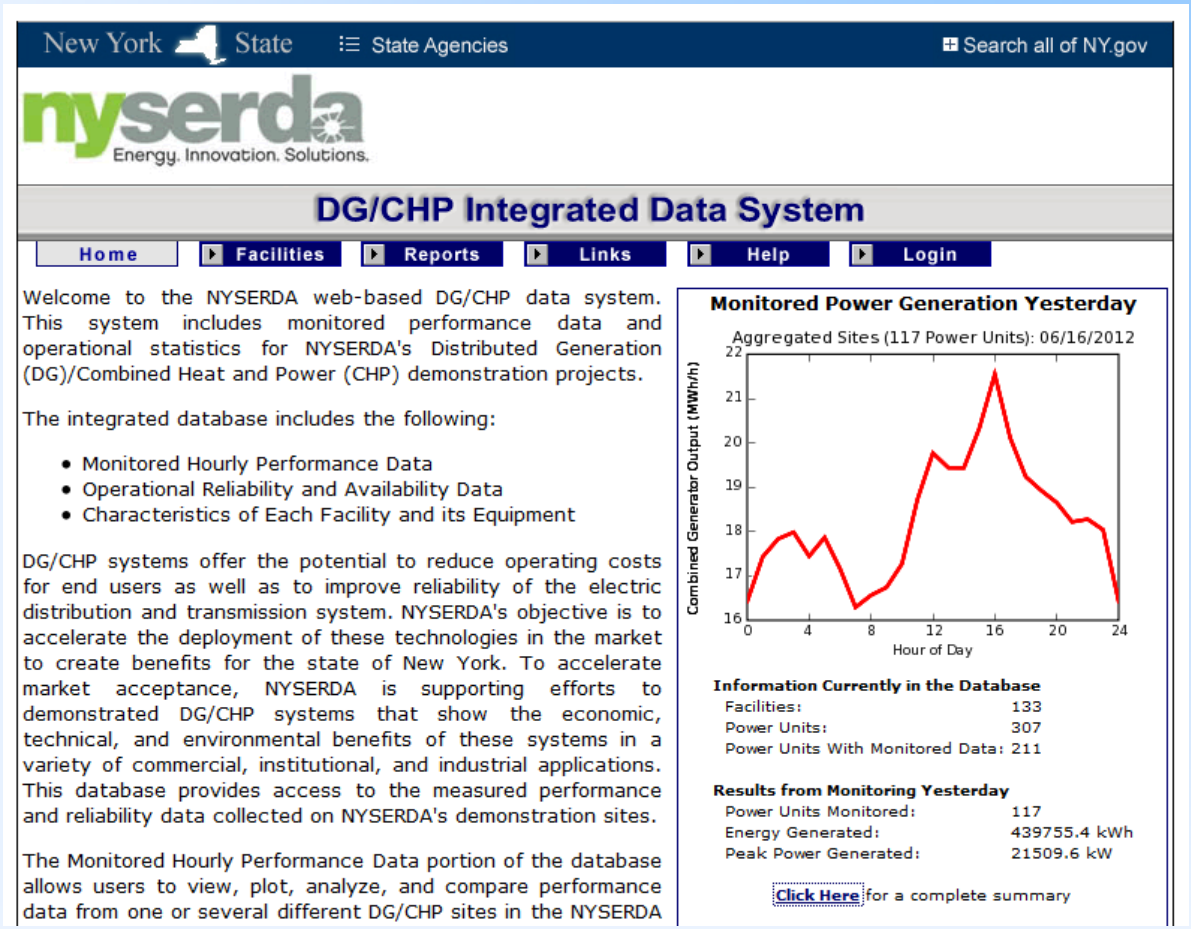
NYSERDA CHP Data Website

chp.nyserda.org



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CDH Energy Corp.

Cazenovia, NY

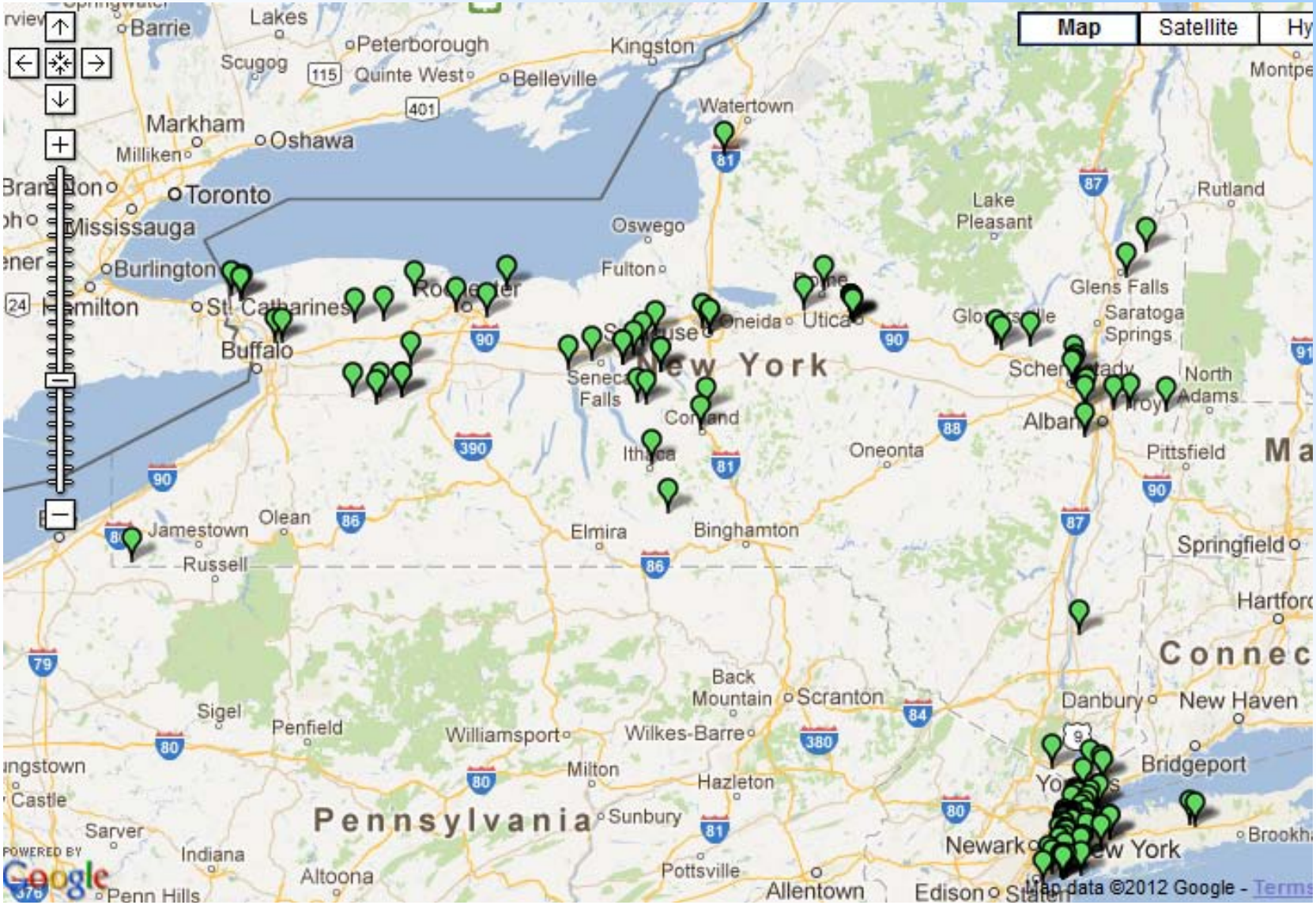
Presentation Overview

- What is the NYSERDA CHP website?
  - Data portal, tool to verify performance, resource for owners considering CHP
  - How much data, what kind of data, etc
  - How the website is used by different NYSERDA programs
- Data collection process for CHP systems
  - On-site monitoring/metering hardware details
  - User guide: what do I have to do to send data to the NYSERDA CHP website
- Future Plans

Web Site has Data on NY CHP Systems

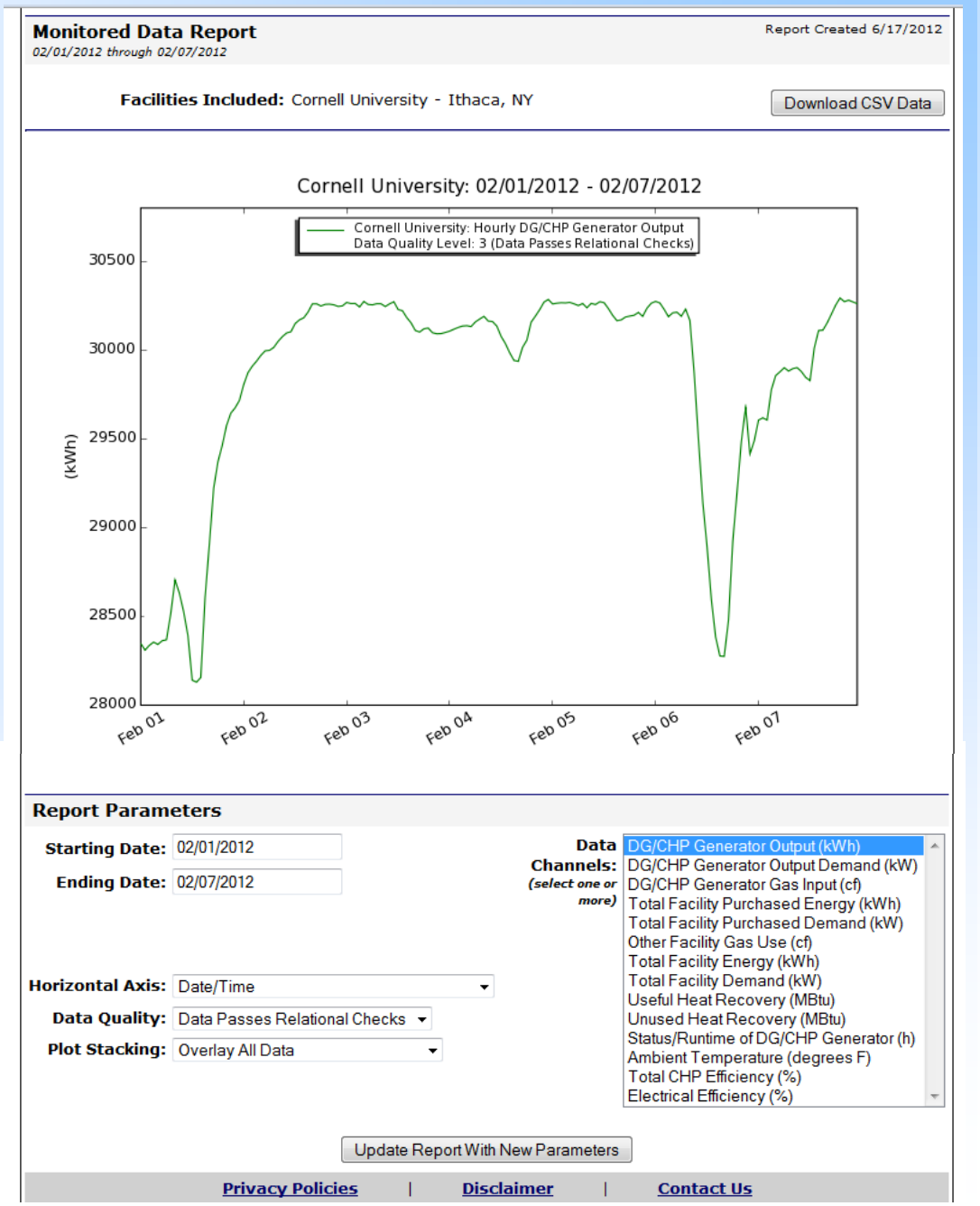
- Some information available for 133 CHP sites since 2005 (data back to 2002)
- Hourly performance data available for nearly 100 NYSERDA-funded CHP systems
  - **Net power out, fuel in, useful heat recovery**
  - **facility power, facility gas use, unused heat**
- Nightly data collection from more than 65 systems each night
  - Automated data comes in by FTP, email, etc

Location of CHP Facilities



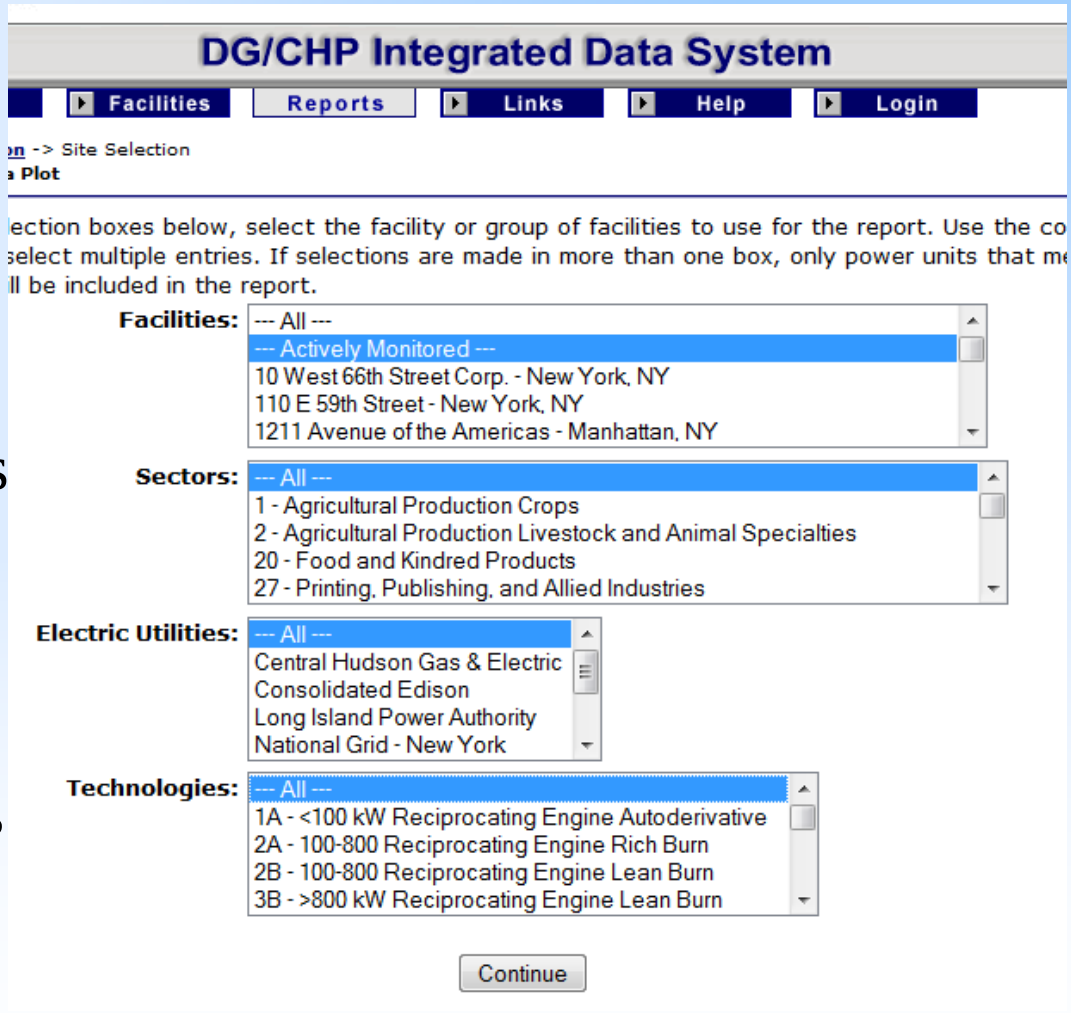
Custom Plots of Hourly Data

- DG/CHP Generator Output (kWh)
- DG/CHP Generator Output Demand (kW)
- DG/CHP Generator Gas Input (cf)
- Total Facility Purchased Energy (kWh)
- Total Facility Purchased Demand (kW)
- Other Facility Gas Use (cf)
- Total Facility Energy (kWh)
- Total Facility Demand (kW)
- Useful Heat Recovery (MBtu)
- Unused Heat Recovery (MBtu)
- Status/Runtime of DG/CHP Generator (h)
- Ambient Temperature (degrees F)
- Total CHP Efficiency (%)
- Electrical Efficiency (%)

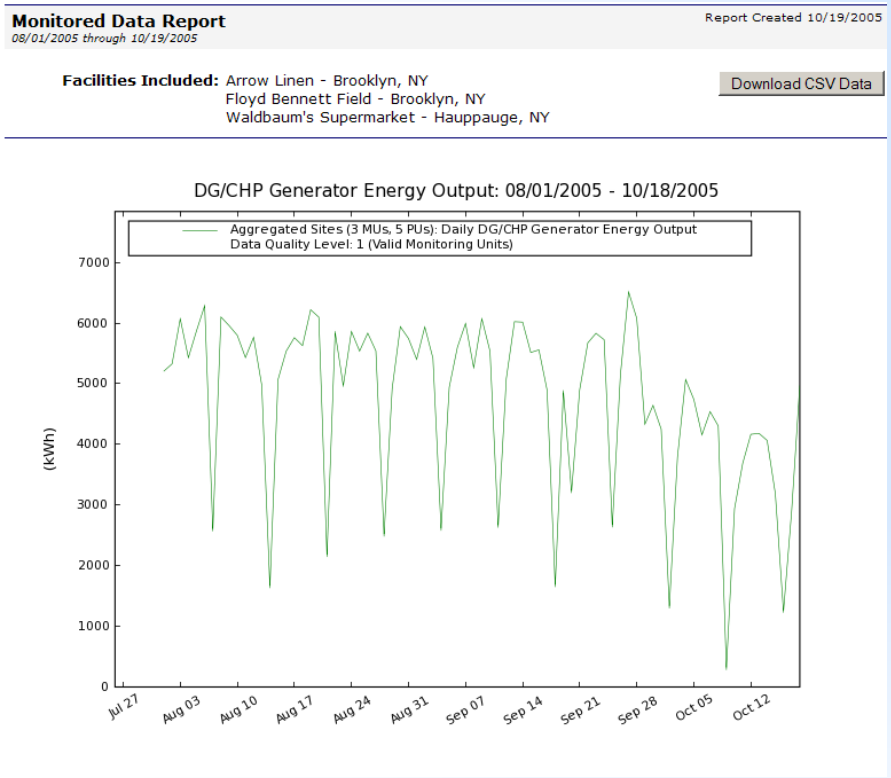


Online Monitored Data Reports

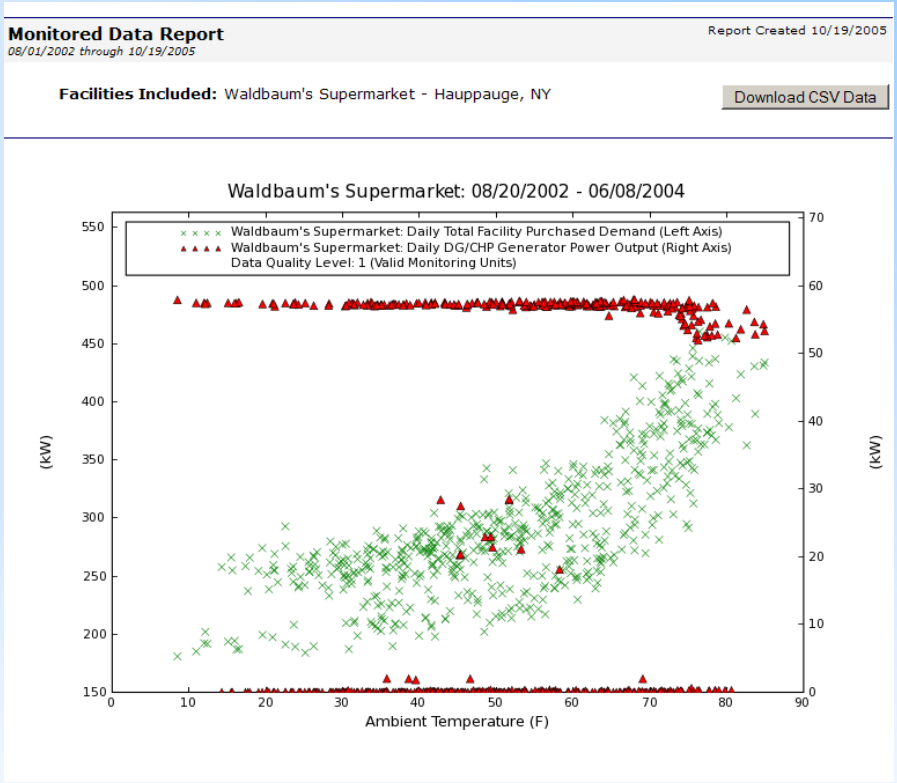
- Select one or more sites, based on user specified criteria
- Combine data across multiple sites
- Compare data between sites (group by utility, technology type, etc).
- Create time series, XY scatter, and daily profile plots
- Choose hourly, daily, or monthly data aggregation



Online Monitored Data Reports



Time series plots of 3 sites with data aggregated together



XY Scatter plot of DG/CHP and Total Facility Power

Summary Table

Closer to a simple "Answer" for a site

DG/CHP Integrated Data System

Octagon Summary Table

Date	DG/CHP Generator Output (kWh x 10^3)	Percent Valid Data: Generator Power (%)	DG/CHP Gas Input (cf x 10^3)	Percent Valid Data: Gas (%)	Useful Heat Recovery (MBTu x 10^3)	Percent Valid Data: Useful Heat Recovery (%)	Electrical Efficiency HHV (%)	Percent Valid Data: Electrical Efficiency (%)	Total Efficiency HHV (%)	Percent Valid Data: Total Efficiency (%)
September 2011	270.8	100.0	2,320.7	100.0	371.7	100.0	38.7	100.0	54.2	100.0
October 2011	283.3	100.0	2,360.0	100.0	306.4	100.0	39.8	100.0	52.4	100.0
November 2011	277.8	100.0	2,269.9	100.0	412.9	100.0	40.5	100.0	58.2	100.0
December 2011	295.8	100.0	2,401.5	100.0	179.8	100.0	40.8	100.0	48.1	100.0
January 2012	297.1	100.0	2,463.5	100.0	369.3	100.0	40.0	100.0	54.5	100.0
February 2012	277.5	100.0	2,250.0	100.0	391.7	100.0	40.9	100.0	57.8	100.0
March 2012	259.7	100.0	2,127.7	100.0	437.9	100.0	40.4	100.0	60.4	100.0
April 2012	271.4	100.0	2,231.1	100.0	290.3	100.0	40.3	100.0	52.9	100.0
May 2012	281.4	100.0	2,342.2	100.0	351.4	100.0	39.8	100.0	54.4	100.0
June 2012	149.2	94.4	1,261.6	94.4	152.2	94.4	39.2	94.4	50.9	94.4
Total	**2,663.9**	**99.7**	**22,028.3**	**99.7**	**3,263.7**	**99.7**	**40.1**	**99.7**	**54.4**	**99.7**

Each Site has a “Facility Page”

DG/CHP Integrated Data System

Home | Facilities | Reports | Links | Help | Login

Return to Facility Listing

Octagon

888 main st
New York, NY 10044
Map It

DG/CHP Developed by

UTC Power
A United Technologies Company

Category: Multi-Family Residence
SIC: 70 - Hotels, Rooming Houses, Camps, and Other Lodging Places
ISO Zone: J - New York City
Electric Utility: National Grid - New York
Gas Utility: Niagara Mohawk Power Corp
Primary Fuel: Natural Gas
Number of Power Units: 1
Total Installed Capacity: 400 kW

Unit	Installation	Fuel	Prime Mover	Heat Recovery	Use	Technology Group	Installed Capacity (kW)
1		Natural Gas	Fuel Cell	Hot Water	Space Cooling	<300 kW Fuel Cell (PAFC)	400

Facility Details
Show Complete Details

Facility Documentation
Octagon - CHP Site Fact Sheet
The Octagon - Database Notes - 6-9-2011

Project Webpages
None

Related Webpages
None

Online Monitored Data Reports
Monitored Data - Plots and Graphs
Monitored Data - Download (CSV file)
Utility Rate Calculation
Monitored Data Quality

Standardized Monitored Data Reports
Generator, Facility, and Meter Power
Generator Status, Gas Use, and Heat Recovery
Generator Power Quality
Facility Meter Power Quality

Summary Reports
Monthly Summary Table

What is the Purpose of this Website?

- It's a Data Portal
  - Provides detailed measured performance data to wider CHP community in NY
  - Provide summary data on practical reliability and efficiency expectations
  - Provide fact sheets and general information about systems and installations
- It's a Tool for Verifying Performance
  - Many NYSERDA programs pay incentives based on measured performance (Digester Gas, CHP, Fuel Cells, solar, etc)

Purpose? (cont)

- Provide feedback to industry
  - Developers and manufacturers can point to their successful systems
  - End users considering CHP can look at performance results for similar facilities

Website Data Collection

Website Operator's Role
(CDH Energy)

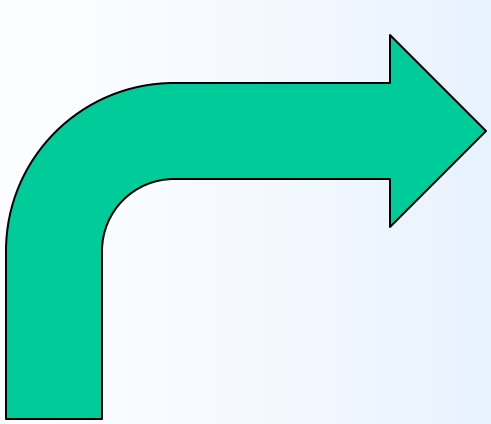
- We provide technical support on monitoring
  - Review and comment on Monitoring Plans (a milestone deliverable for many sites)
- We accept or collect data from "others" as often as once per day
  - Data is sent to our servers or sent to us by email
  - We reach out to other servers to retrieve data
- Provide a basic review/reality check of data
- Provide automated error checking

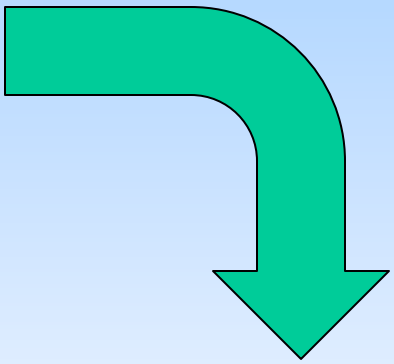
Things we don't normally do...

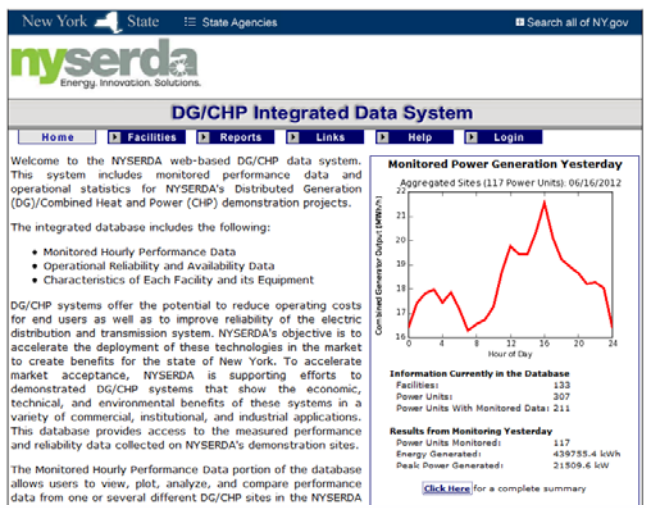
…as the website operator

- Write the monitoring plan
  - though we review it, provide example plans, etc
- Install monitoring hardware on site
- Buy monitoring hardware for you
- Use proprietary software to "call into" monitoring systems
- Debug, program, commission on-site systems
- Come on-site to talk (but we do conf calls)

Data Collection Process







Data Collection Process

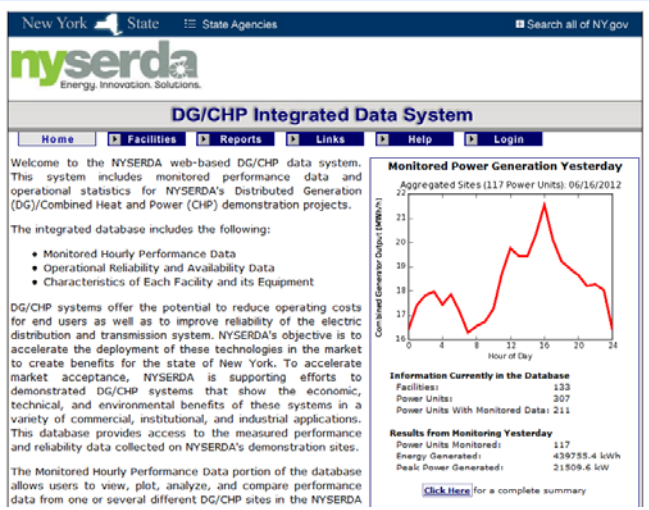
Internet

CDH Servers

CDH Office

On-site Monitoring System

Facility CDH



What do we mean by “Data”?

- An ASCII file, any format
- 1 or more points per file
- Multiple time-stamped records per day

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<?xml-stylesheet type='text/xsl' href='/obix/xsl'?>
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$2d6$20Flow/~historyQuery/" is="obix:HistoryQueryOut"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://obix.org/ns/schema/1.0 /obix/xsd"
xmlns="http://obix.org/ns/schema/1.0">
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tz="EDT"/>
   <real name="value" val="236.0"/>
  </obj>
  <obj>
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,,,,SPPA-T3000,,,,,,,,,,,,,,,,,,
Analog Interval Report,,,,,,,,,,,,,,,,,,,,,,,,
,,Name:,,,/Default_root/River Bay/Reports/NYSERDA/NYSERDA1,,,,,,,,,,,,,,,,,
,,Comment:,,,,,,,,,,,,,,,,,,,,,
,,Created at:,,,03/10/2010 09:27:31.963 PM EST,,,,,,,,,,,,,,,,,
,,Time:,,,From,03/08/2010 12:15:31.012 AM EST,,,,,To,,03/09/2010 12:15:31.012 AM EST,,,,,,,,,
,,Time Interval:,,,0:15:00,,,,,,,,,,,,,,,,,
,,Aggregate:,,,average values per time period,,,,,,,,,,,,,,,,
,,Note:,,,,,,,,,,,,,,,,,,,,
,,,Name,,,,Designation,,,EngUnit,,,,Time,,,Avg,,,,,QF,
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,,Tag7,,.1-63 P||TX1TotalPower,,,,TX1-63 Active Power,,,MW,,,,,,,0.0,,,,,1.0,
,Time,,,,,,,Tag1,Tag2,,,Tag3,,,Tag4,Tag5,,Tag6,,Tag7,,,
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```

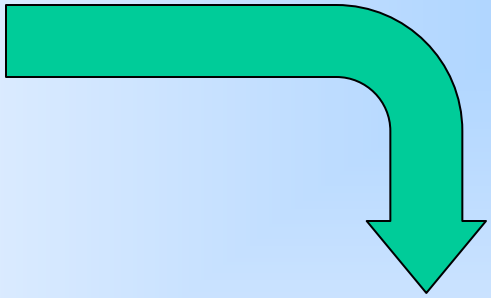
What We Require

- File has to machine-generated
  - so the format will be fixed forever
- File has to be non-proprietary
  - no special software required to access or open
  - .CSV, .DAT, .XML, SOAP,….
- Should have headers or other descriptive information
  - Tag or name, engineering units, description corresponding to monitoring plan

What We Do With the Data

Data we receive…

Data Label	DCS Tag	DCS Point Description
PSH2	PIC-HPS-04	HPS TO REDUCING STATIONS
PSH1	PI-HPS-03	HRSG STEAM HEADER
FSL	FI-LPS-01	LP STEAM TO AHUs
FS	FI-HPS-14	STEAM FROM HRSG'S
WC5_KWi	JI-PC-5-GRID-KW	PWR CNVTR 5 GRID PWR IMPORT
WC5_KW	JI-PC-5-KW	PWR CNVTR 5 ACTIVE PWR OUT
WC5	JQI-PC-5-KWH	PWR CVTR 5 KWH INJECTED AT OUTPUT
WC4	JQI-PC-4-KWH	PWR CVTR 4 KWH INJECTED AT OUTPUT
WC4_KW	JI-PC-4-KW	PWR CNVTR 4 ACTIVE PWR OUT
WC4_KWi	JI-PC-4-GRID-KW	PWR CNVTR 4 GRID PWR IMPORT
WC3	JQI-PC-3-KWH	PWR CVTR 3 KWH INJECTED AT OUTPUT
WC3_KW	JI-PC-3-KW	PWR CNVTR 3 ACTIVE PWR OUT
WC3_KWi	JI-PC-3-GRID-KW	PWR CNVTR 3 GRID PWR IMPORT
WC2	JQI-PC-2-KWH	PWR CVTR 2 KWH INJECTED AT OUTPUT
WC2_KW	JI-PC-2-KW	PWR CNVTR 2 ACTIVE PWR OUT
WC2_KWi	JI-PC-2-GRID-KW	PWR CNVTR 2 GRID PWR IMPORT
WC1	JQI-PC-1-KWH	PWR CVTR 1 KWH INJECTED AT OUTPUT
WC1_KW	JI-PC-1-KW	PWR CNVTR 1 ACTIVE PWR OUT
WC1_KWi	JI-PC-1-GRID-KW	PWR CNVTR 1 GRID PWR IMPORT
WCTOT	JQI-PC-TOT-KWH	Sum of WC1…WC5
WCTOT_KW	Sum	Sum of WC1_KW…WC5_KW
WCTOT_KWi	Sum	Sum of WC1_KWi…WC5_KWi
FG	Sum	GAS TO ENGINES
WGTOT	JI-GEN-TOT-PWR	Total Power from Engines
WG3	JI-GEN-3-PWR	GENERATOR 3 POWER
FG3	FI-E3-156	ENG 1 Gas Fuel Flow
WG2	JI-GEN-2-PWR	GENERATOR 2 POWER
FG2	FI-E2-156	ENG 1 Gas Fuel Flow
WG1	JI-GEN-1-PWR	GENERATOR 1 POWER
FG1	FI-E1-156	ENG 1 Gas Fuel Flow
TJWS	TIC-JWC-04	ENGINE JACKET COOLER OUT HDR TO HX-03_4
TCWR	TI-CW06	Common Return Back to HX-02 & HX-03
TCWR3	TIC-CW-14	HX-02 COND WTR RETURN
TCWR2	TIC-CW-13	HX-03 COND WTR RETURN
THWS	TIC-CW-11	HEATING WTR FROM HX-04
THWR	TI-CW-10	HEATING WTR TO HX-04
TCWS	TI-CW-05	HX-02 COND WTR SUPLY
FCW	FI-CW-16	COND WTR FROM HX-02 & HX-03
FHW	FI-CW-09	HEATING WTR TO HX-04
FMW	FI-SW-02	MAKE-UP WATER
TCO	TI-CR-14	HX-01 OUTLET
TCI	TI-CR-06	COND RTN TK CR-01
TCS	TI-FW-03	Condensate Temperature out of DA
FC	FT-CR15	Condensate Flow Through HX-01
D_HRSG1	HRSG-1-DMPR-BYP	HRSG1 Bypass Damper Position
D_HRSG2	HRSG-2-DMPR-BYP	HRSG2 Bypass Damper Position



Required Calculations

- DG/CHP Generator Output (kWh)
- DG/CHP Generator Output Demand (kW)
- DG/CHP Generator Gas Input (cf)
- Total Facility Purchased Energy (kWh)
- Total Facility Purchased Demand (kW)
- Other Facility Gas Use (cf)
- Total Facility Energy (kWh)
- Total Facility Demand (kW)
- Useful Heat Recovery (MBtu)
- Unused Heat Recovery (MBtu)
- Status/Runtime of DG/CHP Generator (h)
- Ambient Temperature (degrees F)
- Total CHP Efficiency (%)
- Electrical Efficiency (%)

…data on website

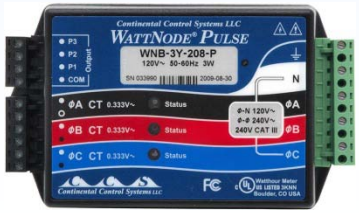
What CHP Program at You In?

- Demonstration Sites
  - Developer/applicant writes monitoring plan, provides monitoring system, connection to internet
- EFP performance-based Sites
  - NYSERDA hires monitoring contractor who develops plan, installs monitoring system
  - Site provides communications and mutually-determined meters
- Fuel Cells under RPS Sites

On-Site Monitoring Details

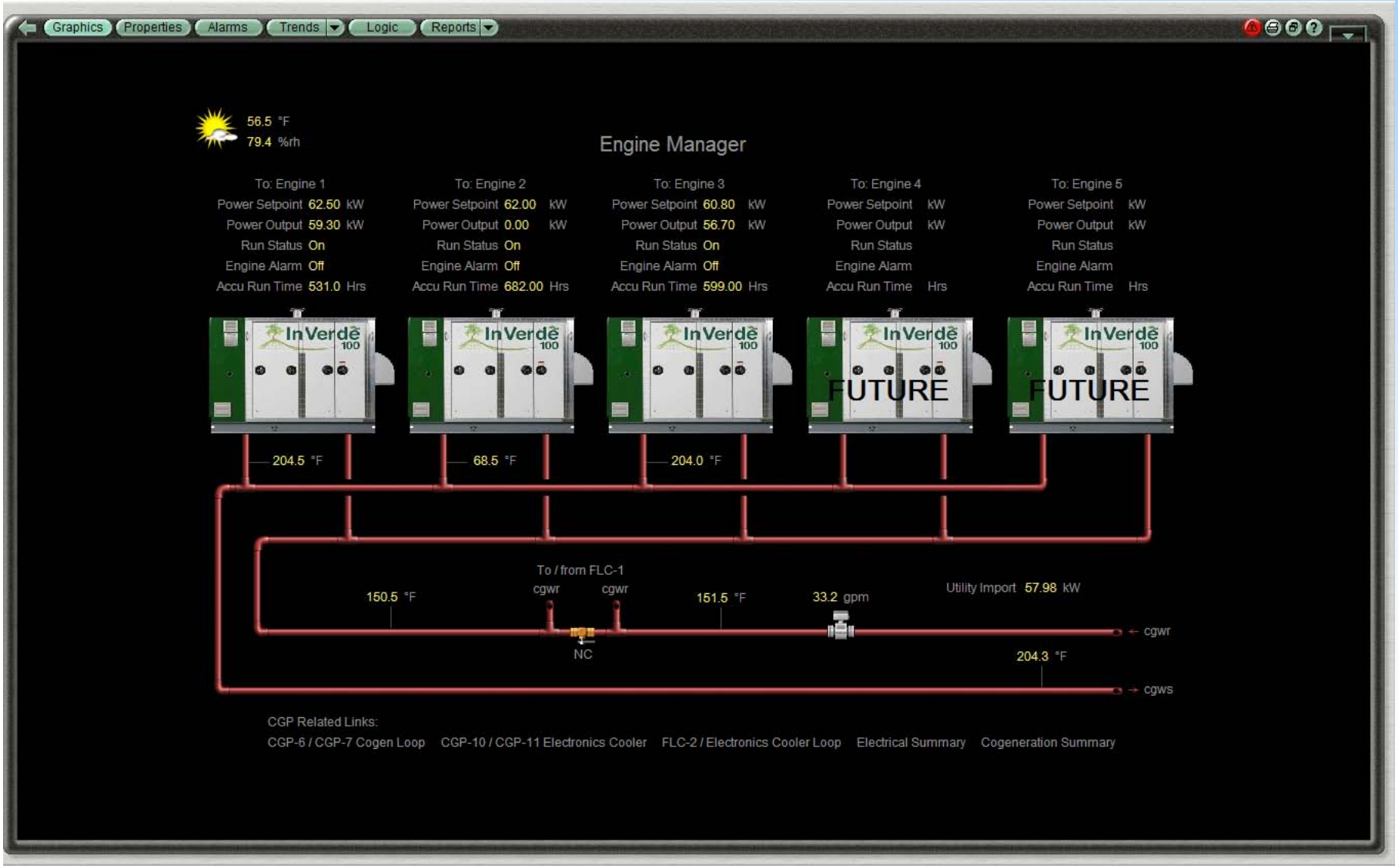
Typical Monitoring System

- Control System (that logs data)
- OR…Datalogger (like a control system, but optimized to communicate and remember)
- Typical Sensors/Transducers/Meters
  - Power transducer (pulse out, modbus, analog)
  - Gas “sub”-meter (pulse out)
  - Hot water flow meter (pulse out, analog, modbus)
  - Temperature Sensors (thermistor)



Control System Screen

This is <u>not</u> what we need…



Control System Data

…..*this is what we need*

- We don't care about User Friendly screens
- We need data sent by automated processes
  - This file is emailed to us by a facility control system after mid-night each day

```
Time,MDP Energy (kWh),MDP Power (kW),CGDP Energy (kWh),CGDP Power (kW),Engines Gas Use (cu ft/hr),Engines Flow (gpm),Er
5/30/2011 12:00:00 AM,-9.2,22.0,5.9,57.8,798.0,27.9,213.0,200.3,163.5,202.9,200.3,42.4,0.0,140.3,71.3
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5/30/2011 2:45:00 AM,-1.9,35.1,23.0,56.7,798.0,28.6,210.7,201.4,171.1,203.0,201.3,42.4,0.0,140.7,72.0
5/30/2011 3:00:00 AM,-1.0,40.6,24.5,57.4,798.0,29.1,205.0,200.8,185.3,201.6,200.8,42.4,0.0,139.9,71.6
5/30/2011 3:15:00 AM,-0.1,32.9,26.0,56.0,798.0,26.7,207.3,200.5,168.1,202.1,200.6,42.5,0.0,140.8,71.4
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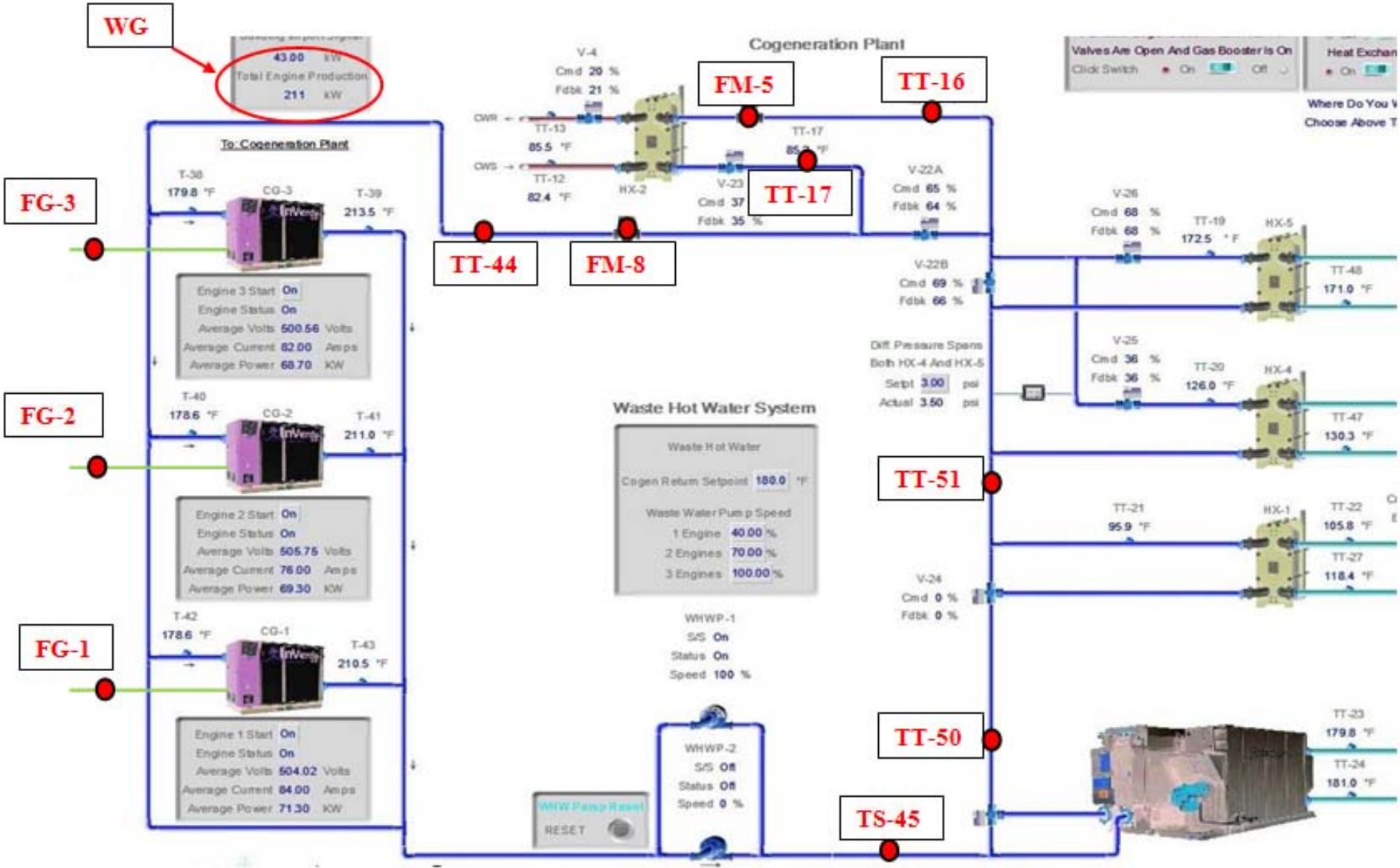
What's in a Monitoring Plan?

- How will you measure NET power output (account for parasitic power)?
- What useful heat is provided to meet facility loads?
- What is the fuel consumption?
- What sensors are required and where will they be located to answer these questions?

ANSWER: annotated schematics & summary table

Monitoring Plan Schematic

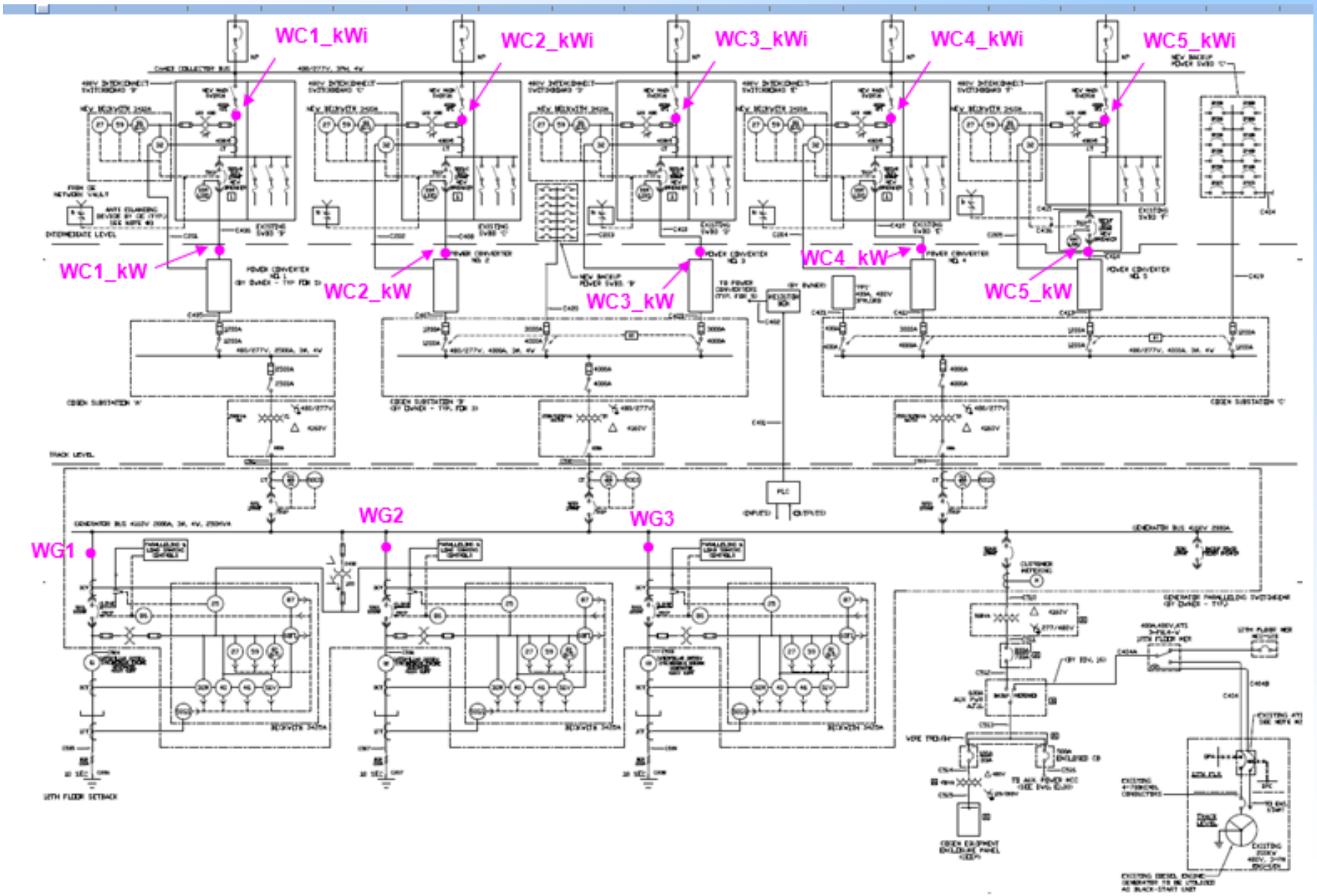
Annotated Control Screen



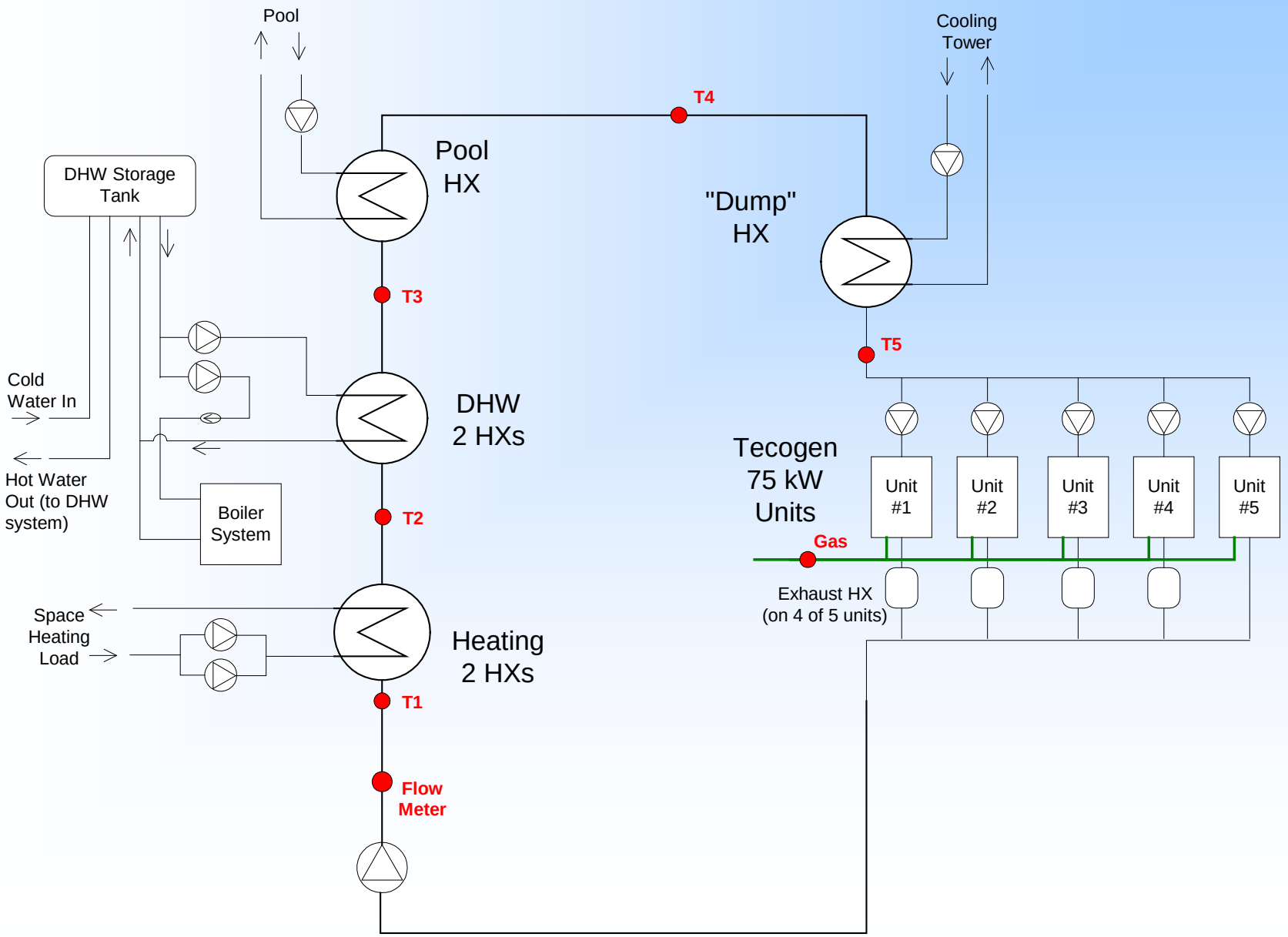
List of Data Points

No.	Actual Tag Name (see pics)	Manufacturer / Model #	Description	CDH Point Name	Eng Units
1	WG	Veris H8053-0800-4 (pulse)	Generator Power (all 3)	WG	kWh
2	FG-1	Sage SIP-150	Engine 1 Gas Input	FG1	cf/h
3	FG-2	Sage SIP-150	Engine 2 Gas Input	FG2	cf/h
4	FG-3	Sage SIP-150	Engine 3 Gas Input	FG3	cf/h
5	FM-8	Flexim / FSM-NNNTS-000	Heat Recovery Loop Flowrate	FM8	gpm
6	T-45	BAPI / ALC M304	HR Loop High Supply Temp	T45	ºF
7	T-44	BAPI / ALC M304	HR Loop High Return Temp	T44	ºF
8	T-50	BAPI / ALC M304	HR Loop Temp - After Abs. Chiller	T50	ºF
9	T-51	BAPI / ALC M304	HR Loop Temp - After HX-1	T51	ºF
10	FM-5	Flexim / FSM-NNNTS-000	Dump/HX2 Flowrate	FM5	gpm
11	T-16	BAPI / ALC M304	Dump/HX2 Supply Temp	T16	ºF
12	T-17	BAPI / ALC M304	Dump/HX2 Return Temp	T17	ºF
13	-	Calculated	Total Heat Recovery	QT	MBTU/hr
14	-	Calculated	Rejected Heat Recovery	QR	MBTU/hr
15	-	Calculated	Useful Heat Recovery	QU	MBTU/hr

Monitoring Plan Schematic



“Simpler” Schematic



“Useful” Heat Recovery

- Question: <u>Would the facility otherwise purchase fuel to meet this thermal load?</u>
  - Heating sidewalks, pools, etc
  - Higher loop losses due to heat recovery?
- Flow meter vs. BTU Meter
  - BTU meter costs more
  - New Modbus BTU meters (provide BTUs, gpm, and temperatures)
  - Flow meter with temperatures can be more flexible in complicated systems (but need 1 minute data)

How to Get Net Power

- Directly measure net power output
  - Sometimes it possible
- Measure generator output, measure parasitic
  - Measure parasitic electrical loads
  - Measure runtime of key loads, combine with handheld (one-time) power readings
- What is a parasitic load?
  - pumps, fans, compressors that would not otherwise be at the facility

User Guide for CHP Developers

How to Prepare for Monitoring

- Monitoring Plan is more than a financial milestone
  - Involve controls engineers AND controls contractor early on
- Make sure your controls contractor is obligated and able to provide automated log files and data transfer
- Who provides communications?
- Need a PID drawing
  - Right sensor, right location, right size, right signal, etc

Summary Tips for CHP Sites

- Understand the rules for your NYSERDA CHP program
- Involve right people in Monitoring Plan development
- Be sure key parties (eg, controls contractor, IT department) understand what is required
- Use the website as a resource to monitor your system’s performance