The Australian Wine Research Institute

Energy Efficient Options for the Future – Adjusting to a Carbon Constrained Economy

WEA National Conference
24 June 2009

Dr Richard Muhlack
Process & Environmental Engineer

The Australian Wine Industry is under intense pressure on many fronts…

Economic downturn

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Market plunges on gloomy Worl

By Online business reporter Michael Janda

Posted 3 hours 10 minutes ago
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ABARE forecasts commodity export slide

Philip Hopkins
June 23, 2009 - 12:32PM

Farm exports will rise in the next two financial years, but Australia's total commodity exports are forecast to fall by 18 per cent to $160 billion in 2009-10 due to the global financial crisis, latest figures show.

Latest news

Banks unlikely to pass on any more official rate cuts

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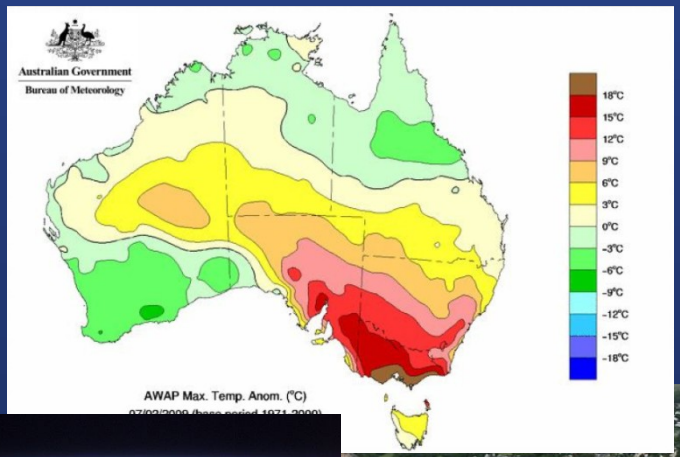
Water shortages

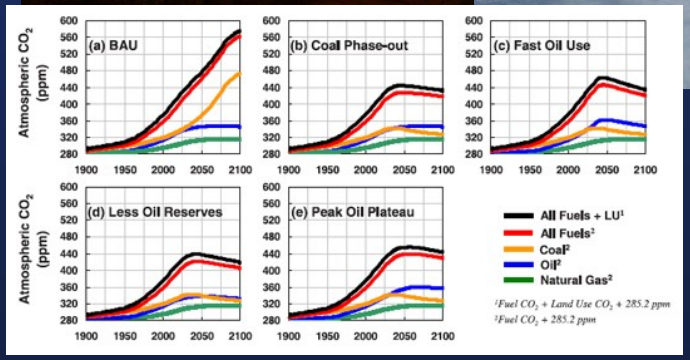
"The persistence and severity of this drought, particularly over the past three years, is unprecedented"

Rob Freeman - Chief Executive, Murray-Darling Basin Authority

"... the prospects for irrigation will be highly dependent on future rainfall and system inflows"

Climate change

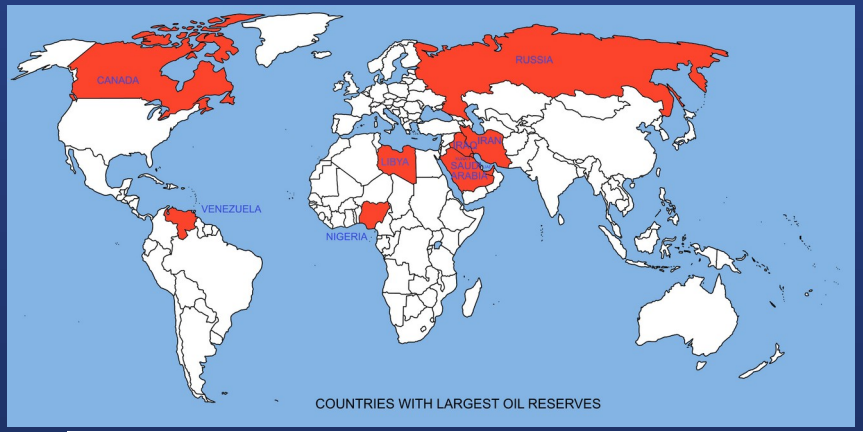


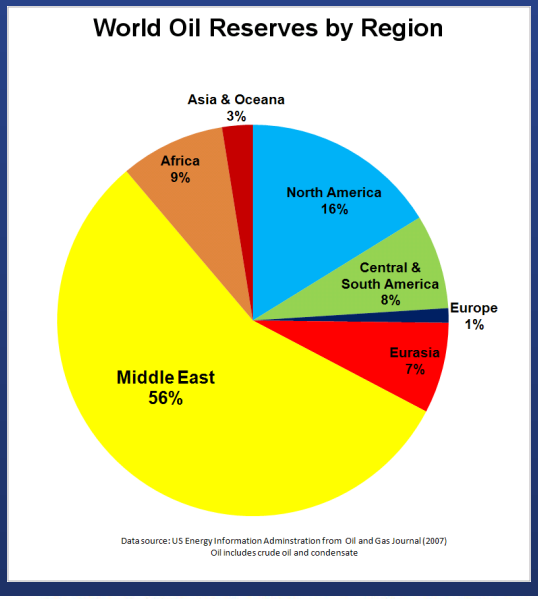


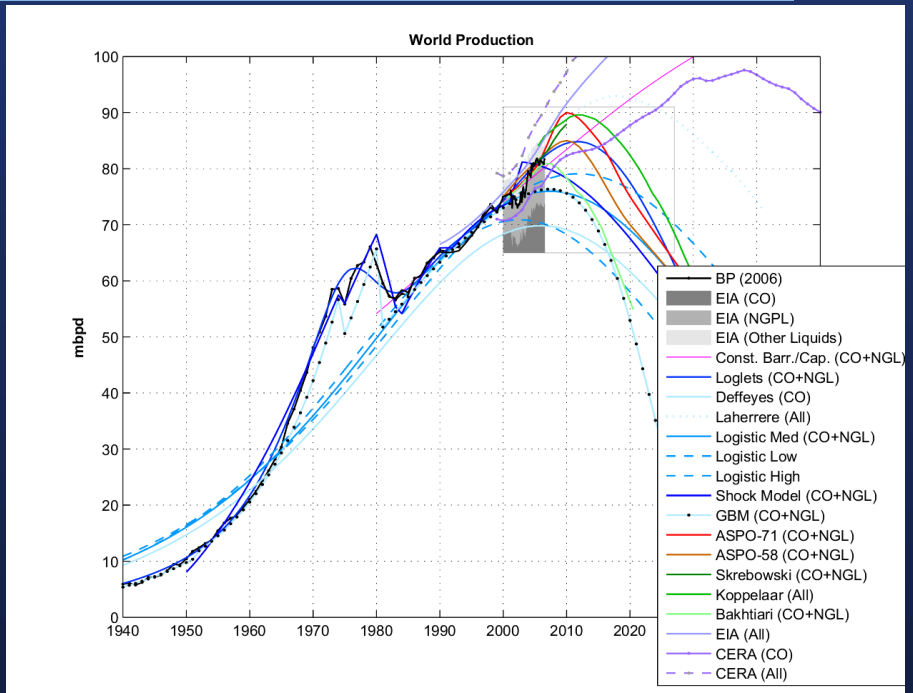
"Warming of the climate system is unequivocal" **UN IPCC**

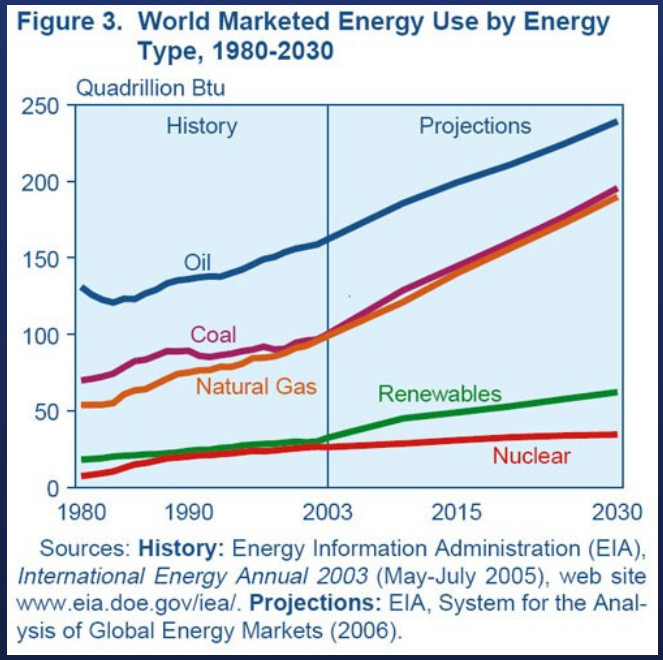
Carbon footprint, emissions, food miles

Energy security & Peak Oil









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A climate of change…

…uncertainty…

…opportunity…?

Transition to the low-carbon economy

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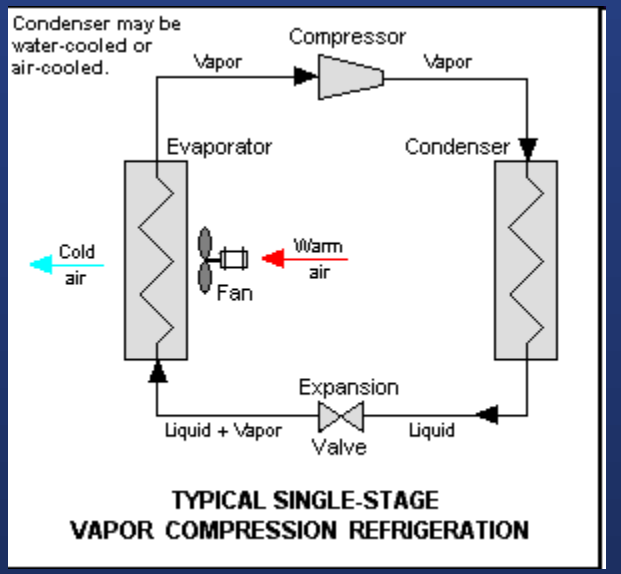
- Resources need to be managed in the most efficient way possible to maintain sustainability
- 'Low-tech' solutions and *existing* process improvement strategies to provide the transitional answer
- i.e. application of existing established process knowledge that can be used ***now*** to achieve an efficiency gain

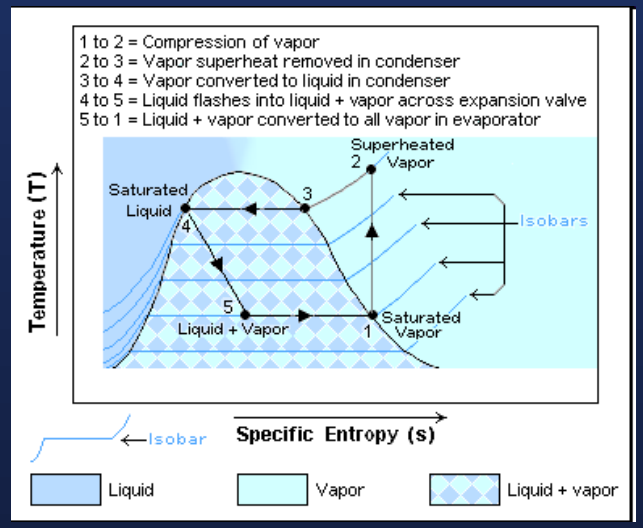
Potential Energy Efficiency Improvements

- Refrigeration, air conditioning and heat exchange systems
- Waste heat recovery
- Hot water generation and reticulation
- Compressed air systems
- Pumps and drives
- Pipe design
- Tank, cellar and office insulation
- Lighting
- Wastewater treatment
- Power factor
- Electrical load balancing to reduce peak demand

Refrigeration

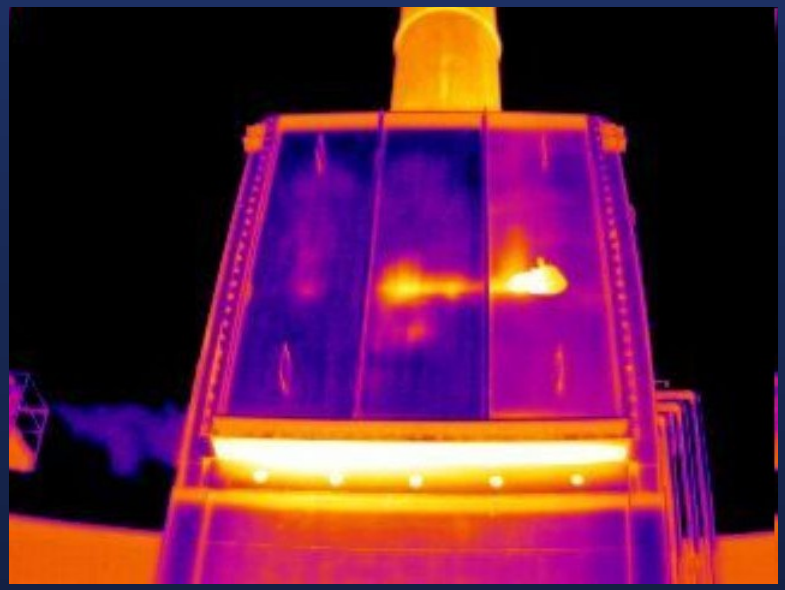
- Efficient temperature control and heat transfer to wine
- Review wine and brine temperature set points
- Effective tank mixing
- Appropriate refrigeration compressor settings and plant operation
- Effect of environmental variables – ambient temperature & RH, peak vs off peak operation
- Site placement – ventilation, solar loading
- Absorption refrigeration





Hot Water and Waste Heat Recovery

- Boiler type
  - LPG/NG, diesel, electric, solar, heat pump
- Feedwater preheating:
  - Boiler economiser (suitable for larger installations)
  - Recovery of heat from “spent” sterilisation water



$$\eta_{th} \equiv \frac{\text{What you get}}{\text{What you pay for}}$$

Air Compression

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- Reduce air leaks - which may account for up to 30% of compressor output
- Eliminate inappropriate uses of compressed air:
  - Eg venturi vacuum generation, open blowing, sparging
- Reduce air intake temperature (increase air density/mass flow rate)
- Isolate idle and decomissioned equipment
- Reduce overall system pressure

Wastewater

- Aeration
- Mixing
- WWT Microflora health
- Control of Fugitive CH_4 emissions

Potential Water efficiency Improvements

- High pressure water for cleaning
- Transfer line ‘pigging’ (inserting a solid plug [or ‘pig’] into the pipeline to separate wine from water during transfers)
- Water pinch analysis / Cleaner Production strategies
- Capture and reuse of transfer push-through water, wash water, filler sanitation water and cleaning chemicals
- Reuse of transfer or stormwater for cooling tower use
- Vineyard irrigation practices
- Wastewater for irrigation of vineyards, site gardens, (biomass or high-value crops) ?

Resources to assist the improvement process

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- **Conduct a site Energy & Water audit !!**

- Energy Efficiency Best Practice Guides:
  - *"A guide to energy efficiency innovation in Australian wineries"*
  - www.ret.gov.au / www.winesa.asn.au

- *Energy Efficiency Opportunities* Program (Federal Government)

- US Dept of Energy's *BestPractices* program
  - Detailed repository of industrial process improvement solutions: case studies, fact sheets, sourcebooks

- University of Adelaide's Institute for Climate Change and Sustainability www.adelaide.edu.au/climatechange/

- AWRI Environment Portal (soon to be launched)
  - www.awri.com.au

Emerging technologies for a carbon constrained world

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- Biomass Energy
- Solar Thermal
- Microalgae

Biomass Energy

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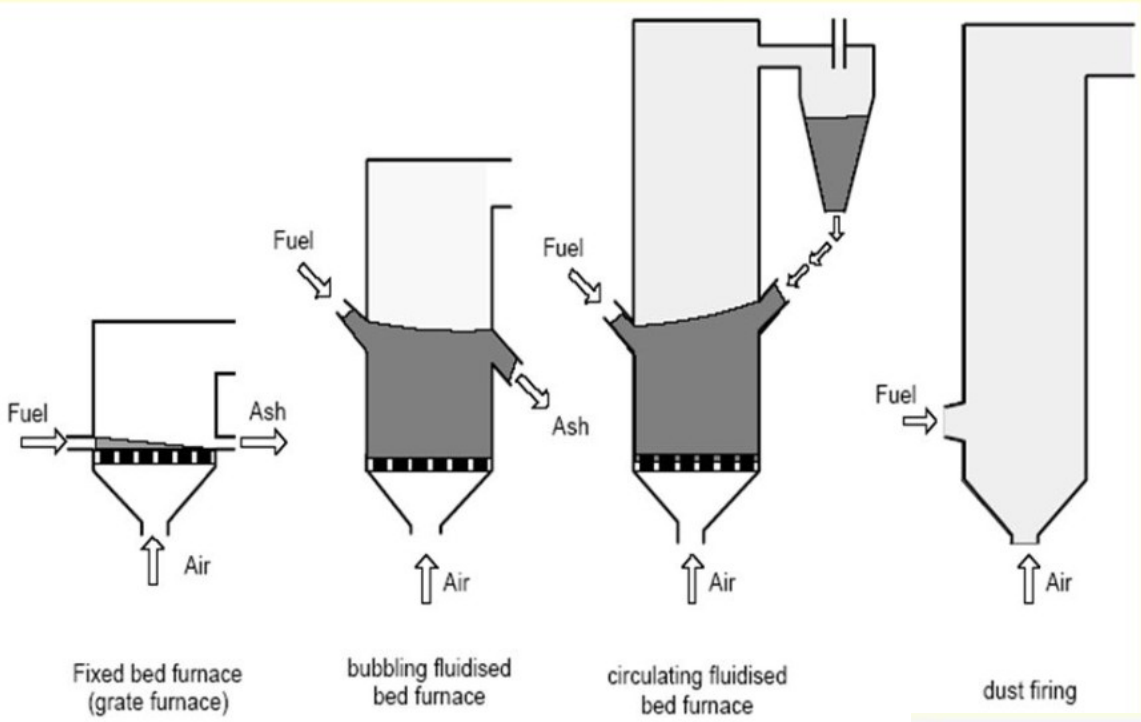
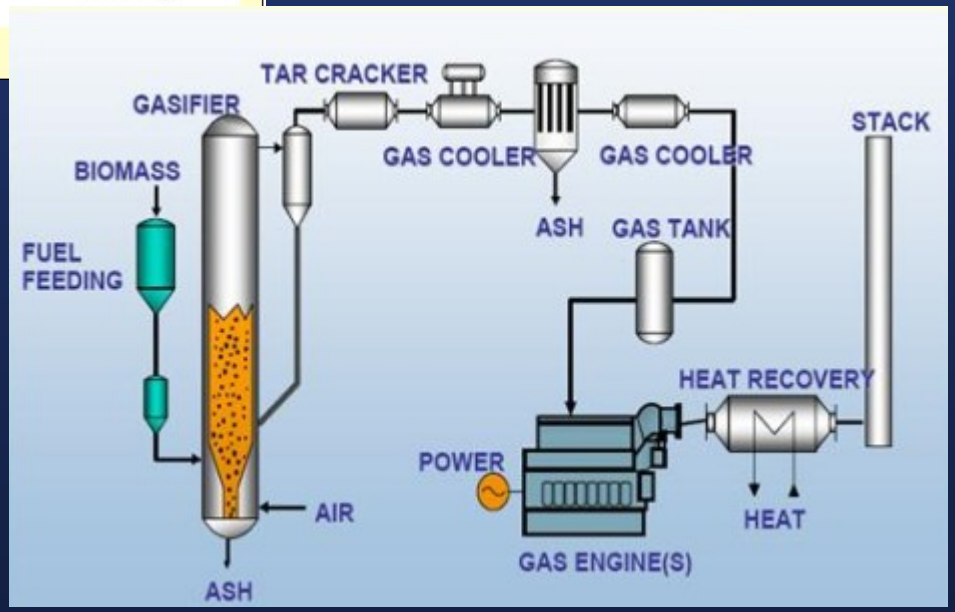
- Combustion/Gasification: Electricity, liquid transport fuels, co-firing with coal in existing conventional power station
- Ligno-cellulosic bioethanol
- Biogas from anaerobic digestion

Combustion Technologies





Source: Bioenergy Australia

Ligno-cellulosics - Bioethanol

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- Cellulose / hemicellulose / lignin: unknown
  40-55% / 25-40% / 15-25% (for other biofuels)
- Relevant capital infrastructure, systems, in-house industry process knowledge
- Scientific expertise within industry
- Ongoing research together with recent developments at AWRI and partner organisations that may assist to fast-track development
- Biorefinery – high-value specialty chemicals

Anaerobic Digestion – combustible biogas

Range of sizes and complexities

Bioenergy Australia

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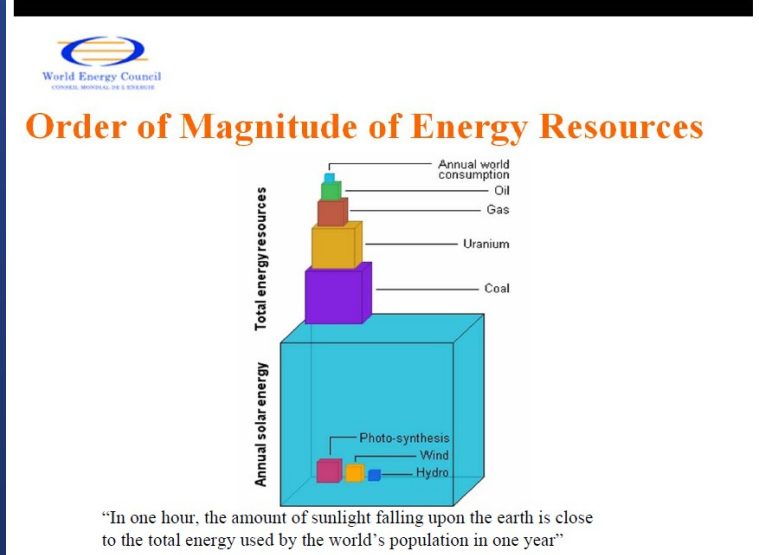
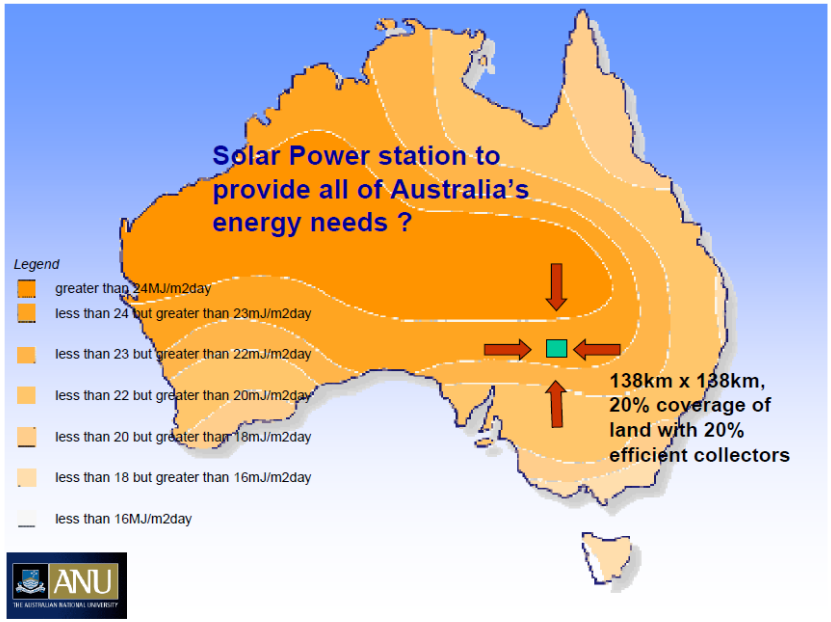
Solar Thermal

- Electricity Generation
- Process Heating and Cooling (Absorption Refrigeration)





Source: Keith Lovegrove, Solar Thermal Group, ANU

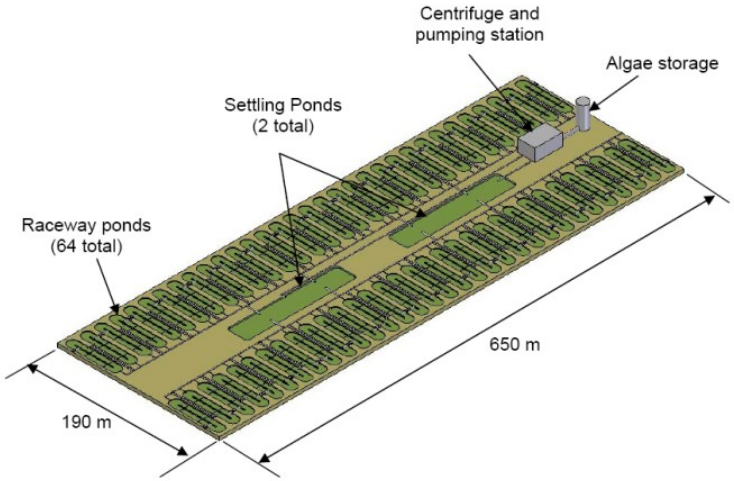
Microalgae

Current systems

Research Institute for Climate Change & Sustainability
Clean Energy Technologies: Biofuels

THE UNIVERSITY OF ADELAIDE AUSTRALIA

Conceptual system



Refer: Climate 2030 seminar series

Tools to position us for the environment and challenges of tomorrow

AWRI

2009

…a year of records

…a reminder that our world is changing, and we need to be ready

In Jan-Feb 2009, the *hottest day on record* was seen in:

Yongala, Cape Borda, Nuriootpa, Mount Barker, Eudunda, Meningie, Murray Bridge, Keith, Mount Gambier, Taralga, Thredbo (Top Stn), Tumbarumba, Cabramurra, Wagga Wagga, Ouyen, Nhill, Warracknabeal, Horsham, Longerenong, Echuca, Kerang, Bendigo, Tatura, Strathbogie, Omeo, Wilsons Promontory, Essendon, Melbourne, Moorabbin, Scoresby, Wonthaggi, Melbourne Airport, Laverton, Geelong, Lake Eildon, Mangalore, Castlemaine, Ballarat, Ararat, Burnie, Launceston Airport, Smithton, Flinders Island AP

This was on top of…

the driest start to a year on record

on top of…

the longest driest drought on record

on top of the…

hottest drought on record.

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…uncertainty…

…opportunity…!!

“Engineers make it happen”

Acknowledgements

AWRI Industry Applications Team

University of Adelaide (School of Chemical Engineering)

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Tarac Technologies

Bioenergy Australia

ANU (Solar Thermal Group)

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