ENERGY

It wasn't long ago that individuals, families, and communities had a much different relationship with energy services such as heating, cooling, and electricity than we do today. Here in Northern Minnesota, many homes and businesses relied on wood for heating. Individuals were physically responsible for felling trees, splitting and hauling wood, and keeping the fires burning through the cold winter months. Physical labor from humans and domesticated animals provided the foundation for the energy needed to survive and thrive. It wasn't until relatively recently that people began to have access to electricity, which meant work and home life are now much less dependent on the natural cycles of the sun, ecosystem functions, and the life cycle of trees. The relationships between people and their environments were thus much more intimate.

Today, many of us take our energy services for granted; coming home to a warm house, having the means to get ourselves from home to work with little effort, and being able to light our homes, power our phones, and quickly and reliably access the internet. For better and worse, we have become distant from the sources of power driving our everyday lives. While many living conditions have become much less harsh, we are also increasingly disconnected from the consequences associated with our modern energy systems that run primarily on fossil fuels such as coal, oil, and natural gas. Emissions from the combustion of these fuels travel across individual property, city, tribal, county, state, and national borders. Environmental and human health impacts from the extraction, processing, and combustion of energy sources are therefore easily externalized in our cost and decision-making equations. As we come to terms with the global climate crisis upon us, and begin to increasingly feel the local ecological, social, and economic consequences, we need to dramatically re-envision and restructure our relationship with energy sources and services once again.

Indigenous communities around the world can help re-envision this future. Throughout Indigenous communities, energy sovereignty is quickly becoming an elevated conversation. Prophesies have foretold of the black snake (oil pipelines) and the two paths that lay before us (one of charred and rough soil and the other soft and green). Energy-related climate change mitigation strategies have had both positive and negative impacts on Indigenous communities. An example of the latter has been renewable energy projects, particularly hydro-power, which have separated Indigenous peoples from their homelands. To prevent similar negative impacts, future projects should involve local input during the planning, development, investment, ownership, and operation phases. Additionally, benefits of energy projects should be distributed locally and collectively, rather than distantly and privately.

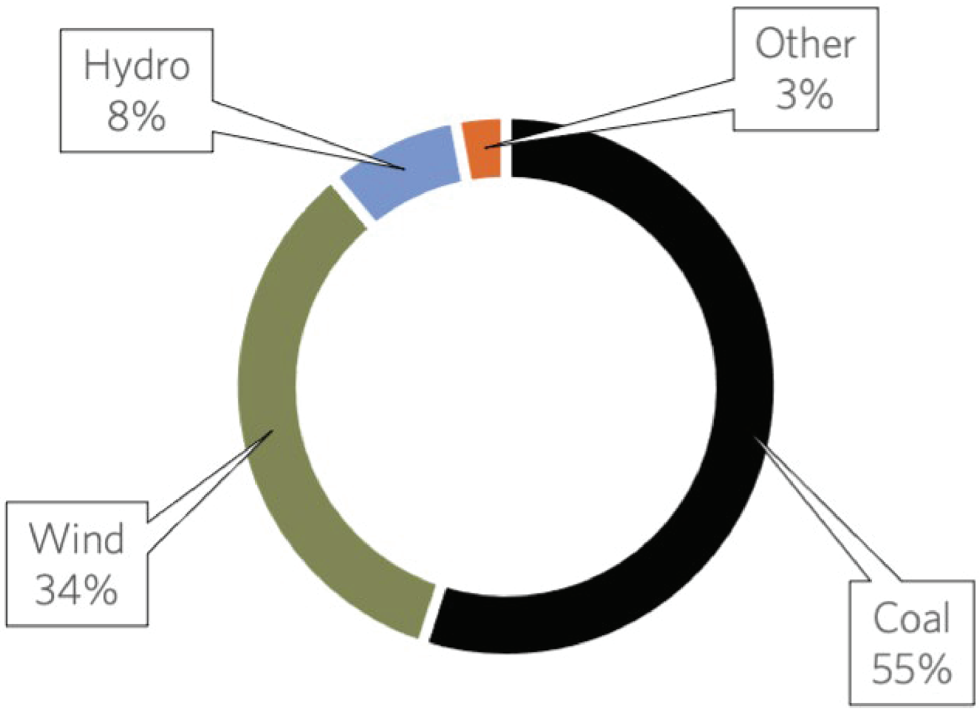
We must also work to build our awareness of the severe inequities that exist in the greater Bemidji community when it comes to energy services. Our region's cold climate requires its residents to expend a high percentage of annual income on maintaining safe and comfortable spaces for living and working. Improving access to affordable energy solutions for individuals at all socio-economic scales has the potential for a dual benefit of increased efficiency and equability of our energy systems.

This report presents information regarding our current local energy conditions to build a better understanding of how our energy services are provided and some of the consequences resulting from our current energy system. It is through understanding where we are that we can begin to formulate reasonable goals and strategies to become a more resilient and sustainable community. While there may be limitations to what we can directly control or influence within our local, state, national, and global energy systems, we do have tools to begin to enact structural change in the greater Bemidji area. We also have the opportunity and responsibility to press individuals and organizations in our spheres of influence to rise to the challenge of working towards a sustainable future for all.

Bemidji State University has a unique and powerful role to play in this understanding and goal setting process. We have expert faculty who can help outline and assess our current energy conditions. We have passionate students who profoundly understand how their future, and indeed our shared future, relies on our ability to tap into the innovative human spirit, reconnect our relationships to the natural world and the cycles that feed our lives, and to develop regenerative energy systems that support life instead of threatening it. We also have tangible actions we can take at the facilities level to ensure that our institution's Shared Fundamental values are represented in the planning, operation, and maintenance of our facilities.

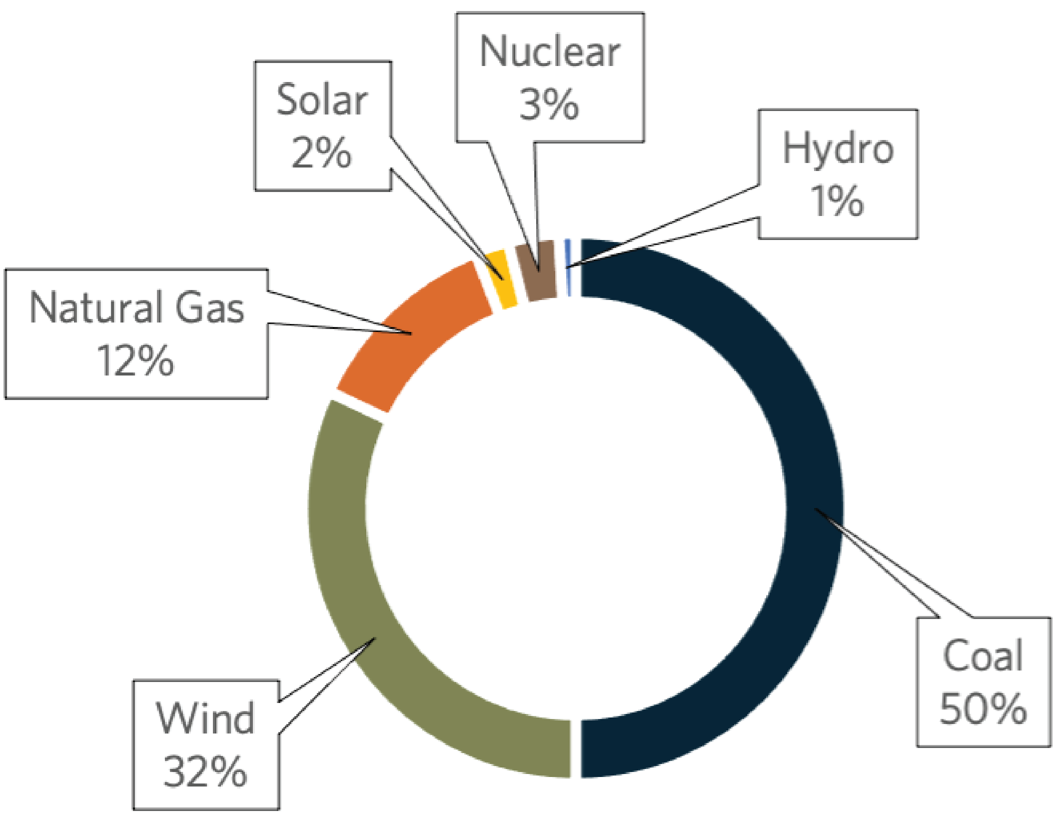
This Energy chapter will be broken down into Community Energy Conditions, Campus Energy Conditions and finally on Local Renewable Energy Opportunities with a primary focus on electricity, heating, and cooling energy services. It should be noted that Transportation has its own distinct chapter in this report.

BELTRAMI ELECTRIC COOPERATIVE



Data Source: Beltrami Electric Cooperative 2022

OTTER TAIL POWER



Data Source: Otter Tail Power Company 2022

COMMUNITY ENERGY CONDITIONS

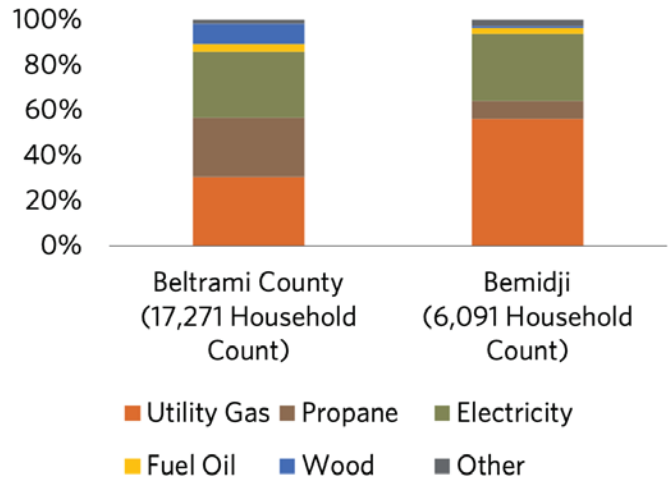
In this section we will highlight our current local energy conditions first by highlighting our energy service providers and their fuel sources, emphasizing the energy burdens in our community, and finally outlining opportunities for increased efficiency and decarbonization.

ENERGY SERVICES

The City of Bemidji, surrounding communities, and rural residents of Beltrami County are served by two electric utility providers. Otter Tail Power Company, an investor-owned utility, services a large portion of residential and commercial accounts within city limits of various municipalities west of Cass Lake including Bemidji, Wilton, Solway, Shevlin, and Clearbrook. Beltrami Electric Cooperative, a member-owned cooperative utility, services outlying accounts throughout the greater Bemidji area. Much of the region's electricity generation is sourced from combustion of coal even as wind and solar resources are further developed.

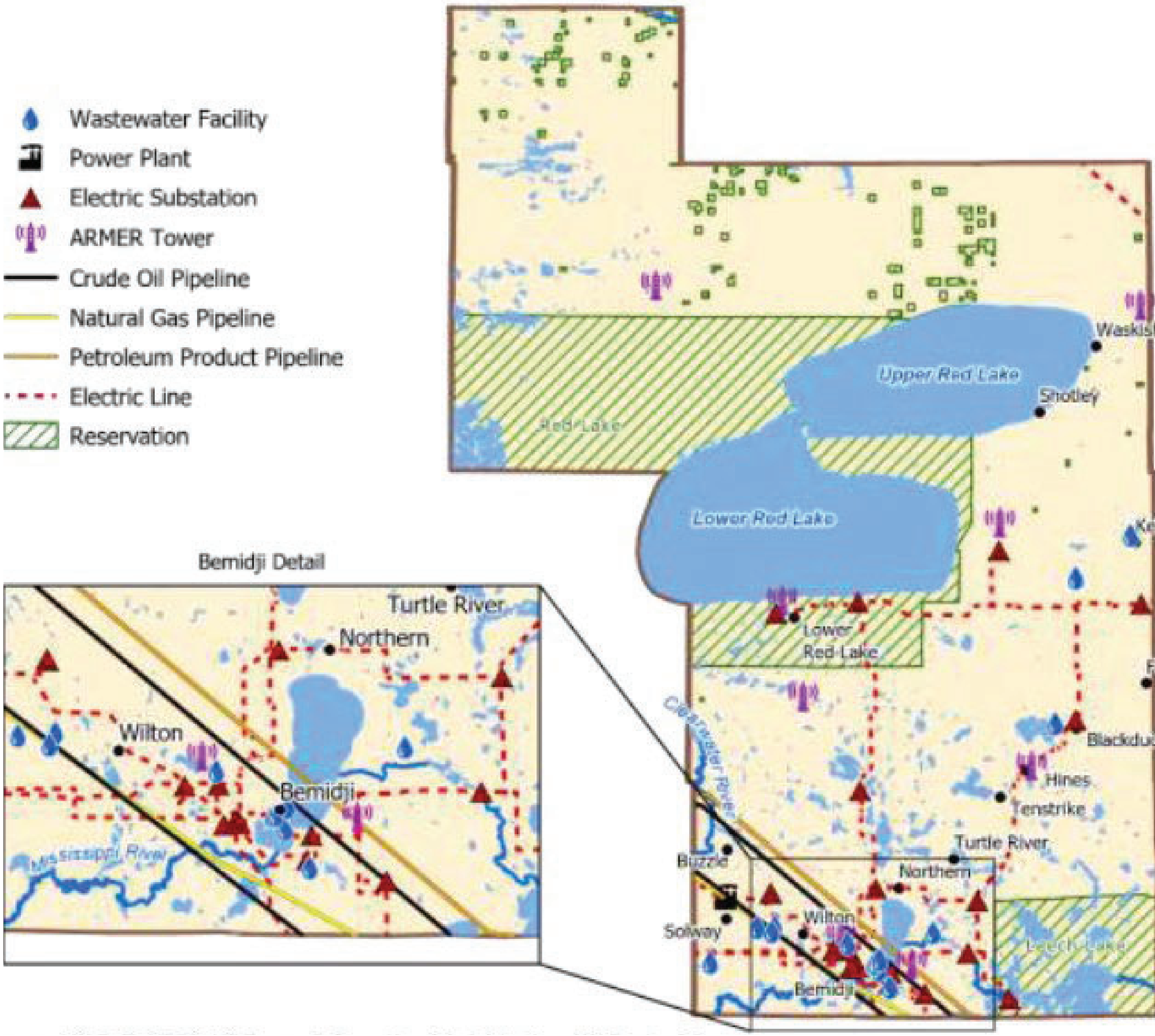
Heating in our community primarily comes from natural gas, propane, and electricity. Natural gas for heating is provided by Minnesota Energy Resources (MERC) through a pipeline network primarily available within the municipal boundary. For community members living outside of the MERC service area, homes are primarily heated with delivered propane, electricity, or wood.

HOME HEATING SOURCES IN BELTRAMI COUNTY & THE CITY OF BEMIDJI



Data Source: Low Income Energy Affordability Data (LEAD) Tool (U.S. Department of Energy, 2018)

UTILITY INFRASTRUCTURE, BELTRAMI COUNTY



MN Dot, MPCA, US Energy Information Administration, MN Department of Commerce (from Multi-Hazard Mitigation Plan, Beltrami County, Minnesota, 2020)

LOCAL EFFICIENCY & CLEAN ENERGY PROGRAMS

Energy efficiency programs run by utilities play a major role in the ability of the community to finance and afford improvements in efficiency.

RESIDENTIAL EFFICIENCY PROGRAMS

The Beltrami and Cass County Community Action Program known as BI-CAP works with low-income individuals and families to reduce the energy consumption of their homes through energy efficiency improvements. They do this work by administering the U.S. Department of Energy's Weatherization Assistance program. Actions such as air sealing, upgrading furnace efficiency, insulation, and window and door replacement are recommended after Energy Auditors preform inspections and determine what is needed. According to a national evaluation of the program, these households save on average $283 or more every year.
Both Otter Tail Power and Beltrami Electric Cooperative offer Conservation Improvement Programs to help income qualified customers save money on their energy bills. These programs focus on electric efficiency opportunities and can include the purchase and replacement of LED light bulbs, aerators, refrigerator replacements, attic, and wall insulation.

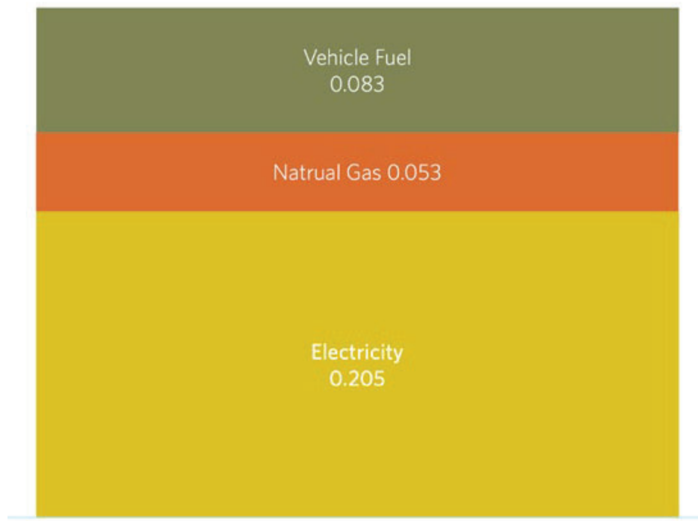
COMMERCIAL EFFICIENCY PROGRAMS

Commercial energy use accounts for over half of energy related carbon emissions, with residential emissions just over a quarter of the total despite representing vastly more distinct buildings. It is important to note Bemidji State University is a major client in the 'Commercial' sector of community-wide energy use and has a large role to play in overall community energy use and carbon emissions - and an equally large role to play in demonstrating and achieving a path towards carbon neutrality.

It is in this spirit that Bemidji State University began a partnership with Otter Tail Power (OTP) through the Commercial Process Efficiency Program. Through the program, OTP issues cash rebates in exchange for completing efficiency improvements, with the goal of mutually benefiting through cost reductions and decreased commercial energy demand. Most improvements through the first nine years (2013-2021) consisted of converting campus lighting to LEDs and replacing older HVAC components with efficient alternatives. Achieving greater energy efficiency reduces the financial burden associated with lighting and heating indoor spaces and prepares campus for the eventual deployment of renewable energy generation projects. As of January 2022, BSU has received over $800,000 in rebates and is already seeing financial and carbon related benefits from the completed upgrades.

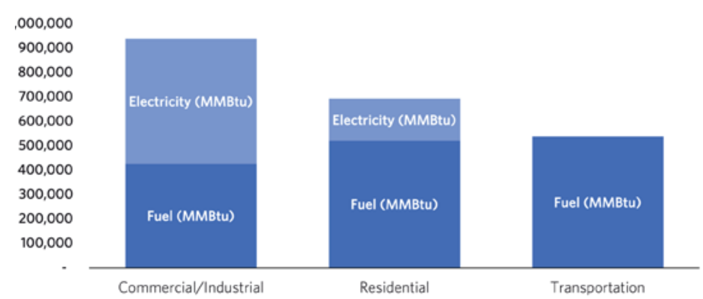
"Ultimately there are structural/systemic barriers to shifting quickly to a carbon free/resilient campus & community"

CO2 INTENSITY BY FUEL TYPE (CO2/MMBTU)



Data Source: Otter Tail Power (2017) and extrapolated MERC natural gas sales to Beltrami County

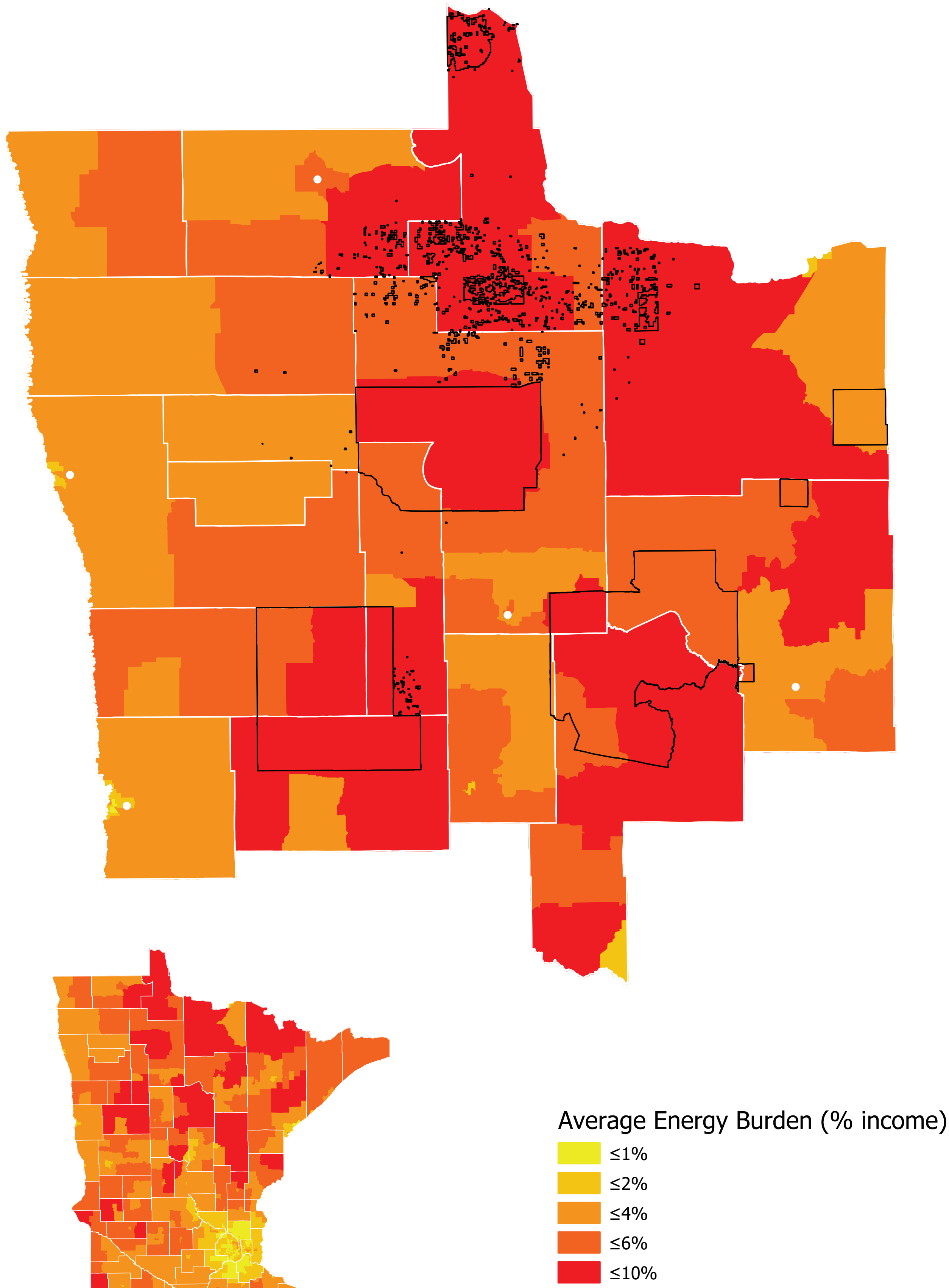
ENERGY EFFICIENCY POTENTIAL



Data Source: Otter Tail Electric (2017). Minnesota Energy Resources Corporation (MERC) (2016), Regional Indicators Initiative (2016), MNDOT (2017).

AVERAGE ENERGY BURDEN

IN NORTHWESTERN MINNESOTA COUNTIES BY CENSUS TRACT



LEAD Tool from the Office of Energy Efficiency and Renewable Energy

ENERGY BURDEN & DECARBONIZATION

It is important to recognize that Beltrami County has among the highest energy burden in the state, with residents paying 4-10% of their annual income on energy costs alone, well above the state average of 2%. Reducing energy burden will be achieved through addressing poverty and reducing the cost of energy used to heat homes. The former goal requires equity-building and improvement to employment opportunities throughout the County. The latter requires energy efficiency efforts paired with increasing the affordability of home heating systems. Building a sustainable and resilient community requires an equal and diligent focus on economic empowerment, energy affordability, as well as decarbonization.

Decarbonizing our energy sector will require a shift to renewable sources of electricity and other fuel sources powering space heating and cooling systems. Renewable heating systems could be efficient wood or other biomass burning stoves or high efficiency heat pumps that tap into latent heat found in the ground or outside air. The latter, require the use of electricity to operate. Both air and ground source heat pumps have dual benefit as they also serve as cooling systems in the warm summer months. A popular strategy to promote the transition to a carbon free energy system includes broad electrification of energy services such as heating, cooling, and transportation. However, it is important to recognize that not all electrification is created equal. For instance, existing electric home heating systems in rural Northern Minnesota are often characterized by electric resistance units such as baseboards that can represent an inefficient and costly option for electrifying space heating. Focusing efforts to promote efficient energy systems while simultaneously improving building envelopes will better enable responsible electrification and decarbonization without placing additional burden upon residents.

Rental properties pose a unique challenge for household energy use and efficiency. According to the 2020 U.S. Census, the City of Bemidji has a renter occupation rate of 52%, meaning most homes are occupied by temporary residents. For rental properties in which tenants pay the cost of utilities, there is very little incentive for landlords to bear the expense of improving building efficiency. Tenants would benefit greatly from efficiency improvements, a situation often referred to as a split incentive, and resulting reductions to utility costs and improvements in comfort and wellness within their dwellings. Community members have voiced interest in seeing incentives for landlords and tenants to explore energy efficiency improvements.

PERFORMANCE CONTRACTING

Another option for Commercial customers is Performance Contracting. This type of partnership typically involves an investor grade energy audit of facilities along with efficiency recommendations and installations by Energy Service Companies (ESCOs). The energy savings experienced through the efficiency upgrades helps pay for the initial investment. Over the past decade the State of Minnesota has offered a unique program modeled after traditional Performance Contracting called the Guaranteed Energy Savings Program (GESP). In this program, publicly owned facilities can additionally benefit from a third-party review process that helps guarantee the savings projected in the energy audits, as well as have access to additional financing options to see comprehensive energy savings projects through.
The City of Bemidji was the first in the State to utilize this program entering a $2.45 million dollar contract with Honeywell. The comprehensive energy retrofit of City owned facilities included upgrades to mechanical systems, building controls, interior and exterior LED lighting and replacement of city-wide street lighting with LEDs. The annual energy savings from this project are equivalent to reducing greenhouse gas emissions from 193 cars each year. While the GESP program sunset in 2021, it would be beneficial to Bemidji State University and the greater Bemidji community to encourage decision makers to ensure similar programs are available into the future.

PROPERTY ASSESSED CLEAN ENERGY (PACE) FINANCING

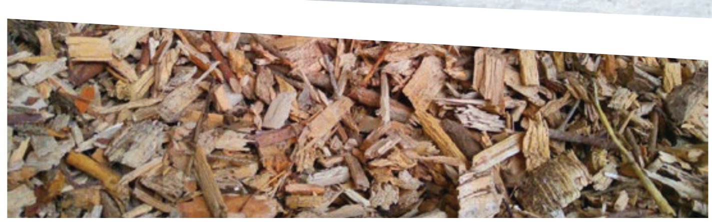
Property Assessed Clean Energy (PACE) financing is available in Beltrami County for new or existing buildings of commercial, industrial, nonprofit, and multi-family housing property owners. This program first utilizes an energy audit and/or site assessment to determine efficiency and/or renewable energy generation potential. Once projects have been identified and selected, the interested property owners apply for funding through the Saint Paul Port Authority (SPPA). The SPPA then provides 100% up front financing for selected projects and the County places a special assessment on the property as a means of repayment. The special assessment is designed to be equal to or less than the amount of money saved each year by the installed efficiency upgrade or renewable energy project. In this way, property owners pay no additional money than prior to the upgrade(s), essentially making their efforts budget neutral, if not budget positive.

Sam Mason of Beltrami Electric Cooperative sharing with Bemidji State University students about the Northern Solar Community Solar Garden.

Students journaling at Bemidji State University's Hobson Memorial Forest, located northwest of Lake Bemidji.

ABOVE: Students learning about the Bemidji Community Food Shelf Farm, an organic farm supplying fresh produce to the Food Shelf.

BELOW: Students learning about the winter sports rental program offered by Bemidji State University's Outdoor Program Center.



ENERGY CONSIDERATIONS IN A CHANGING CLIMATE

The changing climate will likely bring about changes to energy needs through the area, with models predicting warmer summers and less harsh winters. See the figures at right, from the publication Climate change projections, for improved management of infrastructure, industry, and water resources in Minnesota. Weeks of frost compared to 1990 are projected to decrease by 2-7 weeks, while days with highs above 95F projected to increase by up to 14 days per year compared to 1990 levels. This will mean an increased demand for air conditioning through the warmer months, and more dangerous summers for those unable to afford it, paired with decreased demand for heating during colder months. Note the rate of change is less pronounced for the Bemidji area than other areas of the state. This may contribute to eventual climate migration, driving more residents to the area in search of refuge from impacts of extreme weather.

PROJECTED CHANGE

The changing climate brings with it likely changes to the Bemidji area energy needs as well, with warmer summers and less harsh winters. See the figures at right from the publication *Climate change projections for improved management of infrastructure, industry, and water resources in Minnesota.* Weeks of frost compared to 1990 are projected to decrease by 2-7 weeks, while days with highs above 95F projected to increase by up to 14 days per year compared to 1990 levels. This will mean an increased demand for air conditioning (and a more dangerous summer for those unable to afford it) with less demand for heating. Note that the rate of change is less pronounced for the Bemidji area than other areas of the state. This may contribute to eventual climate migration, driving more residents to the area seeking refuge from weather extremes.

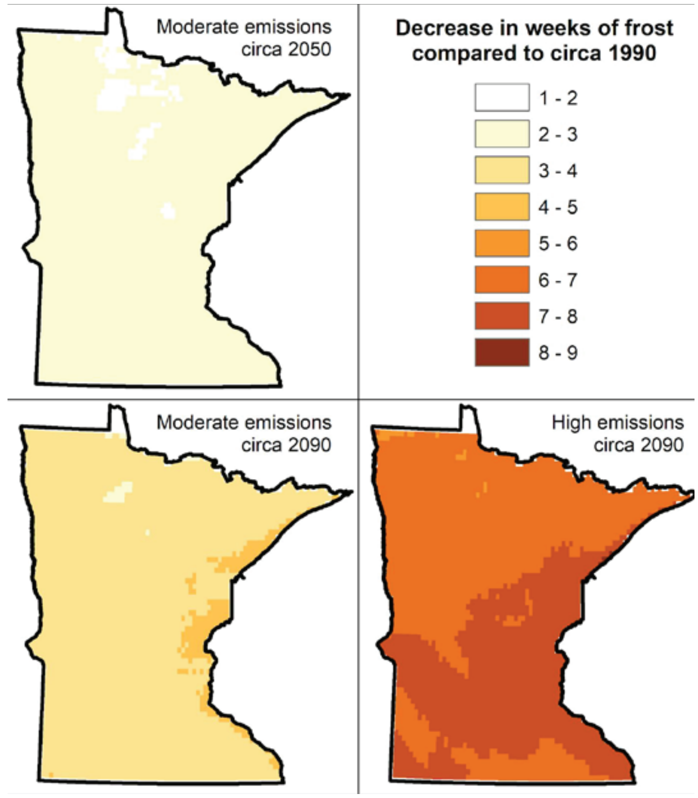
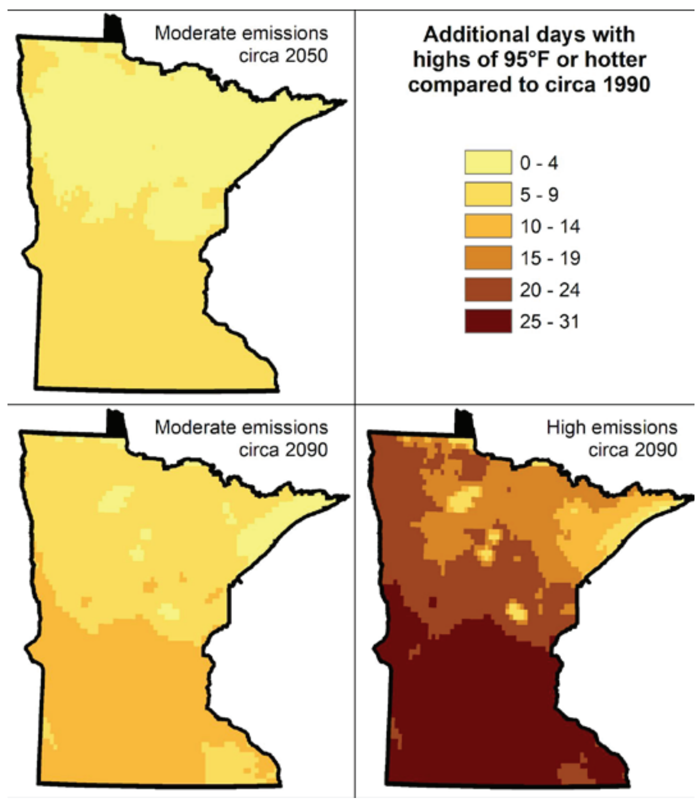


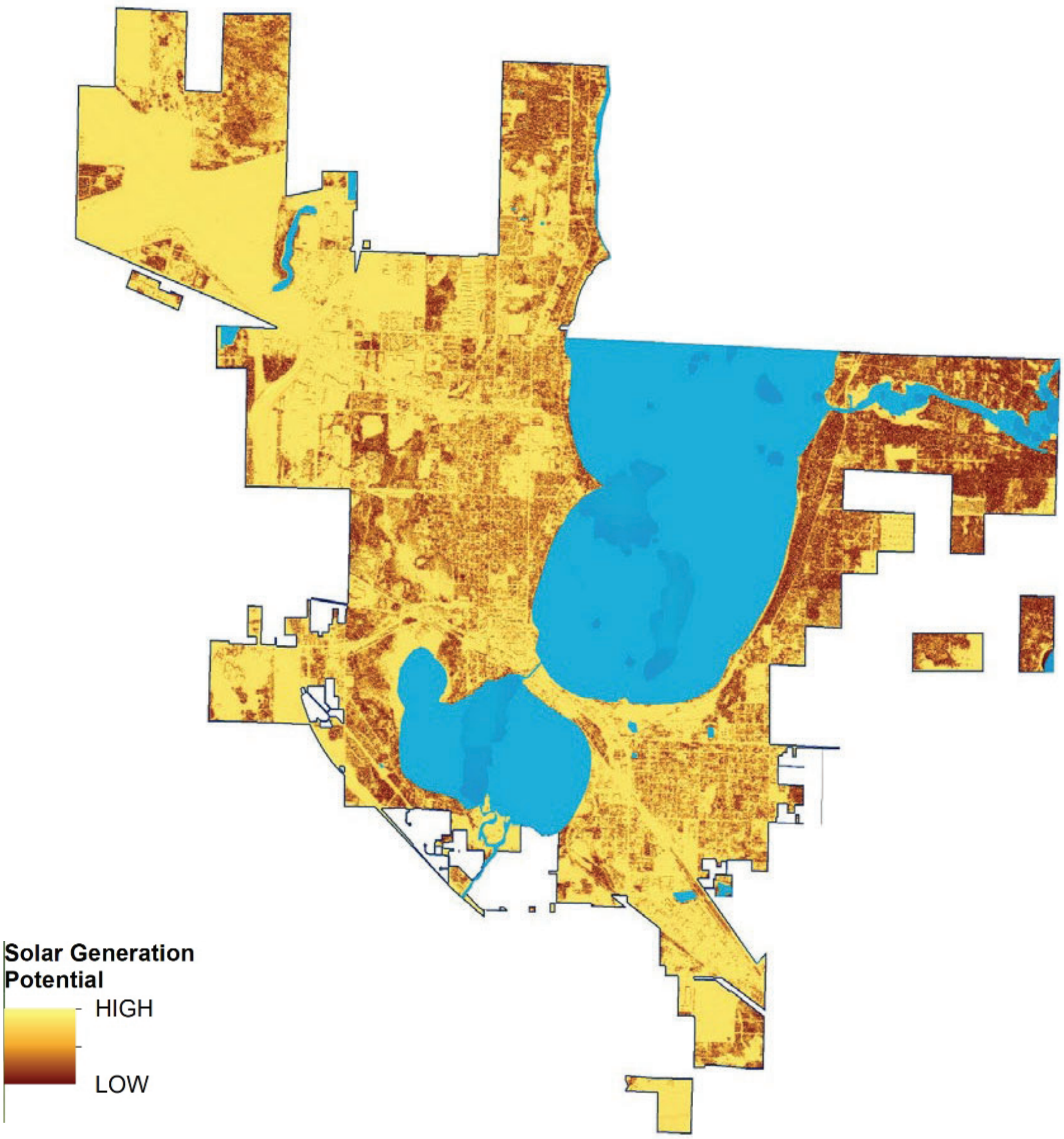
Figure 7. Decrease in the number of weeks of frost.



"Energy relates to economic opportunity – household income"

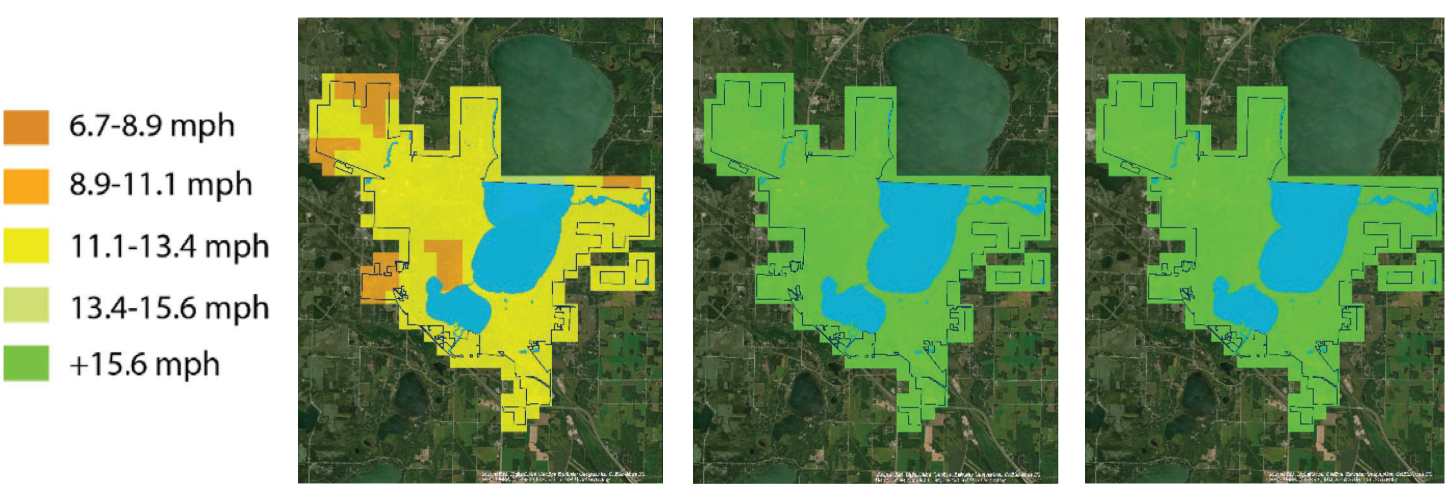
Images at right are from climate change projections for improved management of infrastructure, industry, and water resources in Minnesota

COMMUNITY SOLAR POTENTIAL



Overview of general solar potential in Bemidji, MN (from Bemidji Existing Energy Conditions)

COMMUNITY WIND POTENTIAL



Wind speeds at different tower heights, 30 meters, 80 meters, and 100 meters from left to right. Source: MN Department of Commerce, maps made by Great Plains Institute (from Bemidji Existing Energy Conditions)

COMMUNITY RENEWABLE RESOURCES

SOLAR

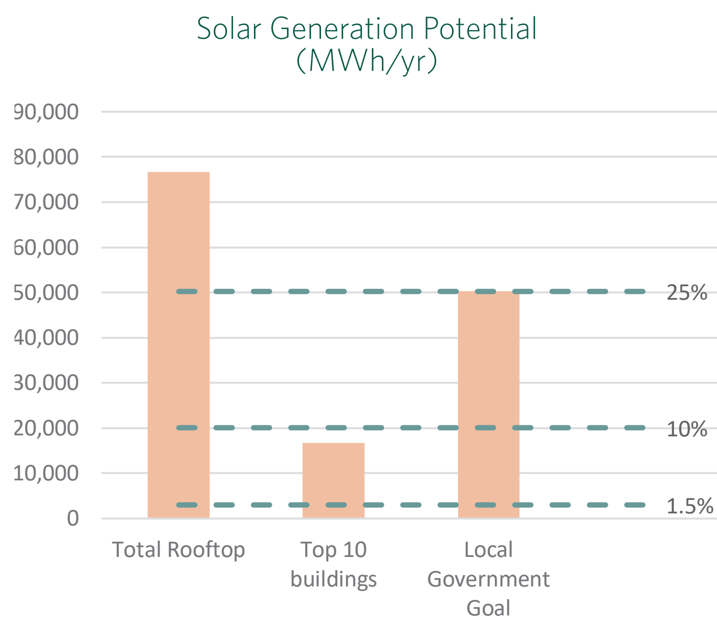
The University of Minnesota developed a high-resolution statewide solar resource map that allows cities to calculate how much electricity they could potentially receive from locally installed solar energy systems. These data (see map at left) were used to calculate the solar resource, or the city's "solar reserves," in Bemidji. The solar reserves are how much solar energy is reasonably economically available for development, similar to the way in which oil or gas reserves are measured. The solar map shows the good sites for solar installations and helps identify where there may be land use conflicts with solar development. The table at right shows the amount of solar energy reasonably available for development in Bemidji. The gross potential includes the total available resource, regardless of location; rooftop capacity and generation include only the resource available on the rooftops of commercial buildings located in the city.

The estimated total capacity of the economic rooftop solar resource in Bemidji is 59 MW, equal to approximately 44.5% of all the electricity consumed in the city. This means that if the city wanted to maximize its entire commercial rooftop solar resource, it could set a solar generation goal of up to 44.5% on-site solar generation (note: this is an upper limit and does not consider individual site limitations due to roof structure, ownership, or local regulations that might limit solar installations). If buildings undergo high levels of energy efficiency investment, the solar resource could meet a higher percentage of electric needs. The efficiency and solar resources are, in this analysis, calculated independently of each other.

Solar installations are not limited to rooftop applications. This analysis does not include ground-mount systems, but the city will want to develop criteria for where they would and would not allow solar installations. For instance, commercial parking lots may make good solar resources or public right of ways; while areas planned for future development or park space may not. These criteria can be used to recalculate potential solar generation and redefine future solar goals for local development. (adapted from Bemidji Existing Energy Conditions)

"Big opportunity for jobs – installing solar panels."

Overview of building rooftop solar potential in Bemidji, MN. Commercial buildings along US-2 Old in downtown Bemidji, an area of greatest solar potential (from Bemidji Existing Energy Conditions)



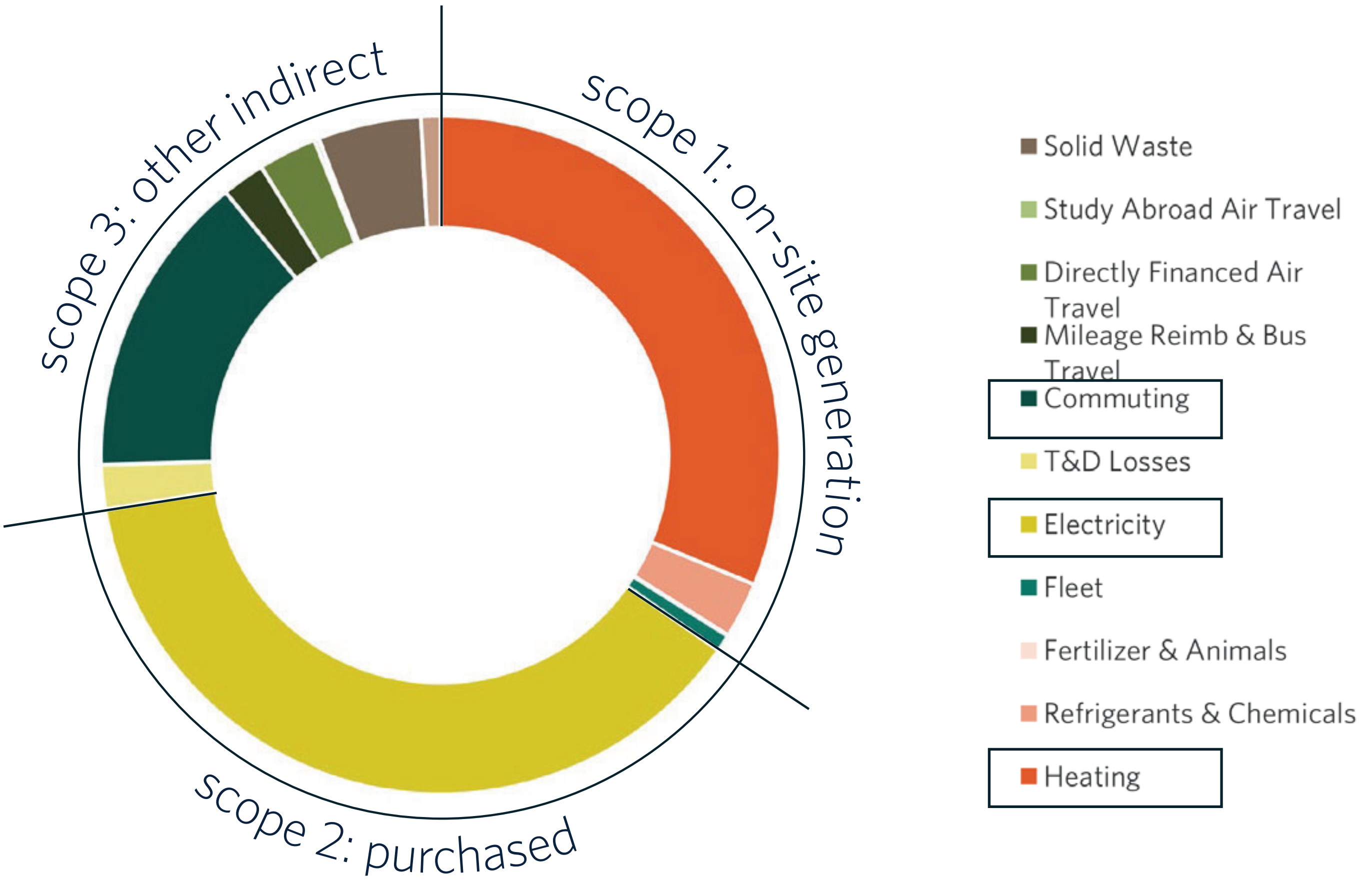
from Bemidji Existing Energy Conditions

WIND

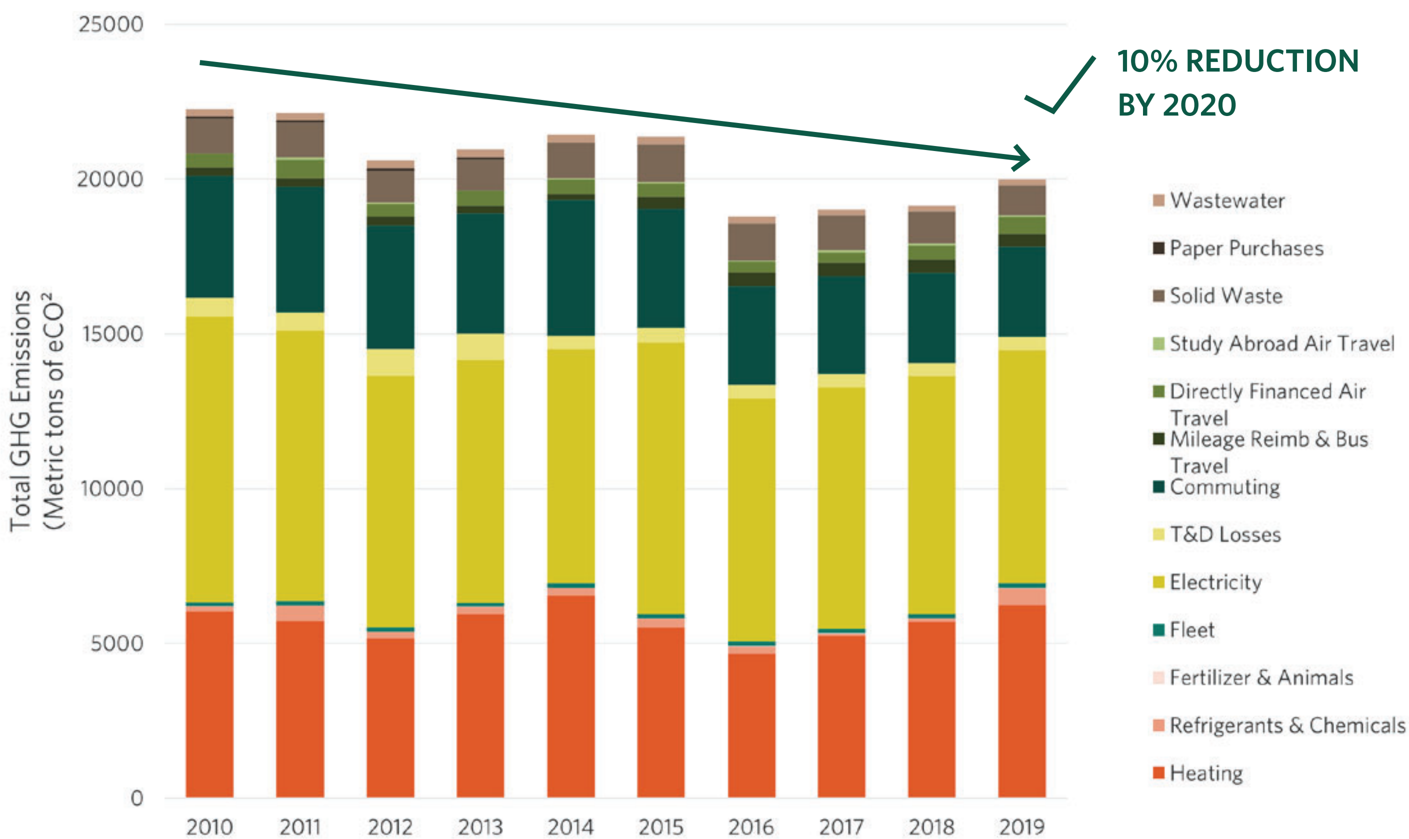
Bemidji is a rural community with both urban and rural characteristics and is suitable for wind development. The Minnesota Department of Commerce developed wind speed maps at a 500-meter resolution to give a general sense of the wind resource at various tower heights, these are not adequate for a specific site assessment (at left). A good rule of thumb is that 12 mph is typically the minimum average annual wind speed for a good wind resource. At 30 meters, much of Bemidji has an average wind speed of approximately 11-13 miles per hour, right around the optimal speed needed for a productive wind energy system. At 80 and 100 meters respectively, there are significantly higher wind speeds, and ample resource for wind turbines to capture energy. (adapted from Bemidji Existing Energy Conditions)

Most of the passion and push behind clean energy and resilience in the Bemidji area seems to be happening at the grassroots level, in the absence of consistent support from positions of power and decision making. To make sustained and rapid progress, city and campus leaders need to establish clearly defined goals, identify pathways for accomplishing those goals, and identify who will be responsible for their achievement.

2019 BSU CAMPUS CARBON EMISSIONS



BSU HISTORIC EMISSIONS BY SOURCE



CAMPUS ENERGY CONDITIONS

BSU's campus wide carbon footprint is nested in the context of its broader sustainability work as well as under its commitment to achieving carbon neutrality, set forth by Second Nature's Climate Commitment. While reductions in the total campus carbon emissions reflect this work broadly, most carbon emissions and associated reductions are from energy used on campus: heating and purchased electricity (see charts at left). Therefore, strategies to further decrease campus energy consumption will be critical for campus to achieve carbon neutrality by 2050.

BSU has achieved its interim 2020 goal of a 10% reduction in carbon emissions. The University has achieved a steady decline in carbon emissions from electricity, due in part to targeted efficiency improvements. Emissions associated with heating, however, have generally held steady, despite observable fluctuations likely explained by weather. These trends are borne out over a decade in which campus gross square footage (GSF) has decreased, meaning there is less space to heat. To achieve future carbon reduction goals, it will be critical to take a multipronged approach to improve building envelope and operational efficiency while exploring options for heating sources aside from steam.

EFFICIENCY PARTNERSHIP

Improvements to operational efficiency have been achieved through a partnership with Otter Tail Power Company (OTPC), the electric utility provider serving campus. Since 2017, BSU Facilities staff have engaged with OTPC's Conservation Improvement Program. Through the program, OTPC issues cash rebates in exchange for completing efficiency improvements, with the goal of mutual benefiting through cost reductions and decreased commercial energy demand. Most improvements through the first five years consisted of converting campus lighting to LEDs and replacing older HVAC components with efficient alternatives. Achieving greater energy efficiency reduces the financial burden associated with lighting and heating indoor spaces and prepares campus for the eventual deployment of renewable energy generation projects.

Through a partnership with Otter Tail Power Company, Bemidji State University is set to save thousands of kilowatt-hours of energy in the coming years, including projects like this lighting conversion as seen above.

ABOVE: Hagg-Sauer was replaced with a more efficient academic building with reduced square footage, saving on operations and maintenance costs while providing an improved learning environment.

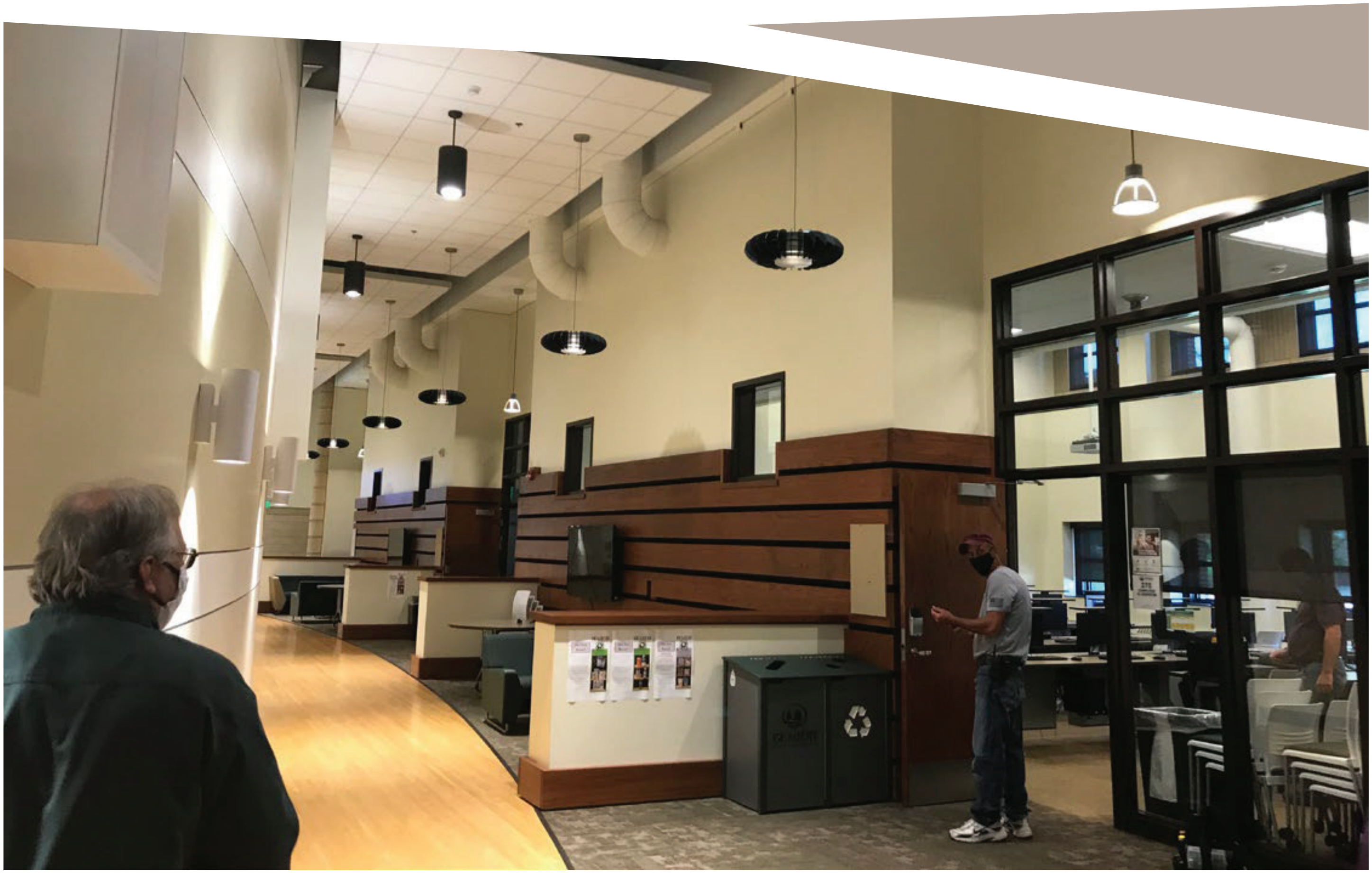
RIGHT: Residential buildings have substantial amounts of deferred maintenance which lead to higher operational costs and decreased comfort for students, but the funding for renovations needing to come from Revenue Bonds and not General Obligation Bonds makes it more difficult to finance renovation or new residential projects.

RENOVATIONS & DEFERRED MAINTENANCE

Recent renovations, demolitions, and new building construction have greatly improved the quality of campus facilities and reduced demand for energy at the same time. However, there are still high deferred maintenance needs which, if addressed, could further improve occupant comfort, and reduce both maintenance needs and energy use. Facilities staff identified a significant portion of their time is spent patching and repairing aging building systems and responding to often unsolvable occupant complaints instead of addressing poor envelope conditions and thermal bridging in older buildings.

The map and table depicting Facilities Condition Index (FCI) on the following page, illustrates buildings of greatest burden of deferred maintenance and thus highest priority for improvement. In the table, the Backlog column depicts the estimated cost of deferred maintenance associated with a building. FCI is a measure of the cost of deferred maintenance relative to replacement cost. The map and table depicting building energy use compared to facilities condition shows relative Energy Use Intensity (EUI) of campus buildings. EUI is a measure of energy used per square foot per year.

The renovation of Memorial Hall (pictures above) is an excellent example of potential future renovations that can reduce energy consumption, stabilize building envelopes, reduce overall campus square footage, improve occupant comfort and well-being, and provide 21st Century learning environments for students.



FACILITIES CONDITION INDEX

CURRENT

20-YEAR

KEY

FCI (backlog/current replacement value)

- <.09
- .10-.19
- >.20

#	BUILDING NAME	GSF	REPLACE. VALUE	BACKLOG	FCI 2020	BACKLOG	FCI 2040
17	American Indian Resource Center	10,388	$4,149,969	$-	0.00	$1,570,000	0.38
1	Central Maintenance Building	14,320	$5,586,428	$42,654	0.01	$2,323,000	0.42
19	Chet Anderson Stadium	19,911	$7,767,553	$917,420	0.12	$1,214,000	0.16
27	Heating Plant & Garage	20,317	$8,307,201	$1,440,272	0.17	$3,891,000	0.47
11	Decker Hall	29,424	$9,609,752	$1,036,302	0.11	$2,104,000	0.22
12	Birch Hall	62,184	$10,154,859	$-	0.00	$2,989,000	0.29
6	Cedar Hall	39,133	$12,781,104	$330,611	0.03	$3,607,000	0.28
2	Oak Hall	128,550	$13,995,101	$6,932,323	0.50	$15,703,000	1.12
5	Pine Hall	50,264	$16,416,564	$2,281,879	0.14	$6,834,000	0.42
4	Walnut Hall Food Service	57,167	$18,671,131	$2,092,590	0.11	$6,584,000	0.35
18	Bensen Hall	53,342	$20,809,444	$2,979,064	0.14	$8,379,000	0.40
24	Memorial Hall	53,893	$21,024,396	$112,872	0.01	$3,257,000	0.15
10	Linden Hall	67,565	$22,067,515	$518,862	0.02	$6,063,000	0.27
23	Hobson Memorial Union	76,756	$25,069,031	$1,428,935	0.06	$10,393,000	0.41
21	Bridgeman Hall	72,424	$26,973,512	$-	0.00	$7,795,000	0.29
20	A.C. Clark Library	71,462	$27,878,303	$2,204,903	0.08	$8,333,000	0.30
26	Deputy Hall	79,556	$30,684,781	$4,882,520	0.16	$12,830,000	0.42
8	Gillett Wellness Center	85,765	$33,458,099	$5,927,449	0.18	$14,130,000	0.42
28	Bangsberg Fine Arts Complex	87,778	$34,707,456	$8,201,927	0.24	$15,332,000	0.44
9	Tamarack Hall	88,410	$35,820,245	$6,793,026	0.19	$16,580,000	0.46
7	Physical Education Complex	121,586	$47,432,361	$14,546,866	0.31	$23,000,000	0.48
25	Sattgast Hall	107,598	$58,570,397	$2,921,437	0.05	$35,096,000	0.60
14	Laurel House	4,056					
13	Glas Scholars House	1,500					
15	Alumni House	1,750					
3	Ballpark Bathrooms	418					
16	David Park House	2,000					
22	Hagg-Sauer						

Unsurprisingly, there is a correlation between buildings with high energy use and those with a high FCI, indicating a backlog of deferred maintenance of building envelope and systems. Addressing deferred maintenance will be critical to meeting carbon reduction goals while improving the wellbeing of building occupants.

BUILDING ENERGY USE COMPARED TO FACILITIES CONDITION

#	BUILDING NAME	GSF	YEAR BUILT	YEAR RENO	EUI (kBtu/SFyear)	ENERGY USE (kBtu/year)
3	Ballpark Bathrooms	418	1994		122	50,968
13	Glas Scholars House	1500			36	54,499
14	Laurel House	4056	2015		36	144,391
15	Alumni House	1750			120	210,466
16	David Park House	2000			225	450,675
1	Central Maintenance Building	14320	1978		73	1,048,353
17	American Indian Resource Center	10388	2001	2009	178	1,848,702
27	Heating Plant & Garage	20317	1926	2020	96	1,945,888
10	Linden Hall	67565	1959	2007	33	2,221,309
11	Decker Hall	29424	1957	1979	111	3,280,705
8	Gillett Wellness Center	85765	1989		39	3,317,650
6	Cedar Hall	39133	1959	1991	92	3,616,594
24	Memorial Hall	53893	1940	2016	77	4,127,787
5	Pine Hall	50264	1961		85	4,292,321
18	Bensen Hall	53342	1950	1986	89	4,727,868
12	Birch Hall	62184	1952		79	4,936,267
20	A.C. Clark Library	71462	1966	1999	69	4,948,286
28	Bangsberg Fine Arts Complex	87778	1971		70	6,123,854
21	Bridgeman Hall	72424	1964	2006	89	6,432,880
9	Tamarack Hall	88410	1969	2010	83	7,302,410
26	Deputy Hall	79556	1919	1981	124	9,868,099
23	Hobson Memorial Union	76756	1967	1972	132	10,109,829
4	Walnut Hall Food Service	57167	1969	1991	188	10,739,490
7	Physical Education Complex	121586	1959	1967	95	11,593,948
2	Oak Hall	128550	1965	1966	104	13,390,157
25	Sattgast Hall	107598	1962	1989	149	16,044,087
22	Hagg-Sauer		2020			
19	Chet Anderson Stadium	19911	1938	1989		

Overview of building rooftop solar potential in Bemidji, MN, lakeshore area of Bemidji State University(from Bemidji Existing Energy Conditions)

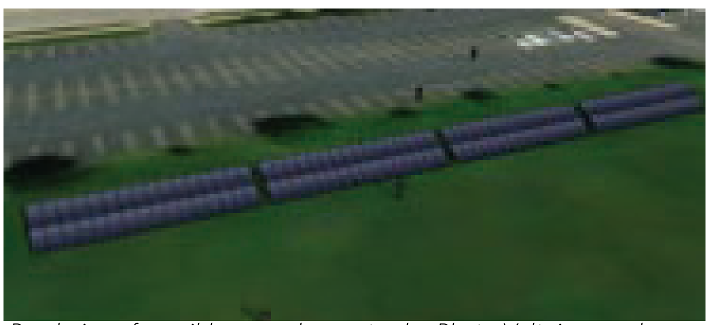
Rendering of possible carport solar Photo Voltaic array in American Indian Resource Center Parking Lot

CAMPUS RENEWABLE ENERGY POTENTIAL

SOLAR POTENTIAL

Bemidji State University has a multitude or ways to tap into the power of the sun. The institution has benefitted from reduced heating demand due to a Solar Transpired Air installation atop the Hobson Memorial Union since it was installed in 2012. BSU continues to explore additional ways to benefit from solar energy and has utilized faculty expertise, particularly in Geographic Information Systems, to estimate electrical generation potential of rooftop solar photovoltaic panels. According to preliminary estimates generated by an initial modeling exercise, BSU-owned buildings could generate up to 4,719 MWh/year of solar generated electricity. This model does not consider however, certain site-specific limitations or practical complications such as the age of the roof, any physical barriers, or structural concerns with adding constructed elements onto BSU rooftops. Therefore, it can be expected that this estimate is high.

With many of the concerns and possible constraints for rooftop solar panels in mind, BSU continues to explore alternative solar installation designs such as ground mounts and carports.



Rendering of possible ground mount solar Photo Voltaic array by Physical Education Complex

BIOMASS FEASIBILITY STUDY

In 2013 BSU hired LHB Engineering and Ever-Green Energy (EGE) to conduct a biomass feasibility study for the campus energy program. At the time, this assessment found biomass to be available at a cost competitive with fossil fuels and could technically be integrated with BSU's existing energy infrastructure. Based upon data received from the Minnesota Department of Natural Resources, EGE estimated there to be over 462,000 tons of forest residuals available annually within a 100-mile radius of Bemidji. It was estimated BSU would require about 13,000 tons of woodchips to serve its hot water load. This equates to less than 3% of the wood chips available within the 100-mile radius of Bemidji. Moreover, integrating biomass into BSU's fuel mix would provide the opportunity to reduce greenhouse gas emissions, increase investments in the local economy, support the resurgence of the local biomass industry, broaden the base for environmental education, and diversify BSU's fuel sourcing. These accomplishments would further the BSU sustainability commitment, provide greater resilience from fuel market volatility, and give BSU more autonomy in providing reliable energy service to its campus. No substantive action was taken to pursue transitioning to biomass.

GEOTHERMAL FEASIBILITY STUDY

Produced by GEOptimize in 2021, this study explores the ability for campus to shift its district heating system from natural gas-fired steam generation to a ground source heat pump system, also known as geothermal. The study outlines a phased implementation approach by which campus may shift to this new technology in phases as opposed to in a single project. Segmenting the project into discrete phases with associated costs helps reduce the challenge of securing a single sum of capital sufficient to complete the entire project. Enabling such a system will require continued energy efficiency improvements to lighting and HVAC systems, the latter of which would benefit from energy recovery ventilators to pre-heat or pre-cool incoming outdoor ventilation air.

RENEWABLE ENERGY CREDITS

Following a student senate initiative in 2005, BSU began purchasing $9,600 of annual wind power credits through Otter Tail Power Company's (OTPC) Tailwinds Program. The initial intent was to offset the electricity consumption of the Hobson Memorial Student Union. As of 2019, participation in the Tailwinds program offset just over 2% of BSU's total annual carbon footprint. In early 2021, OTPC shared news of an opportunity to purchase Renewable Energy Credits (RECs) through the Midwest-Renewable Energy Tracking System (M-RETS). At the time, shifting the dollars previously dedicated to the Tailwinds program was estimated to achieve a total annual carbon reduction of almost 56%. The cost of RECs fluctuates in response to market-driven supply and demand dynamics. Regardless of the exact offset to be achieved, participating in the broader market through the purchase of RECs generates the additional benefit of sending market signals that make renewable energy generation a more highly valued, and desirable, thereby encouraging widespread adoption.

MOVING FORWARD

We recommend the use of community and campus total energy use, energy use per capita, total carbon footprint, carbon footprint per capita, and energy burden as key metrics to track progress over time. By tracking these key metrics, we hope to spur discussion and collaboration with local partners to determine goals and strategies that advance local resilience, sustainability, and equity. The metrics highlighted here represent merely the start to a much more comprehensive understanding of our energy systems. We encourage the consideration of including additional metrics over time and outlining alternative scenarios based on shared visions for the future.