VERNON COUNTY ENERGY DISTRICT

ELECTRIFY / DECARBONIZE

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OWN & PRODUCE ENERGY LOCALLY

***Project Title: Comprehensive Energy Plan for Vernon County***

**Vernon County Energy District**
www.vced.energy

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**Vernon County Energy District Board of Directors**
Alan Buss, President
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# Introduction

After more than a century of building, maintaining, and nursing a national electric grid, the need to transform our energy resources and delivery is vital. The simple science relating to the environmental impacts of increased carbon dioxide in our atmosphere implores that we shift from fossil fuels to clean, renewable and more efficient local generation for our energy needs. This imperative is not only environmental, though that is the primary impetus for electrification and decarbonization.

For many people, the impulse to transform their relationship to energy is economic. In our work with stakeholders across the region, we focus on the cost savings as a result of the shift to locally generated and owned electricity. As Bill Nussey points out in his book *Freeing Energy,*[1] innovation for least cost kWh today is in technology and electronics, rather than fuel.The extremely costly process of extraction, transport, and combustion to meet our energy needs is no longer needed.  But to get there planning must start promptly.

In the 20th century the grid was built for centralized generation, which gave access to electricity to millions of people across the country. However, in the 21st century technological advancements mean that electricity can be produced from sun, wind and water and loads can be shaped to match more distributed and locally-owned generation.

Much of the transformation now underway will take place through new markets and rural economies.  But the glue that connects technology to finance and political will is planning. Good planning begins with an assessment of the current state, including monitoring and analysis of choices. The energy district model serves as a catalyst by providing access to information and technology through a non-profit entity.  Stakeholders benefit from the knowledge and experience of “energy coaches” and program coordinators by sharing data and financial considerations across a diversity of stakeholders. In this way, the fundamental values and goals to electrify and decarbonize are realized. Popular education to help people understand and plan for this energy transition creates opportunity for a better future.  Energy districts provide a way to organize stakeholders at both a local and regional level and show the path to understand the challenges ahead, plan for resiliency and develop cost-saving investments in our communities.

# Chapter 1: Context of the Plan

## Vernon County Energy District – An Introduction

In the summer of 2019, a group of community members in Vernon County were growing increasingly concerned by the lack of local progress and planning to transition away from fossil fuels. This group believed that the cost of doing nothing was too great and urgent action was needed. In November 2019 they invited Joleen Jansen of the Clean Energy Districts of Iowa (CEDI) to give a presentation on their model and discuss their significant achievements in energy planning, policy development, and public education since 2010.

The Vernon County Energy District (VCED) was incorporated as a 501(c)(3) nonprofit on April 22, 2020. VCED is the tenth energy district formed in the U.S. and the first one in Wisconsin.

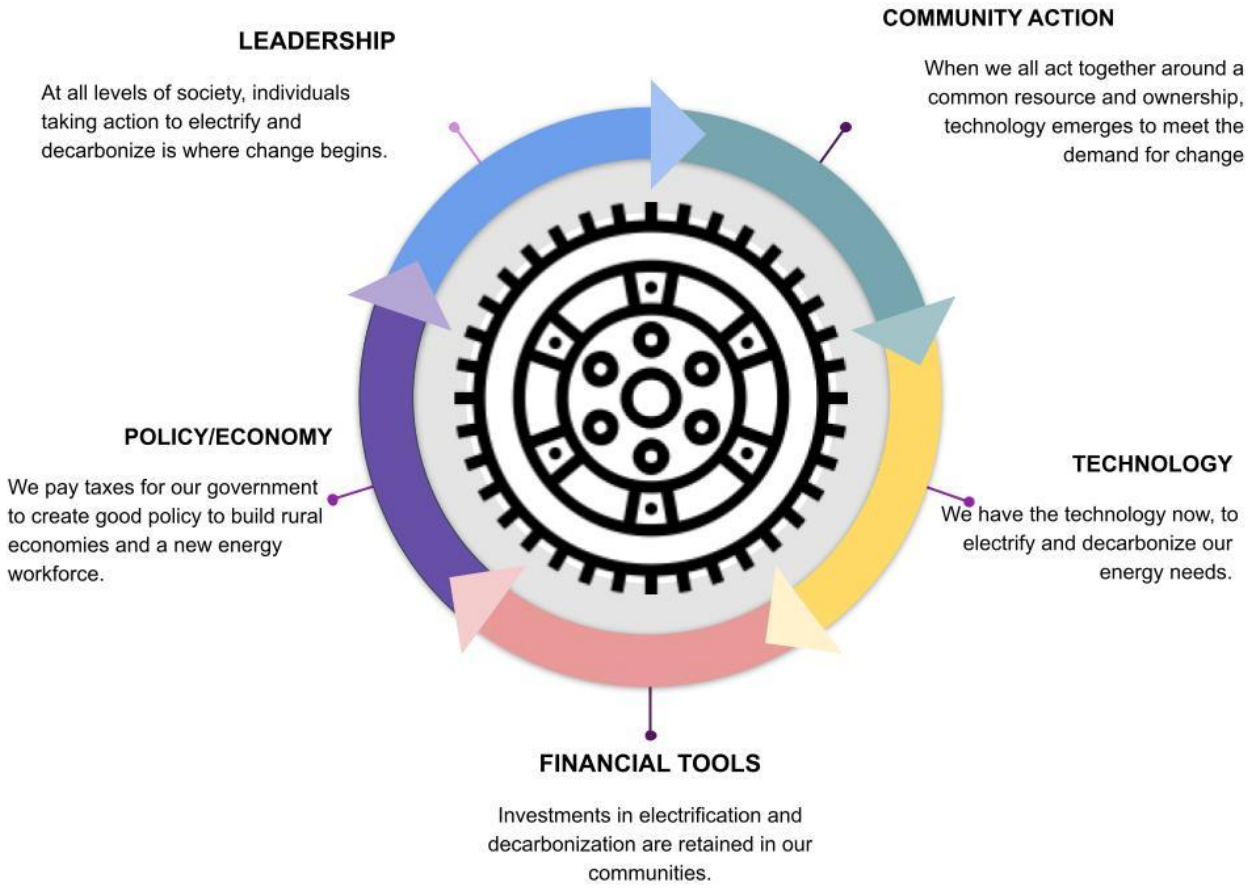
The conceptual framework of the energy district is based upon the soil conservation districts founded in 1933 in Coon Valley, WI.  Farmers and ecologists collaborated to protect water and soil as foundational to

[1] Nussey, B. (2021). Freeing Energy: How Innovators Are Using Local-scale Solar and Batteries to Disrupt the Global Energy Industry from the Outside In. United States: AnEnergyProject, LLC.

agricultural production. That synergy led to the soil conservation district model being replicated across the country.

In a similar vein, energy districts foster the development of locally-tailored energy solutions that account for the unique demographic, geographic, and regulatory factors in a particular county. Energy districts facilitate cooperation between diverse public and private stakeholders, educate the public on current technologies, stimulate the local economy by promoting investment in energy projects and jobs, and support individual and community actions toward the adoption of energy efficiency measures and renewable energy production.

Energy District Flywheel of Change




## Brief History of Utilities

At the start of the 20th century, the electric system was limited primarily to urban areas and owned by private companies known as Investor-Owned Utilities (IOU). Shortly thereafter, cities and municipalities started to form their own publicly-owned municipal utilities. Electric utilities were given monopoly status around this time to keep costs lower for ratepayers by limiting unnecessary and costly redundancies. The Wisconsin Public Service Commission (PSC) was created in 1907 to keep a check on IOUs and municipal utilities.

Meanwhile, less than 10 percent of rural people had access to electricity.[2] When Congress passed the Rural Electrification Act (REA) in 1936, it paved the way for millions of farmers and rural community members across

[2] National Rural Electric Cooperative Association. "The Electric Cooperative Story." https://www.electric.coop/our-organization/history

the country to create member-owned electric cooperatives and apply for funding to build the transmission lines that would reach the countryside. In exchange for member self-regulation, electric co-ops were required to sell electricity to their members at cost.

The IOU as a private, for-profit corporation owned by shareholders, who are often not from the area the utility serves, seeks primarily to provide a return on investment. IOUs inherently benefit from building infrastructure, like power plants and high voltage power lines, which are designed to provide a guaranteed rate of return. IOUs provide 83% of end user electricity sales in Wisconsin.[3] Two IOUs serve Vernon County: Alliant Energy and Xcel Energy.

Municipal utilities (munis), owned and operated by the communities they serve, are public utilities. Like IOUs they serve villages and cities with more population density. However, they operate as a non-profit and provide at-cost electricity rates to their customers. Since they do not typically own power plants or high voltage transmission lines, they buy electricity from outside sources. But they have control over what power supply sources they choose. Munis provide 11% of retail electricity sales in Wisconsin.[4] Vernon County is served by three munis: La Farge, Viola, and Westby.

Today, the US has over 800 rural electric co-ops. They cover the largest land mass and have a more dispersed customer base resulting in fewer electrical meters per mile of lines and poles. Co-ops provide 6% of the retail market in Wisconsin.[5] Vernon county residents and businesses have membership in three co-ops: Richland Electric Co-op, Scenic Rivers Electric Co-op, and Vernon Electric Co-op.

## Vision Statement and Guiding Principles

VCED envisions a Vernon County with 100% locally-owned and locally-produced renewable energy.

Our mission is to retain our annual energy expenditures in Vernon County by:

- Promoting wise and efficient use of energy
- Transitioning to locally-owned and locally-operated renewable energy sources
- Engaging the public through education, workforce development, energy planning, market transformation
- Collaborating with local businesses, utilities, and governments

**Vernon County exports around $76 million in energy costs annually.**[6] This equates to an annual trade deficit of $10,000 per family of four. Our reliance on fossil fuels is a tax on our rural economy, our social well-being, and our environment. Instead of fueling these distant giant oil and gas corporations with our millions of dollars, VCED believes we can better fuel our local economy, creating good local jobs while improving the environment.

Particularly in low-income rural communities, locally-owned and locally-produced renewable energy is a leap toward a clean energy future with a higher standard of living via low cost electrification. By encouraging and

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[3] Wisconsin Academy of Sciences, Arts & Letters. (n.d.). *Your path to cleaner, greener energy ...starts with knowing your provider:*. Retrieved 10 11, 2022, from https://www.wisconsinacademy.org/node/8075

[4] (Wisconsin Academy of Sciences, Arts & Letters, n.d.)

[5] (Wisconsin Academy of Sciences, Arts & Letters, n.d.)

[6] David Abel, and Katya Spear. Wisconsin Opportunity in Domestic Energy Production: The Economic and Health Benefits of 100 Percent In-State Energy Production. COWS, 2019.

facilitating new renewable energy generation and storage, while prioritizing energy savings and efficiency measures, Vernon County will raise the standard of living and also reach 100% energy independence.

## Guiding Principles

1. Equity
2. Resiliency
3. Innovation
4. Local Energy Independence
5. Cooperation and democracy

### Equity

While increased energy costs, health impacts, environmental burdens, and climate change affect all Vernon County residents, the social and economic impacts are not felt equally across all communities. Populations that face socio-economic barriers (e.g. poverty, unemployment, physical and/or intellectual disabilities, housing instability, etc.) experience increased vulnerability to extreme weather events and other related burdens. When compounded, these conditions may reduce a group's ability to avoid, recover from, and/or adapt to hardship.

Home inefficiency in the form of poor insulation, aging appliances, and outdated equipment makes it difficult for residents experiencing economic hardship to pay their bills when faced with a rise in costs of electricity, natural gas, and gasoline in combination, thus putting them at risk of having their service disconnected or having an additional economic burden.

Energy costs absorb a proportionately larger share of the household budget of lower-income families, and energy efficiency and electrification measures often feel out of reach for many. VCED seeks to advance energy solutions that work for everyone, particularly those most affected by climate, economic, and racial injustice. We believe that individual action and responsibility are important pieces of the puzzle, but not the only pieces. We aim to create a path that attracts and works for all by increasing meaningful participation in local decision-making processes and by incorporating collective solutions like community solar, innovative financing options such as on-bill financing and LEG Up Loans, savings from energy efficiency improvements, and more.

### Resiliency

Resiliency requires the ability to anticipate, prepare for, respond to, and recover from the impacts of climate change. These impacts include extreme weather events and flooding, as well as the various social and economic impacts of related shocks and stresses. In recent decades, Vernon County has experienced increasingly intense and more frequent storms that have caused millions of dollars in damages, displacement, and social and emotional turmoil.[7] Since 2000, the county has been included in 11 weather-related (severe storms, flooding, tornadoes, etc.) Federal Disaster Declarations compared to just 4 the previous two decades.[8]

Communities that experience repeated disasters struggle to recover as their wealth is eroded again and again with each recurring disaster. Social connections and mental health can suffer.

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[7] Vernon County. (n.d.). *Emergency Management Home*. Vernon County, WI. Retrieved October, 2022, from https://www.vernoncounty.org/departments/emergency_management/index.php

[8] *Disaster Declarations for States and Counties*. (2021, February 25). FEMA. Retrieved October 24, 2022, from https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Municipal governments, utilities, businesses, community-based organizations, and individuals are critical stakeholders in our energy planning and action efforts. VCED values collaboration, action, and accountability to build stronger community networks and infrastructure that minimize risk and increase resiliency. Communities that come together and help one another through crises are more likely to develop abilities to face the likely increasing challenges of climate change.

**Innovation**

Over the past 140 years, countless scientists, engineers, laborers, and policymakers built today's electric grid. This system has changed and evolved to accommodate some new technologies, increases in electricity demand, and a growing need for reliable, diverse sources of electricity.

Our current grid was designed to transmit electricity from large, centralized power plants, most of which use dirty sources like coal and natural gas. As the consequences of global warming emissions increase and new technologies that provide cleaner and more economical energy sources become more widely available, our grid is becoming increasingly outdated.

We are in the midst of an energy transition and paradigm shift driven by economic, environmental, and social pressures that point to renewable energy, electrification, and improved efficiency and storage technologies as the solutions needed to get us safely to a carbon-neutral economy. Continuous innovation and adaptation by all levels of society are critical to this transition.

**Local Energy Independence**

With approximately $76 million leaving the county annually that end up supporting oil and gas companies outside of Vernon County and Wisconsin, instead these millions of dollars could be invested in locally-owned and renewable generation and  storage alternatives. Solar, wind, and geothermal energy are three generation sources that are affordable and ripe for further development in our rural county. Battery storage alternatives are rapidly being adopted nationwide, scaling from single homes to entire communities. Billions of dollars have been allocated to battery advancement in the Inflation Reduction Act.

Transitioning to local energy resources would bring dollars and jobs back to Vernon County. This represents a vital opportunity to reinvest in our rural economy and serve local community needs.

**Cooperation and Democracy**

Monopoly status given to electric utilities served an important purpose over the past century while the early grid was being built and rural electrification was key. However, monopoly status, centralized power supplies, enormous lobbying budgets, and the energy sector's deeply enmeshed relationship with the fossil fuel industry are current impediments to growing cooperation and clean energy democracy at the community level.

Opportunities exist for electric utilities to partner with locally owned and produced sources of energy and to contribute to increased individual and community resilience.

The current moment of transition towards a clean energy future is at a turning point, and the need for strategic response and action is critical. This requires greater public engagement, awareness, community-based decision-making, and innovative business models that move from wealth extraction towards transparency, accountability, equity, and action. VCED supports education, engagement, and greater participation of utility

customers, co-op members, and local citizens in the planning and decision-making processes of local governments and utilities.

## Purpose of the Plan

In 2020, Vernon County became the first county in Wisconsin to organize an energy district. This energy plan shares the story of that effort, the results and findings from the first year of local energy planning and action, and a view into the current and potential future energy ecosystem of Vernon County.

Vernon County, the City of Viroqua, and the Villages of La Farge and Viola participated in the 2010 Wisconsin Energy Independent Community Partnership and have taken various steps to create and implement 25x25 energy plans. The plans set goals to increase the renewable energy portfolio to 25% by 2025. Viroqua, the county seat of Vernon County, updated its plan in 2020, and La Farge is also actively updating its plan. These recent and ongoing planning efforts laid the groundwork for assessing how county and municipal governments manage and view energy infrastructure.

The VCED plan offers a different and otherwise-missing perspective by looking closer at energy infrastructure at the household and business levels, thereby helping to paint a clearer picture of the education, tools, services, and technologies that would support local residents and business owners to reduce their energy burdens, increase resiliency, and ultimately save on costs.

We believe that Vernon County can be a leader in the energy transition and a model for other rural communities and counties to follow. The goals and recommendations outlined in this plan should be understood as ambitions that cannot be entirely achieved within current budgets, policies, and structures. Our hope is that this plan will help lay the foundation, framework, and priorities for the ongoing work needed to make an equitable and timely energy transition in Vernon County.

## Background on the Plan's Development

Shortly after VCED was incorporated in April 2020, we organized a Drive Electric event that showed off a number of electric vehicle (EV) models available at the time, to introduce ourselves to the community and to begin to understand the opportunities and challenges of electrification and decarbonization in Vernon County.

A few months later we set up a booth at the Vernon County Fair to further introduce VCED as a new community-based organization and gauge interest in our mission. For four days, we fielded questions about residential solar, worked to debunk myths about electric vehicle range and charging, and even raffled off an electric lawnmower. It quickly became clear that the public learning curve was steep and that misconceptions ran deep. This was a vital moment in our process to create accessible messaging and education tools that would be taken seriously and acted upon by a broad-based group of diverse stakeholders in the community.

The energy district model was created because of this precise need—greater knowledge, understanding, coordination, and leadership around local energy systems and issues. VCED held a community visioning session in late September 2021 and kicked off its public educational series, *Rural Re-Charge*, in October 2021. The three sessions conducted from October to December 2021 brought together speakers from both inside and outside the county,  and centered on providing the community with a high-level introduction to our energy system, the challenges we face, and potential solutions.

By the end of the year, VCED established three action teams composed of community volunteers to carry out the goals of the energy plan and its greater mission. These teams would collectively go on to create and carry out the residential and business energy assessment program that guided our work over the next six months.

During this period, VCED provided 310 residential and 22 business energy assessment reports with almost half of them receiving an onsite home energy audit and/or an energy consultation.

Through the process of talking directly to local community members about their energy usage, looking at their energy systems, and answering their questions, several trends emerged:

1. Individual views and knowledge of energy systems and technologies are wide ranging. Some clients may know a lot about one particular aspect (e.g., lighting) but not much about other aspects (e.g., HVAC).
2. Energy costs drive energy conservation and investment in renewables. During the months of January, February, and May 2022—when natural gas prices spiked—VCED saw a surge of participation and interest in the energy assessment program, which continued for several months following the initial price spike.
3. Inflexibility and lack of knowledge by service providers (i.e., contractors, HVAC, electricians, etc.) and utility rate structures inhibit residents and businesses from making more cost-effective efficiency upgrades and investments in clean energy options.
4. Home energy monitors installed by VCED help residents better understand their energy loads, diagnose energy leaches and inefficiencies, and set goals for electrification and decarbonization upgrades.

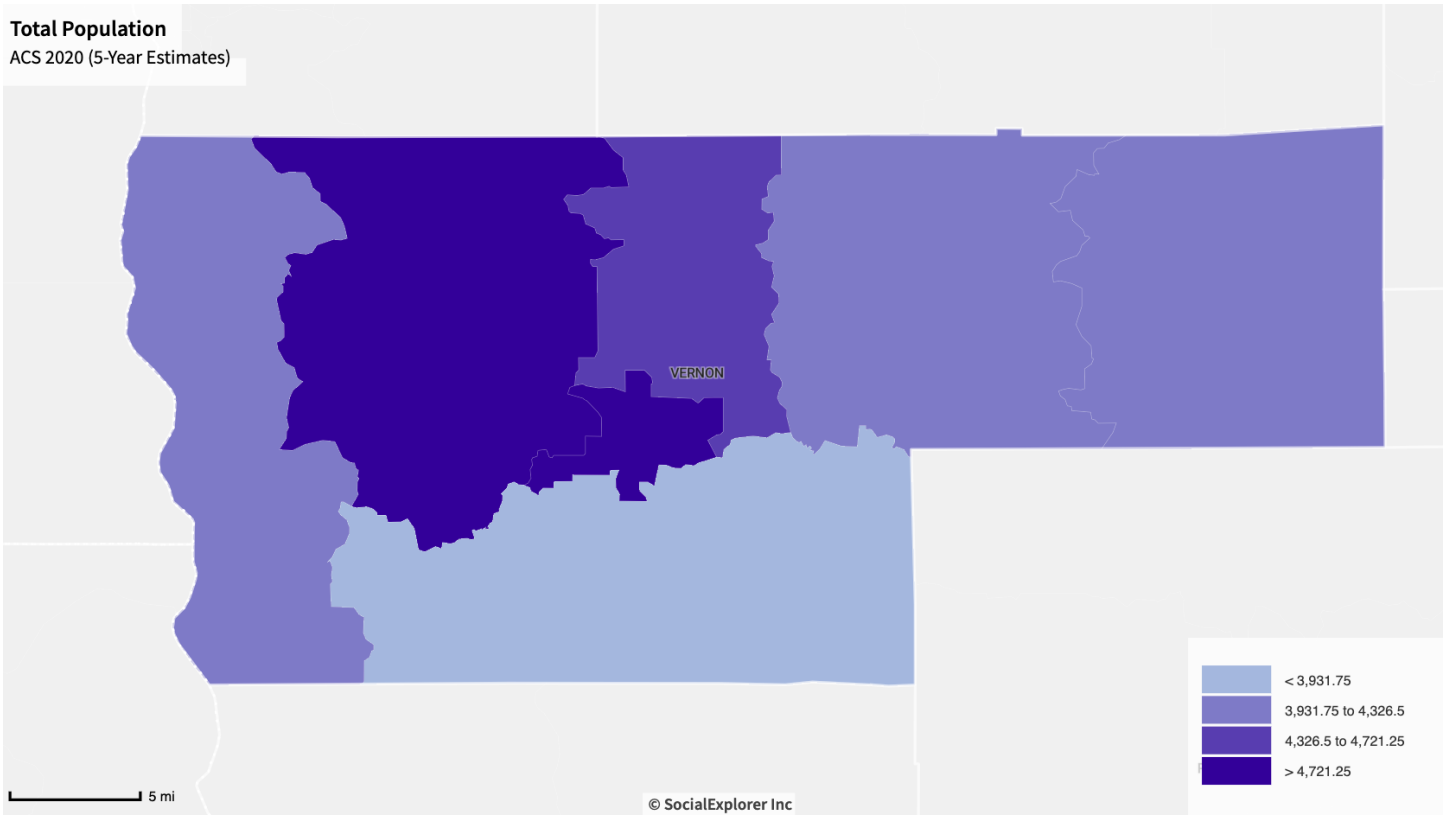
Feedback from VCED volunteers, clients, and community partners are incorporated throughout this report.

The inaccessibility and limitations of energy data sources at all levels, particularly at the county, utility, and local levels, presented challenges for VCED and other interested entities to carry out energy planning. We are thankful to the few utilities and municipalities that were willing to share cost and use data with us for assessment and planning purposes.

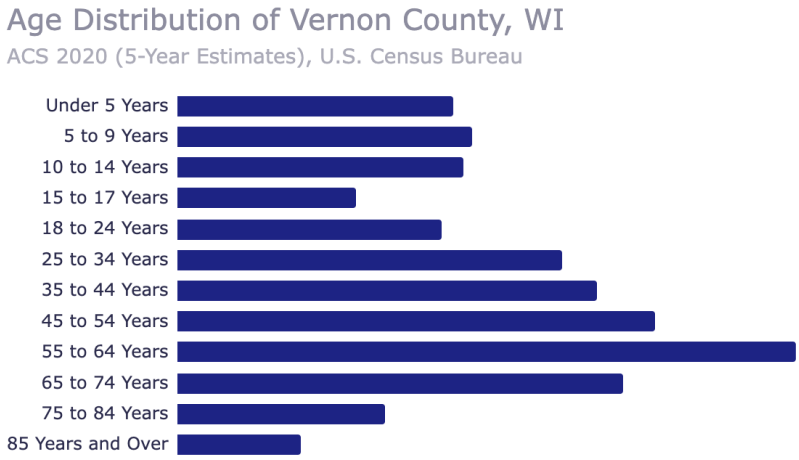
# Chapter 2: Existing Conditions

## Demographics of Vernon County

According to the 2020 U.S. Census, the population of Vernon County is 30,714. The county increased by 943 people or 3.2% between 2010 and 2020. The land area is 792 sq miles and has a population density of 39 people per sq mile. As seen in the *Total Population* map, the highest populated area is in the middle of the county and home to the county seat, Viroqua, which is the largest city in the county.

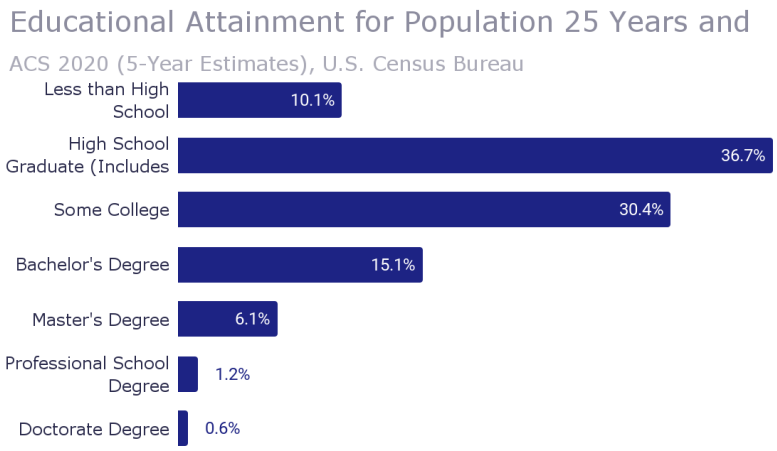



The median age is 42.2 which sways toward a larger aging population. The largest age group is between 55 to 64 years and just approaching retirement. The population is 97% white and 2% identify as two or more races; 11% live with a disability.



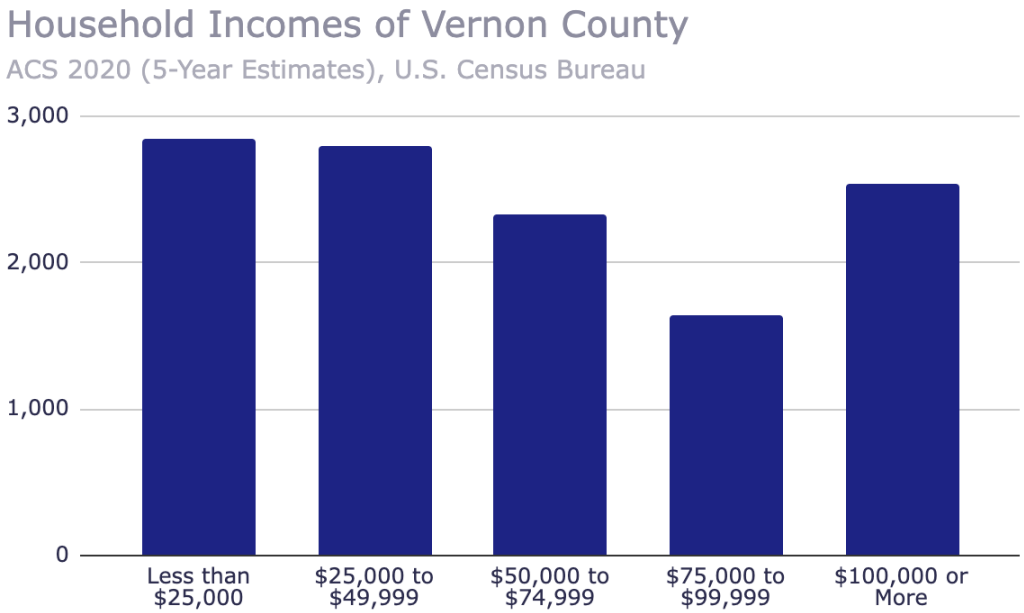
## Education & Employment

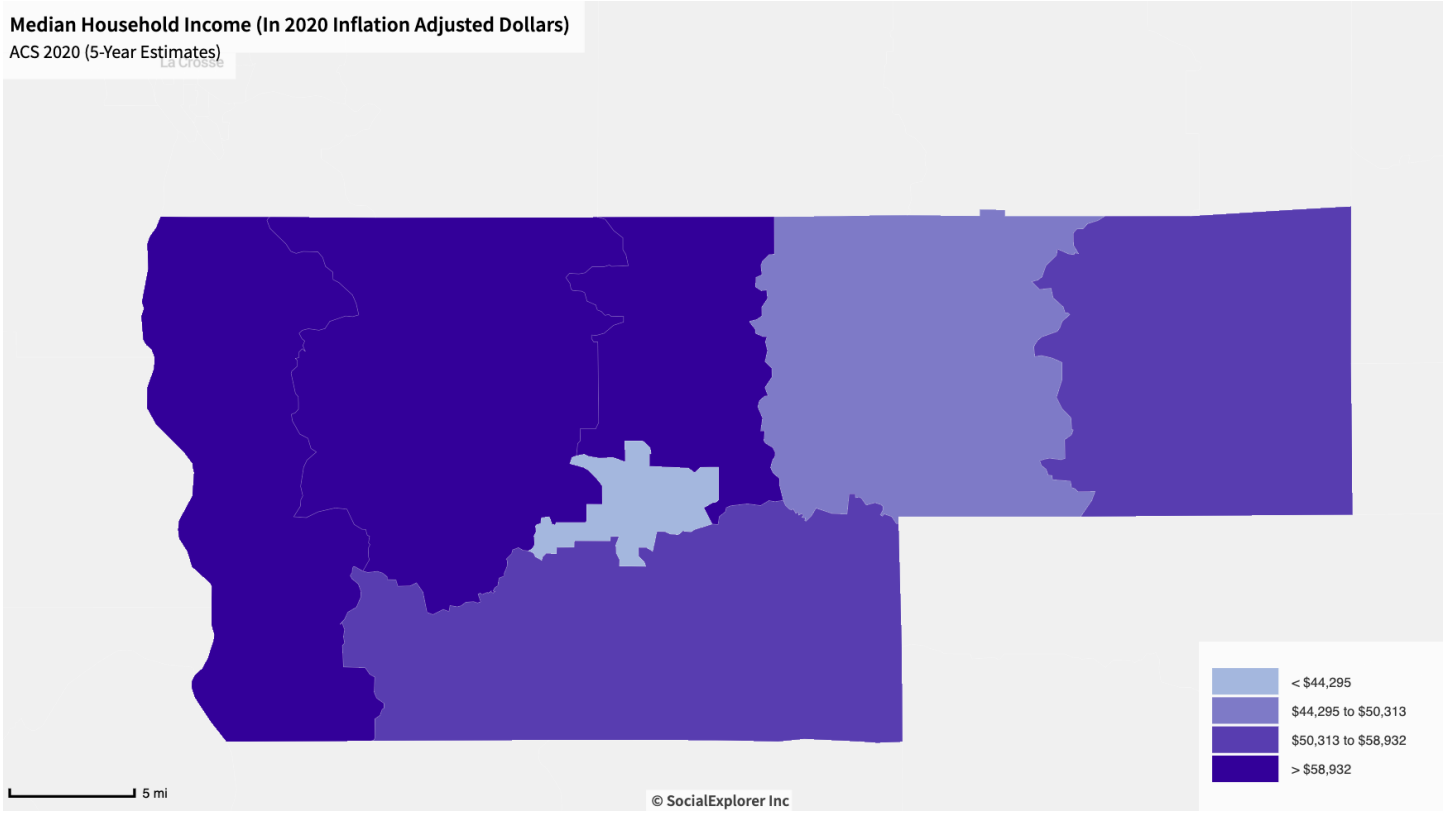
For the population 25 years and over, 37% have completed high school or equivalency,  53% have attended some college or beyond, and 10% have less than a high school diploma. The top industries are educational and health care services at 27%, manufacturing at 15%, and retail trade at 11%. The county experienced low unemployment at an average rate of 2.3% between 2015-2020.




## Economic

The median household income is $53,810; 17% of residents live below the 100% federal poverty line (or in deep poverty); 9% do not have a vehicle; 25% are without internet access, and almost 9% live in mobile homes. These factors paint a picture of a rural, poor population without access to resources to make energy upgrades on their homes or properly prepare for disasters.

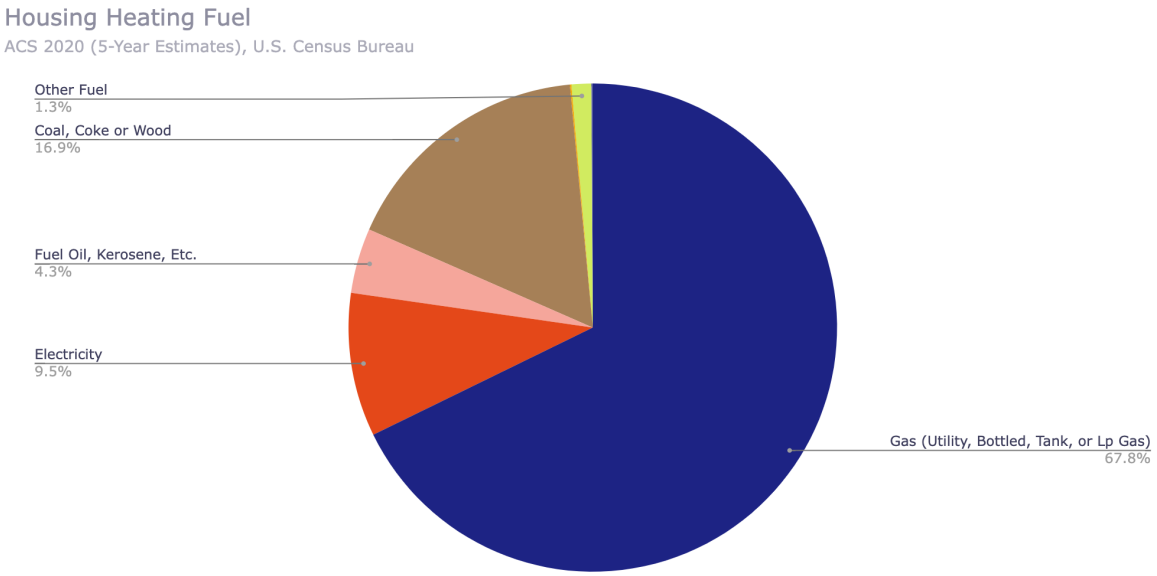





## Housing

There are 14,173 housing units. The median home value is $160,678; 77% of housing is owner-occupied and 23% is rented with a median gross rent of $718 per month.

The median age of housing units is 55 years (built in 1967). Homes over 50 years are less efficient and require greater measures to insulate and update the electrical system. Higher energy demands for these homes can make on site solar energy generation cost prohibitive. Moreover, power outages during periods of extreme heat or cold can leave residents of these homes particularly vulnerable.



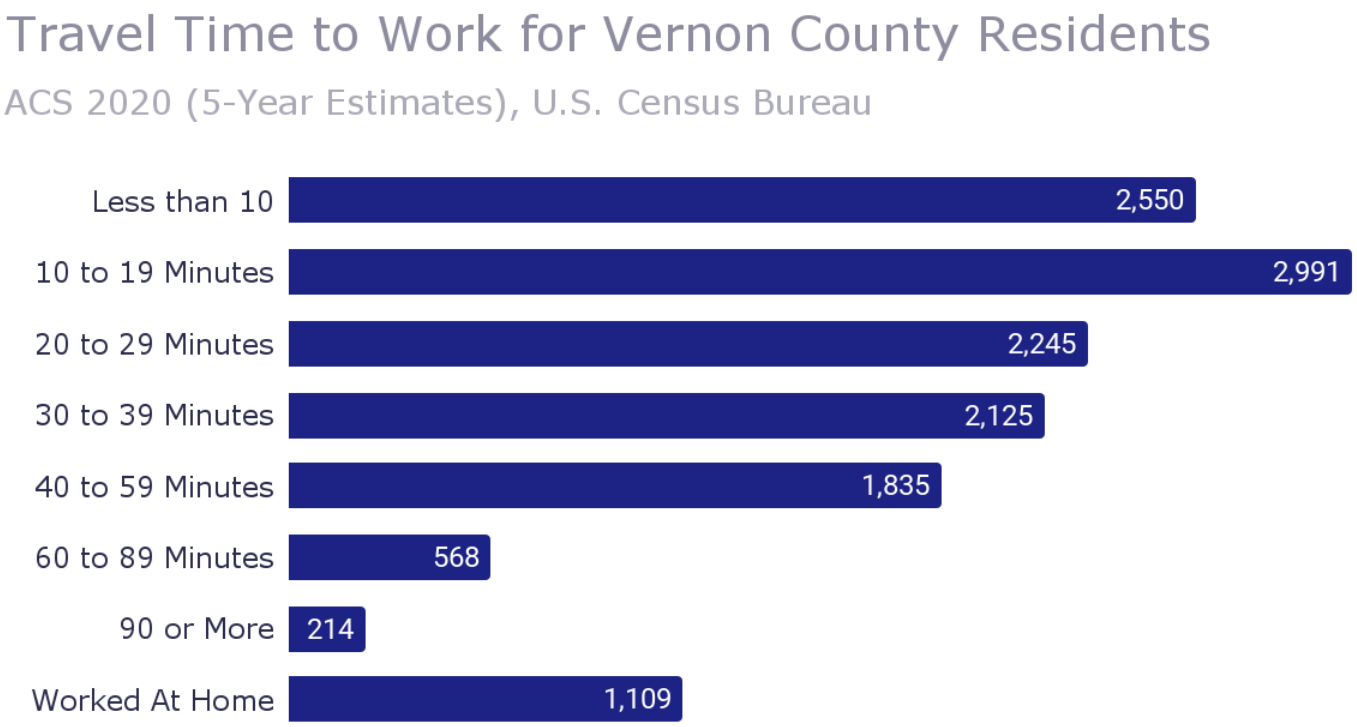
Heating is a major expense for residents. The majority of houses (68%) use natural gas to heat their homes, 17% coal, coke or wood, and 9.5% electricity.

## Transportation

A reported 3,637 workers drive to work each day in Vernon County and 85% drive a car, truck, or van; 77% of them drive alone with a typical commute taking on average between 20-29 minutes.

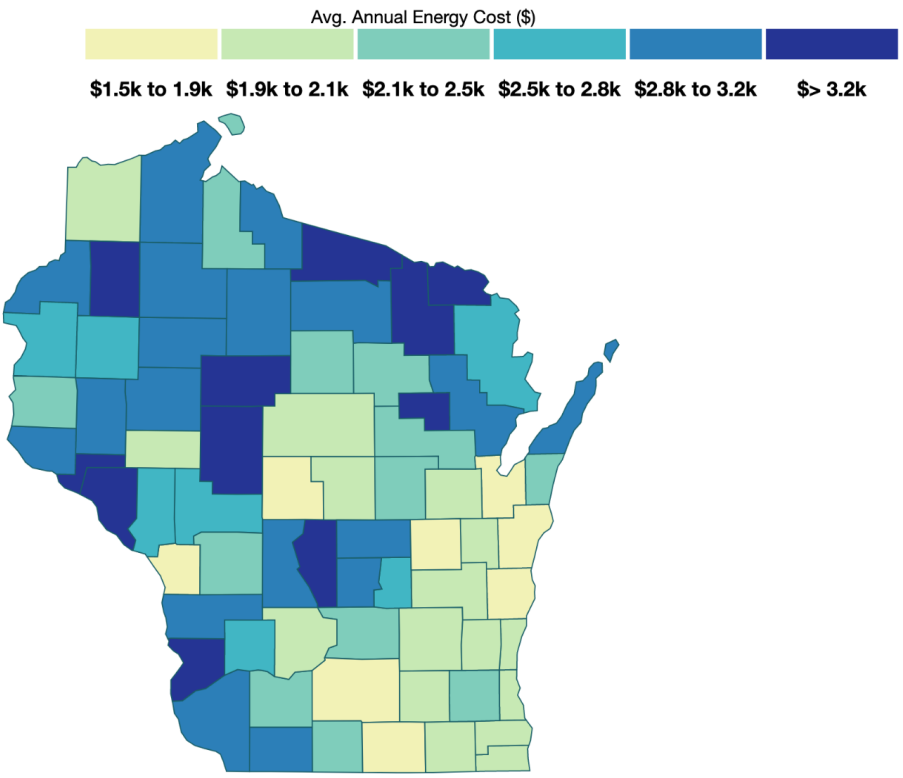
In 2021, Vernon County registered a total of 33,828 vehicles. Only 47 of those vehicles were EVs.[9]

Residents in rural areas often travel significant distances to access employment, healthcare, and important services. Farmers require reliable sources of fuel for operations and to transport goods to market.




[9] Source: Wisconsin Department of Transportation, Report 25 – Registered by Fuel Type, Calendar Year 2021, https://wisconsindot.gov/Documents/dmv/shared/rpt-25-cal-21.pdf

## Energy Burden

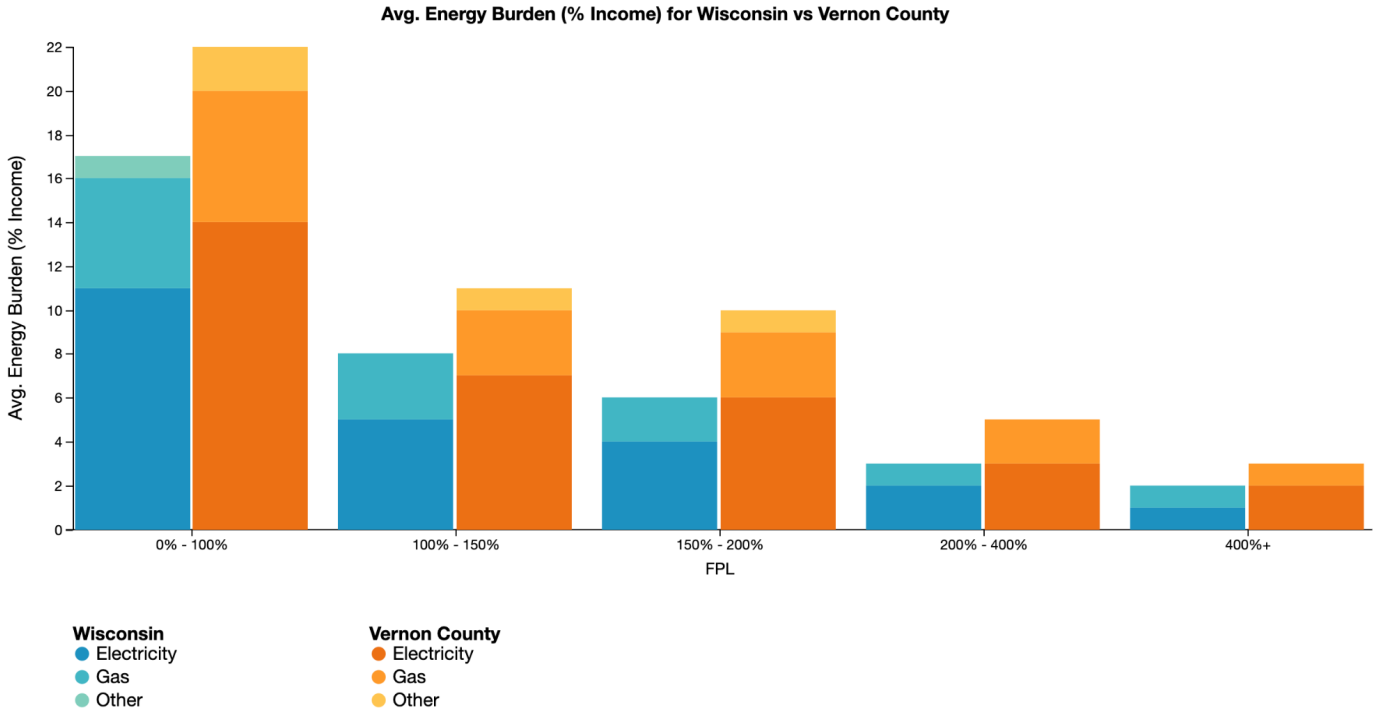



**Low-Income Energy Affordability Data Tool Map Export (https://lead.openei.org/)**
Exported On: 10/12/2022
FPL: 0% - 100%, 100% - 150%, 150% - 200%, 200% - 400%, 400%+
Building Age: Before 1940, 1940 - 59, 1960 - 79, 1980 - 99, 2000 - 09, 2010+
Heating Fuel Type: Utility Gas, Bottled Gas, Electricity, Fuel Oil, Coal, Wood, Solar, Other, None
Building Type: 1 unit detached, 1 unit attached, 2 units, 3 - 4 units, 5 - 9 units, 10 - 19 units, 20 - 49 units, 50+ units, Boat/RV/Van, Mobile/Trailer
Rent/Own: Renter-occupied, Owner-occupied

The energy burden (or % of household income used for energy costs) in Vernon County for households earning 100% Federal Poverty Level (FPL) or below is 22% as compared to 3% for moderate to high-income households. Vernon County pays more in average annual energy cost at $2,875 compared to the state of Wisconsin at $2,063.[10]

In 2020, 26.5% of Vernon County households were paying more than 30% of their incomes on housing costs (rent or mortgage). Households earning less than 100% FPL commonly pay 50% of their income on housing. If you add another 23% on top for energy, that leaves very little for other household expenses like food, childcare, transportation, etc.

[10] *LEAD Tool*. (n.d.). Department of Energy. Retrieved October 12, 2022, from https://www.energy.gov/eere/slsc/maps/lead-tool




**Low-Income Energy Affordability Data Tool Chart Export (https://lead.openei.org/)**
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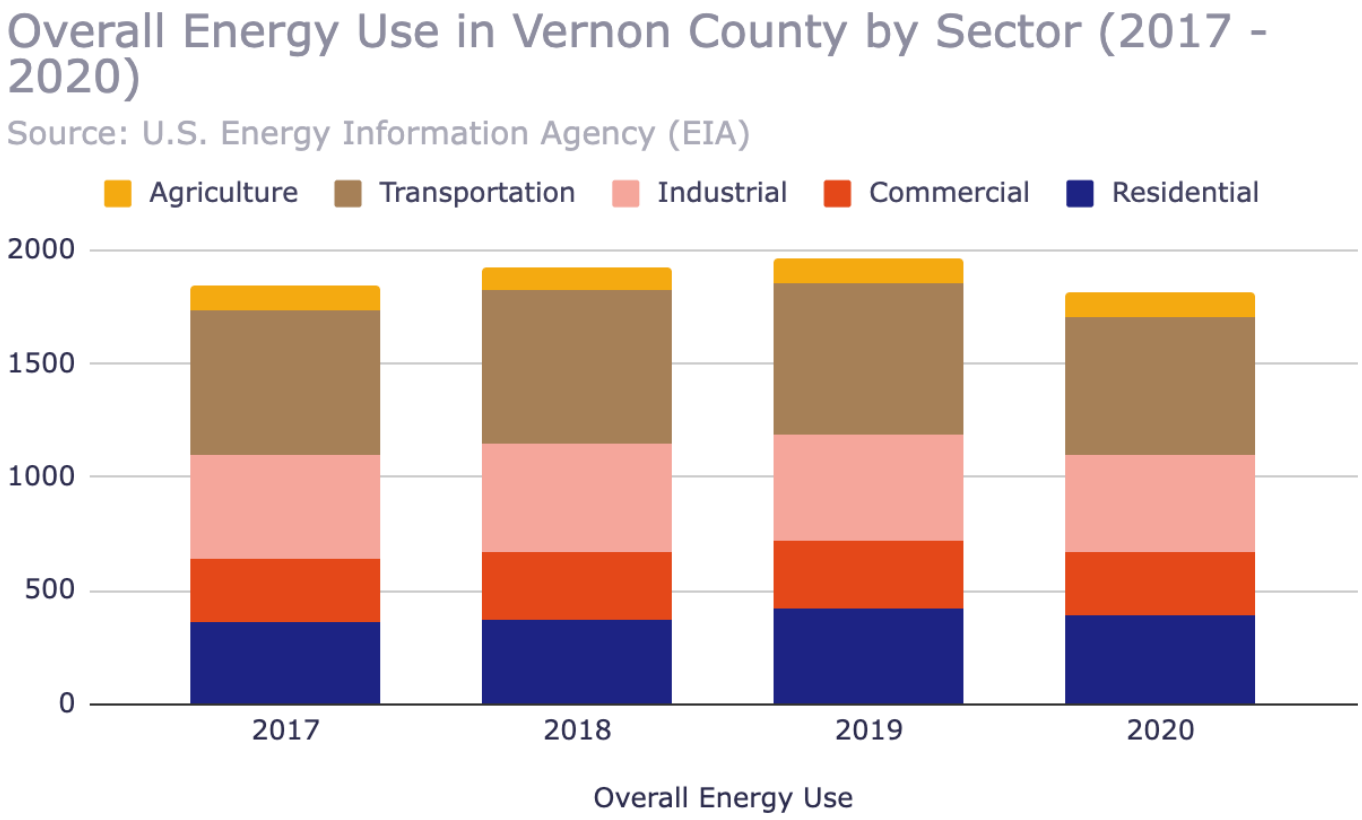
Building Age: Before 1940, 1940 - 59, 1960 - 79, 1980 - 99, 2000 - 09, 2010+
Heating Fuel Type: Utility Gas, Bottled Gas, Electricity, Fuel Oil, Coal, Wood, Solar, Other, None
Building Type: 1 unit detached, 1 unit attached, 2 units, 3 - 4 units, 5 - 9 units, 10 - 19 units, 20 - 49 units, 50+ units, Boat/RV/Van, Mobile/Trailer
Rent/Own: Renter-occupied, Owner-occupied

## Vernon County's Energy and Emissions Profile

The U.S. Energy Information Agency (EIA) provides statewide energy load data by sector (residential, commercial, industrial, transportation and agriculture). By using state and county population data, we can get a rough estimate of our countywide usage. For agricultural energy use, acreage as a unit of measure is used instead of population. For all fuel types, we calculate the kilowatt-hour energy equivalent.

The largest energy use in Wisconsin and Vernon County is transportation followed by industrial and commercial. The highest year of energy use was in 2019 and with steady growth in prior years except for 2020. Due to the COVID-19 pandemic, all sectors, with the exception of agriculture,experienced an unsurprising decline in energy use. We expect energy use would return to near previous levels in upcoming years.

Electricity appears as a small but measurable fuel source for transportation in the EIA data in 2019 and 2020.




County

There are other costs of continued inaction that are not reflected in energy bills, but rather in the broader scientific data. Scientific consensus indicates the accumulation of carbon emissions from fossil fuel combustion is dramatically changing weather patterns. Repeated 500-year floods that have destroyed whole farms, homes and entire communities plus hurricanes and forest fires are costs not seen on our energy bills. Yet these costs are borne by all of us, especially the most vulnerable.

Flooding has historically been a problem in Vernon County due to the steep hillsides and rapid runoff during heavy rainfalls. According to the National Weather Service, between 1844 and 2014, Vernon County had the most (95) flood events of all Wisconsin counties. Severe floods occurred every year from 2016 to 2019, only adding to that total. Repeated floods increase the difficulty for Vernon County residents to recover from and prepare for these threats, and these floods have a significant economic cost. The 2019 Midwest Floods cost the midwest region an estimated 4.6 billion dollars[11]; another 2007 flood cost our county about 35 million dollars[12]. Increasingly frequent and severe flood events have forced utilities and municipal governments to request FEMA recovery funds repeatedly in recent years, resulting in more competition for limited funds.

Damage to electricity transmission and generation equipment due to flooding and high wind events (which are also becoming increasingly more common) have left communities without power for extended periods of time. For example, in the record-setting flood of 2018, the Village of La Farge was without power for 51 hours. These

[11] English, B. C., Smith, S. A., Menard, R. J., Hughes, D. W., & Gunderson, M. (2021). Estimated economic impacts of the 2019 Midwest floods. *Economics of Disasters and Climate Change*, *5*(3), 431–448. https://doi.org/10.1007/s41885-021-00095-2

[12] Shea, T. (2016). *Natural Hazards Assessment Vernon County, WI*. La Crosse, WI; NOAA/ National Weather Service. https://www.weather.gov/media/arx/nathaz/VERhazards.pdf

outages endanger vulnerable community members who count on reliable power to manage life-threatening health issues. Many community members suffer serious financial hardship when power outages occur, such as losses due to spoiled or unsafe food. Repeated power outages also increase risk to utility workers making repairs.

*Flooding in Viola, 2018* [13]

Sudden floods, as well as periods of drought[14], impact agriculture in addition to energy systems. With around 65% of Vernon County as farmland,  residents rely on agriculture. Almost 2,000 farms produce a "market value" of over $181 million of products for our county[15], and these products are actively threatened by our changing climate. While warmer weather currently equates to slightly longer growing seasons for some, extreme storms can shorten growing seasons by waterlogging soil before planting[16]. Even after they are planted, crops are always at risk of extreme temperatures, wind, and precipitation[17]. As the effects of climate

[13] Tighe, M., Haas, J. M., & Thomson, P. (2013, 08 30). La Farge grapples not only with flooding but also no power. *La Crosse Tribune*. https://lacrossetribune.com/news/local/la-farge-grapples-not-only-with-flooding-but-also-no-power/article_34349787-9fce-569c-8fb7-c67430ea5938.html

[14] Of the eight billion-dollar droughts affecting Wisconsin from 1980-2020, six of them occurred after 2000. NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2022). https://www.ncei.noaa.gov/access/billions/, DOI: 10.25921/stkw-7w73

[15] Data from 2017. National Agricultural Statistical Service, 2017 Census of Agriculture County Profile (n.d.). https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Wisconsin/cp55123.pdf

[16] Burakoff, M. (2021, October 26). *Climate connections: Weather extremes push Wisconsin farmers to adapt*. Climate extremes push Wisconsin farmers to adapt. Retrieved October 2022, from https://spectrumnews1.com/wi/milwaukee/news/2021/10/25/climate-connections--weather-extremes-push-wisconsin-farmers-to-adapt

[17] Burke, A. (2022, May 18). *Hot summer temperatures bring severe weather patterns, risk to crops*. Wisconsin State Farmer. Retrieved October 2022, from https://www.wisfarmer.com/story/news/2022/05/18/summer-forecasts-bring-severe-weather-patterns-risk-crops/9792067002/

change worsen, these "extreme" events are becoming more and more commonplace[18]. Overall, climate change is forcing our farmers to spend valuable resources protecting their livestock and crops.

*Flooding in La Farge, 2018* [19]

In addition to making extreme weather events more common, climate change is also increasing average temperatures around the globe. Known for our colder weather, it is difficult to imagine heat as a significant threat to those living in Wisconsin. Still, in 2020 alone, 689 people in the state of Wisconsin visited emergency rooms due to heat-related illnesses[20]. Within the National Weather Service (NWS) of La Crosse's coverage area, 11 people have died due to heat-related illnesses from 2000-2020. In fact, according to the NWS of La Crosse, "outside of flooding, heat is one of our biggest threats"[21]. Unfortunately, climate change will worsen both.

Climate change is already affecting Vernon County; in the last 140 years, the global temperature has increased by about 1°C. If greenhouse gas emissions continue at the same rate, the global temperature increase is expected to double within the next 70 years[22]. As the effects of erratic weather patterns already threaten the

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[18] Environmental Protection Agency. (2022, August 1). *Climate Change Indicators: Weather and Climate*. EPA. Retrieved October 2022, from https://www.epa.gov/climate-indicators/weather-climate#:~:text=Rising%20global%20average%20temperature%20is,with%20human%2Dinduced%20climate%20change.

[19] Vernon, A. C., & Cina, A. (2018, August 31). Vernon County's Jersey Valley, Mlsna dams fail due to heavy rains. La Crosse Tribune. https://lacrossetribune.com/community/vernonbroadcaster/news/vernon-countys-jersey-valley-mlsna-dams-fail-due-to-heavy-rains/article_71e68905-2999-523d-a391-d52abe169f07.html

[20] Kaska, J. (2021, June 3). *Hot weather increases risk of heat-related health issues across Wisconsin*. https://www.weau.com. Retrieved October 2022, from https://www.weau.com/2021/06/03/hot-weather-increases-risk-of-heat-related-health-issues-across-wisconsin/

[21] US Department of Commerce, N. O. A. A. (2021, June 2). *NWS La Crosse Heat Preparedness*. National Weather Service. Retrieved October 2022, from https://www.weather.gov/arx/heat

[22] Reaching 2°C by 2100 under scenario SSP2-4.5 of the most recent IPCC Report. IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy,

economic, environmental, and social wellbeing of our county[23] [24], it is imperative that we act now to reduce our emission of greenhouse gasses that cause climate change. While our county alone can not fully address the threats caused by climate change, a "net-zero" future is impossible as long as there are fossil fuel emissions from Vernon County. Large global problems such as climate change require local action[25], and successful local strategies will spread to other local communities. By acting in Vernon County, VCED can provide a framework for other counties towards decarbonization.

## The Benefits of a Community-based Energy Plan

Energy is essential to our local, national, and global economy. It powers our homes, schools, and workplaces, keeping us warm and cool, moving us from place to place, and making once back-breaking tasks more manageable. However, the surmounting economic, environmental, social, and health costs of using carbon-based energy sources are overtaking the benefits.

Community-based energy planning is a new approach in Wisconsin. Energy policy and regulatory frameworks are typically top-down and determined by the state. Energy needs and challenges, however, vary widely across regions and utility territories. Coordination of stakeholders across the entire state presents significant logistical and communication limitations.

Unlike urban areas where one or two utilities dominate the energy sector, rural communities are served by many municipal, investor-owned, and cooperative utilities. In Vernon County alone, we are served by eight electric utilities: Vernon Electric Coop, Xcel Energy, Scenic Rivers Coop, Alliant Energy, Richland Electric Coop, Westby Municipal, Viola Municipal, and La Farge Municipal. Each has its own policies, tariffs, and regulatory framework.

Community-based energy planning helps address the community's role in the clean energy transition and provides a greater sense of self-determination for local residents, business owners, and leaders. With tens of millions of dollars of annual energy expenditures at stake as well as the compounding external environmental, health and social costs, community members deserve a say in how these dollars are spent and how the future energy system should be shaped.

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J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3−32, doi:10.1017/9781009157896.001.

[23] *Climate Change Impacts in Wisconsin*. Wisconsin Department of Natural Resources. (n.d.). Retrieved October 2022, from https://dnr.wisconsin.gov/climatechange/impacts#:~:text=Increased%20frequencies%20of%20extreme%20heat,bridges%2C%20breaking%20dams%20and%20more.

[24] State of Wisconsin. (2020). *Governor's Task Force on Climate Change Report.* Madison, WI. https://climatechange.wi.gov/Documents/Final%20Report/GovernorsTaskForceonClimateChangeReport-LowRes.pdf

[25] Illick-Frank, E. (2020, June 23). *5 Benefits to Local Action on Climate Resilience*. World Resources Institute. Retrieved October 2022, from https://www.wri.org/insights/5-benefits-local-action-climate-resilience

# Chapter 3: Approach

## Energy District

As a new organization, VCED began to work on raising public awareness of the group and its mission, build trust and capacity, and connect with community stakeholders. An ambitious and committed founding Board of Directors brought their well-rounded set of knowledge and skill sets in renewable energy, small business ownership, municipal government, community organizing, electrical engineering, and rural electric cooperatives to advance these shared goals.

In order to accomplish our mission, VCED needed to understand the community's starting point for the road ahead. This meant engaging local residents and business owners in conversations about their energy usage, knowledge of the energy system, motivations, and opinions, as well as building a network of energy champions who were willing to (or already were) supporting innovative energy technologies and who could share their experiences with others.

In August 2021, VCED hired its first full-time program director. This added otherwise-missing administrative and strategic capacity, and freed up time for the Board to reach out and introduce the energy district to local officials, businesses, associations, community-based organizations, county and village boards, and utilities while seeking opportunities for collaboration. VCED held a community visioning session with an open invitation to all county residents. The meeting was well attended and established a growing list of committed volunteers eager to support the work.

VCED established three action teams which, at the time of this report, are still active:

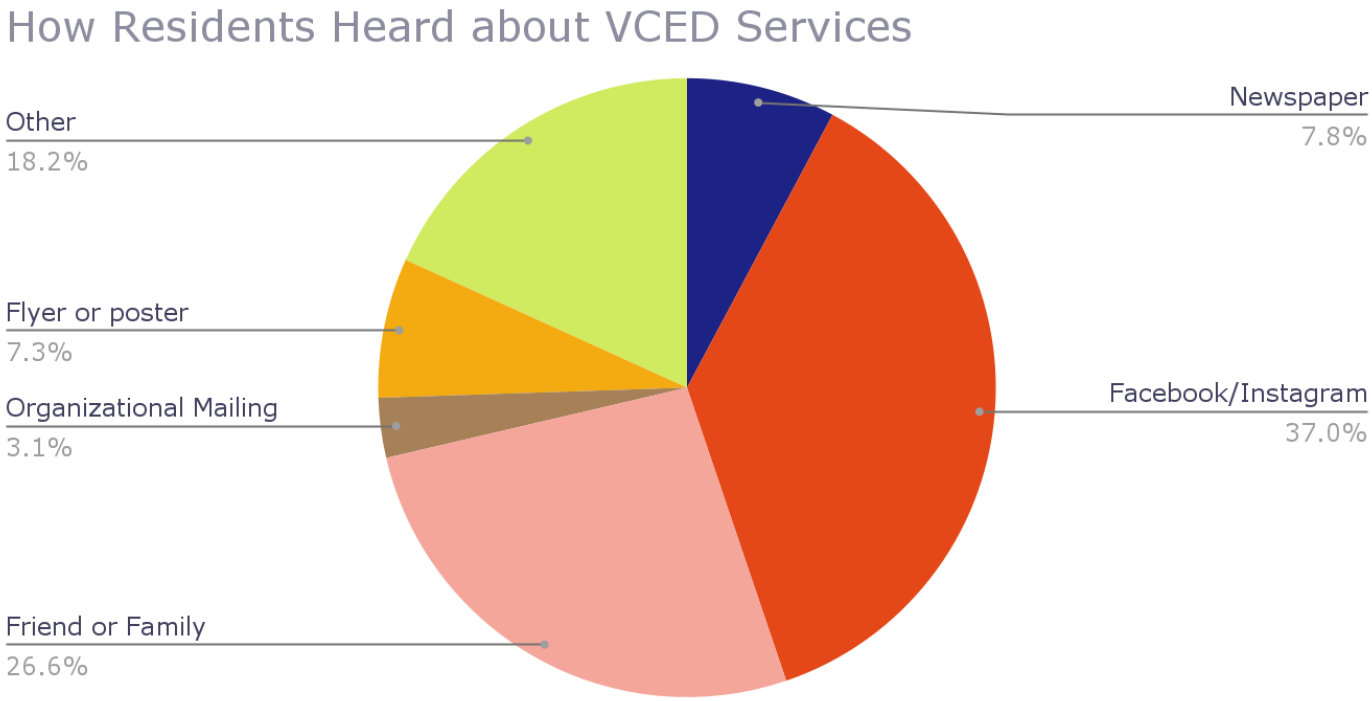
> **(1) Public Education:** This team develops educational opportunities for members of the public and youth to learn more about energy issues, services available through VCED, and how our individual and collective energy use can better support the transition to decarbonization and electrification of our energy system. The team hosts public events and forums. A major portion of the team's work is on K-12 educational curriculum offered in local schools along with extracurricular programming.
>
> **(2) Energy Planning:** This team of "Energy Coaches" work with households, businesses, organizations, municipalities, and schools throughout the county to provide energy assessments, facilitate necessary training and knowledge exchange, and encourage locally-owned and locally-produced solar projects, increased efficiency, and electrification of our communities.
>
> **(3) Participation:** This team works at the level of utility decisions to analyze the policies of electric utilities, the Public Service Commission (PSC), community leaders, and state legislators, and suggest ways to support the transition to electrification and decarbonization in Vernon County. Additionally, they support community-level projects such as a community solar project in La Farge and electric vehicle charging infrastructure expansion in Viroqua.

Outreach and marketing were major components of this work in terms of both necessity and time. We set a goal to connect with and assess the energy use of at least 300 residents, 20 businesses, 4 municipalities and/or school districts, and 2 utilities. Our theory of change is based upon the understanding that energy users who are more aware and actively engaged with their energy usage are more motivated to take greater responsibility and ownership over their energy usage and decisions. Through these connections and assessments, we could begin to facilitate a larger dialogue around community-level energy decision-making.

VCED designed marketing and branding materials, launched a website, and began tabling and presenting at community events. It took creativity and a wide range of communication tools to reach rural residents of all ages, backgrounds, and interests. These approaches included:

- Print materials, including flyers, pamphlets, and stickers
- VCED email listserv and e-newsletters
- Partner organizations' email lists and newsletters
- Social media presence and messaging
- Door-to-door canvassing
- Newspaper articles and radio interviews/programming
- Word-of-mouth efforts

The following chart shows that social media (37%) and word-of-mouth through friends and family (27%) were the most effective means to reach community members.




Throughout the year-long grant period, VCED met/exceeded our goal by serving 310 residents, 22 businesses, 4 municipalities/school districts, and 2 utilities with energy assessments. We also collected 392 utility sentiment surveys and had more than 100 attendees at VCED-sponsored events. The description and results of these interactions are in the following sections.

## Public and Youth Education

All aspects of VCED's work are essentially educational by nature. That said, establishing a specific public and youth education program and charging an action team to focus solely on this element provided the opportunity to narrow in on key portions of the public and tailor learning materials to suit their needs and engagement styles. This work focused on three key areas: public engagement, K-12 education, and workforce development.



Public Engagement

Public engagement involved hosting community events and workshops, the development of educational materials, tools, and campaigns, and peer-to-peer knowledge exchange. Throughout the year, VCED accomplished the following:

- Hosted the *Rural Recharge* speaker and discussions series, which consisted of three sessions on a variety of topics featuring speakers from the Vernon Electric Co-op, Winneshiek Energy District, and the Institute for Local Self-Reliance. These sessions were well attended with 99 people participating in-person and virtually.
- Hosted the third annual Drive Electric Earth Day event at the Viroqua Food Co-op. VCED partnered with Sleepy Hollow Auto, Vernon Electric Cooperative, Viroqua Chamber of Commerce, and Plug-in America to sponsor the event. All community members with and without EVs were invited to attend and

share experiences, take test drives, and celebrate the addition of a new Level 3 charger located in Viroqua. Over 130 people joined the event to talk to us and learn more about electric vehicles. There were plenty of EVs available for participants to look at, sit in, ride and drive, including vehicles from Chevrolet, BMW, Volkswagen, Tesla, Honda, Nissan and Ford.

- Ran booths at the Viroqua and Hillsboro farmers markets, the Kickapoo Valley Reserve Winter Fest, the Driftless Music Festival, and the Vernon County Fair. Volunteers talked to community members about the energy assessment program and service offerings, provided EV test drives, and answered general questions about energy-related topics.
- Presented on a Community Conversations panel sponsored by Echo Valley Hope at the Ontario Public Library discussing the value of solar and other energy efficiency mechanisms.
- Attended the Midwest Renewable Energy Association (MREA) Energy Fair in Custer, WI, where VCED held a booth and sold Vue 2 Energy Monitors and smart plugs. This was an excellent opportunity to meet with Vernon County residents and many other people from around the state and region. Staff participated in breakout sessions, listened to speakers, and visited other booths to gain new ideas to apply in Vernon County.
- VCED staff were also interviewed on three WDRT radio shows, “Who’s in the Kitchen?”, “Driftless Weekend”, and “Conversations” to share about VCED’s work and discuss important energy-related issues.



K-12 Education

The K-12 education program provides exciting opportunities to connect with the next generation. VCED provided input in the development of the STEAM (Science, Technology, Engineering, Arts, and Mathematics) curriculum focusing on energy, sustainability, and STEAM careers.

Careers in STEAM offer more job opportunities and higher wages. Additionally, STEAM encourages student creativity, adaptive thinking, problem solving, and many other critical life skills. Our future energy decisions will be made possible by today's students, and they will help us guide our rural students in a more sustainable, economical, healthy, and peaceful direction.

Throughout the 2021-2022 school year, VCED presented in classrooms from kindergarten through 12th grade in four school districts: Westby, Viroqua, North Crawford, and Seneca. Some highlights are listed below:

- Established a partnership with Southwest Sanitation to collect unwanted computers and devices to take apart in a deconstruction workshop. The students explored and learned about the components and elements inside while actively using their hands and fine motor skills.
- Held a two-day Earth Day event at North Crawford Middle School which created space for intergenerational learning between VCED volunteers and students.
- Presented to Dr. Margot Higgins's environmental studies class at the University of Wisconsin-La Crosse.
- Created a campaign to encourage local school districts to apply for the U.S. Environmental Protection Agency's (EPA) 2022 Clean School Bus Program under the Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act). Students made a promotional video and shared it with school officials and via social media.

## Workforce Development

Workforce development received the least attention of the three action teams, not because it is of lesser importance, but because of its complexities. As described in the next chapter, Vernon County residents and businesses will need to turn to electric vehicles, heat pump water heaters, air source heat pumps, and solar photovoltaic systems to increase their energy efficiencies and transition to clean energy. This requires a workforce that is trained to install and work with these technologies.

Once individuals are aware of the benefits of electrification and decarbonization and are ready to take steps toward investing in more cost-effective and efficient technologies, they often hit a roadblock in finding contractors who are available and willing to do this work. The knowledge and experience with these systems seems to be currently limited in and around Vernon County.

One project that VCED is interested in developing further would support the effort to connect area high school students with Western Technical College through field trips, tours, mentorships, and presentations. The college offers a variety of majors in fields related to energy systems, including solar installation, electromechanics, construction, building science and energy management, etc. which could better prepare young people for the green economy.

Through our work around workforce development it became clear that new and expanded educational programming is in demand. VCED sought input from the community to identify topics of interest to center future workshops, events, and communications around. Community suggestions included:

- Energy incentives and financing
- Battery storage
- Do-it-yourself energy efficiency measures
- Rate structures
- Smart home energy management
- Community solar
- Cost of owning an EV
- Cross-country EV travels
- Solar Tax Credit
- Heat pump water heaters
- Utilities 101
- Stranded Assets
- Peak and off-peak energy use
- Energy Monitoring
- Electrification and Efficiency
- Energy in agriculture
- Energy transmission
- Microgrids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OWN & PRODUCE ENERGY LOCALLY
ELECTRIFY


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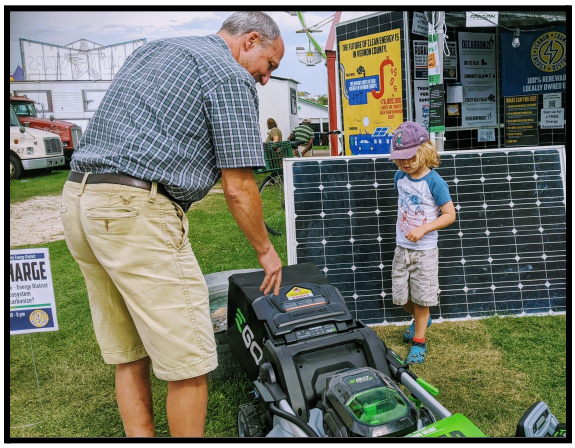
Help Wanted

## Energy Assessment Program

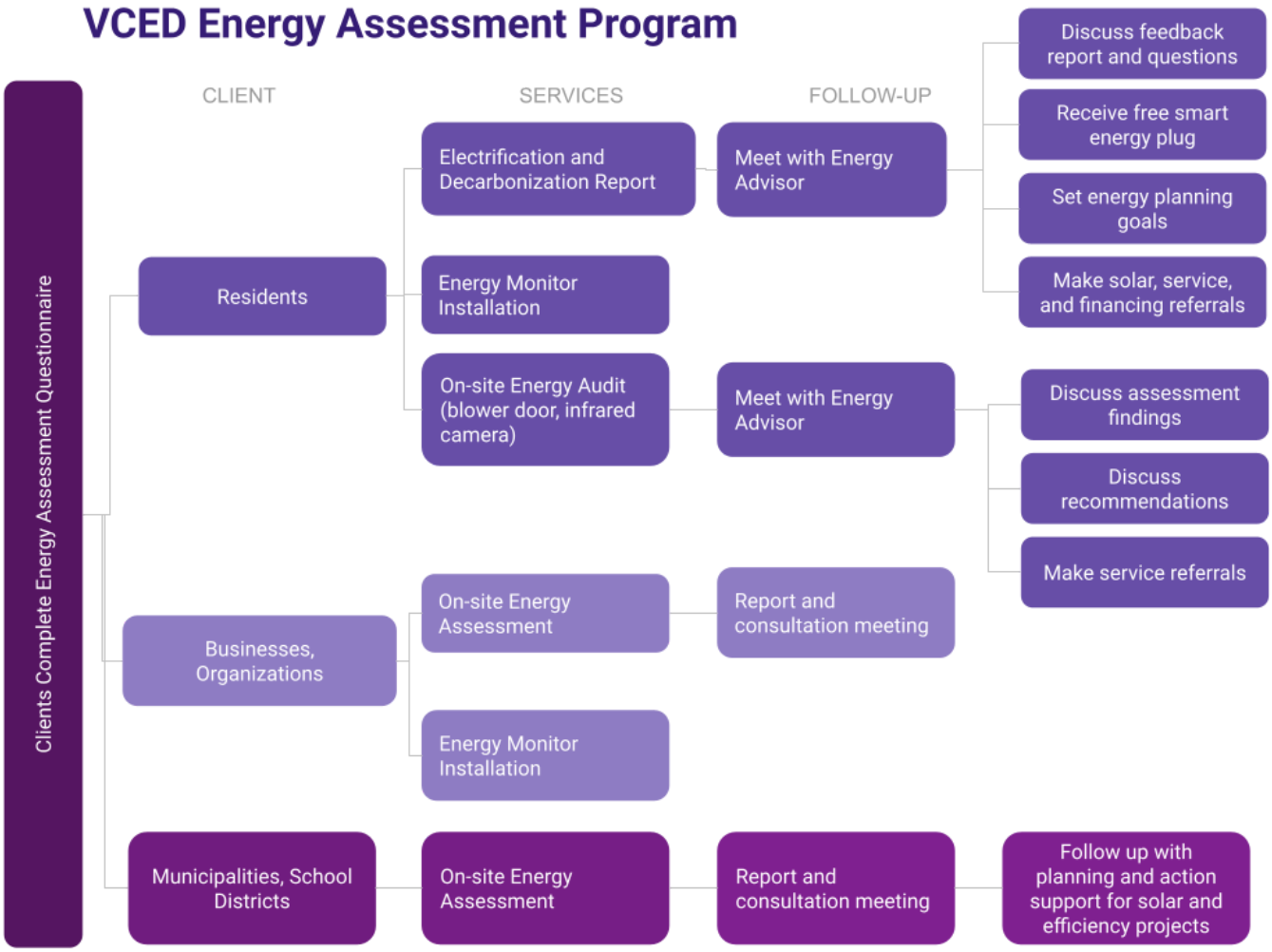
VCED developed an energy assessment program based on the assertion that the only currently functional means to phase out fossil fuels are to electrify and decarbonize. It was grounded in four core understandings:

1. Only electricity can be made without fossil fuels.
2. Fossil energy resources from methane “natural” gas, coal, and oil, all of which are burned and emit excess carbon, will be phased out.
3. Electricity that comes from sunshine, wind, geothermal and hydro, coupled with storage capacity, is the simplest, safest, most equitable and least costly path to power our lives.
4. Locally-owned and locally-produced electricity gives us the power of self-reliance and cost control.

The program worked towards accomplishing VCED’s strategic EIGP objectives by targeting residents, businesses, and municipalities and examining their energy use and efficiency in all aspects of their lives—home heating and cooling, household appliances, transportation, outdoor equipment, energy costs and budgeting, and personal priorities and goals. Individuals applied by filling out an online energy questionnaire that took between 10-15 minutes to complete. For those who were less internet inclined, they completed the questionnaire by phone or had a paper copy mailed.

Three different energy questionnaires—residential, non-residential single building, and non-residential multi-building—were released to the public in December 2021. The first few months were a trial period that allowed VCED to test and improve the language of the questionnaires for clarity and data use.

By mid-January the full energy assessment program was up and running with steady participation rates. The complete energy assessment program included three services at no cost to participants (see *VCED Energy Assessment Program* flow chart).

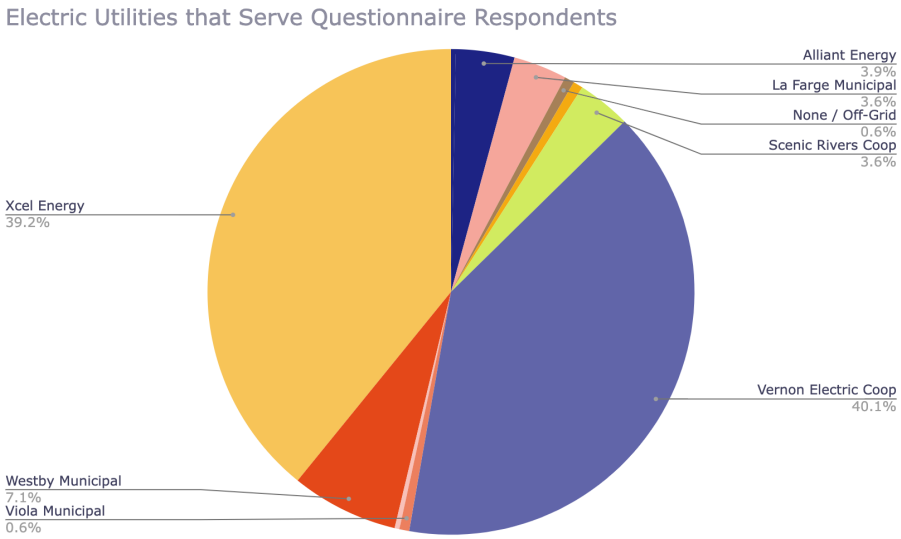



## Electrification & Decarbonization Report and Consultations

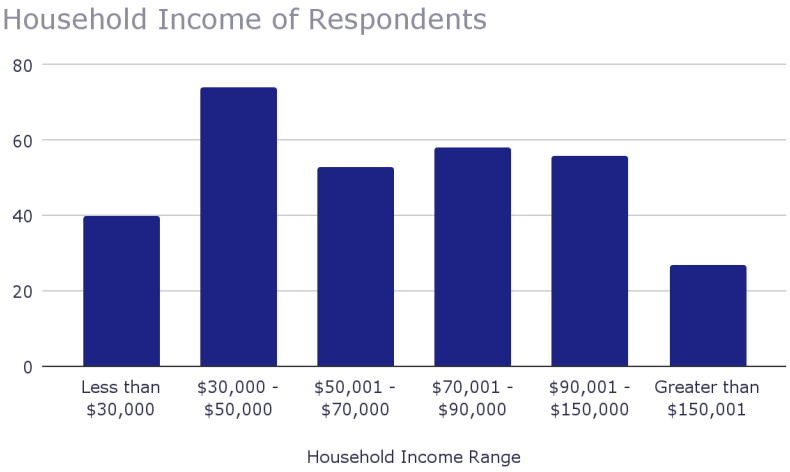
The Electrification and Decarbonization (E&D) Report was generated based off of the responses provided in the online energy questionnaire. The goal is to provide participants with a personalized assessment report that outlines the upgrades they could make to further electrify and decarbonize. Among other information, it also provided cost comparisons and available incentives and financing options.

In March, VCED held a training session for the Energy Planning Action Team so that they could serve as energy coaches and provide one-on-one energy consultations either in-person or virtually. Eight community volunteers attended the training. The less experienced energy coaches shadowed the more experienced on several consultations in order to get acclimated to the program and process.

Over the course of 8 months, 311 residents completed the Energy Assessment Questionnaire. Respondents were served by all eight utilities in Vernon County with the majority in Vernon Electric Coop (40%) and Xcel Energy (39%). Over 11 municipalities were represented with 51% living in Viroqua, 15% in Westby, 12% in La Farge, 5% in Readstown, and 2% in De Soto and Viola.

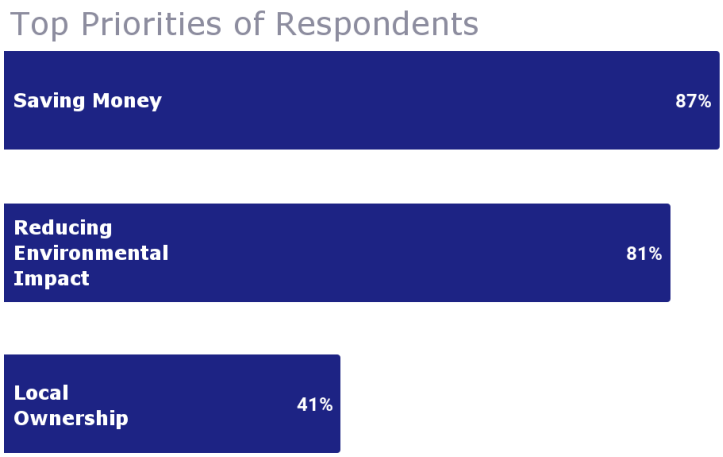



Of the residents who participated, 92% own their homes and the remaining 8% rent. The majority (63%) had 1-2 member household sizes, which is representative of the county at-large.



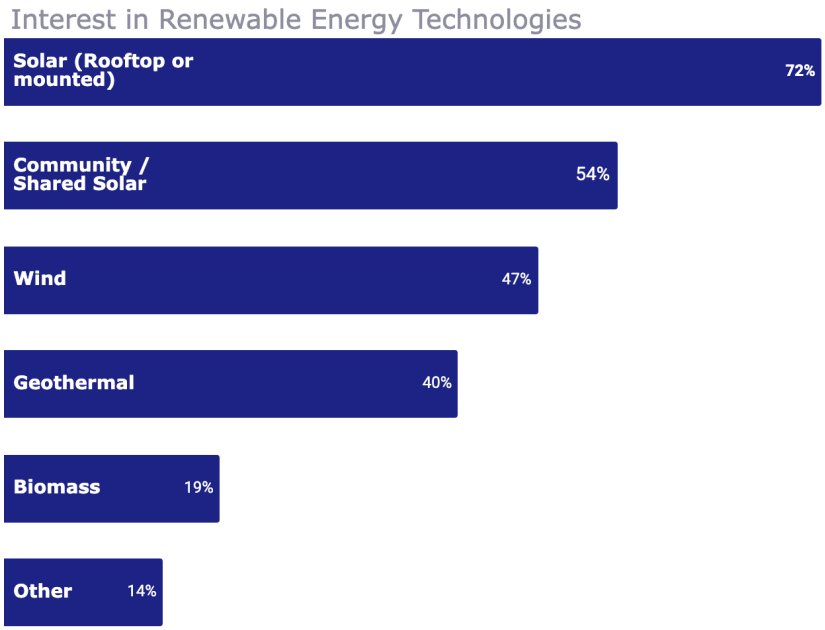

The incomes of respondents are slightly higher compared to the county at-large: 27% of respondent households earned greater than $90,000 compared to the county which is around 21% of higher earners; 37% respondents are low-to-median income (LMI) with 13% of them living below the poverty line.

When asked about the comfort of their homes, 77% of respondents indicated that they had cold spots and 50% reported being happy with the comfort of their homes, 29% not happy, and 21% unsure.




The top priorities included saving money (87%), reducing environmental impact (81%), and local ownership (41%).

Top interests included learning more about energy monitoring (66%), electrification (55%), and home energy assessments (82%).




Interest in renewable technologies was strong with 98% of respondents interested in at least one form of renewable energy technologies. Broken down further, 72% indicated interest in solar, 54% in community/shared solar options, 47% in wind, 40% in geothermal, and 19% in biomass. Just 2% said they were not interested at all in renewable energy sources.

Solar ownership among respondents is 19% which is significantly higher than the general county population at <1%.[26]

Our energy coaches met with 91 residents and several businesses to provide one-on-one energy consultations. Each client received a folder of information that the energy team collected from local solar installers, solar and green mortgage financing, and other useful tips. Together they went through these materials and the client's E&D report, discussed opportunities for improved efficiencies, rebates and incentives, set long-term and short-term goals, and answered questions. The consultations generally last about an hour.

[26] ACS 2020 (5-Year Estimates), U.S. Census Bureau.

While meeting with so many residents and business owners at their homes and buildings, we learned a great deal about the educational, knowledge, and service gaps of energy understanding, the interest and thirst for more information, and identified other champions and skilled people who are motivated to support our work.

VCED believes it will be important to reconnect with all 311 residents and 22 local businesses over the coming months to monitor their progress and provide additional support.

## Onsite Energy Auditing

VCED hired a part-time energy auditor who has over 30 years of experience in energy efficiency and contracting in the region. The new energy auditor and the energy coaches completed a training session with Accurate-Airtight Energy Auditor, Hunter Prochaska, in January 2022. This training helped to organize the VCED energy planning team so that service offerings across the energy assessment and onsite energy audit program were better aligned.

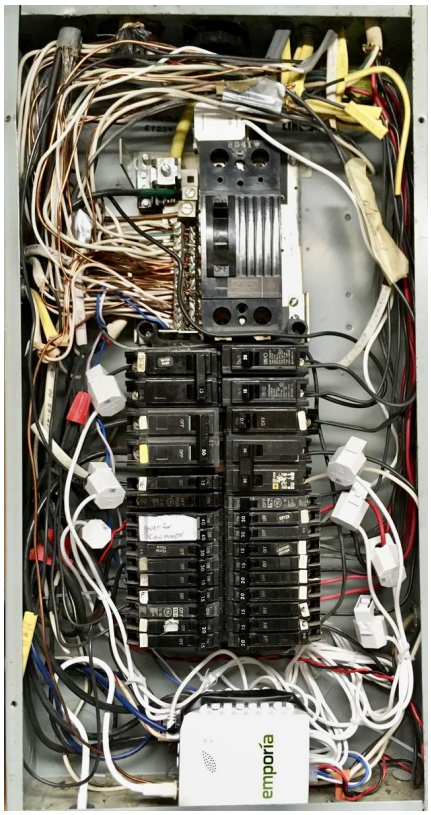
By the end of spring 2022, VCED completed 55 onsite energy assessments with a waiting list of 26 residents. There continues to be a great appetite for the energy audit service. VCED will continue to explore ways to provide this service either free or subsidized beyond the grant term.

## Energy Monitoring

The third and final sub-program that falls under our energy assessment program is Energy Monitoring. VCED worked with Emporía Energy, who manufactures smart home energy management systems, to purchase and install 75 Gen 2 Vue Energy Monitors.

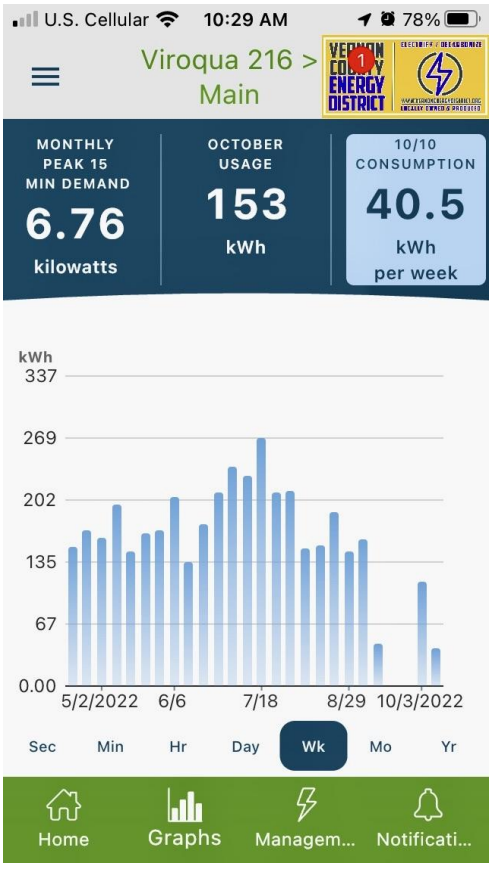
Residents and businesses who installed monitors reported that they are more aware of how their energy is being used and experiment with ways to save more. They learned something about their energy use that they did not know before. Not only do they have more information about how *much* energy their individual appliances are using, they also have an understanding of *when* those appliances are running. Additionally, the Vue monitors the total energy use and solar net metering of homes allowing those with solar to work on balancing loads more effectively and efficiently.

The photo below shows a monitor installed in a typical service panel  The screenshots show the information made available to users on smart devices or computers. The display on the lower left shows a list of circuits measured and the use of kWh over the period of a week. Up to sixteen circuits can be measured with the energy monitor.  On the right, a graph shows energy usage over a period or 26 weeks.  Users can choose up to seven time periods to display.




*Monitor installed inside service panel*


*Energy used in each circuit*




*Energy usage over 26 weeks*

VCED hired an intern from the University of Wisconsin-Madison to help us develop and implement a pilot program to research consumer-driven load shifting. With utilities warning of the potential for rolling blackouts during the summer, this seemed particularly important. This program is still being carried out.

## Utility Sentiment Survey

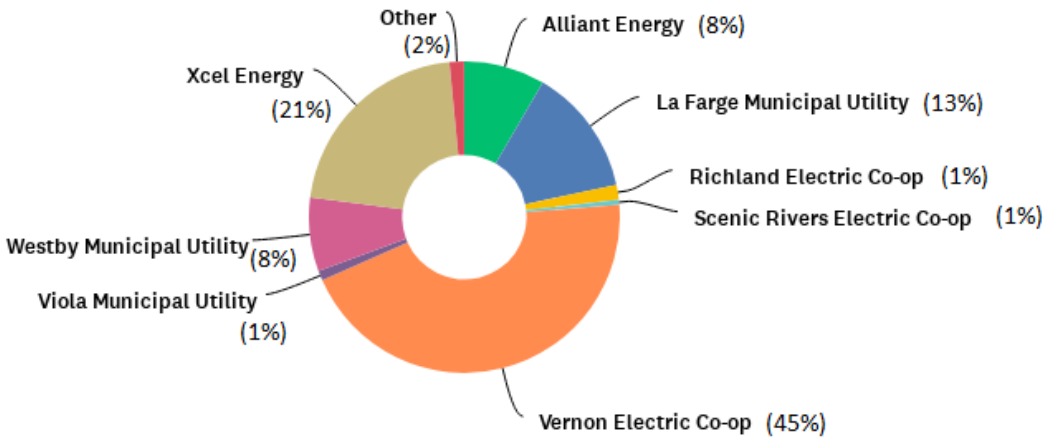
The Participation Action Team developed a survey to identify attitudes and willingness to adopt new behaviors. The findings will be used to inform utilities' strategic direction, shared on the VCED website, and used to inform public education and the energy assessment program.

Survey respondents totaled 392 individuals. All eight utilities in Vernon County were represented.

A summary of key findings revealed the following trends among respondents :

- 75% said they would like to have their utility increase the amount of renewable energy they sell to their customers
- 51% said low electric rates are most important to them regardless of where the energy comes from; however, 33% disagreed with that statement, suggesting the source of energy has importance
- 65% said they would buy solar panels and 63% said they would buy an energy storage system for their home or through community solar/storage if they could recover the investment in a reasonable time
- 72% indicated something other than lack of charging stations is holding them back from an electric vehicle purchase
- 65% indicated the transition to renewable energy is not happening fast enough
- 59% said they would pay $5 more per month on their electric bill if they could buy 100% renewable energy; those who make under $25,000 annual household income would be significantly more willing than those who make up to $125,000 to pay $5 more on their electric bill if they could buy 100% renewable energy
- Nearly universally (90%), respondents believed if they use less electricity, then their electric bill should go down
- Over 75% believed their utilities should invest in energy efficiency before investing in new power plants
- Approximately 33% would be willing to allow their utility to manage loads in their home via the internet; however, a separate 33% would not agree to this approach
- 49% said they would be more willing to install a solar or energy storage system if they could pay for it on their electric bill; however, 62% indicated they would be willing to make energy efficient improvements to their home or apartment if they could pay for it on their electric bill
- 68% were concerned extreme weather could create an extended power outage at their home; 34% had access to a backup power source, with higher-income respondents significantly more likely to have access to a backup power source
- Lower-income respondents were significantly more concerned about an extended power outage than higher-income respondents
- 73% would match their electric usage to utility rates and nearly 62% would use technology to help them manage when they used electricity
- 80% were worried about global warming, with 63% believing global warming will harm them personally, and 83% believing global warming will harm future generations
- 67% believed locally-produced energy sources would have a substantial economic benefit
- 67% believed communities should own their sources of energy

Q1 What is the name of the electric utility that serves your home?




The age of survey respondents tended to be older, with 39% age 65 or older, 23% age 55-64, 13% age 45-54, 13% age 35-44, 9% age 25-34, 1% age 18-24, and 1% age under 18. Females made up 65%, males 34% and non-binary 1%. White or Caucasian comprised 98% of respondents' race/ethnicity. Median income range was between $35,000 and $49,999. Household size averaged  2.43 members.

VCED's services and connection to the community align with many findings from the Utility Sentiment Survey. We have opportunities to educate and inform community members about how they can get solar and/or storage for their homes, manage their energy usage with technology, and reduce their electric bills.

One belief among ratepayers that is nearly universal – if they use less electricity, then their electric bill should go down – will be challenged in the rapidly changing energy landscape. Utilities are moving toward billing demand charges, which means *when* a ratepayer uses electricity will become more important than *how much* they use. As a result, using less electricity will not necessarily lower electric bills. Helping ratepayers manage this change will be an important role for VCED.

## Community-Level Projects

VCED currently supports two community-level projects in the county with meeting facilitation, research, data analysis, and planning.

### La Farge Community Solar

In September 2021, La Farge residents, in partnership with VCED and Organic Valley, formed the Community Solar Committee with the objectives to:

- Review La Farge's 25x25 Energy Plan (2010) and identify where targets were met
- Organize community members, leaders, and other stakeholders in conversations around energy independence, resilience, and community solar
- Establish consistent and ongoing processes to assess energy use, production, and issues in La Farge

The committee presented their findings to the village Utility and Water Committee and sought approval to move forward in the planning process. They held several community engagement meetings between April and July

2022 to seek input from residents. In August 2022, they signed an MOU with the La Farge Municipal Utility to formalize the working relationship in seeking renewable energy projects.

Additionally, the committee is working closely with CouleeCAP to design program and project components that best serve low-to-middle income (LMI) residents and increase equitable access and benefits. The next steps are currently underway to assess costs and funding structures.

#### EV Charging in the City of Viroqua

VCED facilitated a meeting and site tour with Xcel Energy, the Mayor of Viroqua, and Viroqua City Council members to assess the potential for additional EV chargers in the community. Several sites were identified and financing options are now under review.

# Chapter 4: Findings / Analysis and Assessment

## Energy Monitors

Energy monitors offer a wide array of benefits. Accurate, real-time and historical energy data allows people to understand why their electric bills may fluctuate. Historical data for every year, month, day, week, and hour makes it possible to monitor the performance of all our appliances and devices. An energy monitor allows individuals insight into both how much as well as when energy is being used. Appliances and devices often lose efficiency as they near the end of their lifespan. Monitoring this over time could save money and energy that would have been better spent replacing or repairing the appliance. Furthermore, the potential exists for using simple automated controls that could greatly improve participation in utility time-of-use programs and the peak avoidance.

Another potential benefit is sizing a solar system more accurately. Instead of estimating energy usage through crude means such as monthly electric bills, the system could be designed based on actual energy usage data as well as usage patterns.

VCED Energy Coaches found that many folks have had “aha moments” after their energy monitor was installed. For example, one family had extremely high electricity bills and had no idea why. Once their energy monitor was installed they found that a number of “high efficiency” portable air conditioners were consuming far more energy than they realized. They are now working to switch to central air or mini-splits. Another person checked their energy monitor while they were on vacation. They realized that their A/C had been left on. Unfortunately they had no way to turn it off. As soon as they got home they replaced their thermostat with a programmable one that can be controlled remotely.

These examples illustrate how powerful information about energy usage can be. Preliminary analysis of the aggregate data from energy monitor installations suggest a reduction in energy usage with measured energy use decreasing over a period of time. However, more data must be collected to establish whether the pattern is statistically significant and holds over longer time periods. Seasonal and behavioral fluctuations make it difficult to determine if an energy monitor by itself has an impact on energy consumption without multiple years of data and randomly assigned group comparisons.

As a long term investment as a measurement tool, energy monitors could provide insights about what other parts of our program will lead to the greatest movement toward electrification and decarbonization.

*“Toby was just here and completed the set up of vue and helped with the smart plug too. I am happy to have this done and look forward to using the data in the future. I also enjoyed meeting Toby. He was very helpful when arranging time to meet by telling me how to prepare.*
*Thanks again for your help in arranging this!”* - Viroqua Resident

## Electrification

Electrification is the process of moving energy loads from fossil fuel to electricity. Two technologies are responsible for the majority of this load shift:

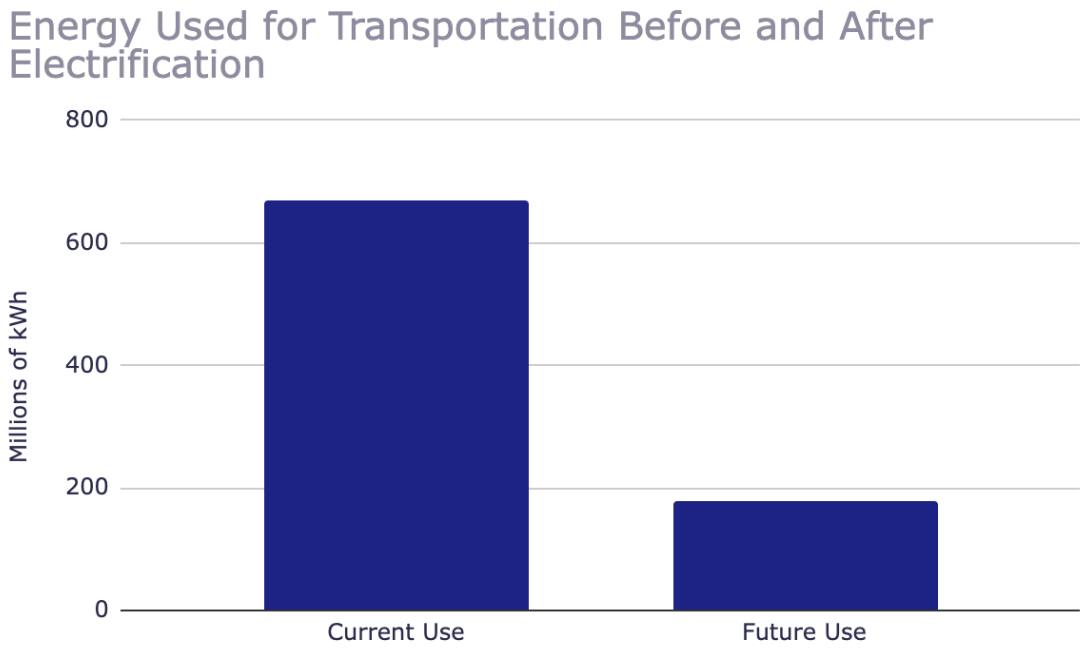
- heat pumps for space and water heating
- electric motors (usually with batteries) for vehicles and other equipment

## *Upgrading to a heat pump water heater saves enough energy every year to power an EV 10,000 miles!*

## Transportation

Electric vehicles offer great potential to transform the transportation sector. Many Vernon County residents have questions, concerns and also misunderstandings about increasing EV adoption, which has been slow but steadily growing.

Energy Assessment respondents indicated annual miles driven per vehicle averaged 10,967 miles for cars and 11,180 for pickup trucks and SUVs, or about 30 miles per day. The average pickup truck/SUV in Vernon County uses around 500 gallons of fuel per year, while an average car uses just over 400 gallons. Most new EVs have a range 200 - 300 miles, likely meeting the majority of daily needs for Vernon County residents. Furthermore, an EV uses only about 27% of the energy an internal combustion vehicle uses or the equivalent of about $.90 to $1.20 per gallon of gas. When we compare the energy content of gasoline and diesel fuel this chart clearly shows the efficiency gained by switching to EVs.



Some common concerns expressed by the general public included: 1) a limited number of available and reliable charging stations; 2)  the cost of replacing the battery as well as the cost of the vehicle itself; 3) potentially destabilizing the grid with simultaneous EV charging. Let us address each of these.

Most recharging currently takes place at home, usually overnight, which is generally during off-peak times. At an average of 30 miles per day of driving, most people can and often do use a standard wall outlet to charge their vehicle (Level 1 or trickle charging). This amount of range generally takes about 7 hours at 1500 watts (about the same as a blow dryer) to charge their car. Electrical circuitry for a Level 2 charger, which uses about the same electricity as an electric clothes dryer, is becoming standard in new construction. Five public Level 2 chargers are available in Vernon County, most of which are currently free to use. Two 50 kW DC fast chargers are installed near well traveled highways and currently cost $0.30/kWh to use. These numbers are expected to rapidly increase as federal infrastructure monies become available.

Another concern often voiced is the cost of replacing the EV battery. Most manufacturers offer an 8 year, 100,000 mile warranty, though some manufacturers suggest the batteries could last well beyond that. Since the cost of the EV is closely tied to the cost of the battery, the perception is that EVs have excessively high upfront costs. Recent pricing announcements from the car manufacturers have many EVs at or near price parity with gasoline vehicles. The Inflation Reduction Act restored the $7,500 tax credit for new EVs and created a $4,000 tax credit for used EVs. These incentives create even more competitive purchase prices and combined with lower maintenance costs and much lower fueling costs, the transition to EVs is likely to continue to accelerate.

Another concern people often raise is how increasing numbers of EVs will affect the stability of the electrical grid. Since many EV owners charge using a standard outlet, the small and steady load factor may be desirable for grid operators. Also, currently those who are most likely to own an EV are also more likely to have solar panels installed. Even if EV owners are not at home when solar production is highest, the excess production spread through a utility's distribution system could be absorbed by EV owners charging at their workplace. While complications can be expected as utilities sort out meeting EV charging capacity, the problems are not likely to be insurmountable.

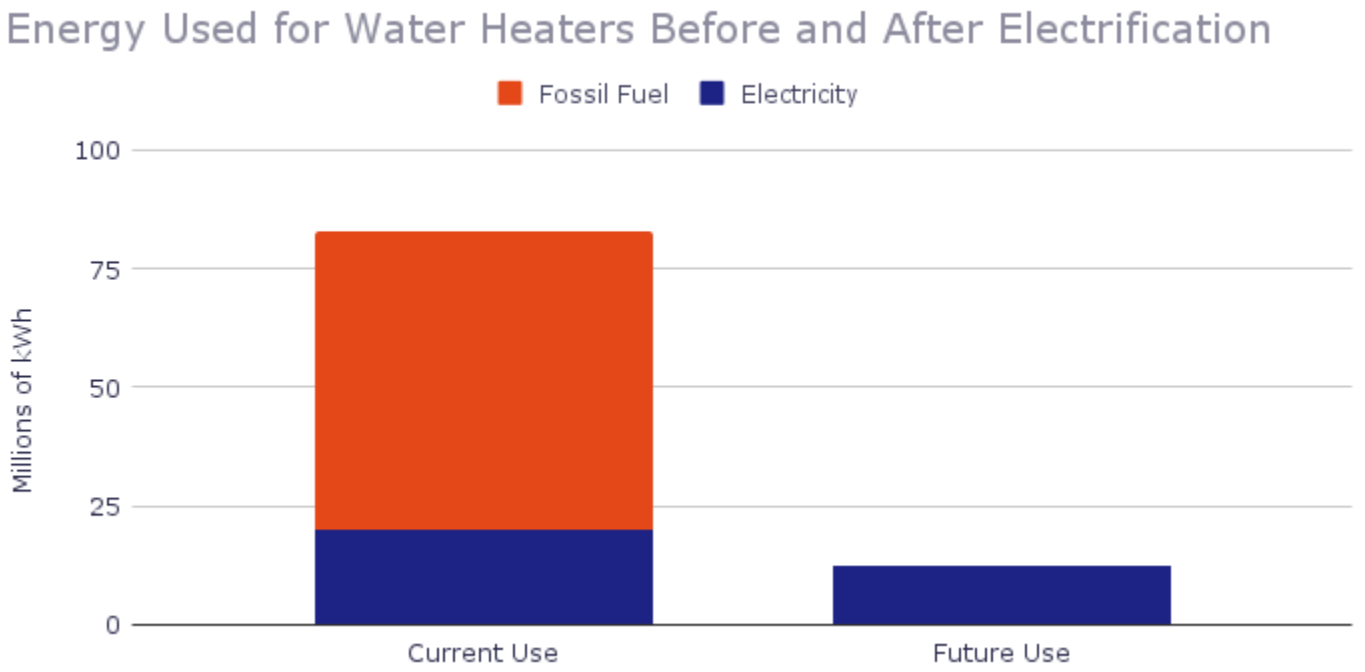
Assuming a 15 to 20 year life span for vehicles, the reported vehicle ages from respondents indicate that over 80% of the vehicles in our county will be replaced in the next 10 years. VCED makes recommendations to switch to an EV.

| Reported vehicle ages | |
|---|---|
| Vehicle Age | Percentage of Total |
| Less than 5 years | 19% |
| 5 to 10 years | 41% |
| 10-15 years | 27% |
| Over 15 years | 13% |

We will continue monitoring vehicle registrations of EVs for Vernon County to track the adoption rate.

## Water Heating

Our energy assessment data shows about 42% of the homes in Vernon County using an electric water heater. Heat pump water heaters (HPWH) use about 25% of the energy of a standard electric water heater. This means we could heat the water in 100% of the homes in Vernon County for almost half (56%) the electricity that the 40% using electric water heaters currently consume.




There are a few instances where heat pump water heaters are not appropriate because of the fact that they pull heat from the surrounding air. For example apartments that have the water heater installed in a closet may not be a good candidate.

Some people have expressed concern about the fact that a heat pump water heater doesn't recover as quickly as a standard water heater. This is easily overcome by either installing a larger water heater or running the heater at a higher temperature and using a mix valve for scald protection.

*“I took your advice and changed our water heater, we are saving $52 a month!”*, Jesse K - family of 5 with 3 small children

A side effect of heat pump water heaters is they provide some dehumidification. It may not be enough to eliminate a dehumidifier but it will certainly make the ones we have not work as hard.

Most local utilities offer rebates of $300 to $600 toward the purchase of a heat pump water heater. The Inflation Reduction Act increased the energy efficiency tax credit, and created income based discounts of up to 100% of the cost with a maximum $1,750. Once these income based programs are set up, many residents in our area could upgrade for no cost.

We recommend that everyone with a propane or standard electric water heater consider replacing their unit with a heat pump water heater as soon as possible. Even with a newer water heater the energy cost savings are large enough to justify replacement. Natural gas water heaters should be upgraded when they have aged out. Natural gas water heaters are more expensive to operate than a heat pump water heater but the difference

isn't enough to justify replacing a fairly new heater. Once the IRA incentives have fully rolled out, this recommendation may change due to the changing economics.

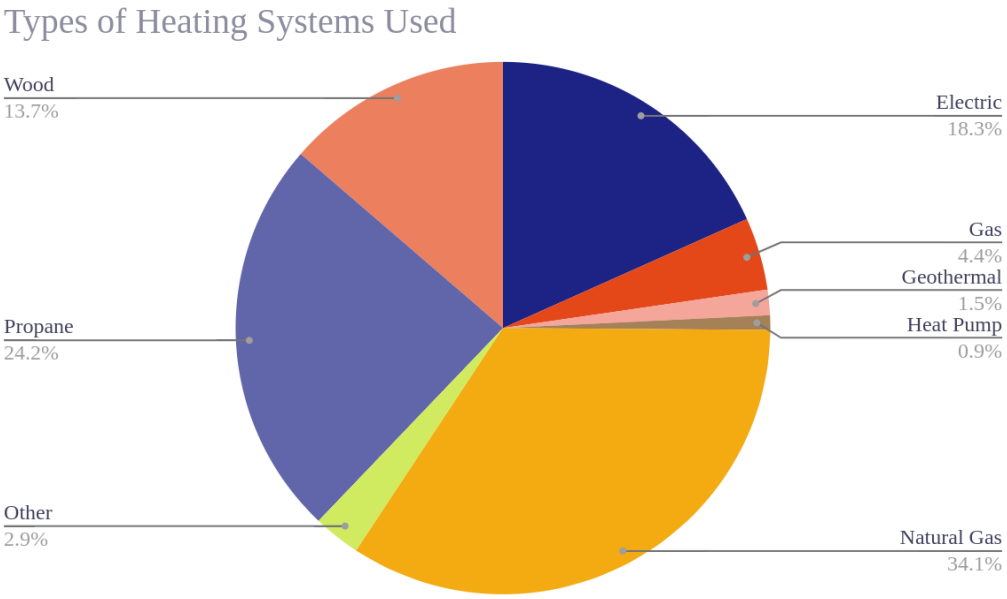
## Space Heating

Space heating accounts for around 56% of our home energy consumption and around 86% of the natural gas consumption[27] in office buildings.

Based on our collected data, the average size of a home in Vernon County is just under 2000 square feet.

Approximately 40% of the homes are leaky (ACH50 > 5.0) and have low efficiency furnaces (< 90%). CouleeCAP has an excellent weatherization program that has improved the energy requirements for many low income families in our area. Without this program the percentage of leaky homes would be much higher.

No matter how it's heated, weatherization provides the best return on investment of any heating upgrade. The Inflation Reduction Act includes a $150 rebate to help pay for a home energy audit.




Natural gas and propane account for almost two-thirds of residential heating fuel.

The three main ways heat pumps are used to heat homes are geothermal, heat pump systems (furnace replacement often with gas backup), and mini-splits.

Geothermal systems are the most efficient systems but are also quite expensive to install.
Heat pump systems resemble a central air conditioner that can pump heat in both directions.

A mini-split has an outdoor unit and one or more indoor units. Their efficiency at lower temperatures has improved greatly in recent years. Several units now advertise heating capabilities down to -31°F, which was unheard of as little as a year ago.

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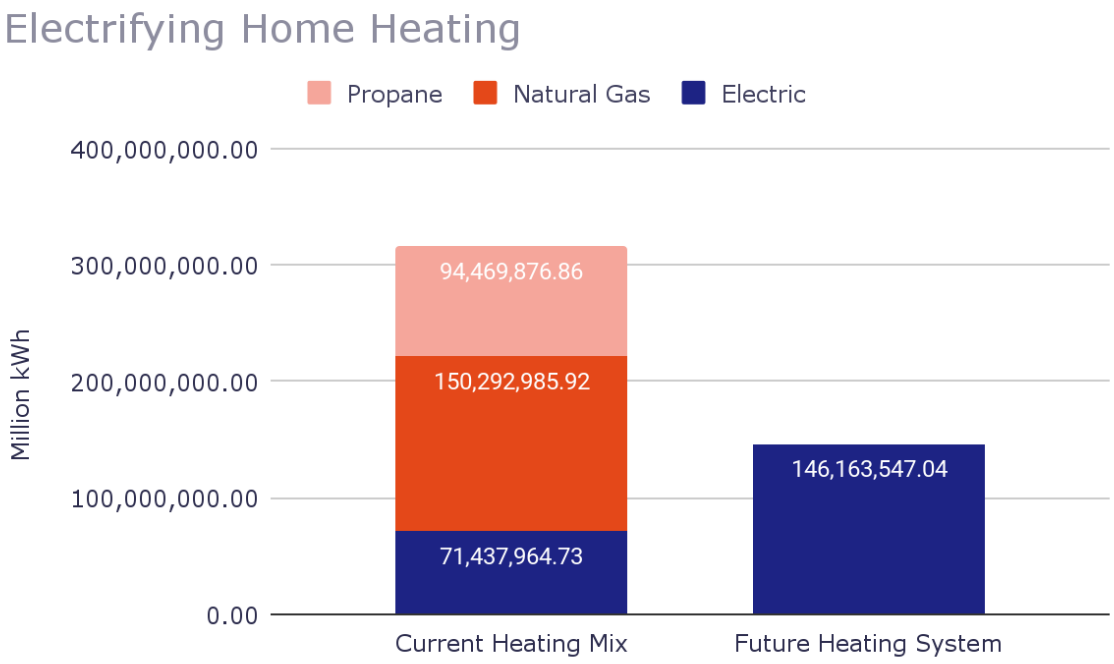
[27] U.S. Energy Information Administration via Madison Gas and Electric Company's Managing Energy Costs in Office Buildings research report. https://www.prescriptivedata.io/content/chart-of-the-day/office-building-natural-gas-consumption

Geothermal systems are currently one of the few heat pump systems that can meet 100% of the heating needs for a building in our area. Some newer cold weather mini-split systems may be able to, but most still require some backup heat.

Using the performance data for one of these newer mini-split systems we have calculated the potential energy savings and use for electrified space heating.




*Vernon County 2019 annual heating load*
*Source U.S. Energy Information Agency (EIA)*

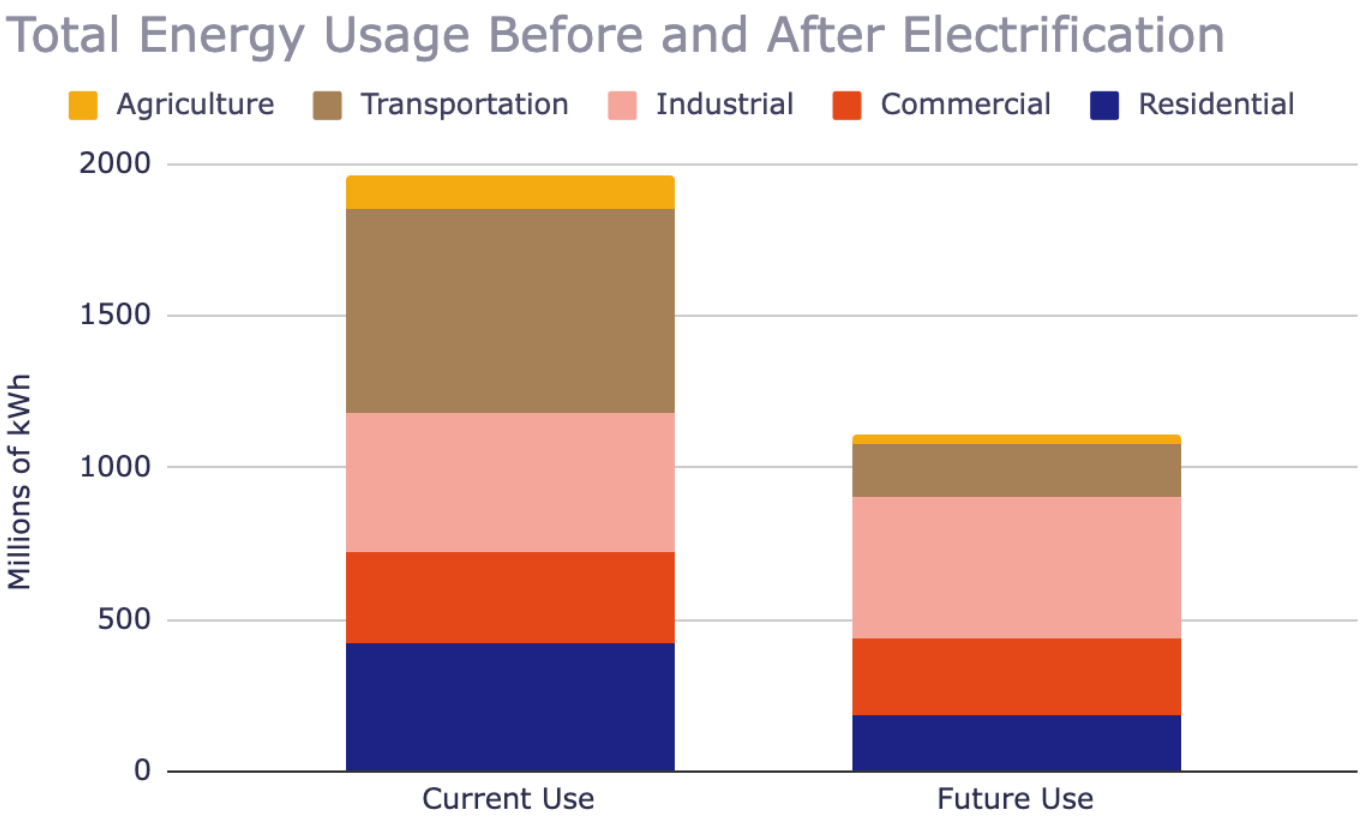
The main challenge in our area with air source heat pumps is the fact that as it gets colder outside, heating capacity and efficiency go down, while heating requirements go up. Extremely cold weather will create winter peak demand events on the grid similar to the demand peaks on very hot summer days.
New air source heat pumps, however, can provide heating down to well-below freezing temperatures with the added benefit of efficiently providing cooling from the same unit in warm months.

## Decarbonization

Our primary recommendation for decarbonization is solar power. It is economical, low maintenance, and reliable. Combined with energy storage , Vernon County is capable of meeting 100% of our energy needs locally and equitably with solar power.

## Solar Power

A conservative estimate of our county-wide energy needs after electrification is just over 1.1 billion kWh per year. It will likely be much lower.

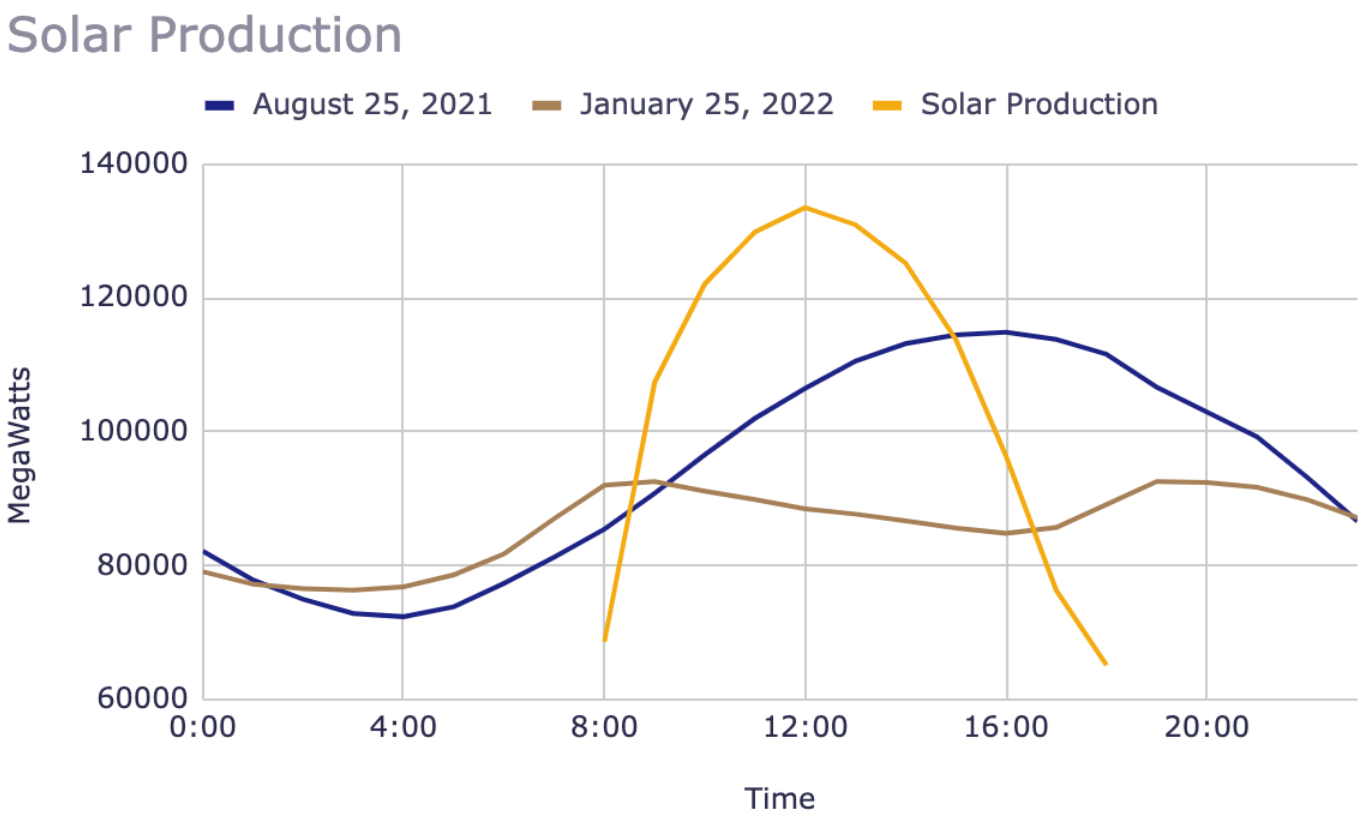



To meet 100% of our net energy will require 746,000 kW of solar power, or about 1.7 million solar panels.

For some perspective, average residential energy needs will require 21 solar panels per home. Transportation needs require an average of 5 panels per car, and 9 panels per pickup truck.

## Energy Storage

As the utilities like to say: “But the sun doesn’t always shine”. While this is true, the sun does rise very predictably *every single morning*. The following graph shows the timing of solar production compared to summer and winter energy consumption.




*Source* [https://www.misoenergy.org/](https://www.misoenergy.org/)

While the timing of solar power doesn't exactly match the demand curves, there is large overlap. Energy storage makes it possible and easy to manage the difference.

When we talk about energy storage, we mean both thermal storage and batteries. There are already massive amounts of thermal storage available; we're just not using it very well. Our homes, water heaters, and freezers are all examples of usable thermal energy storage.

One way of using a house as thermal storage is during the summertime when we are using our air conditioning. With solar panels, a programmable thermostat can be set to a lower temperature during the day when the sun is shining, even if no one is home. In the evening as solar production wanes, bumping the temperature up a few degrees will ensure that the AC doesn't run, likely till the next day when the sun is up again. The house is cool and comfortable while placing almost no load on the grid.

In homes that are well weatherized and have a programmable thermostat, this strategy will cost nothing and be very comfortable, perhaps even more so than the current strategy of keeping the thermostat higher until we get home from work.

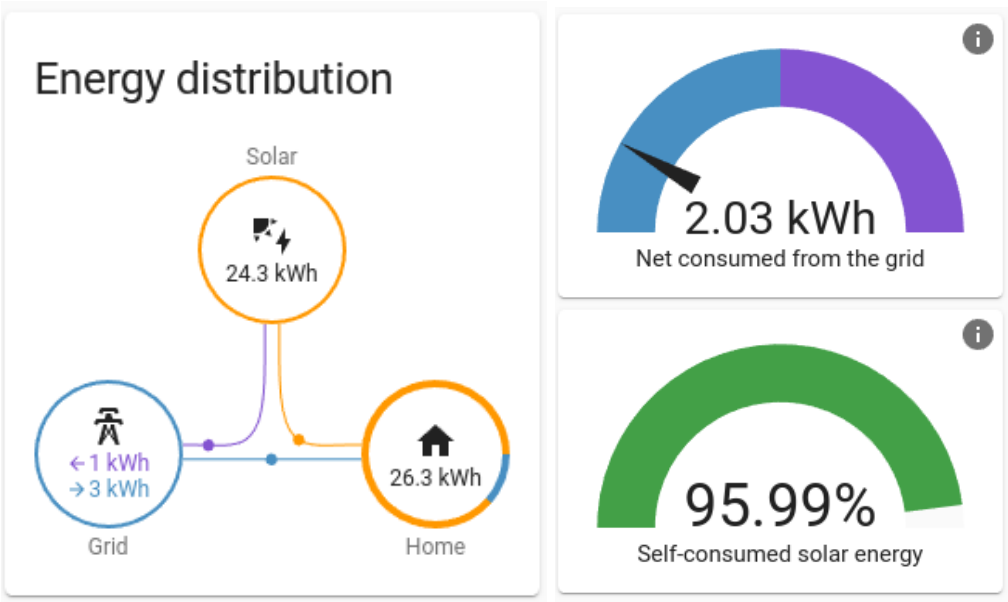
Newer "smart" water heaters can be programmed in a similar fashion so we have plenty of hot water in the evening when people are wanting to shower and do the dishes. Most heat pump water heaters have smart controls that make programming like this very easy.

These types of strategies for storing energy as thermal storage on daily cycles are very inexpensive to implement and once set up we don't even notice them. By using these types of storage strategies, first we greatly reduce the battery storage capacity required.

Home backup batteries, grid scale batteries, and electric vehicles are all commonly used battery storage.

Electric vehicles now have enough range to provide a high degree of flexibility over when we charge them; today, tomorrow, or this weekend. This flexibility works well with solar power by making it much easier to manage a few days of cloudy, less productive weather. Some vehicles can use their battery to power the home providing even more options and energy portability.

After accounting for EV storage and other thermal storage, the energy that needs to be stored and made available for nighttime use becomes a fairly small percentage of our overall energy needs. Smart energy management and storage systems are capable of doing a tremendous job of balancing solar power and loads as the following shows by using water heating, home heating, adjusting freezer temperature, and EV charging to maximize solar energy storage and minimize grid use.




*Energy distribution/consumption for October 3, 2022 These charts show how load management can balance solar production to keep overall demand for battery storage and/or the grid very low.*

## Automation

Many of the energy storage and management techniques we describe can be automated making them easy, reliable and foolproof. Once set up we don't have to worry about when the sun is shining or not, remembering to turn this device on or that one off at a certain time. Most home automation tools offer remote controls so we can adjust the schedules and settings of our devices even if we're not home. This can be very helpful if we leave on vacation and then realize we forgot to turn off the water heater or change our thermostat.

## Cost Savings

How much does it cost to electrify and decarbonize? This is the wrong question, electrification and decarbonization are not costs, they are savings. The question should be, "how much do I save when I electrify and decarbonize?"

10 Year Cost Savings

| Technology | Cost to upgrade | Cost Savings |
|---|---|---|

| | | |
|---|---|---|
| Heat pump water heater | $0 to $500 after rebates | $780 to $4400** |
| EV | -$7,500 to $1,000, see transportation section | $10,000 to $16,500*** |

**Depends on water heater fuel type being replaced.
***Based on 12,000 miles per year and 11 cents per kWh, savings will be greater for those who drive more per year.These figures do not include the added savings from reduced maintenance.

Two simple upgrades that will yield savings of somewhere between $10,000 to $20,000 over 10 years.

During those 10 years the electricity costs to operate our household (heating, appliances, electronics, etc) and power our EVs would be around $25,000. After rebates and incentives, a solar array large enough to meet our power needs would cost around $15,000 or less, adding another $10,000 to our savings. This amount can be expected under most utility rates in our county, but depends somewhat on individual utility policies.
Some other factors to consider:

- Once we install a solar array those electricity costs are “locked in”
- Utility electricity prices will increase during the life of our solar array
- Solar panels have a warranty of 25 or more years and most will produce energy even longer, meaning that for at least the following 15 years our energy is free

Adding the above factors  together can provide  savings of $20,000 to $30,000 or more the first 10 years.

The largest up front cost to electrify and decarbonize is adding solar panels. Depending on financing available, the savings often more than cover the monthly payments. We have extra money in our pockets from day one, this should help to make solar panels within reach for everyone regardless of income. The amount of extra money in our pockets will increase as time goes on, this is the exact opposite of most other energy expenses.

# Chapter 5: Actions and Recommendations

The following sections lay out 28 actions and recommendations for programs, projects, and policies to achieve full electrification and decarbonization of  Vernon County that is equitable and inclusive. The recommendations reflect the findings and analysis completed over the past year of energy assessment and planning completed by VCED.

When recommendations state that Vernon County will take specific actions, we are referring to all the citizens and businesses in Vernon County. We indicate the specific actions VCED will take to support these efforts.

The Inflation Reduction Act (IRA) has financial benefits across many of the following recommendations, and VCED will educate the public on how to take advantage of these and future incentives.

The recommendations are organized by

## Electrification and Efficiency

RECOMMENDATIONS:

1. Transition to heat pump water heaters. Encourage the immediate transition to electric heat pump water heaters, preferably “smart” water heaters, and demonstrate the immediate cost savings. VCED will explore a group buy to further reduce the cost.
2. Use energy monitoring in homes and businesses. Install whole-house energy monitors into circuit breaker boxes and utilize simple energy monitoring smart devices. VCED will provide continued education and tech support to help people make the most of the information monitors provide.
3. Transition to EVs. Educate the public about charging options, benefits of EVs, and provide opportunities for test drives through energy coaching and events like *Drive Electric*. Electrify school buses and city fleets. Ask local car dealers to bridge present EV shortcomings with rentals for activities such as long range towing.
4. Transition outdoor power equipment to electric. Lawn mowers, chain saws, string trimmers, leaf blowers are all available in electric and are more efficient.
5. Promote local city and municipal policies that support electrified renovations on public and private buildings and help future-proof new construction.
6. VCED to support and educate residents about all incentives, tax credits, and other benefits available to them, including the Inflation Reduction Act.
7. Develop and distribute a localized Electrifrication Toolkit/Guide that provides information about the types of technologies, appliances, costs, rebates, and efficiency measures that are available, appropriate, and specific to Wisconsin/Vernon County (see example[28]). This should be an easy-to-use guide to help people choose their best next steps. This guide will need to be updated frequently as incentives and technologies change.
8. Train construction workers, handymen, and DIY homeowners on insulation and air sealing product selection and best practices.

FURTHER RESEARCH AND EXPLORATION

- Research space heating with heat pumps that has the potential for100% locally-produced energy use.
- Monitor new market offerings for electrified heavy equipment such as tractors, combines, snow plows, etc.
- Explore the potential to share battery capacity to balance seasonal grid demands. For example much of the agricultural equipment which is only operated during spring planting and fall harvesting sits idle during the summer and winter when demand is highest and energy storage could be most useful.
- Explore electric vehicle ride sharing programs that are affordable and accessible for rural and low-income residents.
- Research battery recycling processes and how closed loop systems can be established locally to reuse or repurpose batteries from electric vehicles, home energy storage systems, etc. Explore small business and economic development feasibility to address this future need.

## Education and Human Behavior

[28] *A Pocket Guide to All Electric Retrofits of Single Family Homes | Willow*. (n.d.). Redwood Energy. Retrieved October 26, 2022, from https://www.redwoodenergy.net/publications/a-pocket-guide-to-all-electric-retrofits-of-single-family-homes

RECOMMENDATIONS:

9. Build a community culture of mindfulness around energy use and confidence in the decisions we make. VCED to continue to offer and develop its energy coaching and popular education programs to support people and businesses in the transition to electrification and decarbonization.
10. Strengthen and establish clean-energy and green career pathways. Develop and incorporate energy, sustainability, and other STEAM (Science, Technology, Engineering, Arts, and Mathematics) education curriculum into local schools.
11. Maximize customer participation and input in their utilities. Hold educational events to help people understand how utilities can help them achieve energy goals that align with their values. People must also understand how the utilities are hindering these efforts and how they can work together to communicate their values, increase transparency, and hold them accountable.

## Community-Driven Projects

RECOMMENDATIONS:

12. Plan and develop community shared solar projects. Create opportunities for every citizen in Vernon County to be an owner/participant in community shared solar. This is particularly important where residents may not be able to install on site solar. For example, in cities and villages, rural homeowners in valleys, renters, and low-income people.
13. Install more public EV chargers. Identify strategic locations based on state, regional, and local planning that will increase convenience for long range driving. A few strategically located DC fast chargers will provide needed charging capability while people will do most of their charging at home using a standard wall plug.
14. Implement mini grid and microgrids to increase resiliency. Ensure every community has some priority facilities available that will remain functional even during an extended power outage. For example, community members can have a place to charge cell phones, medical equipment, and other critical devices; places to gather and share their experiences (mental health implications); and coordinate support and mutual aid. These backup/storage systems are also critical to establish local renewable energy islands in schools, homes, and community-owned facilities that can operate without grid connection during flooding and other extreme weather events. The addition of battery storage will help meet critical energy needs until grid service is restored giving utilities more time to make repairs avoiding overtime and working in dangerous weather.
15. Develop a clean energy transition plan with metrics and specific target dates for Vernon County by October 2023. Engage with utilities, municipalities, schools, and other key stakeholders to align on shared energy plans and goals.
16. VCED will aim to partner with Couleecap and other community organizations to ensure seamless education and support in the transition to clean energy for all residents of Vernon County regardless of income level or other barriers.

FURTHER RESEARCH AND EXPLORATION:

- Explore the potential for district heating opportunities.
- Monitor advancements in seasonal storage technologies.

## Market Transformation

RECOMMENDATIONS:

17. Connect local electricians, plumbers and HVAC contractors obtain the training and experience they need to recommend and install new, more efficient electrified equipment.
18. Build partnerships with solar and storage installers and contractors to educate on appetite for new technologies and services; offer financial incentives for additional training.
19. Continue to educate consumers about building science and improved technology best practices to hold contractors accountable that they provide high quality work.
20. Engage and support local auto dealers to better serve their customers with helpful and accurate information about EVs.

FURTHER RESEARCH AND EXPLORATION:

- Explore a potentially new business opportunity using automation and energy monitoring to provide comprehensive energy management services to energy consumers. These services will balance solar production with on site consumption, minimize battery storage requirements, and maximize savings from time of use programs.

## Locally-Owned Renewable Energy and Storage

RECOMMENDATIONS:

21. Promote rate structures that encourage consumers to shift their load to match generation and to times of low demand. As the market share of distributed solar generation increases, work with energy consumers and utilities to develop rate structures that are fair and cost-effective.
22. Provide group purchasing opportunities that would bring down the cost of solar and battery storage and support the installation of more residential and business solar.
23. Leverage existing solar financing tools (e.g., commercial PACE) and create new ones. Tools like On Bill Financing or Pay-as-You- Save make solar, storage and energy efficiency more accessible to low-to-middle income families.
24. Accelerate energy storage development to expand levels of renewable resources and increase resiliency. Pursue public-private partnerships to make necessary investments that bring energy storage online through multiple ownership and finance models.
25. Conduct a comprehensive energy storage potential study focused on storage coupled with new or existing renewable generation for communities in Vernon County. The study should look at costs and benefits, including emission reductions, equity, resiliency, and grid support. The study should identify potential sites that maximize these storage benefits. Feasibility studies on specific projects at specific project sites should be considered depending on the results of the study.

FURTHER RESEARCH AND EXPLORATION:

- Explore opportunities for increased geothermal energy use and thermal storage.
- Work with utilities and other stakeholders to better understand and address grid modification needs and costs.

## Energy District

RECOMMENDATIONS

26. Guide other counties in Wisconsin and nationally in implementing the energy district model. Support new and existing energy districts by sharing best practices, tools, and resources.
27. Explore opportunities with the PSC, other state and federal agencies, and/or private foundations to help secure reliable funding for the energy district movement. This funding should include performance criteria for energy districts that ensures progress toward locally-owned renewable energy while being broad enough to permit individual energy districts to customize their offerings at the local level.
28. Seek partnership opportunities that expand VCED's capacity to best support Vernon County's equitable transition to clean energy.

# Chapter 6: Forward Looking

From the creation of the Soil and Water Conservation Districts (1933) to the founding of Organic Valley Cooperative (1988), the people of our county continue to demonstrate the cooperative spirit, prioritization of conservation and pioneering grass roots thinking that will ensure our success. This can-do spirit allows us to work together as we make the transition to local renewable energy. Local connections, community, interpersonal relationships, and trust are important as people consider the implications of their energy choices. Our job is to help our neighbors understand that local renewable energy is a more resilient, secure, and economical way of powering our lives than using imported energy as we do now.

We believe the most effective way to help people seriously consider new alternatives is by one on one sharing of personal experiences. One neighbor sharing with another what they tried, what worked well, what didn't work so well, and how they resolved issues along the way. An energy district can empower people who are willing to take some risks to try doing things differently. Their experience will pave the way for the rest of our community. In this way the energy district becomes a repository of experience and knowledge, and a network of energy coaches and champions to share that information. In one of our consultations the client said, "You're like an energy therapist!", we'll take it.

Marketing hype coupled with misinformation from vested interests can easily overwhelm people when trying to navigate this energy transition. VCED has been and will continue to be very careful to stay with technologies that we have experience with, find and work with people who are willing to test technologies that we don't, and share what we learn along the way. We gain more trust when we honestly tell folks that we don't know enough about a particular technology to recommend it yet.  We don't want to jump on a new technology that hasn't been proven in our area and environment. Just as important, we do not want to wait for the next great technology that's right around the corner. There are plenty of ways we can take action now as other areas are getting worked out.

What does 100% local renewable energy look like?

We begin by producing our energy as close as possible to where it's being used. These will be as small as one or two small solar panels powering lights in a shed to covering the large rooftops of large stores, schools and other buildings. Roof and ground mounted solar panels on location will provide a large percentage of the energy we need.

Some locations are not suitable for solar panels, some people rent their home and cannot install solar panels. Community solar is the next level of local energy providing everyone the opportunity to participate in  energy production within their neighborhood, village or city.

Nearby utility scale solar will produce the remainder. There may be some wind and hydroelectric power however we don't expect this to be much.

The distributed nature of solar energy means that electric utilities will need to adapt their business model. Energy production will no longer be centralized, the distribution grid will become a network instead of a delivery system. This network will facilitate the sharing of energy between connected homes and businesses.

Especially in rural areas the cost of operating our distribution grid will need to drop significantly. Inexpensive batteries and vehicle to home(V2H) technology will make the expense of maintaining poles and wires much more difficult to justify. If these costs can come down enough and/or the rates paid for excess generation high enough customers may choose to stay connected.

Energy demands vary widely based on the time of day, day of week, and seasonally. Solar power is also variable. Some of this variability works together nicely, some does not. How do we bridge the difference between demand and production?

The solution discussed most often is battery storage, the question is how much battery capacity do we need? Are there ways we can reduce that amount? How can we make the energy stored in batteries last longer when there are longer stretches of cloudy weather?

One obvious energy management approach is to simply use the energy when it is being produced. Dishwashers, clothes washers, smart air conditioners, and smart water heaters can all easily be programmed to run when the sun is shining. EV charging can be programmed to happen when the sun is shining as well. Because most EVs have enough range to cover many days worth of driving, charging can be so flexible that we can wait several days or more if we have a stretch of cloudy weather. One challenge is that our car often isn't home during the day. This may be an opportunity for our local utilities to work out a cost effective way to deliver power that our solar panels produce to workplaces, stores and other places where our cars might be during the day.

Seasonal variation in energy demand can be more difficult to overcome, particularly winter when solar production is lowest and space heating needs are the highest. We will continue to look for ways to overcome this challenge.

This idea of using energy as it's produced can be automated and will usually not be noticed by us, the end users. There is so much we can do with smart technologies, automation, and the internet of things to take advantage of excess solar production with almost no intervention on our part. We hope utilities will operate in ways that empower energy consumers to manage their own loads and avoid a big brother style "we'll control everything" approach.

Controlling when our energy is consumed will prepare loads for the intermittency of solar power while also reducing the amount of battery capacity we will need.

Energy storage doesn't always mean batteries, as we've seen it can be hot water stored in our water heater or cooling our home on a hot summer day while the sun is shining so it then stays comfortable throughout the evening. Home insulation and air sealing will be more about improving energy storage, using less energy will be a beneficial side effect. There are many clever people who will figure out even more ways to use and store energy as it's produced.

The cost of solar panels and batteries is dropping quickly and will continue to decrease. This is because solar panels are a technology that is manufactured, not a fuel that is extracted, processed, delivered, and then consumed. Manufacturing efficiencies will continue to improve and engineering costs will be spread among a larger market. The cost curves for solar panels closely resemble computers and flat panel TVs. Think about how the price of flat panel TVs has changed in the last 20 years, we expect solar panels to follow a similar pattern.

Abundant inexpensive energy means we don't have to cut back or do without, we can actually be more comfortable in our homes, drive better cars, and not worry about weather events taking our power out. This will improve our quality of life, *and* we get to keep more money in our pockets and our local economy.

Vernon County Energy District is the first energy district in Wisconsin. We look forward to learning from and sharing what we know with other energy districts, helping other counties that wish to form their own energy

district, and most of all working with our neighbors in Vernon County to help us achieve 100% local renewable energy.

## Glossary

Adaptation - the process of adjusting to new (climate) conditions in order to reduce risk to valued assets.

Affordable housing - housing where the occupant is paying 30% or less of the gross income on total housing, including utilities.

Building electrification - the replacement of fossil-fuel-burning appliances and equipment with efficient electric-powered options.

Building retrofits - improvements made to the energy efficiency of a building that enable energy conservation. This may include insulating roofs and walls and installing high-efficiency appliances, heating, ventilation, and cooling equipment.

Carbon footprint - the amount of greenhouse gasses (and especially carbon dioxide) emitted by something or someone. In most cases we measure the annual carbon footprint—which is the total emissions for a business or household in a year.

Clean energy - energy sources that produce energy without also producing greenhouse gasses or other pollutants. Solar power, wind energy, geothermal, and hydro power are clean energy.

Climate change - a long-term shift in local or global climate patterns, including changes in temperatures, precipitation and wind patterns.

Community solar - any solar project or purchasing program, within a geographic area, in which the benefits of a solar project flow to multiple customers such as individuals, businesses, nonprofits, and other groups.

Decarbonization - the process of reducing or stopping carbon gasses from being released into the atmosphere. This refers to moving away from energy systems that produce harmful greenhouse gas emissions.

Ecosystem Services - benefits that humans receive from natural systems.

Electrification - the process of replacing technologies that use fossil fuels (natural gas, gasoline) with technologies that use electricity as a source of energy.

Energy Burden - the percentage of household income spent on energy costs such as utility bills. According to the US Department of Energy, the energy burden for low-income households is three times higher than for non-low-income households.

Energy efficiency - using less energy to perform a specific task than is typically or previously required.

Energy security - whether an entity—a household, a business, a nation— has access to an energy supply. Because there are no fossil fuel resources in Wisconsin, Vernon County will increase energy security as we transition to renewable energy sources located in our county

Energy storage - the capture of energy produced at one time for use at a later time to reduce imbalances between energy demand and energy production.

Equity - a strategy for addressing racial and social injustices. When we practice equity we give everyone what they need to be successful; this is different from equality, where we treat everyone the same.

Environmental justice - the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Green bank - an entity established to encourage private investments in low-carbon and climate-resilient infrastructure.

Greenhouse gas (GHG) - any gas that, in the atmosphere, absorbs heat radiating off of the Earth's surface and reflects that heat back to the Earth. Greenhouse gasses—like carbon dioxide and methane—act as a "greenhouse" trapping heat in the Earth's atmosphere.

Grid reliability - the capacity of a power system to deliver the quantity and quality of electricity needed by all customers who use the grid.

Global warming - the long-term rise in the Earth's global temperature, which is primarily due to increased greenhouse gas emissions associated with human use of fossil fuels.

Interconnection - the linkage of energy generation systems to the electrical power system. This enables renewable energy sources to connect to power grids.

Just transition - focus on the transition out of high-carbon activities and into the green economy, seeking to ensure harm to workers, communities, countries, and regions is avoided while maximizing the benefits of climate action.

Low- or moderate-income (LMI) - a term used to describe people and households who make less than 80% of the area's median income.

Mitigation - processes that can reduce the amount and speed of future climate change by reducing emissions of heat-trapping gasses and removing them from the atmosphere.

reducing and stabilizing the levels of heat-trapping greenhouse gasses in the atmosphere

Net-zero - when an entity produces as much renewable energy as it consumes over the course of the year.

Popular Education - Popular education is a continual learning process wherein each experience in social change informs subsequent strategies and action

Renewable energy - energy coming from a source that does not deplete—such as solar energy or wind power.

Resiliency - the capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption.

Time-of-use metering (TOU) - a method of measuring and charging a utility customer's energy consumption based on when the energy is used. Utility companies charge more during the time of day when electricity use is higher. TOU rates vary by region and utility.

Underserved - An underserved population or community has limited access to health care and other types of services. People who are underserved face economic and social barriers that prevent them from accessing services or receiving the same quality of services as those who are not underserved.

Vulnerability - used to describe populations or an area that may be more prone to negative impacts due to a combination of socio-demographic, health, and occupational factors. This increased risk reduces their ability to recover and adapt from hardship.

# Appendix

**EIGP Metrics:**

| **Measure and Evaluate current** | % Complete | | Notes |
|---|---|---|---|
| 300 Homeowners | 104% | 311 | |
| 20 Business/organizations | 110% | 22 | |
| 4 Municipal/Schools | 100% | 4 | Viroqua, Readstown, Stark, Kickapoo |
| 2 utility | 100% | 2 | La Farge, VEC |
| **Planning Efficiency savings and local generation** | | | |
| 2 Municipality/Schools | 50% | 2 | |
| 10 Businesses/Organizations | 10% | 1 | 21 Ready-to-go |
| 50 Homeowners/Renters (5 LMI) | 100% | 55 | 8 LMI Completed |
| 1 utility | 100% | 1 | La Farge |
| **Evaluate potential for Locally Owned RE : Desirability Affordability practicality of onsite / community solar** | | | |
| 300 Stakeholders - survey measuring interest | 108% | 392 | Goal is to achieve statistical significance (380) |
| 100 Stakeholders investigate finance options | 91% | 91 | Westby Cooperative Credit Union (WCCU) and GreenPenny Bank provided a total of 10 new solar loans to residents of Vernon County since the start of 2022. |
| 20 stakeholders request a site assessment or project quote from a renewable energy contractor | Undetermined | | 60 new solar projects (1.1 MW) in Vernon County. |
| **Establish Energy Club** | | | |
| 40 unique participants | 163% | 65 | |

Water heater performance. Note: hybrid electric is a heat pump water heater.

| Fuel Type | Water Heater | Quantity/Year | kWh Equivalent |
|---|---|---|---|
| Natural Gas | Standard | 269 Therms | 7,880 |
| | High Efficiency | 249 Therms | 7,300 |
| Propane | Standard | 294 Gallons | 7,940 |
| | High Efficiency | 273 Gallons | 7,370 |
| Electric | Standard | 3,490 kWh | 3,490 |
| | Hybrid Electric | 866 kWh | 866 |

EV vs Gasoline comparison table

| | Gasoline Version MPG | Gasoline kWh/Mile Equivalent | Electric Version kWh/Mile |
|---|---|---|---|
| Hyundai Kona | 32 | 1.05 | 0.28 |
| Ford F150 | 19 | 1.77 | 0.48 |