

REPORT
ENERGY RESOURCE ASSESSMENT

LOXTON WIND FACILITY 3 (PTY) LTD

TECHNICAL WIND RESOURCE DEPARTMENT

CALCULATION OF THE AFFECTION OF LOXTON WIND FARM PROJECT OVER TAAIBOS NORTH,
SOUTRIVIER NORTH AND HOOGELAND NORTH WIND FARMS

LOXTON WIND ENERGY FACILITY 3 (NORTHERN CAPE, SOUTH AFRICA)

MAY 2023



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EXECUTIVE SUMMARY

The proposed Loxton Wind Farm cluster is located between 5-20 km north of the town of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

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The results of the external wake efficiency produced by the construction of Loxton Wind Energy Facility 3, over Taaibos North, reduced Taaibos North, Soutrivier North and Hoogeland North wind farms which are displayed Table 1 below. The wake losses are considered insignificant as these are based on a worst-case theoretical analysis of the existing 39 wind turbine layout. Regarding Hoogeland North wind farm, the analyzed wake impact has no influence over the wind farm and is considered negligible.

Table 1: External wake efficiency summary of the surrounding wind farms

Loxton WF affection over Taaibos North WF	
External wake efficiency	Energy loss (%)
0,984	1,6%
Loxton WF affection over reduced Taaibos North WF	
External wake efficiency	Energy loss (%)
0,990	1,0%
Loxton WF affection over Soutrivier North WF	
External wake efficiency	Energy loss (%)
0,996	0,4%
Loxton WF affection over Hoogeland North WF	
External wake efficiency	Energy loss (%)
1,000	0,0%

1.1. EXTERNAL WAKE LOSSES

Wake losses in Taaibos North, reduced Taaibos North, Soutrivier North, and Hoogeland North wind farms have been simulated with and without the turbines of Loxton wind farm. The difference of the results of both simulations will be considered as the energetic losses due to the construction of Loxton wind farm. In the case of Hoogeland North wind farm the losses are insignificant.

Taaibos North turbine	External wake Efficiency
T01	0,994
T02	1,000
T03	1,000
T04	1,000
T05	0,977

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T06	0,992
T07	0,997
T08	1,000
T09	0,990
T10	0,973
T11	0,977
T12	0,978
T13	1,000
T14	1,000
T15	0,983
T16	1,000
T17	0,999
T18	0,971
T19	0,982
T20	0,968
T21	0,981
T22	0,982
T23	0,997
T24	0,987
T25	1,000
T26	1,000
T27	1,000
T28	1,000
T29	0,997
T30	1,000
T31	1,000
T32	1,000
T33	1,000
T34	1,000
T35	0,966
T36	0,969
T37	1,000
T38	0,981
T39	0,993
T40	0,961

Reduced Taaibos North turbine	External wake Efficiency
T01	0,992
T02	1,000
T03	1,000
T04	1,000
T05	0,977
T06	0,991
T07	0,994
T08	1,000
T09	0,988
T10	0,972
T11	0,976
T12	0,977
T13	1,000
T14	1,000
T15	0,981
T16	1,000
T17	0,999
T18	0,970
T19	0,980

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T20	0,966
T21	0,981
T22	0,981
T23	0,995
T24	0,985
T25	1,000
T26	1,000
T27	1,000
T28	1,000
T29	0,995
T30	1,000
T31	1,000
T32	1,000
T38	0,980
T39	0,991
T40	0,961

Soutrivier North turbine	External wake Efficiency
T01	0,994
T02	0,973
T03	0,939
T04	0,974
T05	0,962
T06	0,973
T07	0,948
T08	0,968
T09	0,936
T10	0,942
T11	0,936
T12	0,908
T13	0,960
T14	0,959
T15	0,916
T16	0,927
T17	0,909
T18	0,915
T19	0,908
T20	0,915
T21	0,907
T22	0,912
T23	0,935
T24	0,906
T25	0,916
T26	0,915
T27	0,933
T28	0,924
T29	0,904
T30	0,947
T31	1,000

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2. APPENDIX 1: TURBINE COORDINATES. SITE LOCATION AND LAYOUT

Wind farm layout					
WGS84 Zone 34 S					
WTG	UTM X	UTM Y	Hub height (m)	Rotor D (m)	Power (kW)
WTG104	640.571	6.518.201	120	163	5.900
WTG105	641.379	6.518.416	120	163	5.900
WTG106	643.336	6.520.518	120	163	5.900
WTG107	643.798	6.521.046	120	163	5.900
WTG108	643.126	6.518.851	120	163	5.900
WTG109	643.469	6.519.150	120	163	5.900
WTG110	643.736	6.519.380	120	163	5.900
WTG111	644.867	6.519.219	120	163	5.900
WTG112	645.049	6.519.659	120	163	5.900
WTG113	645.209	6.520.196	120	163	5.900
WTG114	643.328	6.517.402	120	163	5.900
WTG115	643.813	6.517.736	120	163	5.900
WTG116	644.245	6.518.048	120	163	5.900
WTG117	644.744	6.518.154	120	163	5.900
WTG118	645.151	6.518.370	120	163	5.900
WTG119	637.763	6.512.767	120	163	5.900
WTG120	638.245	6.513.025	120	163	5.900
WTG121	638.684	6.513.222	120	163	5.900
WTG122	638.963	6.513.489	120	163	5.900
WTG123	639.296	6.513.738	120	163	5.900
WTG124	639.633	6.513.975	120	163	5.900
WTG125	640.157	6.514.187	120	163	5.900
WTG126	640.674	6.514.344	120	163	5.900
WTG127	642.357	6.514.623	120	163	5.900
WTG128	642.986	6.514.767	120	163	5.900
WTG129	643.618	6.514.822	120	163	5.900
WTG130	644.001	6.515.098	120	163	5.900
WTG131	644.362	6.515.392	120	163	5.900
WTG132	644.679	6.515.665	120	163	5.900
WTG133	644.977	6.516.096	120	163	5.900
WTG134	638.456	6.511.237	120	163	5.900
WTG135	638.618	6.511.586	120	163	5.900
WTG136	638.844	6.511.944	120	163	5.900
WTG137	639.084	6.512.283	120	163	5.900
WTG138	645.317	6.514.748	120	163	5.900
WTG139	645.901	6.515.165	120	163	5.900
WTG140	646.245	6.515.683	120	163	5.900
WTG141	646.933	6.514.961	120	163	5.900
WTG142	647.111	6.515.522	120	163	5.900

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Taaibos wind farm layout					
WGS84 Zone 34 S					
WTG	UTM X	UTM Y	Hub height (m)	Rotor D (m)	Power (kW)
T01	647.061	6.500.492	120	163	5.900
T02	648.827	6.499.903	120	163	5.900
T03	649.637	6.500.412	120	163	5.900
T04	648.890	6.501.289	120	163	5.900
T05	647.995	6.500.767	120	163	5.900
T06	647.627	6.503.510	120	163	5.900
T07	648.557	6.503.830	120	163	5.900
T08	648.479	6.504.439	120	163	5.900
T09	647.028	6.504.424	120	163	5.900
T10	647.182	6.501.703	120	163	5.900
T11	645.470	6.503.442	120	163	5.900
T12	646.263	6.503.862	120	163	5.900
T13	649.209	6.507.423	120	163	5.900
T14	648.129	6.507.445	120	163	5.900
T15	641.889	6.505.799	120	163	5.900
T16	645.769	6.506.383	120	163	5.900
T17	645.306	6.505.721	120	163	5.900
T18	644.879	6.504.625	120	163	5.900
T19	644.352	6.504.003	120	163	5.900
T20	646.188	6.501.547	120	163	5.900
T21	643.876	6.505.335	120	163	5.900
T22	642.938	6.505.087	120	163	5.900
T23	642.127	6.504.444	120	163	5.900
T24	641.049	6.505.177	120	163	5.900
T25	642.063	6.506.712	120	163	5.900
T26	641.421	6.507.653	120	163	5.900
T27	640.686	6.506.802	120	163	5.900
T28	640.101	6.506.107	120	163	5.900
T29	640.948	6.504.321	120	163	5.900
T30	639.816	6.504.350	120	163	5.900
T31	639.502	6.505.455	120	163	5.900
T32	638.383	6.504.894	120	163	5.900
T33	646.171	6.513.316	120	163	5.900
T34	647.520	6.513.980	120	163	5.900
T35	645.313	6.514.119	120	163	5.900
T36	646.394	6.514.323	120	163	5.900
T37	647.257	6.513.198	120	163	5.900
T38	643.247	6.504.158	120	163	5.900
T39	647.290	6.502.729	120	163	5.900
T40	645.874	6.504.800	120	163	5.900

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Souttrivier wind farm layout					
WGS84 Zone 34 S					
WTG	UTM X	UTM Y	Hub height (m)	Rotor D (m)	Power (kW)
T01	659.831	6.512.919	120	163	5.900
T02	659.864	6.511.717	120	163	5.900
T03	660.937	6.511.596	120	163	5.900
T04	661.339	6.512.460	120	163	5.900
T05	662.298	6.512.189	120	163	5.900
T06	663.440	6.511.577	120	163	5.900
T07	661.833	6.510.904	120	163	5.900
T08	659.671	6.510.175	120	163	5.900
T09	661.147	6.509.774	120	163	5.900
T10	660.571	6.508.571	120	163	5.900
T11	662.335	6.509.301	120	163	5.900
T12	661.557	6.508.647	120	163	5.900
T13	660.158	6.507.762	120	163	5.900
T14	660.683	6.506.665	120	163	5.900
T15	661.391	6.507.655	120	163	5.900
T16	661.994	6.506.579	120	163	5.900
T17	662.445	6.507.771	120	163	5.900
T18	662.913	6.506.352	120	163	5.900
T19	663.323	6.507.915	120	163	5.900
T20	663.830	6.506.171	120	163	5.900
T21	664.267	6.507.126	120	163	5.900
T22	664.856	6.507.833	120	163	5.900
T23	665.469	6.508.439	120	163	5.900
T24	665.257	6.506.528	120	163	5.900
T25	666.210	6.506.173	120	163	5.900
T26	666.168	6.507.278	120	163	5.900
T27	666.544	6.508.381	120	163	5.900
T28	667.658	6.507.904	120	163	5.900
T29	667.102	6.507.217	120	163	5.900
T30	668.068	6.508.729	120	163	5.900
T31	668.302	6.511.679	120	163	5.900

Meteorological stations				
Name	UTM X	UTM Y	Upper sensor height (m)	Met station type
Loxton_1	636.457	6.540.889	141	Wind assessment
Loxton_2	632.581	6.536.708	141	Wind assessment
Loxton_3	636.659	6.531.820	141	Wind assessment
Loxton_4	631.357	6.528.127	141	Wind assessment
Loxton_5	642.674	6.521.292	141	Wind assessment
Loxton_6	644.304	6.515.312	141	Wind assessment
Loxton_7	638.687	6.513.154	141	Wind assessment

Table 2: Turbine coordinates

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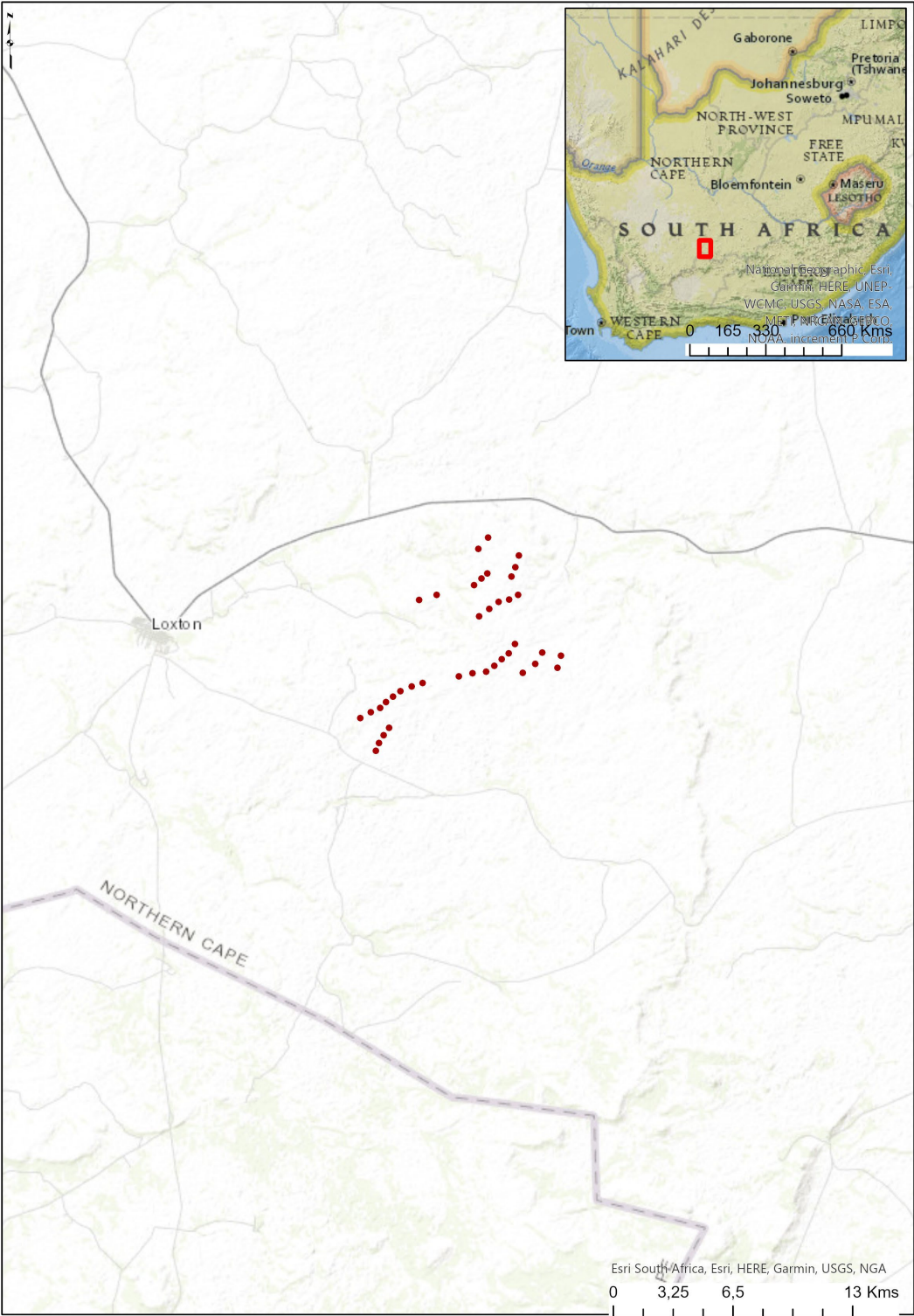


Figure 1: Site location