Market Report: ESS Markets in North America

NAATBatt 2019 Annual Meeting & Conference

Mitalee Gupta | March 12, 2019

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Presentation Overview

- Deployment trends
- Technology and Pricing trends
- Market drivers
- Market Outlook

Americas storage drivers: wholesale markets, utility procurement and customer bill savings

U.S.

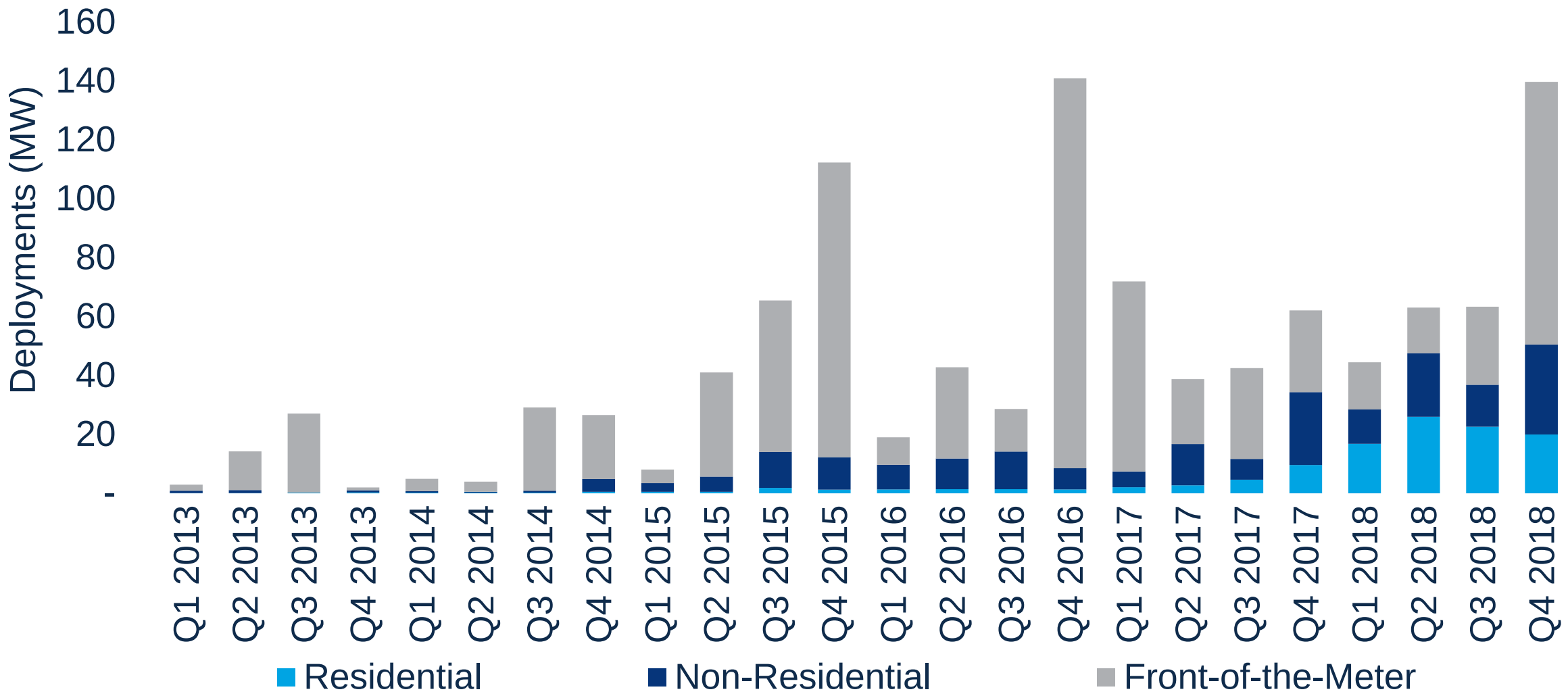
U.S. is by far the most advanced energy storage market, with handful of states with energy storage mandates, and the energy regulator requiring storage participation in wholesale markets.

Canada

Global adjustment charges in Ontario provide attractive storage opportunity, but revenue bankability risks exist. New policies offering certainty may get indefinitely delayed due to current administration. Alberta could see capacity markets related opportunity.

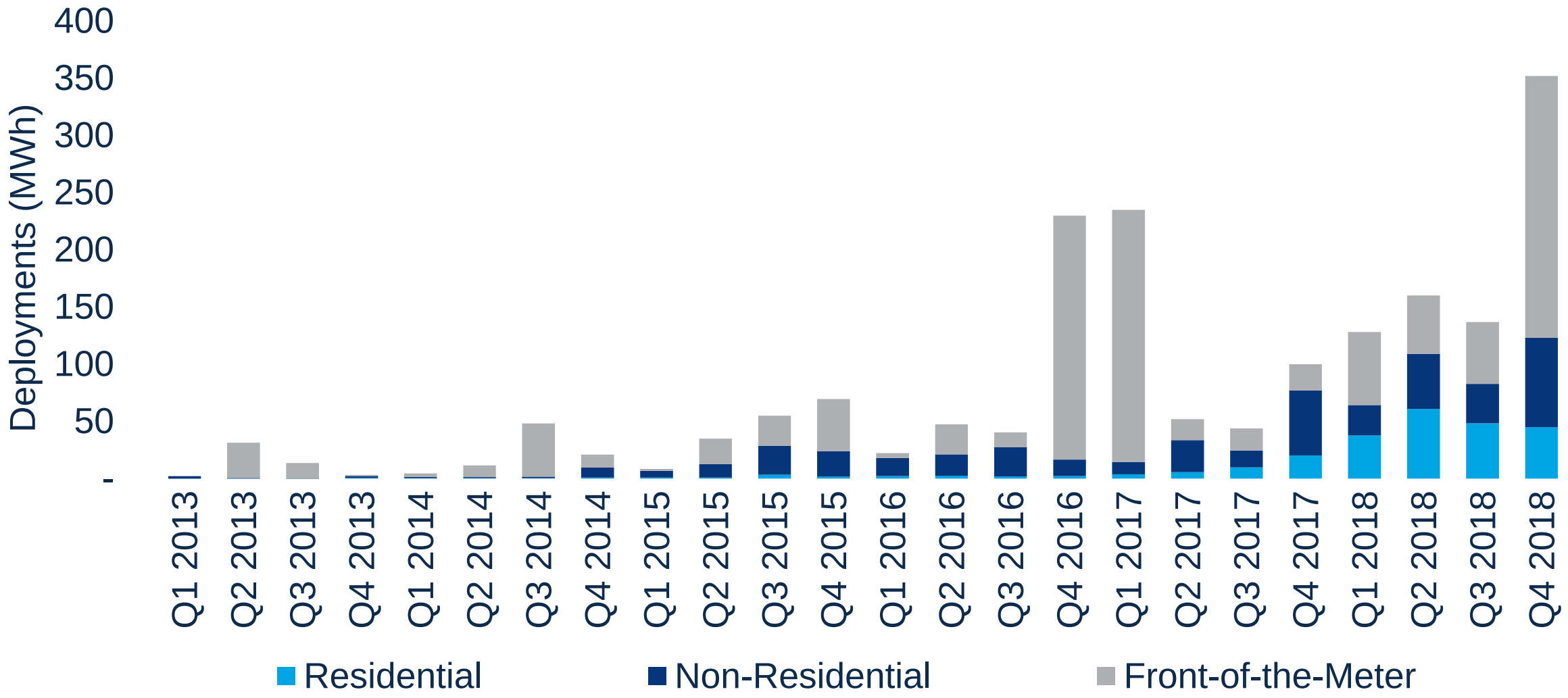
Deployment trends

U.S. 2018 deployments in megawatts rose 44% from 2017



Source: Wood Mackenzie Power & Renewables

777 MWh of storage deployed in the U.S. in 2018, growing 80% from 2017



Source: Wood Mackenzie Power & Renewables

Top energy storage markets 2018

California leads across all segments, Hawaii jumps into top three for FTM

Top 3 markets by segment in Q3 2018 (power capacity)

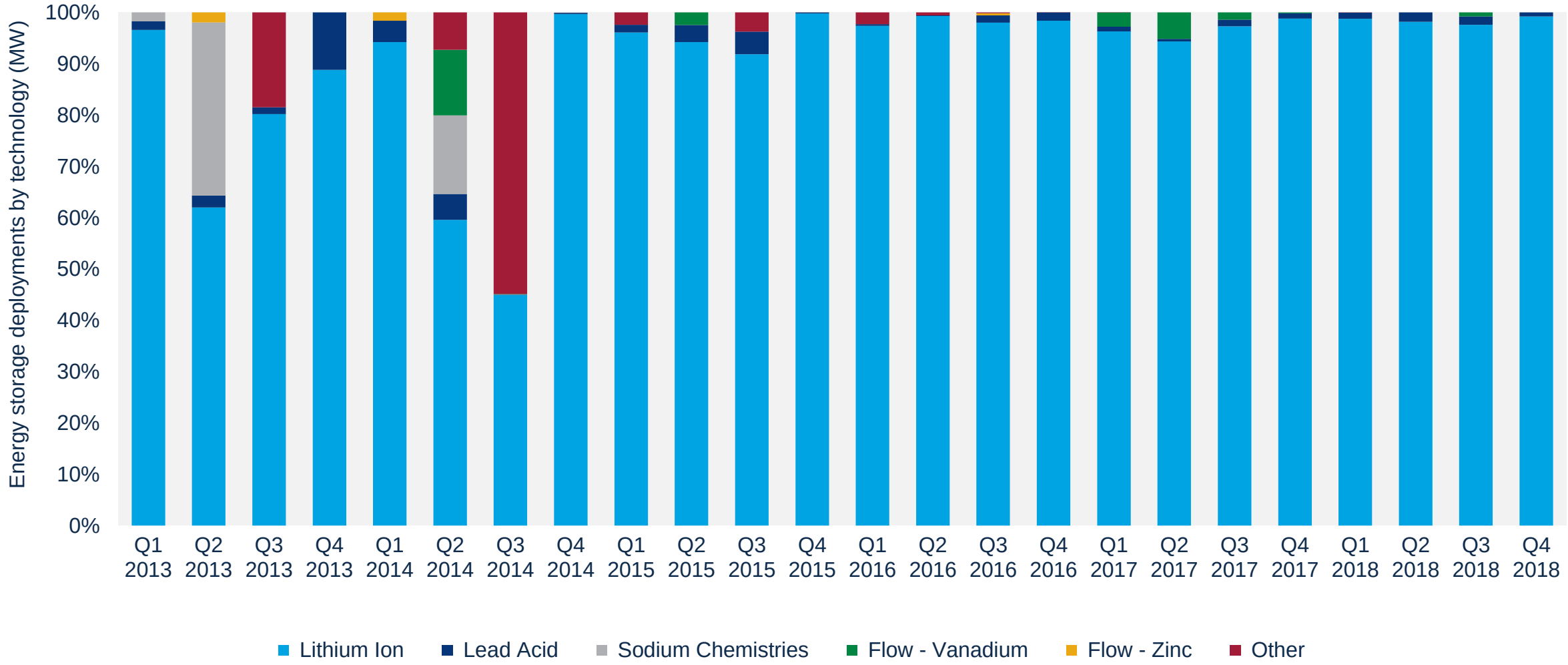
Rank	Residential	Non-residential	Front-of-the-meter
1	California	California	California
2	All Others	Hawaii	All Others
3	Hawaii	New York	Hawaii

Source: Wood Mackenzie Power & Renewables

Note: Wood Mackenzie Power & Renewables is currently monitoring 10 individual markets: Arizona, California, Colorado, Hawaii, Massachusetts, Nevada, New Jersey, New York, PJM and Texas

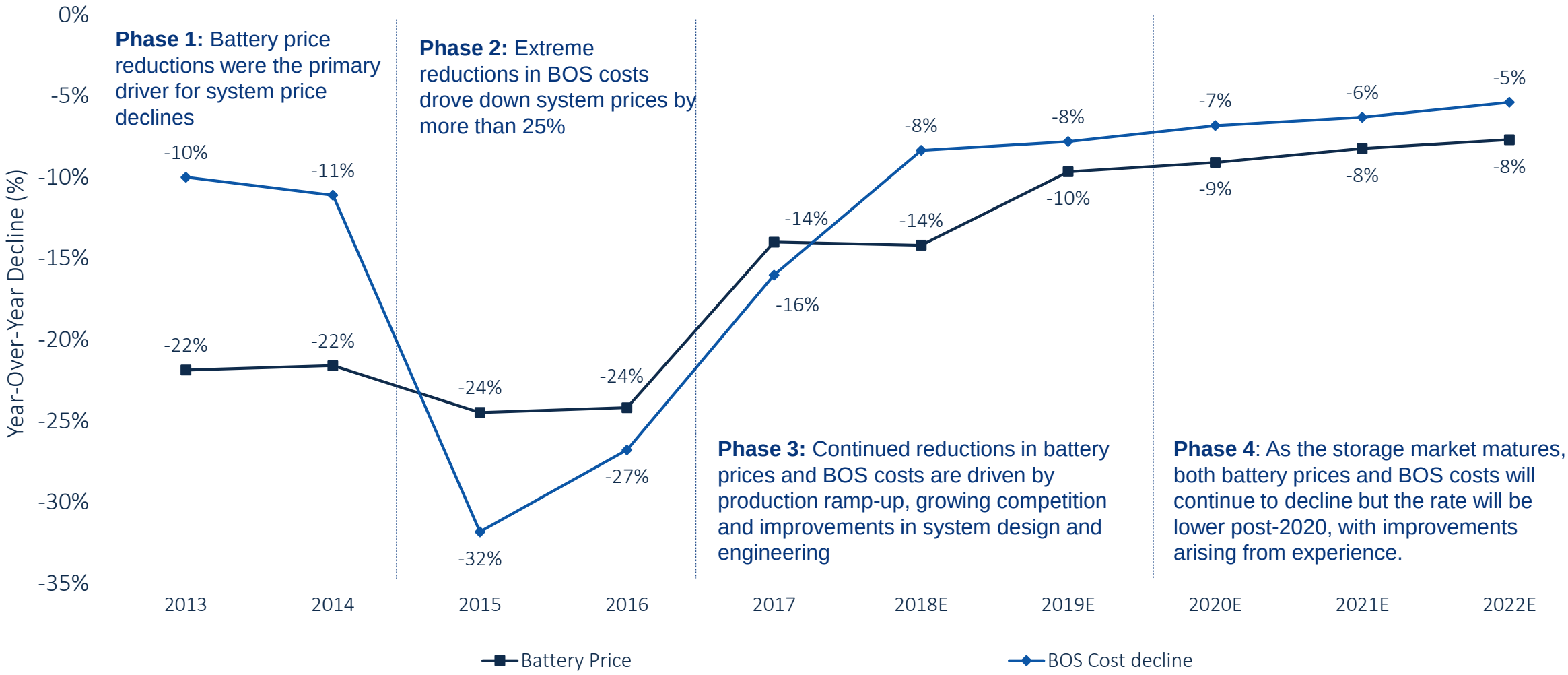
Technology and Price trends

Lithium-ion batteries dominate the storage technology mix



* “Other” includes flywheel and unidentified energy storage technologies.
Source: Wood Mackenzie Power & Renewables/ESA U.S. energy storage monitor: 2018 Year in review and Q1 2019

Cost declines leveling off from steep drops but will persist



Phase 1: Battery price reductions were the primary driver for system price declines

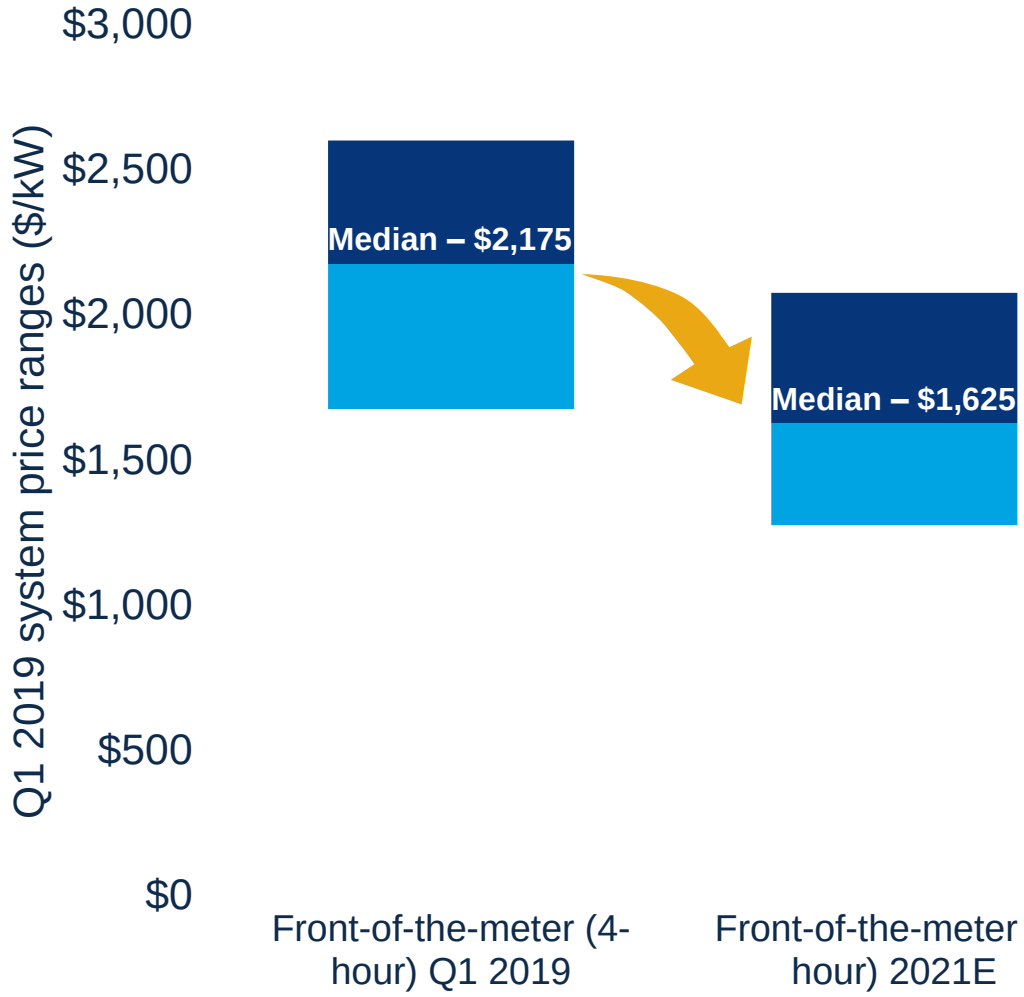
Phase 2: Extreme reductions in BOS costs drove down system prices by more than 25%

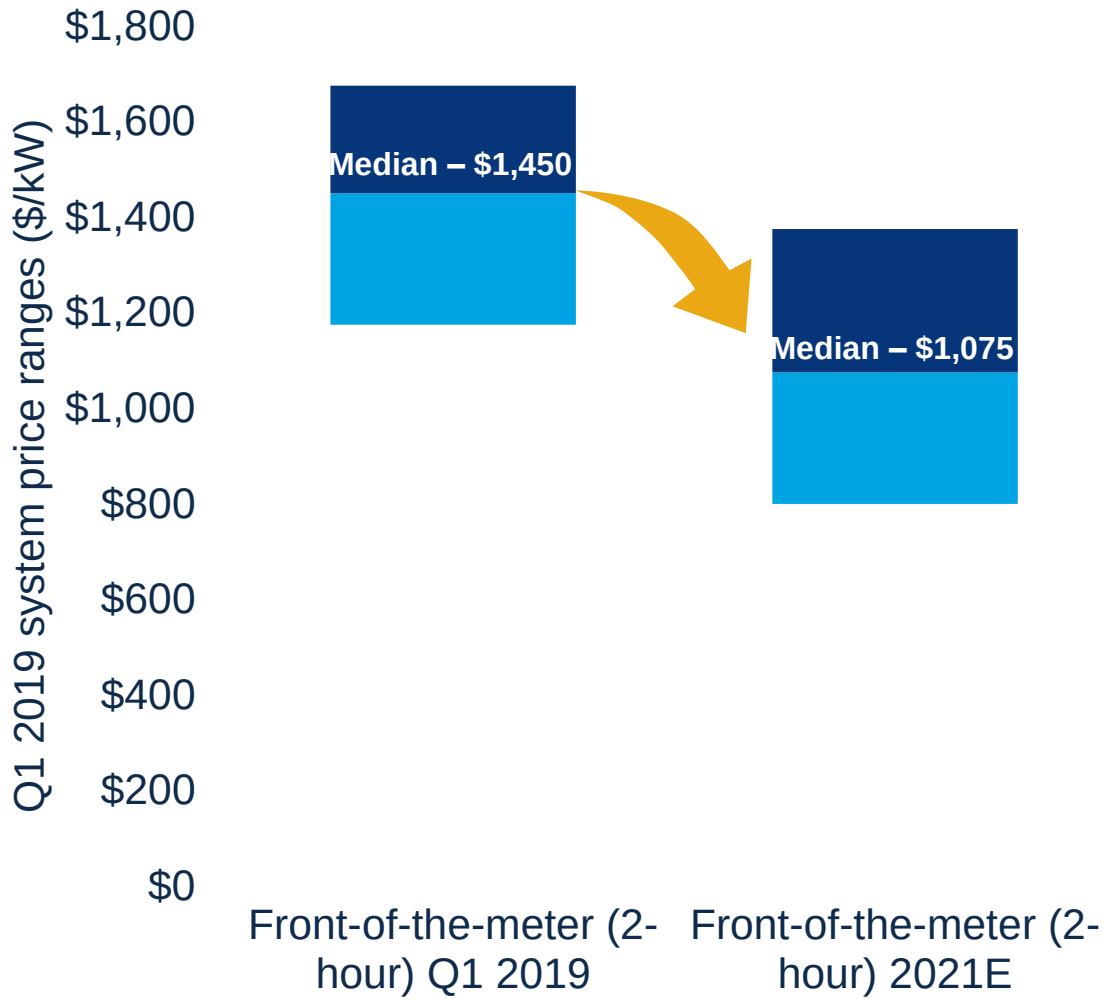
Phase 3: Continued reductions in battery prices and BOS costs are driven by production ramp-up, growing competition and improvements in system design and engineering

Phase 4: As the storage market matures, both battery prices and BOS costs will continue to decline but the rate will be lower post-2020, with improvements arising from experience.

Source: Wood Mackenzie Power & Renewables

Front-of-the meter storage system prices set to decline by 25% by 2021





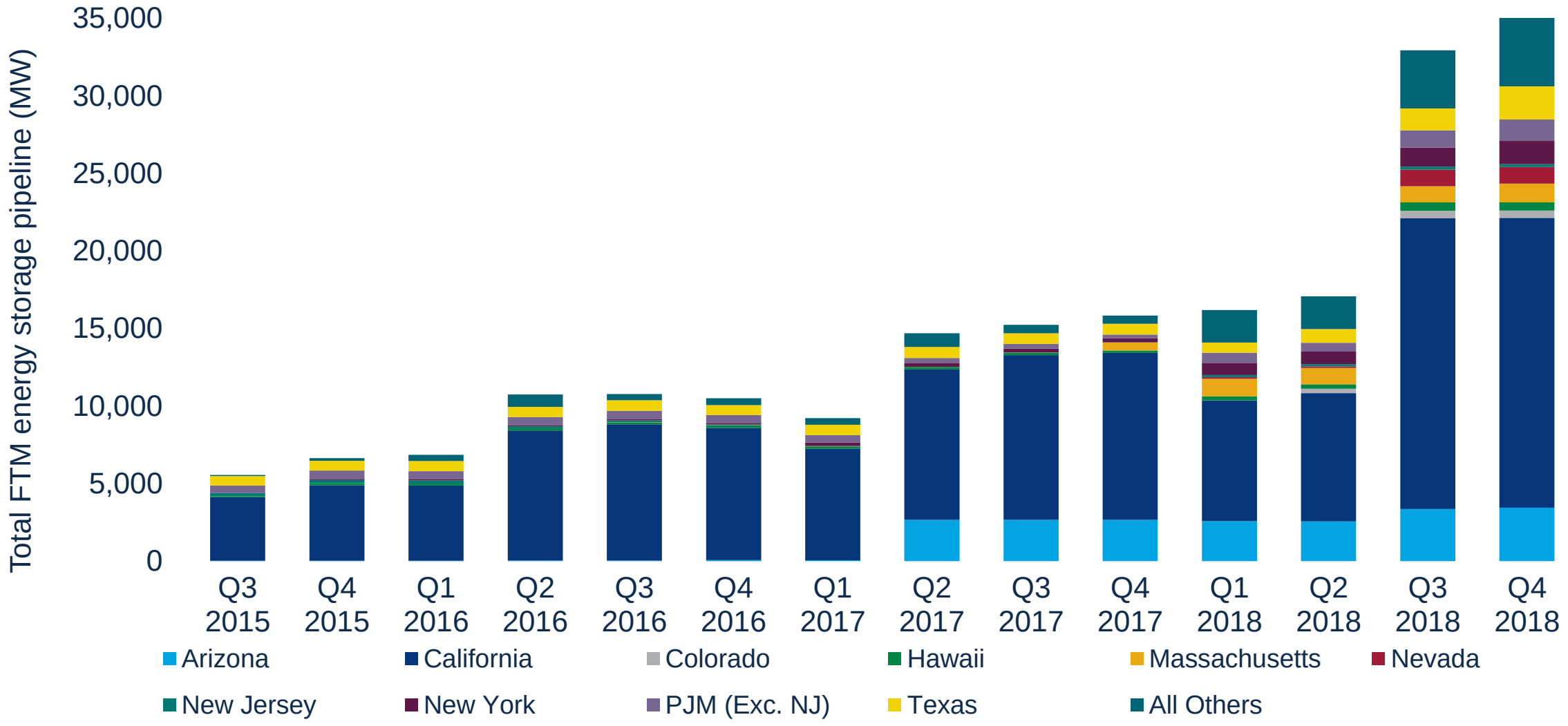
Source: Wood Mackenzie Power & Renewables/ESA U.S. energy storage monitor: 2018 Year in review and Q1 2019

Behind-the-meter system prices have significant room for soft cost reductions

Source: Wood Mackenzie Power & Renewables/ESA U.S. energy storage monitor: 2018 Year in review and Q1 2019

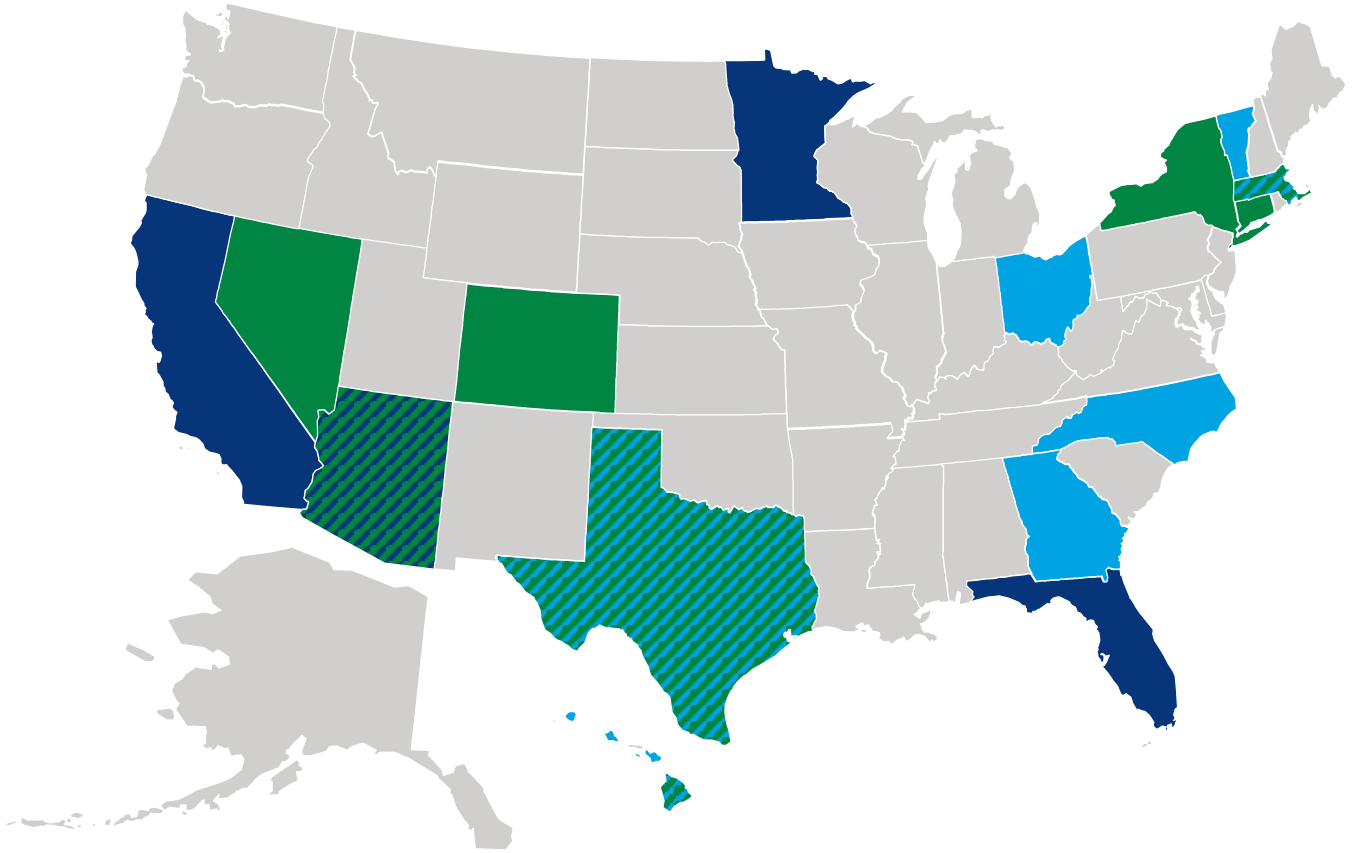
Market drivers

U.S. front-of-the-meter pipeline nearly doubles in the wake of Order 841



Source: Wood Mackenzie Power & Renewables/ESA U.S. energy storage monitor: 2018 Year in review and Q1 2019

Solar-plus-storage deployments driven by utilities in the front-of-the-meter space and incentives behind-the-meter



135 MW of FTM energy storage in the US is solar-paired.

- 6 states (including Puerto Rico) have more than 10 MW of solar-paired storage.
- 6 more have 1 MW or more.
- Eight states have more than 547 MW of solar-paired storage contracted or under procurement

Solar-plus-storage's reach is widening, but much of its value outside incentive states is contingent on the ITC

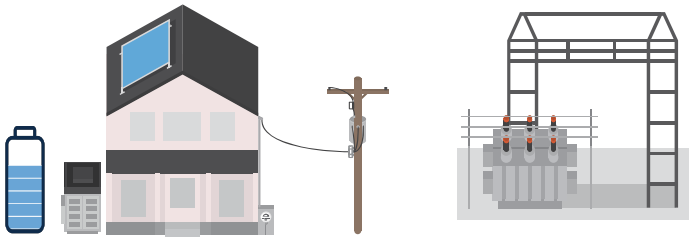
Source: Wood Mackenzie Power & Renewables

Market dynamics affecting behind-the-meter storage growth

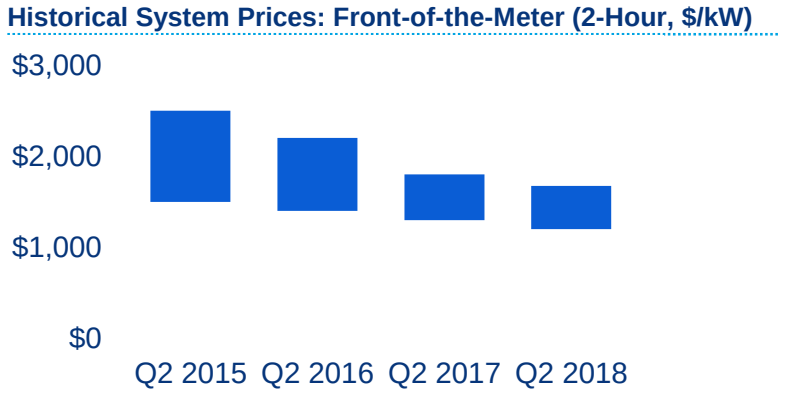
Changing Utility Rate Tariffs

Net-Energy Metering Shifts

Grid Service Opportunities



Declining System Prices



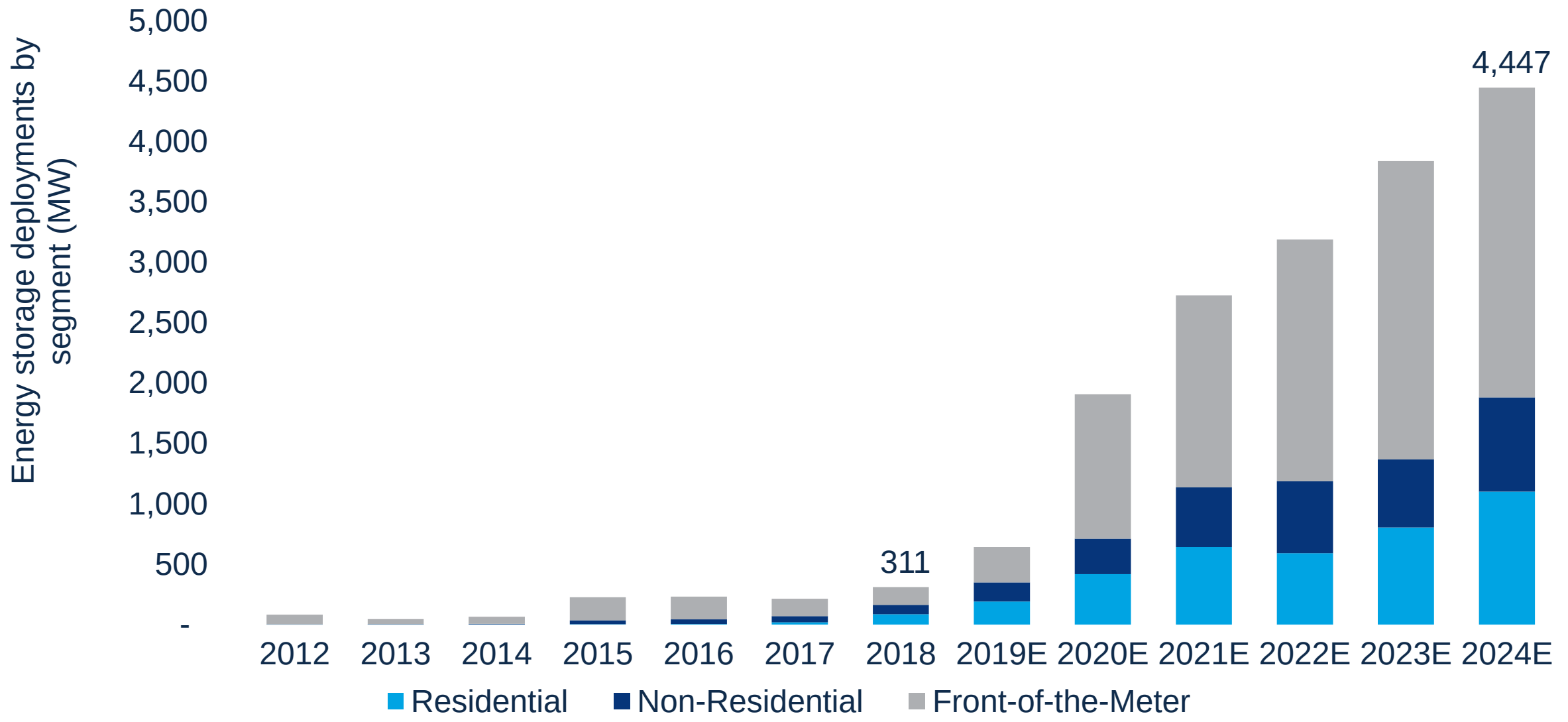
Source: Wood Mackenzie Power & Renewables

Residential storage moved beyond backup in 2018

Entity	Location	Project use case	Residential storage capacity	Timeline
GREEN MOUNTAIN POWER	Vermont	Reduce peak demand	27 MWh when complete (2,000 systems)	Expected completion in H1 2019
Liberty Utilities	New Hampshire	Reduce peak demand	Up to 14 MWh (up to 1,000 systems)	Unclear, first phase (100-200 systems) expected in 2019
sunrun	ISO-NE	Capacity	20 MW solar-plus-storage (5,000 systems)	Installed by 2022
PGE	Oregon	Capacity and ancillary services	14 MWh (525 systems)	TBD (project is proposed, awaiting approval)

Market Outlook

U.S. energy storage annual deployments will reach 4.4 GW by 2024



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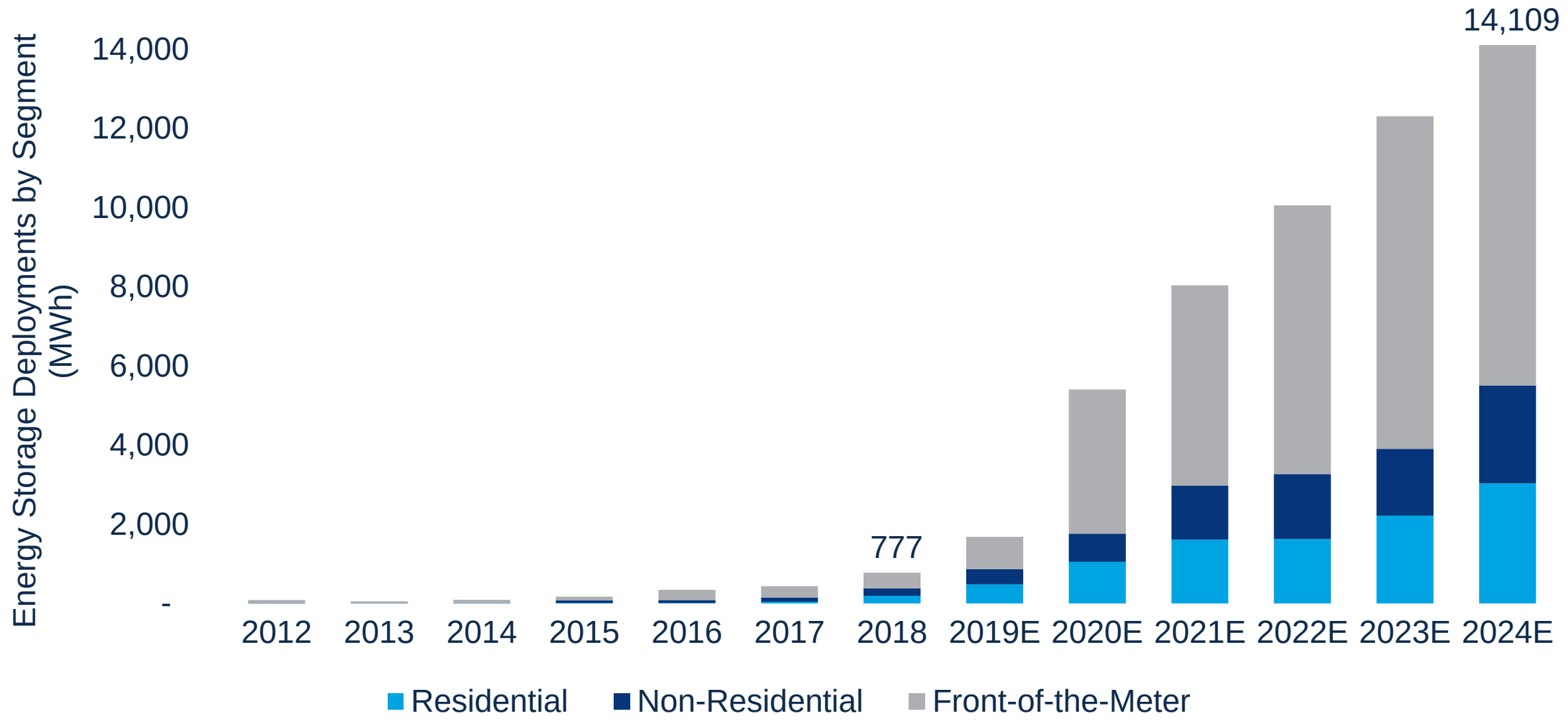
U.S. market will reach nearly 14 GWh in annual deployments by 2024



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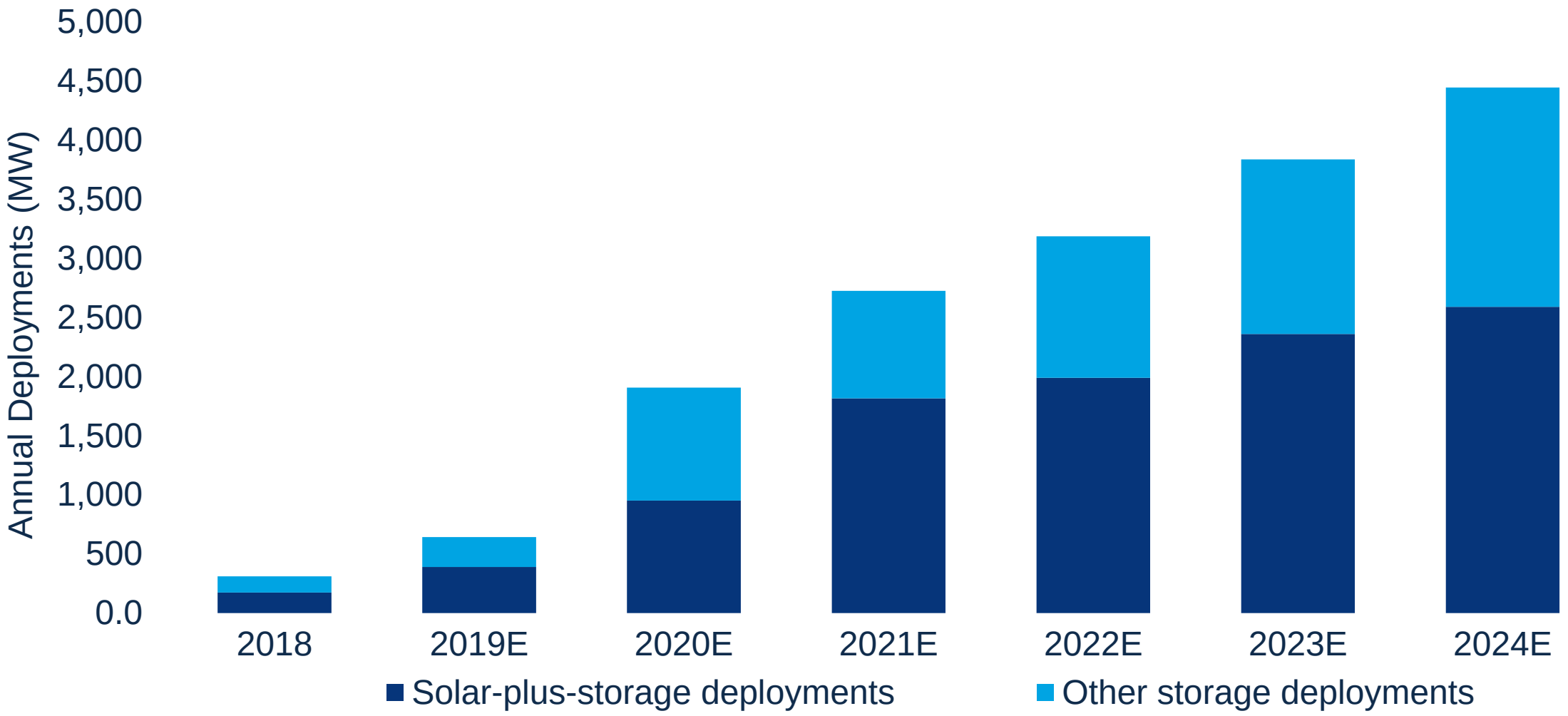
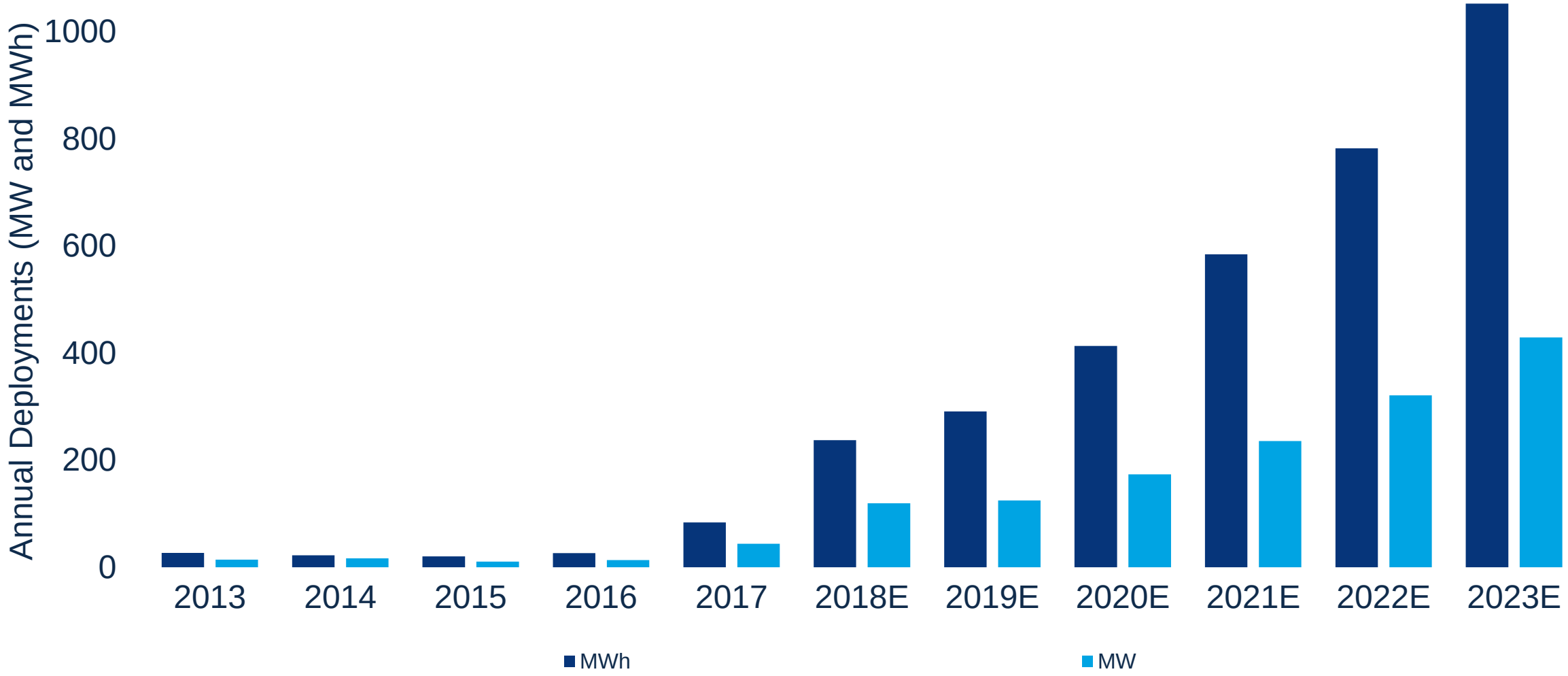
U.S. solar-plus-storage deployments expected to grow by 15x by 2024



Canada will cross 1 GWh annual deployments by 2023



Source: Wood Mackenzie Power & Renewables

Q&A