PlantLab

seven misconceptions

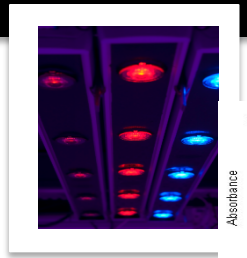
about vertical farming

and how we deal with them

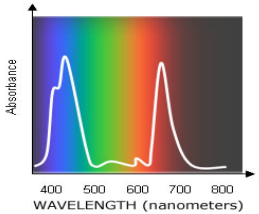
misconception #1

We must make plants adapt to nature.

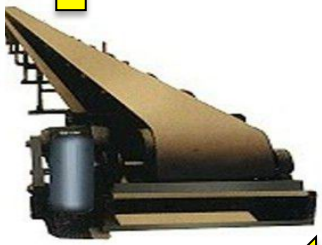
9%



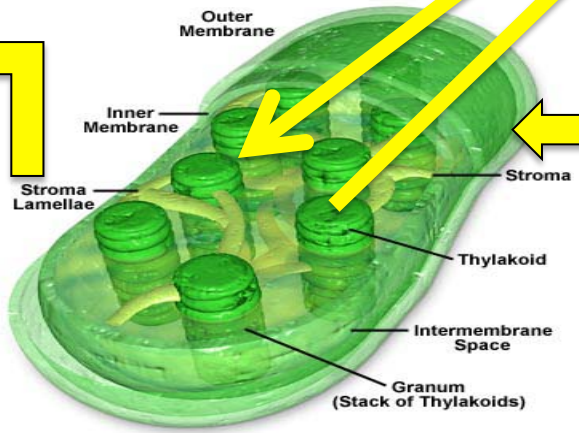
light



fruit



sugars



O_2

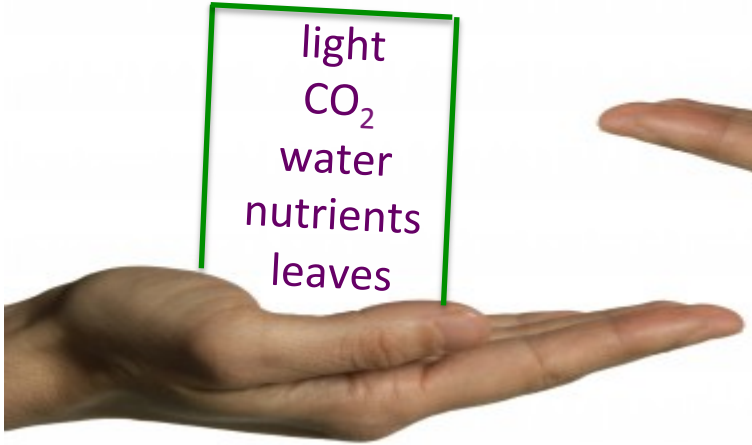
H_2O

CO_2

H_2O

nutrients

1989 nature = mathematics



```
> x:=(3*a*b^2-5*a^2*b)/(a^4-2);
```

$$x := \frac{3\,a\,b^2 - 5\,a^2\,b}{a^4 - 2}$$

```
> int(x,a);
```

$$\frac{3}{8}\,b^2\sqrt{2}\,\ln\left(\frac{-2+a^2\sqrt{2}}{-2-a^2\sqrt{2}}\right) - \frac{5}{4}\,b\,2^{3/4}\arctan\left(\frac{1}{2}\,a\,2^{3/4}\right) + \frac{5}{8}\,b\,2^{3/4}\ln\left(\frac{a+2^{1/}}{a-2^{1}}\right.$$

```
> diff(",a);
```

$$\frac{3}{8}\,\frac{b^2\sqrt{2}\left(2\,\frac{a\sqrt{2}}{-2-a^2\sqrt{2}} + 2\,\frac{\left(-2+a^2\sqrt{2}\right)a\sqrt{2}}{\left(-2-a^2\sqrt{2}\right)^2}\right)\left(-2-a^2\sqrt{2}\right)}{-2+a^2\sqrt{2}} - \frac{5}{4}\,\frac{b}{1+}$$

$$+\frac{5}{8}\,\frac{b\,2^{3/4}\left(\frac{1}{a-2^{1/4}} - \frac{a+2^{1/4}}{\left(a-2^{1/4}\right)^2}\right)\left(a-2^{1/4}\right)}{a+2^{1/4}}$$

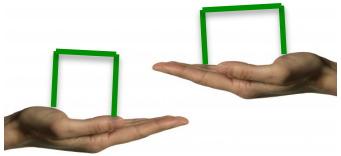
```
> simplify(");
```

$$-2\,\frac{b\,a\left(-3\,a^2\,b + 3\,b\sqrt{2} - 5\,a\sqrt{2} + 5\,a^3\right)}{\left(a+2^{1/4}\right)\left(a-2^{1/4}\right)\left(-2+a^2\sqrt{2}\right)\left(2+a^2\sqrt{2}\right)}$$

$$0$$

Roadmap of PlantLab

Balance 1989



Maths <1999

```
> x:=(3*a*b^2-5*a^2*b)/(a^4-2);
```

$$x := \frac{3\,a\,b^2 - 5\,a^2\,b}{a^4 - 2}$$

```
> int(x,a);
```

$$\frac{3}{8}\,b^2\,\sqrt{2}\,\ln\left(\frac{-2+a^2\,\sqrt{2}}{-2-a^2\,\sqrt{2}}\right) - \frac{5}{4}\,b\,2^{1/4}\,\arctan\left(\frac{1}{2}\,a\,2^{1/4}\right) + \frac{5}{8}\,b\,2^{1/4}\,\ln\left(\frac{a+2^{1/4}}{a-2^{1/4}}\right)$$

```
> diff(%,a);
```

$$\frac{3}{8}\,\frac{b^2\,\sqrt{2}\left(2\,\frac{a\,\sqrt{2}}{-2-a^2\,\sqrt{2}} + 2\,\frac{\left(-2+a^2\,\sqrt{2}\right)a\,\sqrt{2}}{\left(-2-a^2\,\sqrt{2}\right)^2}\right)\left(-2-a^2\,\sqrt{2}\right)}{-2+a^2\,\sqrt{2}} - \frac{5}{4}\,\frac{b\,\sqrt{2}}{1+\frac{1}{2}\,a^2\,\sqrt{2}} + \frac{5}{8}\,\frac{b\,2^{1/4}\left(\frac{1}{a-2^{1/4}} - \frac{a+2^{1/4}}{\left(a-2^{1/4}\right)^2}\right)\left(a-2^{1/4}\right)}{a+2^{1/4}}$$

```
> simplify(%);
```

$$-2\,\frac{b\,a\left(-3\,a^2\,b+3\,b\,\sqrt{2}-5\,a\,\sqrt{2}+5\,a^2\right)}{\left(a+2^{1/4}\right)\left(a-2^{1/4}\right)\left(-2+a^2\,\sqrt{2}\right)\left(2+a^2\,\sqrt{2}\right)}$$

```
> simplify(% - x);
```

$$0$$

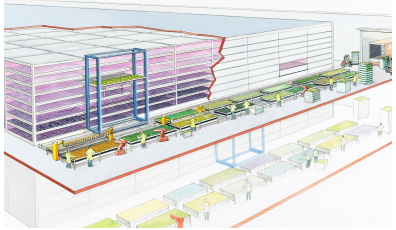
Pilot 2006

Patent 2008

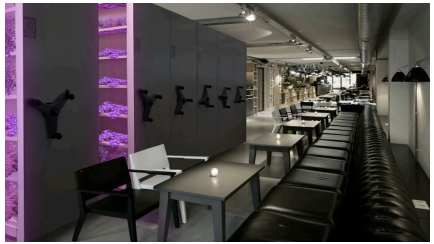
R&D 2009

Prototypes 2010

Engineering 2011



Market 2012



misconception #2

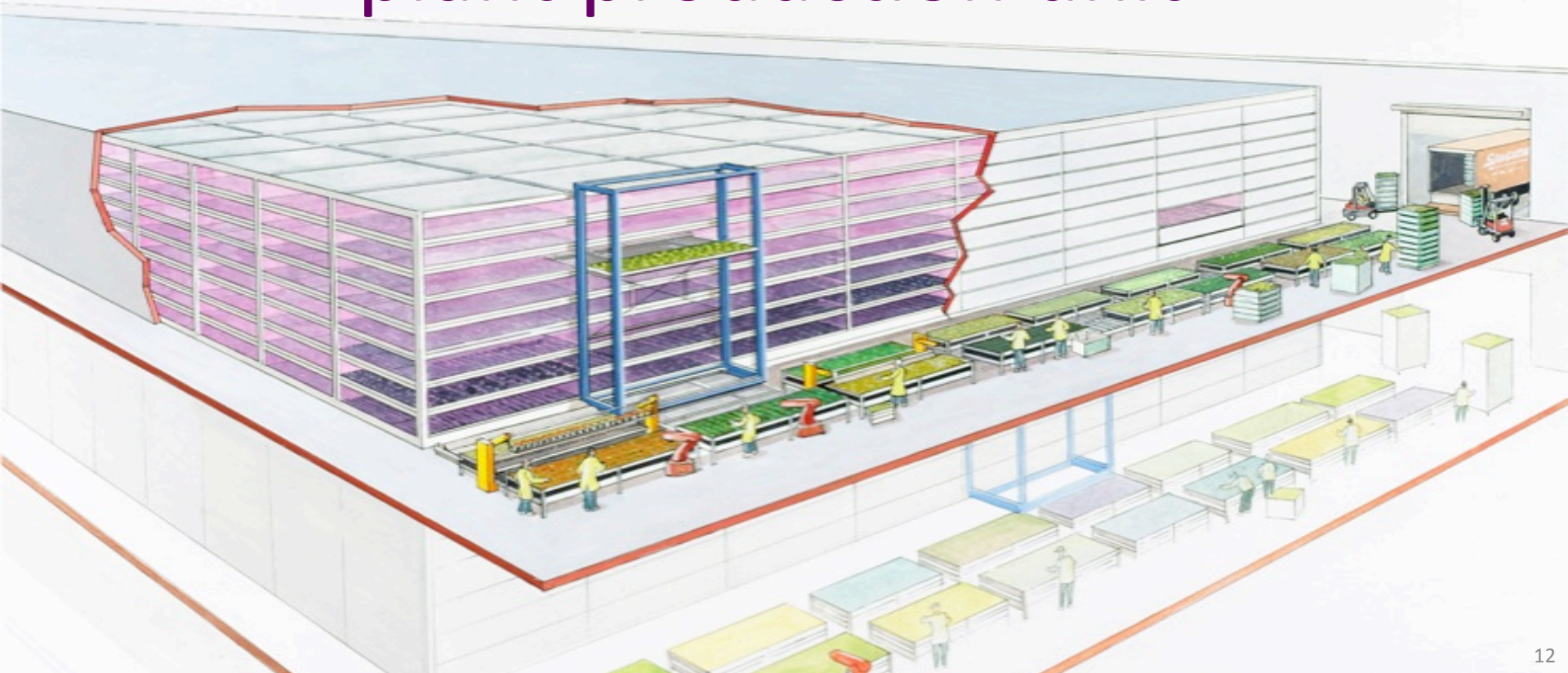
This is paradise for plants.

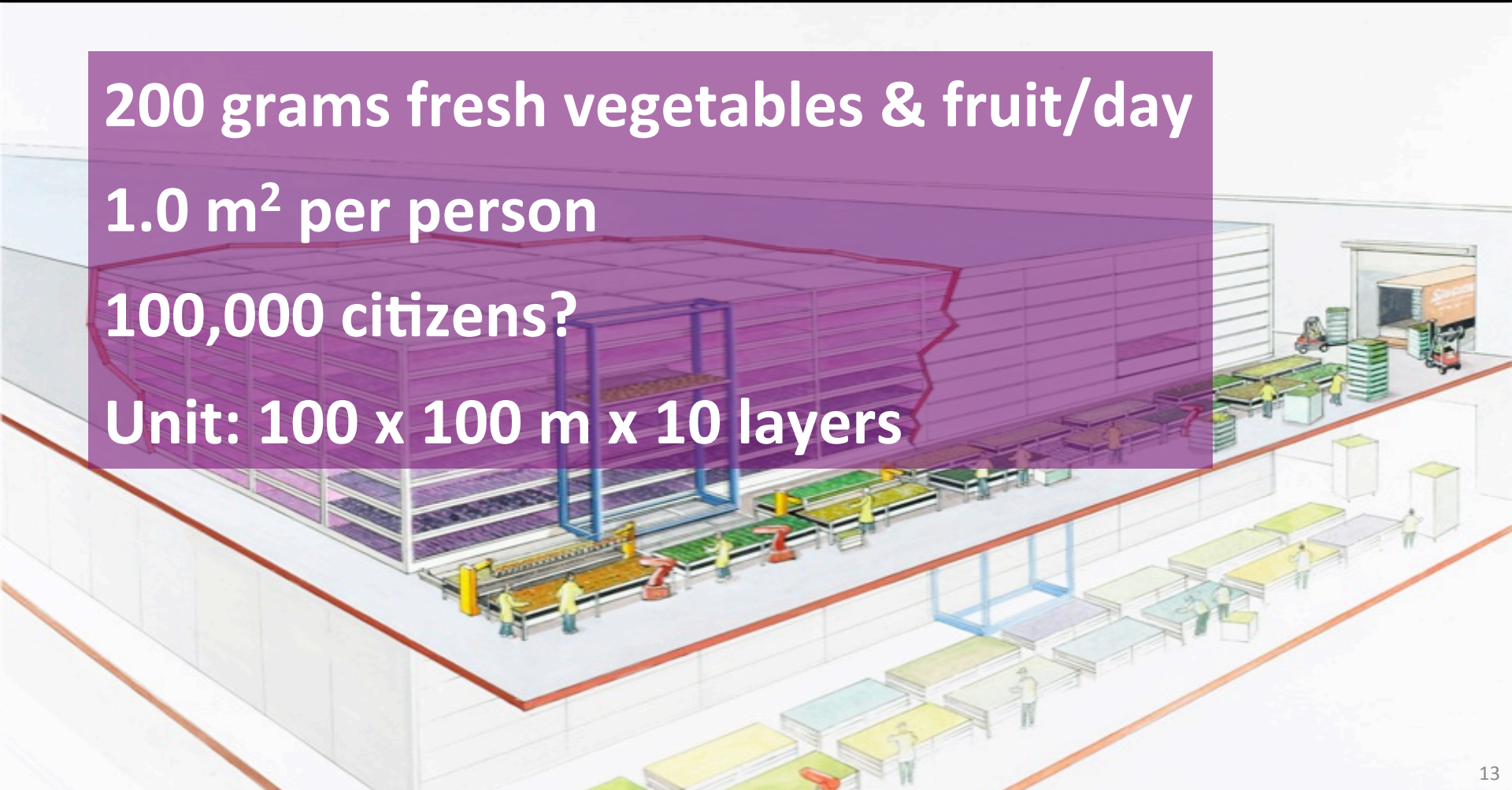
Challenges in Vertical Farming

plant paradise

plant paradise

plant production unit





200 grams fresh vegetables & fruit/day

1.0 m^2 per person

100,000 citizens?

Unit: 100 x 100 m x 10 layers

Growing:

secure & safe

beautiful & nutricious

great taste

higher yields

90% water savings

no pesticides

misconception #3

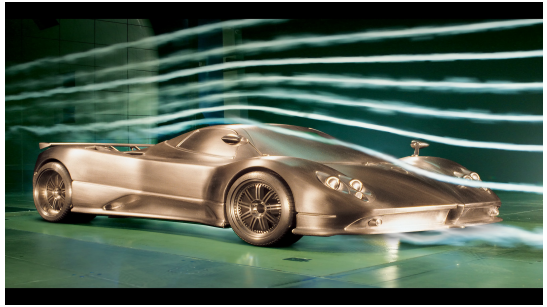
Growing food takes a lot of water and pesticides.

- Red
- Blue
- Far Red
- Infra Red
- Temperature
- Root temperature
- CO_2
- Humidity
- Airflow
- Nutrients
- Water

Plant-ID

The emancipation of the plant

Tell us, what kind of a plant are you?



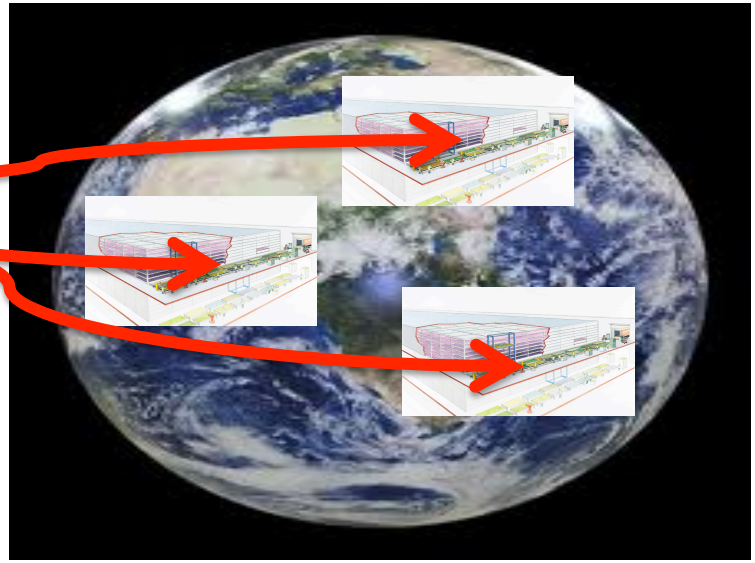
Growing Recipes Customized

We will bring you there safely…

Don’t touch the steering wheel…

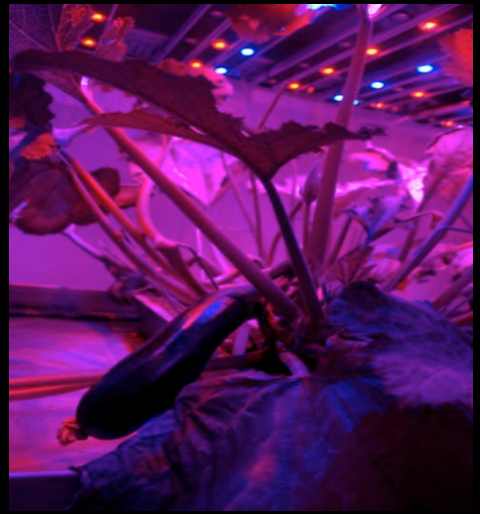
Houston Control

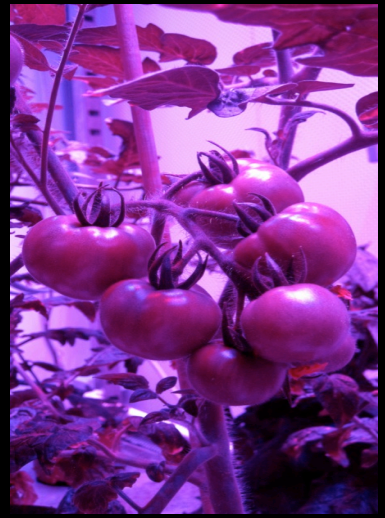
PlantLab® Inside



10 Growing Recipes for Basil

Challenges in Vertical Farming





Challenges in Vertical Farming

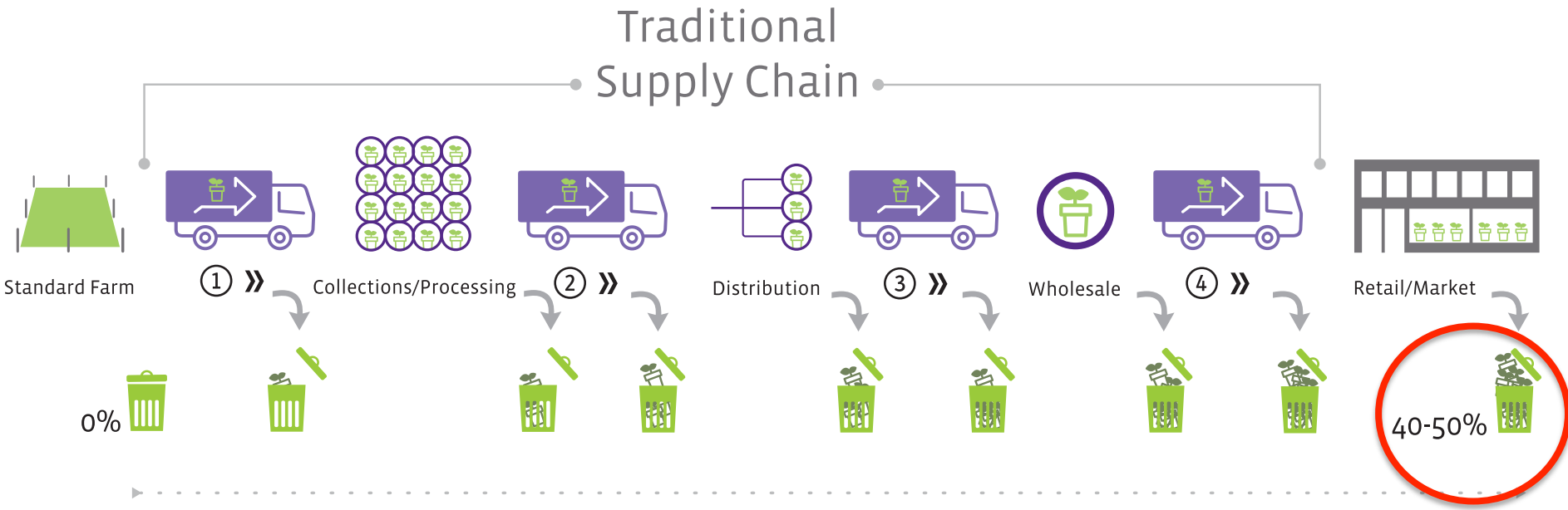
Challenges in Vertical Farming

Challenges in Vertical Farming

misconception #4

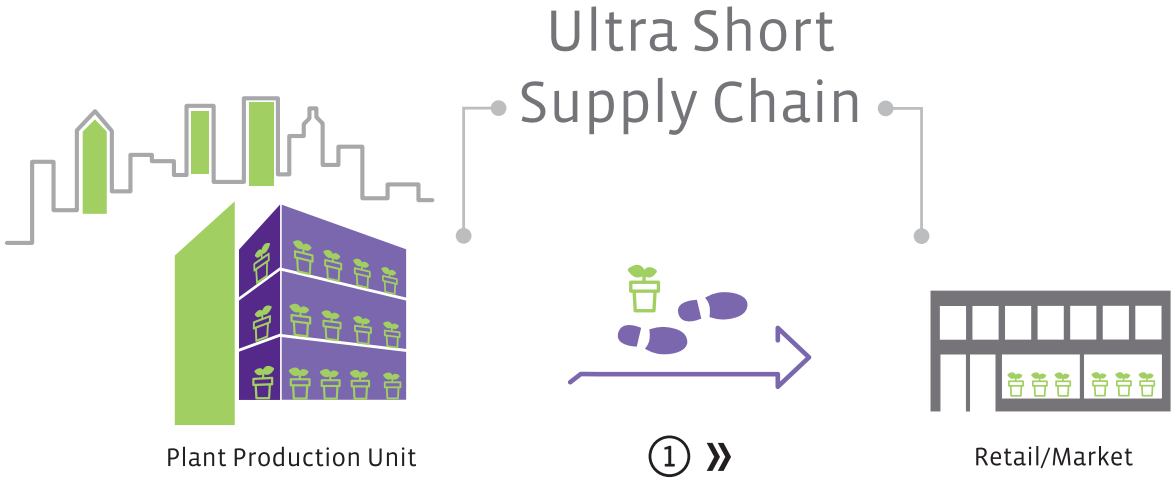
Food must grow where nature is kind to it and then be transported to where we live.

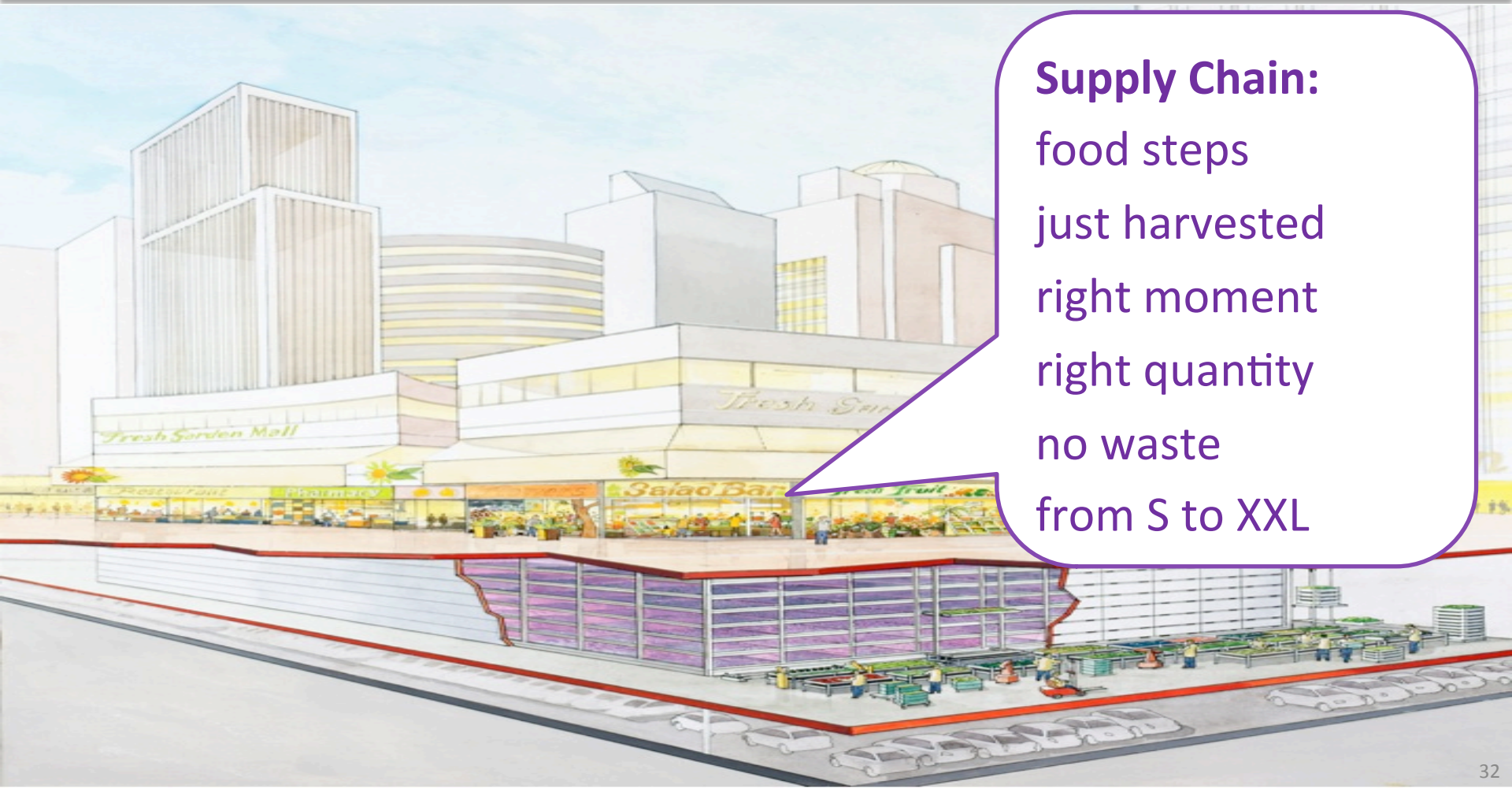
Challenges in Vertical Farming



50%

Challenges in Vertical Farming





Supply Chain:

food steps

just harvested

right moment

right quantity

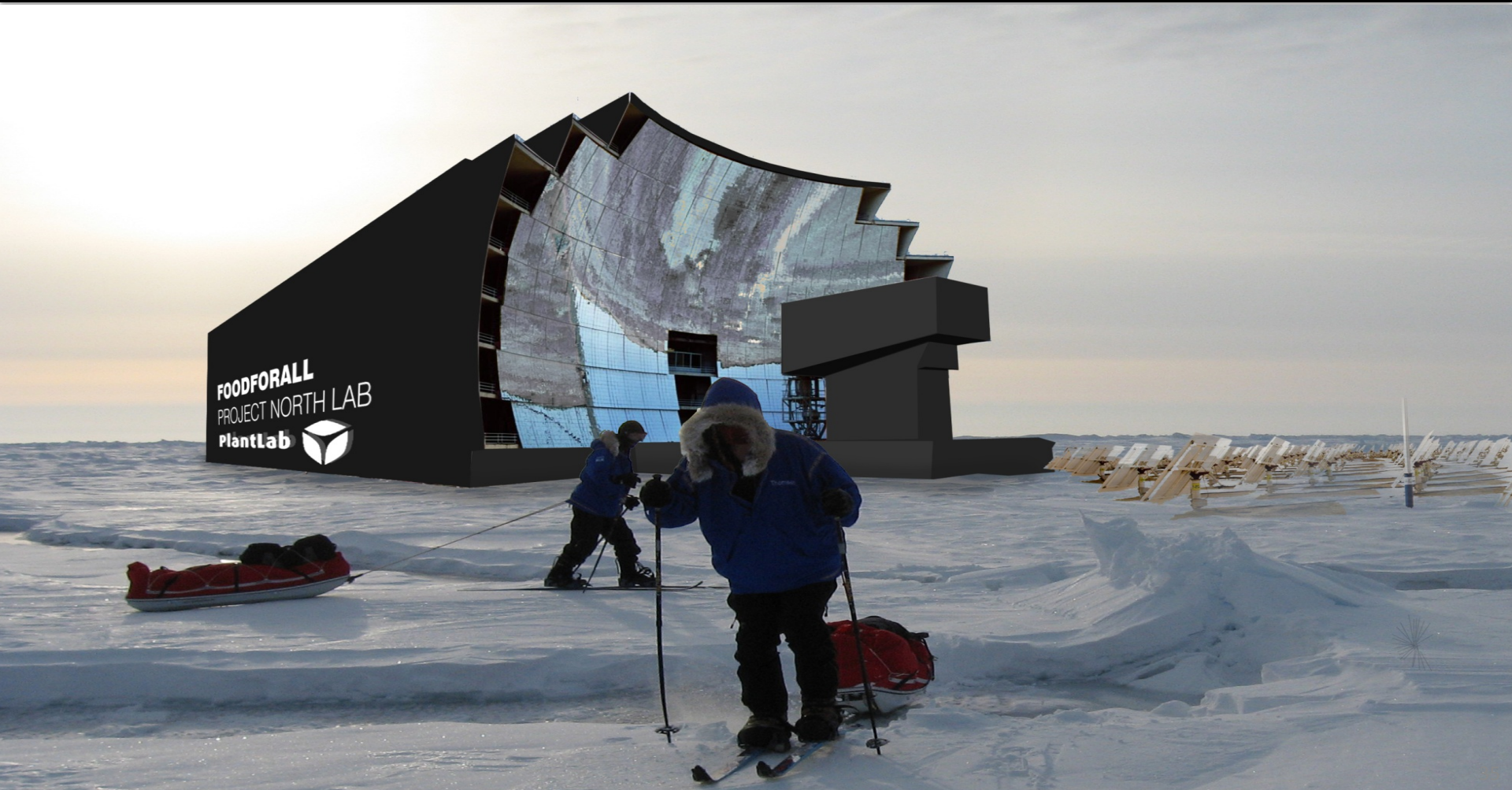
no waste

from S to XXL

no matter what climate….
no matter what season….
no matter day or night….
no matter what location…

Challenges in Vertical Farming

Challenges in Vertical Farming



Challenges in Vertical Farming

misconception #5

Food must be grown large scale.

MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
Pankiare groenten
Gesneden sla

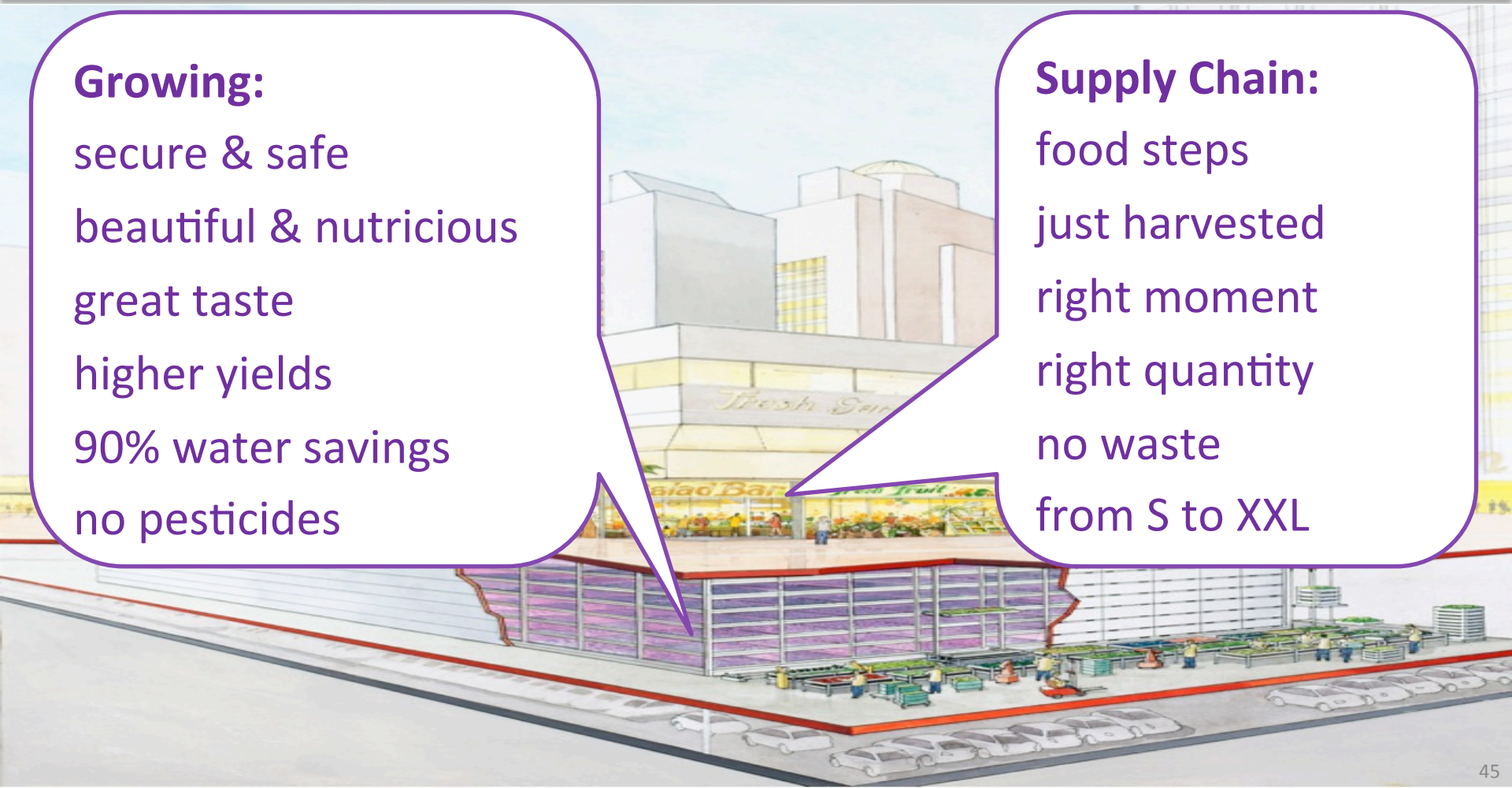
Challenges in Vertical Farming

Challenges in Vertical Farming

Challenges in Vertical Farming

misconception #6

Vertical Farming is just another way of growing.



Growing:

secure & safe

beautiful & nutricious

great taste

higher yields

90% water savings

no pesticides

Supply Chain:

food steps

just harvested

right moment

right quantity

no waste

from S to XXL

0%

misconception #7

It will take years before this is going to happen.

Challenges in Vertical Farming

BALL PARK FIGURES	2012	Step 1	Step 2	Step 3	Step 4
	Today	<18 months LED prices	<3 years LED prices	<3 years LED performance	<3 years PlantLab performance
		-50%	-50%	+50%	+50%

BALL PARK FIGURES Tomatoes@PlantLab	2012 Today	Step 1 <18 months LED prices	Step 2 <3 years LED prices	Step 3 <3 years LED performance	Step 4 <3 years PlantLab performance
Electricity		-50%	-50%	+50%	+50%
kWh/kg tomatoes	23	23	23	11	8
Index	100%	100%	100%	50%	33%

$ 2,80/kg = € 1,26/lb

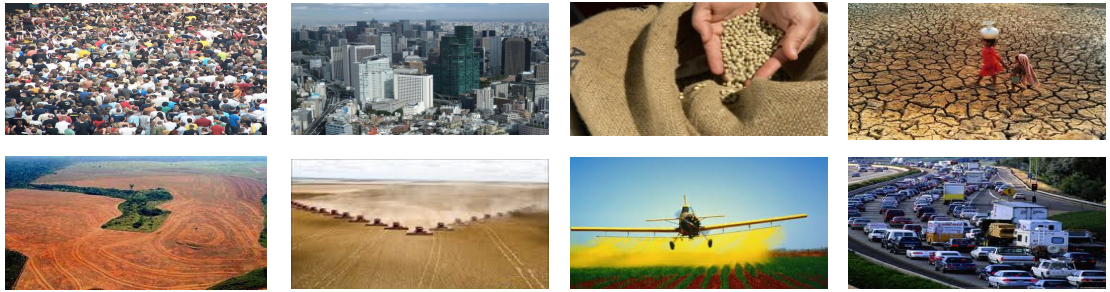
BALL PARK FIGURES Tomatoes@PlantLab	2012 Today	Step 1 <18 months LED prices	Step 2 <3 years LED prices	Step 3 <3 years LED performance	Step 4 <3 years PlantLab performance
Costprice		-50%	-50%	+50%	+50%
Costprice ($/kg tomatoes)	7,02	6,08	5,61	3,80	2,80
Index	100%	87%	80%	54%	40%

$ 2,80/kg = € 1,26/lb
ORGANIC
Canada
Tomatoes On The Vine
This juicy favorite is rich in fiber, beta-carotene, vitamins C, K, E and B6, potassium manganese, thiamin, niacin, folate, magnesium, phosphorus and copper. And it's the very best source of lycopene, a powerful antioxidant.
ANDI SCORE 190
$4.99/lb
Waxed Produce
Some of our fruits and vegetables are waxed to maintain freshness.
A food grade petroleum, beeswax or shellac-based wax is used.
Commonly Waxed Fruits

9 billion

Our Challenge

Vertical Farming



We have to feed the world in a much smarter way!