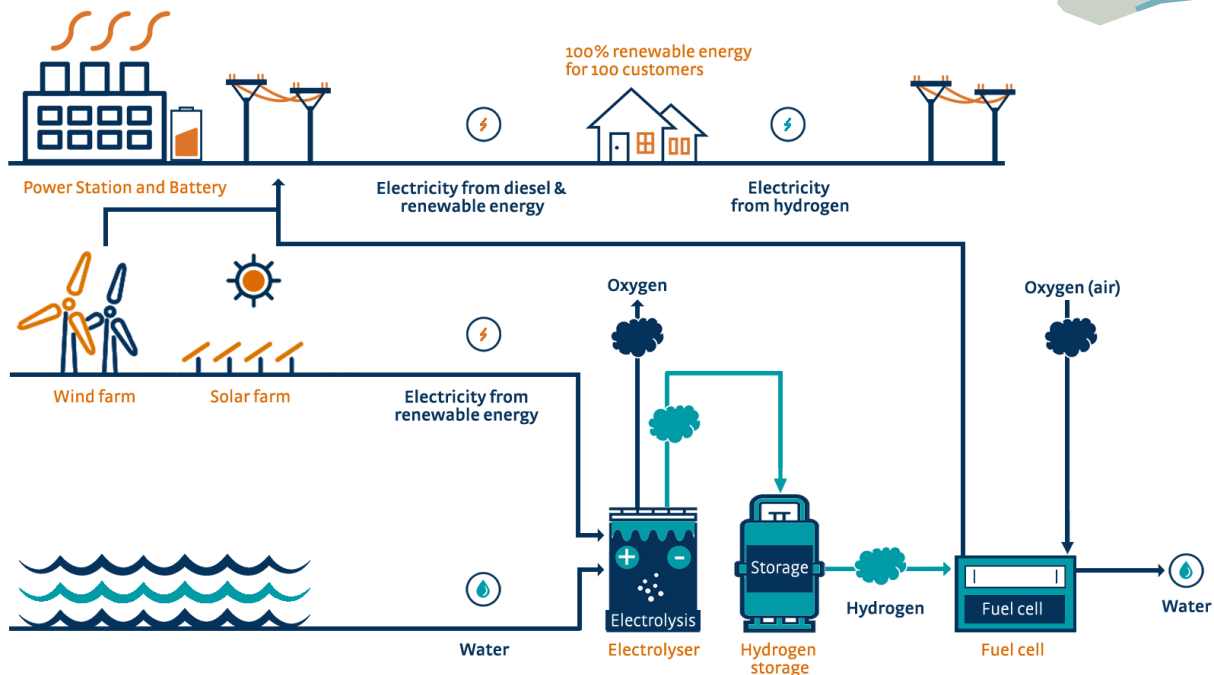


## Renew the Regions

# Denham Hydrogen Demonstration Plant



## Horizon Power is delivering Western Australia's energy future

Horizon Power has awarded WA-based integrated renewables specialist, Hybrid Systems, the contract to build Australia's first renewable hydrogen demonstration plant in a remote power system in Denham.

The hybrid solar and hydrogen power system will test the technical capability of hydrogen as a dispatchable power source in remote microgrids, in anticipation of the technology becoming cost competitive in the future and is a step towards Horizon Power meeting its target of no new diesel generation systems from 2025.

Denham has the ability to inform Horizon Power on the possibility of implementing microgrids and hydrogen technology into other regional power systems across the state, while also helping to advance hydrogen development across Australia.

Hybrid Systems will deliver a 704 kilowatt (kW) solar farm, 348kW electrolyser, hydrogen compression and storage, and a 100kW fuel cell.

The system will use renewable energy to power an electrolyser that will produce hydrogen, which can be stored for later use in the fuel cell to deliver electricity.

The demonstration plant will utilise solar and renewable hydrogen generation and storage to provide 526 megawatt hours (MWh) of dispatchable renewable electricity per year, the equivalent energy used to power 100 homes.

As a result, there will be a reduction in the reliance on diesel generated power from the existing power station, which will reduce emissions and help to preserve the region's pristine world heritage coastline.

The hydrogen plant equipment will be located at the existing power station site, and the dedicated solar farm will be located adjacent to the wind farm and Monkey Mia Road.

*This project has been partly funded by the Australian Renewable Energy Agency's Advancing Renewables Program, and the WA Government's Recovery Plan and WA Renewable Hydrogen Fund.*

# Hydrogen and the demonstration plant

Hydrogen is a low density gas which produces clean electricity and emits only water. This makes it a green energy source, and that's why we're interested in developing a way to harness its capability as a cost-effective, dispatchable power source. This is where our hydrogen demonstration plant comes in.

## How does the demonstration plant work?

The process starts with the electrolysis of water, where electricity from the solar farm is used to split water into oxygen and hydrogen gas. The hydrogen that is produced is then pressurised and stored.

To create electricity, the hydrogen gas is passed through a fuel cell and combined with oxygen. The reaction between the two gases produces electricity, which is supplied to the grid, and water vapour, which is reused at a rate of approximately 50%, the balance evaporating into the atmosphere.

Electrolysis requires purified clean water. To achieve the required standard, mains water will pass through a reverse osmosis system before supplying the electrolyser.

The process to convert water to electricity uses an average of 1,370 litres per day, which is just above the average daily household consumption of water in Western Australia.

Water will also be utilised for cooling the hydrogen equipment, but the overall daily consumption of water will not exceed the average consumption of four households.

# Project benefits

Because hydrogen is a clean source of energy, the development of hydrogen energy systems has become the focus of global research efforts. Horizon Power's investment in this important field is driven by our determination to meet our customers' future energy needs in a responsible and sustainable way.

Denham has been chosen as the site of this important project due to several factors, including the wind farm and Horizon Power-owned power station. This existing infrastructure means we can get the project underway and reduces the project's cost burden on taxpayers and the State.

However, it's important to us that we deliver direct benefits to the Denham community, and these include:

- Increased generation of renewable energy for the town's energy supply, and reduced carbon emissions;
- Job creation during the construction phase of the solar farm;
- Reliance on local businesses for goods and services throughout the duration of the project; and
- Upgrades to the existing power station assets.

We expect this groundbreaking project will continue to attract national media interest, turning the spotlight on Denham's pristine coastline and attractions, and may lead to further interest in Denham as a world-class tourism destination.

## Power station upgrade

The current power supply assets in Denham are aged and much of the equipment has reached the end of its life.

As renewable energy is advancing quickly and becoming more affordable, Horizon Power has made a strategic decision to upgrade Denham's existing power station to support the construction of Australia's first remote microgrid renewable hydrogen demonstration plant.

Building a new power station for Denham now would lock us into a long-term diesel solution, and would delay future opportunities to increase the renewable power generation options for the town.

Contract Power Australia (CPA) has been awarded the contract to upgrade the aged Denham power station assets on Dampier Road, as well as supply and install a new 640kW solar farm and battery.

The 640kW solar farm will be located alongside the 704kW hydrogen solar farm, on land adjacent to Monkey Mia Road, and will increase the renewable energy produced in Denham.

Visit [renewtheregions.com.au](https://renewtheregions.com.au) or [www.wa.gov.au/government/wa-recovery](https://www.wa.gov.au/government/wa-recovery)

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## Key dates

Solar farm construction commences May 2021

Demonstration plant construction commences October 2021

Fully commissioned and operational by October 2022

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## Renew the Regions

# Denham Hydrogen Demonstration Plant

## Frequently asked questions



### The system

#### What does the hydrogen plant consist of?

The hydrogen plant will consist of a dedicated 704kW solar farm, 348kW electrolyser, hydrogen compression and storage, and 100kW fuel cell.

#### Where will the plant be located?

The hydrogen equipment will be located at the existing Denham power station on Dampier Road and will fit into approximately 400m<sup>2</sup>.

The dedicated solar farm will be located on a new site adjacent to the wind farm and Monkey Mia Road.

#### How does the plant work?

The process starts with the electrolysis of water, where electricity that is generated from the dedicated solar farm is used to “split” water into oxygen and hydrogen gas.

The produced hydrogen, which is a low density gas, will be pressurised and stored.

To create electricity, the hydrogen gas is passed through a fuel cell and combined with oxygen. The reaction between hydrogen (H<sub>2</sub>) and oxygen (O<sub>2</sub>) in the fuel cell produces electricity and water vapour.

#### Does the electrolysis process use ocean water? If not, what water source will be used?

Mains water will be used as the base water source, not ocean water.

Electrolysis requires purified clean water. To achieve the required standard, mains water will pass through a reverse osmosis system before supplying the electrolyser.

#### How much water is used in the process?

The process to convert water to electricity uses an average of 1,370 litres per day, which is just above the average daily household consumption of water in Western Australia.

Water will also be utilised for cooling the hydrogen equipment, but the overall daily consumption of water will not exceed the average consumption of four households.

#### Will the hydrogen be produced onsite in Denham or will it be transported in?

Hydrogen will be produced, stored and converted into electricity via a fuel cell at Denham’s existing power station site.

#### Why did you choose to build the plant in Denham?

Denham was chosen as a site for the demonstration plant due to a number of factors, including the existing wind farm, the Horizon Power-owned power station and good site access.

#### Why is Horizon Power refurbishing the power station rather than replacing or relocating it?

Horizon Power has committed to achieving grid-based renewables across 100% of our systems by 2030.

This means that building a new diesel-generated power station in Denham would be an expensive short-term solution for delivering power to Denham, and would further delay opportunities to increase renewable power generation options for the town.

### Operations

#### Will the hydrogen demonstration plant provide a more reliable power supply than the existing power station?

No. However, the project will test if the plant provides a more reliable power supply than the current intermittent renewable power supply options (like wind and solar). If it does, this will allow renewable energy to replace baseload diesel generation in the future and reduce carbon emissions by 335 tonnes per year.

#### Why does the power station upgrade still rely on diesel?

Solar and wind power currently need to be stored for when the sun isn’t shining or the wind isn’t blowing, and to cover the intermittency of this power.

At this point in time, it would not be economically viable to power Denham solely from renewable energy.

However, the hydrogen demonstration plant will provide valuable information on whether this technology can use excess renewable power to provide baseload power.

In addition, we recognise the community’s interest in renewable energy and commit to reducing the carbon emissions and increasing the amount of renewable energy generated in the region over time.

#### What is the future of the wind farm?

Horizon Power has recently taken ownership of these assets and intends to run them until their end-of-life, with future refurbishment or replacement options to be investigated.

## How does it affect me?

### What is the project's timeframe for delivery?

The project commenced in January 2021, and we anticipate that:

- Solar farm construction works will start in April–May;
- Power station upgrades will start in May; and
- Hydrogen plant construction will start in October 2021.

We expect the project to be fully commissioned and operational by mid-to-late 2022.

### Will project-related movement through town be disruptive or damage the environment?

Site access to the new solar farm (adjacent to the wind farm) will be via the existing track, and a permanent access point will be constructed during civil works. During the construction phase, access to the site will be via Monkey Mia Road and Henry Road, and will have minimal impact on the surrounding environment.

The project will follow state and local traffic regulations regarding Standard Restricted Access Vehicle Network ratings of vehicle movements.

During May–June and September–November, regular truck and crane movements will assist with works associated with the temporary generation at the power station site.

We estimate that there will be less than 20 truck access movements across the year of construction, and we expect these to cause only minimal disruption to the flow of town traffic.

### What are the advantages of using hydrogen in electricity generation?

Hydrogen is the most abundant element in the universe. It is lighter than air, colourless, odourless and non-toxic.

Hydrogen can be safely produced from water using a process called electrolysis, and is a clean carbon-free fuel, which only produces water when used to generate electricity.

### Is hydrogen a safe fuel?

Like natural gas, hydrogen is a combustible fuel, but it is lighter and more easily ignited.

In WA, hydrogen was used in town gas supplies for many years before the introduction of natural gas in the 1970s. Hydrogen has also been used safely for energy in countries such as Japan, and in the space industry, the electronics industry, chemical manufacturing and metallurgical applications.

The safe use of hydrogen today is supported by decades of use and the development of safe practices shared among the global community.

### How will safety be managed on the plant?

The project will implement a safety framework appropriate for hydrogen production and storage, including:

- Rigorous application of Australian standards, international standards and best practice guidelines developed for high pressure hydrogen.
- Completion of hazard and risk analysis reviews of design, construction, commissioning and operation.

- Project personnel and suppliers experienced in implementing renewable hydrogen projects.
- Monitoring of plant operating conditions, hydrogen detection and emergency fail safe shutdown systems.

### Will I be able to hear or smell the hydrogen plant?

The hydrogen plant will be located on the existing power station site and is not expected to increase the noise levels from the site.

There will also be no smell associated with the plant as hydrogen is odourless.

### Why can Horizon Power install a solar farm but we cannot put solar on our roofs?

Too much unmanaged solar output in the power system can cause power system instability and create issues with power supply quality and reliability.

When our solar farm is installed, it will be integrated into the power station control system so that its output can be turned down when there is too much solar output in the system. A large battery system will also be installed to minimise the impacts of the solar power intermittency during cloud events.

We do not currently have the ability to control the output of small customer solar systems. Hosting capacity limits are set to safeguard the quality of electricity supply within each community and work by setting a limit on how much rooftop solar the local electricity systems can safely accommodate.

### Will more renewable energy reduce our power bills?

No. The tariffs paid by Denham's customers are the same as those paid across the state under the Uniform Tariff Policy. This is much lower than the actual cost of generating, distributing and retailing electricity.

The State makes this possible by subsidising the price of electricity to ensure no customer in regional or remote Western Australia pays more than a customer in the Perth metropolitan area.

The increase of renewables will assist Horizon Power to reduce the overall subsidy required from the government, thereby lessening the burden on taxpayers and the State.

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This project has been funded by Horizon Power, ARENA's *Advancing Renewables Program*, and the WA Government's Recovery Plan and WA Renewable Hydrogen Fund. Learnings from this project will be shared with the public and will inform the hydrogen industry.

Visit [renewtheregions.com.au](http://renewtheregions.com.au) or  
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