Buildings of the Future: Commercial Partner Strategies for Building Resilience

Thursday, July 11th, 2019
11:00am—12:30pm
Session Panel

Rielle Green  
CBRE

Zachary Brown  
CBRE

Aaron Daly  
Whole Foods

Jim Freihaut  
DOE Mid-Atlantic  
CHP TAP Ctr.

Moderator: Sarah Zaleski, DOE
Better Buildings Solution Center – Resilience Page

- [https://betterbuildingsinitiative.energy.gov/resilience](https://betterbuildingsinitiative.energy.gov/resilience)

- Landing page for partner & industry resources focused on resilience strategies, organized to help you find information most relevant to your resilience goals

- Includes “**Energy Efficiency – Resilience Nexus**” Factsheet

- Contact your DOE lead to contribute a resource or case study!
Rielle Green & Zachary Brown
CBRE
RESILIENCE AT AN INVESTMENT PORTFOLIO LEVEL

JULY 11TH, 2019
INTRODUCTIONS

RIELLE GREEN
Assistant Manager, Energy & Sustainability
CBRE

ZACHARY BROWN
Director, Energy & Sustainability
CBRE
DEFINING RESILIENCE
How is climate change impacting real estate?

ASSESSING VULNERABILITY TO RISK
Developing a checklist

IMPLEMENTATION & MEASURING SUCCESS
Protecting our assets & investor perspective
SCOPE OF WORK
70,135,959 TOTAL SQ FT

- Distribution Center: 31.82%
- Office: 22.13%
- Multifamily: 16.56%
- Non-Refrigerated Warehouse: 16.35%
- Strip Mall: 6.39%

RESILIENCE AT AN INVESTMENT PORTFOLIO LEVEL
DEFINING RESILIENCE

Correct assessment of vulnerability to risks + Ability to successfully plan for and respond to a risk = RESILIENCE

HOW DO YOU ASSESS VULNERABILITY TO RISK?
PILOTING AT A BUILDING LEVEL

CHECKLIST DEVELOPMENT

• Utilize available resources
• Test for success
• Learn along the way

CHECKLIST COMPONENTS

• Protect the asset (property)
• Protect the people (tenants/residents)
• Climate disaster scenarios
ASSESSING VULNERABLE ASSETS
CASE STUDY: FLORIDA

CBRE

RESILIENCE AT AN INVESTMENT PORTFOLIO LEVEL
BUILDING LEVEL CHECKLIST

KEY TAKE-AWAYS

• Check if building is in a flood zone

• Create a list of critical systems

• Create emergency procedures for applicable climate disasters (near & mid-term)

• Educate tenants/residents on types of emergencies and evacuation plans
HOW DO YOU SUCCESSFULLY PLAN AND RESPOND TO RISK?
DIVING DEEPER AT A BUILDING LEVEL

What comes after risk is identified?

Flood Resilience Report
Consultant

CBRE Research, 2019.
IMPLEMENTATION
CASE STUDY: BOSTON, MASSACHUSETTS

Boston’s Fan Pier

Flood Map

Flood Wall
INVESTOR PERSPECTIVE

INVESTORS ARE DEMANDING MORE TRANSPARENCY, BUT HAVE YET TO FULLY UNDERSTAND THE FINANCIAL IMPACTS OF CLIMATE CHANGE
INVESTOR PERSPECTIVE

RISKS

OPPORTUNITIES
INVESTOR PERSPECTIVE

PRE-ACQUISITION & DUE DILIGENCE
• ESG Acquisitions Checklist
  • Resilience Appendix

REPORTING & DISCLOSURE
• GRESB (Global Real Estate Sustainability Benchmark)
  • Resilience Module
INVESTOR PERSPECTIVE
THANK YOU

JULY 11TH, 2019
Aaron Daly
Whole Foods
Resilient Buildings
In Practice
WFM Snapshot
Founded: 1980
Store Count: c500

Our purpose is to Nourish People and the Planet
We Sell the Highest Quality Natural & Organic Foods
We Satisfy and Delight our Customers
We Promote Team member Growth and Happiness
We Practice Win-Win Partnerships with our Suppliers
We Create Profits and Prosperity
We Care About our Communities and the Environment

Whole Foods, Whole People, Whole Planet
Valuing Resilience
Threats to Grid Reliability

Power outages reported across Central Florida as storms roll through
Soggy weather causes crashes, delays

Lightning strikes, causes power outage in northeast Brainerd

Dallas Business Looted As Storm Power Outage Continues
Costs to Grocery Business

- Lost Sales
- Lost Product
- Added Labor
- Equipment Failure
Energy
Program Goals
Energy Usage

- Refrigeration: 40%
- Lighting: 20%
- Operations: 20%
- HVAC: 20%
Energy Reduction
From 2008 Baseline:

-20.6%
kWh Electricity per Sqft
Across 12MM+ sqft area
Energy Infrastructure

- Refrigeration Systems
- Cases
- HVAC
- Lighting
- Controls
- Walk-ins
- Cash Registers
- Kitchen Equipment
Energy Conservation Measures (ECM’s)
OER Solar Photovoltaic (PV)

10 MEGAWATTS OF ROOFTOP SOLAR ON 60 STORES & DISTRIBUTION CENTERS

4.3MW UNDER CONSTRUCTION
OER
Electrochemical Battery Storage

8 Operational Systems; 14 more under construction
OER
Refrigeration
Thermal Storage
Onsite Energy Resources (OER): Fuel Cells
OER
Gas Fired Engine
Combined Heat & Power (CHP) Plants
Case Study: Zero Net Energy (ZNE) Buildings

Whole Foods Market to Transform San Francisco Store to Zero Net Energy

by Pamela Crusich | Apr 13, 2016 | News & Events | 0 comments

Project funded by $3M California Energy Commission grant will convert an existing grocery store to scalable near-zero net energy – serving as a model for stores throughout the state
Waste to Energy: Used Cooking Oil Recycling
Waste to Energy: Biodigester Technologies
Building Micro-Grids

- Solar
- Battery
- Genset
Water
Water Usage

- Cooling: 49%
- Restrooms: 17%
- Kitchen: 15%
- Landscaping: 3%
- Other: 16%
Water Efficiency Measures

- Dual Flush Toilets
- Low-No Flow Urinals
- High Efficiency Process (i.e. Kitchen Equipment)
- High Efficiency Spray Valves
- Real Time Water Monitoring
- Low Flow High Efficiency Faucets
Waste Conservation Measures:
Stormwater Catchment
Waste Conservation Measures: Hybrid Condensers
Waste Conservation Measures:
Ecological Wastewater & Stormwater Treatment

CONSTRUCTED WETLANDS
The water is dispersed under the gravel and travels horizontally through a series of wetlands. The roots of plants, including cattails and bulrushes, extend through the gravel, where they host bacteria that pull nitrogen from the water.
Waste Conservation Measures: Onsite Wastewater Treatment
Presentation complied with the assistance of our sustainability consultants AB Group:
Jim Freihaut
DOE Mid-Atlantic CHP TAP Center
Resilience and Reliability with CHP

J. Freihaut
Pennsylvania State University
Department of Architectural Engineering
Director DOE Mid-Atlantic CHPTAP Ctr.

U.S. DOE CHP Deployment Program
CHP Technical Assistance Partnerships
Power Outages are Costly
CHP System Schematic

Fuel
- Natural Gas
- Propane
- Biogas
- Landfill Gas
- Coal
- Steam
- Waste Products
- Others

Prime Mover
- Reciprocating Engines
- Combustion Turbines
- Microturbines
- Steam Turbines
- Fuel Cells
- ORC turbine

Heat Exchanger

Generator

Electricity
- On-Site Consumption
- Sold to Utility

Thermal
- Steam
- Hot Water
- Space Heating
- Process Heating
- Space Cooling
- Process Cooling
- Refrigeration
- Dehumidification

CHP Technical Assistance Partnerships
CHP: A Key Part of Our Energy Future

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Uses thermal energy for:
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification

CHP provides efficient, clean, reliable, affordable energy—today and for the future.

Source: www.energy.gov/chp
How Does CHP Increase Resilience?

- **For end users:**
  - Provides continuous supply of electricity and thermal energy for critical loads
  - Can be configured to automatically switch to “island mode” during a utility outage, and to “black start” without grid power
  - Ability to withstand long, multiday outages

- **For utilities:**
  - Enhances grid stability and relieves grid congestion
  - Enables microgrid deployment for balancing renewable power and providing a diverse generation mix

- **For communities:**
  - Keeps critical facilities like hospitals and emergency services operating and responsive to community needs
**Critical Infrastructure Sectors Conducive to CHP**

- Host facilities must have a consistent electric and thermal demand, and a reliable source of fuel (pipeline natural gas, anaerobic digester gas, etc.)

<table>
<thead>
<tr>
<th>Who Can Use CHP?</th>
<th>Airports</th>
<th>Chemicals &amp; Pharmaceuticals</th>
<th>Colleges &amp; Universities</th>
<th>Critical Manufacturing</th>
<th>Datacenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution Centers</td>
<td>Fire Stations</td>
<td>Food Processing</td>
<td>Food Sales &amp; Supermarkets</td>
<td>Government Facilities</td>
<td></td>
</tr>
<tr>
<td>Hospitals &amp; Healthcare</td>
<td>Hotels &amp; Lodging</td>
<td>Laundries</td>
<td>Military Bases</td>
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<tr>
<td>Nursing Homes</td>
<td>Police Stations</td>
<td>Prisons</td>
<td>Schools</td>
<td></td>
<td>Wastewater Treatment Plants</td>
</tr>
</tbody>
</table>
# CHP: Proven to be Resilient

## Hurricane Harvey
- University of Texas Medical Branch (UTMB)
- Texas Medical Center (TMC)
- Southwest Energy Data Center
- Lake Charles Manuf. Complex
- DeBakey VA Medical Center

## Hurricane Irma & Maria
- Hospital De La Concepcion PR
- Wyndham Hotel St. Thomas
- Univ. of Florida Shands Medical Center
- Matosantos Commercial Corp
- Captain Morgan Diageo Rum Distillery
- Plaza Extra East Supermarket St. Croix

## Superstorm Sandy
- South Oaks Hospital
- Princeton University
- Salem Community College
- Public Interest Data Center
- Bergen Counties WWTP
- Sikorsky Aircraft Corp.

## Hurricane Ike & Katrina
- Mississippi Baptist Medical Center
- Louisiana State University
- University of Texas Medical Branch (UTMB)
Project Snapshot: Texas Medical Center

- **Location:** Houston, TX
- **Application/Industry:** Hospital
- **Capacity:** 48 MW
- **Prime Mover:** Combustion turbine
- **Fuel Type:** Natural gas
- **Thermal Use:** Steam for heating and chilled water
- **Installation Year:** 2010
- **Resilience Benefits**
  - Provided critical services to hospital patients and staff throughout Hurricane Harvey
  - Elevated CHP system design was able to withstand flooding given significant storm surge in the area
  - Also provides $6-12 million in energy cost savings per year

Brays Bayou before and after flooding from Hurricane Harvey, photos courtesy of the Thermal Energy Corporation (TECO)
Resilience Planning with DOE CHP for Resiliency Accelerator

- The **DOE CHP for Resiliency Accelerator** includes resources and tools designed to assist with resilience planning efforts
  - Distributed Generation for Resiliency Planning Guide
  - CHP for Resilience Screening Tool
  - Issue Brief on Performance of DERs in Disaster Events
  - Partner Profiles

https://betterbuildingsinitiative.energy.gov/accelerators/combined-heat-and-power-resiliency
The CHP for Resilience Screening Tool

**Resiliency Screening**
- **Inputs:** User-defined critical infrastructure ranking criteria, as well as microgrid and load factor ranking assessments
- **Results:** Users receive a resiliency score, microgrid score, load factor score, historical CHP uptake, and combined total resilience score

**CHP Screening**
- **Inputs:** Resiliency score (from resiliency screening), site location, energy consumption data, and energy price data
- **Results:** Estimated CHP size and spotlight screening assessment (taking into account resiliency screening)

**Stoplight Screening Assessment**
- This site has a high potential for CHP, contact your CHP TAP for more information
- This site has medium potential for CHP, contact your CHP TAP for more information
- Limited CHP Potential

**Resiliency Screening Factors:** Government Continuity, Locational Ranking, Leverage/Scalability, Life Safety, Economic Impact, Microgrid, and Load Factor

Access the tool at the accelerator website under “Featured Resources”:
https://betterbuildingsinitiative.energy.gov/accelerators/combined-heat-and-power-resiliency
## Issue Brief – Examining the Performance of Different DERs in Disaster Events

<table>
<thead>
<tr>
<th>Natural Disaster or Storm Events</th>
<th>Flooding</th>
<th>High Winds</th>
<th>Earthquakes</th>
<th>Wildfires</th>
<th>Snow/Ice</th>
<th>Extreme Temperature</th>
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<td>Battery Storage</td>
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<td>Biomass/Biogas CHP</td>
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<td>Distributed Solar</td>
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<td>Distributed Wind</td>
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<td>Natural Gas CHP</td>
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<td>Standby Generators</td>
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[https://betterbuildingsinitiative.energy.gov/sites/default/files/attachments/DER_Disaster_Impacts_Issue%20Brief.pdf](https://betterbuildingsinitiative.energy.gov/sites/default/files/attachments/DER_Disaster_Impacts_Issue%20Brief.pdf)
Distributed Generation (DG) for Resilience Planning Guide

- Provides information and resources on how DG (w/a focus on CHP), can help communities meet resilience goals and ensure critical infrastructure remains operational regardless of external events.

https://resilienceguide.dg.industrialenergytools.com/
Policies and Programs for Resilient CHP

Resilience and Reliability with CHP
NJ Energy Resilience Bank

- Funded with $200MM from US HUD CDBG disaster recovery funds awarded to NJ as a result of Superstorm Sandy and operated by the NJ Economic Development Authority with support from the NJ Board of Public Utilities and NJ Dept. of Treasury.
- Eligible applicants included public and/or not-for profit WWTPs and Hospitals which were impacted by Sandy or other eligible storms.
- Eligible systems included CHP meeting 65% LHV efficiency and capable of operating in grid island mode. The CHP plant, in conjunction with existing emergency generators must be capable of operating the facility’s designated critical loads for 7 days without delivery of fuel to emergency generators.
NJ Energy Resilience Bank

- **ERB Funding Mechanism**
  - The NJ ERB Program provides a financing product that covers 100% of the cost of implementing resilient CHP
  - The financing product is made up of:
    - Grant/forgivable loan for 100% of eligible resilience costs
    - Grant/forgivable loan for 40% of remaining eligible costs (i.e. CHP)
    - Loan at 2% with 20-year term for the balance of ERB project funds
  - Typically the program provided approx. 60% of total project costs in the form of a grant and 40% as a loan resulting in positive cash flow throughout the life of the project.

- **ERB requirements include implementation of a comprehensive 10-year service contract on major equipment at the owner’s expense.**

Gov Christie and PSE&G President David Daly at opening of first ERB CHP project to begin operation. (Photo: ~Courtesy of Gov. Chris Christie's Office)
All the funding has been allocated to projects either upgrading existing CHP facilities or implementing new CHP facilities with the majority of the funding being allocated to hospitals implementing new resilient CHP projects. Eight hospitals were approved by the ERB to move forward with new resilient CHP projects.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Location</th>
<th>Gen Set Size</th>
<th>Gen Set Type</th>
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<tbody>
<tr>
<td>St Peter’s UH</td>
<td>New Brunswick</td>
<td>2 MW</td>
<td>Recip Engine</td>
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<td>Cooper UH</td>
<td>Camden</td>
<td>4.5 MW</td>
<td>Combustion Turbine</td>
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<td>Hunterdon MC</td>
<td>Flemington</td>
<td>1.5 MW</td>
<td>Recip Engine</td>
</tr>
<tr>
<td>St Barnabas MC</td>
<td>Livingston</td>
<td>2.5 MW</td>
<td>Recip Engine</td>
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<td>Jersey City MC</td>
<td>Jersey City</td>
<td>1.5 MW</td>
<td>Recip Engine</td>
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<td>Newark Beth Israel</td>
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<td>Recip Engine</td>
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<tr>
<td>UH Somerset</td>
<td>Sommerville</td>
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<td>Recip Engine</td>
</tr>
<tr>
<td>Trinitas Regional MC</td>
<td>Elizabeth</td>
<td>2 MW</td>
<td>Recip Engine</td>
</tr>
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Thank You!

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Contact Us

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