The future of high performance crop management

by: ***Tony Bundock***
Powerplants Australia Pty Ltd

Leading the way and how…

MODERN AGRICULTURE / HORTICULTURE

- How the public see us

MODERN AGRICULTURE / HORTICULTURE

- The reality - Multi billion dollar industry which embraces protected cropping & technology

Field grown vs Greenhouse ?

Commercial Tomato Production	Open Field Production	Greenhouse Production
Production	5kg /m^2/year	70kg /m^2/year
Water usage	60 litres/kg	5 litres/kg

The modern greenhouse

The modern greenhouse


EXIT

MODERN GROWING

- Allows for control of all aspects of growing to a finite level – Precision Growing

- Control of Irrigation / EC / pH / Temperature / Light / CO2 / Humidity / Labour registration

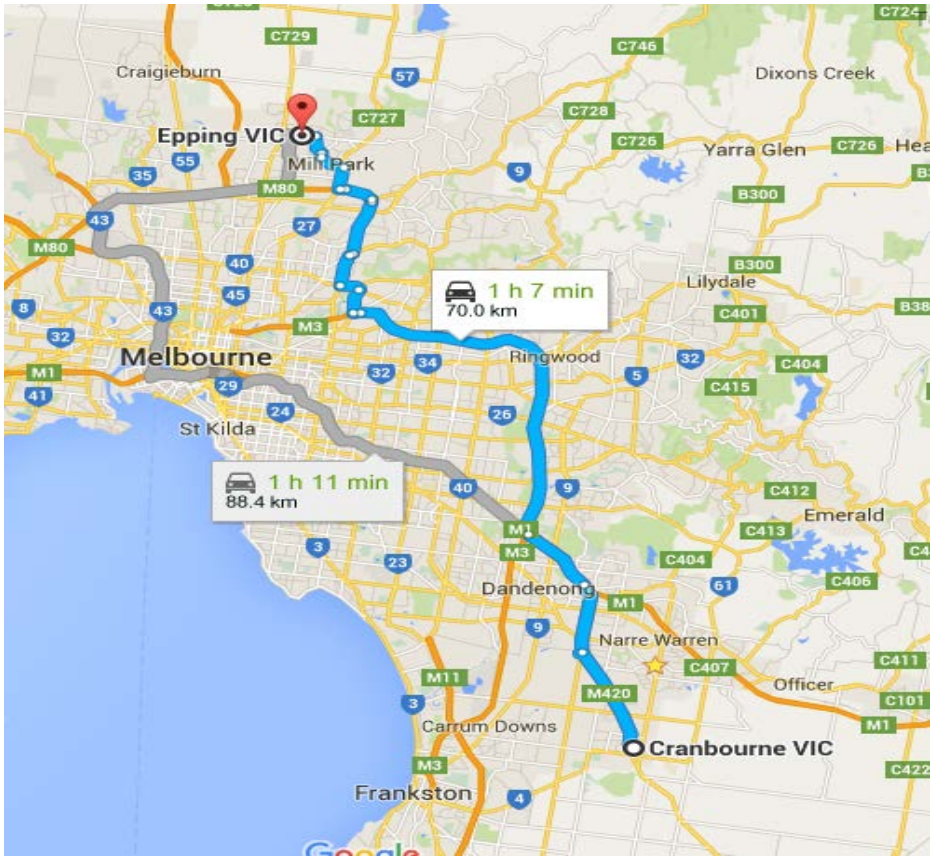
MODERN GROWING

- Controlled by a process computer

Limitations of Outdoor and Greenhouse growing

- Rural locations –

"food miles"

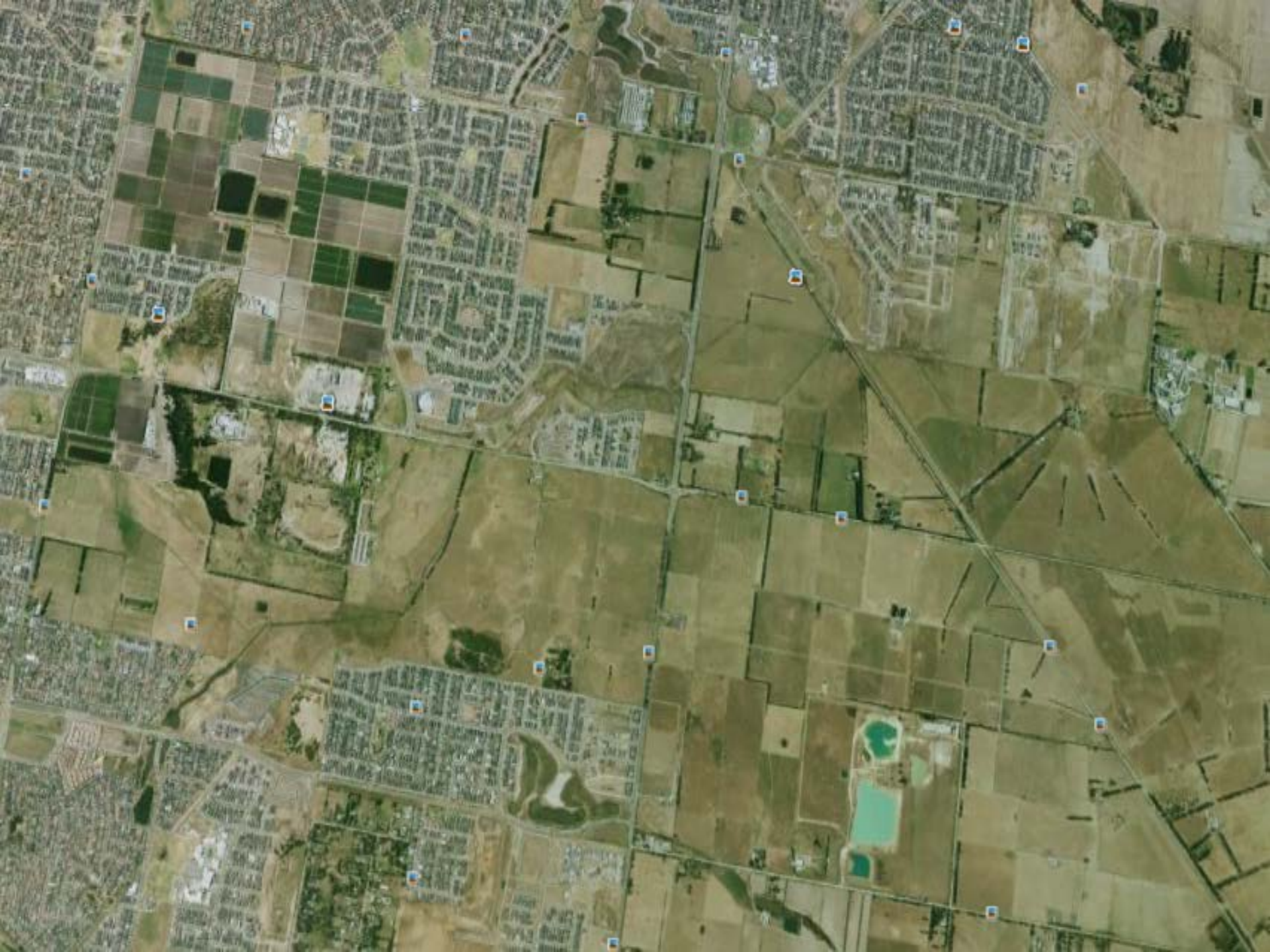


Limitations of Outdoor and Greenhouse growing

- Rural locations – “food miles”
- Relatively large areas of land required
- Capital intensive
- The urban sprawl

Limitations of Outdoor and Greenhouse growing

- The urban sprawl
- City of Casey – 12 new homes a week
- Use of agricultural land for building
- Ultimate population growth world wide – more mouths, less food……



Vertical Farming

- The next step forward…….

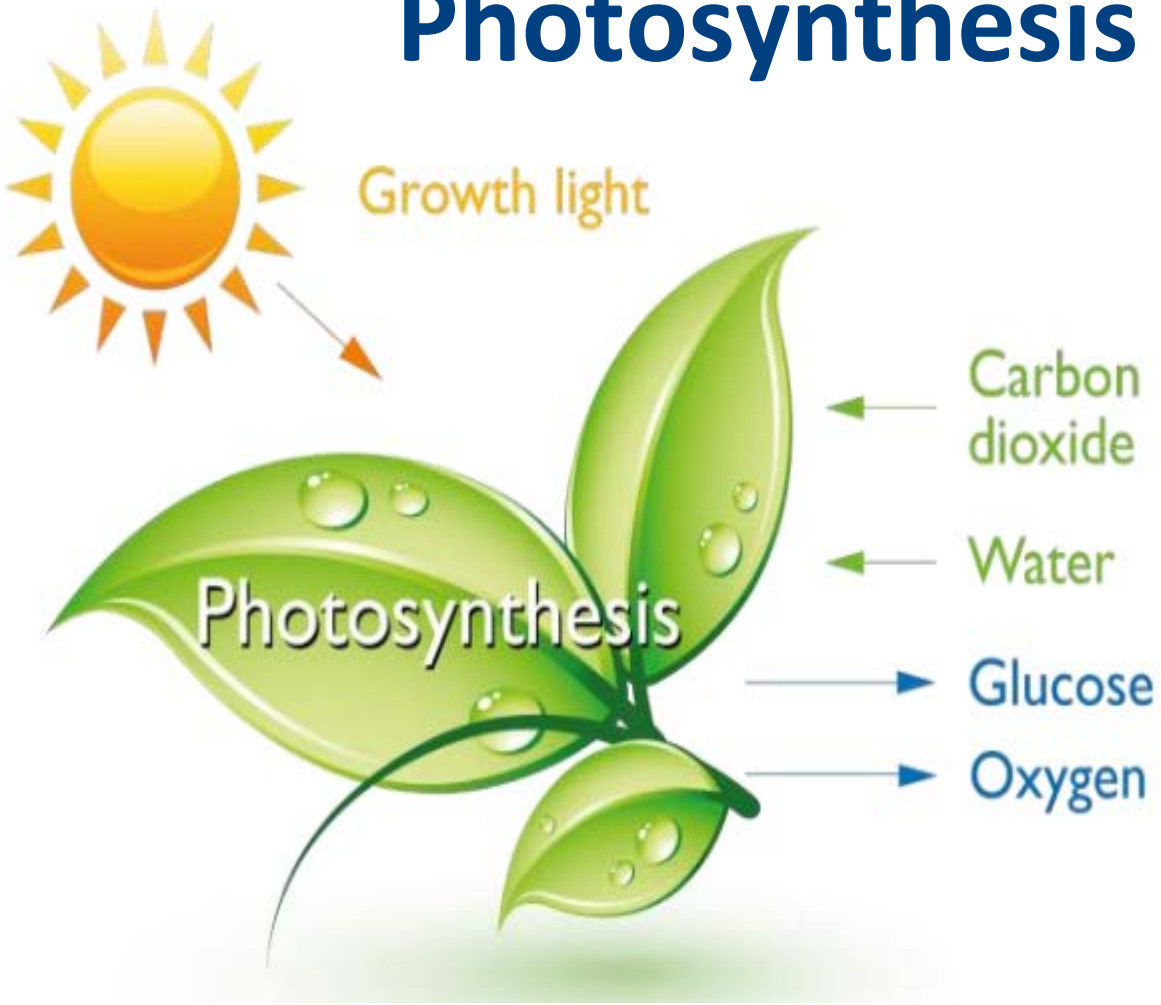
Vertical Farming – The Concept

- Capability of growing in non traditional horticultural buildings
- Utilizes technology for climate control
- Precision growing of vegetable crops
- Hygienic growing conditions – minimal pest and disease issues – nil spraying
- Soilless growing

Vertical Farming – The Concept

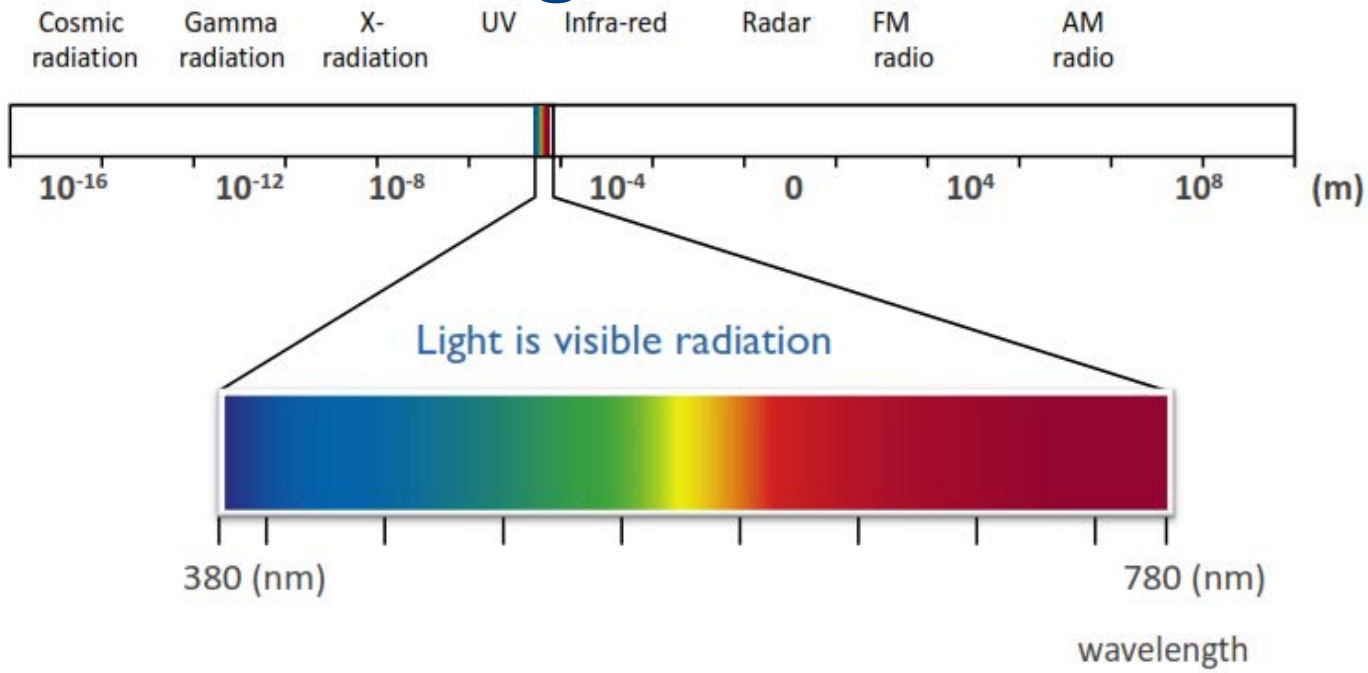
- But where's the sunlight???!!!!

Photosynthesis



What exactly is light?

Light is the visible part of the spectrum in electromagnetic radiation

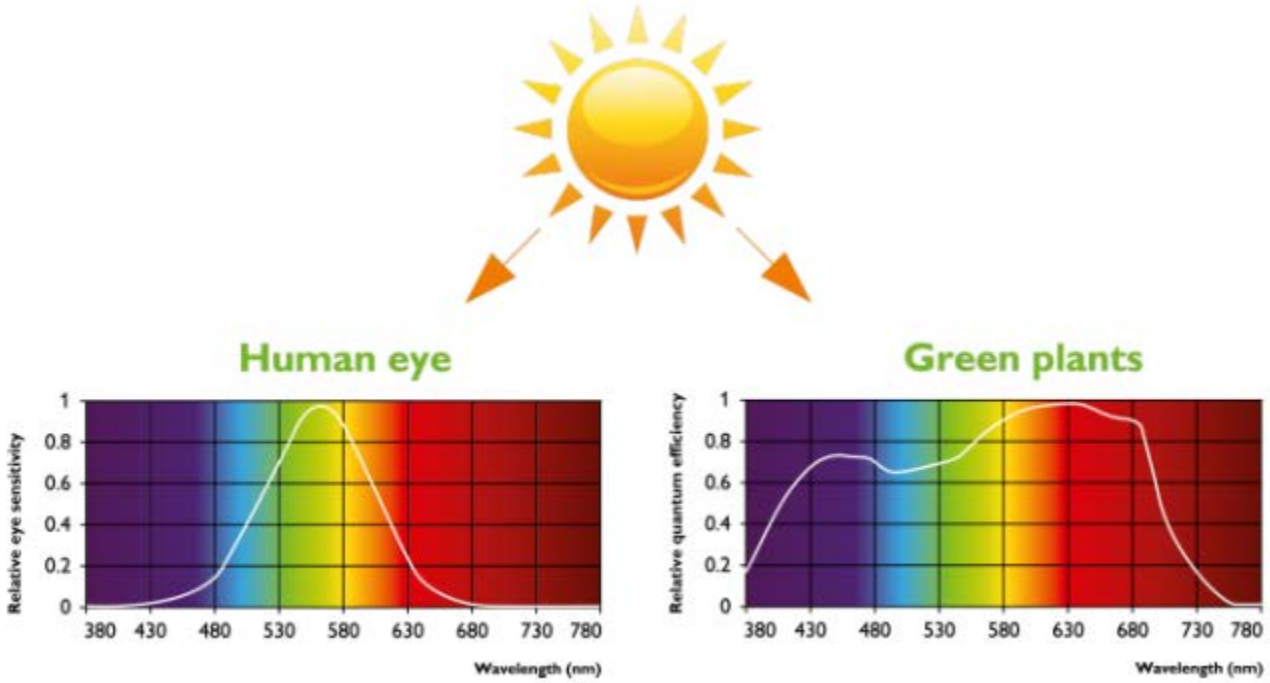


What exactly is light?

Light consists of colours

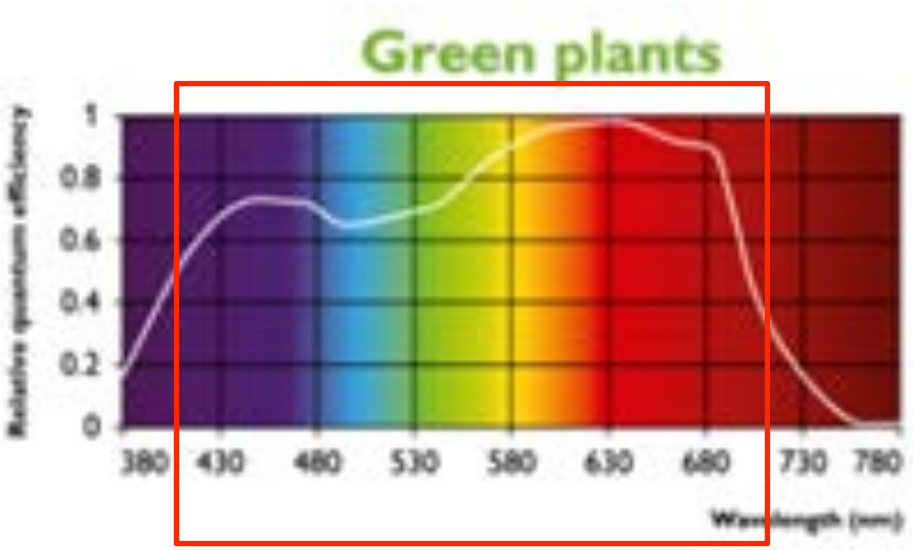
What exactly is light?

Plants see light differently than we do



Photosynthetic Active Radiation

The number of photons per second in between 400-700nm, called PAR area, indicated in micromol/s (µmol/s).



How can we access this light?

- Use of Light Emitting Diodes - LED lighting

Light spectrum

Light colour and plant development

Blue light can lead to:
More compact plants as blue light level increases.
More dark colour leaf and flower
(100% blue will stretch plants)

Light Spectrum

Light colour and plant development

Red/Far red light can lead to:
More stretch in plants as red light level increases.
Effect on Flowering
Effect on Germination

What gives effective lighting?

1. Timing and Duration

2. Positioning – light interception

3. Alignment of light level/spectrum to climate/plant activity at specific moments

Why use LED lighting?

- Uses less energy than other types of lighting
- Choice of spectrum & intensity
- No Infra Red (IR) = no heat radiation
- Uniform Light distribution (spread)

What lights are around?

1. Deep Red / Blue
2. Deep Red / White
3. Deep Red
4. Deep Red / Blue / Far Red
5. Far Red

Lighting = High Electricity Costs?

- Can utilise cheaper night time rates – you denote when night time is for the plants!

Case Study - Fujitsu

Case Study - Fujitsu

Utilising factory area that used to make computer chips

- Operates 365 days of the year
- Seedling to harvest – 35 days
- (outdoor 70/90 days)
- Produces 10,000 head of lettuce per day

Case Studies

Virolan Puutarha
Location - Kangasala, Finland

Case Studies

Challenge – increase efficiency of existing growing area 4000 sq metres

Solution – layering of crop area – additional 3 – 4 layers, 50cm apart.

Total increase of 300% of growing area and potential production

Case Studies

$200,000 investment
vs
300% increase in production

Good or bad decision?

The future?

System not suited for all food types

Limited uptake in Australia so far

The key players to encourage development

The future?

ALDI

LIDL

The future?

Technology the driver…….

1973

2007

2015

PHILIPS

- Questions?