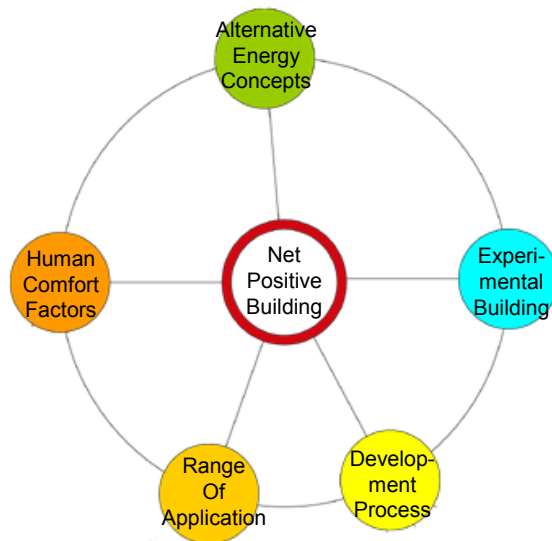


# Chapter 2 Design and Construction of “Net-Positive Experimental” Building

As a prototype for new process of construction



**Net Positive**—Going *beyond* net zero. The MARET center will be designed to create *more* energy than it uses.

**Human Comfort Factors**—The Challenge: An innovative building’s usefulness is directly tied to the amount of added comfort that it provides. The MARET Center will collect and use alternative energy, but the primary goal is to provide a more comfortable and productive environment.

The Solution: While conventional buildings typically only control air temperature, the MARET Center will take into account multiple human comfort factors such as air temperature, the mean radiant temperature of the space, humidity, and air flow as well as maintain high indoor air quality, and day lighting.

**Alternative Energy Concepts**—The Challenge: The U.S. is depleting our natural resources, making us more reliant on other nations. We are yearning to use renewable sources of energy.

The Solution: The MARET Center is focused on using modest amounts of the renewable energies available in our region: solar, wind, geothermal, biomass. The building will allow us to research and develop innovative, new ways to minimize energy usage while maximizing human comfort.

**Experimental Building Concept**—The Challenge: Provide an environment that allows people to experiment with and develop alternative energy concepts in the context of human comfort factors.

The Solution: Design a modular building that will act as a framework for alternative energy systems that will be replaced over time as we develop new ideas and as new technologies become available.

**Development Process**—The Challenge: To enable regional manufacturers to develop new products that will result in practical alternative energy buildings.

The Solution: Provide a working model that demonstrates the feasibility of alternative energy concepts in the region and provides an experimental platform to develop new systems and components with the intention of growing an industry.

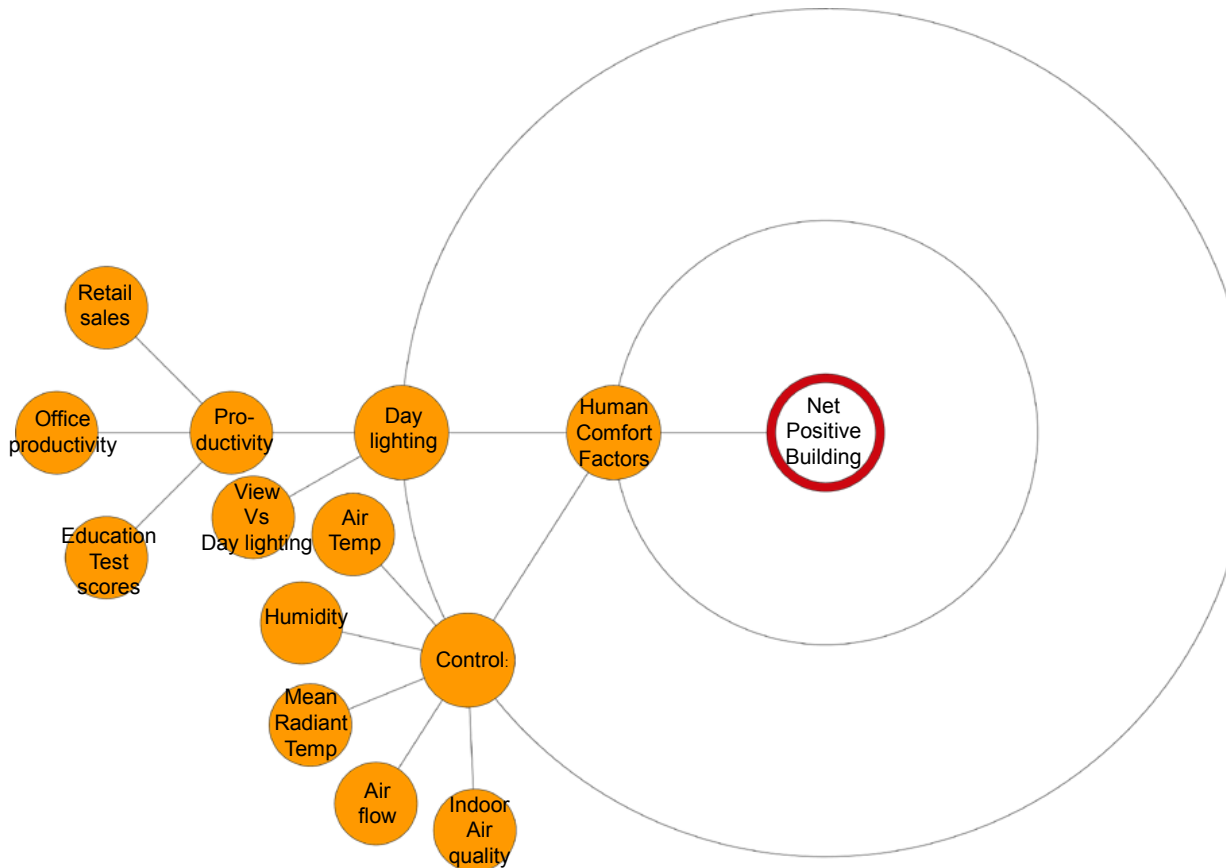
**Range of Application**—The Challenge: To develop a model for the nation by creating a durable and flexible design process that can be applied to different regions and building types.

The Solution: Perfect a pre-engineered design with a carefully limited scope for specific types of buildings (office education and retail) that works well in our regional climate.



# Chapter 2 Design and Construction of “Net-Positive Experimental” Building

As a prototype for new process of construction



The challenge: An innovative building’s usefulness is directly tied to the amount of added comfort that it provides. The MARET Center will collect and use alternative energy, but the primary goal is to provide a more comfortable and productive environment.

The Solution: While conventional buildings typically only control air temperature, the MARET Center will take into account multiple human comfort factors such as air temperature, the mean radiant temperature of each room, humidity, and air flow as well as maintain high indoor air quality and use daylighting. And it will do this and give individuals the ability to adjust conditions in their own workspace.

Throughout history humankind has tackled challenges to improve the quality of life. In the 19<sup>th</sup> Century, the most up-to-date buildings had steam heat allowing us to balance the steam radiator by opening the window above it. By the mid-20<sup>th</sup> Century, we had gas furnaces controlled by thermostats and were just beginning to have air-conditioning in some households. More recently, computers place all kinds of information literally at our fingertips and allow us to control machinery in new ways. The challenge of the 21<sup>st</sup> Century will lie in controlling all the parameters of our environment.

Air Temperature is defined by the temperature of air in contact with the skin. This is the traditional way people control their internal environments. The MARET Center will provide comfortable air temperatures.

Mean Radiant Temperature is the average of the temperature of floors, walls and ceilings. Raising this temperature 1 degree is the equivalent of raising air temperature almost 2 degrees. Controlling both air and mean radiant temperatures in different ways can affect the perception of comfort. We plan to explore this at Maret.

Humidity can make cold air feel warmer and warm air feel hotter! Our region has a specific climate that requires adding humidity in the winter to keep us warm, and reducing humidity in the summer. This is a major factor in climate control, and makes a building in our region different from a building in a less humid climate. But humidity is important to the MARET Center for more than one reason. We will also use dehumidifiers to combat the effect of condensation on heating and cooling panels that will help minimize energy consumption and pollution.

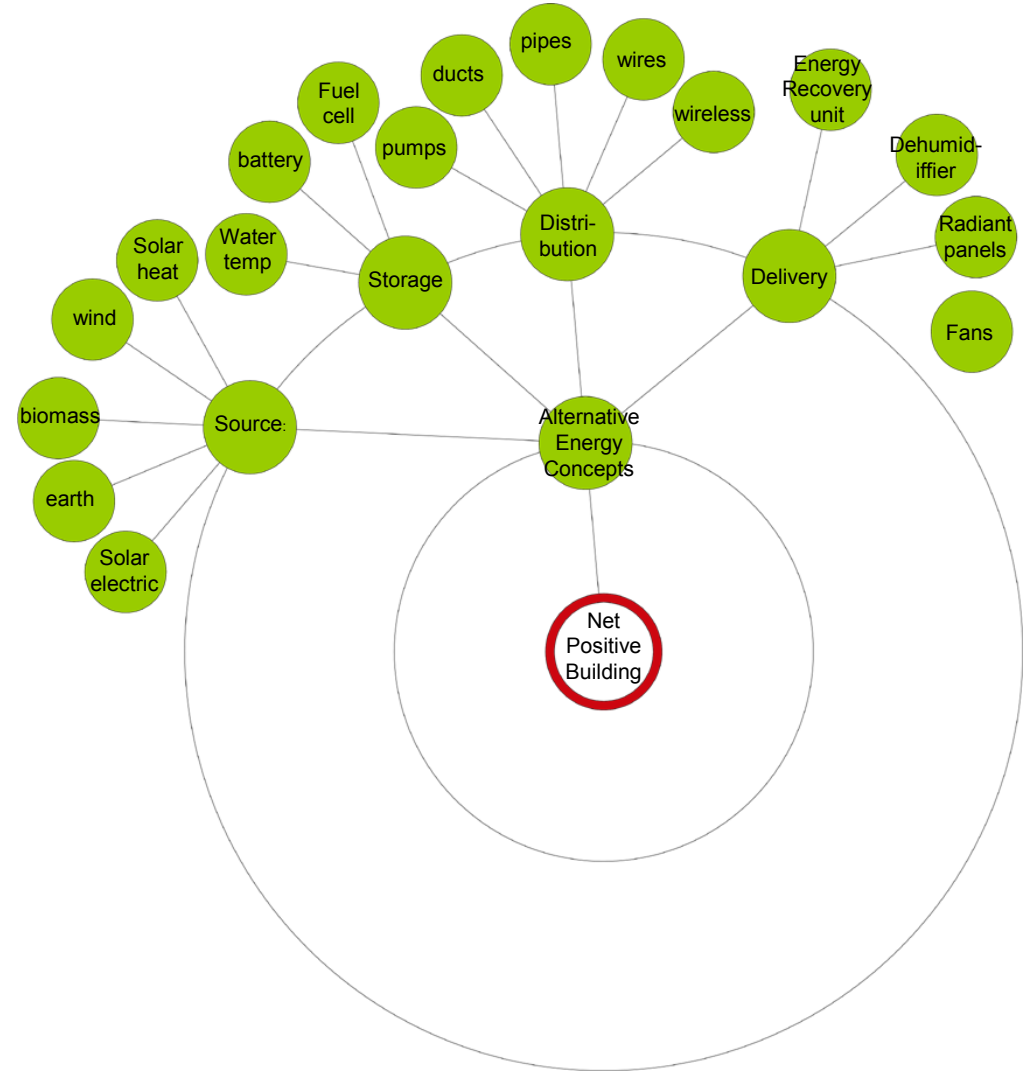
Our bodies are designed to take advantage of Air Flow. When our internal body temperatures get too hot, we begin to sweat. The added moisture on the skin helps us take advantage of any air movement that will cool us down. We’ve known this for centuries, as evidenced by the use of hand-held to high-powered fans. We open windows in a building or car to catch a breeze, but each person has different comfort levels. Maret will provide continuous air flow at varying rates to maximize comfort.

Indoor Air Quality is an important comfort factor as well. People want to breath fresh, clean air. With less toxicity in the air, such as emissions from paint or carpet adhesive, long-term health effects such as asthma and sensitivity to allergens will decrease. This is achieved by reducing the usage of such toxic materials, but also by creating an air filtration system and air distribution system to provide clean air where people are..

Daylighting is increasingly identified as a direct factor not only in human comfort, but in healthy living as well. Studies have documented the effect that daylighting has on psychological moods as well as productivity. The (reference study) has indicated that productivity can increase up to 12% when daylight is introduced to a working environment, and that daylighting in classrooms increase student success and speed on standardized tests by up to 18% and 26%, respectively. However, certain considerations must be taken into account. For example, direct sunlight may actually have a negative effect on comfort and performance due to glare and decreased visibility. Also, the building’s air control systems must be able to counteract any increased heat produced by daylighting. The Maret building will provide glare-free daylighting.

# Chapter 2 Design and Construction of "Net-Positive Experimental" Building

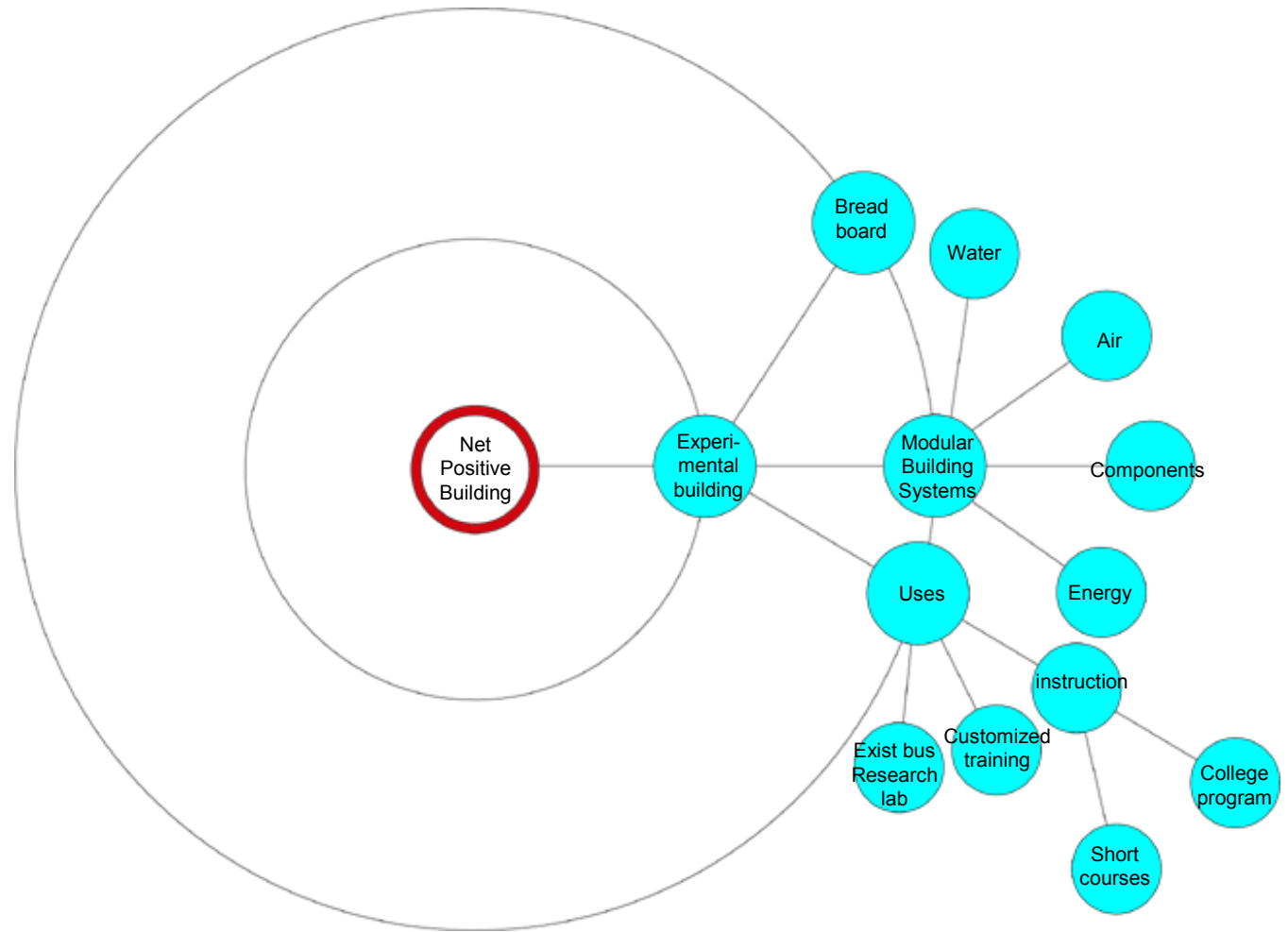
As a prototype for new process of construction



# Chapter 2

## Design and Construction of "Net-Positive Experimental" Building

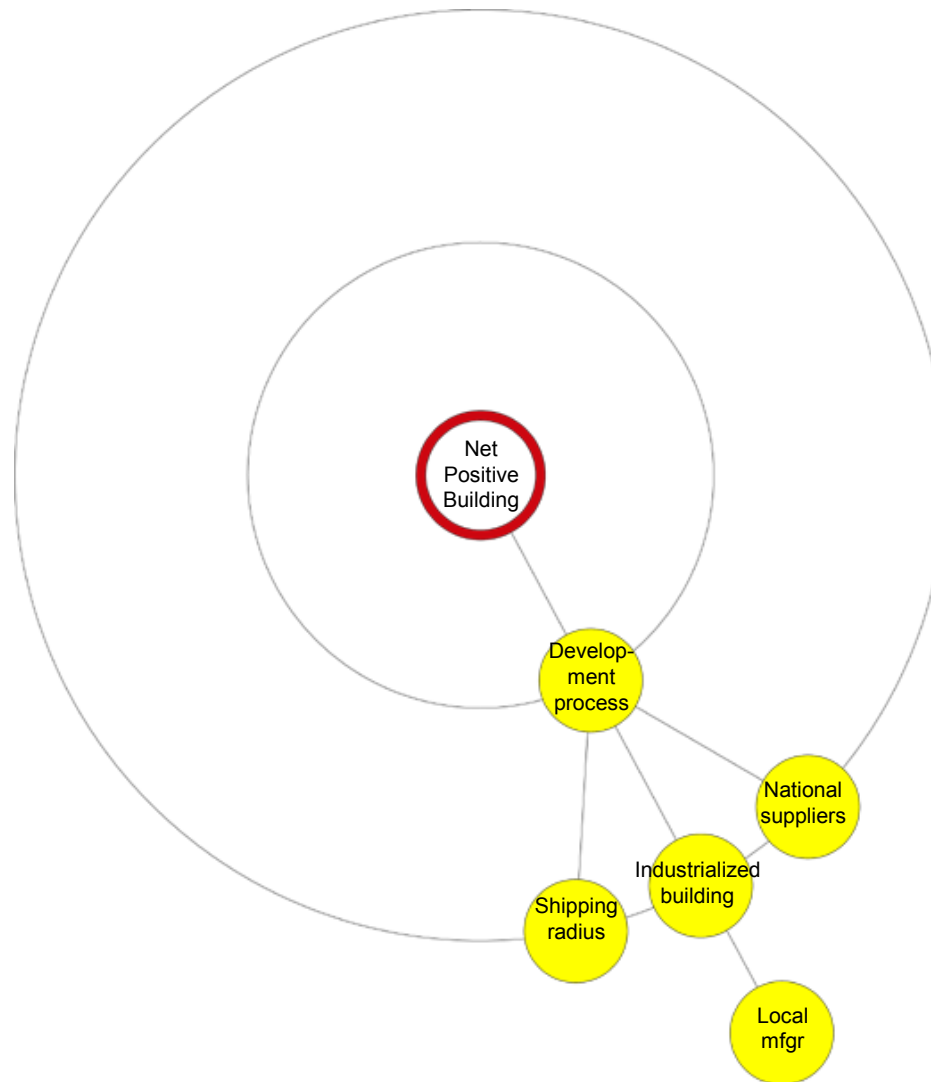
As a prototype for new process of construction



# Chapter 2

## Design and Construction of “Net-Positive Experimental” Building

As a prototype for new process of construction



### Challenge:

To enable regional manufacturers to test unique design processes, develop new products, and train people in a way that will create regional economic opportunities around new renewable energy buildings and components in the context of superb individualized comfort and daylighting. [this needs tout compromising be changed on first page of chapter]

### Solution:

Provide facilities, technical support, customized training, and a business incubator environment in a building that demonstrates renewable energy technology.

There are several ways to build a building. You can order individual parts delivered to a site and assemble them there. You can order sections of buildings or even entire room-sized modules that are assembled at a manufacturing plant and shipped to the site to be put together. Builders and manufacturers choose the best method for each building based on cost efficiency and logistical feasibility.

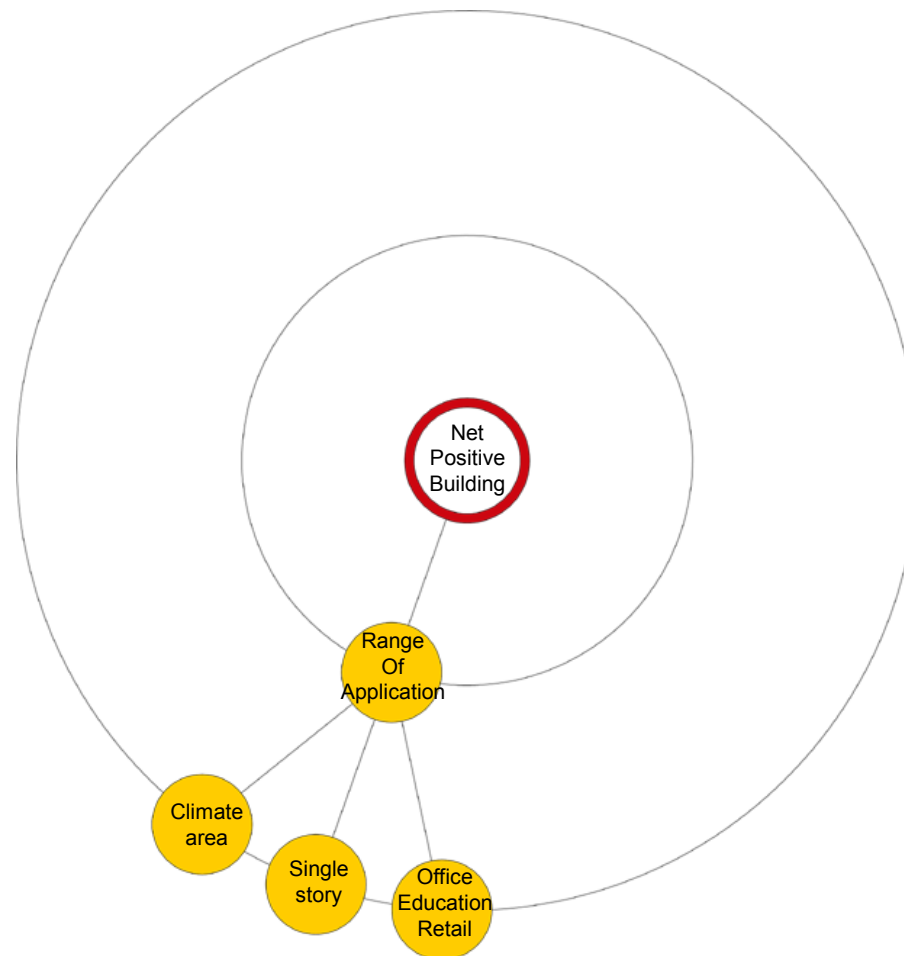
The MARET Team will work with manufacturers to test experimental design processes based on the entire range of methods stated above. The basic structure of the MARET Center is designed in a modular way that will serve as a test site for pre-fabricated components.

The MARET Center will be the experimental platform and model for alternative and renewable energy buildings which have performance requirements that go beyond what is required of conventional buildings—comfort and efficiency. We will make the construction of these new buildings practical by fostering industrialized construction processes. This in turn will help create a new regional industry for buildings that are energy efficient while enhancing comfort.

# Chapter 2

## Design and Construction of “Net-Positive Experimental” Building

As a prototype for new process of construction



### The Challenge:

To develop a model for the nation by creating a durable and flexible design process that can be applied to different regions and building types.

### The Solution:

Perfect a pre-engineered design with a carefully limited scope for specific types of buildings (office, education, and retail) that works well in our regional climate.

The MARET Center will be modest in scope, starting with the basics so that we can build from there. It will be one story to allow a 1:1 roof to floor ratio, but it will be designed in a way that will allow expansion in every direction. It will fit the needs of an industrial building—a college classroom building—but the technology developed here will serve future generations in all types of buildings, from residential to office to manufacturing. And finally, the MARET Center will use technology that works in our regional climate zone (and all the humidity that goes along with it). But the dream is bigger. In building the MARET Center, we will be developing a universal process to serve as a model for the nation. The time for net positive is here.



# Chapter 2 Design and Construction of "Net-Positive Experimental" Building

As a prototype for new process of construction

