

EL SOL
IL SOLE
DE ZON
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DIE SONNE

THE SUN

Sun Tempered Communities: Detroit

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Pisa Cathedral, Italy
Ross Piper Photography



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Introduction

"The Sun is the ultimate source of energy for life on Earth, and it sustains nearly all aspects of human existence. The Sun is an ongoing hydrogen fusion reaction, producing immense quantities of energy in the form of light. At the Earth's surface the Sun's energy evaporates water and thus drives the hydrologic cycle. It powers photosynthesis and it produces the raw material for the creation of fossil fuels. Via its interaction with the Earth, the Sun also drives the seasons, weather and climate, and currents in the oceans. Variations in the Sun's radiation output as well as longer term periodicity of Earth-Sun geometrics are known to strongly affect the Earth's climate over time. The Sun also directly and indirectly supports key environmental services such as the provision of clean water, a stable climate, the creation of fertile soil, nutrient cycles, and biological diversity. Given these vital roles, it is no surprise that the Sun is a dominant historical theme in art, literature, religion, and in the evolution of culture itself.

Not only does the Sun power the natural world, but it is a potential sustainable source of electricity and heat for part of human society's energy needs. Currently, solar power contributes less than one percent of humankind's electrical energy at present. This amount may increase

to as much as 5% of society's energy needs by the year 2030. The efficiency of solar panels is also expected to increase significantly in the next decade. The downside of this rapid progress towards more sustainable energy production is the fact that most solar systems presently being manufactured will be economically obsolete in five to seven years."

The amount of Solar Energy that is intersected by the Earth is plentiful but only accounts for 1% of our energy production. The energy produced, is not harnessed to it's full potential.

"The Sun, like most stars in the Universe, is on the main sequence stage of life. Every second, 600 million tons of hydrogen are converted into helium in the Sun's core, generating 4×10^{27} Watts of energy. For the Sun, this process got going 4.6 billion years ago, and it has been generating energy this way every since. But there isn't an unlimited amount of hydrogen in the core of the Sun. In fact, it's only got another 7 billion years worth of fuel left."



Natural Design

"Nature - the interior essence
of all cause and effect"

-Frank Lloyd Wright
Natural Design

"Electromagnetic energy from the sun comes to Earth in the form of radiation. The term "radiation" simply denotes the fact that the energy travels as rays, that is, in straight lines. In general, the terms "solar energy" and "solar radiation" simply refer to energy from the sun. Electromagnetic energy is produced when electric charges change their potential energy. It is characterized by the property that it is pure energy, not requiring any matter (or medium) for its existence or movement. Electromagnetic energy can therefore travel through space (which is a vacuum), traveling at a speed that is the same for all forms of electromagnetic energy and is equal to the speed of light, 3×10^8 m/sec (or 186,000 miles per second).

The sun radiates energy equally in all directions, and the Earth intercepts and receives part of this energy. The power flux reaching the top of the Earth's atmosphere is about 1400 Watts/m². This measure simply means that on the average, one square meter on the side of the Earth facing the sun receives energy from the sun equal to that from fourteen 100 Watt light bulbs every second!"





<http://blog.1800hocking.com/guest-blogger-program/>

Features naturally formed on the Earth, exhibit passive properties from the Sun. These features discovered over time, and constantly changing with the Earth's crust and atmosphere. One of which, Ash Cave, located in the southern region of Hocking Hills Ohio State Park.

"Ash Cave is the largest recess cave in the state, measuring 700 feet from end to end. It was formed as a result of the erosion-resistant Blackhand Sandstone. Named for the massive piles of ashes found in the location by early settlers, it is believed Native Americans used the cave for shelter and that the ashes resulted from their campfires. Ash Cave is an important historical landmark. Native Americans treated the space as a workshop to prepare meals, craft weapons and skin game. Later, it provided shelter to travelers migrating along the Indian Trail between the Shawnee villages of the Kanawha River region and the Scioto River at Chillicothe. It was also a resting place for captured prisoners being transferred by way of the Trail during the frontier wars."

Over the years the role of Ash Cave has changed, but the use of passive features and properties has remained. The solar orientation

of being shielded from the north and open to the south, paired with indentation into the Earth to take advantage of thermal properties, allows the sun to penetrate the cave deeper in the cold winter months, and provide less sun penetration in the warm summer months providing natural comfort.

Utilizing the natural topography of the ridge system creates protection from the elements and allows benefits from the earth that produces warmth through its core. The location and arrangement, in the cave, of the natural water source affects the movement patterns of the users of the cave.

At the opposite end of the ridge system, is a similar cave but with opposite solar properties. The problem is that, it cannot sustain a natural comfort. Open to intense summer solar rays and decreased winter sun when it is needed most accounts for the immense difference between the two caves and the lack of history with providing natural comfort to users.



Adaptation

"Ecological Design is the art that reconnects us as sensuous creatures evolved over millions of years to a beautiful world. That world does not need to be remade but rather revealed. To do that, we do not need research as much as the discovery of old and forgotten things."

-David Orr

Professor of environmental studies at Oberlin College

Throughout history, animals and humans have had to adapt to the changing environment. Whether it be to conditions, food sources, or natural disaster's; adaptation is necessary for survival.

Merriam-Webster defines Adaptation as, "A change in a plant or animal that makes it better able to live in a particular place or situation. The process of changing to fit some purpose or situation : the process of adapting.

In biology, the process by which an animal or plant becomes fitted to its environment. It is the result of natural selection acting on inherited variation. Even simple organisms must be adapted in many ways, including structure, physiology, and genetics; movement or dispersal; means of defense and attack; and reproduction and development. To be useful, adaptations must often occur simultaneously in different parts of the body."

Adaptation is derived from trial and error and the necessity to survive. Each addition and adaptation is guided by a sense of purpose. The builders do not work from an image of form that can maintain and sustain life which can be described as "ultimate form". The origins of early primitive structure are not well known, but were gradual over time. "It emerged as form emerged; as stones accumulated and as the Earth was scooped out, some purpose arose beyond the single act. Through their tenacious and prolonged efforts to shape and structure an immediate response to environment, form and purpose blended to become inseparable in the mind of the builder."



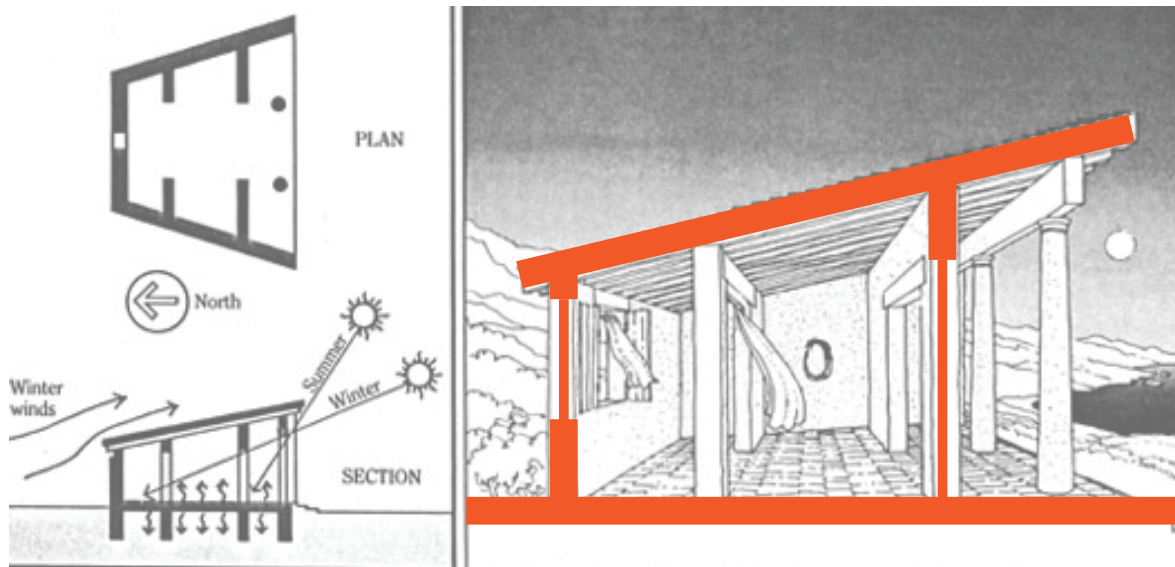
HISTORICAL CASE STUDIES

In Book III, Chapter VIII, of XENOPHON'S MEMORABILIA OF SOCRATES, written a few decades after Aeschylus, and in the midst of a Greek wood fuel shortage, the Greek philosopher, Socrates, observed:

"Now in houses with a south aspect, the sun's rays penetrate into the porticos in winter, but in the summer, the path of the sun is right over our heads and above the roof, so that there is shade. If then this is the best arrangement, we should build the south side loftier to get the

winter sun and the north side lower to keep out the winter winds. To put it shortly, the house in which the owner can find a pleasant retreat at all seasons and can store his belongings safely is presumably at once the pleasantest and the most beautiful."

The Greek wood fuel shortage, caused a realization that architectural design should be more efficient utilizing the sun and display passive properties. Socrates in this simple layout; established key principles of passive design in shape, orientation, indentation and designing for place.

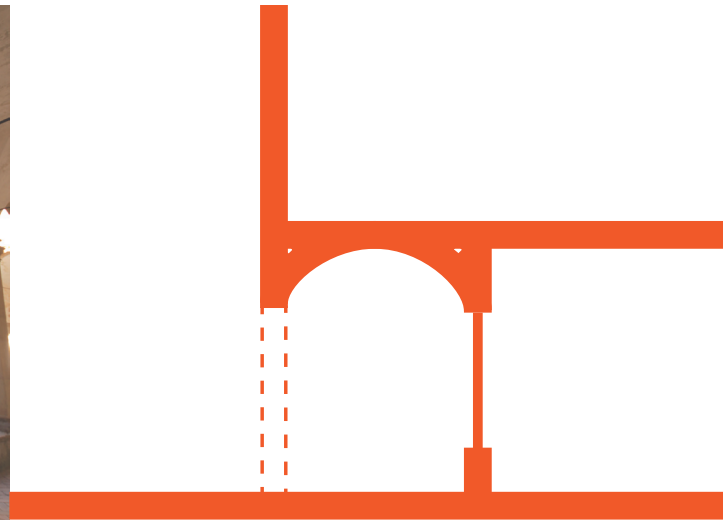


"Romans were also great innovators and they quickly adopted new construction techniques, used new materials, and uniquely combined existing techniques with creative design to produce a whole range of new architectural structures such as the basilica, triumphal arch, monumental aqueduct, amphitheatre, granary building, and residential housing block. Many of these innovations were a response to the changing practical needs of Roman society, and these projects were all backed by a state apparatus which funded, organized, and spread them around the Roman world, guaranteeing their permanence so that many of these great edifices survive to the present day."

The arcade, a Roman innovation, a response to changing needs and changing comfort level. Utilized as protection from the elements for patrons; as they travelled throughout the city providing a covered walk from building to building. Store owners also benefitted from the arcade in their storefront. The shading provided from the arcade, kept the buildings climate controlled during seasons. The objects displayed in the windows, were also protected from the sun. Shops such as markets, could display produce and not worry about spoilage.



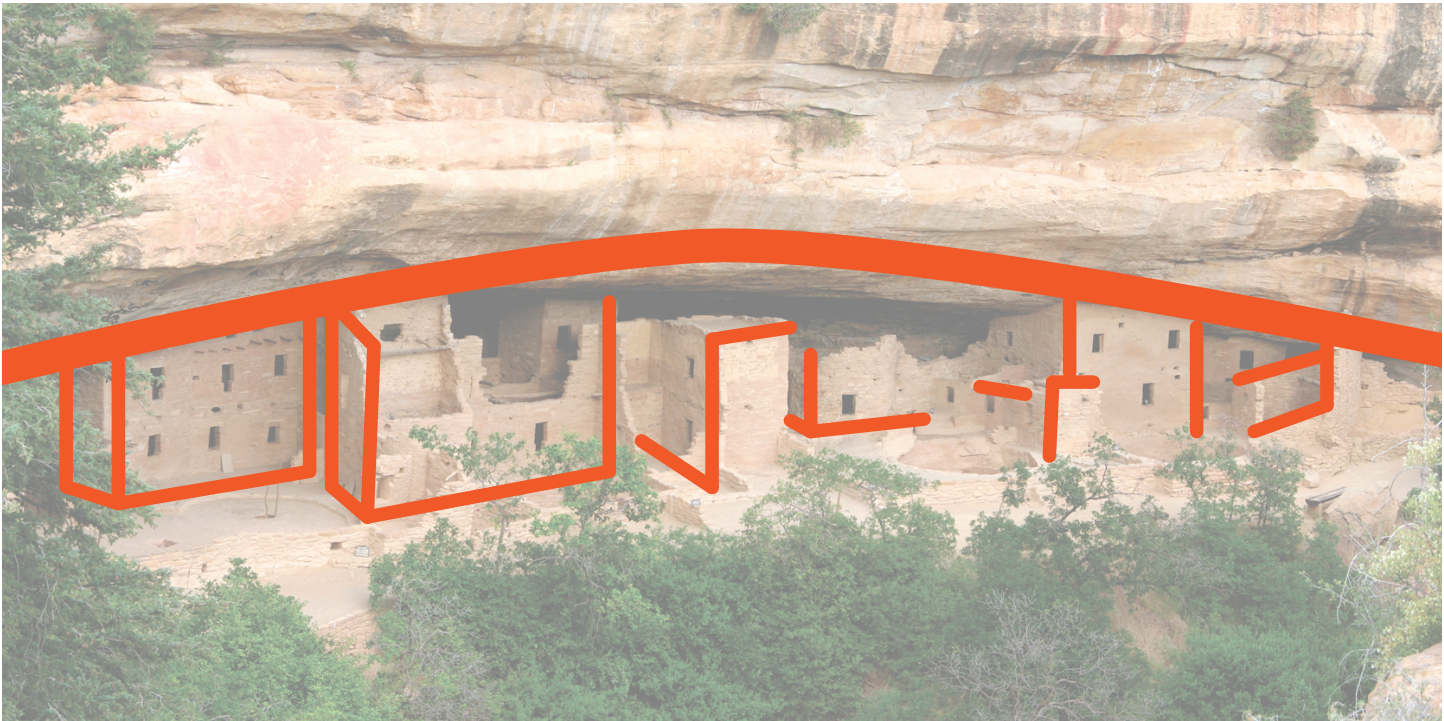
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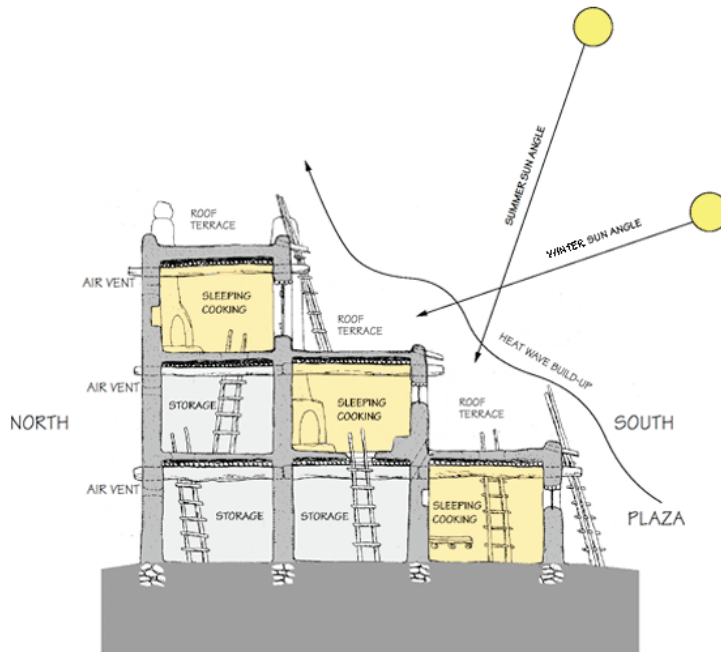


Roman Arcade



"The Anasazi Indians were real pioneers and created roads and irrigation systems for watering their crops. They were also great architects and the cliff dwellings are one of their biggest achievements. Not only that but they were diligent and persevering." Mesa Verde, as shown below, was built in around 1278 A.D.





<http://www.dennisrhollowayarchitect.com/>

Utilizing the southern solar orientation of the cave dwelling to maximize the sun's energy in the summer and the winter with light penetration and thermal storage. Material used by the Anasazi's in their architecture, was that of adobe, timber and stone.

"Today the prevalence of earth as a building material may be attributed to its proven durability demonstrated by the number of ancient earthen buildings that remain standing today. Scientific work have demonstrated that adobe has low thermal conductivity and high heat capacity enabling earthen building thermal stability compared with concrete building."

Understanding the properties of the sun and the importance of choosing the correct material, while using what they had available in the ridge systems of Southwest United States in which they built, was so important.

The natural topography, created a form of protection from not only the sun but from enemies of the Anasazi Indians. Water was an important part of survival in this dry region; so living close and protecting your water source was crucial. Arrangement around that water source created communities, and divided activities and function depending on the need for the use of water.

MODERN CASE STUDIES

The Karen Terry House located in Santa Fe, New Mexico is a culmination of passive systems including thermal massing, southern solar orientation and glazing, roof ponds and a strive for more intimate relationship with natural forces.

"A solar house, geared to both the people who live in it and the cycles of the sun, is seen to exemplify the human relationship to the natural world"

"The house is subdivided into three separate components which follows the contours of the New Mexico landscape upon which it sits. The retaining walls consist of twenty-eight 55 gallon drums of water and an anticorrosive additive, covered with mud plaster. The 45 degree clerestory windows are placed in such a way that sun is a constant presence in the interior, under which the water walls are strategically placed as to allow for the maximum amount of sun exposure."

Fluctuation of the interior temperature of the house can reach 20 degrees throughout the day. When asked how this affects her work she said jokingly, "I put on a sweater, or move to another location"

Throughout the day Karen migrates through her house. Arrangement plays a large role in the function and movement of the house. At the lowest and coolest level is where her studio is located. The middle level and middle range temperatures, is where the living and dining rooms are located. The warmest level, being the top are the location of the bedrooms.

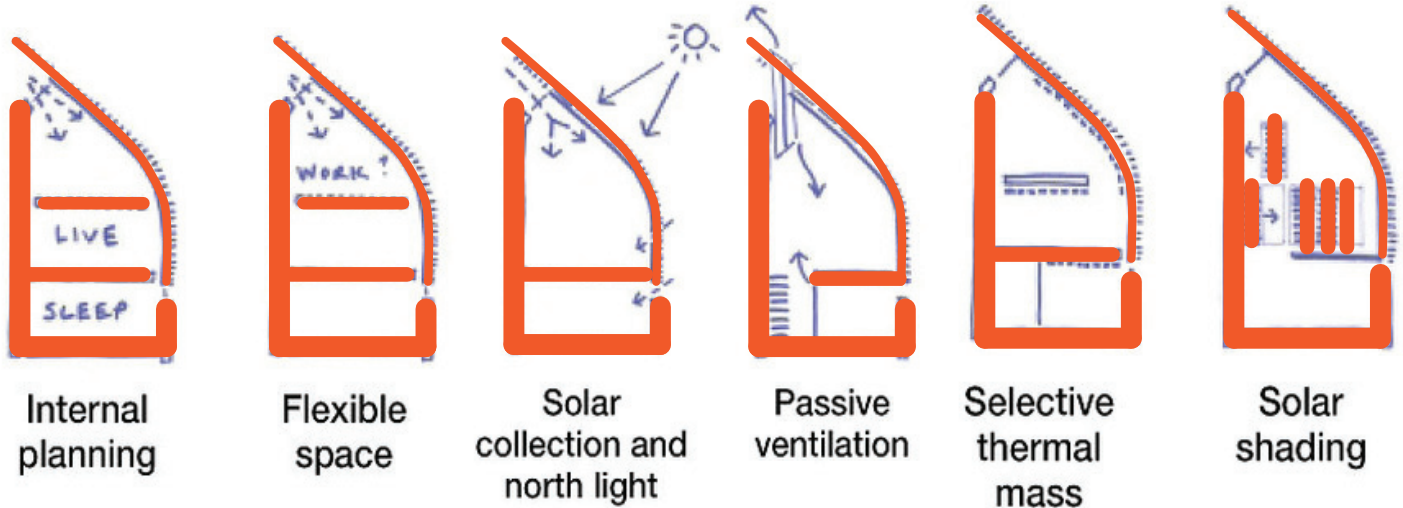


Karen Terry's House



Ben Reed of Sheppard Robson





The Kingspan lighthouse in Hertfordshire, UK designed by Sheppard Robson and located in a technological community with other forward thinking designer houses.

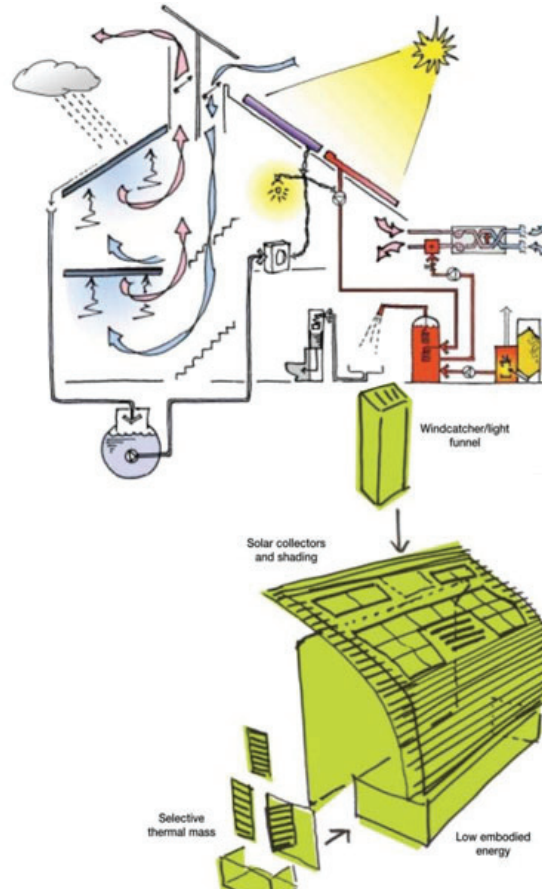
The house features passive building technologies and systems including geothermal, air ventilation system, internal planning, flexible space, solar collection and orientation, thermal mass and solar shading. This allows for the total usage fee and running cost to be around \$40 for the year.

An Integrated "smart system" in the lighthouse, allows the user to have day by day analysis of their actions. This gives the owner the ability to see the result of the negative or positive actions, by the changing data.

The use of thermal storage materials are located throughout the house. The concrete base box allows maximum storage in the most travelled area of the house and which faces the most air loss due to the travel outdoors.



<http://www.wilder-associates.com/>



The ribbon windows located along the south side offer correct solar glazing but are kept small and horizontal. The rating of the house embodies a percentage of glazing.

Rainwater is collected from the roof and run to a storage well located underneath the house. The rainwater collection tank is then fed throughout the house including to the hot water tank which is heated by photo voltaics on the north side of the roof. The water is then also fed throughout the house including to the shower which the runoff is fed to the toilet to be used. This idea of a one off use of products is just non-efficient and we need to be more aware that this can't go on.

The ventilation system, paired with internal planning can keep a house cool. When opened and ventilated, the cool air comes in from the north intake valve and the hot air is siphoned out from the south side.

Located in the BRE Watford innovation park, Wilder Associates states, "The Innovation Park is much more than a collection of clever and sustainable buildings. It is a showcase of our evolving approach to integrated design which includes the use of passive technology and ecosystem services."

Goals for the community include:

- A low to zero carbon demonstration community
- An outstanding showcase of innovative construction and technologies
- A look at sustainable buildings and communities of the future
- An educational facility supporting delivery of the National Curriculum for local schools
- A unique venue for events and away days
- A networking and knowledge exchange hub
- A test-bed for innovative ideas and products, including those which have not yet reached the marketplace
- gateway to BRE's world-leading expert advice, testing and certification

"Collectively we want to reduce carbon emissions, impacts on the environment, while improving the quality of buildings and the lives of people."



PASSIVE COMMUNITY CASE STUDIES

"Over the past few decades designers and policy makers have been working to increase the energy efficiency of buildings, and solid progress has been made. Still, today in the United States buildings account for 49 percent of energy use and 46 percent of greenhouse gas emissions. Successfully tackling the dual challenges of rising energy costs and climate change is going to take massive reductions of building energy use."

An analysis of size and community, sustainability and systems along with topography and site of three passive communities in comparison to the site of Core City in Detroit becomes a guide and design strategy for the Sun Tempered community.

The size of passive/eco communities can range depending on need and location. From the smaller, of the Pomaret houses, the medium Concord Riverwalk and zHomes, to the large scale BedZed community.



Simón García

Pomaret Houses

Location: Barcelona, Spain

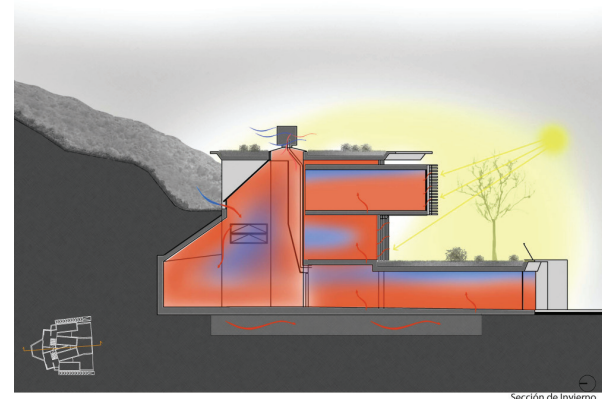
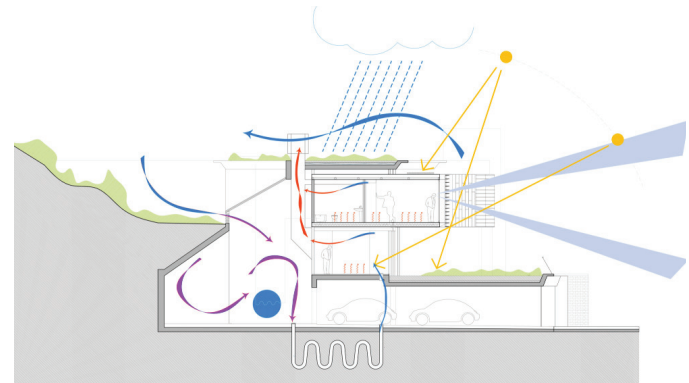
Architect: PichArchitects

The Pomaret houses consisting of semi-detached houses; measures in at 5608 square feet. The building is arranged over three floors, a basement which consists on parking, storage and facilities, a ground floor where it is distributed as the living area and upstairs, the bedrooms and study. Sharing a combined space among two families, allows the sharing of passive properties. Decreasing the number of external walls creates less heat loss and more thermal gain. The drawback to a two family housing unit is not much of a community. The opportunity to share roles is lost and becomes more of two families living next to each other but not necessarily functioning as one unit.

When the architect was asked to explain the systems and material choice for the building, it utilizes "A single ceramic piece, with different textures and positioned as needed cover the four modules, which identify the house, in the vertical opaque facade the ceramic is collocated as a ventilated facade, allowing a good inward bioclimatic behavior, in front of openings the ceramic becomes a deep lattice avoiding excessive radiation. The ceramics are used also as a horizontal coating of the modules, the same ceramic pieces are perforated, which give the inner new textures and provide them with a good acoustic behavior.

Natural cross ventilation is prioritized, in this regard, the interior spaces are designed to facilitate cross ventilation between floors. It has been introduced as an active system of natural ventilation through a Canadian well buried in the basement by which air flows and allows heat exchange between the air circulating and the land surrounding it, this air, cooler then the outside summer air and warmer in winter, is driven into the interior of the house, providing comfort and reducing the conventional energy consumption. The home heating by underfloor is supported by a high-efficiency boiler and solar thermal panels.

The dwelling has got a remote control that allows to inform users about the proper use of energy as well as the most appropriate comfort ranges. Rain water is stored on the roof, gray water is treated and used both for irrigation and other uses allowed.





<http://unionstudioarch.com/>

Concord Riverwalk

Location: Concord, Massachusetts

Architect: Donald Powers

The Concord Riverwalk; A series of 10 net-zero energy capable detached single family residential homes and 2 major renovations in a walkable neighborhood setting. Each house ranging in at 1200-1500 square feet without basements. The close distance home layout, paired with: gravel footpaths and dense gardens, a multi-use community building, community gardens, walking trails and a nature preserve foster interaction and create a pocket community with a close connection to nature.



Parking is discretely located, and the neighborhood is a short walk to the train station and West Concord town center. Having a connection with the existing West Concord community is key for a tie into the city but with a feel all it's own. The site features a 50% preservation of open space and nature.

The Concord Riverwalk, uses ducted and ductless air source heat pumps and heat recovery ventilator's to provide comfort and excellent indoor air quality with reduced energy consumption. Solar thermal panels produce around 75% of the required heat for hot water, with the balance provided by an electric hot water tank. The building utilizes triple pane low-E coating windows, 2x6 w/ 4" of Foil-Faced Polyiso wall construction and Closed Cell Spray Foam roof assembly.



<http://unionstudioarch.com/>



<http://unionstudioarch.com/>

The passive downfall to this community, is the detached single family residential homes. Sharing walls in a community setting allows the greatest potential for passive gain. The detached homes do not utilize shared thermal mass. The design of dormers and added exterior angles make way for greater heat loss. The lack of simple sun shading on the exterior facade, a simple yet beneficial opportunity is lost. Not all homes in the community are designed to be net-zero but have an option to upgrade.





zHomes

Location: Issaquah, WA

Architect: David Vandervort Architects

zHomes is a net-zero community of 10 attached units sitting on 0.6 acres which is located in Issaquah, Washington. The units range from 1200 to 1800 square feet and feature balconies on each of the units. There is a shared community garden, shed and compost space along with surface water collection and wildlife habitat. The community is based as a learning tool for holding classes and tours and becoming a replicable model for interested homeowners and production builders.

"In the 19th century, we devoted our best minds to exploring nature. In the 20th century, we devoted ourselves to controlling and harnessing it. In the 21st century, we must devote ourselves to restoring it."

-Stephen Ambrose

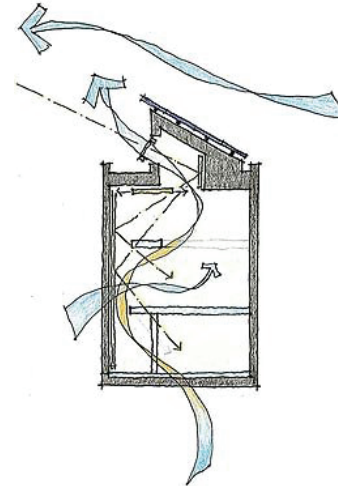


The project goals include:
achieving net zero energy
60% reduction in water use
healthy indoor air quality and creating
community through thoughtful site design

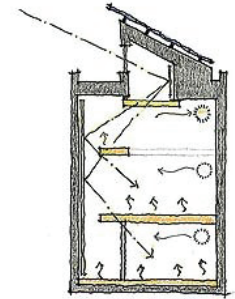
zHome achieves the zero net energy mark through efficiency measures that reduce consumption vs. the typical unit by about two-thirds, and photovoltaics that generate enough electricity to cover the remaining third. The south-facing panels that cover the roofs benefit from the design of the northern orientated wedge shape. During the sunny summer months the PV produce more energy than the buildings need, and the excess is fed back to the surrounding area. That stored energy will offset the gap in energy consumed during the winter months when Photovoltaic output is at it's lowest averaging out the zero net energy use on an annual basis.

Energy:

Ground source heat pumps that provide space heating and domestic hot water
Heat Recovery Ventilation System
A tightly sealed and highly insulated envelope (R38 wall, R63 roof, U-0.33 double pane windows)
Efficient appliances
LED lighting/switched outlets to reduce phantom loads



Summer Cooling Season



Winter Heating Season

The building also feature a real-time energy monitoring system. (The project is also designed to reduce water consumption by 70 percent.) This system gives you real-time data on your impact of the house and the decisions you make on your day to day basis.





<http://www.peabody.org.uk/>

Beddington Zero Energy Development

Location: Hackbridge, south London

Architect: Bill Dunster Architects

The BedZed (Beddington Zero Energy Development) large-scale community is located in Hackbridge, south London sitting on 3.5 acres with 82 mixed tenure residential homes. Social community setting emphasizes public transportation, live and work combined including commercial buildings, an exhibition centre and a children's nursery. Private open space in each home, improvement in air quality, combined to create a closer relationship between neighbors. The creation of clusters of buildings, allocate the sharing of passive properties between neighbors utilizing shared thermal mass.

Energy:

- 100% Renewable energy
- Passive solar heating in winter
- Charging station for electrical cars
- Wind powered ventilation systems

Water:

- Rainwater storage tank underground
- Rainwater used for flushing toilet and irrigating gardens
- On-site ecological water treatment

Waste:

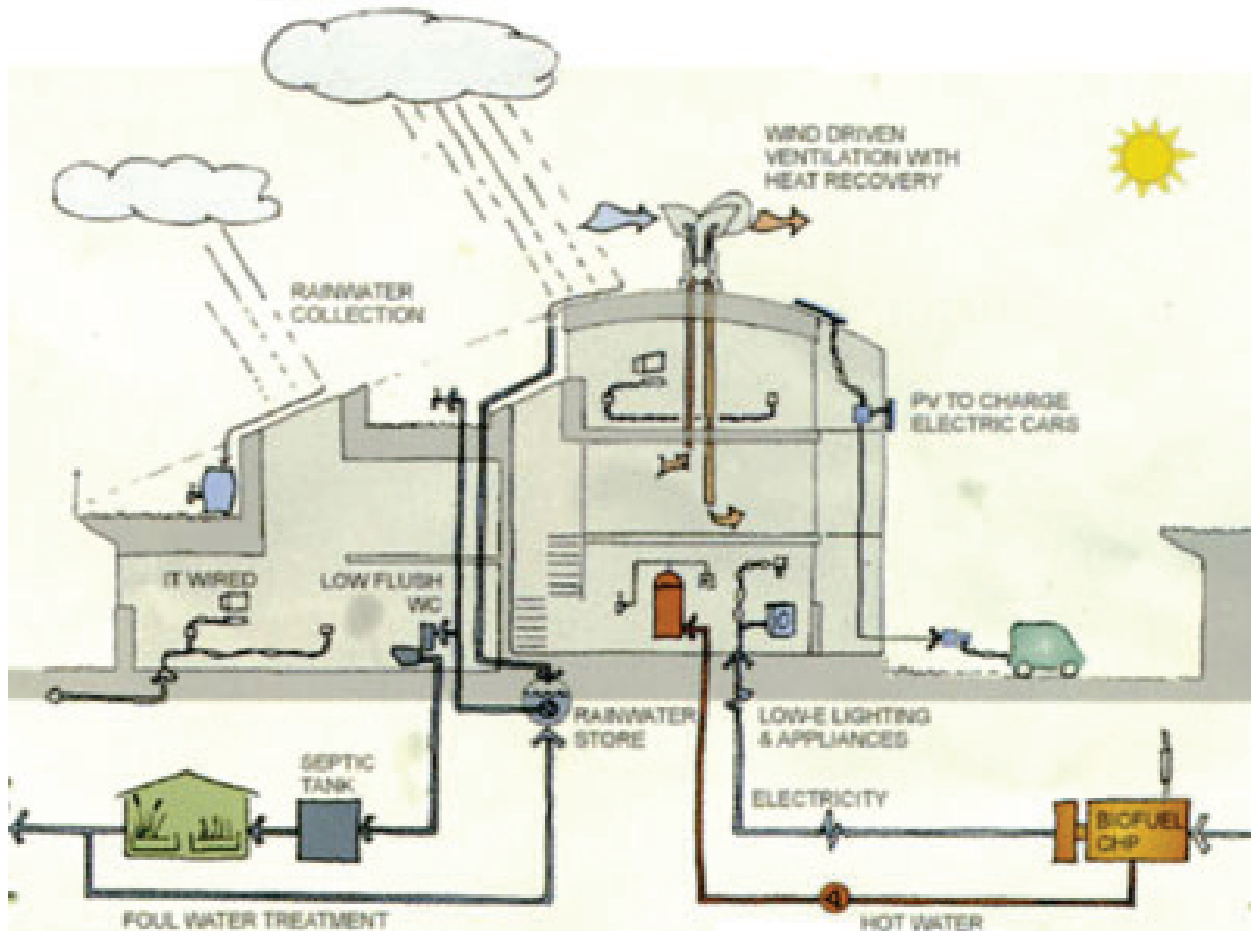
- Recycling facilities divided into 4 sections
- Urban tree waste bio-fuelled CHP

Construction:

- Recycled timbers
- Reused structural steels
- Materials sourced locally
- Timber used in preference to steel/aluminum
- Houses face south for solar gain
- Roof gardens on top of workspaces

Transportation:

- Footpaths and cycle routes encourage walking and biking
- Electric/hybrid cars have priority
- Supermarket internet home delivery
- Public transportation



<http://www.bioregional.com/>

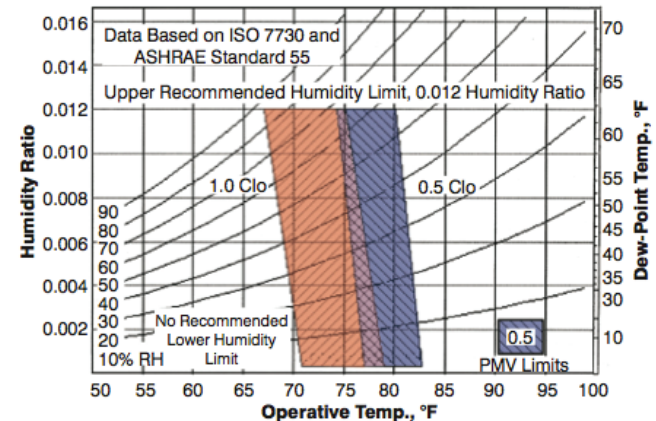
Natural Comfort

Merriam Webster defines comfort as "a state or situation in which you are relaxed and do not have any physically unpleasant feelings caused by pain, heat, cold, etc."

"Buildings that are strongly related to site, climate, local building materials and the sun. It implies a spatial relationship to natural processes that offer the potential for an inexhaustible supply of vital energy. In recent years, however, relying on the misconception of an infinite and inexpensive energy supply, people have chosen to abandon these long-standing considerations"

Our environment directly relates with comfort in architecture. Our location with the sun, wind, rain, and snow should play a role in our design. Today in our current form of design, we have set this aside and have taken a back seat with the sole use of mechanical systems and technology to fill our need for comfort. By the term technology, meaning mechanical systems that use non-renewable fuel. These systems are a temporary fix to a large problem of comfort. Thermostat' historical total energy consumption of the world in the last decades. s that adjust the internal temperature to a very precise degree did not always exist. Before mechanical systems, Architecture had to passively design and adapt to provide and change the comfort of their environment.

The new ASHRAE standard 55 deals exclusively with thermal comfort in the indoor environment. The scope is not limited to any specific building type, so it may be used for residential or commercial buildings and for new or existing buildings. It also can apply to occupied spaces such as transportation means (e.g., cars, trains, planes and ships).

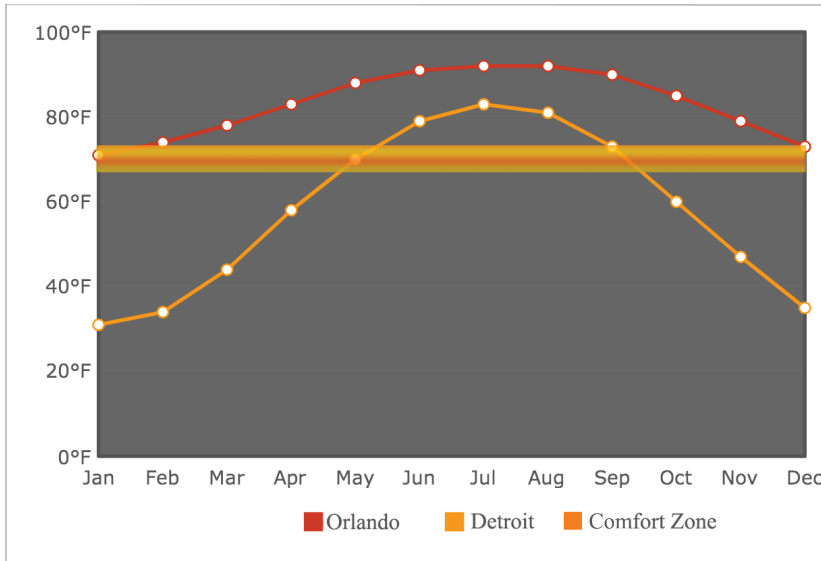
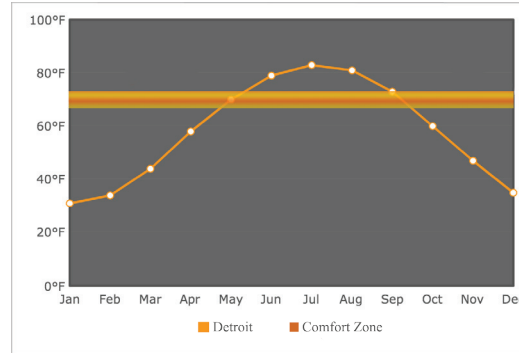
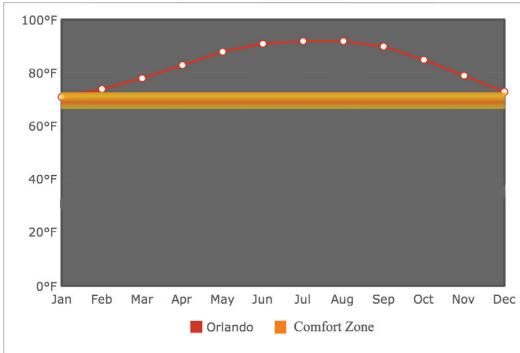


Comparing the comfort zones of two contrasting cities with great temperature differences in Orlando, FL and Detroit, MI.

Orlando as shown in the first graph generally stays above the comfort level zone. This corresponds for a great need for cooling in climates such as this one. What design implementations can affect and balance the temperature and humidity level to keep within the comfort zone indicated as a 10 degree zone on the graph.

Detroit has a great fluctuation of temperature and humidity throughout the year. The 4 seasons create a need for both heating and cooling throughout the year with periods directly in our comfort zone. Michigander's often complain when the temperatures are too cold throughout the winter and in the summer when the temperatures become hot and uncomfortable they want it to be cold again. This balance of hot and cold and the design needing to both correspond to the cold winter months in Michigan and the warm summers where cooling is needed.

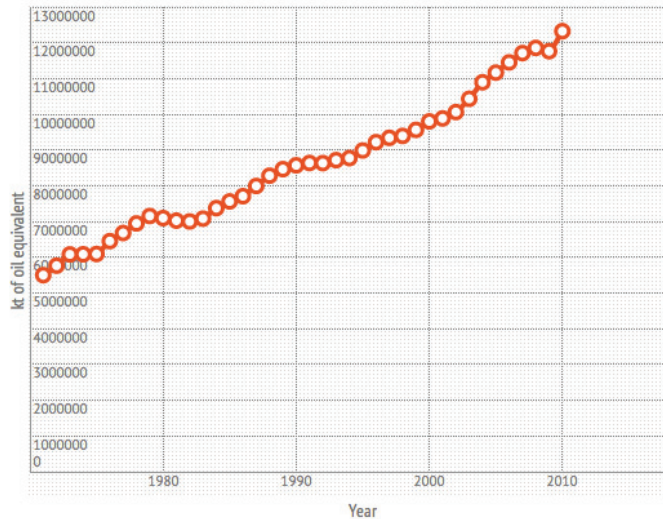
Analyzing the two graphs together, Detroit with a great shift in temperature and balance of the aspects of hot and cold allow for a challenge and first step at developing a sustainable community that accounts for the shift and create a natural comfort and balance.



Comfort Zone
-the temperature range at which one functions with ease and familiarity



ENERGY STATISTICS

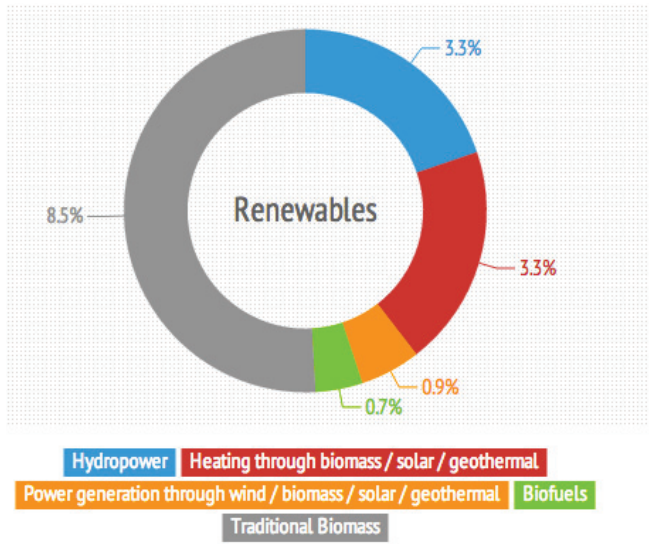
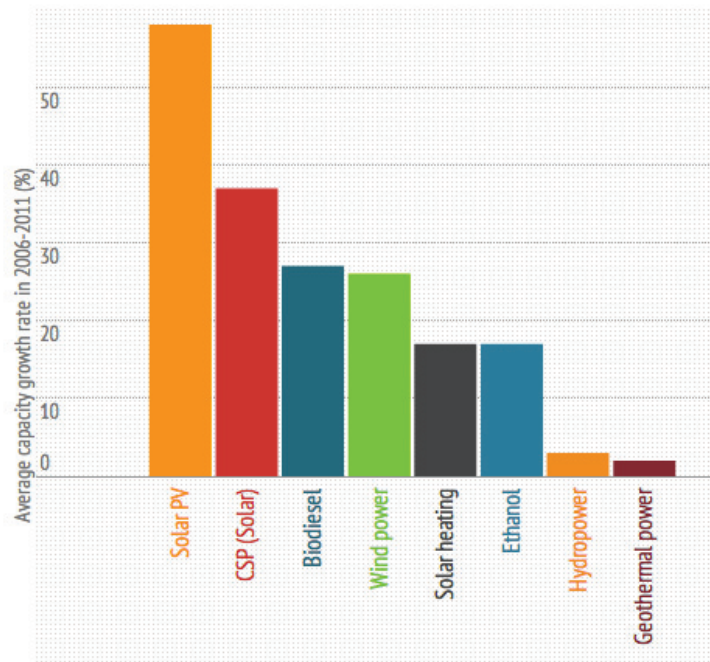
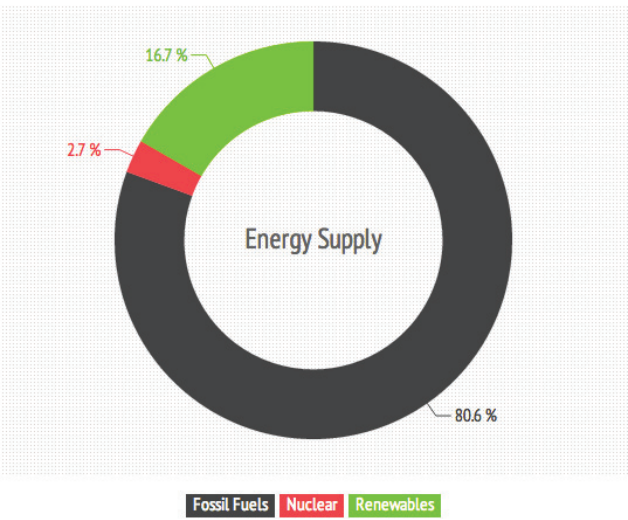


The graph shown above, is the historical total energy consumption of the world in the last decades. The consumption has steadily increased, with rapid increases in the last year breaking the 120,000,000 kt. line. Two areas, the graph actually decreased was during times of recession in the 1980's and in 2009.

Usage will exponentially grow as the cost of non-renewable energy stays low, and remain with limited governmental benefits towards renewable energy usage and design.

Cristen Conger of Discovery news, studied the usage of Fossil Fuels, the "Earth contains a finite supply of fossil fuels - the big three being oil, coal and natural gas. And although we know it's finite, we don't really know how long they will last. As we keep on using oil, gas and coal for our energy needs, we're bound to run out of fuel sooner or later. With global population growth and the development of formerly undeveloped countries, energy demand is growing fast: a nearly 50 percent jump in global energy demand by 2035 is expected.

The pie chart of the energy supply allocation of usage is alarming. Fossil fuels, make up more than 80.6% of the production. Renewables with around 16.7% and nuclear making up the last 2.7%. The breakdown of the 16.7% of renewable production include: Traditional biomass with 8.5%, Heating through biomass including solar and geothermal with 3.3%, Hydropower 3.3%, Power generation through wind/biomass/solar/geothermal making up 0.9% and biofuels with 0.7%. The growth of these alternative energy has remained relatively low. The average capacity growth rate bar graph from 2006 to 2011, with an over 50% increase of Solar (Photovoltaic).



"Not until the mid 20th century, with the widespread construction of roads, distribution of fossil fuels, and manufacture of mechanical systems were we able to turn our backs on the sun and wind as providers of light, heat and air. As a consequence, in just a few decades we have witnessed an exponential growth in the consumption of resources, production of pollution and waste, and alienation from the natural world."

"Spending my summer studying abroad in Italy and traveling Europe, it was amazing to see active shutters on most buildings. Throughout the day the shutters would open and close depending on the usage of the room, the time of day and the preference of the user."

The evolution of architectural design was formed from nature and adapted to technology. Currently, nature has taken the backseat to technology. The shutter- a pure form of passive design used traditionally used as a shading device is now nothing more than an aesthetic. The benefit of shading to control temperature and comfort is now controlled by technology.

That technology that controls the climate maintained in buildings comes with a cost. Analyzing A 1970's brick ranch located in Warren, MI costs around \$250 a month for Water and Sewage, Electric and Gas. These numbers add up to around \$3000 a year, and \$15,000 over the course of 5 years.

The mid-range passive home costs around 50 percent less to run. The well designed passive home with multiple passive systems will eventually pay for itself and end up with a profit.

Tessa Smith with The Artisans Group, states "The up front costs can be fairly modest, ranging from 5% to 10% more on average. In a Passive House there are no expensive heating and cooling systems, so these savings can go directly into the effort of optimizing the building envelope, a key design component in a Passive House."

Contact Information

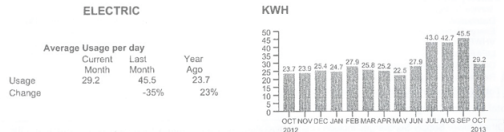
Gas Leak or Gas Emergency 800.947.5000
 Customer Service or Power Outage 800.477.4747
 Hearing-impaired TDD Line 800.886.6866 (Mon-Fri 8am-5pm)
 Web Site cleenergy.com

Summary of Charges

	Account Number 1557 265 0001 2
Account Balance as of Sep 11, 2013	221.34
Payment Received Oct 02, 2013 Thank You!	-221.34
Balance Prior to Current Charges	0.00
Total Current Charges	136.45
Account Balance as of October 14, 2013	\$136.45

Your Monthly Energy Usage

For ways to save energy and save money, go to YourEnergySavings.com



Your average daily electric cost for this billing period was \$4.71
 Your usage is based on an ACTUAL meter reading

Important Information

The average DTE Electric Company residential customer is expected to save \$6.94 each month because of energy optimization programs over the remaining program life.
 For the average Michigan residential customer, renewable energy is estimated to avoid \$3.90 per month of new coal-fired generation costs.
 The U-16472 Rate Realignment Adjustment (U-16472 RRA) surcharge will change effective for service rendered on and after October 1, 2013. This change increases average full service residential rates by approximately 1 percent. The purpose of the U-16472 RRA is to adjust rates to the cost of providing service to each customer class.
 Your October bill includes a one month surcharge for the final reconciliation of DTE Electric's 2011 Restoration Expense Tracker (RET). This surcharge collects a portion of the expenses related to restoring power to customers after storms and other outages, as approved by the MPSC.
 Concerned about debt? DTE has partnered with Green Path, a non-profit credit counseling service that may be able to help. For more information call 888.235.1003.

Detail of Current Charges

Gas Residential Service
 Rate: 250
 Thousand cubic feet used: 2.6 Mcf
 Meter reading: 6556 - 6582 (actual)
 Meter Number: 22187398
 Differential: 26 Constant: 0.1
 POD: 00000013201315
 Correction factor: 1.00000

Gas Charges		
Customer Charge	2.6 @ 2605400	\$6.77
Gas Distribution	2.6 @ 0.303000	\$0.79
Energy Efficiency	2.6 @ 4.586400	\$11.92
Gas Cost Recovery		
Total Gas		\$29.98



November Gas use 2.6 Mcf
 Gas use per day 0.084 Mcf
 Gas cost per day \$0.97

Summary of Charges

Account Number: 1000 1677 5163
Service:
 PAUL PIPER
 11047 GARBOR DR
 WARREN MI 48093-4927

Last Month's Account Balance \$157.85-
 Payment 10/23/13 - Thank You \$69.00-
Balance Forward \$226.85-

Payments applied after Oct 29, 2013 are not included.

Total Gas \$29.98
 Sales Tax \$1.20
Total Energy Charges \$31.18
Ending Account Balance \$195.67-
 Scheduled Budget Plan Payment \$69.00

Total Amount Due \$69.00

Applicable Programs Budget Plan

Billing Period 09/28/13 - 10/28/13
 Bill Month November
 Days Billed 31
 Invoice 205274552200

Your next scheduled meter read date is on or around 11/27/2013.
 Your payment is due November 20, 2013. After the due date, the unpaid balance is subject to a 2% late payment charge.

News You Can Use
 The average residential customer is expected to save \$3.54 each month over the life of the Energy Efficiency programs.
Lower heating costs expected this winter. Consumers Energy's natural gas customers can look forward to saving about \$50 in lower heating costs this winter. The lower cost estimate is due to reduced fuel prices and is based on normal weather patterns. Get money-saving tips at www.ConsumerEnergy.com/gascenter.

Meter Reading Safety. While some utilities automate meter readings, the natural gas meter is actually read by an employee. Please keep the meter clear from shrubs and debris and restrain dogs on reading day. Thank you.

WARREN
 One City Square, Suite 420
 Warren, MI 48092-2248
www.clegham.org
 Bill Date: 04/15/2013

Water/Sewer Bill
 Account Number: 2810-242
 Service Address: 11047 GARBOR
 Account Class: Residential
 Billing Period: 02/03/2013 To 03/03/2013

PLEASE SEE OTHER SIDE FOR ADDITIONAL BILLING INFORMATION AND PAYMENT OPTIONS

ONLINE ACCESS IS NOW AVAILABLE!!!
 Please visit the online services section at www.clegham.org.
 Monthly e-billing of your water bill is also available. Please contact customer service at 586-759-8200 if you're interested in this feature.

BILL INFORMATION
 Last Paid Payment: \$47.32
 Payment Date: 09/03/2013
 Meter Size: 5/8 inch
 Minimum: 2
 1 unit of water = 7.48 gallons
 Water & Sewer Unit Based Billing: \$1,000/Unit
 Other: \$1.00/Unit
 The unit-based charges below apply only to Commercial and Institutional customers.
 Cross-Connection: \$1,500/Unit
 Contaminant: \$1.00/Unit

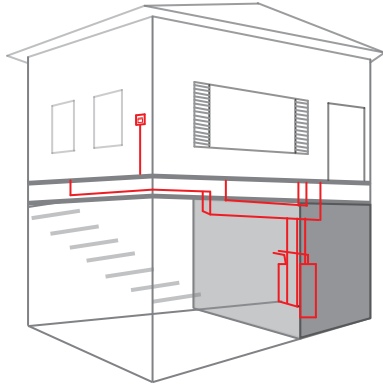
CURRENT BILL DETAILS
 WALTERS: \$17.50
 WATER SERVICE CHARGE: \$0.01
 SEWER: \$12.01
 SEWER SERVICE CHARGE: \$1.94

PREVIOUS BALANCE
 PREVIOUS BALANCE: \$27.50
 PAY THIS AMOUNT: \$32.41
 DUE DATE: 04/03/2013
 PENALTY IF PAST DUE: \$5.97

**\$238 a month.
 \$2856 a year.
 \$14,280 over 5 years.**

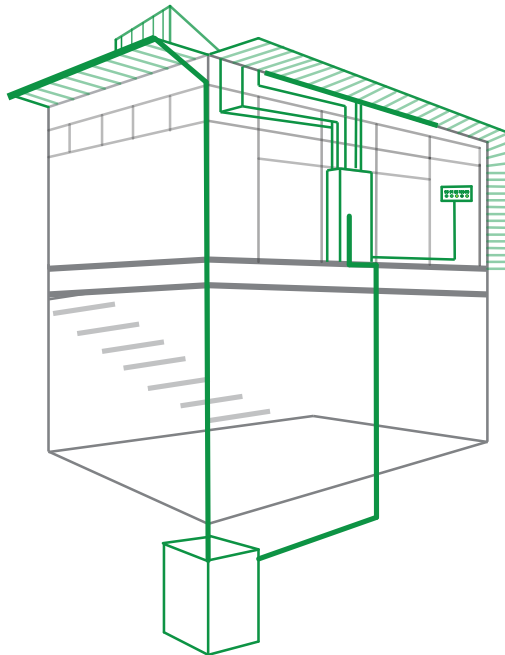


A P P L I C A T I O N S

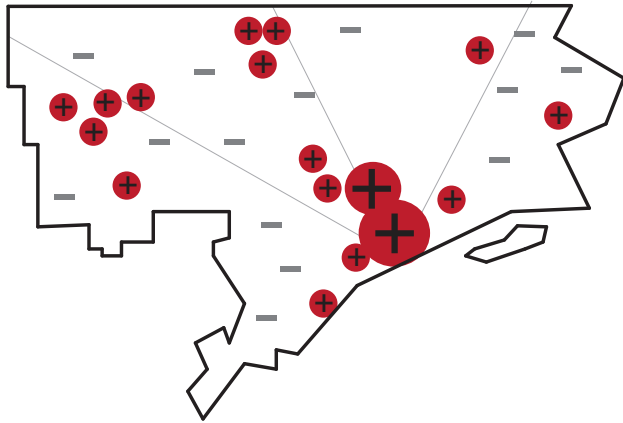


The common layout of a typical home; conceals the mechanical systems away from view. "Machines to maintain our thermal comfort were conceived of as mechanical servants, providing for our every need while, like an English butler, remaining as unobtrusive as possible."

A reversal of concealing mechanical systems, creates an interaction with the building. The example of smart metering in the Kingspan Lighthouse, creating a more conscious effort to reveal the impact of actions with day to day data.



Passive systems can be treated similarly in homes. Interacting with systems, brought out from concealment will create a better understanding with the ability to view the systems working and a greater respect and understanding for renewable production.

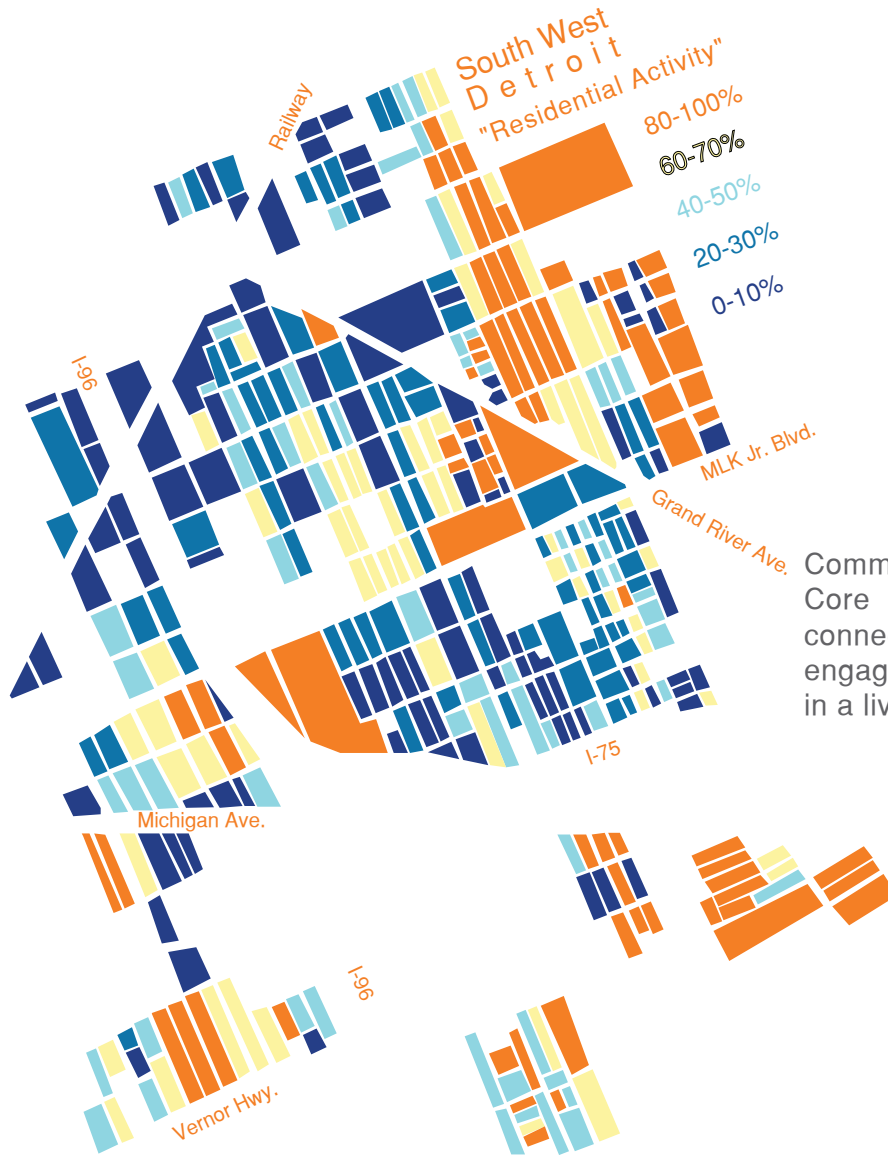


Detroit is a city with many Historic communities; along with a growing Downtown and striving hubs. The neglected neighborhoods, are full of blight and lacking purpose. The historic communities and hubs are very inefficient.

With the creation of Sun Tempered Communities, the added renewable power production would shine a positive light on these blighted communities and would send power back to the grid to power Detroit. Creating a reversal of the map where as now, these communities are the producers and the main hubs are the consumers.



Core City, Detroit



The goal with the Sun Tempered Communities throughout Detroit, starting with Core City is to create natural comfort and a connection with nature through architecture that engages the decomposing, blighted Detroit block in a live/work shared community setting.

When neighborhood action is analyzed and graphed, there is a band that is formed through Southwest Detroit anchored by the strong historical communities of Woodbridge and Corktown. The band is weakened by breaks through Southwest Detroit. When the holes are filled, the band becomes whole again and attains it's full strength and potential.

Core City, a break in the chain, located between Woodbridge and Corktown is a community with a decreasing population, high blight and unemployment rate. Just on the other side of road is Woodbridge a thriving historic community.

The University of Detroit Mercy Dental School is anchored on the I-96 and Martin Luther King Jr. Boulevard. The UDM Dental School provides a great service to the community through dental work and day activity. The problem is that the school is a 9 to 5. People from all over come down to Core City, go to school then head back into the suburbs.

In the Southeast corner, there is newer multi-family housing. In the top corner, is a rehabbed building that features a new artist community with installations starting to pop up around town which is a perfect opportunity to showcase the work and bring life to abandoned lots.

The center of the community is full of blight with nature starting to reclaim some of the land. There are still some houses that have good upkeep of their lot and home but are being overtaken.

This community is one of many to have this set of conditions. There is great opportunity laying in wait in these communities across the city of Detroit.

48208

Population in 2011: 9,968

Population in 2010: 10,234

Population in 2000: 12,867

Unemployment: 23.2%

Core City
Detroit

"Community Activity"

Established

Institutional

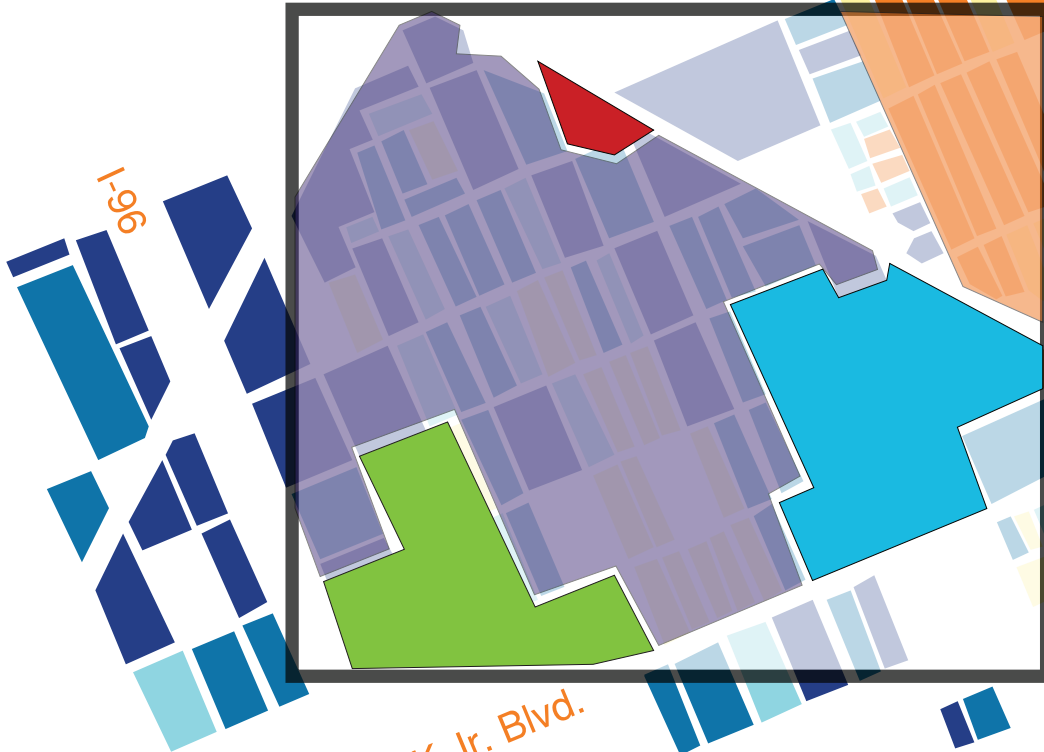
Artist

Multi-Family

Blight

Grand River Ave.

MLK Jr. Blvd.



A survey was conducted in the Core City community and surrounding areas based on the idea of the Sun Tempered Community, long with students and staff from the University of Detroit Mercy Dental school and Wayne State University to gain awareness of the project and to understand the communities thoughts on ecological housing. The importance to get feedback in the community in which you are located is crucial. Understanding the needs of members and gaining community buy in will allow the project a greater chance of success.

The first question- "Are you interested or belong to any environmental groups or organizations?" was a base to see the level of knowledge and interest in "green" groups. Without interest in bringing awareness to reducing our carbon footprint and doing our part green communities would not be successful.

The act of living communally was the second question. "Would you be interested in living in a communal setting?" The benefit of sharing goes much farther then having someone close when you need a cup of sugar. The thermal benefit of sharing walls is immense. The exposure of exterior walls to the elements allows heat to just flow back into the atmosphere. Having an interior connection allows for shared thermal properties.

The up-front cost of building passively is a factor that needs to be made aware and accounted for. The benefit to building passively is long term savings and the fact that you are doing your part in reducing your carbon footprint. The third question- "Would you spend more money up-front to reduce your carbon footprint and obtain long term savings.

Local transportation is a topic that often comes up with a negative connotation in Detroit. The unreliability of the transit system paired with the fright of sharing transportation with other community members. When asked what the percentage of transportation used the results were as expected with almost all responses utilizing only private modes of transit. This creates an opportunity to bring awareness and a positive light on the public transit system in the city.

Benefits and amenities in personal and communal space that would interest participants drew feedback and led to design decisions on layouts and program.

The final question of asking what "Environmentally Friendly Housing" meant was became a benchmark for the level of knowledge and terminology that needed to be used and assessed for the community.

Core City Survey

Sun Tempered Community: Detroit

What is your association with Core City?

Resident Business Owner Investor Other, please specify: _____

Age: 18-30 31-40 41-50 50+ **Sex:** M F T

Are you interested or belong to any environmental/green groups or organizations?

Extremely _____ Somewhat _____ Not at all _____
5 4 3 2 1

Are you interested in living in a communal setting? (Townhouse, Apartment, Live/Work)

Extremely _____ Somewhat _____ Not at all _____
5 4 3 2 1

Would you spend more money upfront in order to reduce your carbon footprint and obtain long term savings?

Extremely _____ Somewhat _____ Not at all _____
5 4 3 2 1

What percentage of time do you use these modes of transportation?

Private Car _____ Train/Bus _____
100% 75% 50% 75% 100%

What benefits or amenities would you want in your personal space?

Please explain: _____

Would a community garden interest you? What additional communal amenities would you be interested in?

Please explain: _____

What do you think of when you hear the phrase "Environmentally friendly" housing?

Please explain: _____

Thank you for your participation. Ross Piper, University of Detroit Mercy School of Architecture





People interested or currently belonging to environmental organizations



People interested in living in a communal setting



A series of info-graphics was formed based on the data collected from the survey. This form of info-graphic is designed to display the information diagrammatically with bright colors that attract attention and become a coordination with the different categories.



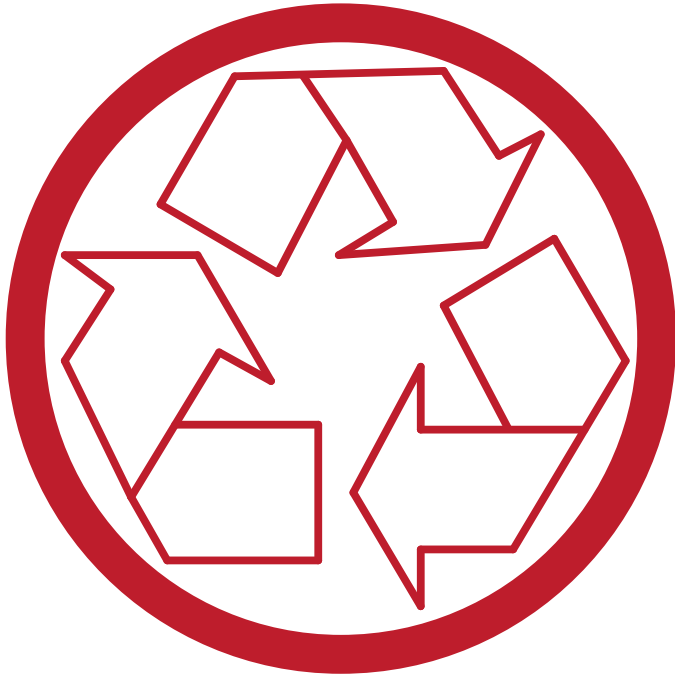
**Spending more upfront =
Sustained savings**

Yes	Undecided	No
55%	30%	15%



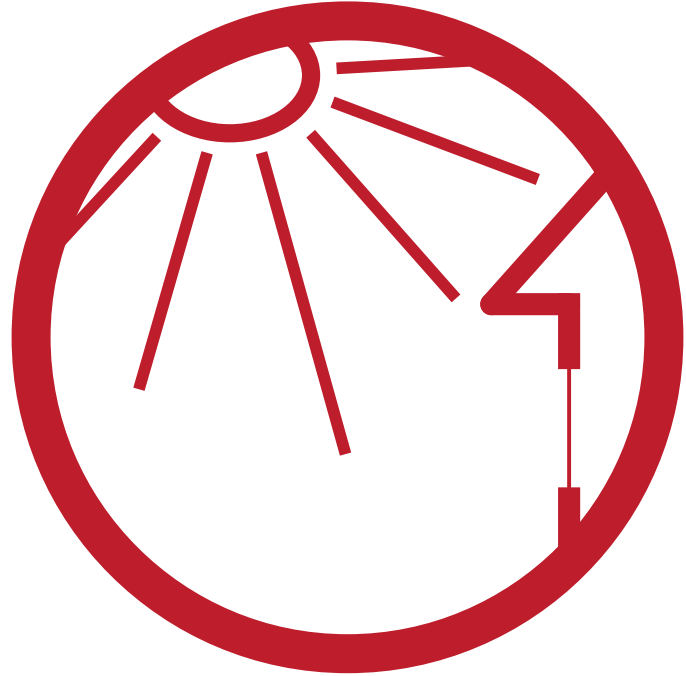
**Usage of private transportation
vs. public transportation**

PRIVATE	PUBLIC
90%	10%



**Benefits desired in
personal space**

Recycling



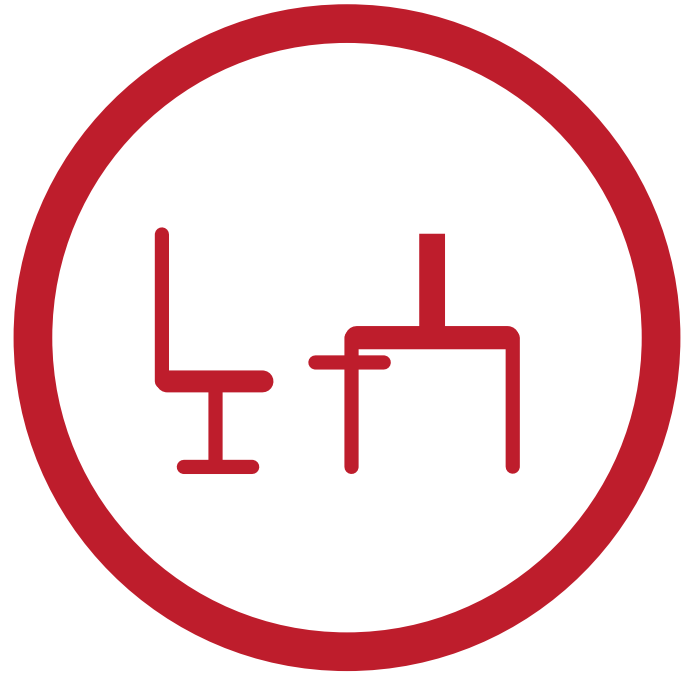
**Benefits desired in
personal space**

Daylighting



**Benefits desired in
personal space**

Garage



**Benefits desired in
personal space**

Office



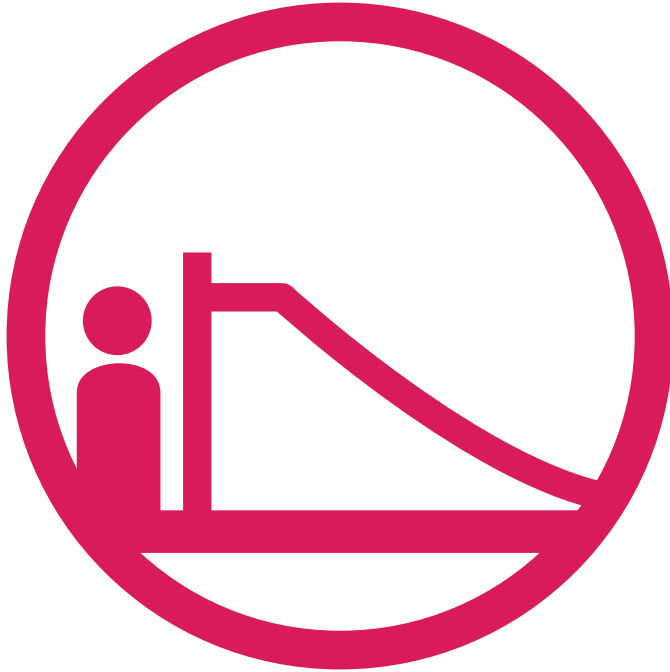
**Benefits desired in
communal space**

Garden



**Benefits desired in
communal space**

Local Transport



**Benefits desired in
communal space**

Parks



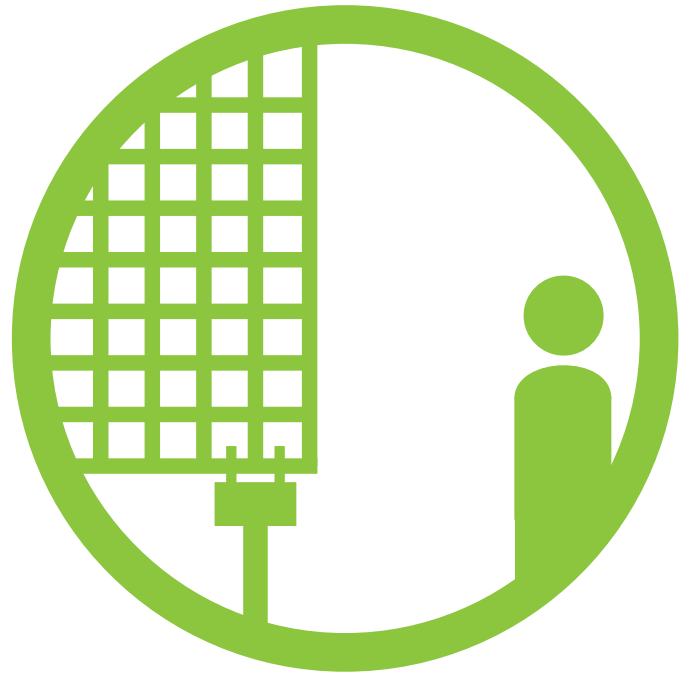
**Benefits desired in
communal space**

Spa



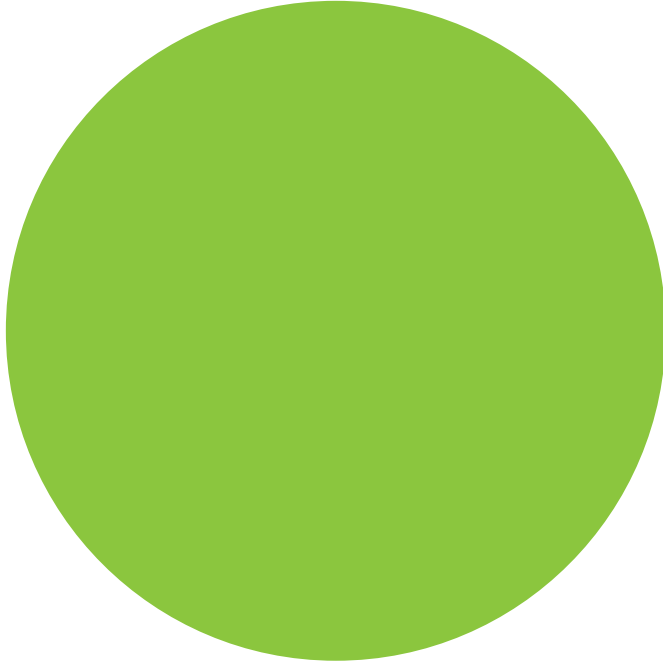
**What does
“Environmentally Friendly”
housing mean?**

Solar Panels



**What does
“Environmentally Friendly”
housing mean?**

Living Off Grid



**What does
“Environmentally Friendly”
housing mean?**

Green



**What does
“Environmentally Friendly”
housing mean?**

Tree Hugger







Preliminary Design

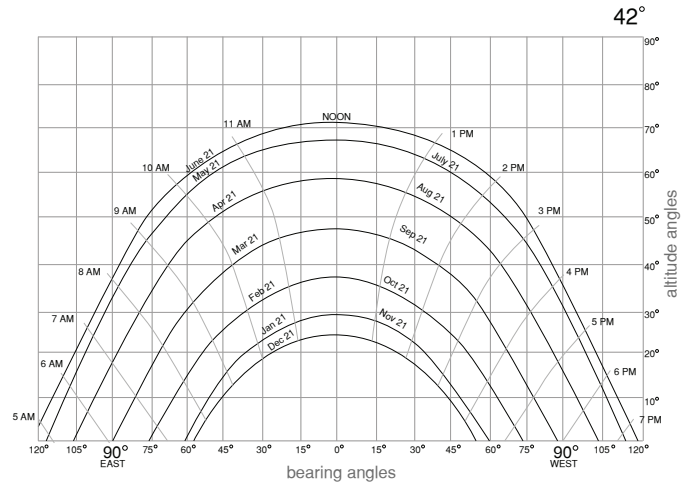
The common Detroit block is flat in topography, holds abandoned blighted homes, with nature re-claiming it's territory. The architecture away from thermal massing has no connection to site. The block does offer a chance for repetition, connection to the grid and "free" space.

Rory Stott of Archdaily.com Thanks to the rapid decline in population since its heyday in the mid 20th Century, the City of Detroit is home to some 78,000 vacant structures."

The Kresge Foundation, who funds many projects throughout Detroit defines it goal, to "Foster sustainability initiatives that will create jobs, advance workforce training, enhance public health and support Detroit as an example of how an aging industrial center reinvents itself as a desirable "green" city. "

The block of 14th and Poplar located in Core City is a typical blighted Detroit block. The once full block is now occupied by a church and an abandoned house with the rest being occupied by nature and open land.

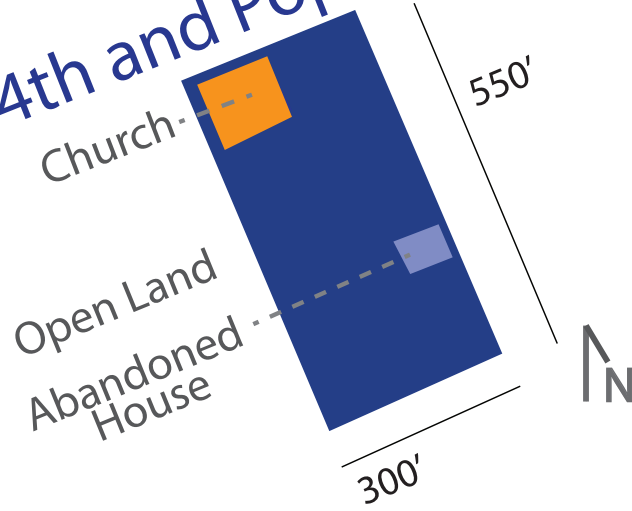
Designing with location and function is a key element in utilizing the natural passive benefits that have been under utilized as our reliance on mechanical systems has grown. The precedent studies of Ash Cave, Mesa Verde and



the Anasazi Indians, Socrates and the Romans utilizing the arcade have been lost with the evolution of the building.

The 42 degree sun chart shown above is based off the location of Core City, and can be utilized to figure out the location and path of the sun which can be taken into account to benefit from it's passive effects.

14th and Poplar



Based off the information gained in the previous case studies, wood models were formed to compare and contrast different aspects of formations on the site. Not only looking at sustainability aspects, but communal aspects as well. The passive community studies allow for a view of a successful framework based on size, density, and shared communal aspects.

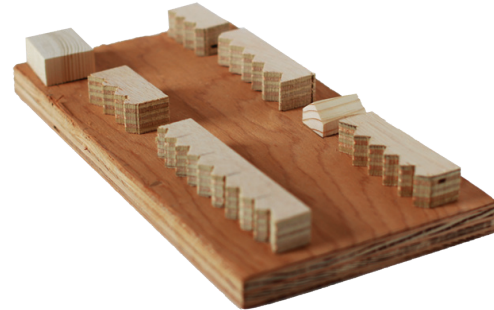
Different blocks were formed based off the studied passive building shapes and forms. When dealing with different building formations, it is a good practice to begin by strategically "playing" with the buildings orientation and location.

A difficulty in designing a passive community in a strong urban fabric, is whether to follow the pre-determined grid or create an entirely new grid inside of a community.



Community: Traditional Grid
Central Core Space

Sustainability: Shared Walls, Wedge Shape



Community: Traditional Grid
Central Core Space

Sustainability: Thermal Massing,
True Southern Orientation



Community: Rotated Grid
Pocket E/W Spaces

Sustainability: Shared Walls, Wedge Shape,
True Southern Orientation



Community: Traditional Footprint
Personal Outdoor Space

Sustainability: Thermal Massing





Community: Rotated Grid
Central Core Space

Sustainability: True Southern Orientation



Community: Pocket Spaces, Proximity

Sustainability: Thermal Massing,
True Southern Orientation



Community: Pocket Spaces

Sustainability: Thermal Massing



Community: Semi- Private Pocket Spaces

Sustainability: Southern Orientation
Shared Walls



Community: Pocket Spaces

Sustainability: Shared Walls,
True Southern Orientation



Community: Rotated Grid
Axis Spaces

Sustainability: Thermal Massing, Shared Walls,
Southern Orientation



Community: Central Core

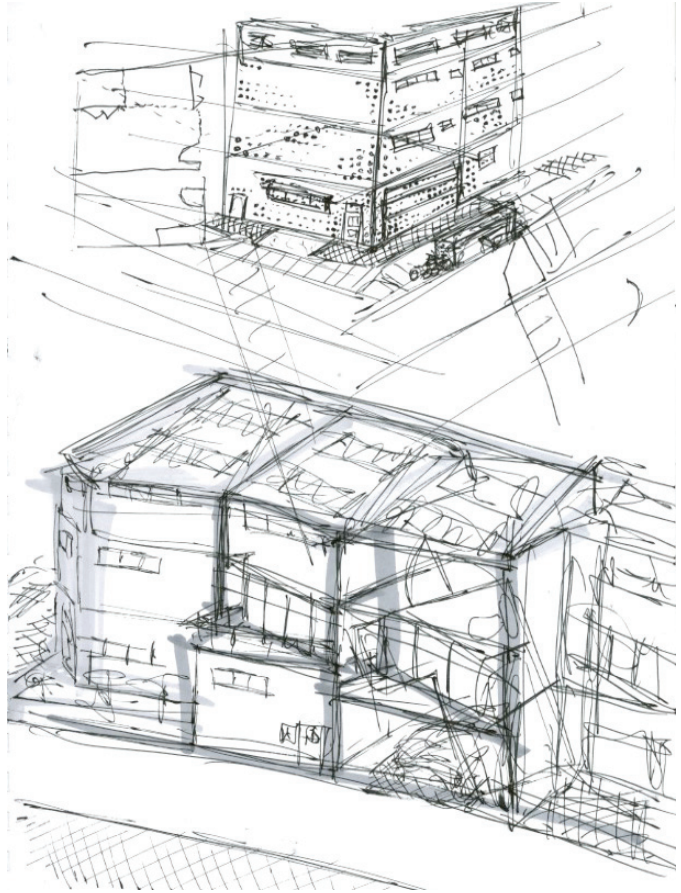
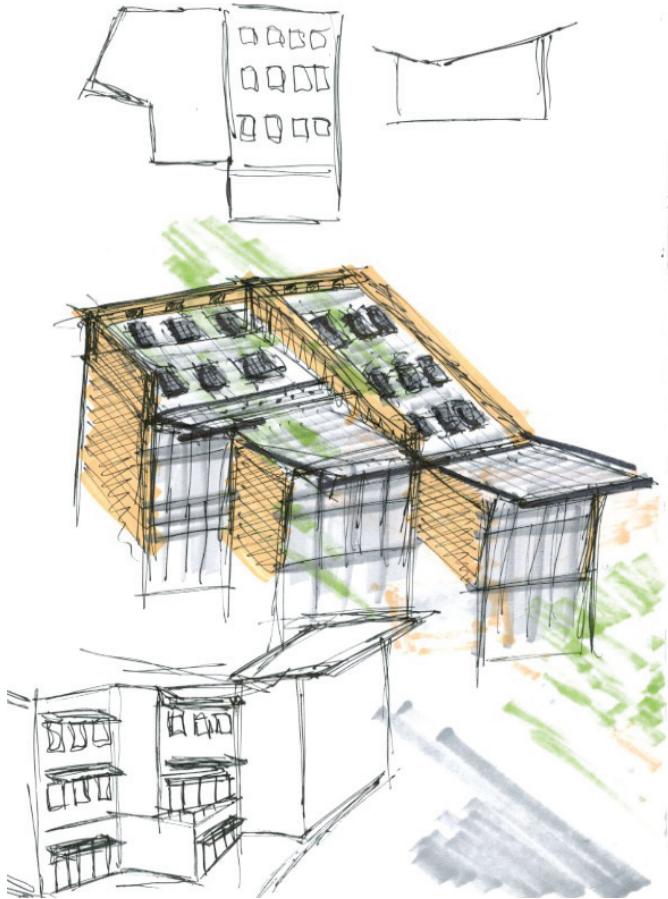
Sustainability: Shared Walls, Central Core,
Southern Orientation

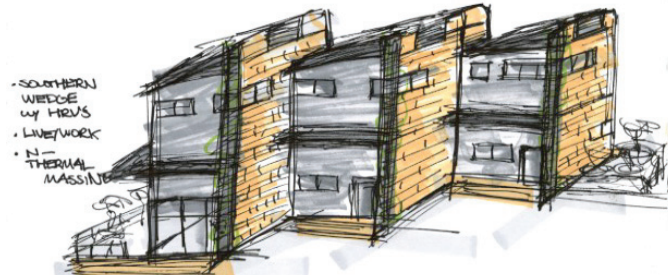
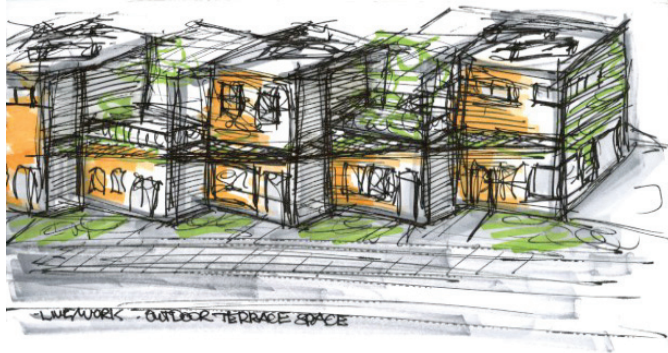


Community: Pocket Spaces
Shared Walls

Sustainability: Thermal Massing,
True Southern Orientation







Final Design

"Sustainability can't be like some sort of a moral sacrifice or political dilemma or a philanthropical cause. It has to be a design challenge."

-Bjarke Ingels

The goal with the Sun Tempered Communities throughout Detroit, starting with Core City is to create natural comfort and a connection with nature through architecture that engages the decomposing, blighted Detroit block in a live/work shared community setting.

When dealing with the creation of a passive eco-friendly community, it is much easier to talk about sustainability with no existing urban grid, open land, and no status quo. The challenge is designing in a strong urban grid such as Detroit. With the abundance of open land in Detroit but with a historical background and urban grid.

The building form and arrangement was chosen based off the precedent studies and wood model studies. The L building form that wraps the corners of the site on the Northeast, Southeast and Southwest create a sense of semi-private pocket spaces throughout the site without the use of fences. Keeping the urban grid and fabric while maintaining a street presence is key for a strong connection to the surrounding community. Utilizing and engaging the corners of the site creates community areas for activity and social interaction.



The site bounded on the north by Buchanan St., the East by 14th, the South by Poplar St., and the West by 15th St.

14th street is a three lane street with heavier neighborhood traffic, which can be looked at as a disadvantage or an opportunity. With the three lane street, this creates an opportunity for the units to become live/work units and a new typology created in a neighborhood scale live/work setting. Neighborhood scale being defined as shops and offices that community members would benefit in their everyday use.

The buildings of the Northeast L form, down to the Southeast L building would be created as live/work lofts and as you transition further into the community the typology transitions to more family orientated townhomes.

The alley is a part of Detroit history but has transformed into a crime and utilities space. In the re-design of the community the alley is transformed in a social and community space. The alley would be a link between pocket and community spaces on the site.

Programming communal spaces throughout the site adds a connection with not only your neighbor but the community. The survey feedback and site create an opportunity for a community garden. The church located

in the Northwest corner of the site currently is for weekend use. The community garden and outdoor green space would allow a chance for church members to interact with the community and a greater connection to the site encouraging greater participation. The church would also play a part in the neighborhood scale typology. Events could be held in shops, such as morning coffee before mass.

The Northeast corner is a bus stop that currently is just a sign and a pole in the ground. Responding to the need of activating alternate and shared transportation. Redesigning what a bus stop can be instead of just a sign, but a community gathering space that also benefits the building passively. The creation and attraction to alternate transportation through form would take the "fright" away, that was identified in the survey.

The pocket spaces formed from the L units creates a semi-private outdoor space for the shops and homeowners. The drive for garages is surrounded by permeable pavers creating a buffer between green space and paved while also draining water. An open green space for tenants that was identified as a amenity desired, can be utilized for throwing around a frisbee, playing with your dog or simply just enjoying the sun.



SCALE: 1" = 1/32"
N

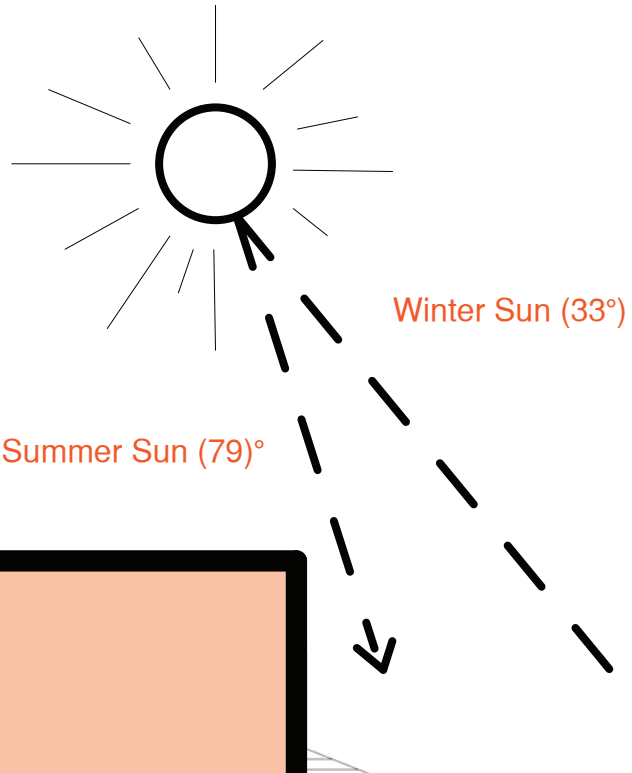


Taking into account the sun angles of summer and winter the distance between buildings is determined by building heights and shading.

The summer sun of 79 degrees creates a steep angle and shadow off the building allowing for the passageway to be lighted. The winter sun of 33 degrees creates for a deep shadow. This number is what sets the distance between buildings and the passageway leading to the open green spaces.

The 29 foot wall of the mixed use building , paired with the 33 degree winter sun creates a triangle that leads to 45 feet of shading. For the path to always be lighted and the dark alley feeling distinguished, taken into account the figure 45 feet of shading at the deepest winter shadow, with 5 feet of path space and 3 feet of buffer space would equal out to 53 feet of space in between buildings.

The passageway would feature deep concrete steps set into the earth berming of the mixed-use building on the northern side. This would create another community engagement opportunity and a chance for the shop to also utilize the space for seating and outdoor events bringing another form of enlightenment to the space.

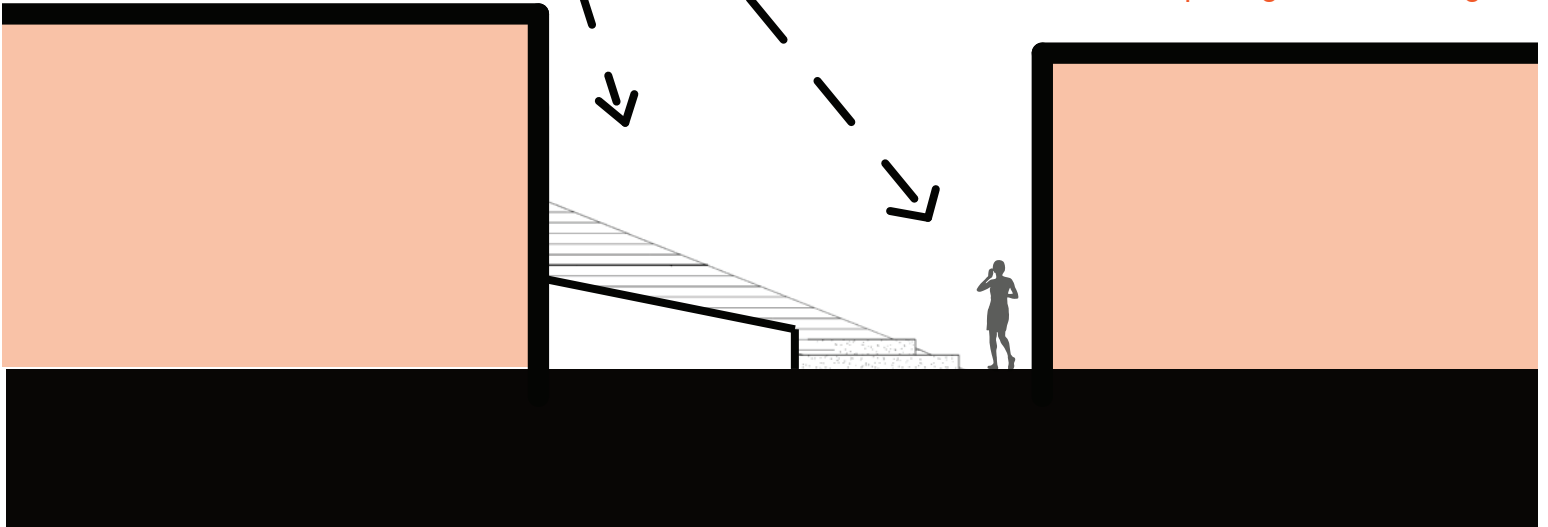


Winter Sun (33°)
29' Wall = 45' of shading

Summer Sun (79°)
29' Wall = 5' 6" of shading

45' + 5' Path + 3' Buffer =
53' Spacing between Bldgs.

SECTION A



The building is designed to recycle and utilize natural power. The wedge shape orientated to take advantage from southern solar gains also acts as a slope for photovoltaic panels. These panels would not only power the house or the shop below, but linked to the garage for an electric vehicle output. The remaining energy would be fed back into the grid and a credit would be received.

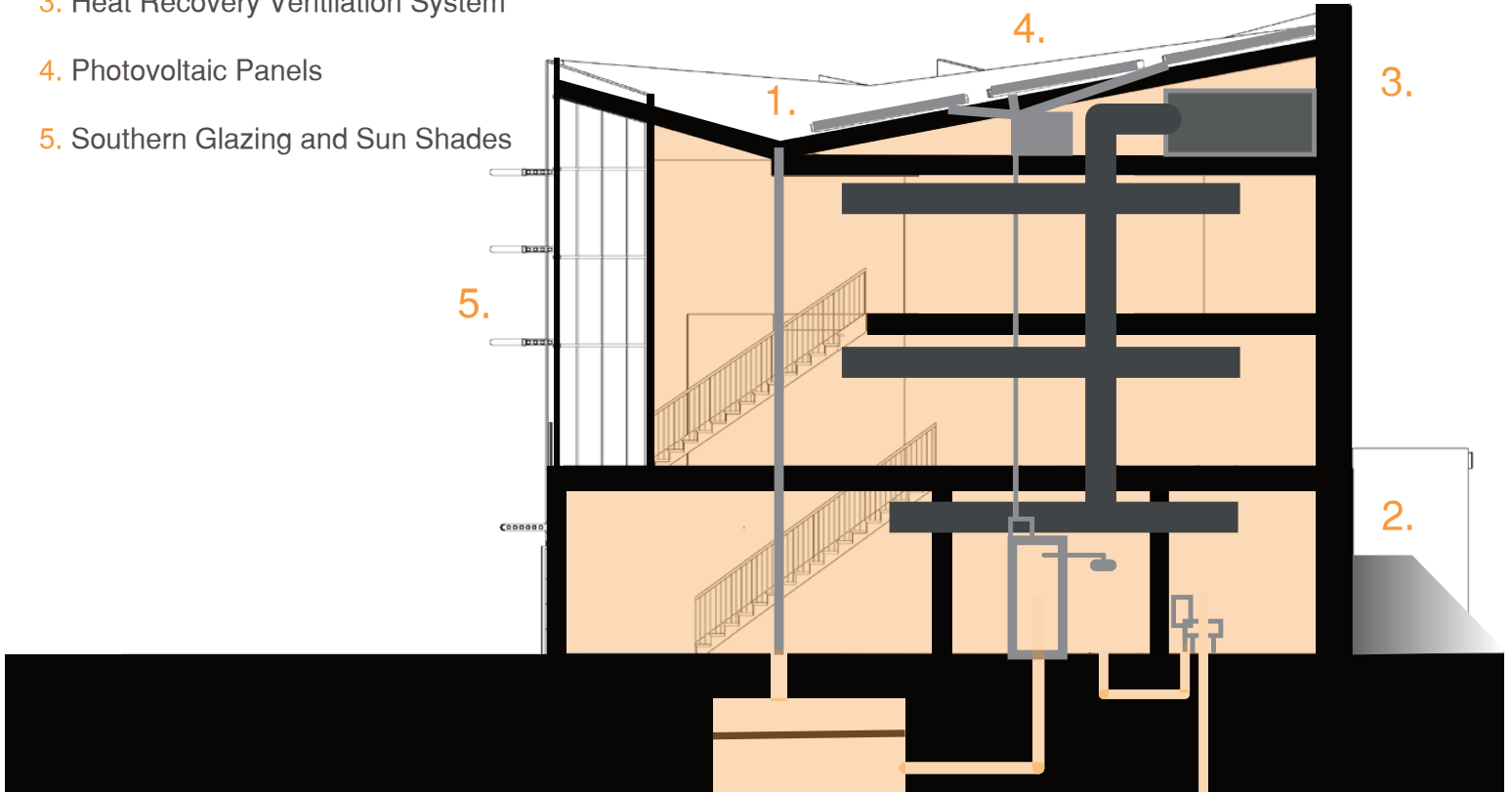
The wedge shape also acts as a rainwater collection system. The water is collected and fed to a storage tank below the building. The water is then utilized inside the building. Water fed to the tank is heated by the photovoltaic panels and used by the shower and sinks throughout the home. The water is then re-used by the toilet then finally after becoming black water is sent back to the ground to be filtered once again.

The orientation of the wedge to the north paired with a heat recovery ventilation system allows the cool northern air to be circulated and exchanged throughout the home. "A heat-recovery ventilator (HRV) is similar to a balanced ventilation system, except it uses the heat in the outgoing stale air to warm up the fresh air. A typical unit features two fans- one to take out household air and the other to bring in fresh air. What makes an HRV unique is the heat-exchange core. The core transfers heat from the outgoing stream to the incoming stream in the same way

that the radiator in your car transfers heat from the engine's coolant to the outside air. It's composed of a series of narrow alternating passages through which incoming and outgoing airstreams flow. As the streams move through, heat is transferred from the warm side of each passage to the cold, while the airstreams never mix. Depending on the model, HRVs can recover up to 85 percent of the heat in the outgoing airstream, making these ventilators a lot easier on your budget than opening a few windows."

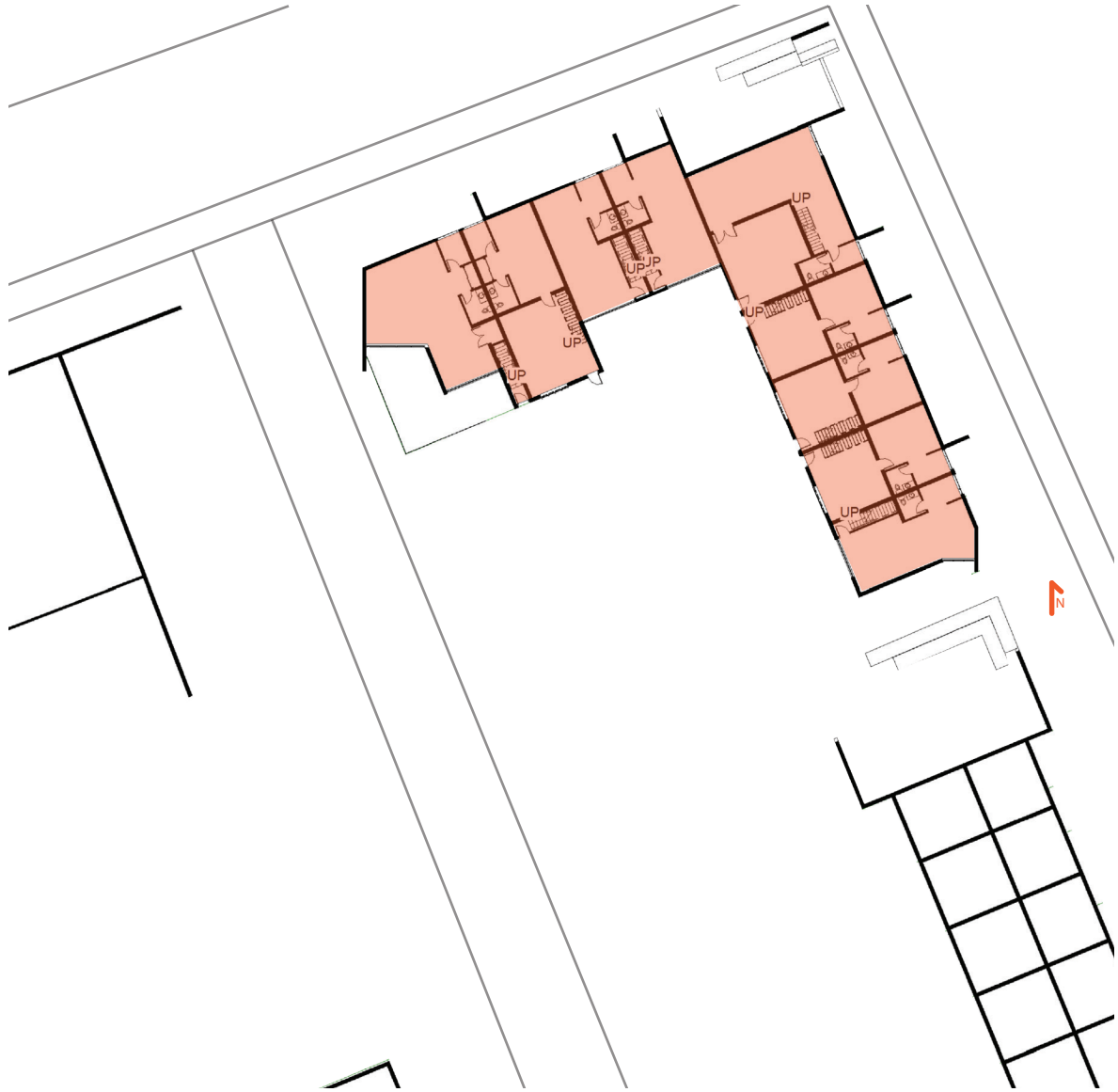
Concrete block thermal massing on the northern facade of the buildings paired with earth berming and small windows creates a thermal barrier to the North. This facade wraps around and opening to the South. The southern facade of the building feature southern orientated glazing in the living spaces and light frame construction benefitting from the southern solar gain.

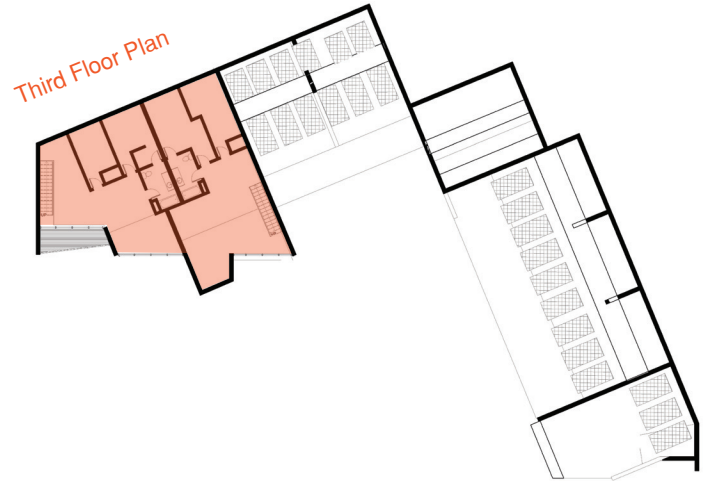
1. Rainwater Collection and Re-use
2. Northern Thermal Mass and Earth Berming
3. Heat Recovery Ventilation System
4. Photovoltaic Panels
5. Southern Glazing and Sun Shades











Based on the 5 proposed buildings of the site, two were detailed because they had an opposite set of characteristics. The building set at the Northeast has the optimal southern orientation facing the courtyard and the northern thermal massing on the street.

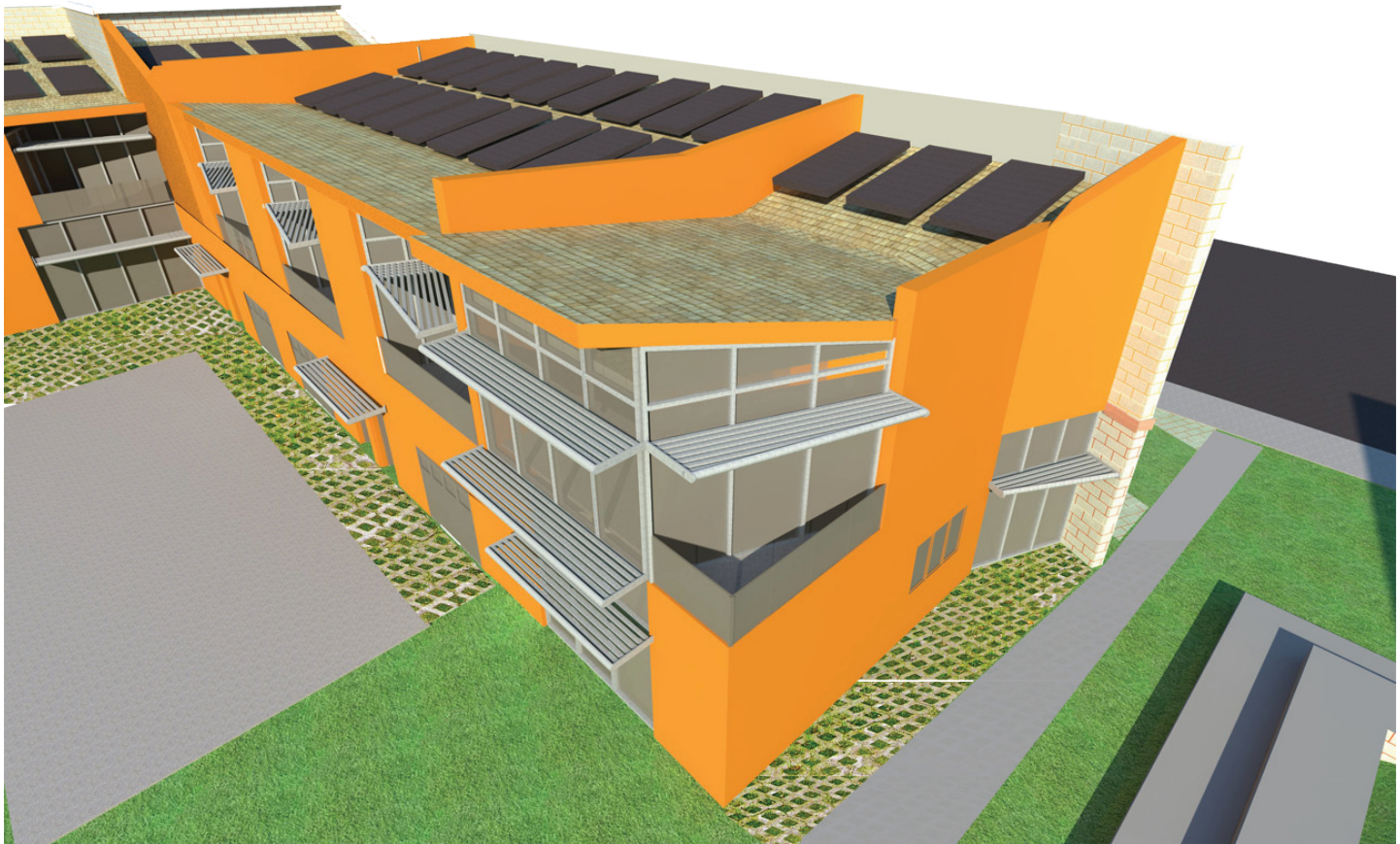
The program for the first mixed use floor includes a coffee shop at the corner closest to the church with an outdoor congregation space. The corner space at 14th and Buchanan that has the communal earth berming and bus stop is a restaurant that features produce grown on-site and locally.

The two units on the Northwest corner are three story units that feature an open living area up to the rooms on the top floor. The other units are loft spaces that have a flexible floor plan and perfect for the professional wanting a small space.

The choice of unit size, garage space and whether you want to live above a shop, or actually own and work in the shop below you add to the customization of your living space.



SECTION A
SCALE: 1" = 1/16"









First Floor Plan
Scale - 1" = 1/16"

UP

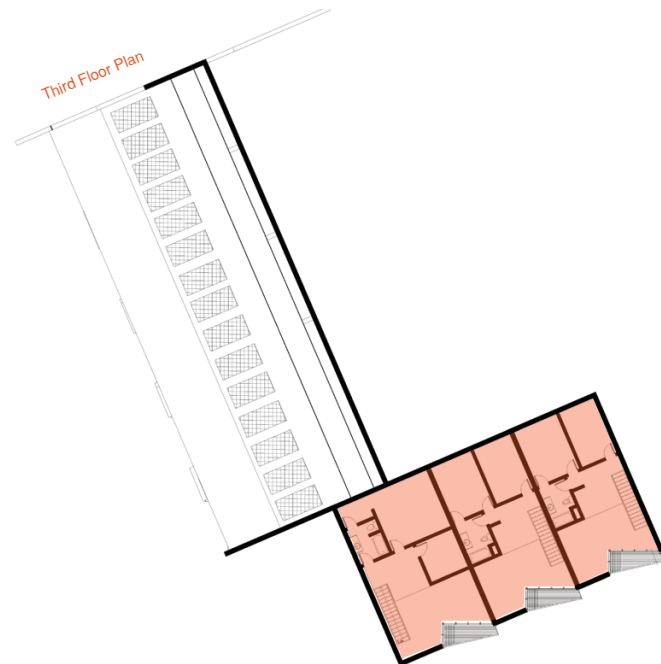
UP

The Southwest corner has the southern exposure facing the street and the northern exposure facing the courtyard. Since this building located further into the site, it is a town home family orientated building. It is set back off the street to create a buffer zone and a private front yard space for the residents. The corner is a community garden and green house to be used by the residents.

The courtyard features thermal massing and earth berming of the first floor with the porch

space being located on the second living area floor. The earth berming features deep concrete steps and a deep open green space.

The 3 units on the Southwest are 3 story spaces feature an open living area up to the rooms on the top floor. The other units are smaller town home spaces which have a two story level with the utilities and garage on the first floor and living on the second.



If we each take responsibility in shifting our own behavior, we can trigger the type of change that is necessary to achieve sustainability for our race or this planet. We change our planet, our environment, our humanity every day, every year, every decade, and every millennia.

-Yehuda Berg





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Thanks,

Ross Piper



