

# City of Hartford: An example of a Real-world Microgrid

## Plenary Session 1

### Quantifying the Power of Distributed Energy Resources

NIST Workshop

New York City; December 6, 2016

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Constellation Distributed Energy



**Constellation**<sup>®</sup>

An Exelon Company

# Constellation: Who We Are




#1 C&I Power provider in the US

8<sup>th</sup> largest Gas provider in the US


Approximately  
**2 million**  
customers served



Continually investing in  
emerging  
energy   
technologies

Headquarters:  
**Baltimore,**  
MD 



Investing over **\$1**  
billion in  
distributed energy  
assets   
since 2010



Delivering RECs for customers  
enabling them to avoid  
**1.2 million metric tons of**  
GHG in 2015









Dedicated team of  
Regulatory,  
Market &  
Wholesale  
Experts

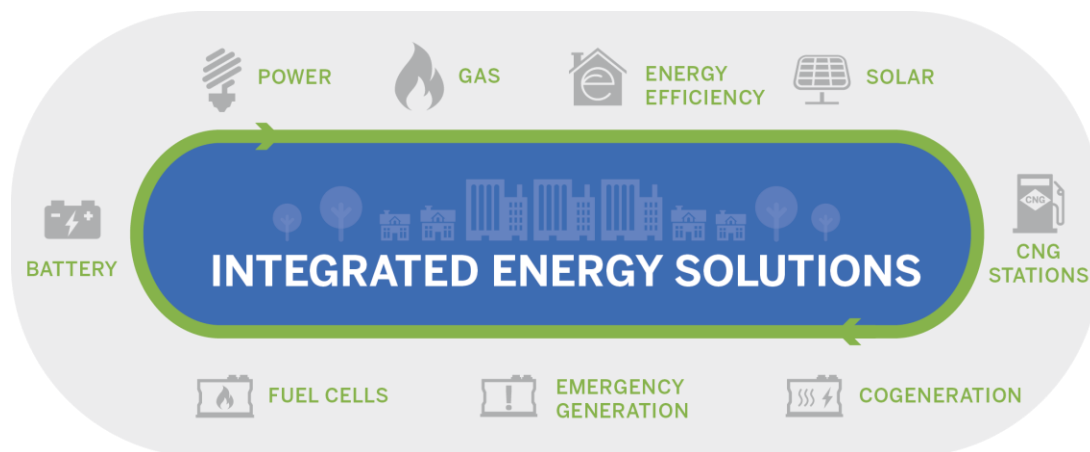
\*2015 data

# The Constellation Distributed Energy Approach

## Value for Customers

-  **Management and operation services** for complex energy assets from experienced generation operator and wholesale market expert
-  **Attractive financials:** no upfront capital requirements, long-term contract backed by Fortune 500 company, and increased budget predictability
-  **“One stop shop”** for energy management expertise
-  **Operational and revenue-stream efficiencies** to alleviate customers’ financial burden for needed infrastructure
-  Scalable assets with customizable turnkey solutions
-  Support of corporate **sustainability and emissions reduction** goals

## Connecting Energy Users to Energy Choices



Constellation is a leader in developing behind-the-meter energy solutions, and has invested over \$1 billion in distributed energy assets since 2010

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# City of Hartford: An example of a Real-world Microgrid in Parkville

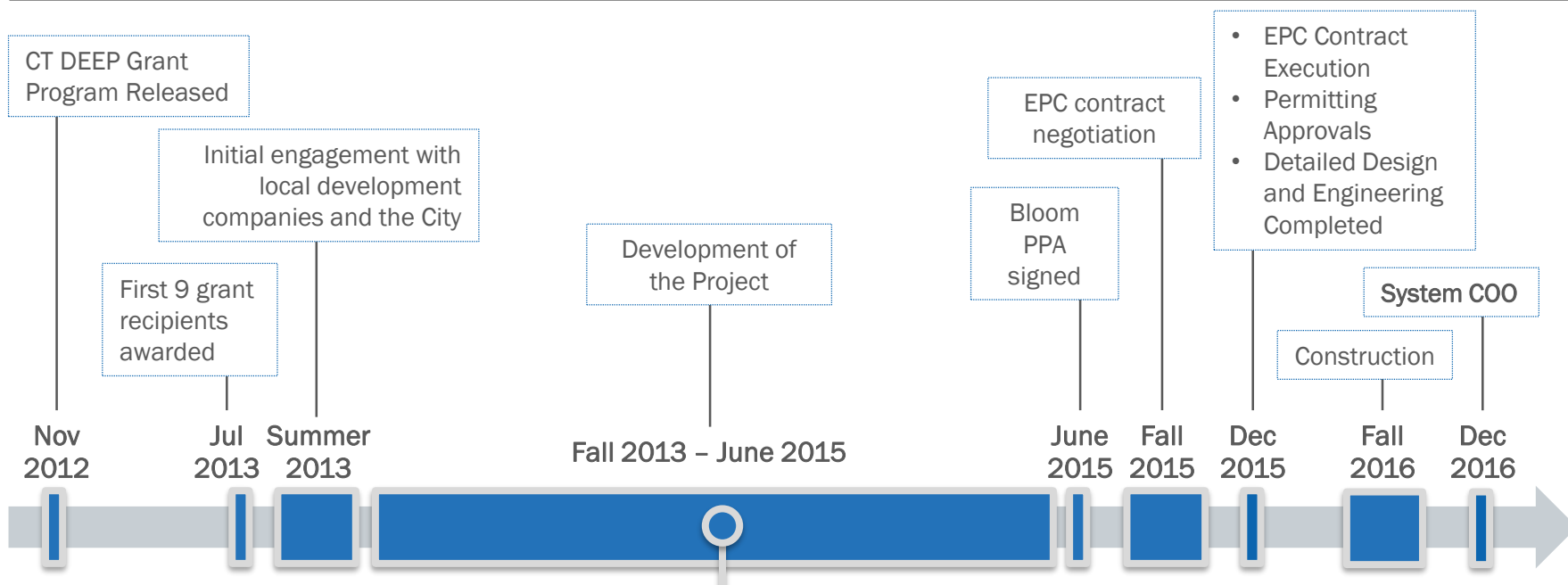


# Parkville Microgrid: Summary

<b>Size</b>	800 kW grid parallel / 600kW microgrid-mode
<b>Power Generation Technology</b>	Bloom Energy Servers (4 ES5 fuel cells x 200kW) + 1 Uninterruptible Power Module (UPM)
<b>Microgrid Equipment</b>	Switchgear and Cabling
<b>Microgrid Owner</b>	Eversource
<b>Fuel Cell Owner</b>	Constellation / Bloom Energy
<b>EPC Provider</b>	Constellation
<b>Developer / Construction Manager</b>	Constellation/GI Energy
<b>Utilities</b>	Eversource; Connecticut Natural Gas
<b>Interconnection</b>	Parallel Grid Connection + Critical Load (microgrid mode)
<b>Contracts</b>	<ul style="list-style-type: none"> <li>• EPC Agreement between Constellation and Hartford</li> <li>• O&amp;M Agreement between Constellation and Hartford</li> <li>• Power Purchase Agreement between Bloom/Constellation “ProjectCo” and City of Hartford</li> </ul>
<b>Target COD</b>	12/30/16



# Parkville Microgrid: Life of the Deal

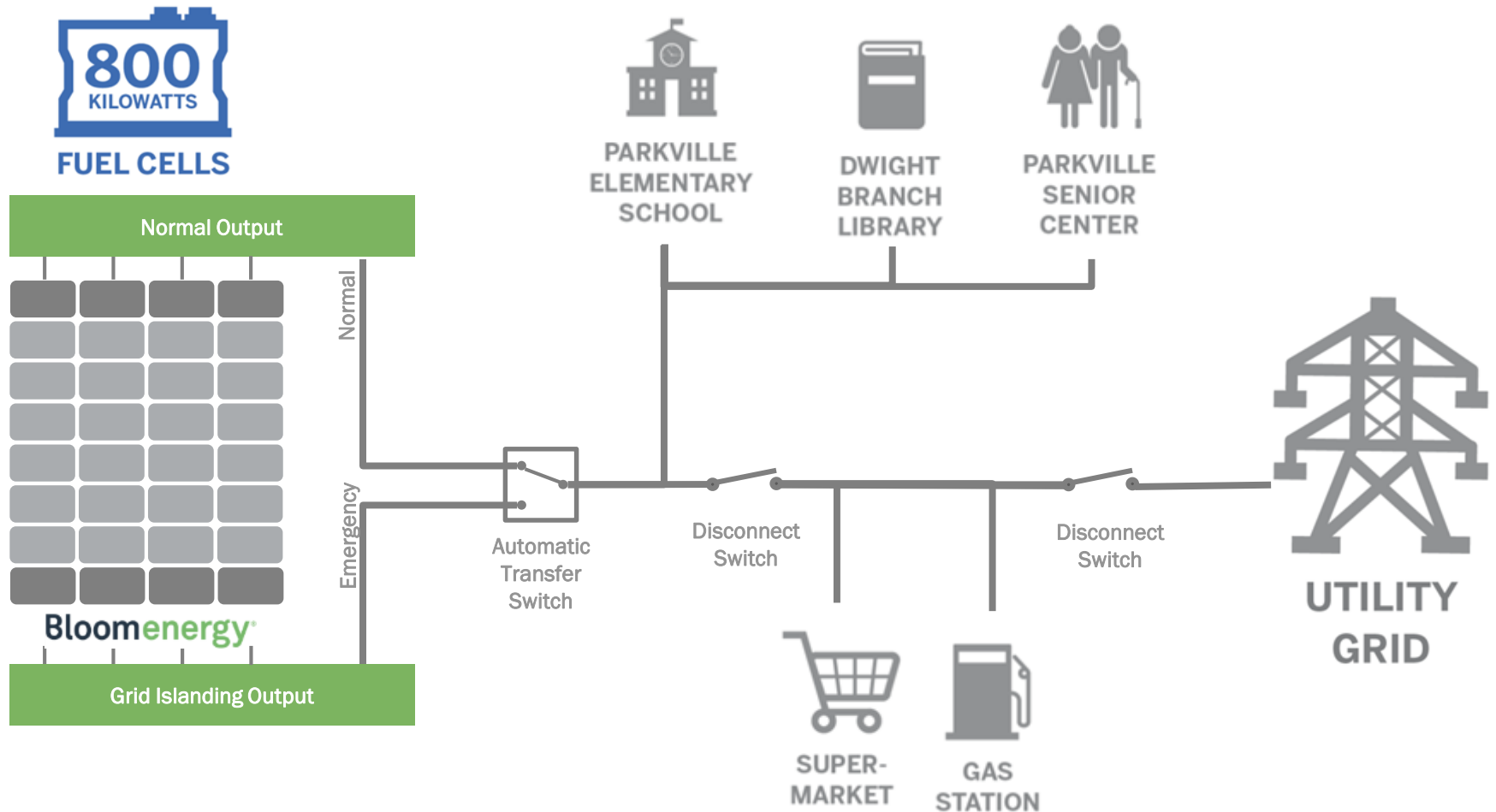


## Key Development Activities

- **Selection of generator technology:** Initially CHP but lack of onsite heat load led to use of a Bloom fuel cell
- **CT LREC bid submission and award:** Bidding strategy required to ensure you are “picked up” while protecting project economics
- **Virtual Net Metering:** Site load under normal conditions @ 20% of fuel cell output required a structure to export excess energy that is only used by the microgrid during grid outages
- **Optimal ownership structure:** SPE ownership structure necessary for economics but not standard for Constellation-owned business model or microgrids in general
- **Securing Eversource engagement and sign-off:** New model for all parties requiring a collaborative effort
- **Ensure adequate pipeline gas pressure:** Dedicated high pressure gas line for Bloom fuel cell provides extra reliability but greater upfront cost



# Parkville Microgrid: Configuration



Excess electricity generated by the system **reduces electricity costs** at four Hartford schools.



# Results

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- ❑ A microgrid system that will help manage electricity costs and supply emergency power to a portion of the city's Parkville neighborhood
- ❑ Connecticut's first microgrid to be developed through a public-private effort
- ❑ One of the first microgrids to be developed under Connecticut's Department of Energy & Environmental Protection (DEEP) Microgrid Grant Program
- ❑ Proof that utilities, project developers, manufacturers, state and local government, and project owners CAN work together to make fuel cell projects happen ...





# Challenges

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- ❑ **Economically viable (at or below current cost of electricity)**
  - LREC (Low Renewable Energy Credit)
  - DEEP Grant
  - Ability to use tax assets (ITC and depreciation)
  - Virtual net-metering legislation
- ❑ **Technology selection**
  - Very little thermal load resulted in switch from a traditional CHP utilizing a reciprocating engine to a Bloom fuel cell
- ❑ **Technical hurdles**
  - Interconnection
  - Gas pressure
  - Fuel cell system working as a micro grid, including spare UPM
- ❑ **Complexity of the Transaction**
  - Many players involved in the Micro Grid – Eversource, Constellation, Bloom, Bloom/Constellation SPE, City and other facilities. Coordination and ability to migrate through varied complexities (VNM, DEEP...)
  - Non-standard Commercial arrangements resulting in uniquely crafted contracts and agreements
- ❑ **“Dumb Grid” Configuration**
  - No tangible financial benefit to a “smart-grid” configuration resulting in a manual operation
- ❑ **Microgrid Ownership**
  - Utility maintains ownership and responsibility of the Microgrid even when segregated from the Utility Grid



Thank you for your time...

Q&A



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