RENEWABLE ENERGY SECTOR SPATIAL PLANNING TOOL

TO FORM PART OF THE NDM GREEN ECONOMY STRATEGY

Final Report

SIMON TODD CONSULTING

Simon.Todd@3foxes.co.za

PREPARED BY SIMON TODD

FOR

CONSERVATION SOUTH AFRICA

Member of the CI Network

SEPTEMBER 2012

This project was funded under the International Climate Initiative (ICI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Contents

Executive Summary

This report forms part of a renewable energy sector planning tool for the Namakwa District Municipality. The purpose of the tool is to highlight opportunities and constraints for the development of renewable energy in the District, to inform the District Municipality for planning purposes and to provide background information that can be used to evaluate and guide the spatial distribution of renewble development in the District.

A spatial analysis of the district is used to identify the ecological and conservation priorities for the district which represent areas where development would be undesirable. Areas where renewable energy is potentially feasible are identified based on the current distribution of roads, overhead transmission lines and electrical substations, which are the overriding technical constraints. The ecological constraints are then overlayed with the technical constraints to identify areas where renewable energy would be both technically feasible and ecologically acceptable.

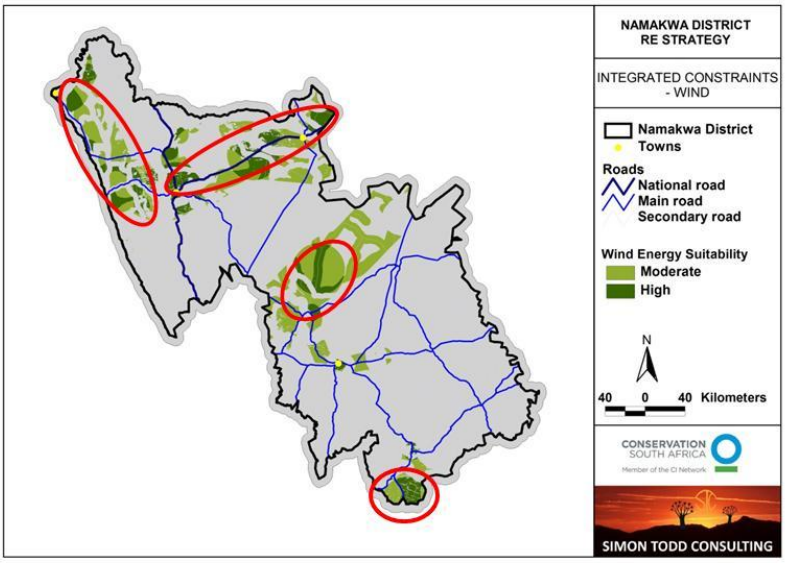
The results of the analysis suggest that there are four primary areas where renewable energy development is likely to be concentrated within the district. These are:

- the coastal plain from Koingnaas to Alexander Bay.
- the inland plateau from Springbok to Poffadder
- Loeriesfontein to Granaatboskolk
- south of Sutherland to the border of the Namakwa District.

The availability of wind and solar energy resources within the district is high and although not all areas are suitable for wind and solar generation, this does not appear to be a significant constraint on the potential development of a renewable energy sector in the district. The analysis suggests that it is the presence of electrical transmission infrastructure rather than the availability of suitable land that is likely to be major constraint on the development of renewable energy in the district. Compared to adjacent districts such as Siyanda and Pixley ka Seme, the transmission infrastructure of the Namakwa district is poorly developed which places a constraint on the amount of electricity that can be accepted by the grid and hence the amount and distribution of renewable energy developments that are possible.

In terms of the ecological sensitivity of the different areas, all of the likely development regions except for the area north of Loeriesfontein can be considered highly sensitive at a broad scale. The coastal plain has already been extensively impacted by mining and the additional threat of wind energy developments within this area could potentially have a negative impact on biodiversity if not carefully located. The area around Spingbok is also considered sensitive on account of the high levels of flora and fauna endemism in this area. However, solar energy is likely to be the major renewable development in this area and as there are already a lot of degraded and previously transformed areas (old lands/mines) present, the impacts of development could be maintained at an acceptable level if these areas are targetted. The area south of Sutherland falls within the Roggeveld centre of endemism and is considered highly sensitive. There are a large number of wind energy facilities being planned for this area and the cumulative impact of these developments could be very high. The area north of Loeriesfontein contains low species richness

and few endemic species and development within this area is likely to have the least ecological impact as compared to the other likely development zones.



Integrated constraints map for wind energy in the Namakwa District. The green areas indicate areas where the development of wind energy is likely to be compatible with biodiversity maintenance as well as being economically feasible. The red outlines identify the four zones where development is likely to be concentrated. Although the figure is for wind energy, a similar pattern emerges for solar energy.

The opportunities and constraints on environmentally positive RE development within the district are also briefly examined. The reluctance of the DoA to cede land to renewable energy developments and the reluctance of the DME to relinquish mining rights are identified as obstacles preventing development within many degraded areas such as old lands and abandoned mines which are ideal opportunities for the development of renewable energy facilities in situations where little or no ecological impact would be generated. Although the development of wind energy facilities in particular, presents an opportunity to leverage land and resources for positive conservation outcomes, this opportunity has not been well realized. This can be partially attributed to a lack of capacity within the provincial conservation authorities, and also to a failure to consider the cumulative impacts of wind energy developments.

In terms of economic benefits, the value of the renewable energy developments approved to date is over 70 billion rand. However, only 22 billion of this is local content and how much of this will actually be spent in the Northern Cape is not clear. Although the construction phase of the RE developments will generate as much as 20 000 jobs, these are likely to last less than 2 years. The operational phase of the approved projects will generate only 728 long-term employment opportunities across the whole country, which clearly illustrates that renewable energy development is not likely to significantly contribute to employment levels within the district.

Background & Introduction

Conservation South Africa (CSA) recently commissioned a study by Midgley and Holness (2012) which examines the likely impact of climate change on the Namakwa District Municipality (NDM) and prioritizes areas for the development of activities related to support ecosystem-based adaptation to climate change. CSA would like to use this study as a starting point from which to develop a renewable energy sector planning tool for the district. The study would identify and prioritise opportunities and constraints for the development of the renewable energy sector in the district.

The main outputs of the project would be a map highlighting areas sensitive to development and/or important for ecosystem services and functioning as well as climate change adaptation; and then prioritizing within the least sensitive areas, the most economically viable sites for renewable energy development. This might include areas where:

- The affected natural resources are plentiful
- road networks exist
- powerlines and other transmission infrastructure are close

This tool will be integrated into and inform the NDM Green Economy Strategy. It has been requested by NDM to help them to lead local decision-making around the most appropriate siting of solar and wind energy facilities.

Renewable Energy and the IPP Process (RFP-IPP)

Before examining the potential of the Namakwa District for renewable energy, it is important to understand the policy and regulatory environment surrounding renewable energy in South Africa.

The current energy policy in South Africa is guided by the Integrated Resource Plan (IRP) for Electricity 2010-2030. The IRP aims to diversify energy supply in South Africa and in addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. From the above it can be seen that more than 40% of new capacity is allocated to renewable energy, largely wind and solar energy. This blueprint indicates government's clear intention not only to diversify the energy mix away from the tradition of fossil-fired power generation, but to take advantage of the possibilities relating to the Green Economy in creating new industries and much needed jobs.

The actual Renewable Energy IPP Bidding Programme was initiated in 2010 and under the current RFP, requires 3725 MW of renewable energy capacity to be committed by 2015. Initially the DoE indicated that a fixed-pricing scheme was going to be offered to IPPs, but in the end, opted for a competitive pricing option in which bids are evaluated on tariff and the identified socio-economic development objectives of the Department. Under the current RFP, bids by IPPs are accepted only during predefined bid windows, the first two of which have already taken place. Bids are evaluated on a variety of grounds including price, job creation, local content, preferential procurement, enterprise development and socio-economic

development. Under the conditions of the RFP, there is also a cap for each renewable energy sector on the number of MW that may be submitted within a bid. This is to encourage more entrants to the market and also to allow smaller developers access. Following the closure of the bid windows all the bids submitted during the bid window are evaluated and the preferred bidders who will be allowed to enter into power purchase agreements with ESKOM are announced.

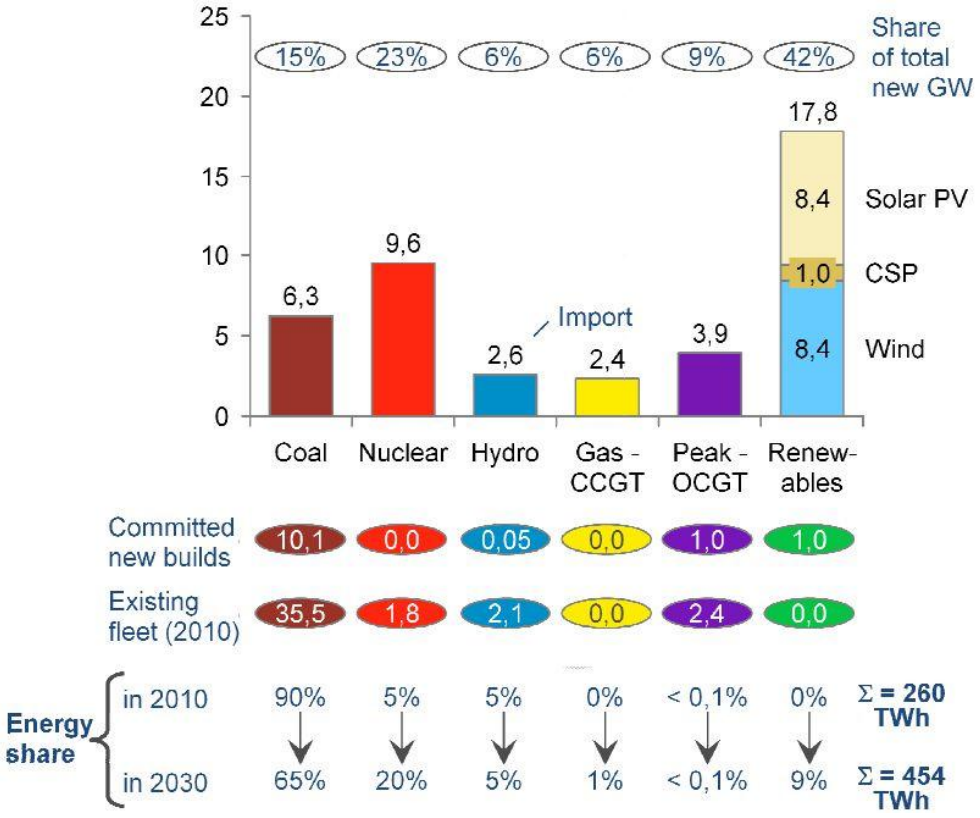


Figure 1. The2010 and desired 2030 energy mix for South Africa, according to the current iteration of the IRP. Figure taken from the 2010 IRP available at Department of Energy website http://www.energy.gov.za/IRP/irp%20files/IRP2010_2030_Final_Report_20110325.pdf.

Summary of Preferred Bidders to Date

As two rounds of the bidding process have already taken place, a relatively large number of renewable energy projects are already approved and will begin construction within the next two years. An analysis of these projects illustrates several important aspects of the current and future development of the industry. In addition, the distribution of the approved projects is likely to be indicative of the likely future spatial distribution of renewable energy facilities in the country.

During the first round of the renewable energy RFP, 53 bids amounting to 2128 MW were received by the DoE. The evaluation resulted in 28 bids with a total of 1416 MW being selected as Preferred Bidders. During the second bid round, 79 bids were received amounting to 3255 MW whilst the cap for the round was 1275MW. In this round only 19 bidders were selected, including two hydroelectric projects. Therefore to date, there are 47 preferred bidders with projects that are likely to go ahead in the immediate future, these are summarized below in Table 1.

Table 1. Various summary statistics for the two renewable energy tender bid windows that have taken place to date.

	Solar		Wind		CSP	
	Bid Window 1	**Bid Window 2**	**Bid Window 1**	**Bid Window 2**	**Bid Window 1**	**Bid Window 2**
Price: Fully Indexed (Ave Rand per MWh)	R 2 758	R 1 645	R 1 143	R 897	R 2 686	R 2 512
MW allocation	632 MW	417 MW	634 MW	563 MW	150 MW	50 MW
Total Project Cost (R'million)	R21 937	R12 048	R 12 724	R 10 897	R 11 365	R 4 483
Local Content Value (R'million)	R6 261	R5 727	R 2 766	R 4 001	R 2 391	R 1 638
Local Content %	28.50%	47.50%	21.70%	36.70%	21.00%	36.50%
Job Creation : Construction (People)	10 386	4 557	1 869	1 579	1 165	662
Job Creation : Operations (People)	221	194	128	65	70	50

Several important patterns which emerge from the two bid rounds that have taken place to date include the large increase in the number of bidders participating in each round as well as the large drop in the price bidders are offering to supply power at. This indicates that competition in the market has increased significantly, in terms of the number of participants a well as the cost for electricity being offered by developers. This has important implications for the development of renewable energy in the country, as it puts pressure on developers to select optimal sites in terms of the available resource as well as the proximity to existing transmission infrastructure. The effects on wind and solar developments are slightly different. Solar developments are costly to install, but rely on low operational costs to make a profit. The solar resource in South Africa is generally very good and across the Namakwa district, the differences are not highly significant as compared to the impact of the proximity of existing transmission lines and substations. Wind energy facilities are less costly to install, but require greater maintenance on account

of all the moving parts present. As wind is less predictable over time and more variable over space, than solar resources, the available wind resource at a site is the key factor in determining the viability of wind energy facilities. Although wind speed may not appear to vary substantially across the district, the effect of even small changes in wind speed on wind energy production is high. With a doubling of wind speed, the power in the wind increases by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm. In general, under the current economic conditions, only areas with average wind speeds above 7m/s are likely to be viable for the establishment of wind farms. Wind energy facilities are also generally larger in terms of output than solar facilities and can better afford to construct substations and transmission lines. An implication of the competitive nature of the market is that small facilities were economical at the prices obtained during round 1 of the program, but are a lot less economical at the current prices, and in the future it is likely that most PV projects submitted to the program will be quite large.

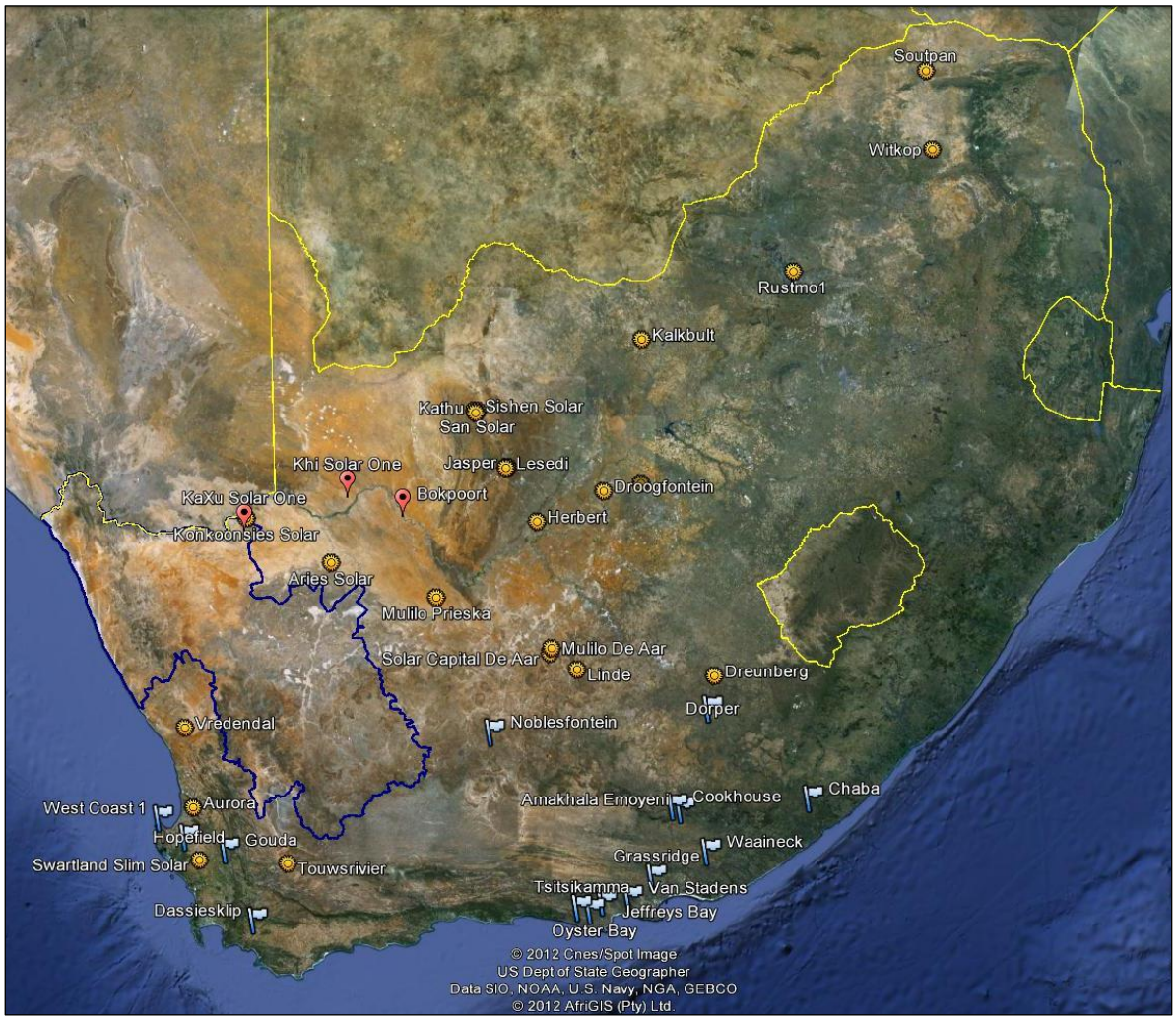


Figure 1. Map of the preferred bidders from round 1 and 2 of the Renewable Energy IPP Procurement Program. Wind energy facilities are indicated by the blue flags, solar PV facilities by the suns and CSP facilities by the red markers.

There are currently only two approved bidders located within the Namakwa District, namely, the 10MW Konkoonsies Solar and the 100MW KaXu Solar One, both of which are near to the Paulputs substation, north of Pofadder. This suggests that the district is currently very poorly represented within the IPP program, as areas of similar extent in other parts of the country have as many as 8 preferred bidders. There are however, a relatively large number of PV and Wind energy projects that have been proposed within the district. It is difficult to accurately quantify these, but the available information suggests that there are 9-11 wind energy facilities that have been proposed

as well as a large number of PV projects of various size. It is likely that at least a few of these will also receive preferred bidder status before the end of the current RFP.

Renewable Energy Potential of the Namakwa District

In this section, the renewable energy potential of the Namakwa district is examined, the purpose is not to provide a quantitative assessment, but rather to examine which broad areas have the greatest potential and what other limitations are likely to be operating. It is also important to recognize that on account of the competitive nature of the industry, the district should not be considered entirely in isolation, but also within a regional context and the potential of the district compared to adjacent areas.

The potential wind resources in South Africa are very good, to the extent that South Africa is considered to be among the top 5 countries in the world in terms of wind resources. It has been estimated that there is sufficient wind to generate at least one third of our energy requirements. Within the district itself, there are two broad areas which contain very good wind resources, the coastal plain and the interior mountains along the great escarpment near Sutherland, along the Northern Cape-Western Cape border. The area north of Loeriesfontein also apparently has good wind resources as indicated by the presence of several proposed wind energy facilities in this area.

The potential for solar energy in South Africa is also exceptionally high and the majority of the country receives sufficient sunlight hours for viable solar energy production. There are however various types of solar energy production, the most common and well-known being Photovoltaic panels. Concentrating Solar Power (CSP) is an alternative in which parabolic troughs are usually used to reflect sunlight onto a central tower where the heat is used to turn water into steam and drive turbine generators. A limitation of this technology is that it requires relatively large amounts of water, which within the Namakwa district would only be available near the Orange River. In the future, water efficient or dry cooling methods may be developed, which would greatly increase the potential of this technology. A study indicates that South Africa could generate more than 500GW of energy using this technology, the major potential being in the Northern Cape.

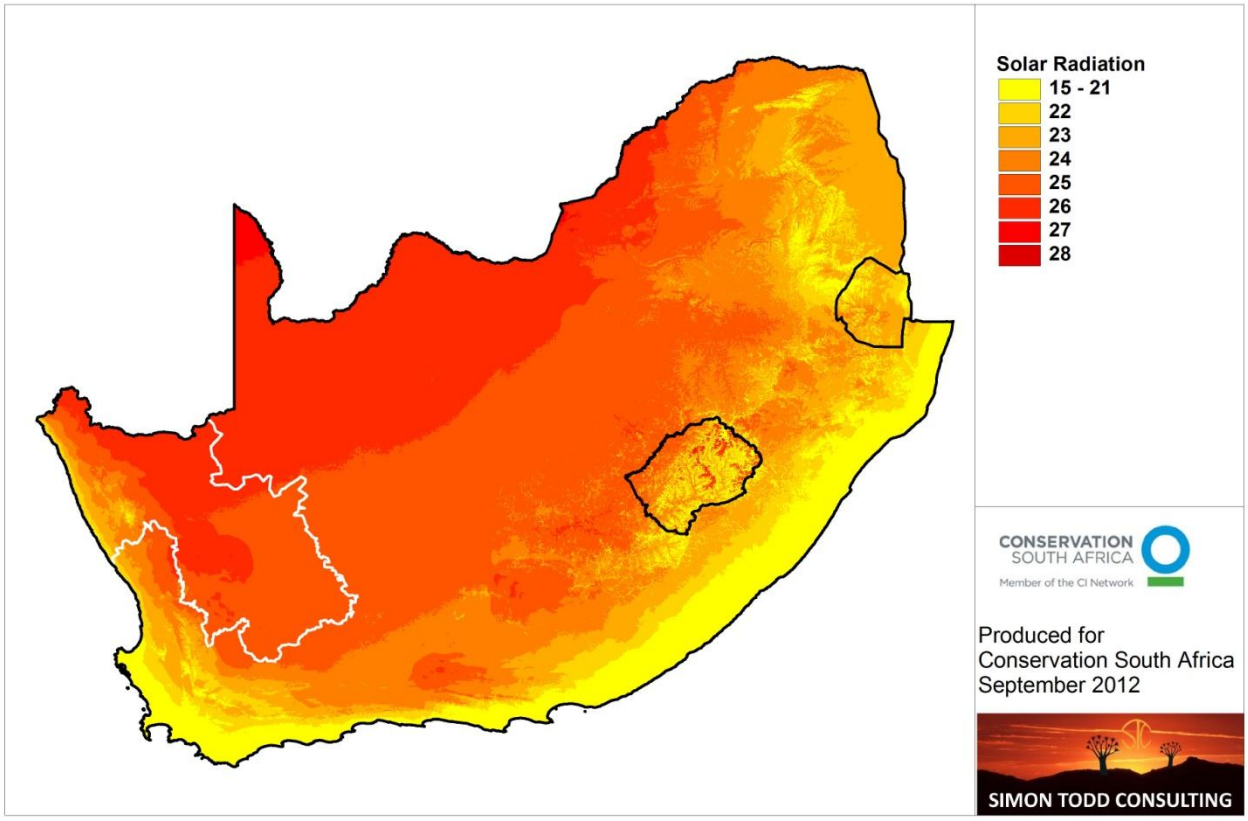


Figure 2. Predicted solar radiation across South Africa in $MJ.M^{-2}.day^{-1}$.

Renewable Energy Suitability Model for the Namakwa District

Although renewable energy can contribute to economic growth and development as well as decrease global environmental problems such as carbon emissions, renewable energy is not necessarily entirely environmentally friendly. The facilities themselves can have a significant local impact through the loss of habitat, direct impacts on fauna and other secondary impacts such as erosion and landscape fragmentation. Problems associated with wind turbines include bird and bat fatalities resulting from collisions with the turbine blades, as well as noise and the loss of habitat resulting from the turbines and access roads of the facility. Solar energy facilities may require that the vegetation beneath the panels is cleared, at least during construction and the panels themselves contain some metals such as cadmium which may be dangerous to the environment if the panels are broken or are not recycled at the end of their lifespan. Both kinds of development result in significant disturbance of the local environment which can encourage erosion as well as alien plant invasion. As with any other kind of development, the potential negative effects of renewable energy facilities should be carefully considered and such facilities constructed only in appropriate locations which minimize the risks.

Within the context of the Namakwa District, large-scale development poses potentially greater risk to biodiversity than in the adjacent districts to the east. This is on account of the high biodiversity and endemism which characterize the district. Particularly vulnerable areas include those parts of the district which fall within the Succulent Karoo Biome. The summer rainfall, north-eastern parts of the district are largely less sensitive and contain relatively few endemic species and lower species richness.

Ecological Constraints

In terms of developing a strategy for the Namakwa District, which takes account of the biodiversity value and sensitivity of parts of the district, the following areas were considered unsuitable for the development of renewable energy facilities:

- Formal protected areas (SANBI BGIS Layer), such as the National and Provincial parks within the District.
- Critical Biodiversity Areas (CBAs) as identified in the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2009). The use of the CBA map for the district has several implications as broad-scale ecological processes such as movement corridors and important ecological gradients are already captured in the CBA map. It is therefore not necessary to include these as independent constraints in the analysis.
- Listed Ecosystems - National List of Threatened and Protected Ecosystems (BGIS Layer)

A number of other criteria were also investigated for inclusion, but the criteria had to be relaxed somewhat as the inclusion of a large number of different criteria became too restrictive and the available area very limited. It is however important to recognize the appropriate scale for the analysis, and the intention here is to identify areas that are broadly suitable or unsuitable. At a site scale, there are always likely to be areas that are locally more or less sensitive and an assessment of each site should therefore be conducted regardless of where it is located.

Physical Constraints

Both solar and wind energy facilities are subject to similar constraints, in terms of their infrastructural requirements. Wind farms need to be reasonably close to existing roads as they require large hardened roads during the construction phase, so that large abnormal vehicles can deliver the turbine blades and support structures. Solar developments are less sensitive to distance from existing roads as the transport requirements for the infrastructure is less demanding and therefore a lot cheaper to build. The most significant constraint is however the proximity to existing power line infrastructure and in particular substations. Power lines are costly to build and obtaining servitudes across multiple landowners to reach a substation can be challenging. Substations are particularly costly and can add a significant amount to the initial cost of a development. These limitations are more significant for solar PV developments which aim to keep their costs as low as possible. The following resource and physical constraints have been implemented in the model:

- 10 km distance to nearest major road for Solar developments
- 20 km distance to nearest major road for Wind Energy Development

- 10 km nearest distance to power line or substation for Solar developments
- 20 km nearest distance to power line or substation for Wind energy developments

The above constraints do not take the capacity of the power lines or substations into account, and the presence of a power line or substation does not necessarily imply that the line or substation will be able to accept the power. Regardless, preferred bidders must negotiate with ESKOM for capacity on their grid.

Results & Analysis

The physical constraints map for wind energy in the Namakwa District is illustrated below in Figure 3. The important aspect of this figure is that it illustrates the paucity of power line infrastructure within the district. This is ultimately one of the major constraints on the widespread development of renewable energy in the district. The ecological constraints map for the district is illustrated below in Figure 4. This map illustrates the high biodiversity potential of the north-western part of the Namakwa District and the relatively low biodiversity value of the central parts of the district.

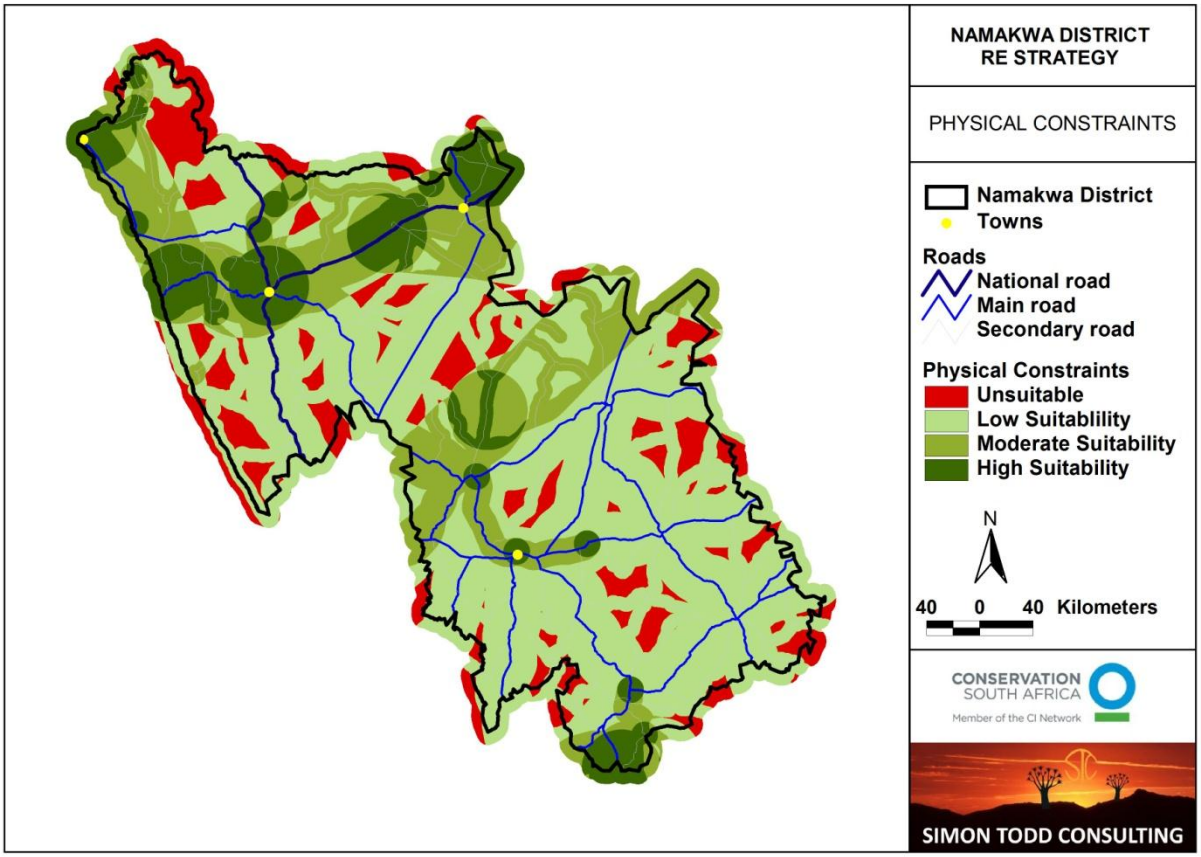


Figure 3. Map of the physical constraints as related to distance from roads and power line infrastructure within the Namakwa District.

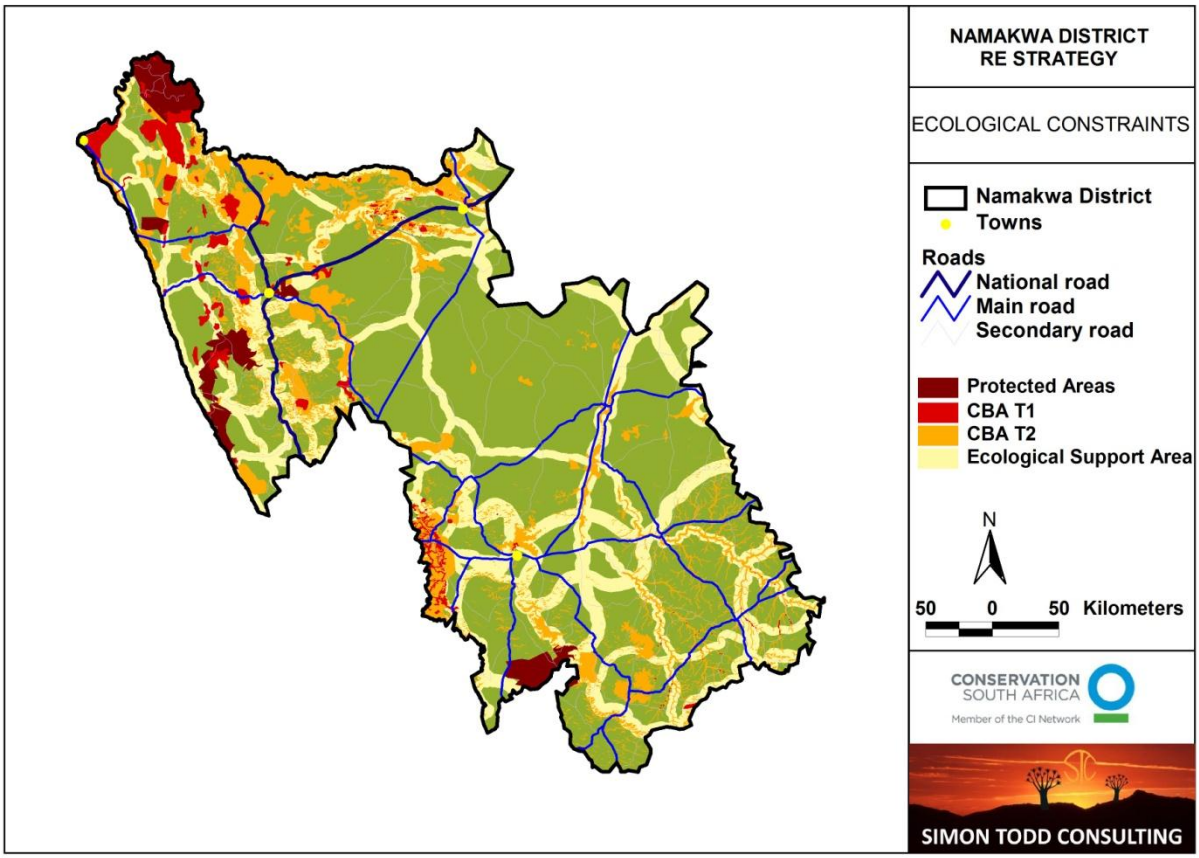


Figure 4. Map of the ecological constraints as related to the presence of formal conservation areas and critical biodiversity areas within the Namakwa District.

The integrated constraints maps for wind and solar energy development in the Namakwa District are illustrated below in Figures 5 and 6 respectively. These figures illustrate the potential for the development of renewable energy in the district is quite low. In terms of wind energy facilities, four main areas of development potential can be identified as follows:

- In the north of the district, there is a distinct potential development area along the coastal plain, from near Koingnaas in the south to near Alexander Bay in the North. There are at least 4 planned wind energy facilities in this area.
- Inland, there is a fairly extensive potential development area between Springbok and Pofadder as well as around the towns themselves. This area also represents the best potential for the development of Solar PV facilities on account of the presence and proximity of substations in these areas. The constraints map for solar PV facilities illustrates the large constraint placed on the development of these facilities by infrastructure presence.
- There is a fairly large potential development area to the north of Loeriesfontein. There is also at least one solar and one wind energy facility proposed in this area.

- In the far south of the district, there is a relatively small area along the great escarpment near Sutherland. There are already several wind energy facilities planned in this area, many of which straddle the boundary between the district and the Western Cape.

The pattern is similar for solar energy development, but the potentially suitable areas are a slightly different shape as a result of the greater constraints operating with regards to solar energy development. An additional factor which can promote the development of solar energy beyond the constraints modeled here is synergy with the development of wind energy facilities. Although many renewable energy developers are focused either on wind or solar energy, some developers have experience in both wind and solar and integrated projects with both wind and solar developments are not uncommon. A consequence of this is that larger wind energy developments which can justify building their own substations and longer power lines can often open up areas for solar development that would previously not have been economically feasible.

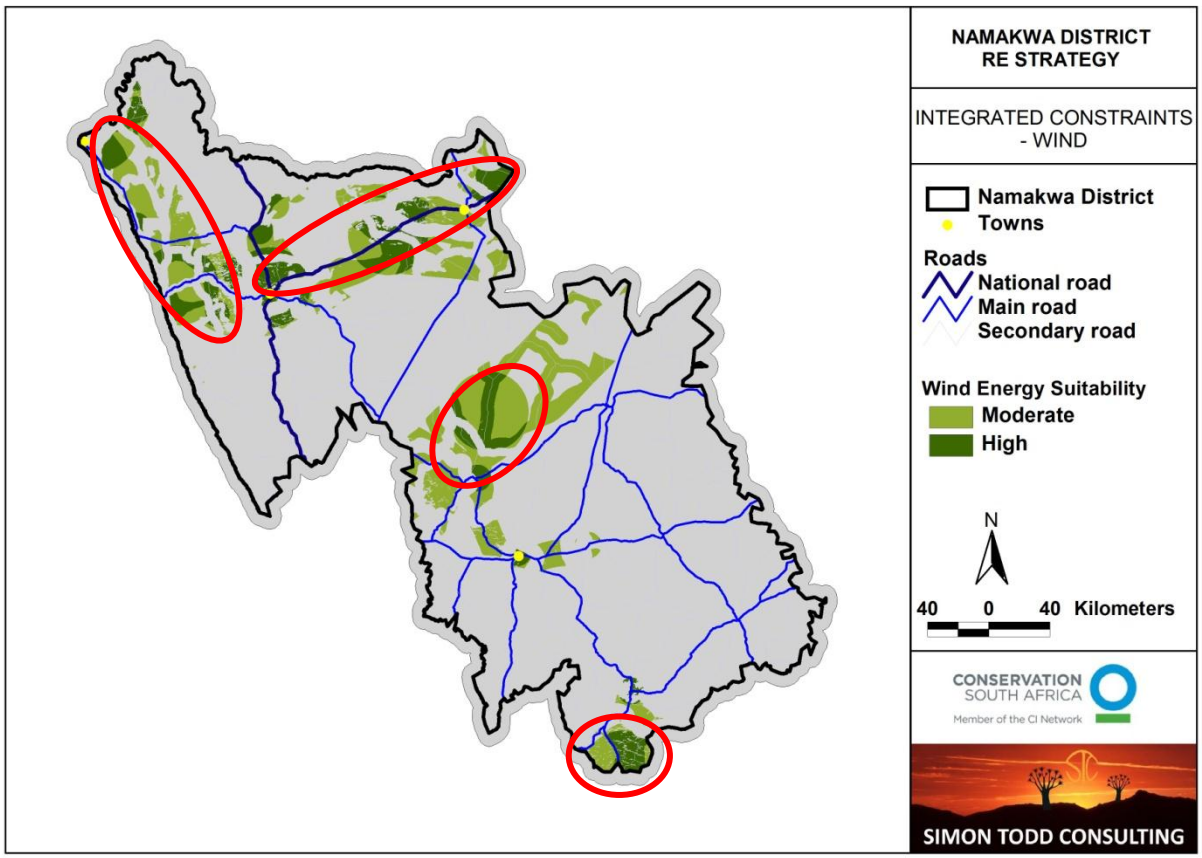


Figure 5. Integrated constraints map for wind energy in the Namakwa District. The green areas indicate areas where the development of wind energy is likely to be compatible with biodiversity maintenance as well as being economically feasible. The red outlines identify the four zones where development is likely to be concentrated.

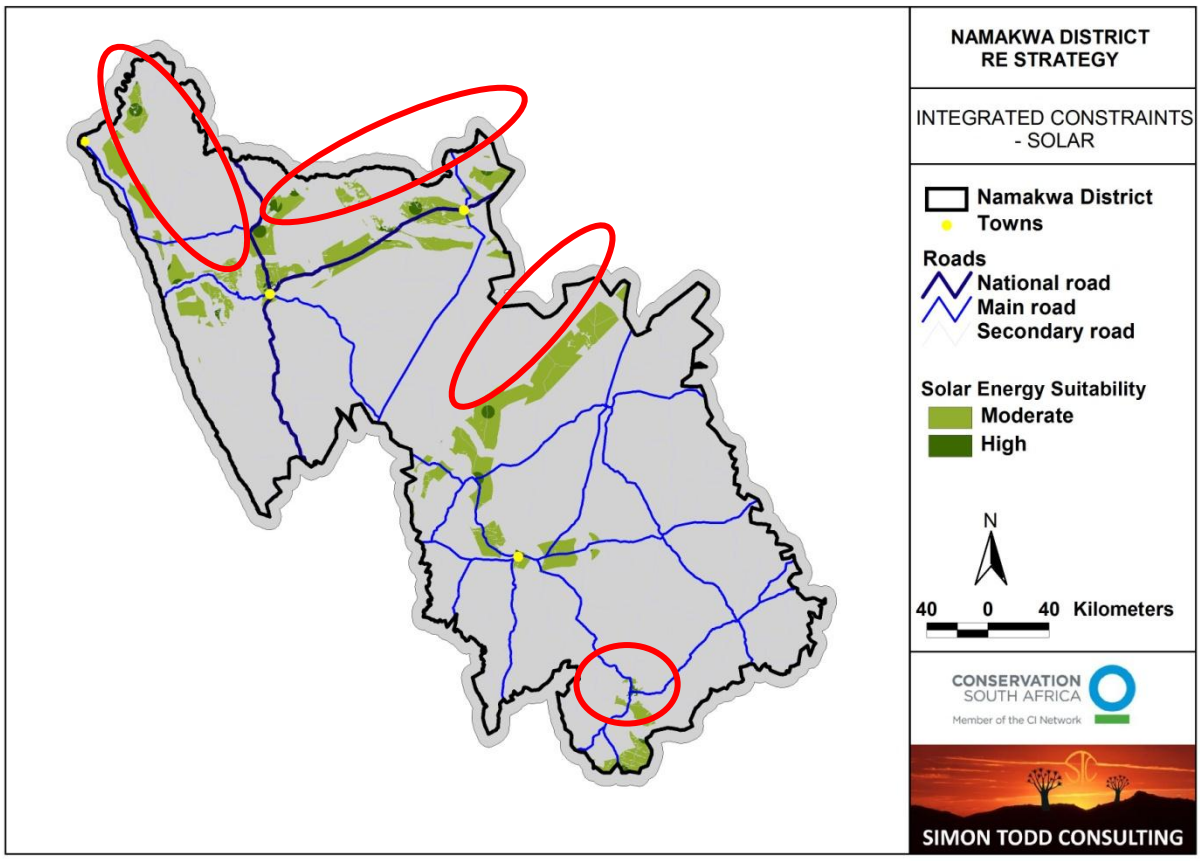


Figure 6. Integrated constraints map for solar energy in the Namakwa District. The green areas indicate areas where the development of solar energy facilities are likely to be compatible with biodiversity maintenance as well as being economically feasible. The red outlines identify the four zones where development is likely to be concentrated.

Renewable Energy Development and Ecosystem-Based Adaptation in the Namakwa District

Ecosystem-based adaptation focuses on maintaining intact natural or near-natural ecosystems to shield and protect humans from the impacts of climate change. It combines socio-economic benefits, climate-change adaptation, and biodiversity and ecosystem conservation, contributing to all three of these outcomes simultaneously. Given that renewable energy has some undesirable environmental impacts, the development of renewable energy in the Namakwa District could potentially impact the potential for ecosystem-based adaptation in the district. The priority areas for ecosystem based adaptation to climate change as identified by Midgley and Holness (2012) are overlaid below (Figure 7, Figure 8), on the integrated constraints map for wind and solar energy in the district. This map illustrates that potential

development areas for wind energy and the priority areas for ecosystem based adaptation do not overlap to a large degree. This suggests that the development of a significant renewable energy sector in the district would not significantly compromise the potential for ecosystem based adaptation. The two options appear to be largely compatible and areas of conflict are small and not likely to be of key significance from either perspective.

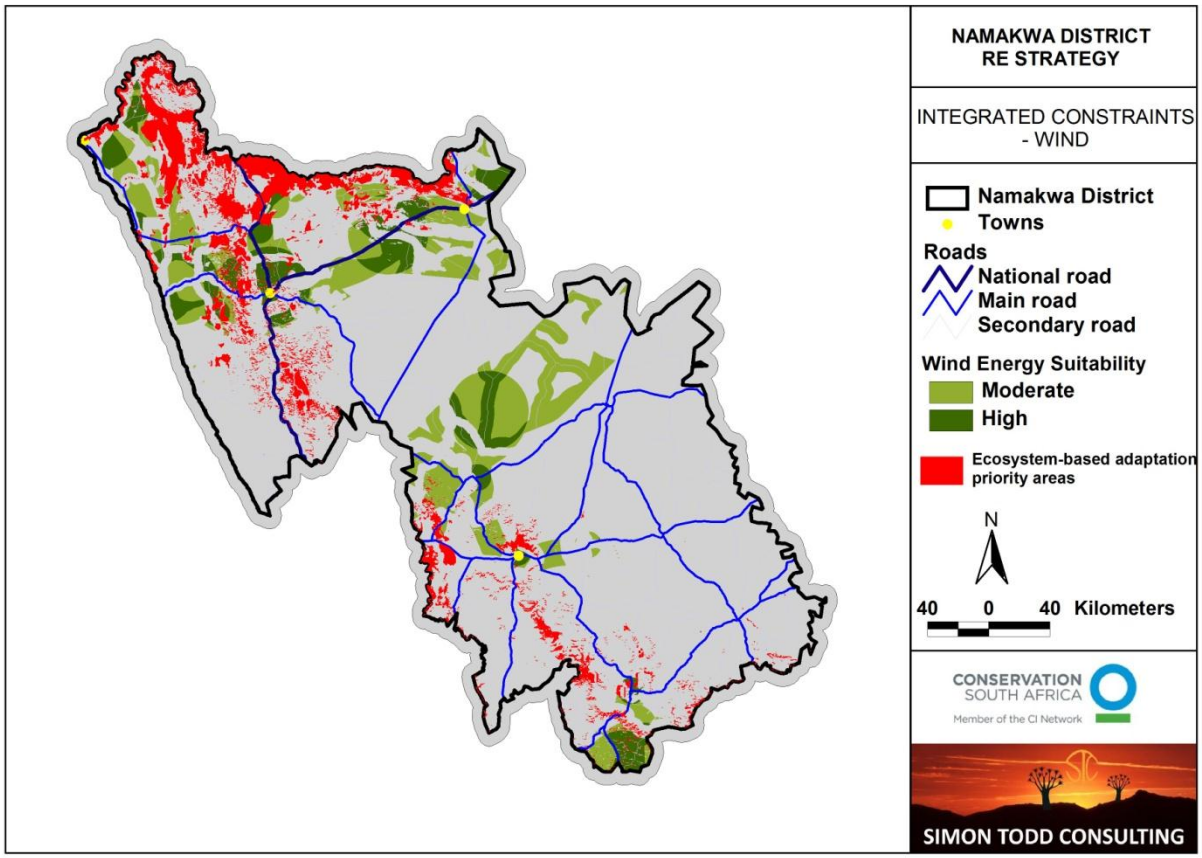


Figure 7. Map illustrating the overlap between ecosystem-based adaptation to climate change priority areas as identified by Midgley and Holness (2012) and the integrated constraints map for wind energy in the Namakwa District. The figure illustrates, that there does not appear to be a lot of conflict between the priority areas as identified by Midgley and Holness and the priority areas identified in the current analysis.

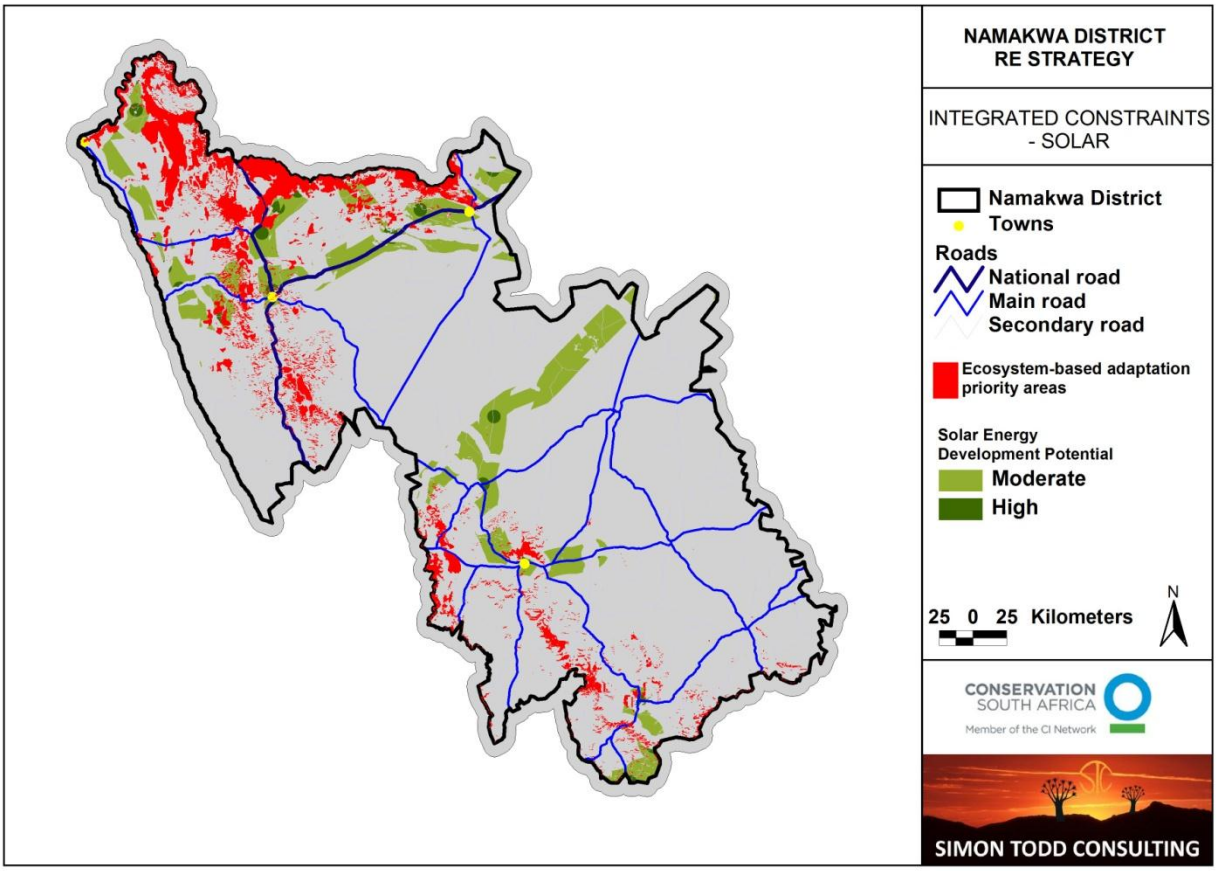


Figure 8. Map illustrating the overlap between ecosystem-based adaptation to climate change priority areas as identified by Midgley and Holness (2012) and the integrated constraints map for solar energy development in the Namakwa District. The figure illustrates, that there does not appear to be a lot of conflict between the priority areas as identified by Midgley and Holness and the priority areas identified in the current analysis.

Analysis of the potential sensitivity of likely development areas

Although the above section suggests that there is not likely to be a high degree of conflict between the development of renewable energy and ecosystem based adaptation potential, this does not really address the potential impact of renewable energy development on biodiversity. In this section, a brief plant species richness and threat status analysis of each likely development zone is conducted to provide a broad overview of the likely ecological sensitivity of each zone and the likely degree of conflict between development and biodiversity maintenance. Table 2 below clearly highlights the potential sensitivity of the Springbok area and the coastal plain. The Sutherland area has less total species and species of conservation concern, but it has probably also not been as well sampled as the Springbok area, so the numbers indicated are probably an underestimate. The table however clearly demonstrates the relatively

low species richness of the Loeriesfontein area and although this area has probably also not been well sampled, this area has naturally low species richness.

Table 2. The number of plant species within the core of each likely development zone as extracted from the SANBI SIBIS database, including the number of species which are listed in the Red Data Book of South African Plants.

Status	Coastal Plain	Springbok	Loeriesfontein	Sutherland
Least Concern	964	1305	319	788
RDB Listed	105	98	16	46
Total	1069	1403	335	834

The high numbers of red-listed species around Springbok and on the Coastal Plain, result from a high level of local endemism as well as a relatively high degree of existing habitat loss and impact within these areas. The coastal plain has been extensively impacted by mining and the widespread development of wind energy facilities within this area would certainly contribute to the further fragmentation and degradation of this area. Although the actual footprint of wind turbines is quite small, the access roads can generate significant impact as they must be large enough to carry the large vehicles which carry the turbine components onto the site. Furthermore, the turbines are usually placed on the highest ground possible as this is where the wind is strongest and this can result in a high impact on the koppies or hilltops which often also contain rare habitats and species such as quartz outcrops. Therefore, although there are certainly some areas suitable for wind energy development along the coastal plain, there are some risks to biodiversity from cumulative impacts and poorly located infrastructure. The area around Springbok also contains very high biodiversity, but as wind resources are relatively poor in this area the major development in this area will be solar PV facilities. Although PV facilities have a very high local impact, they are relatively limited in extent and if these can be placed within less sensitive areas such as on old lands or mine dumps the impact on biodiversity would be reduced to an acceptable level. A risk associated with solar PV development in the Springbok area is the rugged topography of the area which will concentrate PV facilities onto the lowlands between the rocky hills. As these areas have often already been heavily impacted by overgrazing the PV facilities could have a negative impact on this species habitat and any species associated with it. The Sutherland area falls within the Roggeveld center of endemism and is also a potentially sensitive area. The majority of wind energy developments planned for this area are along the escarpment along the boundary with the Western Cape. The escarpment forms an important east-west corridor for faunal migration and is also an important gradient for climate change resilience. Within this area, development of wind energy facilities poses a threat to both local biodiversity as well as broad-scale ecological processes. The area north of Loeriesfontein is clearly less sensitive than the other areas. Except for the area around Loeriesfontein itself, the landscape is relatively flat and less vegetated than the other areas on account of the generally low rainfall. The species in this area are generally widespread species found throughout the Nama-Karoo and Bushmanland, with the result that local-level impacts are much less likely to pose a significant threat to any species. Development within

this area is likely to result in lower ecological impact than the other areas and should be viewed as the most favourable area for development of renewable energy from an ecological perspective.

Opportunities and Constraints on Environmentally Positive RE Development

Given the green label associated with renewable energy it would make sense for renewable energy developers to strive for low ecological impact and ultimately to promote positive conservation outcomes from renewable energy developments. In this regard there are some opportunities that have not been well realized in South Africa to date as well as numerous obstacles the limit the potential for renewable energy to maximize its potential environmental benefits. In terms of the major obstacles, the reluctance of the Department of Agriculture to cede land to renewable energy developments and the reluctance of the Department of Minerals and Energy to relinquish mining rights can be identified as major obstacles in many situations.

It would make sense for renewable energy developments to be located on degraded mining land. However, this usually requires a change in land-use that must be approved by the DME, who are frequently not willing to allow such areas being excluded from future mining potential. Similarly, developments within areas of high agricultural potential are not viewed favourably by the DoA, who oppose development on any land where intensive agriculture may be possible. In some cases this can cause a conflict between the Nature Conservation authorities and DoA as the conservation authorities may oppose development within natural vegetation at a site while the DoA opposes development on the transformed land. This situation is particularly prevalent in the Western Cape where there is a lot of agricultural land within high wind-resource areas, and where the natural Renosterveld or fynbos vegetation types all have very high conservation value on account of the high levels of transformation they have experienced. This is likely to be less of an issue in the Namakwa District on account of the lower levels of transformation the district has experienced as well as the overall lower agricultural potential. Development within the majority of old lands of the Namakwa District and particularly Namaqualand should not be opposed by agricultural officials on account of the fact that most have not been cultivated in decades, their production value is exceptionally low and it is not likely to be economically feasible to cultivate such areas in the future either. The strong stance in this regard by the DoA appears to be more about maintaining apparent control of activity within farmland than a real justified concern over a potential decline in agricultural output or the loss of farmland to renewable energy. The actual amount of land lost to renewable energy is minimal when considered at a national scale and given that many types of agricultural activity can continue within facilities such as wind farms.

When ecologically sensitive areas are targeted for development and there are no less sensitive alternatives, this can and should be used to leverage positive conservation outcomes. In extreme cases where highly sensitive areas are impacted and avoidance measures are not possible, conservation offsets may be appropriate. In these situations, the developer, in exchange for development rights within the sensitive area, contractually commits financially or through the provision of alternative land to providing a positive conservation outcome which offsets the negative impact of the development. The developer may provide funds which are used to purchase or manage an ecologically similar area which is also under

threat and requires improved management to safeguard its biodiversity. Such offset agreements are usually negotiated between the developer and the provincial conservation authorities. In less severe situations, stewardship or contractual conservation arrangements may also be appropriate. Constraining factors include the fact that developers do not usually own the land and so such agreements also require the cooperation of the landowner, and in many instances the provincial conservation authorities are already overburdened and do not want to take additional stewardship or contractual conservation areas on.

Social and Economic Considerations

The total project cost of the developments approved to date is 73 billion rand, however only 22.7 billion of this is local content. In terms of the distribution of this among the provinces, the Northern Cape will receive 40-50% of the total investment. How much of this will be sourced from within the province itself is not clear, but a significant proportion is likely to be brought in from elsewhere. A large proportion of the local content is likely to be provided by the large construction and engineering firms which will oversee the construction of the facilities.

Although renewable energy facilities are highly costly to build, the facilities themselves do not generate a large amount of long-term employment opportunities. During the construction phase, a large workforce is however usually required and according to the media statements released by the DoE, the construction of the round 1 and 2 preferred bidders' projects would generate about 20 000 temporary employment opportunities, about half of which are in the Northern Cape. However, construction of renewable energy facilities usually progresses rapidly on account of the fact that the panels or turbines are built elsewhere and are just assembled on-site and it is just the access and support infrastructure which is required. Most facilities would be built to completion within a two year time frame. During the operational phase a lot less employment is generated and it is estimated that all the renewable energy facilities approved to date would generate only 728 long-term employment opportunities. At this point it is also not clear whether developers are going to provide training for local residents or employ skilled labour from elsewhere to run and manage the facilities.

In the long-term there is some potential for the development of a service industry around renewable energy, similar to that which exists around the mining industry. However, this requires the presence of a large number of renewable energy facilities within an area which is not likely to occur for some time to come. The potential is also much higher around wind energy facilities which require greater maintenance than PV facilities. PV facilities are not likely to generate much secondary industry as the panels are designed to last 20 years and the only regular maintenance required is occasional cleaning of the panels to remove dust. Furthermore, it is not likely that a large PV panel manufacturing industry can be established in the short-term due to the large capacity constraints which operate; the entire current annual solar panel output of the country would not be sufficient for a single medium sized PV facility.

Conclusions

Despite the high biodiversity value of large parts of the Namakwa district and the presence of extensive biodiversity priority areas, the major limitation on the development of renewable energy in the district is the availability of transmission infrastructure rather than any constraints that might be imposed by biodiversity considerations. Furthermore, the development of a renewable energy sector in the Namakwa District does not appear to conflict to a significant degree with the potential for ecosystem-based adaptation to climate change in the district, indicating that the two alternatives are compatible when considered at the scale of the district. However an analysis of the levels of species richness and presence of species of conservation concern with the different likely development zones, suggests that the development of renewable energy within the coastal plain of Namaqualand and around Springbok poses a potentially significant risk to biodiversity. A negative impact on biodiversity is however not inevitable and with suitable avoidance measures, development could proceed in many areas with minimal impact on overall biodiversity. Although the Sutherland area does not appear to have equivalent levels of species richness and red-listed species to the Springbok area, this area falls within the Roggeveld center of endemism and the steep climatic gradients present in the area are seen to play an important role in climate change resilience which would potentially be impacted by the widespread development of wind energy facilities in this area. The area north of Loeriesfontein has low species richness and few species of conservation concern and is seen as the most favourable area for development from an ecological perspective.

Currently, there are only two approved bidders within the Namakwa District, both near Pofadder in the far north-east of the district. Over the next three bidding rounds of the current IPP process, it is likely that additional projects will be approved within the district. However, in the long-term it is not likely that the Namakwa District will be able to compete with the adjacent Siyanda and Pixley ka Seme districts which have better developed grid infrastructure available with greater opportunities for the development of renewable energy facilities. Nevertheless there are numerous opportunities for the development of renewable energy in the district, particularly with regards to the development of wind energy facilities along the coastal plain and small to medium-sized solar PV facilities around Springbok on degraded areas associated with old lands and abandoned mines.

Although the development of the renewable energy industry is likely to bring a large investment to the country as whole, benefits at a local level are not likely to be very large as the facilities do not generate a large amount of long-term employment opportunities.

Additional Resources

Conservation South Africa and the Endangered Wildlife Trust. 2013. Wind and the triple bottom line. Available for download on www.conservation.org/southafrica.

References

Midgley, G and S. Holness. 2012**.** *Impacts of climate change for the Namakwa District. Final expert report.* Prepared for Conservation South Africa.

Desmet, P and Marsh A. 2008. *Namakwa District Biodiversity Sector Plan*. Available from BGIS at http://bgis.sanbi.org/namakwa/project.asp.

Integrated Resource Plan For Electricity. 2010-2030. Revision 2. Final Report. Available at: http://www.energy.gov.za/IRP/irp%20files/IRP2010_2030_Final_Report_20110325.pdf