

MAKE!

STATIONARY AND MOTIVE POWER

Panel Discussion

2016 H2FC Hydrogen and Fuel Cell Forum

Hartford, CT; November 17, 2016

Ben Chadwick (Moderator)

Constellation Distributed Energy



Constellation[®]

An Exelon Company

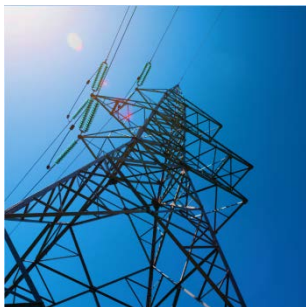
Constellation: Who We Are




#1 C&I Power provider in the US

8th 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

Life of a Stationary Fuel Cell Deal

Parkville Microgrid; City of Hartford, CT

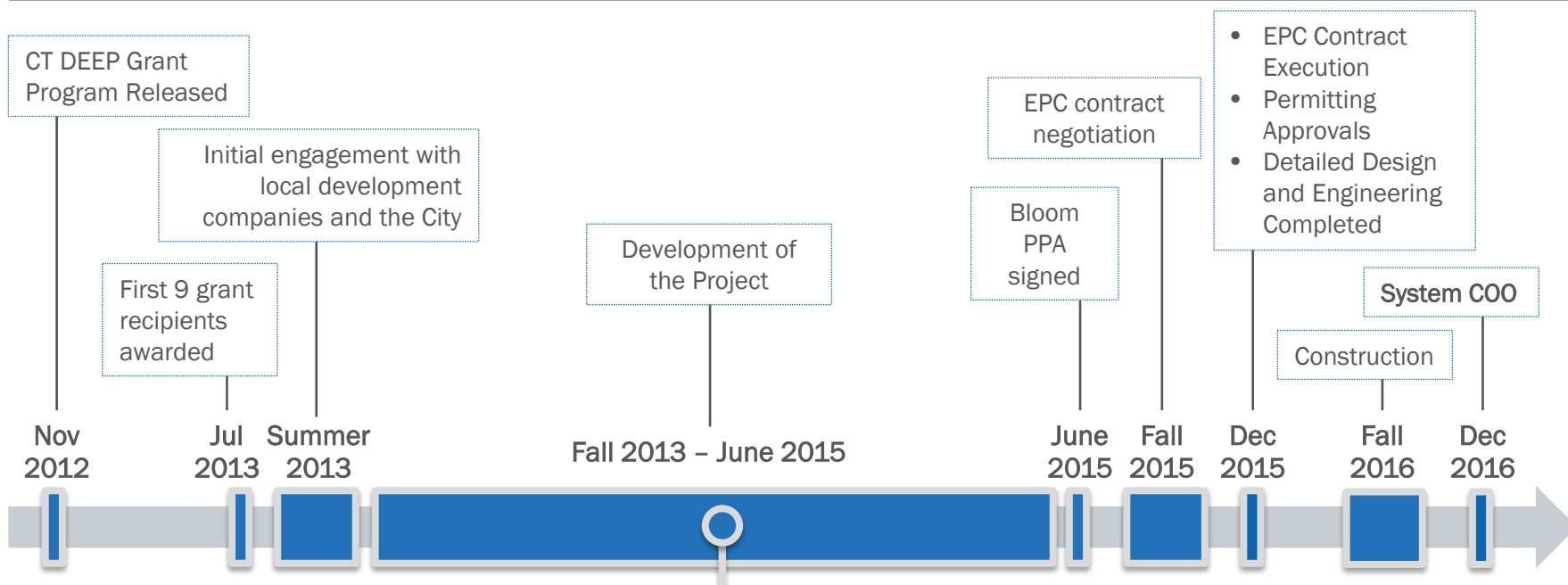


Parkville Microgrid

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



Parkville Microgrid: Life of the Deal



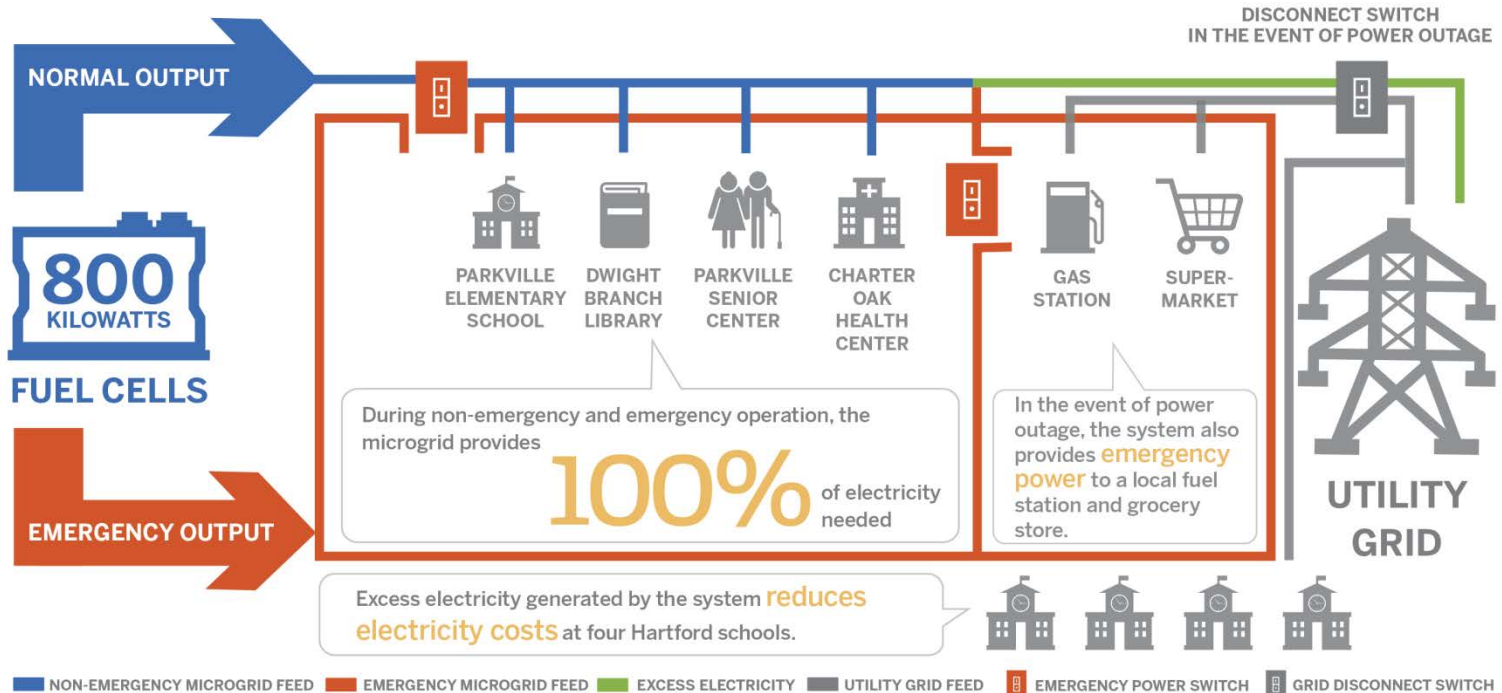
Key Development Activities

- **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

City of Hartford Fuel Cell Microgrid

MIGHTY MICROGRID

AN 800-KILOWATT FUEL CELL-POWERED MICROGRID HELPS HARTFORD REDUCE POWER COSTS AND PROVIDES EMERGENCY POWER FOR PARKVILLE'S NEIGHBORHOOD



Bloomenergy



Constellation
An Exelon Company

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Challenges and Results

Challenges

- Economically viable (at or below current cost of electricity)
 - LREC (Low Renewable Energy Credit)
 - DEEP Grant
 - Ability to use tax assets (ITC and depreciation)
- Technology selection: Very little thermal load resulted in switch from a traditional fuel cell to Bloom
- Technical hurdles – Gas pressure, Bloom working as a micro grid, spare UPM, virtual net metering
- 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...)

Results

- 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 ...**



A second fuel cell project ... building on the momentum

- Constellation will build, own, operate and maintain CHP Fuel Cell Systems at three Connecticut high schools (1.28MW total)
- Waste heat from the fuel cells will be used for pre-heating water, space heating, and heating swimming pools
- Constellation will execute an EPC and Services Contract with Doosan (the Equipment Manufacturer)

Size	1,280 kW
Technology	Doosan PureCell Model 400 Fuel Cell
Target COD	12/31/2016
EPC Provider(s)	Doosan
O&M	Doosan
Offtaker	Three CT Towns/School districts
System Owner	Constellation
Renewable Energy Credits	CT Class 1 REC's will be split between Constellation and offtakers
Deal Structure	Power Purchase Agreement
Term	20 years

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