Environmental Sustainability Assessment Report:

On-Site Opportunities

Prepared for:
Frankfort City Hall
Frankfort, Kentucky

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University of Louisville

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Kentucky's Resource Center for Environmental Sustainability

UNIVERSITY OF LOUISVILLE
J.B. SPEED SCHOOL OF ENGINEERING

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For questions, please call KPPC at (502) 852-0965.

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EXECUTIVE SUMMARY

The City of Frankfort (Frankfort) contacted KPPC, for technical assistance in identifying Environmental Sustainability Opportunities (ESOs) at the Frankfort City Hall facility. Utility and facility information was obtained for the period from May 2008 through April 2009 and used to identify general ESOs that could reduce energy usage, waste generation, and lower operating expenses at City Hall.

Findings from the Environmental Sustainability Assessment are shown in **Table 1**.

Table 1: Summary of Potential Environmental Sustainability Opportunities

Environmental Sustainability Opportunities	Investment Cost	Annual Savings				Payback (years)
		Demand	Energy (MMBtu)	Financial	Environmental Usage Reduction	
ESO No. 1: Implement an Energy Management Program	$0	-	42	$778	12 Ton CO_2	Immediate
ESO 2. Replace T-12 with Energy Efficient T-8 Lighting	$14,918	134 kW	98	$1,888	27 Ton CO_2	8
ESO 3. Install Programmable Thermostats	$770	-	18	$237	Elec: 2 Ton CO_2 NG: 1194 lbs CO_2	3
ESO 4. Upgrade HVAC Equipment	$4,683	N/A	134	$2,415	77 Ton CO_2	2
TOTAL	**$15,688**	**142 kW**	**292 MMBtu**	**$5,318**	**117 Ton CO_2**	**4**

- **Environmental Sustainability Opportunity - Energy**
  As provided within **Table 1**, KPPC has identified four energy ESOs for Frankfort's facility which includes lighting upgrades, HVAC upgrades, and developing an Energy Management Program (EMP). Estimated total savings for the identified ESOs is **82,228 kWh** (**280 MMBtu**) of electrical energy and **118 ccf** (**12 MMBtu**) of natural gas and would provide a simple payback within **four years**. **Section 3.0** provides more detailed information about these ESO recommendations.

  In addition, KPPC addressed some more general EMOs that could offer potential savings, but would require further analysis to verify feasibility and calculate a financial payback. City Hall has installed new windows in portions of the facility, and more savings could be realized by completing the upgrade throughout the rest of the building. Another alternative solution KPPC addressed is for the Reznor heater in the firestation garage. Technologies such as radiant or infrared gas heat could replace the Reznor heater effectively and efficientyly. **Section 4.0** contains more information on upgrading City Hall's windows and gas heater.

- **Summary of System Specific Energy Efficiency Analysis**
  The primary purpose of system specific energy efficiency analysis is to identify predominant energy consuming equipment, calculate the associated costs in relation to other operations and identify ESO recommendations for specific equipment systems.

  Energy Breakdown by Equipment Type
  HVAC constitutes a majority of City Hall's annual energy usage at 879 MMBtu/yr (combined gas and electric), which represents 59% of City Hall's total annual energy usages. The next largest equipment energy users are lighting, plug load, and water heating equipment, using 20%, 16%, and 4% of City Hall's total annual energy usage, respectively. Additional information about CH's energy profile is provided within **Section 2.0**.

- **Incentives for Energy Efficiency:**
  The state and federal governments, regional business development lenders, and utilities offer financial incentives to promote and support energy efficiency efforts. **Section 6.0** provides addition information about incentives applicable to Frankfort**.**

1.0 INTRODUCTION

Frankfort City Hall (City Hall) operates the municipality of Frankfort, KY. Operations at this site include administrative duties as well as housing the Frankfort Fire Department. Office operations occur one shift per day, five days per week and the fire department is operational 24 hours per day, seven days per week. The entire facility encompasses approximately 14,700 sq. ft.

Frankfort contacted KPPC for technical assistance with reviewing operations identifying Environmental Sustainability Opportunities (ESOs). KPPC performed a utility bill and utility rate structure analysis as part of the ES Assessment and were included in a previous report. Utility and facility information provided by City Hall personnel were used to identify general ESOs that could be applicable to reduce energy usage, reduce amount of waste generated, and reduce costs at the facility.

2.0 SYSTEM SPECIFIC ENERGY EFFICIENCY ANALYSIS

The primary purpose of system specific environmental sustainability analysis is to identify predominant energy consuming equipment, calculate the associated costs in relation to other operations and identify ESO recommendations for specific equipment systems. The **Appendix** contains a comprehensive list of major energy consuming equipment. This list should be maintained by City Hall to assist in the management of the equipment inventory. **Section 3.0** of this report contains ESO recommendations and identifies the energy savings, associated cost savings and implementation costs, and simple payback.

2.1 Major Energy Consuming Equipment

The following list is an approximate summary of the major energy-consuming equipment at City Hall. Electrical energy is used to support lighting, office equipment, heating, ventilation and air conditioning (HVAC), and an air compressor. Natural gas is used to support facility heating HVAC units.

2.1.1 Electrical

As discussed within the Energy Bill Analysis, electricity constitutes a majority of City Hall's energy usage and cost at 437,450 kWh (1,493 MMBtu) and $15,093 per year. While lighting is the largest electric user, the entire office and administrative areas are humidity-controlled and are maintained at a certain temperature year round, which requires HVAC to use a large amount of electricity as well. Other systems that require a large amount of electricity include plug load, hot water, and a compressed air unit.

2.1.1.1 HVAC

City Hall operates approximately 10 HVAC units ranging from one cooling tons (12,000 Btu/hr) to four cooling tons. Seven of the air-conditioning units are roof top units (RTUs) and have cooling capacities between one and four cooling tons. The remaining three air conditioning units are window units and have a cooling capacity of one cooling ton each. A summary of City Hall's HVAC energy usage, broken down per equipment type, is provided in **Table 2**. Additional

information about City Hall's HVAC equipment and energy usage can be found within **APPENDIX A**.

Table 2: Electric HVAC Inventory Summary

Unit	Total Number of Units	Total Capacity (tons, kW or hp)	Total Annual Energy Usage (kWh/Yr)
Air Conditioners	6+1 backup	20 tons	**80,006**
Window Units	3	3 tons	**3,465**
TOTAL:	**10**	**23 tons**	**83,471**

2.1.1.2 Lighting

City Hall utilizes fluorescent tube lighting for much of the building. Approximate number, total wattage (kW) and energy usage (kWh) for the different lighting in use is provided in **Table 3**. As shown, the majority of City Hall is equipped with fluorescent T-12 (twelve-eighths, or 1.5 inches, in diameter) lamps, while a small portion has been switched to T-8 lamps. The total lighting energy use is **84,900 kWh/yr**. A more detailed listing of lighting equipment used at City Hall, number of fixtures, light output and hours of operation is provided within **APPENDIX B**.

Table 3: Lighting Inventory Summary

Bulb Type	Number of Fixtures	Total Wattage (kW)	Total Annual Energy Usage (kWh/Yr)
T-8	10	1.3	**3,300**
T-12	213	32.6	**81,600**
TOTAL	**223**	**33.9**	**84,900**

2.1.1.3 Motors

City Hall utilizes approximately 4 electric motors which are integrated into equipment at the facility. Motor sizes are all less than one hp. More motors are built into HVAC, on which we were not able to acquire information. **Table 4** contains the approximate number, total horsepower and energy usage (kWh) for the different motor systems. A detailed listing of motors used at City Hall, total horsepower and annual energy usage (kWh/yr) is provided within **APPENDIX C**.

Table 4: Motor Inventory Summary

Equipment Type	Number Motors	Total Horsepower (hp)	Total Annual Energy Usage (kWh/Yr)
Washer	1	0.5	**48**
Dryer	1	0.5	**48**
Exhaust Fans	1	1	**2,724**
TOTAL	**3**	**2**	**2,820**

2.1.1.4 Air Compressors

City Hall utilizes one air compressor to refill firefighter air tanks throughout the week. **Table 5** summarizes the air compressor in the Fire Department. Specific operational data is provided within **APPENDIX D**.

Table 5: Air Compressor Inventory Summary

Equipment Type	Number Motors	Total Horsepower (hp)	Total Annual Energy Usage (kWh/Yr)
Air Tank Air Compressor	1	20	**1,728**
TOTAL	**1**	**20**	**1,728**

2.1.1.5 Miscellaneous Electrical Equipment

Equipment items that use a smaller amount of electrical energy have been classified as miscellaneous equipment for estimating purposes. Items that have been surveyed and classified as miscellaneous equipment include: hot water heaters, plug load items, and kitchen equipment. Smaller equipment items usually located in administrative and vending areas that plug into standard 110 to 120 voltage electrical outlets are classified as electrical plug loads. KPPC has estimated that the total amount of electrical energy used by these miscellaneous equipment items is approximately **71,165 kWh/yr**. A list of this equipment can be found in **APPENDIX E**.

2.1.2 Natural Gas

As mentioned within the Energy Bill Analysis, natural gas constitutes a smaller amount of City Hall's annual energy usage and cost at 6,447 ccf (644.7 MMBtu) and $10,907 per year. Equipment items that utilize natural gas include two water heaters and nine HVAC units. The approximate number of natural gas heating equipment items, total rated energy input (Btu/hr) and total annual energy usage (MMBtu/yr) is provided within **Table 6**. A listing of gas-fired equipment used at City Hall along with specific operational data is provided within **APPENDIX F**. City Hall also has a solar hot water system which has saved Frankfort approximately 164 MMBtu in water heating expenses as of February 2010.

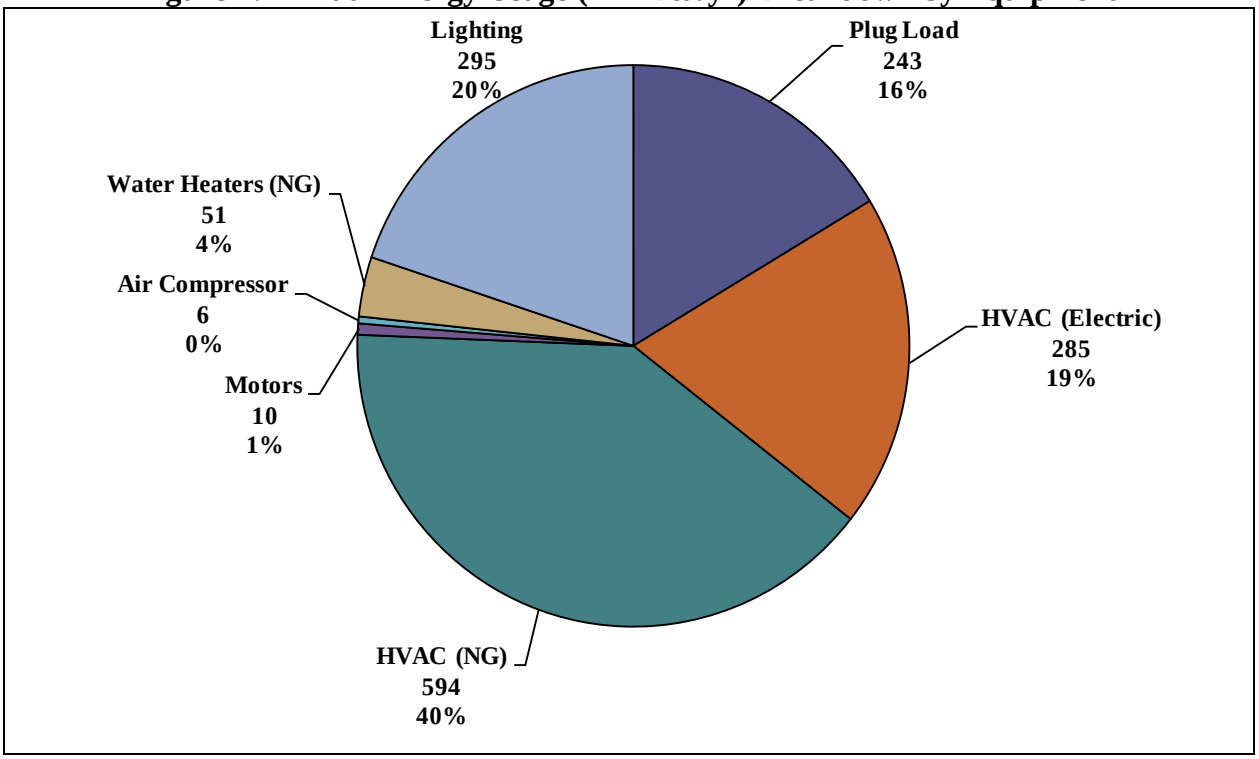
Table 6: Natural Gas Equipment Inventory Summary

Equipment Type	Number of Units	Total Rated Energy Input (Btu/Hr)	Total Annual Energy Usage (MMBtu/Yr)
Water Heater	2	64,000	**51**
HVAC Heaters	9	1,015,000	**594**
TOTAL	**11**	**1,079,000**	**645**

2.2 End-Use Characterization and Energy Balance

As previously mentioned, a majority of City Hall's energy usage profile consists of electrical energy. Major equipment items using electrical energy include: HVAC, facility lighting, motors, air compressors and office plug load. A total annual energy breakdown by major equipment categories is provided within **Figure 1**. As shown, natural gas heating constitutes a majority of City Hall's annual natural gas energy usage by using 594 MMBtu/yr, which represents 40% of City Hall's total annual energy usages. The next largest equipment energy users are lighting, electric HVAC, and plug load, using 20%, 19% and 16% of City Hall's total annual energy, respectively.

Figure 1: Annual Energy Usage (MMBtu/yr) Breakdown by Equipment



3.0 ENVIRONMENTAL SUSTAINABILITY OPPORTUNITIES (ESOs)

The following section discusses ESOs for City Hall. ESOs may include the current practice, proposed ESO, estimated anticipated savings, estimated implementation costs and estimated payback periods. **APPENDIX G** contains data used for calculations so that facility personnel may utilize data to make changes or examine other scenarios. Estimations documented in the ESOs are based upon information provided by the facility or external sources, such as vendors. Engineering assumptions are made when necessary information is not readily available.

Practices or procedures already in place as shown in **Table 7** help reduce the facility's energy consumption.

Table 7: Best Energy Practices

Energy Practice	Result
T8 light fixtures are used in some areas	Increased luminance and reduced electricity and demand consumption
Setback temperature after hours	Reduce HVAC cycle frequency and energy usage

3.1 Recommendation ESO No. 1: Implement an Energy Management Program

In order to effectively manage a facility's energy usage, an Energy Management Program (EMP) should be developed that has the support from top leadership and is driven by a cross-functional team. The first step in developing an EMP is to develop a policy that upper management, supports and stresses to all employees within the organization. While a leader is necessary to spearhead the effort, identifying and selecting a cross-functional team is critical to a EMPs success. The team should have representatives from all of the major departments within the facility. Once a policy and team has been established, KPPC recommends that several tasks be addressed to help the team launch EMP initiatives:

- **Develop a Plug Load Management Program:** KPPC conducted an assessment of non-essential items being left on or plugged in during times of non-use or during times of temporary shutdowns (i.e. nights and weekends). Electrical power consumed by electronic appliances while switched off or in standby mode is called phantom load. From City Hall's list of miscellaneous office equipment, **71,165 kWh/yr** (**243 MMBtu/yr**) of energy is consumed by the phantom loads. By encouraging employees to unplug unused equipment or turn off power strips when not in use, City Hall could realize approximately **$778** annually with an **immediate** payback. Take inventory of non-essential equipment left on and address these items with the appropriate department teams. A list of equipment can be found in **APPENDIX E** under miscellaneous equipment.

- **Develop a Shutdown Procedure:** Conduct an assessment of non-essential items being left on during temporary shutdowns (i.e. nights and weekends) and during longer shutdowns (scheduled annual shutdowns or extended holiday breaks). Take inventory of

non-essential equipment left on and address these items with the appropriate department teams.

Typically EMPs that are developed with top leadership support and utilize a cross-functional team(s) provide a financial savings of 3% of the facility's total energy usage cost. By developing a fully functioning EMP, City Hall would realize an approximate annual electric savings of **12,553 kWh/yr (43 MMBtu/yr)** and an approximate total annual financial savings of **$942**. While this effort would require internal resources and employees' time, the cost to implement such an effort would be small in comparison to the potential savings. Payback for this effort is essentially **immediate**. If City Hall would need training for the cross-functional team or to educate employees about energy efficiency, KPPC would be available to assist and provide specific training to help establish the EMP.

3.2 Recommendation ESO No. 2: Replace T-12 with Energy Efficient T-8 Lighting

The primary lighting throughout the office areas is supplied by 34 and 40-W T-12 lamps. Newer portions of the office (Public Works); however, are utilizing more efficient T-8 lamps. Several options are available for replacing 34 and 40-W fluorescent lamps. The most common replacement is a combination of 32 W T-8 lamps and electronic ballasts that are required to operate these lamps. This combination provides higher quality light while using less energy than the existing magnetic ballasts and 34/40 W T-12 fluorescent lamps. The triphosphor type T-8 lamps provide light that renders color nearly as well as sunlight, thus providing excellent lighting for office and production. A 32 W T-8 lamp provides 5% more light than a 34 W T-12 lamp. An added benefit to electronic ballasts is the high frequency at which they operate, eliminating the flicker often associated with standard older fluorescent lighting.

This analysis considers replacing all of the existing T-12 fixtures with T-8 fixtures. Each new fixture would contain the same number of bulbs as the existing fixture; however, some areas currently are overlit based on the recommended range of footcandles for the area type. These areas are recommended to downsize the number of fixtures and implementation costs are not calculated as a one-to-one replacement. The implementation costs for this recommendation includes the equipment and labor costs required for the new lamps and ballasts. Breaking down the costs:

- Lamp Replacement: $1,369
- Ballast Replacement: $9,529
- Labor: $4,280

The total estimated implementation cost is $15,178. An annual electric usage savings of 28,702 kWh and annual billed demand savings of 134 kW would be expected and result in a total annual cost savings of **$1,888/yr (28,702 kWh/yr**). The lighting upgrade would pay for the implementation cost after **eight years**. A shorter payback could be realized if legislative incentives were utilized. A listing of such incentives is provided within Section 7.0 and **APPENDIX H**.

The energy savings, cost savings, and implementation costs presented in this analysis are based upon total replacement of all applicable fixtures in the facility at once. This would be the case if a

facility has sufficient capital, loans or other funding available for implementation. This method would result in a large and immediate energy savings, but would require a large initial investment. Additional information about implementing lighting upgrades are provided below:

- When removing lamps, the ballast should be disconnected since the ballast draws energy even when there are no lamps in the fixture.

- Ballasts typically draw from 5% to 15% of the energy consumed by the lamps. The values in the calculations above include the usage by the ballasts.

3.3 Recommendation ESO No. 3: Install Programmable Thermostats

A majority of the existing thermostats are not programmable and are not set back in the evening hours. Interpretation of monthly utility bills indicates that natural gas is used for heating the facility about six months (180 days) of the year. Natural gas used for heating the facility is about 594 MMBtu annually. For heating the facility, the natural gas cost is about $1.69/ccf. According to monthly utility bills, electricity used for cooling the facility is used for about six months (180 days). Electricity used for cooling and ventilating the facility is about 285 MMBtu annually. For cooling and ventilation for the facility, the electricity cost is about $0.06/kWh.

The facility should install programmable thermostats and adjust the temperature in the evening and weekends accordingly (dependent on summer or winter time).

There are about 7 thermostats that control the heat and cooling throughout the building. A programmable thermostat can cost anywhere from $30 to $250. For this recommendation, it is estimated that the cost of a programmable thermostat will cost $50 and take 1.5 hours to install at a labor cost of $40/hr. The total cost for programmable thermostats is about $350 and installation cost is about $420.

The facility pays about $11,900 for heating, cooling and ventilation. With programmable thermostats, City Hall should save about 2% for both cooling and heating. Typically this percentage would be higher but facility personnel indicated temperature setback is already happening at City Hall. The total estimated savings is therefore **$237/yr**. The estimated total energy savings is about **18 MMBtu - 6 MMBtu/yr electric** and **12 MMBtu/yr natural gas** - annually. Total implementation costs are $770. The estimated payback for installing programmable thermostats is about **3.2** years

3.4 Recommendation ESO No. 4: Upgrade HVAC Systems

Modern high efficiency HVAC systems are currently available up to SEER values of 21. By our estimates, City Hall could upgrade their HVAC systems in order to have more efficient cooling throughout the facility. KPPC could not obtain SEER values for existing units, but by KPPC's estimates and the age range of the units, more energy efficient units could be installed. Using a SEER value of 10 for the existing units, installing new units that are at least 18 SEER could potentially reduce City Hall's usage by **39,302 kWh/yr** which corresponds with an annual

savings of **$2,415**. We approximated the difference between high efficiency units and standard units using the ENERGY STAR calculator. With City Hall's tonnage between two and four tons per unit, the average price difference is $700 per unit ($3,400 approximate total cost per unit). Using this, the longest payback would be for the 2 ton units which range from **two to three years**. However, the exact cost of this upgrade is unknown and HVAC venders should be contacted for more detailed information.

4.0 GENERAL RECOMMENDATIONS

KPPC examined a number of other possible EMO's but analysis was not completed due to insufficient information gathered. These recommendations are possible EMO's but further research and analysis would be necessary to verify technical feasibility and calculate potential paybacks.

4.1 Install New Windows

City Hall currently has new windows in room 115 in the back of the building. Since the installation, employees have noticed that comfort levels in the room are higher, having to compensate less for heat loss on cold days or heat gain on warm days. Installing new windows throughout the building will amplify this effect for all employees at City Hall, as well as decrease HVAC energy usage. More detailed analysis would be required to determine savings and potential payback.

4.2 Replace Reznor Gas Heater

The firestation currently uses a Reznor Gas Heater (200,000 Btu/hr) to heat the garage space. Personnel indicated that they would like a more efficient way of heating the garage. City Hall should look into radiant or infrared gas heating sources, which could provide more heat throughout the room while using less gas. KPPC recommends City Hall price products based on their specific needs. If assistance is needed for analysis of a new unit, City Hall personnel are welcome contact KPPC.

5.0 GREEN HOUSE GAS EMISSIONS

The following are statistics about green house gas (GHG) emissions for a coal power plant from combustion of coal:

- One ton of carbon-dioxide (GWP =1) is released with generating 1.07 MWh of electricity
- One ton of methane(GWP = 23) is released with generating 91,500 MWh of electricity
- One ton of NO_x (GWP = 296) is released with generating 810 MWh of electricity

Natural gas combustion emission factors are:

- One ton of carbon-dioxide is released with combustion of 20.1 MMBtu of natural gas

For the purpose of this report, only reductions in carbon-dioxide emissions are quantified. With the estimated electricity savings of **125,154 kWh/yr**, **117 tons** of carbon-dioxide emissions and natural gas savings of **12 MMBtu/yr**, **1194 lbs** of carbon-dioxide emissions could be reduced.

Data Source:

1. Kentucky At Work Reporting Resources. "Air Emissions Reduction – Calculation Spreadsheet." (Kentucky Department for Energy Development & Independence, April 2010). http://www.energy.ky.gov/recovery/reporting/

6.0 LEGISLATIVE INCENTIVES FOR ENERGY EFFICIENCY

The state and federal governments, regional business development lenders, and utilities offer incentives to promote and support energy efficiency efforts. A review of available incentives was obtained from the Database of State Incentives for Renewables & Energy (DSIRE) website (www.dsireusa.org) and from the Kentucky Governor's Office of Energy Policy (KY GOEP) website (www.energy.ky.gov/). The list of incentives provided is not exhaustive and Frankfort is encouraged to visit the DSIRE and KY GOEP websites to learn more about incentives offered. In addition, Frankfort is also encouraged to visit the Kentucky Cabinet for Economic Development website (http://www.thinkkentucky.com/kyedc/kybizince.aspx) which encourages economic development, business expansion, and job creation through an array of financial assistance and tax credit programs. All incentives and rebates are located in **APPENDIX H**.

APPENDIX LIST

A. HVAC Survey
B. Lighting Survey
C. Motor Survey
D. Air Compressor Survey
E. Miscellaneous Equipment Survey
F. Natural Gas Equipment Survey
G. Energy Management Opportunity Analysis
H. Legislative Incentives for Energy Efficiency
I. Pollution Prevention Resource

Appendix A: HVAC Survey

Frankfort City Hall - Split System Survey										
Equipment	**Area Served**	**No. of Units**	**Cooling Capacity (tons)**	**Hrs/Day**	**Days/Yr**	**Annual Hours of Operation**	**Load Factor[1]**	**Duty Factor[2]**	**SEER[3](Btu/ W/hr)**	**Total Annual Energy Use(kWh/yr)**
Sanyo	Room 111	1	2	24	365	8,760	1.00	0.60	10.00	12,614
Trane	Planning/Codes	1	3	24	200	4,800	1.00	0.65	10.00	11,232
Carrier	Fire Dept Front	1	4	24	200	4,800	1.00	0.65	10.00	14,976
Luxair	Front/Lobby Area	1	2	24	200	4,800	1.00	0.65	10.00	7,488
Trane	Planning/Pub. Works	1	3	24	200	4,800	1.00	0.65	10.00	11,232
Luxair	Pub. Works/Fire Dept	1	3	24	200	4,800	1.00	0.65	10.00	11,232
Trane	Council Chambers	1	3	24	200	4,800	1.00	0.65	10.00	11,232
Total		**7**	**20**							**80,006**

Notes

1. Load Factor is the ratio of average power consumption to the nominal rated input.
2. Duty Factor is the fraction of the equipment operating hours when the equipment is running (cycling on).
3. Approximated - Seasonal Energy Efficiency Ratio (SEER) is a measure of efficiency used for split systems.

Frankfort City Hall - Window A/C Survey									
Equipment	**Area Served**	**No. of Units**	**Cooling Capacity (Btu/hr)**	**Hrs/ Day**	**Days/Yr**	**Annual Operating Hours (hrs/yr)**	**Duty Factor[1]**	**Efficiency SEER[2](Btu/ W/hr)**	**Total Annual Energy Use(kWh/yr)**
Window Unit	Fire 2nd Floor	2	6000	11	200	2,200	0.70	8	2310
Window Unit	2nd Floor Office	1	6000	11	200	2,200	0.70	8	1155
Total		**3**							**3,465**

Notes

1. Duty Factor is the fraction of the equipment operating hours when the equipment is running (cycling on).
2. Approximated - Seasonal Energy Efficiency Ratio (SEER) is a measure of efficiency used for window A/C.

Appendix B: Lighting Survey

Frankfort City Hall - Lighting Survey									
Building Area	Avg. Light Level (fc)	Type of Lamp	Fixture Code	No. of Fixtures	Fixture Power (watts)	Total Power (watts)	Operating Hours (hrs/yr)	Annual Energy Usage (kWh/yr)	Annual Average Demand (kW/yr)
101	60	4' T-12	A	6	96	576	2,550	1,469	7
102	33	4' T-12	A	6	96	576	2,550	1,469	7
103	50	4' T-12	A	5	96	480	2,550	1,224	6
104	40	4' T-12	A	1	96	96	2,550	245	1
105	30	4' T-12	A	6	96	576	2,550	1,469	7
106	40	4' T-12	A	1	96	96	2,550	245	1
107	44	4' T-12	A	5	96	480	2,550	1,224	6
108	44	4' T-12	A	6	96	576	2,550	1,469	7
109	68	4' T-12	B	6	192	1,152	2,550	2,938	14
110	67	4' T-12	A	6	96	576	2,550	1,469	7
111	20	4' T-12	B	11	192	2,112	2,550	5,386	25
112	38	4' T-12	B	2	192	384	2,550	979	5
113	42	4' T-12	B	4	192	768	2,550	1,958	9
114	83	4' T-8	C	2	132	264	2,550	673	3
115	45	4' T-12	B	6	192	1,152	2,550	2,938	14
116	126	4' T-8	C	2	132	264	2,550	673	3
117	26	4' T-12	B	2	192	384	2,550	979	5
118	75	4' T-8	C	6	132	792	2,550	2,020	10
119	46	4' T-12	A	2	96	192	2,550	490	2
120	38	4' T-12	B	12	192	2,304	2,550	5,875	28
121	30	4' T-12	A	4	96	384	2,550	979	5
122	138	4' T-12	B	4	192	768	2,550	1,958	9
122	138	4' T-12	A	1	96	96	2,550	245	1
123	27	4' T-12	A	2	96	192	2,550	490	2
124	52	4' T-12	B	42	192	8,064	2,550	20,563	97
125	31	4' T-12	A	4	96	384	2,550	979	5
126	24	4' T-12	B	1	192	192	2,550	490	2
126	24	4' T-12	A	4	96	384	2,550	979	5
127	41	4' T-12	A	4	96	384	2,550	979	5
128	26	4' T-12	A	6	96	576	2,550	1,469	7
129	20	4' T-12	A	2	96	192	2,550	490	2
130	0	4' T-12	A	5	96	480	2,550	1,224	6
131	34	4' T-12	A	4	96	384	2,550	979	5
133	20	4' T-12	A	4	96	384	2,550	979	5
137	44	4' T-12	B	4	192	768	2,550	1,958	9
139	50	4' T-12	B	4	192	768	2,550	1,958	9
Upstairs	25	4' T-12	A	2	96	192	2,550	490	2
Hallway 1	60	4' T-12	B	7	192	1,344	2,550	3,427	16
Hallway 2	48	4' T-12	B	10	192	1,920	2,550	4,896	23
Hallway 3	30	4' T-12	B	12	192	2,304	2,550	5,875	28
Totals				**223**	**5,388**	**33,960**		**86,599**	**407**

Appendix C: Motor Survey

Frankfort City Hall Motor Survey																				
Equipment Description	**Location**	**Hp**	**kW**	**No. Motors**	**Total kW**	**Hrs Per Day**	**Days Per Wk**	**Wks Per Yr**	**Hrs Per Yr**	**Duty Factor[1]**	**Load Factor[2]**	**Current Motor Efficiency**	**Current Energy Usage (kWh)**	**Proposed Motor Efficiency**	**Proposed Energy Usage**	**Annual Energy Savings (kWh/yr)[3]**	**Annual Demand Reduction (kW/yr)**	**Energy Cost Savings ($/yr)**	**Demand Cost Savings ($/yr)**	**Total Cost Savings ($/yr)**
Washer	Garage	0.5	0.37	1	0.373	2	3	52	312	0.3	1	0.73	48	0.81	43	5	0.6	0	0	0
Dryer	Garage	0.5	0.37	1	0.373	2	3	52	312	0.3	1	0.73	48	0.81	43	5	0.6	0	0	0
Fans	Fire Garage	1	0.3	1	0.3	24	7	50	8400	0.8	1	0.74	2724	0.817	2468	257	0.5	15	0	15
Total		**21**	**1.05**	**3**	**1.046**								**2820**		**2554**	**266**	**1.7**	**15**	**0**	**15**

Number of months considered per year = 12
Electric Energy cost = $ 0.06 /kWh
Demand Cost = $ 0 /kW

Note

[1] For calculating Duty Factor, either 1) use hrs/dy, dys/wk and wks/yr to calculate Annual Operating Hours of the equipment and delete Duty Factor, or
2) If percentage of facility Annual Operating Hours that the equipment operates is known or estimated, use this number as Duty Factor along with Annual Operating Hours of the facility.

[2] Load Factor is the ratio of average energy consumption to the nominal rated input

[3] For calculating Annual kWh savings, use hrs/dy, dys/wk and wks/yr to calculate motor operational hrs/yr and

Appendix D: Air Compressor Survey

Frankfort City Hall - Air Compressor Survey													
Equipment Description	**Manufacturer**	**HP**	**kW**	**No. of Motors**	**Total kW**	**Hrs/ Day**	**Days/ Yr**	**Annual Operating Hours (hrs/yr)**	**Load Factor[1]**	**Duty Factor[2]**	**Compressor Motor Efficiency**	**Total Annual Energy Use[3] (kWh/yr)**	**Comments**
Compressed Air Unit	Bauer	20	14.9	1	14.9	2.0	50.0	100	1.00	1.00	95.00%	1,728	Filling Air Tanks
Total		**20**		**1**	**14.9**							**1,728**	

Notes

1. Load Factor is the ratio of average power consumption to the nominal rated input.
2. Duty Factor is the fraction of the equipment operating hours when the equipment is running (cycling on).
3. Includes 10% added power consumption over name plate to account for cooling fans.

Coversion Factors

1 motor HP = 0.746 kW

Appendix E: Miscellaneous Equipment Survey

Plug Load Examination Sheet													
Average Electricity Cost (per kWh) =					$0.062								
Electrical Appliance	Quantity in Use	Usage (hrs/day)	Usage (day/week)	Usage (week/year)	Wattage (running)	Cycle Time	Wattage (not running)	Yearly kWh (running)	Yearly kWh (phantom)	Total Yearly kWh	Annual Cost (running)	Annual Cost (phantom)	Total (Running & Phantom) Annual Cost
Coffee Maker	7	4	5	50	900	33%	1	2079.0	58.8	2137.8	$128.90	$3.65	$132.55
Desktop Computer	67	8	5	50	175	100%	1.5	23450.0	677.0	24127.0	$1,453.90	$41.97	$1,495.87
Monitor (LCD)	52	8	5	50	20	100%	0.5	2080.0	175.1	2255.1	$128.96	$10.86	$139.82
Inkjet Printer	15	5	5	50	20	10%	5	37.5	645.8	683.3	$2.33	$40.04	$42.37
Laser Printer	10	3	5	50	200	10%	20	150.0	1732.2	1882.2	$9.30	$107.40	$116.70
Table Fan	10	2	5	25	30	100%	0	75.0	0.0	75.0	$4.65	$0.00	$4.65
Television	14	2	5	50	80	100%	5	560.0	576.5	1136.5	$34.72	$35.74	$70.46
VCR	2	2	1	25	25	100%	3	2.5	52.1	54.6	$0.16	$3.23	$3.39
Large Fridge (up to 6.0 cu. Ft.)	2	24	7	52	300	50%	0	2620.8	0.0	2620.8	$162.49	$0.00	$162.49
Space Heater	11	5	5	25	1500	20%	0	2062.5	0.0	2062.5	$127.88	$0.00	$127.88
Desk Lamp	14	5	5	40	60	100%	0	840.0	0.0	840.0	$52.08	$0.00	$52.08
Cold Drink Vending Machine	3	24	7	52	700	50%	150	9172.8	1965.6	11138.4	$568.71	$121.87	$690.58
Microwave	6	2	5	50	1000	100%	2.9	3000.0	143.3	3143.3	$186.00	$8.88	$194.88
Scanners	5	5	5	50	20	100%	0.5	125.0	18.7	143.7	$7.75	$1.16	$8.91
Copier	10	8	5	50	900	25%	62	4500.0	5106.3	9606.3	$279.00	$316.59	$595.59
Fax	5	8	5	50	80	10%	31	80.0	1323.1	1403.1	$4.96	$82.03	$86.99
Ice Machine	1	8	5	50	1480	30%	0	888.0	0.0	888.0	$55.06	$0.00	$55.06
Mini Fridge	6	24	7	52	100	50%	0	2620.8	0.0	2620.8	$162.49	$0.00	$162.49
Computer Spkrs	24	1	5	50	5	100%	0	30.0	0.0	30.0	$1.86	$0.00	$1.86
Security Camera	7	24	7	52	7.5	100%	0	458.6	0.0	458.6	$28.44	$0.00	$28.44
Toaster	1	1	2	50	1200	100%	0	120.0	0.0	120.0	$7.44	$0.00	$7.44
Router	2	24	7	52	4	100%	0	69.9	0.0	69.9	$4.33	$0.00	$4.33
Treadmill	1	2	7	52	1725	100%	0	1255.8	0.0	1255.8	$77.86	$0.00	$77.86
Washer	1	1	5	50	2000	100%	0	500.0	0.0	500.0	$31.00	$0.00	$31.00
Dryer	1	1	5	50	2000	100%	0	500.0	0.0	500.0	$31.00	$0.00	$31.00
Shredder	5	3	5	50	90	100%	0	337.5	0.0	337.5	$20.93	$0.00	$20.93
Typewriters	3	2	5	50	60	100%	0	90.0	0.0	90.0	$5.58	$0.00	$5.58
CB Radio	6	24	7	52	30	50%	3	786.2	78.6	864.9	$48.75	$4.87	$53.62
Phone Charger	4	3	5	50	40	100%	0	120.0	0.0	120.0	$7.44	$0.00	$7.44
Totals								**58612.0**	**12553.3**	**71165.2**	**3633.9**	**778.3**	**$4,412.24**

Appendix F: Natural Gas Equipment Survey

Frankfort City Hall - Natural Gas Heater Survey												
Equipment Type	**Manufacturer**	**Area Served**	**No. of Units**	**Rated Heat Output (Btu/h)**	**Heat Input (Btu/h)**	**Hrs/ Day**	**Days/ Yr**	**Annual Operating Hours (hrs/yr)**	**Load Factor[1]**	**Duty Factor[2]**	**AFUE[3]**	**Total Annual Energy Use (MMBtu/yr)**
Energy Heater	Lennox	Fire Dept	1	60,000	75,000	24	125	3,000	1.00	0.20	0.80	43.9
Energy Heater	Lennox	Fire Dept	1	60,000	75,000	24	125	3,000	1.00	0.20	0.80	43.9
Energy Heater	Carrier	Fire Dept	1	60,000	75,000	24	125	3,000	1.00	0.20	0.80	43.9
Energy Heater	Luxair	Attic	1	60,000	75,000	24	125	3,000	1.00	0.20	0.80	43.9
Energy Heater	Reznor	Garage	1	200,000	250,000	24	125	3,000	1.00	0.20	0.80	146.3
Energy Heater	Trane	Public Works	1	100,000	120,000	24	125	3,000	1.00	0.20	0.80	70.2
Energy Heater	Trane	Room 129	1	100,000	120,000	24	125	3,000	1.00	0.20	0.80	70.2
Energy Heater	Luxair	Attic	1	80,000	100,000	24	125	3,000	1.00	0.20	0.80	58.5
Energy Heater	Trane	Council Chambers	1	100,000	125,000	24	125	3,000	1.00	0.20	0.80	73.1
Total			**9**		1,015,000							**594**

Notes

1. Load Factor is the ratio of average gas consumption to the nominal rated input.
2. Duty Factor is the fraction of the equipment operating hours when the equipment is running (cycling on).
3. Annual Fuel Utilization Efficiency (AFUE) is the ratio of annual output of useful energy or heat to the annual energy input.

Coversion Factors

1 MMBtu = 1,000,000 Btu

Appendix G: Energy Management Opportunity Analysis

Frankfort City Hall - Proposed Lighting														
Building Area	Existing Fixture Code	Existing Lighting Type	Current No. of Fixtures	Existing Light Level (fc)	Proposed Lighting Type	New Light Level (fc)	% of Existing Lumen Output	Proposed No. of Fixtures	Proposed Fixture Power (watts)	Proposed Total Power (watts)	Total Electric Usage (kWh/yr)	Annual Average Demand (kW/yr)	Annual Energy Savings (kWh/yr)	Annual Demand Reduction (kW/yr)
101	A	4' T-12	6	60	4' T-8	46	77%	5	66	330	842	4	627	3
102	A	4' T-12	6	33	4' T-8	30	92%	6	66	396	1,010	5	459	2
103	A	4' T-12	5	50	4' T-8	46	92%	5	66	330	842	4	382	2
104	A	4' T-12	1	40	4' T-8	37	92%	1	66	66	168	1	77	0
105	A	4' T-12	6	30	4' T-8	28	92%	6	66	396	1,010	5	459	2
106	A	4' T-12	1	40	4' T-8	37	92%	1	66	66	168	1	77	0
107	A	4' T-12	5	44	4' T-8	41	92%	5	66	330	842	4	382	2
108	A	4' T-12	6	44	4' T-8	41	92%	6	66	396	1,010	5	459	2
109	B	4' T-12	6	68	4' T-8	52	77%	5	132	660	1,683	8	1,255	6
110	A	4' T-12	6	67	4' T-8	51	77%	5	66	330	842	4	627	3
111	B	4' T-12	11	20	4' T-8	18	92%	11	132	1,452	3,703	17	1,683	8
112	B	4' T-12	2	38	4' T-8	35	92%	2	132	264	673	3	306	1
113	B	4' T-12	4	42	4' T-8	39	92%	4	132	528	1,346	6	612	3
114	C	4' T-8	2	83	0	83	100%	2	132	264	673	3	0	0
115	B	4' T-12	6	45	4' T-8	41	92%	6	132	792	2,020	10	918	4
116	C	4' T-8	2	126	0	63	50%	1	132	132	337	2	336	2
117	B	4' T-12	2	26	4' T-8	24	92%	2	132	264	673	3	306	1
118	C	4' T-8	6	75	0	50	67%	4	132	528	1,346	6	674	3
119	A	4' T-12	2	46	4' T-8	42	92%	2	66	132	337	2	153	1
120	B	4' T-12	12	38	4' T-8	35	92%	12	132	1,584	4,039	19	1,836	9
121	A	4' T-12	4	30	4' T-8	28	92%	4	66	264	673	3	306	1
122	B	4' T-12	4	138	4' T-8	64	46%	2	132	264	673	3	1,285	6
122	A	4' T-12	1	138	4' T-8	127	92%	1	66	66	168	1	77	0
123	A	4' T-12	2	27	4' T-8	25	92%	2	66	132	337	2	153	1
124	B	4' T-12	42	52	4' T-8	48	92%	42	132	5,544	14,137	67	6,426	30
125	A	4' T-12	4	31	4' T-8	29	92%	4	66	264	673	3	306	1
126	B	4' T-12	1	24	4' T-8	22	92%	1	132	132	337	2	153	1
126	A	4' T-12	4	24	4' T-8	22	92%	4	66	264	673	3	306	1
127	A	4' T-12	4	41	4' T-8	38	92%	4	66	264	673	3	306	1
128	A	4' T-12	6	26	4' T-8	24	92%	6	66	396	1,010	5	459	2
129	A	4' T-12	2	20	4' T-8	18	92%	2	66	132	337	2	153	1
130	A	4' T-12	5	0	4' T-8	0	92%	5	66	330	842	4	382	2
131	A	4' T-12	4	34	4' T-8	31	92%	4	66	264	673	3	306	1
133	A	4' T-12	4	20	4' T-8	18	92%	4	66	264	673	3	306	1
137	B	4' T-12	4	44	4' T-8	41	92%	4	132	528	1,346	6	612	3
139	B	4' T-12	4	50	4' T-8	46	92%	4	132	528	1,346	6	612	3
Upstairs	A	4' T-12	2	25	4' T-8	23	92%	2	66	132	337	2	153	1
Hallway 1	B	4' T-12	7	60	4' T-8	47	79%	6	132	792	2,020	10	1,407	7
Hallway 2	B	4' T-12	10	48	4' T-8	44	92%	10	132	1,320	3,366	16	1,530	7
Hallway 3	B	4' T-12	12	30	4' T-8	28	92%	12	132	1,584	4,039	19	1,836	9
Total			**223**					**214**		**22,704**	**57,897**	**273**	**28,702**	**134**

Frankfort City Hall - Cost Savings & Implementation Costs									
Building Area	Annual Energy Cost Savings ($/yr)	Annual Demand Cost Savings ($/yr)	Annual Lamp Costs Savings ($/yr)	Annual Total Cost Savings ($/yr)	Total New Lamp Costs ($)	Total New Ballast Cost ($)	Total Labor Costs ($)	Total Implementation Costs ($)	Simple Payback (yrs)
101	$40	$0	$1	$41	$19.90	$139	$100	$258	6.3
102	$29	$0	$0	$29	$23.88	$166	$120	$50	2
103	$24	$0	$0	$24	$19.90	$139	$100	$258	11
104	$5	$0	$0	$5	$3.98	$28	$20	$52	10
105	$29	$0	$0	$29	$23.88	$166	$120	$310	11
106	$5	$0	$0	$5	$3.98	$28	$20	$52	10
107	$24	$0	$0	$24	$19.90	$139	$100	$258	11
108	$29	$0	$0	$29	$23.88	$166	$120	$310	11
109	$79	$0	$2	$81	$39.80	$277	$100	$417	5
110	$40	$0	$1	$41	$19.90	$139	$100	$258	6
111	$106	$0	$2	$108	$87.56	$609	$220	$917	9
112	$19	$0	$0	$19	$15.92	$111	$40	$167	9
113	$39	$0	$1	$40	$31.84	$222	$80	$333	8
114	$19	$0	$0	$19	$15.92	$111	$40	$167	9
115	$58	$0	$1	$59	$47.76	$332	$120	$500	8
116	$41	$0	$1	$42	$7.96	$55	$20	$83	2
117	$19	$0	$0	$19	$15.92	$111	$40	$167	9
118	$100	$0	$3	$103	$31.84	$222	$80	$333	3
119	$10	$0	$0	$10	$7.96	$55	$40	$103	10
120	$116	$0	$2	$118	$95.52	$665	$240	$1,000	8
121	$19	$0	$0	$19	$15.92	$111	$80	$207	11
122	$81	$0	$2	$83	$15.92	$111	$40	$167	2
122	$5	$0	$0	$5	$3.98	$28	$20	$52	10
123	$10	$0	$0	$10	$7.96	$55	$40	$103	10
124	$406	$0	$7	$413	$334.32	$2,327	$840	$3,501	8
125	$19	$0	$0	$19	$15.92	$111	$80	$207	11
126	$10	$0	$0	$10	$7.96	$55	$20	$83	8
126	$19	$0	$0	$19	$15.92	$111	$80	$207	11
127	$19	$0	$0	$19	$15.92	$111	$80	$207	11
128	$29	$0	$0	$29	$23.88	$166	$120	$310	11
129	$10	$0	$0	$10	$7.96	$55	$40	$103	10
130	$24	$0	$0	$24	$19.90	$139	$100	$258	11
131	$19	$0	$0	$19	$15.92	$111	$80	$207	11
133	$19	$0	$0	$19	$15.92	$111	$80	$207	11
137	$39	$0	$1	$40	$31.84	$222	$80	$333	8
139	$39	$0	$1	$40	$31.84	$222	$80	$333	8
Upstairs	$10	$0	$0	$10	$7.96	$55	$40	$103	10
Hallway 1	$89	$0	$2	$91	$47.76	$332	$120	$500	5
Hallway 2	$97	$0	$2	$99	$79.60	$554	$200	$834	8
Hallway 3	$116	$0	$2	$118	$95.52	$665	$240	$1,000	8
Total	**$1,910**	**$0**	**$36**	**$1,946**	**$1,369**	**$9,529**	**4,280**	**$14,918**	**8**

Frankfort City Hall - Split System Survey													
Equipment	**Area Served**	**No. of Units**	**Cooling Capacity (tons)**	**Annual Hours of Operation**	**Load Factor[1]**	**Duty Factor[2]**	**SEER[3](Btu/W/hr)**	**Total Annual Energy Use(kWh/yr)**	**Previous Total Energy Use (kWh/yr)**	**Energy Savings (kWh/yr)**	**Energy Cost Savings ($/yr)**	**Implementation Cost Premium ($/unit)**	**Simple Payback (Years)**
Sanyo	Room 111 backup	1	2	8,760	1.00	0.60	**18.00**	7008	12,614	5606	$344	$711	2.1
Trane	Planning/Codes	1	3	4,320	1.00	0.65	**18.00**	5616	11,232	5616	$345	$697	2.0
Carrier	Fire Dept Front	1	4	4,320	1.00	0.65	**18.00**	7488	14,976	7488	$460	$473	1.0
Luxair	Front/Lobby Area	1	2	4,320	1.00	0.65	**18.00**	3744	7,488	3744	$230	$711	3.1
Trane	Planning/Pub. Works	1	3	4,320	1.00	0.65	**18.00**	5616	11,232	5616	$345	$697	2.0
Luxair	Pub. Works/Fire Dept	1	3	4,320	1.00	0.65	**18.00**	5616	11,232	5616	$345	$697	2.0
Trane	Council Chambers	1	3	4,320	1.00	0.65	**18.00**	5616	11,232	5616	$345	$697	2.0
Total		**7**	**20**					**40,704**	**80,006**	**39302**	**$2,415**	**$4,683**	**2**

Notes

1. Load Factor is the ratio of average power consumption to the nominal rated input.
2. Duty Factor is the fraction of the equipment operating hours when the equipment is running (cycling on).
3. Seasonal Energy Efficiency Ratio (SEER) is a measure of efficiency used for split systems.

Appendix H: Legislative Incentives for Energy Efficiency

U.S. Department of Energy- Loan Guarantee Program

Incentive Type:	Federal Loan Programs
Eligible Efficiency Technologies:	Lighting, Windows, Roofs, Yes; specific technologies not identified
Eligible Renewable/ Other Technologies	Solar Thermal Electric, Solar Thermal Process Heat, Photovoltaics, Wind, Hydroelectric, Renewable Transportation Fuels, Geothermal Electric, Fuel Cells, Manufacturing Facilities, Daylighting, Tidal Energy, Wave Energy, Ocean Thermal, Biodiesel
Applicable Sectors:	Commercial, Industrial, Nonprofit, Schools, Local Government, State Government, Agricultural, Institutional, Any non-federal entity
Amount:	Varies. Program focuses on projects with total project costs over $25 million.
Maximum Incentive:	None Stated
Terms:	Full repayment is required over a period not to exceed the lesser of 30 years or 90% of the projected useful life of the physical asset to be financed
Website	http://www.lgprogram.energy.gov
Authority 1:	42 USC § 16511 et seq.
Authority 2:	10 CFR 609

Summary:

Innovative Technology Loan Guarantee Program:

Title XVII of the federal *Energy Policy Act of 2005* (EPAct 2005) authorized the U.S. Department of Energy (DOE) to issue loan guarantees for projects that "avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases; and employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued." The loan guarantee program has been authorized to offer more than $10 billion in loan guarantees for energy efficiency, renewable energy and advanced transmission and distribution projects. The authority to issue loan guarantees granted by EPAct 2005 expires on September 30, 2009.

DOE actively promotes projects in three categories: (1) manufacturing projects, (2) stand-alone projects, and (3) large-scale integration projects that may combine multiple eligible renewable energy, energy efficiency and transmission technologies in accordance with a staged development scheme. Under the original authorization, loan guarantees were intended to encourage early commercial use of new or significantly improved technologies in energy projects. The loan guarantee program generally does not support research and development projects.

The most recent solicitation for this program was issued in July 2008. The application deadline for stand-alone and manufacturing projects, as well as the Part I applications for large-scale integration projects, was February 26, 2009.

Temporary Loan Guarantee Program:

The American Recovery and Reinvestment Act of 2009 (H.R. 1), enacted in February 2009, extended the authority of the DOE to issue loan guarantees and appropriated $6 billion for this program. Under this act, the DOE may enter into guarantees until September 30, 2011. The act

amended EPAct 2005 by adding a new section defining eligible technologies for new loan guarantees. Eligible projects include renewable energy projects that generate electricity or thermal energy and facilities that manufacture related components, electric power transmission systems, and innovative biofuels projects. Funding for biofuels projects is limited to $500 million. Davis-Bacon wage requirements apply to any project receiving a loan guarantee.

Appendix I: Pollution Prevention Resources

Kentucky Pollution Prevention Center Resources - www.kppc.org

Kentucky Industrial Materials Exchange (KIME)
KIME is a free, nonregulatory and confidential database. Through this waste exchange, waste materials can be listed and identified as wanted or available for companies that need or have those materials.

Pollution Prevention Training
KPPC offers pollution prevention training through free workshops, seminars, videos, manuals, interactive CD-ROMs, and the Internet. We regularly schedule workshops and teleconferences throughout the Commonwealth.

Online Consultants List
A searchable database of consultant services for help with waste reduction, pollution prevention, and other environmental management needs.

Energy Efficiency
KPPC offers energy efficiency (E2) assessments, training, and other technical assistance to help Commonwealth organizations reduce energy usage. KPPC provides businesses with identification of E2 opportunities, technologies, financial analysis, and assistance with start-up.

Other P2 Resources
Additional information on P2 technologies and innovations can be found on the following web sites:

Waste Reduction Resource Center (WRRC)
wrrc.p2pays.org/indsector.asp
An online collection of pollution prevention core references includes technical references, fact sheets and case studies on pollution prevention for selected industry sectors. These documents are deemed to be the "best" by the entities that compiled them.

Pollution Prevention Resource Exchange (P2Rx)
www.p2rx.org
The Pollution Prevention Resource Exchange is a national network of regional information centers: NEWMOA (Northeast), WRRC (Southeast), GLRPPR (Great Lakes), Zero Waste Network (Southwest), P2RIC (Plains), Peaks to Prairies (Mountain), WRPPN (Pacific Southwest), PPRC (Northwest).

National Pollution Prevention Roundtable (NPPR)
www.p2.org/inforesources
The National Pollution Prevention Roundtable, a 501(c)(3) non-profit organization, is the largest membership organization in the United States devoted solely to pollution prevention (P2). The mission of the Roundtable is to provide a national forum for promoting the development, implementation, and evaluation of efforts to avoid, eliminate, or reduce pollution at the source.

Global Environment & Technology Foundation (GETF)
www.getf.org/
The GETF contains information resources on environmental news, innovative environmental technologies, government environmental technology programs, contracting opportunities, market assessments, market information, current events and other material of interest to the environmental technology community.

Regulatory Compliance Assistance
Kentucky Division of Compliance Assistance (DCA)
www.dca.ky.gov
The Division of Compliance Assistance (DCA) is located within the Department for Environmental Protection (DEP) and was created in 2004 to provide a nonregulatory approach to environmental protection. DCA's mission is to help facilities excel in environmental compliance, to recognize environmental leadership throughout the Commonwealth, and to facilitate activities that enhance the welfare of Kentucky's citizens and the environment.

Kentucky Excellence in Environmental Leadership (KY EXCEL)
www.dca.ky.gov/KYEXCEL
The Division of Compliance Assistance (DCA) administers an environmental leadership program called KY EXCEL, a voluntary program open to any individual, business or organization that wishes to improve and protect Kentucky's environment in ways that extend beyond Kentucky's environmental requirements.