

Combined Heat and Power Plant Final Operating Report

For

**4 C Foods Corp.
Brooklyn, NY**



March 30, 2007



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1.) Executive Summary

A.) Description of CHP Project

The installed cogeneration system consists of two (2) 150 kW and one (1) 80 kW Coastintelligen[®] units for a total peak power production of 380 kW. The cogeneration units were provided in a pre-wired, pre-piped, sound attenuated enclosure. The enclosure is located on the exterior of the building near the existing warehouse space. Exhaust equipment was assembled on-site and connected to the roof of the cogeneration enclosure.



Fig 1: New Cogeneration Unit Enclosure



Fig 2: Exhaust and Dump Radiator on Roof of New Cogeneration Unit Enclosure

Heat recovery accessories were assembled on site and piped to the roof of the cogeneration enclosure. The absorber chiller system is located in the basement and off-sets the use of the existing chiller. The absorption chiller reduces electric use by eliminating demand on the electric chiller in the summer months. In addition the absorber generates chilled water by using waste heat from the cogeneration system. The absorber system uses very little electricity to generate chilled water.

Additionally, heat recovery provides thermal energy to off-load a steam boiler used to heat inlet air to the cheese dryer on the production floor. The existing steam coil was replaced with a hot-water coil allowing use of cogen hot-water to feed the thermal requirements of the dryer operation. The cogen hot water coil for the cheese dryer has been so effective that the steam boiler is normally shut down.

B.) Summary of CHP Plant Actual Operating Results

Operating results of the 4C Foods CHP plant were analyzed based on several independently measured sets of data. Actual computer recorded cogeneration unit data was used as a primary source of operations results. This was also compared to actual Keyspan utility gas meter records for the dedicated gas meter serving the plant. Also, electric utility bills and gas bills for the “remaining” facility gas used were examined. Although electric loads and thermal process loads have increased at 4C since the base year these records are also instructive. In general the 4C foods CHP plant has run well and consistently once the initial commissioning was completed.

Following is a summary of the initial predicted operations and as actually measured. The actual operating efficiencies are expected to improve when a few improvements as mentioned in the lessons learned are made. As a final note, 4C Foods is presently undergoing business expansion which will increase total plant load and run time.

From the analysis it was estimated that the plant would operate as follows:

Estimated Plant Totals		
kWh Generated	1,221,780	kWh
Therms Consumed	123,807	therms
Therms Recovered	60,275	therms
Engine Run Hours	12,218	hours

The projected cost for the installation was \$1,119,887. Anticipated energy cost savings were \$192,158 (after maintenance adjustments), resulting in a simple payback of 5.8 years.

For 2006, run-data from the engines shows an actual annual outcome of:

Annual CHP Totals (2006)		
kWh Generated	1,045,408	kWh
Therms Consumed	113,884	therms
Therms Recovered	62,195	therms
Therms Utilized	59,844	therms
Engine Run Hours	11,536	hours

A summary of the projected and actual energy cost savings is presented below.

Annual Energy Cost Savings Summary

	Projected (2003)	Actual (2006)
Electrical Cost Savings	\$ 251,755	\$ 283,867
CHP Fuel Cost Increase	- \$ 35,161	- \$ 61,563
Maintenance Cost Increase	- \$ 24,436	- \$ 20,908
Net Annual Cost Savings	\$ 192,158	\$ 201,396

Project Payback Comparison

	Projected (2003)	Actual (2006)
Project Implementation	\$ 1,119,887	\$ 1,215,000
Annual Cost Savings	\$ 192,158	\$ 201,396
Simple Payback	5.8 years	6.0 years

C.) Lessons Learned

1.) Constructability and Cost Issues:

The initial project bids received were over budget. Value engineering was then performed that resulted in significant construction cost savings without compromising system function and savings. Construction cost was saved due to the following:

a.) Constructability and Cost Issues:

Pre-packaging of the cogeneration units and devices in a standard SEA tainer and housed outside the facility. Instead of consolidating electric services, installing one CHP plant but allowing the units to serve different services. This is a site specific cost issue. At some sites consolidating services will often be economical, but not always.

b.) Effect of Related HVAC Systems:

Although thermal site savings is reasonable, additional thermal savings could have resulted if more of the existing and new heating units were placed on EMS control as was the CHP plant. A project is now underway to automate more of the existing units to improve heating efficiency and maximize use of CHP plant waste heat.

c.) Boiler Plant Efficiency and Savings Impact:

At 4C foods significant gas savings was achieved by providing enough thermal recovery to completely keep the old existing steam boiler shut down, versus allowing the unit to cycle at low loads. This was mainly accomplished by diligent owner attention.

d.) Effect of Unusual Large Motor Loads:

The 4C foods facility was served by an existing large air compressor at 75Hp and a large vacuum pump system at 75Hp. These motor loads cycled in a way to make it difficult for the CHP plant to effectively produce power and fully mitigate demand for those units. In early 2006 these units were modified to flatten their load profile, save energy and allow the CHP plant to better hit those loads. A variable speed drive air compressor was installed, leaving the old 75Hp unit as backup. The old vacuum pump was removed and a pair of smaller units installed that now run longer hours but at reduced load. That equipment now presents a better load profile for the CHP plant.

e.) Importance of Computer Control System

The EMS control system as designed and installed has been key to proper operation and trouble shooting of the CHP plant. It allows owners to graphically view CHP plant operations and better understand operating characteristics.

2.) Site and CHP Plant Description

A.) Site and CHP System Description

4-C Foods, Inc. is a food processing and packaging facility located in Brooklyn, New York. The facility of approximately 90,000 sq. ft. uses significant electric power year round for lighting and general power.

Existing space conditioning equipment included DX type air handlers, and electric chilling equipment. Improvements included routing chilled and hot water to new AHU coils, as well as replacement of the existing electric chiller with an absorber unit.

The installed cogeneration facility operates in parallel with the electric utility and generates approximately 80% of the electric energy utilized at the site. Waste heat from the units is used to create Hot water and off-set steam boiler usage, as well as driving the absorber chiller plant. Resulting hot and chilled water production is used for space and process heating and cooling within the facility.

Hot water from the cogeneration units is also used to heat air for the cheese dryer system. The cheese dryer is located on the first floor in the plant process area (see figure 9).



Fig 3: Typical rooftop DX AHU unit with coil converted to chilled water.



Fig 4: Existing unit heater upgraded to new hot water heating coils from cogen units



Fig 5: Former electric chiller (replaced by new absorption chillers)



Fig 6, 7, & 8: Existing electrical services



Fig 9: Cheese dryer system receiving new hot water coil.

B.) Actual Project Construction Costs

Actual project costs are summarized below. Values are based on billing from Energy Concepts for services rendered, as well as construction contracts from the various contractors.

Total Project Costs:

Cogeneration Units	\$ 338,700
Mechanical	\$ 443,300
Plumbing	\$ 17,000
Electrical	\$ 245,000
Controls	\$ 74,000
Design Fees	\$ 97,000
Total Project Cost	\$ 1,215,000
(Cost per kW installed	\$ 3,197)

C.) Construction Process and Schedule

The 4C Foods CHP construction documents were produced to provide competitive bidding via 3 main contracts: Electrical construction, Mechanical construction and the Cogeneration subsystem.

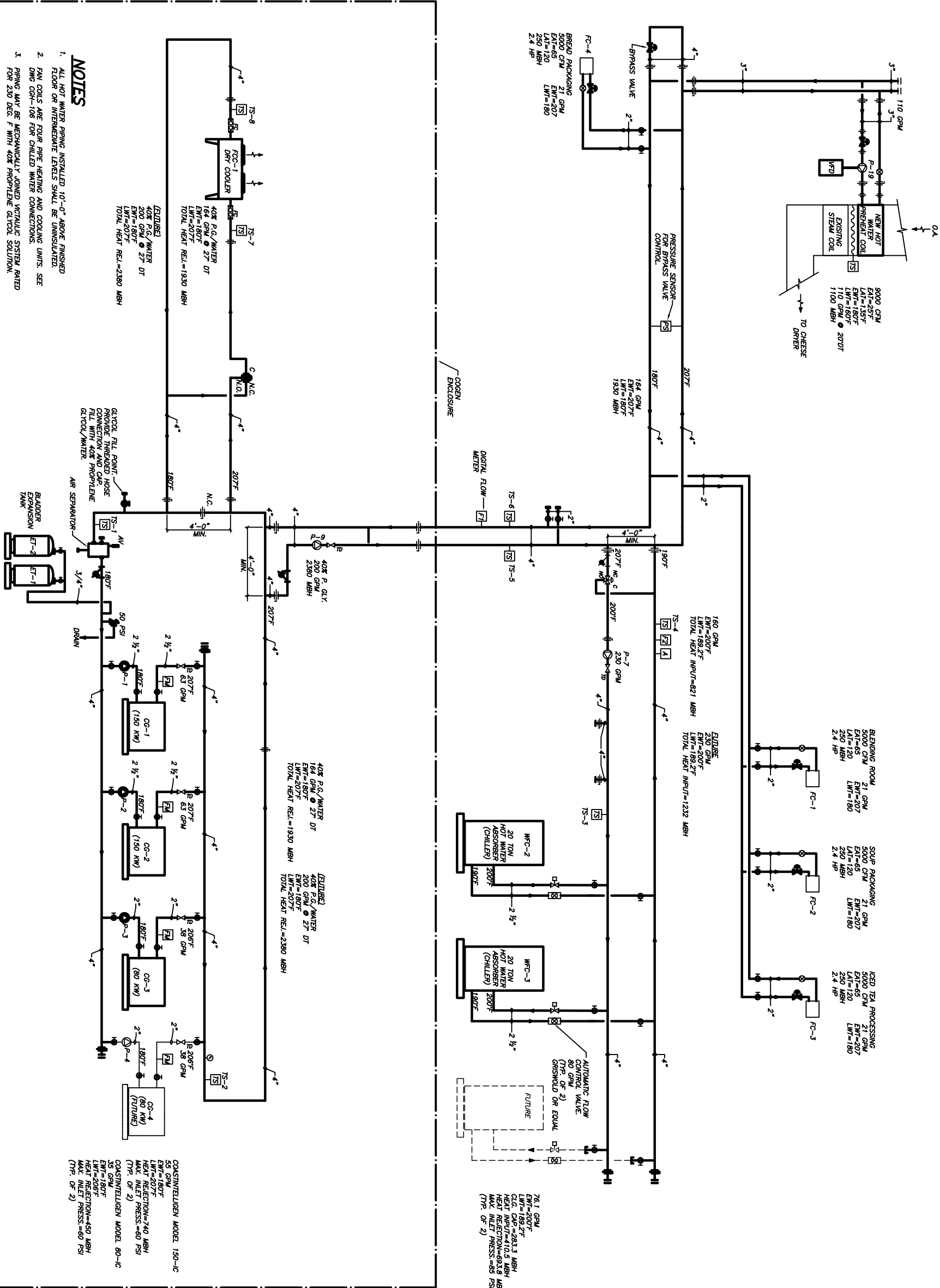
Initial bids were received in June 2003. These bids were substantially over budget due to the high cost of electric service consolidation and to the cogeneration units being located in the basement.

Value engineering was then performed to establish one CHP plant but serving two electric services. In addition, the cogeneration units were engineered to be in a pre-packaged Sea-tainer and located outside. The absorber chiller plant was left in the basement where the electric chiller was removed. Together these value engineering changes saved nearly \$400,000 in construction cost. Functionality and savings remained about the same. (Serving two electric services with cogeneration units specifically designated to specific services results in some loss of the advantage of load aggregation as compared to integrating services.)

Construction began in September 2003 and proceeded to substantial completion in September 2004. Punch list items were completed from September 2004 to December 2004. Preliminary plant operations began in August 2004.

Cost change orders during the project were minimal due to the involvement of contractors in the value engineering process and confirmation of scope and cost at that time.

D.) System Schematic – Heat Recovery



NOTES

1. ALL HOT WATER PIPING INSTALLED 10'-0" ABOVE FINISHED FLOOR OR INTERMEDIATE LEVELS SHALL BE UNINSULATED.
2. FAN COILS ARE FOUR PIPE HEATING AND COOLING UNITS. SEE DWG CGH-106 FOR CHILLED WATER CONNECTIONS.
3. PIPING MAY BE MECHANICALLY JOINED METALLIC SYSTEM RATED FOR 230 DEG. F WITH 40K PROPYLENE GLYCOL SOLUTION.

OVERALL HOT WATER SYSTEM SCHEMATIC DIAGRAM

1

CGH-105

DRAWING NO:

CUSTOMER:
4C FOODS CORPORATION
580 FOUNTAIN AVE.
BROOKLYN, NY
COMBINED HEAT AND POWER PLANT

TITLE:
HEAT RECOVERY AND HVAC
HOT WATER SYSTEM SCHEMATIC

ENERGY CONCEPTS
ENGINEERING, P.C.
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Rochester, NY 14623
Phone: (585) 272-4650
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Combined Heat & Power,
Energy, Mechanical and
Electrical - Consultants

DATE: 8/1/02
PROJECT NO.: 02614
DRAWN BY: C. KREILEY
CHECKED BY: M. HURD
PROJECT MANAGER: W. CRISTOFARO
ISSUE DATE: 5/9/03

REVISIONS	
PROGRESS SET 08/30/02	SCOPE REVISION 07/01/03
95% REVIEW SET12/20/02	REVISED FOR COGEN ENCLOSURE 7/23/03
ISSUED FOR BID 5/9/03	AS-BUILT 3/2/05
ADDENDUM #1 05/30/03	

E.) System Schematic – Electric Power

3.) CHP Plant Measured Performance

A.) Predicted CHP Plant Electric and Thermal Performance

The original study for the cogeneration plant was conducted in 2003. At that time it was determined that a 380 kW plant best fit the existing electrical and thermal load profiles at 4C foods. 4C Foods had a total of four (4) electric meters on two separate Con Ed services. The accepted plant design was to consist of two (2) Coastintelligen[®] 150 kW units serving electrical service-A and one (1) Coastintelligen[®] 80 kW unit for electrical service-B. Consolidation of the existing electrical services was considered, but rejected by the owners due to its monetary impact on the project budget.

Preliminary analysis consisted of a simultaneous energy and financial analysis using the CHP calculation spreadsheet developed by Energy Concepts. The analysis receives inputs of baseline utility use and cost data, and analyzes coincidence of thermal and electrical site loads. CHP plant operational parameters are entered to generate an energy cost savings figure, which defines the payback, and ultimately the feasibility of the system.

The initial analysis for 4C Foods compared the 2003 utility billing against the projected performance of the combined CHP units described above. Manufacturer performance data was used to determine the outputs of the CHP system based on run hours and site demand.

From the initial analysis it was estimated the plant would operate as follows:

Estimated Plant Totals		
kWh Generated	1,221,780	kWh
Therms Consumed	123,807	therms
Therms Recovered	60,275	therms
Engine Run Hours	12,218	hours

The projected cost for the installation was \$1,119,887. Anticipated energy cost savings were \$192,158 (after maintenance adjustments), resulting in a simple payback of 5.8 years, prior to NYSERDA funding.

B.) Current Utility Billing – 2006

Recent billing history for 4C Foods used in cost savings analysis is presented on the following pages.

4-C Foods, Inc.
Consolidated Edison Co.
600 Fountain Ave, ENT
Acct # 69-6111-0549-0000-0
Rate EL-9 General Large

**** SERVED BY (2x) 150 kW UNITS ****

Month	Date		# days	Use Total (kWh)	Demand Peak (kW)	Total Use (\$)	Cost Peak Demand (\$)	Subtotal (\$)	Adjustment Factor (\$)	Billing Total (\$)
Jan-06	12/16/05	1/18/06	32	16,400	68.0	\$0.00	\$4,837.26	\$4,837.26	-\$30.34	\$4,806.92
Feb-06	1/18/06	2/16/06	28	13,200	116.0	\$0.00	\$4,198.28	\$4,198.28	-\$686.06	\$3,512.22
Mar-06	2/16/06	3/20/06	34	13,200	96.0	\$0.00	\$3,948.58	\$3,948.58	-\$450.69	\$3,497.89
Apr-06	3/20/06	4/18/06	28	12,800	88.0	\$0.00	\$3,558.11	\$3,558.11	-\$449.34	\$3,108.77
May-06	4/18/06	5/16/06	28	19,200	200.0	\$2,295.78	\$4,052.69	\$6,348.47	-\$435.23	\$5,913.24
Jun-06	5/16/06	6/15/06	29	17,200	144.0	\$2,013.96	\$3,631.03	\$5,644.99	\$77.04	\$5,722.03
Jul-06	6/15/06	7/17/06	32	18,400	144.0	\$2,351.54	\$3,952.73	\$6,304.27	-\$153.99	\$6,150.28
Aug-06	7/17/06	8/15/06	28	17,200	220.0	\$6,164.67	\$0.00	\$6,164.67	-\$80.62	\$6,084.05
Sep-06	8/15/06	9/14/06	29	14,400	76.0	\$0.00	\$3,846.08	\$3,846.08	\$109.57	\$3,955.65
Oct-06	9/14/06	10/16/06	32	15,200	164.0	\$5,325.06	\$0.00	\$5,325.06	-\$182.08	\$5,142.98
Nov-06	10/16/06	11/14/06	28	15,200	216.0	\$5,272.98	\$0.00	\$5,272.98	-\$207.69	\$5,065.29
Dec-06	11/14/06	12/15/06	31	20,000	108.0	\$2,230.04	\$2,192.30	\$4,422.34	-\$33.54	\$4,388.80
Total			359	192,400	1,640.0	\$25,654.03	\$34,217.06	\$59,871.09		\$57,348.12
Min				12,800	68.0		Usage Rate	\$0.13 / kWh		
Ave				16,033	136.7		Blended Rate	\$0.31 / kWh		
Max				20,000	220.0		Demand Rate	\$20.86 / kW		

4-C Foods, Inc.
Consolidated Edison Co.
580 Fountain Ave, ENT
Acct # 69-6111-0548-0000-2
Rate EL-9 General Large

**** SERVED BY 80 kW UNIT ****

Month	Date		# days	Use Total (kWh)	Demand Peak (kW)	Total Use (\$)	Cost Peak Demand (\$)	Subtotal (\$)	Adjustment Factor (\$)	Billing Total (\$)
Jan-06	12/16/05	1/18/06	32	24,400	104.0	\$4,105.73	\$1,556.60	\$5,662.33	-\$45.14	\$5,617.19
Feb-06	1/18/06	2/16/06	28	29,200	172.0	\$4,631.71	\$2,726.32	\$7,358.03	-\$1,517.64	\$5,840.39
Mar-06	2/16/06	3/20/06	34	25,600	156.0	\$3,515.01	\$3,263.87	\$6,778.88	-\$874.06	\$5,904.82
Apr-06	3/20/06	4/18/06	28	21,200	128.0	\$2,803.44	\$2,387.74	\$5,191.18	-\$744.23	\$4,446.95
May-06	4/18/06	5/16/06	28	20,000	128.0	\$2,390.08	\$2,592.26	\$4,982.34	-\$453.36	\$4,528.98
Jun-06	5/16/06	6/15/06	29	28,400	156.0	\$3,325.71	\$3,934.03	\$7,259.74	\$127.20	\$7,386.94
Jul-06	6/15/06	7/17/06	32	26,000	156.0	\$3,322.49	\$4,281.67	\$7,604.16	-\$217.59	\$7,386.57
Aug-06	7/17/06	8/15/06	28	26,800	152.0	\$3,452.77	\$3,750.92	\$7,203.69	-\$125.61	\$7,078.08
Sep-06	8/15/06	9/14/06	29	26,000	160.0	\$3,070.08	\$4,224.73	\$7,294.81	\$197.83	\$7,492.64
Oct-06	9/14/06	10/16/06	32	27,600	156.0	\$3,127.46	\$4,152.78	\$7,280.24	-\$330.62	\$6,949.62
Nov-06	10/16/06	11/14/06	28	21,600	156.0	\$2,411.36	\$3,262.78	\$5,674.14	-\$295.14	\$5,379.00
Dec-06	11/14/06	12/15/06	31	25,200	112.0	\$2,809.80	\$2,273.46	\$5,083.26	-\$42.26	\$5,041.00
Total			359	302,000	1,736.0	\$38,965.64	\$38,407.16	\$77,372.80		\$73,052.18
Min				20,000	104.0		Usage Rate	\$0.13 / kWh		
Ave				25,167	144.7		Blended Rate	\$0.26 / kWh		
Max				29,200	172.0		Demand Rate	\$22.12 / kW		

**** SERVES COGEN UNITS ****

KeySpan Gas

604 Fountain Ave

Cogen Gas Rate \$0.93 / Therm

Acct # 05730-82680

Meter # 507094

Rate: 4A - High Load Factor

Month	Date		# days	Use Actual (Therms)	Delivery (\$)	Cost Supply (\$)	Subtotal (\$)	Taxes + Fees		Billing Total (\$)
	From	To						MTA (\$)	sale tax (\$)	
Jan-06	12/29/05	1/30/06	31	10,553	\$1,830.93	\$10,798.88	\$12,629.81	\$10.86	\$505.63	\$13,146.30
Feb-06	1/30/06	2/28/06	28	10,803	\$1,857.57	\$9,322.99	\$11,180.56	\$9.62	\$447.61	\$11,637.79
Mar-06	2/28/06	3/28/06	28	8,975	\$1,560.67	\$7,388.22	\$8,948.89	\$7.70	\$358.26	\$9,314.85
Apr-06	3/28/06	4/27/06	29	8,444	\$1,484.60	\$6,441.93	\$7,926.53	\$14.35	\$317.64	\$8,258.52
May-06	4/27/06	5/26/06	29	7,783	\$1,374.37	\$5,728.29	\$7,102.66	\$12.86	\$284.62	\$7,400.14
Jun-06	5/26/06	6/28/06	32	14,286	\$2,432.68	\$8,848.75	\$11,281.43	\$20.42	\$452.07	\$11,753.92
Jul-06	6/28/06	7/28/06	30	14,375	\$2,433.56	\$9,350.94	\$11,784.50	\$21.33	\$472.23	\$12,278.06
Aug-06	7/28/06	8/29/06	31	15,074	\$2,554.29	\$11,585.88	\$14,140.17	\$25.59	\$566.63	\$14,732.39
Sep-06	8/29/06	9/28/06	29	12,841	\$2,188.12	\$9,932.51	\$12,120.63	\$21.94	\$485.70	\$12,628.27
Oct-06	9/28/06	10/27/06	29	14,907	\$2,514.21	\$6,870.64	\$9,384.85	\$16.99	\$376.07	\$9,777.91
Nov-06	10/27/06	11/29/06	32	12,876	\$2,207.08	\$11,830.47	\$14,037.55	\$25.41	\$562.52	\$14,625.48
Dec-06	11/29/06	12/29/06	30	2,967	\$608.28	\$2,911.81	\$3,520.09	\$6.37	\$141.06	\$3,667.52
Total				133,884	\$23,046.36	\$101,011.31	\$124,057.67			\$129,221.15

**** SERVES STEAM BOILER & SPACE HEATING ****

KeySpan Gas

600 Fountain Ave

General Gas Rate \$1.40 / Therm

Acct # 05730-82562

Meter # 507094

Rate: 2-2 General

Month	Date		# days	Use Actual (Therms)	Delivery (\$)	Cost Supply (\$)	Subtotal (\$)	Taxes + Fees		Billing Total (\$)
	From	To						MTA (\$)	sale tax (\$)	
Jan-06	12/29/05	1/30/06	31	6,917	\$2,188.95	\$8,549.41	\$10,738.36	\$9.23	\$0.00	\$10,747.59
Feb-06	1/30/06	2/17/06	17	4,973	\$1,577.80	\$5,592.64	\$7,170.44	\$6.17	\$0.00	\$7,176.61
Mar-06	2/17/06	3/20/06	33	6,104	\$1,933.92	\$5,966.66	\$7,900.58	\$6.79	\$0.00	\$7,907.37
Apr-06	3/20/06	4/19/06	29	2,090	\$677.92	\$2,009.74	\$2,687.66	\$4.86	\$0.00	\$2,692.52
May-06	4/19/06	5/18/06	29	555	\$197.12	\$507.60	\$704.72	\$1.28	\$0.00	\$706.00
Jun-06	5/18/06	6/20/06	32	272	\$111.87	\$221.38	\$333.25	\$0.60	\$0.00	\$333.85
Jul-06	6/20/06	7/20/06	30	185	\$82.22	\$142.89	\$225.11	\$0.41	\$0.00	\$225.52
Aug-06	7/20/06	8/21/06	31	214	\$92.92	\$186.95	\$279.87	\$0.51	\$0.00	\$280.38
Sep-06	8/21/06	9/20/06	29	187	\$82.85	\$165.21	\$248.06	\$0.45	\$0.00	\$248.51
Oct-06	9/20/06	10/19/06	29	246	\$100.49	\$134.69	\$235.18	\$0.43	\$0.00	\$235.61
Nov-06	10/19/06	11/17/06	28	1,581	\$517.94	\$1,376.10	\$1,894.04	\$3.43	\$0.00	\$1,897.47
Dec-06	11/17/06	12/19/06	32	3,496	\$1,119.21	\$4,050.12	\$5,169.33	\$9.36	\$0.00	\$5,178.69
Total				26,820	\$8,683.21	\$28,903.39	\$37,586.60			\$37,630.12

C.) Measured and Logged CHP Plant Power Production,

Coastintelligen[®] provides engine run-time data logs for each of the three cogeneration units installed. Data logs include operational parameters of the cogeneration plant such as; kWh produced, engine fuel consumed, and total unit run-hours. Sample data logs are available in the appendices. A summary of the log data for 2006 is provided below.

CHP Operational Data : 2006						
	Total Produced (kWh)	Total CHP Fuel (therms)	Recovered CHP heat (therms)	Thermal Utilized (therms)	ΔTime Total (hours)	Δ Time Engine (hours)
Jan	76,432	10,553	4,463	3,723	1,944	852
Feb	74,808	10,803	4,342	3,642	1,944	829
Mar	81,035	8,975	4,933	3,478	2,376	919
Apr	59,863	8,444	3,536	2,641	2,170	678
May	88,812	7,783	5,055	3,748	2,598	974
Jun	133,892	14,286	7,937	8,969	2,520	1,460
Jul	113,229	14,375	7,025	7,617	2,082	1,195
Aug	92,043	15,074	5,624	6,206	1,656	985
Sep	103,215	12,841	6,241	7,243	2,091	1,124
Oct	102,441	14,907	6,078	5,988	2,447	1,143
Nov	76,024	12,876	4,469	3,878	2,809	867
Dec	43,614	2,967	2,492	2,711	1,437	510
Totals	1,045,408	113,884	62,195	59,844		11,536

For 2006, run-data from the engines shows an actual annual outcome of:

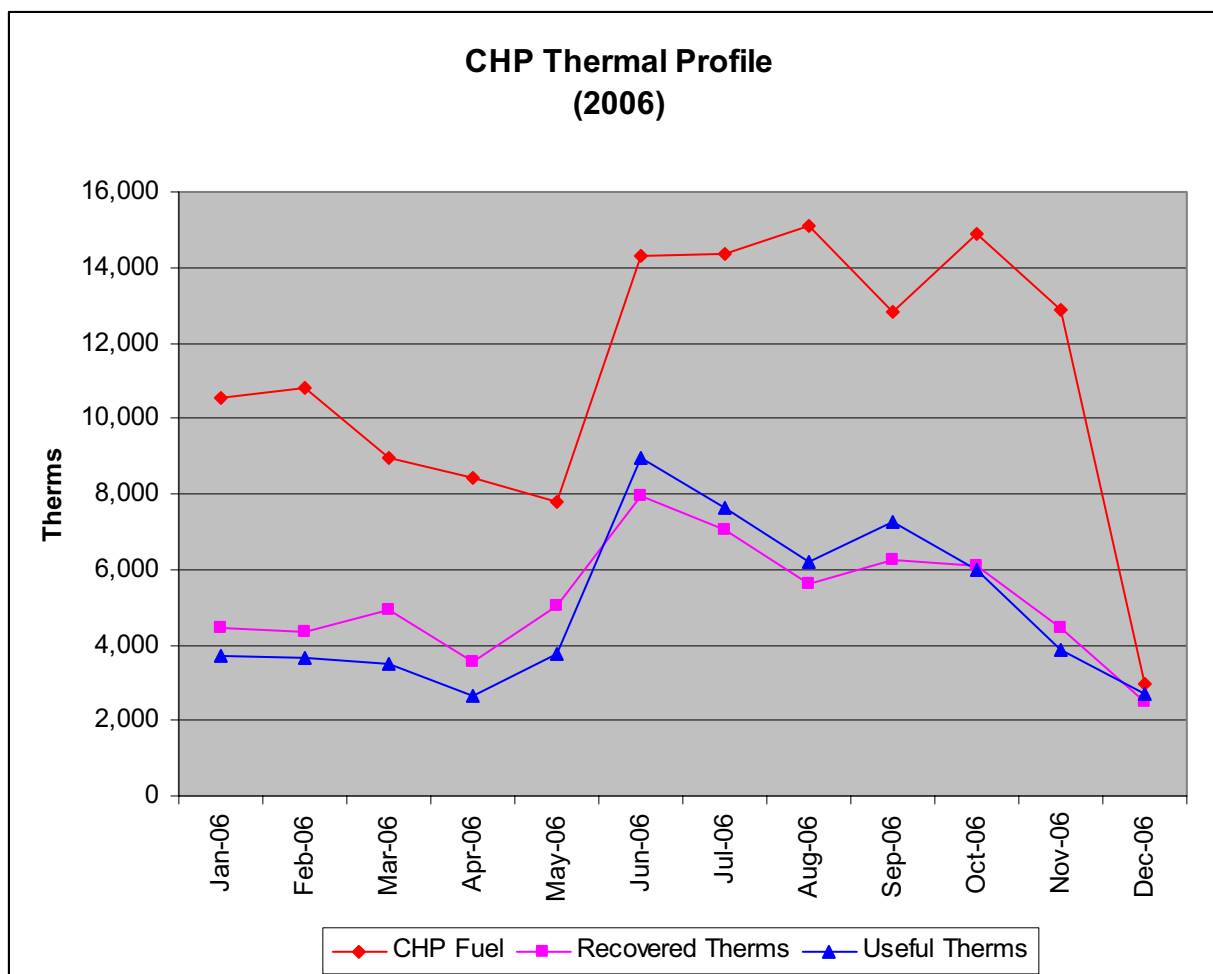
Annual CHP Totals (2006)		
kWh Generated	1,045,408	kWh
Therms Consumed	113,884	therms
Therms Recovered	62,195	therms
Therms Utilized	59,844	therms
Engine Run Hours	11,536	hours

Equivalent boiler burner tip therms = 85,548.
(At 70% boiler cycle efficiency)

D.) Metered CHP Gas Use and Energy Balance of Gas vs. Electric

Natural gas consumed by the cogeneration plant is provided via the Keyspan gas meter (# 507094). Keyspan metering data for year 2006, matches well with data from the engine monitoring system, following the relative trend of use. Comparing the value of cogen fuel consumption (Keyspan meter) with the recorded thermal output of the cogen plant (Coastintelligen[®] loggers) shows an average plant thermal efficiency of around 46%**. The fuel input value is higher than anticipated, and is the result of the cogen units ramping (to match the site load) more often than was anticipated. This also explains the lower thermal efficiency, as efficiency decreases at lower operating outputs.

** [CHP output (therms) / CHP Fuel input (therms)] * 100%



E.) Actual Energy Production Use vs. Predicted

The engine data logs from 2006 show that the installed cogeneration plant operated fewer hours than were originally projected. As a result the total kWh produced was lower than estimated. This is due to a variation in plant operations, which is apparent in the fact that the produced kWh for 2006 accounts for 49.5 % of the total electric load at the facility that year (compared to 76 % projected).

Actual cost savings however, are greater than projected in the original estimate.

F.) Actual Cost Savings vs. Predicted Savings

A summary of the projected and actual energy cost savings is presented below.

Annual Energy Cost Savings Summary

	Projected (2003)	Actual (2006)
Electrical Cost Savings	\$ 251,755	\$ 283,867
CHP Fuel Cost Increase	- \$ 35,161	- \$ 61,563
Maintenance Cost Increase	- \$ 24,436	- \$ 20,908
Net Annual Cost Savings	\$ 192,158	\$ 201,396

Project Payback Comparison

	Projected (2003)	Actual (2006)
Project Implementation	\$ 1,119,887	\$ 1,215,000
Annual Cost Savings	\$ 192,158	\$ 201,396
Simple Payback	5.8 years	6.0 years
NYSERDA Funding		\$ 558,000
Net Project Cost		\$ 657,000
Net Simple Payback		3.26 years

G.) Cheese Dryer Process Operation

The cheese dryer is located on the first floor of the facility, and operates during regular plant hours. In this process, 100% outside air supply is heated to between 90-120 °F. The heated air supply is blown through the machine to remove moisture from grated cheese.

The existing system utilized a steam heating coil which was fed by the existing steam boiler. To improve energy efficiency of the system, the steam coil was supplemented with a hot-water coil. The new coil uses hot water from the cogen heat-recovery loop to heat the incoming air to the dryer, reducing fuel use in the steam boiler.

The existing steam coil has been shut off in order to maximize air flow through the dryer duct. The coil itself has been kept, as a back-up for the new hot water coil.

H.) Absorber Chiller Systems

The absorber chiller plant consists of two (2), 20 ton Yazaki units, replacing the original 40 ton electric chiller. The chillers are driven by the cogen heat-recovery hot water supply loop.

Chilled water supply feeds four (4) fan coil units throughout the facility, providing space cooling in process areas. Chilled water also supplies new chilled water coils for three (3) air handler units on the roof.

Interior fan coil units are in a 4-pipe configuration. This allows cooling via chilled water piping, and alternate heating via cogen heat-recovery water piping. Each unit includes a 2-way control valve to switch between heating and cooling applications. The flow to the coils is controlled in an on/off arrangement, and is not modulated.

4.) Lessons Learned

A.) Constructability and Cost Issues

Pre-packaging of the cogeneration units and devices in a standard SEA tainer and housed outside the facility. Instead of consolidating electric services, installing one CHP plant but allowing the units to serve different services. This is a site specific cost issue. At some sites consolidating services will often be economical, but not always.

B.) Effect of Related HVAC Systems

Although thermal site savings is reasonable, additional thermal savings could have resulted if more of the existing and new heating units were placed on EMS control as was the CHP plant. A project is now underway to automate more of the existing units to improve heating efficiency and maximize use of CHP plant waste heat.

C.) Boiler Plant Efficiency and Savings Impact

At 4C foods significant gas savings was achieved by providing enough thermal recovery to completely keep the old existing steam boiler shut down, verses allowing the unit to cycle at low loads. This was mainly accomplished by diligent owner attention.

D.) Effect of Unusual Large Motor Loads

The 4C foods facility was served by an existing large air compressor at 75Hp and a large vacuum pump system at 75Hp. These motor loads cycled in a way to make it difficult for the CHP plant to effectively produce power and fully mitigate demand for those units. In early 2006 these units were modified to flatten their load profile, save energy and allow the CHP plant to better hit those loads. A variable speed drive air compressor was installed, leaving the old 75Hp unit as backup. The old vacuum pump was removed and a pair of smaller units installed that now run longer hours but at reduced load. That equipment now presents a better load profile for the CHP plant.

E.) Importance of Computer Control Systems

The EMS control system as designed and installed has been key to proper operation and trouble shooting of the CHP plant. It allows owners to graphically view CHP plant operations and better understand operating characteristics.

5.) Appendix

- A.) Baseline Year Utility Use**
- B.) Post CHP Plant Utility Use**
- C.) Projected CHP Operation Analysis (2003)**
- D.) Actual CHP Operation Analysis (2006)**
- E.) Sample Coastintelligen[®] Engine Data Logs**
- F.) 4-C Foods Floor Plan**
- G.) 4-C Foods Electric Meter Summary**
- H.) Equipment Cut Sheets**

4-C Foods, Inc.

Consolidated Edison Co.

**** Now Servied by (2x) 150 kW units ****

600 Fountain Ave, ENT

Acct # 69-6111-0549-0000-0

Rate EL-9 General Large

Date Month	Use Total (kWh)	Demand Peak (kW)	Total Use (\$)	Cost Peak Demand (\$)	Subtotal (\$)	Billing Total (\$)
Jan-01	58,800	270.0	\$6,350.40	\$4,041.90	\$10,392.30	\$10,392.30
Feb-01	58,800	258.0	\$6,026.40	\$3,862.26	\$9,888.66	\$9,888.66
Mar-01	58,800	252.0	\$6,350.40	\$3,772.44	\$10,122.84	\$10,122.84
Apr-01	69,000	282.0	\$7,452.00	\$4,221.54	\$11,673.54	\$11,673.54
May-01	78,600	294.0	\$8,488.80	\$4,401.18	\$12,889.98	\$12,889.98
Jun-01	100,200	306.0	\$10,821.60	\$4,580.82	\$15,402.42	\$15,402.42
Jul-00	97,800	330.0	\$10,562.40	\$4,940.10	\$15,502.50	\$15,502.50
Aug-00	81,000	258.0	\$8,748.00	\$3,862.26	\$12,610.26	\$12,610.26
Sep-00	77,400	270.0	\$8,359.20	\$4,041.90	\$12,401.10	\$12,401.10
Oct-00	64,200	288.0	\$6,933.60	\$4,311.36	\$11,244.96	\$11,244.96
Nov-00	63,600	270.0	\$6,868.80	\$4,041.90	\$10,910.70	\$10,910.70
Dec-00	59,400	270.0	\$6,415.20	\$4,041.90	\$10,457.10	\$10,457.10
Total	867,600	3,348.0	\$93,376.80	\$50,119.56	\$143,496.36	\$143,496.36
Min	58,800	252.0		Usage Rate	\$0.11 / kWh	
Ave	72,300	279.0		Blended Rate	\$0.17 / kWh	
Max	100,200	330.0		Demand Rate	\$14.97 / kW	

4-C Foods, Inc.

Consolidated Edison Co.

**** Now Servied by 80 kW unit ****

580 Fountain Ave, ENT

Acct # 69-6111-0548-0000-2

Rate EL-9 General Large

Date Month	Use Total (kWh)	Demand Peak (kW)	Total Use (\$)	Cost Peak Demand (\$)	Subtotal (\$)	Billing Total (\$)
Jan-01	34,200	126.0	\$3,693.60	\$1,886.22	\$5,579.82	\$5,579.82
Feb-01	31,200	132.0	\$3,369.60	\$1,976.04	\$5,345.64	\$5,345.64
Mar-01	30,600	132.0	\$3,304.80	\$1,976.04	\$5,280.84	\$5,280.84
Apr-01	37,800	150.0	\$4,082.40	\$2,245.50	\$6,327.90	\$6,327.90
May-01	37,200	156.0	\$4,017.60	\$2,335.32	\$6,352.92	\$6,352.92
Jun-01	41,400	162.0	\$4,471.20	\$2,425.14	\$6,896.34	\$6,896.34
Jul-00	38,400	150.0	\$4,147.20	\$2,245.50	\$6,392.70	\$6,392.70
Aug-00	38,400	144.0	\$4,147.20	\$2,155.68	\$6,302.88	\$6,302.88
Sep-00	41,400	138.0	\$4,471.20	\$2,065.86	\$6,537.06	\$6,537.06
Oct-00	37,800	138.0	\$4,082.40	\$2,065.86	\$6,148.26	\$6,148.26
Nov-00	35,400	132.0	\$3,823.20	\$1,976.04	\$5,799.24	\$5,799.24
Dec-00	36,000	132.0	\$3,388.00	\$1,976.04	\$5,364.04	\$5,364.04
Total	439,800	1,692.0	\$46,998.40	\$25,329.24	\$72,327.64	\$72,327.64
Min	30,600	126.0		Usage Rate	\$0.11 / kWh	
Ave	36,650	141.0		Blended Rate	\$0.16 / kWh	
Max	41,400	162.0		Demand Rate	\$14.97 / kW	

KeySpan Gas
566 Fountain Ave Gas Rate \$1.50 / Therm

Date Month	Use Actual (Therms)	Cost (\$)	Average Unit Cost (\$/Therm)
Jan-01	187	\$276.00	\$1.48
Feb-01	169	\$218.00	\$1.29
Mar-01	5	\$18.00	\$3.60
Apr-01	0	\$12.00	-
May-01	0	\$14.00	-
Jun-01	0	\$13.00	-
Jul-00	0	\$14.00	-
Aug-00	0	\$13.00	-
Sep-00	0	\$13.00	-
Oct-00	99	\$139.00	\$1.40
Nov-00	46	\$78.00	\$1.70
Dec-00	405	\$562.00	\$1.39
Total	911	\$1,370.00	

KeySpan Gas
583 Fountain Ave Gas Rate \$1.32 / Therm

Date Month	Use Actual (Therms)	Cost (\$)	Average Unit Cost (\$/Therm)
Jan-01	940	\$1,279.00	\$1.36
Feb-01	37	\$64.00	\$1.73
Mar-01	1,401	\$1,614.00	\$1.15
Apr-01	32	\$58.00	\$1.81
May-01	0	\$14.00	-
Jun-01	0	\$13.00	-
Jul-00	33	\$54.00	\$1.64
Aug-00	29	\$50.00	\$1.72
Sep-00	31	\$57.00	\$1.84
Oct-00	237	\$298.00	\$1.26
Nov-00	687	\$813.00	\$1.18
Dec-00	3,379	\$4,675.00	\$1.38
Total	6,806	\$8,989.00	

KeySpan Gas
600 Fountain Ave Gas Rate \$1.14 / Therm

Date Month	Use Actual (Therms)	Cost (\$)	Average Unit Cost (\$/Therm)
Jan-01	9,035	\$11,147.00	\$1.23
Feb-01	7,581	\$8,010.00	\$1.06
Mar-01	3,327	\$3,401.00	\$1.02
Apr-01	3,330	\$3,599.00	\$1.08
May-01	1,040	\$1,039.00	\$1.00
Jun-01	795	\$729.00	\$0.92
Jul-00	1,286	\$1,283.00	\$1.00
Aug-00	1,588	\$1,824.00	\$1.15
Sep-00	3,405	\$3,638.00	\$1.07
Oct-00	10,869	\$11,384.00	\$1.05
Nov-00	12,645	\$15,899.00	\$1.26
Dec-00	23,512	\$27,151.00	\$1.15
Total	78,413	\$89,104.00	

KeySpan Gas
821 Logan Ave Gas Rate \$1.30 / Therm

Date Month	Use Actual (Therms)	Cost (\$)	Average Unit Cost (\$/Therm)
Jan-01	322	\$441.00	\$1.37
Feb-01	257	\$314.00	\$1.22
Mar-01	155	\$203.00	\$1.31
Apr-01	69	\$107.00	\$1.55
May-01	61	\$91.00	\$1.49
Jun-01	47	\$69.00	\$1.47
Jul-00	74	\$100.00	\$1.35
Aug-00	48	\$75.00	\$1.56
Sep-00	73	\$112.00	\$1.53
Oct-00	221	\$279.00	\$1.26
Nov-00	454	\$507.00	\$1.12
Dec-00	601	\$793.00	\$1.32
Total	2,382	\$3,091.00	

(Steam Boiler & Space Heating)

4-C Foods, Inc.
Consolidated Edison Co.
600 Fountain Ave, ENT
Acct # 69-6111-0549-0000-0
Rate EL-9 General Large

**** SERVED BY (2x) 150 kW UNITS ****

Month	Date		# days	Use Total (kWh)	Demand Peak (kW)	Total Use (\$)	Cost Peak Demand (\$)	Subtotal (\$)	Adjustment Factor (\$)	Billing Total (\$)
Jan-06	12/16/05	1/18/06	32	16,400	68.0	\$0.00	\$4,837.26	\$4,837.26	-\$30.34	\$4,806.92
Feb-06	1/18/06	2/16/06	28	13,200	116.0	\$0.00	\$4,198.28	\$4,198.28	-\$686.06	\$3,512.22
Mar-06	2/16/06	3/20/06	34	13,200	96.0	\$0.00	\$3,948.58	\$3,948.58	-\$450.69	\$3,497.89
Apr-06	3/20/06	4/18/06	28	12,800	88.0	\$0.00	\$3,558.11	\$3,558.11	-\$449.34	\$3,108.77
May-06	4/18/06	5/16/06	28	19,200	200.0	\$2,295.78	\$4,052.69	\$6,348.47	-\$435.23	\$5,913.24
Jun-06	5/16/06	6/15/06	29	17,200	144.0	\$2,013.96	\$3,631.03	\$5,644.99	\$77.04	\$5,722.03
Jul-06	6/15/06	7/17/06	32	18,400	144.0	\$2,351.54	\$3,952.73	\$6,304.27	-\$153.99	\$6,150.28
Aug-06	7/17/06	8/15/06	28	17,200	220.0	\$6,164.67	\$0.00	\$6,164.67	-\$80.62	\$6,084.05
Sep-06	8/15/06	9/14/06	29	14,400	76.0	\$0.00	\$3,846.08	\$3,846.08	\$109.57	\$3,955.65
Oct-06	9/14/06	10/16/06	32	15,200	164.0	\$5,325.06	\$0.00	\$5,325.06	-\$182.08	\$5,142.98
Nov-06	10/16/06	11/14/06	28	15,200	216.0	\$5,272.98	\$0.00	\$5,272.98	-\$207.69	\$5,065.29
Dec-06	11/14/06	12/15/06	31	20,000	108.0	\$2,230.04	\$2,192.30	\$4,422.34	-\$33.54	\$4,388.80
Total			359	192,400	1,640.0	\$25,654.03	\$34,217.06	\$59,871.09		\$57,348.12
Min				12,800	68.0		Usage Rate	\$0.13 / kWh		
Ave				16,033	136.7		Blended Rate	\$0.31 / kWh		
Max				20,000	220.0		Demand Rate	\$20.86 / kW		

4-C Foods, Inc.
Consolidated Edison Co.
580 Fountain Ave, ENT
Acct # 69-6111-0548-0000-2
Rate EL-9 General Large

**** SERVED BY 80 kW UNIT ****

Month	Date		# days	Use Total (kWh)	Demand Peak (kW)	Total Use (\$)	Cost Peak Demand (\$)	Subtotal (\$)	Adjustment Factor (\$)	Billing Total (\$)
Jan-06	12/16/05	1/18/06	32	24,400	104.0	\$4,105.73	\$1,556.60	\$5,662.33	-\$45.14	\$5,617.19
Feb-06	1/18/06	2/16/06	28	29,200	172.0	\$4,631.71	\$2,726.32	\$7,358.03	-\$1,517.64	\$5,840.39
Mar-06	2/16/06	3/20/06	34	25,600	156.0	\$3,515.01	\$3,263.87	\$6,778.88	-\$874.06	\$5,904.82
Apr-06	3/20/06	4/18/06	28	21,200	128.0	\$2,803.44	\$2,387.74	\$5,191.18	-\$744.23	\$4,446.95
May-06	4/18/06	5/16/06	28	20,000	128.0	\$2,390.08	\$2,592.26	\$4,982.34	-\$453.36	\$4,528.98
Jun-06	5/16/06	6/15/06	29	28,400	156.0	\$3,325.71	\$3,934.03	\$7,259.74	\$127.20	\$7,386.94
Jul-06	6/15/06	7/17/06	32	26,000	156.0	\$3,322.49	\$4,281.67	\$7,604.16	-\$217.59	\$7,386.57
Aug-06	7/17/06	8/15/06	28	26,800	152.0	\$3,452.77	\$3,750.92	\$7,203.69	-\$125.61	\$7,078.08
Sep-06	8/15/06	9/14/06	29	26,000	160.0	\$3,070.08	\$4,224.73	\$7,294.81	\$197.83	\$7,492.64
Oct-06	9/14/06	10/16/06	32	27,600	156.0	\$3,127.46	\$4,152.78	\$7,280.24	-\$330.62	\$6,949.62
Nov-06	10/16/06	11/14/06	28	21,600	156.0	\$2,411.36	\$3,262.78	\$5,674.14	-\$295.14	\$5,379.00
Dec-06	11/14/06	12/15/06	31	25,200	112.0	\$2,809.80	\$2,273.46	\$5,083.26	-\$42.26	\$5,041.00
Total			359	302,000	1,736.0	\$38,965.64	\$38,407.16	\$77,372.80		\$73,052.18
Min				20,000	104.0		Usage Rate	\$0.13 / kWh		
Ave				25,167	144.7		Blended Rate	\$0.26 / kWh		
Max				29,200	172.0		Demand Rate	\$22.12 / kW		

**** SERVES COGEN UNITS ****

KeySpan Gas

604 Fountain Ave

Cogen Gas Rate \$0.93 / Therm

Acct # 05730-82680

Meter # 507094

Rate: 4A - High Load Factor

Month	Date		# days	Use Actual (Therms)	Delivery (\$)	Cost Supply (\$)	Subtotal (\$)	Taxes + Fees		Billing Total (\$)
	From	To						MTA (\$)	sale tax (\$)	
Jan-06	12/29/05	1/30/06	31	10,553	\$1,830.93	\$10,798.88	\$12,629.81	\$10.86	\$505.63	\$13,146.30
Feb-06	1/30/06	2/28/06	28	10,803	\$1,857.57	\$9,322.99	\$11,180.56	\$9.62	\$447.61	\$11,637.79
Mar-06	2/28/06	3/28/06	28	8,975	\$1,560.67	\$7,388.22	\$8,948.89	\$7.70	\$358.26	\$9,314.85
Apr-06	3/28/06	4/27/06	29	8,444	\$1,484.60	\$6,441.93	\$7,926.53	\$14.35	\$317.64	\$8,258.52
May-06	4/27/06	5/26/06	29	7,783	\$1,374.37	\$5,728.29	\$7,102.66	\$12.86	\$284.62	\$7,400.14
Jun-06	5/26/06	6/28/06	32	14,286	\$2,432.68	\$8,848.75	\$11,281.43	\$20.42	\$452.07	\$11,753.92
Jul-06	6/28/06	7/28/06	30	14,375	\$2,433.56	\$9,350.94	\$11,784.50	\$21.33	\$472.23	\$12,278.06
Aug-06	7/28/06	8/29/06	31	15,074	\$2,554.29	\$11,585.88	\$14,140.17	\$25.59	\$566.63	\$14,732.39
Sep-06	8/29/06	9/28/06	29	12,841	\$2,188.12	\$9,932.51	\$12,120.63	\$21.94	\$485.70	\$12,628.27
Oct-06	9/28/06	10/27/06	29	14,907	\$2,514.21	\$6,870.64	\$9,384.85	\$16.99	\$376.07	\$9,777.91
Nov-06	10/27/06	11/29/06	32	12,876	\$2,207.08	\$11,830.47	\$14,037.55	\$25.41	\$562.52	\$14,625.48
Dec-06	11/29/06	12/29/06	30	2,967	\$608.28	\$2,911.81	\$3,520.09	\$6.37	\$141.06	\$3,667.52
Total				133,884	\$23,046.36	\$101,011.31	\$124,057.67			\$129,221.15

**** SERVES STEAM BOILER & SPACE HEATING ****

KeySpan Gas

600 Fountain Ave

General Gas Rate \$1.40 / Therm

Acct # 05730-82562

Meter # 507094

Rate: 2-2 General

Month	Date		# days	Use Actual (Therms)	Delivery (\$)	Cost Supply (\$)	Subtotal (\$)	Taxes + Fees		Billing Total (\$)
	From	To						MTA (\$)	sale tax (\$)	
Jan-06	12/29/05	1/30/06	31	6,917	\$2,188.95	\$8,549.41	\$10,738.36	\$9.23	\$0.00	\$10,747.59
Feb-06	1/30/06	2/17/06	17	4,973	\$1,577.80	\$5,592.64	\$7,170.44	\$6.17	\$0.00	\$7,176.61
Mar-06	2/17/06	3/20/06	33	6,104	\$1,933.92	\$5,966.66	\$7,900.58	\$6.79	\$0.00	\$7,907.37
Apr-06	3/20/06	4/19/06	29	2,090	\$677.92	\$2,009.74	\$2,687.66	\$4.86	\$0.00	\$2,692.52
May-06	4/19/06	5/18/06	29	555	\$197.12	\$507.60	\$704.72	\$1.28	\$0.00	\$706.00
Jun-06	5/18/06	6/20/06	32	272	\$111.87	\$221.38	\$333.25	\$0.60	\$0.00	\$333.85
Jul-06	6/20/06	7/20/06	30	185	\$82.22	\$142.89	\$225.11	\$0.41	\$0.00	\$225.52
Aug-06	7/20/06	8/21/06	31	214	\$92.92	\$186.95	\$279.87	\$0.51	\$0.00	\$280.38
Sep-06	8/21/06	9/20/06	29	187	\$82.85	\$165.21	\$248.06	\$0.45	\$0.00	\$248.51
Oct-06	9/20/06	10/19/06	29	246	\$100.49	\$134.69	\$235.18	\$0.43	\$0.00	\$235.61
Nov-06	10/19/06	11/17/06	28	1,581	\$517.94	\$1,376.10	\$1,894.04	\$3.43	\$0.00	\$1,897.47
Dec-06	11/17/06	12/19/06	32	3,496	\$1,119.21	\$4,050.12	\$5,169.33	\$9.36	\$0.00	\$5,178.69
Total				26,820	\$8,683.21	\$28,903.39	\$37,586.60			\$37,630.12

ECM 1

450 kw

Cogeneration System

4C FOODS

Present Condition:

No existing Cogeneration System.

Proposed ECM:

Install three 150 kw natural gas fired cogeneration units. The system will be equipped with complete engine and exhaust heat recovery. Recovered heat will be used for drying processes and space heating

Summary:

Fuel cost per Therm	\$0.5500 /Therm
Electric cost per kWh peak period	\$0.1663 /kWh
Electric cost per kW	\$20.70 /kW
Construction Cost:	\$1,119,887
Estimated Useful Life:	20 Years
Maintenance Costs Effect (+/-) (Positive = Increase, Negative = Decreased)	\$24,436
Estimated Salvage or Disposal Costs (Positive = Cost, Negative = Salvage)	\$0

Interactive Savings:

Estimated Annual Fuel Energy Savings	-85,062 Therms
Estimated Annual Fuel Cost Savings (- Indicates fuel increase.)	-\$35,161
Estimated KW/Month Demand Savings	4,920 kW
Estimated KW/Month Demand Cost Savings	\$101,844
Estimated Annual KWH Savings	1,388,063 kWh
Estimated Annual KWH Cost Savings	\$149,911
Estimated Annual Energy Cost Savings	\$216,594
Net Cost Savings After Maintenance =	\$192,158
Simple Payback	5.8 Years

4C FOODS
COGENERATION ANALYSIS WITH ABSORBER
ENERGY ANALYSIS AND COST SUMMARY
3 150 KW COGEN UNITS: 450 KW TOTAL With ABS

<u>COGEN SYSTEM PRODUCTION EQUIPMENT:</u>				
TYPE OF COGEN UNITS	Fuel Fired			
COGEN FULL KW PER UNIT	100 KW/hr			
NUMBER OF COGEN UNITS	3			
TOTAL ANNUAL RUN HOURS	12,218 hours			
MAX ANNUAL RUN HOURS (8760 HRS/UNIT)	26,280 hours			
% OF MAX RUN HOURS	46%			
<u>COGEN SYSTEM SAVINGS:</u>				<u>% OF EXIST. UTILITY</u>
ELECTRIC				
COGEN ELECTRIC GENERATED	1,221,780 KWh	\$ 131,952		76%
OFFSET ELECTRIC CHILLER SAVINGS	166,283 KWh	\$ 14,731		10%
	1,388,063 KWh	\$ 146,683		87%
ELECTRIC DEMAND SAVINGS	4,920 KW	\$ 101,844		80%
ELECTRIC MAXIMUM DEMAND SAVINGS	5,400 KW			
% OF MAXIMUM DEMAND POSSIBLE	91%			
(Includes 100 Kw per month due to Absorber)				
TOTAL ELECTRIC SAVINGS (KW Demand and KWh)		\$ 248,527		82%
THERMAL				
COGEN THERMAL SAVINGS	38,745 MMBtu	\$ 32,933		44%
TOTAL COGEN GROSS SAVINGS		\$ 281,460		75%
<u>COGEN SYSTEM OPERATING COST:</u>				
COGEN FUEL INPUT (EQUIVALENT IN THERMS.)	123,807 therms	\$ 68,094		
<u>SUMMARY:</u>				
NET COGEN ENERGY COST SAVINGS (W/O MAINTENANCE)		\$ 213,366		
ANNUAL COGEN MAINTENANCE CONTRACT COST		\$24,436		
NET COGEN SYSTEM SAVINGS WITH MAINTENANCE CONTRACT		\$192,158		

COGENERATION ANALYSIS WITH ABSORBER

3 150 KW COGEN UNITS: 450 KW TOTAL With ABS
(Natural gas engines with combustion HR)

CALCULATION PARAMETERS:

EXISTING THERMAL LOAD USE

CONVERSION FACTOR	100,000	Btu/therm natural gas
CONVERSION FACTOR	135,000	Btu/gallon FUEL
EXISTING HEATING PLANT OPERATING EFFICIENCY	75%	
EXISTING AVERAGE COST PER GALLON OF FUEL	\$0.540	includes tax
PROPOSED AVERAGE COST PER GALLON OF FUEL	\$0.6000	includes tax
EQUIVALENT COST PER THERM FOR COGEN USE Using nat gas	\$0.5500	/Therm
EQUIVALENT COST PER THERM FOR BOILER USE	\$0.85	/Therm
DEDUCTION FOR EXISTING FUEL OIL FIRED EQUIPMENT:	0	

EXISTING ELECTRIC USE

AVERAGE COST PER ON-PEAK KWH (WITHOUT DEMAND) + GRS	\$ 0.1080
AVERAGE COST PER OFF-PEAK KWH (WITHOUT DEMAND) + GRS	\$ 0.1080
AVERAGE BLENDED COST PER KWH (WITHOUT DEMAND), INCLUDES GRS	\$0.1080
COST PER DEMAND KW (WEIGHTED AVERAGE)	\$ 20.700
BLENDED COST DURING PEAK HOURS	\$0.1663 Per/KWH

COGENERATION EQUIPMENT

TYPE OF COGEN UNITS						
COGEN THERMAL OUTPUT PER UNIT:		max Btu/hr	% used			
THERMAL OUTPUT AT 100 % OF ENGINE		740,000	100%		740,000	
THERMAL OUTPUT AT 100 RATING	100	493,333	100%		493,333	Btu/hr
15 psig LPS		0	0%		0	Btu/hr
100 psig HPS		0	0%		0	Btu/hr
TOTAL OUTPUT =		493,333	100%		493,333	Btu/hr efficiency = 48.7%

COGEN THERMAL INPUT AT AVERAGE RUNNING POWER

COGEN THERMAL INPUT AT 100 % RATING	1,013,333	Btu/hr
COGEN UNIT FULL RATED OUTPUT	1,520,000	
COGEN KW PER UNIT AVERAGE RUNNING POWER	150	KW/hr
NUMBER OF COGEN UNITS	100	KW/hr efficiency = 33.7%
MAX UP TIME PER COGEN UNIT	3	
MAINTENANCE COST PER RUN HOUR PER UNIT	95%	(or input in column)
	\$2.00	(full maintenance contract)
		Comprehensive Plan

ABSORPTION EQUIPMENT

HOURLY LOAD PER TON	17,800	BTU/h/ton
AVERAGE OPERATING FACTOR	see column values	
AVG KW / TON OF DISPLACED CHILLERS	1.30	KW/ton

OTHER

<u>Screen</u>	
AVERAGE TOTAL HOURS PER MONTH	730.0
PEAK AND SHOULDER HOURS PER MONTH	488
OFF PEAK HOURS PER MONTH	242
Added special demand savings per month (Absorber etc.)	100 KW

EXISTING ENERGY USE: Adjusted for lighting savings and parking garage use.

MONTH	THERMAL USE (Therms) ¹	PEAK DEMAND (KW)	ON-PEAK + SHLDR (KWh)	OFF-PEAK USE (KWh)	TOTAL USE (KWh)	GRS COST	Total Electric Cost
Jun-01	842	554.4	133,152	33,288	166,440	\$0	\$33,142
May-01	1,101	542.4	114,528	28,632	143,160	\$0	\$24,414
Apr-01	3,431	526.8	105,888	26,472	132,360	\$0	\$22,677
Mar-01	4,888	484.8	90,816	22,704	113,520	\$0	\$19,640
Feb-01	8,044	484.8	86,496	21,624	108,120	\$0	\$21,172
Jan-01	10,484	500.4	92,736	23,184	115,920	\$0	\$21,717
Dec-00	27,897	490.8	93,696	23,424	117,120	\$0	\$25,646
Nov-00	13,832	490.8	99,168	24,792	123,960	\$0	\$25,809
Oct-00	11,426	542.4	103,968	25,992	129,960	\$0	\$23,560
Sep-00	3,509	501.6	117,312	29,328	146,640	\$0	\$26,724
Aug-00	1,665	501.6	115,968	28,992	144,960	\$0	\$27,715
Jul-00	1,393	567.6	129,312	32,328	161,640	\$0	\$28,393
TOTALS	88,512	6,188	1,283,040	320,760	1,603,800		\$300,607

COST \$75,235 \$128,100 \$ 138,568 \$ 34,642 \$ 173,210 \$0

UNIT COST \$0.850 \$20.70 0.10800 \$ 0.1080 \$0.1080

AVERAGE 516

TOTAL ENERGY COST \$376,545

TOTAL ELECTRIC COST (Peak+Off-Peak+Demand+GRS) \$301,310

BLENDED COST DURING PEAK HOURS \$0.1663 Per/KWH

Without GRS
\$301,310

**4C FOODS
COGENERATION ANALYSIS WITH ABSORBER**

3

150 KW COGEN UNITS:

450 KW TOTAL With ABS

\$173,885

Peak and Shoulder

\$192,158

THERMAL LOAD OF COGENERATION SETS								COGENERATION SYSTEM OPERATION						
MONTH	HEAT LOAD including deductions (Therms)	ADDED PROCESS LOAD (Therms)	MAXIMUM ABSORBER CHILLER LOAD (tons)	AVERAGE ABSORBER CHILLER CLG. LOAD (% factor)	AVG. NET OPERATING LOAD (tons)	THERMAL LOAD OF ABSORPTION CHILLER (Therms)	TOTAL USABLE LOAD (Therms)	LOAD BASED POTENTIAL RUN HOURS max/month = 1464	MAX COGEN RUNTIME max/month = 95% (percent)	MAXIMUM COGEN RUN HRS 3 UNIT(S)	PREDICTED COGEN RUN HRS 3 UNIT(S)	ON PEAK ELECTRICITY GENERATED (KWh)	ELECTRICITY GENERATED (% of utility Kwh, minus displaced chiller KWh)	COGEN HEAT OUTPUT (Therms)
1	2	3	3	4	5	6	7	8	9	10	11	12	13	14
Jun-01	537	0	50	60%	30	2,606	3,143	637	65.0%	1,391	952	95,160	83%	4,695
May-01	702	0	50	60%	30	2,606	3,308	671	52.0%	1,391	761	76,128	80%	3,756
Apr-01	2,187	0	50	40%	20	1,737	3,925	796	55.0%	1,391	805	80,520	86%	3,972
Mar-01	3,116	0	50	10%	5	434	3,550	720	52.0%	1,391	761	76,128	87%	3,756
Feb-01	5,128	0	50	10%	5	434	5,562	1,128	50.0%	1,391	732	73,200	88%	3,611
Jan-01	6,684	0	50	10%	5	434	7,118	1,443	52.0%	1,391	761	76,128	85%	3,756
Dec-00	17,784	0	50	10%	5	434	18,219	3,693	55.0%	1,391	805	80,520	89%	3,972
Nov-00	8,818	0	50	10%	5	434	9,252	1,875	58.0%	1,391	849	84,912	88%	4,189
Oct-00	7,284	0	50	40%	20	1,737	9,021	1,829	52.0%	1,391	761	76,128	83%	3,756
Sep-00	2,237	0	50	60%	30	2,606	4,843	982	55.0%	1,391	805	80,520	82%	3,972
Aug-00	1,061	0	50	60%	30	2,606	3,667	743	53.0%	1,391	776	77,592	80%	3,828
Jul-00	888	0	50	60%	30	2,606	3,494	708	60.0%	1,391	878	87,840	80%	4,333
TOTAL	56,426				215	18,676	75,102	15,223	55%	16,690	9,648	964,776	84%	47,596

Percent boiler plant at utility peak =

85%

17,568 max

Peak and Shoulder

GROSS SAVINGS FROM COGENERATION UNIT OPERATION										COGEN FUEL USE		NET COGENERATION SAVINGS		
ELECTRICITY							THERMAL LOAD		TOTAL GROSS SAVINGS	COGEN FUEL INPUT (THERMS)	COGEN FUEL INPUT (COST)	GROSS ENERGY SAVINGS	COGEN MAINTENANCE CONTRACT	NET SAVINGS WITH MAINT. CONTRACT
MONTH	AVERAGE DEMAND SAVINGS 80%		ELECTRIC DEMAND COST SAVINGS	GENERATED ELECTRICITY COST SAVINGS	CHILLER ELECTRIC SAVINGS (KWh)	CHILLER ELEC COST SAVINGS	BOILER POTENTIAL SAVINGS (Therms)	COGEN HTG LOAD COST SAVINGS Actual						
1	15		16	17	18	19	20	21	22	23	24	25	26	27
Jun-01	460		\$9,522	\$10,277	19,032	\$2,055	644	\$548	\$22,402	9,643	\$5,304	\$17,099	\$1,903	\$15,195
May-01	460		\$9,522	\$8,222	19,032	\$2,055	842	\$716	\$20,515	7,714	\$4,243	\$16,272	\$1,523	\$14,750
Apr-01	360		\$7,452	\$8,696	12,688	\$1,370	2,625	\$2,231	\$19,749	8,159	\$4,488	\$15,262	\$1,610	\$13,651
Mar-01	360		\$7,452	\$8,222	3,172	\$343	3,739	\$3,178	\$19,195	7,714	\$4,243	\$14,952	\$1,523	\$13,429
Feb-01	360		\$7,452	\$7,906	3,172	\$343	3,812	\$3,240	\$18,941	7,418	\$4,080	\$14,861	\$1,464	\$13,397
Jan-01	360		\$7,452	\$8,222	3,172	\$343	3,986	\$3,388	\$19,404	7,714	\$4,243	\$15,161	\$1,523	\$13,639
Dec-00	360		\$7,452	\$8,696	3,172	\$343	4,246	\$3,609	\$20,099	8,159	\$4,488	\$15,612	\$1,610	\$14,001
Nov-00	360		\$7,452	\$9,170	3,172	\$343	4,506	\$3,830	\$20,795	8,604	\$4,732	\$16,062	\$1,698	\$14,364
Oct-00	460		\$9,522	\$8,222	12,688	\$1,370	2,422	\$2,059	\$21,173	7,714	\$4,243	\$16,930	\$1,523	\$15,407
Sep-00	460		\$9,522	\$8,696	19,032	\$2,055	1,640	\$1,394	\$21,667	8,159	\$4,488	\$17,180	\$1,610	\$15,569
Aug-00	460		\$9,522	\$8,380	19,032	\$2,055	1,274	\$1,083	\$21,040	7,863	\$4,324	\$16,716	\$1,552	\$15,164
Jul-00	460		\$9,522	\$9,487	19,032	\$2,055	1,066	\$906	\$21,970	8,901	\$4,896	\$17,074	\$1,757	\$15,318
TOTAL	4,920		\$101,844	\$104,196	136,396	\$14,731	30,801	\$26,180	\$246,951	97,764	\$53,770	\$193,181	\$19,296	\$173,885

Demand notes :
Demand saved by absorber =

100

Actual % = **90.0%** of potential thermal savings.

Avoided boiler therms gas based, nat gas cost of
Cogen fuel cost based on natural gas fuel cost of
Cogen maintenance contract set at

\$0.850 Per Therm
\$0.550 Per Therm
\$2.00 Per full run hour

ON PEAK

4C FOODS
COGENERATION ANALYSIS WITH ABSORBER

3 150 KW COGEN UNITS: 450 KW TOTAL With ABS

\$18,273

Off Peak

THERMAL LOAD OF COGENERATION SETS								COGENERATION SYSTEM OPERATION						
MONTH	HEAT LOAD including deductions (Therms)		MAXIMUM ABSORBER CHILLER LOAD (tons)	AVERAGE ABSORBER CHILLER CLG. LOAD (% factor)	AVG. NET OPERATING LOAD (tons)	THERMAL LOAD OF ABSORPTION CHILLER (Therms)	TOTAL USABLE LOAD (Therms)	LOAD BASED POTENTIAL RUN HOURS max/month = 689.7	MAX COGEN RUNTIME max/month = 95% (percent)	PRACTICAL COGEN RUN HRS 0	PREDICTED COGEN RUN HRS 3	ELECTRICITY GENERATED (KWh)	ELECTRICITY GENERATED (% off peak, minus displaced chiller KWh)	COGEN HEAT OUTPUT (Therms)
1	2		3	4	5	6	7	8	9	10	11	12	13	14
Jun-01	95		100	20%	20	862	956	194	30.0%	690	218	21,780	81%	1,074
May-01	124		100	15%	15	646	770	156	30.0%	690	218	21,780	91%	1,074
Apr-01	386		100	0%	0	0	386	78	30.0%	690	218	21,780	82%	1,074
Mar-01	550		100	0%	0	0	550	111	30.0%	690	218	21,780	96%	1,074
Feb-01	905		100	0%	0	0	905	183	24.0%	690	174	17,424	81%	860
Jan-01	1,179		100	0%	0	0	1,179	239	30.0%	690	218	21,780	94%	1,074
Dec-00	3,138		100	0%	0	0	3,138	636	30.0%	690	218	21,780	93%	1,074
Nov-00	1,556		100	0%	0	0	1,556	315	30.0%	690	218	21,780	88%	1,074
Oct-00	1,285		100	10%	10	431	1,716	348	30.0%	690	218	21,780	95%	1,074
Sep-00	395		100	10%	10	431	826	167	30.0%	690	218	21,780	83%	1,074
Aug-00	187		100	20%	20	862	1,049	213	30.0%	690	218	21,780	96%	1,074
Jul-00	157		100	20%	20	862	1,018	206	30.0%	690	218	21,780	84%	1,074
TOTAL	9,958				95	4,092	14,050	2,848	30%	8,276	2,570	257,004	89%	12,679

8,276 max

Off Peak

GROSS SAVINGS FROM COGENERATION UNIT OPERATION										COGEN FUEL USE		NET COGENERATION SAVINGS		
ELECTRICITY							THERMAL LOAD		TOTAL GROSS SAVINGS	COGEN FUEL INPUT (THERMS)	COGEN FUEL INPUT COST	GROSS ENERGY SAVINGS	COGEN MAINTENANCE CONTRACT	NET SAVINGS WITH MAINT. CONTRACT
MONTH	AVERAGE DEMAND SAVINGS (KW)		ELECTRIC DEMAND COST	GENERATED ELECTRICITY COST	CHILLER ELECTRIC SAVINGS	CHILLER ELEC COST SAVINGS	BOILER POTENTIAL SAVINGS (THERMS)	COGEN HTG LOAD COST SAVINGS						
1	15		SAVINGS	SAVINGS	(KWh)		(Therms)	Actual		(THERMS)	(COST)			
Jun-01	0		\$0	\$2,352	6,292	\$680	114	\$97	\$3,128	2,207	\$1,214	\$1,915	\$436	\$1,479
May-01	0		\$0	\$2,352	4,719	\$510	149	\$126	\$2,988	2,207	\$1,214	\$1,774	\$436	\$1,339
Apr-01	0		\$0	\$2,352	0	\$0	463	\$394	\$2,746	2,207	\$1,214	\$1,532	\$436	\$1,096
Mar-01	0		\$0	\$2,352	0	\$0	660	\$561	\$2,913	2,207	\$1,214	\$1,699	\$436	\$1,264
Feb-01	0		\$0	\$1,882	0	\$0	1,032	\$877	\$2,759	1,766	\$971	\$1,787	\$348	\$1,439
Jan-01	0		\$0	\$2,352	0	\$0	1,289	\$1,096	\$3,448	2,207	\$1,214	\$2,234	\$436	\$1,799
Dec-00	0		\$0	\$2,352	0	\$0	1,289	\$1,096	\$3,448	2,207	\$1,214	\$2,234	\$436	\$1,799
Nov-00	0		\$0	\$2,352	0	\$0	1,289	\$1,096	\$3,448	2,207	\$1,214	\$2,234	\$436	\$1,799
Oct-00	0		\$0	\$2,352	3,146	\$340	772	\$657	\$3,349	2,207	\$1,214	\$2,135	\$436	\$1,699
Sep-00	0		\$0	\$2,352	3,146	\$340	474	\$403	\$3,095	2,207	\$1,214	\$1,881	\$436	\$1,445
Aug-00	0		\$0	\$2,352	6,292	\$680	225	\$191	\$3,223	2,207	\$1,214	\$2,009	\$436	\$1,573
Jul-00	0		\$0	\$2,352	6,292	\$680	188	\$160	\$3,192	2,207	\$1,214	\$1,978	\$436	\$1,542
TOTAL	0		\$0	\$27,756	29,887	\$3,228	7,944	\$6,752	\$37,737	26,043	\$14,324	\$23,413	\$5,140	\$18,273

↓
90.0% of potential thermal savings.

↑
OFF PEAK

GRAND													
TOTALS	4,920	\$101,844	\$131,952	166,283	\$17,959	38,745	\$32,933	\$284,688	123,807	\$68,094	\$216,594	\$24,436	\$192,158
Total Kwh generated peak and off peak =					1,221,780 Kwh								
Total plant run hours at				100 KW/unit	average =		12,218 Hours total all units added together.						

4-C Foods Gas Use Summary					3/29/2007	
MONTH	Existing THERMAL LOAD USE (Therms) ¹	BOILER POTENTIAL SAVINGS (THERMS) (Therms)	Remaining Boiler Therms	COGEN FUEL INPUT (THERMS) (THERMS)		New Total Facility Therms
Jun-01	842	758	84	11,850		11,934
May-01	1,101	991	110	9,921		10,031
Apr-01	3,431	3,088	343	10,366		10,710
Mar-01	4,888	4,399	489	9,921		10,410
Feb-01	8,044	4,844	3,200	9,183		12,383
Jan-01	10,484	5,275	5,209	9,921		15,130
Dec-00	27,897	5,535	22,362	10,366		32,728
Nov-00	13,832	5,795	8,037	10,811		18,848
Oct-00	11,426	3,195	8,231	9,921		18,153
Sep-00	3,509	2,113	1,396	10,366		11,762
Aug-00	1,665	1,499	167	10,070		10,236
Jul-00	1,393	1,254	139	11,108		11,247
TOTALS	88,512	38,745	49,767	123,807		173,574

**4C FOODS
 COGENERATION ANALYSIS WITH ABSORBER**

3 150 KW COGEN UNITS: 450 KW TOTAL With ABS

MONTH	EXISTING PEAK KW DEMAND	EXISTING TOTAL KWH	FUTURE ELEC (KWH) 0%	ELECTRIC KWH GENERATED	CHILLER KWH SAVED	ELECTRIC KW DEMAND REDUCTION	TOTAL KWH SAVED
15-Jun-01	554	166,440	166,440	116,940	19,032	460	135,972
16-May-01	542	143,160	143,160	97,908	19,032	460	116,940
17-Apr-01	527	132,360	132,360	102,300	12,688	360	114,988
19-Mar-01	485	113,520	113,520	97,908	3,172	360	101,080
15-Feb-01	485	108,120	108,120	90,624	3,172	360	93,796
17-Jan-01	500	115,920	115,920	97,908	3,172	360	101,080
15-Dec-00	491	117,120	117,120	102,300	3,172	360	105,472
14-Nov-00	491	123,960	123,960	106,692	3,172	360	109,864
16-Oct-00	542	129,960	129,960	97,908	12,688	460	110,596
14-Sep-00	502	146,640	146,640	102,300	19,032	460	121,332
15-Aug-00	502	144,960	144,960	99,372	19,032	460	118,404
17-Jul-00	568	161,640	161,640	109,620	19,032	460	128,652
TOTAL	6,188	1,603,800	1,603,800	1,221,780	136,396	4,920	1,358,176

THE COST TO COGENERATE YOUR OWN ELECTRICITY IS = \$0.03408 / KWH
TAKING INTO ACCOUNT HEATING AND ABSORBER CHILLER SAVINGS.

COST PER KWH CALCULATION

(1) NET GAS INCREASE (NGI)

NGI = GROSS COGEN FUEL INPUT (\$'s) - CHILLER KW AND KWH SAVINGS (\$'s) - BOILER PLANT SAVINGS (\$'s)

NGI = \$68,094 - \$17,959 - \$32,933

NGI = \$17,202

(2) TOTAL ANNUAL COST (TAC)

TAC = NET FUEL INCREASE (\$'s) + MAINTENANCE COST (\$'s)

TAC = \$17,202 + \$24,436

TAC = \$41,638

(3) COST PER HOUR (CPH)

CPH = TOTAL ANNUAL COST (\$'s) / TOTAL RUN HOURS

CPH = \$41,638 / 12,218

CPH = \$3.41

(4) COST PER KWH (CPK)

CPK = COST PER HOUR (\$/HR) / COGENERATION KW

CPK = \$3.41 / 100

CPK = \$0.03408

4C FOODS

COGENERATION ANALYSIS WITH ABSORBER

450 KW TOTAL With ABS

**COGENERATION SYSTEM
CONSTRUCTION ESTIMATE**

ITEM	DESCRIPTION	QTY	UNITS	MATERIAL UNIT COST	LABOR UNIT COST	MATERIAL	LABOR	TOTAL
MECHANICAL ITEMS								
1	COGEN UNITS 150 Kw induction unit With Heat recovery and remote cooler. Utility parallel electric gear Full installation per quote (attached) Exterior package with pad, fence drycooler and unit piping.	3	EA	\$62,500	\$45,000	\$187,500	\$135,000	\$322,500
2	CoGen Installation ,Misc devices (Unit installation included in item 1.)	3	EA	\$1,500	\$750	\$4,500	\$2,250	\$6,750
3	Flue System	3	EA	\$2,100	\$1,500	\$6,300	\$4,500	\$10,800
4	CoGen loop Injection Pumps and Accessories	3	EA	\$1,300	\$750	\$3,900	\$2,250	\$6,150
5	CoGen Loop Primary Piping Supply and Return Header (To process coil, absorber and HVAC)	550	LF	\$20	\$15	\$11,000	\$8,250	\$19,250
6	Primary Cogen Loop Hydronic Accessories	1	EA	\$5,500	\$2,000	\$5,500	\$2,000	\$7,500
7	HVAC HW heating units and accessories.	6	EA	\$3,500	\$2,100	\$21,000	\$12,600	\$33,600
8	Process air dryer coil and accessories	1	EA	\$11,000	\$5,500	\$11,000	\$5,500	\$16,500
8	System EMS Controls Work	1	EA	\$45,000	\$25,000	\$45,000	\$25,000	\$70,000
9	Miscellaneous Mechanical	1	EA	\$9,000	\$2,500	\$9,000	\$2,500	\$11,500
10	Absorber chiller system: 130 ton central absorber	1	EA	\$95,000	\$5,000	\$95,000	\$5,000	\$100,000
11	Cooling tower and accessories	1	EA	\$18,000	\$5,000	\$18,000	\$5,000	\$23,000
12	CHW, CTW pumps etc	4	EA	\$1,100	\$750	\$4,400	\$3,000	\$7,400
13	Chiller system piping and hydronics (Includes CTW piping.)	900	LF	\$25	\$15	\$22,500	\$13,500	\$36,000
14	AHU CHW/hw coils and trim	10	EA	\$6,500	\$1,900	\$65,000	\$19,000	\$84,000
15	Related electrical work	1	EA	\$11,000	\$4,700	\$11,000	\$4,700	\$15,700
SUBTOTAL MECHANICAL						520,600	250,050	770,650

ITEM	DESCRIPTION	QTY	UNITS	MATERIAL UNIT COST	LABOR UNIT COST	MATERIAL	LABOR	TOTAL
ELECTRICAL ITEMS :								
1	Copgen panel and 480 volt circuit breakers	1	EA	\$9,000	\$5,000	\$9,000	\$5,000	\$14,000
2	Additional parallel control and devices (Some cost in AllSystems quote.)	1	EA	\$7,000	\$3,000	\$7,000	\$3,000	\$10,000
3	400A (480V) Feeders Co-Gen units to cogen MDP	120	LF	\$26	\$32	\$3,060	\$3,780	\$6,840
4	Cogen utility isolation switch	1	EA	\$3,500	\$1,500	\$3,500	\$1,500	\$5,000
5	400A (480V) Feeders MDP to MCC/Panel	50	LF	\$53	\$51	\$2,650	\$2,550	\$5,200
6	MCC for pumps etc	1	EA	\$10,000	\$5,000	\$10,000	\$5,000	\$15,000
7	Work to consolidate three existing electrical services into one. a.) Electrical gear and modifications b.) Electrical conduit and wiring	3 300	EA LF	\$8,500 \$53	\$4,500 \$51	\$25,500 \$15,900	\$13,500 \$15,300	\$39,000 \$31,200
8	Miscellaneous Electric	1	EA	\$9,000	\$5,500	\$9,000	\$5,500	\$14,500
9	Standby Generator Package 550 Kw Diesel and ATS	1	EA	\$75,000	\$15,000	\$75,000	\$15,000	\$90,000
SUB TOTAL ELECTRIC						\$160,610	\$70,130	\$230,740

PROJECT SUMMARY

MECHANICAL CONST.	\$770,650	(Includes cogen package.)
ELECTRICAL CONST.	\$230,740	
Utility Review fees	\$5,500	
Mechanical room	\$0	
CONTINGENCY	3.0%	\$30,042
Subtotal Construction.		\$1,036,932
PROFESSIONAL FEES	8.0%	\$82,955
TOTAL IMPLEMENTATION COST		\$1,119,887

4C Foods, Inc.
Brooklyn, NY
CHP Cogeneration Plant - Executive Summary

A.) Energy Summary:

	<u>Electric Kwh</u>	<u>Electric Demand</u>	<u>Electric Costs</u>
Existing Electric	1,064,960	5,435	\$255,823
Cogen Plant Electric Savings	1,482,707	3,648	\$283,867

Annual Cogen Plant Electric Savings	\$283,867
Annual Cogen Plant Net Fuel Use Cost Increase	\$61,563
Annual Cogen Plant Maintenance and virtual warranty	\$20,908
Net Cogen Plant annual savings	\$201,396

B.) Proposed Cogen Plant: Total of 380 Kw

The CHP (Cogen) plant estimated includes the following:

- 1.) Multiple lineup of natural gas engine driven units, from 75 kw to 250 kw in size each unit.
- 2.) System operates in parallel with the utility - induction type generators.
- 3.) Sound attenuation, low emissions controls, automatic microprocessor control.
- 4.) Full engine jacket and combustion exhaust heat recovery.
- 5.) Computer control system with remote access for the entire plant.
- 6.) Complete mechanical installation including piping, pumps etc.
- 7.) Electrical installation of power systems, utility required devices and connection to new building electrical service.
- 8.) Engineering design for mechanical and electrical, reviews with bidding package, and project support.

Total estimated costs to implement = \$876,300
System cost per kw = \$2,306

Financial Scenarios	Net Annual Savings	Net Cost	Simple Payback Years
1.) Savings with no assistance	\$201,396	\$876,300	4.35

4C Foods, Inc.

COGENERATION ANALYSIS WITH PEAK/ OFF PEAK ANALYSIS

ENERGY ANALYSIS AND COST SUMMARY

1 380 KW COGEN UNIT: 380 KW TOTAL

COGEN SYSTEM PRODUCTION EQUIPMENT:

TYPE OF COGEN UNITS	Natural Gas Fired	Fuel Utilization Efficiency:
COGEN AVERAGE KW PER UNIT	323 KW/hr	72%
NUMBER OF COGEN UNITS	1	
TOTAL ANNUAL RUN HOURS	24,046 hours	
MAX ANNUAL RUN HOURS (8760 HRS/UNIT)	8,760 hours	
% OF MAX RUN HOURS	275%	

COGEN SYSTEM SAVINGS:

ELECTRIC

COGEN ELECTRIC GENERATED	1,045,408 KWh	\$ 135,903	% OF EXIST. UTILITY 98%
OFFSET ELECTRIC CHILLER SAVINGS	437,299 KWh	\$ 68,692	41%
	1,482,707 KWh	\$ 204,595	139%
ELECTRIC DEMAND SAVINGS	3,648 KW	\$ 79,272	67%
EXISTING TOTAL DEMAND	5,435 KW		
% OF MAXIMUM DEMAND POSSIBLE	67%		
(Includes 0 Kw per month due to Absorber)			
TOTAL ELECTRIC SAVINGS (KW Demand and KWh)		\$ 283,867	111%

THERMAL

COGEN THERMAL SAVINGS	-2,806 Therms	\$ (3,932)	-10%
TOTAL COGEN GROSS SAVINGS		\$ 279,935	95%

COGEN SYSTEM OPERATING COST:

COGEN FUEL INPUT (EQUIVALENT IN THERMS.)	62,195 Therms	\$ 57,630
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SUMMARY:

NET COGEN ENERGY COST SAVINGS (W/O MAINTENANCE)	\$ 222,305
ANNUAL COGEN MAINTENANCE CONTRACT COST	\$20,908
NET COGEN SYSTEM SAVINGS WITH MAINTENANCE CONTRACT	\$201,396

4C Foods, Inc.

COGENERATION ANALYSIS WITH PEAK/ OFF PEAK ANALYSIS

1 380 KW COGEN UNIT: 380 KW TOTAL

CALCULATION PARAMETERS:

EXISTING THERMAL LOAD USE	
CONVERSION FACTOR	100,000
CONVERSION FACTOR	135,000
Boiler Plant Efficiency	80%
EXISTING AVERAGE COST PER GALLON OF FUEL	
PROPOSED AVERAGE COST PER GALLON OF FUEL	
BOILER EQUIVALENT COST PER THERM	\$1.4014
COGEN EQUIVALENT COST PER THERM	\$0.9266
DEDUCTION FOR EXISTING FUEL OIL FIRED EQUIPMENT:	0

EXISTING ELECTRIC USE

AVERAGE COST PER ON-PEAK KWH (WITHOUT DEMAND) + GRS	\$ 0.1500
AVERAGE COST PER OFF-PEAK KWH (WITHOUT DEMAND) + GRS	\$ 0.1000
AVERAGE BLENDED COST PER KWH (WITHOUT DEMAND), INCLUDES GRS	\$ 0.1300
COST PER DEMAND KW (WEIGHTED AVERAGE)	\$ 21.730
BLENDED COST DURING PEAK HOURS	\$0.3348 Per/KWH

COGENERATION EQUIPMENT

TYPE OF COGEN UNITS Natural Gas Fired

COGEN THERMAL OUTPUT PER UNIT:

THERMAL OUTPUT	AT 100%	AT RATING	% used		
HW	1,890,000	1,606,500	100%	1,606,500	Btu/hr
15 psig LPS		0		0	Btu/hr
80 psig HPS	0	0	0%	0	Btu/hr
TOTAL OUTPUT =	1,890,000	1,606,500	100%	1,606,500	Btu/hr efficiency = 48.7%

COGEN THERMAL INPUT AT AVERAGE RUNNING POWER

	3,298,000	Btu/hr
COGEN THERMAL INPUT AT 100 % RATING	3,880,000	<< total for three units
COGEN UNIT FULL RATED OUTPUT	380	KW/hr
COGEN KW PER UNIT AVERAGE RUNNING POWER	323	KW/hr efficiency : 33.4%
NUMBER OF COGEN UNITS	1	
MAX UP TIME PER COGEN UNIT	95%	(or input in column)
MAINTENANCE COST PER KWH PRODUCED	\$0.02	(full maintenance contract)

ABSORPTION EQUIPMENT

HOURLY LOAD PER TON	17,140	BTU/h/ton
AVG KW / TON OF DISPLACED CHILLERS	1.30	KW/ton
Total Chiller Plant	60	Tons

OTHER

AVERAGE TOTAL HOURS PER MONTH	2190.0	total for three units
PEAK AND SHOULDER HOURS PER MONTH	1314	
OFF PEAK HOURS PER MONTH	876	

EXISTING ENERGY USE:

MONTH	THERMAL USE (Therms)	PEAK DEMAND (KW)	ON-PEAK + SHLDR (KWh)	OFF-PEAK USE (KWh)	TOTAL USE (KWh)	TOTAL Electric Cost
Jan-06	6,917	344.4	50,808	33,872	84,680	\$20,463
Feb-06	4,973	451.6	54,816	36,544	91,360	\$21,904
Mar-06	6,104	416.8	52,104	34,736	86,840	\$20,762
Apr-06	2,090	384.0	46,344	30,896	77,240	\$17,595
May-06	555	491.2	49,128	32,752	81,880	\$19,731
Jun-06	272	475.2	58,704	39,136	97,840	\$23,442
Jul-06	185	483.6	59,064	39,376	98,440	\$25,851
Aug-06	214	554.0	55,824	37,216	93,040	\$24,177
Sep-06	187	420.8	57,456	38,304	95,760	\$22,560
Oct-06	246	491.2	54,768	36,512	91,280	\$22,653
Nov-06	1,581	534.4	47,928	31,952	79,880	\$19,149
Dec-06	3,496	387.6	52,032	34,688	86,720	\$17,537
TOTALS	26,820	5,435	638,976	425,984	1,064,960	
COST	\$37,587	\$118,100	\$ 95,846	\$ 42,598	\$ 138,445	\$255,823
UNIT COST	\$1.401	\$21.73	\$ 0.15000	\$ 0.10000	\$ 0.13000	
AVERAGE	453					
TOTAL ENERGY COST					\$294,131	
BLENDED COST DURING PEAK HOURS				\$0.335	Per/KWH	
Average KW per hour=		122 KW		Total blended electric =	\$0.2402	Per kwh

4C Foods, Inc.
COGENERATION ANALYSIS WITH PEAK/ OFF PEAK ANALYSIS
1 380 KW COGEN UNIT: 380 KW TOTAL
Peak and Shoulder

THERMAL LOAD OF COGENERATION SETS							COGENERATION SYSTEM OPERATION						
MONTH	HEAT LOAD including deductions (Therms)	MAXIMUM ABSORBER CHILLER LOAD (tons)	AVERAGE ABSORBER CHILLER CLG. LOAD (% factor)	AVG. NET OPERATING LOAD (tons)	THERMAL LOAD OF ABSORPTION CHILLER (Therms)	TOTAL USABLE LOAD (Therms)	LOAD BASED POTENTIAL RUN HOURS 60%	MAX COGEN RUNTIME max/month = 95% (percent)	MAXIMUM COGEN RUN HRS 1 UNIT(S)	PREDICTED COGEN RUN HRS 1 UNIT(S)	ON PEAK ELECTRICITY GENERATED (KWh)	ELECTRICITY GENERATED (% of utility Kwh, minus displaced chiller KWh)	COGEN HEAT OUTPUT (Therms)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jan-06	3,320	60	0%	0	0	3,320	511	25.0%	1,248	329	45,859	90%	2,234
Feb-06	2,387	60	0%	0	0	2,387	497	95.0%	1,248	1,248	44,885	82%	2,185
Mar-06	2,930	60	0%	0	0	2,930	551	95.0%	1,248	1,248	48,621	93%	2,087
Apr-06	1,003	60	15%	9	2,027	3,030	407	95.0%	1,248	1,248	35,918	116%	1,585
May-06	266	60	35%	21	4,730	4,996	584	95.0%	1,248	1,248	53,287	402%	2,249
Jun-06	131	60	55%	33	7,432	7,563	876	95.0%	1,248	1,248	80,335	3443%	5,381
Jul-06	89	60	60%	36	8,108	8,197	717	95.0%	1,248	1,248	67,937	-2794%	4,570
Aug-06	103	60	60%	36	8,108	8,211	591	95.0%	1,248	1,248	55,226	-974%	3,724
Sep-06	90	60	55%	33	7,432	7,522	674	95.0%	1,248	1,248	61,929	5706%	4,346
Oct-06	118	60	35%	21	4,730	4,848	686	95.0%	1,248	1,248	61,465	325%	3,593
Nov-06	759	60	15%	9	2,027	2,786	520	95.0%	1,248	1,248	45,614	140%	2,327
Dec-06	1,678	60	0%	0	0	1,678	306	95.0%	1,248	1,248	26,168	50%	1,627
TOTAL	12,874			198	44,593	57,467	6,922	89%	14,980	14,060	627,245	557%	35,906

Percent boiler plant at utility peak = **60%** (1,314) HRS PER MONTH PEAK AND SHOULDER

Peak and Shoulder

GROSS SAVINGS FROM COGENERATION UNIT OPERATION										COGEN FUEL USE		NET COGENERATION SAVINGS		
ELECTRICITY							THERMAL LOAD		TOTAL GROSS SAVINGS	COGEN FUEL INPUT (THERMS)	COGEN FUEL INPUT (COST)	GROSS ENERGY SAVINGS	COGEN MAINTENANCE CONTRACT	NET SAVINGS WITH MAINT. CONTRACT
MONTH	AVERAGE DEMAND SAVINGS 80%	ELECTRIC DEMAND COST SAVINGS	GENERATED ELECTRICITY COST SAVINGS	CHILLER ELECTRIC SAVINGS (KW)	CHILLER ELECTRIC SAVINGS (KWh)	CHILLER ELEC COST SAVINGS (Kwh+Kw)	BOILER POTENTIAL SAVINGS (Therms)	COGEN HTG LOAD COST SAVINGS Actual						
1	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Jan-06	304	\$6,606	\$6,879	0	0	\$0	2,513	\$3,522	\$17,007	2,678	\$2,481	\$14,525	\$917	\$13,608
Feb-06	304	\$6,606	\$6,733	0	0	\$0	2,458	\$3,445	\$16,784	2,605	\$2,414	\$14,370	\$898	\$13,472
Mar-06	304	\$6,606	\$7,293	0	0	\$0	2,348	\$3,290	\$17,189	2,960	\$2,743	\$14,447	\$972	\$13,474
Apr-06	304	\$6,606	\$5,388	12	15,374	\$2,560	-498	(\$697)	\$13,857	2,122	\$1,966	\$11,891	\$718	\$11,172
May-06	304	\$6,606	\$7,993	27	35,872	\$5,974	-2,791	(\$3,911)	\$16,662	3,033	\$2,810	\$13,851	\$1,066	\$12,786
Jun-06	304	\$6,606	\$12,050	43	56,371	\$9,388	-2,307	(\$3,233)	\$24,811	4,762	\$4,413	\$20,398	\$1,607	\$18,791
Jul-06	304	\$6,606	\$10,191	47	61,495	\$10,241	-3,980	(\$5,578)	\$21,460	4,215	\$3,906	\$17,555	\$1,359	\$16,196
Aug-06	304	\$6,606	\$8,284	47	61,495	\$10,241	-4,932	(\$6,912)	\$18,219	3,374	\$3,127	\$15,092	\$1,105	\$13,987
Sep-06	304	\$6,606	\$9,289	43	56,371	\$9,388	-3,472	(\$4,866)	\$20,417	3,745	\$3,470	\$16,947	\$1,239	\$15,709
Oct-06	304	\$6,606	\$9,220	27	35,872	\$5,974	-1,279	(\$1,792)	\$20,007	3,647	\$3,379	\$16,628	\$1,229	\$15,399
Nov-06	304	\$6,606	\$6,842	12	15,374	\$2,560	337	\$473	\$16,481	2,681	\$2,485	\$13,997	\$912	\$13,084
Dec-06	304	\$6,606	\$3,925	0	0	\$0	1,830	\$2,565	\$13,096	1,495	\$1,385	\$11,710	\$523	\$11,187
TOTAL	3,648	\$79,272	\$94,087	257	338,224	\$56,327	-9,773	(\$13,696)	\$215,989	37,317	\$34,578	\$181,411	\$12,545	\$168,866

Demand notes :

Actual % = **90.0%** of potential thermal savings.

Avoided boiler therms gas based, nat gas cost of
Cogen fuel cost based on natural gas fuel cost of
Cogen maintenance contract set at

\$1.401 Per Therm
\$0.927 Per Therm
\$0.02 Per Kwh produced

ON
PEAK

4C Foods, Inc.

COGENERATION ANALYSIS WITH PEAK/ OFF PEAK ANALYSIS

1

380 KW COGEN UNIT:

380 KW TOTAL

Off Peak

THERMAL LOAD OF COGENERATION SETS							COGENERATION SYSTEM OPERATION						
MONTH	HEAT LOAD including deductions (Therms)	MAXIMUM ABSORBER CHILLER LOAD (tons)	AVERAGE ABSORBER CHILLER CLG. LOAD (% factor)	AVG. NET OPERATING LOAD (tons)	THERMAL LOAD OF ABSORPTION CHILLER (Therms)	TOTAL USABLE LOAD (Therms)	LOAD BASED POTENTIAL RUN HOURS 40%	MAX COGEN RUNTIME max/month = 95% (percent)	PRACTICAL COGEN RUN HRS 0 832.2	PREDICTED COGEN RUN HRS 1 UNIT(S)	ELECTRICITY GENERATED (KWh)	ELECTRICITY GENERATED (% off peak, minus displaced chiller KWh)	COGEN HEAT OUTPUT (Therms)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jan-06	2,213	60	0%	0	0	2,213	341	95.0%	832	832	30,573	90%	1,489
Feb-06	1,591	60	0%	0	0	1,591	332	95.0%	832	832	29,923	82%	1,457
Mar-06	1,953	60	0%	0	0	1,953	368	95.0%	832	832	32,414	93%	1,391
Apr-06	669	60	0%	0	0	669	271	95.0%	832	832	23,945	78%	1,056
May-06	178	60	15%	9	1,351	1,529	390	95.0%	832	832	35,525	158%	1,499
Jun-06	87	60	25%	15	2,252	2,339	584	95.0%	832	832	53,557	243%	3,588
Jul-06	59	60	35%	21	3,153	3,212	478	95.0%	832	832	45,292	293%	3,047
Aug-06	68	60	35%	21	3,153	3,222	394	95.0%	832	832	36,817	277%	2,482
Sep-06	60	60	25%	15	2,252	2,312	450	95.0%	832	832	41,286	195%	2,897
Oct-06	79	60	10%	6	901	980	457	95.0%	832	832	40,976	138%	2,395
Nov-06	506	60	0%	0	0	506	347	95.0%	832	832	30,410	95%	1,551
Dec-06	1,119	60	0%	0	0	1,119	204	95.0%	832	832	17,446	50%	1,084
TOTAL	8,582			87	13,063	21,645	4,614	95%	9,986	9,986 (876)	418,163	149%	23,938

Off Peak

GROSS SAVINGS FROM COGENERATION UNIT OPERATION										COGEN FUEL USE		NET COGENERATION SAVINGS		
ELECTRICITY					THERMAL LOAD									
MONTH	AVERAGE DEMAND SAVINGS (KW)	ELECTRIC DEMAND COST SAVINGS	GENERATED ELECTRICITY COST SAVINGS	CHILLER ELECTRIC SAVINGS (Kw)	CHILLER ELECTRIC SAVINGS (KWh)	CHILLER ELEC COST SAVINGS (Kwh+Kw)	BOILER POTENTIAL SAVINGS (Therms)	COGEN HTG LOAD COST SAVINGS Actual	TOTAL GROSS SAVINGS	COGEN FUEL INPUT (THERMS)	COGEN FUEL INPUT (COST)	GROSS ENERGY SAVINGS	COGEN MAINTENANCE CONTRACT	NET SAVINGS WITH MAINT. CONTRACT
1	15	16	17	18	18	19	20	21	22	23	24	25	26	27
Jan-06	0	\$0	\$3,057	0	0	\$0	1,675	\$2,348	\$5,405	1,785	\$1,654	\$3,751	\$611	\$3,140
Feb-06	0	\$0	\$2,992	0	0	\$0	1,639	\$2,297	\$5,289	1,737	\$1,609	\$3,680	\$598	\$3,081
Mar-06	0	\$0	\$3,241	0	0	\$0	1,565	\$2,193	\$5,435	1,973	\$1,828	\$3,606	\$648	\$2,958
Apr-06	0	\$0	\$2,395	0	0	\$0	752	\$1,054	\$3,449	1,414	\$1,311	\$2,138	\$479	\$1,659
May-06	0	\$0	\$3,552	12	10,249	\$1,279	166	\$233	\$5,065	2,022	\$1,874	\$3,191	\$710	\$2,481
Jun-06	0	\$0	\$5,356	20	17,082	\$2,132	98	\$137	\$7,625	3,175	\$2,942	\$4,683	\$1,071	\$3,612
Jul-06	0	\$0	\$4,529	27	23,915	\$2,985	-120	(\$168)	\$7,346	2,810	\$2,604	\$4,743	\$906	\$3,837
Aug-06	0	\$0	\$3,682	27	23,915	\$2,985	-755	(\$1,057)	\$5,609	2,250	\$2,084	\$3,525	\$736	\$2,788
Sep-06	0	\$0	\$4,129	20	17,082	\$2,132	67	\$94	\$6,355	2,496	\$2,313	\$4,042	\$826	\$3,216
Oct-06	0	\$0	\$4,098	8	6,833	\$853	89	\$124	\$5,075	2,431	\$2,253	\$2,822	\$820	\$2,002
Nov-06	0	\$0	\$3,041	0	0	\$0	569	\$798	\$3,839	1,788	\$1,656	\$2,182	\$608	\$1,574
Dec-06	0	\$0	\$1,745	0	0	\$0	1,220	\$1,710	\$3,454	997	\$924	\$2,531	\$349	\$2,182
TOTAL	0	\$0	\$41,816	113	99,076	\$12,365	6,967	\$9,764	\$63,945	24,878	\$23,052	\$40,893	\$8,363	\$32,530

90.0% of potential thermal savings.

↑
OFF
PEAK

GRAND TOTALS	3,648	\$79,272	\$135,903	371	437,299	\$68,692	-2,806	-\$3,932	\$279,935	62,195	\$57,630	\$222,305	\$20,908	\$201,396
Total Kwh generated peak and off peak = 1,045,408 Kwh														
Total plant run hours at 323 KW average = 24,046 Hours all units totaled														

Summary of new total gas use: Facility boilers and systems and CHP plant:

Month	Existing THERMAL LOAD USE (Therms)	BOILER POTENTIAL SAVINGS (Therms)	Net Remaining Facility Gas Use	COGEN FUEL INPUT (THERMS)	New Total Facility Gas Use	Net Increase
Jan-06	6,917	4,188	2,729	4,463	7,192	
Feb-06	4,973	4,097	876	4,342	5,218	
Mar-06	6,104	3,913	2,191	4,933	7,124	
Apr-06	2,090	255	1,835	3,536	5,371	
May-06	555	-2,625	3,180	5,055	8,235	
Jun-06	272	-2,209	2,481	7,937	10,418	
Jul-06	185	-4,099	4,284	7,025	11,309	
Aug-06	214	-5,687	5,901	5,624	11,525	
Sep-06	187	-3,405	3,592	6,241	9,833	
Oct-06	246	-1,190	1,436	6,078	7,514	
Nov-06	1,581	906	675	4,469	5,144	
Dec-06	3,496	3,050	446	2,492	2,938	
Totals	26,820	-2,806	29,626	62,195	91,821	65,001
Cost	\$37,587		\$41,519	\$57,630	\$99,149	\$61,563
At Rate	\$1.401		\$1.401	\$0.927		

4C Foods, Inc.

COGENERATION ANALYSIS WITH PEAK/ OFF PEAK ANALYSIS
1 380 KW COGEN UNIT: 380 KW TOTAL

MONTH	Projected PEAK KW DEMAND	Projected TOTAL KWH	FUTURE ELEC (KWH) 0%	ELECTRIC KWH GENERATED	CHILLER KWH SAVED	ELECTRIC KW DEMAND REDUCTION	TOTAL KWH SAVED
30-Jan-06	344	84,680	84,680	76,432	0	304	76,432
28-Feb-06	452	91,360	91,360	74,808	0	304	74,808
28-Mar-06	417	86,840	86,840	81,035	0	304	81,035
27-Apr-06	384	77,240	77,240	59,863	15,374	304	75,237
26-May-06	491	81,880	81,880	88,812	46,121	304	134,933
28-Jun-06	475	97,840	97,840	133,892	73,453	304	207,345
28-Jul-06	484	98,440	98,440	113,229	85,410	304	198,639
29-Aug-06	554	93,040	93,040	92,043	85,410	304	177,453
28-Sep-06	421	95,760	95,760	103,215	73,453	304	176,668
27-Oct-06	491	91,280	91,280	102,441	42,705	304	145,146
29-Nov-06	534	79,880	79,880	76,024	15,374	304	91,398
29-Dec-06	388	86,720	86,720	43,614	0	304	43,614
TOTAL	5,435	1,064,960	1,064,960	1,045,408	437,299	3,648	1,482,707

THE COST TO COGENERATE YOUR OWN ELECTRICITY IS = \$0.00177 / KWH
TAKING INTO ACCOUNT HEATING SAVINGS.

COST PER KWH CALCULATION :

(1) NET GAS INCREASE (NGI)

NGI = GROSS COGEN FUEL INPUT (\$'s) - CHILLER KW AND KWH SAVINGS (\$'s) - BOILER PLANT SAVINGS (\$'s)

NGI = \$57,630 - \$68,692 - (\$3,932)

NGI = (\$7,129)

(2) TOTAL ANNUAL COST (TAC)

TAC = NET FUEL INCREASE (\$'s) + MAINTENANCE COST (\$'s)

TAC = (\$7,129) + \$20,908

TAC = \$13,779

(3) COST PER HOUR (CPH)

CPH = TOTAL ANNUAL COST (\$'s) / TOTAL RUN HOURS

CPH = \$13,779 / 24,046

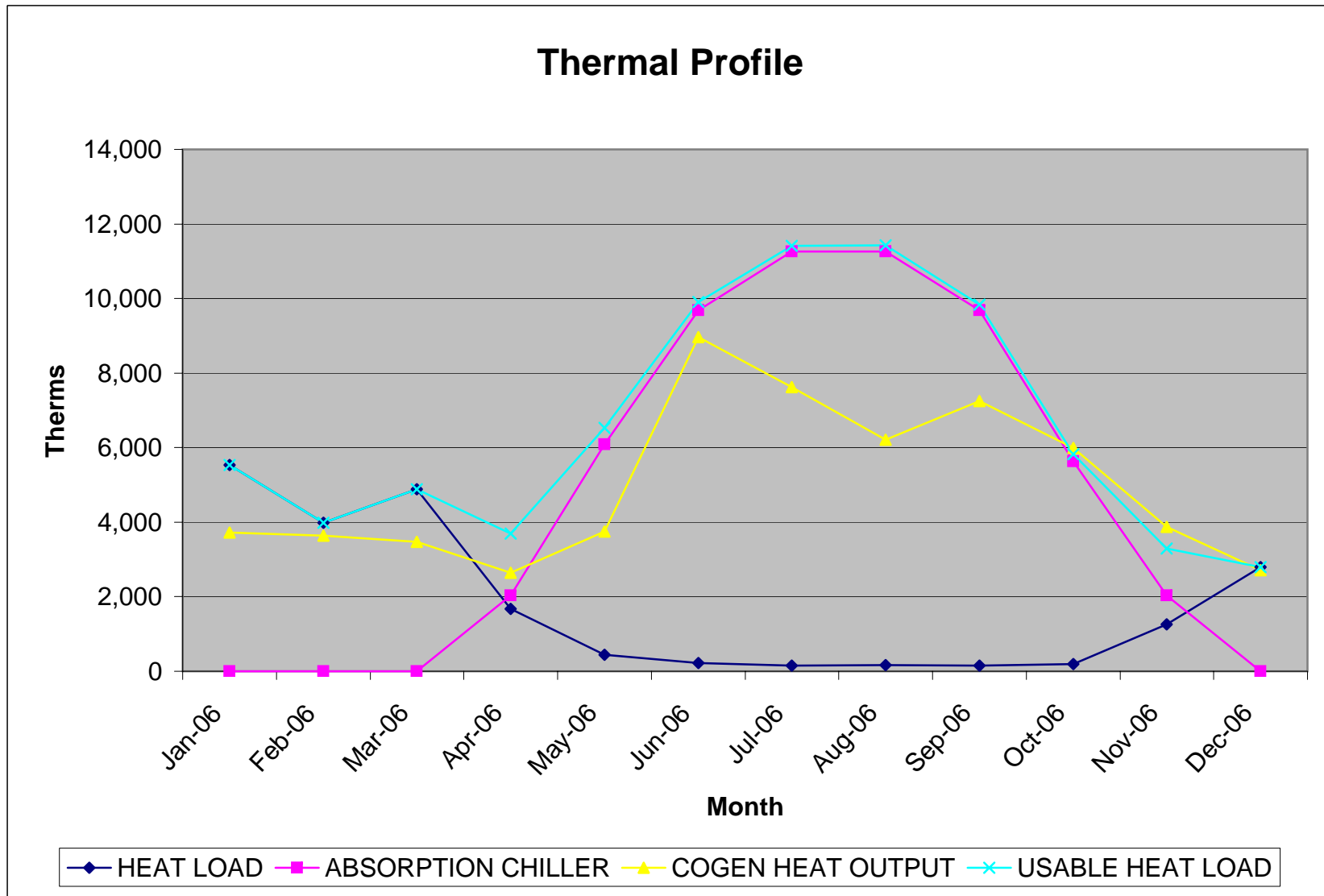
CPH = \$0.57

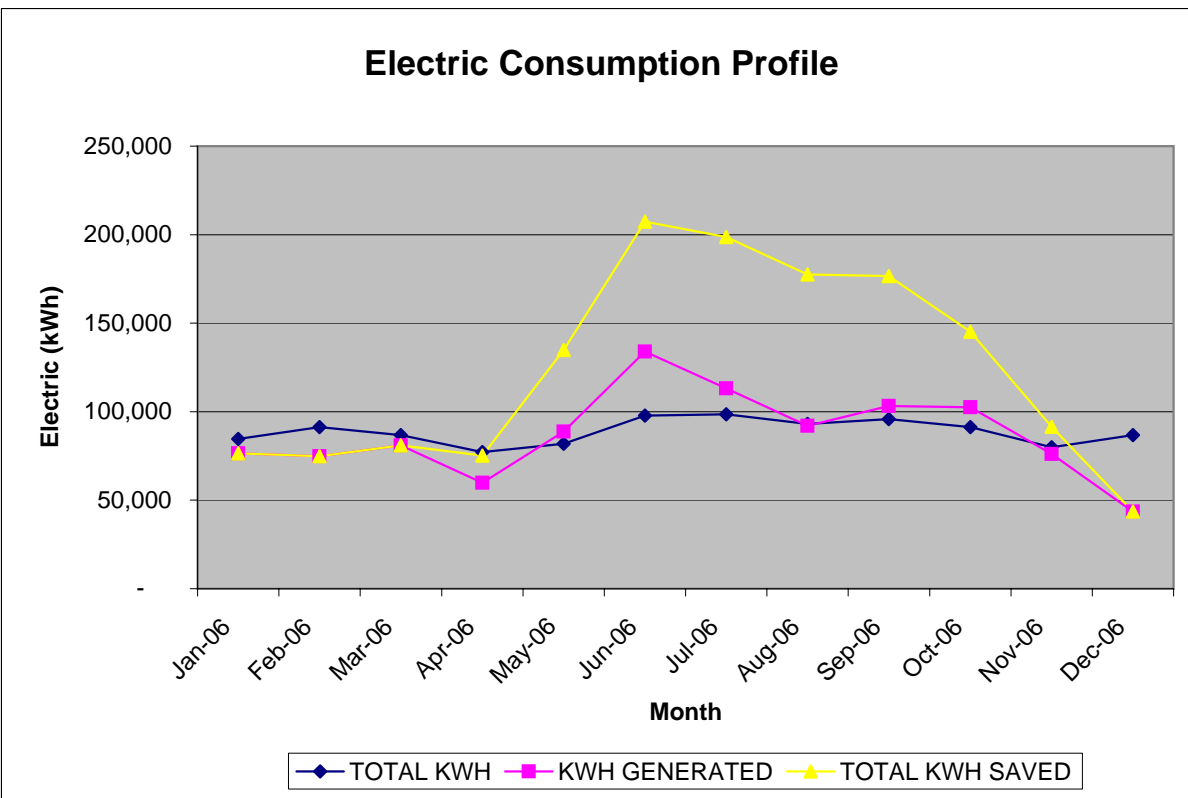
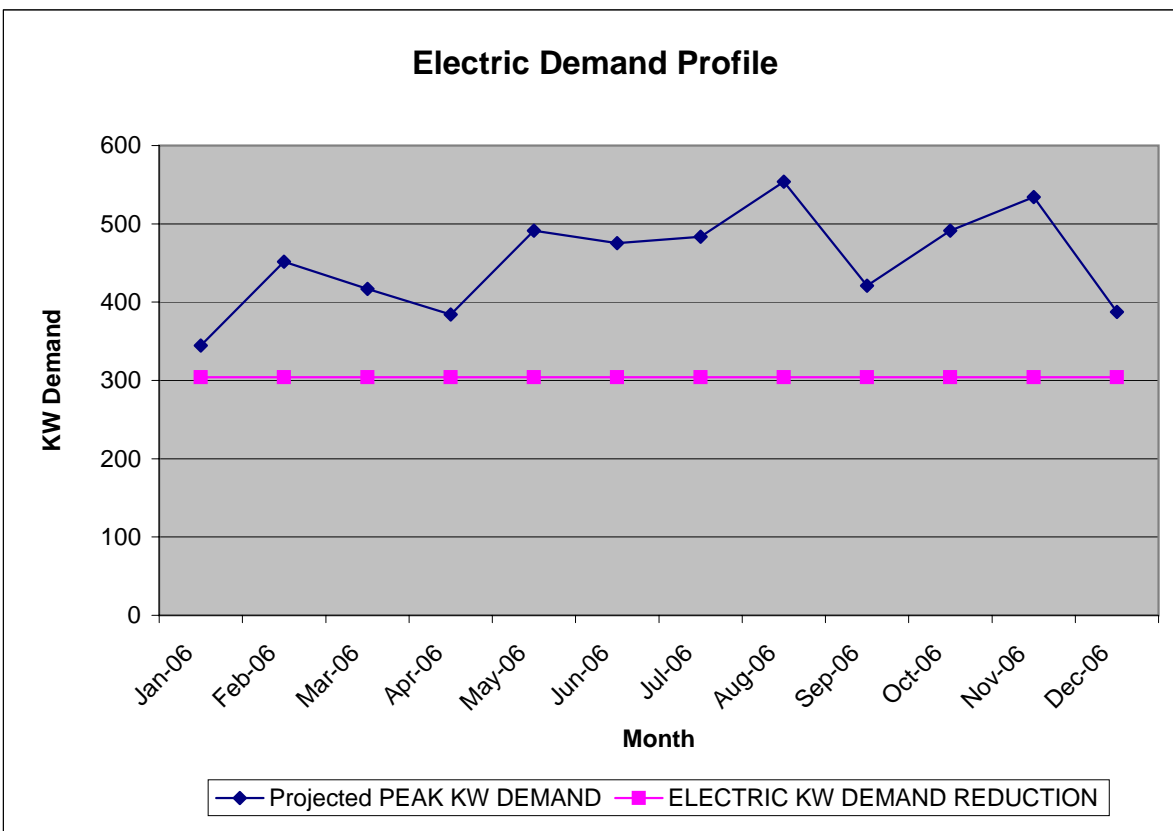
(4) COST PER KWH (CPK)

CPK = COST PER HOUR (\$/HR) / COGENERATION KW

CPK = \$0.57 / 323

CPK = \$0.00177





Monthly Summary:

PrintDate: 08/09/06

4C # 1 150kW (25)

ID = 177 kW = 150

Date	Time	Total kWH	Total Therms	Useful Therms	Engine Hours	Delta Time	Delta Eng Hrs	Off Hours
07/10/06	07:12	262057	13498	16945	2672	0	0	0
07/15/06	05:19	273868	14131	17882	2790	118	118	0
07/16/06	05:19	276174	14253	18072	2814	24	24	0
07/17/06	05:19	278507	14380	18270	2838	24	24	0
07/18/06	05:19	279440	14426	18337	2847	24	9	15
07/19/06	09:38	280331	14471	18405	2855	28	8	20
07/20/06	05:19	282400	14582	18558	2875	20	20	0
07/21/06	05:19	284850	14712	18739	2899	24	24	0
07/21/06	19:34	286252	14787	18840	2913	14	14	0
07/22/06	05:19	287163	14835	18910	2923	10	10	0
07/23/06	05:19	289456	14955	19076	2947	24	24	0
07/24/06	05:30	291822	15079	19257	2971	24	24	0
07/25/06	05:19	294203	15205	19421	2994	24	23	1
07/26/06	05:19	296547	15331	19590	3018	24	24	0
07/27/06	05:19	298307	15426	19716	3036	24	18	6
07/28/06	05:19	298308	15426	19737	3036	24	0	24
07/29/06	05:19	298309	15426	19749	3036	24	0	24
07/30/06	05:19	298310	15426	19765	3036	24	0	24
08/04/06	05:19	304309	15740	20245	3096	120	60	60
08/04/06	19:34	304309	15740	20245	3096	14	0	14
08/05/06	05:19	306685	15867	20419	3120	10	24	-14
08/06/06	05:19	308899	15984	20587	3143	24	23	1
08/07/06	05:19	311172	16108	20783	3167	24	24	0
08/08/06	05:19	313582	16236	20957	3191	24	24	0
Totals		51525	2738	4012		694	519	
Averages		99.3	5.3					

DataOption: All Records

Monthly Summary:
PrintDate: 09/29/06

4C # 1 150kW (25)
ID = 177 kW = 150

Date	Time	Total kWH	Total Therms	Useful Therms	Engine Hours	Delta Time	Delta Eng Hrs	Off Hours
08/08/06	05:19	313582	16236	20957	3191	0	0	0
08/14/06	05:19	327140	16958	21997	3329	144	138	6
08/15/06	05:19	329533	17090	22190	3353	24	24	0
08/16/06	05:19	331950	17221	22373	3377	24	24	0
08/17/06	05:19	334365	17352	22556	3401	24	24	0
08/18/06	05:19	336765	17482	22737	3425	24	24	0
08/18/06	10:44	337337	17513	22778	3430	5	5	0
08/19/06	05:19	339146	17612	22925	3449	19	19	0
08/20/06	07:16	341564	17748	23145	3475	26	26	0
08/21/06	05:19	343609	17862	23328	3497	22	22	0
08/23/06	05:19	348451	18127	23720	3545	48	48	0
08/24/06	05:19	350905	18259	23887	3569	24	24	0
08/25/06	05:19	353331	18391	24054	3593	24	24	0
08/26/06	05:19	355525	18509	24224	3615	24	22	2
08/27/06	05:19	357354	18604	24382	3635	24	20	4
08/28/06	05:19	359214	18702	24552	3655	24	20	4
08/30/06	05:43	363689	18939	24881	3700	48	45	3
08/31/06	05:19	365737	19045	25028	3719	24	19	5
Totals		52155	2809	4071		552	528	
Averages		98.8	5.3					

DataOption: All Records

Monthly Summary:

PrintDate: 08/09/06

4C # 2 150kW (26)

ID = 178 kW = 150

Date	Time	Total kWH	Total Therms	Useful Therms	Engine Hours	Delta Time	Delta Eng Hrs	Off Hours
07/10/06	07:14	146276	10220	5841	1495	0	0	0
07/15/06	05:22	152719	10691	6256	1559	118	64	54
07/16/06	05:22	153595	10755	6311	1568	24	9	15
07/17/06	05:22	154504	10823	6374	1577	24	9	15
07/18/06	05:22	156174	10937	6479	1591	24	14	10
07/19/06	09:40	159207	11148	6670	1618	28	27	1
07/21/06	05:22	161549	11320	6806	1641	44	23	21
07/21/06	19:35	161549	11320	6806	1641	14	0	14
07/22/06	05:22	162529	11393	6859	1651	10	10	0
07/23/06	05:22	163393	11456	6901	1661	24	10	14
07/24/06	05:34	164297	11521	6956	1670	24	9	15
07/25/06	05:23	165600	11616	7019	1683	24	13	11
07/26/06	05:22	166852	11710	7087	1696	24	13	11
07/27/06	05:23	168392	11821	7169	1712	24	16	8
07/28/06	05:22	170947	11990	7345	1731	24	19	5
07/29/06	05:23	173698	12181	7528	1755	24	24	0
07/30/06	05:22	176422	12367	7715	1779	24	24	0
08/04/06	05:22	185541	13005	8278	1861	120	82	38
08/05/06	05:22	186409	13069	8323	1870	24	9	15
08/06/06	05:22	187172	13127	8360	1879	24	9	15
08/07/06	05:22	187538	13151	8386	1883	24	4	20
08/07/06	06:45	187538	13151	8386	1883	1	0	1
08/08/06	05:22	188892	13250	8459	1896	23	13	10
Totals		42616	3030	2618		694	401	
Averages		106.3	7.6	6.5				

DataOption: All Records

Monthly Summary:
PrintDate: 09/29/06

4C # 2 150kW (26)
ID = 178 kW = 150

Date	Time	Total kWH	Total Therms	Useful Therms	Engine Hours	Delta Time	Delta Eng Hrs	Off Hours
08/08/06	05:22	188892	13250	8459	1896	0	0	0
08/14/06	05:22	195236	13713	8808	1961	144	65	79
08/15/06	05:22	196582	13814	8899	1974	24	13	11
08/16/06	05:22	197978	13915	8979	1988	24	14	10
08/17/06	05:22	199339	14015	9057	2001	24	13	11
08/19/06	05:22	201675	14185	9187	2024	48	23	25
08/20/06	05:22	202494	14248	9250	2033	24	9	15
08/20/06	07:18	202620	14257	9260	2035	2	2	0
08/21/06	05:22	203353	14314	9316	2043	22	8	14
08/23/06	05:22	206103	14518	9506	2070	48	27	21
08/24/06	05:22	207531	14620	9574	2083	24	13	11
08/25/06	05:22	208954	14723	9638	2097	24	14	10
08/26/06	05:22	209901	14793	9691	2107	24	10	14
08/27/06	05:22	210727	14854	9742	2116	24	9	15
08/28/06	05:22	211553	14916	9799	2125	24	9	15
08/30/06	05:44	214323	15117	9943	2152	48	27	21
08/31/06	05:22	215747	15218	10013	2165	24	13	11
Totals		26855	1968	1554		552	269	
Averages		99.8	7.3	5.8				

DataOption: All Records

Monthly Summary:

PrintDate: 08/09/06

4C # 3 80kW (27)

ID = 179 kW = 80

Date	Time	Total kWH	Total Therms	Useful Therms	Engine Hours	Delta Time	Delta Eng Hrs	Off Hours
07/10/06	07:15	107068	6591	3420	1554	0	0	0
07/15/06	05:25	110247	6797	3584	1598	118	44	74
07/16/06	05:25	110510	6815	3597	1602	24	4	20
07/18/06	05:25	111863	6904	3676	1622	48	20	28
07/19/06	09:18	112962	6978	3739	1638	28	16	12
07/21/06	05:25	114592	7086	3820	1661	44	23	21
07/21/06	19:37	115195	7128	3847	1671	14	10	4
07/22/06	05:25	115195	7128	3847	1671	10	0	10
07/23/06	05:25	115427	7143	3856	1675	24	4	20
07/25/06	05:25	116658	7222	3909	1693	48	18	30
07/26/06	05:25	117578	7281	3950	1705	24	12	12
07/27/06	05:25	118549	7344	3991	1719	24	14	10
07/28/06	05:25	119501	7407	4055	1731	24	12	12
07/29/06	05:25	120193	7453	4100	1741	24	10	14
07/30/06	05:25	120556	7477	4124	1747	24	6	18
08/03/06	12:24	123784	7690	4297	1793	103	46	57
08/04/06	05:25	124103	7712	4313	1798	17	5	12
08/05/06	05:25	124716	7753	4340	1807	24	9	15
08/06/06	05:25	124923	7767	4346	1811	24	4	20
08/07/06	05:25	125246	7788	4366	1816	24	5	19
08/07/06	06:50	125287	7791	4368	1817	1	1	0
08/08/06	05:26	126156	7848	4407	1829	23	12	11
Totals		19088	1257	987		694	275	
Averages		69.4	4.6	3.6				

DataOption: All Records

Monthly Summary:

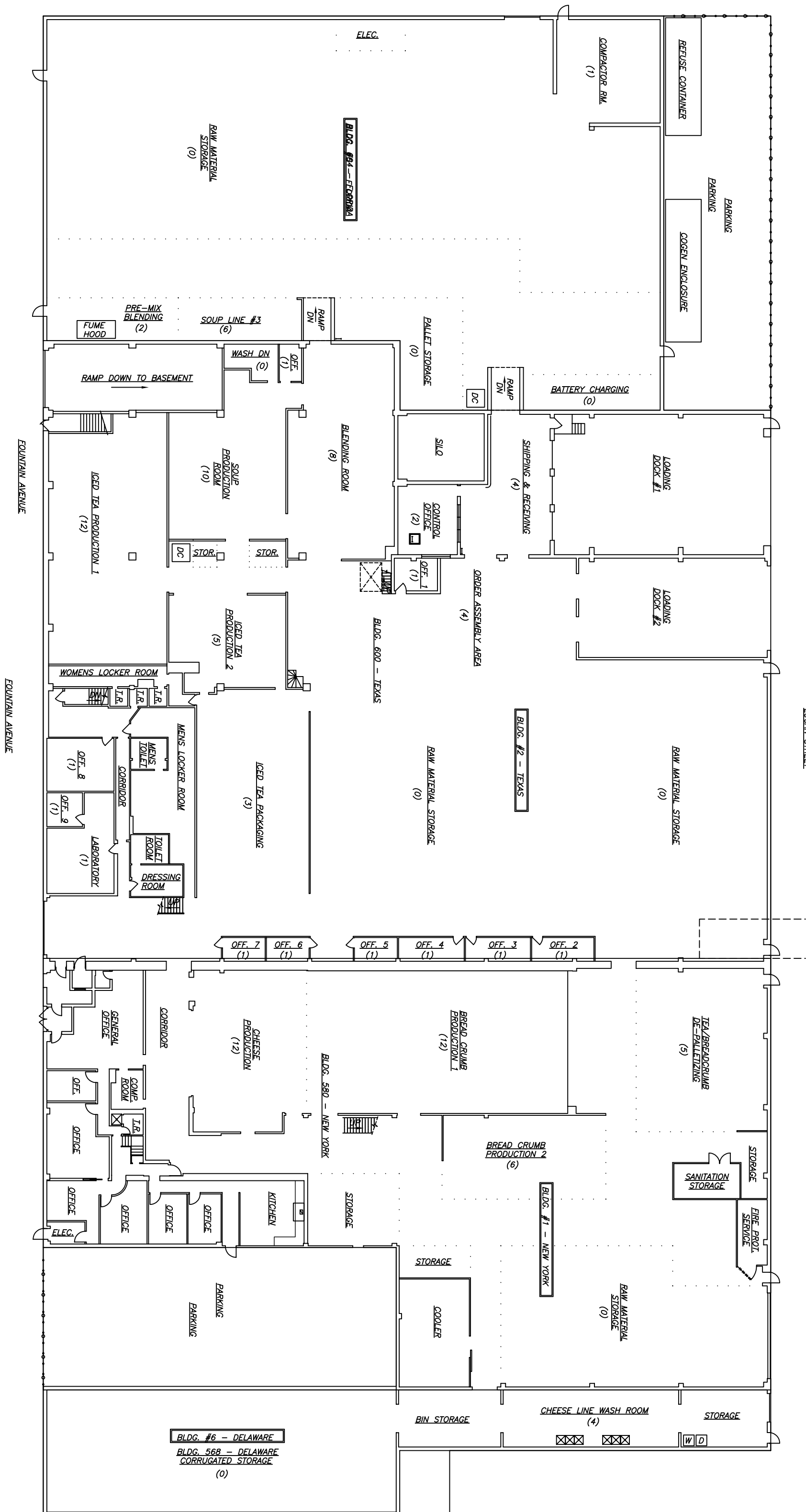
PrintDate: 09/29/06

4C # 3 80kW (27)

ID = 179 kW = 80

Date	Time	Total kWH	Total Therms	Useful Therms	Engine Hours	Delta Time	Delta Eng Hrs	Off Hours
08/08/06	05:26	126156	7848	4407	1829	0	0	0
08/14/06	05:25	129456	8062	4546	1876	144	47	97
08/15/06	05:25	129519	8066	4550	1877	24	1	23
08/16/06	05:25	130359	8122	4590	1890	24	13	11
08/17/06	05:25	131193	8177	4629	1902	24	12	12
08/18/06	05:25	132064	8234	4670	1914	24	12	12
08/18/06	10:48	132064	8234	4670	1914	5	0	5
08/19/06	05:25	132695	8275	4699	1923	19	9	10
08/20/06	05:25	133049	8298	4722	1929	24	6	18
08/20/06	07:20	133084	8300	4724	1930	2	1	1
08/21/06	05:25	133315	8315	4739	1933	22	3	19
08/23/06	05:25	134176	8370	4781	1945	48	12	36
08/24/06	05:25	135053	8426	4815	1957	24	12	12
08/25/06	05:25	135974	8486	4850	1970	24	13	11
08/26/06	05:25	136624	8529	4880	1980	24	10	14
08/27/06	05:25	136661	8531	4881	1981	24	1	23
08/28/06	05:25	136661	8531	4881	1981	24	0	24
08/30/06	05:45	138341	8641	4953	2005	48	24	24
08/31/06	05:26	139189	8695	4988	2017	24	12	12
Totals		13033	847	581		552	188	
Averages		69.3	4.5	3.1				

DataOption: All Records



4C Foods: Service Consolidation Map

Existing Meters

Meter #	69-6111-0548-0000-2
Address	580 Fountain Ave
Panel Amps	
Panel KW	0
Peak Demand	200

Meter #	69-6111-0549-0000-0
Address	600 Fountain Ave
Panel Amps	2500
Panel KW	762
Peak Demand	256

Meter #	69-6111-0550-0000-8
Address	604 Fountain Ave
Panel Amps	1000
Panel KW	305
Peak Demand	89

Meter #	65-5374-2375-0006-8
Address	836 Logan St.
Panel Amps	1600
Panel KW	487
Peak Demand	106

Consolidated Meters

Meter #	69-6111-0548-0000-2
Address	580 Fountain Ave
Panel Amps	0
Panel KW	0
Peak Demand	200

Meter #	69-6111-0549-0000-0
Address	600 Fountain Ave
Panel Amps	2500
Panel KW	761.566
Peak Demand	451



Specifications for Induction Cogeneration Systems

	Model 60-IC	Model 80-IC	Model 150-IC	Model 250-IC	Model 365-IC
Electrical Output:					
kW (a)	60	80	150	250	365
Power Factor	0.91	0.91	0.89	0.89	0.89
Thermal Output:					
Thermal Output (therms/hour)	3.0	4.5	7.4	12.1	16.7
Water Flow Rate (gallons per minute)	30	35	55	141	155
Water Outlet Max. Temp (Fahrenheit)	220	220	220	220	220
Efficiency:					
Heat Rate	9,833 (b)	9,750 (b)	10,133 (b)	9,597 (b)	9,589 (c)
Electrical Efficiency	34.7% (b)	33.3% (b)	35.0% (b)	35.5% (b)	35.6% (c)
Thermal Efficiency	50.1% (b)	52.4% (b)	48.6% (b)	50.4% (b)	47.7% (c)
Combined Total Efficiency	84.8% (b)	85.7% (b)	83.6% (b)	85.9% (b)	83.3% (c)
Emissions (corrected to 15% O ₂):					
VOC - Hydrocarbons (g / BHP - hr)	< . 15 (b)	< . 15 (b)	< . 15 (b)	< . 15 (b)	N/M (c)
NOx - Oxides of Nitrogen (g / BHP - hr)	< . 15 (b)	< . 15 (b)	< . 15 (b)	< . 15 (b)	< . 9 (c)
CO - Carbon Monoxide (g / BHP - hr)	< . 60 (b)	< . 60 (b)	< . 60 (b)	< . 60 (b)	< 4 (c)
VOC - Hydrocarbons (ppmvd)	< 32 (b)	< 32 (b)	< 32 (b)	< 32 (b)	N/M (c)
NOx - Oxides of Nitrogen (ppmvd)	< 11 (b)	< 11 (b)	< 11 (b)	< 11 (b)	< 55 (c)
CO - Carbon Monoxide (ppmvd)	< 72 (b)	< 72 (b)	< 72 (b)	< 72 (b)	< 1,000 (c)
Engine:					
Fuel Consumption (therms/hour)	5.9	7.8	15.2	24.0	35.0
Fuel Pressure (PSI)	2.0	2.0	2.0	2.0	2.0
Horsepower	94	126	238	366	580
Configuration / # of Cylinders	In-Line 4	In-Line 6	In-Line 6	V -12	V -12 (d)
Displacement (cubic inches)	280	419	781	1,338	1,338
RPMs	1,825	1,825	1,825	1,825	1,825
Miscellaneous:					
Dimensions (L x W x H inches)	72 x 44 x 60	96 x 48 x 62	96 x 48 x 62	120 x 60 x 72	120 x 60 x 72
Weight (lbs)	2,800	4,000	5,000	6,800	7,800
Noise (dba @ 2 meters) (e)	70	74	78	82	85

Notes:

(a) Single bearing; 480 Volts; 3 phase; 60 Hertz AC

(b) Based on using optional advanced catalytic converter technology. A catalytic converter is not necessary in all jurisdictions.

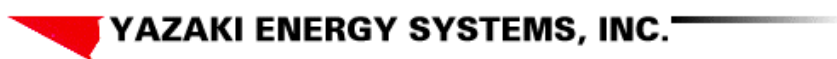
(c) Unit operates as a lean burn engine.

(d) Turbocharged; requires water aftercooler .

(e) Represents the standard enclosure and muffler package. Sound levels can be dramatically reduced with additional sound attenuation where necessary.

Data obtained on units operating at sea level on 1,020 BTU/SCF HHV natural gas during 70° F ambient day. All units are self contained and are controlled by an imbedded processor based electronic control system. Integral to the control system are safety functions designed to automatically shut down the machine in the event of over or under frequency, over or under voltage, over or under current, reverse current, low oil level or pressure, low water flow rate, or excessive temperatures anywhere in the system. All units may be remotely monitored and controlled via an integrated modem and communications interface.

Coast Intelligen reserves the right to change unit specifications without notice.


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Water Fired Single-Effect Chillers and Chiller-Heaters

Specifications

Model	WFC	SC10	SH10	SC20	SH20	SC30	SH30
Cooling	Capacity (Btu/hr x 1000)	120.0		240.0		360.0	
	Chilled Water Temp. (°F)	44.6 Outlet, 54.5 Inlet					
Heating	Capacity (Btu/hr x 1000)	--	166.3	--	332.6	--	498.9
	Hot Water Temp. (°F)	131.0 Outlet, 117.3 Inlet					
Chilled/Hot Water	Rated Water Flow (gpm)	24.2		48.4		72.6	
	Evap. Press Drop (psi)	8.1		9.6		10.1	
	Water Retention Volume (gal)	4.5		12.4		19.3	
Cooling Water	Heat Rejection (Btu/hr x 1000)	291.4		582.8		874.2	
	Inlet Temperature (°F)	87.8 (Standard)					
	*Rated Water Flow (gpm)	80.8		161.7		242.5	
	Cond./Abs. Press. Drop (psi)	12.3		6.6		6.7	
	Water Retention Volume (gal)	17.4		33.0		51.3	
Heat Medium	Input (Btu/hr x 1000)	171.4		342.8		514.2	
	Inlet Temperature (°F)	190.4 (Standard)					
		Temperature Range 158 (min.) - 203 (max.)					
	Rated Water Flow (gpm)	38.0		76.1		114.1	
	Generator Press. Drop (psi)	13.1		6.7		8.8	
Water Retention Volume (gal)	5.5		14.3		22.2		
Electrical	Power Supply	208V, 60Hz, 3 ph					
	Consumption (W)	210		260		310	
Capacity Control		On - Off					
Noise Level	Sound Pressure dB(A)	49		49		46	
Piping	Chilled/Hot Water (in)	1-1/2 NPT		2 NPT		2 NPT	
	Cooling Water (in)	2 NPT		2 NPT		2-1/2 NPT	
	Heat Medium (in)	1-1/2 NPT		2 NPT		2-1/2 NPT	
Weight	Dry (lb)	1,100		2,050		3,200	
	Operating (ob)	1,329		2,548		3,975	

* Minimum cooling water flow

NOTES:

- Specifications are based on water in all circuits and fouling factor of 0.0005 ft²hr°F/Btu.

2. Do not exceed 85.3 psi operating pressure in any water circuit.
3. If heat medium inlet temperature exceeds 203°F the chiller/chiller-heater will shutdown and require manual reset.
4. Optional cooling water crossover piping with 3 in. type "L" copper connections available for WFC-SC20/SH20 and WFC-SC30/SH30.
5. Sound pressure noise level measured in a free field at a point 79 in. behind the chiller/chiller-heater and 59 in. above the ground.

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[Yazaki Energy Systems, Inc.](#)

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