Nether Providence Township Energy Assessment Report

Township Administration Building

214 Sykes Road, Rose Valley, PA 19086

Prepared By:

Practical Energy Solutions of West Chester, PA

Prepared For:

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

APRIL 2016

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Executive Summary

Nether Providence Township is a municipality of 13,456 residents located in Delaware County, PA. The Nether Providence Township administration and police building (10,200 ft^2) is a multiuse facility with administrative offices, a council meeting room, finance offices, and the police department. The building is a 1902 stone barn renovated in the 1970s with a 1992 masonry block addition.

In 2011, Nether Providence spent $14,166 on energy for this facility. The majority of this expense (85 percent; $12,192) was for the use of electricity; the remainder ($1,974) was for the use of natural gas.

The facility's energy use intensity (EUI)—a commonly used measure for benchmarking whole-building energy performance—is 53.4 kBtu per square foot, notably lower than the median score of 81 for similar facilities in our region. Low scores are desirable, as they indicate lower energy use than comparable buildings.

On behalf of the DVRPC Circuit Rider Program[1], Practical Energy Solutions (PES) performed an energy assessment of the facility to identify opportunities for energy savings. Despite the relatively low EUI, opportunities to cut energy use and costs exist. In fact, even high-efficiency facilities often provide opportunities to reduce energy use and costs. In this building, the opportunities lie in building envelope improvements and in several cost-free, practical operational refinements.

Building Envelope

Like many buildings retrofitted over time, this building has significant thermal breaks in the envelope that allow noticeable air infiltration, causing occupant discomfort and excess energy use. The result is widespread use of electric space heaters during the winter season, which increases electricity use and energy expenses. The building thermostats can sense ambient heat from space heaters, and this can prevent the central heating system from functioning, worsening comfort issues and increasing use of space heaters.

Windows

Windows, in particular, represent a major source of infiltration in the historic sections of this building. PES suggests installing operable, interior storm windows over the windows in the original portions of the building (first floor and council meeting room). Contrary to popular belief, after-market storm windows are often more energy efficient than window replacements. They are also much less expensive and can offer a reasonable payback. Storm windows will also preserve the historic character of this building.

Additional Envelope Improvements

Additional recommended building envelope improvements include:

- Filling the under-stair wall cavity in the northern corner office with blown-in cellulose insulation (approximately 3.5 inches deep at R-3.7 per inch). This insulation, along with new windows in this office, will significantly reduce infiltration and heat transfer, and it may eliminate or reduce the need for a personal electric space heater in this drafty office space.
- Improving insulation along the eastern and southern walls of the addition.
- Installing a more effective air barrier in the front teller window.

[1] http://www.dvrpc.org/EnergyClimate/CircuitRider/

Additional Energy Conservation Measures

Operational Refinements

PES also identified several operational measures for further reducing energy use. This facility is overlit, and the thermostatic programs are not uniform. This is often the result of employees changing the settings on unlocked thermostats. These are common findings in municipal buildings and can have a notable impact on energy use and costs. In this building, delamping select fixtures and refining programmable thermostat schedules and setpoints can cut electricity use an estimated 13 percent, reduce natural gas use almost two percent, and save approximately $1,642 per year with little to no investment.

High-Efficiency HVAC Replacement Plan

Finally, PES strongly recommends creating a high-efficiency HVAC (heating, ventilation, air conditioning) replacement plan. Even though the HVAC equipment is generally in good condition, all furnaces, duct heaters, and condensing units (with the exception of the York condensing unit serving the council meeting room) have surpassed the typical unit life of 15 years. A replacement plan will prevent the real possibility that the township will need to seek replacement units on an emergency basis when acute failure ultimately occurs. Urgent HVAC replacements are costly, and they all but eliminate the possibility of a high-efficiency replacement, as high-efficiency units are less likely to be in stock. This can force the township to purchase a standard-efficiency unit at a high-efficiency price and will lock the municipality into paying high operating costs for the 15-year or more life of the new unit. A thoughtful HVAC replacement plan (and timeline) will ensure that the township is prepared to purchase replacement units that will produce the best long-term energy and cost savings over time.

Savings

Overall, these energy conservation measures are estimated to cut electricity use 22 percent and reduce natural gas use by one-third, saving the township more than $3,400 in annual energy costs at today's prices. They will also reduce harmful CO_2 emissions due to fossil fuel use by nearly 37,500 pounds of CO_2 per year, which has the same impact as removing more than three passenger cars from the road per year or planting 780 mature trees. Table 1 provides a summary of calculated savings and paybacks.

Table 1: Summary of Energy Conservation Measures

#	Measure Description	Annual Energy Savings	CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Estimated Project/Premium Cost	Simple Payback [yrs]	Savings Over 15 Years
1	Storm Window Installation	1,993 kWh 301 ccf	2,511 3,619	$589	$3,240 Project	5.5	$30,780
2	Storm Windows, Insulation (Polly's Office)	241 kWh 37 ccf	304 438	$71	$711 Project	10.0	$ 3,555
3	Improve Thermostat Programming	1,462 kWh 29 ccf	1,843 346	$196	$-	Immediate	$ 2,940
4	HVAC Time of Replacement Plan	7,771 kWh 168 ccf	9,791 2,021	$1,060	$3,077 Premium	2.9	$36,924
5	Reduce Light Levels	13,174 kWh	16,599	$1,492	$0 - $2,631 Project*	Immediate to 1.8*	$34,203
TOTAL		24,641 kWh 535 ccf	37,473	$3,408	$7,028 - $9,659*	2.1 - 2.8*	$108,402

Notes: *Range shows costs and paybacks with and without ballast replacement. Evaluation of current ballast wiring configuration is required to make this determination. Savings based on current energy rates. Savings will change as energy prices change. **Source:** Practical Energy Solutions for DVRPC 2014

Building Description

The Nether Providence Township Administration and Police Building (10,200 ft^2) is a multiuse facility. The front half of the building—comprising a lobby and administrative offices on the first floor, a council meeting room on the second floor, and a police department in the basement—is a 1902 stone barn that was renovated in the 1970s. The rear half of the building, which houses finance offices on the first floor and police offices in the basement, is a masonry block addition constructed in 1992.

The office area is typically occupied 40 hours per week. The police department operates 24/7, but not all areas are occupied continuously. The council meeting room is typically occupied for just two to three hours per week.

Benchmarking and Historic Energy Use

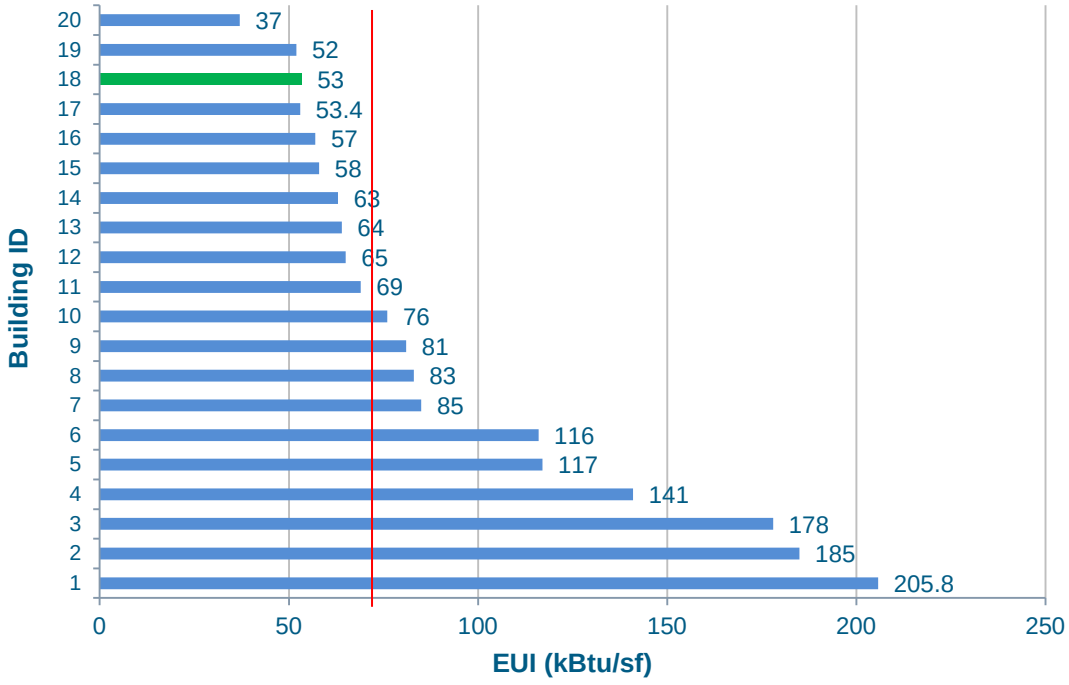
Annual Energy Costs

In 2011, Nether Providence spent $14,166 on energy for the Administration and Police building. The majority of this expense (85 percent; $12,192) was for electricity; the remainder ($1,974) was for natural gas. The annual cost of energy per square foot was $1.39.

Annual Energy Use

The facility's energy use intensity (EUI)—a measure of total energy use per square foot—is 53.4, lower than the median score of 72.5 for similar facilities in our region, as shown in Figure 1 below.

Figure 1: Local Administration and Police Facility EUI Scores



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

= median

CO_2 Emissions

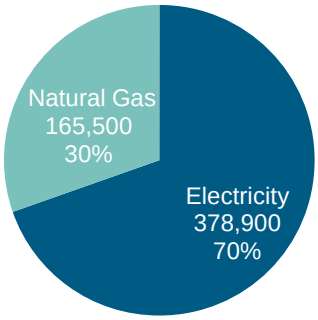
Total energy use at this facility is responsible for approximately 160,000 pounds of CO_2 emissions annually—equivalent to the CO_2 emissions of 14 passenger cars per year. Eighty-eight percent of emissions were due to electricity use; the remaining 12 percent were due to natural gas use.

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, etc.) based on historical utility energy use and our site walkthrough:

- On a Btu basis, 70 percent of all energy used is from electricity, and 30 percent is from the use of natural gas, as shown in Figure 2 below.

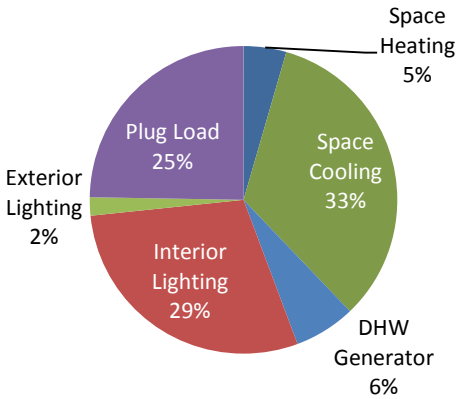
Figure 2: Energy Use in kBtu (10^3 Btu)



Source: Practical Energy Solutions for DVRPC 2014

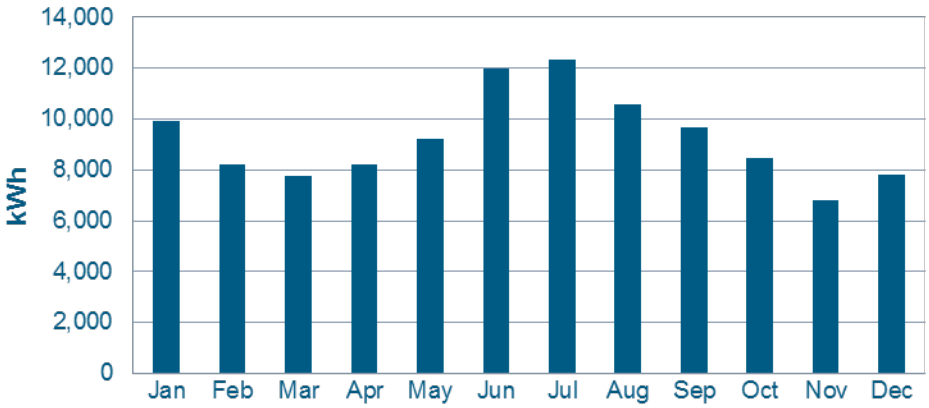
- One hundred percent of natural gas is used for heating.
- One-third of electricity is used for space cooling, and interior lighting uses an additional 29 percent. PES estimated that space heaters use 5 percent of the electric load, costing more than $600 per year. Figure 3 shows all electricity end uses; Figure 4 shows the spike in wintertime electricity use (December, January, February) due to space heaters.

Figure 3: Electricity End Uses



Notes: Plug load = computers, desk lamps, printers, faxes, copiers vending machines, other plug load. **Source:** Practical Energy Solutions for DVRPC 2014

Figure 4: 2011 Electricity Consumption by Month (kWh)



Notes: The spike in wintertime use is due to space heating. Summertime increases are due to air conditioning. **Source:** Practical Energy Solutions for DVRPC 2014

Scope of Analysis

PES performed a general walkthrough of the Nether Providence Administration and Police Building to identify opportunities to reduce energy use and costs. PES evaluated all systems but focused on the building envelope due to concerns about draftiness and old windows.

Building Envelope

PES investigated the major accessible building envelope components including walls, windows, and doors for signs of poor energy performance. The roof was inaccessible during the site visit, but a visual inspection indicated that it is in good condition.

Employees complained of drafts during cold weather, and many employees use personal electric space heaters. Space heaters increase energy use and costs, and they can worsen comfort problems by increasing space temperature and preventing operation of central heating system.

Windows

Windows: Findings

The original portions of the building have old single-pane, wood frame windows that are poorly sealed and that allow considerable air infiltration around the frames. In some offices, the windows were covered in plastic to reduce cold air infiltration.

The windows in the 1992 addition are insulated double-pane units with vinyl-clad wood frames and are in very good condition.

Windows: Recommendation

PES recommends installing operable, interior storm windows over the existing, old windows in the original portions of the building, on the first floor and council meeting room. Storm windows:

- Are less costly than replacement windows. Installing a storm window over a historic window has a typical payback of approximately five years, whereas modern insulated windows can take upwards of 30 years to pay back in energy savings;
- Are often more energy efficient and provide better insulation than new double-pane windows;
- Can be designed to produce minimal visual impact and preserve the historic character of the building. They also help protect historic windows against weathering and damage;
- Are more environmentally sustainable, as new windows typically contain materials such as vinyl, which is composed of nonrenewable resources, as well as six of the most harmful industrial pollutants;
- Are functional and can be designed for easy use.

Storm window installation over the old windows will pay back in 5.5 years, as shown in Table 2 below.

Table 2: Savings: Storm Window Installation

#	Measure Description	Annual Energy Savings	CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Est. Project Cost	Simple Payback [yrs]	Savings Over 15 Years
1	Storm Window Installation	1,993 kWh 301 ccf	2,511 3,619	$589	$3,240	5.5	$30,780

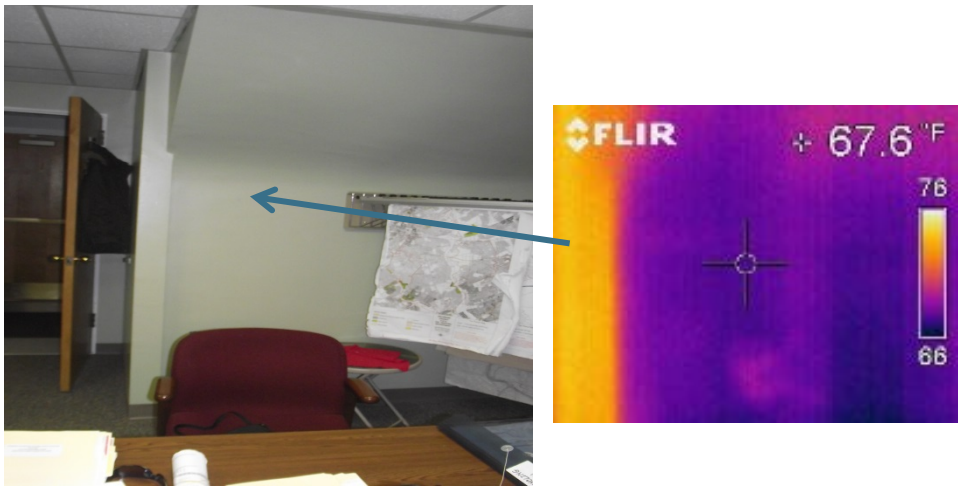
Notes: Does not include cost of frame repair that may be needed. Based on estimated window count only. Contractor quotations recommended. Savings based on current energy rates. Savings will change as energy prices change.
Source: Practical Energy Solutions for DVRPC 2014

Insulation

Insulation: Findings

The foyer of the building is unheated, and the northern corner office (Polly's office) shares an uninsulated wall with an unconditioned cavity under the main staircase located in the foyer. Figure 5 below shows two images captured during our site visit, and the photo on the right is an image taken by our infrared camera. The circle centered in the photo is aimed at the uninsulated wall in Polly's office and measures 67.6°F, while the temperature measured in the rest of the office is closer to 72°F. The northern corner office also has two exterior walls, each with old windows covered in plastic. The room is in almost continuous shade, so it never receives solar heat gain. The large temperature difference on either side of the exterior and staircase walls causes significant heat loss. This, combined with the air infiltration through the windows, makes this office uncomfortable during the winter months.

Figure 5: Infrared Image of Wall under Stairwell Showing Lack of Insulation



Source: Practical Energy Solutions for DVRPC 2014

Infrared imaging also indicated significant cold air infiltration along the back and southern walls of the first-floor office space, suggesting insufficient wall insulation. Figure 6 below is an infrared image showing the temperature differential in the first-floor office space, despite the use of a space heater.

Figure 6: South Wall Cold Air Infiltration

Source: Practical Energy Solutions for DVRPC 2014

PES also noted substantial cold air flow through the front teller window, despite attempts to block it with cardboard, as shown in Figure 7 below.

Figure 7: Teller Window

Source: Practical Energy Solutions for DVRPC 2014

The second floor ceiling recently received new roofing insulation and ceiling fans, both which have helped improve energy efficiency and comfort in the council room, according to employee interviews.

Insulation: Recommendations

- Northern corner office. To improve occupant comfort and reduce energy loss in this office, PES recommends installing interior storm windows over the existing wooden windows and filling the interior wall cavity with blow-in cellulose insulation (approximately 3.5 inches deep at R-3.7 per inch). These measures will significantly reduce infiltration and heat transfer and may eliminate or reduce the need for a personal electric space heater. Table 3 shows estimated savings and payback time.

  However, even these measures may not completely eliminate draftiness and occupant discomfort. Nether Providence may consider converting this room to storage and relocating the employee to a more comfortable office space.

Table 3: Savings: Northern Corner Office Insulation and Storm Window Upgrade

#	Measure Description	Annual Energy Savings	CO_2 Savings [lbs.]	Energy Cost Savings [$/yr.]	Est. Project Cost	Simple Payback [yrs.]
2	Storm Windows, Blow-In Insulation (Polly's office)	241 kWh	304	$71	$711	10
		37 ccf	438			

Source: Practical Energy Solutions for DVRPC 2014

- Back and southern walls. Consider improving insulation along these walls. Contractor evaluation and quotation are recommended.
- Teller window. Consider a more effective, easily removable air barrier for the teller window. This can be made from insulating materials purchased at the local hardware store.

HVAC

HVAC: Findings

The administration and police offices on the first floor and in the basement are heated and cooled by four low-efficiency split systems with direct expansion (DX) outdoor condensing units (approximately 9.0 energy efficiency ratio, (or EER)) and four high-efficiency natural gas furnaces (approximately 92 percent thermal efficiency (Et)). The units were installed in 1995 and are in good condition. The council meeting room is heated by two 1970s indoor natural gas duct heaters in fair condition and is cooled by a 2004 DX outdoor condensing unit. Appendix A contains an inventory of all HVAC units.

All units are controlled by programmable thermostats. PES reviewed and recorded the settings and schedules for each programmable thermostat in this facility.

HVAC: Recommendations

Improve Thermostat Programming

The following list highlights recommended schedule and setpoint temperature adjustments that will improve energy conservation. These changes will better ensure that the HVAC systems are conditioning the air to occupied temperatures only when needed.

- First Floor, front half
    - Inspect thermostat regularly to ensure no permanent holds have been placed.
- First Floor, rear half
    - Increase the weekday “Return” and “Sleep” cooling setpoints from 80°F to 86°F.
    - Decrease the weekday “Wake” heating setpoint from 63°F to 60°F.
- Second Floor, council meeting room
    - Place in continuous unoccupied mode (85°F cooling, 60°F heating). Use a temporary override to initiate occupied mode prior to meetings and events, allowing time for the room to come to the set temperature. The temporary hold setpoint will be maintained until the start of the next programmed time period or until the RUN softkey is pressed.
    - Inspect thermostat regularly to ensure no permanent holds have been placed.
- Basement, front half
    - Decrease the “Wake” and “Return” heating setpoints from 71°F to 68°F seven days per week.
    - Consider increasing the “Sleep” cooling setpoint to between 77°F and 80°F and decreasing the “Sleep” heating setpoint to between 65°F and 63°F seven days per week.
- Basement, rear half
    - Increase the “Wake,” “Leave,” and “Return” cooling setpoints to between 70°F and 73°F seven days per week.
    - Consider increasing the “Sleep” cooling setpoint to between 77°F and 80°F and decreasing the “Sleep” heating setpoint to between 65°F and 63°F seven days per week.

The Department of Energy estimates annual energy savings as high as one percent for each degree of setback over an eight-hour period. Using this estimate, PES calculates that Nether Providence Township could reduce annual energy costs by nearly $200 per year. Table 4 summarizes the potential energy savings. This is a no-cost measure and should be implemented as soon as possible.

Table 4: Savings: Improved Thermostat Programming

#	Measure Description	Annual Energy Savings		CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Est. Project/ Premium Cost	Simple Payback [yrs]
3	Improve Thermostat Programming	1,462	kWh	1,843	$196	$ -	Immediate
		29	ccf	346			

Notes: Savings based on current energy rates. Savings will grow as energy prices rise.
Source: Practical Energy Solutions for DVRPC 2014

HVAC Time of Replacement Plan

All furnaces, duct heaters, and condensing units, with the exception of the York condensing unit serving the council meeting room, have surpassed the typical unit life of 15 years. While it may not be cost-effective to replace all units at once, before they fail Nether Providence Township should develop a plan to replace them with high-efficiency units that meet or exceed the efficiency specifications shown in Table 5.

Although the equipment is functioning well and in good condition, a proactive replacement plan will allow the township to budget for the most efficient equipment possible, instead of replacing equipment upon failure. Urgent HVAC replacements are costly and all but eliminate the possibility of a high-efficiency replacement, as high-efficiency units are less likely to be in stock. This can force the township to purchase a standard-efficiency unit at a high-efficiency price and will lock the municipality into paying high operating costs for the 15+-year life of the new unit.

During the planning process, it is important to define the proper sizes of equipment to be replaced. Simple one-for-one replacements may be costly if existing systems are oversized. Units that are oversized not only waste energy (and increase energy bills), but they may not be able to dehumidify air in the summer because they cycle on and off too rapidly. As part of the HVAC replacement plan, PES recommends performing a load-sizing study to define the appropriate unit sizes based on actual demand and integrating these specifications into the replacement plan.

A thoughtful HVAC replacement plan and timeline will ensure that the township is prepared to purchase replacement units that will produce the best long-term energy and cost savings over time. A good time to consider replacing the units is when maintenance costs start to rise.

Table 5: Time of Replacement Plan: Unit Efficiencies

Item	Efficiency	
	Existing	New*
Outdoor DX Condensing Unit	9 EER	≥ 12 EER
Natural Gas Furnace	70% Et	≥ 92% Et
Natural Gas Duct Heater (Council)	70% Ec	≥ 90% Ec

Notes: EER = Energy Efficiency Ratio. Et = Thermal Efficiency Ec = Combustion Efficiency. *ASHRAE 189.1-2011. Use most current high-efficiency standards at time of purchase.
Source: Practical Energy Solutions for DVRPC 2014

The potential energy cost savings associated with these efficiency improvements is over $1,000 per year. Table 6 summarizes the energy savings and estimated premium cost of installing high-efficiency versus standard units. If units are replaced in the future, efficiency ratings, premium costs, and energy cost savings may change.

Table 6: Savings: HVAC Replacement Plan: All Units

#	Measure Description	Annual Energy Savings	CO_2 Savings [lbs]	Energy Cost Savings [$/yr]	Estimated Premium Cost*	Simple Payback [yrs]	Savings Over 15 Years
4	**HVAC Time of Replacement Plan**	7,771 kWh	9,791	$1,060	$3,077	2.9	$36,924
		168 ccf	2,021				

Notes: Payback is based on the premium cost, or cost difference between standard-efficiency and high-efficiency units, as these units will need to be replaced anyway. Savings based on current energy rates. Savings will change as energy prices change. *Premium cost = Difference in material costs between standard and high efficiency units. Does not include installation or other costs. Premium cost includes estimates for all units (CUs and furnaces).
Source: Practical Energy Solutions for DVRPC 2014

The existing unit sizes and configuration appear to be appropriate, but PES recommends performing a load-sizing study prior to unit replacement. The township should reconsider the whole system design if the facility undergoes significant building additions or renovations in the future.

Lighting

The majority of interior lighting is 4′ × 2′ recessed fluorescent fixtures with three 32W T8 lamps per fixture. The council meeting room has four-lamp fixtures, and the back stairwell has two-lamp CFL fixtures. All lighting is controlled by manual wall switches.

Lighting: Findings

PES noted consistent over-lighting throughout the facility, with many areas exceeding 100 footcandles (FC), as shown in Table 7 below.

Table 7: Light Levels

Location	Light Level [Footcandles]	Recommended*
Lower Level		
Police Lobby	79	20
New Bldg Offices	113	30-50
Kitchen	61	20
Conference Room	54	20-70
Locker Room	104	20
First Level		
Polly's Office	103	30-50
Lobby	110	20
Hallway	100	20
Admin Offices	80	30-50
Dennis's Office	114	30-50
Conference Room	119	20-70
Maureen's Office	88	30-50
Fire Marshal's Office	40	30-50
Second Level		
Meeting Room	30	20-70

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

Lighting: Recommendations

To reduce light levels and conserve energy, Nether Providence should consider removing one lamp from each three-lamp fixture and up to two lamps from each four-lamp fixture. This measure should be implemented on a trial basis to ensure that light levels are satisfactory.

Table 8 shows potential energy savings associated with this measure. PES has included ballast replacement costs in these estimates in case that is needed. Most modern T8 electronic ballasts contain parallel circuits, so a single lamp failure or removal will not affect operation of the remaining lamps in the fixture. However, delamping will impact the remaining lamps if the ballast has a series circuit; in this case, PES recommends replacing the ballast with a high-efficiency parallel-circuit ballast.

Table 8: Savings: Delamping

#	Measure Description	Annual Energy Savings [kWh]	CO_2 Savings [lbs]	Energy Cost Savings + Avoided Lamp Replacement Costs [$/yr]	Estimated Project Cost*	Simple Payback [yrs]*
5	Reduce Light Levels	13,174	16,599	$1,492	$0–$2,631	Immediate - 1.8

Notes: *Depends on need for ballast replacement. Savings based on current electricity rate. Savings will change as electricity prices change. **Source:** Practical Energy Solutions for DVRPC 2014

Appendix A

Appendix A. Inventory of HVAC Equipment

Description	Serves	Make/Model	Year	Cooling		Heating	
				Capacity [Btuh]	Efficiency [EER]	Capacity [Btuh]	Efficiency [EER]
Gas Furnace	Lower/1st Levels	Lennox G26Q4/5-100	1995			93,000	92.0%
Gas Furnace	Lower/1st Levels	Lennox G26Q4/5-101	1995			93,000	92.0%
Gas Furnace	Lower/1st Levels	Lennox G26Q4/5-102	1995			93,000	92.0%
Gas Furnace	Lower/1st Levels	Lennox G26Q4/5-103	1995			93,000	92.0%
Gas Duct Heater	Council Mtg (2nd Level)	Trane GDA 58OA	1970s			64,000	70.0%
Gas Duct Heater	Council Mtg (2nd Level)	Trane GDA 58OA	1970s			64,000	70.0%
Electric Spc Htr	Individuals	Various	n/a			5	
Split-System CU	Lower/1st Levels	Lennox HS29-513-1Y	1995	48,000	*9.0*		
Split-System CU	Lower/1st Levels	Lennox HS29-513-1Y	1995	48,000	*9.0*		
Split-System CU	Lower/1st Levels	Lennox HS29-513-1Y	1995	60,000	*9.0*		
Split-System CU	Lower/1st Levels	York E2RAO48S25G	1996	48,000	*9.0*		
Split-System CU	Council Mtg (2nd Level)	York E2RAO60S0BG	1994	60,000	*9.0*		
Split-System CU	Council Mtg (2nd Level)	York H3RAO60S06B	2004	60,000	*9.0*		

Source: Practical Energy Solutions for DVRPC 2014

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Key Words:

Energy, natural gas, electricity, energy management, heating ventilation air conditioning (HVAC), envelope, air sealing, insulation, interior storm window, thermostat, delamping, CO_2 emissions

Abstract:

On behalf of the DVRPC Circuit Rider Program Practical Energy Solutions (PES) performed an energy assessment of the Nether Providence Township Administration Building. The Nether Providence Township Administration Building (10,200 ft^2) is a multiuse facility with administrative offices, a council meeting room, finance offices, and the police department. The building is a 1902 stone barn renovated in the 1970s with a 1992 masonry block addition. PES identified opportunities to improve building envelope as well as several cost-free, practical operational refinements of the building's HVAC system. Opportunities identified include 1) implementing air sealing, insulation and operable interior storms to reduce air infiltration, 2) improving the operations of the building's HVAC system by refining thermostat schedules and setpoints, 3) delamping select lighting fixtures in the building, and 4) instituting a high-efficiency HVAC (heating, ventilation, air conditioning) replacement plan to replace equipment that has surpassed its unit life. Overall, these energy conservation measures are estimated to cut electricity use 22 percent and reduce natural gas use by one-third, saving the township more than $3,400 in annual energy costs at today's prices. These measures will also reduce CO_2 emissions due to fossil fuel use by nearly 37,500 pounds of CO_2 per year.

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