An Introduction to Energy Storage for Virginia Localities

DECEMBER 10, 2020

WELCOME! WE WILL BEGIN SHORTLY

ENERGY TRANSITION INITIATIVE AT UVA

UNIVERSITY of VIRGINIA | Weldon Cooper Center for Public Service

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Welcome to the webinar:

An Introduction to Energy Storage for Virginia Localities

DECEMBER 10, 2020

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WELCOME

Elizabeth Marshall

Senior Project Coordinator

Energy Transition Initiative

Weldon Cooper Center for Public Service University of Virginia

emm2t@virginia.edu

www.energytransition.coopercenter.org

ENERGY TRANSITION INITIATIVE AT UVA

HOUSEKEEPING

- Webinar is being recorded and will be made public after the event
- Participants are in listen-only mode
- Please use Q&A tab for questions
  - Send to “All Panelists”
  - We will have Q&A at the end
  - Unanswered questions will be addressed following the webinar

NAVIGATING WEBEX

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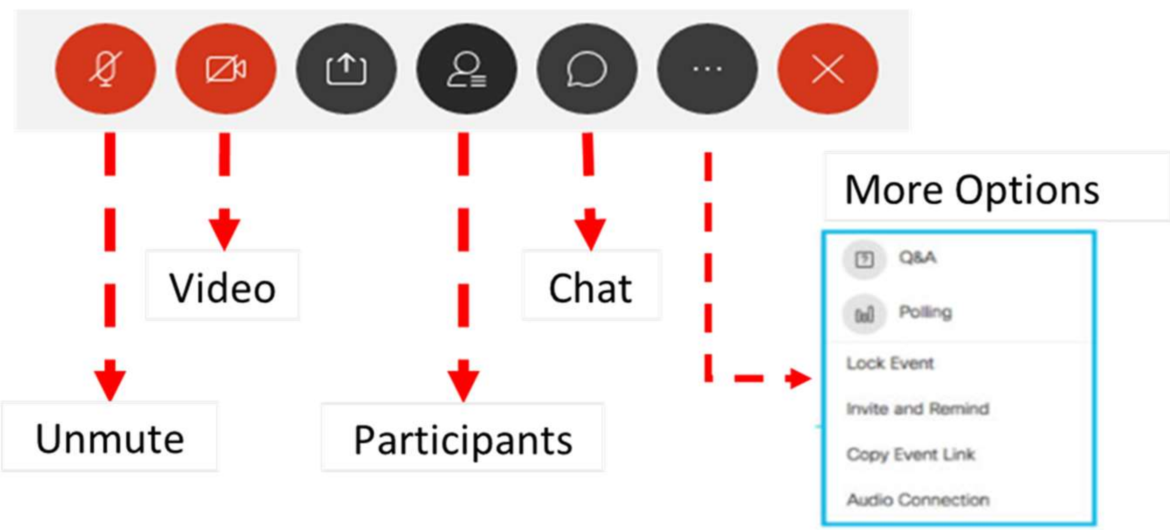
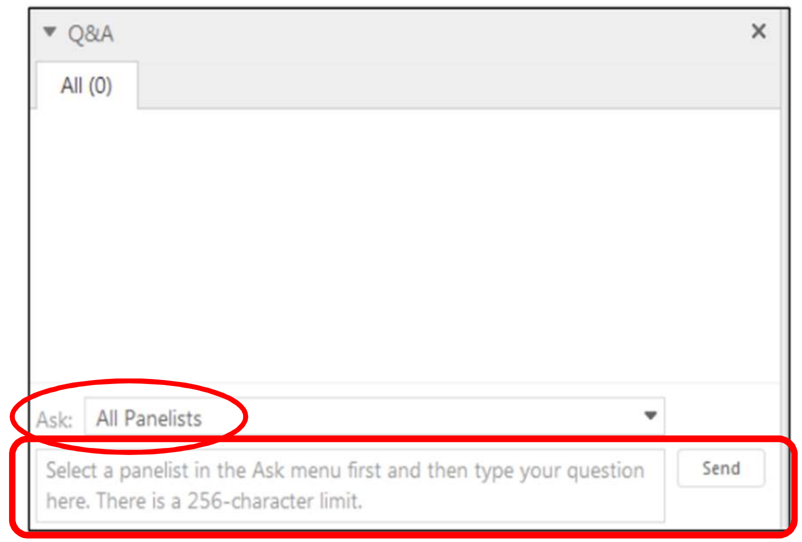


Q&A Panel on the right :



AGENDA

2:05-2:10pm **Ken Jurman**, State Policy Supporting Energy Storage in Virginia

2:10-2:20pm **Ben Lowe**, Perspective on U.S. Energy Storage

2:20-2:35pm **Sam Lines**, Energy Storage Project Development

2:35-2:50pm **Cliona Robb**, Energy Storage Issues for Local Governments in Virginia

2:50-3:00pm Q&A Moderated by **Diane Cherry**

3:00pm Resources and Closing Notes

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Carrie Hearne

Solar Program Manager

Department of Mines, Minerals and Energy

Email: carrie.hearne@dmme.virginia.gov

INTRODUCTION:

STATE POLICY SUPPORTING ENERGY STORAGE IN VIRGINIA

Ken Jurman

Renewable Energy Program Manager

Department of Mines, Minerals and Energy

Email: ken.jurman@dmme.virginia.gov

DMME Virginia Department of Mines Minerals and Energy

State Policy Supporting Energy Storage in Virginia

KEN JURMAN

VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

Existing Storage Deployment

- **Dominion Energy**
  - Bath County Pumped Hydro Storage – 3,003 MW
- **Appalachian Power**
  - Smith Mountain Lake Pumped Hydro – 636 MW
  - Byllesby-Buck Hydroelectric Plant – 4 MW (used for frequency regulation)

Current Laws

Virginia Solar Energy Development and Energy Storage Authority (2015)

- Facilitate, coordinate, and support the development of the solar energy and energy storage industries
- Facilitate the increase of solar and energy storage projects on public and private sector facilities
- Promote the growth of the Virginia solar and energy storage industries
- Provide a hub for collaboration between public and private stakeholders to partner on solar and energy storage projects; and
- Position Virginia as a leader in research, development, commercialization, manufacturing, and deployment **of energy storage technology**.

Current Laws

New Pumped Hydro Storage and Renewable Energy

- Dominion Energy Authorized to petition the State Corporation Commission (Virginia's PUC) for approval of one or more pumped hydro generation and storage facilities
- Specifies on or off-site renewable energy resources as all or a portion of their power source
- Renewable facilities and associated resources must be located in the coalfield region of Southwest Virginia

Current Laws

Grid Transformation and Security Act (2018)

- Established an Energy Storage Pilot Program
  - Appalachian Power – 10 MW
  - Dominion Energy – 30 MW

Current Laws

Southwest Virginia Energy Research and Development Authority (2019)

- Formed to promote opportunities for energy development and to create jobs and economic activity in Southwest, and to position Southwest Virginia and the Commonwealth as a leader in energy workforce and energy technology research and development.
- **Supporting the development of pump storage hydropower in Southwest Virginia and energy storage generally**

2020 Legislation

- **HB 1183** - State Corporation Commission to create a task force to evaluate the regulatory, market, and local barriers to deployment of distribution and transmission-connected storage resources to help:
  - integrate renewable energy into the electrical grid
  - reduce costs for the electric system
  - allow customers to deploy storage to reduce their energy costs, and
  - allow customers to participate in electricity markets for energy, capacity, and ancillary services

2020 Legislation

- **SB 632 – Energy Storage In the Public Interest**
  - Declares that utility construction of energy storage facilities in the Commonwealth having an aggregate capacity not to exceed 2,700 megawatts, **is in the public interest.**
  - At least 35 percent of the storage capacity must be through 3rd party PPAs
  - All storage subject to competitive procurement, except under certain conditions

2020 Legislation

- **SB 851/HB 1526 – Virginia Clean Economy Act**
  - Requires APCo to construct or acquire 400 MW
  - Requires Dominion Energy Virginia to construct or acquire 2,700 megawatts of energy storage capacity
  - At least 35% of such energy storage capacity must be procured from third-party owned resources through PPAs.
  - **Goal** of 10% behind the meter
  - Must be completed by 12/31/2035

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PERSPECTIVE ON U.S. ENERGY STORAGE

Benjamin Lowe
Project Manager
Roland Berger

Member, Board of Directors
Energy Storage Association (ESA)

Email: ben.lowe@rolandberger.com

Perspective on Energy Storage

Overview

December 2020

We are a global top-5 strategy consulting firm with extensive experience across all industries and functional issues

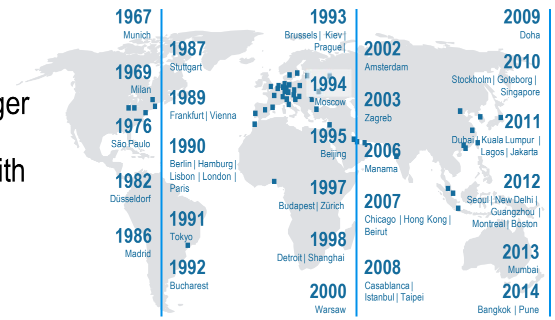
Our profile

Created in 1967
in Germany by Roland Berger

50 offices in 34 countries with
2,400 employees

Over 220 Partners

~1,000 international clients



International position

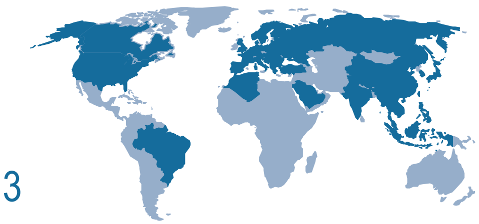
2020
Market position
in the strategy segment

Germany # 3

Core markets in Western Europe # 3

Growth regions China and Russia/CEE # 2

World # 5



Our values

Entrepreneurship
We follow an entrepreneurial approach and provide creative and pragmatic solutions

Excellence
We achieve excellent results and develop global Best-practices to ensure measurable and sustainable success

Empathy
We are insightful and responsible advisors who contribute to the greater good

We serve …

… **The largest** international companies: **30%** of the Global 1000

… **The most dynamic** and innovative mid-size companies

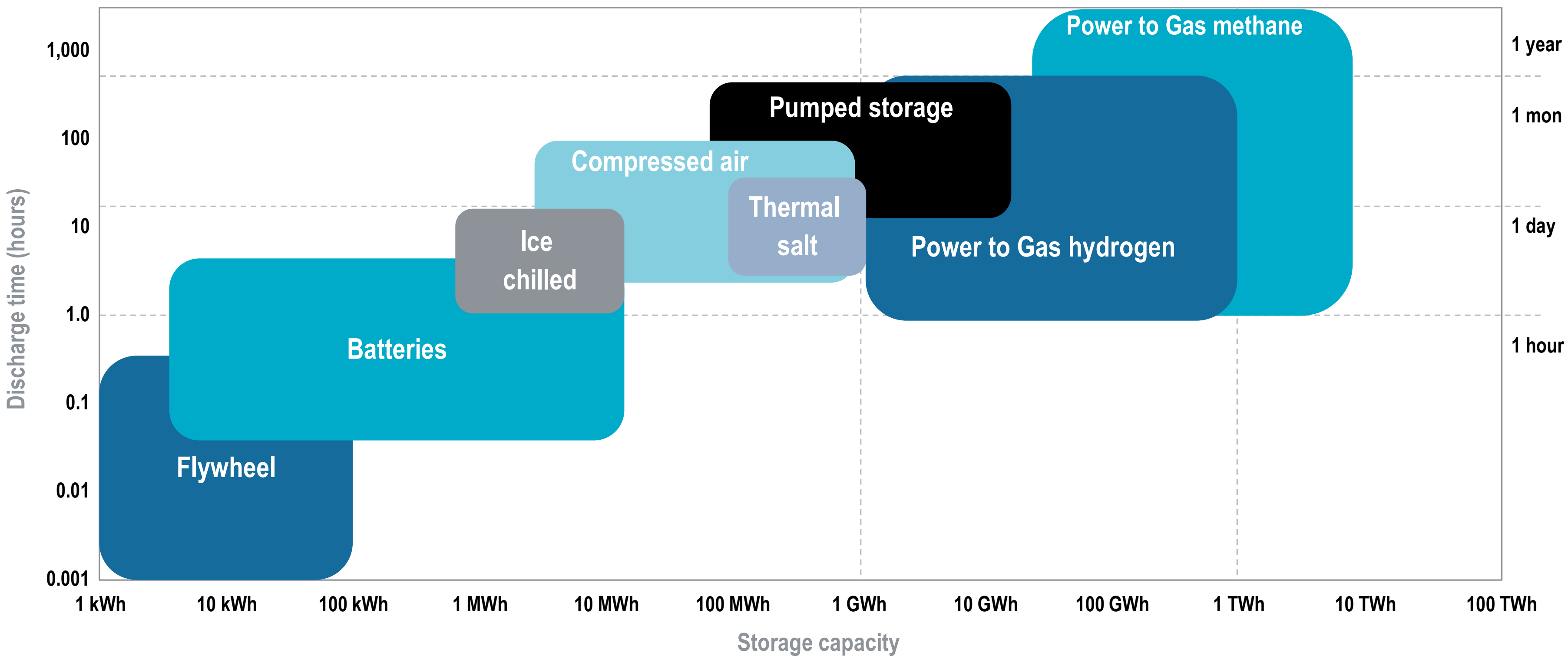
… **Governments** about to deregulate and privatize

Extensive experience

Source: Roland Berger

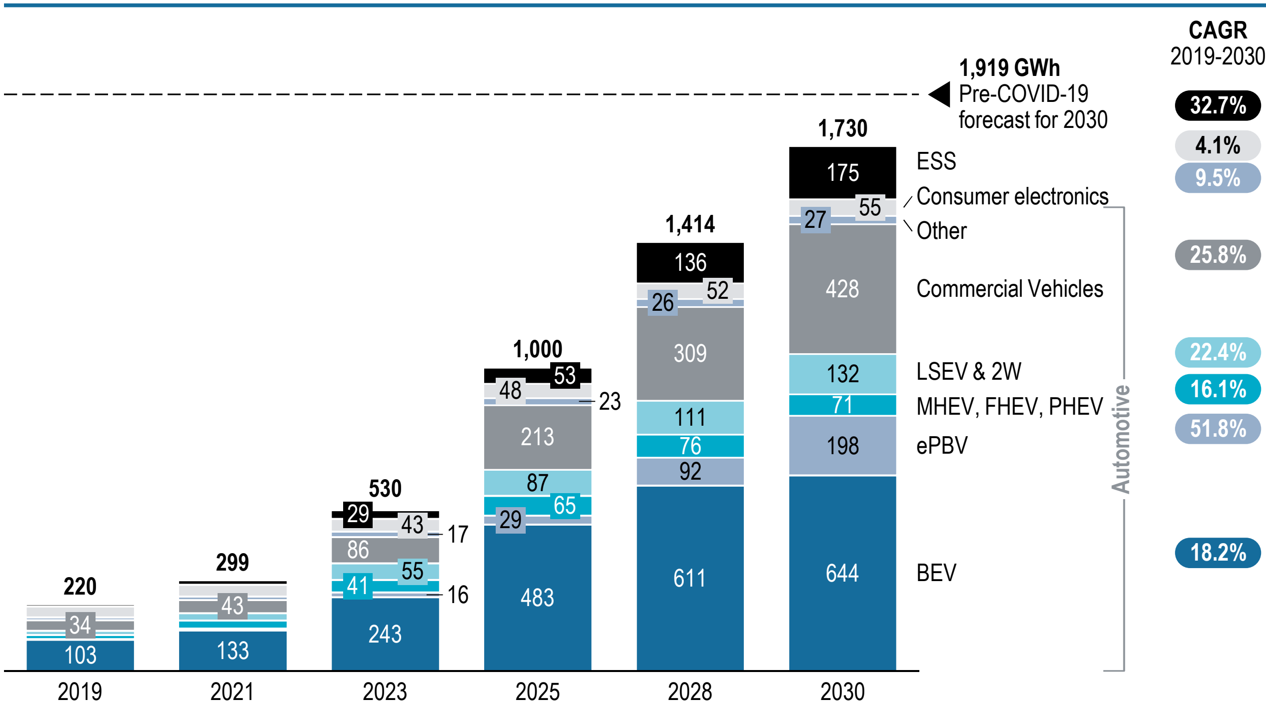
While Lithium-ion batteries have attracted the most attention, there is a broad variety of storage technologies for different durations

Alternative storage system configuration (duration and capacity comparison)



Even after CoVid-19, Automotive is major driver for LiB-demand, that is expected to grow rapidly to more than 1,700 GWh in 2030

Market demand for LiB by application [GWh]



> Due to the long lasting economic effects of COVID-19 the global LiB market is not expected to recover on pre-crisis forecast levels until 2030 but the automotive industry will still account for the majority of the global LiB demand in future
  - Passenger vehicles are expected to increase share of global demand
  - In the passenger vehicle segment, BEV are driving the growth with a CAGR of 18.2% 2019-2030
  - Commercial vehicles (CV) to stand for a significant share of the demand in 2030
  - Other applications such as consumer electronics currently constitute a large share but will be small compared to automotive going forward

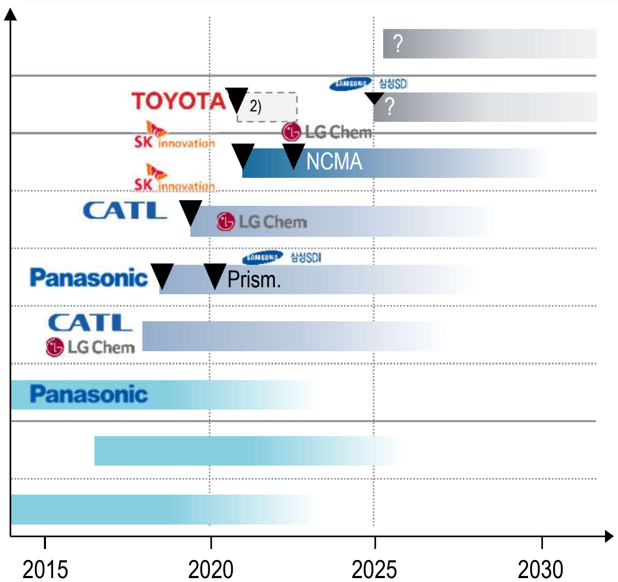
Abbreviations: ESS – Stationary Energy Storage Systems; LSEV – Low Speed Electric Vehicle; 2W – Electric Two Wheelers; MHEV, FHEV, PHEV – Mild Hybrid, Full Hybrid and Plug-in Hybrid Electric Vehicle; PBV – Purpose Built Vehicle; BEV – Battery Electric Vehicle
Source: Avicenne; Fraunhofer; Interviews; Roland Berger

Technology progress towards Ni-rich materials and Solid-State after 2025 can reduce costs to $70-80 / kWh

(NCM 811 base-line used for comparison)

LiB Technology roadmap: Further significant increases in energy density expected

Anode	Electrolyte	Cathode	Volumetric energy density[1] [Wh/L]
Li-Metal[3]	Solid (Oxide or Sulfide)	Ni- or Mn-rich	>1000
	Solid (Sulf.)	Ni- or Mn-rich	800-1000
Graphite/ Silicon[4]	Liquid	Ni-Rich: NCM910, NCM90-5-5, NCMA	700--900
		NCM811	600-700
		Advanced NCA (<3.4% Co)	700-800
		NCM622	350-500
		NCA	600-700
Graphite	Liquid	NCM523	220-400
	(or "Solid" - Polymer)	NCM111	220-250



First serial application in vehicles

- > From 2019/2020 move towards NCM811. LG Chem, SKI, CATL to be first
- > JM will commercialize NCM811 with Cobalt-coated nanoparticles with similar behavior like NCM622 (CamX licence)
- > Majority of volume might switch directly to Ni-rich from 2023ff, first applications from 2021.
- > More Si in anode, higher volumetric energy density Ni-Rich and advanced production processes reduces cost by 10-15% until '25
- > LFP chemistry allows using C2P designs, as well as very large round-cells (44xxx instead of 21700)

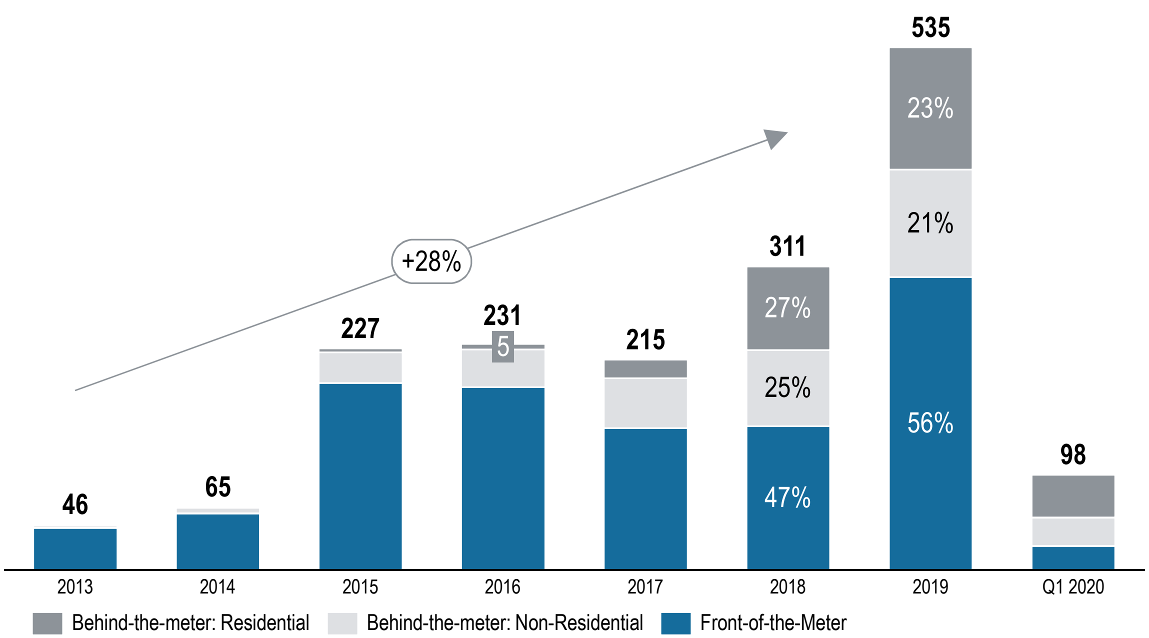
Advanced Technologies

- > NMx; NCM217 (BASF Toda), cycle-life challenges
- > Solid state: Manufacturability, contact issues and dendrites are major challenges
- > Hi-Si anodes - Super-fast charging (>10C)
- > CTP-technologies to increase energy density on system level

1) Stacked electrodes 2) First prototypes 3) Foil or deposited 4) Typically blends of different cathode chemistries and specifically adapted anode chemistries.
With major change of cathode material usually graphite is used first only (Cathode and anode are typically not changed at the same time). Additional increase of energy density requires Si-additives on anode side (up to 20%)
Source: Expert interviews; Roland Berger "Total Battery Cost and Price Model"

Energy storage deployments have been growing at 28% CAGR, dominated by front of the meter projects

Annual energy storage deployments in the US [2013 – 2020, MW]



> Front of the meter (FTM) applications comprise roughly half of the deployments in the past couple of year
  – Between 2013 and 2020, FTM installations have grown 6x
  – Massachusetts, Hawaii and New York are the leading states for FTM installations

> Behind the meter applications in both residential and non-residential sectors have been slowly growing over time
  - California, Hawaii, Arizona and New York have seen the most installations

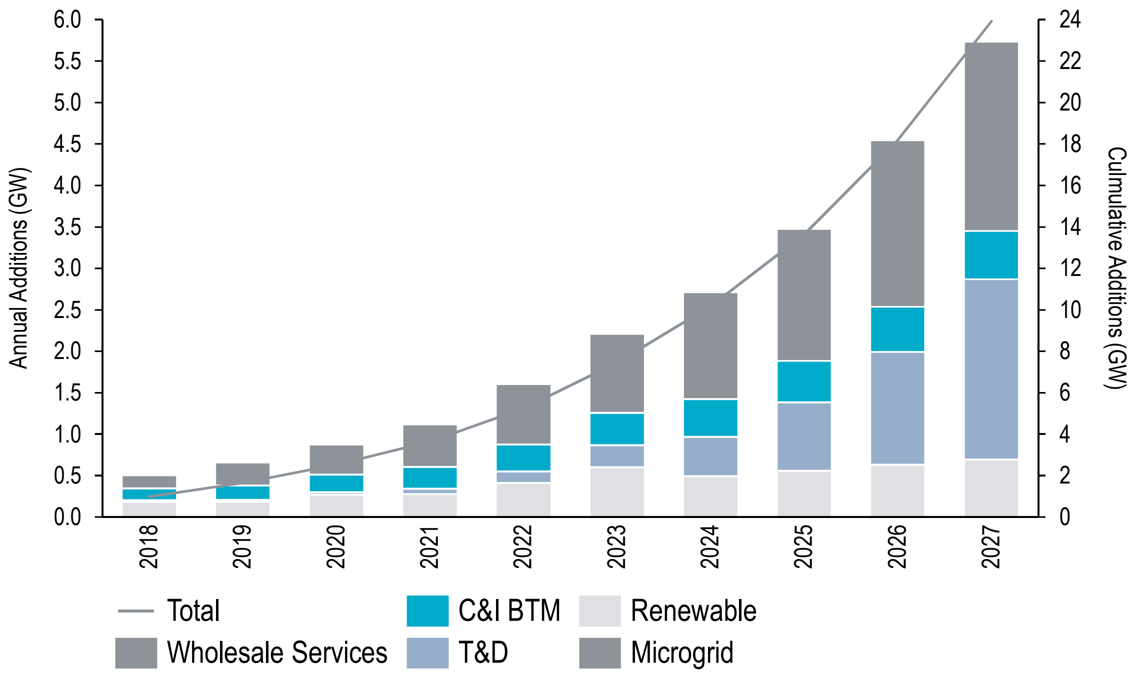
> Growing share of "hybrid" storage installations, paired with wind and PV
  - Decline on net metering and desire for resilience driving residential storage
  - RTO concern with high RE penetration driving FTM hybrid storage

Source: "Wood Mackenzie Power Renewables/ESA U S energy storage monitor" 2020, Roland Berger Analytics

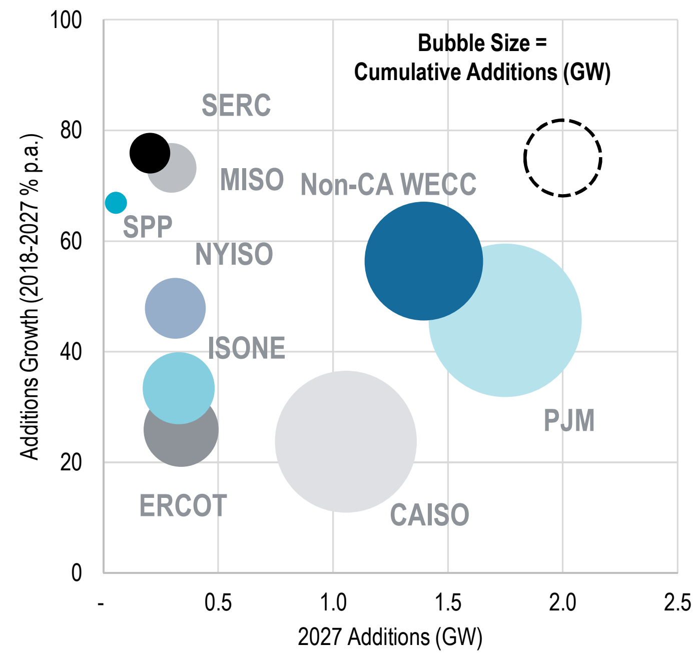
ESS deployment is expected to accelerate across multiple regions with large renewable installations and favorable policy

North American Energy Storage Market Outlook

Annual & Cumulative Additions, 2018-2027 [GW]



ISO – Cumulative Additions vs Growth



Many industry players have migrated from wind to solar and storage

Illustrative

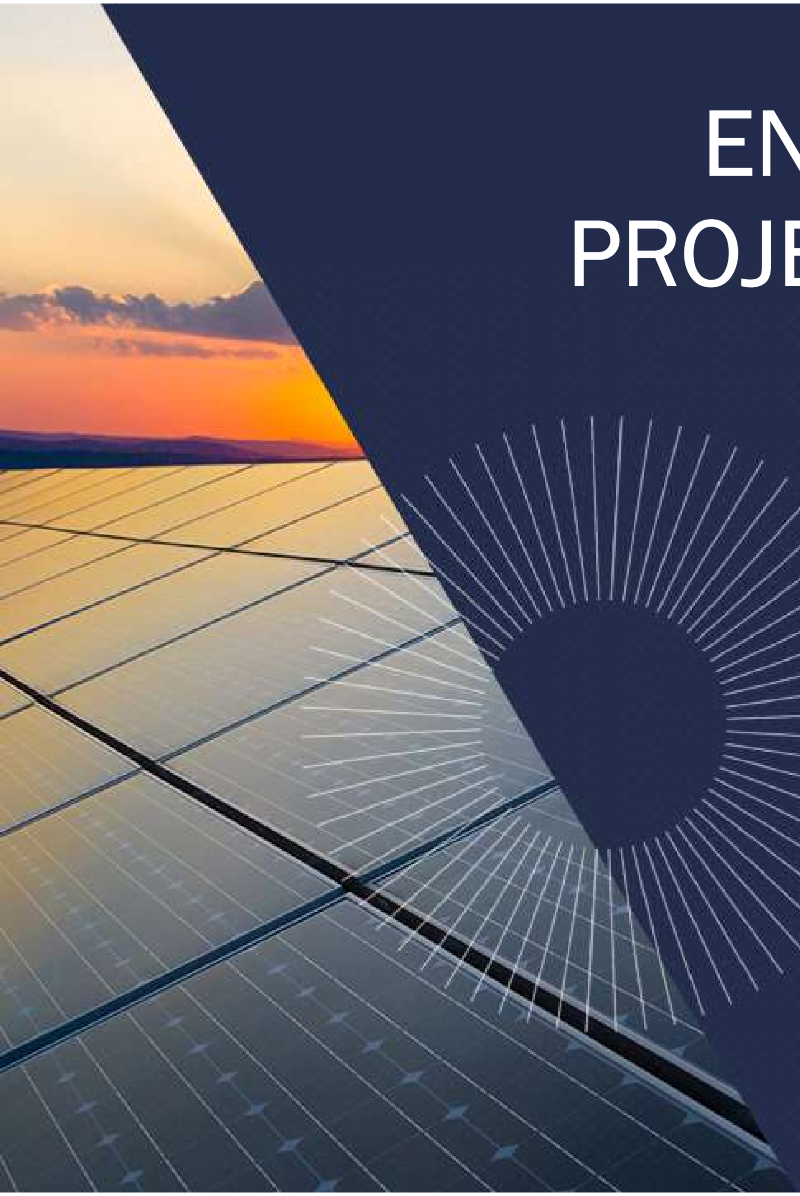
Illustrative list of key storage players

Estimated Cost of Capital: Low → High

	Company	Business Model	Wind Assets Development | Operation	Solar Assets Development | Operation	Storage Assets Development | Operation	Regional Focus	Own & Operate
Privately Held	Invenergy	Private company (52% owned by CDPQ – a Canadian pension fund), develops renewables and gas gen, transmission secondary	4.5 GW | 3.2 GW	367 MW | 490 MW	50 MW | 64 MW	National	✓
Privately Held	res power for good	Develops, builds, operates and owns centralized and distributed energy generation, storage and T&D assets	730 MW | 233 MW	344 MW | 157 MW	300 MW | 21.8 MW	Global, National in the US	✓
IOUs	NextEra Energy Resources	Subsidiary of NextEra. Renewables, conventional generation and competitive transmission	7.6 GW | 1.0 GW	3.6 GW | 0.6 GW	700 MW | 20.4 MW	National	✓
IOUs	Iberdrola	European utility with large American renewable presence	0 GW | 6.4 GW	0 GW | 0.1 GW	-	Global National in the US	✓
Developers	Pattern Development	Focused on renewable (wind and solar) generation and related transmission projects. Primarily acts as a developer.	794 MW | 2.2 GW	-	-	Global National in the US	✓
Developers	Geronimo Energy	Midwest based developer of solar and wind assets, sell majority of assets when they are in operation	2.9 GW | 0 GW	714 MW | 0 MW	-	Midwest	

Roland Berger

THINK:ACT



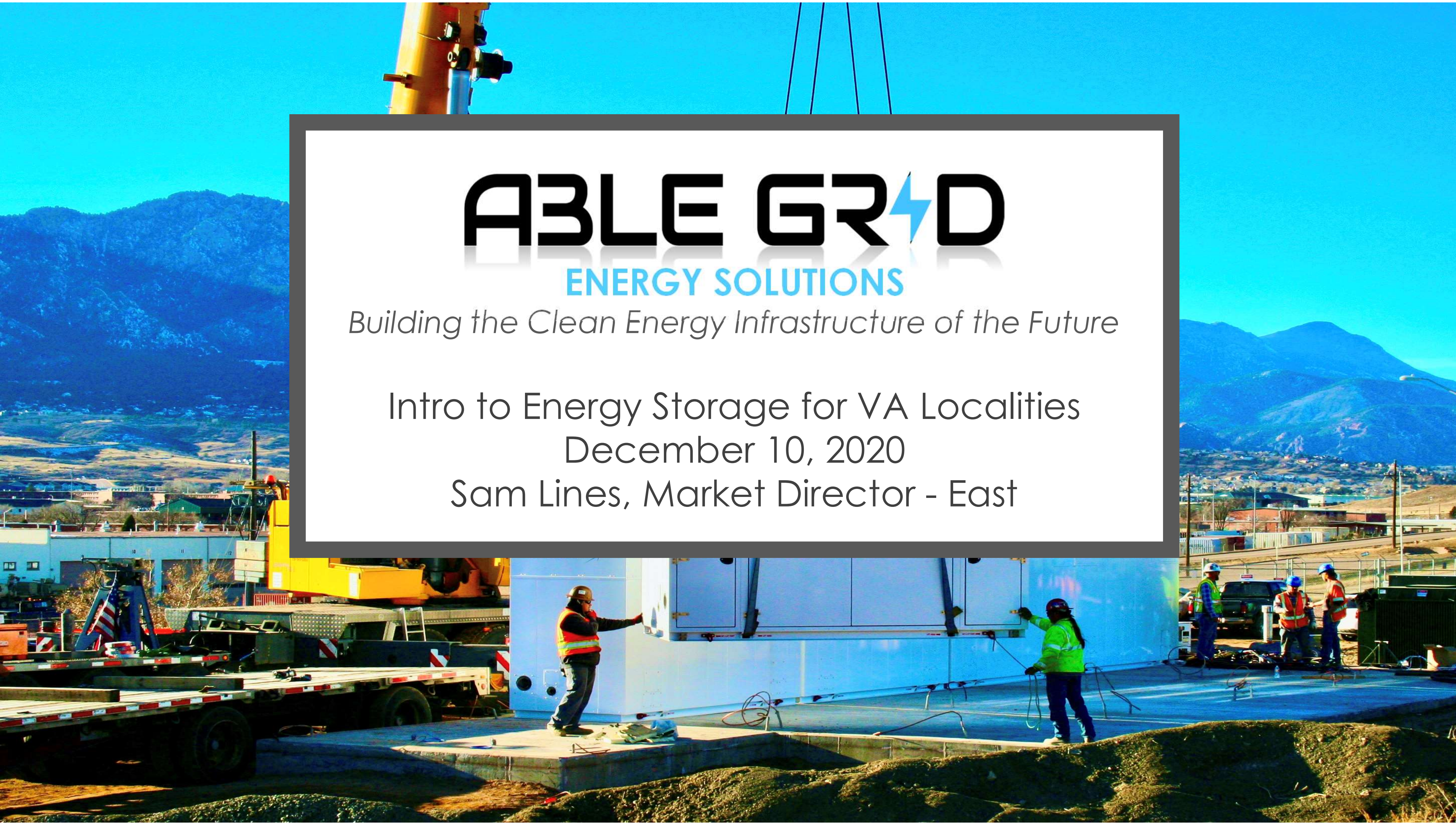
ENERGY STORAGE PROJECT DEVELOPMENT

Sam Lines

Market Director- East

Able Grid

Email: slines@ablegridenergy.com



ABLE GRID ENERGY SOLUTIONS

Building the Clean Energy Infrastructure of the Future

Intro to Energy Storage for VA Localities

December 10, 2020

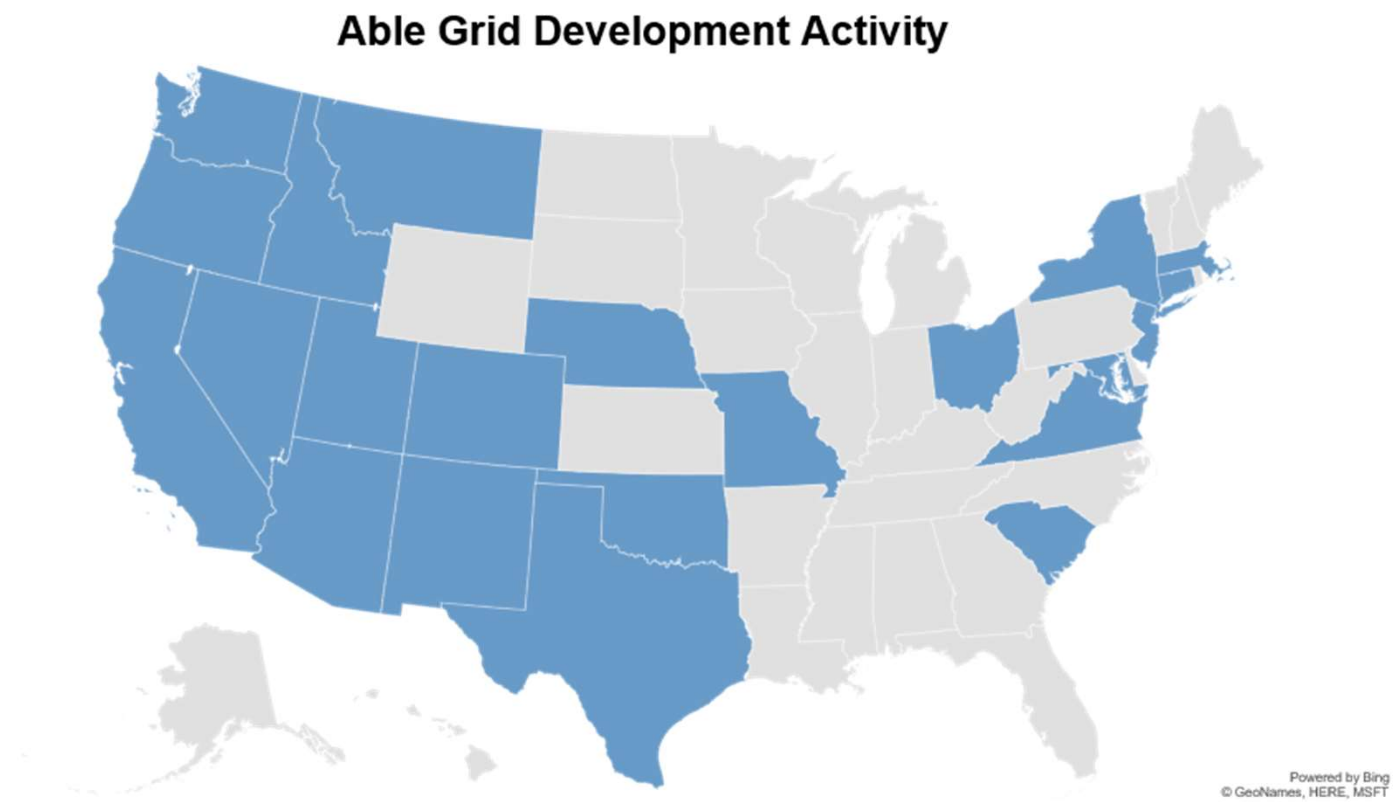
Sam Lines, Market Director - East

Able Grid

Focused on utility scale battery energy storage projects to serve utilities, communities, and corporate customers with solutions for:

- Managing and integrating portfolios of variable renewable energy resources
- Providing emissions free peaking capacity and reliability
- Alternatives and complements to traditional transmission build

Able Grid



Active development pipeline of over 9 GW with median project size of 100 MW

Able Grid – Advanced Developments

<u>2021 Projects</u>

- **Silverstrand Grid** – 11 MW 44 MWh with Southern California Edison Resource Adequacy contract (NWA); financed and under construction

- **Chisholm Grid** – 100 MW project in Texas; financed and under construction

Silverstrand Project

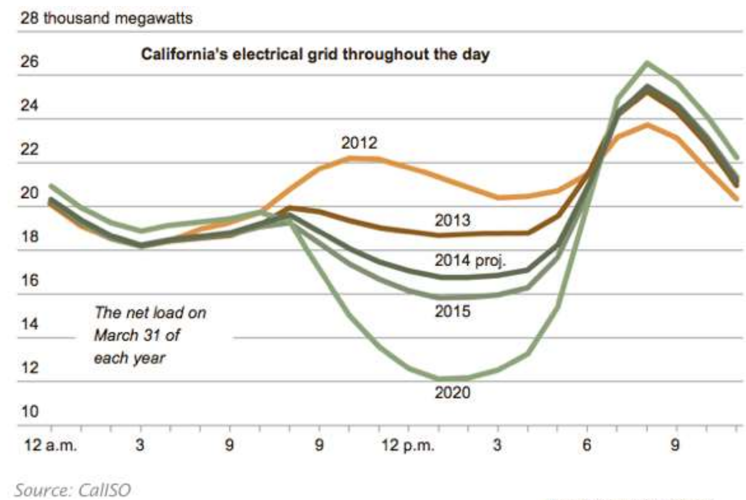
11MW/44MWh - Ventura County, CA

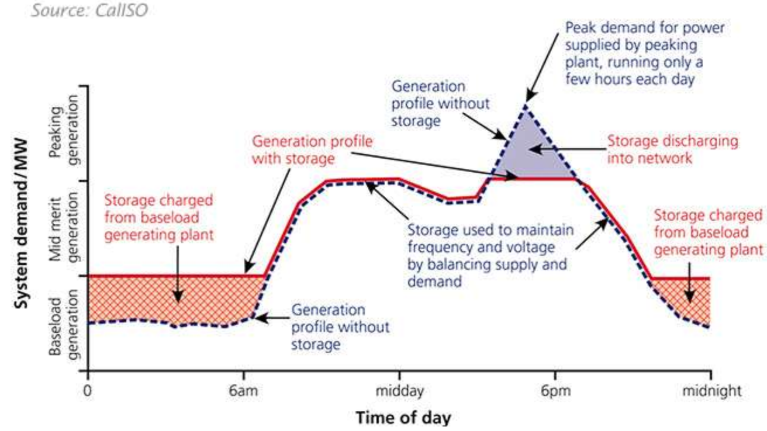
__Value streams__

- **Resource Adequacy** – ensures sufficient local capacity to meet peak conditions and provide resiliency in the case of unexpected demands on the system
- **Energy** – reduces peak energy prices
- **Ancillary Services**
  - **Flexible ramping** – helps to integrate variable production from solar and wind energy
  - **Spinning reserve** – replaces gas peakers as the standby capacity resource
  - **Frequency regulation** – ensures that the grid operates at the optimal frequency

Why Batteries?

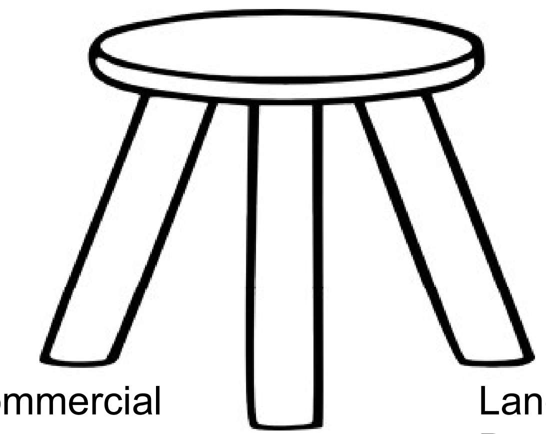
- As renewable energy (wind and solar mostly) more prevalent, grid energy becomes more…
  - Intermittent, weather dependent
  - Non-dispatchable
  - Time-displaced
- Storage is the flexible, dispatchable and instantly responsive resource needed in concert with renewables to provide reliable power
- Batteries, specifically Lithium-Ion, are dominant due to low cost
  - Scale driven by manufacturing supply chain built for electric vehicles
  - Short duration (1-4hr) use cases
  - Longer duration uses will be needed in time as well





How is Battery Storage Developed?

- Batteries storage projects generally go through same process as solar/wind in VA
- Focus here on larger projects (>10MW)
- **Three-Legged Development Process**
  - **Commercial** – Project must have a working idea of how it will earn revenue, and what is CapEx/OpEx given specific site context
  - **Interconnection –** Feasibility**,** timing and cost to connect to the grid
  - **Land Development** – site control, environmental diligence, permitting

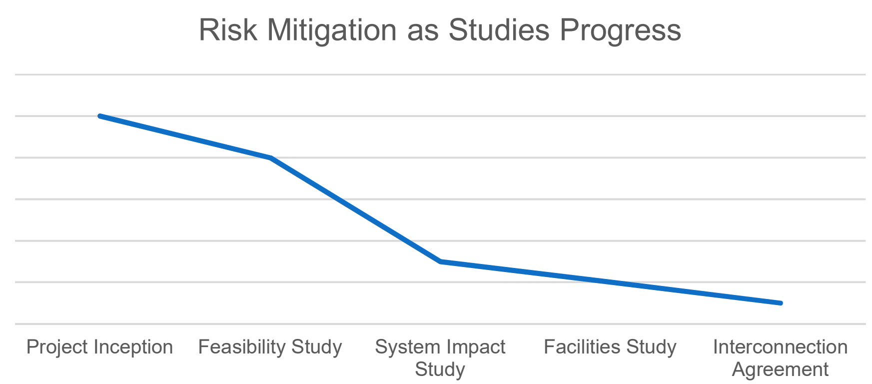


Commercial

- **Revenue**
  - PJM Market – Energy, Ancillary Services, Capacity
  - “Tolling” Agreements – Dominion, AppCo, Coops and Munis
    - More like a lease than a power purchase agreement
- **CapEx**
  - Various based upon technology and vendor
  - Developers have a good sense of this
- **OpEx**
  - Long-term service agreement with technology vendor
  - General site operations and maintenance
  - Property Taxes
  - Insurance, Overhead etc.

Interconnection

- **Large Generators (>20MW)** – 3-5yr process through PJM
- **Small Generators (<20MW)** – 2-4yr process through PJM
- Smaller projects on the distribution system can go through Utility-specific interconnection
- Timing includes typical 18-24mo construction period for Utility, but can be longer depending upon upgrades needed to interconnect project
- Storage can be co-located with renewables or submitted as a standalone project, studied slightly differently, but similar timelines.
- Interconnection, similar to solar/wind, can be a major make-or-break process
  - Feasibility Study
  - System Impact Study
  - Facilities Study
  - Interconnection Agreement



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Land Development

- Steps very similar to solar/wind
- **Site Control** – lease/purchase options through landowners adjacent to substations or transmission/distribution power lines
- **Environmental Diligence** – wetlands, endangered species, historical preservation, Phase 1 etc.
- **Permitting**
  - Local use and site plan approval
  - State approvals through SCC – new process coming from VCEA

What Do Battery Projects Look Like?

Siting and Space

- More likely to be located adjacent to a substation, but can be placed on a line as well
- Unlike solar and wind, may be located on industrial land, but likely on agricultural and other rural uses as well. Depends upon interconnection viability and land availability
- Land use (acreage) depends upon both power and duration
  - Projects in VA generally 4hr duration
  - 100MW/400MWh **battery project uses ~7 acres**
  - 100MW **solar project uses ~500 acres**
  - At similar CapEx, storage will use ~80-100x less land

Project above is 150MW/300MWh (2hrs duration) on 5 acres

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What Do Battery Projects Look Like?

Technology

- Generally three form factors
  - Outdoor cabinets – access only from outdoors
  - Containers – shipping style container
  - Dedicated building – think of a datacenter
- Battery systems pad-mounted in rows with inverters
- HVAC either air or liquid cooled
- Will most often have a project substation unless smaller distribution-scale project
- Heights will vary depending upon setup, 7-8’ for cabinets up to 25’ for buildings
- *Industry moving towards cabinets as preferred, most cost-effective solution*

Safety

- Primary safety consideration = fire prevention
- Industry utilizes UL certifications to govern cell and module-level safety, and
- NFPA 855 to govern all standards for design and installation of battery storage plants
  - This standard covers the “design, construction, installation, commissioning, operation, maintenance, and decommissioning of
  - stationary ESS.”
  - Vendors are developing highly advanced fire suppression systems that are fully integrated into the product (cabinet or container)
  - Developers and technology vendors will need to work with localities to educate and develop protocols for local emergency responders
- Dimensional Requirements
  - Dominion’s 25-foot spacing between containers is not a relevant standard for general permitting, that is a Dominion preference for projects that it will procure.
  - Previous rendering = ~5ft spacing
- Battery Chemistry – two primary Li-Ion chemistries being used, but many more in development
  - NMC (Nickel Manganese Cobalt) – industry seeking to move away from cobalt due to supply chain issues (60% from Congo)
  - LFP (Lithium Iron Phosphate) – cheaper, less energy dense but catching up
- End of Life
  - Batteries degrade as used and are typically replaced during operations every 1-3 years to keep the project at initial capacity
  - Battery recycling is starting to become more developed given high value of materials even after batteries are degraded

Use, Permitting and Taxes

- **Use** – storage very rarely contemplated in ordinances or comprehensive plans, so typical pathways are
  - Use by Right – some counties have found batteries to be a utility use and permissible by right, similar to substation
  - Special Use or Exception otherwise

- Given similarity to solar in terms of need for proximity to transmission infrastructure, some land uses will be similar, but storage more likely to be located in denser urban, suburban, and industrial environments

- More likely to be located adjacent to existing utility substations

- **Tax Density**
  - One of the most tax-dense uses outside of datacenters
  - 50-100x less land use per $ of CapEx than solar

- Conversations are ongoing around how to integrate battery projects into current tax regime, but opportunity for localities is huge on a per acre basis.

Operations

- Battery projects use few local services except for fire, but onsite fire suppression minimizes even this
- Heavy equipment onsite during construction
  - 6-8mos for smaller projects
  - 8-12mos for larger projects
- Projects lifetimes can range from 10-30+ years depending upon use case, augmentation of degraded batteries
- During operational period, light truck will be onsite periodically for O&M, but very minimal traffic impact
- Project all have security fencing and likely cameras
- Heavy trucks will come in every 2-3 years to bring new batteries onsite for augmentation

Questions

Sam Lines

Market Director – East

Able Grid Energy Solutions

slines@ablegridenergy.com

ENERGY STORAGE ISSUES FOR LOCAL GOVERNMENTS IN VIRGINIA

Cliona Robb

Director, Thompson McMullan

Chair, the Virginia Solar Energy Development and Energy Storage Authority

Email: crobb@t-mlaw.com

Energy Storage Issues for Local Governments in Virginia

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What Energy Storage Offers Virginia

1. Makes renewable energy generation more robust	Intermittent renewable energy generation such as solar and wind becomes more viable when paired with energy storage
2. Avoids or delays building new peaker plants	Storage could be a full or partial replacement for planned new peaking power plants
3. Avoids or delays distribution system upgrades	Storage can be targeted to avoid distribution system upgrades in high load growth areas.
4. Enhances resiliency for critical facilities	Storage provides resiliency and other support services for microgrids that serve critical facilities under emergency conditions
5. Lowers electricity bills and improves power quality for large customers	Commercial and industrial customers can use energy storage to reduce peak demand and improve power quality
6. Provides wholesale market opportunities	PJM helps create a market for stand-alone merchant energy storage projects

Comparison of State Energy Storage Policies

State	Goal/Target/Mandate
California	1,825 MW by 2020 (Requirement)
Nevada	1,000 MW by 2030 (Requirement)
Massachusetts	1,000 MWh by 2025 (Requirement)
New Jersey	2,000 MW by 2030 (Goal)
New York	3,000 MW by 2030 (Requirement)
Oregon	Minimum 5 MWh, up to 1% peak load by 2020 (Requirement)
Virginia	3,100 MW by 2035 (Requirement)

Source: Energy Storage Association

- Seven US states have policies that emphasize the role that energy storage will play in their future energy system
- Virginia currently has the largest energy storage procurement mandate in the US

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Virginia State Corporation Commission

- SCC Energy Storage Rulemaking (PUR-2020-00120)
- SCC Energy Storage Task Force (HB 1183)
- SCC Distribution Interconnection Rules (PUR-2018-00107) – See Appendix
- SCC Battery Storage Pilot (PUR-2019-00124) – See Appendix

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SCC Energy Storage Rulemaking

- VCEA establishes energy storage targets in § 56-585.5 E (construct or acquire)
- Dominion (2700 MW) and APCo (400 MW) by 2035
- **At least** 35% of facilities or their capacity to be purchased from non-utilities.
- Commission directed by § 56-585.5 E 5 to adopt regulations by January 1, 2021.
  - Set interim deployment targets
  - Update planning and procurement rules.
  - Address programs and mechanisms to deploy energy storage, including competitive solicitations, behind-the-meter incentives, non-wires alternatives, and peak demand reduction programs.

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Energy Storage in Virginia

SCC Energy Storage Regulations

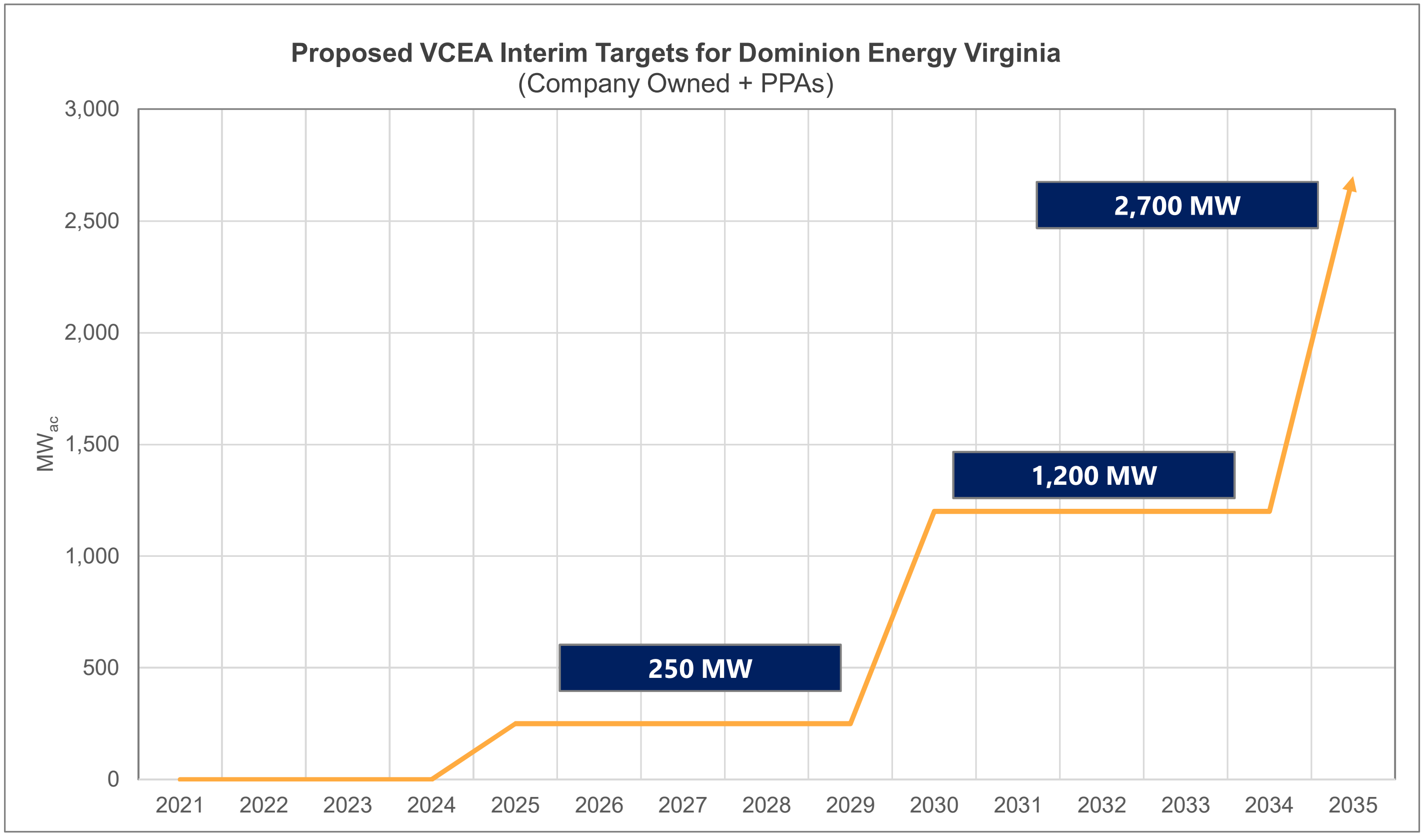
- **Regulations Governing the Deployment of Energy Storage in Virginia**
  - DEV and APCo filed joint responses, SCC draft of regulations provided 9/11/2020
  - Comments received by the SCC on 11/2, Staff report created 11/16
  - **Regulations <u>must be adopted</u> by the Commission 1/1/2021**
- **Main components:**
  - Applicable for utility and non-utility developers, owners, operators and aggregators (not electric co-ops)
  - Establishes minimum interim storage targets for DEV (2,700 MW) and APCo (400 MW), 35% non-utility ownership tied to interim targets
  - Requires annual competitive solicitation efforts
  - Includes provisions for BTM incentives, non-wires alternative programs and peak demand reduction programs
  - Open to all energy storage technologies
  - Similar permitting process to new generating facilities, for utility and non-utility owners
  - Provides framework for energy storage aggregation

Energy Storage in Virginia

Dominion Energy Proposed Interim Energy Storage Goals

Key Themes:

- Gradual ramp up of storage over next 15 years
- Deployment is weighted toward the back half of 15-year period, when more renewables are connected to our grid causing the need for more storage
- Allows for continued evolution of technology, cost reductions and incorporation of lessons learned



Cumulative MWs Shall be Petitioned to the VA SCC

SCC Energy Storage Task Force

- SCC directed by HB 1183 to establish task force to "evaluate and analyze the regulatory, market, and local barriers to the deployment of distribution and transmission-connected **bulk energy storage resources**."
- Task force membership will include representatives of energy storage providers & associations, utilities, utility customers, competitive service providers, Virginia Solar Energy Development and Energy Storage Authority, the Department of Mines, Minerals and Energy, and the Office of the Attorney General.
- SCC to submit a copy of the task force's evaluation and analysis to the General Assembly no later than October 1, 2021.

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SCC Energy Storage Task Force

- Task force goals:
  - Help integrate renewable energy into the electrical grid,
  - Reduce costs for the electricity system,
  - Allow customers to deploy storage technologies to reduce their energy costs,
  - Allow customers to participate in electricity markets for energy, capacity, and ancillary services.
- Task force directed to (i) assess the potential costs and benefits, including impacts to the transmission and distribution systems, of such energy storage resources, and (ii) assess how electric utilities, competitive service providers, customers, and other third parties are able to deploy energy storage resources in the bulk market, in the utility system, and in behind-the-meter applications.

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SCC Staff Contact

Mike Cizenski, Division of Public Utility Regulation
mike.cizenski@scc.virginia.gov

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Outstanding Energy Storage Issues: Permitting

- **Challenges**
  - Local permitting authorities have not yet developed standard guidance for and may not have experience with energy storage equipment & facilities
  - Recent utility RFPs diverge significantly from codes on storage spacing
- **Solutions**
  - Existing codes & standards can inform local permitting practice
  - Virginia state agencies can promulgate model codes for local adoption

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Outstanding Energy Storage Issues: Interconnection

- **Interconnection**
  - **Challenges**
    - Updated SCC rules for interconnection at the distribution level that became effective on 10/15/2020 do not sufficiently take into account the controllability provided by storage facilities
  - **Solutions**
    - Other states have recently updated regulations for interconnection of storage that account for its controllability – see Maryland, Nevada, etc.
    - Model interconnection practices and regulations are being developed by U.S. DOE with Interstate Renewable Energy Council (IREC), Electric Power Research Institute (EPRI), Energy Storage Association and others

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Virginia Solar Energy Development and Energy Storage Authority Members

Cliona Mary Robb
Thompson McMullan
Chair

Will Gathright
Founder
Tumalow, Inc.
Vice Chair

Katharine Bond
Director of Public Policy
Dominion Energy

Paul Duncan
MPR Associates

Damian Pitt
Associate Professor
VCU L. Douglas Wilder School of Gov't & Public Affairs

B. Hayes Framme
Government Relations and Communications Mgr.
Orsted

John Ockerman
CEO
Ockerman Automation Consulting, Inc.

Colleen A. Lueken
Director of Market Analytics
Fluence – AES Energy Storage

Jon F. Hillis
CEO
SolUnesco

John H. Rust, Jr.
Commissioner
CoA-FFX

Careth Cody Nystrom
Managing Director
SJF Ventures

Kenneth G. Hutcheson
Old Dominion Public Affairs

Michael Herbert
Co-Founder/Managing Partner
Delorean Power

Brian M. Gordon
Vice President, Government Affairs
Apartment and Office Building Association

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Observations for Localities from VSEDESA Members

Michael Herbert: he is happy to make local folks comfortable with the technology so that they want it in their communities.

Colleen Lueken: she stresses how the basic characteristics generally help the local permitting process and that understanding safety features is especially important for local governments.

Will Gathright: he advises emphasizing training inspectors on what to look for and being clear and consistent on safety standards.

Dominion (Ricky Elder): Dominion stands ready to provide an introduction to energy storage for Virginia localities

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Observations for Localities from VSEDESA Members
(Michael Herbert)

There are five benefits and one cautionary note regarding the use of energy storage in a locality as compared to other energy infrastructure.

1. **Environmental**
2. **Innovation/Grid Modernization**
3. **Taxes or other financial benefits to the community**
4. **Electrical benefits**.
5. **Land use/Decommissioning**
6. **Fire/Safety**

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Observations for Localities from VSEDESA Members

(Michael Herbert)

1st Benefit: Environmental

- no water or air emissions
- can reduce electrical infrastructure requirements
- can help do away with dirty diesel generation
- can help with renewable integration.

Overall much better for community health and aesthetics than “non wires” alternatives such as substation upgrades and transmission lines.

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Observations for Localities from VSEDESA Members

(Michael Herbert)

2nd Benefit: Innovation/Grid Modernization

This is a new technology that makes the power system work more efficiently and cost effectively, helping save people money on their electric bills.

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Observations for Localities from VSEDESA Members
(Michael Herbert)

3rd Benefit: Taxes or other financial benefits to the community

Communities will benefit via property taxes or some other means. There is an active conversation about tax treatment for storage in Virginia right now.

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Observations for Localities from VSEDESA Members: Dominion

Tax Perspectives / Use of Siting Agreements

Energy Storage Tax Perspectives

- Legislation was enacted in Virginia in 2020 to provide additional revenue and financial benefits to solar facility host localities
- Localities can elect to tax new solar projects via one of two options 1) M&T property tax stepdown (with pollution control tax exemptions) or 2) Revenue Share
- Storage projects that are a component of a solar project would follow the same tax provisions for solar projects
- Storage projects that are not a functional component of a solar project would be taxed at the full amount of tax benefit owed to the host locality (not subject to M&T stepdown) and would not be eligible for pollution control tax exemptions

Use of Siting Agreements with Stand Alone Storage Projects

- Va. Code 15.2-2316.6 establishes requirements for siting of solar facilities in areas that qualify as opportunity zones
- "Solar Facility" is defined within 15.2-2316.6 as to be a commercial solar photovoltaic (electric energy) generation or storage facility
- Va. Code 15.2-2316.7 requires solar facility applicants to meet, discuss and negotiate a siting agreement with the host locality. As such, siting agreements are tied to solar facilities located in areas that qualify as opportunity zones.
- Since stand alone storage projects are to be taxed at the full amount of tax owed to the host locality, the use of siting agreements does not apply and is consistent with the intent of 15.2-2316.6 B: "This article applies only to a solar facility located in an opportunity zone"

Siting agreements do not apply to stand alone energy storage projects

Observations for Localities from VSEDESA Members

(Michael Herbert)

4th Benefit: Electrical

Depending on how the systems are designed, they can offer

- better grid resilience
- power quality and even back-up power to critical infrastructure

These features can help make communities more attractive to businesses that may be thinking about locating there.

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Observations for Localities from VSEDESA Members
(Michael Herbert)

5th Benefit: Land use/Decommissioning

Advantages offered by energy storage systems include

- low impact (especially relative to other power generation projects)
- can easily be shielded from view
- are easy to decommission and restore land to its previous condition due to relatively small footprint and simple construction.

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Observations for Localities from VSEDESA Members

(Colleen Lueken)

5th Benefit: Land use/Decommissioning (cont.)

The basic characteristics of battery-based energy storage generally help the local permitting process. For instance, battery-based storage has

- no direct emissions
- no water use
- limited land disturbance
- low noise

Often grid-scale installations can be placed at substations with available space - which are found in all types of zones (residential, commercial, and industrial).

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Observations for Localities from VSEDESA Members

(Michael Herbert)

One cautionary note: Fire/Safety

- Due to an incident in Arizona last year, there is a bit of a misconception about the safety of these systems. There is minor risk, but if the systems are designed correctly (certifiable through UL and NFPA standards) and response procedures are coordinated with the fire department (generally leave it closed and let it burn if something does go wrong) then there shouldn't be any problems.
- Worth noting that the industry has come a long way since the APS incident, standards are better, battery cells don't run as hot and are constantly being monitored, and there is far more redundancy in fire prevention, detection, suppression and response.

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Observations for Localities from VSEDESA Members
(Collen Lueken)

One cautionary note: Fire/Safety (cont.)

Understanding the important safety features of an energy storage system is especially important for local governments with municipal utilities, but it's also important for local governments that may be leasing land to a developer.

- Useful information about safety features and procedures can be found on Fluence's website - https://fluenceenergy.com/committed-to-safety/ -
- Key things to note are the certifications a storage system should be able to demonstrate, such as UL1973, UL9540a, IEC62619, IEC61508, and NFPA 855
- Key features (such as fire suppression, ground fault detection, deflagration panels, etc.), are also things that a locality would want to ask about and consider requiring when procuring a system.
- And lastly but very important is for emergency response crews to be briefed on how to respond to incidents at an energy storage facility, which is something that the energy storage provider should include in their commissioning plan

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Observations for Localities from VSEDESA Members

(Will Gathright)

One cautionary note: Fire/Safety (cont.)

Train your inspectors on what to do/look for when inspecting energy storage systems. Many localities are understandably not using the most up-to-date version of the national electric code (NEC). That's fine for most things but energy storage wasn't covered in the NEC before a certain year. In this case, consider borrowing language and standards from later year NECs for energy storage in particular.

Be clear and consistent on safety standards. On more than one occasion I have had inspectors come back even after a final approval and demand that we put in another disconnect. If additional gear (such as a disconnect) is required, it should be known at the planning stage of the project and not the commissioning stage.

Observations for Localities from VSEDESA Members: Dominion

Battery Energy Storage System (BESS) Fire Protection

Summary of BESS Mitigation Measures

UL 9540A BATTERY TESTING

- Cell Level Testing
- Module Level Testing (cells assembled into modules)
- Unit Level Testing (modules assembled into units)
- ➢ External effects evaluated at each level of testing

FAILURE DETECTION / EXPLOSION MITIGATION

- Use of Battery Management System
- Smoke/Gas Detection
- Sample Ports
- Exhaust Ventilation
- Deflagration Vents / Roofing

FIRE PROTECTION

- Significant separation from battery to battery, battery to equipment and the public
- Spatial or physical separation to mitigate fire spread
- ➢ 25′ between enclosures / firewalls housing up to 6MWh energy
- ➢ 50′ between enclosures / structures housing more than 6MWh energy

TRAINING

- EPC Firms
- O&M Contractors
- Dominion Energy Operations
- Local First Responders

BESS mitigation measures should carefully be considered and required for all projects

Q&A

PLEASE SUBMIT QUESTIONS VIA THE Q&A BOX ON THE RIGHT OF YOUR SCREEN

MODERATED BY:

Diane Cherry

Principal Consultant

Diane Cherry Consulting

www.dianecherryconsulting.com

Email: dianedcherry@gmail.com

DIANE CHERRY CONSULTING

RESOURCES

- **Virginia Energy Storage Report 2019** by Strategen

https://www.dmme.virginia.gov/de/LinkDocuments/Virginia%20Energy%20Storage%20Study%20-%20Final%20Report%20%202019.pdf

- **Clean Energy Virginia Webinar Series** by DMME and Governor's Office, "Energy Storage," Aug 5, 2020

https://www.youtube.com/watch?v=yKtDPxu7t7w&feature=youtu.be

- **Corporate Responsibility Initiative** by Energy Storage Association (ESA)

https://energystorage.org/about-esa/energy-storage-corporate-responsibility-initiative/

CLOSING NOTES

- Webinar slides and recording will be emailed and posted to ETI website
  - Appendix Slides
- Unanswered questions will be addressed and responses emailed following the webinar
- Post-event survey
- **Keep in touch, let us know how we can support you**.

THANK YOU!

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APPENDIX

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APPENDIX:

STATE POLICY SUPPORTING ENERGY STORAGE IN VIRGINIA

Ken Jurman

Renewable Energy Program Manager

Department of Mines, Minerals and Energy

Email: ken.jurman@dmme.virginia.gov

Virginia Department of Mines Minerals and Energy

Dominion's first three energy storage pilot projects include:

- 2-megawatt battery at a substation serving a solar facility to demonstrate how batteries can help manage voltage and loading issues caused by reverse energy flow
- 2-megawatt battery at a substation to bolster existing grid capacity during peak demand without the need to engage in transmission equipment upgrades
- Two battery systems totaling 12 megawatts at their Scott Solar facility to store energy generated during periods of high production and release energy during periods when load is high or solar generation is low. It would also reveal how well a battery can optimize power production of the solar facility.

2020 Legislation

- Utility may select energy storage facilities without regard to whether such selection satisfies price criteria if the selection of the energy storage facilities **materially advances non-price criteria**, including **favoring geographic distribution** of generating facilities**, areas of higher employment, or regional economic development**
- Such facilities shall not exceed 25 percent of the utility's energy storage capacity

Dominion IRP

EV School Bus Pilot Program and V2G

- Dominion to bring 50 electric buses to 16 localities by the end of 2020. Exploring potential of vehicle-to-grid technology to leverage bus batteries as energy storage resources

Pumped Storage

- The IRP indicates that Dominion is evaluating a pumped storage project in Tazewell County, VA. FERC approved their preliminary application for this project in 2017.

Energy Storage Study (2019)

- To better inform policy decisions for the Commonwealth, Strategen Consulting conducted a review of potential energy storage value streams in Virginia and performed an economic analysis of the total benefits that these value streams could provide under different levels of storage deployment.

Energy Storage Study

- **The Results:**
  - Near-term economic potential for storage ranges from 24 - 113 MW (4-hr duration or less) depending on the installation costs and duration, and net financial benefits ranging from $3 - $9 million to the grid and its customers.
  - Over the next decade, the potential grows to 329 - 1,123 MW, with annual net benefits ranging from $20 - $58 million.
  - Preliminary estimate suggests that this equates to a total estimated job impacts 1,212 - 4,132 job-years and $114 - $387 million in labor income.

Energy Storage Study

- **15 Recommendations in Seven Areas:**
  - **State Level Strategic Actions**
    - Establish statewide storage requirement
    - Convene a statewide issues forum to allow stakeholders to identify challenges
    - Develop strategic plan for accelerating microgrids
  - **Utility Planning and Procurement**
    - Move beyond the 10/30 MW storage pilot program towards more commercial deployment
    - Adopt more advanced methods for considering storage in IRP process
    - Develop formal process for identifying location-specific opportunities on the distribution system for storage – use of storage as a Non-Wires Alternative
    - Study the viability of new pumped hydro storage

Energy Storage Study

- **15 Recommendations in Seven Areas:**
  - **Retail and Customer Programs**
    - Establish ratepayer funded direct incentive programs to accelerate storage deployment
    - Implement retail rate reform and expand or enhance retail customer programs to better reflect the potential grid benefits of storage
  - **Wholesale Markets**
    - Enable storage "value stacking" by providing regulatory certainty through the adoption of a Multi-Use Application (MUA) framework
    - Participate in PJM stakeholder processes to ensure wholesale market rules are continually improved to maximize storage participation options and value creation

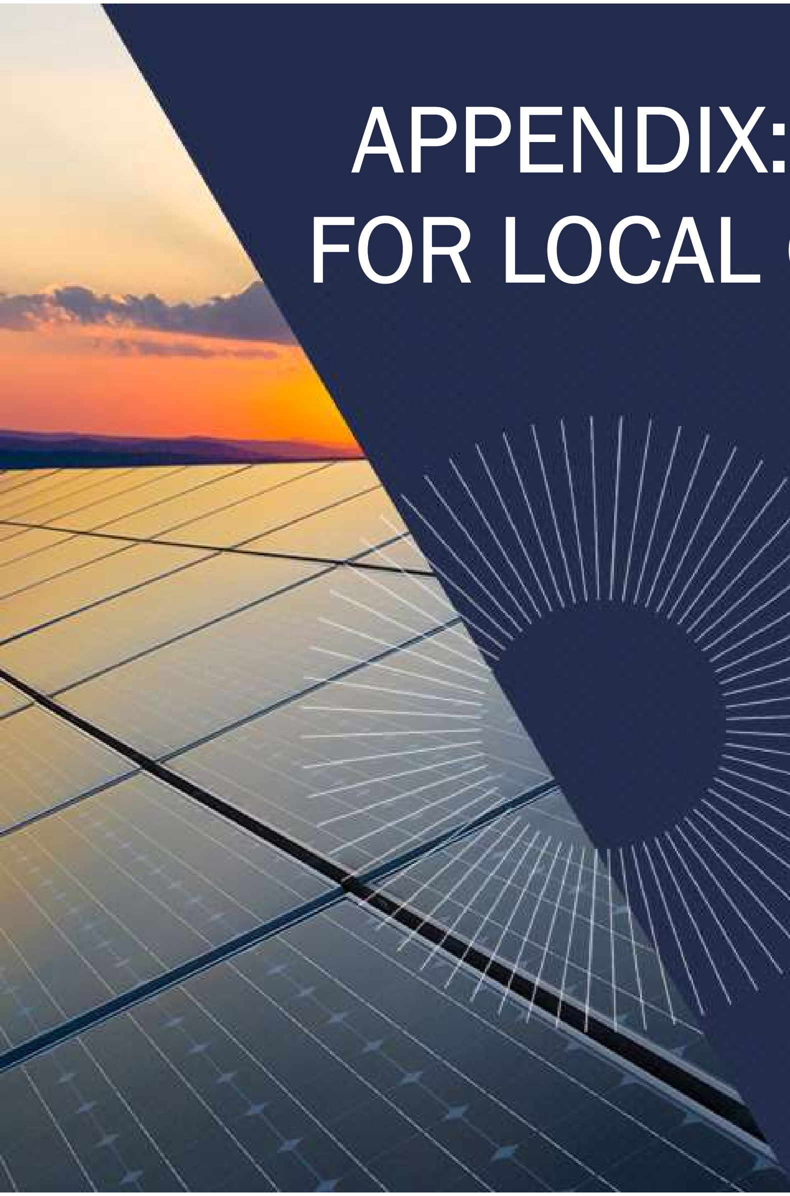
Energy Storage Study

- **15 Recommendations in Seven Areas:**
  - **Interconnection and Permitting**
    - Enact revisions to codes and standards that enhance/streamline safety and permitting processes for local jurisdictions
    - Update the interconnection process for distributed energy to ensure greater visibility for resources that are providing multiple services
  - **Competitive Provider Participation**
    - Revise the definition of “public utility” to exclude storage, to ensure that third-party developers can continue to advance and innovate energy storage throughout the state
  - **Research and Development**
    - Provide Virginia’s universities with additional resources to pursue research and development of new energy storage technologies

DMME Solar + Storage

- **Eligible under DMME's *Solar-Enhanced EPC* program.**
  - Participating entities can use remaining savings from traditional energy conservation measures, such as LED lighting conversions, to fund on-site solar
  - DMME will supplement any shortfall, up to 40% of the solar project cost
  - DMME will allocate approximately $2M for state agencies and institutions of higher education, and $1M for local and public bodies.
  - Single project funding will be capped at $500K.
  - Funding will be available on a first come-first serve basis and will be based on availability of funds at the time of contract signing.

APPENDIX: ENERGY STORAGE ISSUES FOR LOCAL GOVERNMENTS IN VIRGINIA



Cliona Robb

Director, Thompson McMullan

Chair, the Virginia Solar Energy Development and Energy Storage Authority

Email: crobb@t-mlaw.com

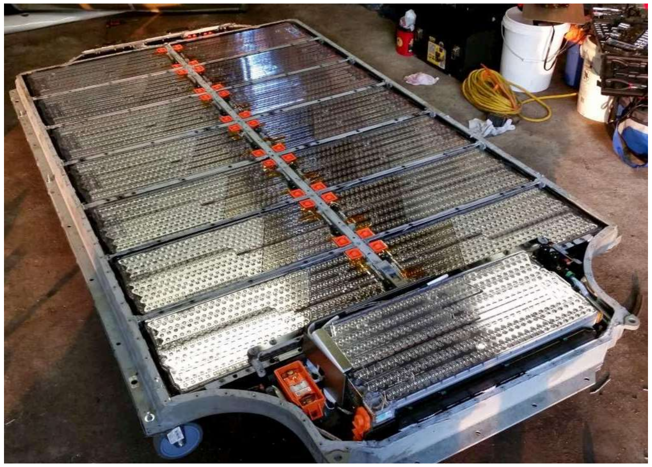
Observations for Localities from VSEDESA Members

Appendix

Energy Storage in Virginia

Battery Storage Systems - What Are They?

Battery Cells



Battery Module

Battery Energy Storage System

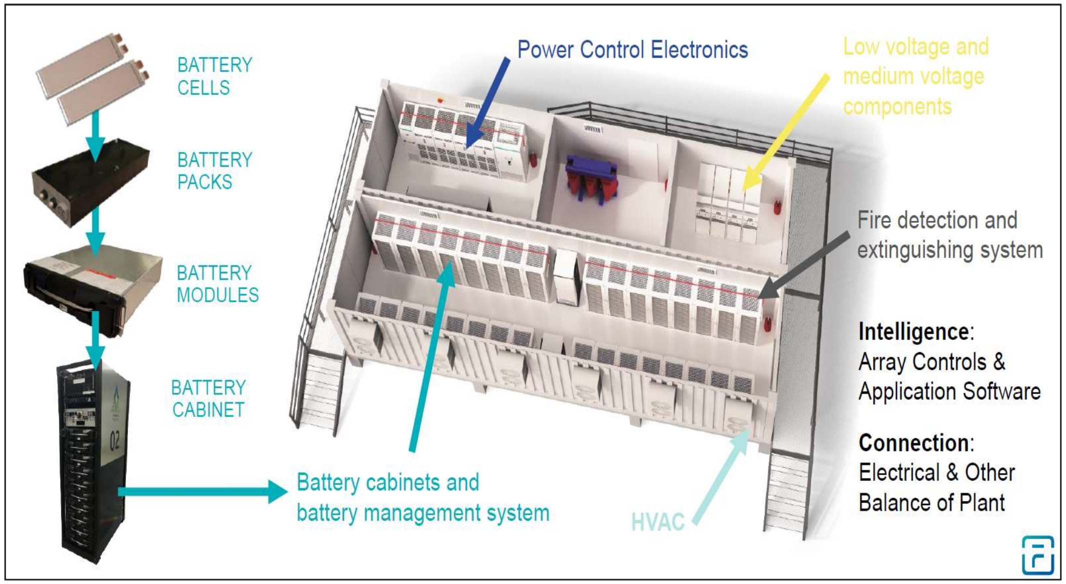
Most Battery systems are modular in design

Lithium Ion is the dominant technology

Overview of Battery Storage Systems

What is a Battery Energy Storage System (BESS)?

Battery Energy Storage System (BESS) Main Components



Source: Fluence Energy

Example Facility – Fluence Energy 30MW Site

Source: Fluence Energy

Most battery systems are modular in design

Lithium-Ion systems are the most prevalent battery storage systems in development today

Energy Storage in Virginia

Benefits / Uses

Electric Supply

- Electric energy time shift
- Electric energy supply capacity

Ancillary Services

- Electric supply reserve capacity
- Load following
- Frequency regulation
- Voltage support
- Blackstart

T&D Grid Services

- Transmission congestion relief
- T&D upgrade deferral
- T&D support

Customer Management Services

- TOU energy cost management
- Demand charge management
- Electric service reliability
- Electric service power quality

Renewable Integration

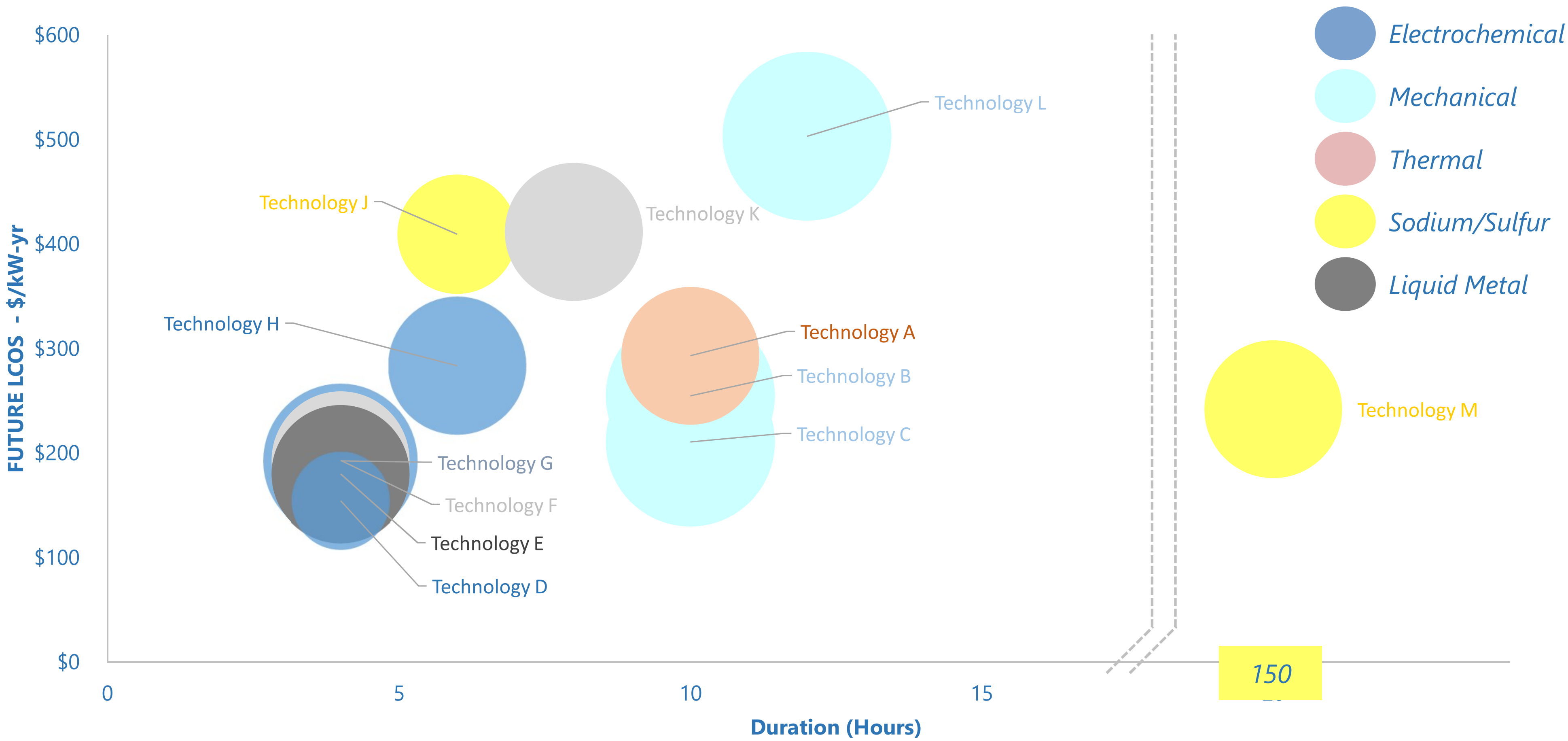
- Renewable energy time shift
- Renewables capacity firming

Battery storage can provide many services outside of providing power

Dominion: An Introduction to Energy Storage for Virginia Localities

Energy Storage in Virginia

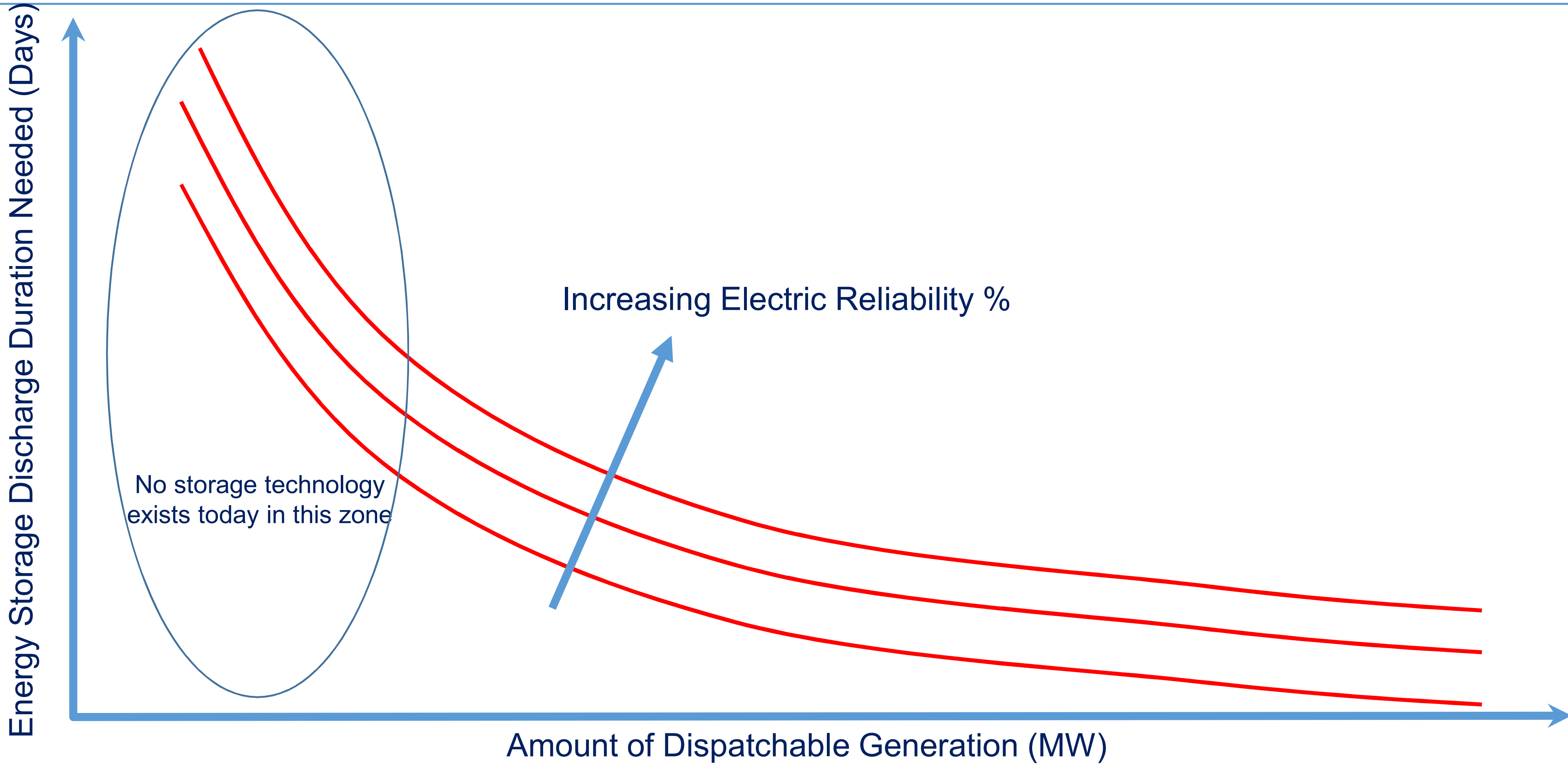
Storage Technology Differences



Dominion: An Introduction to Energy Storage for Virginia Localities

Energy Storage in Virginia

Perspective on Storage Reliability Impacts



Dominion: An Introduction to Energy Storage for Virginia Localities

SCC Distribution Interconnection Rules

- Virginia Administrative Code 20 VAC 5-314 governs electric generators and storage facilities interconnecting at the distribution level. These rules were last updated in 2009 in accordance with § 56-578 C of the Code of Virginia.
- In Case No. PUR-2018-00107 the SCC issued updated interconnection rules on July 29, 2020, which became effective on October 15, 2020.
- Notable Changes
    - Removed 20 MW upper limit
    - Added new study forms
    - Better defined process timelines to ensure projects do not linger in the queue
    - Projects interdependent with one earlier queued project have the option of beginning the study process earlier
    - Study Deposits, if applicable, are paid upfront when the study process begins

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SCC Distribution Interconnection Rules

Request Level	Capacity Limit*	Fee / Deposit*	Comments
Level 1	≤ 500 kW	$100 processing fee	• Quickest process. • Requires at most only minor modifications to utility's system. • May be escalated to Level 2 or 3.
Level 2	≤ 2 MW	$1,000 processing fee	• Longer process than Level 1. • Requires more modifications to utility's system. • May be escalated to Level 3 if it fails utility's initial screening tests or supplemental reviews.
Level 3	> 2 MW	$1,000 processing fee $10,000 plus $1.00 per kWAC deposit	• Longest interconnection process. • Requires most modifications to utility's system. • Studies performed: Feasibility, System Impact, and Facilities study. • Studies may be performed consecutively or rolled into combined studies by mutual agreement.

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SCC Battery Storage Pilot

- Virginia Code § 56-585.1:6
  - APCo – up to 10 MW in capacity
  - Dominion – up to 30 MW in capacity
- Solutions must either:
  - Improve reliability of electrical transmission or distribution systems.
  - Improve integration of different types of renewable resources.
  - Deferred investment in generation, transmission, or distribution of electricity
  - Reduced need for additional generation of electricity during times of peak demand
  - Connection to the facilities of a customer receiving generation, transmission, and distribution service from the utility

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Battery Storage Pilot

Dominion's Battery Storage Pilot (PUR-2019-00124)

Projects	Capacity / Cost	Goal
BESS-1	2 MW / 4 MWh $2.9 million	Study the prevention of solar back-feeding onto the transmission grid. (Dec 2020 in-service)
BESS-2	2 MW / 4 MWh $4.1 million	Study batteries as a non-wires alternative to reduce transformer loading. (Dec 2020 in-service)
BESS-3	2 MW / 8 MWh (DC) 10 MW / 40 MWh (AC) $26.1 million	Study solar plus storage at the Scott Solar Facility. (Dec 2020 in-service)

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