RENEWABLE ENERGY TRANSITION PLAN FOR UPPER DUBLIN TOWNSHIP MUNICIPAL OPERATIONS

For presentation to the Upper Dublin Township Board of Commissioners on November 9, 2021

Authorized by the Upper Dublin Environmental Protection Advisory Board

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Unless someone like you

cares a whole awful lot,

nothing is going to get better.

It's not.

- Dr. Seuss, The Lorax

Until one is committed there is hesitancy, the chance to draw back, always ineffectiveness. .... The moment one definitely commits oneself then Providence moves too. All sorts of things occur to help one that would never otherwise have occurred. .... Whatever you can do or dream you can do, begin it. Boldness has genius, power and magic in it.

- W.H. Murray, The Scottish Himalayan Expedition, 1951, with an excerpt from J.W. von Goethe, Faust, 1835

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Executive Summary

In Upper Dublin, and across the world, climate change is damaging human health and life, threatening food production, increasing the cost of virtually every operation and more. Anyone who has been in the neighborhoods that were affected by the remnants of Ida on September 1 can attest to the tremendous damage of increasingly severe storms. Climate upsets are occurring at rates even faster than first predicted. Human combustion of fossil fuels is the predominant contributor to climate change. Leaders at all levels are acting to reduce the impact, protect communities, and find ways to reduce energy waste.

The good news is that a lot can be done ***right now*** with current technology to reduce our contributions to climate change. A great deal of investment is being made around the world to further these decarbonizing technologies. A pathway now exists for the Township to reach 100% renewable energy in operations by 2050, if not sooner! The current state of technology enables the following Renewable Energy Goals (the "RE Goals"). Because undertaking and meeting these RE Goals requires a substantial change from the current status quo, a sustained commitment on the part of the leadership of this Township is necessary to reach the RE Goals effectively.

Adopting the following Renewable Energy Goals for Upper Dublin will provide the Township with an actionable framework to organize and direct its energy conservation and renewable energy efforts:

1. 100% renewable electricity for all Township municipal operations by 2025
2. 100% renewable energy for all Township municipal transportation and heating by 2040
3. 100% renewable electricity adoption by the community by 2035
4. 100% renewable energy adoption by the community for transportation and heating by 2050

The elected leaders and municipality staff of Upper Dublin Township hold the public's trust for maintenance of a healthy, stable living environment, while also being responsible for wise resource stewardship. In furtherance of that mission and obligation, this Renewable Energy Transition Plan for Upper Dublin Township Municipal Operations ("Plan") outlines strategies and actions towards achieving Goal 1 and Goal 2 in a fiscally responsible manner. A subsequent Plan for Community Action will need to be developed to address Goal 3 and Goal 4.

The Plan is based on four Foundational Steps for achieving the RE Goals and is organized into four Focus Areas. The Foundational Steps form the footing that must be laid to achieve success in each of the four Focus Areas. This footing first involves adoption by the Board of Commissioners ("the Board") of a Resolution (see Exhibit A Model Resolution) formally committing to the RE Goals. Second—and the strongest recommendation to municipality decision makers—is that success will require the consistent, comprehensive dedication that can only be obtained by tasking a professional staffer with coordinating implementation of the recommendations presented in this document and providing current information and resources to all involved. Third, progress should be tracked by establishing and measuring key metrics. Finally, progress and learnings should be communicated to key stakeholders and residents.

With this foundation, the actions required to reduce the Township's municipal energy consumption and transition to renewable energy are divided into four Focus Areas. We appreciate it is the Commissioners' obligation and duty to exercise fiscal responsibility. While renewable energy discussed in Focus Area 1 may cost more than fossil fuels in the near term, the energy conservation measures outlined in Focus Areas 2 and 3 will generate savings freeing funds that can offset those additional costs. In the long-term, we expect renewable energy to be on par or less costly than fossil fuels.

- **Focus Area 1**: **Transition to Renewable Electricity and Renewable Natural Gas for the Township's energy needs:** Establish energy purchasing policies and procedures for Township operations based on an analysis of current and future energy needs; identify and evaluate renewable energy procurement options; and identify and evaluate opportunities to own or lease on-site and/or off-site geothermal, wind and/or solar energy.

- **Focus Area 2**: **Reduce fossil fuel use by Township fleet operations:** Move towards alternative vehicle options, such as hybrid and electric vehicles, to reduce greenhouse gas production; support building the infrastructure required for new transportation technologies; reduce the use of personal and fleet vehicles by staff; replace internal combustion-powered handheld landscape maintenance equipment with electric analogues; and facilitate adoption of clean, renewable liquid fuels in vehicles for which electric options do not exist.

- **Focus Area 3**: **Adopt clean energy best practices for Township buildings and operations:** Conduct benchmarking, building energy audits, and periodic building re-tuning; implement recommendations of energy audits and establish key policies; replace fossil fuel powered HVAC with electric powered sources; and prioritize energy management through mission, planning, training, and collaboration.

- **Focus Area 4**: **Engage and lead the community in the adoption of clean, renewable electricity, for transportation and in commercial and residential buildings.** By implementing the actions in Focus Areas 1–3, the Township will be seen as an authority and leader in clean energy best practices. It will be able to lead the community—including residents, commercial businesses, the School District, and many others—by engaging those stakeholders and educating them about the Township's efforts to save costs and reduce greenhouse gas (GHG) emissions. By sharing its learnings, the Township can lead and facilitate the transition away from fossil energy by the schools and in the community at large.

This Plan was drafted by a four-person team of volunteer Township residents (the "Team") while participating in a program structured according to the U.S. Department of Energy's 2013 *Guide to Community Energy Strategic Planning*. Ten principles, described in Appendix A, were chosen to guide their planning and recommendations. Among these are appropriate resource stewardship, evidence-based decision making, sustainability, and social equity in application. It was the intent of the Team that these principles guide not only their efforts in drafting this Plan but also the implementation of the Plan's recommendations.

The work of the Team was authorized by the UD Environmental Protection Advisory Board ("EPAB") and greatly assisted by the cooperation and input of many in the Township. We thank the following people

from the Township for their support and feedback: Commissioners Meredith Ferleger, Liz Ferry, Alyson Fritzges, Cheryl Knight, Robert McGuckin, Gary Scarpello, and Ira Tackel; Township Manager Paul Leonard; Assistant Township Manager Jonathan Bleemer; Township Staff Jim Ennis, Deborah Barbera, Jerry Gaul, Derek Dureka, and Deb Ritter; the members of the Planning Commission; Cheri Fiory; and Janine Buesgen. We acknowledge the support provided by Paula Kline, Bill Sabey, Henry Alexander, Brandon Ford, and Stephanie Teoli Kuhls.

Introduction: A Description of the Problem

Multiple peer-reviewed publications from academic research labs, the United Nations and the U.S. government reliably establish global climate change as a fact, caused by humans, and occurring now, not only at some future date. The most current, reliable and comprehensive report issued by the United Nations Intergovernmental Panel on Climate Change indicates the necessity for action now.

Carbon dioxide (CO_2) released to the atmosphere by society's prodigious combustion of fossil fuels traps incoming sunlight near the earth's surface, warming it like sunlight warms a greenhouse. Hence, CO_2 and gases with similar properties are called 'greenhouse gases' ("GHG"). CO_2 is by far the predominant GHG.

The indications of a warming planet are sufficiently strong that in 2012 the U.S. Dept. of Agriculture changed its Plant Hardiness Zone Map, shifting the country's planting zones north.

The pace of GHG production is increasing rapidly. Half of the release in the last 300 years occurred after 1980, one quarter since 2000. The disruption of earth's climate, 'global climate change,' is increasing at a corresponding rate. Continuing release will play further havoc with the climate. And, because the half-life of atmospheric CO_2 is approximately 30 years, the CO_2 released this year will cause warming for decades. CO_2 release avoided this year is prevented from doing so.

Climate changes are not restricted to some remote distant location or future time. They are occurring in and impacting our Township now, including the pictured roadway in Ft. Washington. The Delaware Valley Regional Planning Commission ("DVRPC") projects that, absent changes in fossil fuel use, annual precipitation in the Greater Philadelphia area will continue the slight increase seen in recent decades. More precipitation will fall in winter and summer, and during intense storms. The increase in the number of hot days will continue; compared to the average for 1961–1999, there are now 50% more days each year with temperatures exceeding 90° F. Without corrective action, there will be a conservatively predicted

2.5-fold increase in >90° F days over the next 25 years. Similarly, a three-fold increase in the number of nights where temperatures remain above 70° F is predicted.

Global climate change is not just warming – 4 of the 10 largest snowstorms in our area have occurred since 1996.

Municipalities bear the burden of these changes, responding to the impacts of extreme heat, flooding from heavy rainfall, and heavy snowfall. The wise stewardship mandate that is the charge of government leaders dictates action to secure the health and safety of residents, to reduce avoidable expenses for upgrades to climate-stressed infrastructure, and to control energy expenditures. Both a reduction in the factors contributing to climate change and preparation to meet its increased demands are prudent.

We can now begin moving away from the fossil fuel energy sources on which we have built our civilization. We have cost-effective and cost-saving technologies available today to reduce energy use and shift to clean, renewable energy sources. Additional improved technology is being developed rapidly at the time of this writing! The authors, accordingly, generally do not recommend specific technologies herein; rather, we attempt to give a guide to the *current* landscape; an understanding that energy- and cost-saving solutions do exist, right now, today; and an appreciation of the fact that technological advances are being made rapidly. While we give recommendations based on what was available at the time of writing (2021), staff must stay abreast of changes and opportunities in technology that will continue to present themselves.

> "Even as our Nation emerges from profound public health and economic crises borne of a pandemic, we face a climate crisis that threatens our people and communities, public health, and economy, and, starkly, our ability to live on planet Earth. Despite the peril that is already evident, there is promise in the solutions — opportunities to create well-paying union jobs to build a modern and sustainable infrastructure, deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050."
>
> President Joe Biden, Jan. 27, 2021, Executive Order

Governments at all levels worldwide are acting right now. For example, over 180 cities and towns in the United States (as well as more than 10 counties, and 8 states), including at least 39 in the five counties comprising southeast Pennsylvania, have adopted resolutions to power their communities with 100% clean, renewable energy.

The sooner our society avoids CO_2 release, the better, because the health, lives, and property lost due to climate change cannot be recovered. Accordingly, this Plan describes a path for substantial GHG reduction by the replacement of fossil fuel with clean renewable energy in Upper Dublin Township municipal operations.

A Look Back at UD's Renewable Energy Initiatives

Upper Dublin Township has a long history of working towards energy conservation and transitioning to renewable energy. This Plan is a continuation of those initiatives. The *Upper Dublin Clean Energy History Timeline* (see next page) captures some of the efforts taken in the past 30 years to specifically reduce Township energy usage and GHG emissions, such as conversion of all Township building lights, traffic lights and streetlights to LED, resulting in significant energy and cost savings year upon year.

Significantly, in Resolution No. 1983, adopted March 11, 2008, the UD Board of Commissioners endorsed the U.S. Mayors' Climate Protection Agreement and declared its intent to both limit rising energy expenditures and reduce GHG emissions from the community. It called on the EPAB and Township staff to audit Township and resident energy use and develop an action plan to achieve these goals. *See* Appendix B.

Also in 2008, Dr. Lynn Mandarano and collaborators of Temple University Ambler prepared a GHG emission inventory. *See* Upper Dublin PA Greenhouse Gas Emissions Audit ("Audit"). The Audit quantified sources of GHG throughout the Township and recommended actions to reduce GHG emissions. Of 52 recommended actions, at least 37 related to reductions in energy use and GHG release. For nearly all of these, the municipality was identified as the sole, or as a major, actor. The EPAB reviewed the report and began its efforts of implementation by focusing on the single largest contributor of GHGs in the Township: residential heating. *See* EPAB Review of Greenhouse Gas Audit Report of 2008 by Temple University. Regrettably, most of the recommendations in that report remain unadopted. This represents 13 years of time lost in addressing global climate change at our local level. The good news is that technological advances since that report have made many of its suggestions more feasible, affordable, and easier to implement.

In 2018, DVRPC compiled an inventory of Upper Dublin's GHG emissions using 2015 data as part of a larger analysis of GHG emissions in the Greater Philadelphia Area. *See* Appendix C. DVRPC's report gathers the municipally allocated energy usage, GHG emissions, and energy expenditure information for Upper Dublin Township. As the report notes, it is "meant to serve as a starting point for municipal policy-making." Because the DVRPC report does not break out energy use, emissions and expenditure data for Township operations, the Team conducted their own review; the next section summarizes the results.

UPPER DUBLIN CLEAN ENERGY HISTORY TIMELINE

1994

UD SHADE TREE COMMISSION EST.

The Shade Tree Commission planted or gave over 1,300 trees to residents! Trees absorb GHGs and one mature tree supplies the cooling equivalent of five 10,000 BTU air conditioners running 20 hours daily.

2004

LED TRAFFIC LIGHTS

Replaced 48 traffic signals with LEDs saving money and energy.

2006

OPEN SPACE BOND REFERENDUM PASSES

The $30M bond acquired property for open space preservation and created new trails to help provide a walkable/rideable link to community facilities.

2007

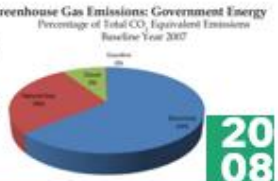
100% RENEWABLE ENERGY

UD Commissioners approved the purchase of 100% of the Township's energy needs from clean energy sources from 2007-2012. UD EPAB won the Philadelphia Sustainability Award.

2008

UD RESOLUTION GHG INVENTORY COMMISSIONED

Temple University Ambler report, commissioned by the UD Board, quantified sources of and recommended actions to reduce GHG emissions.



2008

CLEAN ENERGY COMMUNITY

UD qualified as a Clean Energy Community in a joint effort by the Township, 200 residents, businesses, and school organizations. The Township received a 1kW solar energy system at Robbins Park Environmental Education Center.

2017

LED STREETLIGHTS

The LED Conversion Project converted streetlights, Township parking lot lights, and exterior lights. Pre-conversion, the lights used 1,145,000 kWh; as of 2019, this was reduced to only 390,000 kWh.

2018

TOWNSHIP BLDG LIGHT CONVERSION

Completed a 3 year conversion process of all building lights to LED.

2020

EV

UD purchased a Chevy Bolt for use by the Township Manager, installed an EV charging station for the Township fleet, and made plans to install 2 EV charging stations at the new UD Library.

2021

ACCESS TO SOLAR

Revised Township Code to better accommodate installation of solar panels on buildings in the Township.

Summary of Base Year 2019 Municipal Energy Profile Findings

When we understand our energy use and spending, we gain the necessary context to:

- ✓ set emissions and cost reduction goals;
- ✓ identify activities that will increase municipal energy efficiency; and
- ✓ choose the best ways to invest limited resources in renewable energy.

The most recent year for which substantially complete energy use records for Township operations are available is 2019. Therefore, 2019 was designated the 'Base Year' in this study. Aggregated Base Year energy consumption data tells us where we are now as energy consumers, identifies operations using the largest amounts of energy, and thus suggests the focus of future GHG reduction efforts. It is also a baseline against which future- energy consumption can be compared to measure the effectiveness of attempts to reduce energy use and transition to renewable energy.

In March 2021, the Team compiled and reviewed the data for the attached 2019 Upper Dublin Municipal Energy Profile, *see* Appendix D. The data were collected from calendar year 2019 Township accounts with PECO and other energy-related vendors, consultations with municipal staff, and from the DVRPC GHG emissions inventory. The following table summarizes UD's Base Year energy consumption, emissions, and costs for its four primary energy sources: electricity, natural gas, diesel, and gasoline.

Type of Energy	Amount Consumed	Emissions (Metric Tons)	Annual Cost ($)
Electricity	2,396 MWh	911	$323,652
Natural Gas	32,660 Ccf	167	$30,832
Diesel	68,133 gal	693	$142,272
Gasoline	61,819 gal	493	$109,672
TOTAL		**2,264**	**$606,428**

Some of the data collected in turn shaped the creation of the Plan's Focus Areas:

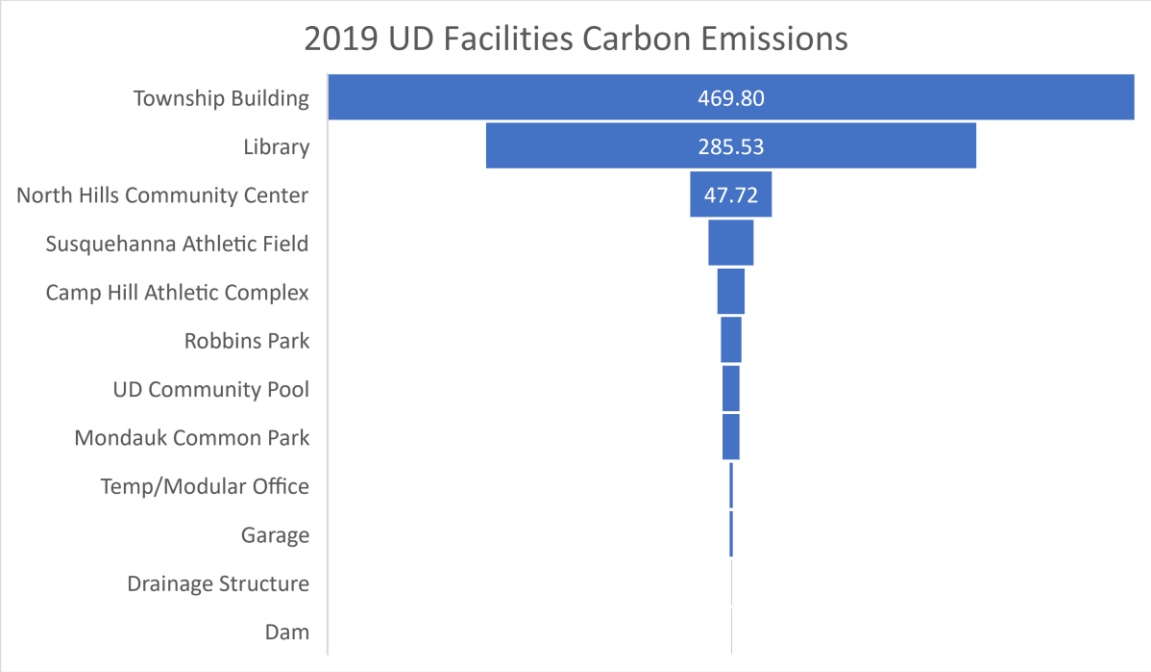
1. **Transition to clean energy sources for the Township's electricity needs.** Currently, the Township only uses the state-mandated minimum amount of renewable energy in its electricity feed (see Focus Area 1 for description of current minimums).

2. **Reduce GHG production by the Township mobile fleet.** Vehicle and equipment fuels (i.e., diesel and gasoline) accounted for 52% of the Township municipal GHG emissions.

3. **Adopt clean energy best practices for Township buildings and operations.** The Township operates multiple facilities that consume energy for heating, ventilation and air conditioning ("HVAC"), lighting, and building operations. The following *2019 UD Facilities Carbon Emissions* ranks the GHG

emissions for each Township facility in 2019. The two largest contributors to Township building energy emissions were the Township Building and the new Library. Together they accounted for 70% of the Township's electricity-related emissions. The Township and Library buildings' emissions so dominate emissions that we expect they will continue to be important to focus on in the move to reduce Township energy consumption and GHG emissions.

We would expect these numbers to look different going forward since a) the Library was not yet operating out of its new location in 2019, being housed in the Township Building prior to that time; b) the Township has since taken over operation of the Twining Valley Park building, adding a new large energy consumer; and c) the Township Building sustained significant damage as a result of the tornado in September 2021 and, as a result, major systems and structural changes will likely be required. Ongoing benchmarking, as discussed in Focus Area 3, is required. By annually compiling energy use data, it will be possible to monitor the success of efforts.



Township staff have been diligent in coordinating building energy use with the hours of occupancy by staff. The PECO-generated 'heat map'[1] below represents electricity use by the Police/Township Building (which was also functioning as the Library during the time period illustrated). The heat map shows that in September 2019 and from June 2020 to August 2020 (warm months) there was high electricity use (red) during business hours as the air conditioning was running. Conversely, we see low energy use (green) between the hours of 4 p.m. and 7 a.m. and on weekends, when building occupancy was low. (Since the map tracks electricity use, and the building is heated with natural gas, the map does not show an energy

[1] By coordinating a building's energy use with the hours of its occupancy by staff one can economize on energy use and expenditures. One means of assessing the degree of control being exercised in the operation of the cooling, lighting and operational functions of a building is to create a 'heat map' of the site. A 'heat map' is simply a representation of electricity consumption data in the form of a diagram in which the data values are represented as colors. From top to bottom the map lists the dates, in this case spanning Sept. 2019 to Aug. 2020. Instantaneous electricity use is indicated by a color scale for each day, beginning at midnight on the left side of the figure. Low energy use is shown in gray and green, grading to red for high consumption.

use spike during the winter heating months.) The impact of the 2020 COVID quarantine, and the response of the Township staff, is also evident on the heat map – with very low energy use during the peak of the quarantine, and the attendant closing of operations and services, in March–May of 2020. Overall, the heat map indicates appropriate attention to efficient energy use in the operation of this building. This Plan will explore other ways the Township can continue to be a good steward of resources and funds through wise energy use.

Moving Forward: Foundational Steps

Energy management is not a 'one and done' task. It requires a sustained commitment, continuing education, measurement of progress and communication of successes, failures, and results. The following Foundational Steps are fundamental to achieve the long-term Renewable Energy Goals ("RE Goals").

1. Adopt a Formal Resolution in Support of the Renewable Energy Goals

A Resolution, such as Exhibit 1 Model Resolution, by the Board of Commissioners in support of the RE Goals is crucial to success because it signals that the Commissioners support the initiative. The Resolution must emphasize the Township's commitment to action, signal staff of the intentions of the Commissioners, and help ensure action and initiative. Resolutions like the one proposed in Exhibit 1 *Model Resolution* have been adopted recently by at least 39 communities in Southeastern PA. By adopting further energy conservation practices and renewable energy in Township operations, the Township will lead the rest of the community by example.

2. Designate an Energy Manager to Coordinate Plan Implementation

This Plan was created by four Township resident volunteers, guided by formal coursework and the U.S. Department of Energy *Guide to Community Energy Strategic Planning*. The greatest lesson learned during this effort, and the strongest recommendation to municipality decision makers by the Team, is that a timely and successful transition to clean renewable energy cannot be achieved using volunteers.

Therefore, after passing the Resolution, the next priority is to designate an existing, or recruit a new, Township staff member, a predominant part of whose assignment is to be the onsite expert in the energy transition. Informal and ad hoc approaches are insufficient to successfully implement a renewable energy transition.

An Energy Manager benefits the Township and municipal operations by:

- maximizing funding sources from grants and low- or no-cost loans for achieving the goals;
- making best possible decisions with respect to energy procurement and production;
- avoiding duplication of efforts by coordination with staff;
- helping lower the Township's energy costs by implementing Plan actions;
- improving Township's public image by communicating results of energy Plan efforts to residents;
- helping to realize cost savings by collaborating at the county- and local-levels; and
- having an EM means the Plan will be implemented more efficiently and quickly resulting in achieving cost savings more quickly.

An Energy Manager is necessary to keep thoroughly apprised of the rapidly expanding area of clean energy and serves as the coordinator and motivator of staff efforts to realize the RE Goals. Essential tasks will range from learning of technological advances, to encouraging and coordinating adoption, to seeking funding to support plan adoption through state, federal and private grants. *See* Appendix E for a list of Funding Resources. Energy transition tasks identified in this Plan must be formally assigned to facilitate

success. The attached Exhibit 2 Energy Manager Position Description captures the tasks that must be performed.

Other local Townships assign energy management duties to the Assistant Township Manager or have dedicated staff responsible for sustainability and energy management.

Township staff tasked with implementation of this Plan should meet regularly to share plans, progress, and bottlenecks encountered. Value will be added by including representatives from the Board of Commissioners, key Departments, Citizen Boards, and Commissions.

3. Establish Metrics, Measure Progress & Share Successes

Tracking performance is essential. It indicates the degree of progress in approaching RE Goals, aids in fine-tuning programs that are underway, can highlight best next steps, and energizes participants to continued action. Some examples of performance metrics the Township can use to gauge success in implementing the plan are below. Other metrics can be developed by the Energy Manager. The Manager will also prioritize efforts, mindful of the resource limited environment. They will set the rate at which each metric is met, dependent on changes to laws, costs/budget, technology, etc. Energy Star Portfolio Manager, as discussed in Focus Area 3, is a tool that can help the Township and the Energy Manager track building-related metrics.

Metric	Definition of Success	Focus Area Supported
Annual fossil fuels (natural gas, diesel, and gasoline) consumption.	Continual reduction of fossil fuels through replacement with renewable sources and reduced use.	1, 2, 3
Grant dollars received for energy initiatives in the Township.	Energy conservation and renewable energy projects within the Township's operations achieved at an acceptable cost to the Township.	1, 2, 3
Percent of energy purchased from local, renewable sources and/or locally installed for Township operations.	Reach 100% local renewable energy.	1
Number of electric charging stations installed in the Township.	All township residents, visitors and employees have equitable access to EV charging.	2, 4
Number of hybrid and electric vehicles in the Township fleet.	Reach 100% renewable energy for all municipal transportation by 2040.	2

Number of electric and battery-powered lawn mowers and handheld lawn/woodland maintenance tools in use by the Township.	Reach 100% electric and battery-powered tools by 2040.	2
Net number of trees, GHG-reducers, in the Township.	A net increase in trees year over year.	2, 3
For each municipal building, energy use per square foot of building space.	Energy use per square foot of building space meets or exceeds national and/or regional benchmarks for all Township buildings.	3

Adopted metrics and regular reports of progress against meeting them should be shared with the community. It is important to adopt a policy of education and outreach to the community and businesses, promoting the Township's achievements in increasing energy efficiency and renewable energy to save costs and reduce GHG emissions. Publicizing achievements and program successes will build community support and establish UD as a leader in wise energy use.

Focus Area 1: Transition to Renewable Electricity and Renewable Natural Gas for the Township's Electricity & Heating Needs

One immediate step that Upper Dublin Township can take to lead by example in reducing its GHG emissions is to procure renewable electricity or renewable energy credits, and renewable natural gas. Pennsylvania's deregulated electricity market allows electricity consumers, including municipalities, to choose their energy suppliers. In fact, from January 2007 to December 2012, Upper Dublin Township purchased 100% of its electricity from clean energy sources.

However, currently Upper Dublin's electricity supply only includes the state-mandated minimum electricity from renewable energy sources. The Alternative Energy Portfolio Standards Act of 2004 ("AEPS Act") requires electricity supplies to acquire a specific percentage of electricity from alternative energy resources. The percentage of alternative energy required in the electricity mix changed each year until 2021, as shown in the table below.

Compliance Year (CY)	Tier I (including Solar PV) *	Tier II**	Solar PV	Total
CY 2017	6.0%	8.2%	0.2933%	14.2%
CY 2018	6.5%	8.2%	0.3400%	14.7%
CY 2019	7.0%	8.2%	0.3900%	15.2%
CY 2020	7.5%	8.2%	0.4433%	15.7%
CY 2021 and beyond***	8.0%	10.0%	0.5000%	18%

* Tier I includes solar photovoltaic (PV), solar thermal, wind power, low-impact hydropower, geothermal energy, biologically derived methane gas, fuel cells, biomass energy, generation of electricity inside of PA utilizing byproducts of the pulping process and wood manufacturing process, and certain municipal and coop-owned hydropower

** Tier II includes waste coal, distributed generation systems, demand-side management (includes energy efficiency, demand response, and use of industrial by-products and technologies such as waste heat), large-scale hydropower, municipal solid waste, generation of electricity outside of PA utilizing byproducts of the pulping process and wood manufacturing process

*** The AEPS Act currently states that alternative energy obligation levels shown in the 2021 energy year are for "2021 and beyond." Future legislation may change the alternative energy obligation levels.

Source: DSIRE. https://programs.dsireusa.org/system/program/detail/262

Accordingly, only 8% of Upper Dublin Township's current electricity supply is produced from Tier I renewable sources. Another 10% is produced from Tier II alternative energy sources, which are less desirable from an environmental standpoint than the Tier I sources. While Tier II sources may provide environmental benefits relative to the use of oil, natural gas, and coal, their potential to improve our air quality and address climate change is less than that of Tier I sources.

Upper Dublin Township recently established a new contract for electricity through December 31, 2024. The Township has an opportunity to purchase electricity with a greater mix of renewables - **up to 100%** - in its next utility contract. This section of the Plan identifies and discusses options that are available to the Township to inform future energy procurements.

1. Establish Energy Purchasing Policies and Procedures for Township Operations Based on Analysis of Current and Projected Future Energy Needs

- **Establish a schedule for regular utility bill audits.**

  The Township's last utility bill audit was performed in 2017. Utility bill audits often identify billing mistakes that result in overpayment; thus, an audit could return money to the Township. For example, a neighboring township recently conducted such an audit of bills from 2019-2021 and identified over $11,000 in overpayment to PECO.

- **Conduct an administrative review of the current contracts.**

  Identify features of the current utility (electricity and natural gas) contract that help to achieve the RE Goals as well as those that may hinder achievement of these Goals. Assess current purchasing contracts and plans, including the electricity contract as well as plans for purchasing large electrical appliances, electric vehicle charging stations, etc.

- **Establish a renewable energy purchasing policy for municipal properties.**

  As described below, there are several options for acquiring renewable electricity, ranging from specifying a certain level of renewable electricity in the electricity supply contract to installing solar panels on Township properties. There are also options for purchasing renewable natural gas. A purchasing policy guides Township staff in making these purchase decisions based on the Township's values, budgetary policies and situation, risk tolerance, and other factors. The policy should prioritize the use of locally produced electricity and natural gas over distantly generated sources to grow local infrastructure, increase local resilience, and strengthen local business and workforce communities.

Montgomery County RE Purchase

On May 20, 2019, the Montgomery County Commissioners announced a wind energy purchase to power 100% of the county's electrical accounts. The renewable energy contract reportedly costs the county $24,000 (1.4%) more, on an annual basis, than purchasing the standard grid mix. The wind energy is produced in Texas. The Commissioners also passed a resolution directing staff to create a working group of county employees to do a comprehensive review and create a plan for Montgomery County government to increase sustainability across all operations. The resolution committed to transition to renewable energy for heating all county-owned buildings and powering all county-owned vehicles by 2050.

2. Identify and Evaluate Renewable Energy Procurement Options

- **Investigate the costs and benefits of using an energy broker that specializes in renewable energy for identifying favorable contract pricing and terms.**

  Electricity contracts are complex, and a good broker can help the Township obtain the best pricing while meeting its emission reduction goals. Potential brokers should be well vetted to ensure the Township's objectives are met.

- **Set aside energy cost savings to purchase renewable energy.**

  Use cost savings achieved through energy reduction measures and/or the allocation of additional energy procurement funds to acquire renewable electricity, to purchase renewable energy credits ("RECs") (see sidebar for description), or to invest in future renewable energy installations on Township property.

  Our data shows an expenditure of $323,652 for about 2,400,000 kWh hours of electricity in 2019, approximately $135/1000kWh. As of 2021, the cost is about $5/1000kWh for a solar PA REC. *See* PJM EIS Generation Attribute Tracking System for current rates. Thus, the cost to purchase an equivalent amount of RECs would be about $12,000. If the cost of switching to a renewable energy supplier is more than 3.7% (12,000/323,652) of the cost of purchasing standard grid electricity with the state-mandated minimum renewable energy content, then the Township should purchase local PA RECs instead of switching suppliers. There are many types of RECs (*see*

Renewable Energy Credits ("RECs")

"One of the easiest and most immediate ways … to get green energy flowing into … buildings and homes is to buy solar or wind power RECs. Here's how it works. Electricity enters the grid from many different sources, ranging from nuclear and gas to wind and solar power, making it impossible to know exactly where your energy is coming from at any given time. To solve this problem, property owners can purchase "renewable energy certificates [or credits]" (RECs) that represent electricity generated by renewable energy sources. RECs, paired with electricity from the grid, represent renewable energy generated and delivered into the grid on your behalf.

A REC is not electricity. It is a virtual item representing the production of renewable electricity. One REC is produced when a renewable energy source generates one megawatt-hour (MWh) of electricity and delivers it to the grid. For example, if a wind power facility produces 5 MWh of electricity, they have 5 RECs to keep or sell. If you buy those RECs, you are buying the "renewable" aspect of the electricity from the wind farm, and you can say that 5 MWh of your electricity use came from a clean renewable source.

RECs represent renewable clean energy being delivered into the grid. Importantly, not all RECs are created equal. Some create new renewable energy projects. Others do nothing to drive renewable energy development because they come from wind and solar farms that already exist. For this reason, it's important to select RECs that drive new projects."

Radnor Renewable Energy and Conservation Plan

Appendix E), and selection can be complicated and require the assistance of a consultant or broker.

- **Identify and evaluate renewable electricity procurement options.**

  There are many options for acquiring renewable electricity, including:

  - selecting an electricity supplier that can guarantee a specific percentage of renewable electricity
  - purchasing RECs
  - entering into a power purchase agreement ("PPA")
  - installing solar panels or windmills

  Electricity contracts, RECs, PPAs, and renewable energy installations are complex, and there are advantages and disadvantages to each option. In addition, the cost of each option is constantly changing. Evaluate the costs, contractual requirements, risks, and benefits of each renewable electricity purchase option. *See* Appendix E, Description of Renewable Electricity Options.

- **Select near- and long-term strategies for renewable electricity procurement.**

  Near-term purchases of renewable electricity should focus on the simplest, lowest-cost options since they have the lowest impact on the budget and require less expertise to implement successfully. It is recommended that the Township initially elect to either (1) purchase renewable power by choosing a renewable electricity supplier to supply a specified percentage of the Township's electricity, or (2) purchase RECs with the funding set aside for renewable energy purchases. In the long term, the Township should evaluate opportunities to (1) purchase renewable energy directly through a PPA, in coordination with other local municipalities or regional government entities, and/or (2) install solar panels on Township facilities.

- **Identify and evaluate opportunities to purchase renewable natural gas (RNG).**

  RNG is produced at organic waste facilities (e.g., landfills, dairies, confined animal feeding operations, and wastewater treatment plants) and can be used for heat and cooking just like conventional natural gas, except without the damage caused by drilling and fracking. The combustion of RNG is considered to have no net impact on GHG because RNG is produced from organic sources that once absorbed carbon dioxide from the atmosphere during photosynthesis. RNG has even greater benefits when it is produced from organic waste that would otherwise decay and create methane emissions, such as landfill gas.

  RNG is currently commercially available in southeastern Pennsylvania (see e.g., the Energy Co-op). No additional gas line infrastructure changes are needed nor is any special new equipment required.

3. Identify and Evaluate Opportunities to Own or Lease On-Site and/or Off-Site Geothermal, Solar, and/or Wind Energy

- **Determine whether to own or lease on-site or off-site renewable energy, and how much energy the Township should generate or purchase.**

  Factors to consider include:

- The Township's RE Goals and the Guiding Principles
- Price
- Long-term cost savings
- Generation resource type (e.g., wind versus solar)
- Ease of procurement
- Direct and indirect effect of their demand-side choices
- Location of the generating facility

The Township should consult with experienced, reputable advisors on topics such as auditing current and future energy procurement (anticipating potential energy efficiency gains sustained in Focus Area 3), financing, entity structures, utility interconnection, markets, legal and regulatory, measurement and verification. The Pennsylvania Department of Community & Economic Development offers grants and loans for the utilization, development, and construction of alternative and clean energy projects. *See* Appendix F Funding Resources.

- **Assess potential for solar and geothermal as part of an updated capital improvement plan.**

  As part of an update to the 2008 10-Year Capital Improvement Plan, we recommend conducting an assessment to determine the potential energy and cost benefits for the installation of solar, wind and/or geothermal energy sources to promote efficiency and reduce emissions. The results of such assessment should be incorporated into the updated Capital Improvement Plan.

  Assessment of sites for solar installation involves three steps:

  1. Create an initial list of possible project locations
  2. Pre-screen the list of sites
  3. Perform an in-depth site evaluation.

- **Determine if there are cost advantages to aggregating purchases with other local municipalities.**

  Cross-municipality aggregation to form a larger purchase may result in cost-per-unit reductions. Some of our neighboring municipalities, e.g., Cheltenham and Springfield Townships, are being notably proactive in transitioning to renewable energy. For purchase aggregation and, more broadly, to form relationships and to learn of new developments in the rapidly advancing area of renewable energy, we recommend the formation/strengthening of relationships with neighboring communities and with relevant county-level bodies and consortia.

  Bucks, Montgomery, Chester, and Delaware counties are currently exploring the possibility of entering into a power purchase agreement to construct a large-scale solar energy facility. The counties have authorized DVRPC to solicit proposals to hire a consultant to explore strategies for long-term electricity and renewable energy purchasing. There is potential for municipalities in those counties to join the power purchase agreement.

Focus Area 2: Reduce GHG Production by the Township Mobile Fleet

The 2019 Municipal Energy Profile, *see* Appendix D, indicates that internal combustion engine ("ICE") use is the largest source of GHG emissions by Township operations, accounting for 53% of all GHG emissions in Township operations. In addition to environmental impacts, combustion emissions can cause mild to severe lung irritation and disease to workers and Township residents. Reductions in the use of ICEs result in both cleaner air and reduced GHG production. The following actions would contribute to such reductions.

1. Reduce GHG Production during On-road Fleet Operations

- **As new vehicles are required, purchase conventional hybrid, plug-in hybrid electric, and battery electric vehicles (BEVs).**

  Township staff wisely follow a timetable for vehicle replacement based on vehicle type and duty cycle. Reliable vehicles powered by innovative technologies that reduce or eliminate GHG production are currently on the market, and the sector is expanding rapidly. In addition to reduced GHG output, in many cases these vehicles offer superior performance and reduced cost of ownership relative to ICE analogues. *See e.g.,* sidebar 'Hybrid Vehicles Are Comparable to Conventional Ones in Performance'. They should be added to the fleet as new units are purchased.

  Required performance capabilities should be the first metric in identifying potential new purchases. Subsequently, the optimal vehicle can be identified via comparative cost-of-ownership calculations. These can be conducted by private sector consultants. Alternatively, one can use publicly available online calculators, such as the federal Alternative Fuels Data Center's, which allows the user to conduct a simultaneous comparison of up to eight currently marketed vehicles with regard to cost of ownership/operation. When using such

Springfield's Hybrid Police Cruisers

Springfield Police Department generally buys two new police cruisers each year. In 2020, a Township Commissioner asked for more information on lower emission vehicles like hybrids to meet the need in 2021.

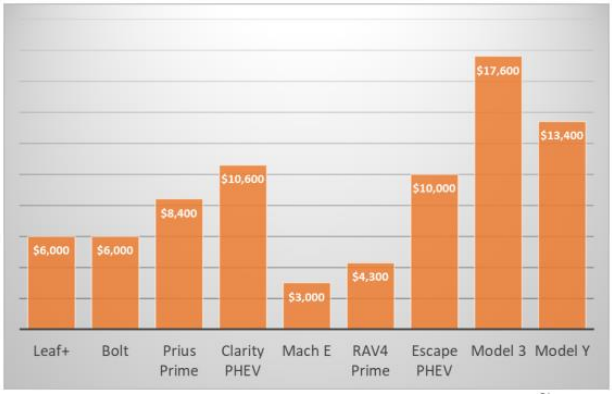
Their research showed that a hybrid would save their police department 343 gal/yr. of gas while driving and 933 gal/yr. while idling (which police vehicles do a lot). This amounts to about $2,400 in annual savings and over 25,000 pounds of CO_2 avoided for a vehicle that costs about $3,500 more than the equivalent conventional ICE model. The additional initial cost would be recovered within a year and a half, with savings accumulating during the lifetime of the vehicle.

Thus, with its two hybrids purchased in 2021, Springfield will avoid 50,000 pounds of CO_2 emissions every year while saving $7,000 for the taxpayers every year after the first 18 months. These savings do not include the anticipated lower maintenance costs of hybrids.

tools, it is recommended that one verify that their cost data inputs, e.g., for liquid fuel and electricity, are comparable to those one is experiencing.

Studies on hybrid sedans, SUVs, etc. show them to be cost competitive to purchase and operate relative to ICE vehicles. A local example of this, from Springfield, Montgomery County, is discussed in the sidebar 'Springfield's Hybrid Police Cruisers'. In a more comprehensive national study (Electric Vehicle Ownership Costs: Today's Electric Vehicles Offer Big Savings for Consumers, C. Harto, Oct., 2020), Consumer Reports ("CR") compared the calculated total cost of ownership (TCO) of 4 hybrid/chargeable electric and 5 full electric vehicles with those for the bestselling, the highest rated (by CR), and the fastest accelerating ICE vehicles in the same vehicle category (see Figure 'Total Cost of Ownership ...', below). In all cases the chargeable hybrid and the fully electric vehicles had TCO values thousands of dollars below those of their counterparts. (The exceptionally high differential for the Tesla models 3 and Y does not pertain today, since the $7500 Federal Tax Rebate for these, and for the Chevrolet Bolt, expired when sales of each exceeded 200,000 vehicles. Reinstatement of the rebates is under consideration.) For electric vehicles, the calculated lifetime cost savings relative to ICEs have been favorable for years and is increasing.

Total Cost of Ownership: Calculated Savings of Electric and Partial Hybrid Electric Vehicles over Comparable Vehicles with Internal Combustion Engines (PHEV = Partial Hybrid Electric Vehicle)



HYBRID VEHICLES ARE COMPARABLE TO CONVENTIONAL ONES IN PERFORMANCE

The Michigan State Police (MSP) routinely evaluate new potential police vehicles. The 2021 Model Year tests included both hybrid and conventionally powered Ford Interceptors, as well as models manufactured by Dodge and Chevrolet.

Hybrid-powered Interceptors were comparable or superior to the conventionally powered, non-turbocharged sister model in time to accelerate from 0 to 60 mph (7.2 secs. for the hybrid vs. 7.8 secs), distance to brake from 60 to 0 mph (7.2 vs.7.8 secs), and top speed (136 mph). The hybrid vehicle exceeded the conventional one in overall EPA-estimated mileage by 26% (24 vs. 19 mpg). In all tests except mileage, where it excelled, the hybrid Interceptor fell within the range of performance data of all vehicles tested. Electric vehicle data is anticipated.

However, we do not recommend the purchase of hybrid medium- and heavy-duty diesel trucks (Class 6 and greater, possibly Class 4 and 5) at this time. Although hybrid versions of these vehicles have been on the market for more than a decade, they are not cost-competitive; as a result, their adoption has been low. Truck manufacturers are currently developing battery electric and fuel cell electric trucks to meet existing and anticipated zero-emission vehicle mandates. Note that the PA Department of Environmental Protection offers reimbursement grants to replace or repower fleets of 6 or more Class 4–8 trucks. *See* Appendix F Transportation Funding Resources.

- **Transition to electric vehicles as appropriate and cost effective.**

  Even today's conventionally generated electricity, produced from coal, natural gas, nuclear and renewable sources, is cleaner in Pennsylvania than power generated with an ICE. As renewable energy is more widely adopted in electricity generation, the clean-air advantages of EVs over ICEs become even greater. Currently, over 20 electric models are on the market and more than 500 are proposed by 2022 according to Bloomberg's EV Market Outlook. Some of these are rather niche in their capabilities. However, the sector is being vigorously developed, and vehicle selections are slated for fast expansion. For example, Ford has just introduced the Lightning, an all-electric version of the popular F-150. Base models cost just $3000 more than a comparable conventional model, an amount probably overshadowed over the lifetime of the EV model by the elimination of fuel, engine oil, filters, engine components replaced as part of periodic maintenance, pollution control system catalysts, maintenance and State Emissions Inspections. In addition, state and Federal tax rebates and subsidies are available for the purchase of plug-in hybrid electric and battery electric models.

  As with hybrid and plug-in hybrid vehicles, full lifetime cost-of-ownership calculations should be conducted to identify the niches where electric vehicles make sense and which models make the most sense. These can be done using the Alternative Fuels Data Center's cost calculator mentioned in the previous paragraph or by hiring private sector consultants to quantitatively analyze the fleet and its duty cycles to identify the most suitable alternative fuel or electric vehicle replacements.

  We strongly recommend that staff rely on DVRPC's authoritative and comprehensive publication, *Electric Vehicle Resource Kit for Municipalities*. This document covers essentially all aspects related to the topic, from a description of the various types of hybrid and electric drivetrains to guides for deciding where and how many charging stations to install, and many relevant topics in between.

  This transition to non-ICE vehicles should be a dynamic process. As models with appropriate capability and affordability become available, they should be included in the fleet. Restrict purchases to models that have been in the field at least 2 years to establish reliability, durability, and performance.

- **Reduce driven miles, improve vehicle and driver performance, and adopt biobased fuels.**

  Minimize vehicle use: Combine multiple trips into single ones. Employ phone and vehicle navigation systems to determine shortest transit routes. Use the smallest vehicle suitable for a task. Conduct virtual meetings when possible, efficient, and allowed by the Commonwealth.

  Adopt a 'no idle' policy: Engines are to be turned off if expected idle time exceeds two minutes. (Accommodate this policy to the need for passenger-compartment heat during winter, air conditioning in summer.)

Be attentive to fleet maintenance schedules: As appears to be current policy, continue to maintain vehicles for optimal fuel efficiency, including tire air pressure.

Monitor vehicle duty cycles: Remote transponders currently communicate fleet vehicle location and movement, on a real-time basis, to the office of the Director of fleet operations. Monitor this data; exploit it to reduce trips and idling.

Conduct a fleet utilization and/or a fleet right-sizing analysis to ensure optimal utilization and number of vehicles to fulfill their mission: The analysis should conclude with recommendations on the most cost-effective alternative fuels and technologies that the Township could use to become more productive and efficient. This can help the fleet save money while reducing emissions.

Offer eco-driving training to fleet drivers: Changes in driver behavior can lead to fuel savings, increased efficiency, prolonged vehicle life, and reduced emissions. Train managers in how to effectively reinforce safe and fuel-efficient driving techniques.

Adopt biobased fuel in the heavy-duty fleet while awaiting suitable EV technologies: Diesel fuel constitutes more than half of the liquid fuel used in Township operations and generates 58% of the GHG originating from liquid transportation fuels.

Essentially all diesel used in the Township is petroleum-based. Diesel fuel produced from biological materials, known as 'biodiesel' and 'renewable diesel,' does not increase net atmospheric GHG when burned, since its carbon was obtained from atmospheric GHG during photosynthetic production of the fuel precursors. All Pennsylvania diesel fuel currently contains 2–4% biodiesel. The successful long-term use of diesel fuels containing as much as 20% biodiesel in standard factory, unmodified engines has been abundantly demonstrated in fleets across the country. The use of much higher blends, up to 100% biodiesel, is regularly practiced without incident. Replacement of fossil diesel with biobased diesels would reduce Township GHG output in proportion to the amount of biofuel adopted. It is a GHG-reducing action that can be taken now, while EV technology for heavy-duty trucks remains under development.

We understand that the School District experienced problems during a past use of biodiesel blends. Based on descriptions of the nature of the problems, it is probable that the fault was a commonly experienced one during fuel-transition events – failure to conduct multiple fuel filter changes early in the transition. Because this fuel has been successfully used around the world for more than 15 years, with 2020 U.S. consumption being 1.7 billion gallons (*U.S. biofuels consumption 2020*, https://www.statista.com/statistics/197216/consumption-of-biofuels-in-the-us-since-2006/), we believe that by consulting readily available educational and industry consultant resources, a smooth adoption could be achieved. Contact information can be provided by the authors of this report.

An advantage of biodiesel use is that modification of the engine and fuel system are not required. However, a disadvantage of using biodiesel at percentages higher than that generally available as a low blend in the state fuel pool is the need to fund and construct separate fuel storage and delivery facilities. This is a consideration but is not insurmountable.

The PA Department of Environmental Protection offers a grant program that assists municipalities with vehicle retrofit and alternative fuel refueling infrastructure projects. *See* Appendix F Transportation Funding Resources.

Monitor and continuously improve fleet average fuel efficiency value: Set fleet efficiency goals. For example, a goal for the fleet of sedans and SUVs might be achieving a fleet average of 40 mpg by 2025. A similar goal should be developed for the heavy-duty fleet as it transitions to electric platforms.

Maximize subsidies, tax incentives, grant programs, etc. made available by state, federal, regional, and private foundations. *See* Appendix F Funding Resources.

2. Support the Infrastructure Required for New Transportation Technologies

- **Require all new municipal parking be EV ready.**
- **Install publicly available EV chargers at Township parking facilities:** Buildings, athletic fields, library, parks, etc.

  There are numerous grant, rebate and other incentive programs for municipalities to install publicly available EV charging. *See* Appendix F Transportation Funding Resources

  Funding availability will most likely mandate prioritization among the list of locations where EV chargers are desired. Prioritize sites where staff and visitors spend multiple hours at a time, such as at the main Township building and, as is already planned, the library. Perhaps most effective would be the encouragement and facilitation of charger installation at such private locations as properties with multiple rental units, such as apartment complexes. Residents of such facilities don't have the property on which to install their own chargers but may well welcome the ability to use them onsite.

- **Install charging stations for the Township fleet** to support the fleets' EV component. We applaud last years' installation of a charger at the main fleet garages.

  For all these considerations, the DVRPC publication *Electric Vehicle Resource Kit for Municipalities* is again recommended as a starting place for information on funding sources and to guide such decisions as charger type, number, and location.

- **Explore innovative ways to reduce the total capital and operational costs of in-fleet charging stations**.

  For example, explore EV support equipment sharing agreements with other public institutions (UD School District) and private businesses.

- **Keep maintenance staff up to date**.

  As new vehicle technologies are adopted, ensure that staff receives appropriate training.

- **Reevaluate the 'all GM' policy**.

  For economy of staff training and for inventory reduction the Township has a policy of purchasing General Motors products when sedans, SUVs and some heavy-duty equipment are needed. Although GM recently announced its intention to produce at least 30 electric models by 2025 and to completely phase out internal combustion engines by 2035, this purchasing policy should be evaluated as other sources of alternate drivetrain models become available.

3. Reduce Use of Personal Vehicles by Staff

- **Reduce travel to work**.

  Allow employees to work remotely, meet via teleconference, and flex their work schedules to avoid peak commute times.

- **Energize the staff regarding alternate modes of transport**.

  Educate, incentivize, and provide infrastructure to replace ICE vehicles with ride sharing, use of public transportation, and non-motorized movement (e.g., walking and biking).

- **Promote attendance at work-related off-site meetings via remote methods such as teleconference, as appropriate and allowed by the Commonwealth.**

- **Reward workplace charging**.

  Provide no- or low-cost charging at preferred parking locations or nearest to work site. Workplace chargers significantly increase EV adoption. Employees are 20 times more likely to drive EVs if they can charge at work.

4. Remove Small Internal Combustion Engines from Township Operations

- **Substitute electric and battery-operated equipment for ICE models as funding is available and as old equipment is replaced.**

  There are at least 4 large riding lawnmowers in the Township fleet, and no less than 36 handheld engine-driven devices – chainsaws, trimmers, blowers, etc. The mowers are powered by 4-cycle engines that lack the antipollution catalyst systems of on-road vehicles. The handheld equipment is powered by 2-cycle engines, which inherently run 'dirtier' than 4-cycle ones. They also lack the sophisticated emissions control systems found on cars and trucks. Thus, they 'punch above their weight class' in terms of fuel use and the emission of pollutants. A study of emissions in the U.S. in 2011 determined that gasoline-powered lawn and garden maintenance equipment, which are predominantly powered by 2-cycle engines, emitted approximately 26.7 million tons of pollutants. This accounted for 24%–45% of all nonroad gasoline emissions. The subcategory of gasoline-powered landscape maintenance equipment (e.g., leaf blowers/vacuums, trimmers, edgers, brush cutters) accounted for 43% of volatile organic compounds and around 50% of fine particulate matter. Rechargeable battery-operated versions of all these devices are becoming commercially available in increasing numbers. Their adoption in Township operations, replacing units powered by internal combustion engines, has begun. We applaud this initiative and urge its expansion.

- **Adopt energy-reducing policies in property and grounds maintenance:**

  Among these are (1) the use of rakes, shovels, brooms, etc. whenever feasible in place of self-propelled blowers and mowers; (2) a continued **reduction in mowing frequency**, especially in open fields and retention basins, and creation of meadows; and (3) an **expansion of tree planting**, specifically strategically placed trees that shade buildings and reduce energy consumption. Overall, such reductions could reduce the number of mowers required, freeing sufficient funds to

purchase newer technologies. We commend the concerted effort by the Parks and Recreation Department in this area, achieving a 30% reduction in mowing hours between 2017 and 2020.

Focus Area 3: Adopt Clean Energy Best Practices for Township Buildings & Operations

To achieve the Township RE Goals, Focus Area 3 identifies the steps to increase energy and cost savings, as well as reduce fossil fuel use in the Township's buildings and operations.

> Nationally, local government buildings alone consume 2 quadrillion Btus each year and have the potential to save $3.7 billion annually through a 20% improvement (U.S. Energy Information Administration (EIA), 2016). Through policies and programs, local governments spur innovative energy efficiency solutions, and by adopting best practices in public buildings, they lead by example. Their efforts are saving taxpayer dollars, freeing up funding for other public priorities, and driving energy efficiency across their communities.

Local Government Better Buildings, U.S. Dept. of Energy ("DOE").

Together, these recommendations can reduce operational costs by saving energy, reducing maintenance bills, and potentially increasing employee productivity. By doing so they free up funds for use in further transition to a renewable energy infrastructure.

Springfield Township Energy Audit

Springfield Township built three new buildings in 2017 (police/admin, library, and public works), replacing three 50+ year old buildings. Once the buildings were brought online, it was assumed that since the new buildings had state-of-the-art HVAC systems, they ran efficiently. Wrong!

In 2019, the Township contracted with West Chester-based Practical Energy Solutions ("PES") to run energy benchmarks on the three buildings. Surprisingly, the library and police/admin building underperformed compared to their "peers," while the public works building performed above average. See *Springfield Township Energy Benchmarking Report*.

With this data, the Commissioners ordered a winter (heating) energy audit. See *Springfield Township Energy Assessment*. After implementing the auditors' straightforward and inexpensive recommendations, **the Township can expect to save $16,000 annually and avoid 200,000 pounds of carbon emissions annually.** The total cost for benchmarking and audit was $6,500. The payback time was less than 6 months!

The Commissioners gave PES approval to perform a summer (A/C) audit to achieve even more savings.

1. Conduct Benchmarking, Energy Audit and Building Re-tuning

- **Benchmark energy consumption in Township buildings using the ENERGY STAR Portfolio Manager system.**

  Benchmarking means measuring and comparing a building's energy consumption to that of similar buildings, past consumption, or a reference performance level. It turns the information on a utility bill into knowledge one can act on. Portfolio Manager is a reputable, free benchmarking resource provided by the U.S. Environmental Protection Agency ("EPA") and the DOE.

  While the Township can conduct benchmarking on its own using the Portfolio Manager system, this option would require a significant amount of staff time to learn how to use the system, as well as to collect and input the data.

  Accordingly, we recommend UD hire a contractor to assist with the work. Cost will be dependent on the size and number of buildings flagged for benchmarking; based on Springfield Township's experience, it is estimated to cost $1500–$2500 to perform benchmarking on three Township buildings. Top candidates based on energy usage and considerations of equitable distribution of focus include Township Building, new Library, North Hills Community Center, and Twining Valley.

  DVRPC can provide technical assistance as well with using the ENERGY STAR Portfolio Manager system. *See also* Portfolio Manager Guide, DVRPC, Feb. 2014.

- **Enroll as a municipality in the DOE Better Building Challenge and get guidance on benchmarking and transparency.**

  The DOE Better Buildings Initiative has numerous resources to help municipalities adopt benchmarking programs originally designed for commercial properties. Its resource, Benchmarking and Transparency: Resources for State and Local Leaders, provides streamlined access to key existing resources for developing and implementing high-impact building energy benchmarking and transparency programs.

- **Conduct Energy Audits & Building Re-tuning**

  Even though many large commercial buildings employ sophisticated energy management and control systems to manage HVAC, the Pacific Northwest National Laboratory ("PNNL") and DOE report that many are not properly commissioned, operated, or maintained, leading to inefficiency, increased energy use and therefore increased costs. *Energy audits* survey major building systems – including the building envelope, mechanical equipment, and lighting. An energy audit also includes *building re-tuning* recommendations. *Building re-tuning* looks at the results of the operations and control systems survey and then provides a guide to building operators on how to better operate and maintain the building heating, cooling and ventilating systems and components to conserve energy. Essentially, it provides a plan for managing these systems more efficiently through behavior changes, control/operational strategies, and equipment/capital upgrades.

  In 2013 and 2014, DVRPC and Practical Energy Solutions worked with nine municipalities in southeastern Pennsylvania to provide direct technical assistance to measure, analyze, and develop implementation strategies for energy management in municipal buildings. DVRPC and municipalities identified opportunities to improve how energy is used in a facility and prioritized implementation of these improvements.

It is possible for the Township to conduct its own energy audit and prepare its own building re-tuning plan. PNNL offers a free interactive e-learning course to improve building energy performance and occupant comfort. As with conducting benchmarking on its own, this option would require a significant amount of staff time to learn how to do this, as well as time to prepare the plan.

Accordingly, again, we recommend the Township engage a contractor to conduct the energy audit. Similar to benchmarking, cost will depend on the number and size of buildings audited. For estimates and a pertinent example of expected savings, see the sidebar about Springfield Township. Additional examples of Energy Assessments performed by PES as part of the DVRPC program, including for Horsham, Cheltenham, Bristol and Upper Darby, can be found on the DVRPC website.

2. Implement Recommendations and Establish Key Policies

- **Implement the system and operational changes from the Energy Audit and Building Re-tuning recommendations.**

  Examples of changes contained in the Springfield Energy Analysis include:

  - Controlling airflow, heating, cooling, and ventilation based on occupants' needs, as evidenced by CO_2 levels (an indicator of air quality) and thermostat setpoints, rather than by maintaining prescribed airflow setpoints.
  - Eliminating unnecessary intake of outside air into the building and preserving previously heated return air for recirculation, to decrease heating and cooling/dehumidification demands.
  - Refining hot water temperature algorithms to prevent overheating of the water used to heat buildings.
  - Setting back unoccupied temperature setpoints by 2°F–3°F.

  See also, Municipal Energy Management: Best Practices from DVRPC's Direct Technical Assistance Program, DVRPC, Apr. 2016.

  There are a number of grant and loan programs, such as the Sustainable Energy Fund Commercial Loan Program, offering financing solutions for municipalities for renewable energy and energy efficiency projects. *See* Appendix F Funding Resources.

- **Establish a reporting schedule for benchmarking findings to educate stakeholders, measure progress, and highlight high-performing buildings.**

  The data will help decision-makers and implementers (e.g., Commissioners, Township Manager, Finance Manager, Facilities Manager, staff) to set realistic energy and cost savings goals, see how they are tracking against those goals, and make informed adjustments.

- **Establish an energy-forward procurement policy.**

  Township policies should promote best practices, continuous improvement, and success in achieving the energy efficiency and performance goals. Township procurement policies in particular should require, whenever possible based on an analysis of cost and availability, the purchase and use of products and practices that reduce energy use and support the RE Goals. For example, the policies may specify that the purchase of ENERGY STAR equipment is preferred.

As a COSTARS member, the Township can take advantage of contracts available for such products and services as LED lighting fixtures, weatherization supplies, window and glass replacement, alternate fuel conversions or vehicles, building energy automation control components, HVAC system enhancements, and much, much more.

- **Establish new construction, capital improvement and renovations policies.**

  The Township should establish a policy that requires advance full life-cycle evaluations of energy savings and costs for any new construction, capital improvement projects, and/or renovations of Township facilities. We recommend the Township use *zero energy* or *zero carbon* building codes such as the Zero Code or the U.S. Department of Energy Zero Energy Ready Home Program or otherwise establish municipal building policies to ensure government buildings achieve high performance green building standards (e.g., NEZB, LEED, etc.). At a minimum, all new municipal buildings should be solar ready (i.e., install required roof and electrical work). As tragic as was the damage to the Township Building during the Sept. 1, 2021, tornado, its reconstruction offers an opportunity to implement these policies on a structure whose prominent energy consumption (*see* Summary of Base Year 2019 Municipal Energy Profile Findings above) makes it a prime candidate for upgrade.

- **Establish a practice of continuous re-tuning in all facilities.**

  Continuously re-tuning a building avoids wasting energy and money. "Buildings need continuous retuning to achieve the best possible efficiency or perfect harmony of systems. Continuous retuning can lead to 5-20% savings in an existing building's total energy costs." At a minimum, buildings should be re-tuned with changing seasons and with major operational changes. *See Continuous Retuning*, U.S. General Services Administration.

- **Continue to plant trees, and support and expand the Shade Tree Commission.**

  Trees pull GHG from the atmosphere and convert it to wood. Planting trees is thus a strategy for alleviating GHG production associated with fossil fuel combustion in building operations. The Township's active Shade Tree Commission should establish annual tree planting goals for open Township land for carbon sequestration.

- **Evaluate and improve where possible traffic signal timing to reduce idling time at intersections and promote anti-idling policies.**

3. Electrify Buildings and Systems

Energy-efficient buildings reduce emissions and improve quality of life. But if those buildings use heating oil and natural gas, efficiency alone will not significantly reduce UD's GHG emissions. We must combine a second strategy with efficiency: the clean and efficient electrification of building energy services, using renewable electricity.

- **Create an inventory of equipment, age, expected service life and transition timeline for equipment replacement.**

  In particular, this timeline would include an actionable phased transition plan for phase-out and replacement of fossil fuel-based HVAC systems (i.e., Township Building, North Hills Community Center, etc.).

- **As building heating systems powered by oil or natural gas need to be replaced, conduct life-cycle analyses on the conversion of these systems and aim to replace them with ones that are powered by electric, geothermal, or other clean energy systems.**

  There are two forms of building thermal electrification: conventional systems that use electricity to directly generate heat in a boiler or a radiant heater, and heat pumps that use electricity to move heat from one location (e.g., outdoor air or ground) to another (the indoor building space). Unlike the conventional approach, heat pumps are very efficient and can reduce GHG emissions by more than 50 percent, when fed by a low-carbon grid, compared with a natural gas system. We note that heat pumps have several constraints. First, they require space outdoors for heat exchangers, limiting their potential where outdoor space (e.g., rooftops) is constrained. Second, as temperatures drop, they become less efficient, and at extremely low temperatures (-5°F) they can cease to operate. As a result, the full electrification of some non-residential buildings may require a mix of heat pumps and a secondary system. We also recognize conventional systems and heat pumps result in an increase in the demand for electricity.

  Alternatively, geothermal heating and cooling systems can provide significant cost savings, eliminate emissions of GHG, and work well in almost all climates. They often require significant upfront installation costs, may result in landscape alterations, and may not be appropriate in all locations.

- **Conduct full life-cycle analysis on installing building solar rooftop panels and/or ground arrays.**

  Since 2009, the Township has benefitted from the installation of solar rooftop panels at Robbins Park Educational Center, which it received from the Pennsylvania Clean Energy Communities Campaign in recognition of its then-purchasing of enough clean energy to cover 100 percent of its municipal energy use.

West Rockhill Solar Project

West Rockhill's municipal solar project is the first in Pennsylvania to provide 100% of a municipality's electricity.

The 70.12 kW system is comprised of 180 panels, 2 ground mounted racks, and 6 inverters. The Township spent $169,000 from its general fund reserves, proud that it did not need to finance the project or pay interest. The electricity generated will power the municipal building, the park, the traffic signals, the streetlights, and the wells for this town of 5200 people. They expect an 11-year payback period, with all savings going back into the general fund's reserve account.

The panels went live on May 17, 2021. The Township has a live link on the township's website so that the public can see stats about the electricity generated by this system. Eleven MWh were generated in each of the months June and July of this year; the goal is 84 MWh for the year, enough to offset all electric use for the Township.

Solarize Southeast PA, August 2021

As the Township moves to maximize efficiency in its buildings and electrify building systems, we recommend it also analyze which buildings are candidates for the installation of additional solar

rooftop panels, and which spaces are candidates for ground arrays. Conduct this analysis in conjunction with the energy procurement activities discussed in Focus Area 1.

Onsite solar often provides the best savings. Currently, roof availability of about 10,000 sq. ft. supports 60 kW to 120 kW of solar, while ground availability of 2 acres supports 300 kW to 500 kW of solar. Pennsylvania Public Utility Commission allows energy from a single array to serve multiple meters with the same account name if the properties are located within 2 miles of the array.

Read the sidebar to learn about how West Rockhill Township in Bucks County recently became the first in PA to obtain 100% of its municipal electricity needs from a solar panel installation.

4. Prioritize Energy Management through Planning, Training and Collaboration

- **Make the RE Goals a center-point of the updated UD Comprehensive Plan.**

  Last updated in 2010, the UD Comprehensive Plan provides a framework for the Township's growth. Updates to the Comprehensive Plan provide an opportunity to incorporate the RE Goals into the Township's broader development goals. An updated Plan should include a discussion of the Township's energy use and need. The vision and goals should incorporate the RE Goals as defined in this Plan. All recommendations should align with and support the RE Goals. For example, the Comprehensive Plan could include a policy or policies relating to the development of access to direct sunlight for solar energy systems, continue to capitalize on the existence of proximate SEPTA train stations, and promote development near the stations. Updates should continue current initiatives to co-locate diverse and affordable residences, services, amenities, and workplaces.

- **Establish a dedicated Energy Savings Reinvestment Plan that tracks energy usage and savings. Reinvest those dollars into municipal energy efficiency, renewable energy and GHG reducing initiatives.**

  The Township should track all municipal energy usage and related expenses. It will then be able to periodically update the data from the 2019 UD Municipal Energy Profile. The Energy Manager (*see* recommendation in Moving Forward: Foundational Steps above) could provide support for this task. By monitoring energy expenses, the Township will be able to identify how much savings it can reinvest into future energy efficiency and GHG reducing measures and renewable energy installments as identified in the updated 10-year Capital Improvement Plan and/or as required by system life-cycle needs.

- **Promote employee energy conservation.**

  Staff should be involved and encouraged to identify ways to achieve additional energy efficiencies. Consider offering rewards and/or recognition to employees that make significant energy use improvements, to incentivize creative and/or disciplined approaches and employee engagement in reducing energy use.

- **Establish training requirements for relevant staff.**

  Inform staff of UD's RE Goals and appropriately train staff on tactics relevant to their job function that can save taxpayer dollars and reduce GHG emissions through efficiency measures. Department heads should receive support from the Energy Manager, who can coordinate training

regarding building and other energy-related codes, policies, and best practices for relevant municipal staff on a regular basis.

- **Through the Energy Manager, support and advance renewable and sustainable energy initiatives through key groups.**

  Some of these groups include the Montgomery County Consortium of Communities ("MCCC"), DVRPC, the PA Department of Environmental Protection, and the International Code Council (ICC).

  Furthermore, the Township should advocate the State legislature to advance initiatives such as the Regional Greenhouse Gas Initiative, *community choice aggregation* programs (*see* Glossary), *community solar* (*see* Glossary), and a return to the automatic adoption of UCC building code updates to ensure energy efficiency in new construction and major renovation projects (*see* Appendix G).

Focus Area 4: Engage & Lead the Community

By implementing the actions in Focus Areas 1-3, the Township will be seen as an authority and leader in clean energy best practices. It will be in a position to lead the community - including residents, commercial businesses, the School District, and many others - by engaging those stakeholders and educating them about the Township's efforts to save costs and reduce GHG emissions.

1. In Adoption of Clean, Renewable Electricity

- **Participate in SolSmart program to reduce soft costs associated with adoption of solar energy.**

  SolSmart is a national designation program (led by the International City/County Management Association and The Solar Foundation, along with a team of partners with deep expertise in solar energy and local governments) recognizing cities, counties, and regional organizations that foster the development of mature local solar markets. SolSmart provides a framework of 90 actions that municipalities choose from to remove obstacles to solar energy development locally. The program is highly recommended by regional organizers and offers FREE professional and technical support to achieve the Plan's important objectives - as well as gain some nice recognition for the Township.

  Participating local governments receive 100 hours of free technical assistance from SolSmart technical experts. SolSmart focuses on soft cost reductions, such as permitting, zoning, inspection and customer education, since this is what municipalities can affect. Participation in the program will do things such as support Township staff with revising the Zoning Code's renewable energy provisions (Art. 35, Sect. 255-259) to be further aligned with and advance the Township RE Goals. DVRPC's Renewable Energy Ordinance Frameworks can also provide specific guidance and model language.

  DVRPC can also provide light review of solar provisions in the Zoning Code if needed.

- **Provide information to residents about how to switch to clean energy through Township publications.**

  For example, the Library could coordinate events with PECO community managers to present information about programs available to reduce energy use. The Township newsletter could highlight how to use PA Power Switch to find low-cost renewable energy suppliers. The Energy Manager leads coordination of this information.

2. In Adoption of Clean, Renewable Energy for Transportation

- **Raise awareness and acceptance in the business and resident communities regarding the benefits of switching to non-ICE modes of transportation. Support, encourage and incentive public and non-ICE forms of transportation.**

  The Municipal Authority oversees the development and funding of the 2.5-mile Cross County Trail that will run parallel to Commerce, Delaware, and Virginia Drives, and will connect the Fort Washington Office Park from Susquehanna Road to the Fort Washington SEPTA train station at Pennsylvania Ave. Eventually it will connect with other sections of the regional trail network to

the west where significant sections have either been constructed or are now funded for construction. Multiple SEPTA bus routes serve the parts of Upper Dublin, and Temple Ambler runs a private shuttle to the Ambler train station.

The Township should continue to support, expand, and promote its bike and walking trails in concert with the Bike Montco bicycle plan developed by Montgomery County. In addition to trails and bike traffic lanes, bikers should be provided with secure and dedicated (covered if possible) bike parking areas, and training can be offered to bikers about state laws regarding rights and responsibilities of bicycle riders.

This Team also encourages the further adoption of the recommendations contained in the UD Transportation Demand Management Plan (April 2018).

Educate the community on the ills of excessive idling and encourage adoption of no-idling policies.

- **Examine Codes to identify barriers to nonmotorized transport and/or the use of hybrid and electric vehicles. Address any identified barriers.**

- **Ease and increase access to EV charging stations.**

  Streamline permitting and inspections as required by zoning and code regulations for installation of commercial and residential EV charging stations so that they are uncomplicated, affordable, and fast. As noted above (Focus Area 2), DVRPC offers an EV Planning Toolkit to municipalities to support this work.

  Consider collaborating with other public institutions and private businesses to make EV charging stations available to the public as appropriate.

  Encourage and facilitate EV charger installation at commercial and multi-unit residential buildings.

- **Encourage EV-ready capability in all new construction.**

  An EV-ready home or commercial building ensures that the conduit and service panel capacity are ready and available for EV charging stations. The estimated cost of pre-wiring a 240V outlet is inexpensive ($50-$300).

3. In Adoption of Clean, Renewable Energy in Commercial and Residential Buildings

The Township can engage and lead the community, including residents, local commercial businesses, institutions, and developers of new buildings, by enacting an Alternative Energy Ordinance. Pennsylvania does not have a solar access law. Accordingly, the regulation of solar and other forms of energy production, like many other uses, falls to each municipality to regulate and govern through

"Commercial buildings account for almost 20% of the total U.S. energy consumption, and a surprising *10-30% of the energy used in commercial buildings is wasted because of improper and inefficient operations*."

buildingretuning.pnnl.gov

local zoning ordinances. Upper Dublin's Zoning Code contains an Alternative Energy provision, UD Zoning §255-259, regulating geothermal, solar, wind and biomass.

The Alternative Energy provision should be updated to incentivize the use of renewable, alternative energy in the initial planning and subsequent construction phases of land development in Upper Dublin. For example, Bucks County's Model Alternative Energy Ordinance includes model language for bonuses that can be offered to encourage the use of alternative and/or emerging energy green technologies and sustainable design features for all new residential and non-residential construction. Bonuses may be used for a reduction in Township permit and escrow fees, increases in the base density, and increases in building coverage permitted. *See* Bucks County AEO at p.13. The Bucks County Model AEO also includes provisions for encouraging passive energy conservation through building orientation, building placement, shading, landscaping, cool/green roofs, green/living walls, and thermal mass walls.

The Township can also engage and lead the community by promoting and/or offering incentives to adopt the following programs. Some of these programs are listed here, and other incentives geared towards businesses and homeowners may be found in Appendix F Funding Resources.

- **Net zero building, ENERGY STAR, LEED, and other green building codes.**

  A net-zero building produces as much clean electricity as it consumes in a year. This achievement is built on a foundation of two primary concepts: all-electric high-efficiency systems plus on-site renewable energy generation. The sidebar, Local Leaders in Green Building, provides just a few examples of how local townships have advanced programs like net-zero building codes.

  The High Performance Building Program offers loans and grants to small business owners and homeowners for high performance certified buildings (Green Globes, LEED, National Green Building Standard). *See* Appendix F Funding Sources.

Local Leaders in Green Building

Bridgeport Borough's new state-of-the-art zero energy-ready residential infill development. This project involved the construction of four twin homes, the first single-family attached homes in the country to be constructed under the DOE's Zero Energy Ready Home program.

Borough of West Chester: Zoning Ordinance § 112-33.1.B(6) requires all new buildings over 45 feet tall in a specified district to be designed to earn the Energy Star rating or achieve LEED-NC certification, and it requires certain new commercial construction in the same district to earn the Energy Star label for commercial buildings and to be annually benchmarked for the Energy Star label.

Borough of Doylestown: The "Green Points" Green Building Incentive Program provides for permit fee reductions or waivers if a proposed building incorporates sustainable building methods that conserve fuel, water, and other natural resources, and promotes the reuse and recycling of construction materials.

Tredyffrin Township: Zoning Ordinance § 208-1 provides for zoning bonuses in the form of modifications to building lot area, building footprint, and building height if a proposed building meets or exceeds a LEED Silver rating.

- **Commercial Property Assessed Clean Energy (C-PACE) Program**

  C-PACE is a financing structure in which building owners borrow money for energy efficiency, renewable energy, or other projects and make repayments via an assessment on their property tax bill. The financing arrangement then remains with the property even if it is sold, facilitating long-term investments in building performance. C-PACE may be funded by private investors or government programs, but it is only available in states, including Pennsylvania, with enabling legislation and active programs.

  Montgomery County passed a resolution to adopt C-PACE in July 2020. The County Commissioners approved C-PACE to help local commercial, industrial, and agricultural property owners obtain low-cost, long-term financing for energy efficiency, renewable energy, and water conservation projects. Sustainable Energy Fund administers the program. Through the C-PACE program, Montgomery County commercial businesses, agriculture interests, and nonprofits can finance clean energy and water efficiency projects with long-term and low-cost financing.

- **Benchmark, conduct energy auditing and re-tuning in commercial, mixed-use, and multifamily residential buildings.**

- **PECO's Smart Ideas program**.

  PECO offers a $49 home energy assessment (conducted virtually or in person), and a free home energy check-up for income-qualified customers. Through the program, customers can also get rebates and discounts on ENERGY STAR certified products.

- **Federal Income Tax Credits**

  The Non-Business Energy Property Tax Credits were retroactively extended from 12/31/2017 through 12/31/2021. Residents may receive a federal Tax Credit of 10% of cost up to $500 or a specific amount from $50-$300. Qualifying improvements must be made to an existing home and principal residence. New construction and rentals do not apply.

- **Homeowners' Energy Efficiency Loan Program ("HEELP")**

  Administered by the PA Housing Finance Agency, HEELP offers loans from $1,000 - $10,000 for energy efficiency projects, with a fixed rate of just 1% and a loan term of 10 years with no prepayment penalties. Eligible energy efficiency projects include insulation installation, window replacement, HVAC system upgrades, and roof replacement.

EXHIBITS

Exhibit 1: Model Resolution

TOWNSHIP OF UPPER DUBLIN

BOARD OF COMMISSIONERS

Resolution No.: __

A RESOLUTION ESTABLISHING AND ADVANCING THE TOWNSHIP'S RENEWABLE ENERGY GOALS

WHEREAS, the Board of Commissioners recognizes global climate change is a long-term threat to the planet to which our community is currently contributing through its use of fossil fuels; and

WHEREAS, adverse impacts associated with climate change pose immediate, long-term, direct and indirect health risks, as well as risks to property, and increasing costs; and

WHEREAS, the Township, residents and local businesses can achieve significant long-term energy cost savings through the adoption of clean energy best practices; and

WHEREAS, the Township can reasonably expect to meet economic, health, and environmental goals by joining the growing numbers of communities in Southeastern Pennsylvania, across the state, country and world that are moving to renewable energy and reducing energy use.

NOW, THEREFORE, BE IT RESOLVED by the Board of Commissioners of Upper Dublin that:

1. Upper Dublin Township hereby adopts the following four Renewable Energy Goals ("RE Goals"):

    1. 100% renewable electricity for all Township municipal operations by 2025
    2. 100% renewable energy for all Township municipal transportation and heating by 2040
    3. 100% renewable electricity adoption by the community by 2035
    4. 100% renewable energy adoption by the community for transportation and heating by 2050.; and

2. Renewable electricity and energy is defined as carbon-free and pollution-free energy generated sustainably from renewable sources such as wind, solar, small hydro, tidal, geothermal, and other similar technologies that may be developed.

3. Prioritize locally produced and distributed energy whenever feasible for the many advantages it provides to the community.

4. We seek to achieve equity, affordability, and access for all members of the community in the transition to 100% renewable energy.

5. The Upper Dublin Environmental Protection Advisory Board (EPAB), in furtherance of these RE Goals, reported to the Board on November 9, 2021, a Transition Plan for Upper Dublin Municipal Operations. The EPAB shall report annually to the Board on the progress of achieving the Renewable Energy Goals according to the Transition Plan.

6. The EPAB shall develop a similar Transition Plan for the Upper Dublin Community, to include collaboration with the UD School District, businesses, nonprofit organizations, community members and other key stakeholders.

7. We commit to a transparent and inclusive process for planning and implementation, ensuring that all members of the community have an opportunity to participate, especially ensuring those who negatively impacted by current energy systems.

RESOLVED THIS ____ day of _____, 2021.

BOARD OF COMMISSIONERS OF

UPPER DUBLIN TOWNSHIP

BY:_____

Ira Tackel, President

ATTEST:_____

Paul A. Leonard, Secretary/Township Manager

Exhibit 2: Model Energy Manager Position Description

Overview

The Energy Manager is primarily responsible for implementation of the Upper Dublin Energy Transition Plan, with roles including development and/or coordination of a municipal energy management program and serving as a champion for other energy projects/programs. The Board of Commissioners is committed to reducing energy waste and realizing other economic and environmental benefits through improved energy efficiency and renewable energy generation.

- Reports directly to Township Manager
- Maintains a functional, working relationship with building/facilities managers, planning staff, financial managers, elected/appointed officials, the Planning Commission, and the Environmental Protection Advisory Board
- Responsible for municipal energy management across departments and service areas such as buildings, facilities, fleet vehicles, infrastructure, and renewable energy generation facilities
- Responsible for directing the work of consultants or other assigned staff as needed for specific implementation programs or projects
- Assists the EPAB in its responsibility to provide community energy recommendations to the Board of Commissioners
- Helps build energy policy into standard practices of the community including revisions to the UD Comprehensive Plan, 10 Year Capital Improvement Plan, economic and community development initiatives, and land use planning
- Acts as a champion and/or project manager for key energy initiatives within the community with the aid and guidance of the EPAB

Roles and Responsibilities

The Energy Manager is the point-person for energy management across the community. Effective management of municipal energy demonstrates leadership to the community while generating operational savings. The Energy Manager also serves as an information resource on energy efficiency and renewable energy topics to the broader community as needed to promote additional energy savings and support the community's energy goals. Responsibilities may include any of the following:

Energy Planning:

- Coordinates the development and periodic update of the Municipal and Community Energy Transition Plans through a transparent public participation process with the guidance of the EPAB.
- Works with the EPAB to prioritize and plan the implementation of actions in the Energy Plan.
- Develops an Action Plan annually to implement the prioritized actions in the Energy Plan.

- Develops an Annual Report of progress along with an evaluation and recommendations for the EPAB, departments, Board of Commissioners, and general public.
- Ensures capital investment projects incorporate energy efficiency and renewable energy and are appropriately prioritized in the Capital Improvement Plan (CIP) to meet the targets in the Energy Plan.
- Researches viable technologies, best practices, and program ideas to advance local clean energy and sustainability goals.

Municipal Energy Management:

- Acts as an energy liaison providing leadership and guidance to all municipal staff. Maintains a functional, working relationship with building/facilities managers, financial managers, planning staff, and elected/appointed officials.
- Monitors municipal energy consumption, measures savings, and provides periodic reports to municipal departments and service areas.
- Works with community and municipal stakeholders to expand energy awareness, find cross-department synergies, share savings, and achieve energy reduction targets concurrent with meeting other community goals.
- Plans and oversees staff education and training on relevant energy topics.
- Plans and oversees orientation and ongoing training of local officials (elected and appointed) on the Municipal and Community Energy Transition Plans and current energy management Action Plan.
- Directs the work of consultants as needed, for specific implementation programs.
- Oversees funding allocation from department fees (or other sources as applicable) for municipal energy management.
- Oversees municipal revolving energy fund allocations from savings generated by completed capital projects (if applicable).
- Assists the municipality with putting together a financial package for energy efficiency and/or renewable energy projects including access to utility rebates, low interest financing, and power purchase agreements.

Community Engagement & Support:

- Raises energy awareness through public outreach and education and develops/utilizes a Community Energy Webpage.
- Works proactively with community partners to advance community energy goals including regional stakeholders, neighboring jurisdictions, and utilities.
- Coordinates with other staff and committees on policies, zoning, and permitting that affect energy conservation and renewable energy generation in the community.
- Acts as an energy liaison and provides technical assistance to community residents and businesses.

- Maintains membership in Montgomery County Planning Commission network, participates in energy networking with other Southeastern PA communities and DVRPC.
- Develops a sustainable funding plan and/or other recommendations for supporting residents and businesses in achieving community energy targets.

Qualifications

The Energy Manager must possess technical knowledge in energy-related topics along with the ability to provide leadership and effectively communicate with residents, businesses, municipal staff, and local officials.

- A minimum of 5 years of related professional experience including development and implementation of energy efficiency and renewable energy programs with an understanding of local government decision-making processes.
- Dynamic and skilled professional in project management, community engagement, analysis, building capacity, teamwork, and implementation skills.
- Preferred Education: Bachelor's degree or higher in Engineering, Environmental Science, Sustainability, Natural Resource Management, Environmental Policy/Management, Urban Planning, Public Policy, Public Administration, or a similar field.
- Desirable certifications include Certified Planner, Certified Energy Manager, LEED Accredited Professional, Project Management Professional, or Registered Professional Engineer
- Fluency with Energy Star Portfolio Manager and other energy benchmarking software.
- A thorough understanding of commercial building energy efficiency measures including those related to the building envelope, lighting, HVAC, occupant behavior, and equipment upgrades.
- An ability to assist the municipality with assessing the technical and financial viability of renewable energy installations.
- An ability to assist the municipality with project scoping, contractor selection, project management, and QA/QC.

Work Environment

The Energy Manager will work in an office environment with occasional navigation of field conditions (HVAC systems, lighting systems, buildings, fleets, renewable energy site, etc.), and community meetings. There will be occasional travel to neighboring communities, state meetings, and conferences.

APPENDICES

Appendix A: Guiding Principles

1. Appropriate stewardship of energy and financial resources: This Plan seeks to prioritize strategies and actions that have the highest rate of return and/or fastest payback period, realizing some options require an upfront investment. For example, this Plan prioritizes best practices in energy conservation and energy efficiency efforts, which are the most cost-effective ways of reducing energy consumption. These strategies comprise the early steps of this Plan and are central to its structure.

2. Redirection in energy expenditures: The community of Upper Dublin spends $72 million annually on electricity, natural gas, propane, heating oil, gasoline, and diesel fuel (DVRPC, 2015). This Plan recommends changes in energy source selections for a smooth, economical, and equitable transition to clean renewable energy. This Plan balances short-term ease of implementation with long-term potential for transformation and impact.

3. Sustainability: This Plan addresses UD's needs for clean and affordable energy. The actions recommended in the Plan support Upper Dublin Township's ability to attract and retain residents and businesses, now and in the future.

4. Public health: This Plan strives to maximize the health benefits provided by the transition from our fossil fuel-based economy to a renewable energy economy. Elimination of air contaminants is one of the goals of this Plan.

5. Climate stabilization: This Plan addresses the need to immediately reduce and ultimately eliminate human-generated greenhouse gases enabling UD to do its part in the world-wide effort to rein in the continuing increase in average global temperature which has destabilized our climate.

6. Social fairness: This Plan considers the impacts of the energy transition on local economic and environmental conditions community wide. Develop job training for impacted workers and energy improvement programs for low-income residents to ensure an equitable transition. Implement the actions outlined here with sensitivity to equitable application across all income levels and with attention to offering retraining to those whose jobs are disturbed or displaced.

7. Energy independence: This Plan endeavors to make UD more self-reliant through energy efficiency, conservation, and on-site renewable energy development, allowing for reductions of purchased fuels.

8. Inclusion: This Plan, developed with input of UD stakeholders, strives to continually obtain and integrate wide-reaching and diverse stakeholder input as the Plan is implemented and updated.

9. Coordination with other governments: This Plan recognizes the wisdom of wider-scale adoption of plans such as this to leverage greater emission reductions and cost efficiency and considers additional opportunities for collaboration with other local communities positioning UD to participate in aggregate planning strategies at the local, county, regional and/or state levels.

10. Evidence based decision-making: This Plan reflects scientific knowledge, assessments of vulnerability and emissions, and other empirical inputs to inform decision-making.

Appendix B: Township Resolution No. 1983 Adopted 2008

2008

RESOLUTION NO: 1983

TOWNSHIP OF UPPER DUBLIN

WHEREAS, an important component of the Township's vision is to preserve and enhance Upper Dublin's leadership as a quality environment for all community members by, in part, identifying and implementing programs and improvements designed to preserve Upper Dublin's natural environment; and

WHEREAS, the Board of Commissioners has promoted a leadership role for Upper Dublin over the years in pursuing local initiatives such as promoting the preservation of open space, purchasing 100% clean energy and promoting clean energy purchases by our residents, instituting the RecycleBank incentive within the Township trash and recycling collection program, planting hundreds of shade trees which has resulted in being named a *"Shade Tree USA"* community for 12 consecutive years, switching to LED traffic lights at all intersections, incorporating LEED-rated green building technologies into the design and construction of the new municipal building, and working with our School District to educate our youth in environmental stewardship through the Robbins Park for Environmental among others;

WHEREAS, the Board recognizes that many members of the community and several institutions have undertaken individual initiatives to reduce their energy consumption and their contributions to the emission of greenhouse gases, and look to the Board of Commissioners to support and build on their efforts; and

WHEREAS, the Board desires to engage the Upper Dublin citizenry in a new initiative addressing opportunities to limit energy costs and contribute to minimizing climate change.

NOW, THEREFORE, BE IT RESOLVED THAT:

1. The Board of Commissioners hereby declares its intent to endorse the U.S. Mayors' Climate Protection Agreement, which calls on cities across the United States to join in establishing goals and strategies to reduce their emissions of greenhouse gases. This commitment will build on the benefits that have previously accrued from Upper Dublin Township's purchase of energy from renewable sources, and investments in efficiencies.

2. The Board hereby declares its intent to develop an action plan to limit the increase in Township energy costs and to reduce greenhouse gas emissions from the community. To that end, the Board charges the Upper Dublin Township Environmental Protection Advisory Board and Township staff to: (a) work in consultation with other experts to conduct an audit of the Township's and its residents' energy uses and practices and their related impacts and (b) to develop a recommended action plan for the Board's consideration; and the Board authorizes the application for membership in the ICLEI Cities for Climate Protection program, which provides technical assistance in carrying out these tasks.

3. The Board also charges the EPAB to continue to reach out to experts and community members in researching additional clean energy options, seeking other funding opportunities, and recommending other ways in which the Township can show continued environmental leadership to further improve the high quality of life of those who live, work and play in Upper Dublin Township.

RESOLVED this 19th day of March 2008.

UPPER DUBLIN TOWNSHIP

By: _____
Jules J. Mermelstein, President

Attest: _____
Paul A. Leonard, Secretary

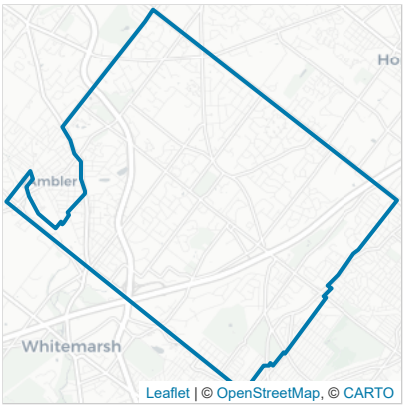
Appendix C: DVRPC Energy and Emissions Profile for Upper Dublin Township, Montgomery County, PA

190 N. Independence Mall West | 8th Floor | Philadelphia, PA 19106-1520
Phone: 215.592.1800 | Fax: 215.592.9125 | www.dvrpc.org

For more information about this report or any other product of the Office of Energy and Climate Change Initiatives please contact Rob Graff (rgraff@dvrpc.org) at 215.238.2826 or visit www.dvrpc.org/EnergyClimate.

Energy and Emissions Profile for Upper Dublin Township, Montgomery County, PA

Introduction



In 2018, the Delaware Valley Regional Planning Commission completed a regional energy use and greenhouse gas emissions inventory for the nine-county DVRPC region. As part of this inventory, DVRPC allocated both energy use and greenhouse gas emissions to individual counties and municipalities based on 2015 data. Please note that not all sectors were allocated to the municipal level, including aviation, freight rail, and intercity rail. The chart on page 20 of the Methods and Sources document indicates which sectors are allocated to the municipal level, and a general assessment of the quality of that allocation. This report gathers the municipally allocated energy usage, greenhouse gas emissions, and energy expenditure information for Upper Dublin Township in an easy-to-read document intended to support local decision-making.

This report is meant to serve as a starting point for municipal policy-making. More detailed local analysis can improve on this inventory and reveal particular opportunities for efficiency improvements and emission reductions in both the public and private sector. DVRPC's Office of Energy & Climate Change Initiatives can provide additional guidance and assistance in performing this local analysis. This report will be updated with new data upon completion of DVRPC's energy use and emissions inventory for 2020.

Upper Dublin Township

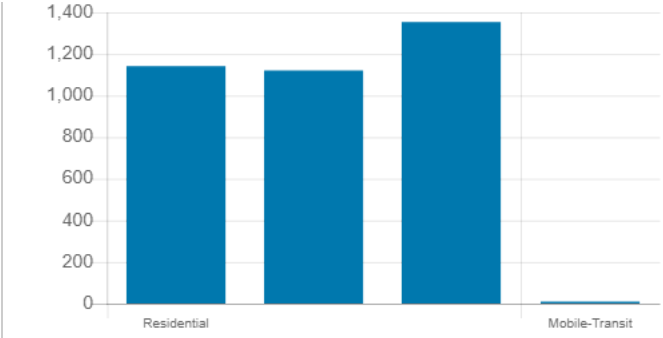
Upper Dublin Township is classified by DVRPC as a Developed Community. A Developed Community is characterized by stability of population and employment growth. Examples include inner ring communities adjacent to core cities, railroad boroughs or trolley car communities, and mature suburban townships.

In 2015, 26,211 people lived in Upper Dublin Township, comprising 9,441 households. The median household income in Upper Dublin Township was $112,000, and 21,600 jobs were located in Upper Dublin Township.

DVRPC estimates that Upper Dublin Township consumed 3,620 billion BTUs (BBTUs) of energy in stationary (e.g., home heating) and mobile (e.g., automobile travel) applications. The total cost of the energy used in the residential, commercial, and industrial sectors and for on-road vehicle travel is estimated to be $71,700,000. Combustion of fuels to produce the energy consumed in Upper Dublin Township, in combination with non-energy sources of greenhouse gases, resulted in the release of 297,000 metric tons of CO_2 equivalent ($MTCO_2e$). Of sectors for which data is available and able to be allocated to the municipal level, the mobile-transit sector consumed the most energy, consuming 1,350 BBTUs of energy. The mobile-highway sector produced the most emissions, emitting 104,000 $MTCO_2e$. Energy use, energy expenditures, and GHG emissions by sector are shown in the three bar graphs below.

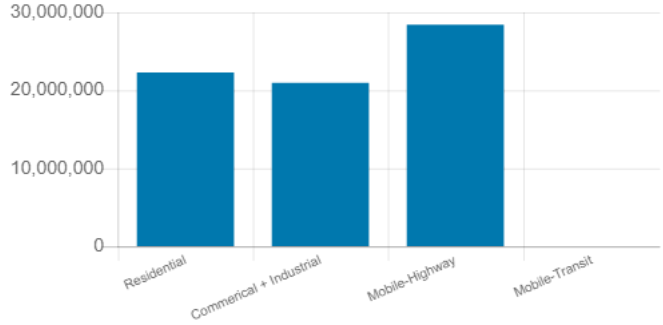
Energy Use By Sector

Sector	Energy Use (BBTU)	%
Residential	1,141	31%
Commercial & Industrial	1,120	31%
Mobile-Highway	1,354	37%
Mobile-Transit	9	<1%
Total	**3,624**	**100%**



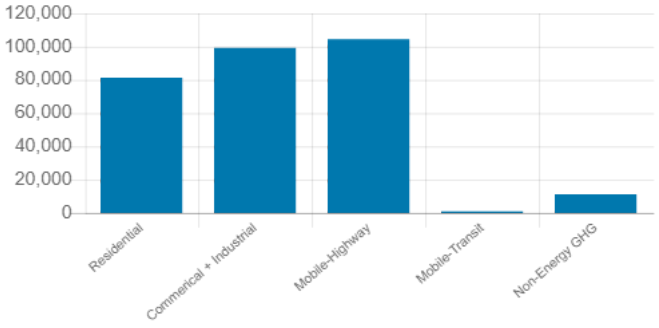
Energy Expenditures By Sector

Sector	Expenditures (Dollars)	%
Residential	22,300,494	31%
Industrial & Commercial	20,986,366	29%
Mobile-Highway	28,401,749	40%
Mobile-Transit	N/A	0%
Total	**$71,688,609**	**100%**



GHG Emissions by Sector

Sector	Emissions ($MTCO_2e.$)	%
Residential	81,395	27%
Industrial & Commercial	99,311	33%
Mobile-Highway	104,445	35%
Mobile-Transit	1,016	<1%
Non-Energy GHG	11,211	4%
Total	**297,378**	**100%**

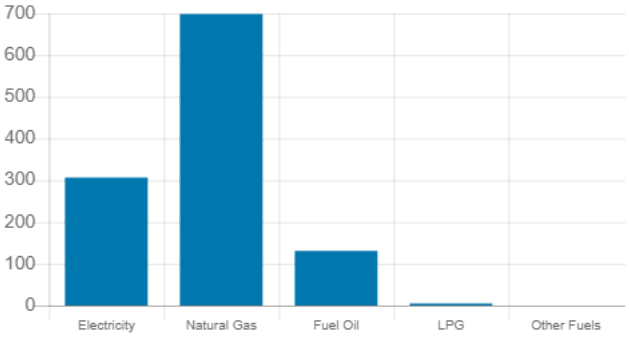


Residential Energy Usage and Emissions

Natural gas provided the most energy for the residential sector in Upper Dublin Township in terms of BTUs consumed. The residential sector used a total of 6,650,000 CCFs or 698 BBTUs of natural gas. Natural gas was the largest source of Upper Dublin Township's GHG emissions by the residential sector, resulting in 37,100 $MTCO_2e.$ of emissions. Of energy sources for which price data was available, electricity consumption resulted in the highest energy expenditures, costing users $12,300,000.

Energy Use By Source

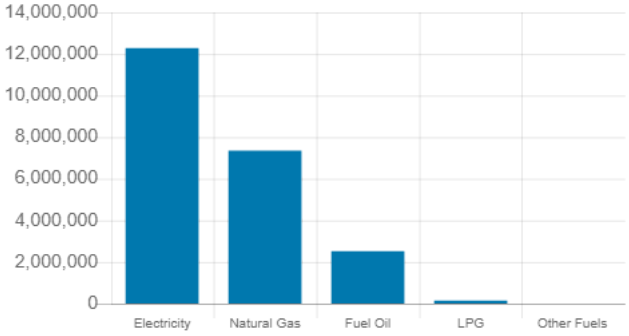
Energy Source	Energy Use (BBTUs)*	%
Electricity	307	27%
Natural Gas	698	61%
Fuel Oil	131	11%
LPG	5	<1%
Other Fuels	0	<1%
Total	**1,141**	**100%**



*The value shown for BBTU of electricity represents only the direct energy content of the electricity itself, not that of fuels used to generate the electricity. An estimated 180 BBTU of coal (9,420 short tons), 4 BBTU of oil (725 barrels), 303 BBTU of natural gas (292,667 million cubic feet), and 4 BBTU of other fossil fuels were used to generate this electricity.

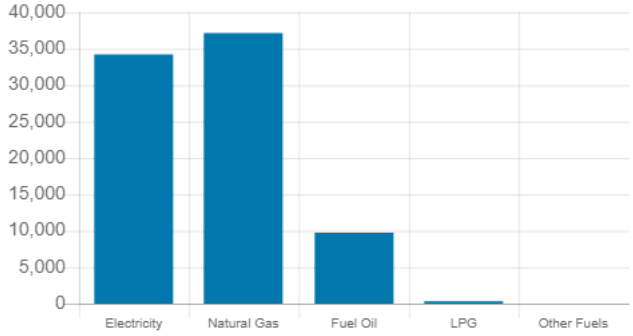
Energy Expenditures By Source

Energy Source	Cost	%
Electricity	$12,287,637	55%
Natural Gas	$7,349,982	33%
Fuel Oil	$2,525,472	11%
LPG	$137,403	1%
Other Fuels	N/A	N/A
Total	**$22,300,494**	**100%**



GHG Emissions By Source

Energy Source	Emissions ($MTCO_2e$.)	%
Electricity	34,238	42%
Natural Gas	37,134	46%
Fuel Oil	9,718	12%
LPG	305	<1%
Other Fuels	0	<1%
Total	**81,395**	**100%**

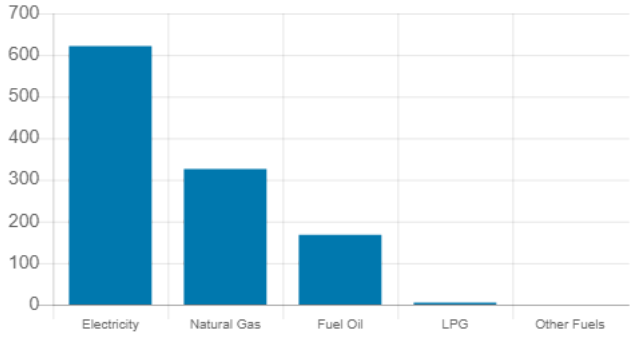


Commercial and Industrial Energy Usage and Emissions

For the combined commercial and industry sector, electricity provided the most used energy in terms of BTUs consumed. Commercial and industrial facilities consumed 182,000,000 kWhs or 621 BBTUs of electricity. Electricity was the largest source of Upper Dublin Township's GHG emissions by the combined commercial and industrial sector, resulting in 69,200 $MTCO_2e$. of emissions. Of energy sources for which price data was available, electricity consumption resulted in the highest energy expenditures, costing users $15,300,000.

Energy Use By Source

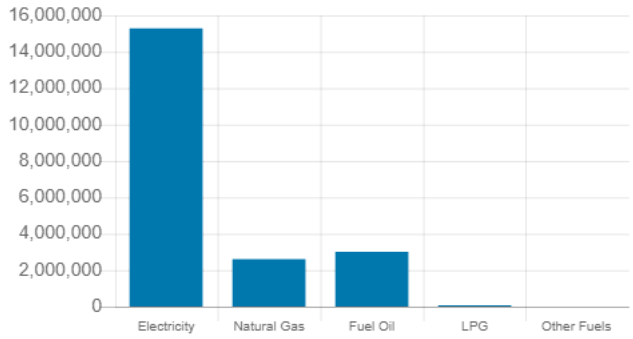
Energy Source	Energy Use (BBTUs)*	%
Electricity	621	55%
Natural Gas	326	29%
Fuel Oil	168	15%
LPG	5	<1%
Other Fuels	0	<1%
Total	**1,120**	**100%**



*The value shown for BBTU of electricity represents only the direct energy content of the electricity itself, not that of fuels used to generate the electricity. An estimated 365 BBTU of coal (19,039 short tons), 8 BBTU of oil (1,465 barrels), 612 BBTU of natural gas (591,515 million cubic feet), and 8 BBTU of other fossil fuels were used to generate this electricity.

Energy Expenditures By Source

Energy Source	Cost	%
Electricity	$15,287,240	73%
Natural Gas	$2,604,051	12%
Fuel Oil	$3,015,984	14%
LPG	$79,090	<1%
Other Fuels	N/A	0%
Total	**$20,986,366**	**100%**



GHG Emissions By Source

Energy Source	Emissions ($MTCO_2e$.)	%
Electricity	69,199	70%
Natural Gas	17,317	17%
Fuel Oil	12,465	13%
LPG	330	<1%
Other Fuels	0	<1%
Total	**99,311**	**100%**

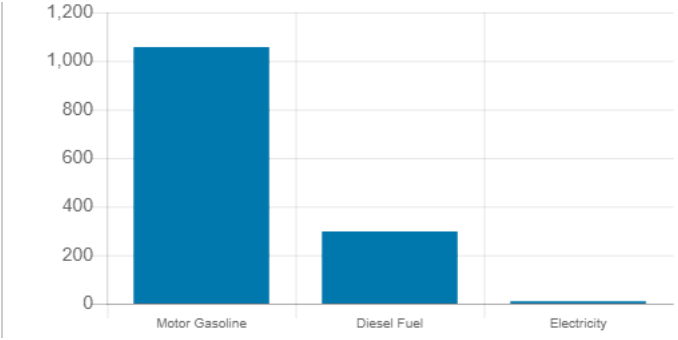
Mobile Energy Usage and Emissions

Vehicles of all kinds, including private passenger vehicles, commercial vehicles, and public transit vehicles, also contribute to energy usage and GHG emissions in Upper Dublin Township. Motor gasoline provided the most energy. Motor vehicles with trips either starting or ending in Upper Dublin Township* consumed 8,770,000 gallons of motor gasoline, containing 1,060 BBTUs of energy. This consumption cost users an estimated $28,400,000. Altogether, emissions related to mobile energy use from all sources attributed to Upper Dublin Township amounted to 105,000 $MTCO_2e$. from all sources. Note that the electricity use for transportation is an allocated amount of electricity use for rail, not for electric cars.

*Half of each trip originating or terminating in Upper Dublin Township was allocated to Upper Dublin Township. The remainder was allocated to the municipality at the other end of each trip.

Energy Use By Fuel

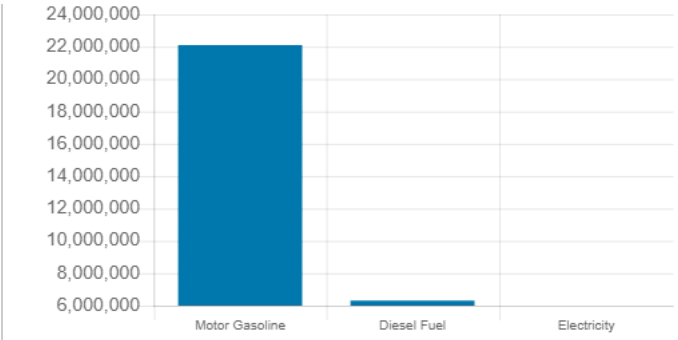
Fuel	Energy Use (BBTUs)*	%
Motor Gasoline	1,057	78%
Diesel Fuel	297	22%
Electricity	9	1%
Total	**1,363**	**100%**



*The value shown for BBTU of electricity represents only the direct energy content of the electricity itself, not that of fuels used to generate the electricity. An estimated 5 BBTU of coal (267 short tons), 0 BBTU of oil (21 barrels), 9 BBTU of natural gas (8,292 million cubic feet), and 0 BBTU of other fossil fuels were used to generate this electricity.

Energy Expenditures By Fuel

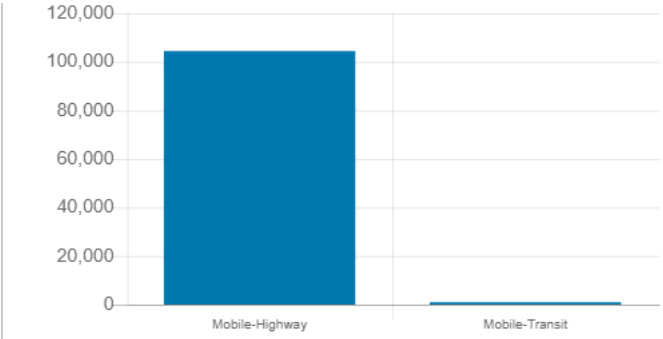
Fuel	Expenditures (Dollars)*	%
Motor Gasoline	22,101,037	78%
Diesel Fuel	6,300,711	22%
Electricity	N/A	0%
Total	**28,401,749**	**100%**



*Does not include estimated expenditures for rail transit.

GHG Emissions By Source

Source	Emissions ($MTCO_2e.$)	%
Mobile Highway	104,445	99%
Mobile Transit	1,016	1%
Total	**105,461**	**100%**



Non-Energy Greenhouse Gas Emissions

Waste management accounted for the largest proportion of Upper Dublin Township's non-energy greenhouse gas (GHG) emissions, contributing 8,520 $MTCO_2e$. of the muncipality's total emissions.

Agricultural Sources	Fugitive Emissions	Waste Management	Wastewater Management	Industrial Processes	LULUCF*	Total
161	1,653	8,522	805	0	70	**11,211**

*Land Use, Land Use Change, and Forestry

Appendix D: 2019 Upper Dublin Municipal Energy Profile

MUNICIPAL ENERGY PROFILE

Upper Dublin Township
MONTGOMERY COUNTY, PA

Why Transition to Renewable Energy?

Combustion of fossil fuels for transportation, manufacturing, electricity generation and heat releases carbon dioxide and other greenhouse gases that contribute to global climate change, as well as pollutants that damage human and ecosystem health. It also consumes a substantial amount of Township funds. Continued use will only amplify these problems.

But the technology to produce energy from nonpolluting, *renewable sources* such as the sun and wind is advancing rapidly and becoming more affordable. Cities, states, and nations around the world – as well as neighboring townships right here in Montgomery County - are pledging to and beginning to make the clean energy transition right now!

Renewable Energy: A Commitment to our Community

When Upper Dublin makes clean energy choices, we protect our Township for future generations and can realize significant cost savings. Clean energy is about good public policy, responsible resource stewardship and enhancing the quality and resilience of our community.

How Municipal Operations Use Energy

Light, power, heat, and cool Township facilities – everything from the Township Building to the Snack Bar at SPARK

Operate 1,700+ streetlights, traffic signals that manage traffic at ~35 intersections, parking lot lights, and athletic field lighting

Fuel Ambler Ambulance, Ft. Washington Fire Department and Township fleets

This public infrastructure enables the Township to efficiently carry out its administrative responsibilities and to provide the services and amenities that Upper Dublin residents have come to expect. Upper Dublin can lead by example by continuing to improve the energy efficiency of its buildings, fleets, and lighting.

2019 MUNICIPAL ENERGY DATA

When we understand our energy use and spending, we gain the necessary context to: set emissions reduction goals; identify activities that will increase municipal energy efficiency; and choose the best ways to invest limited resources in renewable energy.

The data for this Energy Profile was assembled from Township accounts with PECO and other vendors, consultations with municipal staff, and from the Delaware Valley Regional Planning Commission Greenhouse Gas Emission Inventory.

In 2019, Upper Dublin spent roughly $610,000 on energy. Understanding where these costs originate is the first step towards being able to reduce them.

2019 UPPER DUBLIN MUNICIPAL ENERGY PROFILE

Facilities & Lighting

2,396
MEGAWATT-HOURS OF ELECTRICITY

32,660
CUBIC FEET OF NATURAL GAS

— which translates to —

$355,000
TOTAL ENERGY COST

1,078 *metric tons*
TOTAL GHG EMISSIONS

Vehicles & Equipment

61,819
GALLONS OF GASOLINE

68,133
GALLONS OF DIESEL FUEL

— which translates to —

$252,000
TOTAL FUEL COST

1,187 *metric tons*
TOTAL GHG EMISSIONS

UD MUNICIPAL HIGHEST EMITTERS

1,187 TONS | 470 TONS | 286 TONS | 151 TONS | 172 TONS

Upper Dublin Township: Leading by Example

SOME ACCOMPLISHMENTS TO DATE

- ✓ Converted all street lights and traffic lights to energy-saving LEDs
- ✓ Obtained electricity for 6 years (2007-2012) from 100% renewable sources
- ✓ Installed 1 electric vehicle (EV) charging station in the fleet garage and plans to install 2 more at the new library
- ✓ Piloting 1 EV car for township fleet
- ✓ Supported installation of solar panels at Robbins Park
- ✓ Authorized and supported formulation of a Clean Energy Transition Plan

POTENTIAL NEXT STEPS

- ➢ Commit to transition to 100% renewable energy
- ➢ Identify/hire staff to manage sustainability efforts
- ➢ Perform energy audits on Township's major buildings & implement energy conserving facility modifications as indicated by such audits
- ➢ Purchase Energy Star certified equipment
- ➢ Transition fleet to hybrids and/or electric vehicles
- ➢ Use low-polluting biobased fuels in vehicles for which hybrid and EV technology is not yet available
- ➢ Review Planning and Zoning ordinances and policies
- ➢ Support and educate residents and businesses to become more energy efficient and to install renewable energy
- ➢ Investigate feasibility of additional solar installations

Appendix E: Description of Renewable Electricity Options

Utility supply of state mandated minimums without any renewable energy credits (RECs).

UDT currently purchases electricity without specifying the percent of renewable electricity desired and without purchasing any RECs. This option is the current business-as-usual scenario in the Township.

Unbundled REC purchases from national sources.

Customers can buy green power generated anywhere in the U.S., in any quantity of megawatt-hours, by purchasing RECs separately from electricity – an unbundled product option. Purchasing a standalone REC product allows organizations to effectively self-bundle the renewable energy attributes associated with the RECs with the organization's consumed physical electricity. This is in contrast to a supplier that sells a green power product that includes both the electricity and RECs bundled together, as in the case of either a retail green power product from your electricity supplier (i.e., utility) or alternatively through the direct purchase from a specified generator. In purchasing unbundled RECs, organizations can claim receipt of the environmental attributes of the REC-generating facility (or facilities) without affecting their physical electricity purchase and delivery options. Unbundled REC purchases can be scoped to meet an organization's electricity usage over any period of time, but monthly and annual contracts have historically been the most common transaction periods. Unbundled purchases may also be arranged as a percentage of monthly or annual electricity consumption or as a long-term fixed price contract.

For example, starting in April 2020, Chester County began to purchase renewable energy credits (RECs) to offset GHG emissions associated with electricity purchases. The RECs that Chester County is utilizing are sourced from domestic wind energy and have been purchased for 100% of County facilities' electricity supply through January 2024. Electricity accounts for the majority of the County's reported GHG emissions. While an updated Managing for Results (MFR) Facilities GHG inventory has not yet been prepared, purchasing RECs significantly reduces Chester County's current GHG emissions from the use of electricity relative to what they would be in the absence of REC purchases. While this purchase program does not directly add renewable energy sources to the power grid, it does reduce the County's carbon footprint and supports both the use of renewable energy sources and the further development of the renewable energy industry.

Unbundled REC purchases from Pennsylvania/regional sources.

Purchasing unbundled RECs from Pennsylvania/regional sources operates much the same as described above but with the added desirable benefit that it promotes the growth of a green power production industry in this region.

Utility or retail options bundling of RECs and electricity as a single commodity product within the same utility bill, with Pennsylvania or regional RECs purchased as a block.

A block option is a fixed energy quantity, often 100 kilowatt-hours, of 100 percent renewable electricity, offered for a fixed monthly price. The price is usually expressed as a price premium above the price of conventional power. Customers usually can sign up for as many blocks as they desire.

Utility or retail options bundling of RECs and electricity as a single commodity product within the same utility bill, with Pennsylvania or regional RECs purchased as a percent of use.

Percentage of monthly use is an approach whereby customers may choose green power in an amount based on a fixed percentage of their monthly electricity use. In practice, this usually results in the purchase of blended green and conventional power, unless the customer chooses 100 percent green power. This is typically priced as a premium on a "cents per kilowatt-hour" basis over the standard rate. The monthly cost for these products varies with use and the percentage of green power chosen.

Utility or retail options bundling of RECs and electricity as a single commodity product within the same utility bill, with Pennsylvania or regional RECs purchased as a green tariff (sleeve).

A green tariff describes an arrangement by which regulators authorize a utility to negotiate a long-term contract for green power with an individual large customer. The traditional green tariff form is sometimes called a "sleeve" because it is a contract within a contract: the utility enters into a long-term contract with a third-party green power generator, and in turn contracts with the customer to purchase the RECs and electricity. Green tariffs can take several forms under a green tariff arrangement with the utility, renewable generator and green tariff customer taking different roles relative to each other in the transaction. In "sleeve" contracts, the utility provides the balancing power, distribution infrastructure and transactional.

Entering into a Power Purchase Agreement ("PPA")

A PPA is a complex financial agreement where a developer designs, builds, owns, and operates a renewable energy generation installation and a customer commits to buying the clean energy generated by the project for a fixed term, typically 15 to 20 years. It can be an attractive option because the customer can go solar at no upfront cost and typically buy the power at a cheaper rate than they would have otherwise paid to their electric utility in year 1.

- *Off-site physical PPA in Pennsylvania or in the PJM region.* PPAs are long-term contracts (often 10 to 20 years, but sometimes longer or shorter) between the organization purchasing renewable electricity and a party that generates that electricity. The renewable energy generator can be on-site or off-site, but the buyer must be located in the same power market to allow for physical delivery of electricity. The contract specifies the electricity price (generally a long-term rate with a price escalation clause), the schedule for the delivery of electricity, and the transfer of RECs from the generator (seller) to the purchaser. The purchaser must ensure the RECs are included in the PPA for the electricity to be considered renewable and to substantiate green power use and environmental claims.
    - Physical PPAs are not available in all markets due to state regulations. In states without retail access, end-use consumers are not allowed to purchase directly from green power generators. Also, solar installers may be reluctant to offer third-party ownership and solar PPAs in states that do not shield them from regulation as a utility. Purchasing organizations will need to determine from state utility regulators whether PPAs with non-utility owners are an option. The benefits of PPAs are that they require little capital investment on the part of the purchasing organization, offer certainty of electricity cost and allow for the accrual of savings often within the first year.
    - It should be acknowledged that physical PPAs also present risks to the purchaser because they are a bet that future electricity prices will be higher than the PPA negotiated price. If electricity prices go lower than expected, the purchaser will forgo savings. Organizations could find that they are stuck with a PPA price that exceeds what others are paying. The underlying assumptions that go into determining the PPA price are often key to whether it will offer savings to the purchaser organization.

- *Virtual Power Purchase Agreement*. A virtual PPA ("VPPA"), also known as a financial PPA because the energy is not delivered to the buyer, is a long-term contract in which a generator and purchaser agree on a reference electricity settlement price (the "strike price," which may include an escalator rate). The electricity generated by the project is sold into a wholesale regional power market where the generator is located rather than delivered to the buyer, and therefore the buyer's consumption of electricity can occur in a different power market than where the renewable energy generator is located, including in a traditionally regulated retail electricity market.
    - In a VPPA, any difference between the settlement price and the wholesale market price is balanced by both transacting parties over the life of the contract. On a monthly basis, if the generator earns more from the wholesale market than the strike price, it pays the extra revenue to the purchaser; if the generator earns less than the strike price, the purchaser makes up the difference to the generator. Hence, this option is also referred to as a contract for differences.
    - The VPPA is a hedge for both parties, ensuring fixed revenue to the seller and fixed costs to the buyer. As a green power purchase option, a VPPA of necessity must convey RECs to the buyer. In essence, a VPPA is a hedge against rising electricity prices combined with an unbundled REC contract, where the cost of RECs varies depending on the difference between the wholesale market price and the agreed upon settlement price. In order for the contract to have a hedge value, there must be correlation between the wholesale market where the renewable energy project sells its electricity and the retail market where the buyer consumes their electricity.
    - As with a physical PPA, a VPPA does not protect the buyer against the risk of lower retail electricity prices. (Similarly, the seller is protected against lower wholesale market prices, but would miss out on extra revenue from higher retail electricity prices.)

Appendix F: Funding Resources

In addition to the funding resources listed in these two tables, the Database of State Incentives for Renewables & Efficiency (DSIRE) compiles the most comprehensive source of information on incentives and policies that support renewables and energy efficiency in the United States. Established in 1995, DSIRE is operated by the N.C. Clean Energy Technology Center at N.C. State University and receives support from EnergySage.. Visit programs.dsireusa.org/system/program?fromSir=0&state=PA for an updated list.

APPENDIX F

Source: Radnor Township Renewable Energy & Conservation Plan

Loan, Grant, Tax Rebate/Incentive Programs for All Property Owners

		Offerings						Description	Project Eligibility								
											Commercial		Residential				
Program	Administrator	Loans	Grants	Rebates	Tax Incentives	Other Financial Benefits	Building Evaluations/ Technical Services		Energy Conservation / Efficiency	Renewable Energy	New Construction	Existing	New Construction	Existing	Builders/ Contractors	Property Owners	Information
High-Performance Building Program	PA Dept Community & Economic Development, PA Department of Environmental Protection, Commonwealth Financing Authority	✓	✓					Loans and grants for high-performance certified buildings (Green Globes, LEED, Nat'l Green Building Standard): ● Loans to $100,000 for residences, $2 million for small businesses. ● Grants to $1/2 million or 10% of eligible building construction/renovation costs.	✓	✓	✓	✓	✓	✓	✗	● Small business owners (100 or less) ● Homeowners	Link
Alternative & Clean Energy Program	PA Dept Community & Economic Development, PA Department of Environmental Protection, Commonwealth Financing Authority	✓	✓					Loans and grants for the utilitzation, development, and construction of alternative and clean energy projects: ● Loans range from $40,000 for equipment or components to $5 million or 50% of total project cost for alternative or clean energy projects and High-Performance Building projects. ● Grants range from $175,000 to $2 million or 30% of the total project cost, depending on the type of project.	✓	✓	✓	✓	✗	✗	✗	● Business ● Economic Development Organization ● Political Subdivision	Link
Sustainable Energy Fund Commercial Loan Program	Sustainable Energy Fund	✓						Loan financing solutions for 100% of a renewable energy or energy efficiency project (ex. envelope improvements, HVAC, lighting, etc.) ● Loans meeting eligibility requirements will recieve financing for projects ranging in size from $5,000 - $1 million. For projects exceeding $1MM, projects are evaluated on a case by case basis to evaluate financing opportunities	✓	✓	✓	✓	✗	✗	✗	● Commercial ● Industrial ● Municipal ● Agricultural ● Nonprofit	Link
179D Commercial Energy-Efficiency Tax Deduction	Federal Office of Energy Efficiency and Renewable Energy				✓			A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install (1) interior lighting; (2) building envelope, or (3) HVAC systems that reduce the building's total energy and power cost by 50% or more in comparison to buildings meeting relevant ASHRAE requirements. ● Deductions up to $0.60 per square foot are available for individual improvments towards single energy end-use. ● Systems and buildings must have been placed in service by 12/31/2020, which is when 179D expires, but it may be renewed.	✓	✗	✓	✓	✗	✗	✗	● Commercial ● Municipal	Link
PECO New Homes Rebates	PECO			✓				PECO offers rebates for new homes achieving high energy performance. The available rebates are up to $1,750 per home, or through a per unit basis for multifamily projects. ● Incentives are offered on a tiered basis, depending on the level of energy performance. ● Technical resources are available to participating builders free of charge.	✓	✗	✗	✗	✓	✗	✓	N/A	Link
Home Builder Tax Credits	Internal Revenue Service				✓			Home builders are eligible for a $2,000 tax credit for a new energy efficient home that achieves 50% energy savings for heating and cooling over the 2006 International Energy Conservation Code (IECC) and supplements. ● At least 1/5 of the energy savings has to come from building envelope improvements. ● The tax credit expires at the end of this year but has been successively renewed for many years and is likely to be renewed again.	✓	✗	✗	✗	✓	✗	✓	N/A	Link
PECO Home Energy Assessments	PECO						✓	PECO Energy Company sponsors low cost home energy assessments to identify personalized opportunities to save energy, including: ● Home visit ● Utility bill analysis ● Potential opportunity to receive free energy efficient products	✓	✗	✗	✗	✗	✓	✗	● Homeowners	Link

Program	Administrator	Offerings						Description	Project Eligibility								Information
											Commercial		Residential				
		Loans	Grants	Rebates	Tax Incentives	Other Financial Benefits	Building Evaluations/ Technical Services		Energy Conservation / Efficiency	Renewable Energy	New Construction	Existing	New Construction	Existing	Builders/ Contractors	Property Owners	
Community Action Agency of Delaware County (CAADC) Assistance	CAADC, Inc.						✓	CAADC provides a suite of energy services to assist Delaware County residents with: ● Weatherization assistance for income- eligible households ● Utility Asssistance ● Fuel Assistance ● Water Conservation Assistance ● Energy Education	✓	✗	✗	✗	✗	✓	✗	● Homeowners	Link
HEELP	PA Housing Finance Agency	✓						HEELP offers loans between $1,000 and $10,000 at a fixed-rate of one percent (1%); (APR 1%) for ten years with no prepayment penalties for specific energy efficiency repairs: ● Air sealing, insulation and ductwork ● Energy efficient windows and doors ● Energy efficient heating or cooling system repairs or replacements ● Roof replacements	✓	✗	✗	✗	✗	✓	✗	● Homeowners	Link
Equipment Tax Credits for Primary Residents	Internal Revenue Service				✓			The Federal Government provides tax credits for installing energy efficient equipment in a homeowner's primary residence, including air source heat pumps and central air conditioning, among others. The tax credit is 10% of the total project cost, to $500. The tax credit expires on December 31, 2020, but may be renewed.	✓	✗	✗	✗	✗	✓	✗	● Homeowners	Link
PECO Smart Ideas	PECO					✓		PECO complies with Act 129 through the Smart Ideas Program. This program provides financial incentives for energy efficient equipment and new construction. Discounts, rebates, and incentives are available for equipment and efficiency upgrades.	✓	✗	✓	✓	✓	✓	✗	● Commercial + Industrial ● Small businesses ● Multi-family ● Homeowners	Link
National Energy Improvement Fund	National Energy Improvement Fund, LLC	✓		✓				There are three potential financial arrangements through NEIF: ● The financing agreement is between the customer and NEIF, with pre-funding for equipment before the physical work begins. ● The financing agreement is between the contractor and NEIF, provided as working capital up to $200,000 ● NEIF can provide rebate advances to expediate cash flow, rather that waiting for rebate payments.	✓	✗	✓	✓	✗	✗	✓	● Commercial ● Non-profit ● Government	Link
Fannie Mae Green Rewards	Federal National Mortgage Association	✓					✓	Fannie Mae provides low-interest loans for existing and new construction projects that include green building improvements. The eligible projects include but not limited to installing new ENERGY STAR appliances, energy efficient HVAC systems, WaterSense labeled low- flow fixtures, LED lighting, and solar photovoltaic systems. Free energy and water audit reports and technical solar assessments are also available.	✓	✓	✗	✗	✓	✓	✗	● All assett classes with at least 12 months of Stabilized Residential Occupancy	Link
Sustainable Energy Fund Stipulated Energy Savings Agreement	Sustainable Energy Fund					✓		The Stipulated Energy Savings Agreement is a unique financing structure to install energy efficiency projects. This is agreement is between the customer, the contractor and the SEF. The initial capital costs will be paid by SEF, and a portion of the electricity savings will be used to pay SEF over a specified period of time.	✓	✗	✓	✓	✗	✗	✗	● Commercial ● Industrial ● Municipal ● Agricultural ● Non-profit	Link
TRF Sustainable Development Fund	The Reinvestment Fund	✓						SDF's affordable, flexible financing products include: ● Commercial debt ● Subordinated debt ● Lease financing ● Energy Performance contract financing	✓	✓	✓	✓	✗	✗	✗	● Commercial ● Non-profit ● Local government	Link
TRF Green Energy Loan Fund	The Reinvestment Fund	✓						The GELF program can finance energy efficiency projects in existing and new construction through low-interest loans. It is also possible to support financing of on-site renewable energy systems and/or combined-heat-and-power systems, if apart of a larger efficiency project. The available loan amounts are between $100,000 through $2,500,000, with interest rates variable between 4-5%.	✓	✓	✓	✓	✓ (only multi-family)	✓ (only multi-family)	✗	● Commercial ● Non-profit ● Local government ● Multi-family ● Industrial	Link

Program	Administrator	Offerings						Description	Project Eligibility								Information
											Commercial		Residential				
		Loans	Grants	Rebates	Tax Incentives	Other Financial Benefits	Building Evaluations/ Technical Services		Energy Conservation / Efficiency	Renewable Energy	New Construction	Existing	New Construction	Existing	Builders/ Contractors	Property Owners	
Federal Residential Tax Credit	Internal Revenue Service				✓			Tax credits for residential energy efficiency have been extended retroactively, through December 31, 2020. The tax credit for builders of energy efficient homes and tax deductions for energy efficient commercial buildings have also been retroactively extended, through December 31, 2020. The tax credits for residential renewable energy products are still available through December 31, 2021.	✓	✓	✓	✓	✓	✓	✓	• Commercial • Small businesses • Multi-family • Homeowners	Link
IRS Business Tax Credit	Internal Revenue Service				✓			Available for the installation of solar water heater, solar photovoltaics, geothermal heat pumps, fuel cells using renewable fuels. Tax Credit is 26% of the capital costs for systems placed in service by December 31, 2021. Tax Credit is 22% of the capital costs for systems placed in service after December 31, 2021 and before January 1, 2022, and is 10% of the capital costs for systems placed in service after January 1, 2022 and before January 31, 2023.	✗	✓	✓	✓	✗	✗	✗	• Commercial • Industrial • Agricultural	Link
Small Business Advantage Grant	PA Department of Environmental Protection		✓					The Small Business Advantage Grant provides 50% matching grants, up to a maximum of $7,000 to enable Pennsylvania small businesses to purchase energy efficient or pollution prevention equipment, or adopt waste reduction processes. Energy efficiency and pollution prevention projects must save the small business a minimum of $500.00 and at least 25% annually in energy consumption or pollution related expenses. Pennsylvania-based, registered, for-profit small business with 100 or fewer FTE employees are eligible.	✓	✗	✗	✓	✗	✗	✗	• Commercial • Non-profit • Local government • Multi-family • Industrial	Link

APPENDIX F

Source: Radnor Township Renewable Energy & Conservation Plan

Incentive & Rebate Programs for Efficient & Clean Transportation

		Offerings					Description	Project Eligibility								
Program	Administrator	Loans	Grants	Rebates	Tax Incentives	Other Financial Benefits		EV/AFV Infrastructure	EV/AFV Purchasing	Truck and Bus Fleet	Transportation Planning and Projects	Innovative Technology	Eligible Applicants	Eligible Project Types	Eligible Project Locations	Information
DC Fast Charging and Hydrogen Fueling Grant Program	PA Department of Environmental Protection (Driving PA Forward Program)		✓				This grant program is designed to assist with the installation or expansion of strategically significant electric vehicle (EV), alternative fuel vehicle (AFV), and/or zero emission vehicle (ZEV) fueling projects: ● DC Fast Charging: up to 70% may be reimbursed (max $250,000 per award). ● Hydrogen Fueling (>250 kg/day): up to 33% may be reimbursed (max $500,000 per award). ● Hydrogen Fueling (>250 kg/day): up to 25% may be reimbursed (max $500,000 per award).	✓	✗	✗	✗	✗	● Businesses ● Incorporated Nonprofits ● State/Local Governments ● Planning Organizations ● Air Quality or Transportation Organizations ● Federal Government Organizations	1. Publicly accessible DC Fast Charging projects for light-duty EVs. 2. Publicly accessible DC Fast Charging projects for light-duty EVs combined with Level 2 charging at the same location. 3. Publicly accessible hydrogen fuel cell supply equipment projects for light-duty hydrogen fuel cell vehicles.	EV Fast chargers must be installed in: ● Community Charging Hubs ● Transportation Corridors ● Destination Locations. Hydrogen Fuel Cell must be installed in a place available to the public.	Link
Level 2 EV Charging Rebate Pro	PA Department of Environmental Protection (Driving PA Forward Program)			✓			Approximately $7.7 million is being allocated over a 5-year period to fund a rebate program for the installation of level 2 electric vehicle (EV) charging equipment. ● Full Public Access, Networked: up to $4,500 per plug (or up to 90% of total project costs for government-owned/up to 70% for non-government-owned) ● Full Public Access, Non-Networked: up to $4,500 per plug (or up to 80% of total project costs for government- owned/up to 60% for non-government-owned) ● No/Limited Public Access up to $3,500 per plug (or up to 50% of total project costs)	✓	✗	✗	✗	✗	● Businesses ● Incorporated Nonprofits ● State/Local Governments ● Planning Organizations ● Air Quality or Transportation Organizations ● Federal Government Organizations	1. Full Public Access, Networked 2. Full Public Access, Non-Networked 3. No/Limited Public Access ● Maximum of 20 total plugs	● Public use at government owned property ● Public use at non-government owned property ● Non public use at workplaces ● Non public use at multi-unit dwellings	Link
Alternative Fuels Incentive Grant Program (AFIG)	PA Department of Environmental Protection		✓				Through the program, DEP solicits applications for innovative, advanced fuel and vehicle technology projects resulting in cleaner advanced alternative transportation within the Commonwealth. Approximately $5 million in grants is made available annually. The grant expires in 2020, but is typically renewed. Priorities for 2020 funding included: zero emission vehicle (ZEV) projects, renewable natural gas (RNG) vehicle projects, projects in Environmental Justice (EJ) areas, and publicly accessible refueling projects.	✓	✓	✓	✗	✓	● School Districts ● Municipal Authorities ● Political Subdivisions ● Nonpropfit Entities ● Private Companies	● Vehicle Retrofit or Purchase Projects ● Alternative Fuel Refueling Infrastructure Projects ● Innovative Technology Projects	Dependent on project type, see AIFG Guidelines.	Link
Truck and Bus Fleet Grant Program	PA Department of Environmental Protection (Driving PA Forward Program)		✓				There is $3,000,000 available for reimbursement grants to replace or repower fleets of 6 or more Class 4-8 trucks, port drayage trucks, school buses, shuttle buses, and/or transit buses. Replacing or repowering vehicles containing older diesel engines with new technology can reduce emissions by up to 90%.	✗	✗	✓	✗	✗	● Businesses ● Incorporated Nonprofits ● State/Local Governments ● Planning Organizations ● Air Quality or Transportation Organizations ● Federal Government Organizations	1. Replace or repower eligible Class 4-8 trucks, school buses, or shuttle buses with a MY 2019 or newer diesel or alternative fueled engines, including all-electric engines. 2. Replace or repower eligible drayage trucks with a MY 2017 or newer diesel or alternative fueled engines, including all- electric engines. 3. Replace or repower eligible transit buses with MY2019 alternative fueled engines, including all electric engines. Diesel replacements or repowers of transit buses are not eligible for funding under this program.	N/A	Link
Onroad Rebate Program - Trucks and Buses	PA Department of Environmental Protection (Driving PA Forward Program)			✓			The primary goal of the Onroad Rebate Program is to improve Pennsylvania's air quality by reducing oxides of nitrogen (NOX) emissions from diesel-powered mobile sources through funding diesel emission reduction projects. Eligible diesel emission reduction solutions include: certified engine repowers and/or certified vehicle or equipment replacements.	✗	✗	✓	✗	✗	● Businesses ● Incorporated Nonprofits ● State/Local Governments ● Planning Organizations ● Air Quality or Transportation Organizations ● Federal Government Organizations	1. Current vehicles or engines must be scrapped or rendered permanently inoperable for all eligible project types. 2. Replace or repower eligible Class 4-8 trucks, school buses, or shuttle buses with a MY 2019 or newer diesel or alternative fueled engines, including all-electric engines. 3. Replace or repower eligible drayage trucks with a MY 2017 or newer diesel or alternative fueled engines, including all- electric engines. 4. Replace or repower eligible transit buses with MY2019 alternative fueled engines, including all electric engines. Diesel replacements or repowers of transit buses are not eligible for funding under this program.	N/A	Link
Small Business Advantage Grant	PA Department of Environmental Protection		✓				The Small Business Advantage Grant provides 50% matching grants, up to a maximum of $7,000 to enable Pennsylvania small businesses to purchase energy efficient or pollution prevention equipment, or adopt waste reduction processes. Grants for anti-idling technologies or tire inflation systems are available.	*for ✓ lling or tire inflation	✗	✓	✗	✗	Pennsylvania-based, registered, for-profit small business with 100 or fewer FTE employees	Energy efficiency and pollution prevention projects saving the small business a minimum of $500.00 and at least 25% annually in energy consumption or pollution related expenses.	N/A	Link
Plug-in Electric Vehicle (PEV) Rebate	Philadelphia Electric Company (PECO)			✓			Through the Smart Driver Rebates programs, PECO offers rebates for residential and business customers investing in new electric vehicle technology. PECO customers can earn $50 per car when they purchase an electric vehicle.	✗	✓	✗	✗	✗	● You are the account holder who currently receives electric service from PECO or live at the same address as the account holder ● You are a tenant of an apartment that is in the PECO service territory and you pay for your residential electric service as a part of the rent you pay your landlord ● Your primary place of recharging your vehicle is or will be located in the PECO service territory	Only plug-in vehicles qualify for a rebate.	N/A	Link
Transportation and Community Development Initiative (TCDI)	Delaware Valley Regional Planning Commission (DVRPC)		✓				The Transportation and Community Development Initiative (TCDI) is a grant opportunity that supports smart growth initiatives that implement the Connections 2045 Plan for Greater Philadelphia. To date, the TCDI has given out 295 awards and invested $20.27 million throughout the Delaware Valley.	✗	✗	✗	✓	✗	Municipalities including cities, townships, or boroughs, or offices within those entities.	Projects should link land use and transportation by: Improving the overall character and quality of life, enhancing existing transportation infrastructure capacity, promoting active and public transit methods, building capacity in schools and neighborhoods, reinforcing and implementing improvemnets in designated Centers and/or protecting our environment. Past project types have included feasibility studies, trail and sidepath maintenance, TOD strategic plans, and much more. See link for a list of past projects and funding amounts.	Any municipality within the DVRPC region can apply.	Link
Regional Trails Program	Delaware Valley Regional Planning Commission (DVRPC)		✓				DVRPC's Regional Trails Program provides planning assistance and financial support to trail developers, counties, municipalities and nonprofit organizations to complete the Circuit, Greater Philadelphia's 800-plus-mile network of multi-use trails. With financial support from the William Penn Foundation, the Regional Trails Program has provided $20 million in funding to over 110 trail planning, design, and construction projects to date.	✗	✗	✗	✓	✗	Municipalities including cities, townships, or boroughs, or offices within those entities.	Trail planning, design, or construction projects	Any municipality within the DVRPC region can apply.	Link

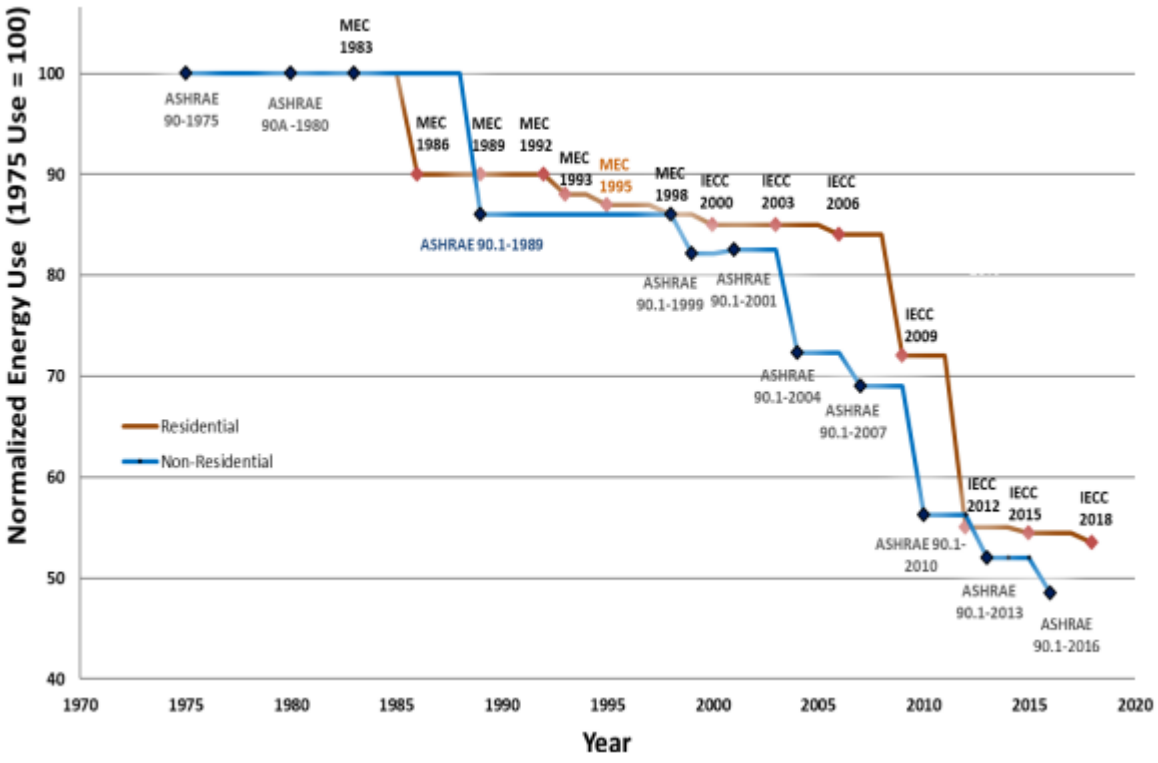
Program	Administrator	Offerings					Description	Project Eligibility								Information
		Loans	Grants	Rebates	Tax Incentives	Other Financial Benefits		EV/AFV Infrastructure	EV/AFV Purchasing	Truck and Bus Fleet	Transportation Planning and Projects	Innovative Technology	Eligible Applicants	Eligible Project Types	Eligible Project Locations	
Congestion Mitigation and Air Quality Improvement Program (CMAQ)	Delaware Valley Regional Planning Commission (DVRPC)					✓	DVRPC's Competitive Congestion Mitigation and Air Quality Improvement Program (CMAQ) seeks to fund transportation projects that will improve air quality and reduce traffic congestion in the DVRPC Region. The CMAQ Program is not a grant program. The sponsor does not receive grant funds to start the project; rather, the sponsor is reimbursed for costs incurred after receiving funding authorization for the project and a notice to proceed. Costs incurred prior to project selection and notice to proceed are not reimbursed. All awarded projects must authorize federal CMAQ funds by the deadline stated in their award letters.	✗	✗	✗	✓	✗	All public agencies, incorporated private firms, or nonprofit entities, including municipalities, Transportation Management Associations (TMAs), and transportation system operators are eligible. Private firms and nonprofits must partner with a local public agency sponsor and have a formal agreement in place with the public agency at the time of funding award. Private individuals are not eligible to apply. Please refer to DVRPC's latest CMAQ Guidance for details.	Trail planning, design, or construction projects	Any eligible applicant within the DVRPC region can apply.	Link

Appendix G: Background on Building Codes

States adopt mandatory commercial and residential energy efficiency codes, or IECC codes, as part of a larger building code package known as the Uniform Construction Code, or UCC. The building energy codes require a minimum level of energy efficiency for new construction and are the basis upon which architects, builders, and developers make decisions about energy efficiency.

Every three years, global experts representing the International Code Council automatically update the IECC/UCC to reflect recent technologies and safety standards. As technology has rapidly improved, the code updates have greatly improved energy efficiency of the standards.

Improvement in Residential and Non-Residential Energy Codes (1975-2018)



Source: Pacific Northwest National Laboratory

Pennsylvania does not automatically adopt these updates. PA has an appointed "Review and Advisory Committee" ("RAC") that determines which provisions, if any, to adopt. This means PA is always behind in adopting new codes. For close to a decade, the RAC prevented adoption of updated building codes in PA, resulting in substantial lost opportunities across the state, including in Upper Dublin, for energy efficiency in new construction and major renovation projects. The process burdens local governments, because building code inspectors attend training for codes they cannot even enforce in our state. Importantly, UD cannot simply adopt the updated codes on its own; local governments are effectively pre-empted from doing so, trapping us in the state's outdated process and preventing progress on our RE Goals.

Appendix H: References & Resources

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The International Council of Local Environmental Initiatives (ICLEI). icleiusa.org

Intergovernmental Panel on Climate Change (IPCC). ipcc.ch/ The United Nations Environment Programme and the World Meteorological Organization jointly established the IPCC in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change.

Leadership in Energy and Environmental Design (LEED). usgbc.org/leed An internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at achieving energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. The U.S. Green Building Council developed it.

National Renewable Energy Laboratory (NREL). nrel.gov/ A government-owned, contractor-operated facility funded through the DOE. It specializes in renewable energy and energy efficiency research and development.

Solarize Campaigns. https://solarizesoutheastpa.com/ and solarizephilly.org/ An organized national effort by local citizens groups to vet qualified solar contractors, find interested customers for the solar contractor, provide assistance to customers concerning working with the contractors, and negotiate lower prices for the customers. The DOE assists the program.

United States Energy Information Agency (EIA). eia.gov/ The principal agency responsible for collecting, analyzing, and disseminating energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.

Renewable Energy

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Federal Income Tax Credits

energystar.gov/about/federal_tax_credits/non_business_energy_property_tax_credits

Homeowners' Energy Efficiency Loan Program ("HEELP")

phfa.org/programs/heelp.aspx

Appendix I: Glossary

Term	Definition
Alternate Energy Portfolio Standard (AEPS)	The PA AEPS Act requires that a certain percentage of all electric energy sold to retail customers be derived from alternative energy sources such as solar, wind, hydropower, biomass, biologically derived methane gas, and demand-side management resources.
Aggregated Purchasing	Group buying of electricity by multiple customers to achieve competitive rate from renewable energy.
Air source heat pump	A heat pump that employs the outside air as a sink for energy transfer.
Battery electric vehicle (BEV)	A vehicle that has an electric motor that is solely powered by an on-board battery.
Building electrification	The replacement of furnaces and hot water heaters that burn natural gas, oil, or propane with heat pumps powered by electricity.
British thermal units (Btu)	The amount of heat energy needed to raise the temperature of one pound of water by one degree (roughly the energy in a lit match). This is the standard measurement used to state the amount of energy that a fuel has as well as the amount of output of any heat-generating device. MMBtu is the common symbol for one million Btus.
Carbon dioxide equivalent (CO_2e)	A unit of measure that allows emissions of greenhouse gases of different strengths to be added together based on their global warming potential.
Carbon footprint	A measurement used to calculate the impact human activities have on the climate change. It is measured in terms of the amount of greenhouse

	gases emitted from each activity and reported in units of carbon dioxide equivalents (CO_2e).
Community choice aggregation (CCA)	Community Choice Aggregation (CCA) programs allow local governments to procure power on behalf of their residents, businesses, and municipal accounts from an alternative supplier while receiving transmission and distribution services from their existing utility providers. CCA requires state enabling legislation, which PA has not passed. There are legislative efforts to develop CCA in PA.
Community solar	Not all residents and businesses are able to install solar on their property. Community solar enabling legislation allows municipalities to partner with a utility to create and support a robust community solar program which allows solar installations on public properties. Community solar programs allow residents and business to purchase solar panels from an existing solar farm and receive an on-bill credit as if those panels were actually on their roof.
Conservation	Reduction of demand for a resource such as electricity by eliminating the need for it in the first place.
Distributed energy resources (DER)	Small-scale power generation or storage technologies (typically in the range of 1 kW to 10,000 kW) used to provide an alternative to or an enhancement of the traditional electric power system.
DVRPC	Delaware Valley Regional Planning Commission: the regional planning organization for the five southeastern PA counties and four adjacent counties in New Jersey.
Energy efficiency	A change which reduces the amount of energy needed to accomplish a specific task.

Electrification roadmap	A plan to guide building electrification efforts, including policy and program recommendations, targets for building electrification, and measures with which to judge success.
Energy Star	A joint program between the DOE and EPA that provides energy efficiency standards for products and buildings.
Equivalent metric ton	A unit of mass equal to 1,000 kg (2,204.62 lbs.). This is the commonly used measure of green-house gas emissions. Its weight is approximately 10% more than a US, 2,000-lbs ton (i.e.., a short ton).
Electric vehicle (EV)	A vehicle that uses one or more electric motors for propulsion.
EV-ready ordinance	A law which requires that residences or a percentage of spaces in private and/or public parking facilities be designed and built with the necessary infrastructure to accommodate electric vehicles.
Federal Investment Tax Credit (FITC)	A national tax credit that allows solar panel owners to deduct 26% of the cost of solar from their federal tax burden for solar arrays installed in 2021. The tax credit is set to gradually decrease each year from 2020 and onward.
Fossil fuel	A general term for combustible geologic deposits of carbon in reduced (organic) form. Fossil fuels are of biological origin and include coal, oil, natural gas, oil shales and tar sands.
Geothermal heat pump	A heat pump that employs the ground as a sink for energy transfer rather than the outside air. It is a highly efficient heating and cooling system.
Greenhouse gas (GHG)	A gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect on planets. The primary greenhouse gases in Earth's atmosphere

	are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.
Green building	Sustainable or "green" buildings employ a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.
Heat pump	A device that transfers heat from a colder area to a hotter area by using mechanical energy, as in an air conditioner. It can be used to heat buildings. A new generation of heat pumps has been developed in the last two decades that have much higher efficiencies than traditional heat pumps installed before that time. These heat pumps can efficiently provide heating down to as low as -7 degrees Fahrenheit.
Hybrid electric vehicle (HEV)	A vehicle that combines a conventional internal combustion engine (ICE) system with an electric propulsion system (hybrid vehicle drivetrain).
Kilowatt (KW)	Equal to 1,000 watts or 3,412 Btus.
Kilowatt-hour (KWh)	A unit of energy equal to 1,000-watt hours or 3.6 mega joules. A heater rated at 1,000 watts (1 kilowatt), operating for one hour uses one kilowatt hour of energy. Using a 60-wat bulb for one hour consumes 0.06 kilowatt hours of electricity. Using a 60-watt light bulb for one thousand hours consumes 60 kilo-watt hours of electricity.
Light Emitting Diode (LED)	A lighting technology that is much more efficient and lasts much longer that incandescent, mercury, or sodium lights and contains no hazardous chemicals. They have a higher initial cost, which is more than offset by the energy savings.
Megawatt (MW)	A megawatt hour is a unit for measuring power that is equivalent to one million watts. One megawatt is equivalent to the power of 10 automobile engines.

Megawatt-hour (MWh)	A MWh is equal to 1,000 kilowatt hours (KWh). It is about equivalent to the amount of electricity used by about 330 homes for one hour.
PA Tier 1 RECs	Renewable Energy Credits for the generation of one megawatt-hour of electricity from the following sources: photovoltaic energy, solar-thermal energy, wind, low-impact hydro, geothermal, biomass, wood pulping and manufacturing byproducts from energy facilities within the state, biologically derived methane gas, coal-mine methane, and fuel cells.
PA Tier 2 RECs	Renewable Energy Credits for the generation of one megawatt-hour of electricity from the following sources: new and existing waste coal, distributed generation (DG) systems less than 5 MW in capacity, demand-side management, large-scale hydro, municipal solid waste, wood pulping and manufacturing byproducts from energy facilities located outside the state, useful thermal energy, and integrated gasification combined cycle (IGCC) coal technology. Two thirds of the RECs have been provided for the burning of waste coal.
PA Solar RECs	Renewable Energy Credits for the generation of one megawatt-hour of electricity from solar arrays.
Peak Load	The maximum instantaneous load or the maximum average load over a designated interval of time. Also known as peak demand.
Plug-in hybrid electric vehicle (PHEV)	A hybrid electric vehicle whose battery can be recharged by plugging it into an external source of electric power, as well as by its on-board engine and generator.
Power Purchase Agreement (PPA)	An arrangement in which a third-party developer installs, owns, and operates an energy system either on a customer's property or on other land.

	The customer then purchases the system's electric output for a predetermined period.
Public Utility Commission (PUC)	The state commission that regulates public utilities in Pennsylvania. For electric utilities, it has the power to regulate the distribution systems (in our case PECO), approval and siting of electric generators and transmission lines, and in Pennsylvania, requirements for renewable energy, among other powers.
Renewable Energy Credit (REC)	Tradable, non-tangible energy commodities that represent proof that one megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource (renewable electricity) and was fed into the shared system of power lines which transport energy.
Renewable energy	Energy sources that, within a short time frame relative to the Earth's natural cycles, are sustainable. They include non-carbon technologies such as solar energy, hydropower, and carbon neutral technologies such as biomass.
Solar array	A collection of solar panels electrically combined and coupled with other equipment to deliver solar-generated electricity.
Solar Renewable Energy Credit (SREC)	A solar incentive that allows homeowners to sell certificates for energy to their utility. A homeowner earns one SREC for every 1,000 kilowatt hours produced by their solar panel system.
Virtual Power Purchase Agreement (VPPA)	A long-term financial arrangement between a renewable energy supplier (seller) and a customer that enables the customer to purchase electricity either at a fixed or floating price depending on the value of the electricity at the time of supply.