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1. Purpose of Energy Planning

Energy planning investigates issues centered on energy use and delivery in the community; identifies how these issues intersect with other planning topics like land use patterns and transportation choices; and formulates strategies to improve the efficiency of energy use in the community. Energy planning at the local level becomes the convergence of planning for many other issues. Energy planning and initiatives have a large role in quality building standards; emergency management planning (since most community –wide emergency events involve the disruption of power delivery); facility cost and fiscal projections; air quality; and land use.

This Energy Plan was produced through the efforts of the Ohio Kentucky Indiana (OKI) Regional Council of Governments and the Greater Cincinnati Energy Alliance working with a steering committee named by Delhi Township. This planning effort was funded through the Duke Class Benefit Fund with the aim of bringing about improved energy efficiency in southwest Ohio.

The goals and objectives included in this plan were drafted by the energy plan steering committee after reviewing the information included in the associated chapters. Feedback was also solicited via a web survey, which received 89 responses. The detailed results of the survey are shown in Appendix A of this document. A draft version of these goals was posted on the Community Energy Plan website at energy.oki.org.

This plan will serve to organize action by Delhi Township, its residents, and businesses to meet the stated goals. This plan should be evaluated periodically to ensure the proposed actions are bringing the desired outcomes, and the stated goals remain relevant to the overall needs and desires of the community.

2. Overview of Delhi Township's Energy Strategy

The process of determining this energy strategy and goals is the work of an appointed eight-member committee. The committee reviewed information and public input in order to develop an energy strategy for Delhi Township. Early in the process, the committee provided input, and adopted the mission statement below to guide the development of the plan.

Mission Statement

Delhi Township will continue to promote energy efficiency in government operations and in the broader community because it saves residents and businesses money, promotes investment in the community, and will result in a more livable Delhi. The township will accomplish this through careful investments in community facilities and by partnering with other organizations to bring the best programs and information to residents and businesses.

Feedback from Public Outreach

Public feedback on several energy related issues was collected through an online survey. Key takeaways from the survey include:

- There is a widespread interest in energy efficiency among the respondents. Over 95 percent indicated that they have already installed LED lightbulbs in their homes. However, over 70 percent of respondents indicated that a lack of money was preventing them from investing in additional energy saving improvements.

- Approximately 73 percent of respondents indicated that they would prefer that Delhi Township prioritize the lowest cost when selecting a provider for its utility aggregation program.

- Approximately 49 percent of respondents felt it was "very important" or "most important" for Delhi Township to address the issue of energy burden in the community and promote energy efficiency to low- and moderate-income households and renters.

A summary of the complete results of the survey is found in Appendix A.

Energy Plan Goals

Goal 1	Delhi Township will reduce energy consumption in township owned buildings by 10 to 25 percent by identifying and implementing energy and cost saving opportunities.
Goal 2	Delhi Township will take simple steps to educate its residents and businesses about the benefits of energy efficiency.
Goal 3	Delhi Township will strive to ensure that zoning regulations and infrastructure projects take energy related issues such as urban heat island, transportation, and other emerging energy topics into consideration.

Strategies

The Delhi Township Energy Plan recommends implementing the following strategies to achieve the goals of the plan and to ensure that it remains an energy efficient, sustainable, affordable, and attractive community for residents and businesses.

Residential Strategies

1	Improve pedestrian connections between residential neighborhoods and Delhi Pike to reinforce the connection to businesses, public transportation, and parks for all residents.
2	Partner with the Hamilton County Health Department or local OSU Extension office to provide residents with information about “use by” or “sell by” dates to help reduce food waste.
3	Distribute information and resources to educate residents on energy literacy and low-cost DIY friendly energy efficiency improvements they can make to their own homes.
4	Partner with a local hardware store to host a workshop on air sealing, weather stripping, insulation, and programmable thermostats.
5	Serve as a resource for residents seeking advice and/or financing for larger energy-efficiency projects by connecting them with appropriate organizations and resources.
6	Create a checklist for navigating the permitting process for residential wind or solar projects.

Commercial and Industrial Strategies

1	Extend parking lot landscaping standards to all districts so that trees are required in and around all large parking lots to reduce the formation of heat islands.

2	Implement improvements outlined in the Facility Energy Efficiency Report to save energy and money on township operations.
3	Serve as a resource for businesses seeking advice and/or financing for larger energy-efficiency projects by connecting them with appropriate organizations and resources.
4	Join the Western Community ESID to allow projects in Delhi Township to take advantage of PACE financing

3. Energy Consumption

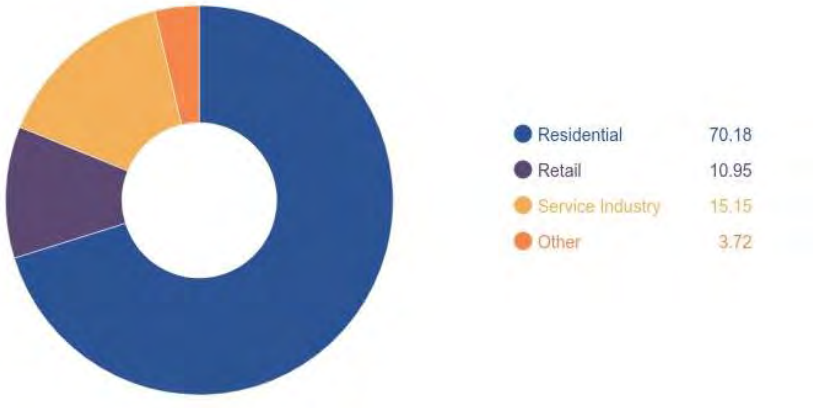
A major component of a community energy plan is understanding how much energy the community uses, who is using it, how it is being used, and how much it costs. This information can inform priorities when deciding between efficiency initiatives that target different users while also serving as a baseline to measure the impact of future energy efficiency initiatives in the community. Residential and commercial structures in Delhi Township consumed over 1.19 billion kBtus of energy from Duke Energy in 2016 at a total cost of over $24 million.[1]

Figure 1: **Total Energy Consumption and Cost 2016**

	Amount Consumed	Cost
Electricity	157,839,694 kWh	$17.7 million
Natural Gas	6,366,828 CCF	$6.3 million

The residential sector accounted for 70 percent of electricity consumption in 2016 while the commercial and industrial sectors accounted for 30 percent. Residential usage is likely to remain the largest consumer of electricity in the future given the composition of the township.

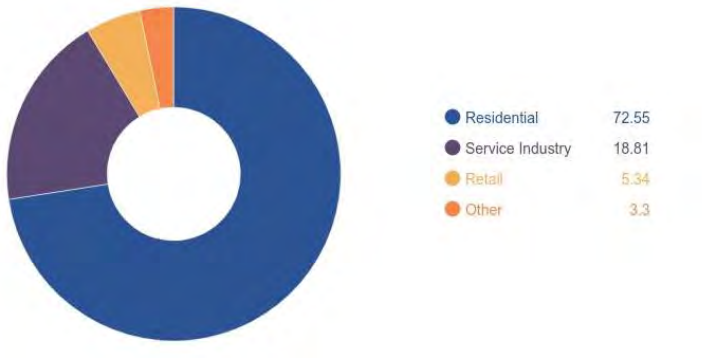
Figure 2: **Delhi Township Electricity Consumption by Sector, 2016**



Natural gas is used for space heating, water heating, and some manufacturing processes. In 2016, the residential sector accounted for 72 percent of natural gas consumption while the commercial and industrial sectors accounted for 28 percent.

[1] This figure does not include the costs associated with fuel sources such as propane and fuel oil purchased by residents or businesses.

Figure 3: **Delhi Natural Gas Consumption by Sector, 2016**



Residential Energy Use

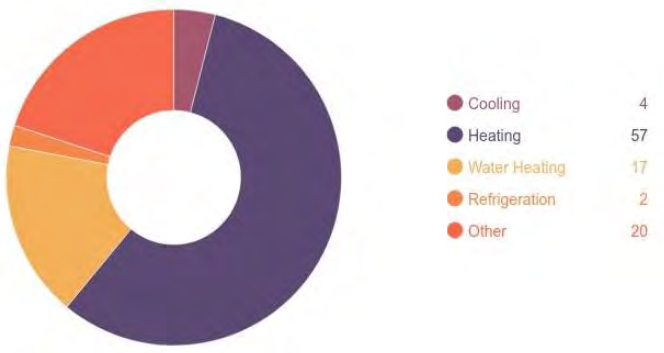
Residential energy use depends on the energy consuming devices used in the home and the efficiency of those devices. Natural gas and electricity are the most-consumed energy sources in residential buildings throughout Delhi. Figure 4 shows the amount of energy consumed by Delhi residents and the estimated total cost by energy source. The estimated total annual energy cost of $20.02 million equates to an average cost of $675 per capita or $1,882 per household. Improving the energy efficiency of residential buildings by an average of five percent could save residents over $1 million annually based on 2016 utility rates and usage.

Figure 4: **Residential Energy Consumption and Cost**[2]

	Amount Consumed	Cost
Electricity	110,774,922 kWh	$13,528,266
Natural Gas	4,619,298 CCF	$6,489,371

Space heating accounts for the largest share of energy use in residential buildings. Natural gas is the most common source of fuel for heating residential buildings in Delhi followed by electricity.

Figure 5: **Residential building fuel consumption by end use.**[3]



[2] Data obtained from Duke Energy and the 2017 American Communities Survey.
[3] U.S. Energy Information Administration, 2015

Figure 6 provides a snapshot of residential energy consumption in the community relative to three other communities in the region (Colerain Township, Silverton, and Turtlecreek Township). Delhi residents appear to consume less electricity and less natural gas per household than the weighted average of the other communities based on the available data.

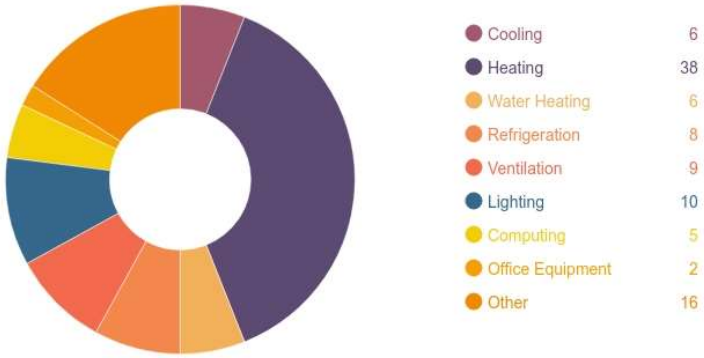
Figure 6: **Annual Residential Energy Consumption and Costs, 2016.**[4]

	Delhi	Peer Cities
Average kWh per household	10,418	11,640
Average annual cost per household	$1,272	$1,344
Average CCF per household	434	510
Average annual cost per household	$610	$662

Commercial and Industrial Energy Use

Commercial and industrial buildings range in size from small storefronts to large industrial and retail facilities. In general, commercial and industrial buildings have an energy profile like that shown in Figure 7. However, the actual profile will vary depending on the type of facility.

Figure 7: **Commercial building fuel consumption by end use.**[5]



Green House Gas Emissions

Greenhouse gases are gases that emit radiant energy in the Earth's atmosphere and contribute to changes in global temperatures. There are several different greenhouse gases released into the atmosphere including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

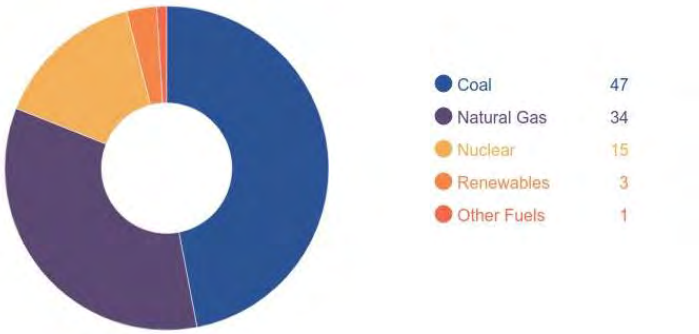
The amount of greenhouse gases produced by a community can be traced in part to how its electricity is generated. In Ohio, most of the electricity is generated by coal-fired power plants. Coal plants in Ohio are

[4] U.S. Department of Energy, 2016
[5] U.S. Energy Information Administration, 2012

gradually being replaced by power plants fueled by natural gas which have lower greenhouse gas emissions. A 2014 study by the National Oceanic and Atmospheric Administration found that power plants fueled by natural gas release approximately 40 percent less carbon dioxide than coal-fired plants.[6]

While these forms of energy production are relatively cheap, they generate pollution and greenhouse gases which negatively impact public health in our region. In the American Lung Association's 2019 State of the Air report, Hamilton County received an F for its number of high ozone days while the Cincinnati metropolitan area was ranked the 13th worst for annual particulate pollution out of over 200 metropolitan areas.[7]

Figure 8: **Ohio Electricity Sources, 2018**



The residential and commercial and industrial sectors in Delhi Township emitted 146,576 metric tons of greenhouse gases in 2016. This figure includes emissions from electricity production as well as from the burning of natural gas for heating or industrial processes. Table 9 shows household greenhouse gas emissions by source in 2016 for Delhi as compared to three other communities in the region (Colerain Township, Silverton, and Turtlecreek Township).

Table 9: **Household Annual Greenhouse Gas Emissions by Source (metric tons), 2016**

Source	Delhi	Peer Cities (Avg)
Residential	9.75	11.03
Commercial and Industrial	4.03	8.23
TOTAL	13.78	19.26

Delhi Township's greenhouse gas emissions are much lower than the weighted average of the three other communities for residential as well as commercial and industrial emissions. The large discrepancy in commercial and industrial sector emissions is likely due to the fact that this sector is predominately commercial in Delhi while the industrial component has a larger presences in the peer communities.

[6] de Gouw, J. A., Parrish, D. D., Frost, G. J. and Trainer, M., 2014
[7] American Lung Association, 2019

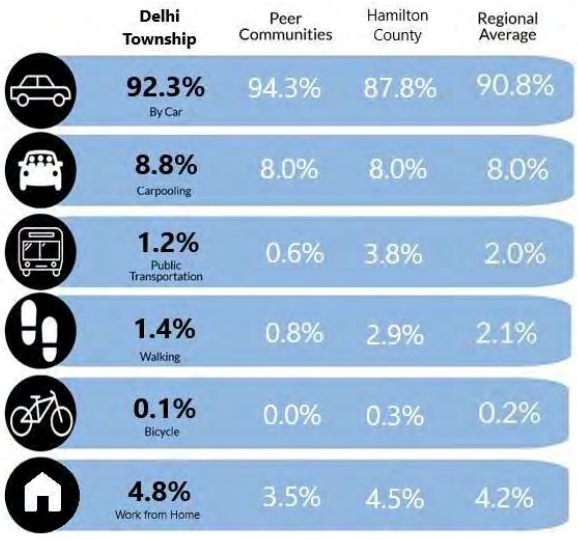
4. Transportation, Land Use, and Food Waste

Transportation

Measuring the use of energy for transportation for a local community is a difficult task. This plan looks to data regarding means of transportation to work gathered by the U.S. Census Bureau as part of the American Community Survey. This data is available for any local political jurisdiction, can be tracked for changes over time, and can be compared with other communities. The peer communities chosen for this comparison are Green Township, Colerain Township, Miami Township, Bridgetown (CDP), and the Village of Cleves.

The percentage of workers living in a community who opt to commute in a way which saves energy – by carpooling, riding the bus, biking, walking, or working from home is used as an indicator of the efficient use of energy for transportation. It should be recognized that some workers may commute to work via the above means for reasons other than conserving energy. However, these means of travel are more energy efficient than commuting to work alone in a car.

Figure 10: **Means of Commuting to Work**



As with all communities in the Greater Cincinnati Region, a strong majority of Delhi Township residents commute alone in their personal vehicles. It is notable that Delhi Township trends slightly lower than the peer communities selected. The township is about even with its peer communities for the number of commuters who carpool.

Delhi bests its peers in public transportation use. Delhi is served by Routes 77X and 32, both of which travel between Downtown and the Glenway Crossing Transit Center. There is also a Park and Ride available at the Delhi Plaza Shopping Center.

The number of residents walking or biking to work is relatively small. However, Delhi residents are more likely to walk or bike than the group of peer communities.

Also, on the positive side, Delhi Township leads in the most energy efficient commute – which is no commute at all. Approximately 4.8 percent of township residents indicated that they work from home.

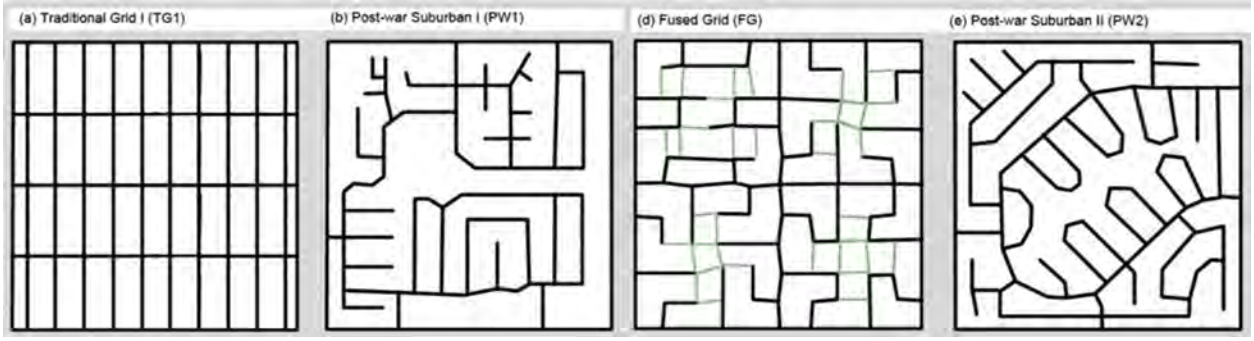
Walkability

With transportation comprising a significant percentage of a community's energy usage, designing roads that accommodate pedestrians, bikes, and buses provides an energy saving alternative to cars. Walking for short trips reduces the amount of air pollution and is a good form of exercise. Patterns of development and existing infrastructure can promote walking as an alternative to car travel. A summary of the ample benefits of a capable sidewalk network are listed below.

- Increases the opportunity for physical activity thus positively impacting public health by combating inactivity.
- Increases property values.
- Forges a better sense of community.
- Improves air quality and decreases energy use by reducing vehicle trips.

The advent of the automobile and post-war development changed the complexion of American streets. The traditional grid pattern is now typically reserved for high density areas while suburban developments adopted patterns similar to (b) and (e) below.

Figure 11: **Residential Development Patterns**[8]



All four patterns have a direct impact on the daily decisions of commuters. The decision between walking versus driving us dependent on multiple variables such as distance and traffic volume. Both post-war development models (b and e) prioritize car travel over walking. There are limited incentives for pedestrians in these patterns.

The fused grid pattern (d) incentivizes walking by providing more direct routes for pedestrians. The fused grid also maintains the suburban hierarchy of cul-de-sacs and collectors for cars. Even without implementing a full-scale fused grid pattern, tenants of its design can be implemented to incentivize walking over driving.

Mixed use development and walkable communities boost the rate of pedestrian activity. Many of these concepts are being applied to the 14-acre Delhi Mixed Use Project that is currently under consideration. Delhi Township is also prioritizing the creation of additional pedestrian connections from residential neighborhoods and Mount St. Joseph University to the commercial district along Delhi Pike.

[8] Jin, Xiangbing and White, Roger

Urban Heat Island Effect

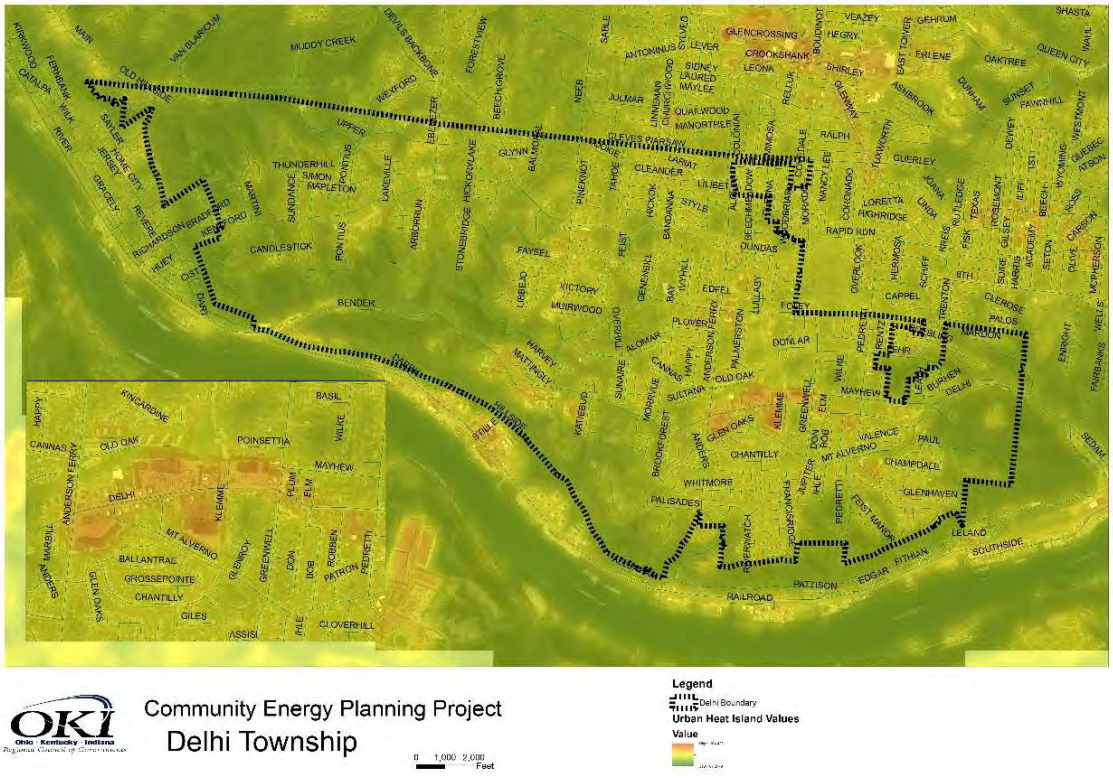
Asphalt streets, parking lots, and large black roofs absorb heat from the sun during the day, and release that heat at night, keeping temperatures higher during the summer. In urbanized areas, this creates a dome of hot air that causes air conditioners to run harder and longer – called the urban heat island effect. Impervious surfaces that contribute to increased heat values include:

- Dark roofing material
- Parking lots
- High concentration of buildings
- Lack of tree canopy

The urban heat island phenomenon impacts energy use, particularly in the summer months, when air conditioners are forced to run more often, and for longer periods of time due to the increased air temperatures.

Due to the large amount of tree cover in Delhi Township, the urban heat island impacts are relatively low. There are a few hotspots including the commercial area on Delhi Pike between Anderson Ferry and Greenwell as well as some large apartment complexes in the southeastern part of the township.

Figure 12: **Delhi Township Urban Heat Island Analysis**



The best way for a community to reduce the size and impact of urban heat islands is to preserve and promote the urban tree canopy. The Delhi Township Zoning Resolution currently requires new construction to protect existing trees and for new trees to be planted. This includes a requirement of one tree for every 10 parking spaces for new development in the Delhi Pike Business Corridor District. These trees provide shade that prevents asphalt surfaces from absorbing excessive amounts of radiant heat from the sun, while also directly cooling the air through evapotranspiration. While most of the larger

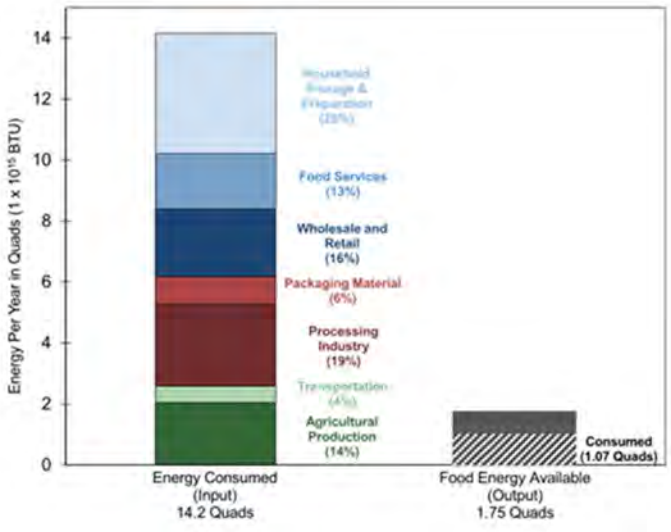
developments are expected to occur along Delhi Pike, the current Zoning Resolution does not provide for trees in any development activity in the rest of the township.

Food Waste

While it might be difficult to see the connection between food and energy, food is the physical manifestation of many layers of added energy. Food must be grown or raised, processed and/or packaged, transported and distributed, adding more layers of energy. According to the USDA, food related energy use accounts for nearly 16 percent of total energy use in the United States. It takes over eight calories of energy to deliver one calorie of food to the customer. Some products, like beef, requires ten times as much energy.

With so much energy required to produce food in the U.S., it should be viewed as a precious commodity. However, estimates show that about 40 percent of the food produced is wasted.[9] Some of this waste occurs as a byproduct of food processing, bulk storage, or transportation before it reaches store shelves. Unfortunately, a majority of the waste can be attributed to food bought by consumers that is thrown away instead of eaten.[10] Accounting for waste, we spend 14 times more energy producing food than we derive from it.

Figure 13: Energy Flow in the U.S. Food System



Food waste is the single largest component going into municipal landfills, composing 22 percent of total municipal solid waste generated.[11] Once it reaches the landfills, food waste begins to decompose and create methane gas. Food waste is responsible for eight percent of global emissions of this potent greenhouse gas. If food waste was a country, it would rank third in the world for GHG emissions behind China and the United States.[12]

There are simple actions that can be taken to reduce the energy impact of food and reduce the amount of food waste.

[9] National Resource Defense Council
[10] Buzby, Jean C., Hodan F. Wells, and Jeffrey Hyman. 2014
[11] U.S. Environmental Protection Agency. 2015
[12] Food and Agriculture Organization of the United Nations. 2015

Eat Local
Food products in the U.S. travel increasingly long distances before they land on the shelf in the local supermarket. Buying locally grown produce can save a significant amount of energy through cutting transportation. Promoting the Delhi Farmers' Market is a great way to get more residents to eat local.

Eat Less Meat
A meat-based diet (28 percent of calories from animal products) uses twice as much energy to produce as a vegetarian diet.[13] Also, meat and dairy products are among the highest contributors to food waste in production and spoilage.

Eat Organic
Organic produce does not use chemicals that require lots of energy to produce.

Use Less Refrigeration
Home refrigeration accounts for 13 percent of the total energy cost used by the U.S. food system.[14] Processed and convenience foods typically require refrigeration, but whole foods, like beans, rice, produce, and cereals do not.

Reduce Waste
Most household food waste is due to spoilage. This can be avoided by buying smaller amounts, planning meals, and freezing or canning extra produce. Also, most discarded foods are still safe to eat, but are tossed due to confusion over "sell by" or "use by" dates.[15]

Even with careful planning, excess food still occurs. The diagram below illustrates the hierarchy of preferred ways to dispose of excess or spoiled food.

Figure 14: **Food Recovery Hierarchy**

[13] Heller, M. and Keoleian, G. 2000
[14] Center for Sustainable Food Systems, University of Michigan. 2018
[15] U.S. Department of Agriculture Economic Research Service. 2016

5. Utility Aggregation and Energy Resiliency

Duke Energy Ohio is the utility responsible for the delivery of electricity and natural gas services for residents and businesses in Delhi Township. It is responsible for maintaining the electric and natural gas infrastructure that delivers energy throughout the township. However, residents and businesses are able to choose their own energy provider. This section reviews how Delhi has used utility aggregation to secure a competitive electricity and natural gas rate for its residents as well as an overview of different considerations related to the resiliency of the energy grid.

Understanding Utility Usage

One key component to helping residents understand the benefits of energy efficiency is equipping them with the skills necessary to read their monthly utility bill. The ability of residential and commercial utility users in Ohio to select their own energy suppliers has resulted in an influx of companies trying to obtain new customers. In some cases, companies offer very low energy rates that either are accompanied by a hefty monthly fee or escalate rapidly over time. Customers that do not read the agreement closely and do not know how to read their utility bill may find that they are ultimately paying more per kWh of electricity or CCF of natural gas than they were with their previous provider.

As the local utility provider responsible for the delivery or transmission of electricity and natural gas in Delhi, Duke Energy is also responsible for billing customers. It has several resources on its website to help customers understand how to read and understand their utility bill.[16] A sample Duke Energy bill highlighting the key places to review is also provided in Appendix B. By knowing the correct place to find the rate that they are paying for natural gas or electricity, customers can determine if they are paying more than the local "Price to Compare" rate. In addition, the Public Utilities Commission of Ohio's "Energy Choice Ohio" website at www.energychoiceohio.gov allows customers to compare the rates and programs offered by different electricity and natural gas suppliers operating in their area.

Utility Aggregation

Ohio's deregulated energy market enables property owners to select their own electricity and natural gas providers. Communities are permitted to aggregate their residents together to buy electricity and/or natural gas as a group to gain buying power in the marketplace. During the May 2014 election, almost 70 percent of Delhi electors voted to approve the creation of an aggregation program for both electric and natural gas.

Utility aggregation is also the most significant way a community can affect greenhouse gas emissions. As discussed earlier, the production of electricity in Ohio is dominated by coal and natural gas. By choosing to purchase electricity from a supplier that relies on renewable energy sources, the township can greatly reduce the greenhouse gas emissions attributable to electricity used by residents and businesses. In addition, because of the advantages of aggregation, the price of electricity produced by renewable sources is often less than residents and businesses can find on their own.

Delhi currently has a contract with Dynegy Energy Services to serve as the electricity provider for the township. The contract guarantees an electricity generation rate for residents of $0.0549 per kWh for electricity from conventional sources and $0.0559 per kWh for electricity from renewable sources over a

[16] Information on reading your utility bill can be found at https://www.duke-energy.com/home/billing/reading-your-bill

36-month period. The aggregation rates secured by Delhi are lower than the $0.0572 per kWh rate offered by Duke Energy during January and February of 2020. As the local utility provider, Duke Energy adds a distribution charge to the electricity generation rate regardless of whether the user participates in the aggregation program or opts to use a different electric supplier.

Residents are also able to participate in Delhi's natural gas aggregation program through Constellation Energy. The contract secures a rate of $0.396 per CCF for a 36-month period beginning in June 2019. The aggregation rate secured by Delhi is higher than Duke's published rate with the PUCO over the past 12 months. However, while Duke's rate may increase in the future, the Constellation rate will remain consistent. Delhi should consider joining with other local governments to obtain a more competitive rate when its current contract expires. The Center for Local Government has been coordinating this effort locally.

Residents and businesses that want to determine if they can save money by opting out of the aggregation program offered by Delhi, should visit the Public Utilities Commission of Ohio's "Energy Choice Ohio" website at www.energychoiceohio.gov. The website allows users to compare the rates and programs offered by different electricity and natural gas suppliers operating in their area.

Energy Resiliency

Resiliency is how susceptible a community is to threats, and how capable they are in overcoming threats when they do occur. One of the factors that goes into determining a community's resiliency is the condition of its energy infrastructure. Delhi primarily has an above ground utility infrastructure although below ground wires may be present in newer residential developments.

There are a number of types of events that may test the resiliency of the energy infrastructure. First and foremost are weather events, such as wind and ice events, that can impact above-ground power and communications networks. Underground utilities are also susceptible to disruption by shifting ground or by accidental damage from construction activity.

There are three components to a resilient energy system: prevention, recovery, and survivability.[17]

Prevention
This focuses on preventing damage to the distribution system. Damage can occur in numerous ways, including from weather incidents or traffic accidents. The utility works to minimize the risk of damage through design standards, inspection procedures, and maintenance routines. The utility will periodically trim trees and vegetation in the vicinity of transmission or distribution lines to reduce the risk of damage in a weather event. The distribution network is designed to provide multiple pathways to deliver electricity in the event of damage to a portion of the network.

Recovery
This component centers on how the community and the utility can work together to quickly assess and repair damage to the energy utility network. In the aftermath of a major weather event that causes significant damage to the energy utility network, communication between local emergency responders and utility companies is essential to identifying and assessing locations where disruption of the network occurred and dispatching utility crews to those locations. Coordination is often required between local responders and utility crews on dealing with downed trees or accident scenes.

The Hamilton County Emergency Management Agency (EMA) maintains an emergency response plan and provides information to local governments to prepare their own emergency response plans. The county emergency response plan designates the local community as the party responsible for addressing energy related issues. It must assess local conditions, identify areas affected by

[17] Electric Power Research Institute

shortages or outages, communicate and coordinate with utilities regarding outages and facilities of high priority, and communicate with residents and businesses. Delhi coordinates with the Hamilton County EMA and is equipped to perform the necessary functions in the event of a significant energy outage.

Survivability
The survivability component refers to a community's ability to continue to provide essential functions and service through an energy shortage or outage. Essential functions typically include communications, public order and safety, potable water, and essential power to certain health care facilities. The role of ensuring these core functions typically fall to local governments and institutions.

A new aspect to the survivability function involves distributed generation (privately owned solar panels and wind turbines). Most distributed generation systems are designed to shut down in the event of a power outage. This is to prevent power lines from being energized while utility crews are attempting to repair them. If certain safeguards are installed, then distributed generation systems can be temporarily isolated from the grid and used to provide power in the event of an outage to the property where they are installed.

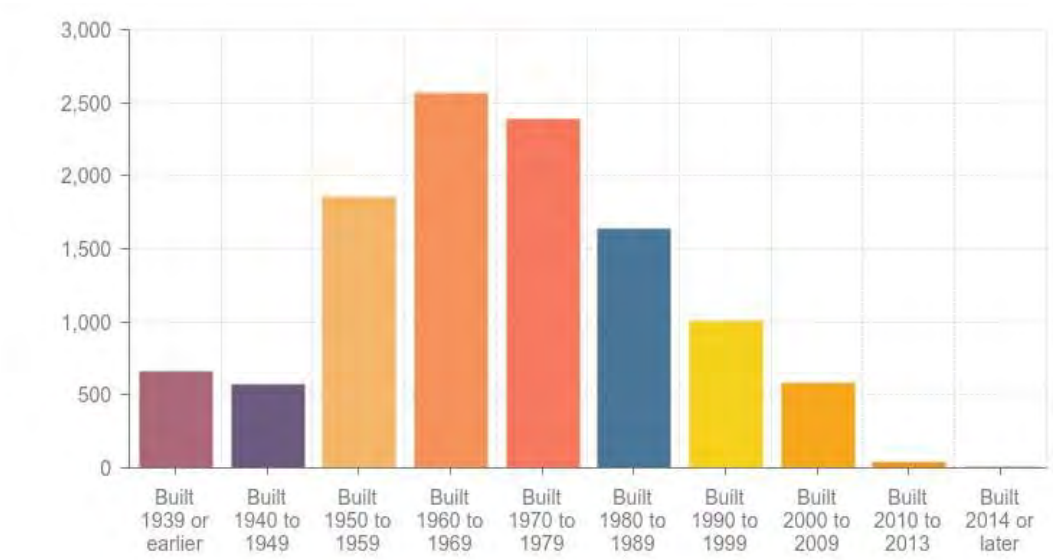
6. Residential Energy Efficiency

Delhi Township contains over 10,000 residential housing units according to the American Communities Survey. These buildings offer significant opportunities to reduce energy waste and save money on annual utility costs. This section identifies priorities for improving existing residential buildings and provides options for programs that can encourage property owners to install efficiency measures.

Residential Building Stock

Delhi Township contains a diverse housing stock that has developed over time. Approximately 85 percent of residential buildings in Delhi were built prior to 1990 which is when building codes began to require energy efficient construction practices.

Figure 15: **Delhi Township Residential Building Age by Decade Built**[18]



Residential Energy Improvements

Buildings built within the same decade share characteristics that impact their overall energy efficiency. Older homes were not designed with energy efficiency in mind, so they present significant opportunities to reduce energy usage and improve comfort. A study conducted by the Joint Center for Housing Studies of Harvard University found that homes in the Midwest built prior to 1970 use 20 percent more energy per square foot than homes built since 1990.[19]

The amount of energy consumed by a household is determined by a variety of factors including those outlined in the table below. Energy consumption is dictated not only by the age and construction of the home, but also by the behaviors and purchasing decisions of its residents.

[18] U.S. Census Bureau, 2017
[19] Joint Center for Housing Studies of Harvard University, 2007

Figure 16: **Factors impacting household energy consumption**

Electricity	Natural gas
Square footage	Square footage
Presence and efficiency of air conditioning	Building age
Efficiency of lighting	Building envelope efficiency
Efficiency of appliances and systems	Efficiency of heating system
Occupant behavior	Occupant behavior
	Systems operation and maintenance

While elements of construction, such as insulation, are not constant among homes of the same era, they can help define the general energy efficiency of a home and dictate the type of improvements required to improve efficiency. The improvements listed below represent five of the most common energy efficiency improvements for homes in Delhi.

Attic insulation
Older homes were not constructed with attic insulation, but small levels may be present in homes built from the 1960s onward. If old insulation is present, then it has likely lost most if not all its insulating value and should be evaluated by a professional. In homes with a Cape Cod style attic, it is important to properly insulate the attic floor, knee walls, slopes, and ceiling. ENERGY STAR recommends that attics in this region have insulation levels between R49 and R60.

Air sealing
Most older homes have significant issues with air infiltration. Special attention should be paid to sealing penetrations into the home in order to reduce drafts and improve comfort. Penetrations and gaps in the attic plane such as electrical boxes, plumbing stacks, ductwork, chimneys, and chases should be sealed prior to adding additional insulation. All penetrations in the foundation, including the rim joists if present, should be properly air sealed.

Heating systems
Older homes were often heated using hot water or steam boilers. If an older boiler is still in use, it should be replaced with a new ENERGY STAR rated unit. In addition, all accessible distribution piping should be insulated. Other homes may have a forced air system installed. Older furnaces should be replaced with an ENERGY STAR high efficiency unit. If natural gas is not available, then a ground source or air source heat pump should be installed. Duct work should be sealed with mastic and insulated if located in unconditioned space.

Cooling systems
Many older homes did not originally have cooling systems. A forced air system may have been installed at some point in time. Older air conditioning units should be replaced with an ENERGY STAR high efficiency unit or an air source heat pump. Ductless mini-split heat pumps provide an energy efficient alternative to a window air conditioning unit if forced air is not present.

Windows
Home built during the early 1900s originally had single pane windows with wood frames. By the 1950s, steel or aluminum single pane windows became commonplace. Neither of these types of windows were designed to prevent air infiltration or to provide any insulation value. Simple repairs to older windows can be made to make them more energy efficient. Windows should be properly sealed

and caulked to reduce infiltration. Older wood windows should be examined to ensure that their weights and ropes work properly so that the windows close correctly. Storm windows should also be installed to provide additional insulating properties and to protect the wood windows. If steel or aluminum windows are present, the best option is to replace them with ENERGY STAR rated replacement windows.

Appendix C provides an overview of the different types of energy efficiency improvements needed by residential properties in Delhi based on age.

Delhi residents who responded to the survey show that making energy efficient improvements to their homes is a priority. Topping the list of improvements is changing out old lightbulbs for new LED bulbs, 97 percent of survey-takers reported that they have made this improvement. Nearly 37 percent said they have installed extra attic insulation and almost 53 percent have upgraded to a high efficiency furnace or air-conditioner. Approximately 40 percent of respondents indicated they have installed energy efficient doors or windows. The top challenge respondents face when it comes to making energy efficient improvements is the lack of money (72 percent) followed by other priorities that are more important (28 percent).

Energy Burden

Energy burden is defined as the percentage of a household's annual gross income that goes toward payment of annual utility costs (electric, natural gas, or other heating fuel). This measure illustrates how the impact of high energy prices and inefficient housing are disproportionately felt by different population groups or households in different parts of the community. Energy costs that may be affordable to a middle-class household, may not be affordable to a low-income household. In fact, low-income households spend three times more of their income on energy bills than higher income households.[20]

$$\text{Energy Burden} = \frac{\text{Total Annual Energy Utility Spend}}{\text{Total Gross Household Income}}$$

Households that face high energy burdens experience many negative long-term economic and health related burdens. Research has found that there are three separate but interrelated consequences of energy burden: (a) illness and stress, (b) financial challenges, and (c) housing instability.[21]

Figure 17: **Drivers of household energy burden**[22]

Type of Driver	Examples
Physical	Inefficient and poorly maintained HVAC systems Poor insulation, leaky roofs, and inadequate air sealing Weather extremes that raise the need for heating and cooling

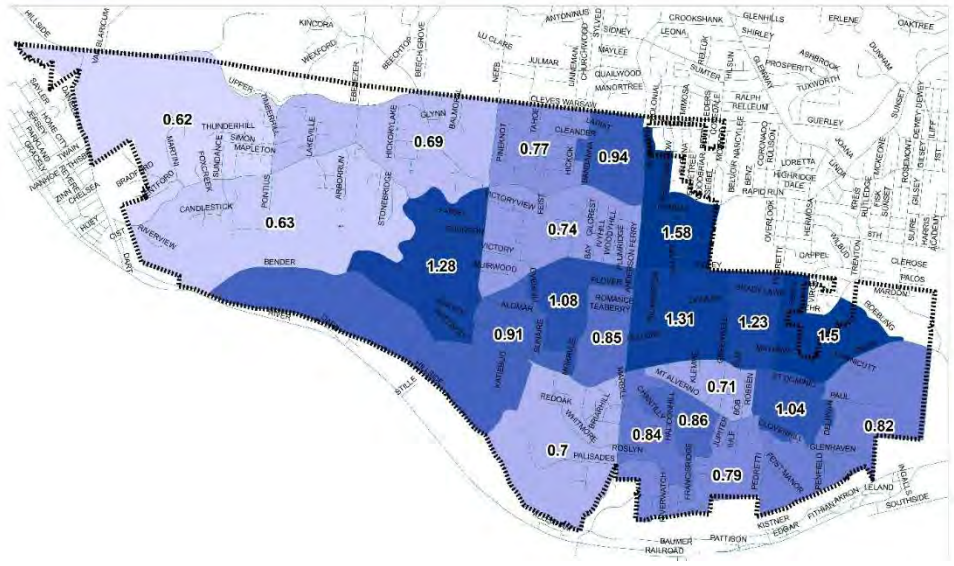
[20] Drehobl and Ross, 2016
[21] Hernandez and Bird, 2010
[22] Drehobl and Ross, 2016

Economic	Chronic economic hardship due to persistent low income Sudden economic hardship Inability to afford the up-front costs of energy efficiency improvements
Policy	Insufficient or inaccessible policies and program
Behavioral	Lack of access to information about bill assistance or energy efficiency programs Increased energy usage due to age or disability

Residential utility data from 2016 was obtained from Duke Energy and used to determine average annual utility cost per household at the census block group level. The utility data provided included the total number of residential accounts in each census block group as well as the total amount spent on residential utilities. In order to determine the average annual household utility cost, the total amount spent on utilities was divided by the number of accounts. The average annual household utility cost per census block group includes all applicable fees and riders as well as generation and distribution costs.

The U.S. Census Bureau's American Communities Survey was used to obtain median household income data at the census block group level.[23] Energy burden was calculated at the census block group level by dividing the average annual utility cost per household by the median household income.

Figure 18: **Relative Energy Burden by Census Block Group**



Census block groups with high energy burden levels in Delhi Township are represented by darker colors on Figure 18. The median household energy burden in Delhi is 2.70 percent, which is far below the energy poverty threshold of 6 percent. The census block group with the highest energy burden is located to the north of Delhi Avenue. It has an energy burden of 5.00 percent, which while still below the energy poverty threshold, is over a quarter point higher than the next closest census block group. A complete listing of energy burden by census block can be found in Appendix D.

[23] Census Bureau, 2017

Energy Burden often coincides with low income, elderly and minority residents, and residents who rent. In Delhi Township, energy burden mostly coincides with lower household incomes and households that rent.

It also should be noted that there also are parallels with the age of the housing stock. The areas shown to experience the most energy burden are areas with homes built from the 1950s and 1960s. Because older houses were built with less, or sometimes no insulation, they require more energy to heat and cool.

While there do not appear to be any census block groups in Delhi with extremely high levels of energy burden, there are likely individual households where it is an issue. Delhi should be aware that high energy burden exists and have resources available to assist residents. The three strategies listed below can be implemented at the local level.

Leverage community-based organizations to implement energy related programs
Low-income households may not trust government agencies, utilities, or energy efficiency contractors. It is important to work with community-based organizations that are viewed as trusted sources of information and who advocate for residents. These organizations can be utilized to sponsor programs designed to educate community members about energy efficiency related topics.

Conduct outreach and education programs to increase energy literacy
Low-income homeowners and tenants can be better positioned to act if they understand how to save energy in their dwelling. Programs that promote greater energy literacy and teach energy saving strategies that households can implement on their own, can help to decrease energy burden.[24]

Connect residents with existing energy programs
In many cases low-income households lack access to communication channels that can inform them about the variety of programs designed to address energy related issues. It is important to provide residents with information about programs available in the community that could assist them with addressing high energy bills or installing energy saving improvements.

Rental Housing

Rental housing poses a unique challenge to improving the energy efficiency of residential buildings. This stems from the fact that owners of rental housing do not have an economic incentive to improve the energy efficiency of their buildings since they will not reap the financial benefits of the improvements. This results in what is known as a split incentive. It occurs when one party owns the property and can make significant investments in its energy efficiency; but the benefits of those improvements go to another party (the renter). This situation results in neither party having a significant interest in investing in the energy efficiency of rental properties.

Approximately 20 percent of Delhi Township's housing units are rentals so overcoming the split incentive problem is one way the township can boost residential energy efficiency. While there are several solutions that can be pursued to address the split incentive issue, most research has focused on the three strategies listed below.

Incentives
Designed to encourage investment by offering grants, loans, or rebates to offset the costs of energy efficiency improvements. The value of the incentive needed to overcome the split incentive problem is extremely high. While incentives are a popular mechanism to encourage investment in energy efficient improvements among homeowners, they have not shown to be effective when applied to rental housing.

[24] Hernandez and Bird, 2010

Transfer of Benefits Agreements
Allows a share of the utility savings experienced by the renter to flow back to the landlord, thus providing an economic incentive to invest in energy efficiency. This provides the renter with a more comfortable and efficient space and the landlord with a return on their investment. However, it is difficult to predict the value of the resulting energy savings so a high level of trust is required between the two parties.

Residential Energy Conservation Ordinance
An ordinance passed by a local or state government that requires the owner of an applicable residential property to document a minimum standard of energy efficiency when a property is sold. The benefits of a RECO ordinance is that it sets and enforces a minimum standard of energy efficiency.

More information about each strategy to overcome split incentives is available in Appendix E.

Programs to Boost Residential Energy Efficiency

Delhi Township should educate residents about existing programs designed to assist them with improving the energy efficiency of their home. These programs range from utility incentives and loan programs to low income weatherization programs. A listing of these programs is available in Appendix F.

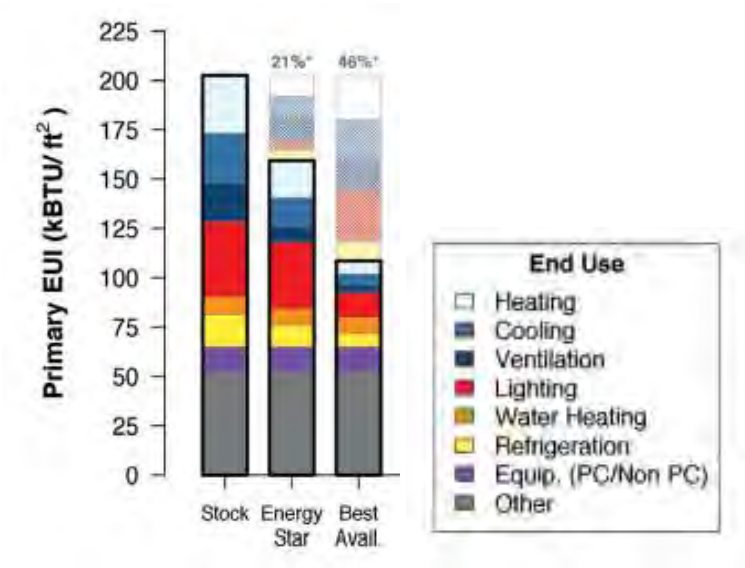
In addition to leveraging existing programs, Delhi should consider developing new programs to assist its residents with reducing energy consumption. It is important to ensure that new programs are designed to meet the specific needs of the community in order for them to produce their desired outcomes.

Education and Outreach
Delhi should work to improve the energy literacy of its residents. The township can leverage its communication channels such as newsletters and social media to provide residents with energy saving tips and information designed to educate them about the benefits of improving the efficiency of their homes. A sample document is shown in Appendix G. In addition, the township could partner with local groups to host energy efficiency workshops in the community. The workshops would focus on steps that both property owners and renters could take to reduce their energy usage and improve comfort.

7. Commercial, Industrial, and Governmental Energy Efficiency

According to the U.S. Department of Energy, improving heating and cooling related building components in commercial buildings such as windows, walls, roofs, controls, and HVAC equipment to ENERGY STAR recommended levels can decrease energy consumption by 21 percent. Upgrading to the best available technologies could reduce energy consumption even further, saving property owners up to 46 percent.

Figure 19: **Potential Commercial Energy Savings.**[25]



While the commercial and industrial buildings in Delhi vary in age and usage, there are several improvements that property owners can make to reduce energy usage.

Lighting
Many commercial and industrial buildings continue to rely on incandescent or florescent bulbs for lighting. Switching to high efficiency LED bulbs can reduce energy usage by up to 70 percent. In some cases, it may be necessary to switch out the fixture or remove the ballast prior to installing a LED bulb.

Building Controls
While most commercial and industrial buildings have set hours of operation, they often do not have systems in place to effectively manage their lighting or heating and cooling systems. Installing proper building controls can ensure that the building operates in an efficient manner. Controls can range from a simple programmable thermostat in a small commercial storefront to a more advanced computer-based system in larger facilities. On the lighting front, property owners can utilize occupancy sensors, timers, and other controls to ensure they are not lighting areas that are not in use.

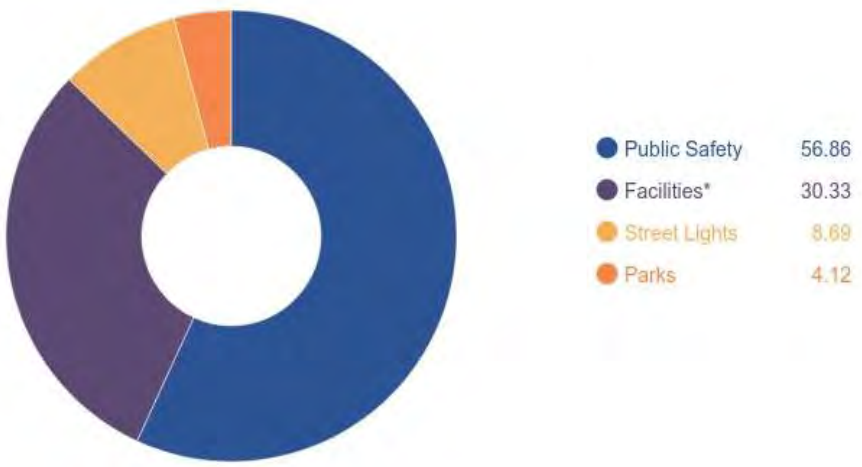
[25] U.S. Department of Energy, 2015

Heating and Cooling Systems
Commercial and industrial property owners should develop a plan to replace heating and cooling equipment rather than waiting until failure. This will reduce costs associated with emergency repairs and/or rental chillers that would be required to keep the system operational until a new unit could be obtained. Property owners should install high efficiency equipment in order to maximize energy savings.

Delhi Township Government Energy Usage

Delhi Township relies on electricity and natural gas to power governmental functions ranging from facilities to lighting. Currently, most of the energy consumed to provide governmental services is utilized to support public safety services. This is due to the large amounts of electricity and natural gas required to keep the township's fire and police stations operational year around.

Figure 20: **Delhi Township energy consumption by source**



*Facilities includes administration, maintenance, community building, and park lodge

Delhi's energy usage can also be analyzed to see the major end uses that fuel consumption is going to support. Currently, most of the energy consumed by Delhi Township is used to heat its facilities. It is important to note that one unit of natural gas (CCF) produces a high number of kBtus relative to its cost per unit. As a result, while natural gas for heating may be the highest energy consumer, it does not represent a similar percentage of the township's utility spend.

Figure 21: **Delhi Township governmental energy consumption by end use**

	Percentage of energy usage
Streetlighting	8.7%
Electricity	39.4%
Heating	51.9%

Streetlighting

Streetlighting plays an important role in economic growth and community safety. On average, streetlighting accounts for as much as 40 percent of a local government's electric bill. In the case of Delhi, streetlighting accounts for 18.1 percent of total governmental electricity consumption.

Figure 22: **Delhi Township governmental electricity consumption by end use**

	Percentage of electricity usage
Streetlighting (excludes lighting districts)	18.1%
Facilities – Electricity (Admin, Park Lodge, Community Building, Maintenance)	30.5%
Public Safety Facilities - Electricity	42.8%
Parks - Electricity	8.6%

Switching to energy efficient streetlighting that utilizes LED technology could help Delhi reduce its electricity demand for lighting. LED bulbs last longer and offer significant maintenance and operational benefits when compared to existing high-intensity discharge (HID) sources.

Decision-makers often cite the upfront costs of LED technology as the most significant roadblock toward prospective streetlighting conversions. Conversions to LED technology should be evaluated using a full life cycle cost/benefit analysis. The U.S. Department of Energy offers a lighting retrofit analysis tool though its Better Buildings Outdoor Lighting Accelerator to assist local governments with this process.[26]

The Outdoor Lighting Accelerator created the decision tree shown in Appendix H to help local governments determine the best way to pursue lighting projects. One of the first steps is to determine who owns the streetlights. Currently all streetlights in Delhi are owned and maintained by Duke Energy. This means that the township would need to work directly with Duke Energy to purchase and install the fixtures.

Delhi should evaluate the cost effectiveness of any proposal for streetlighting improvements it receives from Duke Energy. The township may be able to leverage funds from its Tax Increment Financing (TIF) districts to pay for LED upgrades. LED bulbs produce a better light than traditional streetlights which would improve the physical environment of the community and enhance public safety.

Facility Audit

Graphet Data Mining conducted an energy audit of the Delhi Township Senior/Community Center and the Park Lodge to identify potential energy conservation opportunities. The study completed a review of each building's energy usage patterns as well as their heating and cooling equipment, lighting, and control systems.

The Senior/Community Center used just under $13,000 in natural gas and electricity during the twelve-month period examined. Electricity represents the largest utility cost. An analysis of the data showed that

[26] U.S. Department of Energy, 2016. *Outdoor Lighting Accelerator Toolkit*.

the township is paying $0.010 per kWh for electricity which is slightly high for a commercial user. On the natural gas side, Delhi is paying $1.19 per therm which is not a competitive rate.

Figure 23: **Delhi Township Senior/Community Center Energy Usage**

	Amount Consumed	kBtu Equivalent	Cost
Electricity	80,749 kWh	275,527	$7,984
Natural Gas	4,075 therms	407,500	$4,857

The Park Lodge used just under $9,00 in natural gas and electricity during the twelve-month period examined. Electricity represents the largest utility cost. An analysis of the data showed that Delhi is paying $0.12 per kWh for electricity, which is high for a commercial user. On the natural gas side, the township is paying $1.14 per therm which is not a competitive rate.

Figure 24: **Park Lodge Energy Usage**

	Amount Consumed	kBtu Equivalent	Cost
Electricity	46,885 kWh	159,978	$5,664
Natural Gas	2,674 therms	267,400	$3,045

One way to compare the amount of energy used in each building is to look at its site energy usage intensity, or EUI. The EUI expresses a building's energy use as a function of its size and other characteristics.

Figure 25: **Energy Usage Intensity**

	kBtu Consumed	Area (ft^2)	EUI ($kBtu/ft^2$)
Senior/Community Center	683,027	9,944	68.69
Park Lodge	427,378	5,172	82.63

The Environmental Protection Agency has determined median EUIs in the United States for different building classifications. While it is difficult to fit the Senior/Community Center and Park Lodge into specific categories, there are a few benchmarks that can be compared. The median EUI for a social/meeting hall is 56.1 $kBtu/ft^2$ and for a library is 71.6 $kBtu/ft^2$.[27] The Senior/Community Center falls within this range, but the Park Lodge falls outside of it. The fact that the Park Lodge is used less frequently than the Senior/Community Center but has a higher EUI indicates that significant opportunities for energy savings exist in that facility.

[27] ENERGY STAR Portfolio Manager, 2018

The occupancy of both buildings varies throughout the day and week depending on the programmatic offerings or special events scheduled. This results in a building dynamic that must be properly managed in order to maximize energy efficiency.

A complete version of energy audit report prepared by Graphet can be found in Appendix I. The report identified the following energy conservation opportunities (ECO) as high priorities:

Retrofit interior and exterior lighting at Senior/Community Center
The Senior/Community Center relies on fluorescent bulbs for almost all its interior lighting. Converting to LED bulbs will significantly reduce overall electricity usage. The township should begin the process of upgrading its interior lighting to Type A LED bulbs. These bulbs can be plugged directly into the existing fluorescent ballasts. If the existing ballasts are reaching the end of their useful life, then Type B LED bulbs should be used instead. While more expensive, Type B LED bulbs bypass the ballast and are connected to the existing electrical wiring. This means that the ballasts do not need to be replaced. By converting to Type A LED bulbs, the township could save an estimated $994 to $1,104 in electricity costs annually.

The exterior metal halide bulbs at the Senior/Community Center should also be replaced with Type A LED bulbs. By converting to Type A LED bulbs, the township could save an estimated $1,296 to $1,440 annually.

Insulate the roof and walls of the Park Lodge
Given the high energy usage for heating and cooling at the Park Lodge, the township should investigate improving the building's thermal envelope. This can be accomplished through air sealing and insulation. A qualified insulation and air sealing contractor should be able to provide solutions that take into consideration the unique architecture of the building. Increasing the insulation could save the township an estimated $509 to $637 annually. While those savings levels do not appear to be significant, this improvement should be completed before upgrades to the building's HVAC are considered.

Adjust temperature settings on the HVAC units during unoccupied hours
Significant HVAC cooling and heating energy savings can be achieved by actively adjusting zone temperatures during periods of unoccupied times. This is already actively done at both SCC and PL. It is suggested to further reduce the winter unoccupied thermostat setpoint in both buildings from its current setpoint of 70-72°F to 65°F.In the summer, the unoccupied setpoint could be increased incrementally to the 78-80°F range. The cost to implement this ECO is minimal as it would likely take facilities staff only a few minutes to update the current setpoint to the proposed setpoint.

Figure 26 provides a basic overview of the major ECOs identified by Graphet.

Figure 26: **Energy Conservation Opportunities for Delhi Township**

ECO	Priority	Investment Required	Estimated Annual Cost Savings
Implement temperature setbacks	High (Operational)	Minimal	$666 - $832
Interior LED lighting retrofit at Senior/Community Center	High (Investment)	Low	$994 - $1,104
Exterior LED lighting retrofit at Senior/Community Center	High (Investment)	Low	$1,296 - $1,440
Insulate Park Lodge	Mid (Investment)	Low	$509 - $637
Replace HVAC units at Park Lodge	High (Investment)	Medium	$976 - $1,287
Insulate Senior/Community Center	Low (Investment)	Medium	$344 - $429
Replace windows at Senior/Community Center	Low (Investment)	High	$147 - 197

Programs to Boost Commercial and Industrial Energy Efficiency

The following programs are available to encourage investment in energy saving improvements by commercial and industrial property owners.

Duke Energy Smart $aver
Rebates are available to help offset the costs associated with installing certain approved energy efficiency measures. As of 2020, Duke Energy offers rebates for lighting, HVAC, and commercial and industrial equipment.

PACE Financing
Property Assessed Clean Energy (PACE) is a financing mechanism available to commercial and industrial properties for energy efficiency and renewable energy improvements. PACE provides financing for 100% of an energy project's cost and is repaid for up to 25 years with a voluntary special assessment added to the property's tax bill. Property owners can increase the value of their building and reduce energy costs with no down payment or personal guarantee.

In order to implement PACE, a local political jurisdiction must create or join an Energy Special Improvement District (ESID). Delhi Township is eligible to join the Western Suburban Communities ESID since it is adjacent to Green Township, one of the ESID's members.

8. Emerging Energy Trends

Energy and our energy infrastructure are poised for some dramatic changes in the coming decades. From the Smart Grid to electric vehicles, these changes will impact our communities. Local governments should be aware of these trends so that they can create policies and regulations that promote adoption in their community.

Distributed Generation

Distributed generation refers to electricity that is generated, and in many cases fed to the electric grid, from sources that are dispersed throughout the community. The most common example of this are privately owned solar panels that provide energy for individual homes or businesses, but also feed excess power back to the grid through net metering. Distributed generation is also becoming a larger portion of the nation's energy generating capacity. In 2017, the U.S. Energy Information Agency projected a 400 percent increase in solar distributed generation capacity by 2040, making it the fastest growing sector of new electric generation capacity.

Distributed generation offers several key benefits to a community. First, most sources of distributed generation are renewable like solar or wind and provide power with little to no emissions. Secondly, distributed generation facilities improve the resiliency of the utility network because they lessen the chance of an event knocking out a critical portion of generating capacity on the grid. Finally, distributed generation reduces line losses from the transmission of electricity over longer distances.

Solar Photovoltaics

Solar photovoltaics have been available for decades, but only recently gained widespread popularity due to lower costs. Ten years ago, the cost of a solar panel installation was $8.82 per Watt. Today, a similar installation would cost less than $3.00 per Watt. These price declines have shortened the payback on a solar PV system and made them more affordable to homeowners in the region.

Most solar installations remain connected to the electrical grid even though they have solar panels. Any excess electricity produced by the solar panels that cannot be used by the property at the time it is produced is sent to the grid. Under the current regulatory structure in Ohio, property owners are compensated for any excess electricity produced through a process known as net metering.

According to the Public Utilities Commission of Ohio (PUCO), there are currently two commercial facilities and one residence in Delhi registered as certified solar facilities.[28] However, because property owners are not required to register their solar installations with PUCO, there could be additional commercial or residential properties in the township that have installed solar panels.

One of the biggest potential barriers to solar energy use is the failure of local zoning codes to clearly state what types of solar energy systems are permitted in different locations. Delhi has already set clear procedures for permitting solar energy in Section 35.06 of its Zoning Resolution.[29] The code is not overly restrictive and provides guidelines for installing ground, roof, or wall mounted solar energy systems.

There are a few additional steps that Delhi Township can take to make it easier for property owners to invest in solar in the future.

[28] https://www.puco.ohio.gov/utility-maps/electric-maps/ohio-certified-renewable-facilities/
[29] Delhi Township, 2020

Launch a Solarize Campaign
Solarize campaigns create a group purchasing and community outreach program in order to accelerate demand and reduce individual costs for solar installations in a community. They also seek to increase awareness of solar energy and financing options, thereby helping to build sustained growth of the local solar market. The Greater Cincinnati Energy Alliance partners with local governments to conduct a Solarize campaign each spring.

Develop a Permit Checklist
A permit checklist can help guide a solar installer or other interested party through the permitting process by clearly stating the necessary types of plan reviews and required permits for a solar installation. A basic permit checklist outlines the sequential steps of the permitting process while a more comprehensive checklist also includes applicable standards for each step in the review process. The checklist should include all the information that Delhi residents and businesses are required to provide in order to receive a permit for a solar installation.

Engage Homeowners Associations
Homeowners associations often include stricter aesthetic and architectural restrictions and requirements that, sometimes, prohibit residents from installing solar systems on their properties. Homeowners associations across the country are beginning to develop guidelines to allow for solar installations while preserving aesthetic character and causing minimal inconvenience for neighbors. Homeowners associations should be engaged and encouraged to develop solar friendly policies.

Electric Vehicles

Electric vehicles (EVs) are vehicles that use motors fueled by electric energy for propulsion. There are three types of EVs: hybrid electric, plug-in hybrid electric, and battery electric vehicles. EVs provide several benefits including higher fuel efficiency than internal combustion (gasoline) systems, lower operating costs, and reduced air pollution. Over the past eight years, U.S. plug-in electric vehicle sales have continued to increase, with sales nearly doubling from 2017 to 2018.

Figure 27: **Growth of U.S. Electric Vehicle Sales 2011-2019**[30]

There are two main ways of fueling electric vehicles. The most popular is with batteries that are charged by connecting the car to a source of electricity. There are two major disadvantages to cars of this type. First, the batteries add considerable weight to the vehicles which causes them to consume more energy and limits travel range. Second, battery electric vehicles currently require considerable time to recharge.

[30] EVAdoption.com, 2020

The other less common type of electric vehicle uses a hydrogen fuel cell (HFC) to generate power. HFC vehicles use a fuel cell that mixes air with pure hydrogen to create an electric current. There are no batteries to charge so HFC vehicles can be refueled in five minutes and have a travel range similar to a traditional gasoline powered vehicle. Unfortunately, the infrastructure for refueling HFC vehicles needs to be developed before they become a viable option.

There are currently over 1,000 electric charging stations in Ohio. Depending on the type of battery and the charger, the battery can take a full day to charge (Level 1 chargers), several hours (Level 2 chargers), or 30 minutes (DC Fast Chargers). Chargers can be located at residential properties, workplaces, and public destinations. There no public EV charging stations in Delhi Township at this time. The nearest public charging stations are on Harrison Ave at the Bob Sumerel Tire and at the intersection of Harrison Ave and Interstate 74.

There are equity considerations that must be kept in mind when siting charging stations and other alternative fuel stations, a topic relevant to land use and potential zoning regulatory action. As the use of electric vehicles and their charging stations increase, local communities will need convenient access to a charging infrastructure. This is especially relevant to residents who rent and are unable to install private chargers at their homes. While the popularity and affordability of EVs has not yet reached a level where that is a concern, there may be a time in the near future when the township will need to consider how to provide equitable access to a charging infrastructure for its residents.

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10. Appendices

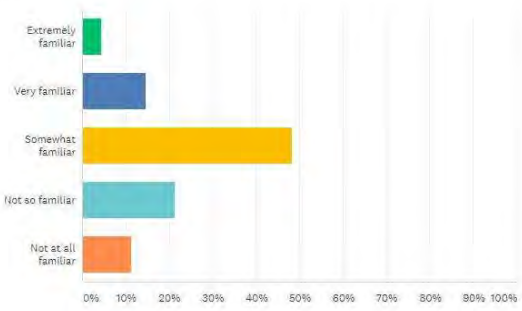
Appendix A: Survey Results

A survey of Delhi residents was conducted in from January 31, 2020 to February 19, 2020. The goal of the survey was to gain an understanding of resident's views on several energy related issues. The survey was distributed through email, social media, and the energy.oki.org website. A total of 89 residents responded to the survey.

Question 1

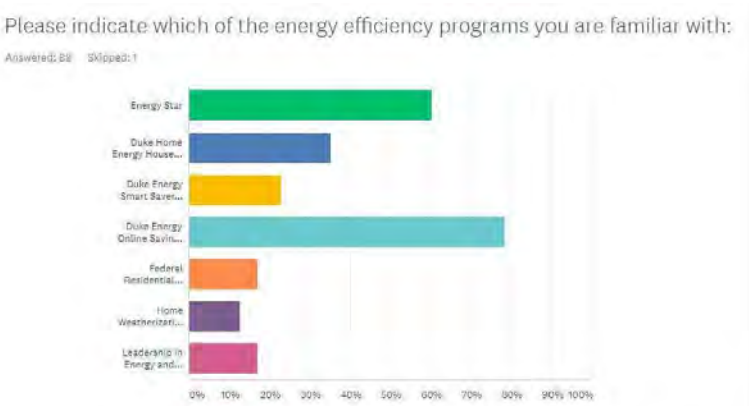
How familiar do you consider yourself to be with programs designed to encourage energy efficiency?

Answered: 89 Skipped: 0



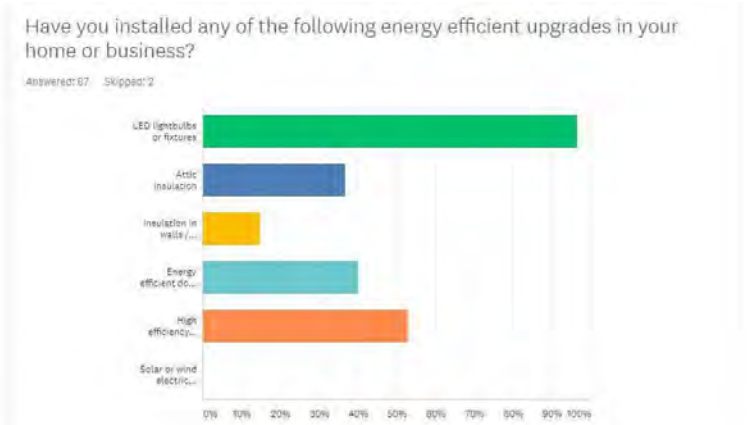
ANSWER CHOICES	RESPONSES	
Extremely familiar	4.49%	4
Very familiar	14.61%	13
Somewhat familiar	48.31%	43
Not so familiar	21.35%	19
Not at all familiar	11.24%	10
Total Respondents: 89		

Question 2



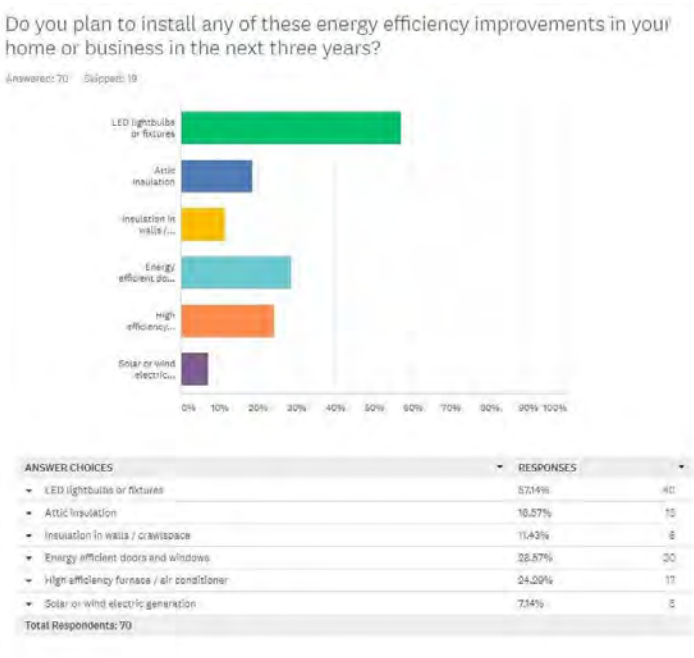
ANSWER CHOICES	RESPONSES	
Energy Star	60.23%	53
Duke Home Energy House Call	35.23%	31
Duke Energy Smart Saver rebate program	22.73%	20
Duke Energy Online Savings Store for LED lightbulbs	78.41%	69
Federal Residential Renewable Energy Tax Credit	17.05%	15
Home Weatherization Assistance Program (HWAP)	12.50%	11
Leadership in Energy and Environmental Design (LEED)	17.05%	15
Total Respondents: 88		

Question 3



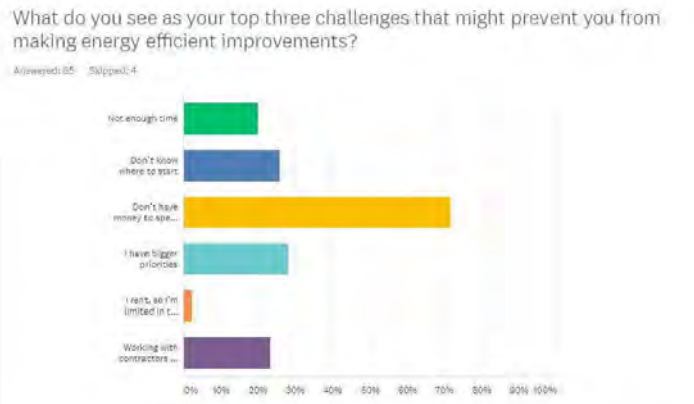
ANSWER CHOICES	RESPONSES	
LED lightbulbs or fixtures	96.55%	84
Attic insulation	36.78%	32
Insulation in walls / crawlspace	14.94%	13
Energy efficient doors and windows	40.23%	35
High efficiency furnace / air conditioner	52.87%	46
Solar or wind electric generation	0.00%	0
Total Respondents: 87		

Question 4



ANSWER CHOICES	RESPONSES	
LED lightbulbs or fixtures	57.14%	40
Attic insulation	18.57%	13
Insulation in walls / crawlspace	11.43%	8
Energy efficient doors and windows	28.57%	20
High efficiency furnace / air conditioner	24.29%	17
Solar or wind electric generation	7.14%	5
Total Respondents: 70		

Question 5



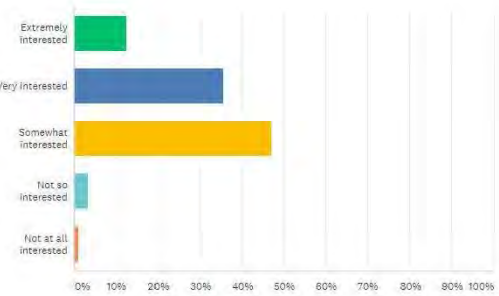
ANSWER CHOICES	RESPONSES	
Not enough time	20.00%	17
Don't know where to start	25.88%	22
Don't have money to spend on improvements	71.76%	61
I have bigger priorities	28.24%	24
I rent, so I'm limited in the types of improvements I can make on my own	2.35%	2
Working with contractors is a hassle and I don't know who to trust	23.53%	20
Total Respondents: 85		

Comments (5)

Question 6

How interested are you in learning more about programs designed to help you save energy and money?

Answered: 87 Skipped: 2

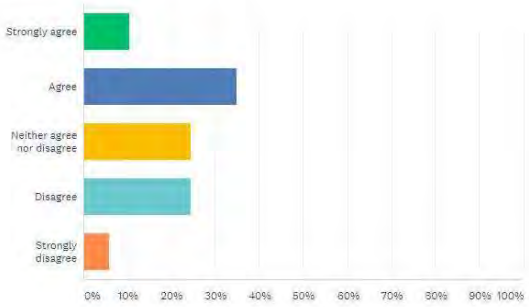


ANSWER CHOICES	RESPONSES	
Extremely interested	12.64%	11
Very interested	35.63%	31
Somewhat interested	47.13%	41
Not so interested	3.45%	3
Not at all interested	1.15%	1
TOTAL		87

Question 7

Delhi Township is a walkable community.

Answered: 86 Skipped: 3

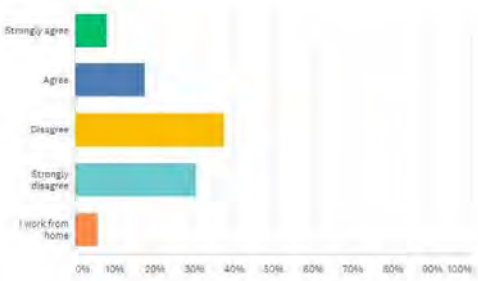


ANSWER CHOICES	RESPONSES	
Strongly agree	10.47%	9
Agree	34.88%	30
Neither agree nor disagree	24.42%	21
Disagree	24.42%	21
Strongly disagree	5.81%	5
Total Respondents: 86		

Question 8

If I could not use my personal vehicle to commute to work or school, I could reliably get there without too much trouble by walking, biking, carpooling, or taking public transportation.

Answered: 85 Skipped: 4

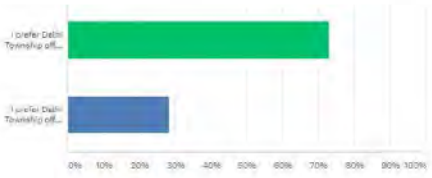


ANSWER CHOICES	RESPONSES	
Strongly agree	8.24%	7
Agree	17.65%	15
Disagree	37.65%	32
Strongly disagree	30.59%	26
I work from home	5.88%	5
Total Respondents: 85		

Question 9

Utility aggregation programs allow local governments in Ohio to negotiate lower prices with energy suppliers for their residents. Delhi Township currently participates in an energy aggregation program that provides lower electric rates to participating households. The electricity currently provided in the aggregation program is not renewable, but rather provided by power plants using coal or natural gas. Would you prefer Delhi Township continue selecting the energy provider offering the lowest price, or would you rather the township select a provider offering 100% renewable energy, such as solar or wind power, even if it costs a bit more? Residents are not obligated to participate in the utility aggregation program, and can choose their own energy provider if they wish.What stance toward utility aggregation do you prefer Delhi Township take?

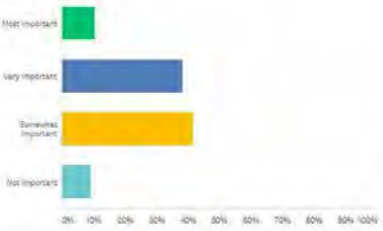
Answered: 85 Skipped: 4



ANSWER CHOICES	RESPONSES	
I prefer Delhi Township offer a utility aggregation program that prioritizes the lowest cost.	72.94%	62
I prefer Delhi Township offer a utility aggregation program that supplies 100% renewable energy, even if the cost is a little higher.	28.24%	24
Total Respondents: 85		

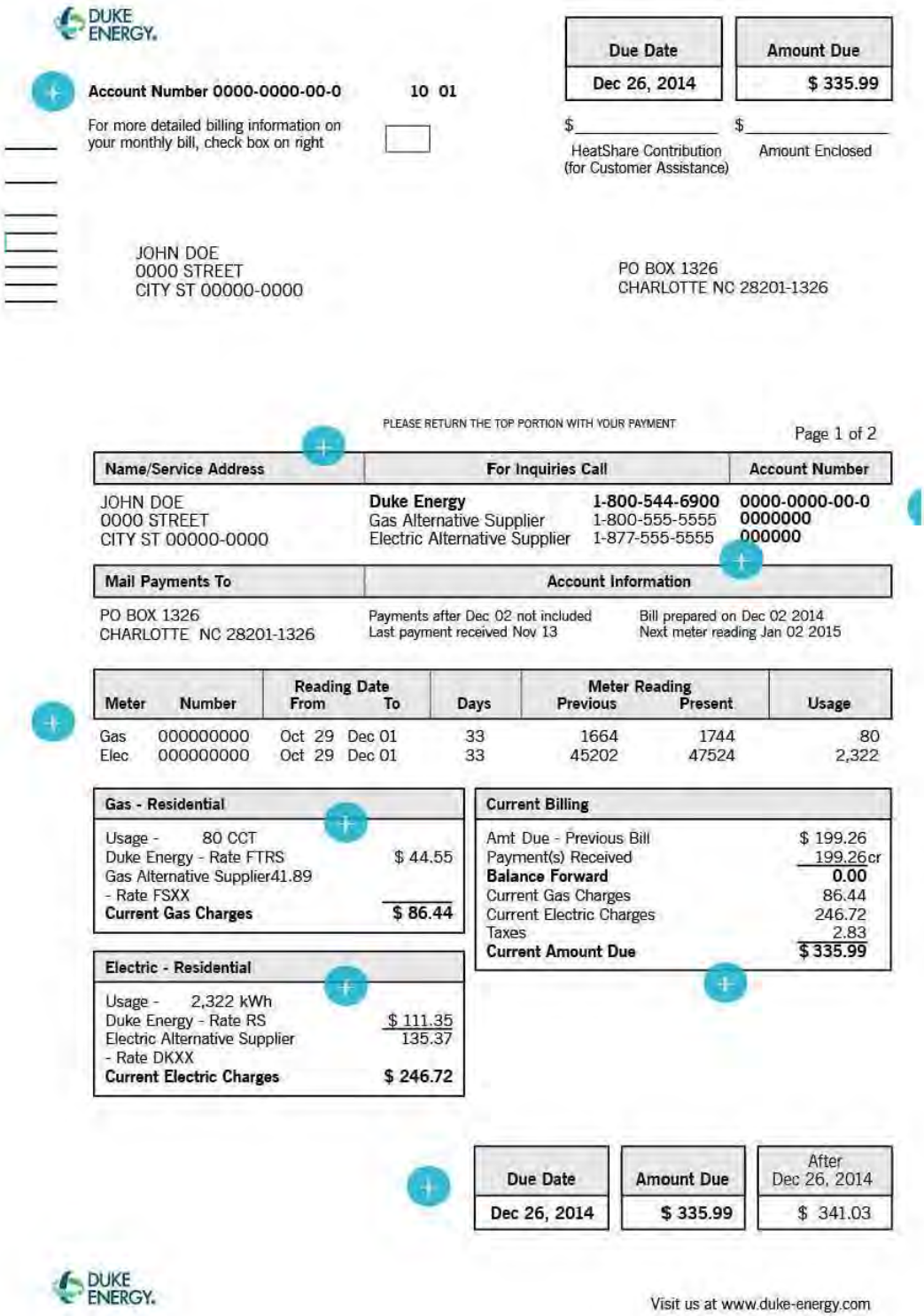
Question 10

Traditional programs used to incentivize energy-efficient improvements to residential dwellings usually come in the form of rebates, and are typically restricted to homeowners. These programs produce the most energy savings per cost of the incentive. However, these programs are not eligible to renters, and are not successful in reaching low to moderate income households because the owner must pay for the improvements upfront to receive the rebate. The result is households that are the most burdened by energy costs, and typically live in the oldest, least energy-efficient housing in the community, are not being helped by the majority of current incentives to boost energy efficiency.How important is it to you that Delhi Township addresses the issue of energy burden and promotes energy efficiency to low and moderate income households and renters?



ANSWER CHOICES	RESPONSES	
Most important	10.47%	9
Very important	38.37%	33
Somewhat important	41.86%	36
Not important	9.30%	8
TOTAL		86

Appendix B: Sample Duke Energy Bill



DUKE ENERGY.

Due Date	Amount Due
Dec 26, 2014	$ 335.99

Account Number 0000-0000-00-0 10 01

For more detailed billing information on your monthly bill, check box on right ☐

$_____ HeatShare Contribution (for Customer Assistance)

$_____ Amount Enclosed

JOHN DOE
0000 STREET
CITY ST 00000-0000

PO BOX 1326
CHARLOTTE NC 28201-1326

PLEASE RETURN THE TOP PORTION WITH YOUR PAYMENT

Page 1 of 2

Name/Service Address	For Inquiries Call		Account Number
JOHN DOE 0000 STREET CITY ST 00000-0000	**Duke Energy** Gas Alternative Supplier Electric Alternative Supplier	**1-800-544-6900** 1-800-555-5555 1-877-555-5555	**0000-0000-00-0** **0000000** **000000**

Mail Payments To	Account Information	
PO BOX 1326 CHARLOTTE NC 28201-1326	Payments after Dec 02 not included Last payment received Nov 13	Bill prepared on Dec 02 2014 Next meter reading Jan 02 2015

Meter	Number	Reading Date From	To	Days	Meter Reading Previous	Present	Usage
Gas	000000000	Oct 29	Dec 01	33	1664	1744	80
Elec	000000000	Oct 29	Dec 01	33	45202	47524	2,322

Gas - Residential

Usage - 80 CCT	
Duke Energy - Rate FTRS	$ 44.55
Gas Alternative Supplier41.89 - Rate FSXX	
Current Gas Charges	**$ 86.44**

Electric - Residential

Usage - 2,322 kWh	
Duke Energy - Rate RS	$ 111.35
Electric Alternative Supplier - Rate DKXX	135.37
Current Electric Charges	**$ 246.72**

Current Billing

Amt Due - Previous Bill	$ 199.26
Payment(s) Received	199.26cr
Balance Forward	**0.00**
Current Gas Charges	86.44
Current Electric Charges	246.72
Taxes	2.83
Current Amount Due	**$ 335.99**

Due Date	Amount Due	After Dec 26, 2014
Dec 26, 2014	$ 335.99	$ 341.03

DUKE ENERGY.

Visit us at www.duke-energy.com

DUKE ENERGY.

Name	Service Address	Account Number
JOHN DOE	0000 STREET CITY ST 00000-0000	0000-0000-00-0

This month's Gas Cost Recovery (GCR) charge for customers purchasing their natural gas from Duke Energy is $0.3528500 per CCF, which includes a base GCR of $0.3364000 and Ohio excise tax of $0.0164500.

PRICE TO COMPARE: In order for you to save money, an electric supplier must offer you a price lower than 5.68 cents per kWh for the same usage that appears on this bill. To review competitive offers from electric suppliers, visit the Public Utilities Commission of Ohio's "Energy Choice Ohio" website at www.energychoice.ohio.gov. To learn more about Price to Compare, visit www.duke-energy.com or contact Duke Energy for a written explanation.

If you have any questions about electric supplier service received from Dynegy Energy Services, please call them at 1-877-331-3045 or write to: 6555 Sierra Rd Irving, TX 75039

If you have any questions about gas supplier service received from Constellation NewEnergy, please call them at 1-888-367-4493 or write to: P.O. Box 4911 Houston, TX 77010

The charges for the current billing period include the following amounts to meet each of these Ohio requirements: Energy Efficiency = $1.58. Peak Demand Reduction = $0.39. and Renewable Energy = $1.37.

Explanation of Current Charges

Gas Meter - 000000000 CCF Usage - 80 Oct 29 - Dec 01 33 Days	**Duke Energy** Rate FTRS - Res Transportation Fixed Delivery Service Charge Usage-Based Charge 80 CCF @ $0.03272800 Gas Delivery Riders Applicable Surcharge 80 CCF @ $0.00466540cr	$ 33.03 2.62 9.27 0.37cr	$ 44.55
	Gas Alternative Supplier Rate FSXX – Gas Alternative Supplier Gas Supplier Energy Chg 80 CCF @ $0.52360000	41.89	41.89
	Total Current Gas Charges		**$ 86.44**
Electric Meter - 000000000 kWh Usage - 2,322 Oct 29 - Dec 01 33 Days	**Duke Energy** Rate RS - Residential Svc-Winter Distribution-Customer Chg Delivery Charges Distribution-Energy Chg 2,322 kWh @ $ 0.02534200 Delivery Riders Total Delivery Charges	$ 6.00 58.84 36.79 $ 95.63	
	Generation Riders	9.72	$ 111.35
	Generation Charge Electric Alternative Supplier Rate DKXX – Electric Alternative Supplier Supplier Energy Charge 2,322 kWh @ $ 0.05830000	135.37	$ 135.37
	Total Current Electric Charges		**$ 246.72**

Appendix C: Residential Energy Efficiency Improvements

The table below provides an overview of the different types of energy efficiency improvements needed by residential properties in Delhi Township based on their age.

	Cost	Savings Impact	Pre-1900	1900-1940s	1950s	1960s	1970s	1980s - 1990s	2000 and beyond
Air Sealing	Low	High	✓	✓	✓	✓	✓	✓	
Rim Joists	Low	High	✓	✓	✓	✓	✓		
Attic Insulation	Low	High	✓	✓	✓	✓	✓	✓	
Basement Insulation	Medium	Medium	✓	✓	✓	✓	✓		
Crawlspace Insulation	Low	High	✓	✓	✓	✓	✓		
Wall Insulation	High	High	✓	✓	✓	✓			
Heating Systems	High	Medium/ Low	✓	✓	✓	✓	✓	✓	✓
Cooling Systems	High	Medium/ Low	✓	✓	✓	✓	✓	✓	✓
Windows	High	Low	✓	✓	✓	✓	✓	✓	
Areas above unconditioned spaces	Low	High		✓	✓	✓	✓	✓	
Knob and tube wiring	Medium	NA	✓	✓					
Asbestos	High	NA		✓	✓	✓			
Vermiculite	High	NA			✓	✓			

Appendix D: Energy Burden by Census Block

Neighborhood	Census Block Group	Median Household Income	Average Annual Household Energy Cost	Energy Burden
Delhi Township	213023	$ 117,050.00	$ 2,287.03	1.95%
Delhi Township	213022	$ 114,091.00	$ 2,499.99	2.19%
Delhi Township	213044	$ 91,450.00	$ 2,031.17	2.22%
Delhi Township	214211	$ 82,535.00	$ 1,860.50	2.25%
Delhi Township	213033	$ 90,500.00	$ 2,115.94	2.34%
Delhi Township	213031	$ 86,313.00	$ 2,085.43	2.42%
Delhi Township	214214	$ 99,375.00	$ 2,473.73	2.49%
Delhi Township	214221	$ 69,701.00	$ 1,810.14	2.60%
Delhi Township	214213	$ 81,750.00	$ 2,156.57	2.64%
Delhi Township	213042	$ 70,150.00	$ 1,883.09	2.68%
Delhi Township	214212	$ 84,688.00	$ 2,302.76	2.72%
Delhi Township	213043	$ 65,795.00	$ 1,891.94	2.88%
Delhi Township	213032	$ 70,469.00	$ 2,086.67	2.96%
Delhi Township	214222	$ 53,500.00	$ 1,757.39	3.28%
Delhi Township	213041	$ 59,762.00	$ 2,033.47	3.40%
Delhi Township	214013	$ 39,042.00	$ 1,512.03	3.87%
Delhi Township	213021	$ 40,588.00	$ 1,640.75	4.04%
Delhi Township	214012	$ 42,583.00	$ 1,754.19	4.12%
Delhi Township	214014	$ 31,875.00	$ 1,503.25	4.72%
Delhi Township	214011	$ 37,167.00	$ 1,857.76	5.00%

Appendix E: Strategies to Address Split Incentive Issue

Incentives

Incentives are a standard practice to encourage energy efficient investments for both homeowners and businesses. Incentives can be offered through utilities, non-profits, or government to encourage investments in energy efficiency. However, the amount of incentive needed to overcome the rental housing split incentive problem is reportedly very high. A 2008 study found that an incentive covering 80 percent of the cost of an improvement was necessary to spark interest from 50 percent of landlords eligible for the program.[31]

Other factors impact the market penetration of incentive programs beyond the dollar amount offered. The type of incentive can be a significant factor. Incentives can be offered as grants, where money is provided up front. Another type of incentive is a rebate, where the customer must pay the total cost of the improvement before being reimbursed. Finally, incentives can take the form of loans, which don't reduce the principal cost, but can help those who don't have cash on hand for the improvement.

Another factor in the success of any incentive program is how effectively the program is marketed to its intended target population. To achieve success, an incentive program must effectively reach and drive the targeted population to make desired energy efficient improvements. If the population is not aware of the incentive, or the incentive isn't enough to drive action, the incentive will not be successful.

While incentives are a popular mechanism to encourage investment in energy efficient improvements among homeowners, they have not shown to be effective when applied to rental housing.

Transfer of Benefits Agreements

Another strategy to combat the split incentive problem is using agreements to create a bridge between landlords and renters over which the benefits of energy efficient improvements can flow. When a landlord invests in energy efficient improvements, the renter realizes an economic benefit in the form of lower utility bills. A Transfer of Benefits Agreement (TBA) allows a share of that economic benefit to flow back to the landlord, thus providing an economic incentive to making the investment in energy efficiency.

A literature review uncovered two ways a TBA program can be structured.[32] One way, dubbed Pay-As-You-Save, or PAYS, is organized through the utility. The other, called a Green Lease, is an agreement between tenant and landlord that adjusts the rent to share the economic benefits of the improvements.

Pay-As-You-Save (PAYS) offers loans to landlords to make energy efficient improvements. This loan is then repaid through a surcharge the tenant agrees to have placed on their utility bill. The amount of the surcharge is set so that the tenant still sees a net reduction in their utility bill. The surcharge remains on the utility bill until the loan is paid off, even if the tenants change. This type of program requires the close cooperation of the utility company to handle billing. It is also unclear what mechanism ensures that the tenant's utility bill achieves a net decrease. Without this assurance, a tenant likely wouldn't be comfortable with the program.

A Green Lease is where the landlord and tenant(s) enter into a more direct agreement with one another, through the help of an energy consultant. The energy consultant certifies the expected savings the tenant will see on their utility bill due to the improvements. A portion of that expected savings is paid each month to the landlord. Again, the tenant sees a net reduction in total costs of rent plus utilities while most of the savings from reduced utility bills flow to the landlord who paid for the improvements. However, since this

[31] Nexus Market Research, Inc., 2005.
[32] Williams, 2008.

is an agreement between the landlord and a particular tenant or set of tenants, if the tenant(s) move out, the payments to the landlord cease. There is a significant risk that the landlord might not recoup his or her investment.

Transfer of Benefit Agreements directly address the root of the split incentive problem by creating a mechanism of transferring most, but not all of the immediate economic benefit of lower utility bills to the landlord, who pays for the improvements. Some of the benefit is retained for the tenants to provide both parties with an interest in energy efficient improvements. Where the TBAs tend to fall short is the relative transience of tenants and the reliance on a high level of trust and transparency between landlords and tenants.

Residential Energy Conservation Ordinance

A Residential Energy Conservation Ordinance (RECO) is an ordinance passed by a local or state government that requires the owner of an applicable residential property to document a minimum standard of energy efficiency at such time when the property is extensively renovated or right before the property is sold. The documentation is provided by a certified inspector or licensed engineer and typically documents the amount and condition of insulation, the efficiency of heating systems, and the level of air infiltration.

Of the communities reviewed that have passed a RECO ordinance, most are located in northern climates where energy use for heating is more significant than average. There were no examples of a RECO found in Ohio, and therefore cannot be sure that such an ordinance would be deemed a valid use of a community's police powers.

One example – Burlington, VT – specifically targeted rental properties in its RECO ordinance. The Burlington ordinance contains a few key compromises: first, if a property is not found to be in compliance with the ordinance at the time of transfer, the new owner has one year to make the improvements (extensions may be granted due to cost or financing issues), and second, the ordinance sets a cap to the cost of the required improvements. However, once the transfer of the property is done, there are no other enforcement mechanisms to ensure the promised improvements are made by the new owner.

The benefits of a RECO ordinance is that it sets, and somewhat firmly enforces a minimum standard of energy efficiency. Through this, all renters can be assured of dwellings that are reasonably comfortable and efficient with low utility bills. Also, it also alerts buyers of a property if it didn't pass inspection, which contributes to an informed marketplace.

Because the main triggering mechanism to a RECO is the sale of a property, Delhi Township would require the Hamilton County Auditor's Office to enforce the ordinance by not allowing sales to be executed without documentation of compliance. It would be logical that landlords and real estate professionals would be opposed to legislation that added additional barriers to the transfer of properties.

Appendix F: Residential Energy Efficiency Programs

Duke Energy Residential Programs

Smart $aver
Rebates are available to help offset the costs associated with installing certain approved energy efficiency measures. As of 2020, Duke Energy offers rebates for heat pump water heaters, insulation and air sealing, variable-speed pool pumps, and high efficiency air conditioners and heat pumps.

Home Energy House Call
Homeowners may request a free in-home energy assessment that will identify ways to improve energy efficiency. The program is only available to homeowners.

LED Program
Duke customers can receive up to 15 LED bulbs every 5 years. In addition, Duke offers an online lighting stores where customers can purchase various types of LED bulbs at discounted prices.

Income Qualified Programs

A wide variety of programs are available to low-income households to help reduce high energy burden. Unfortunately, many low-income households are either not aware of the programs or do not know how to access them. Harlan Township should work with local partners to educate residents about these programs and help sponsor events to facilitate the registration process.

Home Energy Assistance Program (HEAP)
Provides eligible households assistance with their home energy bills. This one-time benefit is applied directly to the customer's utility bill or bulk fuel bill. The Winter Crisis Program (HEAP Winter Crisis Program) helps income eligible households maintain their utility service if they are threatened with disconnection, have been disconnected, or have less than a 25 percent supply of bulk fuel in their tank. The program runs from November 1 until March 31. The Summer Crisis Program (HEAP Summer Crisis Program) provides bill payment assistance for persons 60 years of age and older or those with a certified medical condition. The program runs from July 1 until August 31.

- **Eligibility:** Households must have a household income at or below 175 percent of the federal poverty guidelines to participate in the program and must report total gross household income for the past 30 days (12 months preferred) for all household members. Both homeowners and renters are eligible for assistance.
- **Local program implementer:** Community Action Agency – Cincinnati | Hamilton County

Home Weatherization Assistance Program (HWAP)
Provides eligible individuals with assistance to improve the energy efficiency of their homes and reduce their energy costs. HWAP provides a home inspection to identify energy saving improvements and the installation of cost-effective improvements.

- **Eligibility:** Households must have an income at or below 200 percent of the federal poverty guidelines. Priority is given to households with residents older than age of 60, those with disabilities, those with children in the home, and households with a high energy usage and/or burden. All families who have received assistance any time during the last 12 months under Supplemental Security Income (SSI), Temporary Assistance for Needy Families (TANF), or Home Energy Assistance (HEAP) (does not include Emergency HEAP) are automatically income eligible for weatherization services.

- **Local program implementer:** People Working Cooperatively

Duke Energy Weatherization Program
Helps eligible households save energy and reduce expenses through the installation of energy saving improvements and by providing education on energy saving behaviors the household can adopt. The program is available to single-family and multi-family units.

- **Eligibility:** Households must have a household income of less than 175 percent of the federal poverty guidelines. Both homeowners and renters are eligible for assistance.
- **Local program implementer:** People Working Cooperatively

Duke Energy Furnace Replacement
Provides eligible households with a replacement for inefficient or inoperable heating systems.

- **Eligibility:** Households must have a household income of less than 175 percent of the federal poverty guidelines and use more than 1 therm of natural gas per square foot of living space.
- **Local program implementer:** People Working Cooperatively

Duke Energy Refrigerator Replacement
Provides eligible households with a replacement for inefficient refrigerators as determined by a two-hour metering test.

- **Eligibility:** Households must have a household income of less than 200 percent of the federal poverty guidelines. The program is available to single-family and multi-family residences. Participants must show verification of refrigeration ownership.
- **Local program implementer:** People Working Cooperatively

Electric Partnership Plan (EPP)
Assists eligible households in reducing their electricity usage. EPP provides in-home audits and installs appropriate electric energy efficiency measures to reduce electric usage. Customers also receive information on how they can reduce their electric use and improve their home's efficiency.

- **Eligibility:** Households are eligible for EPP if they are on or eligible for the Percentage of Income Payment Plan Plus (PIPP), have 12 months of electric usage at their current address, and have an annual electric baseload usage of at least 5,000 kWh.
- **Local program implementer:** People Working Cooperatively

Percentage of Income Payment Program Plus (PIPP Plus)
Helps households manage their energy bills by establishing consistent monthly payments based on a percentage of household income. Homes heated with gas have a monthly payment of 6% of their household income for their natural gas bill and 6% of their household income for their electric bill. Homes heated with electric have a monthly payment of 10% of their household income. The balance of a household's utility bill is subsidized by the state of Ohio. There is a minimum monthly payment of $10.00. Paying 24 on-time and in-full payments eliminates any outstanding balance with the utility company that a household may have.

- **Eligibility:** Households must have a household income at or below 150 percent of the federal poverty guidelines and have utility service from an electric or natural gas company regulated by the Public Utility Commission of Ohio. Households applying for PIPP must report total

gross household income for the past 30 days (12 months preferred) for all members. Both homeowners and renters are eligible for assistance.

- **Local program provider:** Community Action Agency – Cincinnati | Hamilton County

Table F1: Summary of income qualified programs

Program	Weatherization Assistance	Utility Bill Assistance	Income Qualification	Renters Eligible	Program Provider
Home Energy Assistance Program		✓	Less than 175%	✓	Community Action Agency – Cincinnati | Hamilton County
Home Weatherization Assistance Program	✓		Less than 200%		People Working Cooperatively
Duke Energy Weatherization Program	✓		Less than 175%	✓	People Working Cooperatively
Duke Energy Furnace Replacement	✓		Less than 175%		People Working Cooperatively
Duke Energy Refrigerator Replacement	✓		Less than 200%	✓	People Working Cooperatively
Electric Partnership Plan	✓		Less than 150%		People Working Cooperatively
Percentage of Income Payment Program Plus		✓	Less than 150%	✓	Community Action Agency – Cincinnati | Hamilton County

Other Energy Efficiency Programs

Federal Income Tax Credit
Residential property owners are eligible to receive a federal tax credit for renewable energy products installed prior to December 31, 2021. The tax credit is limited to solar water heat, solar photovoltaics, geothermal heat pumps, and small wind turbines. The tax credit is equal to 26 percent of the project cost for projects installed by the end of 2020 and 22 percent for projects installed by the end of 2021. The tax credit is scheduled to expire at the end of 2021.

State of Ohio ECO-Link Loan Program
The Office of the Ohio Treasurer of State works local lending partners to provide up to a 3% interest rate reduction for loans that are used to fund energy efficiency improvements. Additional information is available at www.ECOLink.ohio.gov.

Zonolite Attic Insulation Trust
Homeowners that have asbestos-containing vermiculite insulation in their attic may qualify to receive financial compensation to offset the costs associated with removing the hazardous substance. Homeowners who think they may have asbestos-containing vermiculite insulation should visit www.zonoliteatticinsulation.com for additional information.

Appendix G: Sample Outreach Document

ENERGY SAVING TIPS FOR YOUR 1950 ERA HOME

The end of World War II brought with it a housing boom that extended well into the 1950s. Large numbers of Cape Cod and ranch style homes were built during this period. Energy continued to be cheap during the 1950s, so attic insulation and wall insulation were not commonplace. Many homes built during this period may still have their original steel or aluminum single pane windows. These windows were not designed to prevent air infiltration or to provide any insulation value.

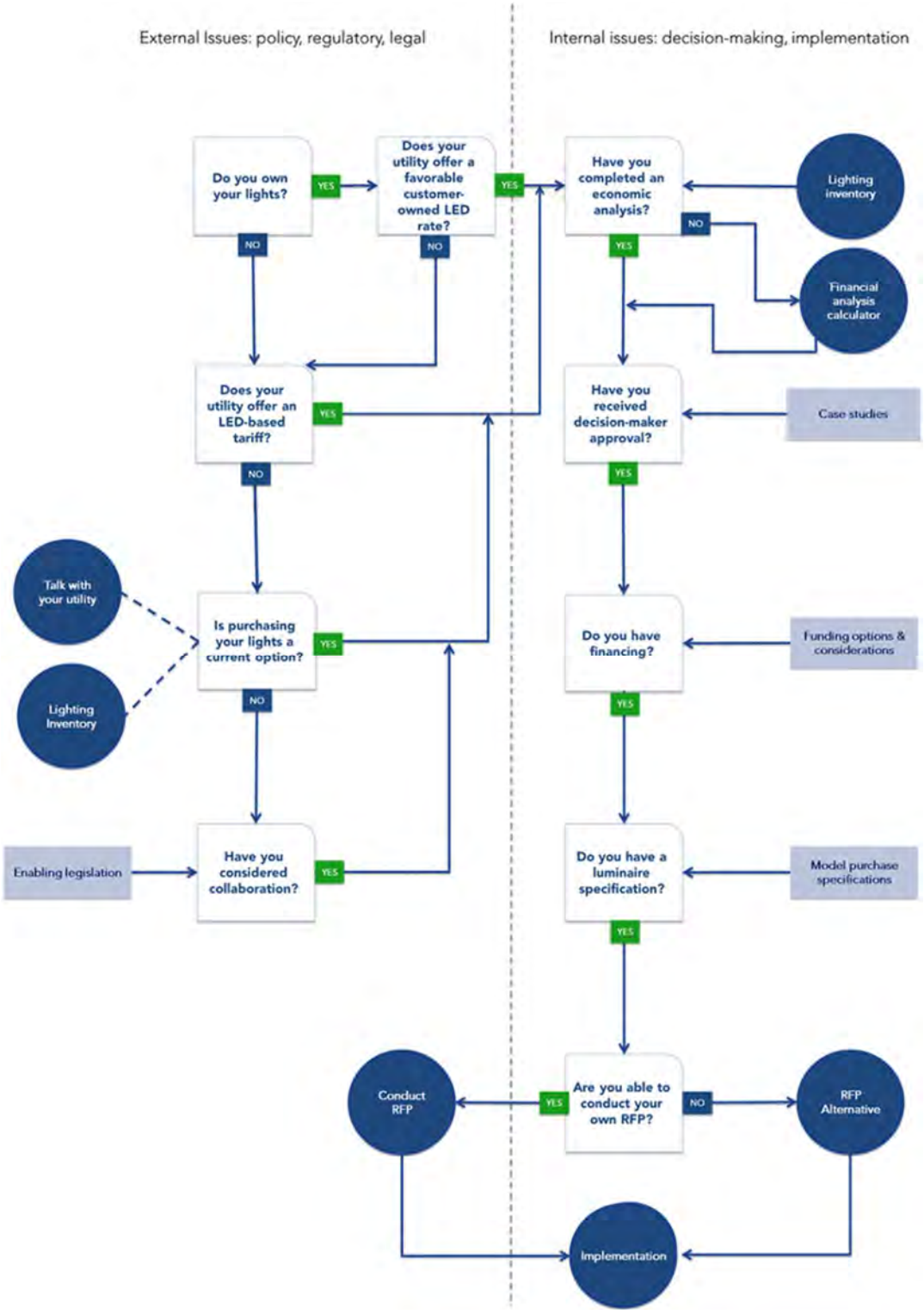
COMMON PROBLEMS	DO-IT-YOURSELF	CALL A PROFESSIONAL
Drafty rooms	Caulk and weatherstrip doors, windows, and attic hatches that leak air.	Air seal penetrations in the attic plane and basement with spray foam.
Attic insulation levels	Check to make sure that your attic insulation is evenly distributed and that your attic hatch is insulated.	Install additional insulation to bring attic to R-49 level.
Heating and cooling system	Change your filter once a month or as recommended.	Have your heating and cooling systems maintained annually.
	Install a programmable or smart thermostat.	Upgrade your system by installing ENERGY STAR rated equipment.
Dust, dirt, or cobwebs along ductwork	Use mastic or butyl tape to seal joints and holes in ductwork.	Reconnect broken ductwork and insulate and seal any ductwork in attics or crawl spaces.

DID YOU KNOW?

A 60-Watt incandescent bulb that is used five hours a day for a year costs $12.59 to operate. An equivalent LED bulb only uses 9-Watts and costs $1.89 to operate!

Appendix H: Lighting Accelerator Decision Chart

The U.S. Department of Energy through its Better Buildings Outdoor Lighting Accelerator designed the decision tree below to assist local governments with implementing energy efficient streetlighting improvements.



Appendix I: Energy Audit Report