

CESA Webinar

Maryland Energy Storage Pilot Program: Exploring Business Models and Revenue Streams in PJM

April 14, 2021



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CleanEnergy States Alliance



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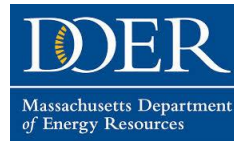
Maryland
Energy
Administration



NYSERDA



Department of Commerce
Innovation is in our nature.



Webinar Speakers



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Maryland Energy Storage Pilot Program

Exploring Business Models and Revenue Streams in PJM

Presented to Clean Energy States Alliance
April 14, 2021

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Introduction to Customized Energy Solutions and Baltimore Gas & Electric

Customized Energy Solutions



Customized Energy Solutions

Established in 1998, **Customized Energy Solutions (CES)** is a consulting and services company that assists clients in managing and staying ahead of the changes in the wholesale and retail electricity and natural gas markets. Serving hundreds of clients, Customized Energy Solutions offers best-in-class hosted energy market operations platforms and a wide spectrum of consulting services. CES is committed to promoting economic development through the advancement of transparent, efficient, and non-discriminatory wholesale and retail electricity and natural gas markets.

Presence

Headquartered
Philadelphia, PA



Over 175 Associates across 9 Regional offices in United States, Canada, India, Japan & Mexico.

Resources

>11,000 MW assets under Active Management

>330 MW Energy Storage under Management

Awards and Recognitions



Inc. 5000 – Eleven Time Honoree, Philadelphia 100 - 2001, 2004 – 2012, 2019
 Best Places to work: 2014, 2016
 2016 Energy Storage Association Brad Roberts Award Winner


Clients

500+ Clients Worldwide



Our consulting services enable competitive suppliers, technology providers, marketers, utilities, and their customers to prosper through change, by turning knowledge into value

CES Business Lines

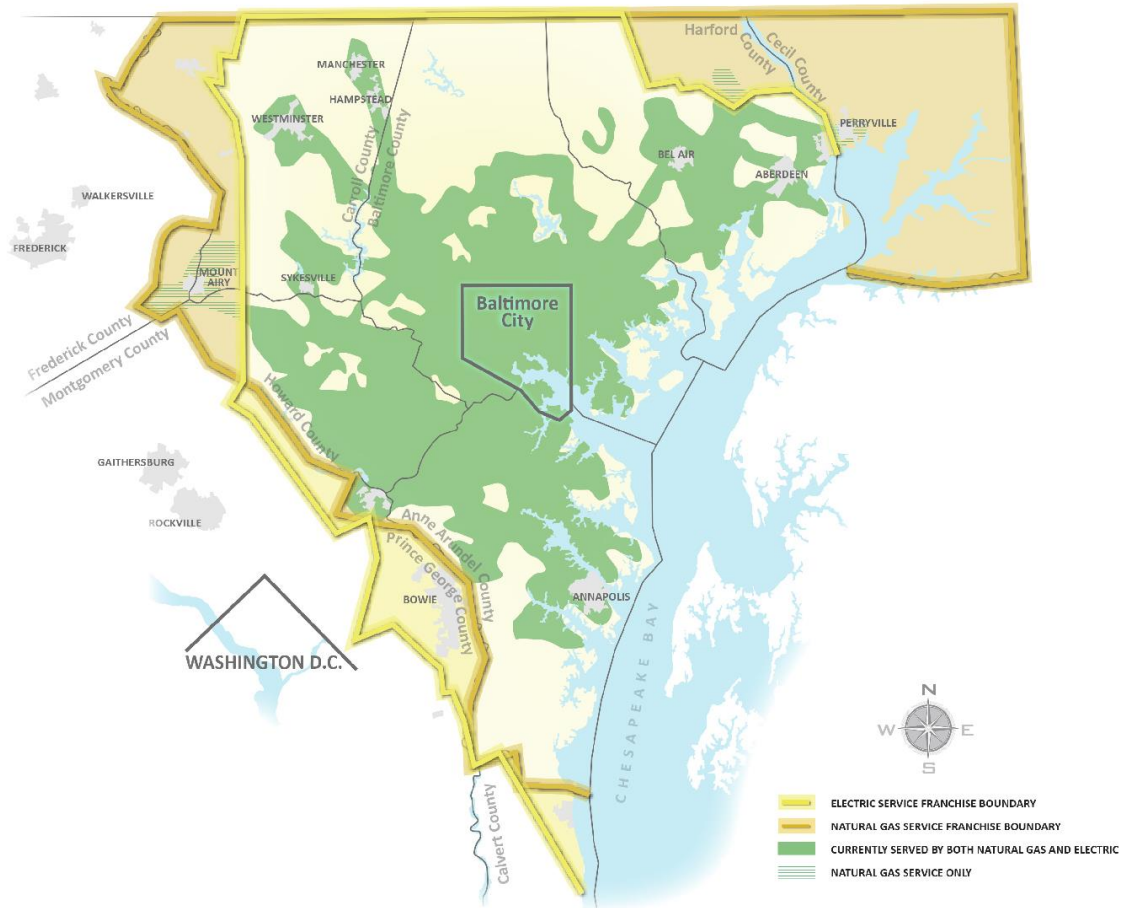
Wholesale Services	Retail Services	Future Grid		Market Intelligence
<p>Dispatch Settlements</p> <p>Scheduling 24 Hour Desk</p> <p>Monitoring Market Optimization</p> <p>Bidding DA / RT Strategies</p> <p>Telemetry</p>	<p>Market Entry Pricing</p> <p>EDI/Billing Headroom Analysis</p> <p>Forecasting Managed Portfolio Services</p> <p>Scheduling</p> <p>Settlements</p>	<p>Distributed Resource Integration</p> <p>Market Rules and Entry Telemetry & Resource Registrations</p> <p>Market Integration Consulting Market Operations</p> <p>Revenue Modeling Scheduling, Dispatch and Control</p> <p>CES GREEN</p> <p>Demand Response Mgmt SecureNet Tracking Settlement</p> <p>CES GREEN</p>	<p>Emerging Technologies</p> <p>StorageIQ</p> <p>Revenue Modeling</p> <p>Bid Advisory Services</p> <p>Energy Market Forecasts</p> <p>Market Sizing, Entry, Strategy</p> <p>Policy & Research</p> <p>Technology Due Diligence</p> <p>Financial Services</p> <p>Microgrid Analysis</p> <p>CoMETS</p>	<p>Comprehensive Markets Coverage</p> <p>ISO Rules & Reporting</p> <p>Market Rule Changes</p> <p>Regulatory Proceedings</p> <p>CES MARKETIQ</p> <p>  </p>
<p>CES GOLD</p> <p>Congestion Management</p> <p>ARR Analysis</p> <p>FTR Analysis</p> <p>Congestion Analysis</p> <p>Power Flow Studies</p>	<p>CES BLUE</p> <p>Renewable Management</p> <p>RPS Management</p> <p>Plant Registration</p> <p>REC Optimization</p> <p>Compliance</p>			<p>STATE OF CHARGE Massachusetts Energy Storage Initiative Study</p> <p>STATE OF CHARGE Massachusetts Energy Storage Initiative</p>

CES was the lead consultant for the MA State of Charge report, we supported MassCEC on Solar + Storage for Manufacturers, and supported MA DOER on the CPS. We advise the Energy Storage Association on its wholesale electricity market policy efforts.

Baltimore Gas and Electric

The Leading Gas and Electric Provider in Maryland

- **Founded:** 1816 — nation's first gas utility and one of the first electric utilities
- **CEO:** Carim Khouzami
- **Employees:** 3,200
- **Customers Served:** 1.28 million+ electric and 670,000+ gas customers
- **Region:** State of Maryland
 - Electric service ~2,300 square miles
 - Gas service ~800 square miles



Background on the MD Storage Pilot Program

Legislation that Led to the Pilot Program

- **May 13, 2019 – MD Gov. Hogan signed into law the Energy Storage Pilot Project Act (2019 MD SB573)**
- **August 23, 2019 – MD PSC establishes the Energy Storage Pilot Program, [Case No. 9619](#)**
 - **The Energy Storage Pilot Program case evolved out of the existing Public Conference 44 (PC 44) and the Energy Storage Working Group**
 - **The Working Group drafted a proposal to test innovative regulatory and business models which have the potential to reduce ratepayer costs and provide benefits to customers, utilities, competitive storage providers and the grid**
 - **The proposed design offered a framework for project selection and metrics for evaluating the success of proposed pilot projects**
- **The Act and Commission Order required that each MD Investor-owned Utility (Potomac Edison, Pepco MD, Delmarva Power and Light MD and BGE) submit two pilot projects by April 2020, of which at least one shall not be owned by the utility. The cumulative capacity of the program across the 4 IOUs is capped at 10 MW.**
- **The WG proposed four models to consider:**
 - **Model 1 – Utility Only Model**
 - **Model 2 – Joint Utility and Third-Party Model**
 - **Utility own, control for grid reliability and 3rd party operates in wholesale markets**
 - **Model 3 – Third-Party Model**
 - **Owned by 3rd party for grid reliability and when not providing grid reliability, 3rd party operates in wholesale market**
 - **Model 4 – Virtual Power Plant (VPP)**

RFP Creation & Criteria for Selecting Bids

- **October 2, 2019 - Joint Exelon Utilities (Pepco MD, DPL MD and BGE) issued RFI to 65 potential vendors (in consultation with the Energy Storage Association)**
- **Dec. '19/Jan. '20 – Joint Exelon Utilities issued Request for Proposals (RFP)**
 - **17 vendors submitted 73 bids for the six projects (two each for the Exelon Utilities)**
- **Proposal selection was based on the following criteria:**
 - **Technical qualifications**
 - **Project experience**
 - **Commercial financial viability**
 - **Project timeline**
 - **Proposal characteristics**
 - **Project costs**
 - **Proposed business model**
- **Winning bidders included: Ameresco, Hitachi Power Group, Sunverge, MESA Veterans Power, A.F. Mensah and AlphaStruxure**

Project Description	BGE		Delmarva Power		PEPCO		Total
	Chesapeake Beach Project	BESS at Fairhaven Substation Project	Elk Neck, Maryland Project	Ocean City, Maryland Project	National Harbor/Livingston Road Project	Montgomery County Electric Bus Depot Project	
Capacity	1.0 MW	2.5 MW	0.5 MW	1.0 MW	1.0 MW	1.0 MW	7.0 MW
Guaranteed End of Life Usable Capacity	1.5MWh	4.0 MWh	1.5 MWh	3.0 MWh	3.0 MWh	3.0 MWh	16.0 MWh
Initial Usable Capacity	2.0 MWh	7.1 MWh	2.2 MWh	3.6 MWh	4.3 MWh	4.3 MWh	23.5 MWh
Model 1: Utility Owned and Utility Operated		X		X			2
Model 2: Utility Owned and Third Party Operated					X		1
Model 3: Third Party Owned and Third Party Operated	X					X	2
Model 4: Virtual Power Plant			X				1

Economics of Proposed Storage Projects

Battery Value Streams – Wholesale Market

- **Frequency Regulation:** Per Order 755, there are two parts: Regulation “Capacity” and “Performance”. PJM generates two different types of normalized automated signals that Regulation Market resources can follow.
 - The Regulation D signal is a fast, dynamic signal that requires resources to respond almost instantaneously. It is the most suitable for battery storage. State-of-charge (SOC) management is left up to the resource owner and is critical for optimizing performance.
 - Regulation A is a slower signal that is meant to recover larger, longer fluctuations in system conditions.
- **Energy Arbitrage - Day Ahead LMP:** Price variations allow storage to charge during low prices hours and discharge during high prices hours to capture energy arbitrage. The DA market allows market participants to secure prices for electric energy the day before the operating day and hedge against price fluctuations that can occur in real time.
- **Energy Arbitrage - Real Time LMP:** The RT market allows market participants to buy and sell in real time on a hourly basis. Units are dispatched on a 5-minute basis. High fluctuations in real time LMP can theoretically give better arbitrage than day ahead market.
- **Operating Reserves:** Reserves are additional generation capacity above the expected load—either off line or on line—that can deliver electric energy within 10 or 30 minutes. PJM has following RT Reserves products: Synchronized Reserve (Synchronized), Non- Synchronized Reserve (Off-Line). Storage can only provide Synchronized Reserve service to the market.
- **Capacity Market (RPM):** called the Reliability Pricing Model, is a 3-year Forward Market that ensures long-term grid reliability by procuring the appropriate amount of power supply resources needed to meet predicted energy demand. Under the “Capacity Performance” model, resources must deliver on demand during system emergencies or owe a significant payment for non-performance. Currently, Capacity Storage Resources are awarded Capacity based on the output that can be sustained for a period of 10 hours.

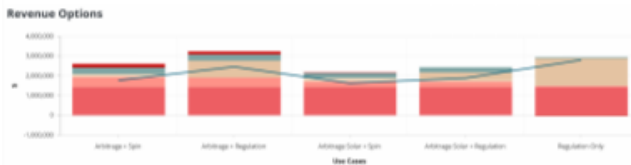
Battery Value Streams – Distribution Utility

- **Distribution System Benefits** – Storage systems will improve the flexibility and reliability of the distribution grid by charging and discharging in times of need.
- **Distribution Upgrade Deferral** – Increasing distribution line capacity
- **Back-Up Power** – Storage system to provide backup power to the distribution grid



CoMETS Modeling

CoMETS



- CES has developed a proprietary set of analytical models called **CoMETS (Comprehensive Market Evaluation Tools for Storage)** which use a mixed integer linear programming (MILP) based approach to determine optimal dispatch of the BESS in order to **maximize potential market revenues** subject to participation in various market segments and under relevant operating constraints.
- CES analysis include potential revenues from all applicable and relevant energy market applications and revenue streams such as
 - **Frequency Regulation**
 - **Energy Arbitrage – Day Ahead Market (DAM)**
 - **Synchronized Reserves**
 - **Capacity**
- CES modeled revenues with three sensitivities (Low, Base and High)

Operational Considerations & Challenges

- **Frequency Regulation (RegD) Market Size** – Non-Ramp = 210MW, Ramp = 320MW
 - RegD is limited to serving 40% of PJM Regulation Requirement
 - 255+ MW of Energy Storage currently qualified for RegD
 - If “oversupplied”, PJM clears RegD MWs based on Performance Score
 - 1,000+ MWs of Stand-Alone Energy Storage in PJM Interconnection Queue
- **Distribution System Benefits & Backup Power** – Battery needs to abstain from wholesale market participation during times of “system need”
- **Capacity Market Participation** – DA Energy Must-Offer Requirements, Reserving Energy & Responding to PJM Emergency Events

Future ISO Market Developments

- **Frequency Regulation Market Change** – In their Regulation Market Settlement filing, PJM eludes to a future change to the Regulation Market that may involve collapsing RegA & RegD into one non-energy neutral regulation signal
 - PJM has not released details plans regarding this change
 - FERC mandated that “fast-responding resources” be compensated for their fast-response capabilities
- **Capacity Market ELCC Implementation** – PJM is currently restructuring and reconsidering the value of limited-duration and intermittent resources
 - Changes will likely take effect for 2023/24 Base Residual Auction
 - 4-Hour Storage will receive ~80% Capacity Value against Nameplate Rating
- **Reserve Market Change** – FERC recently approved PJM’s Reserve Market Filing that altered the procurement mechanism and structure for non-Regulation Reserves

CES | StorageIQ

Thank you!



**Customized
Energy Solutions**

Analyze · Simplify · Implement

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