St Joachim CHP Power Data

During the site visit on September 17, 2015 it was confirmed that the CGDP meter reading was off by a factor of 2.0. The cause of the discrepancy is still unknown; however CDH documentation dating back to June 29, 2011 indicates that this was a known issue that was being corrected at the database level.

During the September 17, 2015 site visit, the CGDP meter reading was consistently half of the sum of the individual Inverde unit outputs. ICE had indicated that a report provided to Energy Concepts used the sum of the three Inverde unit outputs (gathered via Modbus). At several other CHP sites, CDH has found that the power reported by the Inverde unit (as output from the inverter) is sufficiently accurate to characterize the gross output of the units.

During the site visit, ICE updated the NYSERDA M&V report provided to CDH Energy to be consistent with the report provided to Energy Concepts, using the sum of the three CHP unit outputs for the combined plant gross power. To verify that our past assumptions on the CGDP meter multiplier were correct, ICE provided CDH with the same report provided to Energy Concepts.

The Energy Concepts report contains the following columns (Table 1).

Table 1. Columns in Report Provided to Energy Concepts

Utility Import (KW)
Cogen-1 Output (kW)
Cogen-2 Output (kW)
Cogen-3 Output (kW)
Total Plant Output (kW) (sum of Cogen 1,2, & 3)
Plant Thermal Output (BTU)
Plant Electrical Output (BTU)
CGW Entering
CGW Leaving
CGW Flow
Plant Total Gas Use (cf)
FLC-1 Entering
Engines Inlet Temp
Total Heat Rejection (BTU)
Plant Efficiency
Chiller 1 Status
Chiller 2 Status
Chiller 3 Status
Cooling Tonnage

Figure 1 displays the CGDP meter data provided to CDH with the **Total Plant Output (kW)** data from the Energy Concepts report. No substantial difference is noted between the data provided in the reports, and the past data provided to CDH in the M&V report and reported to the website is correct and consistent with the data provided to Energy Concepts. Gross power data for the two reports will be identical from 9/17/2015 forward.

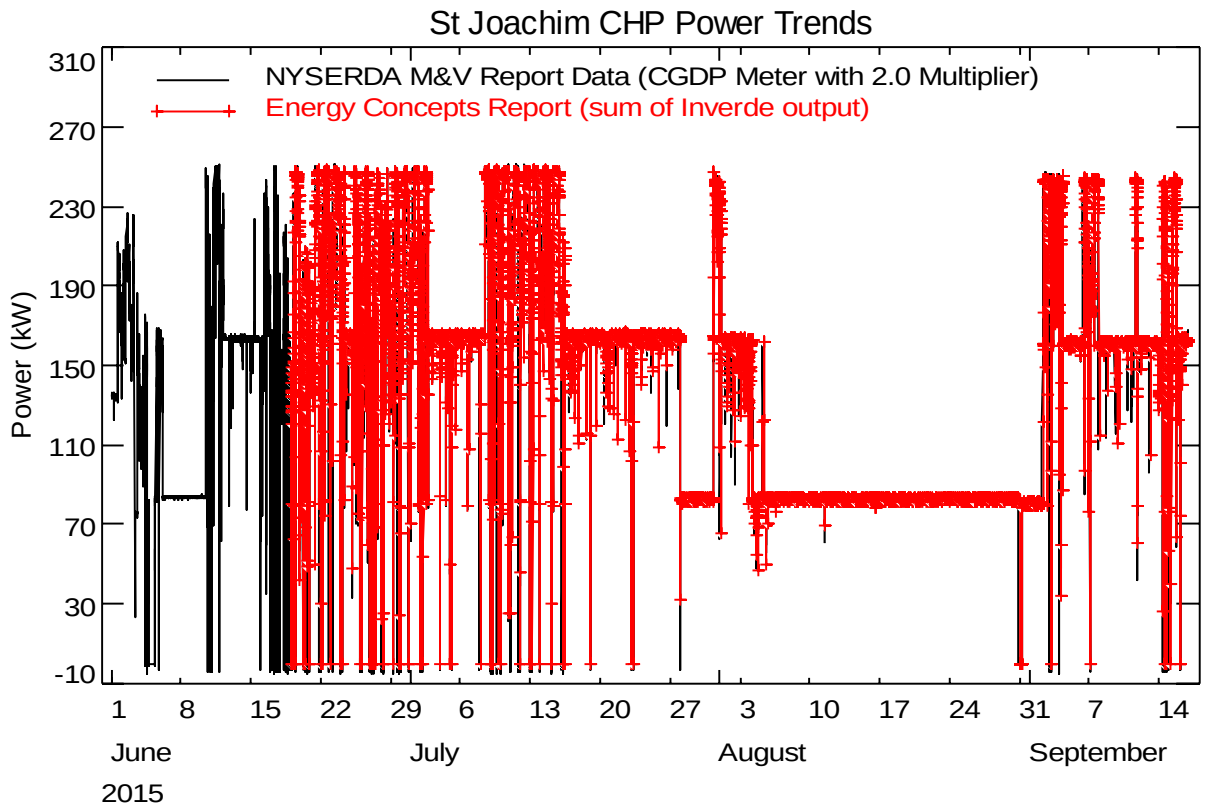


Figure 1. Comparing Data from NYSERDA M&V Report to Energy Concepts Monthly Report

The parasitic power meter is installed on the entire MCC-1 panel board (Figure 2) that contains a mixture of CHP parasitic and non-parasitic loads. CDH Energy performed one time measurements on these loads to assess the typical level of non-CHP parasitic loads measured by this meter (Table 2).

Figure 2. MCC-1 Containing CHP Parasitic and Non-parasitic Loads

Table 2. One-Time Power Measurements – MCC-1 Parasitic Load Panel

Tag	Description	Total Motor Size (HP)	Power (kW)	Measurement Type (Measured / Calc'd from Amps)	CHP Parasitic?
FLC-1	Electronics Cooling - Inverde 1	3	OFF	N/A	Yes
FLC-2	Electronics Cooling - Inverde 2	3	1.98	Calc'd from Amps @ 0.85 PF	Yes
FLC-3	Electronics Cooling - Inverde 3	3	2.19	Calc'd from Amps @ 0.85 PF	Yes
FLC-5	Cogen HW Fluid Cooler	15	4.45	Calc'd from Amps @ 0.85 PF	Yes
CGP-5	CHP Loop Pump	10	2.76	Calc'd from Amps @ 0.85 PF	Yes
CGP-6	CHP Loop Pump	10	OFF	N/A	Yes
CGP-7	Absorber HW Pump	7.5	5.90	Measured	Yes
CGP-8	Absorber HW Pump	7.5	OFF	N/A	Yes
CWP-1	Chilled Water Chiller Pump	7.5	4.60	Measured	No
CWP-2	Chilled Water Chiller Pump	7.5	OFF	N/A	No
CWP-3	Chilled Water Secondary Loop	15	OFF	N/A	No
CWP-4	Chilled Water Secondary Loop	15	3.75	Calc'd from Amps @ 0.85 PF	No
CDP-1	Condenser Water	25	11.60	Measured	No
CDP-2	Condenser Water	25	OFF	N/A	No
HWP-1	HX-1 HW Pump	5	OFF	N/A	Yes
HWP-2	HX-1 HW Pump	5	2.08	Calc'd from Amps @ 0.85 PF	Yes
CT-1	Cooling Tower	10	0.92	Calc'd from Amps @ 0.85 PF	No
	MCC-1 Total Power (kW)		40.23		
	MCC-1 Observed Power at Meter (kW)		41.00		
	Total Non CHP Parasitics (kW)		**20.86**		

Based on the one-time measurements, there are approximately 21 kW of non-CHP parasitic loads in this panel that are being included in the calculation for net power. All of the non-CHP parasitic loads are associated with the chilled water and condenser water side of the absorption chillers. Based on a further review of the project drawings, it was deemed that pumps and heat rejection equipment indicated on drawing M3.01 of the system drawings (located on the hot water side of the system) would be classified as a CHP-parasitic. Pumps and equipment indicated on drawing M3.02 were classified as non-CHP parasitic. These drawings and the associated mechanical schedule for the plant are attached at the end of this summary.

The M&V report does not contain the operating status or speed of all the equipment located in MCC-1, and therefore subtracting the exact amount of non-CHP parasitic power is impossible. However, a review of the historic parasitic power data (Figure 3) indicates the following:

- Parasitic power jumps substantially during the operation of the absorption chillers, typically between May and October each year.
- During 2015 the increase in parasitic power due to chiller operation is relatively constant, compared to more variable operation in 2013 and 2014.
- Parasitic power during the winter operation displays some variation due to heat rejection of the dry cooler, ranging between 7 – 15 kW.

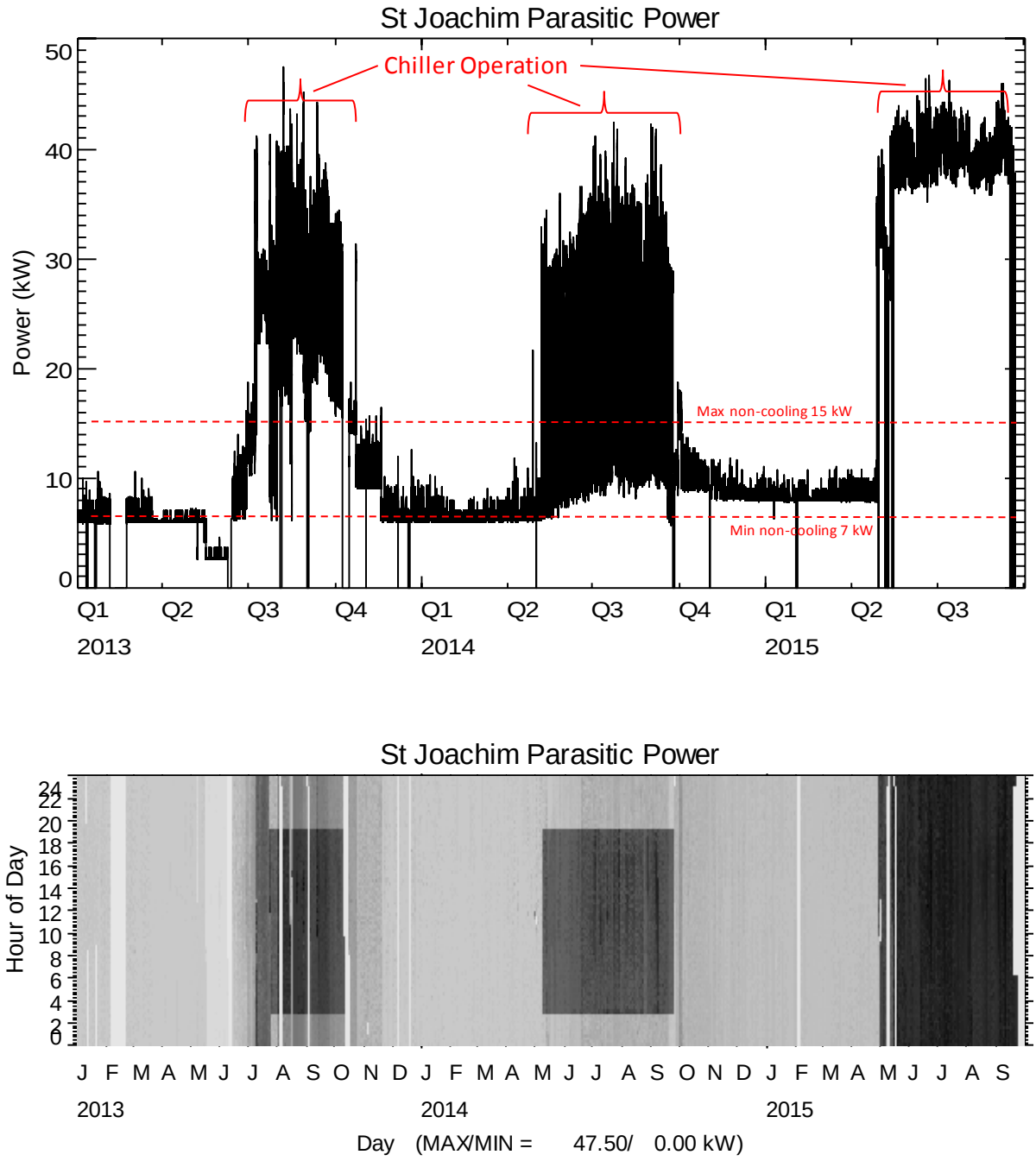


Figure 3. MCC-1 Parasitic Power Patterns

Based on the one-time measurements, and historic power trends, the following correction to the parasitic power is recommended:

Table 3. Adjustments to Parasitic Power to Account for Non-CHP Loads

Period	Power Criteria	Adjustment for CHP Parasitic Calculation
April 1 – Oct 31	WPAR > 21 kW (cooling mode)	WPAR = 21 kW
April 1 – Oct 31	WPAR < 21 kW	No adjustment (full measured power)
All other periods	Any	No adjustment (full measured power)

This correction is based on the following "typical power" for each CHP related parasitic load.

Table 4. CHP Parasitic Power Calculation During Chiller Operation

CHP Parasitic Load	Power Each	Typical Qty	Total Power
FLC-1/2/3	2.0 kW	2	4.0 kW
FLC-5 Dump Rad	2.0 kW	3	6.0 kW
CGP-5/6 CHP Pump	3.0 kW	1	3.0 kW
CGP-7/8 ABS CH Pump	6.0 kW	1	6.0 kW
HWP-1/2	2.0 kW	1	2.0 kW
Total			21.0 kW

This correction removes much of the power consumption for the chiller equipment, and account for the most probable level of loading for the CHP related load (Figure 4).

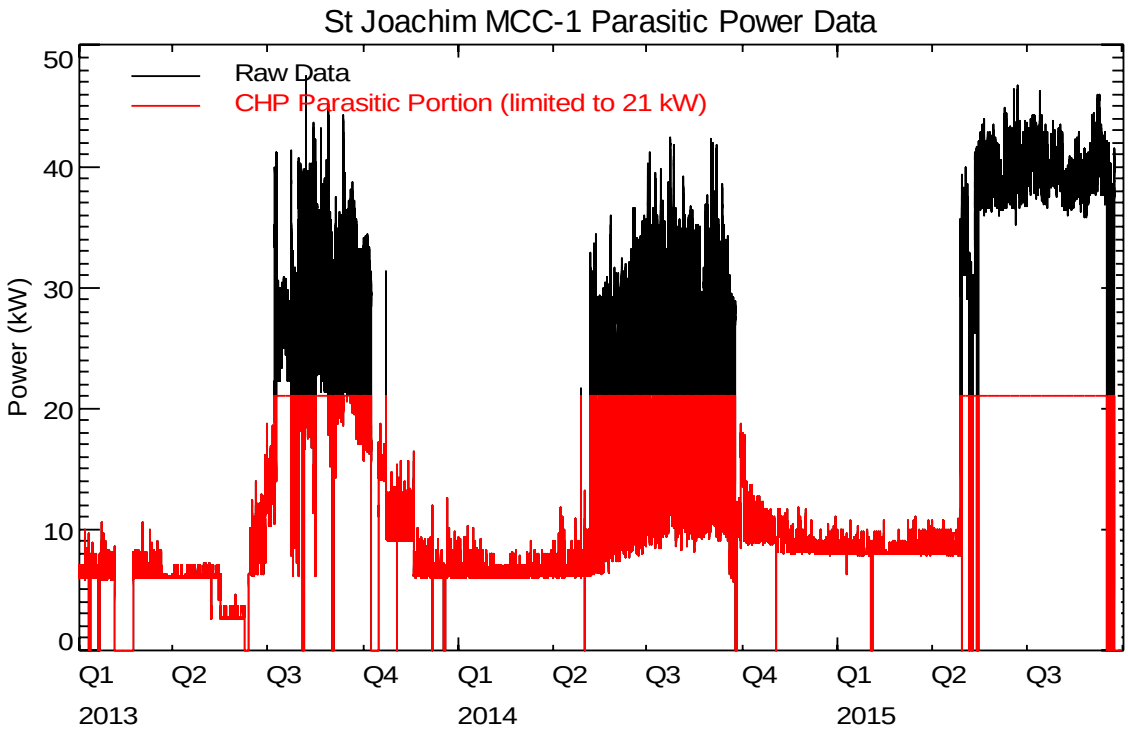


Figure 4. MCC-1 Parasitic Power with Proposed Adjustment

This adjustment reduces the CHP related parasitic energy for the period of August 1, 2014 – July 31, 2015 from 142,234 kWh/year down to 84,354 kWh/year, which would increase the annual generation by 47,663 kWh. The impact on CHP FCE from this change is an increase of approximately 1.4%, which would be sufficient to meet the minimum 50% LHV criteria for a reduced incentive (Table 5).

Table 5. Impact of Parasitic Adjustment on FCE

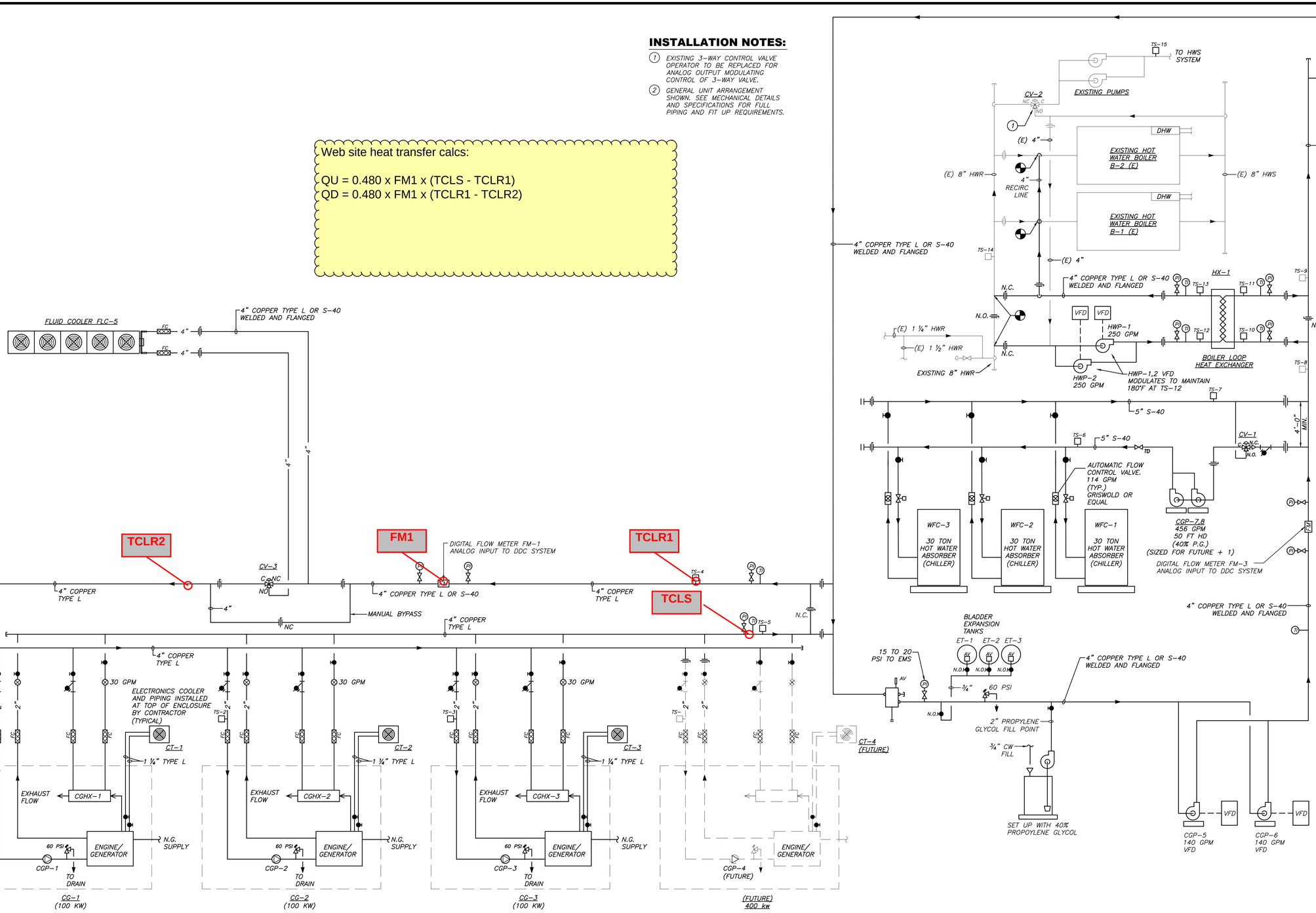
Currently Reported on Website (Aug 2014 - July 2015)		
Total Energy	(kWh)	879,727
Total Gas	(CF)	12,497,445
Heat Rec'd	(MBTU)	2,593,351
Resulting CHP FCE	(% LHV)	49.5%
With Parasitic Adjustment		
Total Energy	(kWh)	879,727
Parasitic Correction	(kWh)	47,663
Total Energy w/ Parasitic Correction	(kWh)	927,390
Total Gas	(CF)	12,497,445
Heat Rec'd	(MBTU)	2,593,351
Resulting CHP FCE	**(% LHV)**	**50.9%**

INSTALLATION NOTES:

1. EXISTING 3-WAY CONTROL VALVE OPERATOR TO BE REPLACED FOR ANALOG OUTPUT MODULATING CONTROL OF 3-WAY VALVE.
2. GENERAL UNIT ARRANGEMENT SHOWN. SEE MECHANICAL DETAILS AND SPECIFICATIONS FOR FULL PIPING AND FIT UP REQUIREMENTS.

Web site heat transfer calcs:

QU = 0.480 x FM1 x (TCLS - TCLR1)
QD = 0.480 x FM1 x (TCLR1 - TCLR2)



TECOGEN CM-100
WITH ECS (CATALYTIC CONVERTER)
732 MBH HEAT REJECT.
30 GPM
180°F EWT
230°F LWT
(TYP. OF 3)

TOTAL BID
300 kW
2,196 MBH HEAT REJECT.
90 GPM
180°F EWT
230°F LWT

1 M3.01 PRELIMINARY SCHEMATIC DIAGRAM, CHP SYSTEM

ENERGY CONCEPTS

INTEGRATED ENERGY CONCEPTS ENGINEERING, P.C.
3445 Winton Place, Suite 102
Rochester, NY 14623
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Combined Heat & Power, Energy, Mechanical and Electrical - Consultants

CLIENT INFORMATION

SEAL

REVISIONS

NO.	DATE	DESCRIPTION
A	9/17/08	BID WALK THRU SET
C	07/06/09	ISSUE TO DOB
D	03/12/10	FIELD MODIFICATIONS PER ENERGY CONCEPTS

ST. JOACHIM & ANNE
2720 SURF AVENUE
BROOKLYN, NY 11224

ENERGY CONSERVATION

PROJECT NAME

SCALE | PHASE

COMBINED HEAT & POWER PLAT FLOW SCHEMATIC

DRAWING TITLE

08003-m301.dwg DRAWING FILE	CLK DRAWN BY
08003 PROJECT NO.	CV CHECKED BY
4/10/2008 DATE	WHC PROJ. MANAGER

M3.01
DRAWING NO.

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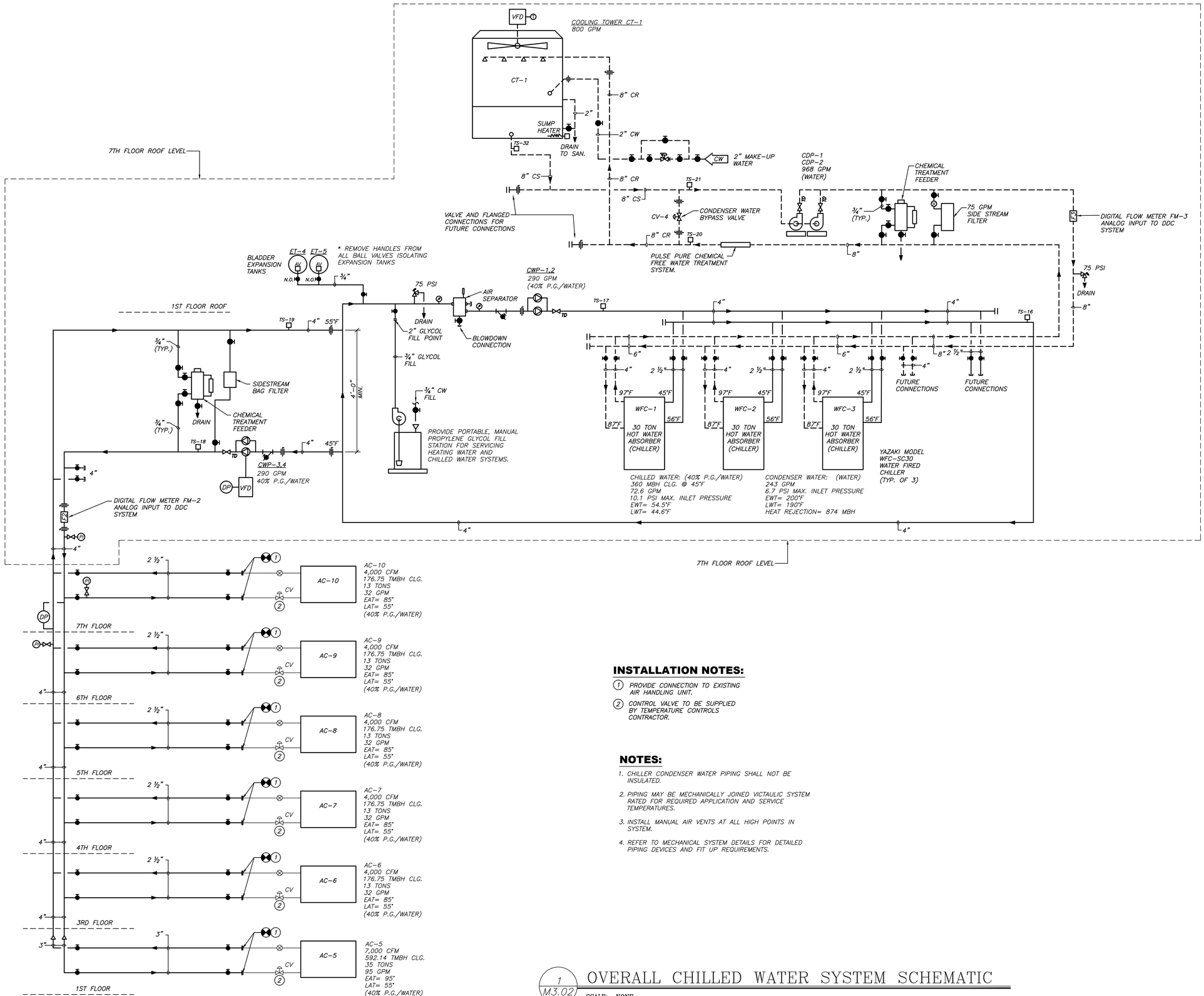

INSTALLATION NOTES:

1. PROVIDE CONNECTION TO EXISTING AIR HANDLING UNIT.
2. CONTROL VALVE TO BE SUPPLIED BY TEMPERATURE CONTROLS CONTRACTOR.

NOTES:

1. CHILLER CONDENSER WATER PIPING SHALL NOT BE INSULATED.
2. PIPING MAY BE MECHANICALLY JOINED VICTAULIC SYSTEM RATED FOR REQUIRED APPLICATION AND SERVICE TEMPERATURES.
3. INSTALL MANUAL AIR VENTS AT ALL HIGH POINTS IN SYSTEM.
4. REFER TO MECHANICAL SYSTEM DETAILS FOR DETAILED PIPING DEVICES AND FIT UP REQUIREMENTS.

1 / M3.02 OVERALL CHILLED WATER SYSTEM SCHEMATIC

SCALE: NONE

ENERGY CONCEPTS

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NO.	DATE	DESCRIPTION
A	9/17/08	BID WALK THRU SET
B	10/24/08	CD ISSUE TO DOB

ST. JOACHIM & ANNE
2720 SURF AVENUE
BROOKLYN, NY 11224

ENERGY CONSERVATION

PROJECT NAME

SCALE | PHASE

OVERALL CHILLED WATER SYSTEM SCHEMATIC

DRAWING TITLE

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08003 PROJECT NO.	CV CHECKED BY
4/10/2008 DATE	WHC PROJ. MANAGER

M3.02

DRAWING NO.

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