

# From GIS Analysis to Renewable Energy Development Opportunities

by Pregar Pillay

## Where are the most suitable areas for development of large-scale wind energy initiatives in the Gert Sibande District Municipality?

I explored this question through a macro-scale assessment of wind energy development opportunities in the Gert Sibande District Municipality. The inquiry served as the basis for the spatial analysis, which sought to determine the usefulness of GIS in renewable energy planning.

The analysis goes beyond wind resource data alone and considers several other parameters using a multi-criteria decision-making approach. Parameters considered include grid access, road access, biodiversity sensitivities, and settlement sensitivities, all of which were fed into the multi-criteria suitability model to identify areas with the best wind development potential.

### Key Findings and Analytical Highlights

- **Constraint and Suitability Modelling:** Identified 160 Potential Wind Development Areas (PWDAs)
- **Wind Developable Areas Hierarchy:** PWDAs were divided into Supporting PWDAs (500 ha -1,500 ha) and Anchor PWDAs (> 1,500 ha).
- **Strategic Aggregation:** A 4 km buffer around the anchor PWDAs, combined with spatial clustering, identified three Development Corridors where PWDAs are concentrated: Eastern Highveld, Central Highveld, Western Highveld.
- **Indicative Modelled Annual Generation Potential:** Based on a conservative 5 MW/km<sup>2</sup> density assumption and capacity factors, the modelled development footprint represents **26, 108 GWh of indicative annual generation potential**.

**Beyond the maps, decision-support is the real value driver.** This framework demonstrates how spatial analysis can help government agencies and Development Finance Institutions (DFIs) de-risk early-stage site selection, improve capital allocation decisions, and inform regional energy planning.

I welcome feedback, discussion and opportunities to further develop this type of spatial analysis into practical planning and decision-support applications.

Strategic wind Assessment, spatial analysis, and maps are below.

#RenewableEnergy #WindEnergy #GIS #SpatialPlanning #EnergyPlanning #Geospatial #SouthAfrica

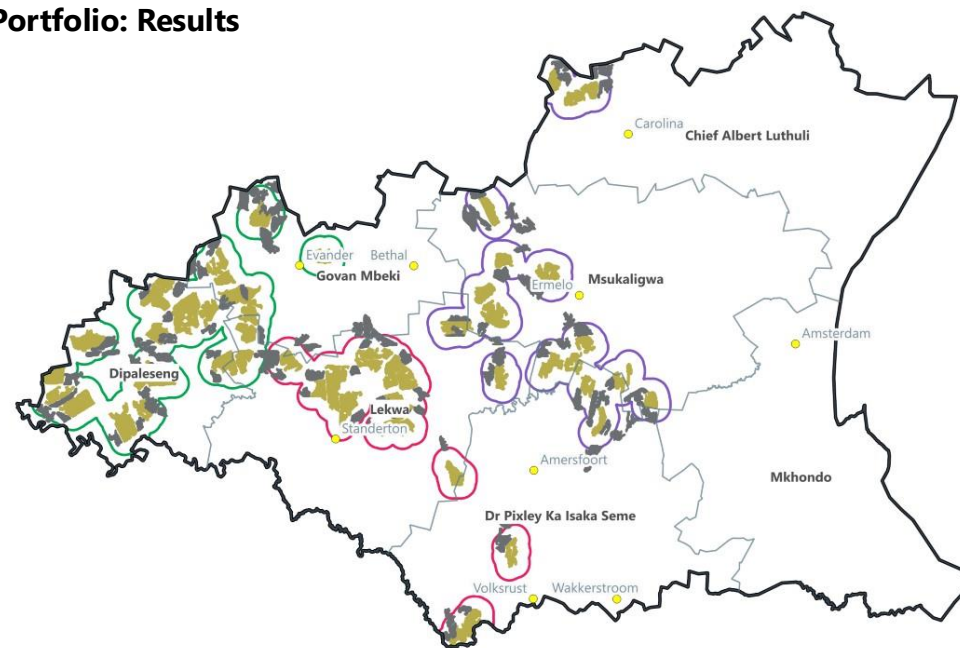
# Gert Sibande District Asset Portfolio



## Gert Sibande District Asset Portfolio: Results

**216,656 ha**  
**Potential Wind  
Developable Area**

**26,108 GWh**  
**Modelled Annual  
Yield**



### Legend

- Towns
- Local Municipalities
- Gert Sibande DM
- Potential Wind Developable Areas**
  - Anchor PWDA (≥ 1,500 ha)
  - Support PWDA (≥ 500 ha - 1,500 ha)
- Wind Developable Corridors**
  - Central Highveld
  - Eastern Escarpment
  - Western Highveld

### Data Sources

BGIS – SANBI  
IBA  
DFFE & MDB  
Global GRIP 4  
Global Wind Atlas  
Grid 3 Population  
MP Biodiversity Sector Plan  
OSM Towns

Coordinate System EPSG:9221  
Hartebeesthoek94 / ZAF BSU Albers 25E

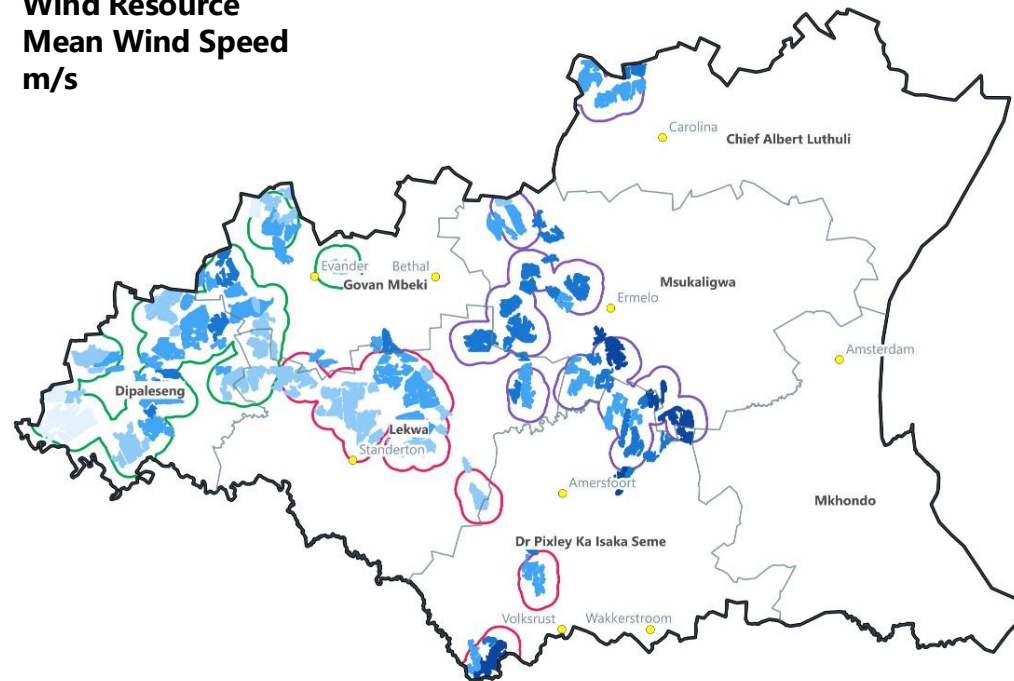
Prepared by Pegan Pillay  
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Mean wind speed: 7.25 m/s

The mapped areas generally exhibit **favourable wind-resource conditions**, with several areas showing wind speeds of **7.5–9.0 m/s**

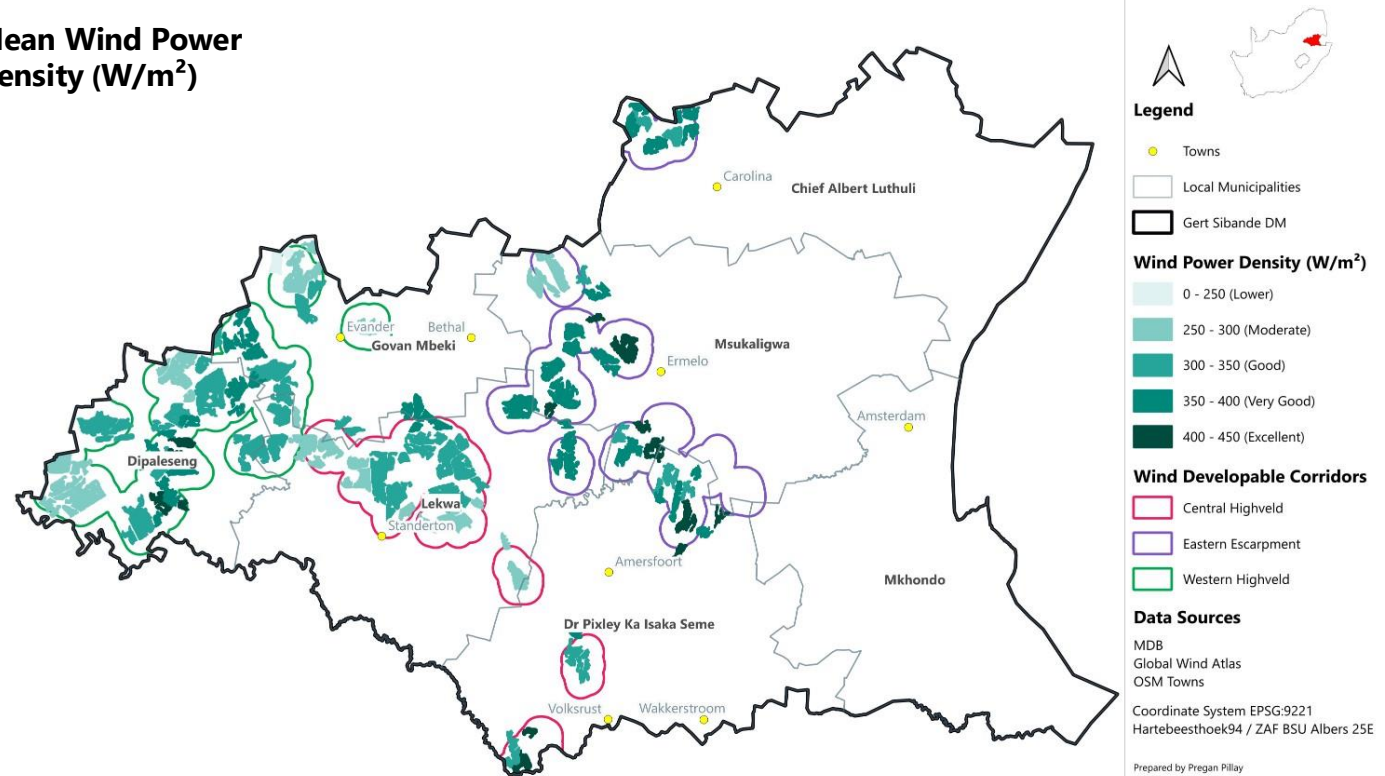
## Wind Resource Mean Wind Speed m/s



## Mean Wind Power Density (W/m<sup>2</sup>)

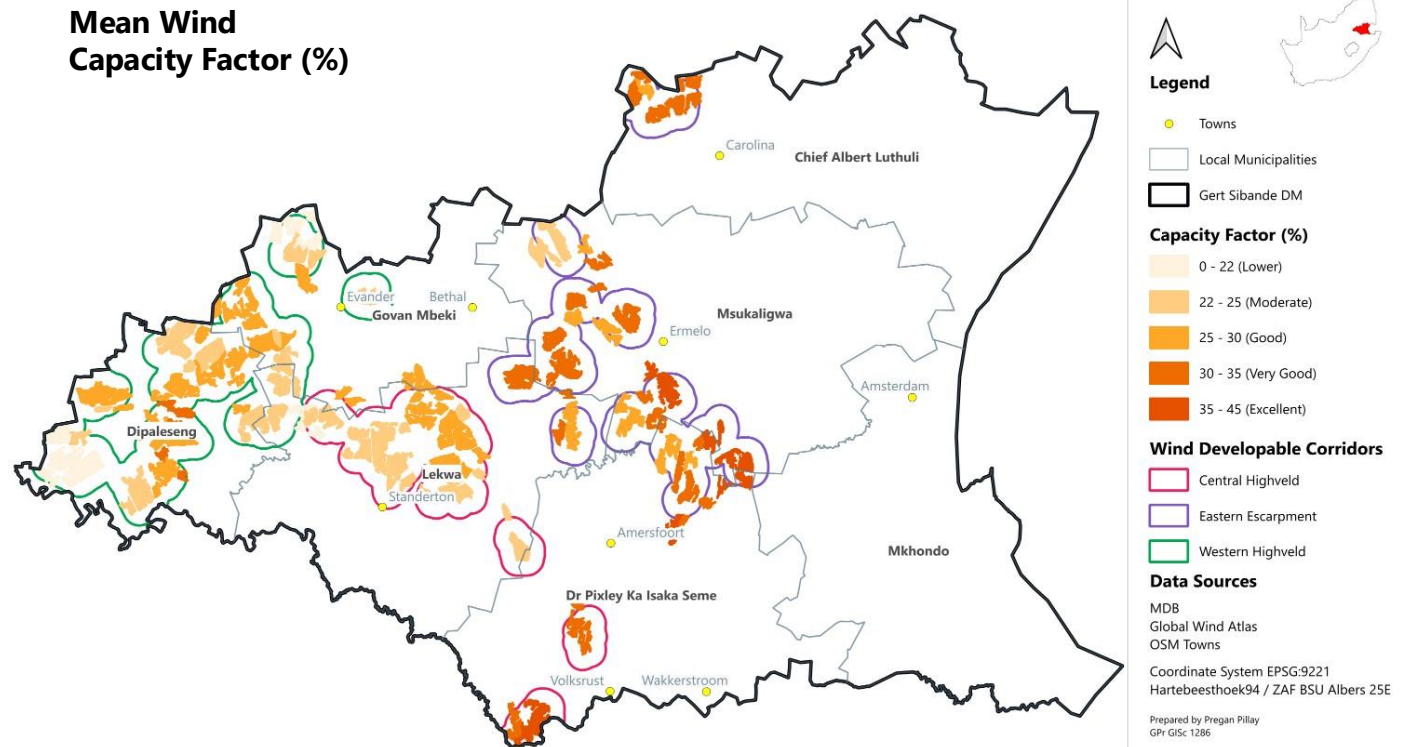
Mean wind Power Density:  
347,6 W/m<sup>2</sup>

The mapped areas generally exhibit **favourable wind-power density conditions**, with several areas showing **350–450 W/m<sup>2</sup>**.



Mean wind  
Capacity Factor:  
27,8 %

The mapped areas  
generally exhibit  
**favourable wind-  
energy potential**,  
with several areas  
showing **30–45 %  
Capacity Factors**



# Thank you

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