future farm institute

presents

Green Applied Sciences

Beyond Organic

The Future Farm Institute has the exclusive, international rights to market and use the Green Applied Sciences vertical farming system when combined with the Genifuel wet waste to energy technology

High-Density Hydroponic Food Farms

The Checkered History & Future of Hydroponics

Beyond the Greenhouse Model

Sustainable Agricultural Food

Food Demand

Food Shortages = Less selection/availability

Rising Food Prices = More money per family spent

World Over-Population = More demand for food

Consumers w/ Less Food = Hunger & Malnutrition

The Dutch Hydroponic Greenhouse Model

This model was created in the Netherlands and was designed to work in & benefit the Netherlands.

This model sells their own countries goods and services, for example:

- Heating
- Ventilation Systems
- Lighting
- Structures
- Consultants/Engineers
- Universities

The science and engineering of a greenhouse is based on incorrect plant science and engineering.

Just because other growers have followed that model, doesn't make it proper or efficient.

Let's look at some of the problems of the hydroponic greenhouse model…….

Problems with Commercial Hydroponic Greenhouses

Wasted Space

Pictured Left – Extreme interior height is inefficient for one linear level of plants. This poor design creates massive energy loss and massive energy consumption.

•The structures are built this way to profit selling more greenhouse construction materials.

•Wasted space impacts energy costs, yield and efficiency.

Problems with Commercial Hydroponic Greenhouses

Does this light look like the Sun?

It's really only 22% of the Sun! Living things evolved with100% of the Sun.

The natural spectrum of the Sun is also filtered and broken by the glass of the greenhouse. This is another inefficient part of these designs.

Improper Spectrum

This is one of the most expensive mistakes made by greenhouses.

•HPS lights are truly designed for street lighting not plants.

•It makes no sense to pay money to make light that does not behave like the sun, when it has set or behind the clouds.

•It is not a real lighting solution for plants.

Problems with Commercial Hydroponic Greenhouses

<u>Improper Plant Development</u>
(unnatural Plant Morphology)
Greenhouses improperly stretch their plants to make the best of a bad situation. This causes stress and improper plant development.

Its not as nature intended.

Pictured above left:
Greenhouse tomato vines

Pictured Left:
Tomato plants grown in nature.

Problems with Commercial Hydroponic Greenhouses

Waste Carbon Dioxide Emissions

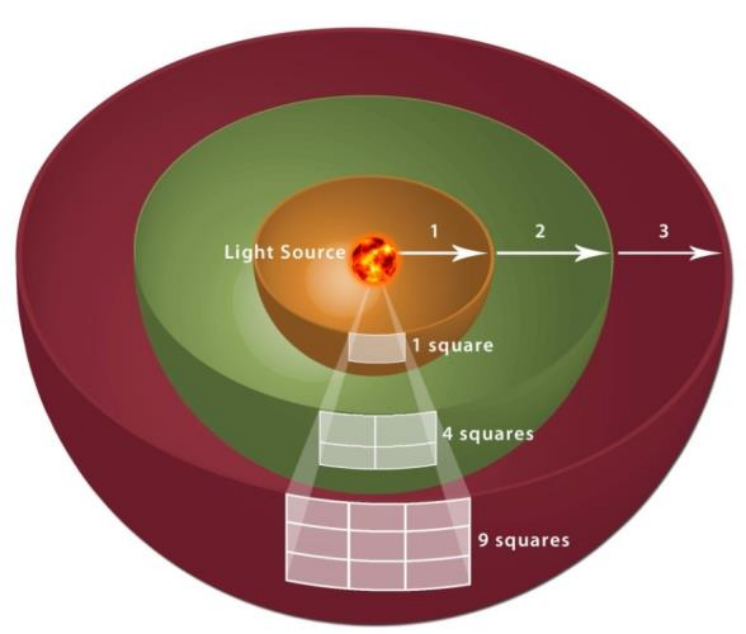
Because the greenhouse environment is so poor in function and design, CO2 is added to make a bad environment a little better.

Plants only need the levels of CO2 that nature provides in witch they evolved with.

The world cannot afford a system of food production where each facility puts out thousand of pounds of extra CO2 into the environment.

Future generations must have a more efficient method of growing their food.

Problems with Commercial Hydroponic Greenhouses



Improper Light Placement

Inverse Square Law

(the power of the light will be inversely proportional to the square of the distance.)

Every 30cm / 12inches from the light, the light is losing more and more of its energy. There is no scientific reason to hang lights high above the plants.

The plants get no benefit from the light at all when mounted too high.

Knowing this, why would a greenhouse hang a light so high?

Old Technology vs. Advanced Technology

Society can no longer grow food in buildings made of glass, (a greenhouse),that we pay money to heat and cool. It's too inefficient.

Item	Traditional Greenhouse	Food Pods
Lighting	70Yr Old Magnetic Ballasts	**State of the art digital lighting**
HVAC	Traditional Fans and controls	**Real Time Control systems**
Solar/Wind	Not used	**Used**
Hydroponics	Used Improperly	**Used Properly**
Nutrients	Harsh chemicals	**No harsh chem.**
CO2	Used	**Not Used**
Run to Waste	Commonly done	**Never Done**

Trials & Errors of Hydroponic Vertical Farming

In the early days to Present

Korean Verti Grow

Verti grow

Chicago vertical grow

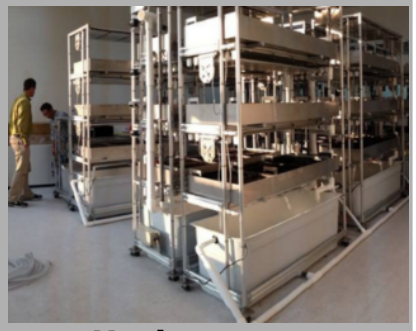
Phillips lighting co.

Toshiba Co.

Vertical grow

Test Grow in Taipei

Daiwa Agri-Cube



Horimatsu corp.

Vert Grow in grade school

Valsent algae in uk

Japan verti system

UK System

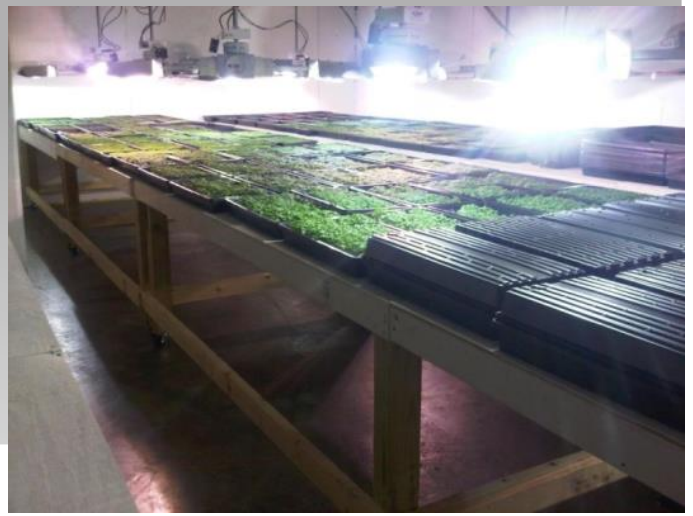
What's a Scientifically Engineered Environment?

- Scientifically Engineered Environments are facilities where food or other biomass can be grown sustainably 365 days a year.
- This is the next level of food production, beyond the greenhouse model.
- The environments provide a constancy of conditions in any climate of the world. Like a perfect day in Hawaii, everyday & night.
- Uses life science and technology to produce healthy, safe and flavorful food.
- Many different kinds of buildings can be converted for growing food.
- Systems are customized for clients needs

This barn in New Jersey, pictured right, is currently being converted into a facility to grow Basil and Mint for regional distribution.

Hydroponic Food Factories in the USA

Examples of Food Factories as they were developed for the American market and specific crops where horizontal spinning lights were the best choice .
(pictured below) Specific premium crops grown with vertical towers.



Hydroponic Food Factories in the USA

This farm in the Midwestern United States is currently converting unused animal buildings into Food Factories for growing Wheat-Grass, Micro-Greens, herbs, to supply regional demand.

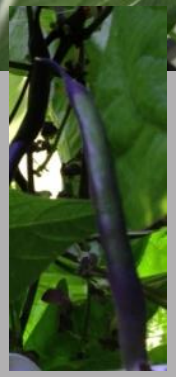
There are very hot summers and freezing winters here, but these systems will operate all year long.

Hydroponic Food Crops in the USA

Snow Peas

Strawberries

Purple Beans



Basil

Swiss Chard

Mixed Greens

Root Crops

Bok Choy

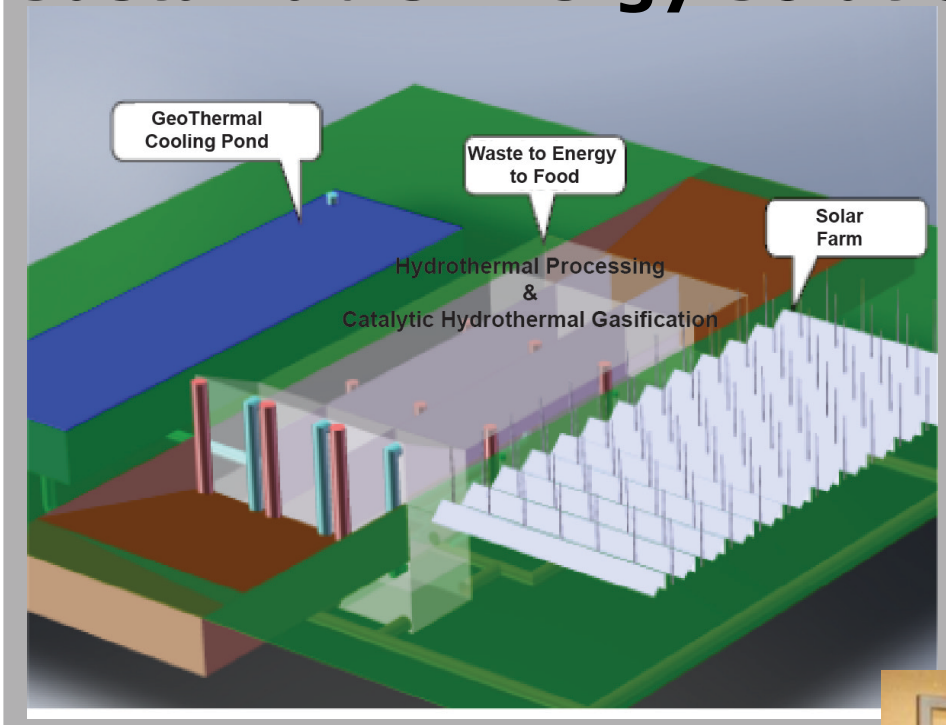
Sage

Making a Custom Scientifically Engineered Environment

Food Factories can be built in micro and macro-sizes.

The tools and technology can be scaled according to the desired crop and where the client wants to build the Factory.

Sustainable Energy Solutions



Scientifically Engineered Environment designs can include:

- **Hydrothermal Processing**
- **Catalytic Hydrothermal Gasification**
- **Geothermal Ponds**
- **Specially designed Air and Water systems**
- **Other sustainable options Solar Panels & Wind turbines**

Many forms of sustainable energy systems can be integrated into Scientifically Engineered Environments. Steam turbines, co-generation systems, and more

Crop Selection Examples

Vegetable Crops

Beans
Beets
Broccoli
Cabbage
Carrots
Cauliflower
Cucumbers
Garlic
Dill
Parsley
Lettuce
Onions
Peas
Peppers
Rhubarb
Spinach
Squash
Tomatoes
Turnips
Artichokes
Asparagus
Capsicum
Celery
Chicory
Endive
Eggplant
Leek
Marrow
Okra
Pak-Choi
Parsley
Parsnip
Radish
Sweet Potatoes
Taro

Fruits

Black Currant
Blueberry
Papaya
Raspberry
Red Currant
Strawberry

Herbs

Basil
Lemon Balm
Marjoram
Mint
Parsley
Rosemary
Sage
Thyme

Flowers

African Violet
Begonia
Carnation
Chrysanthemum
Freesia
Gerbera
Iris
Orchid
Rose

Other

Fodder
Turf
Wheatgrass
Tobacco
Cannabis
Hemp

Food Benefits with Scientifically Engineered Environments

- ✓Healthier Foods
- ✓Pesticide Free Food
- ✓Locally Grown Food
- ✓Free of Chemicals
- ✓Beyond Organic

- ✓Uses 90%+ less water than field crops
- ✓Superior Tasting Food
- ✓Less Plant Maintenance

Food – Direct to Consumers (optional)

Scientifically Engineered Environments

Consumer

- **Provide clean and safe food**
- **Sell to smaller local markets**
- **Little to no transportation costs**

- **Can be made in urban or suburban areas**
- **Upgrade existing buildings to Food Factories or build new.**
- **Sell direct to the public and grow on-site if desired.**

Vertical Tower Units (VTU)

Self-Contained Vertical Growing Systems

Vertical Tower Units

- Vertical Tower Units are specially designed for use with Scientifically Engineered Environments

- Instead of growing in an area with one level, we can grow 8 times the food on 8 levels.

- A spinning light delivery system hangs down the middle of the VTU, providing light to all levels.

- Growing vertically is the most efficient way to increase yield with the fewest watts of energy & the smallest number of Square Feet used.

- Each VTU is on wheels and can be conveniently moved.

- VTU's are then connected and placed in rows.

- Each VTU consumes less than 500 watts of energy and produces 8X the food in the same area.

Examples-Output Specifications (1/8th Acre or .05 ha)

Tray Systems

- Total Lights for (1) Factory - (340 Vertical Tower Systems per 1/8th acre)
- Growing Unit Dimension: 4'x4'x10' (8 Levels)
- Flats per Growing Unit - 12 flats x 8 = 96 flats
- Flats per 1/8th Acre - 96 trays x 340 units = 32,640 per 1/8th acre

Plant Site VTU Systems

- Total Plant output per Growing Unit (crop dependent) - 256 plant sites
- Total 256 plant sites x340 Growing units = 87,040 plant sites per 1/8th acre

Example; Estimate - Lettuce: Harvest approx every 21 days = 17 turns/year
87,040 plant sites x 17 turns/yr = 1,479,680 plants harvested per 1/8th acre

1 full acre (.4 ha) (8 Grow sites) can yield approx. 11,837,440 plants/year

Energy Consumption: (Example: 1/8th Acre or .05 ha)

- Total KWH– Lighting - 550w/VTU x 340 lights

= 187,00 Watts per area or 187 KWH x 13 hours/day

- Total KWH + *Variance* - 187 KWH + 30%

= 243 KWH (variance/overage)

Sustainable energy systems will off-set the total costs of electrical consumption.

Education

New education is required to understand how to operate and maintain the technologies used in a Food Factory.

▪New educational programs would be created in each region to teach how to use the Scientifically Engineered Environments.

Or

▪Use current vocational schools to teach these sciences and offer courses.

The Hydroponic Society of America (H.S.A.) is the non-profit association that teaches the sciences of **Controlled Environment Agriculture** around the world.

Bio-Loop Systems™

- Bio-Loop Systems are an advanced system for integrating the growing of plants with the breeding of aquatic life.
- These systems are not like traditional aqua-culture or aquaponic systems.
- These custom systems are designed for clients during the consulting process.

Food Factory Allied Groups

Green Applied Science