



HYDROGEN

in Victoria's Mallee

The Mallee Hydrogen Technology Cluster will **deliver the region's vision to be a leader** in the emerging hydrogen economy

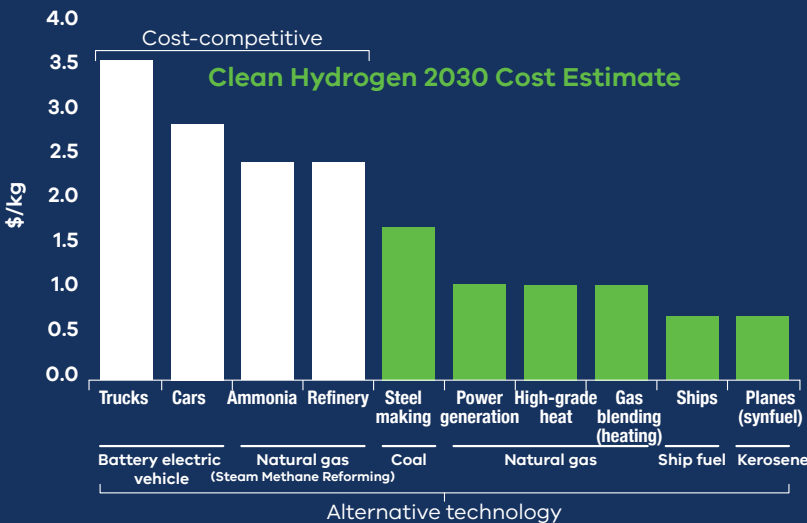
By leveraging the region's considerable renewable energy capacity, a competitive hydrogen industry can be established in the Mallee.

If we take actions now, we will develop an alternative energy source for the region's industry and transport, as well as developing a new commodity for export.



OUR FUTURE with Hydrogen

As project scale increases and production efficiencies are realised, the competitiveness of 'green' hydrogen production via electrolyzers is expected to improve considerably by 2030. This will enable 'green' hydrogen to displace incumbent fuels across an increasing number of uses.



The value of the global hydrogen market is estimated to reach US\$25 trillion dollars by 2050. Hydrogen's desirable properties as a clean fuel and energy carrier, combined with global commitments to reduce carbon emissions, have resulted in hydrogen's renaissance. Market forecasts project hydrogen may make up 18% of the world's energy demand by 2050.

An Australian hydrogen industry could generate about 7,600 jobs and A\$11 billion in GDP in 2050.

Cost Competitiveness of Hydrogen Applications

Source: Council of Australian Governments (COAG) Energy Council



LODDON MALLEE

The Mallee's Competitive Advantage IN HYDROGEN PRODUCTION

A Modern, Sophisticated and Connected Region

The Victorian Mallee is a home to entrepreneurs and a place where large scale projects are realised. There is a highly urbanised population situated along the Murray River that contributes to a diverse economy with plentiful services such as universities, world class health services and an enviable lifestyle.

- ◆ Mildura Airport is the second busiest passenger airport in Victoria with regular flights to Melbourne, Sydney and Adelaide.
- ◆ Mildura is the epicentre of road freight connecting Melbourne, Sydney and Adelaide and is well know for its exports.
- ◆ We have a standard gauge rail connection to the ports of Melbourne, Geelong and Portland with the prospect of further improvements being made to the freight rail network.

Cheap Land and Room for Everyone

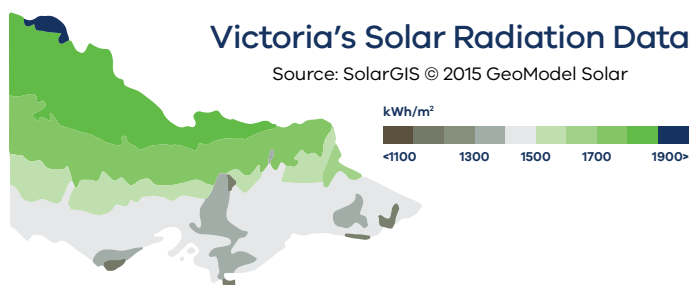
Outside the Mallee's urbanised areas, cropping land sells for between \$750 - \$2500 per hectare depending on improvements and average rainfall.

In comparison to other parts of Victoria that are more densely populated, there is greater acceptance of the role played by new industry developments in creating jobs and wealth for the region.

This is evidenced by the lower rate of planning permit objections that have been received for the solar farm developments in the Mallee compared to other parts of the state.

Plentiful Solar Radiation

Utility-scale solar farms are being rolled out throughout the north west of Victoria. Planned grid augmentation will help unlock our abundant natural resources well into the future.



Plentiful Sources of Biomass

The strong horticultural sector within the Mallee region provides a range of biomass products suitable as feedstock for conversion into green, high value energy products.

This includes the production of renewable drop in fuels(diesel) and gases (includinghydrogen) to transition the transport sector to hydrogen.

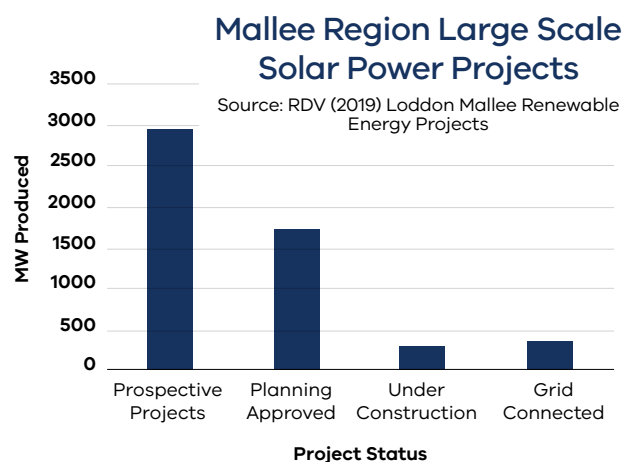
This also allows the agricultural sector to immediately benefit from low carbon, renewable fuel to power trucks, trains, farm machinery, hydrogen fuel cell forklifts and stationary energy on its way to hydrogen future as production increases and machinery options emerge.

A Growing Utility Scale Solar Farm Industry

Currently the Mallee supports 19 large-scale solar projects that are either operating, being built or with planning permission approved.

These Solar Farms provide a combined energy capacity of 2380MW and are valued at over \$2.8 billion.

A further 13 prospective solar farm developments have an estimated regional energy capacity of 2,050 MW. Combined, they have an estimated total energy capacity of 5,280MW.

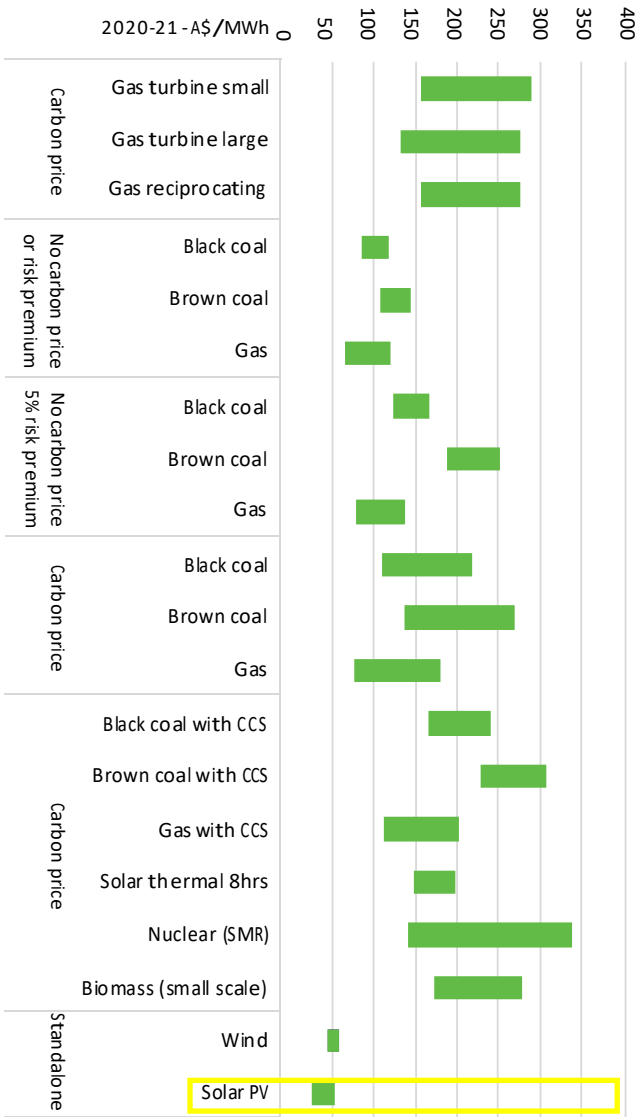




Solar Electricity Prices to Continue Falling

The highest input cost in the production of green hydrogen is the renewable energy required to drive electrolysis.

The CSIRO is predicting that by the time the hydrogen economy matures (2030 – 2050), large scale solar electricity production will have become cheaper than wind generated electricity, making the Mallee the most economical producer of green hydrogen in Victoria.



Pre-existing Infrastructure allowing export of Hydrogen from the region

From Mildura there is a standard gauge freight rail connection to the ports of Melbourne, Geelong and Portland and a pre-existing natural gas pipeline to Adelaide. If peak demand electricity was to be supplied via stored hydrogen, then the Mallee is connected into the National Electricity Market through two 220kV transmission lines to Ballarat and Melbourne and interconnectors to NSW and SA.

The region has been advocating for upgrades to both the electricity distribution network and freight rail network with recent commitments from the Commonwealth and State Governments for the KerangLink electricity interconnector and both governments have committed to make improvements to the Murray Basin Freight Rail network.



Water Availability

Thanks to the Murray River, annual water usage in the Mallee exceeds 600 Gigalitres, the vast majority of this being used by horticultural enterprises.

Markets for water encourage the available water to move to the highest value use. With water only being between 1-2% of input costs in the production of hydrogen, the hydrogen industry should be able to weather fluctuations in price.

There is an abundance of groundwater beneath the Mallee – but this is of a poorer quality and would require purification before being used in hydrogen production, and an additional cost to the production process.

Calculated Levelised Cost of Energy (LCOE) by technology and category for 2030

Source: CSIRO GenCost 2020-21 – December 2020

KEY DEMAND OPPORTUNITIES in the Mallee

Given the Mallee's competitive advantages and those uses of hydrogen that are closer to being financially viable, the following opportunities will be actively pursued:

◆ Hydrogen Fueling our Logistics Companies

Our region boasts 4 truck retailers and 31 truck fleets, with established logistics companies including Pickering Transport, Sunraysia Freight, GTS Freight Management, Seaway Intermodal Freight and Transport and Lindsay Rural. The cluster of freight companies in Mildura and Swan Hill is due to the region's centrally located position within the freight tri-state corridor.

◆ Injection into Natural Gas Pipeline

Without major infrastructure costs, hydrogen can supplement natural gas (up to 10%) for use in domestic and industrial uses. Mildura is connected to a natural gas pipeline that connects to Adelaide.

◆ High Energy Use Manufacturing Processes

Many pre-existing food processing businesses within the Mallee are candidates for eventual conversion to hydrogen power. With the potential of plentiful and relatively cheap energy production, there is scope to attract greenfield industries to the region.

◆ Remote Microgrid Supplier

The Mallee Regional Innovation Centre is the farthest inland NERA Hydrogen Technology Cluster and is well placed to develop technologies that support remote communities. Domestic hydrogen batteries such as the LAVO™ system are already available for sale. Unlike Lithium Ion batteries, hydrogen batteries are suited to long-term storage and can be scaled up to respond to changes in need.

◆ Offtake and Storage

With major electricity interconnectors travelling through the Mallee there is scope for the region to store excess electricity as hydrogen and release it back into the electricity grid when peak demand occurs.



Next steps

Establish Hydrogen Projects

Working with our research partners, local electricity producers and potential users of hydrogen we will develop pilot scale hydrogen projects that help build the region's capabilities. To achieve scale, there will be a need to build production capacity in step with domestic demand.

Infrastructure Required for Hydrogen Export

By 2030, it is expected that export markets for hydrogen will begin to expand rapidly. We need to act now to ensure that the export infrastructure we require is available by this time.

Alternate Water Sources

Investigate the utilisation of alternate water sources to produce hydrogen, including the use of the Mallee's plentiful groundwater resources.

Build Social Licence

Work with our local community to raise awareness, educate and understand the benefits of hydrogen as a new industry for the region.