Where IS the best place to grow greenhouse crops in Australia?

Facilitated by

GRAEME SMITH CONSULTING

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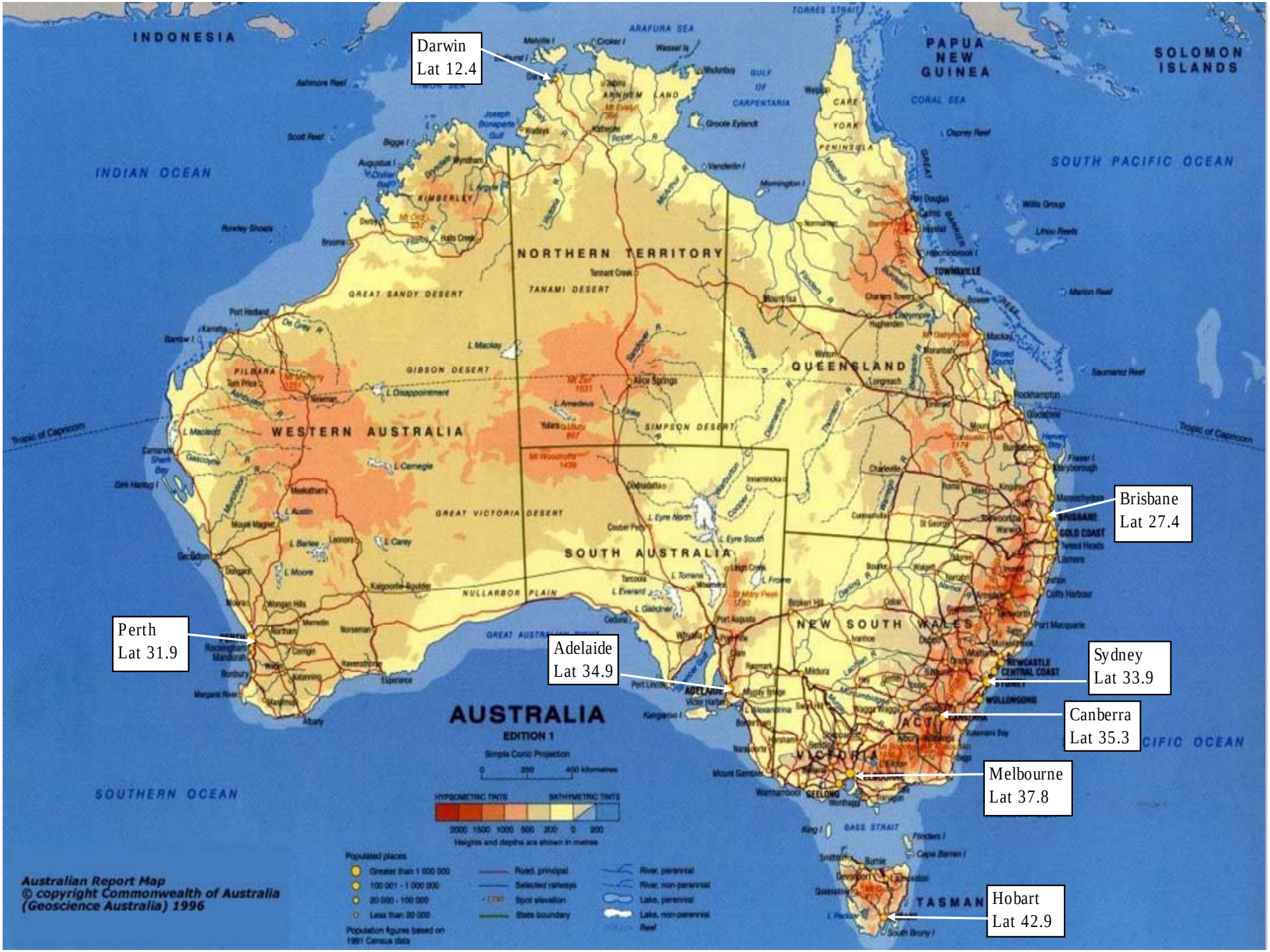
CRITICAL FACTORS

- Compare 8 Australian Capital Cities
  (Adelaide, Brisbane, Canberra, Darwin, Hobart, Melbourne, Perth, Sydney)
- What tools needed for a fair assessment?
- Outcomes are:
  tools to develop a business plan; or
  an improved understanding of your own situation
- Knowledge of some critical factors in protected cropping
- Grading Matrix


Darwin
Lat 12.4
Brisbane
Lat 27.4
Perth
Lat 31.9
Adelaide
Lat 34.9
Sydney
Lat 33.9
Canberra
Lat 35.3
Melbourne
Lat 37.8
Hobart
Lat 42.9
AUSTRALIA
EDITION 1
Simple Conic Projection
INDONESIA
PAPUA NEW GUINEA
SOLOMON ISLANDS
INDIAN OCEAN
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN
TASMAN SEA
NORTHERN TERRITORY
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
ACT
GREAT SANDY DESERT
GIBSON DESERT
GREAT VICTORIA DESERT
TANAMI DESERT
SIMPSON DESERT
NULLARBOR PLAIN
Australian Report Map
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CRITICAL FACTORS
(for the 8 Australian Capital Cities)

- Climate
  - radiation
  - temperature
  - rH
  - wind

  } (Production Potential!)
- Water / Rain
- Energy
- Freight
- Market Strength & Access
- Labour
- Local/State Government Support
- Food Miles
- Lifestyle

CLIMATE - Radiation

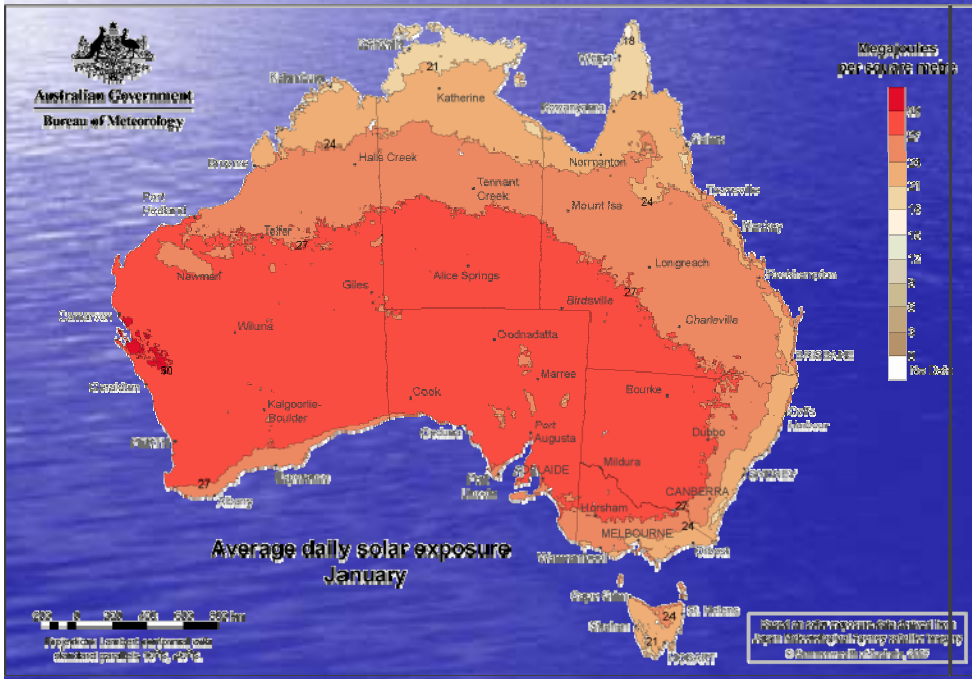
- The sun drives all the planets (& greenhouse) processes
- Radiation (sunlight) levels are directly proportional to production potential

- Crops can suffer from too much as well as too little radiation (daily & annual basis)
- Most greenhouse set-points can be linked to radiation levels (or sum)

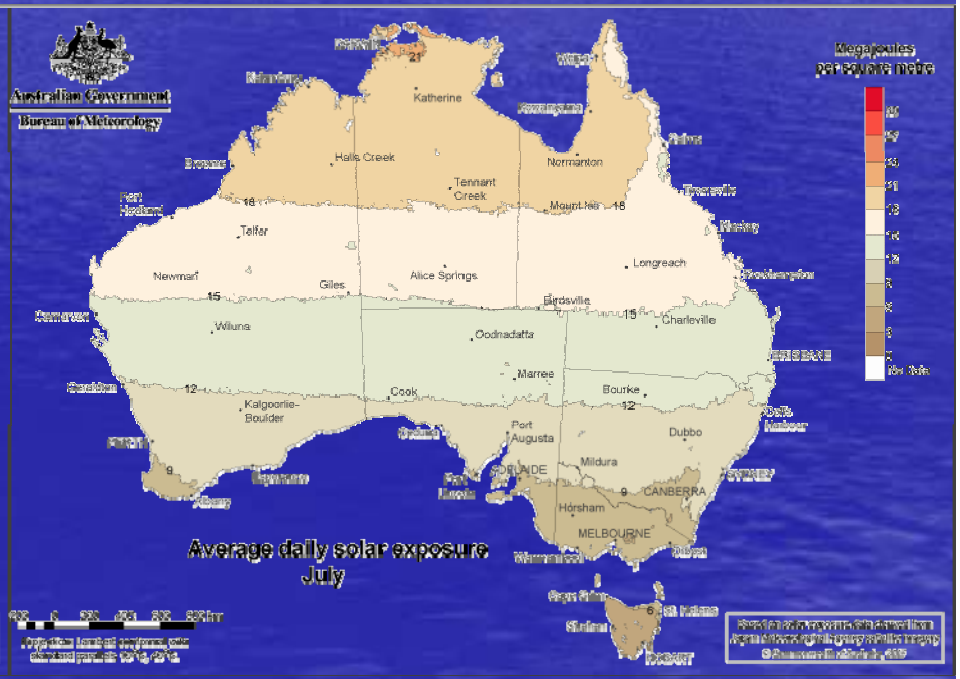
CLIMATE - Radiation

Average Daily Solar Radiation

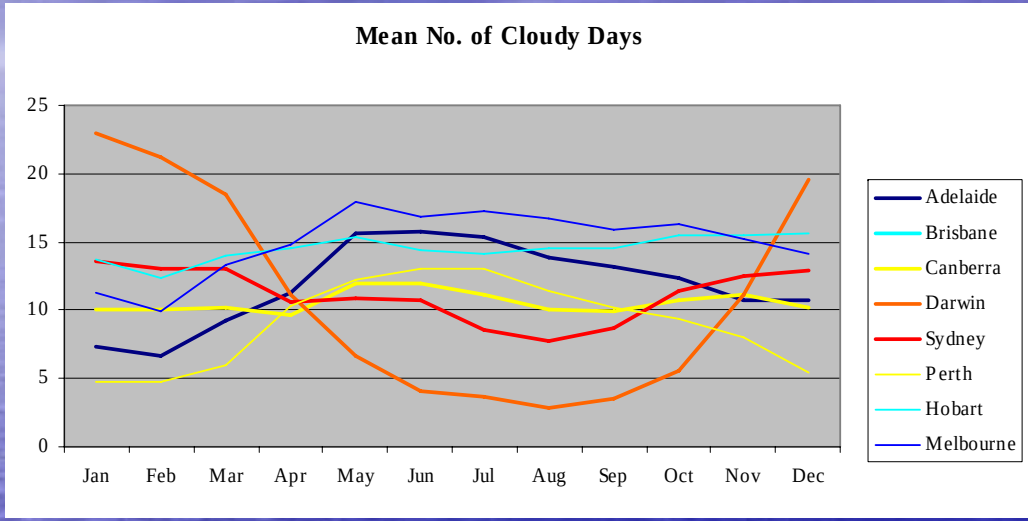
January

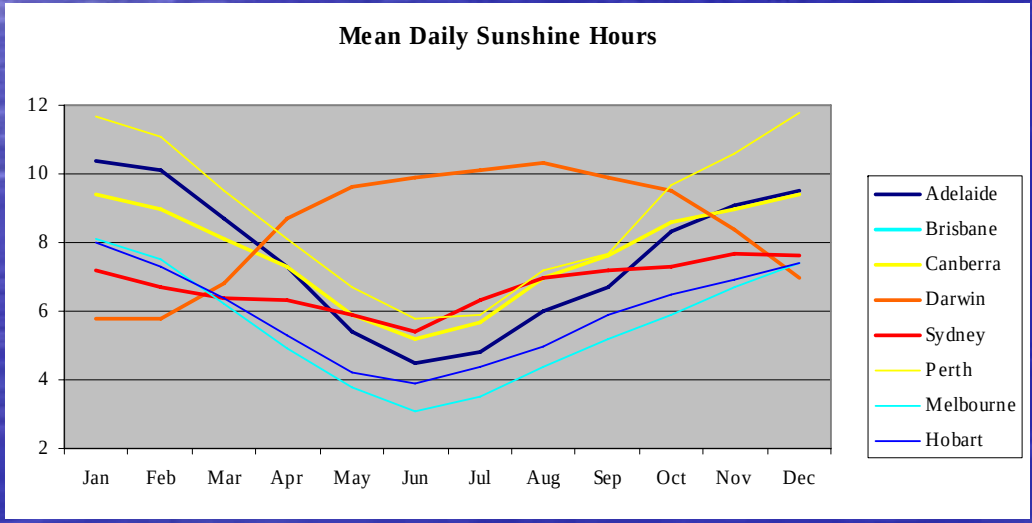


July

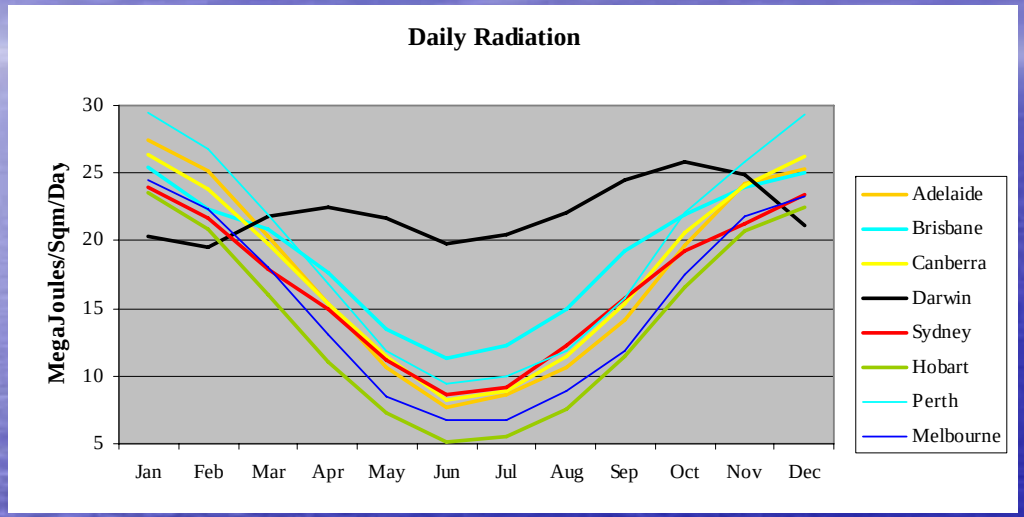


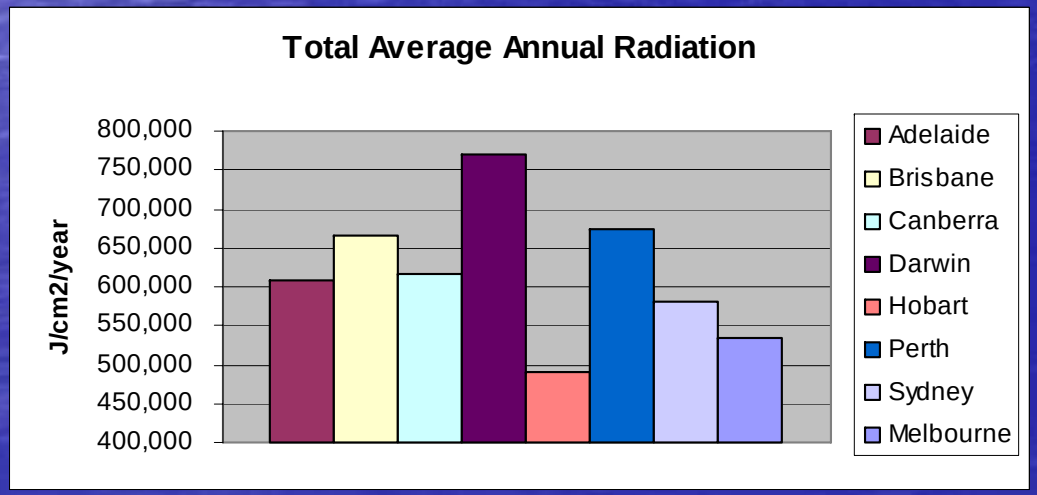
CLIMATE - Radiation





CLIMATE - Radiation





CLIMATE - Radiation

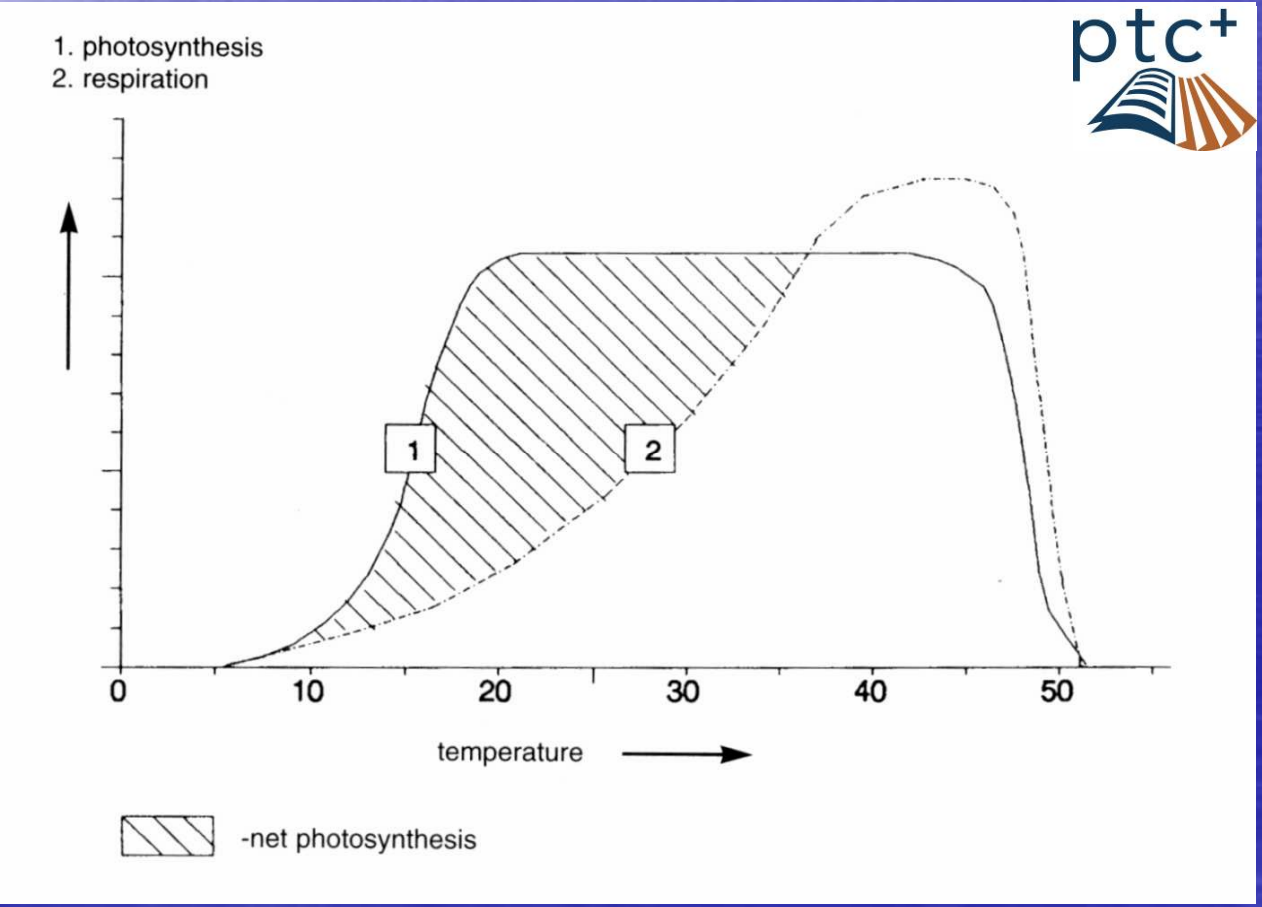
Radiation M/Joules/m2/day* * Monthly summary for period 1990-2006

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Adelaide	27.4	25.1	20.3	15.3	10.6	7.7	8.6	10.6	14.2	19.7	24.2	25.3	17.4
Brisbane	25.4	22.4	20.9	17.6	13.5	11.3	12.3	14.9	19.3	22.0	24.0	25.0	19.1
Canberra	26.4	23.8	19.8	15.4	11.4	8.2	8.9	11.4	15.3	20.6	24.1	26.3	17.6
Darwin	20.3	19.5	21.8	22.5	21.6	19.8	20.4	22.1	24.5	25.9	24.9	21.1	22.0
Hobart	23.5	20.8	16.0	11.1	7.3	5.1	5.5	7.5	11.5	16.6	20.7	22.5	14.0
Melbourne	24.5	22.4	18.0	13.1	8.5	6.7	6.8	8.9	11.9	17.5	21.8	23.3	15.3
Perth	29.4	26.8	22.0	16.8	11.8	9.5	10.0	11.8	15.8	22.1	25.8	29.3	19.3
Sydney	23.9	21.6	17.9	15.0	11.2	8.6	9.2	12.2	15.7	19.2	21.2	23.4	16.6

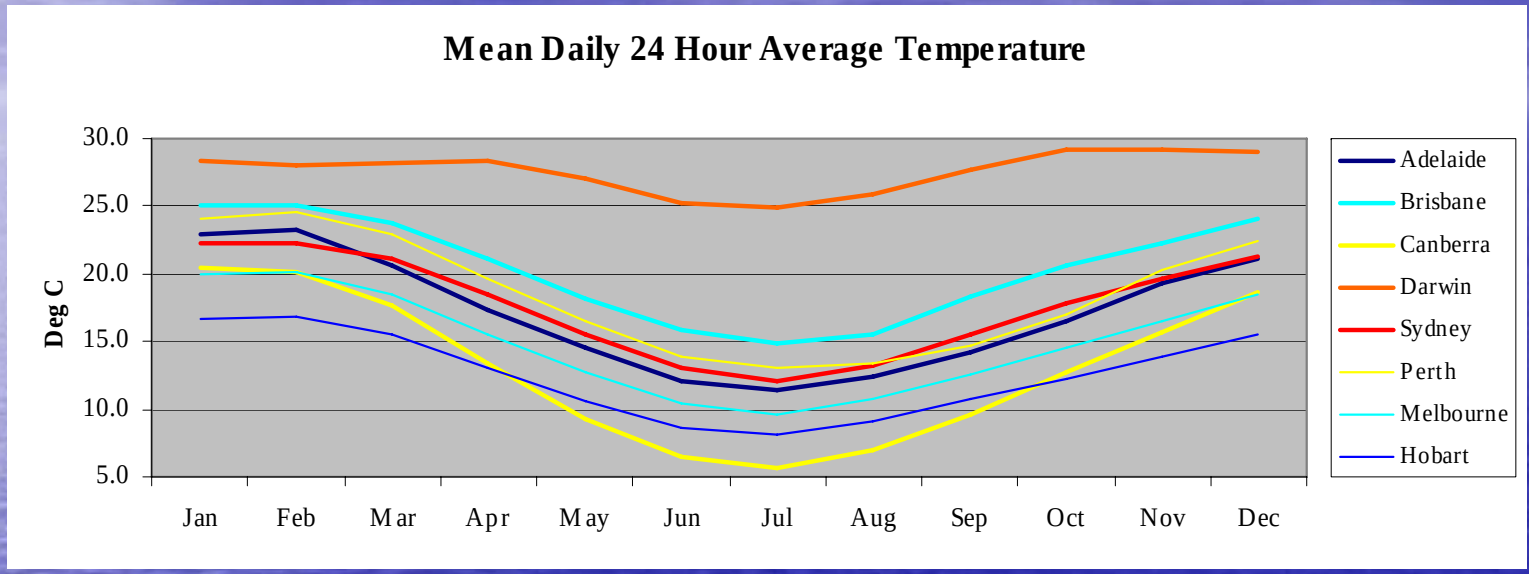
CLIMATE - Temperature

- Crops respond to 24hour temperature averages (plant development)
- Ideally we should be measuring PLANT temperature
- ± 18 – 20ºC is optimum photosynthesis (growth) rate for most crops (day temp!)

CLIMATE - Temperature



CLIMATE - Temperature

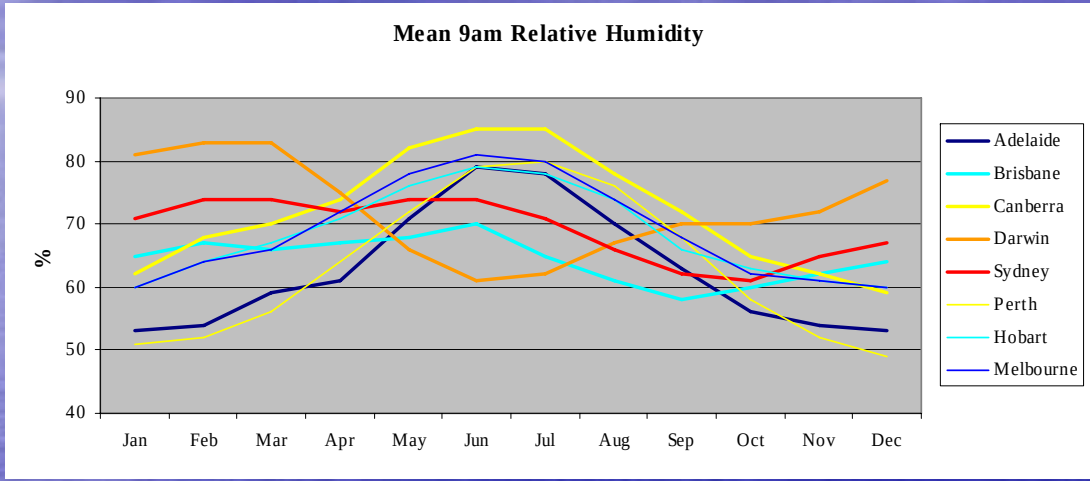


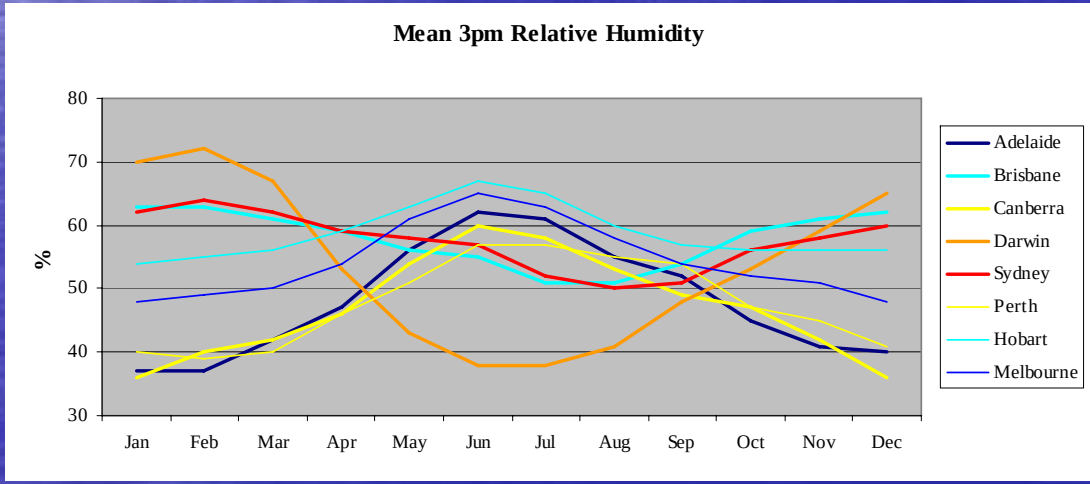
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Adelaide	23.0	23.2	20.7	17.4	14.5	12.2	11.4	12.4	14.3	16.6	19.3	21.2	17.2
Brisbane	25.1	25.1	23.8	21.2	18.2	15.9	14.9	15.6	18.4	20.6	22.3	24.1	20.4
Canberra	20.5	20.2	17.6	13.4	9.3	6.6	5.6	7.0	9.7	12.7	15.7	18.7	13.1
Darwin	28.3	28.1	28.2	28.4	27.1	25.3	24.9	25.9	27.8	29.1	29.3	29.0	27.6
Hobart	16.7	16.8	15.5	13.1	10.7	8.6	8.1	9.1	10.7	12.3	13.9	15.6	12.6
Melbourne	20.0	20.2	18.5	15.5	12.7	10.5	9.7	10.8	12.6	14.6	16.5	18.6	15.0
Perth	24.0	24.6	23.0	19.7	16.6	13.9	13.0	13.4	14.8	17.0	20.3	22.5	18.5
Sydney	22.3	22.3	21.1	18.6	15.5	13.1	12.1	13.3	15.5	17.8	19.6	21.4	17.7

CLIMATE – Humidity (rH)

- Ideally we should be aiming for ± 60 – 80% greenhouse humidity (± 3 – 7gm/m³ HD)
- Greenhouse humidity is influenced by external climate (radiation, temp, rH, wind, etc)
- High humidity slows transpiration (costs energy to drive with heat)
- Low humidity increases transpiration (every 1% below 50%, increases transpiration rate 1.5 times)

CLIMATE – Humidity (rH)



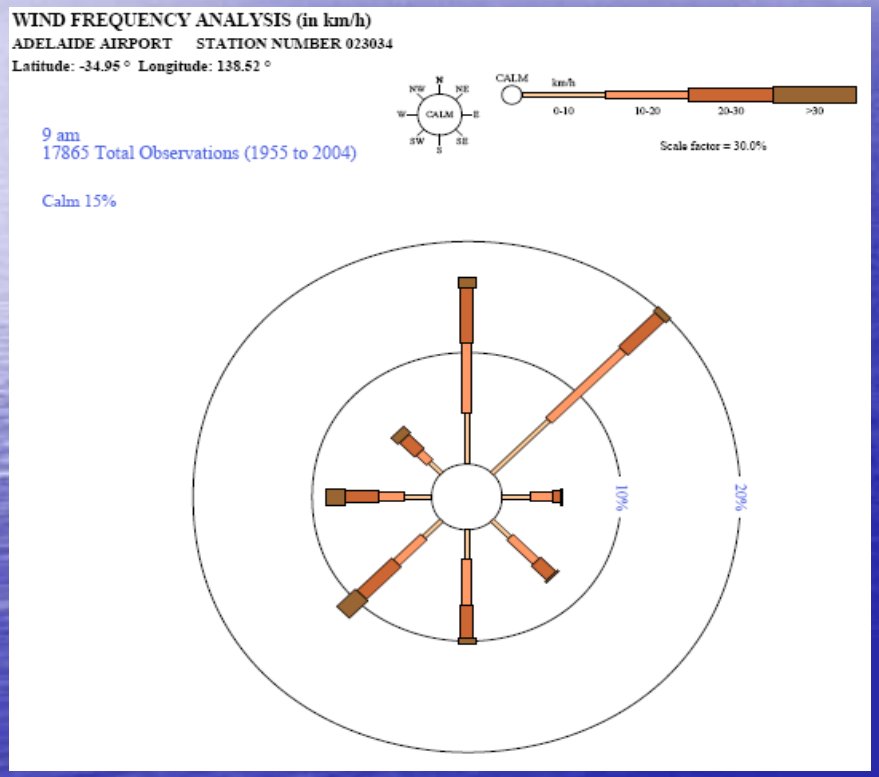


CLIMATE - Wind

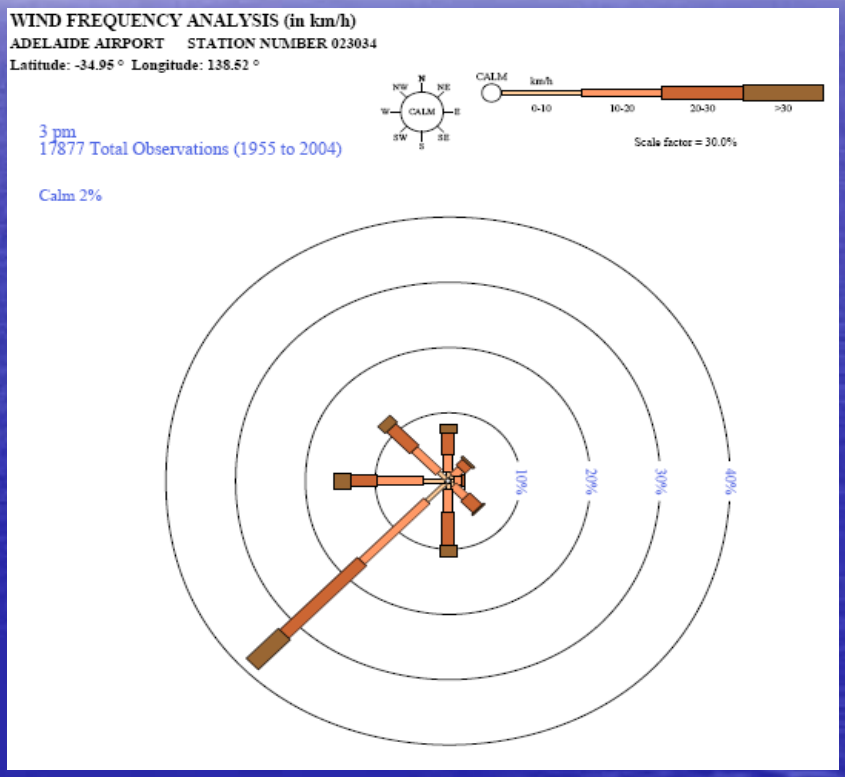
- Wind speed and direction influences greenhouse climate and orientation (e.g. wind speed >10m/s greatly affects CO_2 efficiency – related to light levels)
- Improved ventilation related to greenhouse alignment
- Physical affect on ventilators (eg. ageing)

CLIMATE – Wind Roses (e.g. Adelaide)

9am



3pm



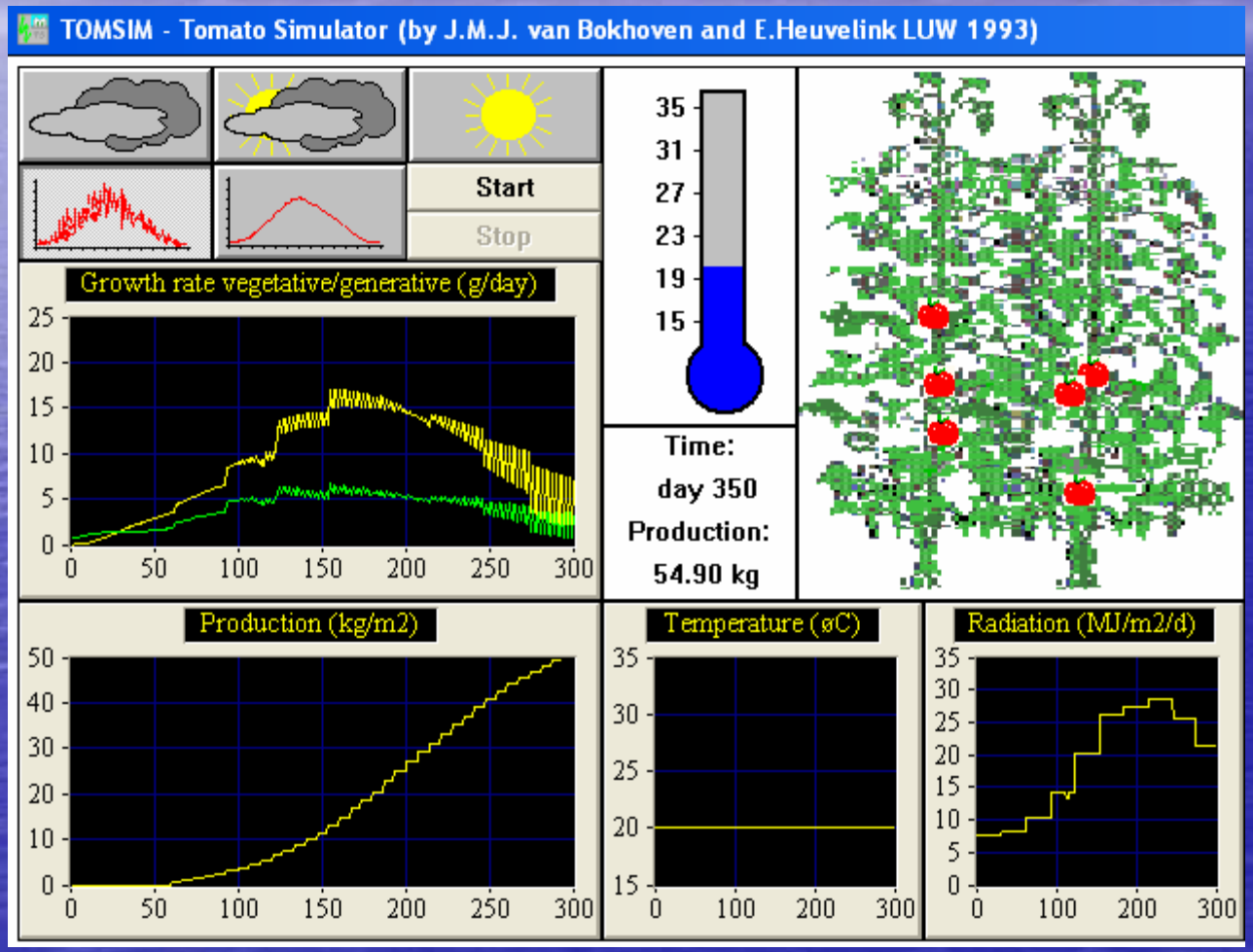
(nb. km/h to m/s, divide by 3.6)

Production Potential

- Production Potential can be modelled using TomSim (Tomato Simulator)
- TomSim models using unique site data:
  - average daily radiation levels
  - average 24hour temperature
  - greenhouse CO_2 levels
  - growth period (days)

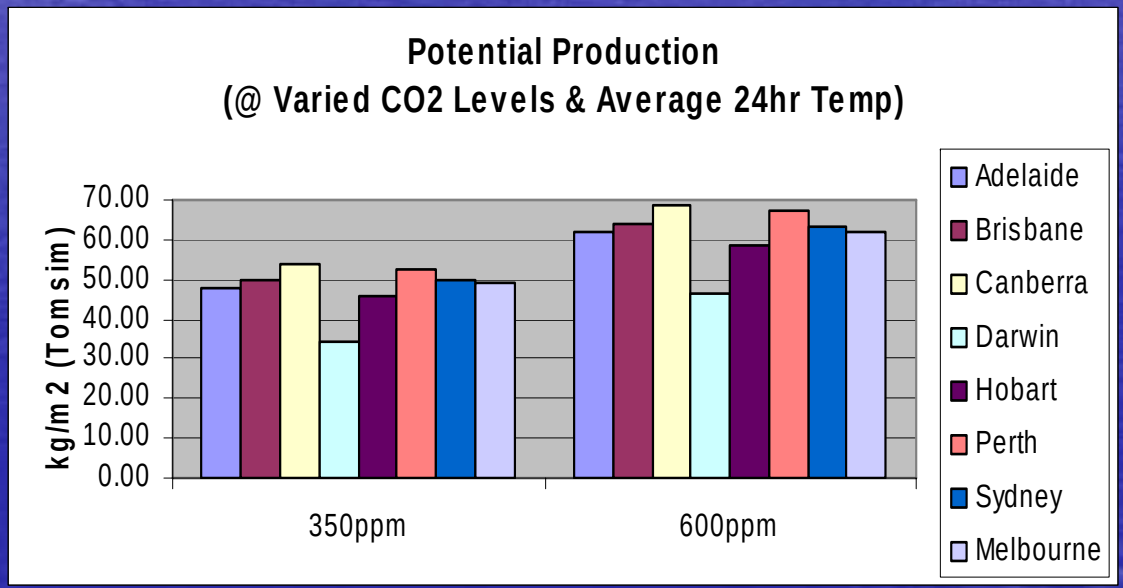
Tomsim.exe

Production Potential - TomSim



Production Potential - TomSim

CO2 Level	350ppm	600ppm
Adelaide	47.90	61.70
Brisbane	49.60	63.70
Canberra	53.90	68.40
Darwin	34.50	46.50
Hobart	46.10	58.70
Melbourne	49.00	62.00
Perth	52.20	67.40
Sydney	50.00	63.20



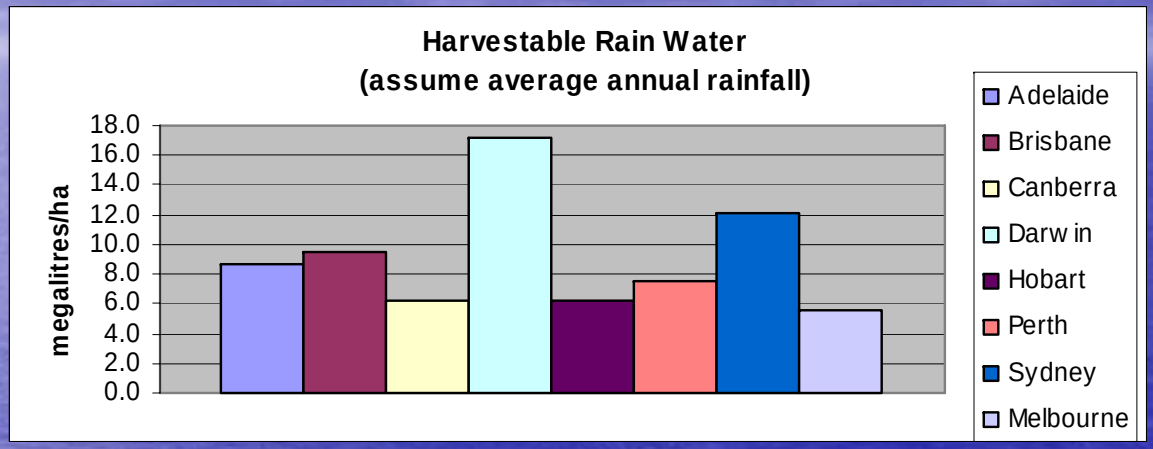
CLIMATE – Water / Rain

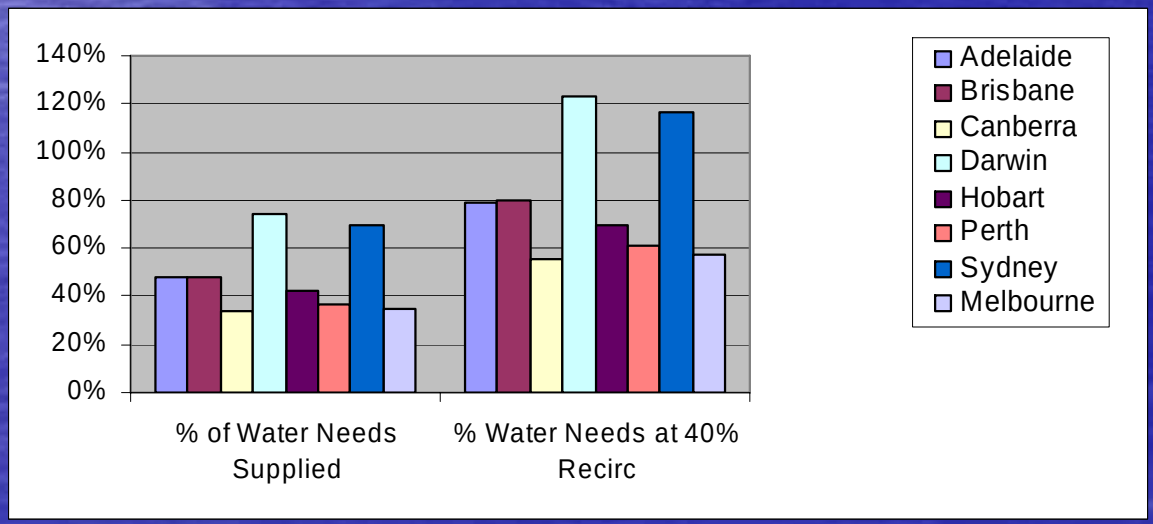
- Harvestable water off roof
  (average annual rainfall)
  assume 100% capture & retain
- Plant transpiration & drainage
  assume 3ml per Joule light over 350 days

CLIMATE – Water / Rain

Ann Rainfall (mm)	Harvestable Water (M1/ha)	Annual Radiation (J/cm2)	Typical Water Use (Ml/ha)	% of Water Needs Supplied	% Water Needs at 40% Recirc	
869	8.7	609,583	18.3	48%	79%	Adelaide
953	9.5	666,750	20.0	48%	79%	Brisbane
619	6.2	617,167	18.5	33%	56%	Canberra
1,714	17.1	771,167	23.1	74%	123%	Darwin
617	6.2	490,292	14.7	42%	70%	Hobart
552	5.5	534,917	16.0	34%	57%	Melbourne
746	7.5	674,042	20.2	37%	61%	Perth
1,213	12.1	580,708	17.4	70%	116%	Sydney

CLIMATE – Water / Rain

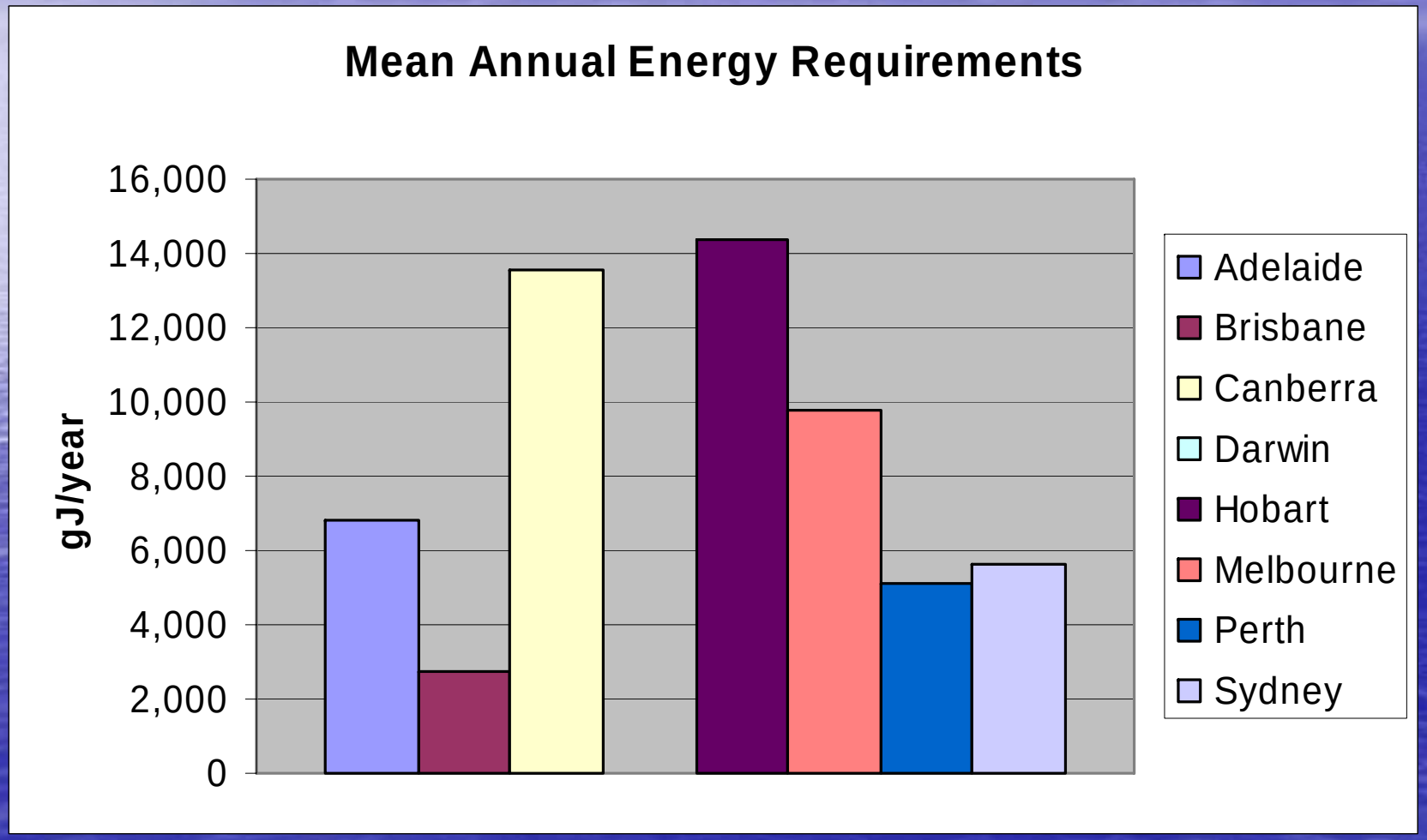




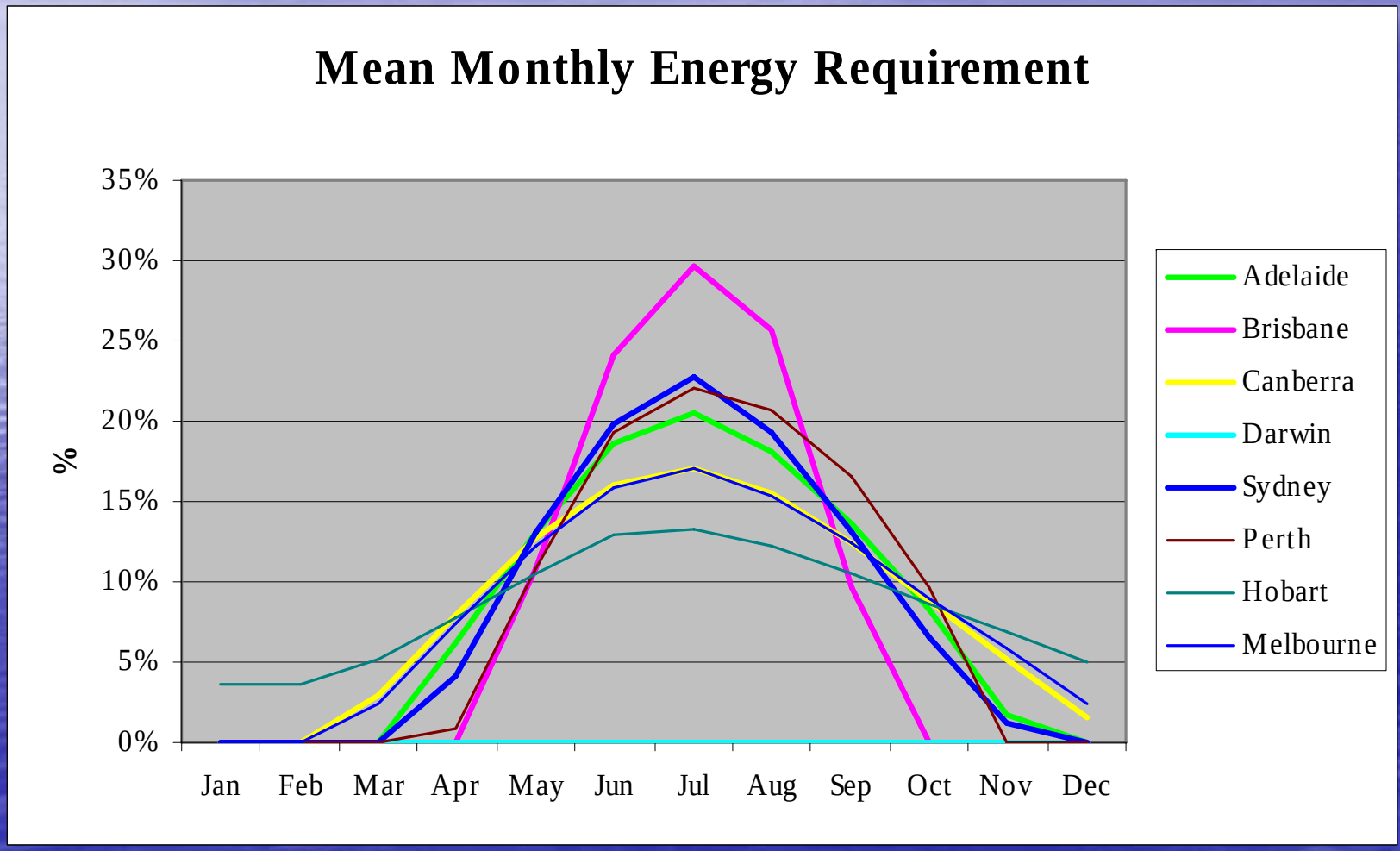
ENERGY

- Energy demand is a function of climate (internal & external), crop and stage
- Rule of Thumb
  '*for each ºC difference between external 24hr temp & target greenhouse temp = 5m³ natural gas consumed'*
  (e.g. external average temp = 10ºC, target G/H temp = 20ºC, Difference = 10ºC
  10 x 5 = 50³m natural gas)
- Assume average natural gas price = $9.80/gJ energy & 1m³ natural gas = 38.8mJ energy
- Assume target average G/H 24hour temp = 20ºC

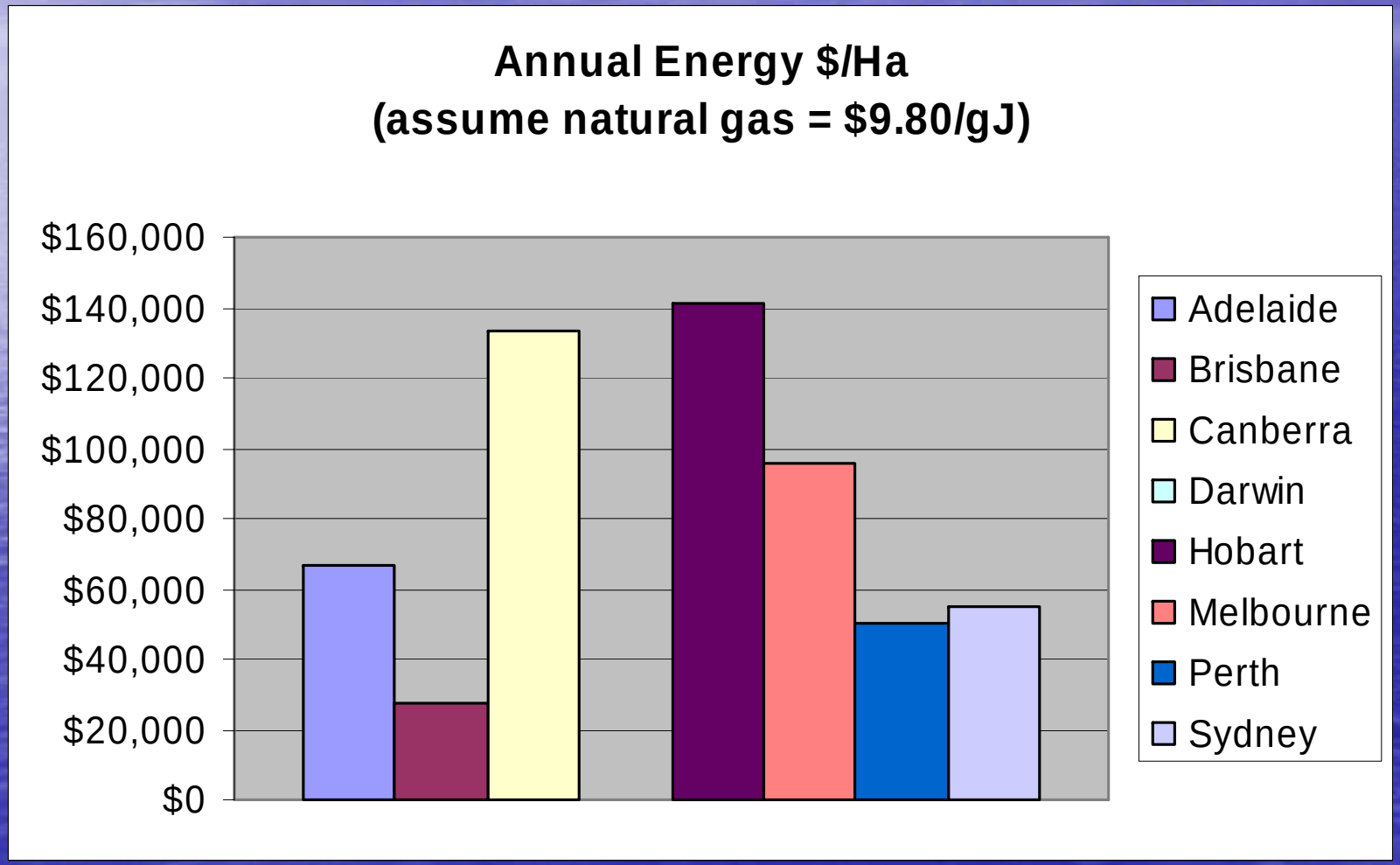
ENERGY


Mean Annual Energy Requirements
gJ/year
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Adelaide
Brisbane
Canberra
Darwin
Hobart
Melbourne
Perth
Sydney

ENERGY


Mean Monthly Energy Requirement
35%
30%
25%
20%
15%
10%
5%
0%
%
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Adelaide
Brisbane
Canberra
Darwin
Sydney
Perth
Hobart
Melbourne

ENERGY


Annual Energy $/Ha
(assume natural gas = $9.80/gJ)
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Adelaide
Brisbane
Canberra
Darwin
Hobart
Melbourne
Perth
Sydney

FREIGHT & MARKET STRENGTH

- Costs relatively same to each local market
- Arguably the strongest markets would be:
  - Sydney
  - Melbourne
  - Brisbane
  - (based on population, supply/demand, etc)
- Other market destinations would bear significant costs

FREIGHT COSTS

(nb. Not including GST or fuel Levy)

Pallet Rate in $ **TO**

FROM	Adelaide	Brisbane	Canberra	Darwin	Hobart	Melbourne	Perth	Sydney
Adelaide	n/a	$170	$160	$240	$275	$75	$250	$150
Brisbane	$150	n/a	$140	$290	$365	$105	$450	$95
Canberra	$185	$170	n/a	$495	$310	$80	$440	$75
Darwin	$190	$210	$340	n/a	$480	$220	$310	$360
Hobart	$215	$250	$150	$470	n/a	$95	$400	$140
Melbourne	$95	$165	$100	$410	$200	n/a	$375	$95
Perth	$130	$260	$250	$460	$350	$170	n/a	$190
Sydney	$165	$140	$95	$490	$295	$95	$410	n/a

LABOUR

- access relatively same to each local market
- Strong need to plan early your labour needs for future enterprise development
- Each new stage may strain a depleting market?

MUNICIPAL/STATE SUPPORT

- Early signs that some areas are actively discouraging protected cropping development (e.g. Sydney & Brisbane)
- Strong need to plan early your permit needs for future enterprise development

FOOD MILES

- a potential indicator for the environmental impact of the food and its components
- not only how far the food has traveled but how it has traveled
- how the food has been produced and what energy is used in its production
- Carbon imprints, carbon tax & credits
- Opportunity to produce ‘local foods’

LIFESTYLE

- Are we content in this location?
- Do suitable services, facilities & infrastructure exist for happy, healthy & productive situation?
- Are we willing to forgo potential production or $ advantages for a selected location?

GRADING MATRIX

	ADELAIDE	BRISBANE	CANBERRA	DARWIN	HOBART	MELBOURNE	PERTH	SYDNEY
Production Potential	6	8	10	1	5	8	9	8
Energy								
Water/Rain								
Freight								
Market Strength								
Labour Access								
Municipal Support								
Food Miles								
Lifestyle								
totals								

GRADING MATRIX

	ADELAIDE	BRISBANE	CANBERRA	DARWIN	HOBART	MELBOURNE	PERTH	SYDNEY
Production Potential	6	8	10	1	5	8	9	8
Energy	6	9	2	10	1	4	7	7
Water/Rain								
Freight								
Market Strength								
Labour Access								
Municipal Support								
Food Miles								
Lifestyle								
totals								

GRADING MATRIX

	ADELAIDE	BRISBANE	CANBERRA	DARWIN	HOBART	MELBOURNE	PERTH	SYDNEY
Production Potential	6	8	10	1	5	8	9	8
Energy	6	9	2	10	1	4	7	7
Water/Rain	5	5	3	7	4	3	3	7
Freight								
Market Strength								
Labour Access								
Municipal Support								
Food Miles								
Lifestyle								
totals								

GRADING MATRIX

	ADELAIDE	BRISBANE	CANBERRA	DARWIN	HOBART	MELBOURNE	PERTH	SYDNEY
Production Potential	6	8	10	1	5	8	9	8
Energy	6	9	2	10	1	4	7	7
Water/Rain	5	5	3	7	4	3	3	7
Freight	?	?	?	?	?	?	?	?
Market Strength								
Labour Access								
Municipal Support								
Food Miles								
Lifestyle								
totals								

GRADING MATRIX

	ADELAIDE	BRISBANE	CANBERRA	DARWIN	HOBART	MELBOURNE	PERTH	SYDNEY
Production Potential	6	8	10	1	5	8	9	8
Energy	6	9	2	10	1	4	7	7
Water/Rain	5	5	3	7	4	3	3	7
Freight	?	?	?	?	?	?	?	?
Market Strength	?	?	?	?	?	?	?	?
Labour Access	10	10	10	10	10	10	10	10
Municipal Support	10	5	10	10	10	10	10	5
Food Miles	?	?	?	?	?	?	?	?
Lifestyle	?	?	?	?	?	?	?	?
totals								

GRADING MATRIX

THE BEST PLACE TO GROW GREENHOUSE CROPS IN AUSTRALIA IS ?

Thank You.

Questions?

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