Willow Point Nursing Home
Detailed Energy Audit

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PART I

Executive Summary

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B. Background

The purpose of this Report is to provide recommendations to improve energy efficiency for the Willow Point Nursing Home in Broome County New York. The summary and Facility Improvement Measures recommended are as a result of a detailed energy audit and interviews with the staff.

C. Summary of Building Baseline Energy Usage

The table below represents twelve months of utility information that was furnished by the facility staff.

		Electric			Gas		Water		
Site Name	**Square Footage**	**kWhr**	**kW**	**Cost**	**Therms**	**Cost**	**1000 gal**	**Cost**	**kBtu/sf**
Willow Point Nursing Home	**155,849**	2,000,115	4,680	$190,011	145,388	$100,173	5,005	$41,091	137.1

Notes:

1. Energy and water data was supplied by Broome County for the year of 2014.
2. kBtu/sf is based on total building square footage served by each electric, gas, fuel oil and propane account as applicable.

D. Study Objective

The objective of this study was to identify and analyze specific Facility Improvement Measures (FIMs) for the locations listed above. These FIMs would then be implemented in a Performance Contract.

Part II

EXISTING CONDITIONS: WILLOW POINT NURSING HOME

GENERAL

Willow Point Nursing Home was constructed in 1971, and the West Wing addition built in 1987. The Nursing Home serves all of Broome County and has a high occupancy rate. There are two boiler rooms with two hot water boilers in each boiler room, the northwest boiler room also has a water cooled chiller for the north wing.

OCCUPANCY

The building is occupied 24 hours per day, 7 days per week for patient care needs. Staff level decreases after 5 pm when administration personnel leave. There are approximately 300 resident beds and the Nursing Home is about 90% occupied.

UTILITIES

Electricity to the Willow Point Nursing Home (WPNH) is supplied by Integrys and delivered by NYSEG, through two meters (1001-1462-867, 1001-1462-875). During 2014, the facility consumed a total of 2,000,115 kWh with a maximum demand of 510.7 kW, which occurred in July 2014. During 2013, the facility consumed a total of 1,967,105 kWh with a maximum demand of 516.3 kW, which occurred in July 2013. The average blended electric rate for the facility during these periods was $0.095 per kWh and $0.095 per kWh respectively.

Natural Gas to the Willow Point Nursing Home is supplied by Direct Energy and delivered by NYSEG, through one meter (Account No 1001-0015-716). During 2014 and 2013, the facility consumed a total of 145,388 therms and 134,260 therms respectively. The average natural gas rate for the facility during these periods was $0.687per therm and 0.617 per therm respectively.

Water and sewer for the Willow Point Nursing Home is supplied by the town of Vestal, through one meter. During 2014 the facility consumed a total of 7,165,000 gallons. The average water rate including sewer for the facility during this period was $8.21per gallon.

HEATING SYSTEM

Heating hot water (HHW) is supplied from two (2) boiler rooms by four (4) natural gas fired Peerless sectional hot water boilers (2 in each boiler room) with nameplate data showing approximately 3000 MBH maximum input capacity and 2400 MBH output capacity.

The heating hot water (HHW) and chilled water (CW) in the north wing boiler room is circulated by two (2) constant speed 15 HP pumps and is supplied to finned tube radiation (FTR), resident room and common area fan coil units (FCU), make up air units (MAU) and cabinet unit heaters (CUH) in the north wing and admin areas.

The HHW in the west wing boiler room is circulated by two (2) constant speed 2 HP pumps and is supplied to FTR, resident room and common area FCU's, MAU's and CUH's in the west wing. There is a supply to the old south wing boiler room where an additional two (2) 2 HP pumps circulate HHW from the west wing boilers, through a B&G plate and frame heat exchanger with 3,000 MBH capacity to heat the south wing heating loop. The south wing HHW loop is then circulated with two (2) constant speed 15 HP pumps.

HEATING/VENTILATION DISTRIBUTION SYSTEMS

Fresh air is supplied to the building through patient room FCU's that have a fixed outdoor air supply rate and three (3) make up air units (MAU), plus an MAU for the southwest boiler room. A small air handler supplies the kitchen. Fan coil units in the older part of the building operate on a 2 pipe system with heating / cooling changeover occurring in the fall and spring, this system can only operate in either heating or cooling mode at any given time. The West Wing as a four pipe system and is capable of simultaneous heating and cooling, these FCU control valves are two way and the southeast boiler room HHW pumps are on speed drives.

COOLING SYSTEM

Cooling is supplied by chilled water from two (2) Carrier 30HX chillers (model number 30HXC106RY-571 in the north boiler/mech room, and 30HXC161RY-560KA in the south boiler/mech room) with 106 and 161 tons of cooling capacity respectively, and a Trane air cooled model located outside of the West Wing (model # CGACC406KANFF423DGHW) with 40 tons of cooling capacity. The West Wing chilled water system is drained during the winter due to the outdoor location of the chiller.

Two condensing water towers serve the chillers, they are located on the roof above their respective mechanical rooms. They are both BAC model FXI130 condensers with 7.5 HP single speed fans.

The same pumps that circulate HHW in the north wing/admin areas and south wing also circulate CW due to the 2-pipe system (in the original building) and there are four (4) 15 HP pumps. The west wing chilled water is circulated with two (2) 3 HP B&G pumps.

TEMPERATURE CONTROL

The patient room FCU's are controlled by a mix of Trane and other thermostats located on the wall in each room. There are issues with temperatures due to the staff desires to keep temps around 70-72 and patient needs to keep temps around 74-80.

DOMESTIC HOT WATER

The building is served by four (4) AO Smith Burkay boilers and associated storage tanks. Domestic hot water is used for hand washing, cooking, cleaning, and patient showers.

LIGHTING

Lighting is a mix of technologies, there are LEDs in the Arena installed by the County, incandescent, HID, CFL's and fluorescents on the concourse, linear fluorescents in offices, bathrooms and stairwells and HID fixtures for outside lighting. Exit lighting has been cited by Codes as being inadequate.

Outside lighting for the marquis is LED installed in 2003.

Part III

FACILITY IMPROVEMENT MEASURES: WILLOW POINT NURSING HOME

LIGHTING IMPROVEMENTS

Existing Conditions

Lighting is a mix of technologies, there are LEDs in the Arena installed by the County, incandescent, HID, CFL's and fluorescents on the concourse, linear fluorescents in offices, bathrooms and stairwells and HID fixtures for outside lighting.

Recommendation

Lighting scope details will be shown in electrical drawings in the form of a table. This table will list existing fixtures and counts, wattages, retrofit counts and wattages.

Existing Fixture Summary	
F43LL	299
F42LL	668
I60/1	23
F23LL	4
F23SS	1
F82ES	48
F42EE	14
CFQ42/1	23
F44LL	195
F41LL	35
F41EE	4
CFQ85/1	2
I200/1	2
I65/1	20
F22LL	23
CFQ13/2	56
I50/1	2
CFT32/2-L	3
I60/3	3

Total	1425

New Fixture Summary	
LED037	302
ALED-12	1219
ALED-9.5	40
LED020	120
ALED-8.5	3
LED088	12
LED025	14
LED031	2
LED036	186
LED012.5	4
LED044	40
ALED-13	4
NO ACTION	71
LED013	16
A19LED9.5	3

Total	2036

PIPING AND FAN COIL UNIT REPLACEMENTS IN THE NORTH AND SOUTH WINGS

Existing Conditions

The 2 pipe system for heating and cooling in the north and south wings is original to the building (1971) and is reported to be in poor condition with frequent leaks occurring due to very thin pipe walls. The fan coil units (FCU's) used for heating and cooling in the north and south wings were installed in 1996 but were plagued with problems due to obsolete controls installed when new.

Recommendation

1) Siemens will replace all the HW/CW piping in the north and south wings.
2) The replacement will roughly parallel the existing piping to minimize disruption to the Nursing Home.
3) All FCU's (approximately 300) in the north and south wings will be replaced with new Carrier FCU's (model line F42VB)
4) Finned tube radiation (FTR) will also be replaced during this retrofit.
5) New Siemens controls will be included with all new equipment
   - Resident rooms shall have a software limit programmed in the EMS for thermostats to prevent setting of space temperature out of DOH required range
   - FCU's shall be connected to the EMS for monitoring

Sizes and counts of new FCU for resident rooms and common areas:

Count	Size	Model	Coil Rows	CFM	V/Ph/Hz	Amps	ECM HP
7	VO3/2A	42VBC08	2	300	115/1/60	0.70	1/7
66	VO3/4B	42VBC08	4	300	115/1/60	0.80	1/7
85	VO4/3A	42VBC08	3	300	115/1/60	1.00	1/7
24	VO6/3A	42VBC08	3	600	115/1/60	1.40	1/6
86	VO6/3B	42VBC08	3	600	115/1/60	1.40	1/6
14	VO8/4B	42VBC08	4	600	115/1/60	1.70	1/6
3	RVO8/4B	42VBC08	4	600	115/1/60	1.70	1/6
6	HO4/3	42VBC08	3	600	115/1/60	2.14	1/6
12	HO6/3	42VBC08	3	800	115/1/60	3.40	1/6

UPGRADE BOILERS FOR N, S + W WINGS

The existing Peerless boilers in both boiler rooms are in poor condition and are past the end of useful life.

Siemens will replace all 4 boilers. Each boiler room will be a hybrid boiler plant consisting of one PK Harsco Mach condensing boiler and one PK Harsco Modu-fire non condensing boiler (each with a capacity of 2500 MBH). Boiler work will include removal of existing boilers.

Building	Location	Boiler Man./Model Line	Boiler Model	Removal count	Install count	Existing Capacity (MBH each)	Proposed Capacity (MBH each)
Willow Point Nursing Home	North boiler/mech room	Peerless	G-719	2		3031	
Willow Point Nursing Home	North boiler/mech room	PK Harsco	C2500		1		2500
Willow Point Nursing Home	North boiler/mech room	PK Harsco	2500-FD		1		2500
Willow Point Nursing Home	West boiler/mech room	Peerless	G-720	2		3111	
Willow Point Nursing Home	West boiler/mech room	PK Harsco	C2500		1		2500
Willow Point Nursing Home	West boiler/mech room	PK Harsco	2500-FD		1		2500

Scope of Work Details:

1) Demolition and removal of four (4) existing boilers
2) Furnish and install two (2) new PK Mach-2500 boilers (or equivalent) and two (2) new PK Modufire 2500 boilers
3) Furnish and install pipe, valves, and fittings to run new gas vent lines
4) Boiler circulation pumps to remain, connect new piping to existing pumps
5) Boiler piping shall connect to existing piping in accordance with all manufacturers recommendations and code requirements
6) Disconnection and reconnection of existing gas and oil piping
7) Install combustion venting in accordance with manufacturers specs
8) Install CO monitor
9) Test and Commission system

Siemens will implement a hot water reset schedule to reset the heating hot water loops to 180°F at 0°F outdoor air temperature and 110°F at the heating on point of 55°F outdoor air temperature.
Provide DDC programming to reset the hot water supply temperature based on the need for heat and the return water temperate instead of the outdoor air temperature

INSTALL VFD'S ON HOT WATER PUMPS

Existing Conditions
The existing 15 HP circulating pumps in the north wing boiler/mechanical room are constant speed.

Recommendation
Siemens will install two (2) 15 HP variable frequency drives (VFD's) on the HHW/CW circulating pumps in the north wing boiler/mech room. these VFD's will work with the new 2-way valves on the new FCU's to enable lower pumping volumes and therefore lower pumping kW required.

INSTALL VFD'S ON CHILLED WATER PUMPS

Existing Conditions
The existing 15 HP circulating pumps in the south wing boiler/mech room are constant speed.

Recommendation
Siemens will install two (2) 15 HP variable frequency drives (VFD's) on the HHW/CW circulating pumps in the south wing boiler/mech room. these VFD's will work with the new 2-way valves on the new FCU's to enable lower pumping volumes and therefore lower pumping kW required.

BUILDING ENVELOPE

Existing Conditions

During the initial review of WPNH and analyzing the natural gas utility bills, opportunities to improve the facilities' ability to retain thermal energy were observed.

Recommendation

Existing Conditions:

All entry doors and overhead doors (on the garage level) showed significant leakage of air. Also, rooftop ventilators are in need of being air sealed. The rooftop ventilators are not sealed, rooftop ventilators will be pulled, cleaned, lubricated and air sealed. Soffit (overhangs) barriers above the entry doors are non-existent and are open to the exterior of the structure.

Summary of usage and air gap square footage:

Fuel Type	*Annual Use*	*Annual $*	*Usage Units*
Natural Gas	134260	$ 92,505.00	*therms*
Oil			*gallons*
Propane			*gallons*
Other			*therms*
Total Electrical Usage	1967105	$ 186,875.00	*kWh*
Adj Electric Usage	393421	$ 37,375.00	*kWh*
Totals		$ 129,880.00	

KRAKEN Calcs	INS Therms/SFT	Thermal Imp. Area	Gap SFT
Doors			1.92
Overhead Doors			0.21
Roof Top Fans			2.11
Roof-Wall Gaps			2.43

Gap SFT
6.67

RECOMMISSIONING OF AIR HANDLING EQUIPMENT

Existing Conditions
There is significant negative pressure in the admin area noted at the main entrance, when the doors to outside are opened a great deal of outside air is pulled into the building. Also, in the basement where the north wing and south wing meet there is a breeze in the hallway indicating an imbalance in airflows between the wings.

Recommendation
Siemens will air balance the building to reduce the amount of outside air pulled in at the entrance and reduce the air movement from the south to the north wing in the basement. This will be accomplished by measuring total exhaust and intake air and re-sheaving MAU's and exhaust fans as necessary to balance air flows.

INSTALL HIGH EFFICIENCY DISHWASHER

Existing Conditions
The existing dishwasher is a Hobart CPW-100A and has had significant repair work in the last several years. some parts have become difficult to obtain making maintenance and repairs more difficult.

Recommendation
Siemens will remove the existing dishwasher and install a new Meiko K-200 PW dishwasher with heat recovery. All electrical and water connections will be modified or moved to work with the new unit.

REPLACE 40 AIR COOLED CHILLER

Existing Conditions The existing Trane air cooled chiller has 40 tons of nominal capacity and supplies chilled water to the west wing 4-pipe system. The chiller was installed in 1987 when the west wing was built. The chilled water piping from the boiler room to the chiller is drained in the winter to prevent freezing and damage to the chiller and associated piping.

Recommendation
Siemens will remove the existing Trane chiller and install a new air cooled Carrier 30RA040 chiller with 40 tons of nominal capacity. The new chiller will have an efficiency of .78 kW/ton or COP of 4.5.

WATER CONSERVATION

Existing Conditions
Opportunities exist for water conservation at the Nursing Home, there are 250 toilets, 4 urinals, 278 sinks, 13 wall showers and 16 hand held showers.

Recommendation
Siemens will install the following water conservation components:

- New Valve X-Body: Remove and replace flushometer valve assembly
- Spud Replacement: Siemens will remove and replace the fixture spud
- Flushtube Replacement: Siemens will remove/replace the flushometer tube assembly

- Vandal-Resistant Flow Control:flow control device with appropriate flow rate and pattern. Include appropriate adapter (if necessary) to ensure uniformity across the affected buildings.
- Table of components and counts:

Measure Detail	Count
Vandal resistant sink flow controls	271
New flush valve X-body	255
Spud replacements	164
Flush tube replacements	164

Site Information		Quantities on Site										Scope of Work Option #3					
												Flushometers Recommissioning				Sinks	
Building or Meter	In Scope of Work	Lavatory Sinks	General Use Sinks	Multipurpose Lav Sinks	Tank Toilets	Pressure Assist Toilet	Flushometer Toilets	Urinals	Hoppers	Wall Showers	Handheld Showers	Valve Recommissioning	New Valve X-Body	Spud Replacement	Flushtube Replacement	Vandal-Resistant Flow Ctrl	Hands-Free Sink Faucet
Willow Point Nursing Home	x	39	27	212			250	4	1	13	16		255	164	164	271	

PLUG LOAD MANAGEMENT

Existing Conditions

The Nursing Home has a number of plug loads including copiers, printers, soda machines, etc.

Recommendation

Siemens will install twenty nine (29) plug load control devices at the Nursing Home to reduce unoccupied and parasitic electric loads. The BERT system will connect to the buildings wireless network and be controlled by a user accessible scheduler.

The installer will note the location and plug identifier (if available) for as-built documentation to be provided to the County.

Equipment	Number of Berts	Total Number of Devices	Typical Use, Hours/Week	Off Time Hours (Weekdays)	Off Time Hours (Weekends)	Watts	Months/Year
Large Copier	9	9	168	13	24	60	12
PC Lab Monitors (3 per Bert)	1	3	168	13	24	12	12
Medium Printer	4	4	168	13	24	20	12
Soda Machine	1	1	168	13	24	350	12
LCD\CRT TV	14	14	168	13	24	20	12
TOTAL	**29**	**31**					**12**

Part IV

OPTIONAL FACILITY IMPROVEMENT MEASURES FOR WILLOW POINT NURSING HOME:

Facility	Facility Improvement Measure
Willow Point Nursing Home	Upgrade Motors
Willow Point Nursing Home	Install Vending Machine Controls
Willow Point Nursing Home	Refrigeration Upgrades

Part V

PROFORMA CASHFLOW

The proforma showing the Broome County Willow Point Nursing Home Energy Performance Contract cashflow is on the following page.

Total Implementation Cost:	**($9,257,841)**	**Other Costs(Construction Interest):**	**($281,586)**
l Implementation Cost + Other Credits:	**($9,257,841)**	**Other Credits (Rebates/Incentives):**	**$86,874**
Interest Rate (5):	**3.00%**	**Net Financed Investment:**	**($9,539,427)**
Financial Term in Years:	**20**	**Construction Period Escrow Interest:**	**$8,872**
Medicaid Reimbursement Rate:	**85.0%**		
		Service Inflation Rate:	**3%**
Guarantee Period(yrs):	**20**	**Energy Inflation Rate:**	**3%**
Annual Payment:	**($634,865)**	**Operational Savings Inflation Rate:**	**3%**

20 *-Year Cash Flow Model*

	Energy Costs	***Assets***					***Liabilities***				
Yr	Base Year Energy Costs	Energy Savings	Associated Savings	Escrow Interest, Potential Rebates & Incentives (11)	Medicaid Reimbursement - (Measure Depriciation Based)	**Total Assets**	Payment (2)	On-Going Services (3,4)	**Total Liabilities**	Net Annual Benefit	**Cumulative Cash Flow**
0	Construction	$26,647	$0	$0	$0	**$26,647**	$0	$0	**$0**	$26,647	***$26,647***
1	$2,541,012	$88,822	$50,154	$60,996	$539,635	**$739,608**	($634,865)	($27,787)	**($662,652)**	$76,956	***$76,956***
2	$2,617,242	$91,487	$51,658	$34,749	$539,635	**$717,530**	($634,865)	($28,620)	**($663,486)**	$54,045	***$131,000***
3	$2,695,759	$94,232	$53,208	$0	$539,635	**$687,075**	($634,865)	($29,479)	**($664,344)**	$22,731	***$153,731***
4	$2,776,632	$97,059	$54,804	$0	$539,635	**$691,498**	($634,865)	$0	**($634,865)**	$56,633	***$210,365***
5	$2,859,931	$99,970	$56,448	$0	$539,635	**$696,054**	($634,865)	$0	**($634,865)**	$61,189	***$271,554***
6	$2,945,729	$102,969	$58,142	$0	$539,635	**$700,747**	($634,865)	$0	**($634,865)**	$65,882	***$337,435***
7	$3,034,101	$106,059	$59,886	$0	$539,635	**$705,580**	($634,865)	$0	**($634,865)**	$70,715	***$408,150***
8	$3,125,124	$109,240	$61,683	$0	$539,635	**$710,559**	($634,865)	$0	**($634,865)**	$75,693	***$483,844***
9	$3,218,878	$112,518	$63,533	$0	$539,635	**$715,686**	($634,865)	$0	**($634,865)**	$80,821	***$564,665***
10	$3,315,444	$115,893	$65,439	$0	$539,635	**$720,968**	($634,865)	$0	**($634,865)**	$86,103	***$650,767***
11	$3,414,907	$119,370	$67,402	$0	$539,635	**$726,408**	($634,865)	$0	**($634,865)**	$91,543	***$742,310***
12	$3,517,354	$122,951	$69,425	$0	$539,635	**$732,011**	($634,865)	$0	**($634,865)**	$97,146	***$839,456***
13	$3,622,875	$126,639	$71,507	$0	$539,635	**$737,782**	($634,865)	$0	**($634,865)**	$102,917	***$942,372***
14	$3,731,561	$130,439	$73,652	$0	$539,635	**$743,727**	($634,865)	$0	**($634,865)**	$108,861	***$1,051,234***
15	$3,843,508	$134,352	$75,862	$0	$539,635	**$749,849**	($634,865)	$0	**($634,865)**	$114,984	***$1,166,218***
16	$3,958,813	$138,382	$78,138	$0	$539,635	**$756,156**	($634,865)	$0	**($634,865)**	$121,291	***$1,287,508***
17	$4,077,578	$142,534	$80,482	$0	$539,635	**$762,651**	($634,865)	$0	**($634,865)**	$127,786	***$1,415,295***
18	$4,199,905	$146,810	$82,897	$0	$539,635	**$769,342**	($634,865)	$0	**($634,865)**	$134,477	***$1,549,771***
19	$4,325,902	$151,214	$85,383	$0	$539,635	**$776,233**	($634,865)	$0	**($634,865)**	$141,368	***$1,691,139***
20	$4,455,679	$155,751	$87,945	$0	$539,635	**$783,331**	($634,865)	$0	**($634,865)**	$148,466	***$1,839,605***
Total		***$2,386,691***	***$1,347,650***	***$95,746***	***$10,792,709***	***$14,622,795***	***($12,697,304)***	***($85,886)***	***($12,783,190)***	***$1,717,786***	

Notes:

1. *Associated Savings include operational cost savings.*
2. *Payment represents an annual sum of periodic payments.*
3. *Technical Support Program is escalated at Service Inflation Rate.*
4. *Performance Assurance required during guarantee period only.*
5. *Interest Rate Subject to Change.*
6. *Simple Payback=(Total Project Cost - NYSERDA) / (First Year Energy Savings plus Associated Savings plus Maintenance Savings plus First Year On-Going services).*

-7869164.938
($10,792,708.56)
$0.00
-10792708.56
-539635.4278

7. *Annual guarantee may not exceed Total Project Cost.*
8. *Construction interest based on 12-month funding to payment sch*
9. *Annual guarantee amount is based on revenue neutral program.*
10. *Cash Flow is for discussion purpose only.*
11. *Total NYSERDA grant incentives applied over years 1, 2.*