

CO2 Mitigation / CCR
(Carbon Capture & Reuse)
using highly profitable and sustainable
closed greenhouse system:

SolaRoof

Invented by Richard Nelson

CEA
Closed
Or, **C**ontrolled
Environment
Agriculture
increases
plant growth
by 2000%



Protected Hydroponic Floating Technology
500 plants/m²/year



Protected Soil Horticulture
108 plants/m²/year



Outdoor Soil Farming
36 plants/m²/year

CO₂ from power stations



- CO₂ from gas Power Stations used across Europe
- Cannot be classed as mitigation/sequestration as majority is vented to atmosphere

Heating



- Gas burnt during the day to produce CO₂
- Heat stored in water tanks and distributed at night
- Can only use gas or kerosene for clean CO₂
- Energy inefficient process at each stage

Cooling and humidity control



- Only way to cool currently is venting – releasing 60% of added CO₂
- Humidity controlled by 'burst' heating then venting
- Creates a heating / cooling seesaw effect – very energy intensive

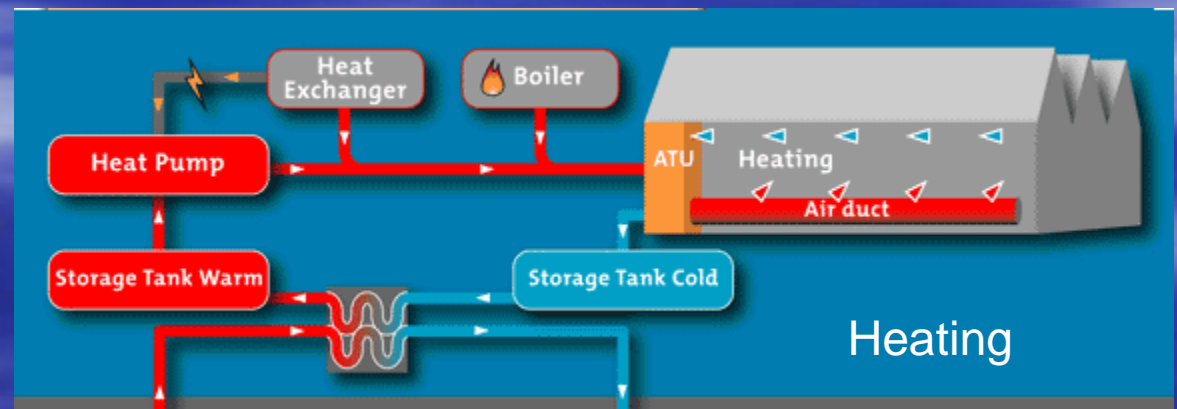
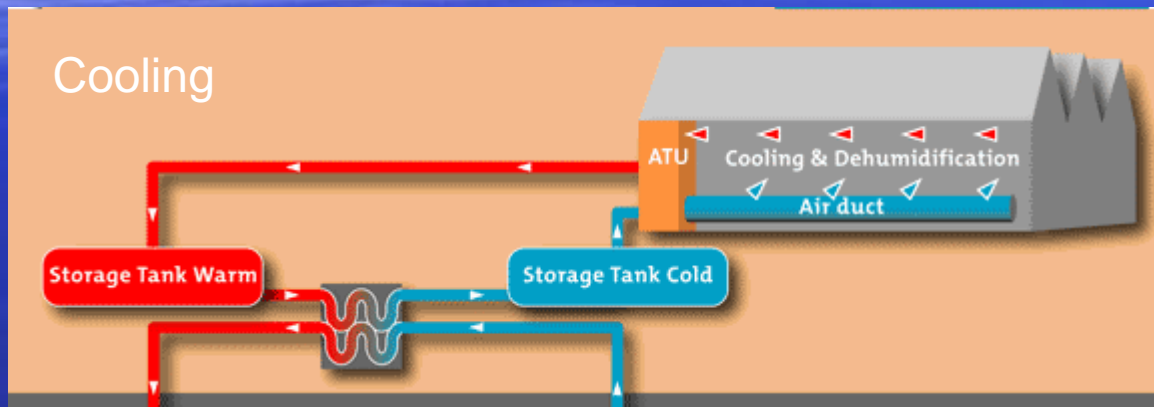
Horticultural Industry's panacea is a 'closed' greenhouse system

Allowing:

- 1000ppm CO₂ Enrichment
- No ventilation causing loss of heat energy
- Retain transpired water
- Increased yields with reduced energy costs

Closed Greenhouses

- Subject of much research over last 30 years
- Current system – Innogrow – is not viable:



Innogrow - issues

- Uses highly inefficient “Venlo” glasshouses with no insulation properties
- Use of groundwater – site specific
- Significantly more expensive to build and maintain
- Reports serious issues controlling humidity – climate sensitive

Essentially **Innogrow** is an attempt at using best practice heat-pump system from commercial buildings put into inefficient glasshouses

Ideal sustainable Closed greenhouse

- Would collect solar heat gain and store the energy until needed at night
- Heat without use of fossil fuels
- Cool without expensive capital equipment
- Retain all transpired water
- Be readily adaptable to any climate
- No release of CO₂ to atmosphere

SolaRoof

Technology

A revolutionary new design that utilises 'bio-mimickery' to maximise plant response within a dynamically controlled closed environment with minimal energy requirements

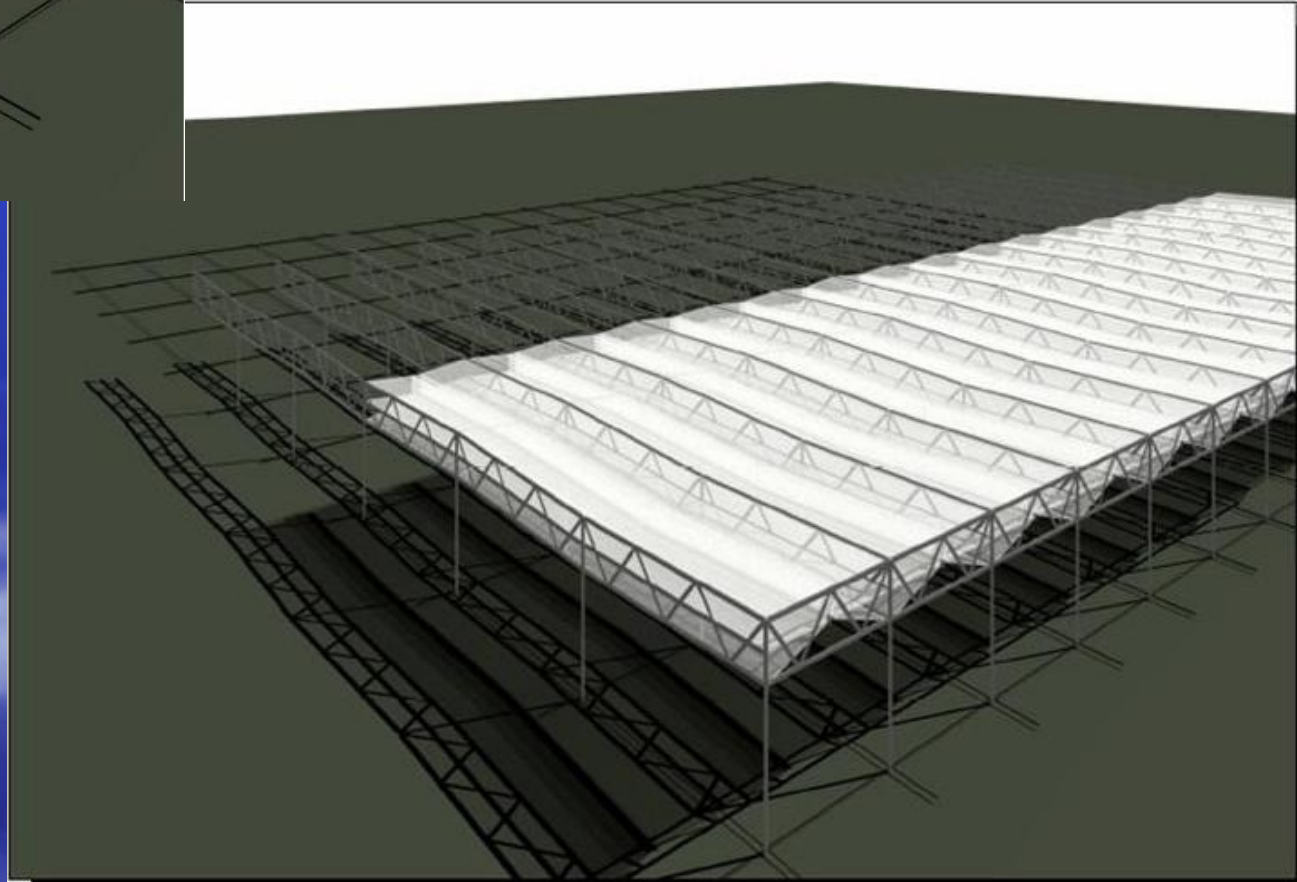
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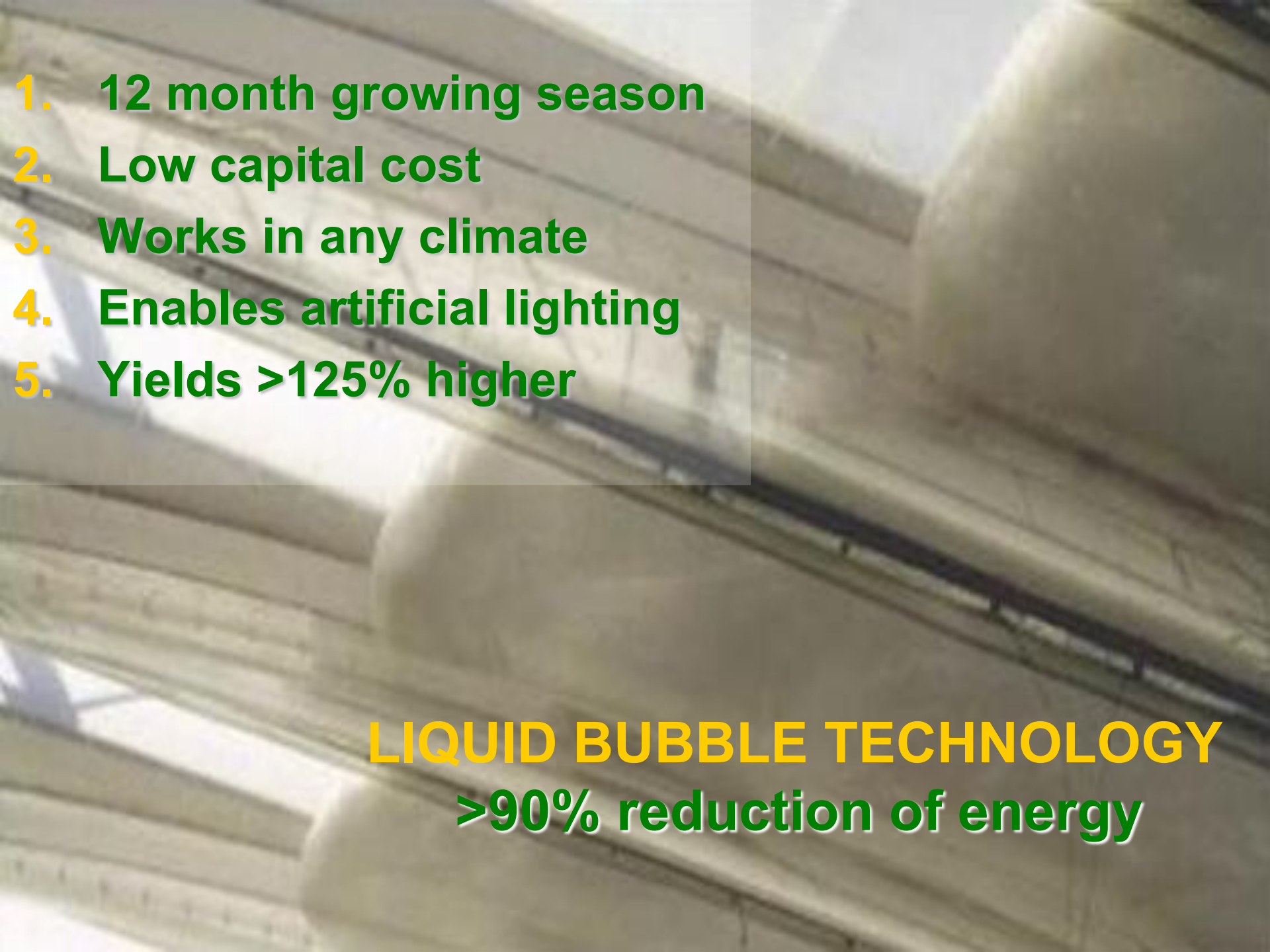
- Using liquid bubble Insulation
 - 20 times better than glass
 - added or removed in minutes

SolaRoof structural system

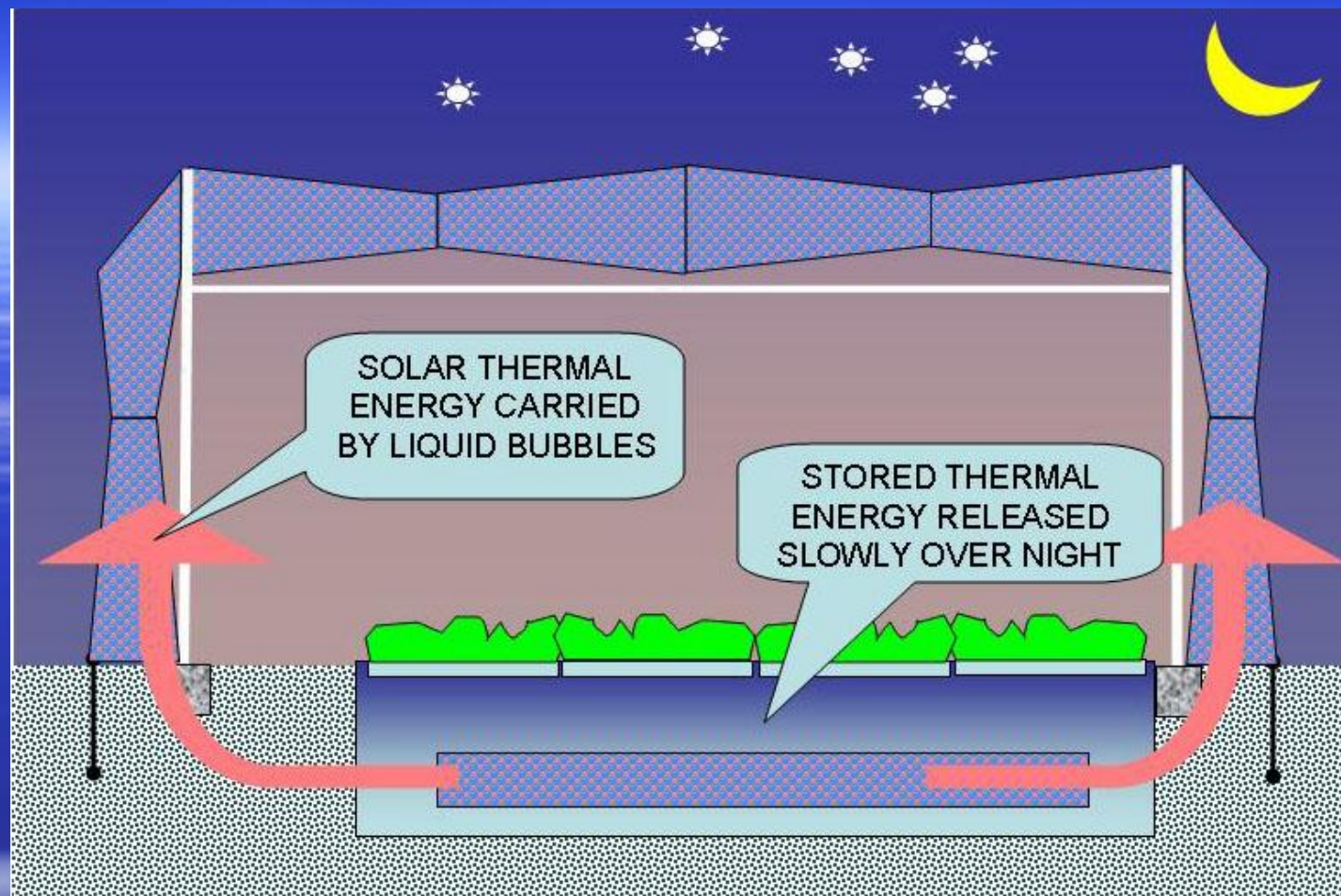
- Modular, bolted frame
 - High transparency multi-layer cover
- prefabricated for rapid and precision instalation



ISOMETRIC SCHEME VIEW

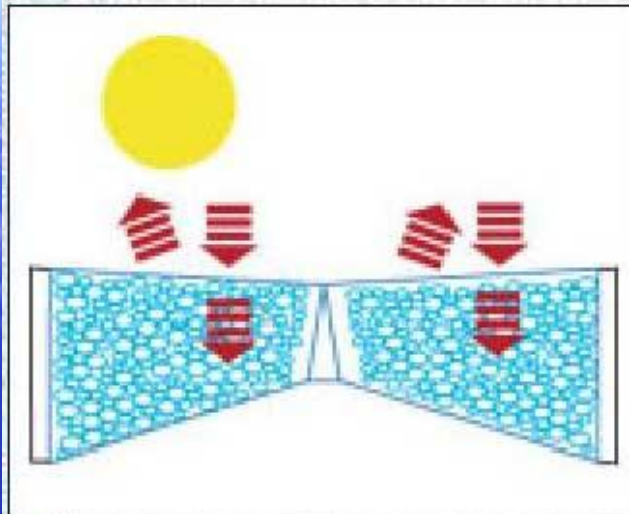
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1. 12 month growing season
 2. Low capital cost
 3. Works in any climate
 4. Enables artificial lighting
 5. Yields >125% higher

LIQUID BUBBLE TECHNOLOGY
>90% reduction of energy



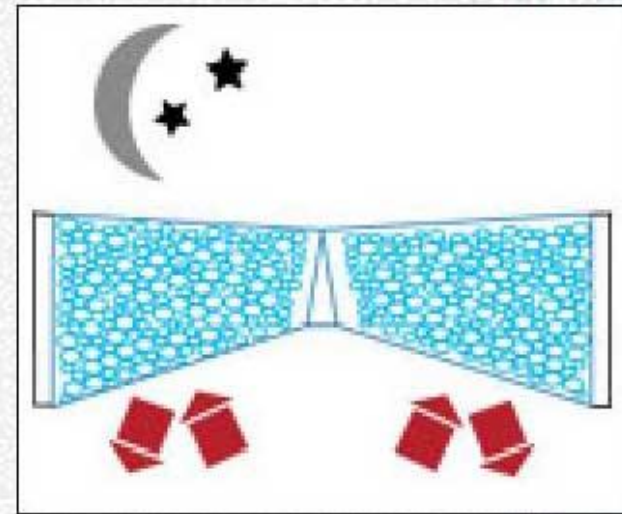
- during a cold night liquid bubbles are regenerated
 - a large liquid thermal mass is the key concept
 - efficient use of low temperature thermal energy

Dynamic renewal of the liquid foam maintains a nearly constant building envelope temperature



SHADING

DLF reflects and absorbs solar heat for use during cold nights, and for snow melting.



HEATING

DLF insulates and also reflects and traps radiant heat.

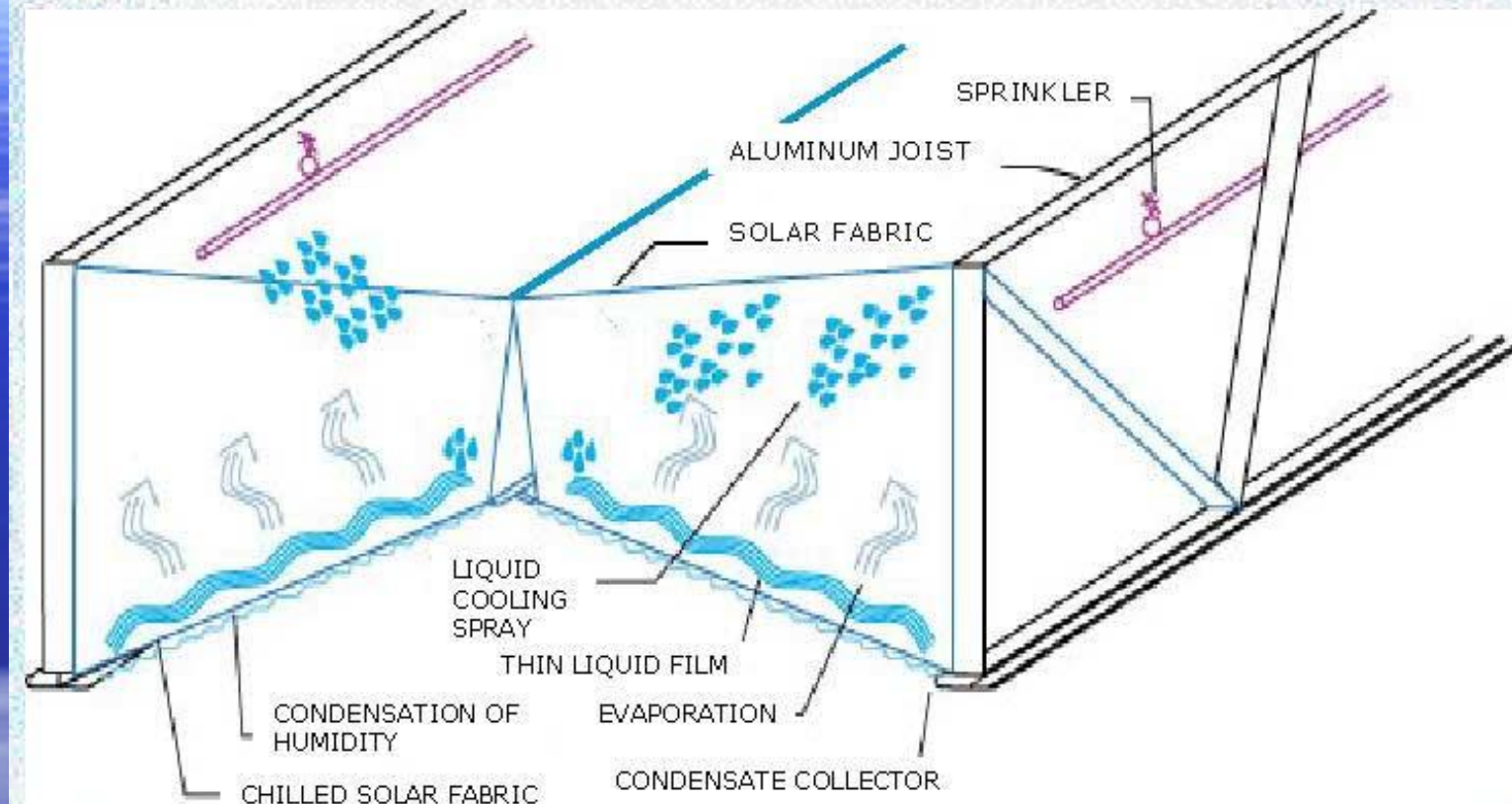
- Dynamic liquid bubble shading & cooling
 - using cold water resources efficiently
- using low temperature waste heat effectively

CLIMATE CONTROL

- Temperature control
- Humidity control

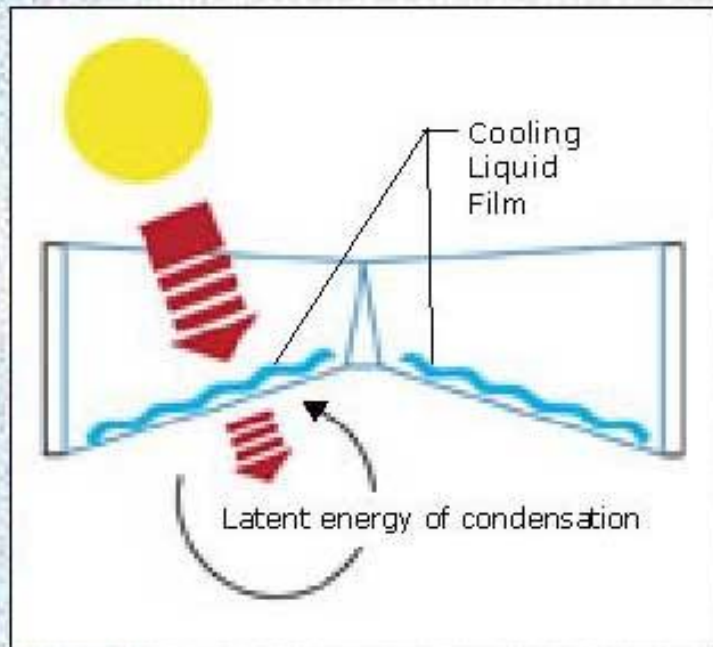
SOLAR ENERGY SYSTEM

- Solar energy capture and storage
- Excess solar energy rejection



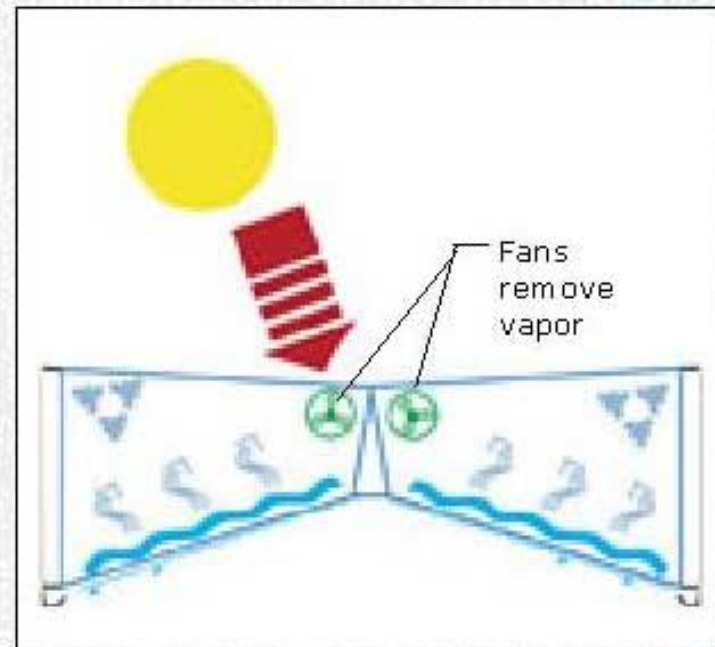
- Daytime Liquid Cooling
 - during the mid day a flowing thin liquid film
 - prevents overheating and excessive brightness

The solar energy captured by the Liquid Cooling or it is rejected by the Chiller process



Cooling

The cool ceiling condenses humidity and captures latent heat from building interior. It also absorbs solar infrared. This solar energy gain is used to offset overnight heat loss.



Chilling

Exhausting vapor from the cavity space facilitates further evaporation of the water film, therefore chilling the ceiling surface and allowing for efficient rejection of excess solar gain.

- cold water can be generated by chiller process

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SolaRoof

Manufactured
by
LifeSynthesis



Replacing conventional greenhouse
Glass and Plastic Film Covers
With
Advanced transparent polymers
Laminated
to strong glass fabric scrims

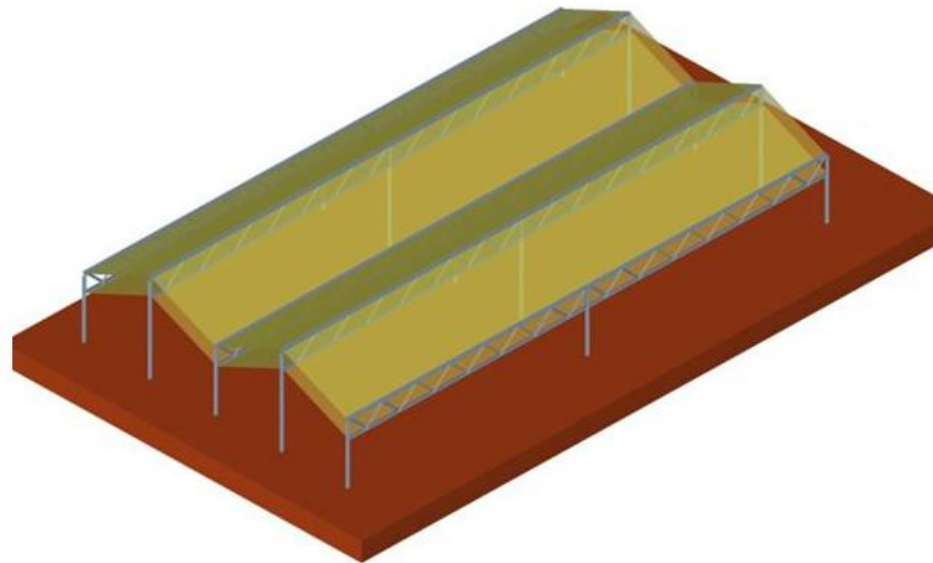
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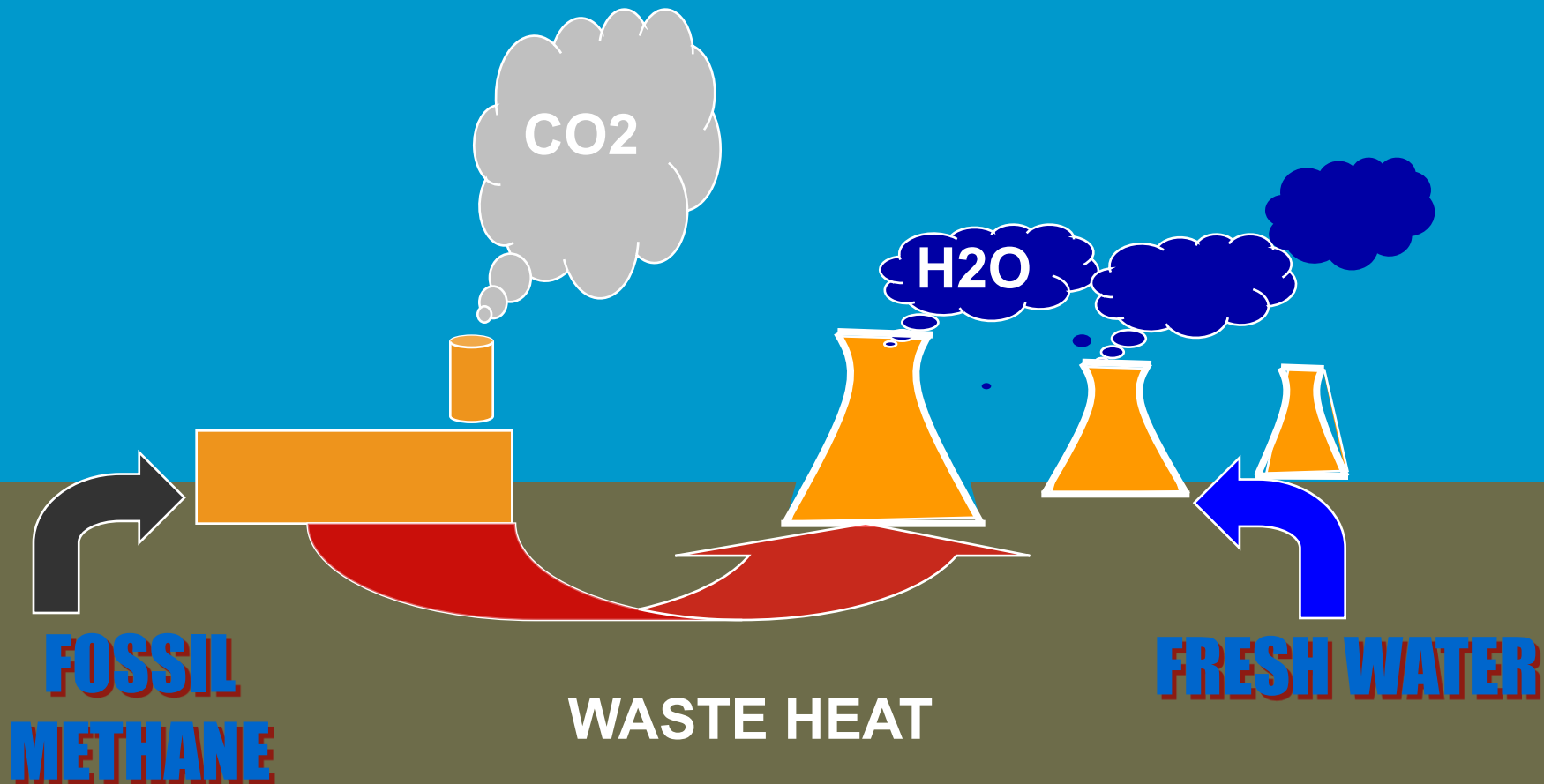
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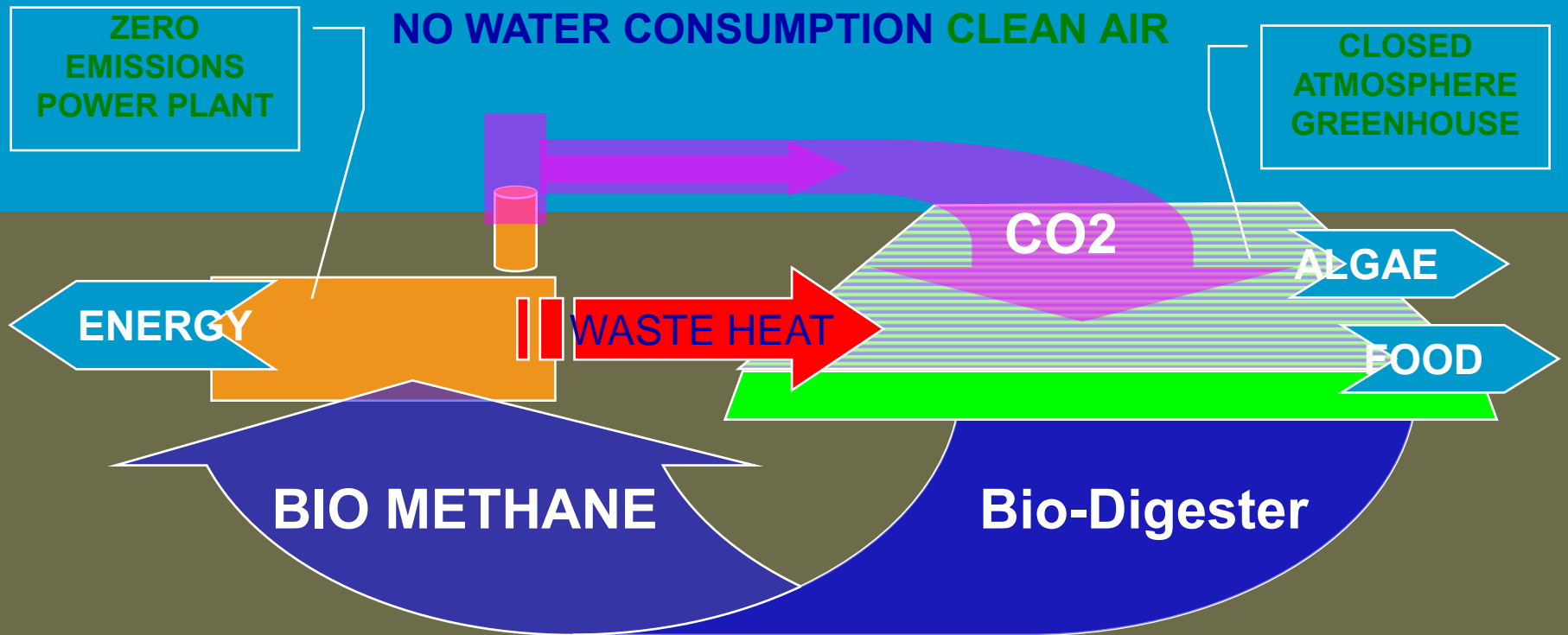


CURRENT TECHNOLOGY OPERATES IN “OPEN “ PROCESSES





SOLAROOF PROCESSES ARE “CLOSED CYCLE”



SolaRoof



Richard Nelson, inventor - social entrepreneur

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