



Economic Dispatch of DER Resources with VOLTRON™

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- **Who are we?**
- **Why work with us**
- **What we bring to the NYS Market Place**
- **How we became engaged in the dispatching of DER Assets Business**
- **What our DER Software Platform is**
- **What our expertise is**
- **Resiliency, DERs & Microgrids**



Who Are We?



Cogen Power Technologies (CPT)

- Design Build CHP firm since 2006 located in Latham, NY
- A division of Bette & Cring, national construction firm, \$250 M annual revenue
- Evolving from a MW-scale CHP Turnkey to a Hybrid Turnkey Supplier



Frontier Energy (FE) - *formerly CDH Energy*

- Long term partner for data analytics and automated economic dispatch
- Energy consulting firm with offices in NY, CA and TX
- NYSERDA Consultant



We serve the 1 MW – 20 MW market (hospital, university, industrial, etc.)



Why work with us?



- **Our broad experience and domain expertise with generation assets, building load forecasting, real time prices, make us especially qualified as multiple components and systems are added together**
- **A tool box of vetted components available in VOLTTRON™ for PV, batteries, other plant components, etc.**
- **Our team has already implemented a FORMAL day-ahead optimization for CHP systems responding to day ahead prices. Including other technologies (solar, storage, etc.)**
- **We have successfully delivered 7 CHP Systems as the Design-Build contract holder**
- **We own and operate a Plant that has successfully dispatched multiple prime movers for over 10 years**



What we bring to the effort for NYS marketplace:

Pre-Analytics to determine Size-mix of Technologies	Solar Equipment & Installation	Storage Equipment & Installation	CHP Equipment & Installation	Controls Equipment & Installation	Dispatching Algorithm, Signaling, Monitoring	Systemwide Responsibility (Interface to Customer)
★	★ (install)	★ (install)	★ (install)	★(install)	★	★

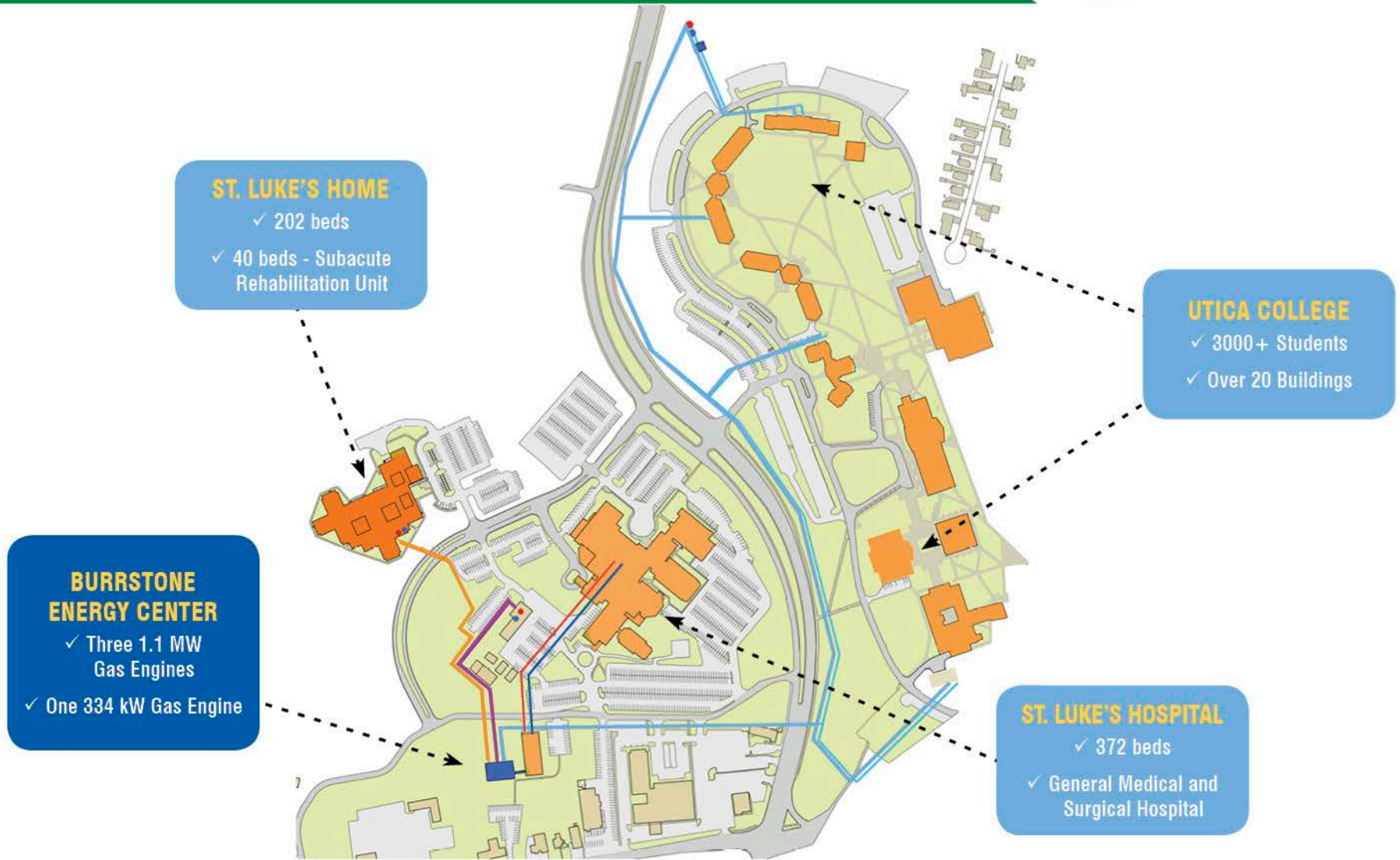
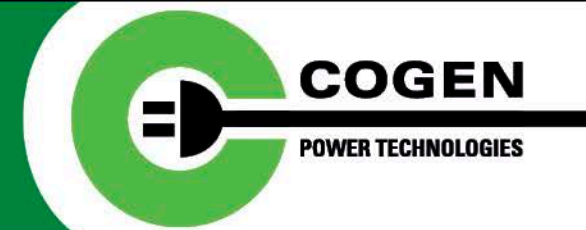
Audience-members we want to connect with to form a team in NYS:

Pre-Analytics to determine Size-mix of Technologies	Solar Equipment & Installation	Storage Equipment & Installation	CHP Equipment & Installation	Controls Equipment & Installation	Dispatching Algorithm, Signaling, Monitoring	Systemwide Responsibility (Interface to Customer)
★	★	★	★	★		★

“We are flexible in the role we play”

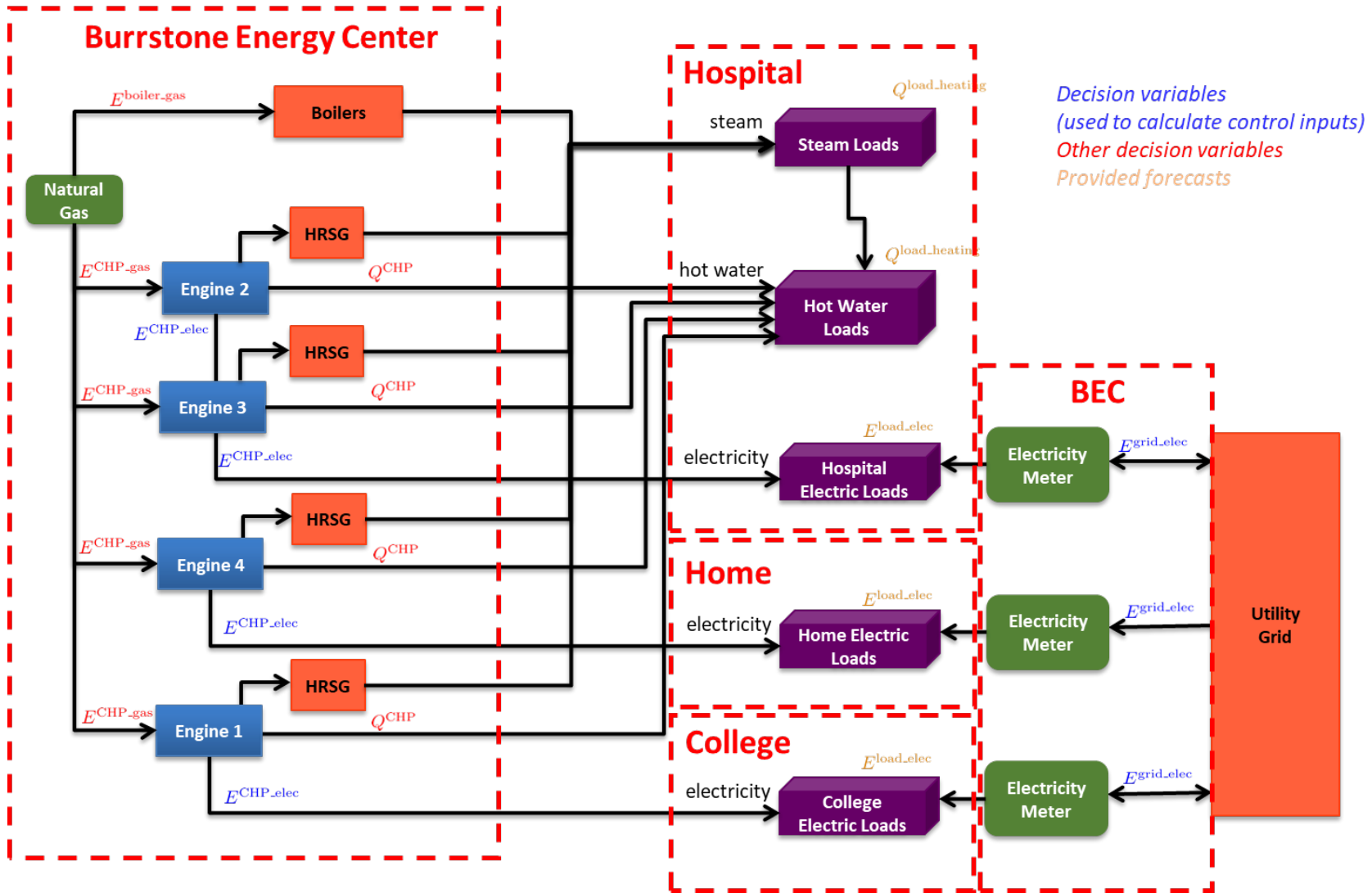
In 2006, CPT Developed the St. Luke's Hospital & Utica College Burrstone Energy Microgrid

UTICA, NY



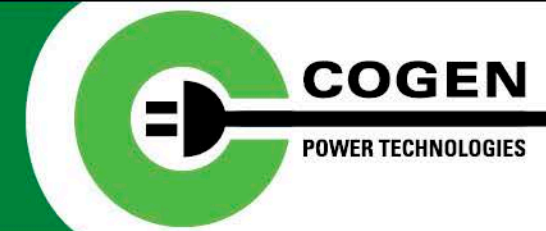
The Optimization Problem

Maximize "profit" within constraints



St. Luke's Hospital/Utica College Burrstone Energy Center Microgrid

UTICA, NY



WE FINANCED, OWN & OPERATE

Project Overview

- New 5,400 SF Building
- \$15 Million Design-Build Project
- Start - Nov 2007 | Operational - Aug 2009

Output

- 3.6 MW of 13.2 kV electricity,
- 7000 lbs/hr of 85 psig Steam
- 700 gpm of 200 degree hot water
- Output to Date:
 - Generated over 140 M kWh of Electricity
 - Exported over 10 M kWh of Electricity
 - Produced over 120 M lbs of Steam

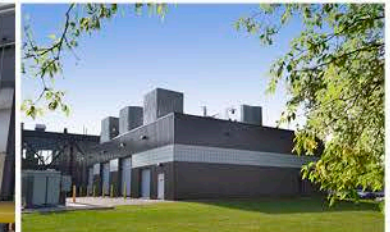
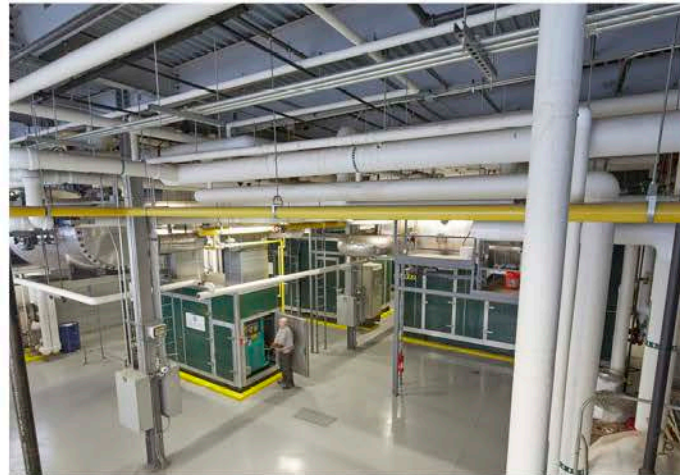
Technology

- Three 1.1 MW and One 334 kW Lean Burn Natural Gas Reciprocating Engines
- 300 Ton Double Effect Steam Absorption Chiller, One 100 Ton Hot Water Absorption Chiller
- 750 kw Black Start Generator

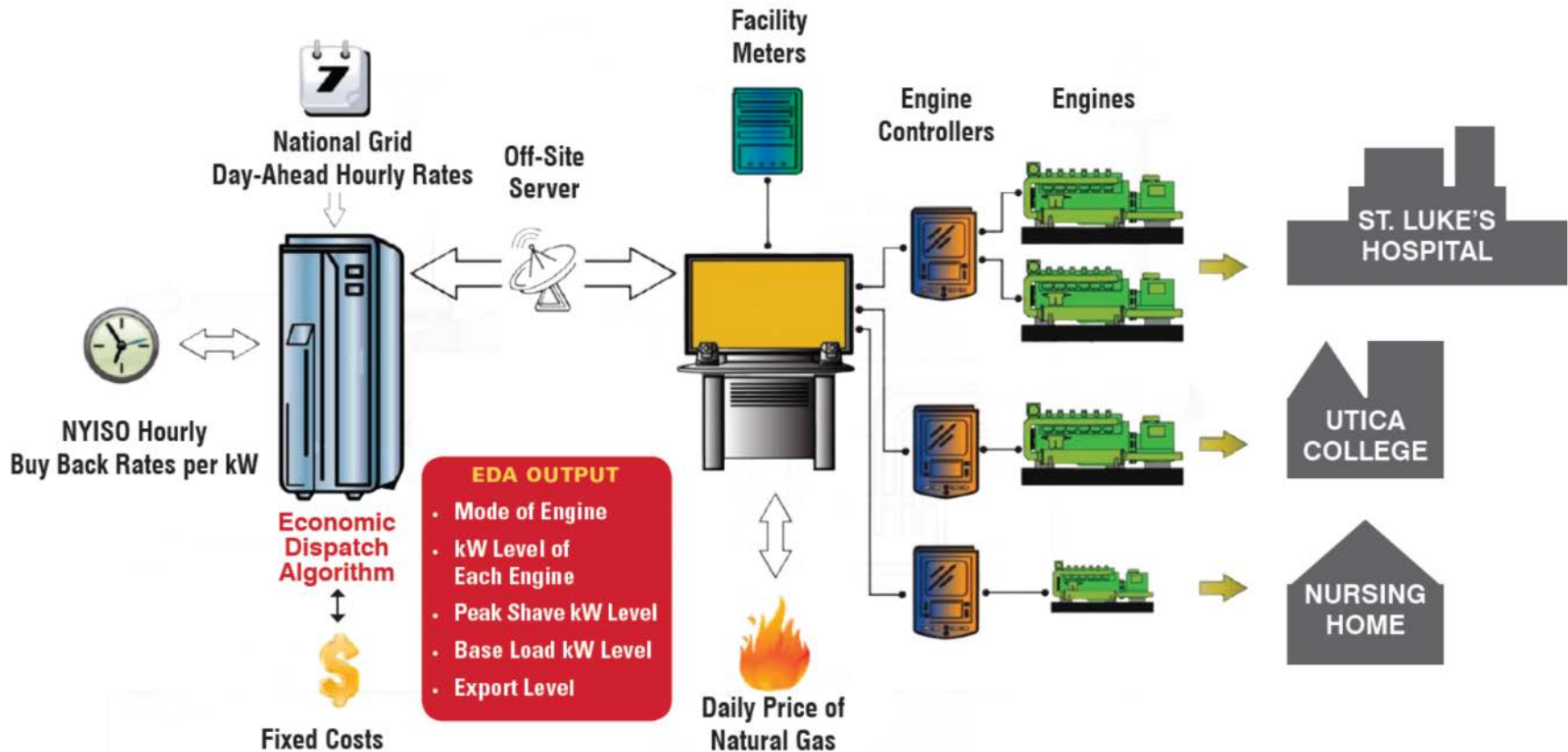


KEY FEATURES:

- ✓ Multiple Gas Engines
(3) 1.1 MW & (1) 334 kW
- ✓ Connection to Multiple
Utility Services
- ✓ Load Management System
- ✓ Black Start Capability
- ✓ Campus Environment



We developed our own Automated Economic Dispatch System...



What is VOLTRON™?



Pacific Northwest National Labs (PNNL) *approached us* to implement their open-source software platform developed with DOE funding.

- Provides a common, secure framework that runs on local, low-cost hardware or in the cloud (as needed)
- A robust library of agents to:
 - Gather and manage data from diverse sources (building system data, utility prices, weather data, etc.)
 - Forecasting tools (building loads, etc.)
 - Models of physical components (building equipment, solar arrays, inverters, batteries, chillers, boilers, thermal storage, etc.)
 - Send commands to control systems
 - Robust, formal optimization
 - Not dedicated to single technology/resource



Why use an Open Source Platform?

- It is open source like the programming languages FORTRAN or PYTHON are
- Someone still needs to know how to program the language to get the desired outcome... *we have that expertise*
- Proprietary programs are black boxes
- VOLTRON has been Third Party Verified by a National Laboratory (PNNL)
- More transparency & more certainty it is doing the best thing



Why a new VOLTRON™-Based Economic Dispatch System?



Enhancements that Address New (and Expected) Opportunities under NY REV

- **Respond to new 24 hour day-ahead and hour ahead export pricing from National Grid DSP Pilot at Burrstone**
 - Day ahead hourly pricing that includes value for both wholesale commodity AND distribution system benefits
- **Provide better load forecasting to address wide range of “day ahead” price-response issues (demand limiting, energy storage, etc.)**



Formulate Problem in VOLTRON™ (Linear Programming)



- **Define function to optimize**
- **Develop constraints in linear form**
- **Run optimization for each hour, looking 24 hours ahead**

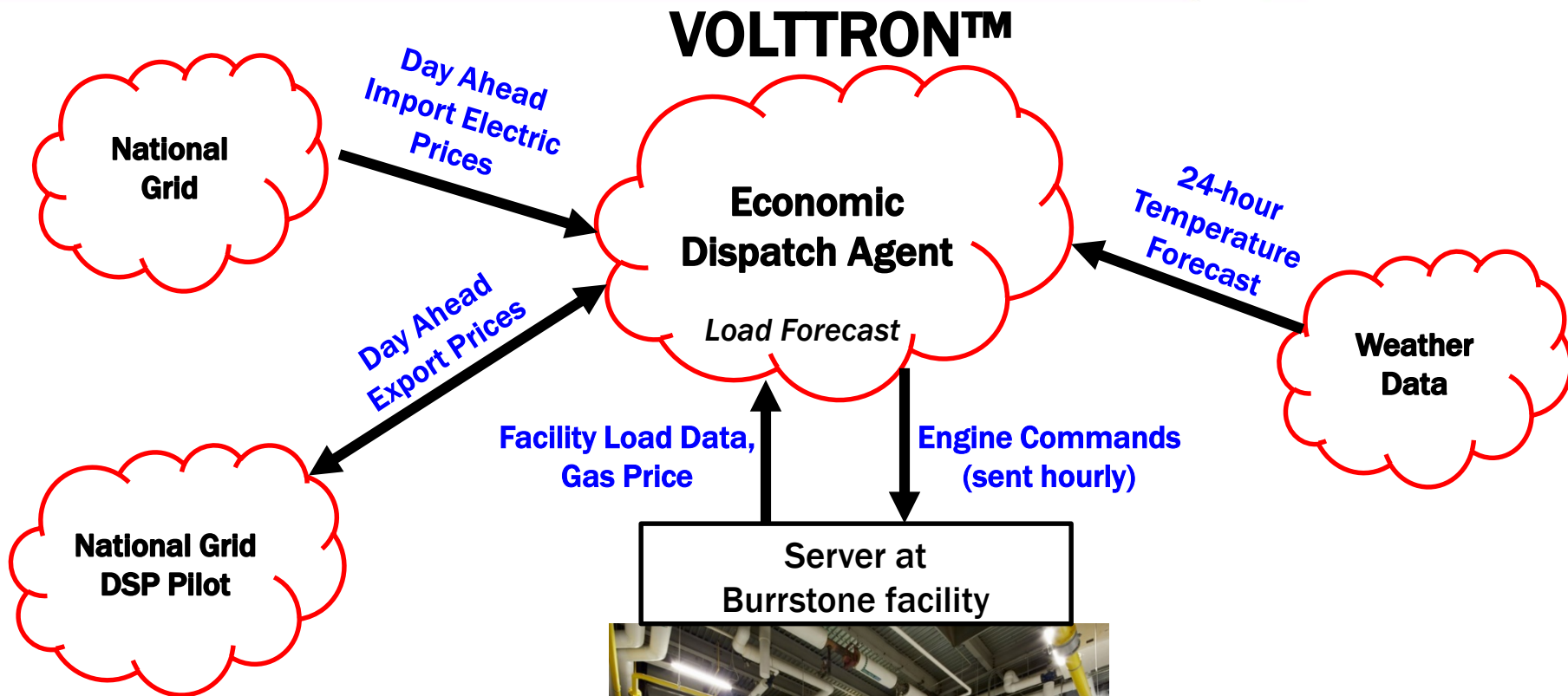
$$\text{Load}_{f,h}^{\text{elec}} + \text{Commit}_{f,h} - \sum_i \text{Gen}_{i,h}^{\text{elec}} - \text{Import}_{f,h} = 0, \quad \forall f, h$$

$$\text{Load}_h^{\text{steam}} + \text{Reject}_h^{\text{steam}} - \sum_i \text{Gen}_{i,h}^{\text{steam}} - \text{Boiler}_h^{\text{steam}} = 0, \quad \forall f, h$$

- **Allows us to Optimize Value for Portfolio of DER Resources in facility**



Data Exchange at Burrstone



Since our collective Burrstone experience,
we have...



CPT

- **Completed 7 different CHP Projects as the Design-Build contract holder... of which 4 are at Level 1 Trauma Centers**
- **Produced over half-a-billion kWhs exported over 20 million kWhs**
- **Supported operations, maintenance, and troubleshooting at 2 Plants**
- **Implement islanding, Automatic Load Shed, and Black Start at 6 of the Plants**

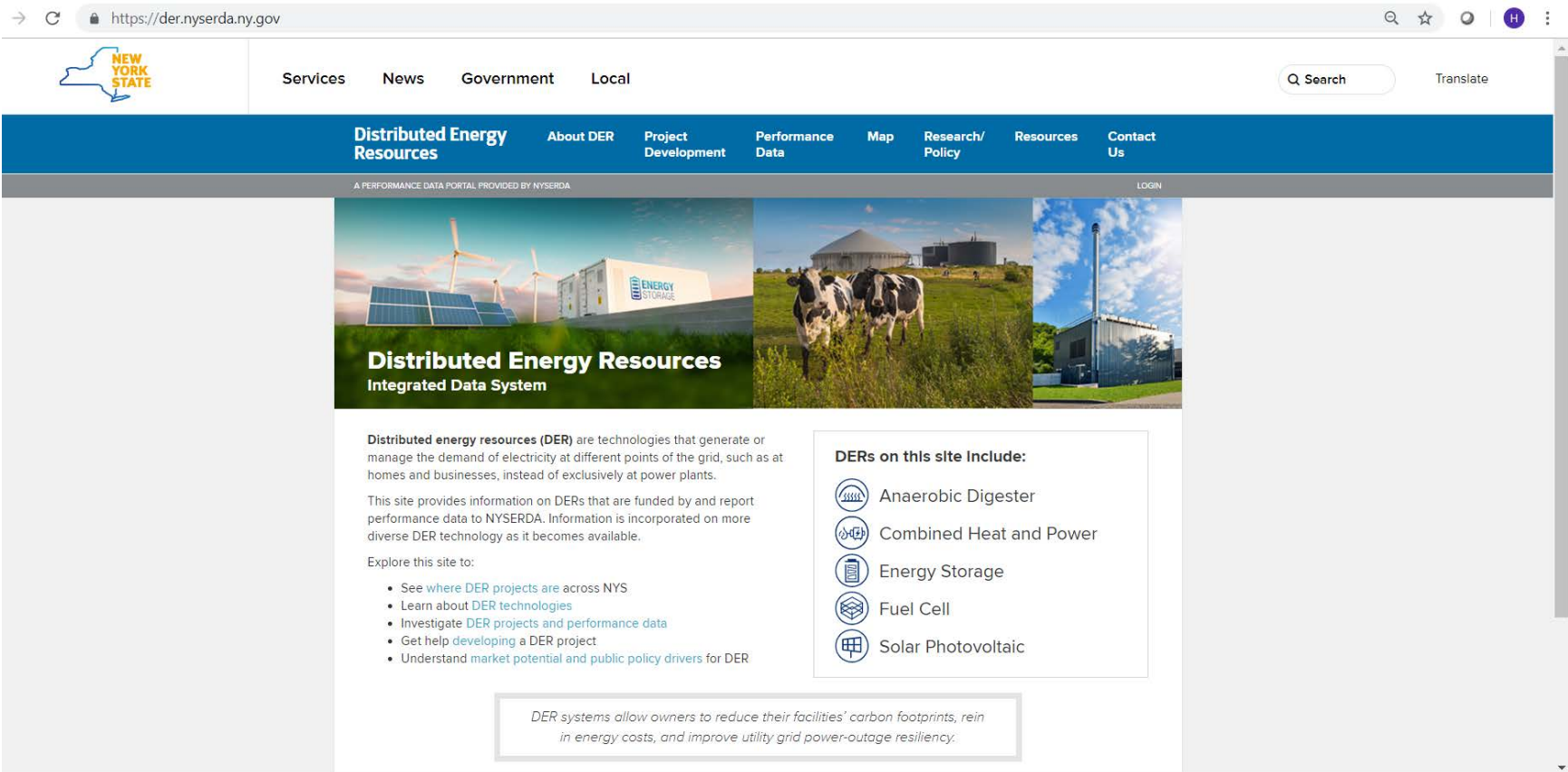
Frontier Energy

- **Collects performance data from 500 different systems each night**
- **Run analytics and make recommendations to meet customer needs**
- **Developed a deep tool box to quickly interface to a wide variety of data streams from control systems, websites, etc. using Modbus, BACNet, OBIX, JSON, XMC, etc.**

...AND



Frontier Energy built and operate this site presenting data for various DER



The screenshot shows the NYSERDA DER website interface. At the top, there is a navigation bar with links for Services, News, Government, and Local. Below this is a blue header with 'Distributed Energy Resources' and other menu items like 'About DER', 'Project Development', 'Performance Data', 'Map', 'Research/Policy', 'Resources', and 'Contact Us'. The main content area features a large banner with images of wind turbines, solar panels, and an 'ENERGY STORAGE' container. Below the banner, there is a section titled 'Distributed Energy Resources Integrated Data System' with a descriptive paragraph and a list of DER types. A callout box at the bottom highlights the benefits of DER systems.

<https://der.nyseda.ny.gov>

NEW YORK STATE

Services News Government Local

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Distributed Energy Resources

About DER Project Development Performance Data Map Research/Policy Resources Contact Us

A PERFORMANCE DATA PORTAL PROVIDED BY NYSERDA LOGIN

Distributed Energy Resources Integrated Data System

Distributed energy resources (DER) are technologies that generate or manage the demand of electricity at different points of the grid, such as at homes and businesses, instead of exclusively at power plants.

This site provides information on DERs that are funded by and report performance data to NYSERDA. Information is incorporated on more diverse DER technology as it becomes available.

Explore this site to:

- See [where DER projects are](#) across NYS
- Learn about [DER technologies](#)
- Investigate [DER projects and performance data](#)
- Get help [developing a DER project](#)
- Understand [market potential and public policy drivers](#) for DER

DERs on this site include:

- Anaerobic Digester
- Combined Heat and Power
- Energy Storage
- Fuel Cell
- Solar Photovoltaic

DER systems allow owners to reduce their facilities' carbon footprints, rein in energy costs, and improve utility grid power-outage resiliency.

Resiliency

- **10 years of Plant Operations at our Hospital customer, plus 4 CHP Plants at Level 1 Trauma Centers has immersed us in why resiliency of reliable power is so critical.**

DER Technologies

- **The integration of DERs enables the developers much more flexibility to customize the solution(s) to meet the customer's resiliency and financial needs.**

Microgrids

- **The inherent resiliency of microgrids will make them invaluable to their communities... however, there are still many obstacles to overcome (regulatory, DER Technology Performance, cost).**

“This Audience will Solve this Problem”

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