Increasing Energy Efficiency in Greenhouses

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What is a solar greenhouse? Don’t all greenhouses use the sun?

Types of greenhouses

Cold frames & Hoop houses

- A good 1st step but limited
- Cheap upfront, costly over time

Conventional Greenhouses

- No insulation; hard to grow many things year-round without heating

Solar greenhouses

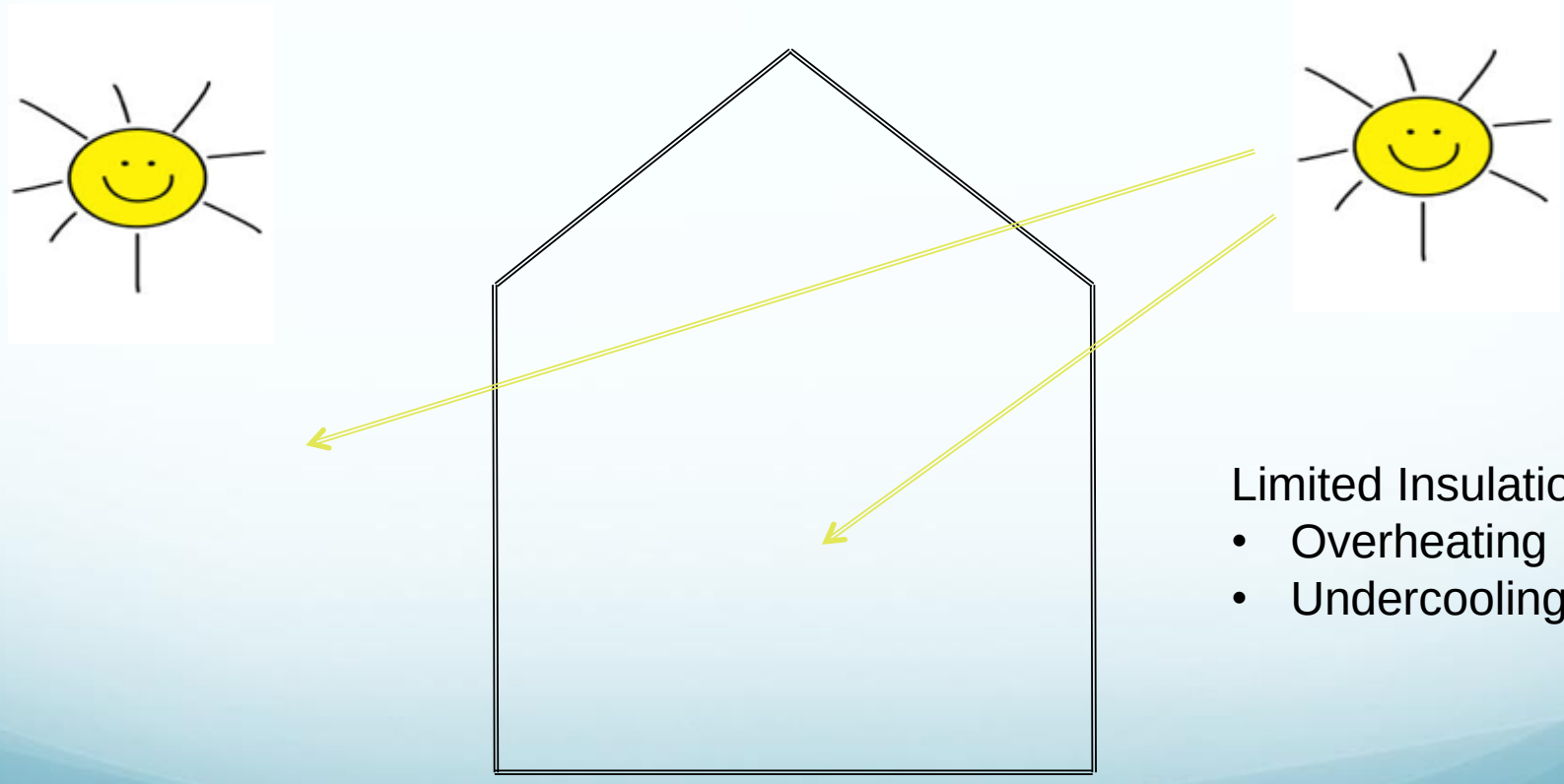
- Rely on the solar energy for growth, plus heating and cooling needs

4 Design Principles of a Smart Greenhouse

1. Glazing – just right
2. Insulation – wherever there is no glazing
3. Earth is your friend – use it wisely. The greenhouse is just the top of the iceberg AND without good soil you will not succeed no matter how good the greenhouse
4. Increase thermal storage – Phase change, water, stone, etc.

Conventional Greenhouse

Orientation
North - South

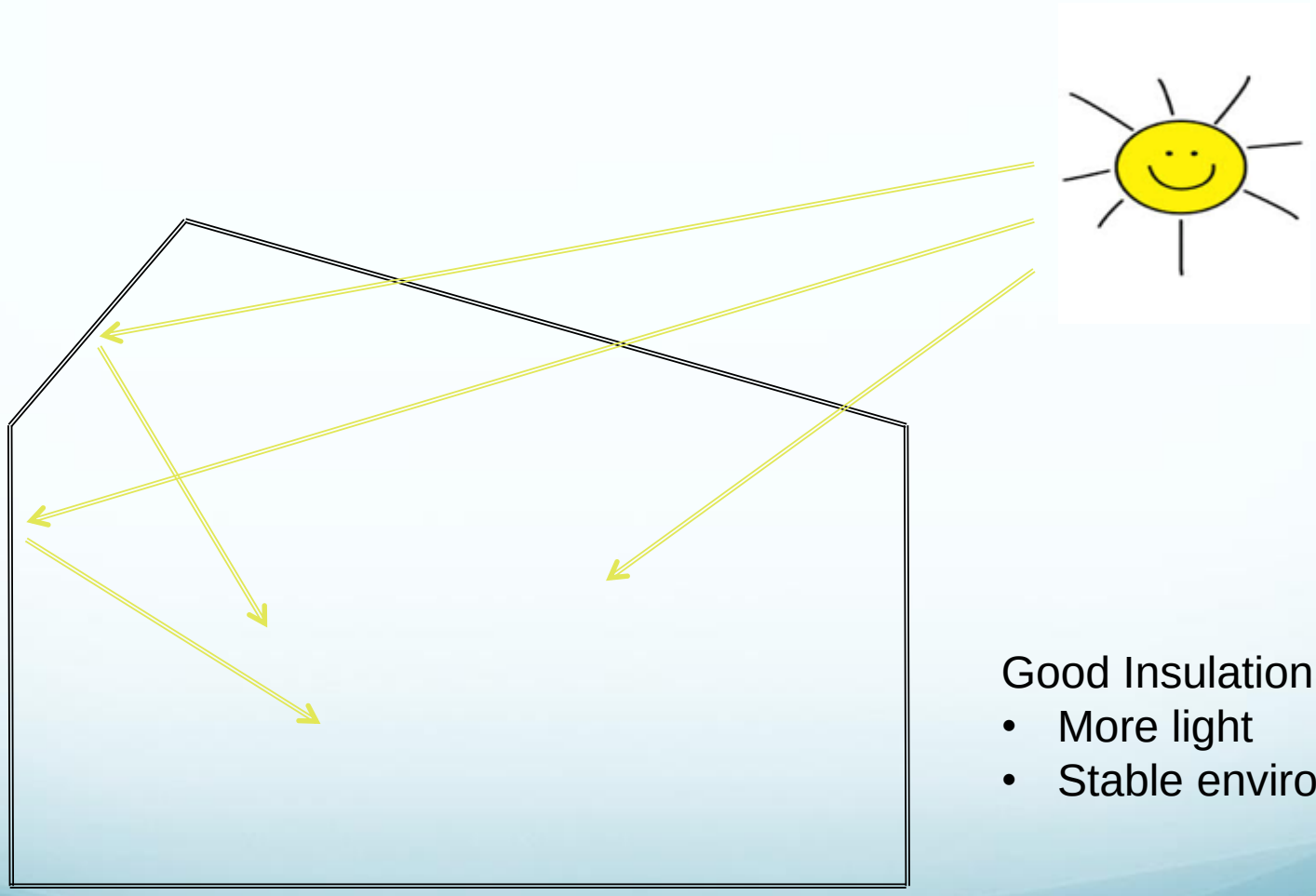


Limited Insulation

- Overheating
- Undercooling

Ceres Greenhouse

Orientation
East - West



Good Insulation

- More light
- Stable environment

Challenges with Conventional Greenhouses

- No insulation or heat retention = very high heating load if trying to grow many crops through the winter
- Not made for high wind or snow loads

The Problem:
Conventional Greenhouse Design

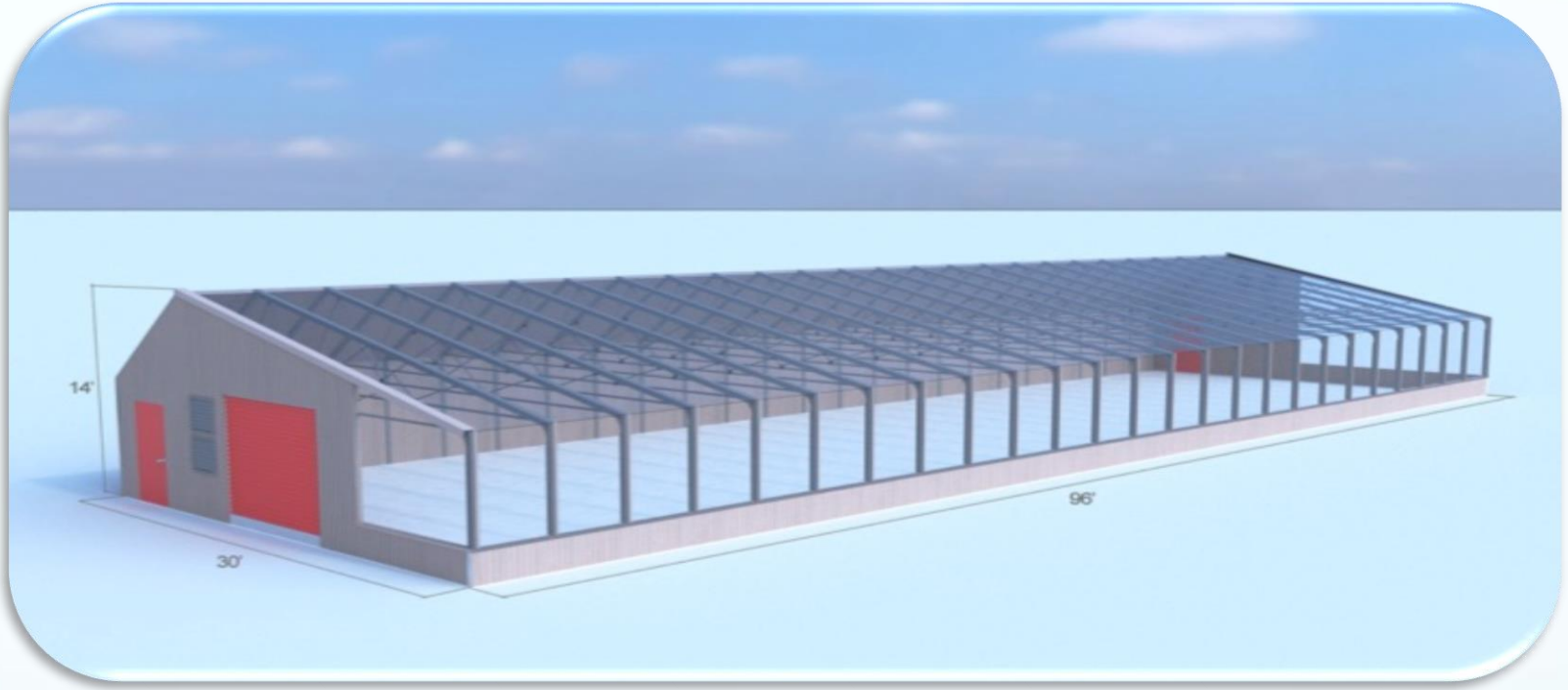
R-Value normal greenhouse: 2 (best case)
Heating / cooling cost: $3-4/SF/ year

R-Value normal house: 8-15
Heating / cooling cost: $0.10-$1 /SF/year

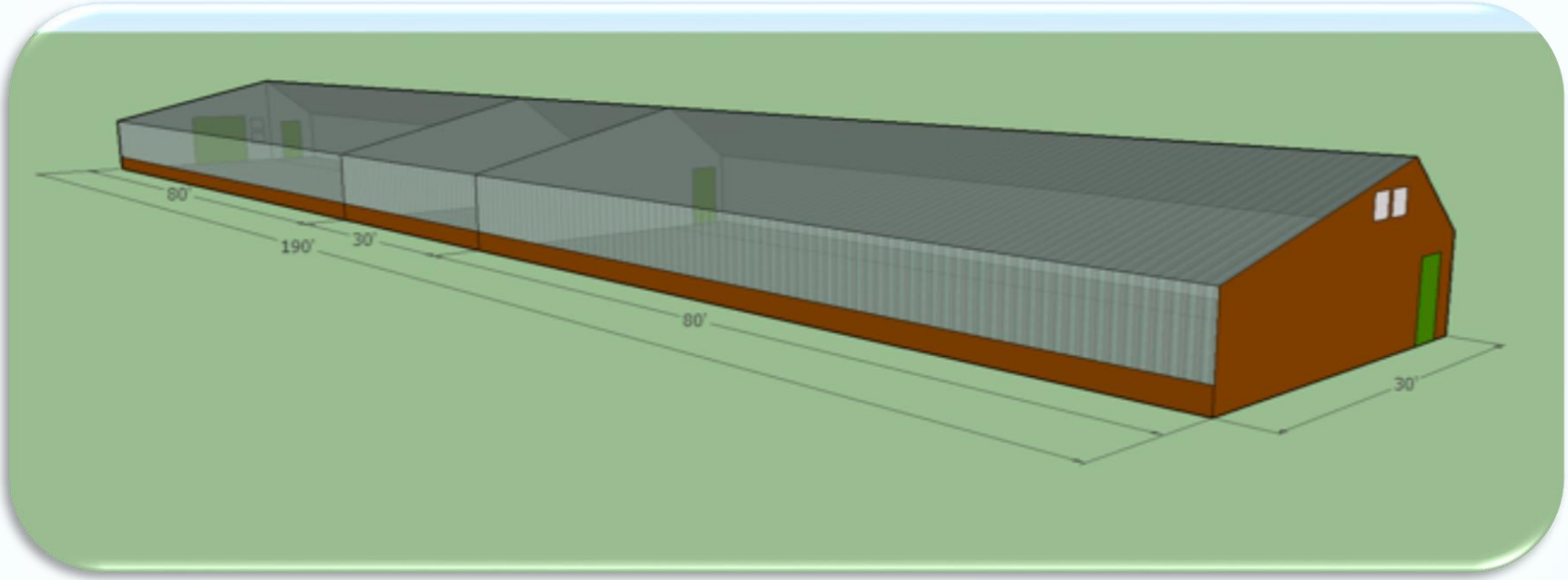
A typical greenhouse is 30x more energy intensive than a home
if growing year-round in most N. American climates

So how do we get there?

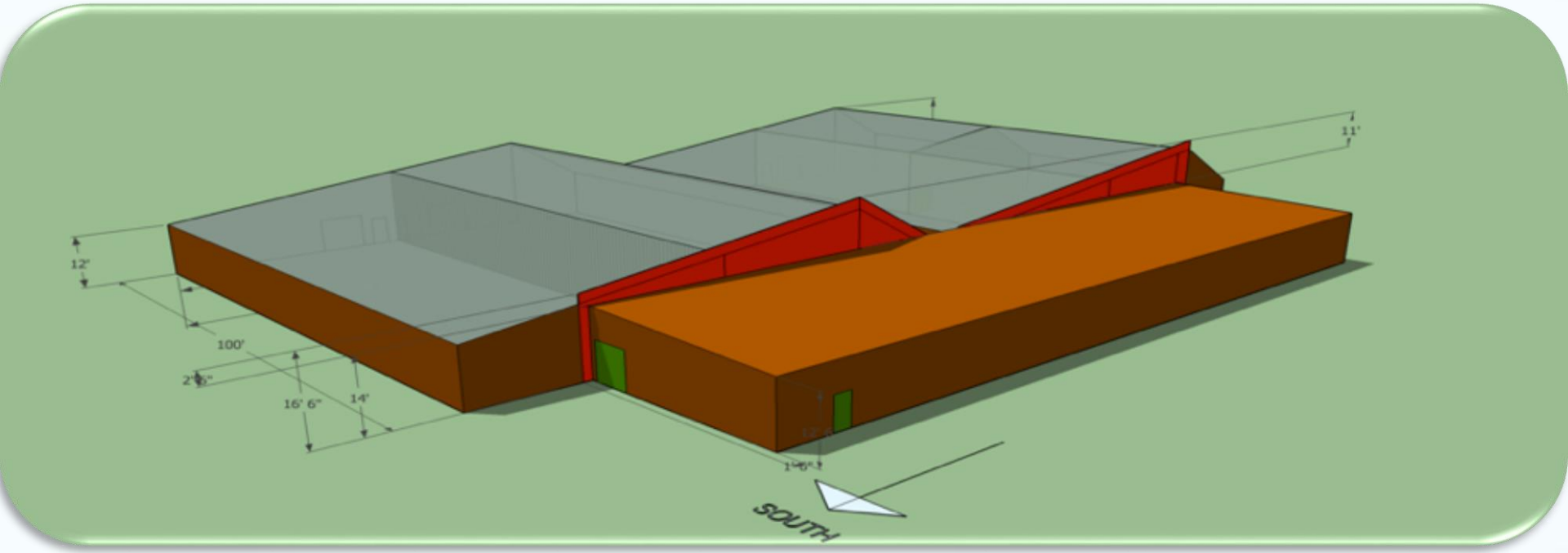
HighYield™ Steel Prefab Greenhouses

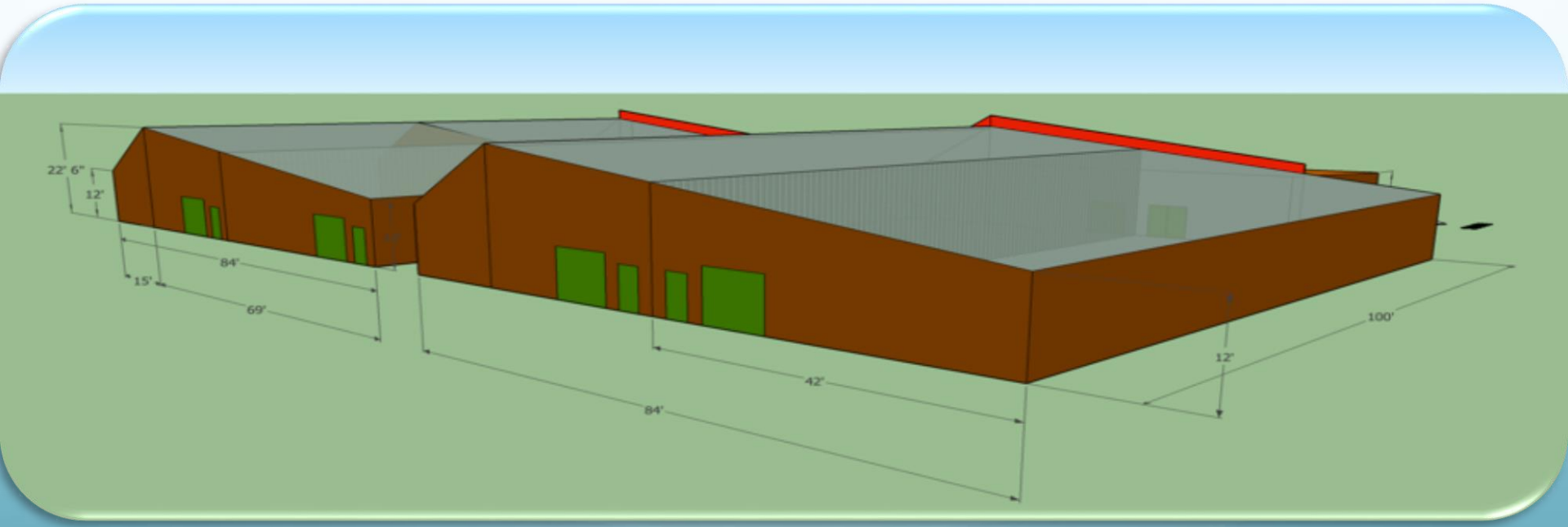


A Ceres™ Greenhouse will be more than 90% more efficient than a conventional greenhouse saving $200,000 (heating with propane) over 10 years in St. Joseph with min. temp of 50F

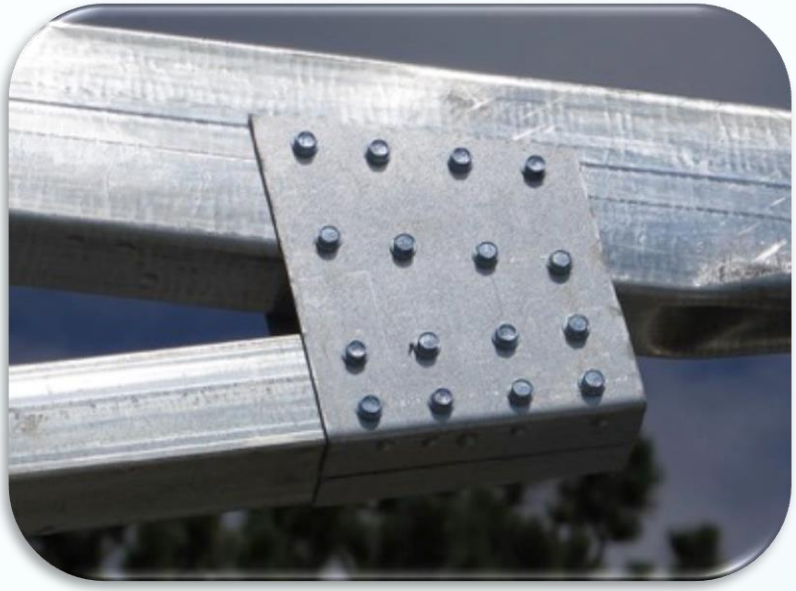

80'
190'
30'
80'
30'


80'
190'
30'
20'
80'
30'


11'
12'
100'
16' 6"
14'
SOUTH


22' 6"
12'
84'
15'
69'
42'
84'
100'
12'

HighYield™ Framing

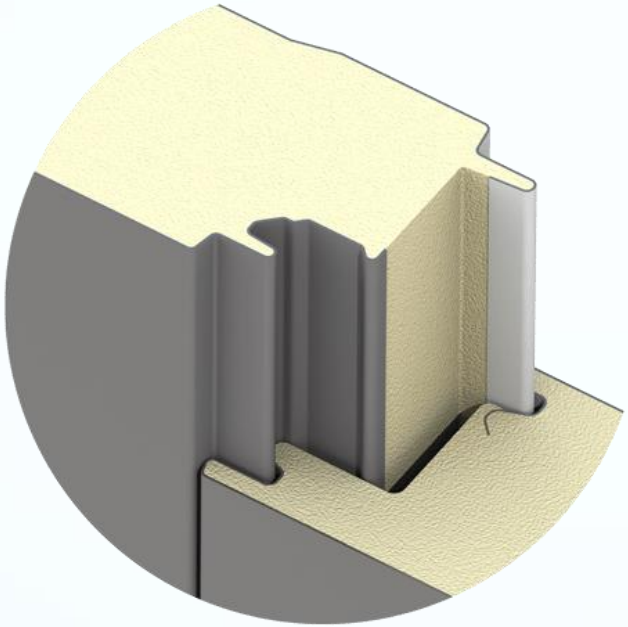


- 14 gauge hot dipped galvanized steel
- Rust proof, 25 year warranty
- Local snow and wind requirements up to 95 psf and 130 mph, stamped engineered architectural plans
- Shorter install time, no need for specialized heavy equipment
- Scalable from 30 feet to 200 feet.

The best Polycarbonate

- Designed to maximize 24 ft material spans
- Highest snow and wind load – can be designed as needed
- Thickest upper layer for best hail resistance
- 10 yr warranty
- Aluminum Megalock™ track system dovetails with steel stud framing
- Leak proof design
- Ample opportunity for sealing around glazing
- Easy to replace polycarbonate if ever needed

High Yield: Tougher Insulation



- 24 gauge embossed steel built to last
- 2” to 6” thick – up to R-42
- Insulated metal panels (IMPS) go on the outside and *automatically provide inside walls*
- *Easy install, impermeable vapor and air barrier*
- *A variety of colors and finishes*

HighYield™: The Complete Package

Custom Greenhouse

Many variations

Alberta Canada

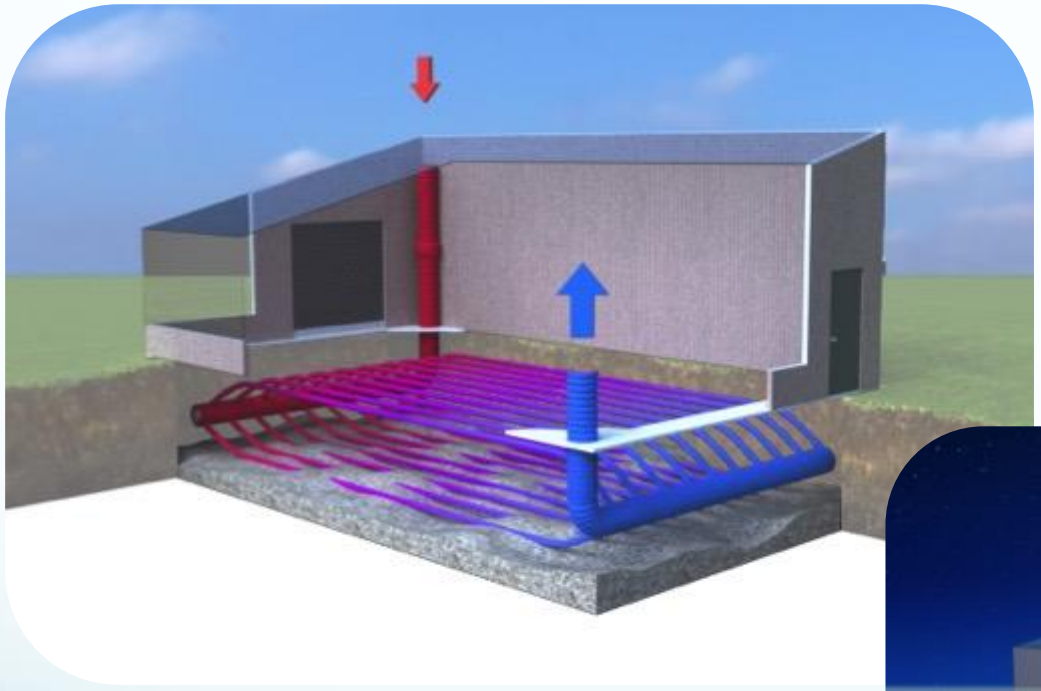
Colorado

Dallas, Tx

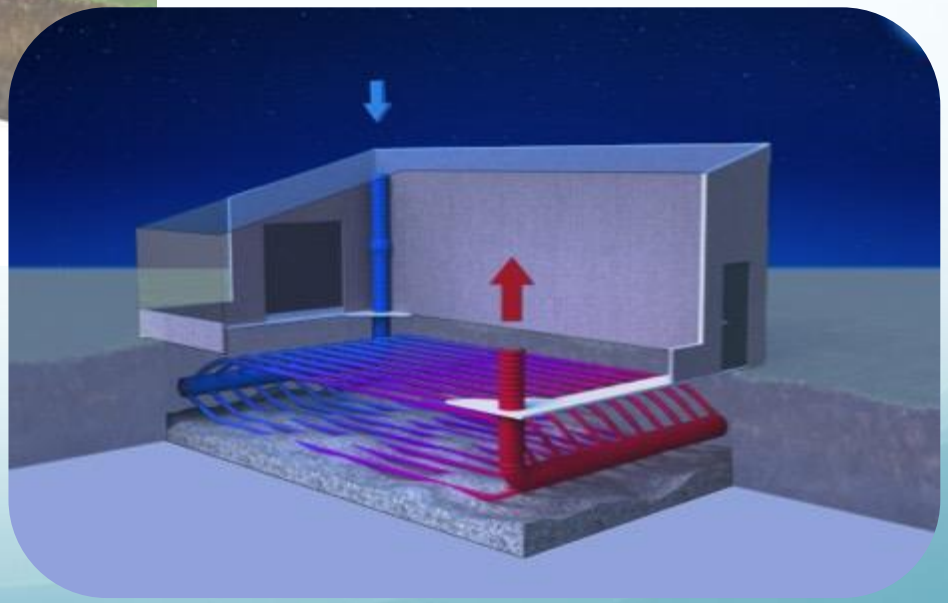
China

Colorado

One step further… A Ground to Air Heat Transfer (GAHT) System



Cooling
Hot days & the summer

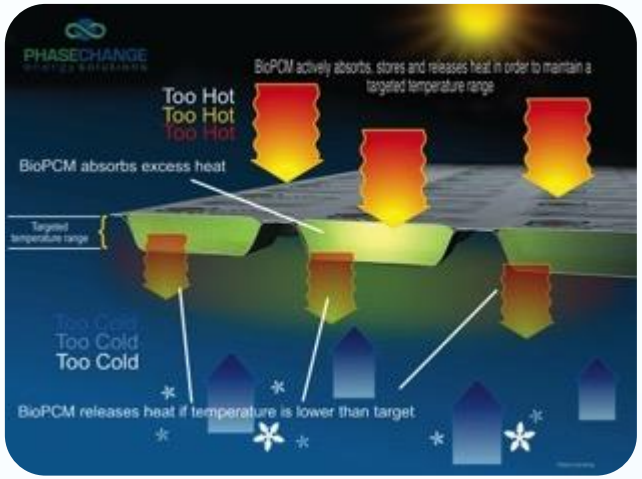


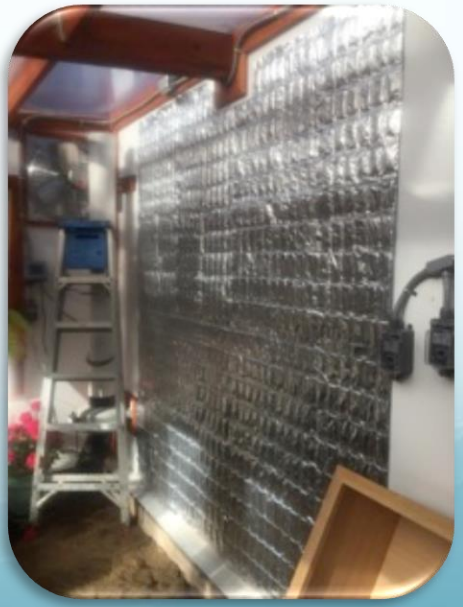
Heating
Cold days & the winter

GAHT system in practice

Phase Change Material (PCM)

- Think of this as water 2.0.
- It works to store and release energy in the same way as water does, but can store / release much more energy in a much smaller space.
- Why? Because by absorbing / releasing energy during the phase change from a liquid to a solid
- Heat storage capacity about 5x more than the same volume of water





Other options

- Rocket mass stoves
- Compost heaters
- Solar hot water

Photos:
Top- The Sage School, Idaho
Bottom – Verge Permaculture, Alberta Canada

+ Renewable Power

+ Growing systems

Customizable

Combine with chicken coops, sheds, sunrooms, sitting area, saunas

Educational

The Result

An abundant year-round garden that relies on the sun

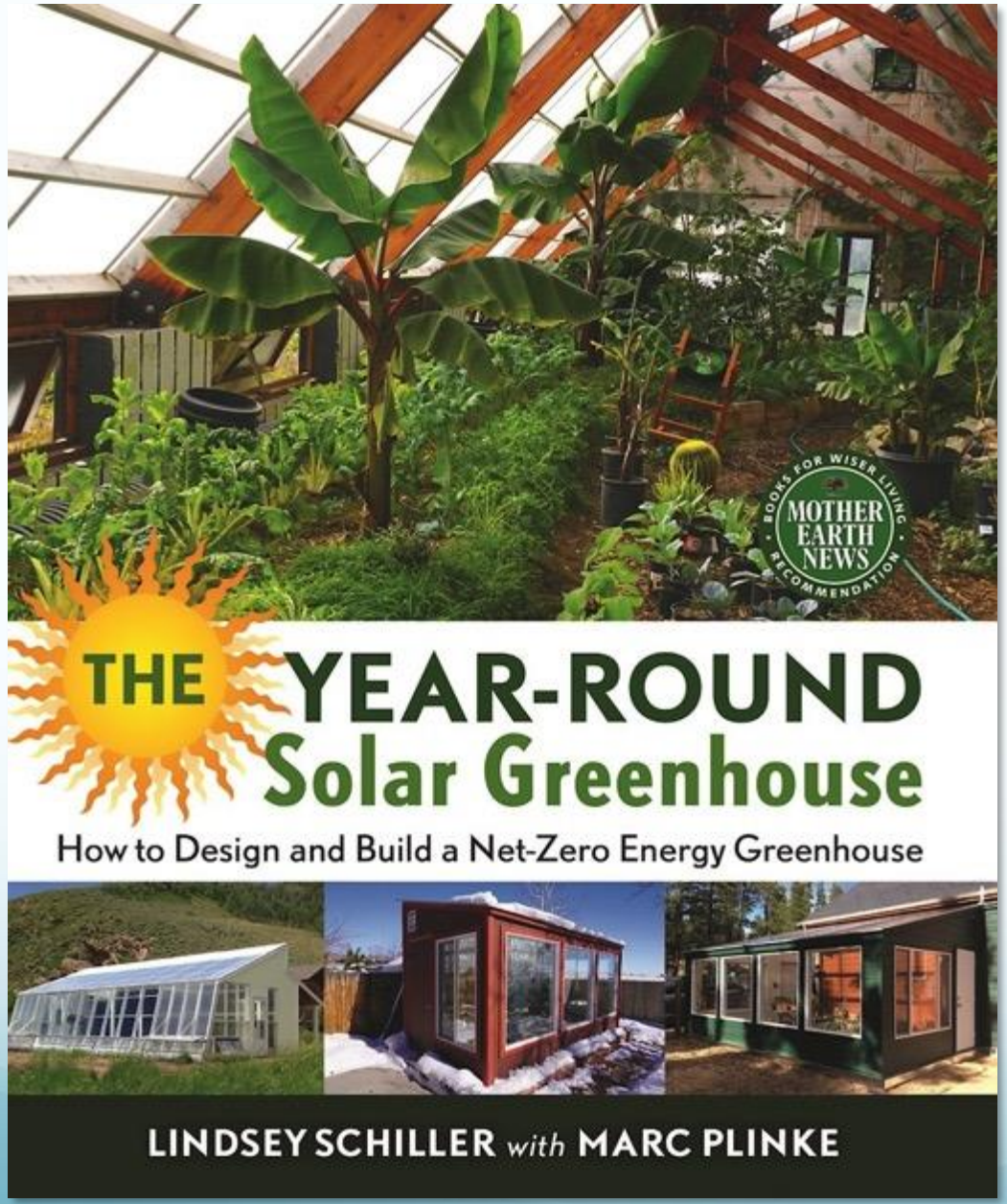
Your own slice of Costa Rica, right in your back yard

Fresh, home-grown bananas, veggies, tomatoes, figs…

Fresh, local food grown food that is

smart, sustainable & abundant

is possible with energy-efficient greenhouse design!



By

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