EXHIBIT 6

CLEVELAND PUBLIC LIBRARY

Finance Committee
September 15, 2011

RESOLUTION ON AGREEMENT WITH SPECTRUM ENERGY CONCEPTS, INC., TO CREATE BID PACKAGES FOR STEAM CONVERSION AND DEMAND CONTROL VENTILATION PROJECTS

Whereas, The Cleveland Public Library engaged Spectrum Energy Concepts, Inc., to determine the cost savings inherent in switching from the present electrical resistance heating system to a retro-fit steam system; and

Whereas, Spectrum Energy Concepts' steam conversion analysis and report recommends that the Cleveland Public Library implement the demand control ventilation, and the electric heating to steam heating conversion projects; and

Whereas, The concurrent implementation of these projects is expected to return a savings of about $1,260,000, over the next ten years, additionally, these projects have ancillary benefits that will be obtained by dramatically improving the humidity control in the Main and Louis Stokes buildings; now therefore be it

RESOLVED, The Cleveland Public Library Board of Trustees authorizes the Director to execute an agreement with Spectrum Energy Concepts, Inc., to provide the balance of the analysis and to help create a bid-able document at a cost not to exceed $11,200 to be charged to General Fund Account 11020053-53710 (Professional Services).

SPECTRUM
ENERGY CONCEPTS, INC.

3346 Arbor Way
Westlake, Ohio 44145

440-915-1200 V
440-835-5484 F

Cleveland Public Library
325 Superior Avenue
Cleveland, OH 44114
Attn: **Mr. Myron Scruggs** – Property Management Administrator

Dear Myron:

As a follow-up to our meetings and discussions, we are pleased to offer the following Consulting Services as a result of our investigation into the electric heating to steam heating analysis:

Two immediate opportunities that are outside the scope of our just completed consulting arrangement deserve immediate attention, **Lighting Retrofits** and **Energy Efficiency Upgrades for Main and Stokes.**

LIGHTING RETROFITS – First Energy serviced Branches

As you may be aware, First Energy is currently offering a rebate program designed to encourage energy savings by their customers.

In the case of the library, the Branches are eligible to receive cash rebates for energy efficient lighting retrofit programs for all buildings served by First Energy. We will provide overview analysis of the lighting surveys currently in progress and assist in filing the rebate applications with the First Energy administrators.

In order to project the rebate amounts and complete financial analysis of the lighting retrofits additional analysis is needed. We have located the firm, ECO Engineering, which conducted the branch lighting surveys and analysis several years ago. At our recommendation the library has engaged ECO Engineering, to complete the field surveys and prepare and file the pre-approval rebate forms to First Energy for all the lighting projects. Spectrum will review the ECO work and Rebate Applications and work with First Energy to obtain all possible rebates.

Please be aware that submission of the pre-approval forms to obtain the rebates does not actually obligate the library to complete the project(s) unless the library decides to do so. In many cases clients are withholding final approvals pending the favorable outcome of their pre-approval rebate requests.

We anticipate this work can be completed within 30 days at a cost not to exceed $2500.

ENERGY EFFICIENCY UPGRADES FOR MAIN AND STOKES

As a result of the recently completed steam study, several opportunities need to be finalized and bid packets prepared to take advantage of the significant energy savings opportunities available to the library. The opportunities include converting the present electric heating to steam heating for the district steam system; the installation of a demand controlled ventilation system for both the Stokes and Main Buildings; lighting retrofits for the Main building.

If you will refer to the previously submitted analysis, you may discover that annual energy savings from the demand ventilation system are in the range of $100,000 per year and that the steam conversion opportunity will provide an additional projected savings of $200,000 over a ten year period. Coupled with substantial reductions in humidification loads and some updated energy-efficient lighting, we expect the 10 year savings to fall in the range of $1,250,000 to as much as $1,500,000.

Substantial work needs to be completed in order to create bid packages for this work. We look forward to continuing the relationship with the library as we work together to obtain energy conservation and savings. We are hopeful that the library will recognize the opportunity to greatly increase their energy savings and find it sensible to provide an additional consulting award to Spectrum to continue the process.

We anticipate the cost of the services needed to complete the balance of the analysis and to help create a bid-able document can be accomplished for a cost not to exceed $11,200.

Thank you for the opportunity to provide our services and we look forward to a continued working relationship.

Sincerely,

Timothy B Janos, CEM, CEA, CDSM, CBEP, CSDP
President

STEAM CONVERSION ANALYSIS AND REPORT

FOR

JULY 2011

PREPARRED BY:

SPECTRUM ENERGY CONCEPTS, INC.

3346 ARBOR WAY WESTLAKE, OHIO 44145 440-915-1200

BACKGROUND

Spectrum Energy Concepts, Inc. was engaged to perform a feasibility study to consider possible cost savings which might be obtained if the Cleveland Public Library (CPL) would convert from the present Electrical Heating System to a Steam Heating System with Purchased Steam supplied by Cleveland Thermal's district heating system.

Cleveland Thermal currently provides Chilled Water for Air Conditioning the Main Building at 325 Superior as well as the Stokes Tower at 525 Superior.

Our work considers the costs to operate the CPL's Stokes and Main Building's heating systems to help management see the impact of converting from Electric Resistance Heating systems to steam heating in the most appropriate Air Handling Units (AHUs).

The energy and operational cost estimates which follow are calculations made from information obtained off the CPL original construction plans and from multiple visits and mechanical system review and field verification of the CPL Main and Stokes buildings in April, May and June of 2011. The following are ideas for the Main and Stokes buildings heating options, budgetary estimates to install the options and cost savings estimates to help establish a basis for rendering a decision on the strategies recommended below.

Providing a "comprehensive energy study" of all opportunities uncovered at the Main and Stokes buildings was not the intent of this project, although in the course of our investigation and analysis, opportunities were uncovered that warrant additional investigation and analysis. Should the Library wish to engage in follow-up or additional studies, other savings ideas can be identified and offered for more savings in these buildings. Opportunities we discovered that impact the core project analysis of electric to steam heating conversion have nonetheless been included in this report as their omission would render the analysis incomplete.

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EXECUTIVE SUMMARY OF FINDINGS

Our mission was to determine the cost savings inherent in switching from the present Electrical Resistance Heating System to a retrofit Steam System. Since PUCO approved the new First Energy Electric Rate filings effective June 1, 2009, the Electric Space Heating Rate was abolished. The Library had two electric meters in the Stokes Building as was typically required in order to receive this low-cost heating rate. The metering is still in place although the special rates have vanished. The resulting increase in electrical rates causes the CPL to consider alternate heating systems.

In the process of working thru the field details and underlying assumptions and engineering we uncovered a variety of opportunities that will benefit the Cleveland Public Library. Given the likelihood of substantial increases in future electrical rates and comparing that with the opportunity to fix "steam heating rates" over a 10 year period provides the library with reasonable alternatives.

As with any facility, it is appropriate to review all of the installed systems to be sure these systems are being operated and maintained in accordance with standard practices and moreover in accordance with current Code Requirements. It is proper procedure to first implement all of the energy conservation opportunities uncovered so as to project the real system needs into the analysis.

At the Main and Stokes Buildings we have determined that a substantial reduction in energy consumption can be obtained by revising the existing HVAC equipment to current ASHRAE and Code Standards. These code-compliant, energy-conserving projects should be executed concurrently with the switching of heating sources from electrical resistance to steam heating.

These opportunities will result in the reduction of unnecessary outdoor ventilation air coupled with a substantial reduction in Humidification loads.

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RECOMMENDATIONS

- Implement the **Demand Control Ventilation** and the **Electric Heating to Steam Heating Conversions Projects** as further described in the following pages. The concurrent implementation of these projects is expected to return a savings of about **$1,260,000** over the next ten years. Additionally, these projects have ancillary benefits that will be obtained by dramatically improving the **Humidity Control** in the Main and Stokes Buildings.

- The construction costs to design-build, completely install and fully commission into operation are budgeted at $600,000. Presently, due to the new First Energy Demand Side Management Rebate Program, Rebates in the approximate amount of $80,000 are available for a short period of time and will reduce the first capital costs of the project by that amount improving the return on investment.

- Cleveland Thermal, LLC. Has indicated willingness to include all the construction costs as well as any financing costs as part of a 10 year Contract to Purchase Steam from their plant. This may enable the CPL to implement these worthwhile projects in the near term, taking advantage of the First Energy Rebate funding, and without creating any delay in construction. They anticipate having these systems up and running by the start of this heating season. We anticipate a NET POSITIVE CASH FLOW to the Library each month over the life of the agreement since a portion of the utility expense normally paid to First Energy and Municipal Power will be diverted to pay for the purchased steam. The savings on the electricity costs will exceed the costs of the Purchased Steam Projects.

- We also recommend additional consulting work, beyond the scope of the original contract, be authorized to analyze the lighting retrofit opportunities for both the Stokes and Main buildings so this work can be bundled into these projects. This will permit the use of additional First Energy lighting rebates. Also, we recommend similar studies for all First Energy branches immediately.

COMMON TERMS

The option to use a less expensive heating source i.e., Cleveland Thermal's steam supply on a 10 year guaranteed rate program is the current option being considered at this time in this report. When comparing alternate fuel sources a number of different techniques can be employed although at the core of the issue is producing the heat needed to satisfy the seasonal heating needs of the buildings. Most often this is expressed in common units of heat as BTU's. A BTU -British Thermal Unit – is defined as the amount of heat needed to raise one pound of water one degree Fahrenheit. At the Cleveland Public Library's Main Building and the Stokes Building the needed BTU's are being produced by Electricity. Each Kilowatt Hour (kWh) of electricity consumed by the electrical heating system produces 3412 BTU's.

When the Stokes Tower was constructed approximately in 1995 and the Main Building HVAC systems renovated at the same time, the Illuminating Company (First Energy) offered special "all electric heating" rates that were far below market. In the Stokes Tower there was installed special electric metering to permit the utility to offer this rate on the heating functions only while the second meter recorded consumption on the lighting, plug loads, elevators, computers, etc. at the normal tariff electrical rate. The PUCO allowed Ohio to become a de-regulated state officially on June 1, 2009 and all of the special electrical rates were eliminated resulting in an increase in the cost of heating the library buildings.

The alternative being considered is the purchase of district steam from Cleveland Thermal who is also the provider of Chilled Water for Air Conditioning in the Main and Stokes Buildings. Cleveland Thermal would provide steam from their central facility to the library. In general, for a very basic comparison, 1000 lbs. of steam contains about 1,000,000 BTU's. In order to produce 1,000,000 BTU's electrically the library would need to purchase about 293 kWh's since every kWh provides 3412 BTU's.

Considered in this light, the underlying question is simply described at what is the cost for each source of heat? The table below is useful in considering these costs in terms we would describe in Point of Use Costs.

Point of Use Costs for 1,000,000 BTU Common Unit

Quantity needed	$ Cost/ per unit	Total Cost for 1MM BTU
1000 LBS of Steam	$24.00	$24.00
293 kWh	$0.979*	$28.71
293 kWh	$0.072*	$21.10

*May 14 thru June 16, 2011 actual Illuminating Company Bill. Note that First Energy is offering a reduced fixed rate of $0.0532/kWh plus Delivery charges from the Illuminating Company of approximately $0.0184/kWh for a new cost of $0.072. Please note that the delivery portion of the electrical utility is a regulated entity and will gradually increase over time due to the guaranteed return bestowed upon that part of the utility by the PUCO. The Supply (commodity) power will be subject to shopping opportunity from various suppliers. While we have a 3 year fixed offer from First Energy Solutions, the clear market trend is increasing prices beyond that term as the economy recovers.

As is discernable from the foregoing table, some of the pricing advantage that was available by purchasing steam in lieu of electricity disappeared with the new electrical price. However, the CPL is nonetheless projected to save almost $200,000 in operating expense by switching to steam over the next 10 years. This portion of the discussion would be incomplete if we failed to offer some discussion on the trends in the utility industry and forward pricing predictions.

While we are in an economic soft spot due largely to the lack of Industrial Energy Consumption which created a near-term pricing advantage for electricity, this condition cannot continue over the long term for a number of reasons:

1. EPA Regulations that are now in effect create substantial compliance costs for utilities that use Coal as a fuel source for the production of electricity. In fact, very inefficient and environmentally unfriendly plants have already been shut down by various utilities which are unwilling to invest in the technology required to comply with these new regulations.
2. Since Coal is still the single largest fuel source for the production of electricity in the United States, the cost to comply with these new regulations will certainly be added to the cost of each kWh of electricity.

3. As Industrial production begins to re-emerge the Regional Transmission Operators will be accumulating power from all of the generating sources to meet the demand. For example, Nuclear is the lowest cost source of electricity, followed by Coal, and then followed by Natural Gas. This blend of generating sources determines the cost the end user must pay. As the need increases, the most expensive generators – the gas-fired "peaking" plants – become a larger contributor to the cost equation.
4. The DOE and EPA are driving our country to use the shale gas deposits as both the best source of Domestic Fuel and also as a cleaner alternative to Coal which has significant negative environmental impacts. While beneficial from an environmental standpoint, the reality is that Natural Gas is a more expensive fuel source when used to produce electricity.

These factors are very complicated, very political, and every credible source is uniform in predicting significant increases in the cost of electricity. This is important to understand so as to not unfairly distort this assessment with only a near-term analysis. While we have no firm pricing beyond three years, it is simply enough to assume that electrical rates may double with the next 4-10 years. We properly must include that analysis to be fair. Since Cleveland Thermal is offering a fixed tariff with 1% annual increases we have constructed the following table to compare costs of each heating source over the next 10 years using some possible increases in kWh for analysis.

Year	Steam Rate	kWh Rate*	Steam cost	Electricity cost
1	$24.00	$.072	$24.00	$21.10
2	$24.24	$.073	$24.24	$21.39
3	$24.48	$.075	$24.48	$21.98
4	$24.72	$.085	$24.72	$24.90
5	$24.97	$.094	$24.90	$27.52
6	$25.22	$.103	$25.22	$30.18
7	$25.47	$.113	$25.47	$33.11
8	$25.73	$.125	$25.73	$36.63
9	$25.99	$.137	$25.99	$40.14
10	$26.25	$.151	$26.25	$44.42

*Use various predictions of a 15% jump in year four followed by a 10% annual increase. This is offered for illustration only as the increases for electricity are a best guess.

ANNUALIZED HEATING COSTS – STEAM –VS- ELECTRICITY

The Cleveland Public Library's probable annual consumption from a heating standpoint must be integrated into this analysis. Keep in mind that it is not possible to completely eliminate all of the electric heating needs and consumption if the conversion to Cleveland Thermal Steam were completed. It is a very difficult analysis due to the interaction of many different electric heating systems and our team is estimating that approximately 1,125,000 kWh will be displaced if the buildings were converted to steam.

YEAR	Steam cost per MM BTU	Steam annual cost	Electricity $ per MM BTU (STOKES) .072	Electricity $ per MM BTU (MAIN) .98	Electricity annual cost
1	$24.00	$91,824.00	$52,486.20	$38,467.45	90953.65
2	$24.24	$92,742.24	$53,215.18	$39,621.47	92836.65
3	$24.48	$93,660.48	$54,673.13	$40,017.68	94690.81
4	$24.72	$94,578.72	$61,962.88	$40,417.86	102380.73
5	$24.97	$95,535.22	$68,523.65	$40,822.04	109345.69
6	$25.22	$96,491.72	$75,325.45	$41,230.26	116555.71
7	$25.47	$97,448.22	$82,374.18	$41,642.56	124016.74
8	$25.73	$98,442.98	$91,121.88	$42,058.99	133180.86
9	$25.99	$99,437.74	$99,869.58	$42,479.58	142349.15
10	$26.25	$100,432.50	$110,075.23	$43,329.17	153404.40
TOTALS		$960,593.82	$749,627.32	$410,087.07	$1,159,714.39

NET SAVINGS OVER 1O YEARS FROM STEAM HEATING $199,120

An analysis of the "Heating" Electric meter for the facilities is used to determine the actual heating loads imposed by the facilities. From the metered data, one can calculate a total seasonal electric heating consumption of about 2,236,800 kWh for the Stokes Building. As previously mentioned, it is not possible to completely eliminate the consumption of electricity to heat the facility. Please recall that the VAV units are electric reheat for zone control and there exist electric pedestal heaters at the window line to handle that heat loss. Our best estimate of the amount of electric heat that can be replaced with steam heat is approximately 1,121,500 kWh per year.

The following pages provide additional analysis of the energy savings opportunities described herein to aid in understanding the scope of the proposed energy conservation modifications.

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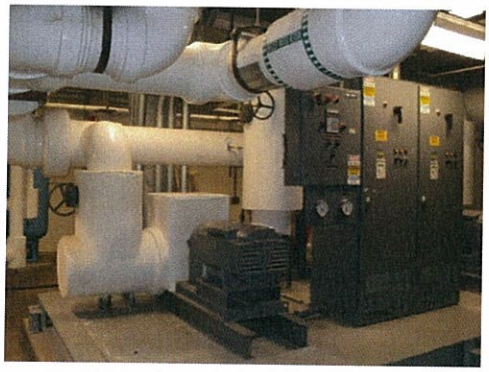
Details for Stokes Building Conversion to Steam

Although the following discussion discuss both the "steam coils" and "hot water" options, our recommendation clearly favors the use of steam for a variety of reasons outlined below.

Bring Cleveland Thermal's low pressure steam into the Lower Level of Stokes and supply "steam" to Stokes AHUs 1-4 and to the Stokes Humidifiers 1,2,3,5 and 6. Also if hot water (HW) option is selected, provide steam to a new "steam to hot water plate and frame heat exchanger", add lead lag hot water pumps to deliver a hot water heating to the Main building AHUs (see MAIN building details). For delivery of hot water from Stokes to the Main building, consider converting the existing chilled water lines to work "dual duty" to be in service for either heating or cooling (2 pipe performance).



Contrast the cost option by installing new HW supply lines and its' own pumping system vs. running a steam pipe to the Main building: with HW consider using adding a small plate heat exchanger and hot water pumping system for the heating water option – Warning – this will be a problem at times when changing from heating to cooling is required quickly and the system will need time to switch over from hot to cold or back again. At the high pressure steam service entrance to the building, CPL will need to provide a pressure reducing valve; we can recommend other building energy saving options associated with steam- not part of this study.

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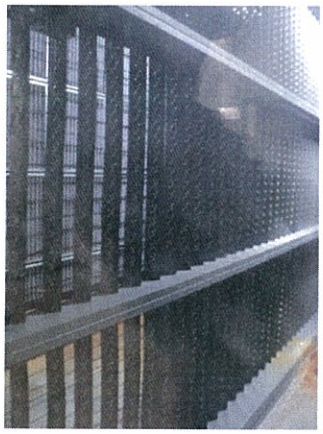
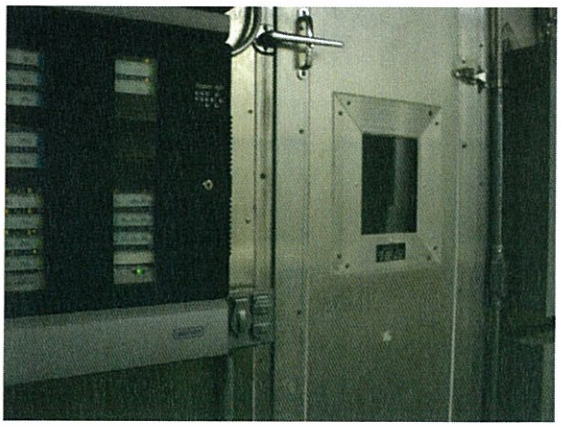
Stokes Building: AHU HEATING COILS



In AHUs 1-4, leave the electrical heating in place (total 2,663 KW design capacity) but add steam heated, non-freeze, 1" tube distributing coils (1/3, 2/3), designed to operate at increased performance in place of the old electric heating bank. Pipe low pressure steam to these new coils and reprogram the BAS to control heating with steam instead of electric; change set point temperatures to near 105 degrees F delivery in winter; reset as major areas are satisfied. Removal of the old electric coils will offer some air "pressure drop reduction" but with the new steam coils, the HP savings will be small as the increased air pressure of the new heating coils will not require much HP. **As an option to reduce up-** front costs: consider abandoning the electric heating coils in place in AHUs 1-4, not install a steam coil but and re-pipe "2 of each AHU's 4" chilled water coils to perform in winter as a hot water heating booster coils and automatically switch back to chilled water in summer or as needed.



Stokes Building: AHU HEATING COILS (con't)

Control each coil's steam flow valve by re-programming the Siemens' BAS system to the new performance requirements. Replace each AHU's mounted temperature sensors; install & wire new units to BAS MBC or MEC panels (panels are old technology, but serviceable for the next few years). Control modulation of the heating valves on leaving air temperature.

Increase all AHU discharge temperatures to take as much load off the perimeter heating systems as possible yet be comfortable in each space. The new set-points for the AHUs' mixed air leaving supply air temperature should be controlled close to 95- 105 degrees F (and re- set as outdoor temperature changes and room conditions are met) to relieve the load off the building's perimeter heating (the existing Leaving Air Temps- LATs in Stokes' AHUs range from 45 to 68.1 degrees F and require the other distributed electrical heating units to maintain each zones' 72 degree F set point).

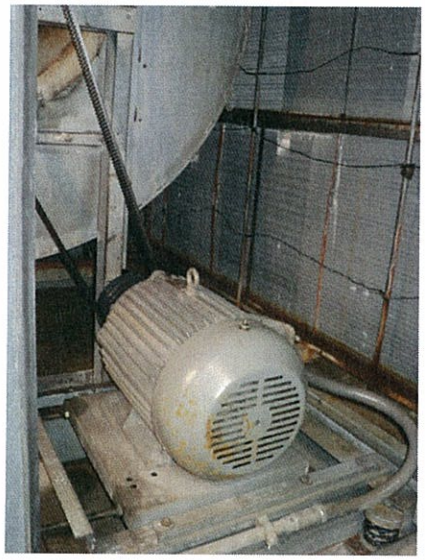
Stokes Building: CONDENSATE COOLING

Steam condensate goes to sewer & must be reduced in temperature to 140 degrees F or less. Add a condensate collector tank and a 3 way modulating valve to automatically blend city cooling water to achieve set point. Provide this at each central area steam is condensed and will dump to sewer.

Consideration must be given to additional load imposed on the existing sump ejector pumping systems.

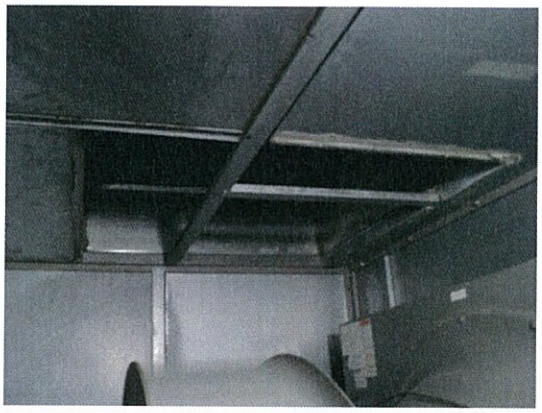
Main Building: AHU HEATING COILS

Abandon the electrical heating bundles in place for AHU 25 and add a non-freeze steam heating coil.



If the CW to HW option is selected, convert to a 2 pipe change over system to use the existing chilled water (CW) coils for hot water (HW) in winter heating requirements. In this option we recommend using glycol run around loops designed for AHU 24 & 25 as these units see 100% OA and this will offer the most protection from freezing. Removal of the old electric heating coils from 24 & 25 (total 500 KW) will offer some air "pressure drop reduction" but the savings is small with existing units operating on VFDs, therefore abandon in place. For AHUs 20-24 add new steam coils (hot water coils as the least desirable option) in the supply air duct above the fan.

Main Building: AHU HEATING COILS (Con't)



Control each coil's heating valve by programming the BAS system based on leaving air temperature. Install new temperature sensors; install and wire to the nearest MBC or MEC panels & program the steam valves to modulate on air temperature. Increase AHU 25's discharge temperature from 55 degrees F to 104 degrees F to take as much load off the perimeter heating systems as possible yet be comfortable in each space (site will need to establish the best set point by trying different settings). The added steam (or HW) coils in AHUs 20-24 should boost the supply air temperature from AHU 25 to 95-105 degrees F final to the building and modulate as local conditions are satisfied. This combination will take a significant load off the other electrical heating equipment throughout the building.

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Main Building: CONDENSATE COOLING

Steam condensate will go to sewer & must be reduced in temperature to 140 degrees F or less. Re-condition the DriSteem condensate collector tank and the modulating valve to automatically blend cooling water to achieve set point for sewer discharge.

ENERGY SAVINGS OPPORTUNITIES

In the process of analyzing the air flow, heating loads, and humidification loads for the Main and Stokes Buildings, significant energy-saving opportunities have been discovered that will dramatically benefit the Cleveland Public Library.

The design basis of the Stokes Building and the concurrent design modifications that were implemented in the Main Building included a substantial amount of outdoor air being introduced into the facilities during operating hours. This amount of outdoor air was determined in compliance with applicable codes and ASHRAE Standards in effect in 1995 which have undergone substantial changes.

ASHRAE Standard 62 defines the amount of outdoor (fresh) air needed to keep the indoor environment in a satisfactory condition in terms of adequate ventilation and occupant comfort. These versions of the Standard are calculated based on projected full occupancy. Rarely, if ever, are the library buildings filled to design capacity.

A good way to think of this might be a College Lecture Hall which has 500 seats. The code requires that we design the outdoor air based on full occupancy of 500 students. If that called for 10 CFM of outdoor air per person, then it totals of 5000 CFM of outdoor air which would require heating and humidification as well as cooling. This load would be brought into the space continually even if only 5 people were in the room creating a substantial "parasitic load" and consequential increased operating costs.

Updates to these Standards allow for a system of measurement, based generally on CO2 content of the air, to determine the actual requirements and optimize the quantity of outdoor air required. Our calculations indicate, based on occupancy numbers derived from conversation with the staff, that substantial operating costs will be realized by implementing this strategy.

In the Stokes Building, out calculations indicate a savings potential of $64,735 in electricity each year. In the Main Building, the calculations show a savings of $34,219 each year. Added together, the library has the opportunity to save nearly $100,000 per year in operating costs. Our best estimate of the implementation cost for this project is between $200,000 and $225,000 for a quick return on investment. Additional motivation has recently been supplied by the First Energy Rebate program discussed further on.

CO2 DEMAND VENTILATION CONTROL – OPTION

Stokes Building:

This design will work well within both the Main & Stokes building spaces to reduce heating and cooling loads but not compromise health, safety and IAQ. CO2 sensors will need to be installed into each floors' return air duct and be wired to the nearest BAS control panel. The BAS system would need to be reprogrammed to modulate the OA feeds to each AHU based on controlling each space's CO2 levels. Design for the space to be controlled for CO2 at about 1000 ppm in each space. This design is allowed by the ASHRAE 62.1 standard to control outdoor air for people comfort and savings energy. The design offers significant load reduction in both summer and winter when the OA can be significantly reduced many hours each day due to few people in the building. This will also reduce the load on the carbon filters from contaminants coming in the outdoor air.

CO2 VENTILATION CONTROL QUICK CALC

Notes:
CPL Stokes Building based on Electrical heating

VENTILATION REDUCTION SAVINGS CALCULATION: STOKES BUILDING

	316,000	...TOTAL SUPPLY FAN CFM (CFM)	
	18%	...PRESENT O.A. VENTILATION PERCENTAGE (VENTPER)	
	400	...NUMBER OF OCCUPANTS DURING OCCUPIED PERIODS (AVGOCC)	
	41	...REQUIRED CFM/PERSON and sq ft combined (CFMPER)	
	16,200	...ASHRAE CFM (AVGOCC * CFMPER.) REQUIRED (VENTCFM)	
	60	...HRS/WK OF BUILDING OCCUPANCY (HRSOCC)	
	72	...SPACE HEATING SETPOINT (HTSP)	
	33.6	...AVERAGE O.A. TEMP. DURING HEATING SEASON (AVEDBT)	
	5745	..AVG.HRS/YR OF 3 yrs HEATING SEASON FROM WEATHER DATA (HHPY)	
	Electric	...TYPE OF FUEL (GAS MCF, OIL GAL, COAL TONS)	
$	0.06	... COST / UNIT OF FUEL	
	3,413	...BTUs / UNIT (BTUs/UNIT)	
	0%	...LOSSES OF HEATING SYSTEM (EOSH)	
(Heating)		((CFM * VENTPER) - VENTCFM) * 1.08 * HRSOCC * (HTSP - AVEDBT)	
		* HHPY / 168 HRS/WK / (BTUs/UNIT * (1 - EOSH)) ==========:	990,583.57 KWHs
		MCF SAVED * COST / UNIT OF FUEL ==========:	$60,029.36 SAVINGS
$	0.0606	...ELECTRICITY UNIT ($) COST/KWHR (ELECCOST)	
	0.60	....Avg. KW/TON OF CHILLER (KW/TON) - ***SEE TABLE BELOW***	
	0.00	....AVG. KW/TON OF SUPPORT EQUIPMENT (KWSUPT)	
	1079	..AVG .COOLING HRS/YR FROM WEATHER DATA (CHPY)	
	6.42	...COOLING WEEKS PER YEAR (CWPY) = (CHPY/168)	
	6.42	...COINCIDENT COOLING WEEKS (CLGWKS) = MAX((CHPY/168-(52 WKS-WPY)),0)	
(Cooling)		((CFM * VENTPER) - (VENTCFM)) * CBTU / 1000 * HRSOCC /50 *	
		CLGWKS / CWPY * (KW/TON + KWSUPT) *1000000 / 12000 ========	77,651.43 kWh
		kWh SAVED * ELECCOST ==========:	$4,705.68 SAVINGS
		TOTAL SAVINGS ====:	**$64,735.04 SAVINGS**

CO2 DEMAND VENTILATION CONTROL – OPTION (con't)

Main Building:

This design will work well within the Main & Stokes building spaces. New CO2 sensors will need to be installed in the return air ducts on each floor level. Provide new power wiring to each sensor and provide control wiring back to the nearest BAS control panels. The BAS system would need to be reprogrammed to modulate the OA feeds to each AHU based on controlling each space's CO2 levels to not go over 700 ppm more CO2 than measured in the OA (which is about 300 ppm) i.e., control at about 1000 ppm in each space. This design is allowed by the ASHRAE 62.1 standard for controlling outdoor air for people comfort and savings energy. The design offers significant load reduction in both summer and winter where the OA can be practically shut off a good number of hours each day due to few people in the building.

CO2 VENTILATION CONTROL QUICK CALC

Notes:
CPL MAIN Building based on Electrical heating

VENTILATION REDUCTION SAVINGS CALCULATION: MAIN BUILDING based on 2010 rates in 3 months

	156,300	...TOTAL SUPPLY FAN CFM (CFM)
	15%	...PRESENT O.A. VENTILATION PERCENTAGE (VENTPER)
	200	...AVERAGE NUMBER OF OCCUPANTS DURING OCCUPIED PERIODS (AVGOCC)
	50	...REQUIRED CFM/PERSON (CFMPER)
	10,000	...AVERAGE CFM (AVGOCC * CFMPER.) REQUIRED (VENTCFM)
	60	...HRS/WK OF BUILDING OCCUPANCY (HRSOCC)
	72	...SPACE HEATING SETPOINT (HTSP)
	32	...AVERAGE O.A. TEMP. DURING HEATING SEASON (AVEDBT)
	5745	...HRS/YR OF HEATING SEASON FROM WEATHER DATA (HHPY)
	Electric	...TYPE OF FUEL (GAS MCF, OIL GAL, COAL TONS)
$	0.10	... COST / UNIT OF FUEL
	3,413	...BTUs / UNIT (BTUs/UNIT)
	0%	...LOSSES OF HEATING SYSTEM (EOSH)

(Heating)

((CFM * VENTPER) - VENTCFM) * 1.08 * HRSOCC * (HTSP - AVEDBT)
* HHPY / 168 HRS/WK / (BTUs/UNIT * (1 - EOSH)) ==========: 349,172.69 KWHs
MCF SAVED * COST / UNIT OF FUEL ==========: $34,218.92 SAVINGS

$	0.0980	...ELECTRICITY UNIT ($) COST/KWHR (ELECCOST)
	0.60	....Avg. KW/TON OF CHILLER (KW/TON) - ***SEE TABLE BELOW***
	0.00	....AVG. KW/TON OF SUPPORT EQUIPMENT (KWSUPT)
	1079	...COOLING HRS/YR FROM WEATHER DATA (CHPY)
	6.42	...COOLING WEEKS PER YEAR (CWPY) = (CHPY/168)
	6.42	...COINCIDENT COOLING WEEKS (CLGWKS) = MAX((CHPY/168-(52 WKS-WPY)),0)

(Cooling) No savings as the Main AHU 25 needs to run continuous to cool the space

kWh
$0.00 SAVINGS

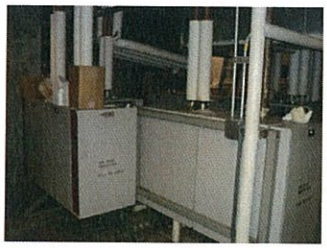
TOTAL SAVINGS ====: $34,218.92 SAVINGS

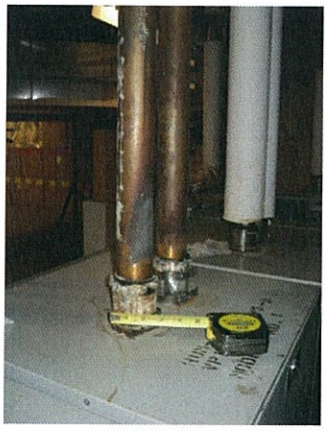
HUMIDIFICATION -

The Cleveland Public Library will benefit significantly by implementing the Demand Controlled Ventilation Systems described in the forgoing. We need to point out that the staff has had a difficult time maintaining the desired humidity during the heating season for a variety of reasons. One very valuable benefit of the Demand Controlled Ventilation Project is the reduction in outdoor air quantity. This is critical as most of the humidity load required by the library is caused by the quantity of outdoor air. When we dramatically reduce the outdoor air quantity through the implementation of the DCV Project, we greatly reduce the need and operating costs of the Humidification System.

Stokes Building: HUMIDIFIERS

The design of all the VAPAC electric humidifiers (total design capacity 884 KW) uses raw city water with multi tube steam injection. We suggest replacing the existing VAPAC with capacity-adjusted DriSteem units. The new units will only need a capacity of about 224 KW due to the reduction in outdoor air quantity.





Reuse the installed dispersion tube systems if the old dispersion tubes have not been a problem. Mount new humidity sensors at a distance down-steam of the dispersion tubes, per manufacturer's recommendations. Size each of the direct injection systems to achieve 40% maximum RH in the occupied space at 68 degrees F in winter; measure on the inside of each supply duct and in constantly attended areas The existing VAPAC steam systems are reported to have acceptable dispersion performance although they continue to represent a source of maintenance costs for a variety of reasons.

Main Building: HUMIDIFIERS

The 3 electric heated duct mounted DRI Steem humidifiers are not in the best location nor sized to control humidity to achieve the desired 50% RH levels with the present system design.

The additions of CO2 demand ventilation control (see option below) should allow the existing DriSteem humidification units to perform to the RH levels needed with reduced OA. No relocation of the DriSteem units is recommended unless set points cannot be reached.

There are no energy $ savings associated with reconditioning the DriSteem humidifiers back into use; in fact the electrical costs will increase because the existing units have not been operating for the last few years. If CPL were using the existing 3 electric humidifier systems, they would have cost an additional $8,000.00 per year in electricity for the Main building at the existing levels of OA– this does not consider the water softening $ costs that are also associated with the existing design.

ENERGY SAVING – SUMMARY INCLUDING DCV AND HUMIDITY

A) CO2 Demand Ventilation Control with Humidity Load Reduction:

For this Estimated savings are:

For **Main Building** with existing electrical heating in the major AHUs, the savings are estimated at a REDUCTION of 552,906 KWHs per year in electrical HEATING Consumption with the existing heating system.

For **Stokes Building** with electrical heating in the major AHUs, the savings are estimated at a REDUCTION of 1,334,670 KWHs and REDUCTION in 96,866 tons of cooling per year in electrical heating costs and chilled water costs with the existing systems.

Combined **total** electrical and chilled water savings with CO2 demand ventilation control is:

(1.8 million kWh's and 96,000 tons) per year reduction.

Analyzing the results that can be obtained by implementing the Demand Control Ventilation Project for both the Stokes and Main Buildings along with the resulting reduction in Humidification Loads yields a total annual electrical utility savings of about $126,000. Additional savings will be realized from a reduction in purchased Chilled Water.

We estimate the implementation cost of the project to be between $225,000 and $245,000 including the modifications to the Humidification System for Stokes.

As a result of the First Energy DSM Rebates currently offered, we estimate an incentive payment of about $80,000 from First Energy. Assuming the high end of the project cost range and subtracting the rebate leave a project of about $165,000 that delivers annual savings of about $126,000. The Simple Payback period for this project is 1.3 years which is extremely attractive. Favorable bids could product a one year payback.

Summary of CPL building RECOMMENDATIONS:

Apply for the rebate on a Pre-Approval Basis. Once the rebate amount is approved at an acceptable level, implement CO2 Demand Ventilation Control to minimize the heating, humidification and cooling loads.

STOKES building related recommendations:

1 Install CO2 Demand Control Ventilation to minimize Out Door Air (OA) per ASHRAE 62.1
2 Replace the VAPAC humidifiers HUM 1-6 with DriSteem direct injection on the new calculated loads
3 Replace duct temperature, humidity and damper control systems in AHUs 1-4 and re-commission all AHUs' performance
4 Chemically clean the chilled water coils both internally and externally to help achieve top performance
5 Recalibrate chilled water pressure sensors
6 Reprogram the BAS to control AHUs, humidifiers, dampers and pumping to greater efficiency levels
7 Annually test for IAQ

MAIN building related recommendations:

1 Install CO2 Demand Control Ventilation to minimize Out Door Air (OA) per ASHRAE 62.1
2 Re-commission the DriSteem electric heated humidifiers HUM 20-22
3 Install Steam heating coils in AHUs 20-23, 25 and for AHU 25.
4 Replace duct temperature, humidity and damper control systems in AHU 25 and re-commission the AHUs' performance
5 Add duct temperature, humidity and CO2 sensors in AHUs 20-23
6 Chemically clean the chilled water coils both internally and externally in AHU 25 to help achieve top performance
7 Reprogram the BAS to control AHUs, exhaust and return fans, humidifiers, dampers and pumping to greater efficiency levels

GENERAL recommendations for all buildings:

1) Consider all new motors being purchased be NEMA "Premium Efficiency" rated
2) Consider adding VFDs on exhaust fans and control through the BAS
3) Consider expanding the energy study to all aspects of building operations
4) Consider an Energy Consulting Company (ESCO) to implement the above recommended items on a turn key basis and give guaranteed cost benefit savings
5) Give a key CPL HVAC employee advanced training in BAS programming to be able to adjust set points and track performance of building systems controlled through the BAS
6) Both the Stokes and the Main buildings chilled water (CW) coils have been losing efficiency and the loss of temperature performance means that CPL is not optimizing operations and losing Cleveland Thermal cooling rebates for high performance cooling.

MOTORS:

Consider Providing NEMA "Premium Efficiency" motors for all applications and for all HP sizes. The Premium Efficiency will average a 2 % motor efficiency increase for each motor and a simple payback on this upgrade usually shows a 2 to 3 year payback based on motor's cost with installation vs. Energy $ savings (see Sample Comparison for 50 HP motor attached). Run the DOE "Motor Master" software program (free) to calculate your other motor saving options. Also take advantage of the local Utility Companies' motor and drive rebate programs.

CLOSING SUMMARY

- **Present utility rates suggest the best cost savings will result from combining several projects as part of the electric heating to steam heating conversion.**

- **Substantial energy and cost savings can be obtained by implementing a demand control ventilation system for the Main and Stokes Building and should be implemented using the current First Energy Rebates to reduce costs of the project.**

Spectrum Energy Concepts, Inc. wishes to acknowledge the cooperation and valuable assistance rendered by Myron Scruggs and Timothy Murdock who tirelessly tolerated many visits and questions during the course of the field investigations and whose valuable insights measurably aided the completion of this report.

SPECTRUM
ENERGY CONCEPTS, INC.

Supplemental Data

Cleveland Public Library Buildings HVAC Equipment

In 1985 the Stokes building was constructed and the Main Building's HVAC systems were renovated and upgraded at the same time. Both buildings are electrically heated with Electric Resistance Heating Coils in the main AHUs. The Main Building also has Perimeter Fan Coil Units with electric coils to overcome the heat loss at the window line. The Stokes Building uses Variable Air Volume Terminal Units with electric heating elements for individual zone control as well as some Electrical Pedestal Heaters located at the window line to address that heat loss. All of these systems work together to satisfy the building zone temperature requirements using electrical resistance heating.

MAIN BUILDING HVAC EQUIPMENT

The Main Building HVAC Equipment includes a number of Air Handling Units. (AHU's) AHU-25 is configured to serve as the 100% outside air delivery system as it supplies outdoor air to five additional AHU's. AHU-20, AHU-21, AHU-22, and AHU-23 are Variable Air Volume units located in the Basement Mechanical Room. AHU-24 is a Constant Volume Unit serving Brett Hall on the first floor.

AHU-25, the dedicated Outside Air Unit, has a chilled water coil to temper the air in the summer to a temperature of 52 degrees and a bank of Electrical Resistance Heating Coils for winter use to temper the outdoor air to 55 degrees.

The four VAV AHU's are used to deliver air to the building thru vertical ducts to all six floors of the building which deliver this air to VAV Boxes with Electric Reheat Coils. Additionally there are four Air Handlers that contain filters only and are located in the top floor attic mechanical space.

A significant part of the HVAC is supplied by the Perimeter Fan Coil Units located at the window line. As mentioned previously, these units have chilled water coils for cooling and electric resistance coils for heating.

The following is a list of HVAC Equipment presently in use in the Main Building along with associated capacity data.

CPL MAIN Building HVAC

	Cooling mode chilled water from Cleve Thermal				Heating mode elect			
AHU #s w VFDs	Supply CFM	OA CFM	supply fan HP	LAT DB	Supply CFM	DB F	LAT	KWs
AHU 20	38000	5600	50					
AHU 21	35600	5300	50					
AHU 22	35100	5000	50					
AHU 23	36600	5300	50					
AHU 24	11000	1800	15	52	11000		104	100
AHU 25	23000	23000	25	52	23000		55	400
AHU 26	6150	0	7.5	53				
AHU 27	6750	0	7.5	53				
AHU 28	8750	0	10	53			65	5
AHU 29	5600	0	7.5	53				170
MAU 1	6300	6300	2		6300		60	120
Other Fans-summarized								
EF 20-32 (13)	22000	0	10					
RF 20-24 (5)	144000	0	42					
DriSteem Humidifiers								
HUM 20	10900							40
Hum 21	10900							40
HUM 22	1800							7

STOKES BUILDING EQUIPMENT

The Stokes Building HVAC main air handlers are located in the basement of that building. These are custom built air handling units that are "twined" together to create two pairs. Variable Air Volume units AHU-1 and AHU-2 are configured to supply a total of 140,000 CFM and each contains a 200 HP supply fan motor.

Variable Air Volume units AHU-3 and AHU-4 are designed to supply 160,000 CFM and each unit is also furnished with a 200 HP supply fan motor.

CPL Stokes HVAC

	Cooling mode chilled water				Heating mode elect		
AHU #s	Supply CFM	OA CFM	supply fan HP	LAT F DB	Supply CFM	LAT DB F	KW
1- VFD	70000	10500	200	47.9	49000	45	856
2- VFD	70000	10500	200	47.9	49000	61.5	100
3- VFD	80000	15000	200	48.7	58000	45	1014
4- VFD	80000	15000	200	48.7	56000	68.6	243
5- VFD	15980	5056	25	50	15980	50.1	280
6 no vfd	2900	0	5	52	2900	60	5
7 no vfd	3080	0	5	55			
8 no vfd	9320	0	10	55			
9 no vfd	3065	0	3	75		65	5
10 no vfd	7680	0	10		7680		170
Other Fans-summarized							
EF 1-7 (7) no vfds	86000	0	70				
SF 1-5 (5 smoke)	117000	0	125				
RF (23) vfds	253000	0	120				