

# Kimberley Clean Energy Roadmap

## Key Findings

Image: @Hans, Pixabay



This study has modelled and mapped a comprehensive, fully-costed Renewable Energy (RE) roadmap for the Kimberley. The key findings of this report demonstrate that RE can provide a cleaner and cheaper energy future across the West Kimberley while providing much needed long term jobs.

**Currently, the Kimberley is powered by 94% fossil fuelled generation. This report found that transitioning to 60-90% Renewable Energy will result in savings of a minimum of \$30 per Megawatt-hour (MWh).**

The generation mix modelled is for solar, wind and batteries to be rolled out across every town and community in the West Kimberley region. The results of these total: 117 MW of Wind and 97 MW of utility-scale solar Photovoltaic (PV) generation, with battery storage of 132MWh, whilst retaining some fossil-fuelled backup.

**This visionary roadmap will deliver energy savings of more than \$14.8 million per year** for local Kimberley towns, communities, industry and the WA State Government, with \$13.1 million alone in the Broome-Derby region.

A new sustainable workforce could also be created, if appropriate planning and training programs are rolled out, **producing 184 direct long term jobs for the Kimberley region and State of WA**, including local indigenous employment opportunities.

If this transition to a clean energy future is adopted, emissions of CO<sub>2</sub> in the Kimberley would be reduced by at least 150,000 tonnes per annum – the equivalent of taking 25,000 petrol-powered cars off the roads each year.

The Kimberley Clean Energy Roadmap provides opportunities to act on renewable energy innovation and secure a safe climate future for WA, while saving millions on energy bills and helping to deliver the WA Government's Plan for Jobs.

## Modelling details

Sustainable Energy Now (SEN) have developed an innovative open source modelling software package called SIREN and Power Balance, which was used to compare the Levelised Cost of Energy (LCOE) generation for a range of RE options and fossil-fuelled generated options (diesel and gas). The LCOE is derived from the cost to build and operate a power station, and its expected output, averaged over its lifetime. This is the commonly-used method of comparison of different generation methods.

Scenarios were modelled for various towns, projects

and communities, which included: Broome, Derby, the proposed Thunderbird mineral sands mine, Fitzroy Crossing, Halls Creek, Beagle Bay and Kalumburu, and extrapolated for other communities. The amount of RE modelled was limited to a level that cost \$30 / MWh less than the equivalent fuelled cost.

Full details of the modelling are shown in Table 1, with an overview of the generation mix at each of the major locations in Figure 1. The full report is available at [Kimberleycleanenergy.org](http://Kimberleycleanenergy.org).

## Towns and Industry

Across the larger centres of Broome, Derby, and the proposed Thunderbird mine, 80-85% RE can be achieved for between 15-18% less than the cost of fossil-fuelled generation. This would result in annual savings of \$13.1m. In Broome, for example, annual savings of \$5.8 million can be achieved with a:

- **37 MW Wind Farm** of 962 ha with nineteen 2 MW turbines
- **33 MW Solar Farm** of 172 ha with 132,000 solar panels
- **45 MWh battery**

In the smaller towns of Fitzroy Crossing and Halls Creek, approximately 75% RE can be achieved for 11-12% less cost than fossil-fuelled generation. For example, in Fitzroy Crossing, annual savings of \$420,000 can be achieved with a:

- **4.2 MW Wind Farm** of 109 ha with nine 0.5 MW turbines
- **3.9 MW Solar Farm** of 20 ha with 15,600 solar panels
- **1.8 MWh battery**

## Medium Communities

West Kimberley communities of between 200-1000 people include: Ardyaloon, Beagle Bay, Bidyadanga, Camballin, Djarindjin, Kalumburu, Warmun, Yungngora: 60-70% RE can be achieved for 9.5-11% less cost than fossil-fuelled generation. For example, at Beagle Bay, annual savings of \$49,000 can be achieved with the following:

- **560 kW Wind Farm** of 14.5 ha with three 225 kW turbines
- **720 kW Solar Farm** of 4 ha with 2,900 solar panels
- **670 kWh battery**

## Small Communities

There are 58 small communities (other than those close to towns) with populations of greater than 10 and less than 200 occupants. A typical example is Pandanus Park (population 135) where 64% RE can be achieved with a renewable energy mix of:

- **115 kW Wind Farm**
- **150 kW Solar Farm**
- **135 kWh battery**

## Employment

The Kimberley Clean Energy Roadmap, if implemented, will result in a total of 184 long-term jobs within the State, made up as follows (details in the full report):

- 88 long-term jobs in Construction and Installation
- 26 long-term jobs in Manufacturing across WA
- 70 ongoing Operations and Maintenance jobs
- 162 long-term jobs in the Kimberley
- 184 long-term jobs across the State

## Investment options

The majority of the investment required for the Kimberley Clean Energy Roadmap need not come from the State Government, or funds like the WA New Industries Fund. Renewable Energy investment projects with long-term Power-Purchase Agreements are attractive 'fortress investments' for superannuation funds and other investors, who could partner with local indigenous corporations and communities to deliver social as well as economic benefits to the region.

The modelling has indicated that with an initial investment of \$449 m in renewable energy assets, the region could save more than \$14.8 million per year, over a 25 year period.

Investment options could also include grant funding from national sources like the Australian Renewable Energy Agency (ARENA), the Northern Australian Infrastructure Fund (NAIF), and the newly formed Business Renewables Centre – Australia (BRC-A); whose purpose is to support the uptake by big business of long-term and large-scale renewable energy Power Purchase Agreements (PPAs).

City/Town/Community	Population	RE as portion of Gen. (%)	Savings \$p.a.	Total RE Investment (\$)	LCOE (\$/MWh)	Wind (MW)	Wind Farm Area (ha)	Turbine size (MW)	Number of Wind Turbines	PV (MW)	PV Farm Area (ha)	Number of Panels	Battery Capacity (MWh)	Fossil-fuelled Capacity Capacity. (MW)	CO <sub>2</sub> -e saved (kilo-Tonnes)	
Towns and Industry	Broome*	14,000	80%	\$5.8m	\$168m	\$197	37	962	2.0	19	41	172	132,000	45	27	54.0
	Thunderbird*	N/A	85%	\$6.0m	\$203m	\$204	49	1456	2.0	28	45	198	152,000	61	18	61.5
	Derby*	3,300	82%	\$1.3m	\$46m	\$225	9.5	247	2.0	5	12	58	44,400	13	6.0	13.5
	Fitzroy Crossing	1,140	74%	\$419k	\$17m	\$223	4.2	109	0.5	9	3.9	20	15,600	1.8	2.8	5.5
	Halls Creek	1,550	74%	\$380k	\$16m	\$223	3.8	99	0.5	8	3.5	18	14,179	1.6	2.5	5.0
	Abattoir	N/A	77%	\$353k	\$15m	\$218	3.0	78	0.5	6	3.0	16	12,000	5.5	1.8	4.5
medium Sized Communities	Beagle Bay	350	60%	\$49k	\$2.0m	\$247	0.30	7.8	0.23	2	0.39	2	1,560	0.36	0.40	0.7
	Kalumburu	400	69%	\$62k	\$3.1m	\$278	0.54	14.0	0.23	3	0.58	3	2,320	0.44	0.38	1.0
	Ardyaloon	350	62%	\$56k	\$2.3m	\$247	0.34	8.9	0.23	2	0.45	2	1,783	0.41	0.46	1.0
	Bidyadanga	600	62%	\$92k	\$3.7m	\$247	0.56	14.5	0.23	3	0.72	4	2,898	0.67	0.74	1.5
	Camballin	550	62%	\$73k	\$3.0m	\$247	0.45	11.6	0.23	2	0.58	3	2,318	0.53	0.59	1.0
	Djarindjin	450	62%	\$49k	\$2.0m	\$247	0.30	7.8	0.23	2	0.39	2	1,560	0.36	0.40	0.7
	Warmun	200	71%	\$90k	\$3.7m	\$278	0.56	14.5	0.23	3	0.72	4	2,898	0.67	0.74	2.0
	Yungngora	400	62%	\$99 k	\$4.0m	\$247	0.60	15.6	0.23	3	0.78	4	3,120	0.72	0.80	1.5
	<b>Total</b>	<b>23,290</b>	<b>N/A</b>	<b>\$14.8m</b>	<b>\$449m</b>	<b>N/A</b>	<b>117</b>	<b>3046</b>	<b>N/A</b>	<b>95</b>	<b>97</b>	<b>505</b>	<b>388,636</b>	<b>132</b>	<b>62</b>	<b>153</b>

**Table 1 Full details of the stand-alone scenarios, for all towns and communities supplied by Horizon Power (plus industrial sites), using price predictions for 2019, and optimised to be \$30/MWh less than the equivalent fuelled cost. The figures provided here result from evidence-based assumptions. RE generation is not subsidised.**

\* Modelled on the latest, lower AEMO price predictions for solar PV for 2021-22. This results in a cost \$40-44 /MWh less than the equivalent fuelled cost.

If the Federal Government's RET subsidy was added, further savings of approximately \$4.7 m p.a. are achievable.

If a hypothetical \$20 /Tonne Carbon Price on fossil-fuelled generation is also included, savings of approximately \$2.6 m p.a. are also possible.

Electricity generation capacity is measured in Kilowatts (kW) or Megawatts (MW). Electricity energy use is measured in kilowatt hours (kWh) or Megawatt hours (MWh) – the amount of electrical energy consumed.

**Figure 1 Overview of the Kimberley Clean Energy Roadmap (See overleaf on p4)**







# Indigenous Community Benefits

The Kimberley Clean Energy Roadmap provides significant opportunities for employment and investment opportunities for Native Title groups and indigenous communities. Investment in RE assets, some of which are either fully or partly owned by local indigenous communities or corporations, can provide co-benefits of long term investments for Traditional Owner groups.

The proponents and supporters of this report advocate for meaningful consultation with Native Title groups and Indigenous communities, based on the principles of free, prior and informed consent.

The major providers of electricity supply services in the Kimberley (Horizon Power, Department of Communities and Kimberley Remote Service Providers) have already committed to training and employing indigenous workers as part of their activities.

If this roadmap is implemented with upgraded training programs and suggested policy settings, it could see the development of a long term sustainable indigenous workforce in the renewables sector.

## Opportunities

The Kimberley Clean Energy Roadmap provides the opportunity to act on renewable energy innovation and secure a safe climate future for WA, while saving millions on energy bills and helping to deliver the WA Government’s Plan for Jobs.

There is a sound economic rationale for adopting this vision for a RE roadmap across the Kimberley.

Meaningful consultation with Traditional Owners, the involvement of other local stakeholders, and the State Government Department of Communities and Horizon Power, will be crucial to its success.

This research shows that significant amounts of surplus RE will be generated at some times. This energy could be used for new industry opportunities, such as to produce liquefied hydrogen fuel.

A managed transition plan led by the WA government is key to maximising the benefits from implementing this RE roadmap. Such a plan would:

- build on Horizon Power’s plans for micro-grids in the region
- create a direct opportunity for the the WA Labor Government to deliver on their jobs plan
- provide investment certainty and economies of scale to reduce installation costs
- open up the potential for investment by indigenous communities or Native Title groups
- map out the creation of a new sustainable regional workforce, and provide training opportunities to boost local indigenous employment
- create a sustainable regional workforce
- reduce reliance on fossil fuels; such as gas and diesel energy

## Horizon Power’s Role

Horizon Power appears to be positioning itself to be a leader in the transition to renewable energy, and is preparing for a managed transition to RE, through its development of:

- an advanced microgrid roadmap
- designs for off-grid, utility-scale, micro-power systems
- ‘Distributed Energy Resources Management Systems’ standards

Direct support is required to encourage Horizon Power to progress their renewable energy plans for the Kimberley region, which have been internally developed, but not yet publicly released.



Image: Andreas Gückhorn, Unsplash

## Prospects for Fracking

There is no economic benefit in using fracked gas generation for electricity in the Kimberley. The proposal to use road trains in a 'virtual pipeline' to deliver fracked gas from local wells to Kimberley communities is not significantly cheaper than the existing LNG and diesel solutions. The modelling in this report shows that a direct transition to RE, would save millions per year on energy bills in the region.

Should unconventional gas fracking be permitted by the State Government, other factors are likely to ensure fracked gas extraction is more expensive than the modelled cost assumptions. This is due to the high costs of stringent regulations, monitoring and offsetting methane fugitive emissions, as well as the potentially significant costs of remediating any contamination of freshwater sources.

## Recommendations

This pioneering research study and modelling demonstrates that the commitment to a RE future for the Kimberley will create a reliable, economically-favourable source of electricity for the future, reduce electricity costs for consumers, and create long-term jobs.

Before implementation can commence, some technical and regulatory challenges need to be overcome. Achieving these changes requires clear political direction from the Western Australian Government.

This report recommends that the WA Government:

- Adopts the Kimberley Clean Energy Roadmap
- Supports implementation of Horizon Power's advanced microgrid roadmap
- Develops a Kimberley Electricity Transition plan from this Roadmap
- Updates policy settings to enable HP to facilitate a RE transition in the Kimberley (update generation rules, adopt microgrid standards, and enable an ongoing pipeline of RE installation, with associated economies of scale)

- Conducts in-depth feasibility studies for the uptake of renewable electricity in the Kimberley as soon as possible
- Allocates funding in the forward estimates to develop the managed transition plan and implement a Kimberley Clean Energy Roadmap
- Pre-approves RE development zones and transmission corridors, after meaningful consultation with Traditional Owners, to enable rapid implementation
- Develops plans/ support for a Kimberley RE construction industry
- Develops tender requirements, reverse auction conditions and Power Purchase Agreement criteria
- Develops staged plans of works for the Towns and Industry, Medium Communities and Small Communities

The Kimberley Clean Energy Roadmap could act as a pilot for the wider adoption of RE across the south western corner of the State. And ultimately, if adopted, this model could be rolled-out to other parts of regional and remote WA.



Image: Damian Kelly Photography