# Overcoming the Challenges to Reach Net Zero

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# Executive Summary

With needs to decarbonise, and the rapid pace of digitisation, the industry is expected to research, trial, and install technologies that enable a reliable and affordable future energy system.

There are numerous external factors which affect the renewable energy future including the challenges associated with Horizon Power's geography, existing mining infrastructure, uptake of Electric Vehicles (**EV**), future of the National Electricity Market (**NEM**), and changing customer wants/needs. Each of these factors impact different stakeholders such as remote and regional Indigenous communities, large mines, automobile manufacturers, and the remainder of Western Australia's metropolitan areas.

Currently, the wider power and energy industry similarly faces uncertainty associated with the renewable vision. Effective planning, coupled with a step change development mentality, is important to meet set industry targets. On the community side, communication methods must be tailored depending on the customer group, where managing small rural communities can be done through more intimate and personalised channels.

Emerging technologies such as electric vehicles, biodiesel and hydrogen for microgrid and fleets are options for Horizon Power to consider as they head towards net zero.

The uncertainty of the technology transition combined with the consumers growing emotional and financial involvement in their energy needs requires that they can no longer be just the end user. Early and continued community involvement from the network planning stages onwards is critical to ensure goals are shared and expectations on the impacts of technological limitations are communicated. A culturally appropriate and well-timed collaborative marketing campaign with easy to understand and attractive solutions is recommended.

Acquiring a skilled workforce to engage with communities, and, construct, commission, maintain and optimise the assets is also recommended.

# 1 Purpose

The purpose of this paper is to discuss the challenges associated with the disconnect between how visions for future energy systems are developed versus the appreciation of the constraints and magnitude of uncertainty involved to achieve these visions.

# 2 Background

Horizon Power supplies power to homes and business across 2.3 million square kilometres, spanning the vast remote areas of Western Australia (WA). Operating as both a generator and distributor of energy, Horizon's network comprises some interconnected networks in Pilbara and Kimberley regions, numerous microgrids and gas, diesel, solar, wind and hydro generation. Parts of this network area is also exposed to some severe weather conditions, in particular extreme heat and cyclones.

The energy industry is facing pressure to reduce carbon emissions associated with generating and distributing energy and Horizon Power has recently set an ambitious target to not commission any new diesel generators by 2025 and to be Net Zero by 2030. However, Horizon Power currently plans to maintain 10% of its diesel generations, which adds to the challenge of achieving Net Zero as further carbon emission savings will need to be found elsewhere in the business.

The energy industry is not alone when it comes to ambitious climate change targets. Some mining companies, which is a significant industry in Western Australia, are also developing strategic plans to reduce carbon emissions in the near future.

These goals are not only aligning with the outcomes from COP26, held in Glasgow in 2021, but also reflecting the growing expectations of the broader community. These are ambitious goals for any industry or organisation. Horizon Power will need to embrace new opportunities in order to overcome a unique set of challenges in order to achieve this goal.

# 3 Challenges and Stakeholders

## 3.1 Remote and Regional Communities

Horizon Power's network spans the vast and mostly remote areas of Western Australia, where communities can be very isolated and have a high Indigenous population. They may live in social housing and at times, exist below the poverty line. This can result in an equity issue, where communities may have the desire, but not the means to invest in individual renewable schemes, despite the potential long term savings and environmental benefits.

These communities are spread across an extensive land area and are serviced primarily through fossil fuel sources. Population in these areas is very sparse (refer to Figure 1 for Horizon Power's supply areas). There are approximately 53 remote and Indigenous communities on the network, with a potential to increase/introduce supply to another 117 sites. In addition, there are approximately 38 independent microgrids in regional WA, which are not interconnected to the remainder of Horizon Power's network, or the greater south-west interconnected system.

The regions can also be exposed to some very extreme weather conditions, especially temperatures regularly above $50^{O}C$ and cyclones. This poses a greater risk to isolated grids and assets due to not having a greater interconnection or higher reliability as compared to more semi-urban counterparts.

Depending on the load and social profiles of these communities, these locations may require greater interconnections with new renewable energy zones or connect with the rest of the WA power network (where practical), to enable a robust and reliable security of supply. Initiatives currently undertaken by Horizon Power in some of these communities include the installation of new battery energy storage systems (**BESS**), to allow customers to benefit from lower energy prices. Refer Figure 2. This will be critical as some of these communities are in low income areas.

## 3.2 Mining Infrastructure

As per Figure 1, the Pilbara region of Horizon Power's franchise area is host to multiple large-scale mines, which produce iron ore, lithium and various other minerals. The mining cohort is responsible for a major share of Australia's GDP, and as such, these are large stakeholders in the presented challenge.

These customers/businesses are primarily supplied via Horizon Power's transmission network, which is currently all fossil-fuel based. There is now a combined need for more renewable penetration in the Pilbara region, as these large stakeholders are also establishing green energy goals and targets for minimal emissions in the near future.

## 3.3 Electric Vehicles and Car Manufacturers

The penetration of electric vehicles presents another emerging challenge for the microgrids as it would not take many to overwhelm the available generation capacity. Conversely, the fleet requirements for Horizon Power inhibit the adoption of electric vehicles as the capability of the current vehicles available on the market does not meet the needs of the organisation (to cover rugged terrain or sufficient range to reach remote communities).

Horizon Power's consumers in the metropolitan areas supplied by microgrids (e.g. Esperance area) are increasingly purchasing EVs, that account for a quarter of the grid's load at times. This is expected to increase and therefore is a challenge at the micro level, as well as a macro level.

Automobile manufacturers are crucial stakeholders in this space and may need to consider the use-cases of vehicles in WA and adjust their R&D for EVs to cater for additional versatility, reliability and range. This will also need support from further charging stations, network augmentations and the like.

Along with network wide augmentations to the existing electricity network to increase capacity, areas such as this will also benefit from further interconnections to the greater electricity network.

## 3.4 NEM and WEM

Plans for an interconnection between the WEM and NEM via the SA border will influence the energy market and thus, the entire NEM and its counterparts such as the AER and AEMO will have a large role in this space. Similarly, the Wholesale Electricity Market (WEM), which is part of the South West Interconnected System (under Western Power), is also another stakeholder that will be part of the journey to a net-zero future.

Challenges such as minimum demand will need to take into account WA's load profiles, load growth, and PV uptake. Opportunities are available to transfer excess PV generation from eastern states during the day into WA due to the time / load flow difference (or vice-versa).

Due to its geographical isolation, the SWIS also presents opportunities for renewable sources in Horizon Power's franchise to provide support to the WEM system. Federal, state and local governments will need to work collaboratively to enable the transition to a robust renewable future.

## 3.5 Workforce training and new technology development

Within Horizon Power, workforce training, upskilling and recruitment to suit the rapid change in the industry is also a challenge. A large portion of the workforce will be affected, from planning and design to construction and commissioning. There is a need for specialist professionals in this area.

Secondly, research and development into alternate sources such as biofuels and battery technologies is a challenge that requires appropriate funding and collaboration with stakeholders such as universities, research professionals and technical working groups.

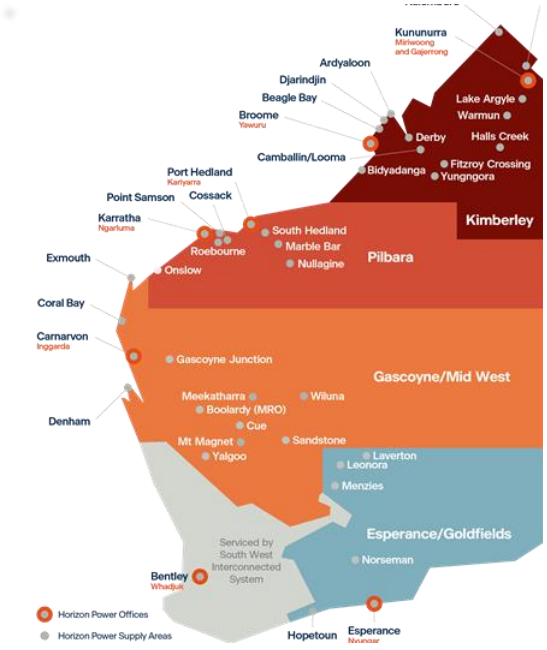


Figure 1: Horizon Power's Franchise Area

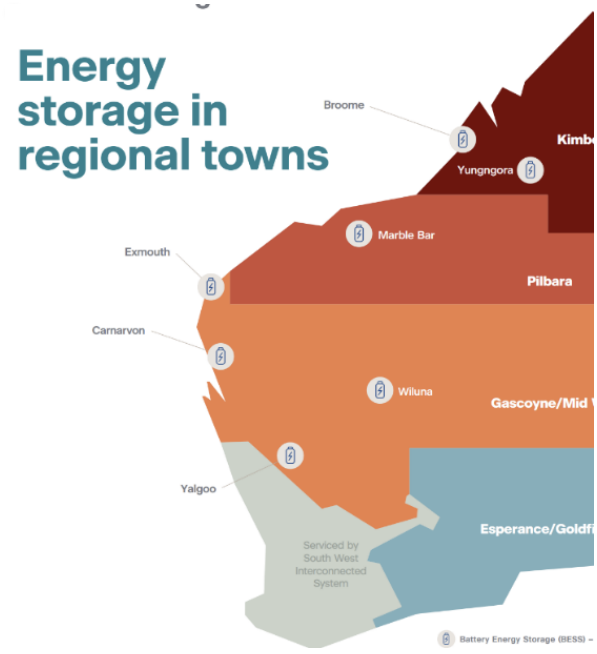


Figure 2: Current Pilot BESS Projects

# 4 Current Strategies

In an ideal world, customers would be well educated on the challenges associated with the energy transition and understand that the path is not particularly straight forward. However, this is not the case, and effective communication is a major theme which is currently applied to bridge the gap between the renewable generation vision and the constraints associated with achieving this, as shown below through examples across the Australian networks.

## 4.1 Community

Energy consumers are concerned with reliability, affordability, and safety, and these pillars must be upheld during and after the green energy transition. Having a customer base where the larger proportion are rural customers raises opportunity to bring intimacy in the communication channels.

TasNetworks for example similarly powers small rural communities. A microgrid development project at a small town (Derwent Bridge with a population of 23) introduced a mix of renewable technology as a solution to energy needs. TasNetworks set objectives to build rapport with the community, raise awareness for the project, and obtain insights from residents on their current understanding of DER and their feelings towards where their electricity comes from. The engagement activities undertaken to meet these objectives included face to face sessions with individuals and larger in-person presentations at local community gathering hotspots.

These sessions provided TasNetworks insight on the town's reliability concerns, renewable generation interests, and load characteristics which are important to utilities. However, of equal importance, these sessions allowed TasNetworks to educate the community on the challenges involved with the energy transition, with the primary challenge at Derwent Bridge being resource availability and how this affected their reliability. As a result, most community members were open to being involved in the project and willing to host equipment to test the feasibility of the microgrid as a permanent, renewable energy solution.

## 4.2 Industry

The industry is aware of the technical challenges associated with a renewable energy transition. There are theoretical solutions and plans made to address these challenges, however uncertainty surrounding expected growth, availability in technology, supply chains, and ability to build social license halts development.

This uncertainty cannot be avoided but can be managed through effective planning. Players in the sector have taken a step change approach to the transition to renewable energy, with SA Water setting a vision for a net zero energy future to be implemented within a two-year timeframe. SA Water faced similar uncertainty when transitioning their energy demands to a net zero scheme using renewable generation. This uncertainty was managed this through efficient scenario analysis (to test robustness of plans), option value assessments (to test regret of under or over investment), and project staging (to retain flexibility in the planning).

SA Water's success in transitioning to renewable energy indicates that the disconnect between a vision and its challenges is bridged by first becoming comfortable with the fact that uncertainty is unavoidable, and then applying effective planning.

# 5 Emerging Opportunities

## 5.1 Electric Vehicles

Horizon Power's existing fleet of vehicles are powered by oil derived fuel. In Australia, a limited range of battery based electric trucks and vans are available from vendors such as Ford, BLK Auto etc., however, these must be tested first under rural WA conditions.

In a historic move, Horizon Power together with Synergy and the WA State Government will build Australia's longest electric vehicle fast-charging network, from Kununurra in the north to Esperance in the south, with 90 EV chargers spread across 45 locations along major transport routes, as shown in Figure 3. Efforts to improve consumer awareness of EV technology is also being undertaken.

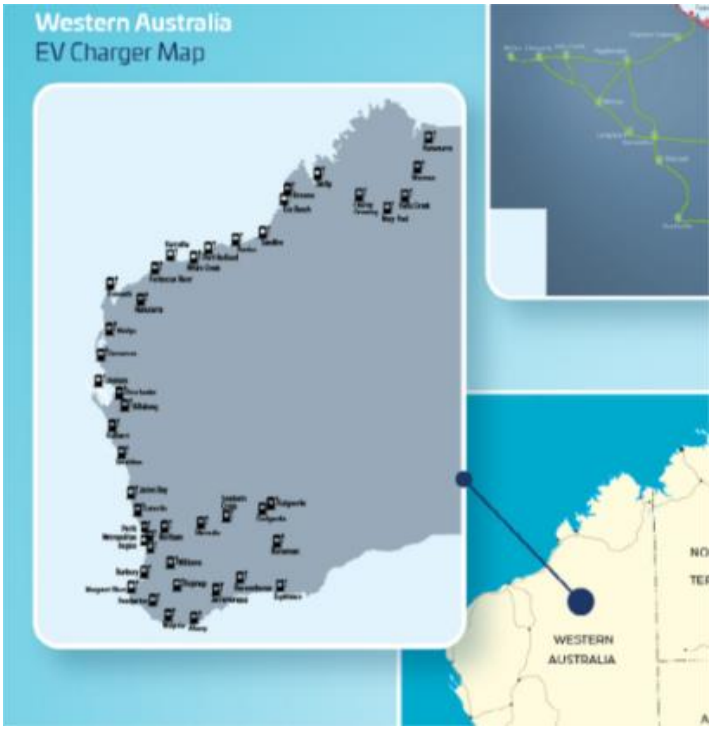


Figure 3: WA's EV Charger Map

In a mining context, equipment such as electric draglines and drill rigs are available now, and it is expected that by 2030, more equipment such as haul trucks, excavators and shovels will be available in the market, as research and development is currently underway for commercial readiness.

## 5.2 Hydrogen

Hydrogen is being called a future superpower. In another historic move, Horizon Power is delivering Australia's first hydrogen demonstration plant in a remote power system in Denham, WA. This end-to-end project will trial and test the technical capability of green hydrogen as a power source in microgrids. The hydrogen plant's dedicated solar farm is finished, the BESS installation is under way, and the hydrogen equipment is due to land on site in Denham in May 2022.

Hydrogen can also be used as fuel for Horizon Power's vehicle fleet. In Australia, Hyundai Nexo, Toyota Mirai and H2X Warrego Ute are a few hydrogen fuel cell EVs that are available in the market. Again, these must be trialed first in WA roads. For mining equipment, research and development is underway to develop hydrogen powered mining equipment and it is expected that they may be commercially ready after 2030. Hydrogen refueling stations are also a necessity.

## 5.3 Biodiesel

Biodiesel is a renewable, biodegradable fuel made from vegetable oils, animal fats, with alcohol and catalyst through processes such as transesterification. Biodiesel can be used in existing diesel engines without modification to a large extent.

Horizon Power can explore the possibility of biodiesel in their fleet by undertaking a demonstration study for biodiesel production on site under WA weather conditions, to be trialed and tested for vehicle suitability, which could possibly be another historic move for Horizon Power.

# 6 Recommendations for Action

## 6.1 Technology development

Invest into the research and development of the following technologies and pilot at suitable locations onto the network:

- Hydrogen manufacturing and control schemes
- Biodiesel including lifecycle feasibility and environmental costs
- BESS including VPP, community and individually owned.
- EV and explore the potential for manufacturing and conversion partnerships that address long range requirements under WA road conditions

Improvements to state government rebates and grants for customer DER and battery systems would assist with prosumer uptake, as installation costs tend to be 2-3 times higher in rural locations.

## 6.2 Community Engagement

Although many consumers are already eager to reduce carbon emissions, involving communities in the technology development process will provide a smoother transition and outcome for all.

A marketing campaign using the EAST methodology (Easy, Attractive, Social, Timing) is a feasible communication method. The recommendations listed below are designed to make the process easy and attractive to the consumer, while being sensitive to social and cultural needs:

- Complete rudimentary surveys to confirm current community expectations and assist with site selection. Survey results can be used to identify which communities may be open to trailing new technologies and can be converted at an earlier stage.
- Prepare clear and transparent technology solutions and its limitations in an easy to interpret method such as fact sheets, FAQ, videos etc. Include additional features that may appeal to individuals, such as:
    - Time of use tariffs as incentives to save
    - Energy usage and generation visibility via app, metering etc
    - Flexible payment options
    - Buyback schemes
    - Government rebates and initiatives
- Engage with Indigenous Elder groups using culturally appropriate channels. Informal meetings over coffee may be appropriate. Larger town meetings can follow
- Engage with mining companies to propose partnerships within mining communities. Larger town meetings can follow.
- Consult on potential solutions, how they will differ from the existing network, and how it will impact the end users

- Listen to community requirements and preferences. Use the information to individualise solutions where possible, or provide insight into technical limitations and settle on a compromise. It is important to know what the community will value most to help the transition
- Communicate the need to prepare for the future with reducing carbon emissions, increasing fuel (diesel) costs and the future of the electric vehicle industry. However, expectations need to be set that the technologies will be evolving over the next few years while we develop the best customised solutions together
- Select site conversion stages in-line with community readiness to move forward. When trial sites have been proven effective, trust is gained from less confident communities.
- Stage a transition period, where back up energy sources are available until the new solution has proved effective
- Post implementation, continue to survey and engage with consumers for feedback and improvements

## 6.3 Workforce Engagement

The right workforce is needed to support the transition and solution. In some cases, existing staff may be upskilled, and specialised staff will need to be employed, such as:

- A variety of workers who relate to the different community types (Indigenous, mining and small communities) and can effectively communicate. Developing trust and a working relationship with each customer is a critical part to co-developing a solution
- Asset construction and commissioning staff
- Asset management and maintenance staff
- Data analysts to optimise operation and expand solutions
- Subject Matter Experts (SME) for emerging technologies

# 7 Contributors

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