

Renewable Energy Zones

Defining Tasmania's Renewable Energy Zones: Spatial Analysis Technical Summary

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Introduction

The Renewable Energy Coordination Framework outlines the importance of spatial analysis to understand the potential development implications of the Government's 200% Renewable Energy Target and to inform the identification of Renewable Energy Zones (REZ).

In 2022 the Tasmanian Government commissioned Aurecon Australasia Pty Ltd (Aurecon) to undertake the first stage of geospatial mapping analysis. The purpose of the spatial analysis was to identify areas of high-quality renewable resources that are technically developable, relatively unconstrained and can accommodate at least 500 MW capacity of wind in a similar geographic area.

The analysis considered the following primary datasets¹ in the constraint model:

- **Energy resources** – the level of wind resource and other technical constraints impacting generation capacity;
- **Environmental, heritage, land use, and primary resources** – identification of potential compatibility of various values with renewables development.

The base mapping was then overlaid with other important considerations (secondary layers) such as:

- **Cost-effectiveness** – proximity to existing and planned transmission infrastructure;
- **Solar resources** – levels of solar iridescence;
- **Investor interest** - proximity to areas with the highest probability of commercial development based on the registration of interest process and planned infrastructure investments such as Marinus Link and Battery of the Nation;
- **Social impacts** – including sentiment towards renewables development and high-level social evaluation.

In 2023, following the announcement of the north west as the preferred region for Tasmania's first REZ, the Tasmanian Government commissioned further geospatial mapping analysis to refine the proposed area boundaries.

A participatory mapping process was also undertaken with the community to gather new social data including areas of importance to the community and areas in which there was a high level of consensus that might be suitable for hosting renewable energy projects. This data provides qualitative insights into local community sentiment, possible social license challenges, and the extent to which the communities' values align with the candidate area identified.

This paper outlines the methodology that underpins the proposed REZ map.

Methodology Overview

Aurecon utilised its SSAT© approach to adopt a multi-criteria risk assessment framework to REZ identification as summarised by Figure 1 below (modelling assumptions and limitations detailed in

¹ Primary data sets are those spatial layers identified as being critical and requiring direct inclusion in the model.

Appendix 2). Stage one of the process comprises steps 2.1 to 2.4, Stage two of the process steps 2.5 and 2.6.

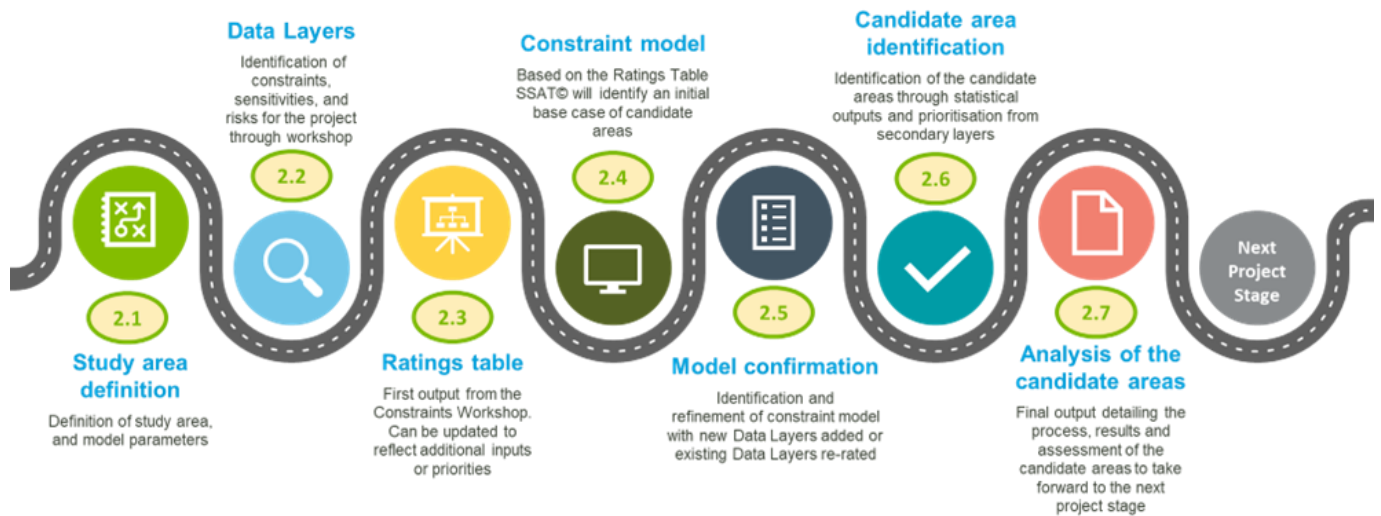


Figure 1: Methodology used for Candidate area identification.

The initial analysis was undertaken in six key stages, as summarised below:

1. First, an intergovernmental working group (working group) was established with stakeholders from relevant State Government agencies to identify key attributes for consideration and source relevant data.
2. The identified data (more than 380 individual spatial features from over 60 spatial data layers²) fall into the broad categories of land use, resource, natural and heritage values, and technical constraints, for which several subcategories exist. These categories were equally weighted because each layer is mutually exclusive.
3. Stakeholders rated each of their data sets regarding its compatibility with onshore wind farm developments on a scale of 1 (compatible) through to 5 (very highly constrained).
4. The data for each subcategory were combined (using a 25-metre-wide cell) and assessed with a max/mean algorithm to create heatmaps for each category.
5. Modelling was then run based on a MAX/MEAN approach - this method takes the mean score for each cell when the ratings for all data layers are combined. However, this was not applied in a cell where any single data layer is rated as 5 (very highly constrained). This is because a 5 is considered so highly constrained, that the development of renewable energy would be highly unlikely regardless of whether the other data layers are favourable.
6. Areas of high wind resource were then overlayed with the areas of least constraint as identified by the MAX/MEAN model. Candidate areas were identified as groupings of hexagons which had 5 or more hexagons in close proximity with a MAX/MEAN rating of less than 2.75 (i.e., equivalent to 5,000ha or 500MW maximum generation capacity), meaning they are least constrained. **This means that, just because a hexagon is within the REZ it doesn't mean that anywhere in the hexagon can be built upon, but that a significant enough proportion of the hexagon is applicable for a REZ definition.**

² See Appendix 1 for list of data layers used.

7. The validation for the candidate areas was undertaken using the Neighbourhood Focal Statistics tool. This output uses an alternative methodology to check and validate that the outputs from the previous stage.
8. The base case was then overlaid with secondary data layers including proximity to the existing 220kV transmission network to identify proximal connection distances to transmission assets as a potential constraint; levels of commercial interest and planned infrastructure such as Marinus Link and Battery of the Nation; and solar resources.

In 2023 further analysis was undertaken to further refine the candidate areas, as summarised below:

1. The analysis focused on previously identified candidate areas in the north west of Tasmania.
2. The working group first provided feedback on the preliminary mapping values.
3. They were also asked to identify any additional information not yet captured by previous datasets³. This information is transformed into quantitative layers which are then added as additional very highly constrained areas to the stage 1 model and refine the identification of more specific candidate areas.
4. The adjusted model with new constrained areas was then used to determine a more detailed delineation of candidate areas. The boundaries were simplified, and gaps were removed to present a more holistic area to create a generalised region that is appropriate for renewable energy development, with acknowledgement that there are still constraints within its bounds.
5. Finally, a simplification algorithm was applied that preserves essential geographic features. The purpose of this was to avoid a direct correspondence with fine-grained details that could potentially mislead or allow for the extraction of unintended information, such as putting a clear line between properties and thus segregating on property into the zone with the neighbouring property out of the zone.

ReCFIT also ran a public consultation process in parallel called Mapping Important Places, which provided an interactive tool for the north west community to identify both values of importance to them in the region (i.e., areas new renewables should avoid) and areas the community believe would be best suited to renewables development.

³ Additional constraints included land tenure, orthophotography, mineral deposits, and Strategic Prospectivity Zones.

Key Findings

A proposed REZ in the north west of Tasmania was identified. Spatial statistics and location summations were then determined to assess the capability of the area.

Table 1: Candidate area composition statistics

Candidate Area Statistics	NW REZ
Total REZ area (Ha):	114,244
Potential development area (Ha):	95,301
Land Parcels (number):	3744
Private freehold:	87 %
Reserved land (mainly regional reserves)	3%
Forestry land	4 %
Roads and railways	3 %
Conservation areas (including covenants)	3 %
Potential generation capacity of development area (MW):	9530

In addition to the composition statistics, summaries on the different key land-uses were determined and captured in Table 2. Note: there can be several land use classifications assigned to the same land parcels. For example, mining exploration licences and private timber reserve classifications.

Table 2: Candidate area land use by percent coverage

Candidate Area Land Use Stats (%)	NW REZ
Forestry	69.8%
Agriculture - Grazing/Pasture	15.8%
Agriculture - Cropping	1.2%
Urban Areas	0.1%
Mining Leases/Licenses	57.3%

Appendix 1: Data layers used for identifying preliminary area boundaries

Value Type	Value/Data Layer	Buffer Applied (if applicable)
Agriculture	CLUM TAS	
	List Land Capability	
	Tasmanian Irrigation Transmission Lines	
Forestry	Forestry Constraint Ratings	
	Tasmanian Reserve Estates	
	Public Land Class (Forestry)	
	Private Timber Reserves	
Heritage	Tasmanian Heritage Register (Polygons)	
	National Heritage Public	
Hydrology	Hydrology Lines	
	Hydrology Areas	
	Irrigation District	
	Irrigation Tasmania Dams	
	Irrigation Tasmania Pipelines	
	Floodplain 1:250k	
	Public Flood Inundation Extent Models	
	Hydrographic Areas	
	Hydrographic Points	
Infrastructure	Enwave Gas Declared Pipeline Corridor	
	Gas Pipeline Planning Corridors	
	Transport Segments	
	Road Access	
	Road Proximity	
	Transmission Line Proximity	
Mining	Exploration Licence	
	Leases	500m
	License Categories 1-6 (exploration only)	
	Retention Licenses	500m
	Mining State Areas	
	Mineral Occurrence Points	
	Strategic Prospectivity Zones	
Natural Values	Geoconservation Sites	
	Private Reserves (Conservation Covenants)	
	Private Nature Reserve and Conservation Covenant (NCA)	
	Private Sanctuary and Conservation Covenant (NCA)	
	Local Government Reserves	
	Raptor Nests	500m
	Threatened Flora	
	Threatened Fauna	
	Threatened Native Vegetation Communities	
	Tasveg 3.0	
	Public Land Class	
	Ramsar Wetlands	
	Tasmanian Wilderness WHA	
Planning	Interim Planning Scheme Overlays	
	Interim Planning Scheme Zoning	
	Land Tenure	
	Planning Scheme Code Overlays	
	Planning Scheme General Overlays	

	Planning Scheme Zones	
	Prohibited Areas	
	Cadastral Parcels	
Terrain	Acid Sulphate Soils (Inland and Coastal)	
	Karsts	
	NCH Landform Classifications	
	Slope Aspect	
	Slope Class	
	Global Wind Atlas, Australia	
	Ridge Landform parallel to prevailing wind direction	
	Ridge Landform perpendicular to prevailing wind direction	
	Ridge Landform with prevailing wind direction at an angle	
	Solar PVOUT	

Appendix 2: Modelling assumptions and limitations

Detailed spatial modelling of large areas can become extremely complex and involve numerous inputs – both spatial and non-spatial. It is not feasible to model every conceivable input, and careful consideration needs to be given to the selection of input layers.

The following basic assumptions are made when setting up a spatially based MCA model such as SSAT©:

- The assessment is a desktop study and the outputs are entirely dependent on the quality and availability of spatial layers identified for input.
- Outputs provide at best a high-level indication of areas where potential for wind energy generation exists. Further detailed investigations, including field verification and negotiations with potentially affected landowners would be required before any development took place.
- Spatial datasets should be freely available from reputable sources and conform to basic data quality standards in terms of:
 - Currency
 - Spatial accuracy/topological integrity
 - Completeness
 - Validity
 - Descriptive attribute data
 - Metadata describing the layer's source, lineage, attribution and usage restrictions.
- Datasets are freely available for download from open data sources or the TWG. Web-based datasets cannot be used as the modelling processes require access to the source data.
- Modelling is performed on a raster grid representation of the constraint layers. The grid cell size chosen for the model should be carefully chosen with the following in mind:
 - The size of the study area: very small cell sizes (e.g., 5m or less) in a large study area can result in huge datasets which are slow to process and unwieldy to manipulate.
 - The size of features to be modelled. The grid cell size represents the minimum size of features to be included, so a large cell size (e.g., 50-200m) can artificially exaggerate the size of smaller features. This is particularly relevant for point and line features: these need to be buffered by at least half the cell size to facilitate representation by at least one grid cell. For example, for a model resolution of 25m:
 - a point layer of raptor nests will be represented at a minimum as a 25 x 25m grid cell.
 - a road 5m wide will be represented by a line of grid cells 25m wide.
 - Some features (point, line or polygon) may require additional buffering to indicate exclusion areas or separation distances. In the above example, raptor nests may be buffered by 500m to represent their exclusion area. Buffer sizes themselves should be whole multiples of the grid cell size: in our example, a 500m buffer is 20 grid cells (20 x 25 = 500).
- Only layers that would likely have a critical influence on the target solution and risk assessment should be included directly in the model. Model complexity rises steeply as the number of datasets

increases, affecting processing times and the interpretation of the results. The intention of the modelling process is not to model every factor present to the nth degree.

- Target generation capacity has been based on an indicative yield of 100kW per hectare, requiring 10ha per megawatt of wind power generated. This figure has been provided as a useful indicative measure by Aurecon's wind energy SMEs.



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