

# Solar energy opportunities for local government

MAV Regional Planning Conference - Shepparton

Ken Guthrie  
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## Background

Ken Guthrie

- Working on Solar Energy and Energy Efficiency since 1978
- Chair of the International Energy Agency Solar Heating and Cooling Program
- Chair of the International Standards Committee on Solar Energy (ISO TC180) from 1997 to 2017
- Chair of Australian and NZ Standards committee on solar water heating



## Outline

### Solar PV farms

- Siting
  - Solar Resource
  - Access to Power grid
  - Support
- Issues

### Solar Industrial process heat

- Opportunities - heat networks

## PV Farms

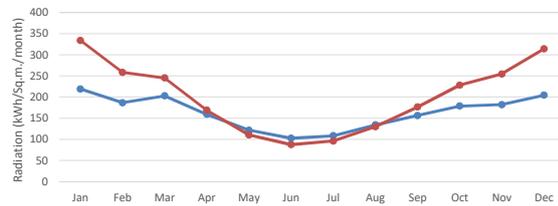
- Currently 102 MW is largest solar farm in Australia at Nyngan
- 370 MW planned within 30 km of Shepparton
- Sizing  $\sim 2$  Ha/MW
- Large systems mainly single axis trackers



Source: APVI

## Siting of solar farms - Solar resource

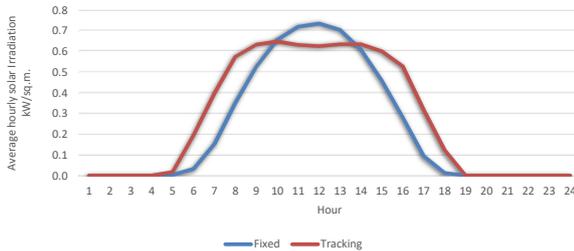
Shepparton Radiation Comparison - Fixed vs Tracking Surface



**Tracking**

- intercepts 23% more solar radiation over the year

Shepparton Radiation Comparison - Fixed vs Tracking Surface



- Provides a lower and wider daily output
- Less electricity infrastructure
- More output in afternoon peak



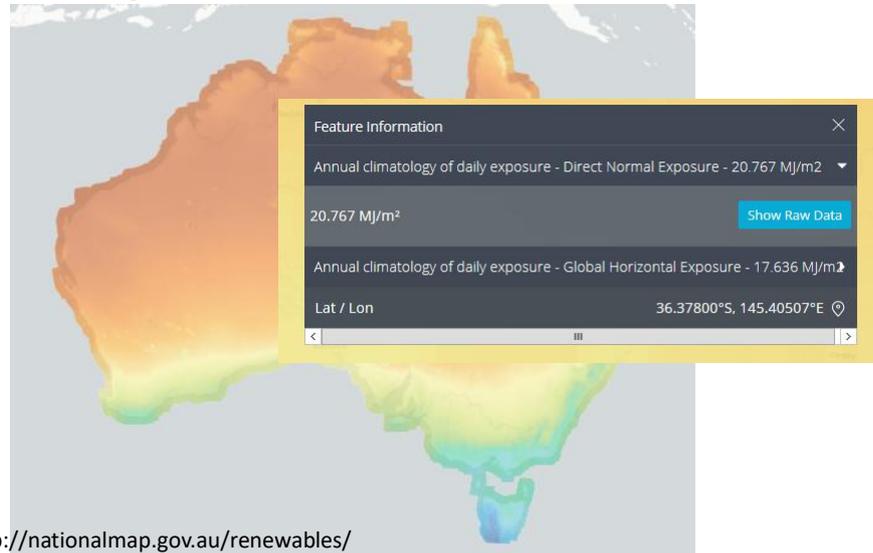
## Siting of solar farms - Solar resource

- Availability of solar energy is one important criteria for a financially viable solar site.
- The solar resource is measured as Global Horizontal Irradiance (GHI) and Direct Normal Irradiance (DNI).
- GHI is the solar power falling on a horizontal surface.
- DNI is the energy coming directly from the sun to the collecting surface. A high level of DNI gives increased performance for tracking collectors.

	Shepp.	Mildura	Melb.	Wang.	Kerang	Albury	Alice Springs	Bendigo
GHI MJ/m <sup>2</sup> /day	17.6	18.8	15.2	17.5	18.1	17.5	23.0	17.2
DNI MJ/m <sup>2</sup> /day	20.7	22.5	15.4	20.7	21.5	20.6	26.4	19.6



## Siting of solar farms - Solar resource



## Connecting to the Power Network

- To the proponent of a solar farm, proximity to the grid is a key criterion as construction of distribution and/or transmission lines can significantly add to project cost.
- >10 MW needs to connect to the 66kV system
- Around Western Victoria, Powercor will build the powerlines and local switching station at the proponent's expense and be responsible for the safe operation according to regulations and codes.



## Support

- In the past, Govt support has been through the Renewable Energy Target. It is now almost fully subscribed.
- State support is available in Victoria and Qld
  - The Victorian Renewable Energy Target solar and wind to supply 25% by 2020 and 40% by 2025
  - The Victorian Renewable Energy Action Plan to “*create jobs, attract investment and grow our economy through boosting the new energy technologies sector.*” And states “*In the northwest of our state, solar PV is beginning to be rolled out at utility-scale. Planned grid augmentation will help unlock our abundant natural resources well into the future.*”



## Issues

- Noise
  - Generally very quiet in operation
    - slow moving trackers
    - sometimes a 'hum' from inverters, during daylight hours
- Dust
  - During construction?
  - Operator will want to keep panels clear of dust to get better output

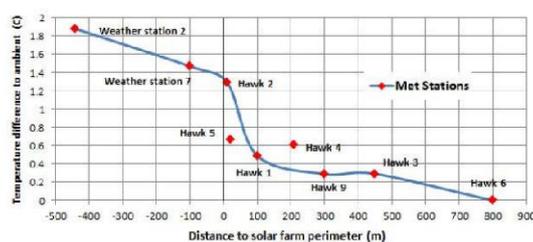


## Issues

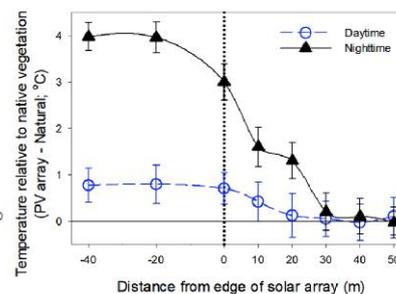
- Glare and Glint
  - Panels have low reflectance
  - Any reflection upwards for tracking collectors
- Birds
  - International studies show no bird issues
- Heat
  - Concern has been raised about PV Heat Island effect (PVHI) impacting local agriculture

## PVHI

Higher temperatures within the PV field but drops off quickly  
Vegetation 'Hedge' can reduce heat flow into adjacent areas



Source: *Analysis of the Potential for a Heat Island Effect in Large Solar Farms* Fthenakis and Yu, Columbia University NY, IEEE Photovoltaic Specialists Conference (PVSC), 2013



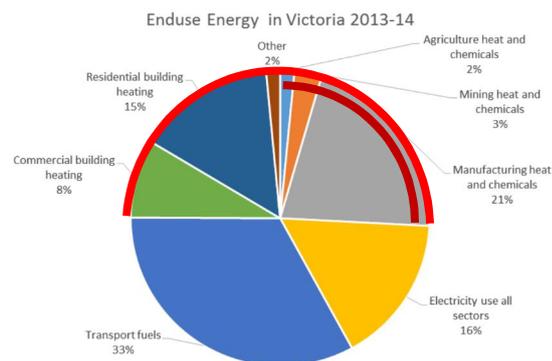
Source: Greg Barron-Gafford, PhD  
University of Arizona

## Energy Consumption What proportion is Electricity?

Audience Question- what percentage of final energy is consumed as electricity in Victoria?

- 20%?
- 40%?
- 60%?
- 80%?

## End use energy in Victoria



- ~ 50% as heat.
- Industry uses ~1/2 of that heat most provided by natural gas
- Key sectors
  - Food, Beverages and Tobacco
  - Textiles, Clothing and Footwear

Source: Personal Communication - Keith Lovegrove IT Power

## Malcolm Turnbull's 'last warning' to gas giants



Malcolm Turnbull says the states' and territories' moratoriums "are putting our energy security, industries and Australian jobs at risk". Ben Rushton

"The AEMO report said the projected shortfall risk for 2018 was between **54 petajoules to 107 petajoules**, and between 49 petajoules and 102 petajoules in 2019, with a credible risk it could be at the higher end of the scale in both years.

Similarly, the ACCC calculated a **55 petajoule** shortfall in domestic gas supply for the east coast for 2018, **but the supply gap could be as much as 108 PJ**, depending on demand."

<http://www.afr.com/news/politics/malcolm-turnbulls-last-warning-to-gas-giants-20170924-gynxwj#ixzz4uzHqeC7b>



## Study by IT Power for ARENA

"ARENA commissioned consultancy group IT Power (Australia) Pty Ltd, working in conjunction with Pitt and Sherry and the Institute for Sustainable Futures at the University of Technology Sydney, to **investigate the renewable energy alternatives available for industrial gas users.**"

"**Bioenergy and solar thermal systems were found to be the most prospective** renewable energy alternatives for the provision of industrial process heat. "

"Based on the analysis of gas consumption and renewable alternatives, the **potential viable market** at this stage for the application of renewable energy for industrial processes is in the order of **50 to 100 PJ each year.**"

<https://arena.gov.au/about/funding-strategy-investment-plan/renewables-for-industrial-processes/>



## Green Brewery – Solar thermal collector field

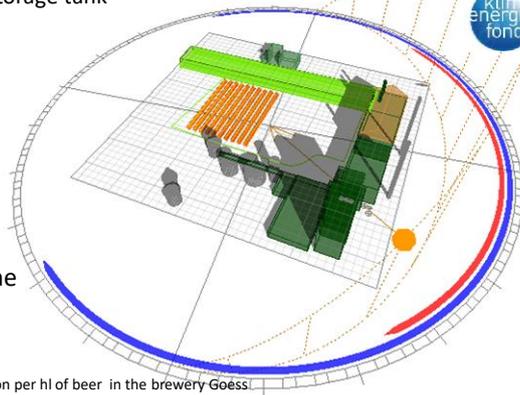


### BREWERY GOESS

- Solar assisted mashing process
- 1,470m<sup>2</sup> ground mounted flat plate collector field (15m<sup>2</sup> collectors)
- 200m<sup>3</sup> pressurized hot water energy storage tank
- **Commissioned: June 2013**



**4.6 million pints of beer per year brewed with the power from the sun\***



\* assuming 60 MJ thermal energy consumption per hl of beer in the brewery Goess!

## State of the project



### BREWERY GOESS

- Construction of the 1,500m<sup>2</sup> solar thermal collector field



## Opportunities and Barriers

- Lack of awareness & experience
- Uncertain future at any specific site leads discourages investment
- Heat network
  - Diversity of heat suppliers and off-takers reduces risk
- International experience shows solar in district heating networks is very competitive
- Opportunity for a local government with food and beverage industries that are stressed by energy prices.



## Solar District Heating



Source: <http://www.vojensfjernvarme.dk>

Vojens, DK

70,000 m<sup>2</sup>  
(49 MW),  
207,000 m<sup>3</sup>.

€0.035/kWh

With Seasonal  
Storage !!!



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