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Table of Contents

The Purpose of Energy Planning

Energy planning investigates issues centered on energy use and delivery in the community; identifies how these issues intersect with 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 the Village of Silverton. 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 plan steering committee after reviewing the information included in the associated chapters. A draft version of these goals were presented for public review at an open-house meeting on February 13, 2019 at Silverton Town Hall, displayed in the Council Chambers from February 13th through March 21, as well as posted on the Community Energy Plan website at energy.oki.org.

Feedback was also solicited via a web survey, which received 71 responses. The detailed results of the survey is shown in the Appendix of this document. The open-house meeting was promoted in person to the Silverton Blockwatch Group, via the energy.oki.org website, and via Facebook. Also, the meeting was promoted via boosted social media posts, reaching over 1,600 Facebook users in the Silverton area.

This plan will serve to organize action by the Village, 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.

Overview of Silverton'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. They deliberated to collectively arrive at the enclosed strategy. Early in the process, the committee provided input, and adopted the following mission statement to guide the development of the plan:

MISSION STATEMENT

Silverton is committed to being a leader in the region for prioritizing energy efficiency and reducing the community's carbon footprint. This energy plan will provide specific guidance to community leaders to comprehensively, effectively, and equitably address the energy needs and goals of the village. The implementation of this plan will provide for a more energy efficient, sustainable, inexpensive, and attractive community for residents and businesses.

Feedback from Public Involvement

Public feedback was solicited on a number of topics during the planning process. This feedback was primarily gathered through an online survey and at a public open house meeting. The following are the primary takeaways from the public feedback received:

- A majority support going with a 100% renewable electricity option for the Village's aggregation program
- Residents' primary motives for reducing energy consumption is split between saving money and slowing the effects of climate change. Most ranked reducing air pollution as second of the three motivations presented.
- Respondents felt both reducing the harm caused to the environment and reducing energy burden are very important issues for the Village to address.

Complete Details of the survey responses are located in Appendix A at the end of this document.

Energy Plan Goals

Goal 1	Silverton will be a leader and role model in the area of energy efficiency within the county and throughout the region.
Goal 2	Reduce overall Greenhouse Gas emissions by at least 26% by 2030, matching the United States' previous Paris Agreement pledge.
Goal 3	Embrace energy efficiency and the challenge to become more efficient as a pathway to promote community engagement and shared values.

Strategies

The Village of Silverton 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	Encourage residents to modify behaviors in order to conserve energy
2	Silverton should partner with reputable home energy efficiency providers to increase residents' awareness and access to incentives and programs that will help increase the installation of energy efficient improvements.
3	Adopt a 100% renewable source for Silverton's electric aggregation program and set a goal of maintaining at least 50% enrollment to ensure that the Village has reduced its GHG emissions enough to reach the level of the US pledge to the Paris Agreement.
4	Encourage on-site renewable energy for residential buildings
5	• Silverton should address the rental property split incentive through the following actions: ○ Identify rental housing for low-income residents in the Village and partner with People Working Cooperatively to make tenants and landlords aware of the Home Weatherization Assistance Program (HWAP)

	○ Engage property owners of the handful of large apartment complexes in the community about the availability of PACE financing for improvements. ○ Increase awareness of energy efficiency as a housing market consideration among local landlords. ○ Engage renters with ways they can improve the energy efficiency, and reduce their energy bills, through simple, low-cost, and easy improvements such as LED lightbulbs, weather stripping windows and doors, managing their thermostat, and low-flow showerheads.

Commercial and Industrial Strategies

1	Encourage energy efficient upgrades to existing commercial and industrial buildings
2	Achieve Net-Zero status for the Town Hall building by 2021
3	Encourage on-site renewable energy for commercial and industrial buildings

Actions

The Village of Silverton Energy Plan encourages the Village Government to commit to the following action items that will assist the Village in implementation of the recommended strategies.

Action 1	Install Solar Panels on Town Hall by 2021
Action 2	Recycle 20% of waste stream by 2020.
Action 3	Consider joining with the City of Cincinnati for electrical residential aggregation program in 2020 that would procure energy from renewable sources
Action 4	Launch a Solarize campaign for Village residents.
Action 5	Adjust the Village's zoning code to require more shade trees in and around parking lots for commercial and multi-family properties.

Action 6	Continue working with Duke Energy to evaluate converting the Village's streetlights to LED fixtures.
Action 7	Provide residents the ability to drop off non-perishable food donations at the local fire stations to make donating excess food more convenient.
Action 8	Promote composting by hosting a workshop for interested residents and engaging food service businesses about the availability of food waste collection services.
Action 9	Work with Metro to identify barriers for Silverton workers using transit.
Action 10	Work with Port Authority or other non-profit (Working in Neighborhoods?) to develop a "model remodel" project for homes to attract homebuyers back to first suburbs.

Energy Use and Delivery

The Village of Silverton is in the northeast portion of Hamilton County and covers an area of 1.11 square miles. The main business district is located along Montgomery Road, which bisects the village. There were 2,394 occupied housing units in Silverton in 2017. Approximately 43% of the housing units in Silverton are multi-family dwellings. More than 44% of Silverton households are rentals.

Green House Gas Emissions

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

Electric & Natural Gas Use

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 Village of Silverton consumed over 306 billion kBtu of energy in 2016. The greenhouse gas emissions associated with this amount of energy consumption is equivalent to 7,200 cars. The estimated amount of CO^2 for the Village's electricity use is based on the typical mix of sources for electricity available in the region, which currently is mostly supplied by coal and natural gas power plants. Line losses are also a significant factor because much more electricity is produced than is delivered to the customer. All of this adds up to electricity producing much more CO^2 per unit of energy (kBtu) than natural gas produces, as shown below in figure 1. The key to significantly reducing the Village's production of CO^2 lies in adopting a clean source of electricity.

Fig 1: Energy Use and CO2 Consumed in Silverton 2016 (GCEA)

	Amount Consumed	Total kBtu	Tons of CO_2	lb CO_2 / kBtu
Electricity	31,648,709 kWh	107,989,903	25,963	0.48
Natural Gas	1,942,873 CCF	198,173,078	11,582	0.11

Natural gas is used for space heating, water heating, and some manufacturing processes. In 2016, the residential sector accounted for 63 percent of natural gas consumption while the commercial

and industrial (C&I) sectors accounted for 36 percent (Figure 2). The portion of natural gas use attributable to the residential sector is much larger than its proportion of electric use.

The residential sector accounted for 52 percent of electricity consumption in 2016 while the commercial and industrial (C&I) sectors accounted for 48 percent (Figure 3). Residential use will likely remain the largest user in the future even if its share of overall use declines.

Because the residential sector dominates energy use in the community, it is essential to address actions targeted towards energy efficiency in the residential sector.

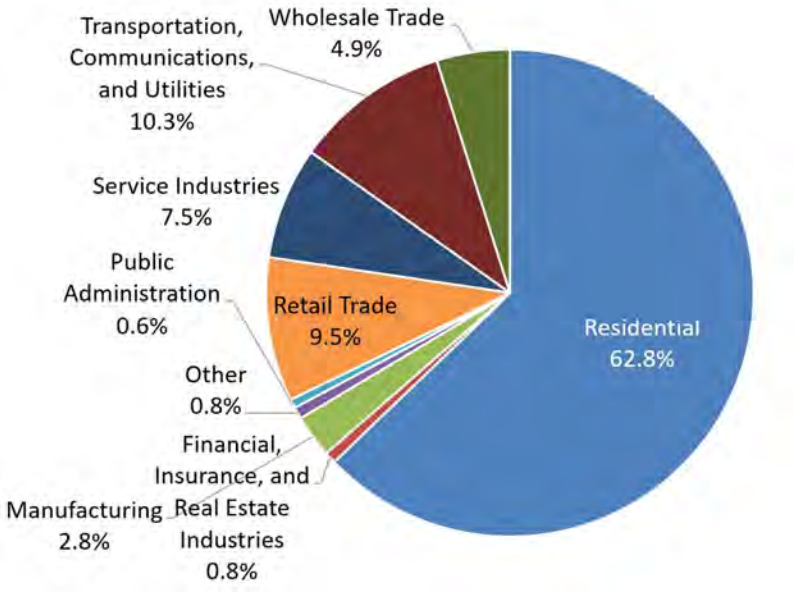


Fig 2: Natural Gas Use in Silverton – 2016 (Duke Energy)

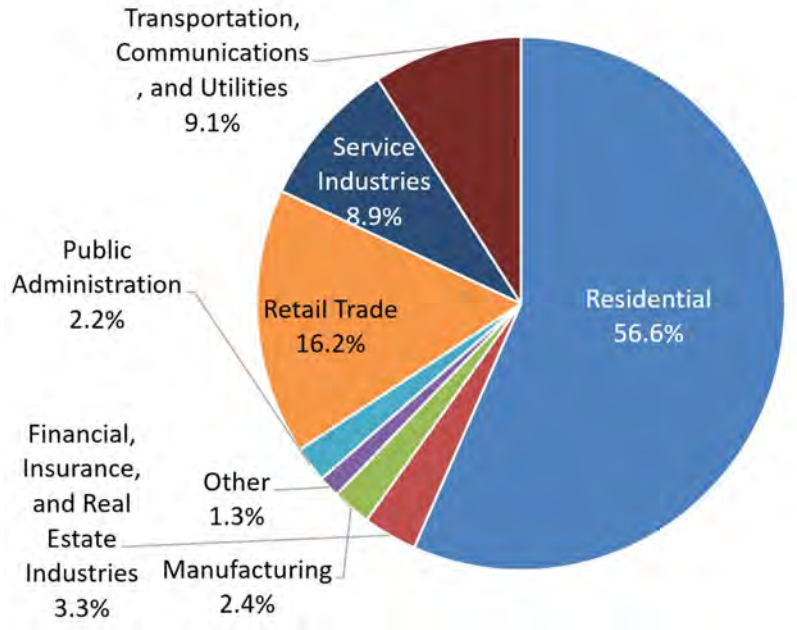


Fig 3: Electricity Use in Silverton – 2016 (Duke Energy)

Residential Energy Use

Natural gas and electricity are the most-consumed energy sources in residential buildings throughout the Village of Silverton.

Space heating accounts for the largest share of energy use in residential buildings (Figure 3). Natural gas is the most common source of fuel for heating, although some buildings may use electricity. Key improvements in reducing the amount of energy

consumed by heating is sealing air gaps in the home's exterior and attic, attic insulation, and high efficiency furnace or heating equipment.

Figure 5 below provides a snapshot of residential energy consumption in the community relative to three local peer communities (Deer Park, Newtown, and North College Hill). Silverton consumes fewer kWh of electricity and CCF of natural gas than its local peers. The average Silverton home appears to be consuming 18% less electricity and 6% less natural gas than the typical home in these peer communities. Residents responding to the survey reported they installed the following energy-efficient improvements: LED lightbulbs (97%), attic insulation (38%), energy-efficient doors and windows (41%), high-efficiency furnace / air conditioner (47%).

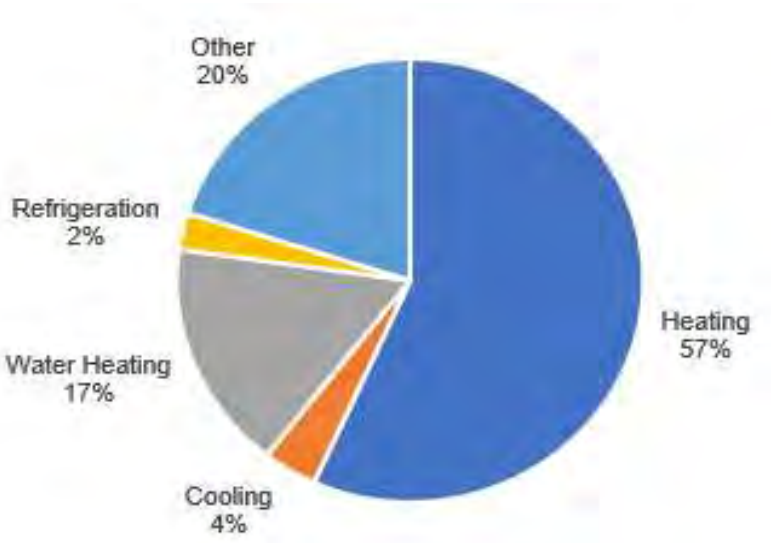


Fig 4: Residential building fuel consumption by end use
Source: U.S. Energy Information Administration, Residential Energy Consumption Survey (RECS) 2015. Table CE3.3

Fig 5: Residential Energy Consumption and Costs, 2016
(U.S. DOE City Energy Profile https://apps1.eere.energy.gov/sled/#/)

	Silverton	Peer Cities
Number of households	2,440	8,459
Average kWh per household	9,000	11,033
Average annual cost per household	$1,070	$1,297
Average CCF per household	540	575
Average annual cost per household	$660	$707

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 6. However, the actual profile will vary depending on the type of facility.

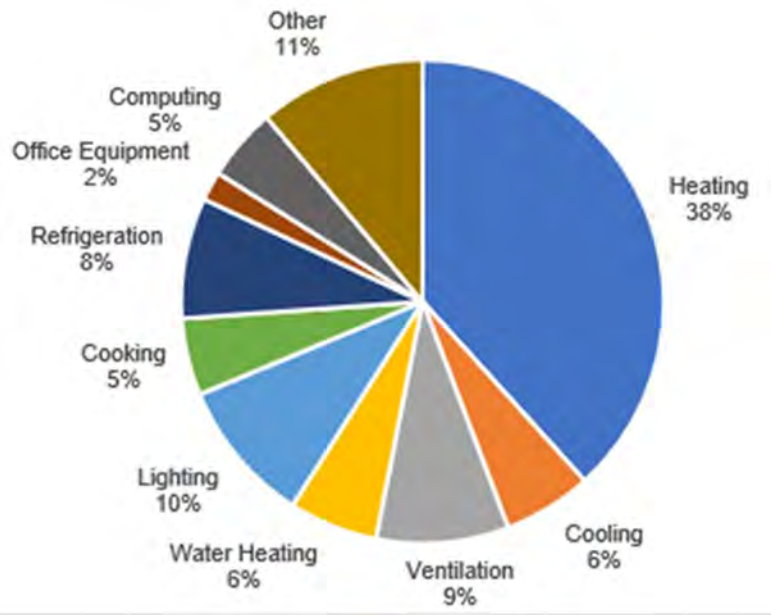


Figure 6: Commercial building fuel consumption by end use
Source: U.S. Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey, Table E1

According to a 2015 report from 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 usage for heating by 33% and cooling by 40% (Figure 6). While only accounting for 10% of energy use, upgrading to energy efficient lighting offers a low-cost way for commercial properties to reduce their energy costs. With being low-cost, lighting and controls upgrades in commercial buildings typically supply the best return on investment of all possible efficiency upgrades.

Energy Delivery

Duke Energy Ohio is the utility responsible for the delivery of, and billing for, electricity and natural gas for residents and businesses in the Village of Silverton. Duke maintains the electric and natural gas infrastructure delivering energy to homes and businesses.

Energy Resiliency

Resiliency is how susceptible a community is to threats, and how capable they are in overcoming threats when they do occur. In regards to energy infrastructure, there are a number of common, and not so common events that may test the resiliency of the system. First and foremost on this list are weather events that can impact above-ground power and communications networks. Wind and ice events are the most common phenomenon that have the ability to impact utility 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[1].

Prevention **-** This is about preventing damage to the distribution system. Damage can occur in numerous ways. The most common are as the result of 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 **-** Recovery is about how the community and the utility works 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 the utility companies is essential to identifying and assessing locations where disruption of the network occurred and how to get 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. Regarding energy, the county emergency response plan designates the local community responsible for assessing local conditions, areas affected by shortages or outages, communication and coordination with utilities regarding outages and facilities of high priority, communication with residents and businesses providing energy information and recommending actions to conserve energy. Silverton 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.

[1] Electric Power Research Institute (www.epri.com)

A new aspect to the survivability function is allowing for distributed generation (privately owned solar panels and wind turbines). Given the proper setup, these facilities can be of use in a power outage situation, but also can pose a risk to utility crews working to repair the electric grid. In an outage situation, distributed solar panels or wind turbines could push power out onto the electric grid, which would endanger workers working to repair the grid. Typical solar and wind power systems are not equipped to provide backup power in the event of an outage.

Aggregation

Ohio's deregulated energy market enables property owners to select their own electricity and natural gas providers. Communities are permitted to join their residents together to buy electricity and/or natural gas as a group to gain buying power in the marketplace. Since 2012, the Village of Silverton has offered an electric aggregation program for residential customers that reduces utility costs for property owners. As the local utility provider, Duke Energy adds distribution charges to the rate offered through the aggregation program. Electricity costs in Silverton are currently around $0.102 per kWh, which is below the 2017 average retail price for electricity in the Cincinnati region of $0.1143 per kWh.

The Village of Silverton also offers residential and small commercial customers the ability to participate in its natural gas aggregation program. Excluding fixed delivery charges, the 2017 average retail price for natural gas in the Cincinnati region was $0.655 per ccf. It is difficult to compare the rate Silverton residents pay through the aggregation program to the regional average due to the complex nature of natural gas distribution charges.

Aggregation programs are beginning to offer renewable and carbon free options in their portfolio. The Village currently purchases its municipal electricity from a 100% carbon free and renewable source (wind and solar). These options will be key in helping Silverton reach its goals in reducing greenhouse gas emissions related to community energy use. The City of Cincinnati is currently adopting renewable sources for its aggregation program.

Strategies

- Prioritize sourcing clean, renewable energy sources for municipal electricity and through the Village's electric aggregation program to cut greenhouse gas emissions.
- Prioritize residential energy efficiency programs because residential makes up the majority of Silverton's energy use.
- Continue to work with Duke and Hamilton County EMA to ensure a resilient and well-maintained energy utility network and procedures are current in the event of a significant energy outage.

Transportation and Land Use

Transportation Energy Use

Measuring the use of energy for transportation for a local community is a very difficult task. This plan looks to data regarding means of transportation to work gathered by the US 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 North College Hill, Wyoming, Deer Park, Fairfax, and Mariemont.

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.

Silverton stands out in a couple ways. On the positive side, significantly more Silverton residents walk to work than peer communities, the county, or region. This indicates that Silverton is a very walkable community and that more residents live close enough to work to comfortably walk than in peer communities. One thing that surprised is that Silverton lags behind peer communities and Hamilton County in public transportation use. Silverton has exceptional access, with 4 different routes providing service along Montgomery Road. Another area where Silverton lags is in biking. While bike use in the region is low, Silverton at 0.0% is negligible. A likely factor is Montgomery Road. It's

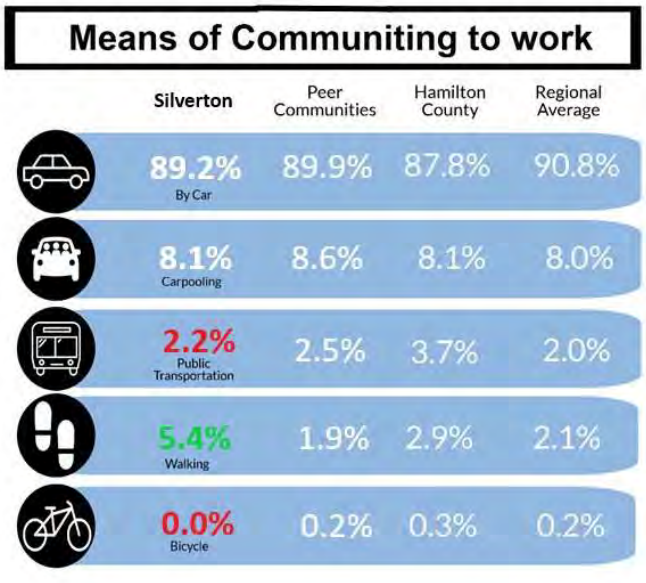


Fig 7: Means of Commuting to Work – 2016 (US Census)

difficult to get anywhere from Silverton without using Montgomery Road, which isn't comfortable for cyclists to use. We saw similar numbers in Colerain and judged the likely cause to be Colerain Avenue.

Urban Heat Island

The urban heat island effect is created by impervious surfaces, such as roads, parking lots, and buildings, which retain heat from the sun's radiation. At night, these surfaces release the retained heat, creating a localized area of higher temperatures. Localized "hot-spots' combine to create a dome of hot air over a metropolitan area.

Impervious surfaces causing increased heat values:

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

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

The highest surface temperature values are concentrated along Montgomery Road, particularly at the intersection with Plainfield Road where industrial buildings and commercial spaces are highly concentrated. Heat retaining surfaces such as large roof tops and parking lots contribute to the higher values in this area.

Residential areas in Silverton display cooler tones due to less concentrated impervious surfaces. However, homes near commercial zones experience heightened heat values.

Areas that have tree cover show cooler tones. In fact, the prevalence of tree cover

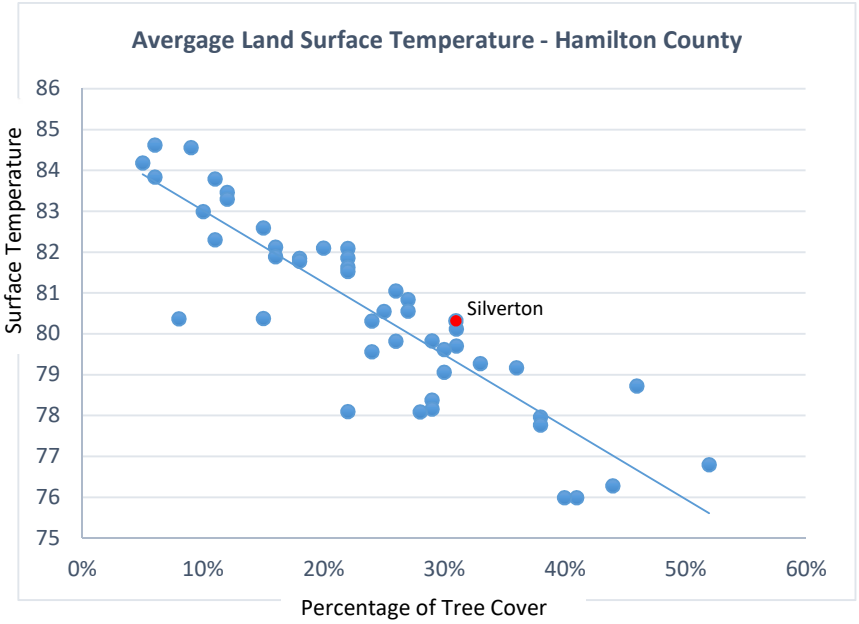


Fig 8: Relationship between Urban Heat Islands and Tree Cover (OKI)

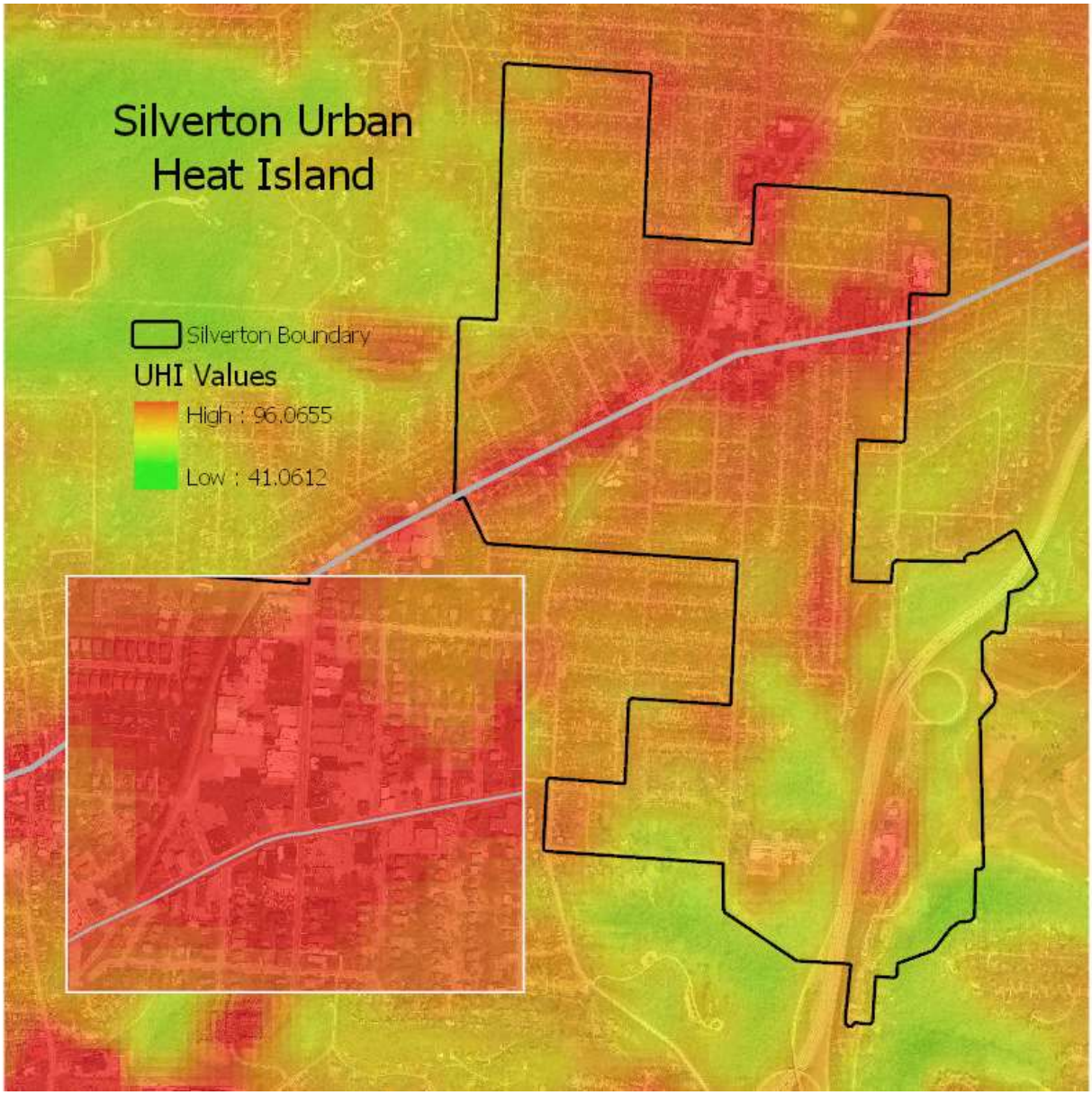


Fig 9: Heat Island Map of Silverton (OKI)

in a community is found to be the leading indicator of heat island effect. The chart below shows the clear relationship between the two.

The best ways to combat the urban heat island effect is by limiting the amount of large impervious surfaces like roofs, streets, and parking lots within the urban landscape; and by reducing the amount of heat absorbed by these features by using light colored coatings and providing as many deciduous shade trees as possible in their vicinity.

Food and Energy

While it might be difficult to see the connection between food and energy, food is, in fact, the physical manifestation of many layers of added energy. Food must be grown or raised, taking energy from the sun, water, and nutrients in the soil to grow plants. Those plants are actually food themselves, or fed to raise animals. Food must be processed and/or packaged, transported and distributed, adding more layers of energy. According to the USDA, food related energy use accounts for nearly 16% of total US energy use and growing. On the whole, food is very energy intensive to make and deliver to the customer. In the US, it takes over 8 calories of energy to deliver one calorie of food to the customer. Some products, like beef, requires ten times as much energy.

The table in figure 10 details the various components in the energy profile of the nation's food system.

Food Waste

With so much energy used to produce food in the US, it should be seen as a precious commodity. However, estimates show that about 40% of the food produced is never actually eaten [2]. Some of this happens as a byproduct of food processing, bulk storage, or transportation before it reaches store shelves. But, it's estimated that 31% of food bought by consumers is thrown away [3]. Accounting for

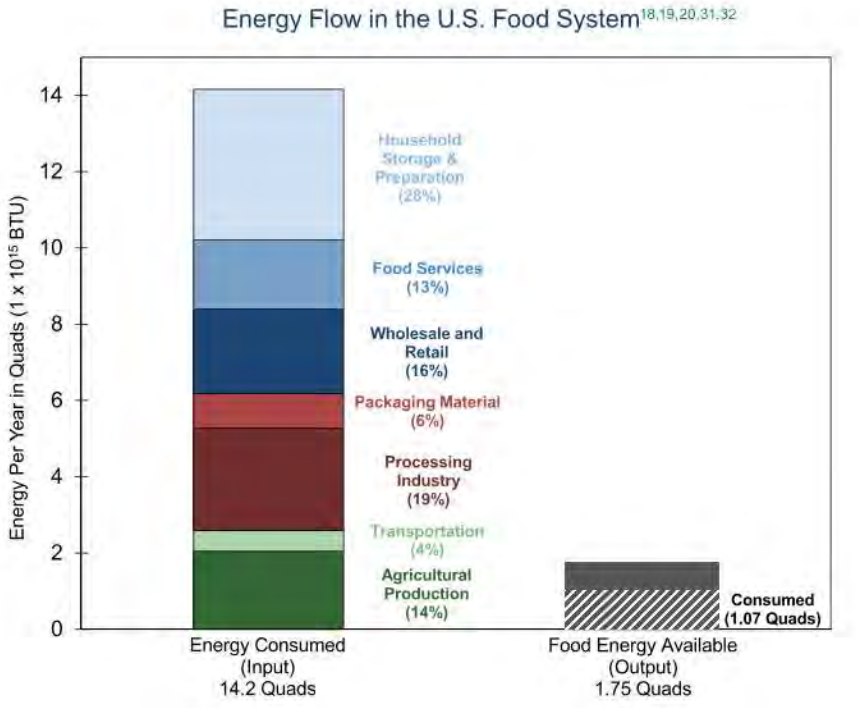


Fig 10: Measure of energy in the U.S. Food System (University of Michigan)

[2] National Resource Defense Council (NRDC). https://www.nrdc.org/issues/food-waste

[3] Buzby, Jean C., Hodan F. Wells, and Jeffrey Hyman. 2014. The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States. US Environmental Protection Agency Economic Research Service (ERS). https://www.ers.usda.gov/webdocs/publications/43833/43680_eib121.pdf?v=0 , accessed 1/28/19

waste, we spend 14 times more energy producing food than we derive from it.

That wasted food then becomes a whole different problem – a trash problem. Food waste is the single largest component going into municipal landfills, at 22% of total municipal solid waste generated. [4] There, food waste contributes to another environmental problem – the creation of methane gas. Methane is a potent greenhouse gas and food waste is responsible for 8% of global greenhouse gas emissions. If food waste was a country, it would rank third in the world for GHG emissions behind China and the United States.[5]

Fig 11: Ways to Reduce Food Waste (US EPA)

Reducing the Energy Impact of Food

Given the above, the problem of food waste seem like a herculean task to overcome. While that may be true, there are simple actions we all can take to reduce the energy impact of food and reduce the amount of wasted food.

Eat Local – food products in the US 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.

Eat Less Meat – a meat-based diet (28% calories from animal products) uses twice as much energy to produce as a vegetarian diet.[6] Also, meat and dairy products are among the highest contributors to food waste in production and spoilage.

[4] US Environmental Protection Agency. 2015. https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf

[5] Food and Agriculture Organization of the United Nations. http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/FWF_and_climate_change.pdf

[6] Heller, M. and G. Keoleian (2000) Life-Cycle Based Sustainability Indicators for Assessment of the US Food System, The University of Michigan Center for Sustainable Systems, CSS00-04

Eat Organic – Organic produce don't use chemicals that require lots of energy to produce.

Use Less Refrigeration – Home refrigeration accounts for 13% of the total energy cost of the US food system.[7] Processed and convenience foods typically require refrigeration, whereas whole foods, like beans, rice, produce, and cereals don't. Refrigerators today are more energy efficient, but increases in size have largely offset the gains.

Reduce Waste – Most household food waste is due to spoilage. Avoid this by buying smaller amounts, planning meals, and freezing or canning extra produce. Also, much of the food we discard is still safe to eat, but is tossed due to confusion over "sell by" or "use by" dates.[8]

Even with careful planning, excess food still occurs. The diagram in Figure 11 illustrates the hierarchy of preferred ways to reduce the amount of food waste. Here are local resources to aid with sustainably dealing with unwanted food.

- There are several dozen food banks serving southwest Ohio. Here is a website listing them https://www.help4seniors.org/Find-Resources/Resource-Directory-Results.aspx?CategoryID=Food+Pantries+and+Soup+Kitchens
- Start a food rescue program at schools. Amity Elementary School in Deer Park has a Food Share Table in the cafeteria. Students can place unwanted food items on the table where other students can select them. Any unwanted items at the end of lunch are taken to a local food pantry.
- Food waste collection – GoZero offers food waste collection and hauling in the Cincinnati area. The food waste is composted and then the company sells the compost. www.gozero.org
- Residential Composting – The Hamilton County Solid Waste District holds yearly workshops to teach residents how to compost in their own backyards.

Recycling

Recycling is another community activity that can significantly reduce energy use. Many of the products and packaging we use and throw away everyday can be recycled. Recycling an item is often a less energy intensive process than making new items from virgin materials[9].

Here are the typical energy savings for recycling certain materials:

- Glass: 10 – 15% energy savings

[7] Center for Sustainable Food Systems, University of Michigan. 2018. "US Food System Fact Sheet." Pub. No. CSS01-06

[8] USDA, ERS (2016) "Food Product Dating" https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/food-product-dating/food-product-dating

[9] The American Geosciences Institute. How does recycling save energy?. https://www.americangeosciences.org/critical-issues/faq/how-does-recycling-save-energy, accessed 5/17/19

- Aluminum: 94% energy savings
- Iron and Steel: 72% energy savings
- Plastics: 55 – 65% energy savings
- Paper: 64% energy savings

Silverton provides trash removal service to residents via a contract with Rumpke. This contract includes curbside recycling service.

Strategies

- Work with Metro to identify barriers for Silverton workers using transit.
- Adjust the Village's zoning code to require more shade trees in and around parking lots for commercial and multi-family properties.
- Provide residents the ability to drop off non-perishable food donations at the local fire stations to make donating excess food more convenient.
- Promote composting by hosting a workshop for interested residents and engaging food service businesses about the availability of food waste collection services.

Residential Energy Efficiency

The Village of Silverton contains over 2,500 residential units. 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,

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.

Buildings built within the same decade share characteristics that are relevant to energy efficiency. Older homes were not designed with energy efficiency in mind, so they present significant opportunities to reduce energy usage and improve comfort. In fact, 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.

The Village of Silverton has concentrations of older homes built during the 1800's and 1900-1920's along

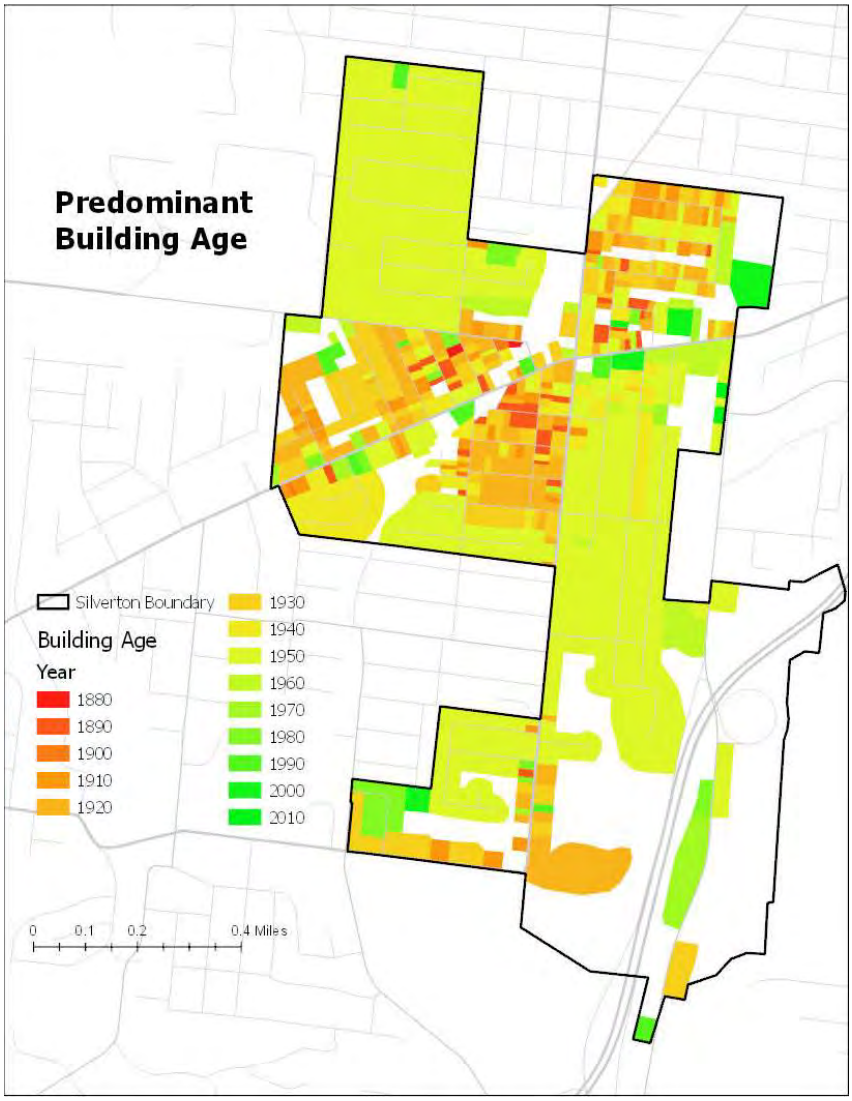


Fig 12: Predominant Building Age (OKI)

Montgomery Road. As one moves away from the areas adjacent to Montgomery Road, older homes begin to give way to homes built from the 1930s to the 1950s.

Below are some key energy efficient improvements that would be relevant to many homes in Silverton, given the predominant age of its housing stock:

Figure 13: Applicable Energy efficiency improvements by building age (GCEA)

	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	●	●	●	●	●	●	●
Cooling Systems	High	Medium	●	●	●	●	●	●	●
Windows	High	Low	●	●	●	●	●	●	
Areas above unconditioned spaces	Low	High		●	●	●	●	●	
Knob and tube wiring	Medium	NA	●	●					
Asbestos	High	NA		●	●	●			
Vermiculite	High	NA			●	●			

Silverton 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% of survey-takers reported that they have made this improvement. Also, nearly 40% said they have installed extra attic insulation, and almost 50% have upgraded to a high efficiency furnace or air-conditioner. 40% have also installed energy efficient doors or windows. It's important to note that most residents who responded to the survey are homeowners. Only 10% who responded are renters, while 44% of Silverton households rent.

Energy Burden

Energy burden is the percentage of a household's total income that is spent on energy. The higher the percentage, the higher the energy burden. This measure illustrates how the impact of high energy prices and inefficient housing are disproportionately felt by different population

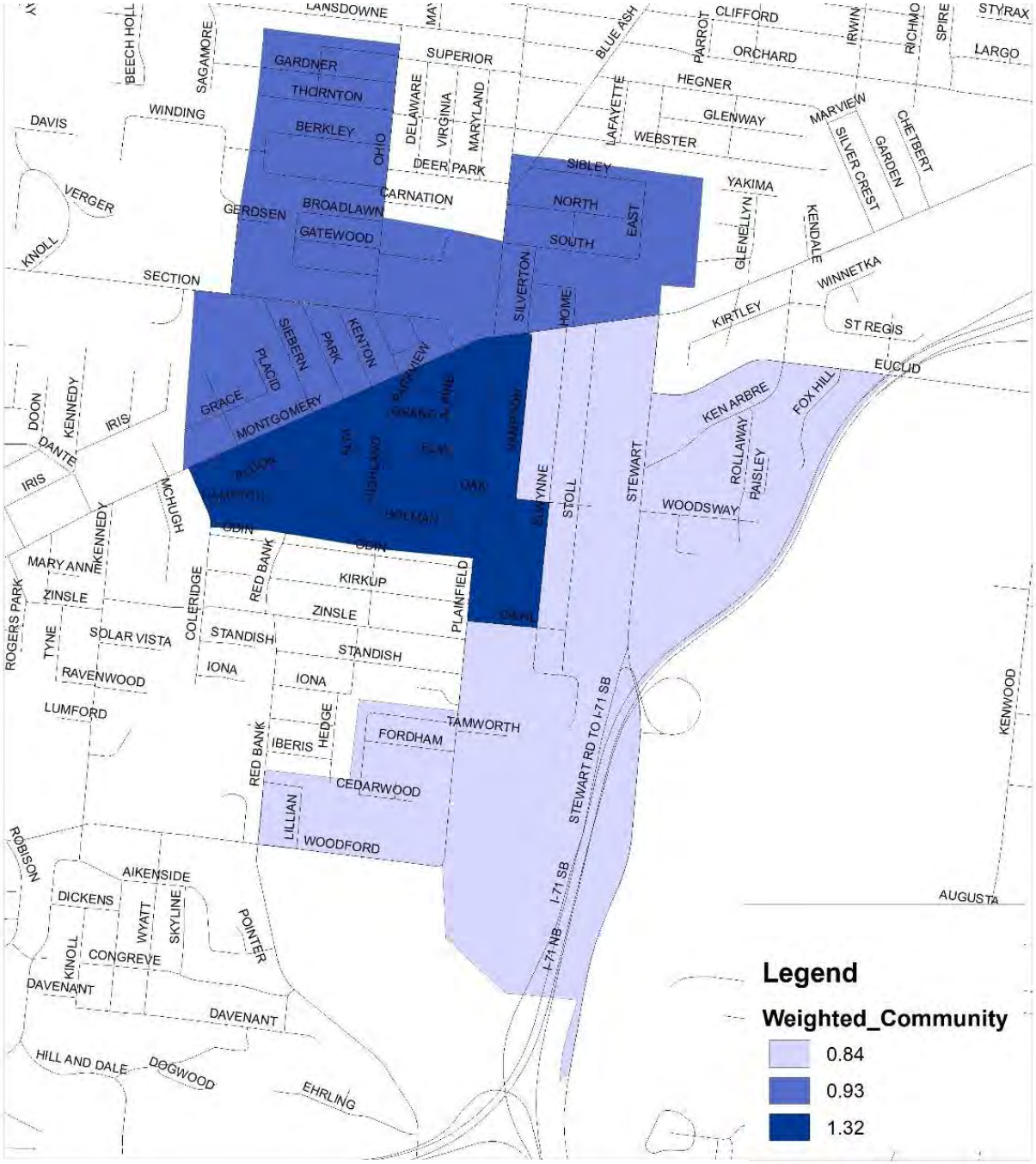


Fig 14: Relative Energy Burden by Census Block Group (OKI)

groups or households in different parts of the community. This information can be used to guide efforts to specifically reach out to households with high energy burdens with programs that can improve energy efficiency and costs.

Energy burden is measured by combining the average electricity and natural gas sales in a census block and dividing by household income. The result is then divided by the community average. Values over one indicates an average household energy burden greater than the community average. Values less than one indicate energy burden that is less than average.

Energy burden in Silverton seems to be mainly concentrated in one block group along the south side of Montgomery Road, along and to the west of Plainfield Road. This area happens to contain some of the oldest housing in the village. This is typical for a community; the lower income residents are frequently found in the oldest and least energy efficient housing. To reduce the amount of energy used by households with high energy burden, investments must be made in improving the energy efficiency of the dwelling and equipment used in the home. Reducing the cost of energy can be done through aggregation deals and with income-based energy cost assistance programs.

Rental Housing and Energy Efficiency

Rental housing poses a unique challenge to encouraging energy efficiency. The nature of this challenge stems from owners of rental housing not having an economic incentive to improve the energy efficiency of their buildings. This lack of incentive stems from the usual arrangement of the renter paying the utility bill. Any extra investment in energy efficiency would not benefit the owner, but only benefit the renter through lower utility bills. Given this, the renter would be the one incentivized to invest in energy efficient improvements. Renters are not financially tied to the property and would not be comfortable investing significant money into the energy efficiency of a property given that such investments have lengthy payback periods. Also, renters would not be able to make some improvements without the permission of the owner.

This situation is called a split incentive. It is where one party (the landlord) is the owner of the building, has a presumably long-term interest in the property, and has the ability to make significant investments in the energy efficiency of the building; but, the benefits of those improvements go to another party (the renter) who is not inclined to make significant investments in a property they don't own and have only a temporary attachment to the property. This situation results in neither party having a sufficient interest in investing in the energy efficiency of these properties. As a consequence, encouraging the improvement of these properties pose a significant challenge.

Research into the topic of split incentives relating to energy efficiency in rental properties reveals three ideas to overcoming the problem:

- **Incentives:** providing monetary grants or rebates to encourage energy efficient improvements. Studies show that extremely generous incentives are needed to overcome split incentives.
- **Transfer of Benefits Agreements:** formal agreements between a landlord and tenants which transfer some of the savings tenants see in lower utility bills to the landlord who pays for the energy efficient improvements to the building. These agreements are brokered through an organization that promotes energy efficiency, who monitors the agreement to ensure both parties benefit from the agreement. There currently aren't any organizations in the Greater Cincinnati area offering services to manage transfer of benefit agreements.
- **Residential Energy Conservation Ordinance:** requires owners certify a residential property meets a certain minimum energy efficiency standard before ownership of the property can transfer.

More information about each strategy to overcome split incentives is available in Appendix __. Overcoming the split incentive problem is key for Silverton to make significant strides in boosting residential energy efficiency. Over 44% of Silverton's housing are rentals. Furthermore, lower income households tend to be disproportionately renters. Addressing energy efficiency in rental housing is also important to reducing energy burden in the community.

Existing Programs to Boost Energy Efficiency

A number of programs exist to help homeowners improve the energy efficiency of their homes.

Duke Energy

Duke Energy offers a wide range of programs to help homeowners reduce their energy usage.

- **Smart $aver**: Rebates are available to help offset the costs associated with installing certain approved energy efficiency measures. As of 2018, 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.

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.

People Working Cooperatively

People Working Cooperatively offers programs that provide weatherization assistance to homeowners and renters in Hamilton County that meet certain income guidelines. Assistance includes free energy audits, installation of insulation and air sealing improvements, lighting upgrades, as well as other efficiency related measures.

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.

Strategies

- Addressing energy efficiency in residential structures is key to significantly improving energy efficiency in Silverton. The survey responses show a high level of engagement among residents to make improvements.
- Partner with the Port Authority, who operates the county's land bank, to undertake an energy efficient "model rehab" of a home in Silverton as a demonstration of how energy efficient renovations can increase a home's market appeal and bolster property values.
- Silverton should partner with reputable home energy efficiency providers to increase residents' awareness and access to incentives and programs that will help increase the installation of energy efficient improvements.
- Silverton should address the rental property split incentive through the following actions:
    - Identify rental housing for low-income residents in the Village and partner with People Working Cooperatively to make tenants and landlords aware of the Home Weatherization Assistance Program (HWAP)
    - Engage property owners of the handful of large apartment complexes in the community about the availability of PACE financing for improvements.
    - Increase awareness of energy efficiency as a housing market consideration among local landlords.
    - Engage renters with ways they can improve the energy efficiency, and reduce their energy bills, through simple, low-cost, and easy improvements such as LED lightbulbs, weather stripping windows and doors, managing their thermostat, and low-flow showerheads.

Energy Efficiency in Commercial Buildings

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 (Figure 15). Upgrading to the best available technologies could reduce energy consumption even further saving property owners up to 46 percent.

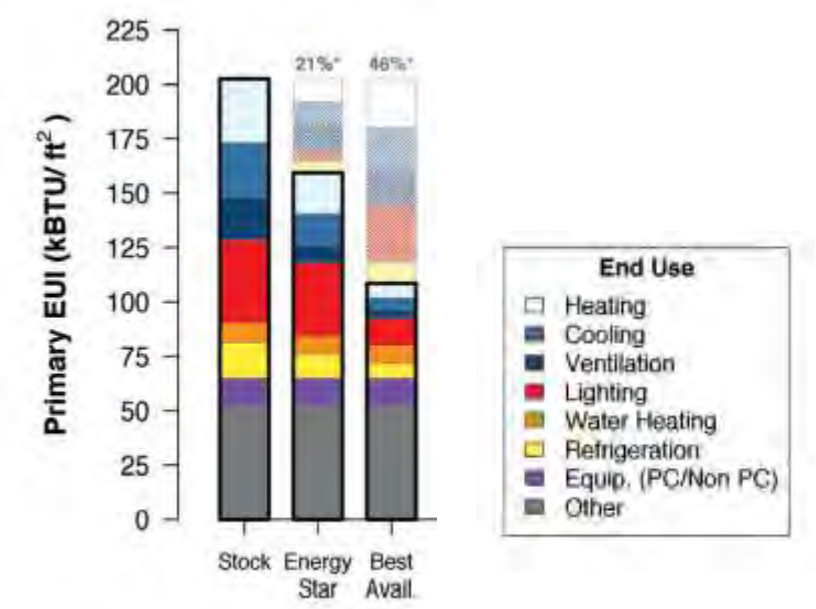


Figure 15 Potential Commercial Energy Savings (US DOE, Quadrennial Technology Review, Chapter 5, September 2015, page 146)

While the commercial and industrial buildings in Silverton vary in age and use, there are several improvements that any building can do to reduce energy use.

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 use 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.

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.

Municipal Energy Use

The Village of Silverton relies on electricity to power governmental functions ranging from facilities to lighting. Silverton has contracted with an energy provider that purchases electricity from renewable sources. While Silverton has eliminated its carbon output by purchasing green power, significant opportunities remain to reduce the amount of electricity that it consumes. Currently, most of the electricity used to provide governmental services is consumed by street lighting. Figure 16 provides a breakdown of electricity consumption by end use.

Figure 16: Village of Silverton municipal electricity consumption by end use 2018

	Percentage of electricity usage
Streetlighting	69.37%
Facilities	15.88%
Traffic lights	10.86%
Park and parking lot lighting	3.89%

Street Lighting

Street lighting plays an important role in economic growth and community safety. On average, it accounts for 40 percent of a municipality's electric bill. In the case of Silverton, street lighting account for over 69 percent of governmental electricity consumption.

Switching to energy efficient streetlights that utilize LED technology could help Silverton reduce its electricity use for street lighting by 50 percent or more. 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 streetlight 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 through its Better Buildings Outdoor Lighting Accelerator to assist local governments with this process.[10]

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

Silverton should evaluate the cost effectiveness of any proposal for street lighting improvements it receives from Duke Energy. Switching to LED fixtures should have a relatively short payback. If Duke Energy's proposal has what Silverton deems an excessive payback period, then there may be other replacement options it could pursue. Some local governments are purchasing the street lights back from their local utilities and financing the improvements through arrangements with an energy service company (ESCO). Funds are repaid through guaranteed savings achieved by the contractor. Another tool offered by ESCOs are tax-exempt lease purchases (TELP). Lease payments are made through the energy savings resulting from the lighting upgrades. TELP agreements are lease-to-own, so the local government will take control of the lighting at the end of the agreement.

Facilities

The Village of Silverton has made significant investments in energy efficiency in municipal owned facilities. The new Village Hall was renovated with energy efficiency in mind. The building was upgraded to include geothermal heating and cooling, LED lighting, energy efficient windows, and wall insulation. These measures will help the Village reduce energy costs relative to the old building.

Based on the large number of energy efficiency measures installed in the building, Silverton should investigate what it would need to do in order to receive a LEED certification from the U.S.

[10] https://betterbuildingsinitiative.energy.gov/outdoor-lighting-toolkit

Green Building Council or an ENERGY STAR certification from the Environmental Protection Agency and the U.S. Department of Energy.

The Village should also ensure that other municipal owned facilities are upgraded to reduce energy consumption. Future energy efficiency projects should focus on improvements with a relatively fast pay back including LED lighting and controls for lighting and HVAC systems.

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 2019, 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. It enables property owners to increase the value of their building and reduce energy costs with no down payment or personal guarantee. PACE is a simple and effective way to finance new construction and upgrades to buildings.

Strategies

- Continue working with Duke Energy to evaluate converting the Village's streetlights to LED fixtures.

Renewable Energy

The majority of energy used by Silverton residents and businesses is produced by coal or natural gas power plants. While these forms of energy are relatively cheap, they generate air pollution and releases large amounts of greenhouse gas. The American Lung Association's annual *State of the Air* report ranked Cincinnati 27th for the number of high ozone days and 18th for annual particle pollution out of over 200 metropolitan areas.

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 US Energy Information Agency projected a 400% 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 – solar, wind turbine, or

Paris Agreement

The Paris Agreement was reached in December 2015 with the aim of avoiding the most serious global impacts of climate change. The central goal of the agreement is to limit average global temperature rise to less than 2° C. This is to be accomplished by individual countries setting targets in reducing greenhouse gas (GHG) emissions. 197 countries signed the Paris Agreement. Over 186 countries, representing over 90% of the world's GHG emissions, have set targets to reduce emissions in furtherance of the Agreement.

The United States established the target of reducing GHG emissions to 26-28% below 2005 levels by 2030. The two main features of the US plan to meet this target is the Clean Power Plan and an increase of automotive fuel economy standards. The Clean Power Plan is a state-by-state plan to reduce carbon emissions from power plants by 32% by 2030, compared with 2005 levels.

In 2017, the United States announced its intention to withdraw from the Paris Agreement and began efforts to end the Clean Power Plan. In 2018, the Federal Government rolled back the previously adopted increases in automotive fuel economy standards. In the absence of national efforts to meet the Paris Agreement goals, some states have taken up their own initiatives to curb GHG emissions.

geothermal. Also, these energy sources provide power with no emissions. To be fair, there are also some distributed generation sources that are based on combustion and do involve emissions; such as municipal solid waste incinerators and gas turbine generators. Distributed generation improves 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, because it is located closer to the point of use, reduces line losses from the transmission of electricity over longer distances.

The public benefits of distributed generation are strong enough that the California Energy Commission now requires all new homes in the state be equipped with solar panels. Each new home and business adds to the need for new generating capacity, causing the existing power plants to work harder and, as a result, increasing air pollution. Once enough new homes and businesses are added a new power plant would be required to keep up with the demand. Solar panels can greatly offset the demand increase from new development, reducing air pollution and the need for additional power plants in the future.

Renewable energy offers clean, sustainable, and increasingly cost-competitive sources of energy. The two renewable sources that can be installed at the local level are solar and geothermal.

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 $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.

Fig 17: Solar panels are adaptable to most roofing types

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. Homeowners and commercial property owners can ensure that their system is designed and installed correctly by working with solar companies that have NABCEP certified employees on staff.

Currently, there are no properties in Silverton registered with the Public Utilities Commission of Ohio (PUCO) as certified solar facilities. However, because property owners are not required to register with the PUCO, there could be some commercial or residential properties in Silverton that have installed solar panels.

As part of a previous project, OKI built tool that estimates the solar potential of rooftops in the region. The tool is open for anyone to use at https://solar.oki.org . Many of the rooftops of commercial buildings show very good potential for solar.

There are several steps that the Village of Silverton can take to make it easier for property owners to invest in solar. Here are a few best practices a community can take:

- **Launch a Solarize Campaign –** The Village of Silverton currently partners with the Greater Cincinnati Energy Alliance to bring solar to its residents and businesses. 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.

- **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 Silverton requires in order to permit a solar installation.

Geothermal

Geothermal heat pumps, or ground source heat pumps, use the constant temperature of the earth for heating and cooling. Most geothermal systems circulate a refrigerant through a closed loop that is placed in horizontal or vertical wells dug in the ground. The refrigerant is used to extract heat from the ground in the winter and to transfer heat back into the ground in the summer. The refrigerant then passes through a heat exchanger where it is distributed through a forced air system.

Because geothermal systems rely on the temperature of the earth, there's no onsite combustion and therefore no emissions of carbon dioxide, carbon monoxide or other greenhouse gases like there is with a gas furnace or boiler. However, the heat pump unit does use a small amount of electricity, which may be generated using fossil fuels.

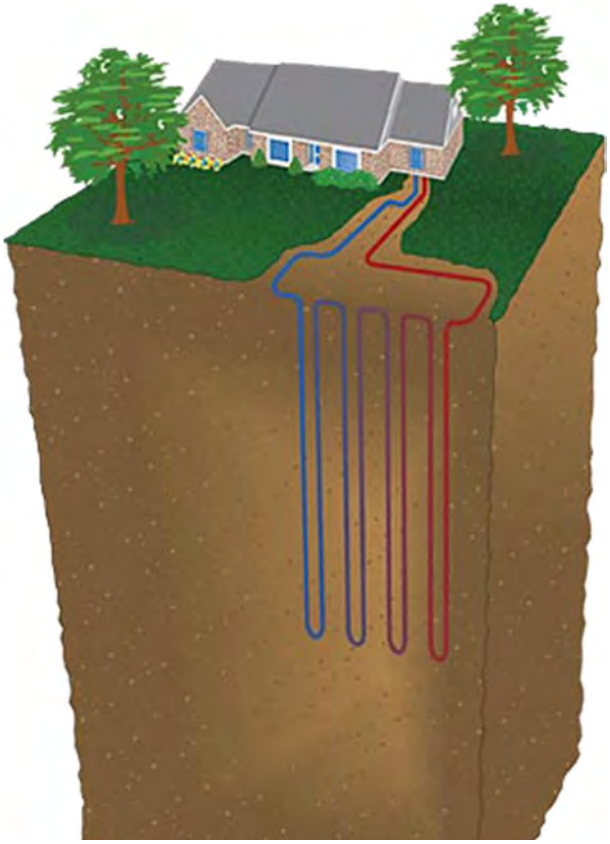


Fig 18: Geothermal systems use the consistent temperature of the earth to more efficiently heat and cool buildings

Geothermal systems are expensive to install due to the costs associated with digging the wells, but they can reduce annual operating costs by up to 50 percent. Their performance is impacted by extremely cold temperatures, so it is important to have a back-up source of heat such as electric resistance heat or a gas furnace that can turn-on when needed.

Property owners should work with a contractor that is certified by the International Ground Source Heat Pump Association (IGSHPA) to ensure that the system is designed and installed correctly.

Strategies

- Adopt a 100% renewable source for Silverton's electric aggregation program and set a goal of maintaining at least 50% enrollment to ensure that the Village has reduced its GHG emissions enough to reach the level of the US pledge to the Paris Agreement.
- Promote solar through the following methods:
    - Launch a Solarize Campaign
    - Address Solar in the Zoning Code and other Local Ordinances
    - Develop a Permit Checklist

Appendix A: Silverton Energy Survey Results

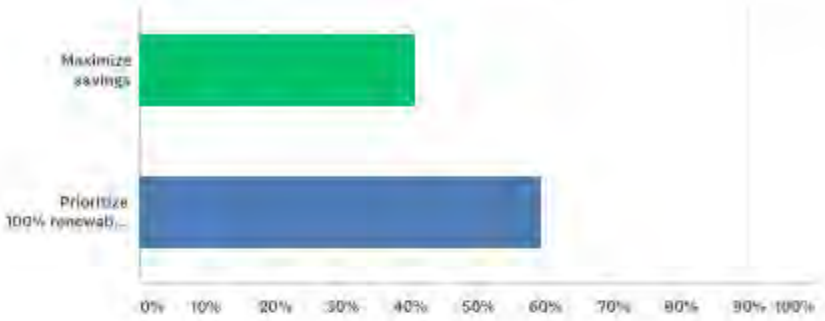
The Silverton Energy Survey was launched in January 2019 and promoted in the following ways:

- Targeted Facebook posts to residents living in the Silverton area
- Via the Energy Plan Website, https://energy.oki.org
- In person to the Silverton Blockwatch Group

By February 13, 2019, the survey received 71 responses. The results of these responses are analyzed in the following pages.

Q1 Would you prefer Silverton to continue selecting the energy provider offering the lowest price, or would you rather Silverton select a provider offering 100% renewable energy, such as solar or wind power, even if it costs a bit more?

Answered: 71 Skipped: 1



ANSWER CHOICES	RESPONSES	
Maximize savings	40.85%	29
Prioritize 100% renewable energy option	59.15%	42
Total Respondents: 71		

1 / 9

Q2 What is your primary motive for wanting to reduce energy consumption? Place these motives in order of importance to you.

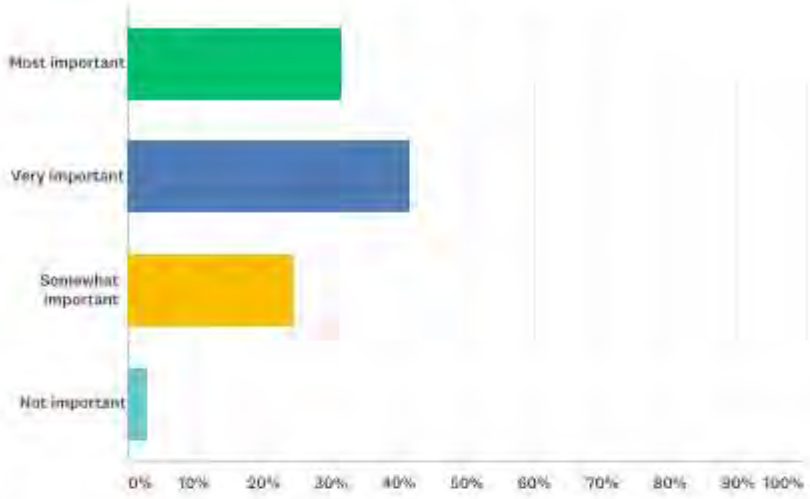
Answered: 68 Skipped: 4

	1	2	3	TOTAL	SCORE
Saving money	47.06% 32	14.71% 10	38.24% 26	68	2.09
Reduce air pollution in the region	13.64% 9	60.61% 40	25.76% 17	66	1.88
Slowing the man-made effects on climate change	40.00% 26	24.62% 16	35.38% 23	65	2.05

2 / 9

Q3 How important to you is reducing the harm to the environment caused by fossil fuels?

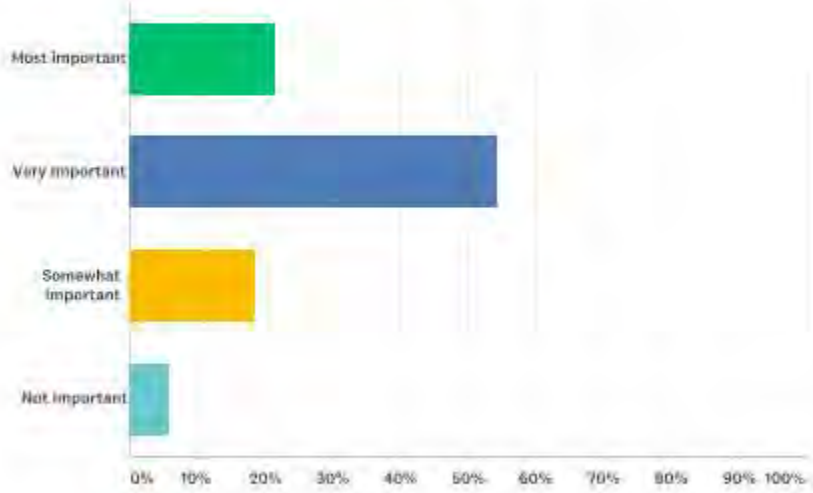
Answered: 70 Skipped: 2



ANSWER CHOICES	RESPONSES	
Most important	31.43%	22
Very important	41.43%	29
Somewhat important	24.29%	17
Not important	2.86%	2
TOTAL		70

Q4 How important is it that Silverton address the issue of energy burden among its most vulnerable residents?

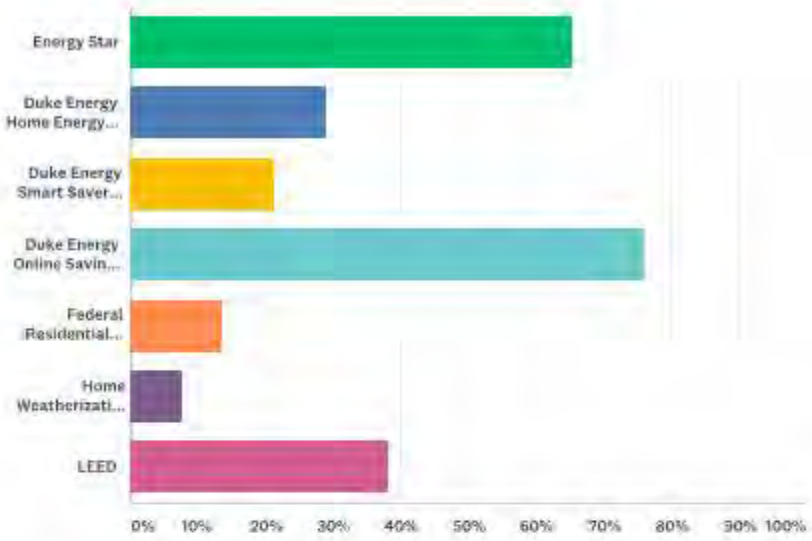
Answered: 70 Skipped: 2



ANSWER CHOICES	RESPONSES	
Most important	21.43%	15
Very important	54.29%	38
Somewhat important	18.57%	13
Not important	5.71%	4
TOTAL		70

Q5 Please indicate which of the energy efficiency programs you are familiar with:

Answered: 66 Skipped: 0

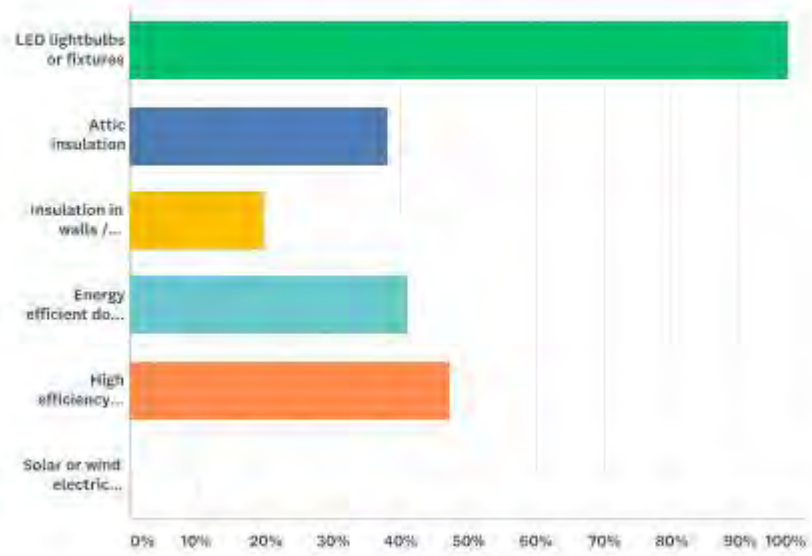


ANSWER CHOICES	RESPONSES	
Energy Star	65.15%	43
Duke Energy Home Energy House Call	28.79%	19
Duke Energy Smart Saver rebate program	21.21%	14
Duke Energy Online Savings Store for LED lightbulbs	75.76%	50
Federal Residential Renewable Energy Tax Credit	13.64%	9
Home Weatherization Assistance Program (HWAP)	7.58%	5
LEED	37.88%	25
Total Respondents: 66		

5 / 9

Q6 Have you installed any of the following energy efficient upgrades in your home?

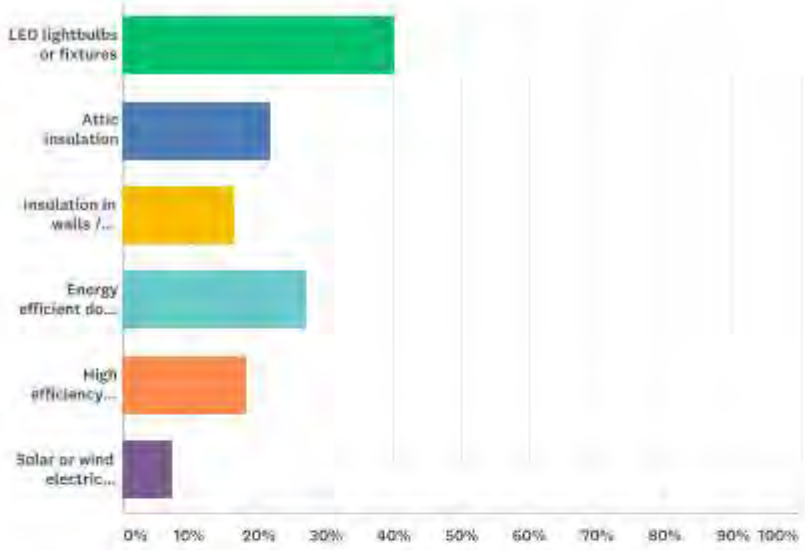
Answered: 66 Skipped: 0



ANSWER CHOICES	RESPONSES	
LED lightbulbs or fixtures	96.97%	64
Attic insulation	37.88%	25
Insulation in walls / crawlspace	19.70%	13
Energy efficient doors and windows	40.91%	27
High efficiency furnace / air conditioner	46.97%	31
Solar or wind electric generation	0.00%	0
Total Respondents: 66		

Q7 Do you plan to install any of these energy efficiency improvements in your home or business in the next 2 years?

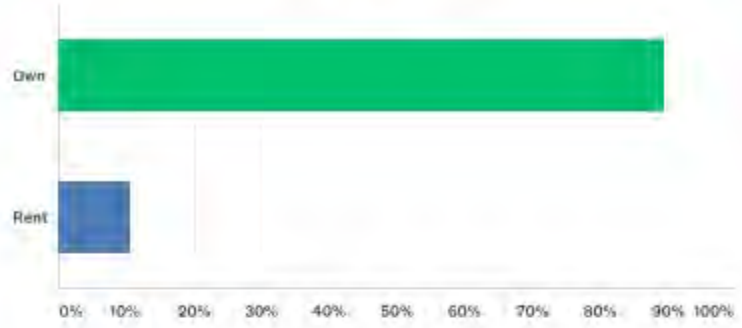
Answered: 55 Skipped: 17



ANSWER CHOICES	RESPONSES	
LED lightbulbs or fixtures	40.00%	22
Attic insulation	21.82%	12
Insulation in walls / crawlspace	16.36%	9
Energy efficient doors and windows	27.27%	15
High efficiency furnace / air conditioner	18.18%	10
Solar or wind electric generation	7.27%	4
Total Respondents: 55		

Q8 Do you own or rent your home?

Answered: 67 Skipped: 5



ANSWER CHOICES	RESPONSES	
Own	89.55%	60
Rent	10.45%	7
TOTAL		67

8 / 9

Q9 The name of the street I live on is

9 / 9

Appendix B: Improvements to Building Energy Efficiency

Attic insulation: Energy continued to be cheap during the 1950s, so attic insulation was not commonplace. The second floor of Cape Cod style homes built during this period are often hot in the summer and cold in the winter due to the lack of insulation. The attics, slopes, and knee walls of Cape Cod style homes should be properly insulated to save energy and improve comfort. Ranch style homes are easier to insulate due to the open attic spaces and may have already had insulation added. ENERGY STAR recommends that attics in this region have insulation levels between R38 and R60.

Vermiculite is a lightweight brownish-gold mineral that became a popular insulation material in the 1950s. Unfortunately, most of the vermiculite used in insulation was contaminated with asbestos. If you suspect that your insulation is vermiculite, do not disturb it. Contact a qualified professional to test the insulation for asbestos. Vermiculite insulation must be removed before additional insulation is installed. Homeowners may qualify for financial assistance with removing vermiculite.

Windows: Home built during this period originally had steel or aluminum single pane windows which were viewed as an upgrade over wood windows. The windows were not designed to prevent air infiltration or to provide any insulation value. While replacement with modern energy efficient windows is the best solution, windows that are not replaced should be sealed and caulked to reduce infiltration. Storm windows are a more cost-effective option to replacement, but do not provide the benefits associated with new windows.

Air sealing: Homes from this period often 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 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 95% efficient ENERGY STAR unit. In addition, all accessible distribution piping should be insulated. Other homes may have a forced air system that was installed at some point in time. 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.

Appendix C: Urban Heat Island

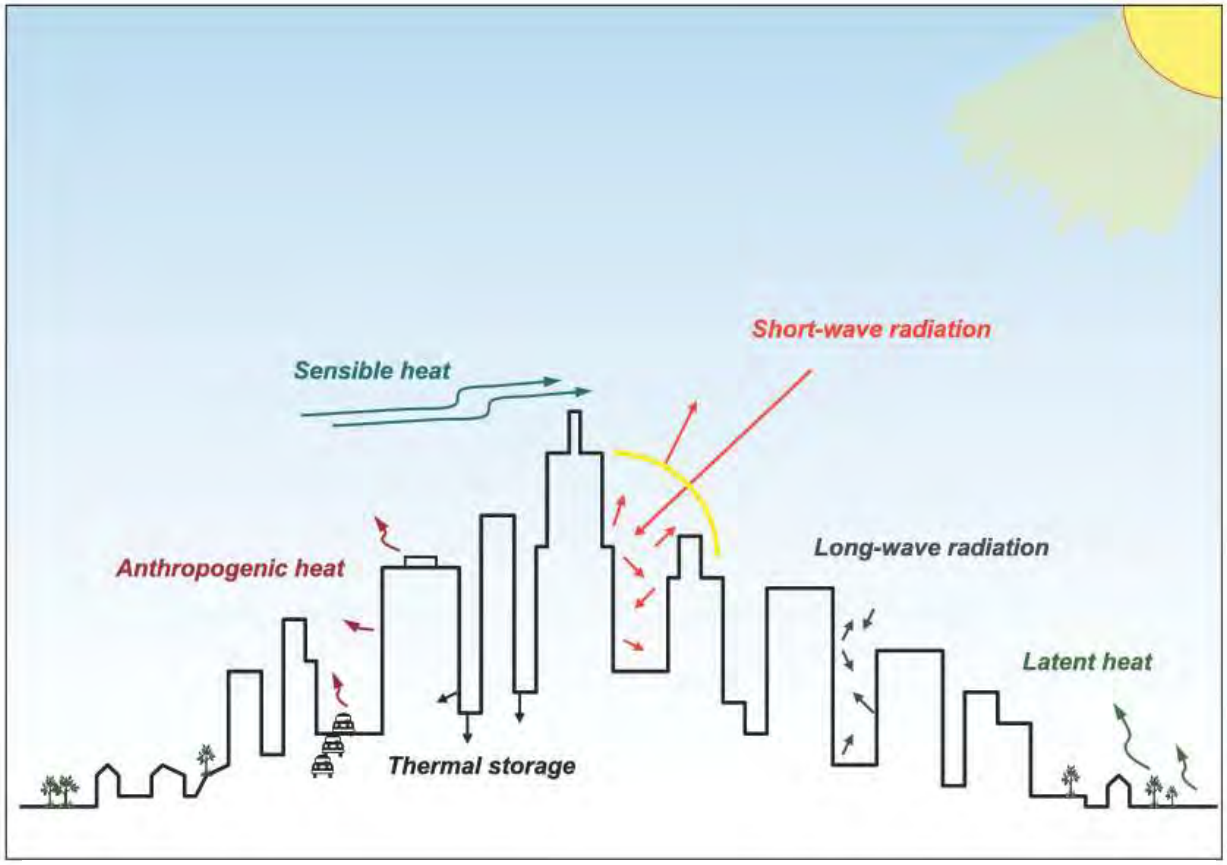


Fig 7: Sources of Urban Heat Island Effect (US EPA)

The urban heat island effect is created by impervious surfaces, such as roads, parking lots, and buildings, which retain heat from the sun's radiation. At night, these surfaces release the retained heat, creating a localized area of higher temperatures. Localized "hot-spots' combine to create a dome of hot air over a metropolitan area.

Impervious surfaces causing increased heat values:

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

Appendix D: Ways of Addressing Rental Housing Split Incentive

Incentives

Incentives are a very 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 study[11] found that an incentive covering 80% of the cost of an improvement was necessary to spark interest from 50% of landlords eligible for the program. That is a lot of money needed to gain just moderate interest in the program.

Other factors affect 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 isn't 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.

[11] Nexus Market Research, Inc. 2005. "Results of Focus Groups Among Landlords Eligible for the MassSAVE Program: Draft." Cambridge, MA.

Literature review[12] uncovered two ways a TBA program can be structured. 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, locally Duke Energy, 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 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, efficiency of

[12] Williams, Beth E. 2008.."Overcoming Barriers to Energy Efficiency for Rental Housing" Master's Thesis for the degree of Master in City Planning, Massachusetts Institute of Technology, pg. 31-39

heating systems, and sometimes includes a measurement of air-tightness using a blower door test.

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.

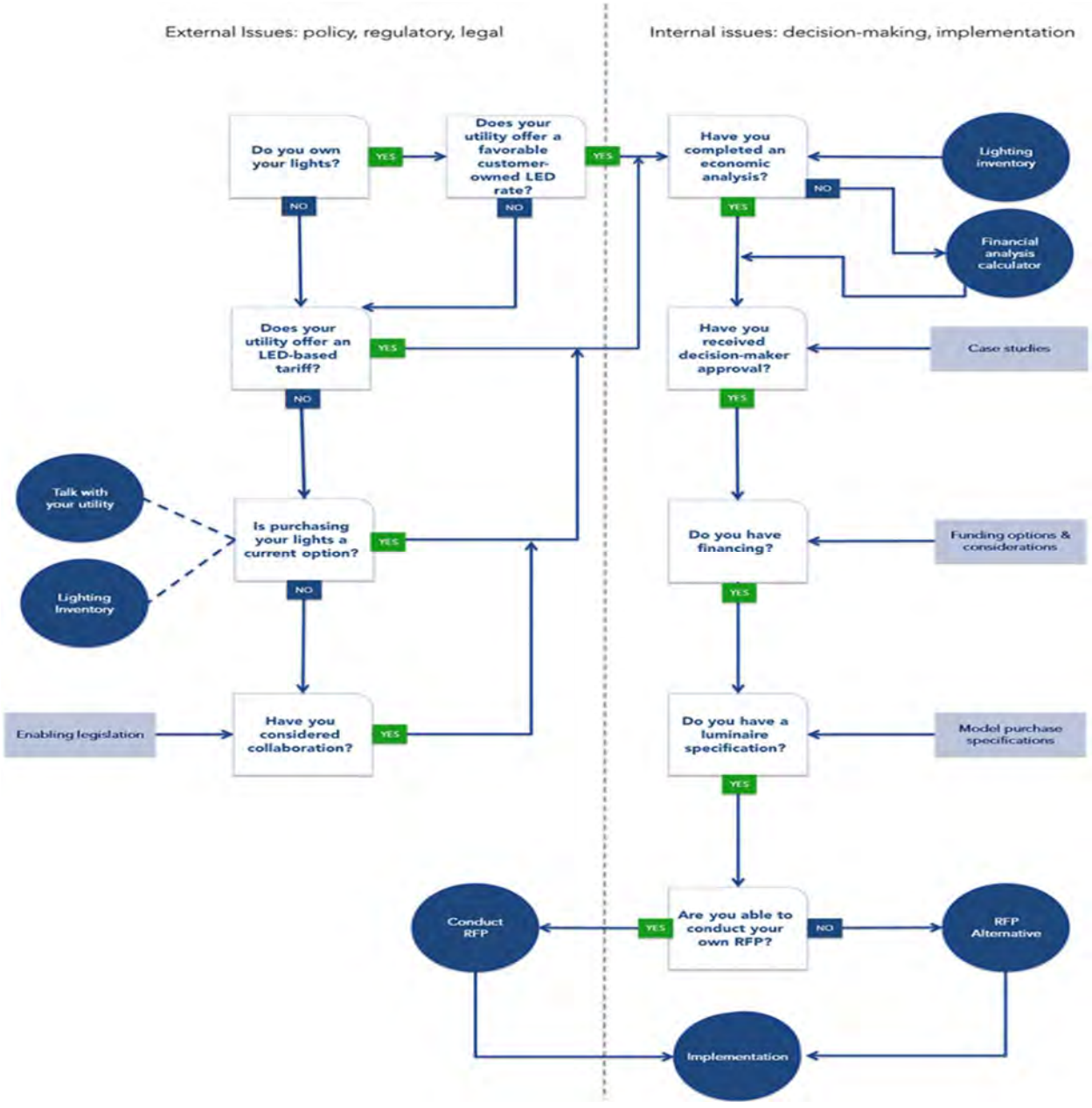
One example – Burlington, VT – specifically targeted rental properties in its RECO ordinance. The text of this ordinance is included in the Appendix of this plan. The Burlington ordinance contains a few key compromises: first, if a property is not found to be in compliance with the ordinance at the time 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, Silverton 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 E: Municipal Decision Tree for Upgrading Street Lighting

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.



Source: https://betterbuildingsinitiative.energy.gov/solutions-at-a-glance/outdoor-lighting-decision-tree-tool-successful-approaches-cities-states-and