ROMICH FOUNDATION MAKERSPACE
SERVING THOSE WHO SERVE OTHERS

OHUDDLEMENTORS
LIFE IS A JOURNEY. WHO'S IN YOUR HUDDLE?

New Building Plan

11-1-2026

This document introduces the plan for construction of a building on the property at 300 South Main St., Creston. (This is directly across the road, slightly to the south, from the current location of Romich Foundation Makerspace. The parcel is between Norwayne Elementary School and the Middle School / High School.) This document is intended to introduce the notion to a range of interested parties, so all sections may not be of interest to all parties. It is divided into two parts: Basic Function and Environmental Impact.

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Part One: Basic Function

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Background

Romich Foundation is a modest 501c3 nonprofit charitable private foundation formed in 2005, prompted by the ownership transition of Prentke Romich Company. The need to provide for succession meant changing ownership. Barry Romich was co-founder in 1966 and around half owner, with a small number of others making up the remainder. The usual option of passing ownership to next generation family wasn't practical as they were not in the area. Selling to another company or to an unrelated party had the risk of change in mission, culture, location and other factors. So the decision was made to convert ownership to an ESOP trust (Employee Stock Ownership Plan).

Today the company, now PRC-Saltillo (**https://www.prc-saltillo.com**), is 100% owned by the ESOP trust. It continues to thrive and today has roughly 450 employees worldwide, with subsidiaries in the UK, Germany, India, Singapore, Australia, and Canada. ESOPs operate financially for the retirement benefit of the employees. So the IRS oversees the process of ESOP establishment and there is annual appraisal and reporting.

At the time of the transition of ownership to the ESOP trust, the company was much smaller than today. Still, the value of Barry's shares was more money than he and his wife Robin needed, so most of it was given to the Romich Foundation, was invested, and today provides for perpetual philanthropy. The IRS expects private foundations to give at least 5% of their previous year value annually to charitable organizations, such as 501c3 organizations, schools, churches, etc.

Romich Foundation provides financial support for:

1) Initiatives that promote **justice and harmony** in Wayne County, Ohio.

2) Public schools, with particular interest in Wayne County, Ohio schools and programs involving **STEAM** (Science, Technology, Engineering, Arts and Mathematics);

3) Charitable organizations in Wayne County, Ohio, that address the needs of disadvantaged individuals;

4) Initiatives working with people with disabilities, especially those who use **AAC** and other forms of **assistive technology**;

5) **Makerspaces** that agree to provide value to their local nonprofit community;

6) Sustainable energy initiatives; and

7) Programs that promote, encourage and support entrepreneurship in northeast Ohio.

To learn more, visit **https://RomichFoundation.org/index.html**.

Romich Foundation Makerspace

Several years ago, what had been Barry's private shop made the transition into the Romich Foundation Makerspace. **(https://RomichFoundation.org/Makerspace/)** In part, this came to be as a result of Barry's interest in making things and finding that there was a need in the community for things to be made, much of which was for nonprofit organizations. This gradually grew into its current state. A significant development came through connection with a then student at Norwayne High School, Izy Meshew. She became a part time worker as a sophomore and by the time she graduated the need was such that she was offered and accepted full time employment. Her knowledge and skills complemented Barry's. Barry has ideas and access to some financial resources. That combination is essentially worthless without action. Izy is now the makerspace manager and is thus responsible for the needed action. In turn, she now has several Norwayne High School students working part time.

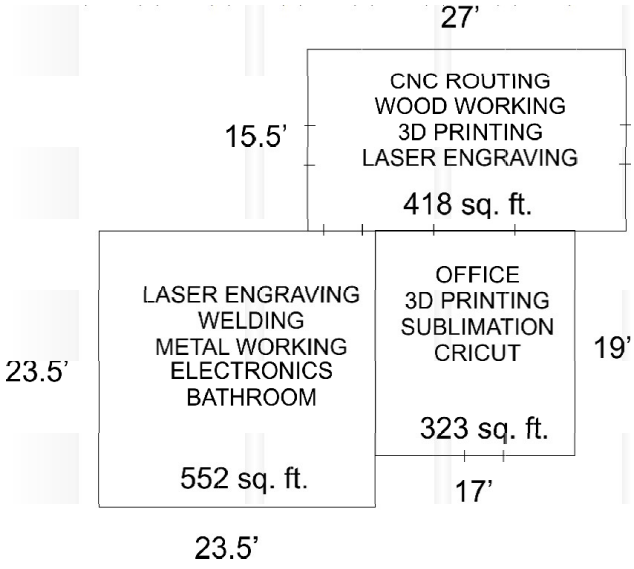
Operation of the makerspace is under the umbrella of Romich Foundation and over 40% of foundation philanthropy is now going through the makerspace. We have found that the makerspace can give greater value to the nonprofit community than would happen if the foundation simply wrote checks. Examples can be seen with a Facebook search on Romich Foundation Makerspace. "Customers" do not pay for value received as this is considered part of foundation charitable donations to nonprofit organizations. Customers that are not nonprofits are directed to make a donation to a nonprofit organization, perhaps Joyful Café, one of the recipients of foundation donations. This arrangement is rather unique among makerspaces and foundations and provides good value to the community.

In addition to making things and facilitating others to make things, the makerspace hosts various groups, including public school and home school students, especially those with an interest in STEAM (Science, Technology, Engineering, Arts and Math). They get an overview presentation and then are divided into groups for hands on opportunities with laser engraving and sublimation printing. They typically leave with a pencil, keychain and/or a mug that the students have had a hand in personalizing.

The makerspace also hosts meetings of other organizations, such as monthly Schantz MakerSpace Maker Mondays, the Wayne County Community Youth Foundation, Lions Club, and more. In such cases, we often provide a presentation and the organization has their usual business meeting. This new building will be an even more valuable community resource.

The makerspace today operates in a facility that at one time was Barry's grandfather's garage, perhaps around one hundred years old, and his father's farm shop, added around fifty years ago. An additional room was added in 2022, bringing the total space to just under 1,300 square feet. The addition of more equipment and functions has reached its limit with the current space restriction. An annex in an adjacent building was being considered prior to this planned new building.

Here is the current makerspace layout:



Romich Foundation Makerspace collaborates with other organizations in the local community and beyond: nonprofit organizations, businesses, such as screen printers, and other makerspaces. We work closely with Schantz MakerSpace (**https://www.SchantzMakerSpace.com**), which organizes monthly Maker Monday meetings, generally hosted in our facility, as well as build workshops on various topics (3D printers, CNC routers, Arduino micro-controllers, lights control, and more).



We have also facilitated and supported the establishment and enhancement of makerspace functions within other organizations, such as Wayne County Public Library, Dover Public Library, Wayne College, Apple Creek Historical Society, Lodi Family Center, various schools and more.

Our geographic area has an unusually strong maker movement. Among the roles of the makerspace is helping others to learn and supporting each other in various ways. A current initiative is to assure that every county library system in Ohio has at least one 3D printer, a common first step in creating a makerspace. The goal is that every resident in the state of Ohio would have easy access to 3D printing.

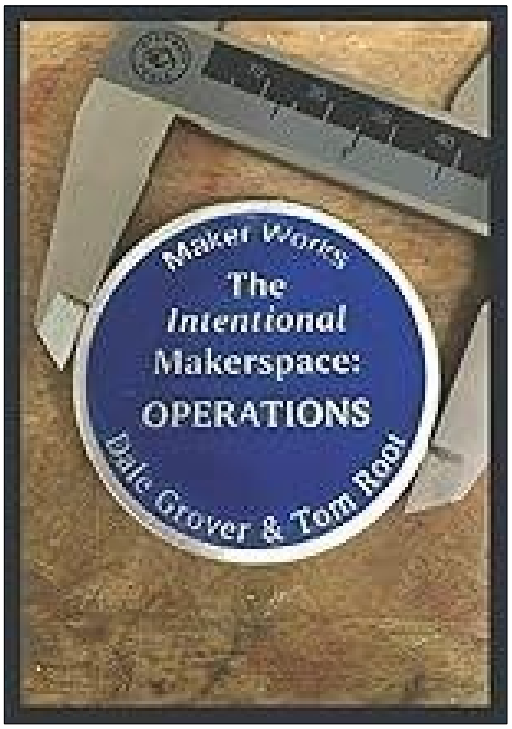
A common occurrence at Romich Foundation Makerspace is meeting with representatives of various nonprofit organizations. Sitting around the conference table, we listen to their needs and brainstorm with them about how we might be of service.

Needs often relate to fundraising activities, recognition of various forms, items to sell, nametags, signage and more. This wall in the makerspace identifies only a small number of organizations with which collaboration happens.

Makerspace Design and Operation

While we have had a working and productive makerspace for some years, what is being proposed now would be a quantum leap forward. The intent is to solicit input from the local maker community and beyond on the basic design of the space and function of the makerspace. We want it to serve the existing users and visitors as well as identify additional groups that find value in a makerspace.

One resource that can be useful for this process is this book. Co-author Dale Grover and Barry first became acquainted decades ago through the field of assistive technology for people with disabilities. In 2011 Dale and Tom Root opened Maker Works, a makerspace in Ann Arbor, Michigan. They have been helping others learn how to operate makerspaces. Izy and Barry made a day trip to visit Maker Works a couple years ago. If you are part of the group contributing to our effort and don't already have a copy of this, just ask and one will be provided. It's available at Amazon for $50, but we purchased a quantity directly from Maker Works for a small fraction of that and provide them to those with interest in makerspace operation.



This new facility development represents the opportunity to upgrade the basic operation of Romich Foundation Makerspace.

Here are some categories for consideration. This list was prepared early in the process.

User groups

The various people who will be occupying the makerspace include: full time and part time (student) staff, individual visitors, group visitors, delivery people, (UPS, FedEx, Amazon, individuals), pickup people, organizations having meetings, and others? If large groups exceed the parking capacity, parking at either school should be possible and is within walking distance.

Basic functions

The current functions beyond office and meeting space in the existing makerspace include:

- Basic computer functions (drawing, scanning, printing, etc.)
- Laser engraving (2 Epilog Helix, XTool, dedicated computers)
- 3D printing (3 Creality Ender 3, 2 Creality CR-10S, Prusa i3, FLSUN V400)
- CNC routing (ShopBot Desktop, dedicated computer)
- Sublimation printing
- Cricut sheet material cutting
- Shear/Brake/Roller
- Electronics and microcontrollers
- Large format printing
- General woodworking (table saw, bandsaw, planer, router, wood lathe, etc.)
- Metalworking (drill presses, belt sanders, bandsaw, small CNC mill, etc.)
- Hardware, components and material are stocked for the above functions.

Additional functions that could be considered:

- Sewing
- Long arm quilting
- Embroidery
- Screen printing
- Water Jet Cutting

The existing space includes some metalworking equipment, including a vertical milling machine, metal lathe, cutoff/bandsaw and welder. With the exception of the bandsaw, these machines are rarely used. So the current plan is to leave them in the existing makerspace area. However, a metal working area is provided for the future addition of such tools.

Here are some things to consider for the building and floorplan:

- Good wheelchair access, including two ADA bathrooms
- Energy efficient construction
    - Address all heat loss/gain factors: conduction, convection, radiation
    - Geothermal? (No fossil fuel use)
    - Solar panels on south-facing roof, grid tied with backup battery system
    - General exterior appearance (brick or stone appearance facing south)
- ADA parking hard surface into the building
- Covered entryway
- Powered entry doors
- Reception areas with desks and seating
- Makerspace entry into large open area
- Offices for Izy, Barry and entrepreneurs
- Closed, but windowed woodworking area for noise and dust control
    - Dust collector in another closed area with duct ports at machines
- Closed, but windowed and ventilated/air filtered room for:
    - Laser engraving (good air filtering)
    - Painting/staining
    - Screen printing
- Large open area for quiet and clean functions.
    - Some equipment on rolling carts, normally on the sides of the area
    - 3D printing
    - Sublimation printing
    - Cricut
    - Electronics
    - Open space for larger meetings, group build classes, etc.

        - Projector and screen or large video monitor
        - Dimmable lights
        - Audio amplification for presenters
        - Outside windows with blinds
        - Place for photography
- Closed and quiet conference room for small meetings, recording, etc.
- Kitchen with sink, microwave, full size refrigerator, dishwasher, cabinets, etc.
- Project storage shelving
- Receiving of shipments
- Utility room and storage area for folding tables, chairs, etc.
- Recycling and trash storage
- EV charging
- Lighting to the parking area, perhaps motion sensing

Parcel for Proposed Building

Additional background, more on the personal side but relevant, is that Barry's late aunt, his late father's sister, passed away in the summer of 2025. She was 101 years old. When her long term financial needs were being planned, decades ago, life expectancy was capped at 100 years. So when she reached 100, her liquid funds were exhausted. At that time, in early 2024, Robin and Barry began to purchase her 3.8 acre property and home to keep her cash flow going. That process has been completed. The property is currently owned by 300 South Main LLC.

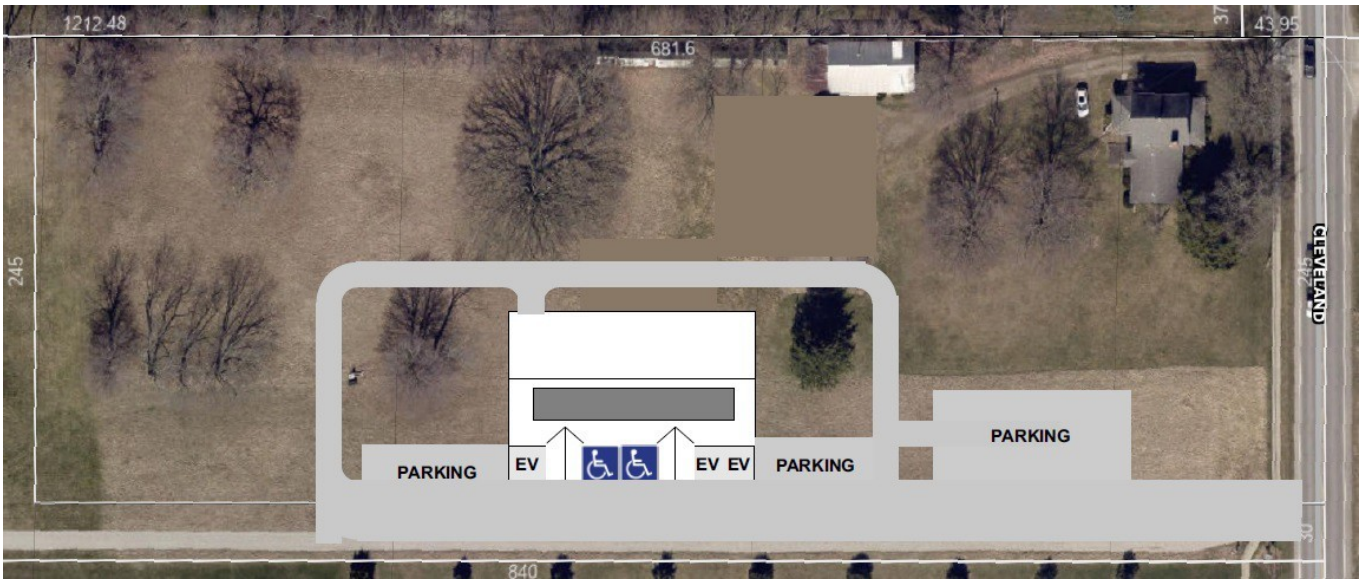
The initial thought was that we would sell the property to Norwayne Local Schools, as it is located adjacent to the elementary school and just north of the high school/middle school. Further consideration of that made it less attractive in that the school really isn't in the business of house rental and property maintenance that isn't school related. Further, we didn't want to see the house, a secondary living quarters, and lovely old trees going away to create parking areas. So we began to explore alternative ways in which the property could become a resource to the community.

An initial idea was to put up a building that would include a latchkey alternative program to accommodate families with elementary school students and working parents. The proximity to the school made that seem attractive. Familiarity with Lodi Family Center (**https://LodiFamilyCenter.org/**) was a factor in this notion as aspects of their operation could be modeled and they have been a recipient of Romich Foundation philanthropy. However, when Barry talked with Norwayne Superintendent Kevin Leatherman, he learned that a latchkey alternative program was soon to start within the elementary school building, an even better situation. Romich Foundation is now planning to provide financial assistance to help move that along. So that notion is now off the table relative to use of this property.

Another idea, suggested by Creston mayor Brenda Norris, is that some higher level Norwayne students and recent graduates may have interest in starting businesses. So having the ability to encourage and support entrepreneurship has become a consideration. This resonates in multiple ways. Thinkbox, the innovation center (including makerspace) at Case Western Reserve University, has entrepreneurship support available to students. Romich Foundation played a role in the establishment of Thinkbox. Further, Romich Foundation Makerspace is currently supporting multiple individuals, both adult and student, in their entrepreneurial endeavors. The makerspace is also making products that nonprofit organizations sell as fundraisers.

Here is a draft image showing the property lines. The house, upper right near the road, is being upgraded to be made available for either traditional rental or as a temporary residence for families who have experienced a housing emergency, such as a fire, etc. The small building at the top is to be upgraded as a modest residence. The proposed location for the makerspace building is shown at the bottom center. Except for the parking adjacent to the building, parking and driveways will be gravel initially.

Parking adjacent to the building will be hard surface for wheelchair and hand truck (delivery) use.

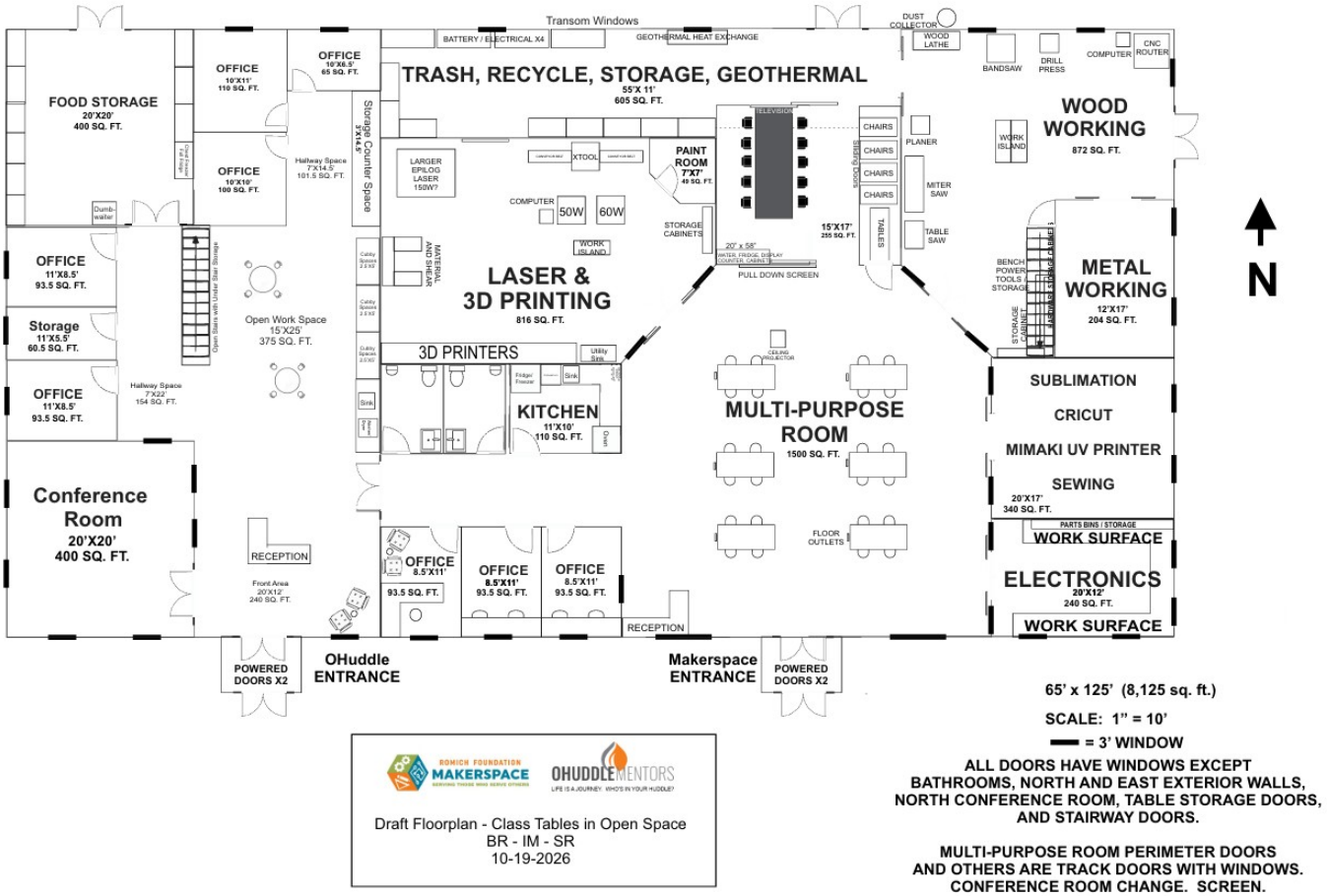


Vehicle access is shown using the drive of the religious education building located to the west. Communication with that organization has confirmed their willingness to cooperate on this point at no cost to them. (Romich-McKelvey Farm partnership donated the land for their building and Romich Foundation contributed financially.) This minimizes use of the farmhouse access drive. The section to Cleveland Road will need to be widened and made suitable for delivery trucks. The connection to Cleveland Road is presently weak and would need to be improved.

Floor Plan

The proposed inside floor plan is 65’ x 125’ (8,125 sq. ft.). It is single story and the makerspace part is over four times the area of the current makerspace. There is no plan for a basement. Ceilings are planned to be ten feet. Non-climate controlled storage space is above the ground floor.

The current floor plan is shown here. An 11” x 17” version with 1” = 10 ft. scaling is available.



OHuddle

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A more recent development is the plan of adding an additional 2600 sq. ft. to the building to provide for housing the headquarters of OHuddle, a nonprofit organization working in Wayne County schools. OHuddle (https://www.OHuddle.org) manages mentor relationships between school students and members of the community. There are presently over 800 such mentorships happening. Romich Foundation Makerspace hosts three students and we much appreciate the mission and work of OHuddle. When Sara Reith, OHuddle founder and Executive Director, learned of our plans, she shared that they also were in a position of needing more space. So the current building plan includes room for OHuddle. The plan is that this space will be made available on a no cost rental basis.

The above floor plan shows the OHuddle office on the left. This is 2600 sq. ft. OHuddle would have a separate entrance. Bathrooms, kitchen and the multi-purpose room would be shared.

Upon arrival, OHuddle visitors will find one electric vehicle (EV) charging space and two handicap-accessible parking spaces located directly outside the main entrance. Additional parking will be available farther from the building. The entrance will include a double-door vestibule system to help reduce energy loss.

As guests enter the building, they will be greeted in a welcoming reception and waiting area measuring approximately 240 square feet. This space will include a reception desk and room for individuals to gather or mingle before meetings or sessions.

To the left of the reception area, visitors can access a conference room designed for training sessions and group meetings. The conference room will measure roughly 400 square feet and feature both interior and exterior windows, offering natural light and visibility into adjacent office areas. The space will be equipped with a projector and screen or a smart TV to support presentations and educational activities.

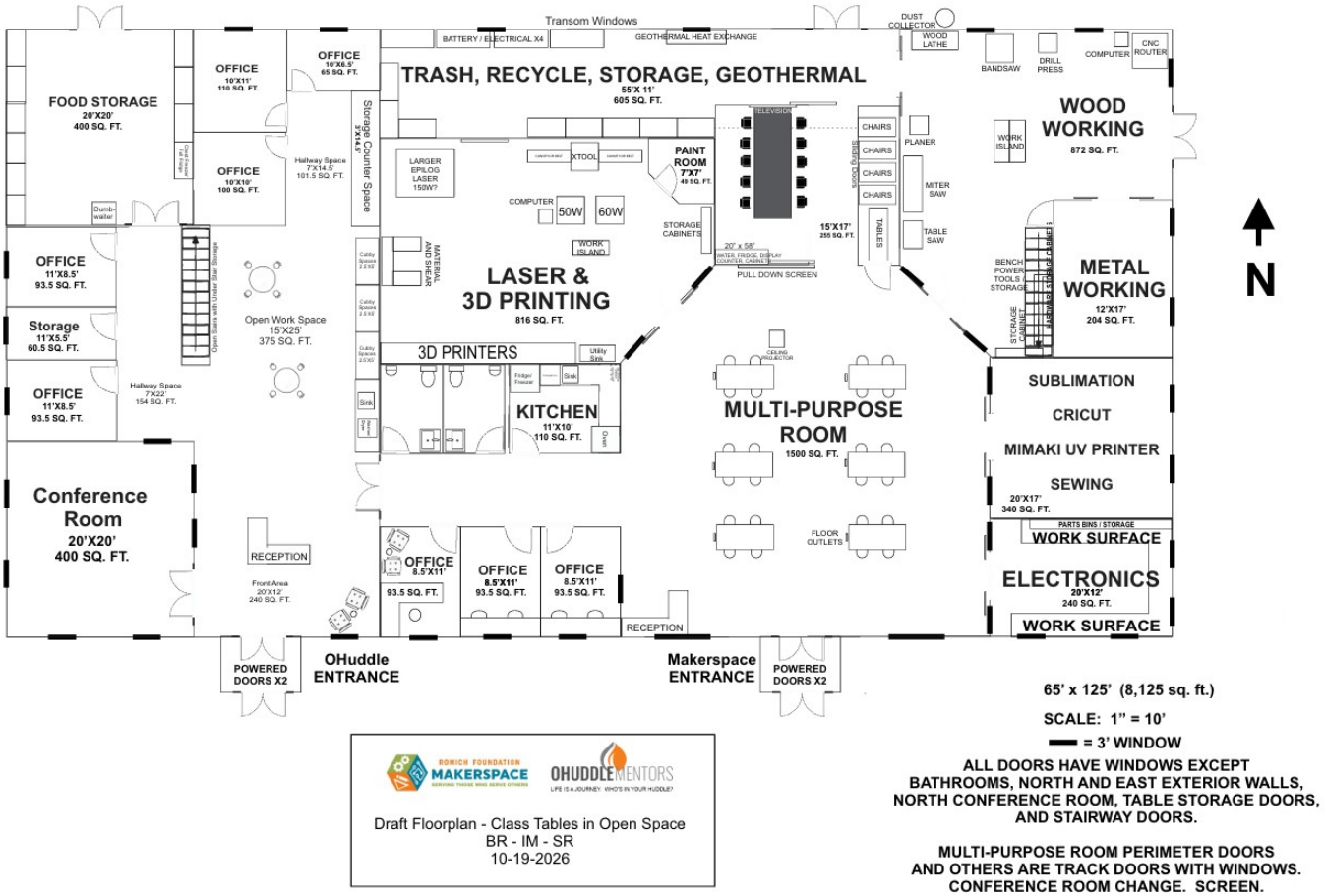
Continuing through the building, guests will enter an open workspace of approximately 375 square feet, ideal for collaboration and mentoring. The workspace will include shared tables in the center and individual work booths along the right-hand wall. To support life-skill development for mentees, the area will also include a washer, dryer, and sink for hands-on learning opportunities such as laundry instruction.

A set of open stairs on the left side of the workspace will serve as both a visual divider and functional access to attic storage. Additional storage will be located beneath the staircase.

At the rear of the open workspace, three private offices will occupy the back right corner of the building. Nearby, a built-in counter and storage area will support the distribution of supplies to mentors and school coordinators throughout Wayne County.

Returning toward the front of the building, a set of double doors will connect the OHuddle space to the Romich Foundation Makerspace. Through this connection, OHuddle will have access to two ADA-compliant restrooms and a full kitchen, which may be used for both personal and educational purposes. OHuddle will also have access to the 1,500 square-foot multipurpose room within the Makerspace for large events, trainings, and group activities.

On the left side of the OHuddle space, two additional offices and a storage room will provide workspace for staff and volunteers. In the back left corner, a 400-square-foot food distribution room will support OHuddle's efforts to serve children across Wayne County. This area will include an overhead door and man door, designed for loading and unloading supplies. The food storage area will also feature a full-size refrigerator, deep freezer, and a dumbwaiter system for lifting items into the upper-level storage area safely and efficiently.



Romich Foundation Makerspace

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The new Romich Foundation Makerspace will feature a thoughtfully designed 5,525-square-foot facility focused on accessibility, functionality, and collaboration. See the floor plan on the previous page.

Upon arrival, visitors will find two electric vehicle (EV) charging stations and three handicap-accessible parking spaces conveniently located near the main entrance. Additional parking will be available farther from the building. The entrance will include a double-door vestibule system designed to help reduce energy loss and maintain climate control.

As guests enter the facility, they will be welcomed into a spacious 1,500-square-foot multipurpose room. On a typical day, this area will be arranged with six work tables, each surrounded by four chairs, creating a collaborative environment for projects, classes, and workshops. For larger events, the tables can be easily moved to accommodate up to 75 folding chairs, transforming the space into a presentation or event venue.

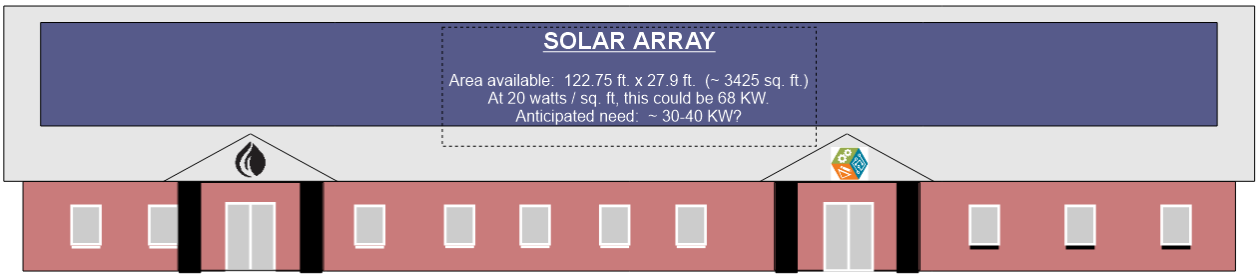
The multipurpose room will also feature surround sound, enabling presenters and instructors to communicate clearly with their audience, as well as a projector and screen or smart TV for visual presentations and demonstrations.

In the lower left-hand corner of the multipurpose room, a reception desk will serve as the first point of contact for visitors, offering assistance and guidance. Along the outer edges of the multipurpose room, there will be individual workspaces, each featuring two interior windows for visibility into the central area and double glass doors for entry. These semi-private spaces will allow for focused work, noise, dust control, and ventilated/filtered air while maintaining a sense of openness and connection to the larger environment.

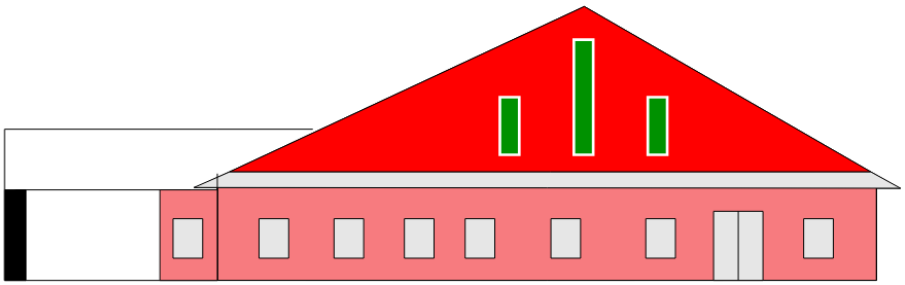
The left of the larger work areas at the back of the space is for laser engraving and 3D printing. These are both fairly clean and quiet activities. The work area to the right is for woodworking and metalworking. These activities are often dusty and noisy. The metalworking area includes a stairway to the attic storage area.

Clever features may be included, such as https://www.facebook.com/share/r/1BPnuLtXUW/, and https://www.facebook.com/share/r/1BWLS7ND9T/

Exterior Views



South View – Main Entrances



East View

The south facing roof angle is shown as 25°. The three items under the peak are decorative and are to resemble the ventilators in the barn at 13875 Cleveland Road, the site of the current makerspace. The surface behind them would replicate the appearance of horizontal red shiplap siding. The lower surface would replicate the appearance of red brick. Trim would be white. All exterior surfaces would be minimum maintenance.

Part Two: Environmental Impact

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"What were you thinking?!!"

One looks at the world differently upon becoming a grandparent. Or at least there is the potential for that. Much of human life today has adverse environmental impact. This can have a negative effect on the quality of life for future generations. Yet, too often we just continue to do what we've always done without thinking of the impact that will be experienced by those living in the future.

Climate change is a real and growing threat to future generations, and the effects are being experienced today. The evidence is clear and indisputable. Climate change is the result of greenhouse gases being put into the environment. The primary contributor is CO2, carbon dioxide. There are others, but CO2 has a greater impact than the others combined. CO2 entering the environment is primarily a result of human activity, largely the burning of fossil fuels. The worst culprits are: air travel, driving internal combustion engine vehicles, using commercial electricity that is based on fossil fuel, heating buildings with fossil fuels, eating beef, and more.

I have this imaginary future conversation with my grandchildren's grandchildren. They look back at how we live today and ask **"What were you thinking?!!"** I want to have a better answer and am trying to work toward that in general and with this proposed building.

For a rough understanding and perspective, here are some numbers.

Item	Quantity	CO2 Generated (lbs)
Gasoline burned in an engine	1 Gallon	20
Consumption of Beef	1 lb.	30
Economy seat flight from Cleveland to Denver	1 way	462
Commercial Electricity in Ohio	1 MW-Hr	1,000
6" x 12" concrete foundation for proposed building	25,536 lbs.	3,160
Concrete floor 4" thick x 8,125 sq.ft.	360,208 lbs.	44,575
ICF walls for proposed building 4" thick	197,283 lbs.	24,413
Ground screw (6' 7", steel)	1	173

Ground screws every 8’ for proposed building	144	25,000
One typical tree (depends on size, type, etc.)	CO2 per year	**- 50**

References

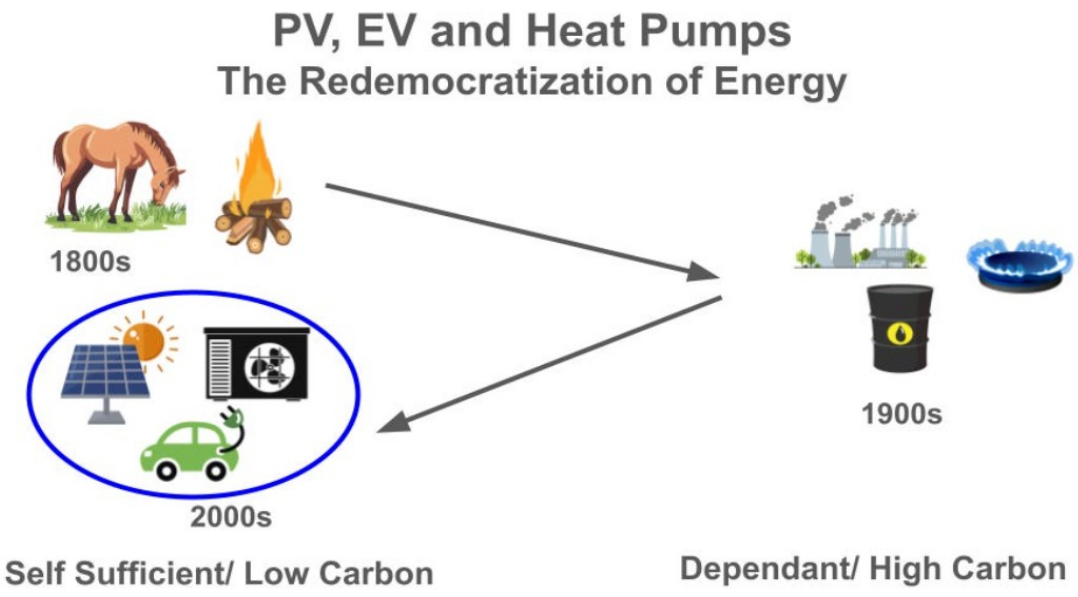
Google: CO2 per gallon of gasoline

https://calculator.carbonfootprint.com/calculator.aspx?tab=3

https://www.eia.gov/electricity/state/ohio/

There are ways to address most of these. For example, when buying air tickets today, some airlines will provide information on the carbon impact of each flight leg as well as offer the purchase of offsetting tree planting or other carbon credits. Solar panels can generate electricity that is sustainable and non-polluting. When that is used to charge electric vehicle batteries, transportation can be cleaner. The underlying requirement for all of these mitigation approaches, however, is the need to think. And thinking in this way is alarmingly uncommon.

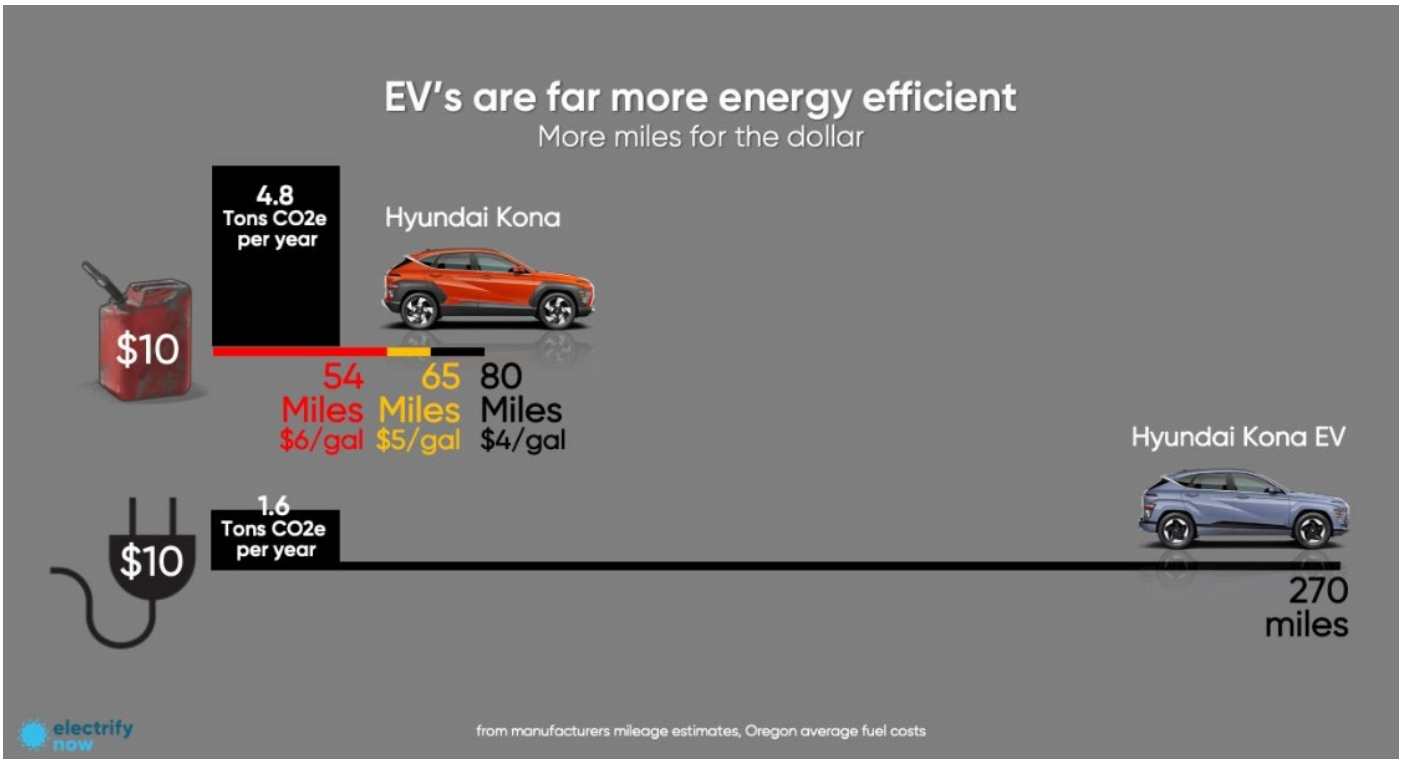
This graphic is from **https://cleantechnica.com/2026/04/22/pv-ev-heat-pumps-the-three-technologies-behind-our-zero-energy-bills/.**



With PV (solar), EV (or e-bike), and heat pumps, we can become our own energy producers and providers.

It represents the general notion that we're no longer living in the past centuries. Today abundant energy is possible in ways that are not harmful to future generations. We want this building to be a reasonable example of that.

Further, from the same source, this graphic shows that costs don't necessarily need to be excessive. With this personal transportation example, the cost of driving an electric vehicle (EV) can be much lower.



Both construction and operation of buildings have an intrinsic environmental impact. While the functions housed within this proposed building are deemed to be positive, it is our desire to minimize or perhaps negate altogether the harmful environmental effect of the construction of this proposed building project on future generations. This would require using methods that are not simply a continuation of doing things the same old way. If successful, it is our intention to share the methods used with others who also wish to not be harmful to future generations.

To the degree that the construction and operation of this building have net carbon emission, the purchase of carbon offsets can be considered to bring the net effect to zero or better.

Net Zero Principles for Engineers

As a registered Professional Engineer in the state of Ohio, I am expected to complete thirty hours of professional development every two years. One of the providers of such education is SunCam (www.suncam.com). Coincidentally, at the point in our process of identifying an architect partner for the next stage, I received notice of a SunCam course entitled **Net Zero Principles for Engineers** by **Mark Ludwigson, P.E.** . Upon reading the course description, I registered for the course and contacted the author to request permission to make the course document available. Permission was granted and the document is being made available to accompany this document.

Here is the course description:

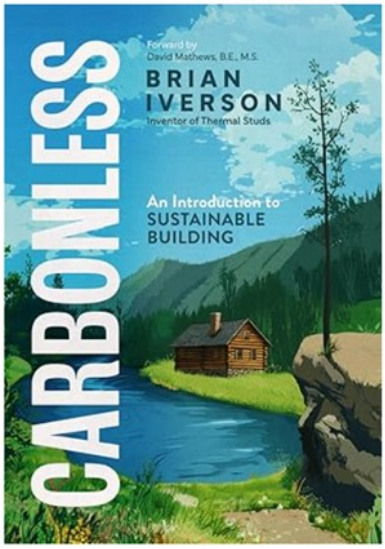
> Achieving net zero greenhouse gas (GHG) emissions is a global strategy that offers the hope of slowing down or even stopping global warming. Engineers are being called on to apply net zero emissions to a variety of applications including buildings, facilities, industrial processes, and entire companies. The net zero concept has also been extended to apply to energy use, waste management, and water use. This course covers all these applications and provides examples that teach basic principles for net zero balance calculations.
>
> The following topics are covered:
> - Defining Net Zero
> - Net Zero GHG Emissions
> - NZE 2050
> - Net Zero Energy
> - Net Zero Waste
> - Net Zero Water

The course document provides an excellent background to support our plans for this building.

Energy, Carbon Neutrality and Sequestration Resources

A Google search yields many references on energy, carbon neutrality and sequestration. This might be a good time for the reader to do this. While results from such searches can cover a wide range of areas, our interests at this point are in the areas of building construction and building operation.

One reference that has been useful is this book. Copies will be made available to those who are chosen to be part of the project.



Midwest Climate Collaborative

Coincidentally, at the time of preparing this document, the annual summit of the Midwest Climate Collaborative (MCC) (**https://midwestclimatecollaborative.wustl.edu/**) was hosted at Case Western Reserve University (CWRU) in Cleveland. Romich Foundation joined MCC and I attended the three day conference with the idea of gathering additional information and contacts. This document now includes information from that event. It was largely reinforcing.

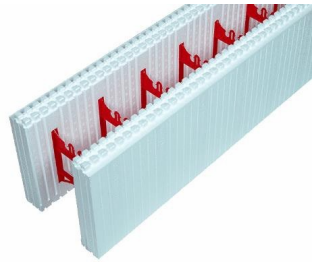
Great Lakes Energy Institute

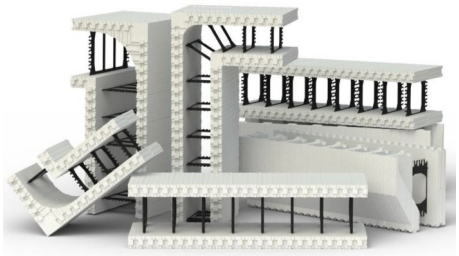
Great Lakes Energy Institute (**https://engineering.case.edu/research/institutes/great-lakes-energy**) has been contacted with the offer to collaborate in mutually beneficial ways. This could include incorporating research ideas, acting as a demonstration site, incorporating data collection, and more.

Building Construction

This section deals with the process of constructing the building, not the end operation performance, which is the topic of the next section. There are multiple methods for construction that can produce the desired performance results, primarily limiting unwanted transfer of heat. This section deals with identifying and comparing some of those methods.

Earlier versions of this document were prepared with the assumption that traditional building methods would be used. Then information on the environmental impact of various methods came to be known. As an example, the original thought had been to use traditional concrete foundations, floors, and perhaps in the walls using ICF (insulated concrete forms).







While the thermal mass and inertia of concrete has an element of attraction, along the way it was discovered that cement, the primary functional component of concrete, is responsible for around 8% of worldwide CO2 that goes into the environment. While efforts are under way to reduce this adverse environmental impact, the best commercially available products are still not good in this regard. **This article from Arizona State University addresses this issue.**

So our current thinking, to be least harmful to future generations, is to try to proceed with this building using zero concrete. There are other methods that can replace the traditional foundation. A few are **Montana Ground Screw**, **TechnoMetalPost**, **Postech Screw Piles**, **GoliathTech**, and others that can be identified using Internet searching. However, as seen in the preceding table, the CO2 emissions for making steel can be significant.

Another approach could be to use treated wood posts in holes with a paver in the bottom and loose stone around, eliminating ground contact with the wood. A product called **PostProtector** is a plastic sleeve that separates a wood post from the surrounding material. They are typically of a length that the top end is several inches above grade level, which is where even treated posts are subject to deterioration. Post Protectors have horizontal elements to resist vertical force when connected to the post. While they are often used with soil backfill, we are thinking of using loose stone backfill as an extra measure of non-contact with soil. Other protection means may be possible.



Wood sequesters carbon. Current thinking is that walls would be made of wood, perhaps using the thermal break studs described in the **Carbonless** book. Similarly, the rafter system would be made of wood. An attic storage system with no climate control would be included with access stairs near each end.

Wood is susceptible to termites and carpenter ants and that may still be a factor with traditional treating of wood. To counteract this, additional treatment with Borax may be useful. For discouraging termites, ants and bees from upper portions of the building, dragonflies are a possibility. **https://haybarbie.com/products/3d-dragonfly-clip-bug-repellent?_pos=1&_sid=5359f03c2&_ss=r**

With the goal of zero concrete use, the proposed floor would be wood joists supported by the wood post system. This would require excavation such that the resulting floor level would be just above surrounding ground level, as there should be no steps needed for entry into the building.

Other building design features include minimizing unwanted heat transfer from the three

methods by which that occurs: conduction, convection and radiation. All methods can occur on all six surfaces of the building envelope.

Conduction is generally the largest type of loss. The insulation R value is what determines the level of loss. There are various insulation methods.

While we have experienced recent rather extreme temperatures, it seems reasonable to provide for maintaining 70 degrees inside temperature with 20 degrees 24 hour average outside temperature. (In the rare times when outside temperatures are lower, usually overnight, then lower inside temperatures will be tolerated.) Those numbers were used in the next section.

Using the calculator at **https://calculator.academy/heat-loss-r-value-calculator/**, the energy required for the walls during such extreme conditions would be just under 0.5 watts per square foot. This would be 2.2 KW for the walls. For the windows/doors, 2.9 watts per square foot, or about 1.6 KW for the building. For the top of the envelope, the power required would be 1.98 KW. For the floor, a temperature differential of 20 degrees is assumed. The sum would be around 6 KW total for the building.

	Square Feet	R Value	Watts	Watts / 3.5
Walls	4450	30	2170	620
Windows / Doors	550	5	1610	460
Top	8125	60	1980	566
Floor	8125	60	790	226

Using a geothermal HVAC system with a performance factor of 3.5, the total power requirement for maintaining 70 degrees inside when outside temperature is 20 would be around 1.7 KW, or around 41 KW-Hr per day. In a grid failure situation, a fully charged 60 Kw-Hr battery, with no solar charging, would power the HVAC system for around 35 hours. Outside temperature of 45 degrees could extend that operational time to nearly 3 days, again with no solar or other battery charging. A high performance geothermal system might extend that by nearly 50%.

The proposed solar panel array dedicated to the HVAC system is 24 KW. December is the worst month of the year for solar production, with projected daily average of 52 KW-Hr for a 24 KW system. This is about 25% higher than what was calculated above. **(https://pvgis.com/en)**

Convection and radiation can be addressed using reflective surface insulating panels that are tape sealed. Foam insulation can also address unwanted air flow.

Water

One of the concerns today is the availability of water during an extended grid failure. This concern is primarily for drinking but also for other purposes. As this building will be within the Village of Creston, there will be a required connection to the village water supply. That supply has various components, but it is essentially a water tower, well and pump.

The pump is primarily grid powered, but a back-up generator is part of the system for operation during grid failure. The normal fuel reserve is enough to keep the system operational for a few days. Then additional fuel would need to be procured. However, during a grid failure this may or may not be possible. Therefore, it is possible that within days into an extended grid failure, no one on the village water supply system could have water. Further, during an extended grid failure few residential or other wells would be functional after backup generator fuel is exhausted, assuming a back-up generator even exists.

Water usage for this building is not expected to be out of the ordinary, probably on the order of a single residence. One of the components of LEED certification is the collection and use of rainwater. With a roof area of over 8,000 square feet, the collection and storage of water should be feasible. From an environmental responsibility perspective, the use of the village water supply is likely to be more harmful than the use of collected and processed water, as there would be no use of fossil fuel and the corresponding release of CO2 into the environment.

Therefore, it is proposed that the building design provide for the collection and storage of rainwater. This should be at a level well beyond the expected needs for the building operation so that the building could provide for limited community needs. A water storage system that does not involve concrete is preferred.

Sewer

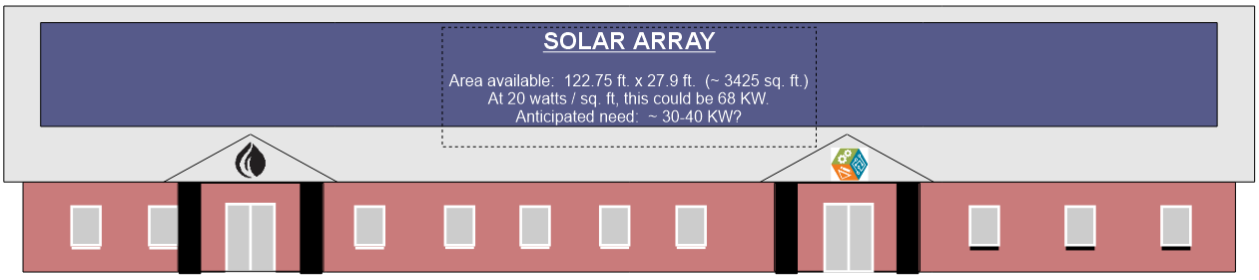
Similarly, during an extended grid failure, the village sewer system is likely to not function. The sewer system connection must assure that waste from higher elevations cannot enter the building. Most waste water from the building can be spread on the associated grounds. A composting toilet can be placed in a restroom for the collection of solid waste. Experience using a composting toilet in the existing makerspace suggests that solid waste volume would be such that this is workable for years.

Building Operation

The goal is for the operations to be carbon neutral. As local commercial electric energy is largely generated by burning fossil fuels, carbon neutrality means that we plan to generate more electric energy from renewable sources than we use, initially through a solar panel array. Carbon neutral buildings are uncommon today, so we plan for this building to be a model for others considering doing the right thing for the benefit of future generations and the environment.

The electric power situation may push the boundaries of common practice even further. Basic electrical power requirements for the activities in the building are not significantly out of the ordinary. While the loads may not be exceptional (laser engraving, CNC routing, 3D printing, sublimation printing, woodworking and metalworking power tools, lighting, computers, etc.), other features may be unusual.

- The south-facing roof can support around 3,425 square feet of solar panels. At around 20 watts per square foot, it is expected that enough solar panels can be installed to generate more energy than would be consumed, perhaps by a factor of two, with the remainder being fed back to the grid, limited by what the power company will allow. A roof angle of 25 degrees is being proposed. (**https://sunsolartilt.com/pages/calculator**) To determine how large an array needs to be installed, an estimate of required energy will be needed. See previous page.



- Following attendance at the 2026 Zonna Solar Energy Conference earlier this week, a ground mount solar array is being considered as an alternative. Evaluation of the site will be needed. The advantages are:
    1. Tiltable panels can be adjusted seasonally for optimized performance;
    2. Panels can be adjusted to near vertical for snow removal (Our recent winter experience reinforces the value of this.);
    3. The building roof design can return to symmetry.

- Consideration is being given to normal electrical power coming from zones of rechargeable batteries as opposed to the power grid.

- A microgrid that includes the two other buildings on the property is a possibility.

- If the above is pursued, the power grid connection could be programmable. Under normal operating conditions, there could be no connection to the grid. Various parameters would be monitored, including available solar energy and battery charge level. Grid connection would occur under certain conditions: 1) if solar energy is available and batteries are full charged; 2) if batteries are low on charge. Condition 1) allows excess energy to be fed onto the grid. Condition 2) charges the batteries from the grid.

- Multiple systems could be used by setting up zones of the building, each with a battery/inverter and dedicated solar panel. Zones might be: 1) OHuddle, 2) Makerspace west, 3) Makerspace east, and 4) HVAC. Each of zones 1) – 3) is planned to have 8 KW of solar panels, while zone 4) would have 24 KW. The total (48 KW, should take around 2400 square feet, just over two thirds of the available space.

- A rectifier bank could allow the battery with the highest charge level to power emergency and exit lighting and related loads. This battery concept may be novel and beyond the experience of local builders.

- At least three Level 2 electric vehicle charging stations would be installed initially, with provision for additional to be added in the future when more people are driving EVs. Charging stations initially would be located in priority parking. These charging stations may provide for bidirectional energy flow. So during grid failure EVs can contribute to powering the building. When the solar array has excess output, EV charging can occur during grid failure. GM Energy (**https://gmenergy.gm.com/**) is one of the electrical energy management systems being explored.

- Separate from EV connection, during grid failure the battery/inverter systems located in the building will power essential loads for several days with no solar charging and indefinitely with solar charging.

- Ideally during grid failure, when batteries are fully charged and the solar array is generating, non-essential loads, such as geothermal heating and cooling, clothes dryer, etc. could be powered.

- Online monitoring of electric energy generation and use would be included.

- Laser engraving fumes may be exhausted after filtering, with makeup air coming from the space below the floor joists with a year round moderate temperature. A vent at the opposite corner may be included.

- Telepath Systems (**https://www.telepathsystems.com/**) has expressed an interest in using this building as a case study in their microgrid and related energy programs.

- The intent is for the building to be a model for others trying to achieve carbon neutrality and grid isolation for the benefit of future generations. Information will be shared and visitors will be welcomed.

- LEED (**Leadership in Energy and Environmental Design**) (**https://www.usgbc.org/leed**) certification will be explored.

- As indicated in the previous section on **Water** and **Sewer**, the operation of the building should be possible in isolation from normal utilities (electric, water, sewer) during extended grid failure.

- Other sustainability and energy-related ideas are invited.