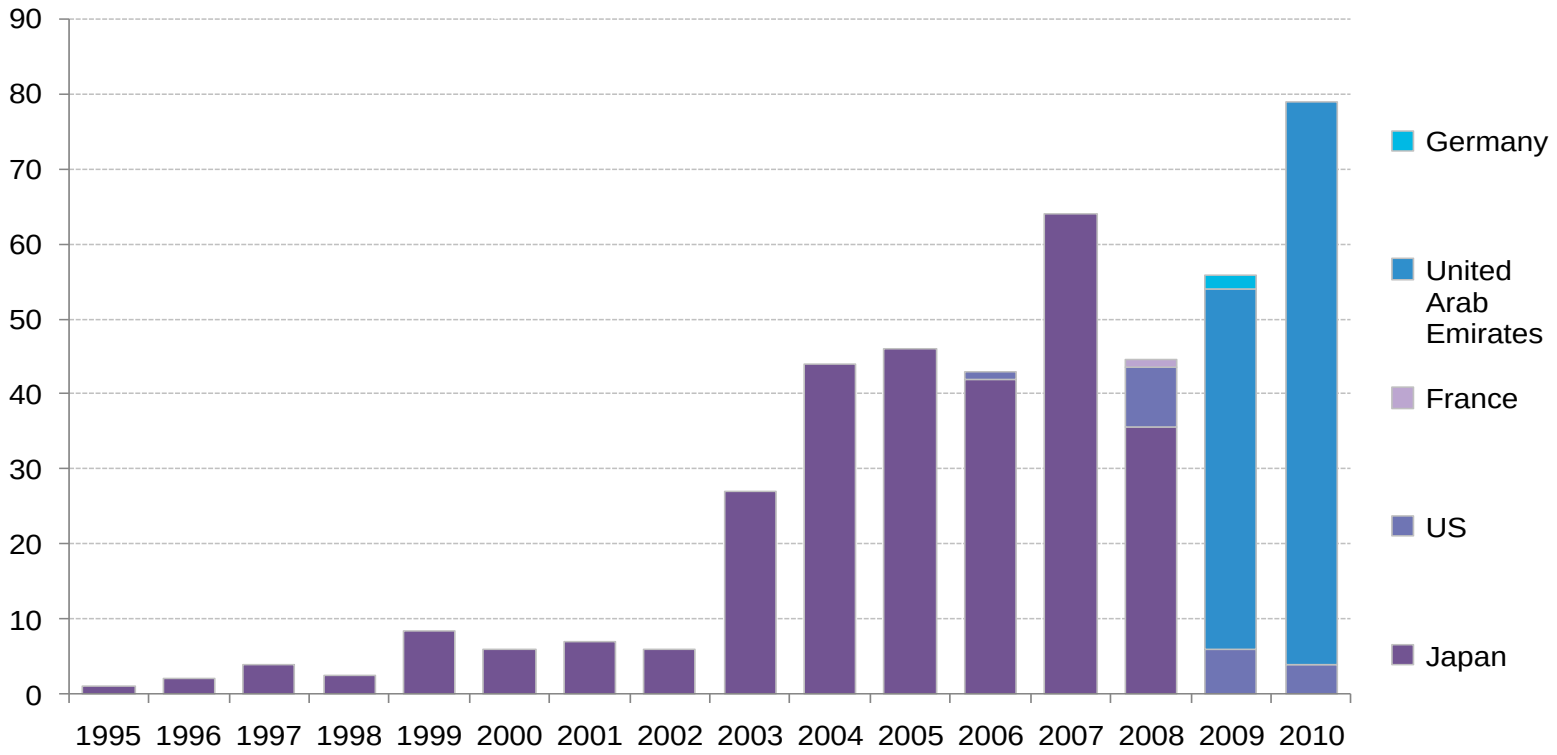
Source: Bloomberg New Energy Finance

SODIUM SULPHUR BATTERIES

45% of total commissioned storage capacity outside pumped hydro

55% of total future storage capacity outside pumped hydro

Historical annual new NaS installations by location, 1995-2010



Note: 'Future storage capacity' includes projects under the status of 'announced / planning begun', 'financing secured / under construction' and 'permitted'.

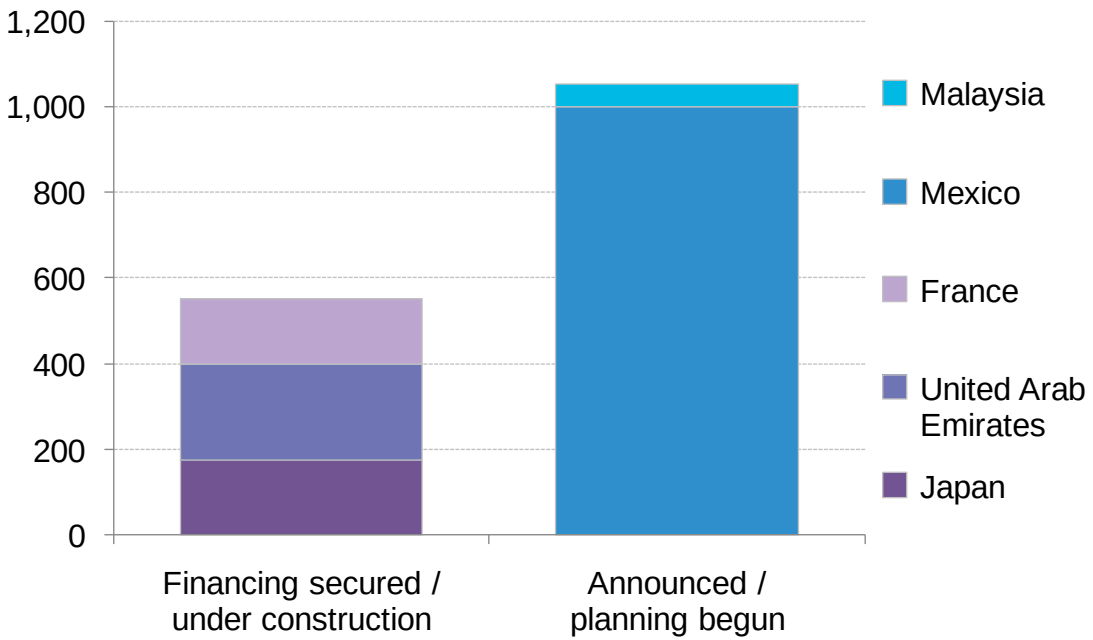
Source: Bloomberg New Energy Finance

SODIUM SULPHUR BATTERIES

45% of total commissioned storage capacity outside pumped hydro

55% of total future storage capacity outside pumped hydro

Future installations by status and location (MW)



- NGK Insulators the only company producing NaS batteries
- Current manufacturing capacity stands at 150 MW/yr
- Potential for future cost reduction questionable

Note: 'Future installations' include projects under the status of 'announced / planning begun', 'financing secured / under construction' and 'permitted'.

Source: Bloomberg New Energy Finance

COMPRESSED AIR ENERGY STORAGE

41% of total commissioned storage capacity outside pumped hydro

37% of total future storage capacity outside pumped hydro

CAES technology

	Fuel input	Efficiency	Maturity
Diabatic	Yes	40-70%	Mature
Isothermal	No	70-90%	Developing
Adiabatic	No	70%	Developing

Technological uncertainty

Note: Future projects include projects under the status of 'announced / planning begun', 'financing secured / under construction' and 'permitted'.

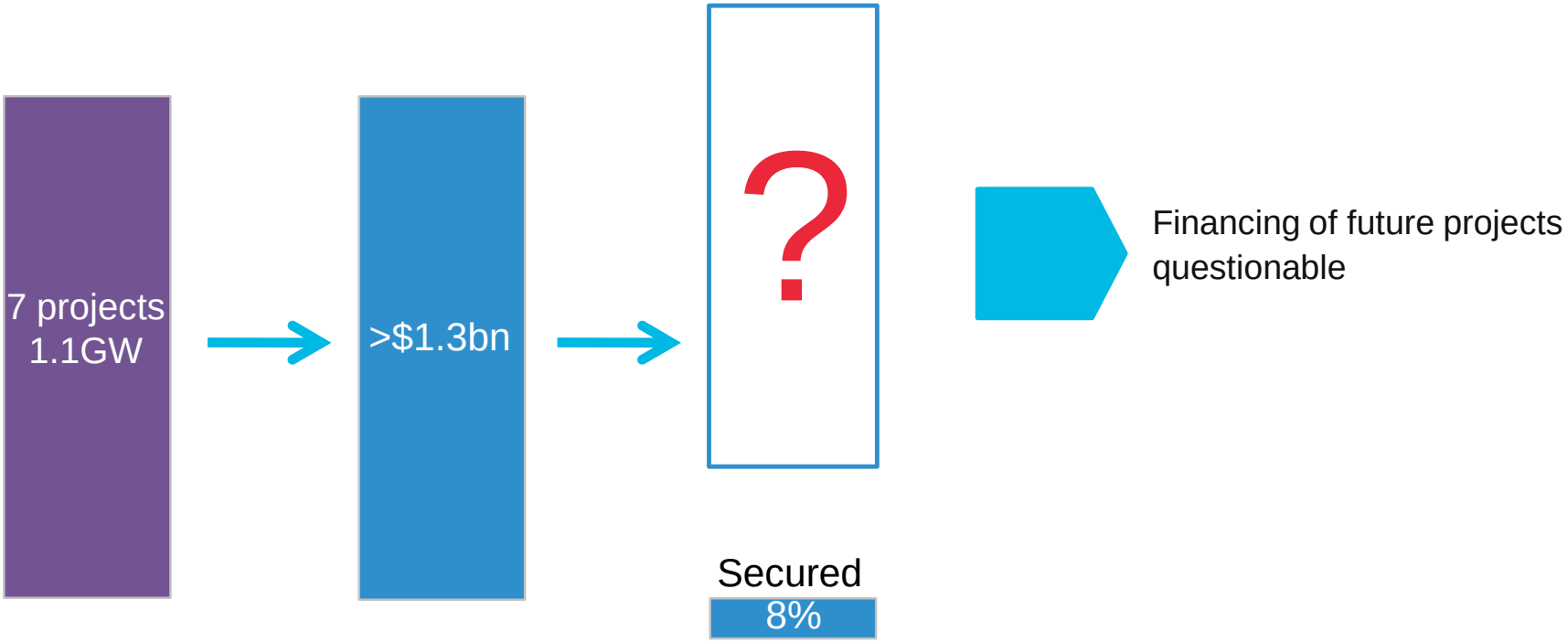
Source: Bloomberg New Energy Finance

COMPRESSED AIR ENERGY STORAGE

41% of total commissioned storage capacity outside pumped hydro

37% of total future storage capacity outside pumped hydro

Future CAES projects

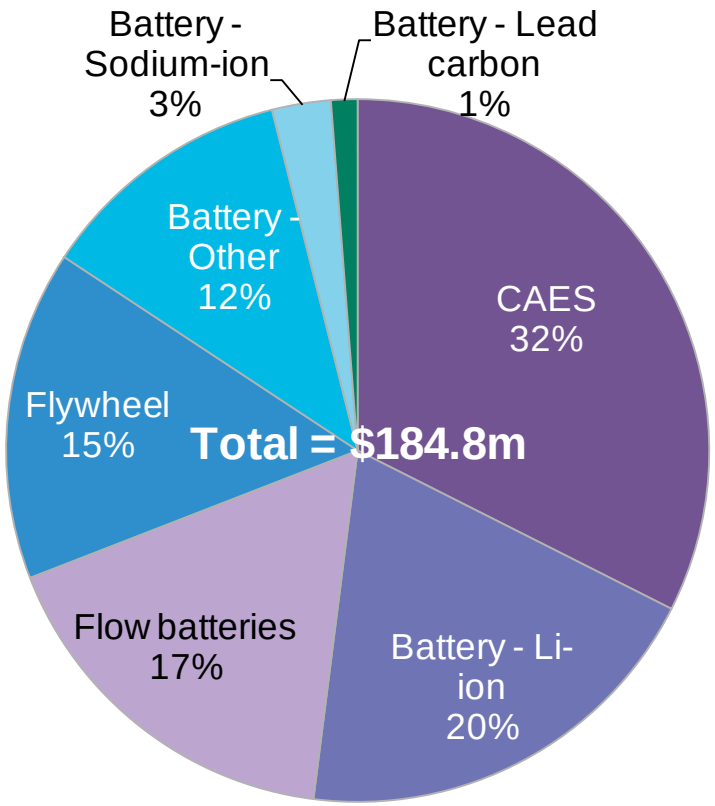


Note: Future projects include projects under the status of 'announced / planning begun', 'financing secured / under construction' and 'permitted'.

Source: Bloomberg New Energy Finance

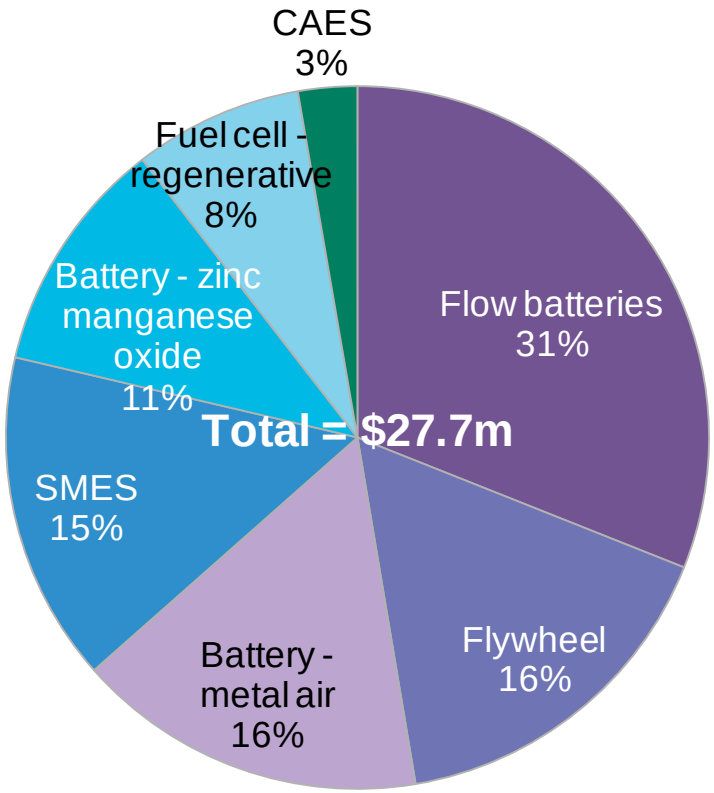
DISTRIBUTION OF US DOE FUNDS TO ENERGY STORAGE

DOE SMART GRID DEMONSTRATION GRANTS – ENERGY STORAGE



Source: US Department of Energy, Bloomberg New Energy Finance

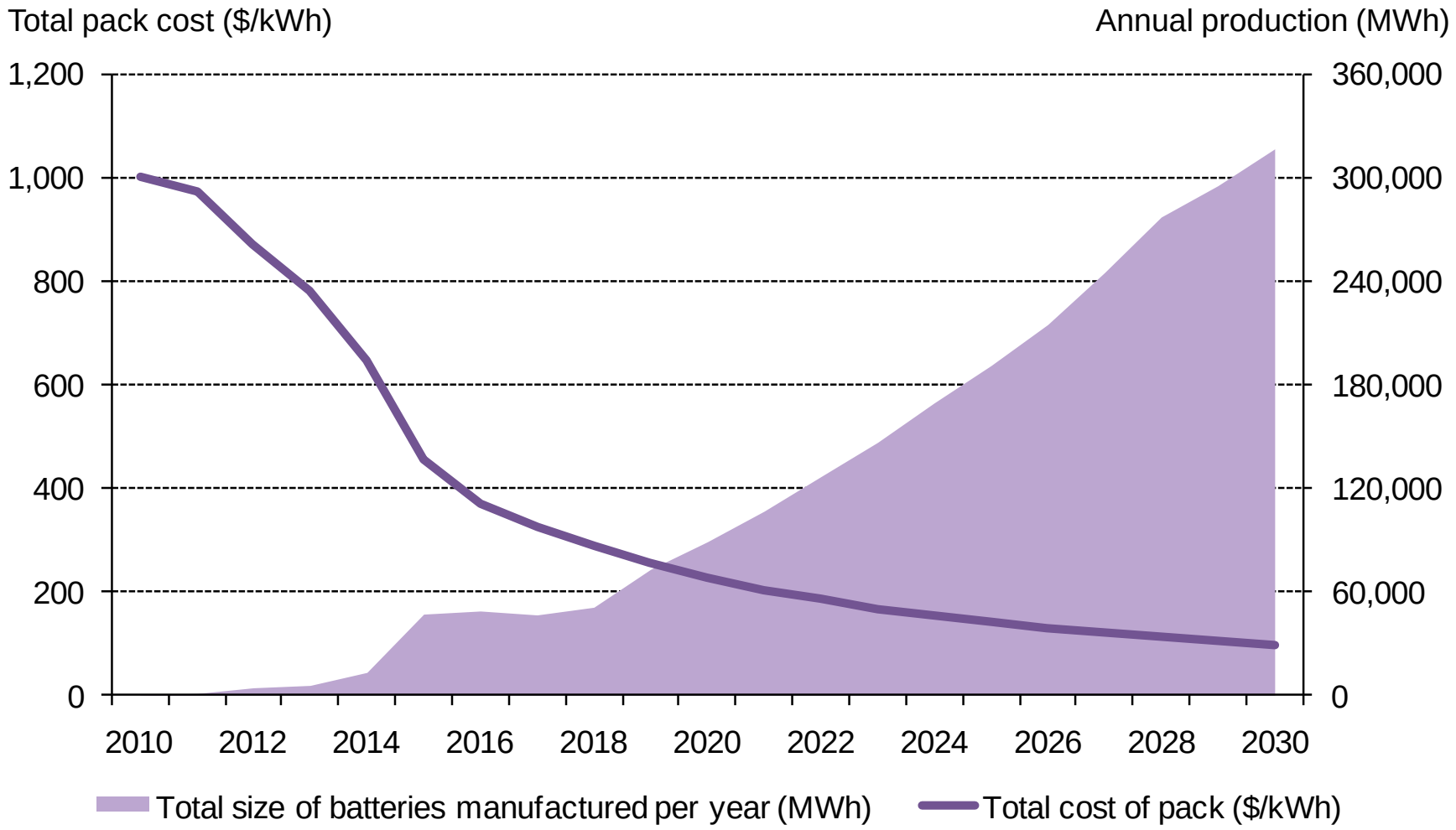
DOE ARPA-E GRANTS: GRIDS



Source: US Department of Energy, Bloomberg New Energy Finance

Note: GRIDS stands for Grid-scale Rampable Intermittent Dispatchable Storage

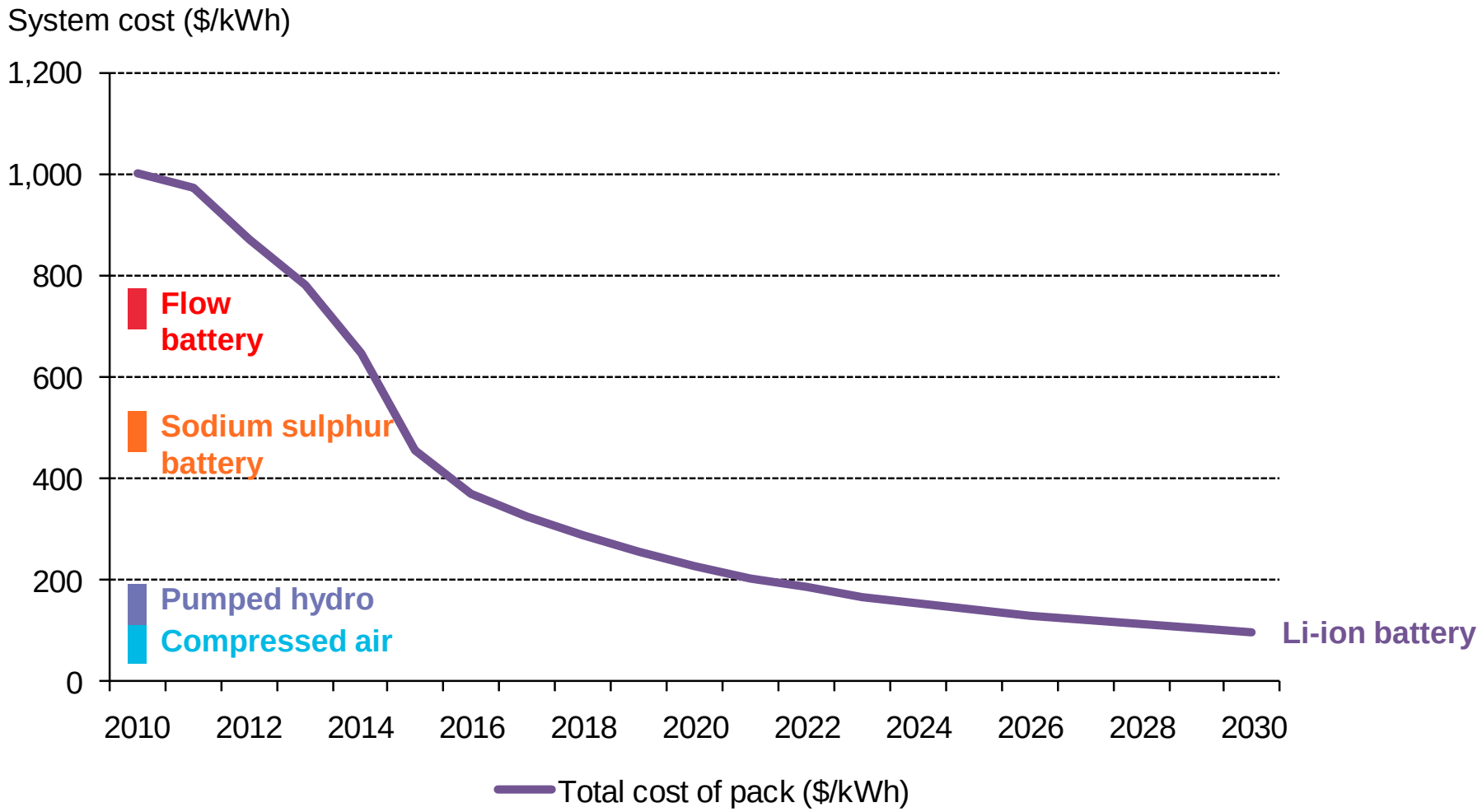
LITHIUM-ION BATTERY PACK COST, TRACTION BATTERY PRODUCTION, 2010–30



Note: Total pack cost includes the battery management system

Source: Bloomberg New Energy Finance

COST OF LITHIUM-ION BATTERIES VS. OTHER STORAGE TECHNOLOGIES



Note: System cost includes the cost of power control electronics and other components required to build a complete storage system.

Source: Bloomberg New Energy Finance

ACTIVITIES OF WORLD'S LARGEST BATTERY COMPANIES

	Consumer electronics	Automotive battery (SLI)	Automotive battery (traction)	Industrial / back-up	Grid-scale storage
BYD	✓	✓	✓	✓	✓
SAMSUNG	✓	✓	✓	✓	✗
Panasonic SANYO	✓	✗	✓	✓	✗
GS YUASA	✗	✓	✓	✓	✗
SONY	✓	✗	✓	✗	✗
LG Chem	✓	✗	✓	✗	✗
EnerSys Power/Full Solutions	✗	✓	✗	✓	✗
Johnson Controls	✗	✓	✓	✗	✗
DURACELL	✓	✗	✗	✗	✗
Energizer	✓	✗	✗	✗	✗

Source: Bloomberg New Energy Finance

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Energy Smart Technologies
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Carbon Capture & Storage
Power
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