SPRING 2017

A MULTI-FLOOR HEXAGONAL DESIGN FOR THE HYDROPONIC PRODUCTION OF LETTUCE

AHMAD S. AMMAR

GRADUATION PROJECT II

SUPERVISOR: MSc. Chidi Wilson

OUTLINE

THE DANGERS

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10 BILLION

HUMANS WILL LIVE ON EARTH BY 2050

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MONOCULTURE

The practice of cultivating a single crop species possessing similar maintenance and growing requirements in the same field

CONVENTIONAL TILLAGE

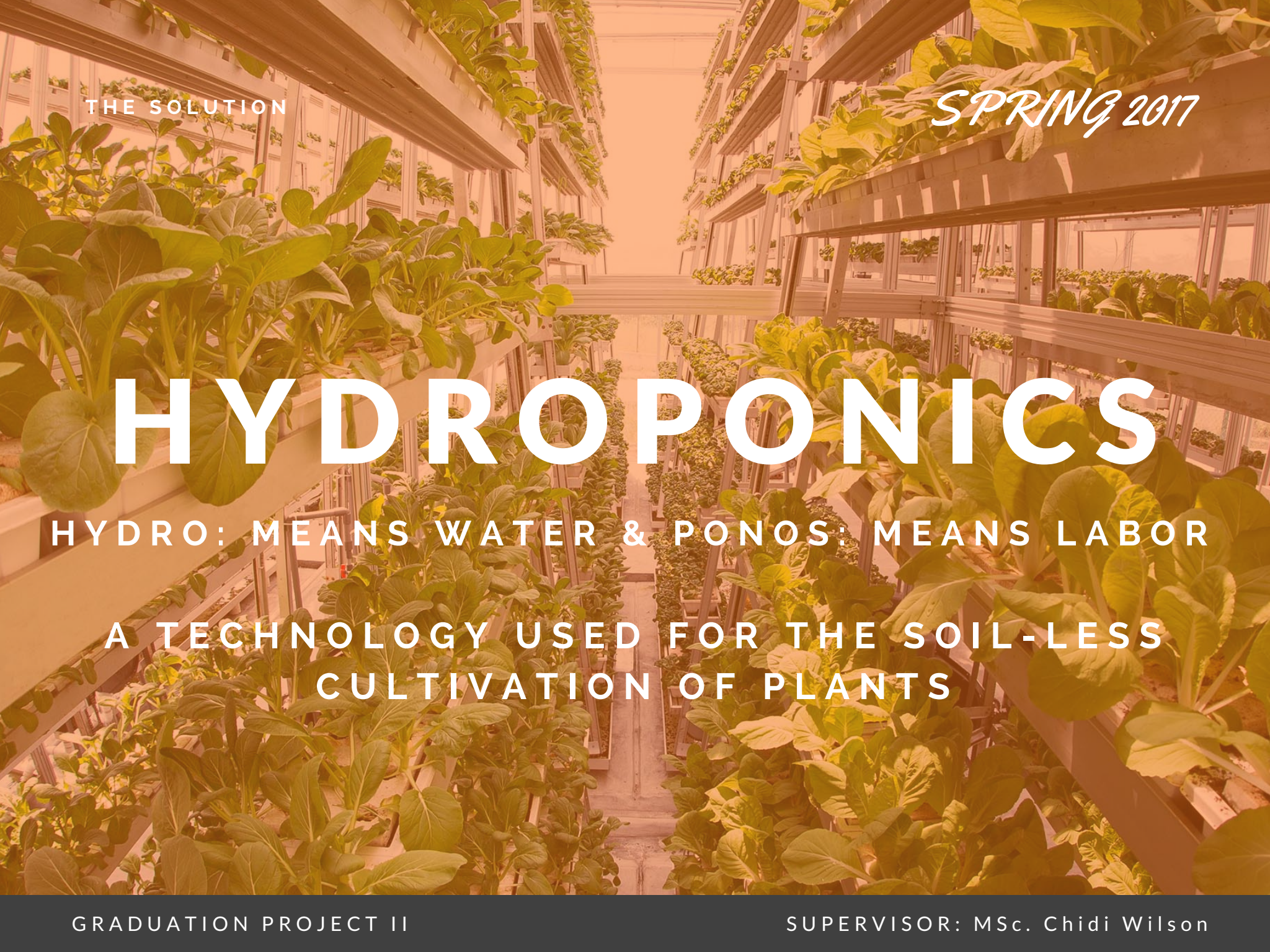
The practice of plowing the soil to promote the loosening of soil structure, drainage, & aeration

INTENSIVE HILLSIDE CULTIVATION

Since arable land is finite, hillsides are being cultivated to cope with the increased demand for food

REPRECUSSIONS

why conventional practices are harmful to the environment



THE SOLUTION

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HYDROPONICS

HYDRO: MEANS WATER & PONOS: MEANS LABOR

A TECHNOLOGY USED FOR THE SOIL-LESS CULTIVATION OF PLANTS

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HYDROPONICS TIMELINE

ANCIENT CIVILIZATIONS

Hydroponics is traced back to the hanging gardens of Babylon and the floating gardening rafts of the Aztecs

RENAISSANCE (1699)

The English Physician John Woodward grew plants in water culture taken from the Thames River

WW2 (1939-1945)

Lettuce was hydroponically grown by the US army for troops stationed on the infertile islands of the Pacific

20th CENTURY (1963)

The term Hydroponics was coined by Dr. W.F. Gericke. Hydro means water and Ponos means labor

ADVANTAGES

what gives hydroponics the edge over other systems

COMPARISON BTW AVERAGE YIELDS

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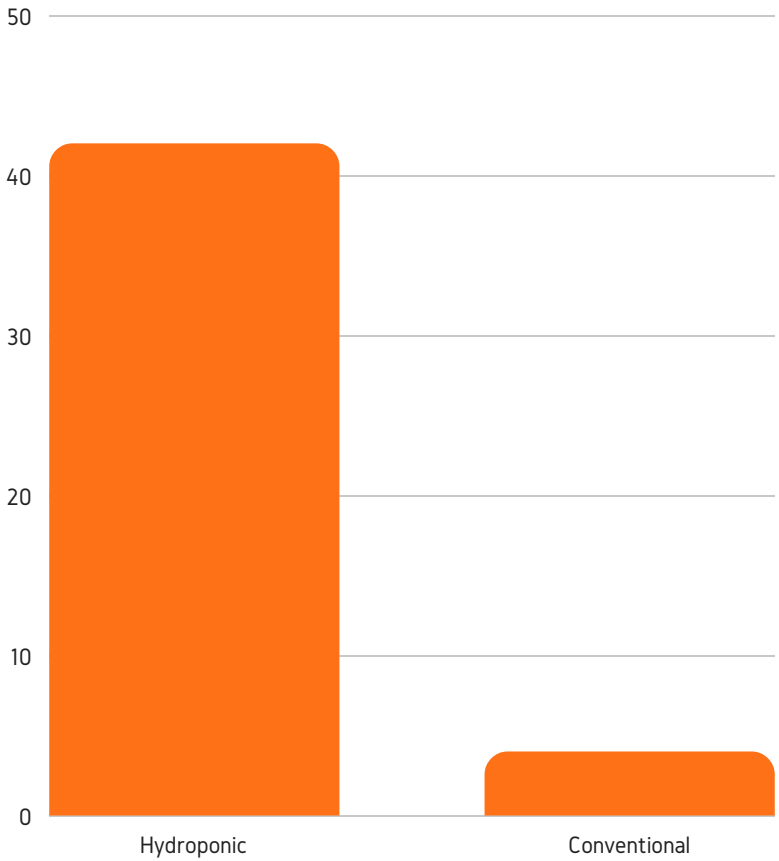


HIGHER YIELDS

25%

more harvest than conventional soil agriculture

HIGHER DENSITY PLANTING RESULT IN INCREASED HARVEST PER ACRE

LIMITATIONS

what makes hydroponics
a less favorable investment

- HIGH COSTS
- ENERGY INPUTS
- CONVOLUTED LAWS
- SKEPTICISM
- LACK OF DATA
- SYSTEM FAILURE

AIMS OF THE PROJECT

DESIGN AN AFFORDABLE SYSTEM WHILE...

#1

INCREASING THE SYSTEM'S PRODUCTIVITY

#2

INCREASING THE SYSTEM'S RELIABILITY

#3

REDUCING THE RISK OF SYSTEM FAILURE

MAINTENANCE OF ESSENTIAL PARAMETERS

WATER QUALITY

Utilization of filtered water prevents the clogging of irrigation systems

OXYGENATION

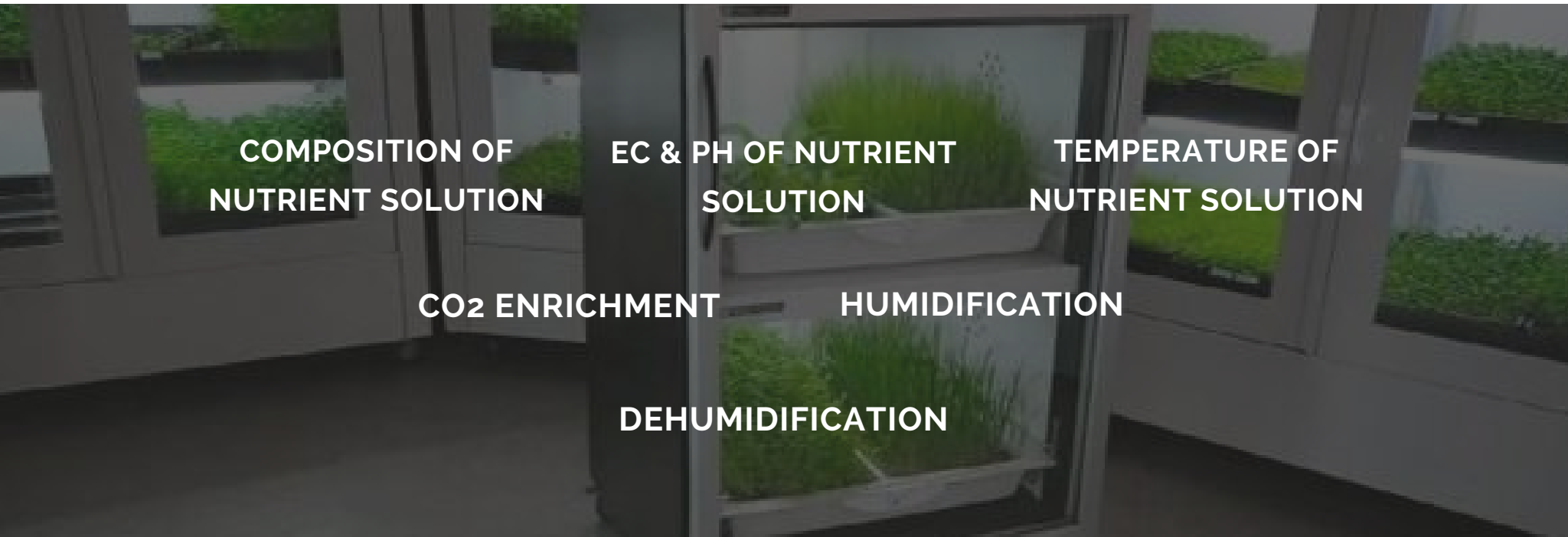
Improves physiological processes, accelerates vegetative growth, & fructification

LIGHTING

The output of irradiated light in LED lights could be adjusted

MAINTENANCE OF OPERATION

what other parameters could be controlled to optimize hydroponic (not monitored)



LOOSE-LEAF LETTUCE OSCARDE
(ASTERACEAE LACTUCA SATIVA L.)

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PLANT MATERIAL

The Lettuce variety that will be produced is the loose-leaf lettuce Oscarde (Asteraceae Lactuca Sativa L.). It is one of most commercially produced variety in hydroponic systems..

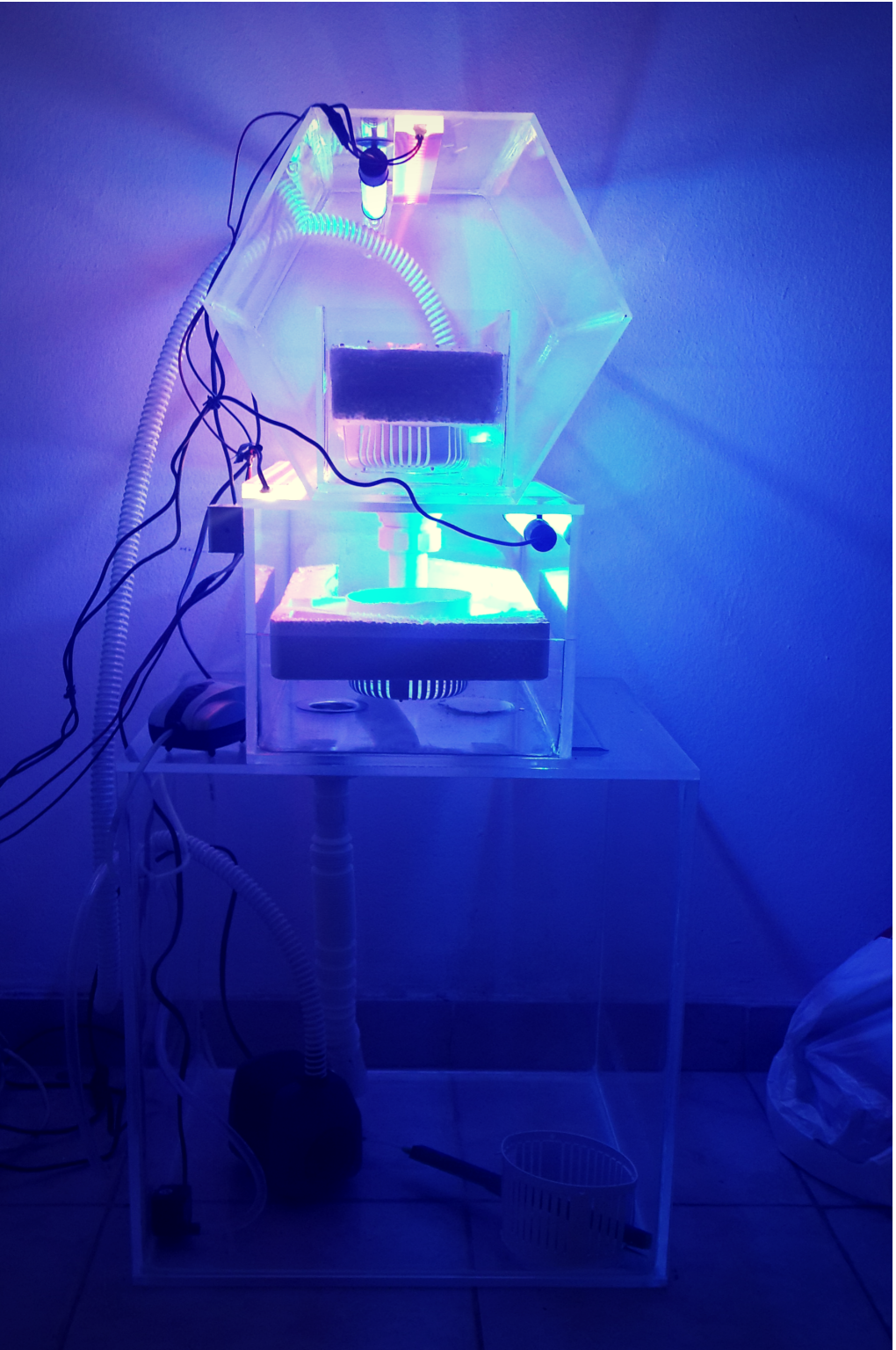
UTILIZED EQUIPMENT

There are several requirements for the initiation of the operations in both of the Germination and Production Chambers.

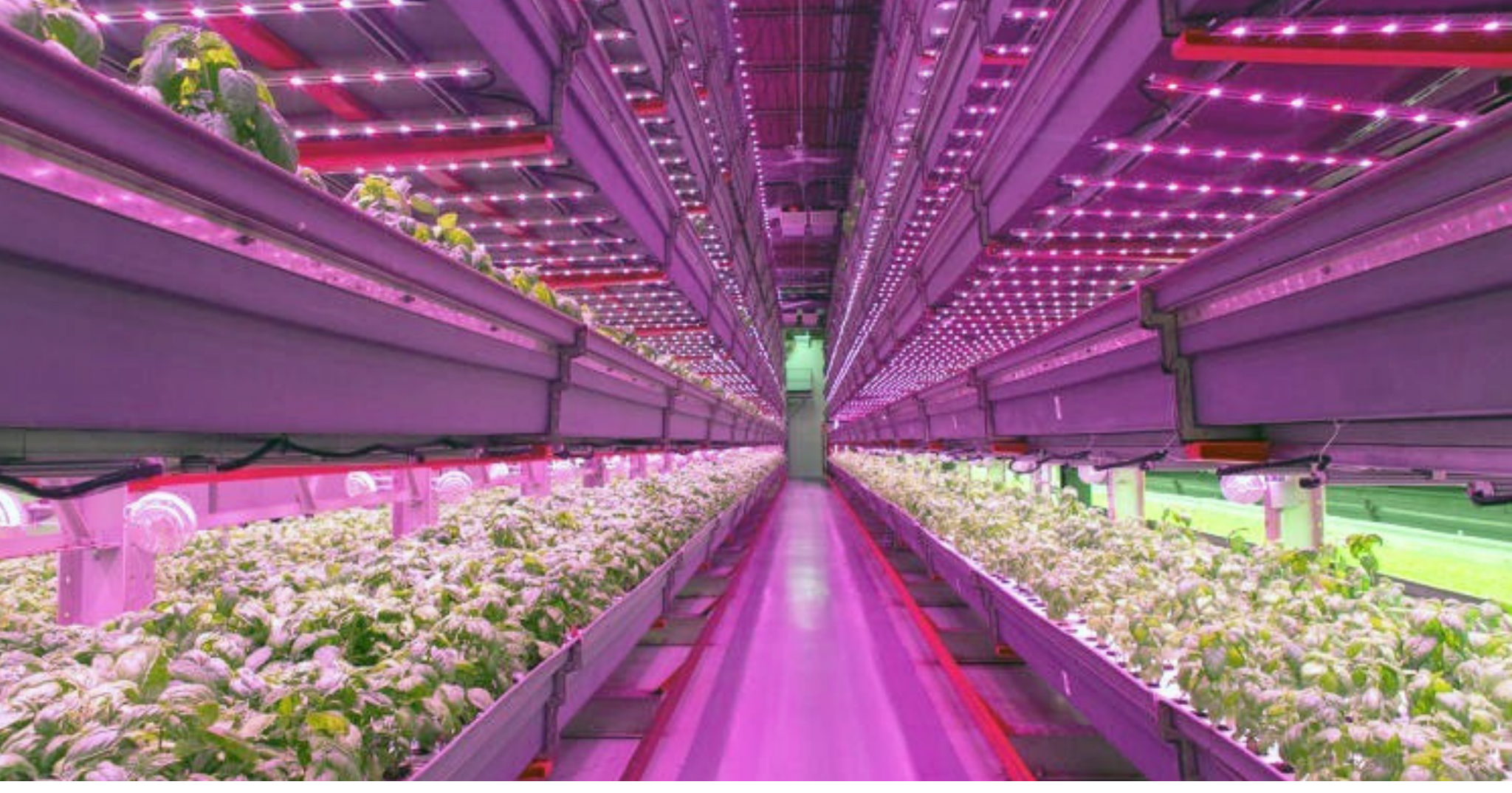
- CIRCULATION PUMP
- SECONDARY PUMP
- PLEXI GLASS
- LED LIGHTS
- AIR STONE
- WHITE FOAM
- PIPES FOR PLUMBING
- PLASTIC CONTAINERS

MODULAR STRUCTURE OF THE ASSEMBLED PROTOTYPE

TESTING THE LIGHTING SYSTEM OF ASSEMBLED PROTOTYPE



THE FINAL STRUCTURE OF THE ASSEMBLED PROTOTYPE



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THANK YOU!

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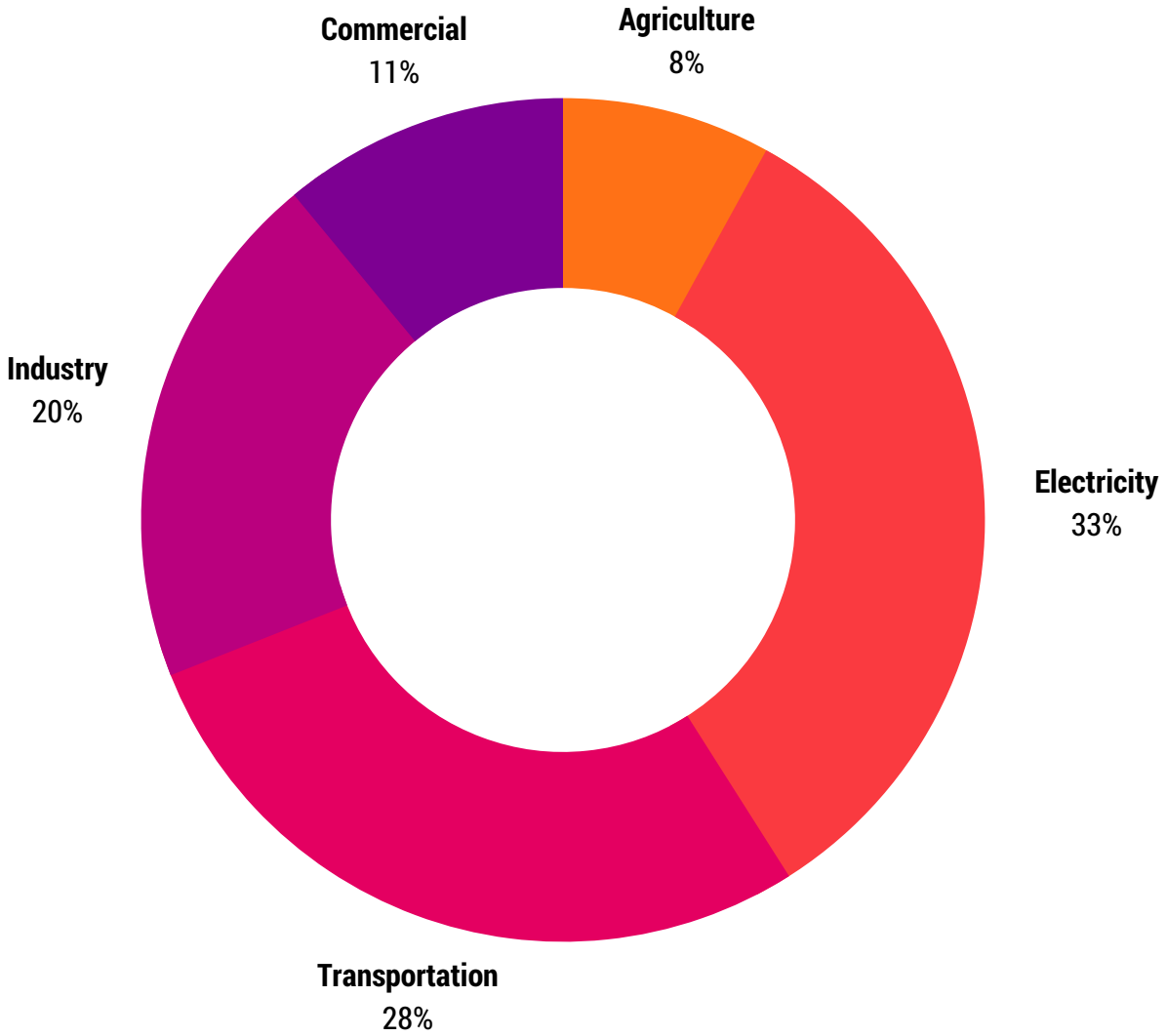
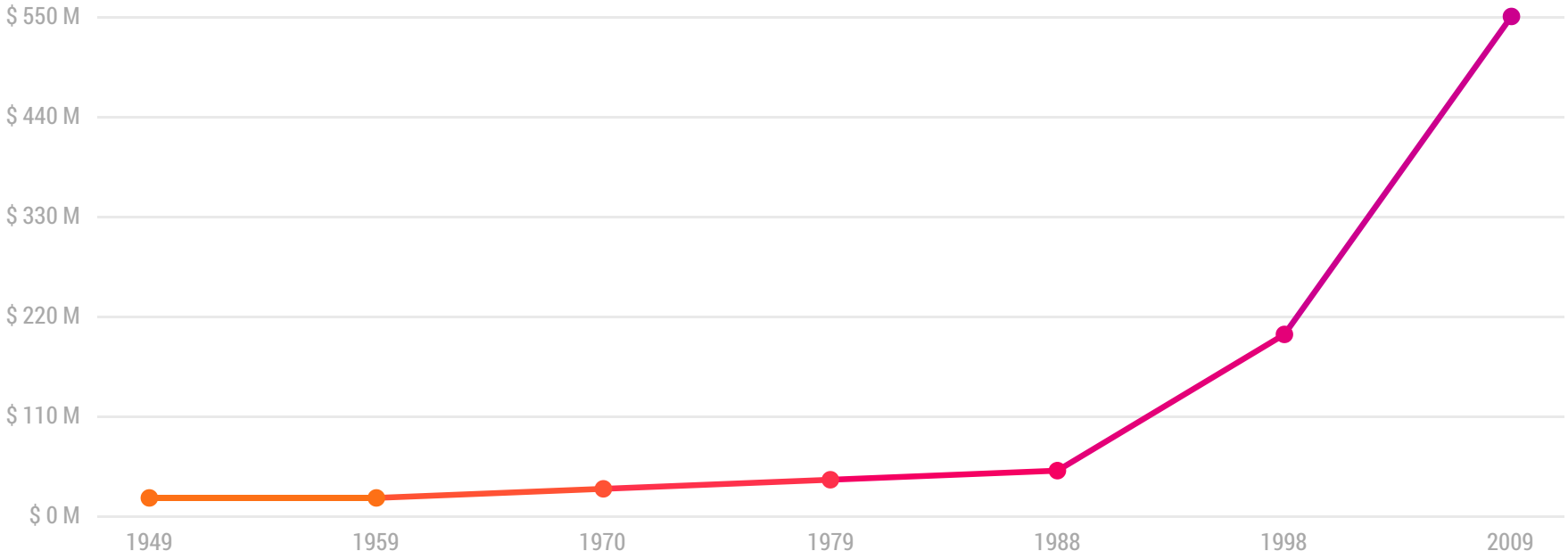
GREENHOUSE GASES EMISSIONS

Conventional agricultural practices are responsible for 8% of the overall global greenhouse gases emissions.

Many industrial crops processing technologies require the intensive use of fossil-fuel dependent machinery.



SALES OF FOOD CROPS GROWN UNDER PROTECTION IN THE US



Source: United States Department of Agriculture (USDA), 2011