James/Kilmer
Condominium Association

Economic Feasibility Study

September 12, 2008

VERSION HISTORY

Version	Date	Author	Change Description
1.0	9-8-2009	Siemens SBT	Initial creation.
1.1	9-9-2008	Siemens SBT	Deleted ASRAE Code (U=.057) Window Economics. Removed last column of Table 3.1 Included net MMBtu savings. Clarified Make-Up Air and balancing timeline. Deleted Water Riser Cost in Association Budget. Updated Heat Pump Cost Estimate. Added estimated cost for lateral pipes.
1.2	9-12-2008	Siemens SBT	Removed ASRAE Code (U=.057) from Table 3.1 Added percentages to tables Incorporated updated capital budget

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Scope of Economic Feasibility Study

Siemens Building Technologies, Inc. (Siemens) is pleased to submit our economic findings for the James/Kilmer Condominium Association. We have carefully and thoughtfully prepared an economic impact on decentralized heating and cooling of the James and Kilmer House and window replacement of the James House.

Siemens has completed a thorough economic feasibility study of recommended energy cost savings measures for new windows in James House (43 stories, 520 units). Provided is a baseline analysis and four simulations of window replacement in James House, including an economic analysis of window replacement if minimum code requirement regarding energy efficient window product is met. Economic feasibility of recommended energy cost savings measures of new windows if additional energy efficient technologies such as tinting were included. The analysis will demonstrate energy consumption and cost to individual unit based on seasonal temperature, location and size of unit.

Siemens completed an economic analysis of energy cost savings for decentralized heating and cooling for James and Kilmer House (6 stories, 96 units), and an economic assessment of existing mechanical systems and analysis of alternatives for replacing the mechanical systems.

A simulation of decentralized heating and cooling (air to air heat pumps and air conditioners) in James House based on new window analysis is included in the feasibility study.

Summary Report – Energy cost analysis of window replacement and heat pump alternative

Sandburg Village James House and Kilmer House were simulated using the DOE-2 a state-of-the-art simulation tool to develop building performance baselines and to simulate window replacement, heat pump and cooling in the individual units for the James House and a heat pump and cooling system in the Kilmer House. The energy analysis computer program is used to determine predicted energy cost savings from replacement of windows in James House with new low-E windows and from replacement of fan-coil units with air source heat pumps. Energy savings from replacement of windows with code (ASHRAE 90.1) compliant windows, in lieu of high efficiency low-E windows, were also calculated. The results are summarized below and shown in table 3.1 “Sandburg Village Energy Cost Profile”.

Existing conditions

Existing conditions will result in annual energy cost, based on current rates, of $1,152,881 per year; this is divided into three categories, unit electric, $220,181 a year; common area electric, $300,277 a year; common area natural gas, $632,423 a year. Also shown are individual unit energy costs by unit number; the floor areas shown are used for reference only in order to assign an energy cost budget for each unit. Actual floor areas were used in the modeling to simulate heat loss and gain for determining heating and cooling consumption.

Table 1.1 - Existing Conditions

	Usage (Therms/kWh)	Cost ($)
Natural Gas	520,719	$ 632,423
Association Electricity	3,661,915	$ 300,277
Owner Electricity	2,685,134	$ 220,181
Total Building Electricity	6,347,048	$ 520,458
Association Energy Cost ($)	---	$ 932,700
Owner Energy Cost ($)	---	$ 220,181
Total Building Energy Cost ($)	---	$ 1,152,881

New Windows

New Windows represent replacement of windows with low-E fenestration having an assembly U-value of 0.42, and will result in reducing air infiltration from 1.2 air change per hour to 0.5 air change per hour. This will result in annual energy cost, based on current rates, of $869,696 per year. Unit electric, $192,001 per year; common area electric, $246,132 per year; common area natural gas, $431,563 per year. The total predicted energy cost saving is $283,185 a year, compared to existing conditions. This annual energy cost savings results from an annual energy savings of 19,534 MMBtu – incorporating natural gas and electricity savings.

It is recommended that the corridor make-up ventilation system be evaluated. The make-up air system will likely require upgrading in order to balance the make-up air flow rate with the kitchen and bathroom exhaust flow rates. Additional make-up air capacity should be installed prior to the Window installation to prevent premature deterioration of seals. Additionally, testing and balancing should occur following the Window installation to enable a fine tuning of the desired balance between exhaust air and make-up air.

Table 1.2 - New High Efficiency Windows

	Usage (Therms/kWh)	Cost ($)	Savings vs Existing ($)	Associated Percentage
Natural Gas	359,636	$ 431,563	$ 200,860	31%
Association Electricity	3,001,610	$ 246,132	$ 54,145	18%
Owner Electricity	2,341,476	$ 192,001	$ 28,180	13%
Total Building Electricity	5,343,088	$ 438,133	$ 82,325	16%
Association Energy Cost ($)	---	$ 677,695	$ 255,005	27%
Owner Energy Cost ($)	---	$ 192,001	$ 28,180	13%
Total Building Energy Cost ($)	---	$ 869,696	$ 283,185	25%

Heat Pump Scenario

Window replacement with low-E fenestration having an assembly U-value of 0.42, in conjunction with replacement of fan-coil units with air source heat pumps will result in annual energy cost, based on current rates, of $823,453 per year. Unit electric, $403,220 per year; common area electric, $166,093 per year; common area natural gas, $254,140 per year. The total predicted energy cost saving is $329,428 a year, compared to existing conditions. This annual energy cost savings results from an annual energy savings compared to existing conditions of 28,861 MMBtu – incorporating natural gas and electricity savings. The incremental annual energy cost saving resulting from replacement of fan-coil units with heat pumps is $46,243 per year (this incremental saving applies to the scenario of low-E fenestration). This incremental annual energy cost savings results from an incremental annual energy savings of 9,327 MMBtu – incorporating natural gas and electricity savings.

Table 1.4 - New Windows with Air-to-Air Heat Pumps

	Usage (Therms/kWh)	Cost ($)	Savings vs. Existing ($)	Associated Percentage	Savings vs. New High Efficiency Windows ($)	Associated Percentage
Natural Gas	211,783	$ 254,140	$ 378,283	59%	$ 177,423	41%
Association Electricity	2,025,524	$ 166,093	$ 134,184	45%	$ 80,039	33%
Owner Electricity	4,917,317	$ 403,220	$(183,039)	-83%	$ (211,219)	-110%
Total Building Electricity	6,942,843	$ 569,313	$ (48,855)	-9%	$ (131,180)	-30%
Association Energy Cost ($)	---	$ 420,233	$ 512,467	55%	$ 257,462	38%
Owner Energy Cost ($)	---	$ 403,220	$(183,039)	-83%	$ (211,219)	-110%
Total Building Energy Cost ($)	---	$ 823,453	$ 329,428	29%	$ 46,243	5%

Heat Pump Installation

The estimated cost of installation of air-to-air heat pumps including both James House and Kilmer House is $13,492,500 for the following scope of work.

Scope of Work

- Disconnect and remove existing condo fan coil units
- Furnish and install electric heat pump units of similar capacity to replace original fan coil units
- Provide power wiring for new equipment
- Furnish and install condensate drain piping to existing riser
- Insulate new pipe as required
- Start up and commission new equipment

Cost_____$13,492,500*

** Pricing is estimated and does not represent a formal quote.*

The two bedroom units currently do not have sufficient power to serve required heat pump units. This would require upgrades to the electrical infrastructure. We estimate this will add a minimum of $1,000,000.00 in additional costs.

Alternate: Perform all work as described above, with the exception that we will furnish and install two pipe fan coil units connected to existing hydronic heating and cooling system.

Cost_____ $9,855,000*

** Pricing is estimated and does not represent a formal quote.*

Premium time, toxic material abatement and removal and restoration of existing walls, covers, etc. as required for routing of electrical conduit and/or piping, or as required to adapt to configuration of new equipment is not included.

James/Kilmer Condominium Association Utility Analysis

Table 2.1 – Association Natural Gas

	Natural Gas (Therms)	Natural Gas ($)	Association Savings vs. Existing ($)	Association Savings vs. New High Efficiency Windows ($)
Existing Conditions	520,719	$ 632,423	-	-
New High Efficiency Windows	359,636	$ 431,563	$ 200,860 32%	-
New Windows with Air-to-Air Heat Pumps	211,783	$ 254,140	$ 378,283 60%	$ 177,423 41%

Table 2.2 – Association Electric

	Association Electricity (kWh)	Association Electricity ($)	Association Savings vs. Existing ($)	Association Savings vs. New High Efficiency Windows ($)
Existing Conditions	3,661,915	$ 300,277	-	-
New High Efficiency Windows	3,001,610	$ 246,132	$ 54,145 18%	-
New Windows with Air-to-Air Heat Pumps	2,025,524	$ 166,093	$ 134,184 45%	$ 80,039 33%

Table 2.3 – Owner Electric

	Owner Electricity (kWh)	Owner Electricity ($)	Owner Savings vs. Existing ($)	Owner Savings vs. New High Efficiency Windows ($)
Existing Conditions	2,685,134	$ 220,181	-	-
New High Efficiency Windows	2,341,476	$ 192,001	$ 28,180 13%	-
New Windows with Air-to-Air Heat Pumps	4,917,317	$ 403,220	$ (183,039) -83%	$ (211,219) -110%

Table 2.4 - Electricity (Owner and Association)

	Total Building Electricity (kWh)	Total Building Electricity ($)	Total Building Savings vs. Existing ($)	Total Building Savings vs. New High Efficiency Windows ($)
Existing Conditions	6,347,048	$ 520,458	-	-
New High Efficiency Windows	5,343,088	$ 438,133	$ 82,325 16%	-
New Windows with Air-to-Air Heat Pumps	6,942,843	$ 569,313	$ (48,855) -9%	$ (131,180) -30%

Table 2.5 - Association Costs (Natural Gas and Electric)

	Association Energy Savings ($)	Association Savings vs. Existing ($)	Association Savings vs. New High Efficiency Windows ($)
Existing Conditions	$ 932,700	-	-
New High Efficiency Windows	$ 677,695	$ 255,005 27%	-
New Windows with Air-to-Air Heat Pumps	$ 420,233	$ 512,467 55%	$ 257,462 38%

Table 2.6 - Owner Costs (Electric)

	Owner Energy Savings ($)	Owner Savings vs. Existing ($)	Owner Savings vs. New High Efficiency Windows ($)
Existing Conditions	$ 220,181	-	-
New High Efficiency Windows	$ 192,001	$ 28,180 13%	-
New Windows with Air-to-Air Heat Pumps	$ 403,220	$ (183,039) -83%	$ (211,219) -110%

Table 2.7 - Total Building Costs

	Total Building Energy Cost ($)	Total Building Savings vs. Existing ($)	Total Building Savings vs. New High Efficiency Windows ($)
Existing Conditions	$ 1,152,881	-	-
New High Efficiency Windows	$ 869,696	$ 283,185 25%	-
New Windows with Air-to-Air Heat Pumps	$ 823,453	$ 329,428 29%	$ 46,243 5%

Table 2.8 - Pay backs

	Cost ($)	Association Payback	Owner Payback	Building Payback
Pay back of New Efficiency Windows	$ 13,000,000	51.0	461.3	45.9
Pay back of Air-to-Air Heat Pumps	$ 13,492,500	52.4	**-63.9***	291.8**
Pay back of Windows and Heat Pumps	$ 26,492,500	51.7	**-144.7***	80.4**

* Represents cost increase

** Payback representative of savings for association and owners combined.

Individual Unit Utility Analysis

Table 3.1 – Sandburg Village Energy Cost Profile

Unit No.	Area SF	No. of Units	*Cost Existing Base	*Cost New Windows	*Cost Heat Pumps & Windows
J1	1200	40	$ 477	$ 416	$ 930
J2	1200	40	$ 477	$ 416	$ 905
J3	800	40	$ 318	$ 277	$ 544
J4	800	40	$ 318	$ 277	$ 529
J5	600	40	$ 238	$ 208	$ 392
J6	800	40	$ 318	$ 277	$ 529
J7	600	40	$ 238	$ 208	$ 392
J8	800	40	$ 318	$ 277	$ 529
J9	600	40	$ 238	$ 208	$ 392
J10	800	40	$ 318	$ 277	$ 529
J11	800	40	$ 318	$ 277	$ 544
J12	1200	40	$ 477	$ 416	$ 940
J13	1200	40	$ 477	$ 416	$ 966
K1	1400	6	$ 556	$ 485	$ 1,152
K2	1400	6	$ 556	$ 485	$ 1,136
K3	1200	6	$ 477	$ 416	$ 883
K4	1200	6	$ 477	$ 416	$ 873
K5	1200	6	$ 477	$ 416	$ 883
K6	1200	6	$ 477	$ 416	$ 873
K7	1200	6	$ 477	$ 416	$ 883
K8	1200	6	$ 477	$ 416	$ 873
K9	800	6	$ 318	$ 277	$ 664
K10	800	6	$ 318	$ 277	$ 705
K11	800	6	$ 318	$ 277	$ 664
K12	800	6	$ 318	$ 277	$ 705
K13	800	6	$ 318	$ 277	$ 664
K14	800	6	$ 318	$ 277	$ 705
K15	800	6	$ 318	$ 277	$ 718
K16	800	6	$ 318	$ 277	$ 706

** Unit electric cost excludes fixed charges not related to kWh consumption*

Capital Budget Overview

The James/Kilmer Condominium Association's capital budget relating to the central plant for the next 10 years represents approximately $5,542,361 in repairs and equipment replacement.

Table 4.1 – James/Kilmer Condominium Association Capital Budget

Equipment	**Budget**
Heat Exchanger replacement	$170,000
Pumps; heating/cooling replacement	$137,747
Chillers, capital repairs	$152,250
Chiller replacement	$1,116,500
Cooling Towers, capital repairs	$71,050
Various valves and controls	$82,169
Horizontal pipes	$3,250,914
Trane contract	$286,597
Repairs to equipment	$229,278
Chemical treatment	$45,856
Total	**$5,542,361**

Next Steps

The energy model is presented independent from the initial Siemens phase 1 findings, however the window installation and decentralized heating and cooling will drive the focus of the phase 2 assessment provided by Siemens. Prior to phase 2 Siemens recommends that James/Kilmer Condominium Association investigate outside air and metering options at James House;

Review cost estimate for testing of outside-make up air in James House prior to the Window installation to enable a fine tuning of the desired balance between exhaust air and make-up air after Window installation. Additionally investigate cost for installation of a make-up air unit (MAU) at the James House.

Investigate wireless meter installation with web-based Energy Monitoring and Controlling (EMC) for internal billing. This project could provide the James/Kilmer Condominium Association the opportunity to contract in bulk with utility companies.

Phase 3

Option 1: **$6,000**

Assuming that James House installs new windows and air to air heat pumps and Kilmer House installs air to air heat pumps, Siemens will provide the James/Kilmer Condo Association with a letter of intent to investigate occupancy sensors, high efficient lighting, and water conservation measures at James House and Kilmer House.

Option 2: **$20,000**

Assuming that James House installs new windows and does not install decentralized heating and cooling in either building, Siemens will provide the James/Kilmer Condo Association with a letter of intent to investigate option 1 along with replacing chillers with resized and higher efficiency chillers. Replacing boilers with resized boilers with O_2 trim burners and reconfiguring the heating and cooling zones to separate the East and West side of James House. Lighting, water conservation and occupancy sensors will be considered at Kilmer House.

Option 3: **$15,000**

Assuming The James/Kilmer Condo Association does not move forward with new windows or decentralized heating and cooling, Siemens will provide James/Kilmer Condo Association with a letter of intent to investigate option 1 along with chilled water/condenser water reset, installing high efficiency motors and pumps. Operate one boiler when possible and reducing the boiler temperature set point as well as installing a new burner with O_2 trim on boiler and boiler stack heat recovery.

We understand your business objectives and will work with you as your business partner in achieving those goals. If you have additional questions or comments on the findings in the Economic Feasibility Study please contact Becky Werra at 312.215.2137 and/or Jonathan Aardsma at 847.493.7783.