

The logo for VERTIGROW, featuring the word 'VERTIGROW' in a bold, dark green, sans-serif font. On either side of the text are decorative elements consisting of four vertical green lines of varying heights, with small circles at the bottom of the outermost lines.

green. lean. clean.

# Challenge

Supplying rapidly  
growing population

By 2050 crop yield  
reduces by 17%

(Hasegawa et al., 2018)

# Problems with traditional agriculture

climate change +  
resource scarcity +  
food security

Anthropogenic  
activity

Food waste due to  
overproduction &  
supply chain

(Godfray et al., 2010)

# Solution

||| VERTIGROW |||  
lean. clean. green.

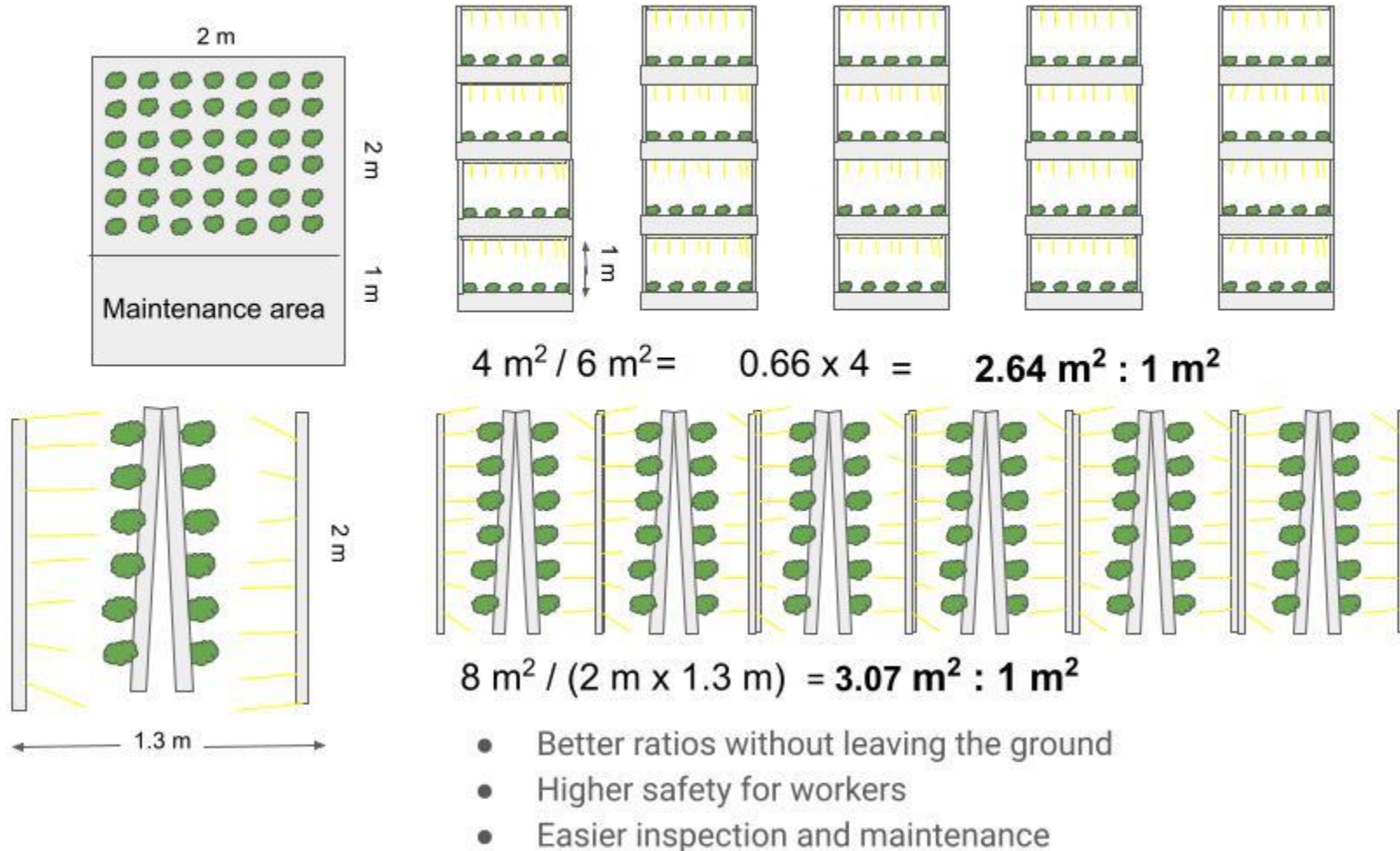
# Vertical Farming - traditionally horizontal



<https://www.dwih-newyork.org/en/2020/10/01/the-worlds-largest-indoor-vertical-farm/>

# Novelty of VERTIGROW

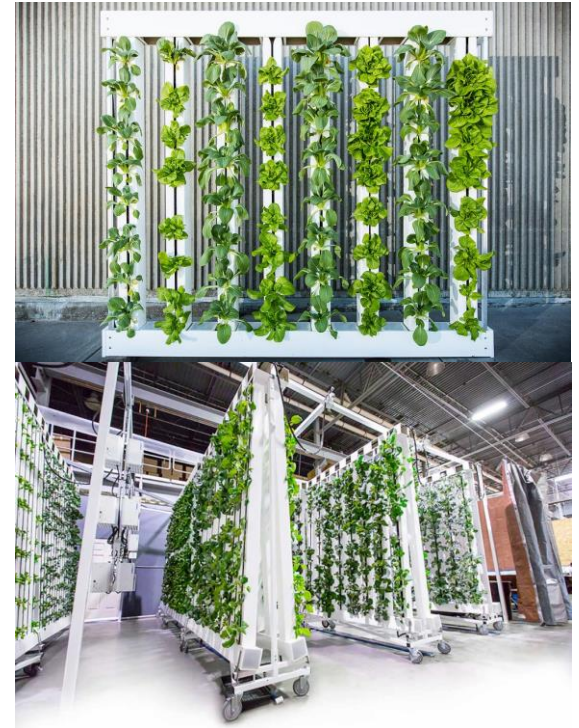
Example Comparison of Grow Ratios between Horizontal and Vertical Growing Methods:



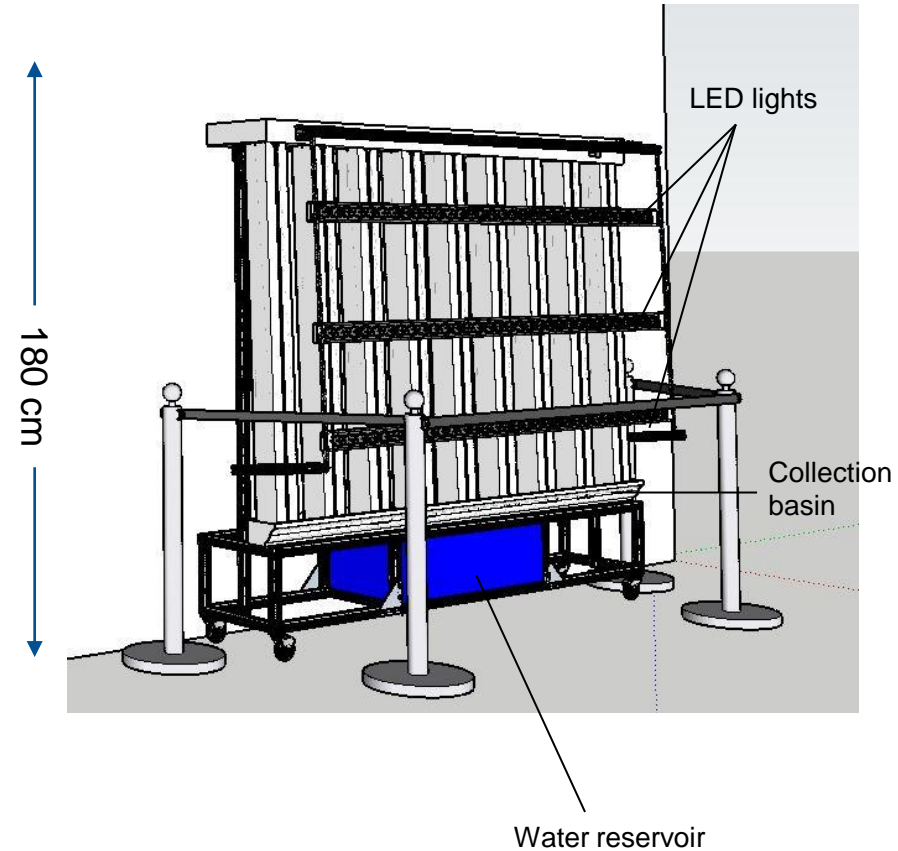
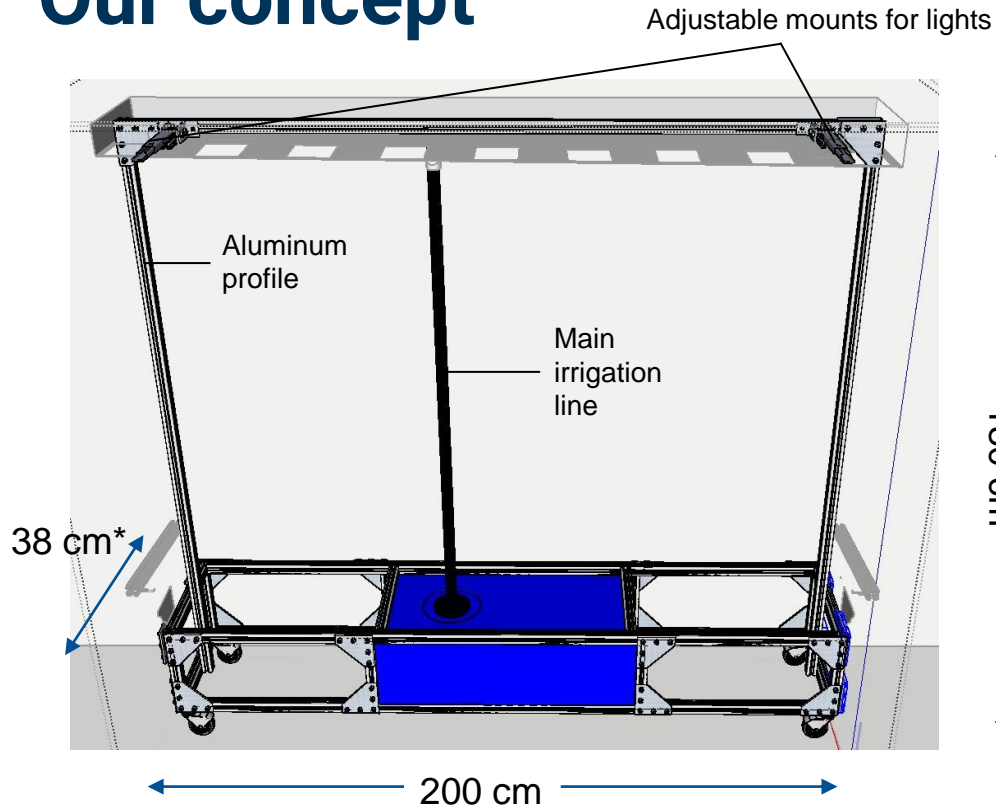
# Our concept



Inspiration for our design:

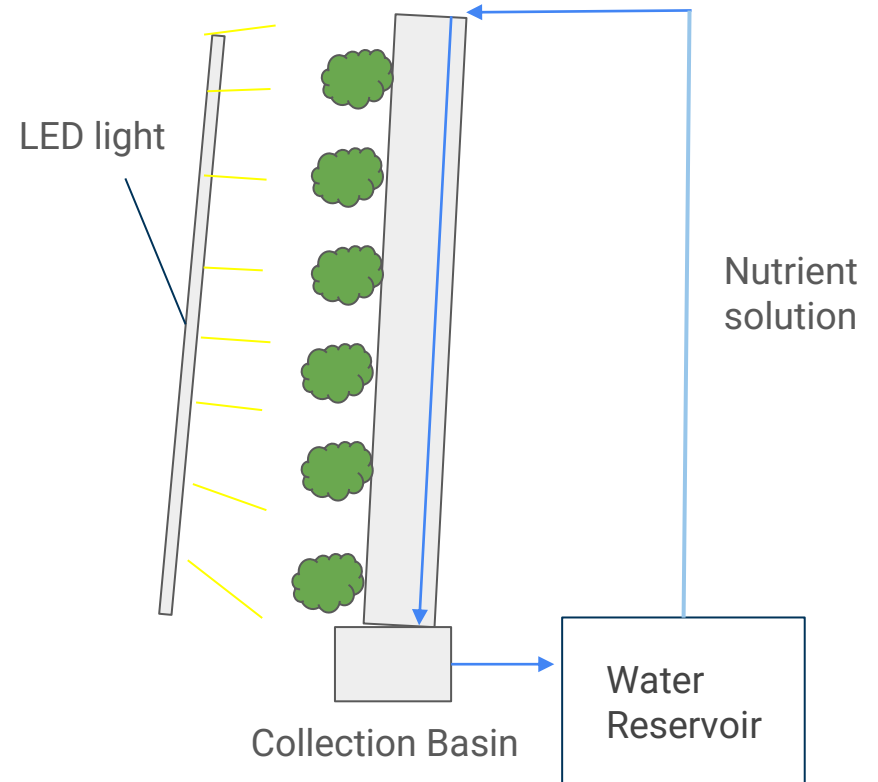
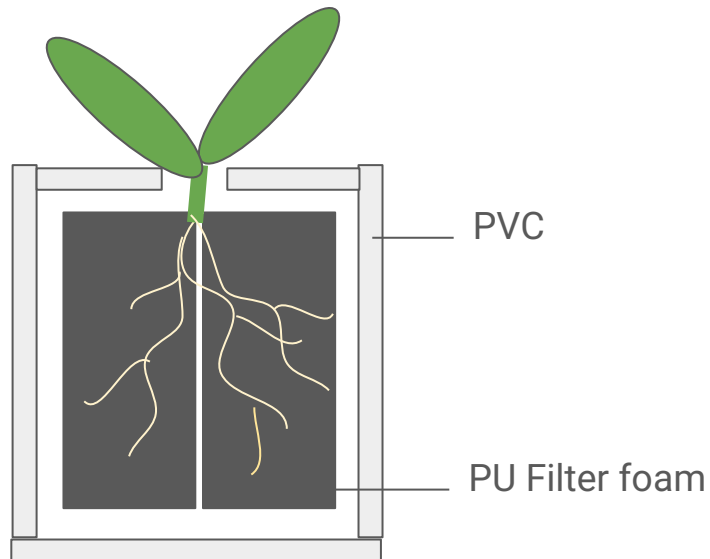


# Our concept



\* Max 88 cm with lights on one side  
Max 138 cm with lights on both sides

# How does it work?



# Lights

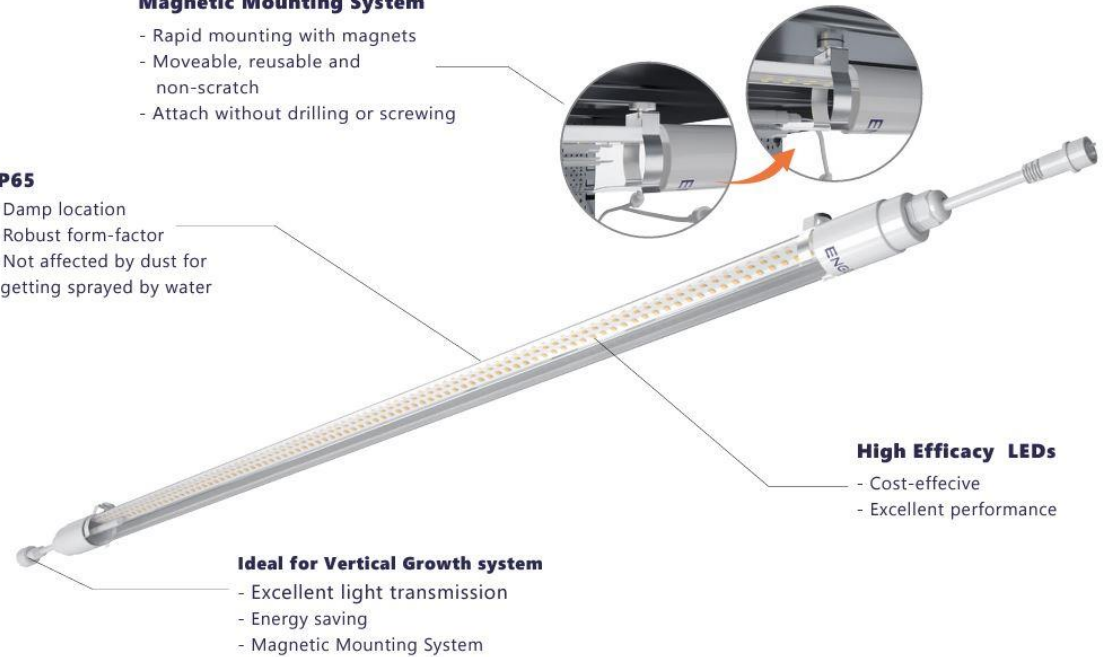


### Magnetic Mounting System

- Rapid mounting with magnets
- Moveable, reusable and non-scratch
- Attach without drilling or screwing

### IP65

- Damp location
- Robust form-factor
- Not affected by dust for getting sprayed by water



### High Efficacy LEDs

- Cost-effective
- Excellent performance

### Ideal for Vertical Growth system

- Excellent light transmission
- Energy saving
- Magnetic Mounting System

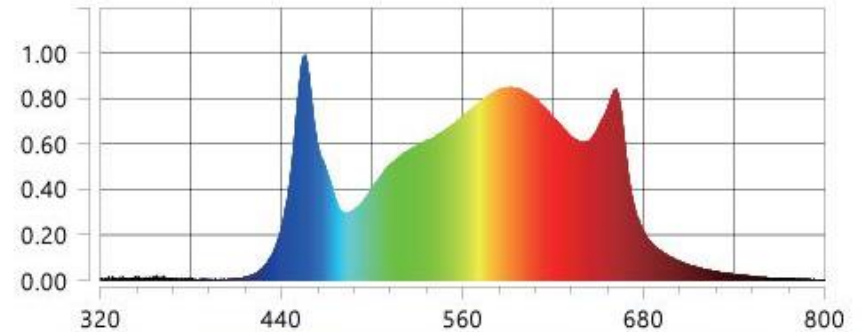
# Lights

Technical Specifications eGrow Tube	
Technical Specifications	eGrow Tube
Light Source	LED
Spectrum	Full spectrum
Input Voltage	220-240 Vac
Waterproof	IP65
Number of fixtures	1
PPF	52 $\mu$ mol
PPFD@30 cm	87 $\mu$ mol/m <sup>2</sup> s
Input Power @ 277V AC	20W
Dimensions (L x $\varnothing$ )	902mm X $\varnothing$ 28mm
Weight (with driver)	0.20kg
Thermal Management	Passive
Operating temperature	-14-104 °F(-25 - 40°C)
Dimming	Non Dimmable
Light Distribution	120°
Lifetime	@25°C L70 >50.000hrs
Power Factor	> 90%
AC Power Cord	5.2ft (1.6m)
Certifications	CE, RoHS
Warranty	3 years

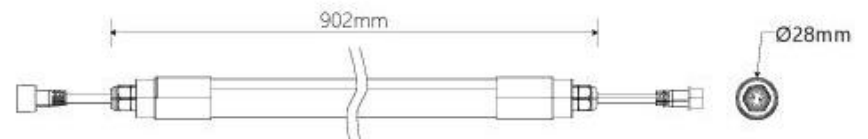
## Electical Specifications

Voltage	220-240V
Frequency	~50/60Hz

## Full Spectrum



## Fixture Mounting Dimensions



# Estimates of Energy Consumption

	Unit	Water Pump	LED Lights
no. of component		1	12
power consumption per component	W	10	20
operation time	h/day	4	12
energy consumption	kWh/day	0.04	2.88
energy consumption	kWh/year	14.6	1051.2
cost	€/year	5.11	420.5

assuming price of energy in Germany is 40cent/kWh

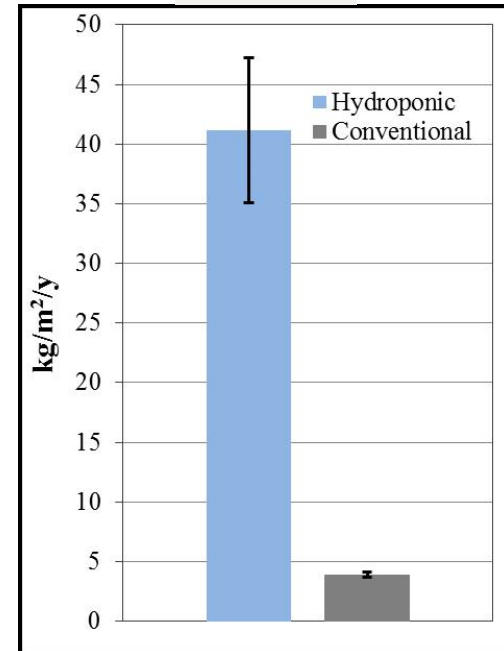
\*[https://www.kaufland.de/product/373899576/?search\\_value=pumpe](https://www.kaufland.de/product/373899576/?search_value=pumpe)

\*<https://engel-lighting.com/products/egrow-tube-led-pflanzenwachstumslampe>

# Crops and Yield

Yield per one grow tower (estimate):

- 11 kg/year of lettuce (6 towers) (butterhead “May Queen”, lollo rosso, oakleaf “Dubacek”, red-green lettuce “Carmina”)
- 14 kg/year of basil (2 towers)
- 34 kg/year of arugula (2 towers)



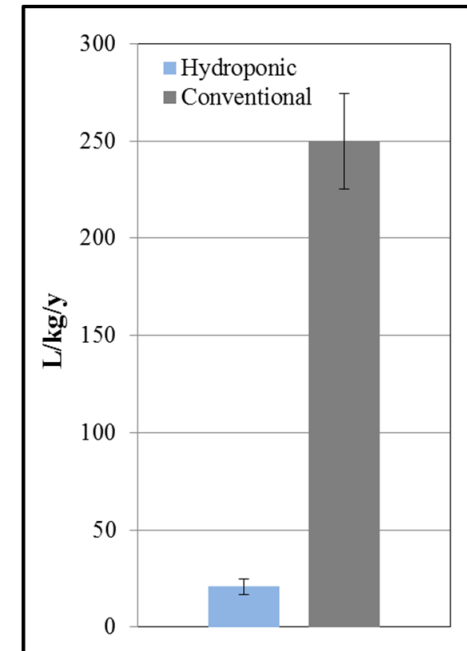
Modeled annual yield in kilograms per square meter of lettuce grown in southwestern Arizona using hydroponic vs. conventional methods (Error bars indicate one standard deviation).

# Estimates of Water Consumption



Our prototype

Water Reservoir Volume	L	64
Water lost to evaporation <i>(overestimate)</i>	%/day	1.5
<b>Water Loss</b>	L/day	0.96



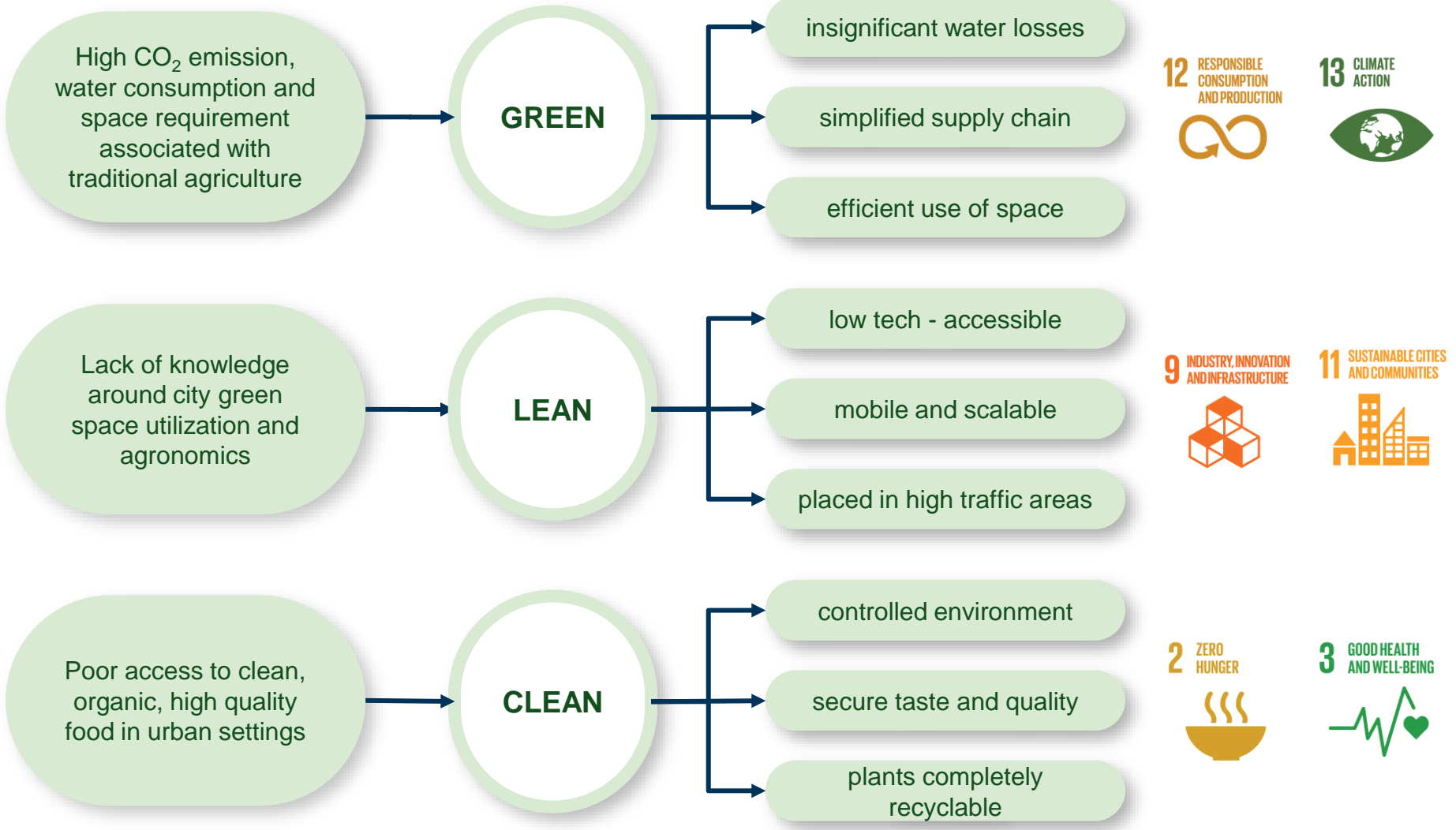
Modeled annual water use in liters per kilogram of lettuce grown in southwestern Arizona using hydroponic vs. conventional methods (Error bars indicate one standard deviation).

# General Safety Precautions

- CE compliance of electric and electronic components
- Rack is placed on wheels for mobility in case it needs to be moved temporarily
- Electrical wiring for the lights will be placed above and away from the irrigation lines in case of unforeseen dripping or leaks
- Chemicals used for fertilization and maintenance should be kept in a locked space and MSDS standards must be followed
- Water reservoir should be handled with caution to avoid spillage and potential hazards
- To prevent unwanted moving of a rack and touching of the plants from passersby, but maintain presentational visibility, it is recommended to have the area taped-off, much like the current display in the location is now
- A safety sheet must be placed in a visible location to inform people about potential hazards

# PROBLEM

# SOLUTION



# Roadmap

Phase 1:  
Vertical  
Farming on  
Campuses

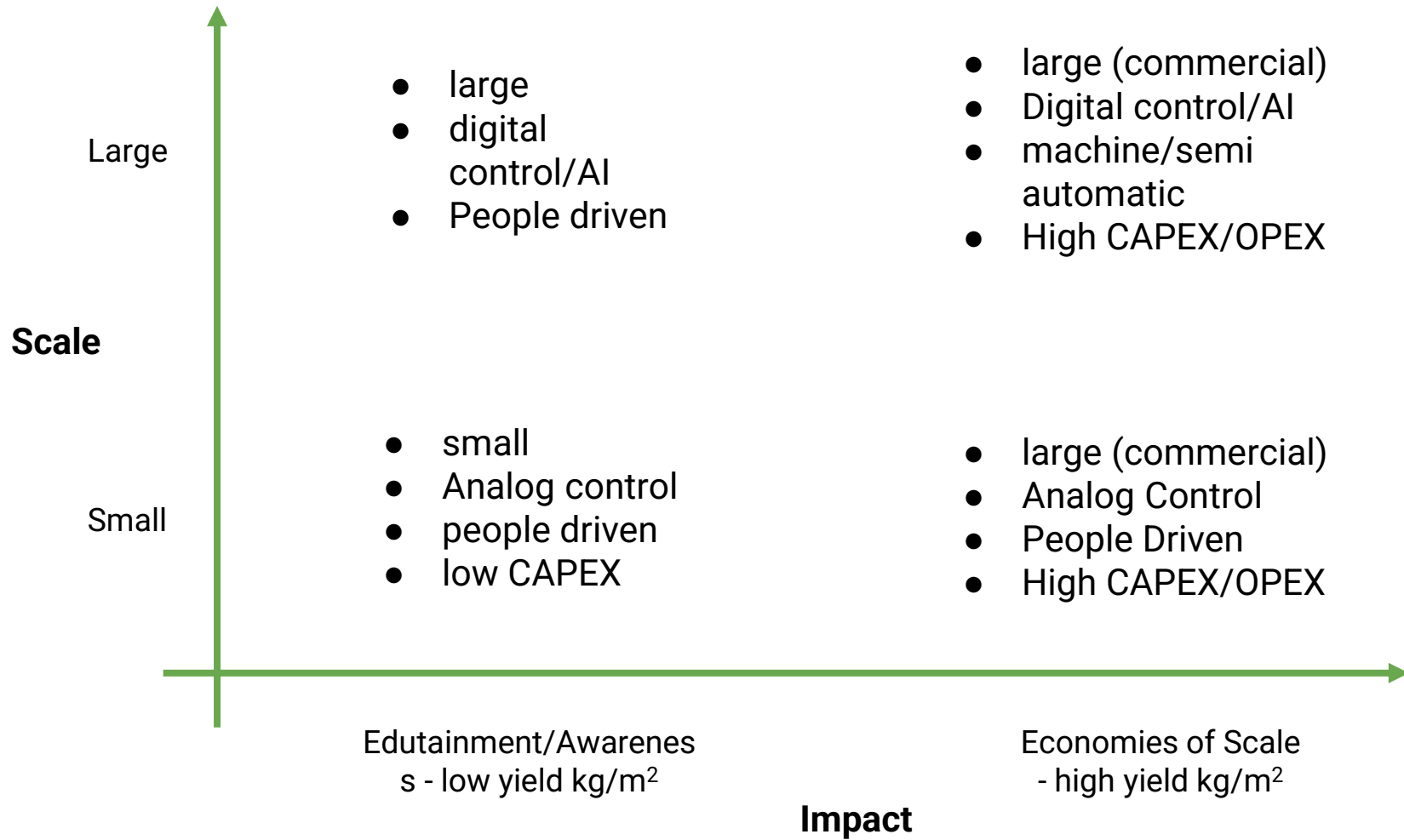
Phase 2:  
Targeting  
urban  
communities

Phase 3:  
Policies &  
long-term  
solutions

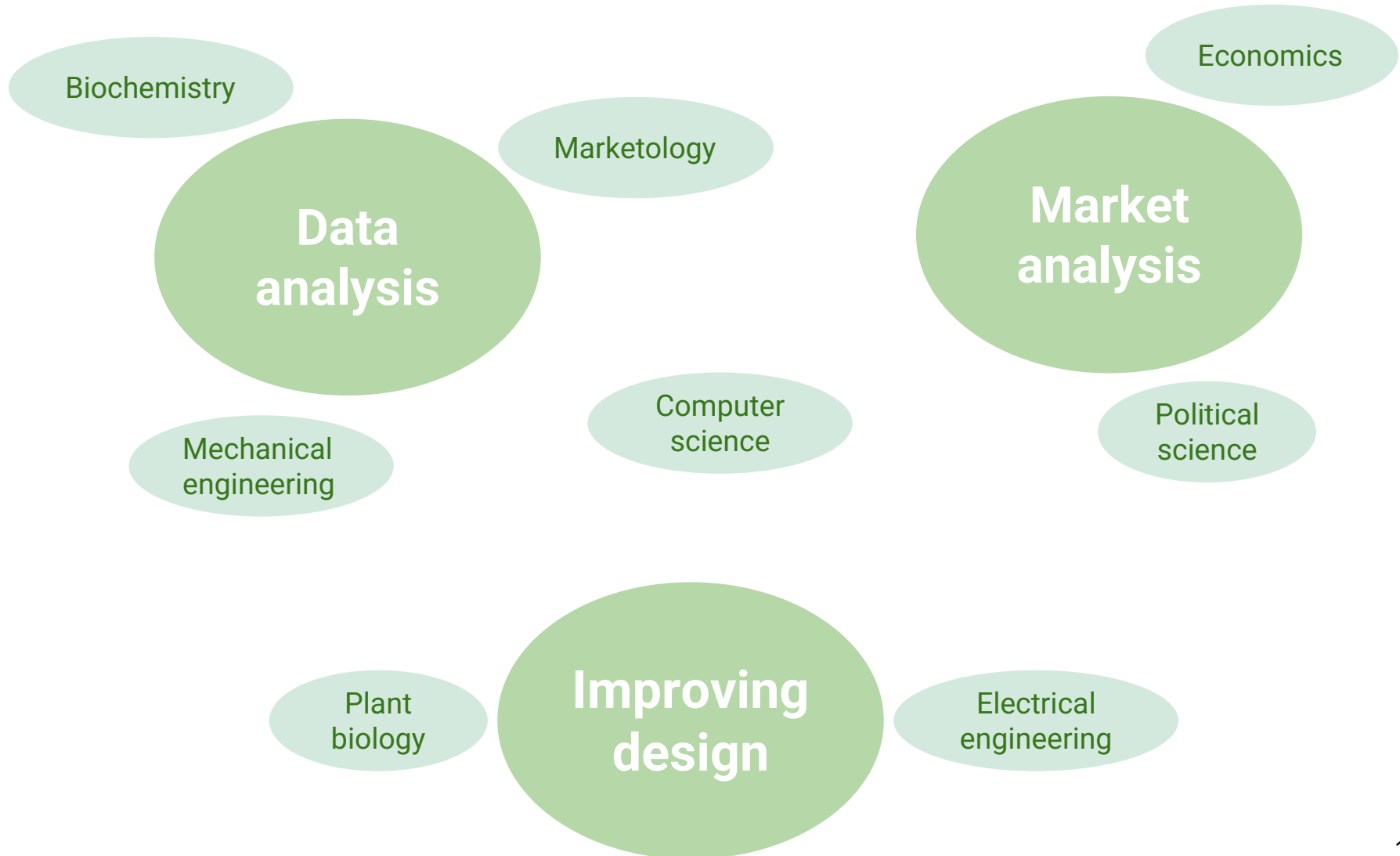
# Target Groups



# Scalability



# Future steps



Thank you for your attention!

