Charging Ahead on U.S. Storage Markets & Policy

Session: Energy Storage Policy: The International Perspective

Jason Burwen
Vice President of Policy, **Energy Storage Association (USA)**

ESA represents a diverse membership

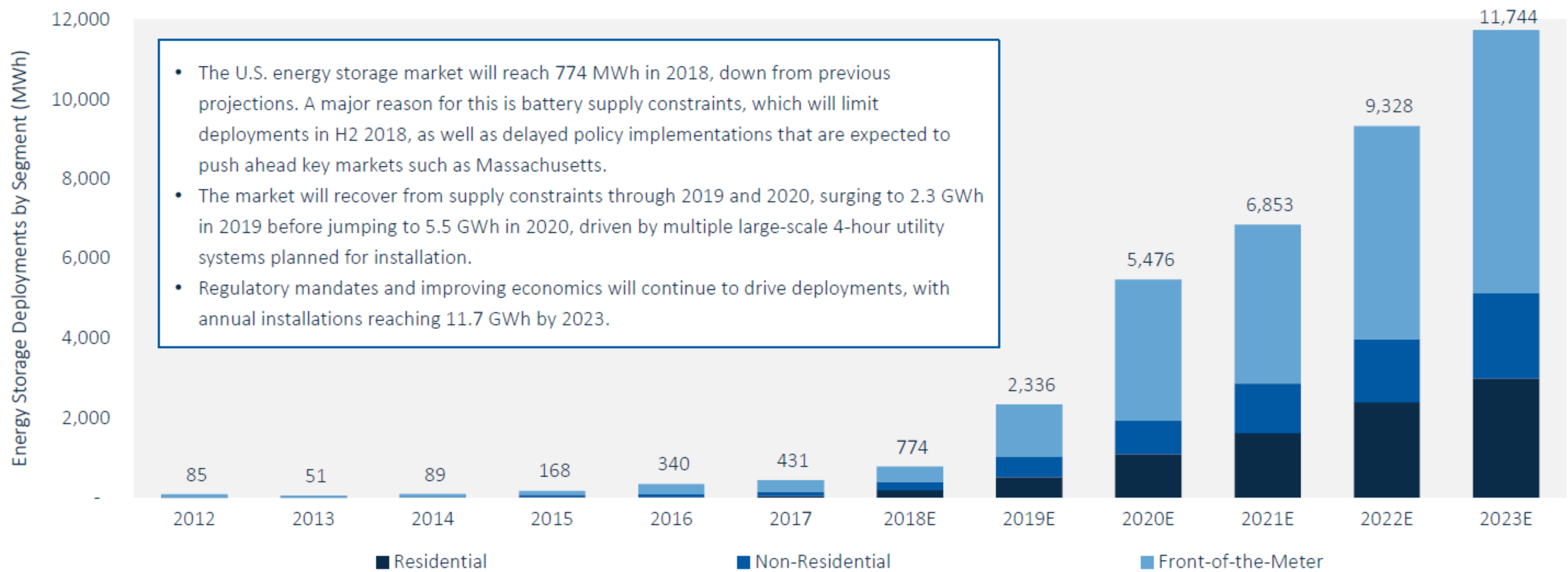
Accelerating the widespread use of competitive and reliable energy storage systems in North America

Diverse membership—vendors, developers, independent generators, utilities & other power sector stakeholders

Federal, regional, & state policy engagement

U.S. market to increase pace of installation

U.S. Annual Energy Storage Deployment Forecast, 2012-2023E (MWh)



Source: GTM Research

Storage bids & contracts now more common

Notable recent utility procurements

- PG&E (California): 568 MW of 4-hr storage proposed (one project 300 MW, 4-hr)
- Xcel (Colorado): 225 MW of 4-hr storage approved
- NV Energy (Nevada): 100 MW of 4-hr storage proposed
- APS (Arizona): 106 MW of storage solicited in RFP

Xcel (Colorado): $30-32/MWh PPAs for 4-hr storage plus solar

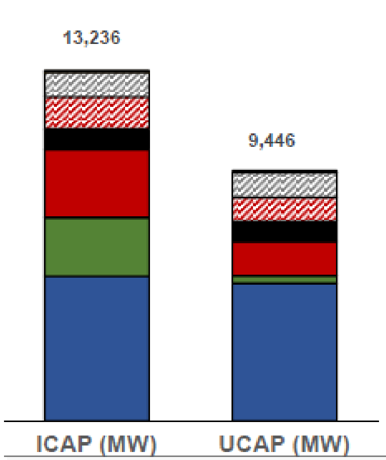
- Received bids for 8-hr and 10-hr storage

RFP Responses by Technology

Generation Technology	# of Bids	Bid MW	# of Projects	Project MW	Median Bid Price or Equivalent	Pricing Units
Combustion Turbine/IC Engines	30	7,141	13	2,466	$ 4.80	$/kW-mo
Combustion Turbine with Battery Storage	7	804	3	476	6.20	$/kW-mo
Gas-Fired Combined Cycles	2	451	2	451	[redacted]	$/kW-mo
Stand-alone Battery Storage	28	2,143	21	1,614	11.30	$/kW-mo
Compressed Air Energy Storage	1	317	1	317	[redacted]	$/kW-mo
Wind	96	42,278	42	17,380	$ 18.10	$/MWh
Wind and Solar	5	2,612	4	2,162	19.90	$/MWh
Wind with Battery Storage	11	5,700	8	5,097	21.00	$/MWh
Solar (PV)	152	29,710	75	13,435	29.50	$/MWh
Wind and Solar and Battery Storage	7	4,048	7	4,048	30.60	$/MWh
Solar (PV) with Battery Storage	87	16,725	59	10,813	36.00	$/MWh
IC Engine with Solar	1	5	1	5	[redacted]	$/MWh
Waste Heat	2	21	1	11	[redacted]	$/MWh
Biomass	1	9	1	9	[redacted]	$/MWh
Total	430	111,963	238	58,283		

NIPSCO (Indiana): average $35/MWh for storage plus solar

- Storage in over 20% of bid capacity



	ICAP*** (MW)	UCAP (est. MW)
Demand Response	70	70
Storage	925	925
Solar + Storage	1,220	902
Wind + Solar + Storage	0	0
Coal	772	772
Solar	2,580	1,291
Wind	2,209	287
Natural Gas (CT)	0	0
Natural Gas (CCGT)	5,470	5,199
	13,236	9,446

Note that totals are on a project basis, which eliminates double counting of multiple proposals for the same facility.

Barriers to deployment that policy can address

Cannot VALUE or compensate storage flexibility

Solutions

Deployment targets

Incentive programs

Tariff/rate design

Wholesale market products

Cost-benefit studies

Unable to COMPETE in all grid planning and procurements

Solutions

Long-term resource planning

Distribution planning

Transmission planning

GHG/renewables standards

Wholesale market rules

Resource adequacy rules

Cannot ACCESS grid or constrained to narrow use

Solutions

Interconnection processes

Multiple-use frameworks

Ownership rules

States storage deployment targets spreading

Nevada:
Study plus target
(process underway)

New York:
1,500 MW x 2025 target
(2030 target TBD)

Oregon:
Min of 10 MWh and max 1% of peak load per utility

Massachusetts:
Target of 200 MWh x 2020 and 1,000 MWh x 2025

California:
1,325 MW x 2020
+ extra 500 MW

New Jersey:
Study plus 600 MW x 2021 and 2,000 MW x 2030 *goal*

Arizona:
3,000 MW x 2030 *(proposed by ACC)*

State storage incentives focus on solar

NEVADA

$10MM solar+storage incentive

CALIFORNIA

$166MM annual SGIP program

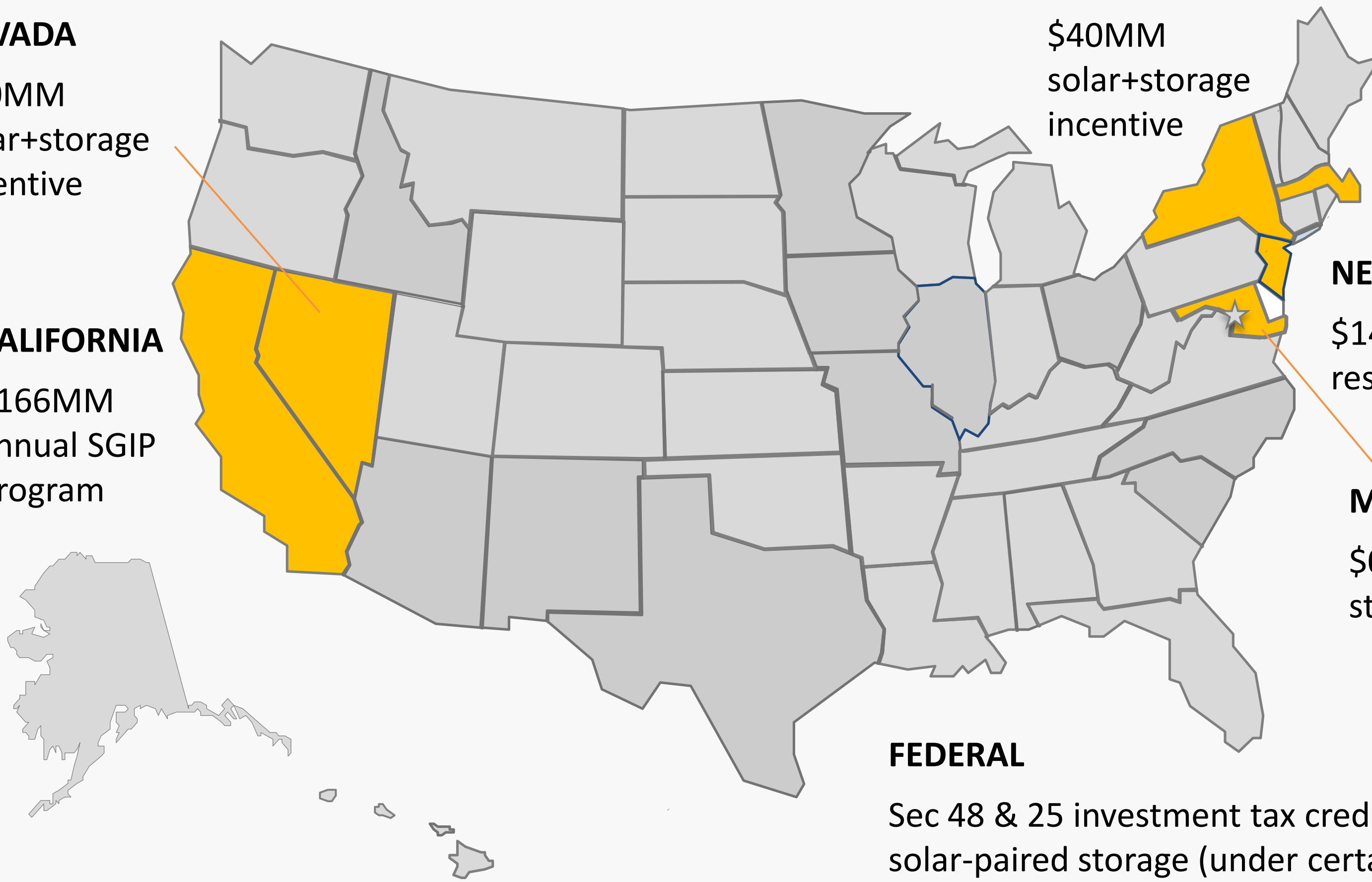
NEW YORK

$40MM solar+storage incentive

MASSACHUSETTS

SMART tariff for solar+storage

Clean Peak Standard (?)



NEW JERSEY

$14MM storage resilience incentive

MARYLAND

$0.75MM/yr storage tax credit

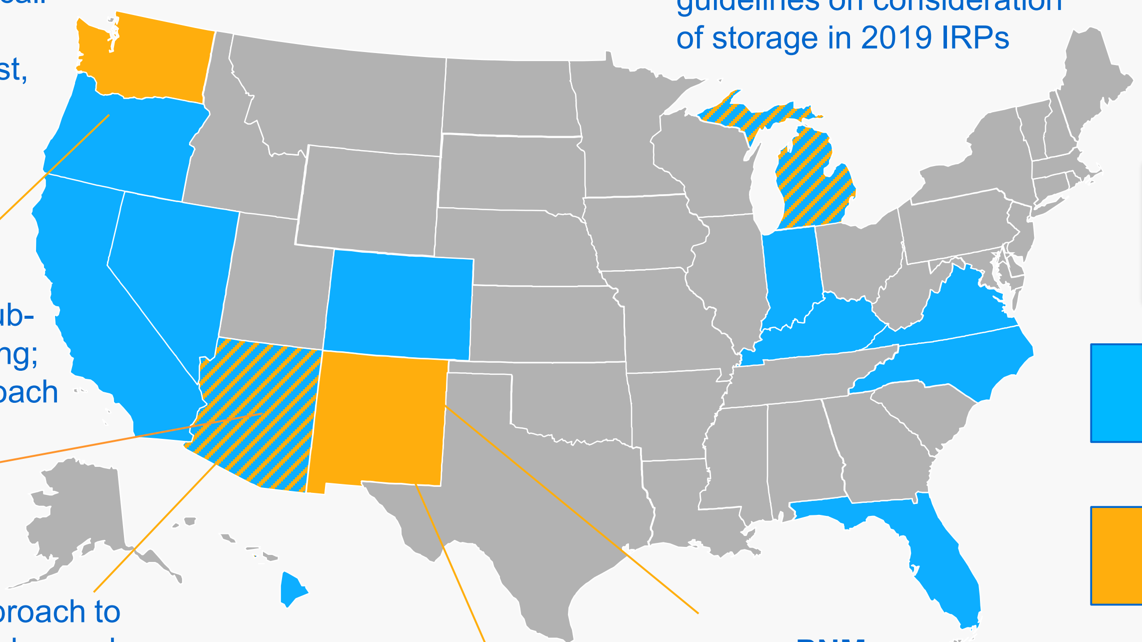
FEDERAL

Sec 48 & 25 investment tax credit for solar-paired storage (under certain conditions)

Storage entering U.S. utility resource planning

Washington: Policy Statement and draft regulations call for sub-hourly modeling, net cost, and

Michigan: PSC issued guidelines on consideration of storage in 2019 IRPs



IRPs in ~32 states

Utility IRP selected storage

State requires consideration of storage in IRP

PGE: First to use sub-hourly modeling; net cost approach

Arizona: Regulators rejected utility IRPs, called for evaluation of storage

APS: Novel approach to modeling demand resources

New Mexico: Revised IRP rules to require consideration of energy storage

PNM: Utility employed novel LOLE approach to capture flexibility needs

States updating DER storage interconnection

- **Making Refinements to Already Good Standards**
  - California
  - Hawaii
- **First Update Included Most Storage Needs**
  - New York
  - Nevada
  - Arizona (not final yet)
- **Exploring Storage Concepts**
  - Maryland
  - Minnesota
  - North Carolina
  - Colorado
- **Getting Ready to Start**
  - Michigan

Federal Energy Regulatory Commission (FERC) updates to wholesale markets

The Past

- **Order 890 – non-generator resources in energy & ancillary services markets**
- Order 719 – comparable treatment of demand response in all market products
- Order 745 – compensation of demand response in wholesale markets
- **Order 755 – pay for performance (speed, precision) in frequency regulation**
- Order 784 – 3rd party provision of ancillary services
- Order 819 – frequency response bilateral markets
- Order 825 – 5 minute settlements & shortage pricing

The Future

- **Policy Statement PL17-2 – multiple-use storage as transmission & generation**
- **Order 841 – storage participation models in all markets**
- **Order 845 – interconnection reforms for co-locating resources**

FERC Orders 841 and 845

Order 841: RTOs/ISOs must establish a "participation model" for storage

- Eligible to provide all capacity, energy, and ancillary services that resource is technically capable of
- Account for the physical and operational characteristics through bidding parameters
- Minimum size requirements do not exceed 100 kW
- Pay wholesale LMP for charging energy, with specific accounting/metering needed for DER storage
- Currently pending requests for rehearing, focused on DER issues

Order 845: RTOs/ISOs must revise interconnection agreements/processes to enable tailored service

- Allow interconnection below rated capacity
- Allow use of surplus interconnection service outside of queue
- Should expedite co-location of storage with large wind/solar
- Currently pending requests for rehearing

Other recent U.S. wholesale market activities

MISO

Established Energy Storage Task Force

Updating capacity accreditation of storage

Instituting AGC enhancement

Discussing storage-as-transmission

SPP

841 jumpstarting discussion

ISO-NE

Filed Enhanced Storage Participation model

CAISO

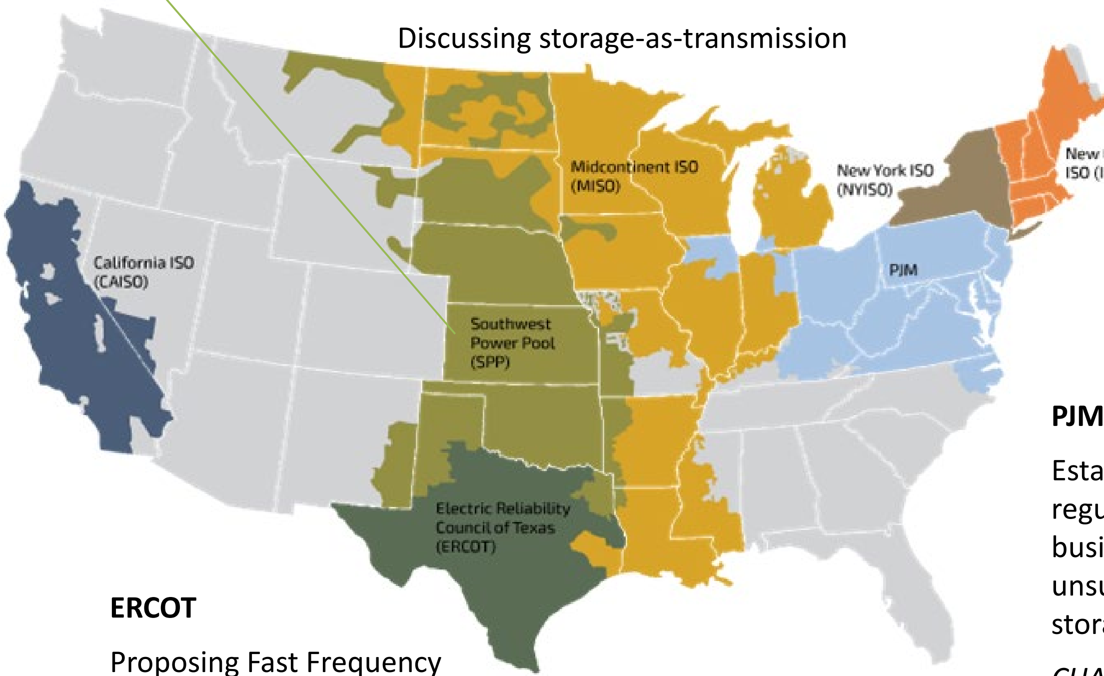
Flexible capacity (ramping) construct

Flexible resource adequacy construct

Enabled BTM storage participation

Discussing storage-as-transmission

Aligning with CA state policy (GHGs, storage target, etc)



NYISO

Planning carbon pricing

Aligning with state policy (REV, storage target, etc)

CHALLENGE: Capacity accreditation

PJM

Established fast frequency regulation market (1st business case for unsubsidized battery storage worldwide)

CHALLENGE: Capacity accreditation

ERCOT

Proposing Fast Frequency Reserve product

U.S. Congress and Administration may play role

Positive Developments

- Bipartisan legislation for a federal investment tax credit for energy storage
- New and pending IRS guidance on tax treatment of storage
- Increasing public sector storage R&D investments
- Interest in storage for infrastructure resilience
- Courts defend authority of state policy supports over FERC rules

Negative Developments

- Uncertainty over tariffs
- Federal efforts to bail out incumbent generators in wholesale markets
- Lack of meaningful power sector emission policies
- Continuing legislative deadlock

- **States will be primary drivers of near-term policy that accelerates storage deployment in the U.S.**
- **FERC/wholesale market activity moving slower but setting longer-term foundations.**

ENERGY STORAGE POLICY FORUM
ENERGY STORAGE ASSOCIATION

5th Annual Energy Storage Association Policy Forum

February 13, 2019 | Washington, D.C.

ESA ENERGY STORAGE
29TH ANNUAL CONFERENCE & EXPO

29th Annual Energy Storage Association Conference & Expo

April 16-18, 2019 | Phoenix, AZ

ENERGYSTORAGE STUDIO

2019 Energy Storage STUDIO

October 15-16, 2019 | Bellevue, WA

Thank you

Jason Burwen
j.burwen@energystorage.org

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