Upper Darby Township Energy Assessment

Township Administration Building

100 Garrett Road, Upper Darby, PA 19082

Prepared By:

Practical Energy Solutions of West Chester, PA

Prepared For:

Upper Darby Township, as part of the Delaware Valley Regional Planning Commission's *Circuit Rider for Energy Efficiency* program

APRIL 2016

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

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Acknowledgments

practical energy solutions

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Executive Summary

The Upper Darby Township administration building (45,034 ft^2) is a 1929 heavy masonry block building with offices, conference rooms, a large hearing room, a parking garage, and storage space. It is typically occupied about 50 hours per week.

From November 2011 through October 2012, Upper Darby spent $74,588 on energy to operate the facility, with 53 percent of this expense ($39,358) going to electricity, 44 percent for #2 heating oil ($32,646), and the remainder ($2,594) for natural gas. The facility's energy use intensity (EUI)—a commonly used measure for benchmarking whole-building energy performance—is 68.2 kBtu per square foot. This compares favorably with EUI scores for similar local facilities.

On behalf of the *DVRPC Circuit Rider Program*[1], Practical Energy Solutions (PES) reviewed an energy assessment report prepared for this facility in July 2010. PES then performed a targeted assessment to verify these prior results, identify new opportunities, and help prioritize energy conservation measures based on in-progress and planned renovations and upgrades.

Target #1: Windows

PES focused on the quarter-inch single-pane windows, as they have very poor thermal and infiltration performance and likely account for more than 30 percent of the building's heating and cooling demand. The prior assessment recommended insulated window shades. While these shades can reduce heat transfer when drawn, their effectiveness depends entirely on occupant behavior. They also block natural daylight, which, in this building, can play an important role in reducing lighting energy use and supporting employee well-being. As an alternative, PES suggests high-efficiency, low-e, removable, operable, interior storm windows. Storm windows will maintain daylighting and views, function with no employee participation, and provide energy savings comparable to replacement windows at a fraction of the cost (i.e., 20 percent). Specifically, the township can install two storm windows as a trial measure, to evaluate usability and comfort. This measure will cut space conditioning energy use by approximately 18 percent.

Target #2: HVAC

PES identified or verified four measures for reducing HVAC (heating, ventilation, and air-conditioning) energy use:

- *Continue thermostatic radiator valve (TRV)/steam trap renovation.* Facilities personnel are in the process of renovating the facility's steam radiators with two-pipe thermostatic radiator valves (TRVs) and new steam traps. This will allow facilities staff to control each radiator and minimize balance issues. PES recommends continuing this upgrade on all radiators throughout the building to produce energy savings and improve occupant comfort. Overall, this measure could reduce steam energy use by up to 22 percent.
- *Downsize to a natural gas steam boiler.* PES performed an hourly computer simulation of the facility, and the results confirm the prior assessment finding that the existing boilers are substantially oversized. In fact, downsizing from the existing two 1,904 MBH[2] oil-fired steam boilers to a single 600–800 MBH boiler could reduce steam system energy use up to 16 percent. PES strongly recommends that a qualified mechanical engineer perform a detailed boiler load-sizing study using the Manual J heat loss/heat gain calculation to ensure proper sizing. PES also agrees with the prior

[1] http://www.dvrpc.org/EnergyClimate/CircuitRider/
[2] Thousand BTUs per hour.

assessment recommendation that the township should transition to a natural gas-fired boiler; this will reduce pollutants and cut fuel costs as much as 41 percent.

- *Install programmable thermostats and establish an energy management policy*. PES recommends replacing the digital, nonprogrammable thermostats that currently control the nine indoor, packaged, water-cooled direct expansion (DX) air-conditioning units with seven-day *programmable* thermostats, and scheduling them to increase room temperature by 10°F–15°F during unoccupied hours. The township should consider Internet-controlled thermostats for remote programming and should draft an energy management policy outlining appropriate thermostat settings. This could reduce space cooling energy consumption by up to 21 percent.
- *Consider air-side economizers*. Adding economizers to the existing water-cooled DX units will provide “free” cooling when outside air temperature and/or enthalpy conditions are favorable and could reduce space cooling energy use by approximately eight percent. Economizer performance is highly dependent on frequent maintenance and sensor calibration, however, and this must be considered.

Target #3: Lighting

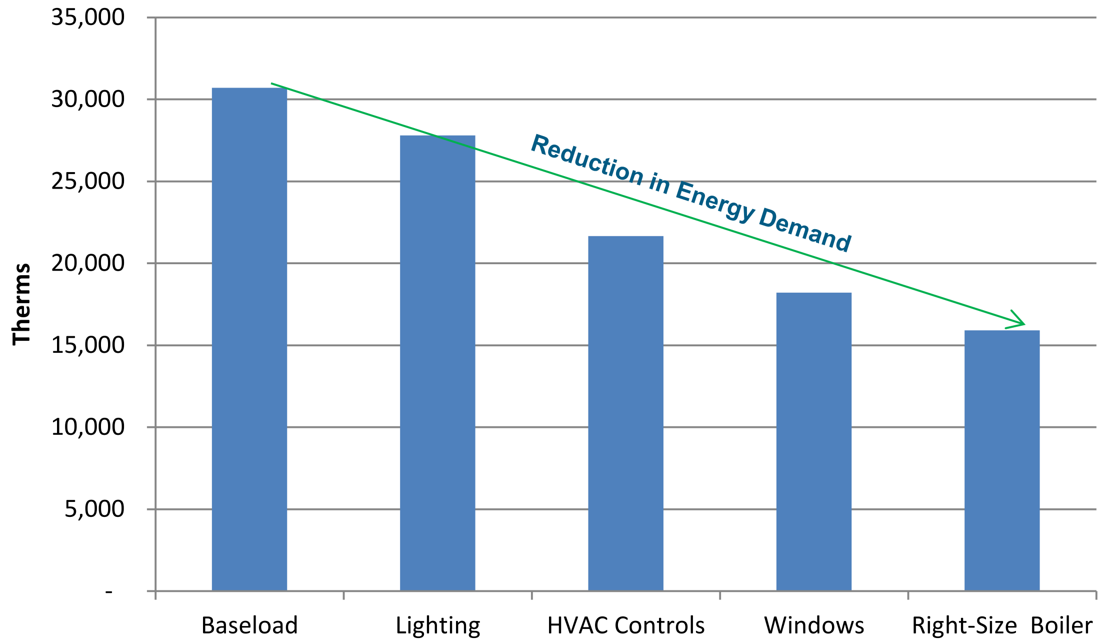
Facilities personnel have partially renovated the lighting systems on a trial basis with a mixture of T8, compact fluorescent, and LED fixtures, but the majority of the building still has older, inefficient T12 fixtures. PES recommends proceeding with the lighting upgrade as follows:

- Replace all four-lamp 4′ T12 fixtures with high-efficiency, two-lamp 4′ 28W T8 fixtures with high-efficiency electronic ballasts and reflectors.
- Replace all remaining 4′ 32W fluorescent T8 lamps in existing fixtures with high-efficiency 4′ 28W T8 lamps as bulbs burn out. This will streamline lamp inventory.
- Replace two-lamp, 2′ T12 fixtures with single-lamp 2′ T5 high-output retrofits.
- Replace 8′ garage fixtures with high-output 4′ 32W T8 retrofit fixtures.
- Permanently remove up to 25 percent of fixtures from overlit areas (Public Works, L&I, Tax, and Finance offices).

In addition to reducing lighting electricity use by two-thirds, this measure will greatly reduce the number of fluorescent lamps in the building and increase average lamp life, saving up to $225 per year in lamp replacement costs and freeing up facilities staff time currently used replacing those lamps.

Whenever possible, PES recommends performing these measures in a logical sequence, as shown in Figure 1 on the next page. This will help Upper Darby achieve two important goals. First, performing the fast-payback measures first (lighting, TRVs) will reduce energy use and utility expenses, enabling the township to reinvest these savings into the other energy-saving projects (windows). Second, the lighting, controls, and building envelope projects will all reduce heat and air-conditioning demand. This will allow the township to purchase an even smaller boiler (i.e., a right-sized boiler) and properly sized air-conditioning equipment as replacements are needed in the future, provided a load study is performed. Right-sized equipment saves money in first-cost capital equipment and long-term utility expenses, since smaller units cost less to purchase and use less energy during operation. In addition, right-sized equipment will improve conditioning effectiveness and comfort. While equipment failures and capital priorities may not make this ideal progression of work possible, it is nonetheless helpful to apply this principle to as much of the project as possible.

Figure 1: Sequential Reduction of Base Load (and Energy Expense) Due to Energy-Efficiency Projects



Source: Practical Energy Solutions for DVRPC 2014

Overall, these measures can cut total energy expenses 68 percent, save more than $50,000 a year, pay back in less than 2.5 years, and reduce CO_2 emissions due to fossil fuel use by more than 428,000 pounds annually, as shown in Table 1 below. This has the same CO_2 reduction impact as removing more than 37 passenger cars from the road per year or planting more than 8,900 mature trees.

Table 1: Summary of Energy Conservation Measures

#	Measure Description	Annual Energy Savings		CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Estimated Project Cost	Simple Payback [yrs]
1	Interior Storm Windows	17,712	kWh	68,247	$8,430	$111,000^	13.2
		2,052	gal oil				
2	TRV/Steam Trap Renovation	2,247	gal oil	50,304	$7,509	$22,440*	3.0
3	Right-Size Steam Boiler	1,661	gal oil	37,181	$5,550	$34,102	6.1
4	Oil to Natural Gas Conversion	8,110	gal oil	53,739	$13,317	**	-
		(10,561)	ccf gas				
5	Programmable Thermostats	53,136	kWh	66,951	$4,723	$4,767	1.0
6	Air-Side Economizers	35,424	kWh	44,634	$3,149	***	-
7	Lighting Upgrades	83,341	kWh	105,010	$7,408	$21,925****	3.0
	TOTAL	**189,613**	**kWh**	**426,067**	**$50,086**	**$194,234**	**3.9**
		14,070	**gal oil**				

Notes: ^ Does not include cost to repair window frames. Qualified contractor evaluation/quotation recommended. *No labor costs due to installation by in-house staff. **Request contractor quotation for interior piping and a natural gas adequacy assessment from PECO to accurately quantify project costs. ***Consult a mechanical contractor for estimates. **** a qualified lighting contractor should be consulting before making changes to lighting. Savings based on current electricity prices. Savings will change as energy prices change.
Source: Practical Energy Solutions for DVRPC 2014

Building Description

The Upper Darby Township administration building (45,034 ft^2) was constructed in 1929 of heavy masonry block, which is generally in good condition with the exception of the main exterior steps. The facility has three above-grade floors and one partial below-grade floor. It contains offices, conference rooms, a large hearing room, a parking garage, and storage space.

The offices are typically occupied about 50 hours per week. The conference rooms and hearing room may be used only a few hours per week, typically outside of normal office hours.

Benchmarking and Historic Energy Use

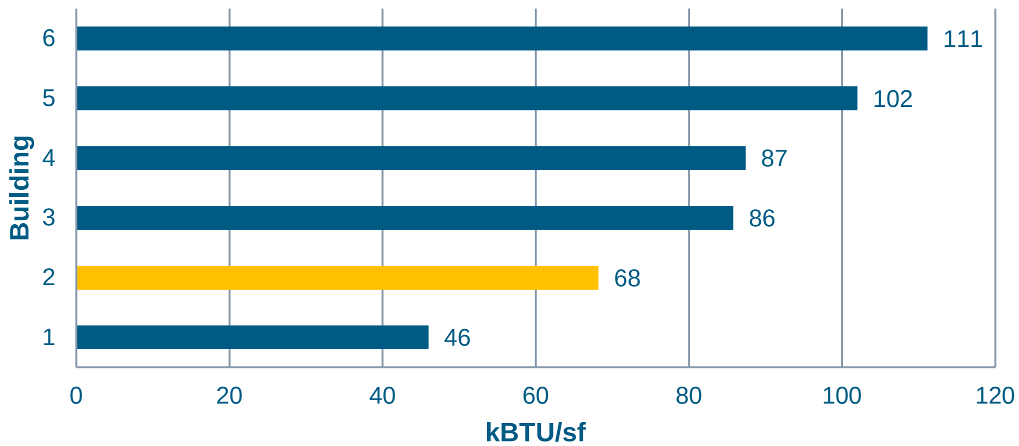
Annual Energy Costs

From November 2011 through October 2012, Upper Darby spent $74,588 on energy for the administration building—53 percent of this expense ($39,358) was for electricity, 44 percent was for #2 heating oil ($32,646), and the remainder ($2,594) was for natural gas, used for domestic hot water and limited space heating. The annual cost of energy per square foot was $1.66.

Annual Energy Use

The facility's energy use intensity (EUI)—a measure of total energy use in kBtu per square foot—is 68.2, which compares favorably with EUI scores for similar local facilities, as shown in Figure 2 below. This favorable score is largely due to the heavy masonry block construction.

Figure 2: EUI Scores for Local Municipal Administration Facilities



Notes: EUI data set courtesy the County of Delaware and DVRPC Circuit Rider Program.
Source: Practical Energy Solutions for DVRPC 2014

CO_2 Emissions

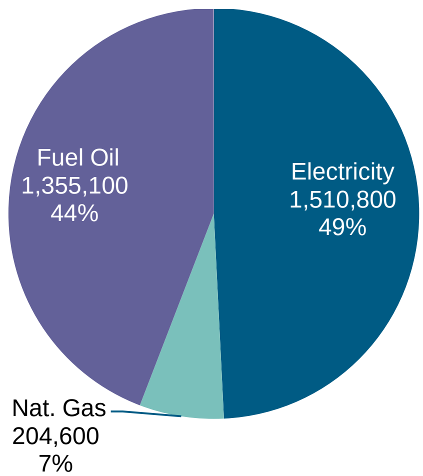
Total energy use at this facility is responsible for approximately 800,700 pounds of CO_2 emissions annually—the CO_2 emissions equivalent of 70 passenger cars per year. Seventy percent of emissions were attributable to electricity use, 27 percent were due to #2 heating oil combustion, and the remaining 3 percent were due to natural gas use.

Energy End Uses

To determine the most appropriate energy conservation measures, it is important to understand how the building systems use energy. PES developed a breakdown of energy “end-uses” (i.e., lighting, space cooling, ventilation fans, etc.) based on historical utility energy use and its site walkthrough:

- On a Btu basis, approximately half of all energy used is due to electricity, 44 percent is due to oil, and the remaining 7 percent is due to natural gas, as shown in Figure 3 below.

Figure 3: Energy Use in kBtu (103 Btu)

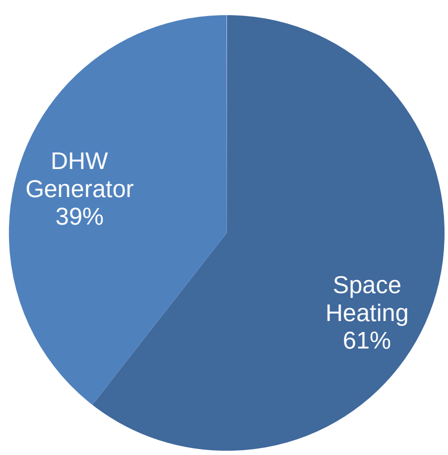


Source: Practical Energy Solutions for DVRPC 2014

- One hundred percent of #2 fuel oil is used for heating.

- Sixty-one percent of natural gas is used for space heating; the remainder is used for domestic hot water (DHW), as shown in Figure 4 below.

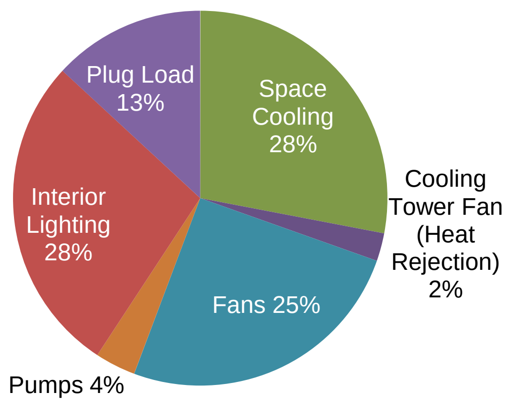
Figure 4: Natural Gas End Uses



Notes: DHW = Domestic hot water.
Source: Practical Energy Solutions for DVRPC 2014

- Interior lighting and space cooling each use approximately 28 percent of the total electric load. Figure 5 shows all electricity end uses.

Figure 5: Electricity End Uses



Notes: Plug Load = computers, desk lamps, printers, faxes, copiers, vending machines, other plug loads. Fans = air handlers/ventilation.
Source: Practical Energy Solutions for DVRPC 2014

Scope of Analysis

PES reviewed an assessment report that was prepared for this facility in July 2010. PES then performed a targeted assessment to verify these prior results, provide cost-effective alternatives where possible, and help prioritize energy conservation measures based on in-progress and planned renovations and upgrades.

Building Envelope

PES investigated the major accessible building envelope components including exterior walls, windows, and doors. The roof was inaccessible and was not inspected.

Windows: Findings

The primary building envelope concern from an energy conservation standpoint is the windows, which have very poor thermal and infiltration performance and may account for more than 30 percent of the building's heating and cooling demand.

The windows are quarter-inch single-pane clear glass with leaky metal frames, and they appear original to the building. They account for nearly 25 percent of the exterior wall area and range in size from approximately 15 ft^2 to 70 ft^2, with the majority of windows measuring about 40 ft^2. Most are in poor condition, and some surrounding wood framing is damaged due to moisture and/or age. The images shown in Figure 6 below were captured during the site visit, and they show a typical example of the poor condition of the window frames in the building.

Figure 6: Original Windows, Frame Damage

Source: Practical Energy Solutions for DVRPC 2014

The July 2010 assessment report recommended installing insulated window shades on the interior of each window. Insulated shades can effectively reduce heat transfer when drawn; however, their effectiveness depends entirely on occupant behavior. It is unlikely they will be used effectively in this facility due to the large amounts of desirable natural daylight that the windows provide, and because the existing window shades have not been used in many years.

Windows: Recommendation

Due to the quantity, uniqueness, and historic nature of the windows, replacement will be expensive. However, window replacements are sometimes necessary and, as such, should be viewed as essential facility investments, not just energy-saving projects.

Given the expense, PES recommends that the township consider all options—including high efficiency, low-e, removable, operable, interior storm windows. After-market, operable interior storm windows are available from several manufacturers and are highly configurable for window size. Unlike insulated shades, interior storm windows create a tight seal around the window frame to reduce drafts, do not block natural daylighting or views, do not require employees to operate them unless desired, and will provide energy savings throughout the heating and cooling seasons.

Placing these on the inside will also ease installation and removal and enable employees to operate them as needed. These storm windows can provide energy savings comparable to replacement windows—saving approximately 18 percent of current space conditioning energy use—while costing approximately 80 percent less to install. They are not likely to last as long as window replacements; however, they will enable the township to buy time before investing in wholesale window replacements. PES recommends installing one or two trial storm windows to evaluate usability and comfort.

Table 2 below shows a comparison of estimated costs and savings for window replacements and interior storm windows.

Table 2: Savings: Window Replacement/Upgrade Options

Measure Description	Annual Energy Savings		CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Est. Project Cost	Simple Payback [yrs]	Estimated Product Life	Est. Savings Over Product Life
Interior Storm Windows	17,712	kWh	68,247	$8,430	$111,000	13.2	15 years*	$16,860
	2,052	gal						
Replacement Windows	17,712	kWh	72,621	$9,083	$485,000	53.4	30 years	--
	2,247	gal						

Notes: *Manufacturer provides a 20-year warranty. 15-year estimate is based on potentially heavy use of Upper Darby's interior storm windows, since they will be operable. Does not include cost to repair window frames. Contractor evaluation/quotation recommended. Savings based on current energy costs. Savings will change as energy prices change. **Source:** Practical Energy Solutions for DVRPC 2014

HVAC: Findings

The Upper Darby administration building is cooled by nine indoor, packaged, water-cooled direct expansion (DX) units (11.3 EER[3], 1,300 MBH total estimated capacity) served by a rooftop cooling tower. An air-cooled, packaged DX unit (57 MBH) supplements cooling in the hearing room. The cooling units are controlled by digital, nonprogrammable thermostats.

The facility is largely heated by an oil-fired perimeter steam radiator system, although the Licensing and Inspection (L&I) office contains renovated steam radiators served by a dedicated, small Weil-McLain CG-4-PION natural gas-fired hot-water boiler manufactured in 1994 (88 MBH, 84 percent thermal efficiency).

The existing boiler plant comprises two oil-fired Weil-McLain 888 steam boilers in fair condition, each with a rated output of 1,904 MBH and a rated efficiency of 16.6 gph (approximately 83 percent thermal efficiency). The July 2010 energy assessment report suggests that the boiler plant is oversized and recommends installation of a smaller, dual-fuel boiler (i.e., oil and natural gas). The new, smaller unit would be sufficient to heat the building, and one of the existing boilers would remain in place as backup.

The heating distribution systems are in relatively good condition, and facilities personnel are in the process of renovating the steam radiators with two-pipe thermostatic radiator valves (TRVs) and new steam traps. These two-pipe TRVs provide individual space control by automatically opening and closing the steam valve, thereby controlling the supply of steam coming into the radiator and allowing each radiator to maintain its own temperature setpoint. The result is that perimeter rooms, which are cooler due to air infiltration, are sufficiently heated but core spaces do not overheat. To date, this renovation has been favorable and cost-effective.

HVAC: Recommendations

Continue TRV/Steam Trap Renovation

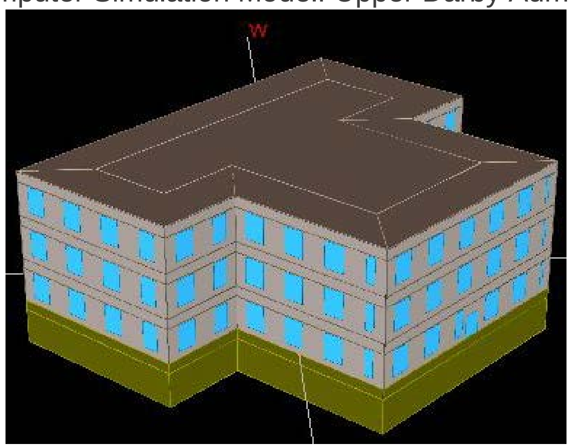
PES recommends continuing the TRV/steam trap renovation on all radiators throughout the building to produce energy savings and improve occupant comfort. Overall, this measure could reduce steam energy use by up to 22 percent.

[3] Energy efficiency ratio.

Downsize to a Natural Gas Steam Boiler

PES performed an hourly computer simulation of the facility using the eQUEST Energy Simulation Tool to verify the downsizing recommendation proposed in the July 2010 energy assessment report. An image of the computer model, developed by PES, is included as Figure 7 below. The results confirm that the existing boilers are substantially oversized, and modeling suggests that downsizing to a single 600–800 MBH boiler could reduce steam system energy use by up to 16 percent.

Figure 7: Computer Simulation Model: Upper Darby Administration Building



Source: Practical Energy Solutions for DVRPC 2014

PES recommends that a qualified mechanical engineer perform a detailed boiler load-sizing study using the Manual J heat loss/heat gain calculation, to ensure that the new system can handle peak loads with maximum energy efficiency. Such an analysis is important to ensure proper boiler sizing. Commonly used rule-of-thumb calculations can result in oversizing and higher capital and installation costs.

As part of the boiler replacement project, Upper Darby Township should consider transitioning to natural gas, which burns cleaner than fuel oil. It is also currently less expensive and may reduce current steam heating energy costs by as much as 41 percent in the near term. Likewise, CO_2 emissions may be reduced by approximately 27 percent, and other pollutants such as sulfur oxides, particulates, and carbon monoxide may be reduced by 35 to 75 percent.

Even with a smaller "right-sized" gas boiler, the natural gas service to the building may be insufficient. The cost to upgrade natural gas service can vary depending on existing street line pressures and line sizes, but the cost is typically minimal. The township should request a gas line adequacy assessment from PECO, as this will determine what needs to be done and how much, if anything, PECO will charge for any needed upgrades. A copy of PECO's Application for Natural Gas Services is included as Appendix A. The township should request this assessment only after the qualified HVAC contractor has performed the Manual J load study and properly calculated the replacement boiler size, as this will dictate gas piping needs.

Install Programmable Thermostats for DX Units

The digital thermostats that control the air conditioning units should be replaced with seven-day programmable thermostats and scheduled to increase room temperature by 10°F–15°F during unoccupied hours (i.e., nights and weekends). The township should consider Internet-controlled thermostats for remote programming. Temperatures in the hearing room, which does not follow a typical weekly occupancy schedule, should be increased 5°F–10°F when unoccupied, and the thermostat should provide a timed occupancy override to cool the room during events. The township should also draft an energy management policy outlining the appropriate thermostat settings and setbacks, as policies are important tools for empowering facilities personnel to enforce reasonable building temperatures and schedules. Together, these measures could reduce space cooling energy consumption by up to 21 percent.

Consider Air-Side Economizers

The existing water-cooled DX units provide cooling and ventilation to the majority of the building. Adding economizers to these systems will allow them to provide "free" cooling when outside air temperature and/or enthalpy conditions are favorable and could reduce space cooling energy use by approximately 8 percent.

Importantly, economizer performance is highly dependent on frequent maintenance and sensor calibration. Poorly calibrated sensors or incorrect control settings can negate energy savings or even increase energy use. The township should carefully consider this commitment before embarking on this project.

The cost to implement this measure is hard to quantify or estimate because it involves new ductwork, new controls, and possibly new penetrations in the floors and roof to accommodate additional ductwork. A mechanical contractor should be consulted to estimate project costs, and the township should evaluate these costs in light of the estimated annual savings for this measure, as well as the need for ongoing maintenance and calibration.

Table 3 shows estimated savings for this and all other HVAC measures, as well as estimated project costs and simple paybacks where possible.

Table 3: Savings: HVAC Measures

#	Measure Description	Annual Energy Savings		CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Estimated Project Cost	Simple Payback [yrs]
2	TRV/Steam Trap Renovation	2,247	gal oil	50,304	$7,509	$22,440	3.0
3	Right-Size Steam Boiler	1,661	gal oil	37,181	$5,550	$34,102	6.1
4	Oil to Natural Gas Conversion	8,110	gal oil	53,739	$13,317 *	**	-
		(10,561)	ccf gas				
5	Programmable Thermostats	53,136	kWh	66,951	$4,723	$4,767	1.0
6	Air-Side Economizers	35,424	kWh	44,634	$3,149	***	-
TOTAL		**12,018**	**gal oil**	252,809	$34,248	-	-
		88,560	**kWh**				

Notes: *Due solely to current cost difference between #2 heating oil and natural gas. As natural gas and oil prices change, these results will also change accordingly. **Request contractor quotation for interior piping and natural gas adequacy assessment from PECO for exterior piping upgrades, to accurately quantify project costs (see Appendix A). ***Consult a mechanical contractor for estimates.

Source: Practical Energy Solutions for DVRPC 2014

Lighting

Lighting has been partially renovated on a trial basis with a mixture of T8, compact fluorescent, and LED fixtures, but the majority of the building still has older, inefficient T12 fixtures. As a result, lighting upgrade opportunities remain.

PES recommends proceeding with the lighting upgrade as follows:

- For all existing 4′ four-lamp T12 fixtures:
    - Replace all four-lamp fixtures with high-efficiency, two-lamp 4′ 28W T8 fixtures.
    - Choose a fixture that has reflectors to direct light down into the room, enhancing light spread and output.
    - Consider high-efficiency programmed start ballasts for all new T8 fixtures. Programmed start ballasts are more expensive than the standard “instant-start” ballasts, but they pay for themselves over time because they further reduce energy use and preserve the life of the bulbs, thereby reducing maintenance costs. Programmed start ballasts require a special lamp, as most T8 lamps are designed for the instant start ballast.
    - Select a ballast with a low ballast factor. This will save energy and further reduce operational lighting costs.
    - Buy new lenses with the new fixtures; using old, dirty lenses will compromise light quality and output.
- Replace all remaining 4′ 32W fluorescent T8 lamps in existing fixtures with high-efficiency 4′ 28W T8 lamps as bulbs burn out. This will reduce lamp inventory to one type of 4′ T8 bulb and further reduce energy use.
- Replace all two-lamp 2′ T12 fixtures with single-lamp 2′ T5 high-output retrofits.
- Replace 8′ garage fixtures with high-output 4′ 32W T8 retrofit fixtures.
- Permanently remove up to 25 percent of fixtures from the Public Works, L&I, Tax, and Finance offices. Light level readings taken in these areas show that they are two to four times brighter than the recommended range of 30 to 50 footcandles, as shown in Table 4 below. Figure 8 on the next page is an image of the significant overlighting found in the L&I offices captured during our site visit.

Table 4: Overlit Areas

	Footcandles	
Area	**Actual**	**Recommended***
Room 103	97	30–50
Room 104	118	30–50
Room 215	73	30–50
Rooms 301–302	136–147	30–50
Engineering Conference Room	131	30
L&I-Admin	104	30–50
L&I-Director	122	30–50
Tax Office-Reception	78	30–50

Notes: *Energy Standard for Buildings Except Low-Rise Residential Buildings, ASHRAE/IESNA Standard 90.1 (2004), Lighting Handbook Reference and Application, 9th ed., Illuminating Engineering Society of North America.
Source: Practical Energy Solutions for DVRPC 2014

Figure 8: Significant Overlighting

Source: Practical Energy Solutions for DVRPC 2014

In addition to reducing lighting electricity use by more than two-thirds, this measure will reduce the total number of fluorescent lamps in the building by approximately 49 percent and increase average lamp life, saving up to $225 per year in lamp replacement costs, as well as free up facilities' staff time.

To ensure adequate light levels, a qualified lighting contractor should be consulted before making changes to the lighting system.

Table 5 shows estimated savings and project costs for these lighting measures. Savings due to delamping are included.

Table 5: Savings: Lighting Upgrades

#	Measure Description	Annual Energy Savings [kWh]	CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Est. Project Cost*	Simple Payback [yrs]
7a	4-lamp T12/T8 to 2-lamp T8	75,155	94,695	$6,680	$16,192	2.4
7b	2-Lamp 2' T12 to 1-Lamp T5	3,710	4,675	$330	$3,608	10.9
7c	8' T12 to 8' T8 Retrofits	3,536	4,455	$314	$2,125	6.8
7d	32W to 28W T-8 Lamp Replacement	940	1,185	$84	$0	-
TOTAL		**83,341**	**105,010**	**$7,408**	**$21,925**	**3.0**

Notes: Savings based on current electricity prices. Savings will change as energy prices change. *Assumes installation of fixtures by in-house electrician. Outside contractor installation will increase project costs.
Source: Practical Energy Solutions for DVRPC 2014

Since Upper Darby has trialed some LED lights with great success, PES also evaluated energy and costs associated with installing 32W LED lights in lieu of the recommended two-lamp T8 fixtures (measure 7a). The assessment shows that this will further increase energy savings by $441 per year and approximately double the payback duration for this one measure, as shown in Table 6 below.

Table 6: Savings: LED Upgrade for Existing Four-Lamp T12s (Alternate)

#	Measure Description	Annual Energy Savings	CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Est. Project Cost	Simple Payback [yrs]
7a-Alternate	4-lamp T12 to 32W LED	80,122 kWh	100,953	$7,347	$32,200	4.4

Source: Practical Energy Solutions for DVRPC 2014

Appendix A

Revised January 2013

PECO
An Exelon Company

Application for Natural Gas Service

DELAWARE, YORK, & CHESTER COUNTIES, ALSO LOWER MERION: 1050 W. SWEDESFORD RD, BERWYN, PA. 19312
PHONE #610-725-7160; FAX # 610-725-1416
BUCKS & MONTGOMERY COUNTIES: 400 PARK AVE, WARMINSTER, PA. 18974
PHONE #215-956-3270; FAX #215-956-3240
NEW RESIDENTIAL CONSTRUCTION (UNDERGROUND ELECTRIC): 400 PARK AVE, WARMINSTER, PA. 18974-ALL COUNTIES
PHONE #215-956-3010; FAX #215-956-3380

1. Please provide the following information for the location of the gas service.

Customer Info: ☐ Own Property ☐ Lease Property

Contact Person ______________________

Company Name ______________________

Service Address ______________________

City, State, Zip ______________________

Telephone ______________________

Acct. Number ______________________

2. PECO Energy requires that our gas customers enter into an agreement prior to the installation of gas facilities. Please furnish the name and address for the person authorized to this contract.

Contact Name ______________________

Company Name ______________________

Street Address ______________________

City, State, Zip ______________________

Telephone ______________________

Tax ID # ______________________

3. LOAD REQUEST TYPE:

☐ New Construction
☐ New Gas Service, Existing Building
☐ Fuel Conversion from Oil/Propane
☐ Additional Gas Load/Service Adequacy

4. TYPE OF BUSINESS:

☐ Retail Store ☐ Institutional
☐ Office/Commercial ☐ Governmental
☐ Restaurant ☐ Industrial
☐ Warehouse ☐ Apartment/Condo
☐ Other ______________________

☐ Residence ______________________

5. Rates:

A. ☐ PECO Tariff or ☐ Transportation (5000MCF)
B. ☐ FIRM or ☐ Interruptible

6. CURRENT HEATING SOURCE: (If you don't know the BTU rating, please estimate or provide last year's total energy usage for the equipment that will be replaced).

☐ Gas ______________ MCF/yr ☐ Propane ______________ gal/yr
☐ Oil ______________ gal/yr ☐ Other ______________ /yr

7. EQUIPMENT LIST ITEMIZATION Will "heating load" Be added (ie: furnace, boiler, IR heat, rooftop heater)? Will "process load" be added (ie: water heater, paint dryers, fryer, grills)? Please provide the BTU input for EACH PIECE of equipment to be installed.

****************************MUST HAVE THIS INFORMATION TO PROCESS REQUEST**************************

New or Existing	Fuel Type (Nat Gas, Oil, Propane)	Equipment Type (Boiler, Furnace, WH, Grill)	No. of Units	BTU Input/Unit or MCF (BTU/hr, Gallons/hr)	Equipment Pressure	Hours Used Per Day
Sample: New	Natural Gas	Furnace	1	500,000 BTU's	LOW	12 hrs/day
NEW						
TOTAL						

Application for Natural Gas Service (con't)

8. TOTAL HEATED SQUARE FOOTAGE FOR THIS BUILDING THAT WILL UTILIZE NATURAL GAS:

☐ Office/Commercial/Retail Use ______________________ Sq. ft. Ceiling Height ______________

☐ Warehouse/Manufacturing space ______________________ Sq. ft.

☐ Residence ______________________Sq. ft.

9. WHICH NATURAL GAS DELIVERY PRESSURE IS REQUIRED TO YOUR BUILDING:

☐ Low ☐ 12.2" ☐ 2 PSIG *☐ 5 PSIG *☐ 10 PSIG *☐ LINE

10. WHAT DATE IS SERVICE NEEDED BY? ______________________________

11. EQUIPMENT INSTALLATION DATE? ______________________________

12. PLEASE PRINT THE INFORMATION BELOW FOR THE CONTRACTOR THAT WILL BE INSTALLING THE NEW GAS EQUIPMENT:

CONTRACTOR NAME: ______________________________

COMPANY: ______________________________

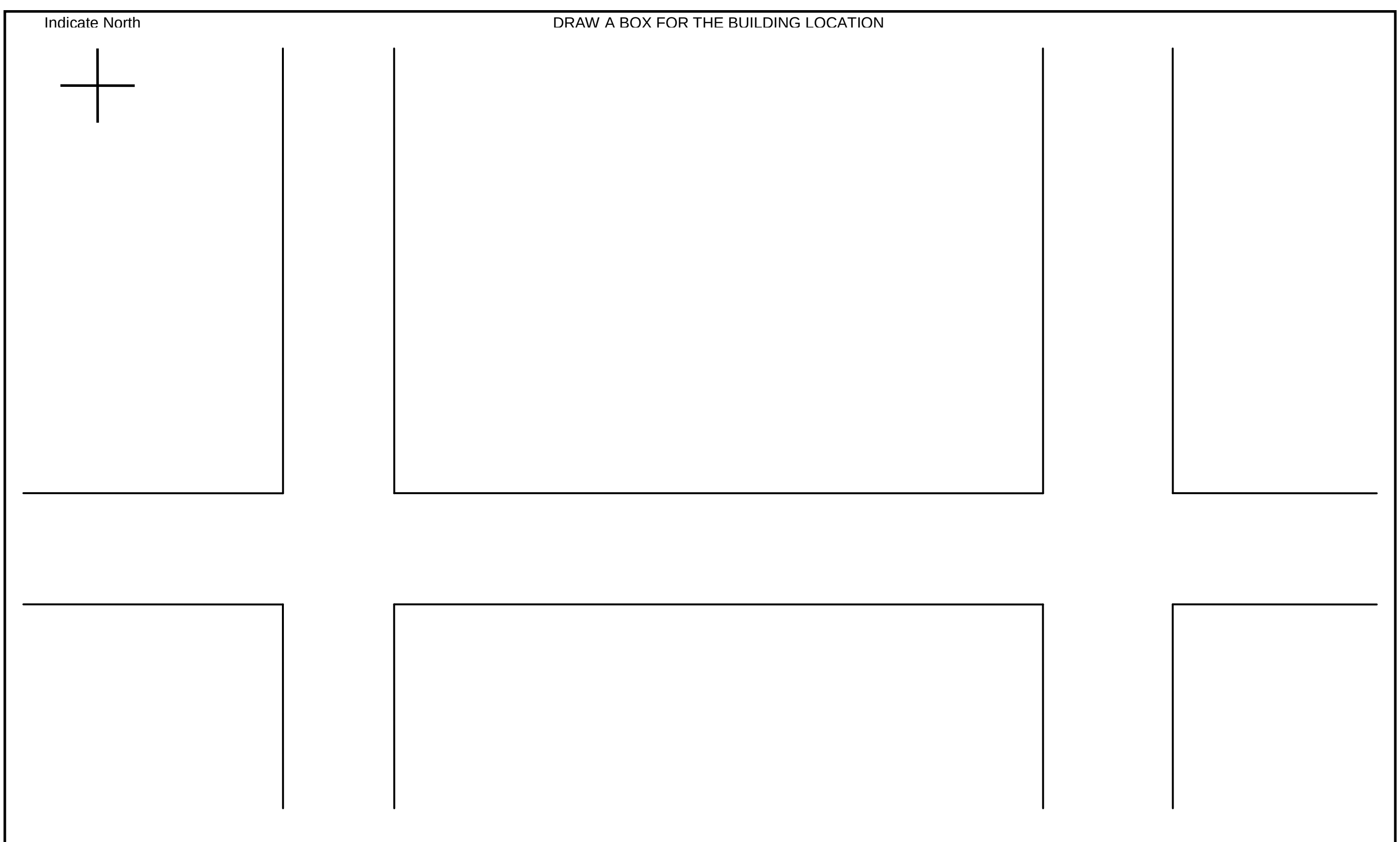
TELEPHONE: ____________________ FAX NUMBER: ____________________

13. Customer/Contractors Signature: ______________________________ **DATE:** ____________________

14. Final Contract delivered to: ☐ Customer ☐ PECO Account Executive/Account Manager (For Internal Use only)

15. IN THE BOX BELOW, PLEASE DRAW A SIMPLE SKETCH OF YOUR BUILDING SHOWING:

- Building Location
- Street Address and closest intersecting cross street(s)
- Location of your Equipment Room
- Preferred Meter Location
- **# OF METERS REQUESTED** __________



Upper Darby Township Energy Assessment

Township Administration Building

Publication Number: 15024K

Date Published: April 2016

Geographic Area Covered: Upper Darby Township

Key Words:
Energy, heating oil, natural gas, electricity, energy management, heating ventilation air conditioning (HVAC), steam, boiler, lighting, controls, CO_2 emissions

Abstract:
On behalf of the DVRPC Circuit Rider Program Practical Energy Solutions (PES) performed an energy assessment of the Upper Darby Administration Building. The Upper Darby Township administration building (45,034 ft^2) is a 1929 heavy masonry block building with offices, conference rooms, a large hearing room, a parking garage, and storage space. It is typically occupied about 50 hours per week. PES evaluated the building's HVAC, lighting, and envelope for opportunities to save energy at this building. PES identified several energy management opportunities for this facility, including 1) improve the building's thermal infiltration by installing interior storm windows, 2) continue maintenance upgrades to the building's steam system to improve functionality and improve comfort, 3) right-size the buildings boiler and convert from heating oil to natural gas, and 4) institute a lighting upgrade by retrofitting existing T12s to energy efficient T8s or LEDs and delamp in overlit areas. These measures are estimated to save the township $50,086 in energy costs annually and pay back in 3.9 years.

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