environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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# EXTENSION OF A STRATEGIC ENVIRONMENTAL ASSESSMENT TO FACILITATE THE EFFICIENT AND EFFECTIVE IMPLEMENTATION OF WIND AND SOLAR PHOTOVOLTAIC ENERGY DEVELOPMENT IN SOUTH AFRICA

## Technical Considerations

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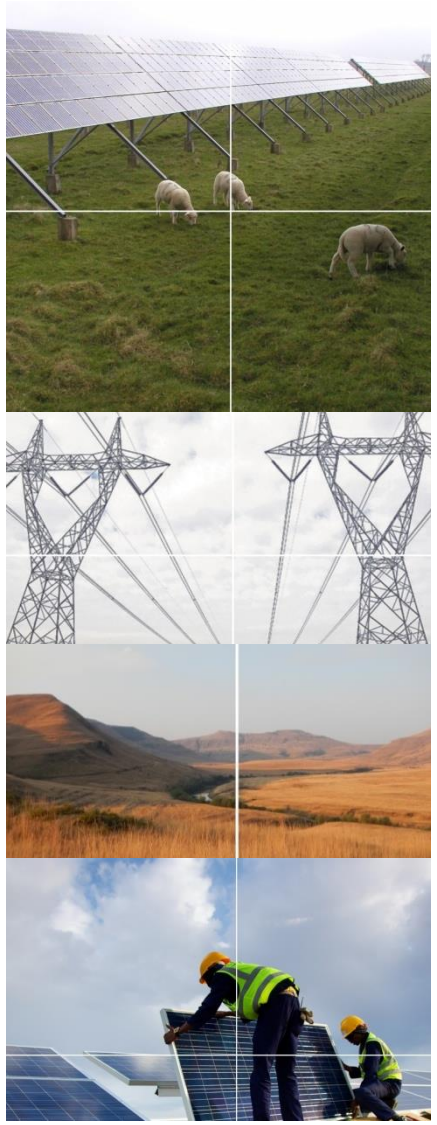
# Technical Considerations

1. Capacity Factor dataset for wind energy development
2. PV tracking yield dataset for solar PV energy development
3. Network capacity: proximity to existing and planned MTS substations
4. Access to site and transport: proximity to main roads
5. Access to site and transport: presence of slopes > 10%
6. Geotechnical risk: presence of dolerite and hardrock formation
7. Strategic coordination: REDZs and power corridors
8. Spatial planning: REIPPPP selected preferred bidders and existing approved EIAs for wind and solar PV projects



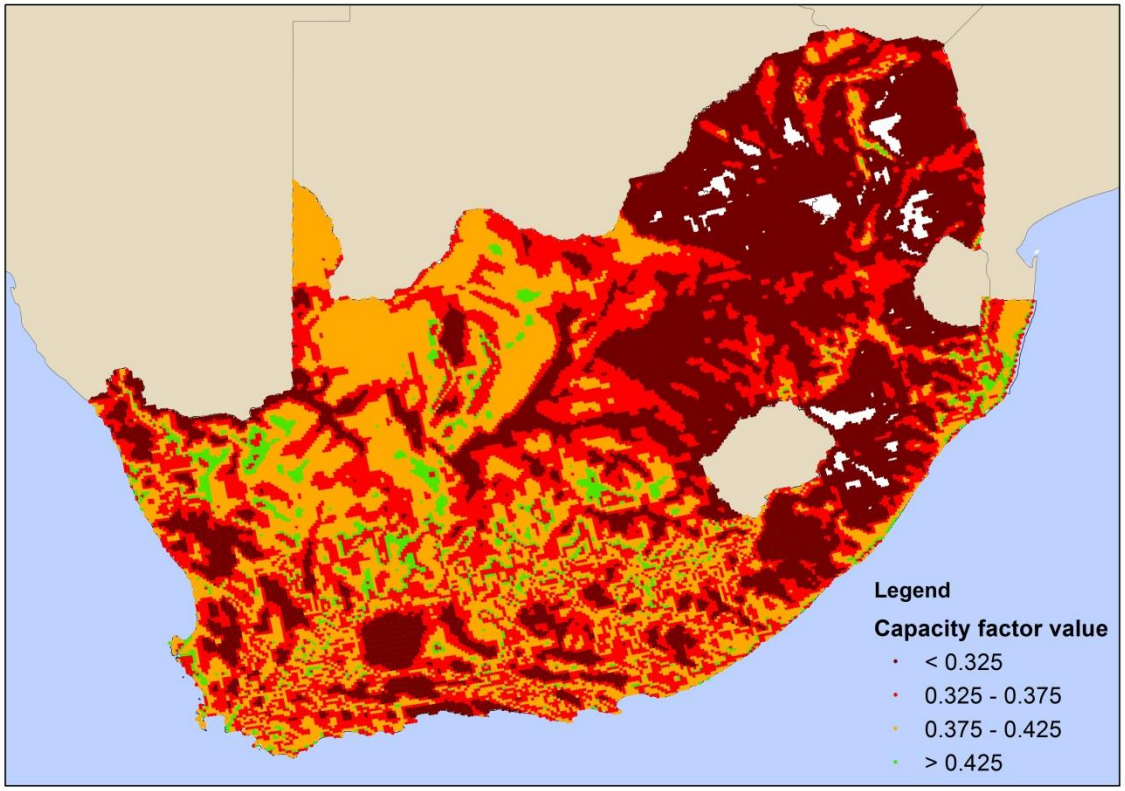
# Capacity Factor dataset for wind energy development

**Assumptions:**

1) Wind turbine types 1 to 3 considered / Space requirement of 0.1 km² per MW
2) Wind turbine type 1 with a nominal power of 3 MW, a rotor diameter of 90 m and a hub height of 80 m is selected for pixels with high average wind speed.
3) Wind turbine type 2, with a nominal power of 2.2 MW, a rotor diameter of 95 m and also a hub height of 80 m is selected for pixels with moderate average wind speed.
4) Wind turbine type 3 with a nominal power of 2.4 MW and a rotor diameter of 117 m is supposed to be installed with a hub height of 100 m is selected for pixels with low wind conditions.
5) Feed-in of electricity generated from wind energy is simulated for every 15 min and every pixel , based on the WASA data and using a Fraunhofer IWES software tool.

**Data source:** CSIR Energy Centre Wind and Solar Resource Aggregation Study for South Africa, Fraunhofer IWES, 2016.

| Turbine type no. | 1 | 2 | 3 |
|---|---|---|---|
| Nominal power | 3 MW | 2.2 MW | 2.4 MW |
| Rotor diameter | 90 m | 95 m | 117 m |
| Swept rotor area | 6362 m² | 7088 m² | 10750 m² |
| W/m² | 442 | 310 | 223 |
| Hub height | 80 m | 80 m | 100 m |
| Selection criterion | øv at 80 m > 8.5 m/s | øv at 80 m < 8.5 m/s and øv at 100 m > 7.5 m/s | øv at 100 m < 7.5m/s |
| Turbine type | High wind speed | Medium wind speed | Medium low wind speed |

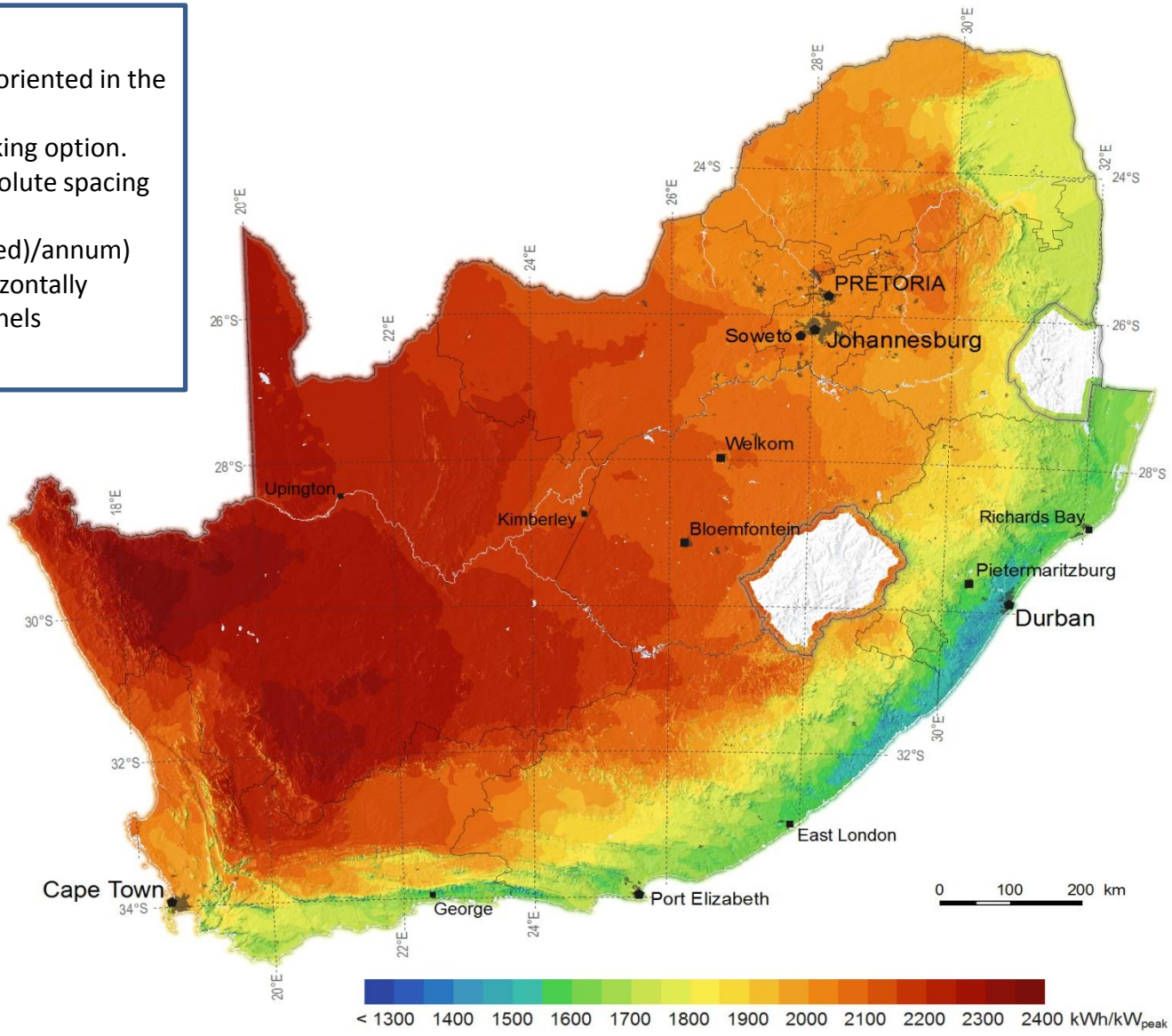


# PV tracking yield dataset for solar PV energy development

**Assumptions:**

1) One axis tracker with horizontal axis oriented in the North-South direction.
2) Angle limitation is 45º with backtracking option.
3) Relative row spacing 2.5 (ratio of absolute spacing and width of a tracker wing)
4) Unit: kWh(electrical)/kWpeak(installed)/annum)
5) Single axis tracking North-South-Horizontally installed typical Crystalline Silicon panels
6) Resolution 250m x 250m

**Data Source:** DEA, 2013 SolarGIS map, GeoModel Solar



# Network capacity: proximity to existing and planned MTS substations

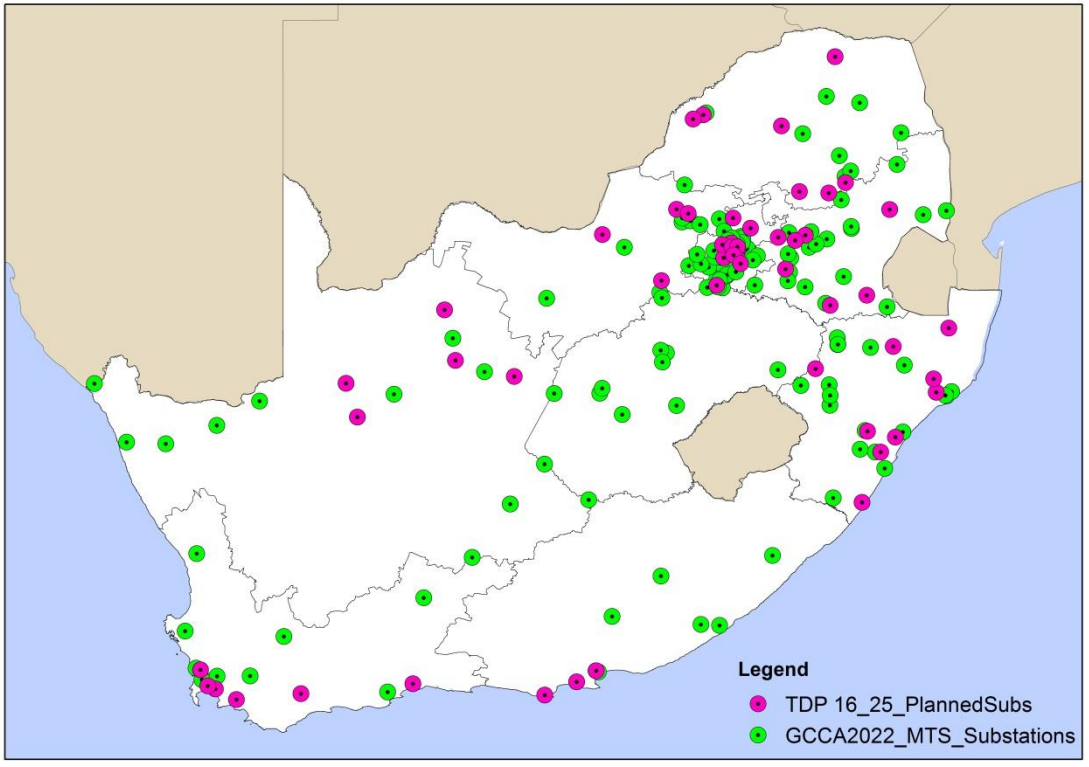
**Assumptions:**
1) Substations in areas with Area Stability Limit >1000MW;
2) Substations with Transformer limit (existing or planned) >100MW;
3) Planned substations up to 2020 according to GCCA and TDP.

| Proximity – Wind energy | Proximity – Solar PV energy |
|---|---|
| < 10 km | < 5 km |
| 10 - 20 km | 5 - 10 km |
| 20 – 30 km | 10 - 15km |
| >30 km | >15km |

The GCCA-2022 now includes all the projects expected to be completed by 2022 as contained in the TDP for the period 2015 to 2024.

The objective is to provide developers and investors with an indication of the **potential available capacity for the connection of new generation at or within the supply areas of the MTS substations** on the Eskom transmission network by 2022 based on the current TDP.

The most significant change in the capacity calculation is that **connection at the lower distribution-level voltages does not require an N-1 connection**. Thus, the full installed transformer MVA capacity at an MTS substation is available for providing generation connection capacity.




**Data source:** Eskom Generation Connection Capacity Assessment (GCCA) of the 2022 Transmission Network (GCCA-2022) and Eskom transmission development plan (TDP) 2016-2025

# Access to site and transport: proximity to main roads

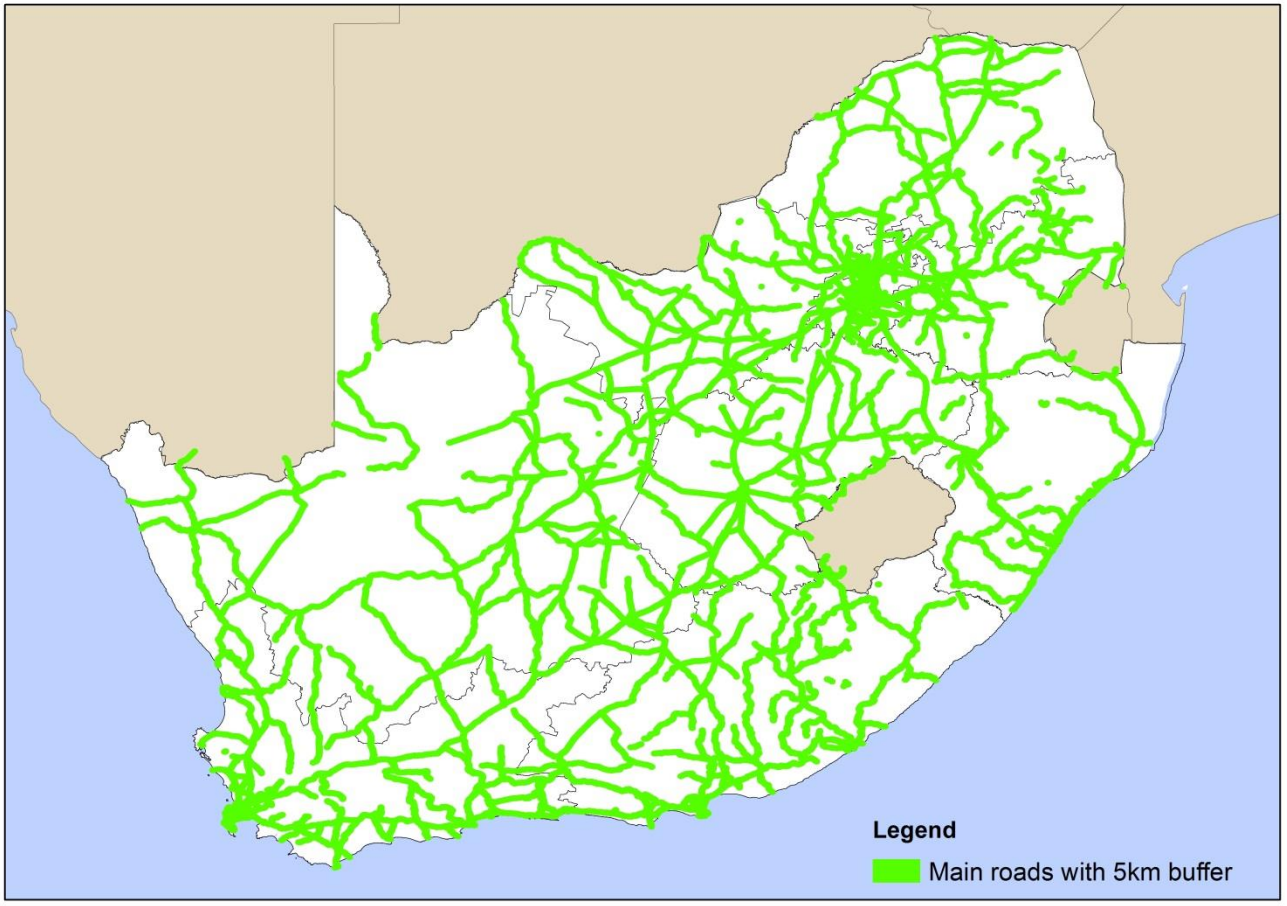
**Assumptions:**

1) Only main access roads capable of accommodating abnormal loads and heavy material/component transport were included
2) A 5 km buffer was applied as threshold of easy access to site

| Proximity – wind and solar PV energy |
|---|
| < 5 km |
| 5 - 10 km |
| 10 - 15km |
| >15km |

**Data source:**

Surveys and Mapping 1:50 000 topographical maps of South Africa



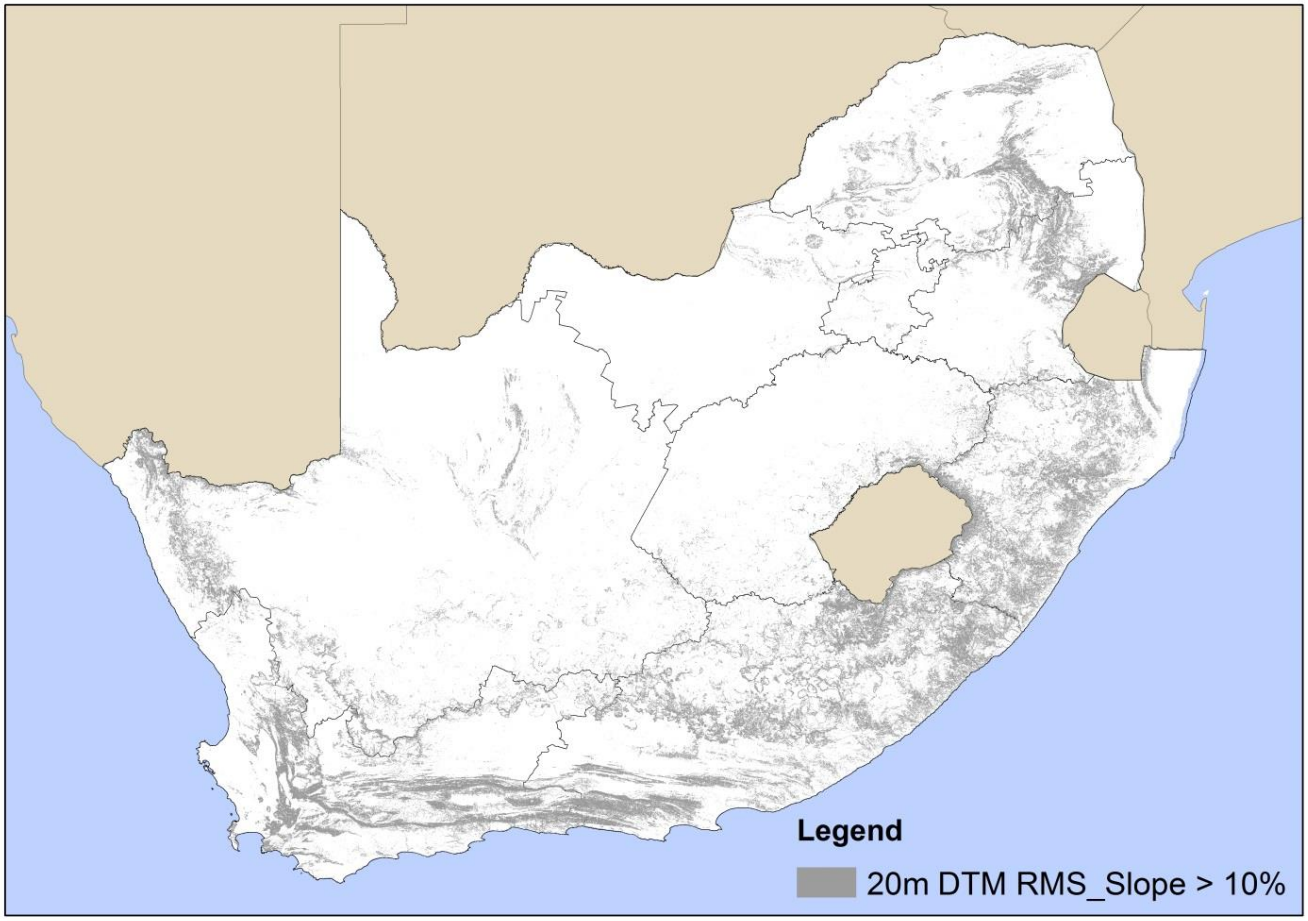
# Access to site and transport: presence of slopes > 10%

**Assumptions:**

1) Only slopes> 10% were considered as threshold of engineering risk for transport and access to site, and site terrain construction requirement (especially for solar PV)

**Data source:** 20m Digital Terrain Model of South Africa (2002)

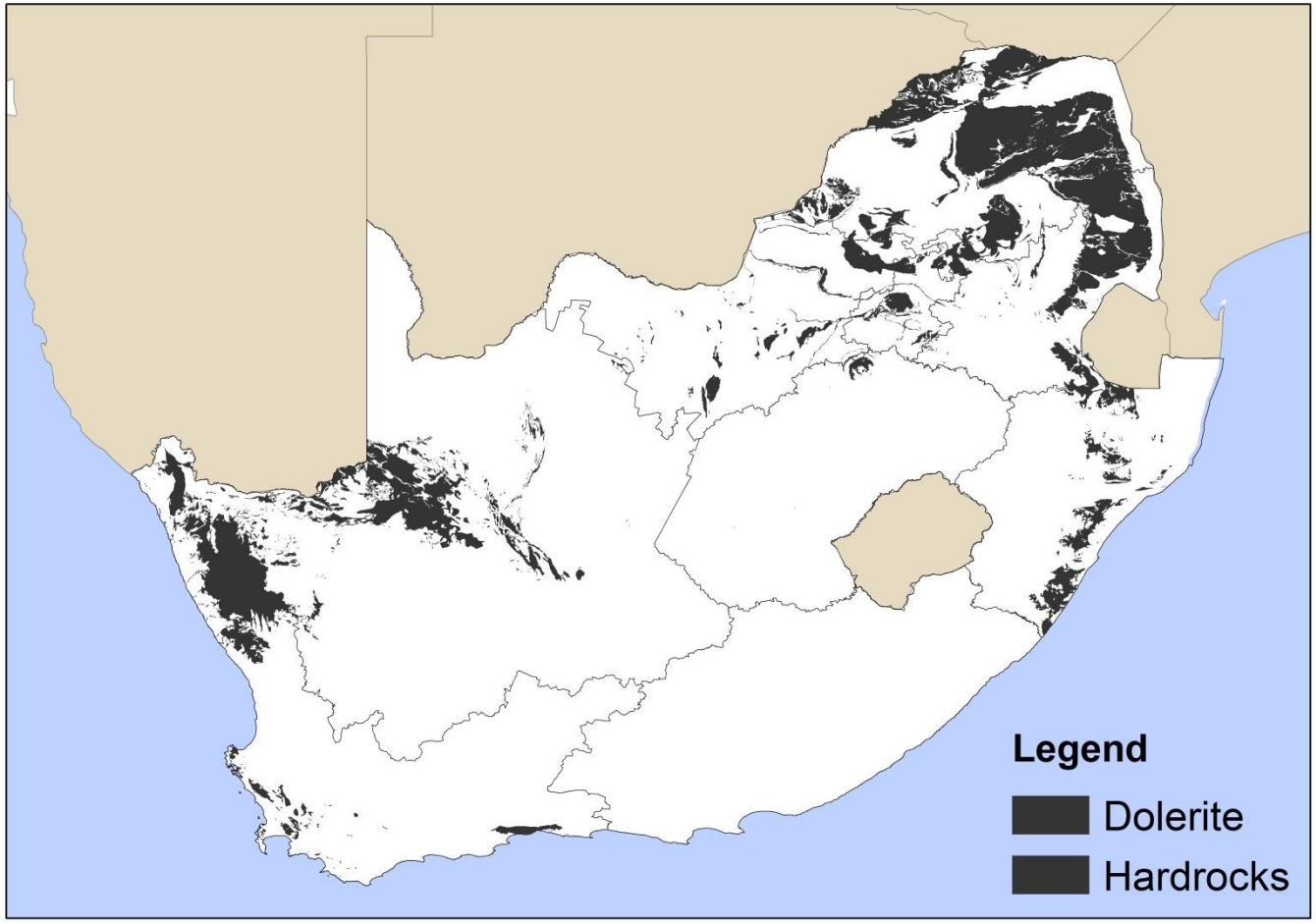
- DTM source material is 20m digital contours
- Spotheights, coastline and inland water area data captured from South African 1:50 000 scale topographical mapping
- DTM was generated from the contour, spot height , coastline and inland water area data using ANUDEM from the Australia National University, recognised as the most advanced gridding software available for creating DEMs from contour and spot height data.
- The vertical datum of the DTM is mean sea level (MSL).
- GPS altitude readings are referenced as height above the WGS84 ellipsoid.



# Geotechnical risk: presence of dolerite and hardrock formation

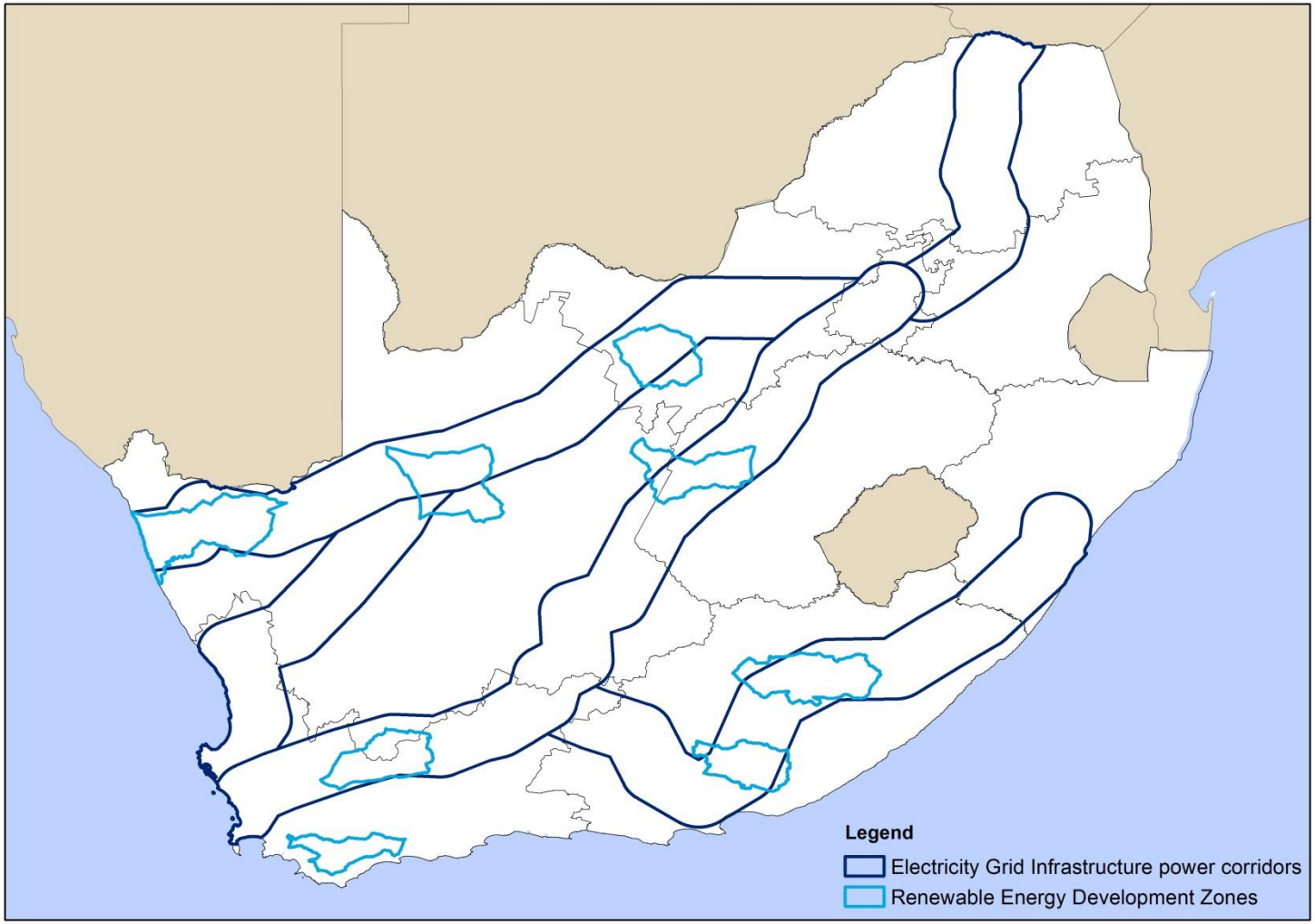
**Assumptions:**

1) Dolerites and hardrock formations considered as engineering risk for development of solar PV and wind energy projects in terms of geotechnical requirements



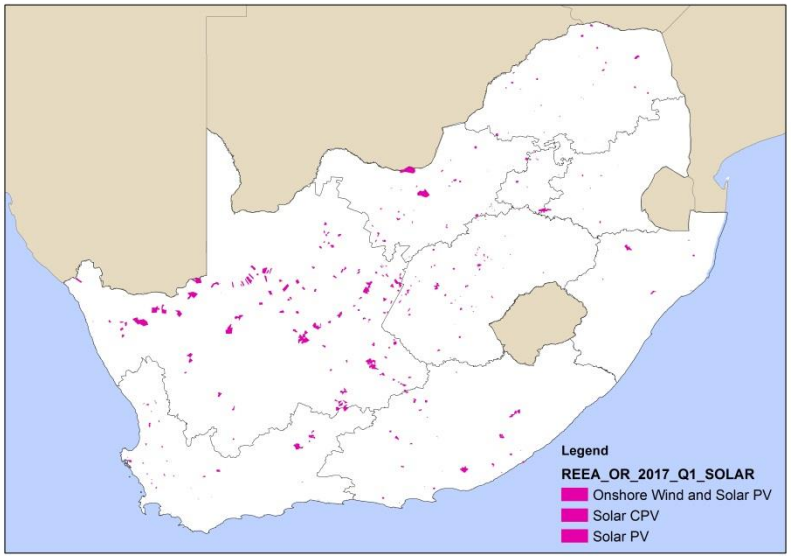

**Data source**: Council for geoscience, 1:1 000 000 Geological Data for South Africa, Lesotho and Swaziland

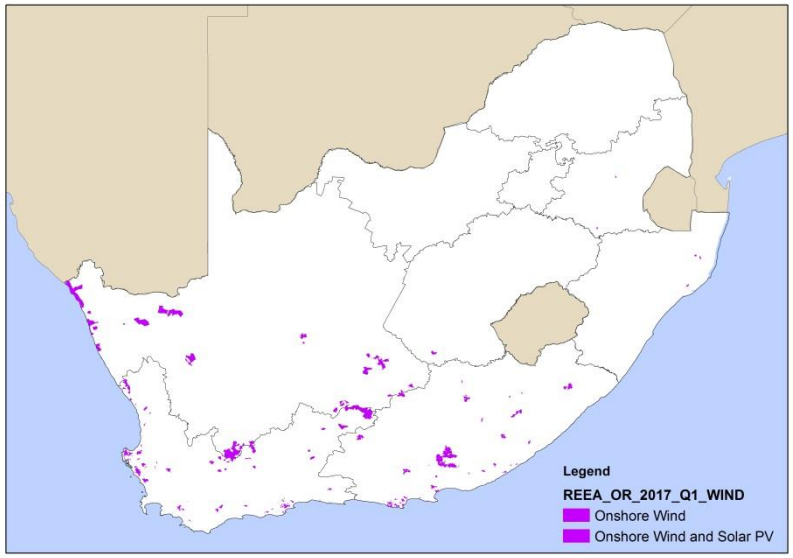
# Strategic coordination: REDZs and power corridors

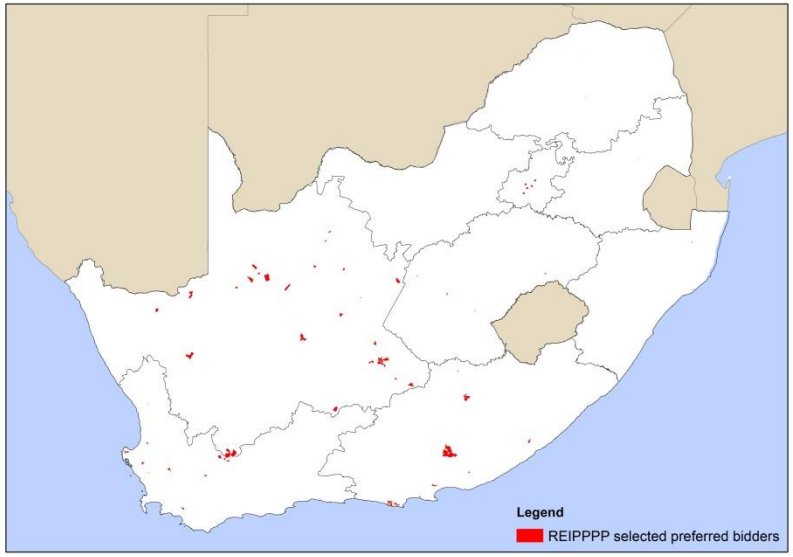



**Data source:** CSIR, 2015, SIP 8 and Sip 10 Strategic Environmental Assessments

# Spatial planning: REIPPPP selected preferred bidders and existing approved EIAs for wind and solar PV projects




**Data source:** DoE, 2015 IPP office dataset / DEA, First Quarter of 2017 EIA application dataset

# Thank you for your participation to this second ERG/PSC meeting on 25th July 2017

Please send your inputs to the SEA project manager:

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