THE EFFECTS OF RENEWABLE ENERGY ON COMMUNITIES: THE CASE OF UPINGTON IN THE NORTHERN CAPE, SOUTH AFRICA

BY

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Declaration

I, **Modirapula Bernard Mabele**, declare that the thesis **"EFFECT OF RENEWABLE ENERGY ON COMMUNITIES: UPINGTON IN THE NORTHERN CAPE, SOUTH AFRICA"** now submitted for the qualifications of **Masters in Development Studies** at the **University of the Free State**, is my work and that have not previously submitted the same work for a qualification at another institution of higher learning.

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15 November 2021

Name Date

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Abstract

The study examines the effect of renewable energy on the communities of Upington in the Northern Cape, South Africa. The researcher analysed the secondary data (through the qualitative method) collected through focus groups and key informants' interviews. The research participants described their knowledge of how renewable energy affect the community. The 1998 White Paper of Energy (amended in 2003) aimed to reduce the environment's energy-related impact. This was followed by the promulgation of the National Energy Act (Act no. 34 of 2008) to implement the Integrated Energy Plan. The plan regulates the present and future energy services needed socially and efficiently while minimising the energy sector's adverse environmental impact.

The government continued with its aspirations of green energy by introducing the Integrated Resource Plan in 2010 and reviewed it in 2018 and 2019 to ensure a steady shift towards more cost-effective and sustainable energy. The Renewable Energy Independent Power Producers Procurement Programme was introduced in 2011 to enable the independent power producers to participate in viable bids to construct and maintain large renewable energy projects. The programme created a stage for Eskom to enter into power purchase agreements with the independent power producers to generate clean electricity and contribute to job creation, industrial policy and energy security.

The study proceeded with discussions and the participants' views. At first, renewables contributed to jobs, climate mitigation, energy supply, especially in areas without grid access, and economic growth. However, the participants stated that because renewables have a boom effect, especially during the construction phase, they could cause harm to the community. The following socio-environmental issues have been identified because of renewable energy: crime, social disruption, negative impact on the environment and population growth that ultimately strain infrastructure, like roads, schools and housing. The participants cited housing prices that escalated, resulting in a severe affordability challenge for the local people.

In addressing the local adverse effects of renewable energy, especially on crime and social disruption, the study recommended that the social integration workshops play a central role in mitigating the social ills in the host communities. Social integration means that the newcomers must be integrated into the host society. Renewable energy was introduced into the area without involving all the key stakeholders, especially the local ones. The study, therefore, recommends

collaborative planning. Collaborative planning is an ideal plan to ensure that all key stakeholders work together to ensure a conducive environment (without any harm to the local resources and infrastructure) for renewable energy.

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Abbreviations and Acronyms

BBBEE	Broad-based black economic empowerment
CSP	Consolidated solar panel
DMRE	Department of Mineral Resources and Energy
DOE	Department of Energy
ED	Economic development
EnD	Enterprise development
GDP	Gross domestic product
GW	Gigawatt
GWh	Gigawatt per hour
IEP	Integrated energy plan
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent power producers
IRENA	International Renewable Energy Agency
IRP	Integrated resource plan
MW	Megawatt
PV	Photovoltaic
RE	Renewable energy
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SAPVIA	South African Photovoltaic Industry Association
SED	Socio-economic development
SLTO	Social license to operate
STI	Sexually transmitted infections
USD	United States dollar

Chapter 1
Setting the Scene

1.1 Introduction

South Africa became one of the first developing countries to reduce greenhouse emissions by developing the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The White Paper on National Climate Change response indicates that investment in the renewable programme is one of the most promising climate change mitigation options in the electricity sector (World Wide Fund for Nature [WWF] 2017). The Integrated Resource Plan (IRP) (South Africa, Department of Mineral Resources and Energy [DMRE] 2019) presents a combined new construction of 28.6 gigawatts (GW) using renewable energy plus 2 GW of battery storage by 2030 (Yelland 2020). These targets are made possible by inviting the private sector to participate in the REIPPPPs competitive process using solar photovoltaic (PV), small hydro, biomass, biogas or landfill gas projects (Eberhard and Naude 2016).

The key motive for utilising renewable energy (RE) is to move away from coal energy. The use of RE or clean energy in the country would have concrete environmental benefits, given that 93% of energy production originates from coal (Wrinkler 2005). The investment in RE in the country has reduced the carbon emission by 57 megatons, of which 3.8 megatons came towards the end of the December 2020 reporting quarter (Independent Power Producers Office [IPP] 2021). The introduction of RE technologies has grown remarkably, influenced by qualifying strategies and sharp cost drops (Ferroikhi, Lopez-Pena, Kieffer et al. 2016). The potential benefits of RE on economic growth and job creation are why the policymakers have become gradually attracted to renewables (Ferroukhi et al. 2016). Islam (2016) corroborates that RE projects contribute to local economic growth by using local materials, business shareholders and labour from rural areas.

South Africa has attracted an investment (both equity and loan) to the value of R209,7 billion, of which a total of 57 236 jobs has been created (IPP 2021). A total of 56 206 gigawatts per hour (GWh) of RE procured under REIPPPP has been generated to the grid since the first project became operational in 2013. As enshrined in the constitution since 1996, South Africa has systematically been creating strategies for ecological and sustainable development and energy planning (Van der Walt, Van den Berg and Cameron 2017). Since then, various government strategies and plans have supported the drive towards RE.

1.2 Problem statement

REIPPPP is a programme designed to enable the Independent Power Producers (IPPs) to take part in the viable bids to construct and run big RE plants to generate electricity using wind, solar, biomass and hydro technology (Thopil, Bansal, Zhang et al. 2018; Wlokas, Boyd and Andolfi 2012). Through the sector's socio-economic merits, renewable energy has demonstrated job creation. For example, the number of jobs created by RE sources is higher than conventional sources (International Labour Organisation [ILO] 2014). The ILO (2014) states that jobs in RE are directly created by it and through the supply chain in the sector.

However, RE is not always green. It can often create conflicts between policymakers and society. The RE sector's rapid growth can cause boomtowns[1] to the host communities, benefiting or straining local economies (Ryneski 2015). Within this context, I investigate the local effects of renewable energy projects in Upington, South Africa.

1.3 Aim and objectives of the study

This study evaluates the effects of RE on communities: the case of Upington in the Northern Cape Province. The dissertation seeks to address the following objectives:

a) To analyse the adverse effects of large infrastructure projects in remote communities.

b) To critically analyse renewable energy policy concerning local benefits.

c) To analyse the local adverse or positive effects of renewables (what pressures are they creating).

1.4 Glossary of terms

Foreigners: The researcher uses the term to explain that the RE sector hires people from other countries or provinces (in South Africa) to perform specialist jobs that local people cannot execute. These are the people whom the research participants labelled as Spaniards.

[1] Sudden flow of big groups of construction workers and associated collections within isolated, small and local communities, instigating public disruptions at the community level (Cernea 2004).

Renewable energy: The researcher uses this term to explain the process of reaping sources of energy either through wind, solar, biomass and hydro to produce electricity.

Upington: The primary study area comprises the following neighbouring towns that form part of the study: Keimoes, Louisvale and Raaswater.

Social disruption: The author uses the term to illustrate that RE can also cause an adverse social effect on the community. This implies that social ills will emerge due to the influx of construction workers in the area. The author argues that these people often contribute to the change in the social lifestyle of the community.

50 km radius: The researcher uses this term to explain the IPPs' corporate social investment qualifying criteria. Regarding the IPPs contractual agreement, the prime beneficiaries of corporate social investments are the communities residing within this specified radius.

1.5 Research methodology

Methodology refers to obtaining answers by following a particular approach (Taylor, Bogdan and DeVault 2015). This study will use the qualitative data analysis method to analyse data collected through focus groups and key informant interviews focusing on the experience or perceptions of the communities and experts and gather publicly available data.

1.6 Research selection of the study area

The study focuses on Upington, including three neighbouring towns, Keimoes, Louisvale and Raaswater. These four areas fall within the 50 km radius of the IPPs (Table 1.1).

Table 1.1 Settlements within 50 km from the IPPs

IPPs	Raaswater	Keimoes	Upington	Louisvale	Kalksloot
Khi Solar one	9,97 km	27,6 km	13,85 km	7,77 km	5,08 km
Upington Airport	21,57 km	39,29 km	2,38 km	19,03 km	18,27 km
Neusberg Hydro Electrical Project	48,86 km	28,47 km	64,34 km	50,71 km	47,87 km
Ilanga Consolidated Solar Panel (CSP)	35,87 km	63,82 km	32,11 km	34,76 km	38,49 km
Sirius solar PV Project one	9,80 km	20,88 km	21,35 km	9,51 km	16,87 km
Dyason's Klip 1	12,82 km	17,54 km	26,17 km	13,23 km	9,10 km
Dyason's Klip 2	13,61 km	16,84 km	12,64 km	13,29 km	8,92 km

Upington, including the three neighbouring towns mentioned above, falls within Dawid Kruiper Local Municipality. This municipality forms part of the five local municipalities that fall under the municipal jurisdiction of ZFM Mgqawu District Municipality in the Northern Cape Province (Figure 1.1).

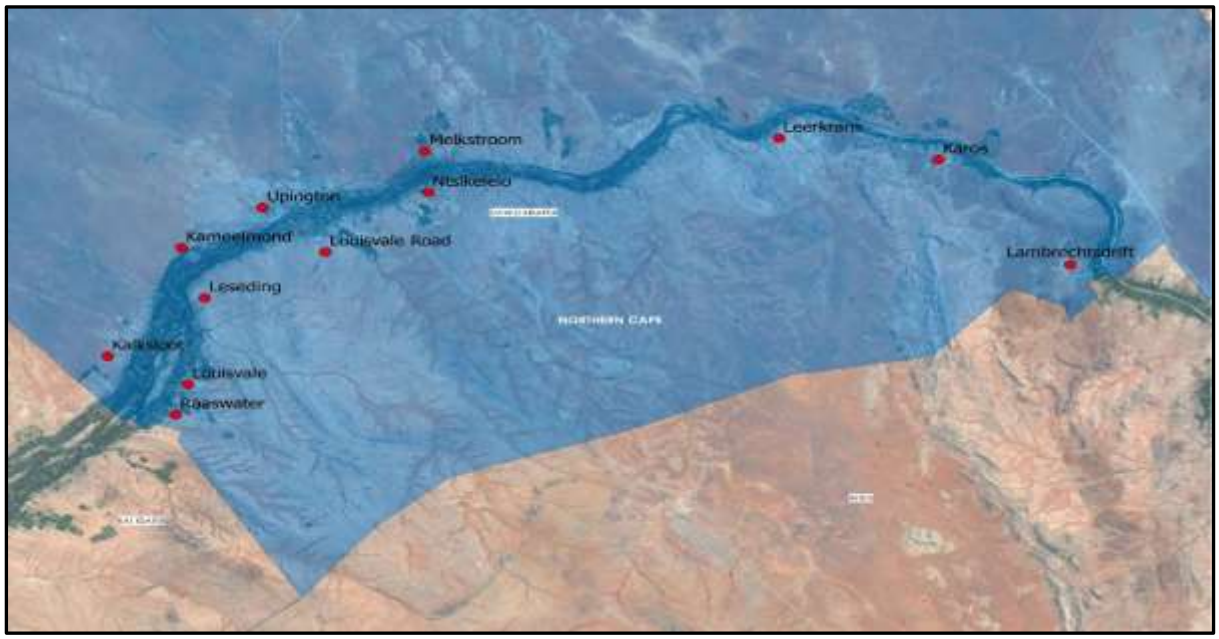


Figure 1.1 Map of Dawid Kruiper Local Municipality

The Northern Cape is one of the best solar resources areas in the world. This opportunity calls for vast investments of electricity production to the transmission network grid (Mbuli, Matshidza, Pretorius and Xezile 2011). The famous corridor for solar radiation is in Upington that falls within South Africa's RE development zones. The town experiences solar radiation,

ideal for solar energy production (Dawid Kruiper Local Municipality 2017). Out of the 48[2] active projects in the Northern Cape with a capacity of 3 566 megawatts (MW), Dawid Kruiper is host to six projects (already connected to the national grid) with a total combined MW capacity of 383.9 MW (Energy Blog 2021; Independent Power Producers, 2021). In terms of projects by technology, a total of 150 MW comes from consolidated solar panel (CSP) technology and 233.9 MW from four PV projects. Of these projects, the first project to be constructed was Khi Solar One (dated November 2012) and also the first project to be connected to the national grid (dated February 2016) (Table 1.2).

Table 1.2 List of REIPPPP projects in Dawid Kruiper Local Municipality

List of projects in Dawid Kruiper procured from BW 1–B 4) including two small projects								
BW	**Project name**	**Bidder name**	**Town**	**Local Municipality**	**Technology**	**Mega-watt**	**Construction date**	**Operation date**
1	Khi Solar One	Khi Solar One (RF) (Pty) Ltd	Upington	Dawid Kruiper	CSP	50,00	Nov 2012	Feb 2016
2	Upington Airport	ACSA	Upington	Dawid Kruiper	PV	8,90	18-Sep-15	18-Apr-16
3	Ilanga CSP	Karoshoek Solar One (RF) Proprietary Limited	Upington	Dawid Kruiper	CSP	100,00	Nov, 2015	Dec 2018
4	Sirius Solar PV Project One	Scatec	Upington	Kai!Garib3	PV	75,00	07-Dec-18	18-Feb-20
4	Dyason's Klip 1	Scatec	Upington	Kai!Garib	PV	75,00	Sep 2018	Feb 2020
4	Dyason's Klip 2	Scatec	Upington	Kai!Garib	PV	75,00	Oct 2018	April 2020
					Total Megawatts	**383,9**		

1.7 Research approach and design

The study approach follows the qualitative research method. Qualitative cases understand the reasoning behind human behaviour (Bryman 2012). Mohajan (2018) shares the following insights about qualitative research: The qualitative research methods use people's experiences to understand their reality in the form of social action that emphasises the way people interpret things. It is the method of analysing and interpreting data obtained through interviews, classroom annotations, open-ended questionnaires and engagements. The main objective of choosing qualitative research is to understand the views of the affected community and the experts about the effect of RE on the community. The researcher will connect the thoughts and

[2] IPPs have reached a financial close.
[3] Projects located on the Dawid Kruiper and Kai! Garib cross-border municipalities.

perceptions of the people with the existing body of literature and make an informed argument about the findings. This study may greatly assist all of the affected stakeholders in the RE sector to develop a concerted approach in implementing RE successfully.

1.8 Data collection strategy

The primary data was collected through focus groups and key informant interview methods. The questions were semi-structured and prepared ahead of the interviews. The questions were designed in an open-ended manner to allow the interviewees the opportunity to express their feelings. In the case of this research, the researcher analyses the secondary data. From time to time, the researchers are encouraged to deposit the data they collected in their data archives, allowing others to analyse them (Bryman 2012). The information was organised for the project titled "The impact of the Concentrated Solar Powerplant project in the local community of Upington, in the Northern Cape Province in South Africa". The Centre for Development Support collected the primary data. The data was collected through empirical research using a bottom-up approach to investigate the comprehensive impact of the CSP plant on local communities.

The data was meant to assess the socio-economic and livelihoods impacts of CSP plants on local communities. This information is relevant to this research as the research seeks to address both the local adverse effects and the benefits of RE. The following factors influenced the organisation of the workshops: traditions of having mixed-gender groups, local culture, age groups and income. The research teams were explicitly interested in the perception associated with costs and benefits of the CSP plant on the nearby residents, the CSP plant's impact on water resources availability and any changes imposed upon their daily lives. The following issues were central to the research: community benefits on public, community ownership, acceptability of RE projects, lack of public trust and importance of place attachments.

The interviewees were asked the following two main questions:

Focus groups questions:

Question 1: Can you tell us about any changes the CSP plant (Khi Solar One) has made to your town's social structure (such as population size and social inequality)? How significant these changes are/were? How long these changes last?

Question 2: What is your view on the impact of the Khi Solar One plant on the cultural identity and regional reputation of your city/town?

Interviews questions:

Question 1: Can you tell us about any changes that the CSP plant has made to the social structure (such as population size by immigration) of local communities around the plant? How significant these changes are/were? How long these changes last?

Question 2: What is your view on the impact of the CSPs on the community atmosphere and culture of the local community around the plants?

The research team recorded the discussions for both the focus group and interview methods after obtaining consent. The interview sessions were held telephonically, except for the focus group, which was conducted physically. The research team transcribed all the interviews during the data collection stage. At the end of the primary data collection, the researcher transcribed the data from the audio recorder and labelled them according to the location of the focus group participants as outlined under Table 1.3. In the case of the key informants, the participants were allocated numbers as outlined under Table 1.4.

1.9 Sampling design

Sampling is a process of estimating the characteristics of the population by selecting the sample for investigating it. It is simply the process of obtaining information about the entire population by investigating only a portion of it (Kabir 2016). The non-probability sampling technique was used during the collection of data. This technique involves choosing elements based on assumptions regarding the population's interests, forming the criteria for selecting any event. With this technique, random sampling was not used to select a sample of the population for research. This implies that some units in the people are more likely to be chosen (Bryman 2012). The project used two research methods: First, the research team used semi-structured interviews where 16 key informants were interviewed telephonically and face to face. After that, five focus group meetings took place. A total of 45 participants were interviewed.

Table 1.3 Respondents' demographic and biographic data

Focus group	Participants	Profile
5 Raaswater 1	Interviewee 1	Unemployed
	Interviewee 2	Farmer/Councillor
	Interviewee 3	Housewife
	Interviewee 4	Care worker
	Interviewee 5	Unemployed
	Interviewee 6	Unemployed
	Interviewee 7	Community development worker
6 Raaswater 2	Interviewee 1	Care worker
	Interviewee 2	Community Works Programme
	Interviewee 3	Community Works Programme
	Interviewee 4	Community Works Programme
Upington	Interviewee 1	Nurse/Farmers wife
	Interviewee 2	Financial advisor
	Interviewee 3	Pensioner/Retired librarian
	Interviewee 4	Housewife
	Interviewee 5	Student
	Interviewee 6	Housewife
	Interviewee 7	Retired teacher
Kalksloot	Interviewee 1	General worker
	Interviewee 2	Builder
	Interviewee 3	Unemployed
	Interviewee 4	Unemployed
	Interviewee 5	Unemployed
	Interviewee 6	Unemployed
	Interviewee 7	Unemployed
	Interviewee 8	Spaza shop owner
	Interviewee 9	Unemployed
	Interviewee 10	General worker
Louisvale	Interviewee 1	Student
	Interviewee 2	Learnership
	Interviewee 3	Housewife
	Interviewee 4	Pensioner
	Interviewee 5	Pensioner and Housewife
	Interviewee 6	Learner
	Interviewee 7	Police officer
	Interviewee 8	Unemployed
6 Keimoes 1	Interviewee 1	Vice-principal
	Interviewee 2	Unemployed
	Interviewee 3	Occupational health & safety officer
	Interviewee 4	Unemployed
N= 6	**N=45**	

Table 1.4 Interview participants' profile

Interviewee number	Capacity of interviewee
1	Businessperson: the transport industry
2	Politician (Councillor) and business person
3	Community Liaison: solar plant
4	Businessperson: construction
5	Engineer
6	Local Municipality
7	Social worker
8	Estate Agent
9	NGO
10	Department of Environmental Affairs
11	Department of Environmental Affairs
12	Businessperson and contracts with CSP plant
13	Businessperson
14	National African Farmers Union (would like to be updated on research results)
15	Industrial Development Corporation (would like to be updated on research results)
16	Department of Economic Affairs

1.10 Data analysis

Data analysis in qualitative research can be defined as the grouping and understanding visual materials to produce data about clear and understood structure (Flick 2013). This stage of data analysis is essentially about deduction. It is the stage where the researcher needs to make sense of the bulk information gathered to address the research question (Bryman 2012). Data deduction occurs throughout the analysis, as it is not separate but part of the data analysis (Punch and Oancea 2014). In the early stage, it takes place through the synopsis, breaking down and editing of data. In the mid-stage, data deduction happens through coding, where the themes are developed. In the last stage, it happens through explaining and conceptualising.

In analysing secondary data, the researcher used the process of thematic analysis. The processes include marking critical ideas in the data using coding techniques, classifying the same data types into one group, and grouping data with similar themes (O'Connor and Gibson 2003). The analysis allows the researcher to associate the frequency of a theme with the entire content (Alhojailan 2012). Codes are then developed to represent the identified themes, link raw data as summary markers, and later analyse them (Guest, MacQueen and Namey 2012). Thematic data analysis moves beyond counting prominent words and emphasising identifying and

describing both understood and obvious ideas to develop themes. The researcher coded the data, then deducted them into themes to link them with the study's literature review and later analysed them.

1.11 Research ethics

The term research ethics constitute and control scientific activities by various values, norms and institutional arrangements. Research ethics is a classification of practical scientific principles (National Committee for Research Ethics in the Social Sciences and the Humanities [NESH] 2019). The process entails considering the potential issues that might arise from the study by completing a form to declare such (Bryman 2012). On that note, the researcher has obtained ethical approval from the University's ethics committee to conduct the study. The role of the ethics committee is to review the study proposal and ensure that they comply with the locally and internationally accepted ethical frameworks (World Health Organization [WHO] 2009). The interview was done in a language that suited the research participants (Afrikaans for all the focus groups and English and Afrikaans for some key informants). Therefore, the study complied with the following research ethics:

1.11.1 Informed consent

This is one principle in research ethics that ensures that the rights of the research participants are explained and respected. The research team explained to all the participants the research objectives and the importance of their participation. All the respondents from the selected samples participated in the research. The voluntary agreement of the individual to participate in research is critical. This means that the research participants must be able, without the intervention of any element, to freely exercise their power of choice whether to participate or not (WHO 2009). The researcher's responsibility is to provide the participants with information about the research to decide if they want to participate in the study or not (Bryman 2012). On that note, all the research participants were given consent forms to sign. The consent forms contained information about the project, the nature and purpose of the study, and the researcher's profile. The following items were shared with the participants:

- What the research is all about.
- The rights of the participants were explained, and the following was outlined:
    - ground rules were laid down before the interviews;
    - the participants were informed of their rights.

- The participants were advised of the duration of the workshop.
- The participants were informed of the interview recording, where the researcher stated that the objective was to write about the interview accurately.

1.11.2 Confidentiality and anonymity

The participants were informed beforehand that their information would be treated with confidence and anonymity. The researcher did not call the participants by their real names; instead, the researcher used the term “interviewees” (Table 1.3 and 1.4). The privacy and anonymity of research participants must be respected and protected (Bryman 2012). In terms of confidential information, the WHO (2009) states that the participants should be informed of who will have access to that information and confidentiality protections that will be implemented. In drawing the above advice about this research, the researcher treated the participants' information with strict confidence.

1.12 Overview of the chapters

In addition to this chapter, the study is outlined in terms of four additional chapters.

In **Chapter 2 (Literature review on renewable energy: Global perspective),** I discuss the state of RE globally, emphasising the socio-economic effect on the communities. The local adverse effects of RE will also be discussed, drawing lessons from the social disruption theory. The social disruption theory states that RE is not always green because it has a boom effect, as the social ills will develop due to the influx of construction workers in the host communities.

Chapter 3 (Renewable Energy in South Africa) discusses the state of RE in South Africa from a policy perspective. This chapter presents the policies and legislation governing the implementation of RE in the country, emphasising the sector's socio-economic effect on the communities. Finally, this chapter also shares an insight from the body of literature regarding research around socio-economic development (SED) and enterprise development (EnD) in REIPPPP.

In **Chapter 4 (Research Findings)**, I analyse secondary data from the University of the Free State archives. This identifies the connection between the community and RE. This chapter follows a detailed analysis of empirical data obtained from the research participants. Finally, this chapter shows how the community can be positively and negatively affected by RE.

In **Chapter 5 (Conclusions and Recommendations)**, I summarise the research and share the main findings. This chapter shares recommendations and future research topics.

Chapter 2
Literature Review on Renewable Energy: Global Perspective

2.1 Introduction

Energy is of paramount importance for sustainable growth since social activities like production of food, utilisation of goods, security and services are related to energy (Islam 2016). The establishment of RE technologies supported by enabling policies has seen outstanding growth in current years (Ferroukhi et al. 2016). Policymakers are gradually interested in the potential benefits of RE, such as economic growth and job creation, which comes as many economies continue to struggle to regain momentum (Ferroukhi et al. 2016). Islam (2016) corroborates with the latter stating that RE projects use local labour for rural areas, local material and business shareholders to a certain extent to contribute to local economic growth. Moreover, RE improves environmental impacts by reducing greenhouse gasses and making the community aware of climate change (Kumar 2020).

On the other side, RE is not always green as its selection can often create conflicts between policymakers and society. Notwithstanding the status of introducing RE technology, there are many discussions about its effect on the environment and nature conservation (Pratiwi and Juerges 2020). Another critical issue is the temporary boomtowns that the growth of RE can bring to the host communities with both benefits and strains on the transitioning economies (Ryneski 2015). The boom studies have shown that the distribution of cost and benefit is not always parallel, as costs associated with growth sometimes exceed benefits (Jones and Mayzer 2021).

In light of the above background, the literature review will focus on the effect of RE sources on the communities: job creation, climate change mitigation, gross domestic product (GDP) and welfare. The next part of the literature will focus on the adverse effects of RE on the environment. The final part focuses on social issues that are negatively impacted by the boom effects: education, crime, housing, health, population growth, social structure, municipal services, and personal interaction patterns.

2.2 Benefits of renewable energy

Energy security is based on the idea, amongst others, that there is an uninterrupted supply of energy vital for economic growth (Owusu and Asumadu-Sardokie 2016). Access to energy supply is essential to political and economic challenges in developed and developing countries regarding the relationship between economic growth and energy consumption. In addition, energy is regarded as a critical option to reduce energy imports and contribute to the diversification of energy supply (Owusu and Asumadu-Sarkodie 2016).

The accelerated investment in RE can influence the world's economy through investment, trade and electricity prices (Ferroukhi et al. 2016). Table 2.1 shows that the selected establishment of RE at the regional and sectoral levels are mainly positive (Ferroukhi et al. 2016). According to Table 2.1, amongst other considerations, the level of impact of RE on GDP will depend on the country's economic structure and the cost of RE sources, and whether the required services and equipment are sourced locally or imported (Ferroukhi et al. 2016). Furthermore, the existing studies also indicate that continuous investment in RE contributes towards job creation. Also, depending on a given country's policy structure, employment could increase from thousands to under a million in 2030. Finally, the number of jobs created will offset the number of jobs lost under the fossil fuel sector because the RE supply chain sector is more labour intensive (Ferroukhi et al., 2016).

Table 2.1 Effects of green energy production from previous research

Country (origin)	Projected year	Policy imperatives	Effect GDP	Job creation
Chile (NRDC and ACERA 2013)	2028	Clean energy at 20% rate of power production (except for big hydro)	+0.63% (USD 2.24 billion)	7 800 worth of indirect and direct jobs (+0.09%)
European Union (European Commission 2014)	2030	-40% of carbon emission by 2030[1]	+0.46%	+1.25 million economy-wide jobs (+0.5%)
Germany (Lehr et al.2012; Bohringer et al. 2013)	2030	Clean energy production at varying targets.	Up to +3%	From adverse to +1% on net job creation.
Ireland (Pöyry Management Consulting and Cambridge Econometrics 2014)	2020	Meeting the target for wind by 2020	+0.2% to +1.3%	+1 150 to +7 450 net jobs relate
Japan (IRENA and CEM 2014)	2030	Counting 23.3 GW of solar PV	+0.9% (USD 47.5 billion)	N/A
Mexico (own calculations based on K.A. CARE 2012)	2030	21 GW of extra green energy volume	+0.2%	+134 000 in the sector
Saudi Arabia (Own calculations based on K.A. CARE 2012)	2032	54 GW of green energy volume	+4% (USD 51 billion)	+137 000 in the sector[2]
United Kingdom (Cambridge Econometrics 2012)	2030	The more significant role of off-shore wind except for natural gas	+0.8%	+70 000 net job creation
USA (ICF International 2015; Synapse Energy Economics et al. 2015)	2030	Carbon emission reduction determined by green energy	0.6%	+0.5 to +1 million net

Source: Ferroukhi et al. 2016.

2.2.1 Job creation

Analysts classify employment in RE as green jobs (Gkatso, Kounenou, Papanagiotou et al., 2014). Meyer and Sommer (2014) describe these jobs as the type of jobs that help protect and restore environments and ecosystems and lessen or evade all forms of material waste and pollution. Most stakeholders, including government agencies, academic institutions, the public, and businesses, have focused on job creation in the RE sector (Ram, Aghahosseini and Breyer 2020). RE can positively influence job creation, although the literature available differs in terms of the magnitude of net employment (Edenhofer 2011).

Estimates are that around 16.7 million people will be working in this sector globally by 2030, and 2017 figures are approximately 10.3 million (Ram et al. 2020). In the United States, the

[1] The research measured productivity and green energy selections. The optimistic effects relate to both (Ferroukhi et al. 2016).
[2] Both this figures on GDP and employment includes the others from other "alternative energies" as per the original source (Ferroukhi et al. 2016)

solar industry hires more people than the coal industry. In 2016, about 374 000 people were employed, translating to 43% of the workforce in electric power generation, while fossil fuels employ 187 117 people, equivalent to only 22% of the workforce (Kabel and Bassim 2019). By 2018, there were about 855 000 indirect jobs in the United States (McGinn and Schneer 2019). The United States Energy and Employment Report reports that solar power support 242 343 jobs in the RE sector, natural gas supports 43 526, and biofuels support 86 202 jobs.

The Solar Foundation USA's annual census attributes this decrease due to tariffs and uncertain state policies that stopped significant solar projects (Gioutsos and Ochs 2017). Despite this decrease, the foundation recorded long-term growth between 2013 and 2018, where solar employment grew by 11% annually, six times faster than the overall US employment (Gioutsos and Ochs 2017). Generally, RE creates more jobs than other energy creation industries. A literature review of 15 job studies found that RE sources create more jobs per energy unit than coal or natural gas (Kabel and Bassim 2019).

Every dollar spent on RE would create 7.42 full-time jobs, whereas 2.65 full-time equivalent jobs will be created on fossil fuel (Kabel and Bassim 2019). In terms of investment measurement, fossil fuel creates 5.3 jobs per US$1 million, whereas RE creates over three times more than this amount translating to 16.7 jobs per $1 million (Gioutsos and Ochs 2017). Most RE employment in 2016 existed in Asia, which accounted for 4.5 million jobs. 3.6 million jobs were created in China alone, 1.2 million in Europe, 876 000 in Brazil, and 61 000 in Africa (Gioutsos and Ochs 2017:4). As indicated in Table 2.2, the developing countries with the most significant absolute employment numbers in RE after China are Brazil, India and Bangladesh (Gioutsos and Ochs 2017:4).

Table 2.2 Less developed countries' green energy employment

Country	Quantity of green jobs
China	3 643 000
Brazil	876 000
India	385 000
Bangladesh	162 000
South Africa	30 000
North Africa	16 000
Rest of Africa	15 000
Total	**5 127 000**

Source: Gioutsos and Ochs (2017:4)

In terms of employment by technologies, analysis has revealed that solar PV technology has the highest potential for creating jobs. Almost 0.87 job-years per GWh are created through solar PV[3], followed by CSP[4] with 0.23 job-years per GWh Edenhofer (2011). Biomass energy projects[5] significantly create local job opportunities and local areas' development (Kumar 2020). These plants provide significant jobs for the local community and play a key role in developing the community (Kumar 2020). Wind energy[6] does not have any emigration problem, and it can create high job opportunities for engineers (Kumar 2020). Geothermal projects[7] provide socio-political benefits such as local people's education, living standards and improved health care (Kumar 2020).

2.2.2 Energy supply

The absence of access to reliable energy sources and energy services is energy poverty, affecting more than 1.6 billion people worldwide (Costa 2019). Energy caters to human needs like heat, lighting and good water services (Costa 2019). There is proven evidence of many poverty sources, like lack of education, infant mortality, lower life expectancy, higher fertility

[3] Solar PV is a system that generates electricity directly from solar. PV system do not emit greenhouse gases in electricity generation (Boggio, Zignol, Jaramillo et al. 2008).
[4] CSP depends on mirrors to concentrate sunlight onto a receiver called an element to change solar enrgy into power (Hernandez et al. 2014).
[5] Biomass is a renewable organic material derived from animals and plants. It can be converted to gas or directly burnt for heat and liquid fuels through various processes (United States Energy Information Administration 2021).
[6] Wind energy is the process whereby the wind generates energy through kinetic conversion by wind turbines into mechanical power. A generator, therefore, produces electricity from the conversion of mechanical power using a generator (National Renewable Energy Laboratory 2018).
[7] The heat is produced from deep in the earth's core. It is a clean renewable energy source that can be harnessed for use as electricity and heat (Turgeon and Morse 2012).

rate, and access to insufficient power facilities (Costa 2019). This does not shock legislators as industries, academic institutions, transportation services, and health services depend on their energy supply for their activities (Costa 2019).

Terrapon-Pfaff, Dienst, Konig, et al. (2014) supported the above statement that reducing energy poverty in developing countries is critical as it provides access to sustainable and affordable energy services. Insignificant projects can increase and improve access to energy for communities and individuals that would have been supplied by market structure (Terrapon-Pfaff et al. 2014). A total of 23 projects were evaluated in the Millennium Development Goals 1: *reducing extreme poverty and hunger.* The appraisal was based on minor green-powered projects in less developed areas. The five projects alone provided 350 supplementary persons with clean energy, heating, cooking, or lighting solutions (Terrapon-Pfaff et al. 2014). Kabel and Bassim (2019) share another renewable energy impact evidence in Bangladesh; since 2002, more than 3.5 million households have had access to green energy using solar energy. Solar home systems can help poor households save kerosene costs of over $600 million and reduce CO2 emission by 1.7 million tons during the 20 years of the solar home systems' lifecycle.

Solar PV can deliver energy to various areas where the connecting cost to the primary grid is unaffordable (Edenhofer 2011). Edenhofer (2011) states that other benefits are the replacement of indoor-polluting kerosene lamps, incompetent cook stoves, better indoor reading, a concentrated gathering of wood (allowing women and children who usually gather it to focus on other priorities). Edenhofer (2011) finally concludes that the benefit of providing streetlights for security and enhanced health by preserving inoculations and food products provide countless paybacks that advance people's lives.

2.2.3 Community projects

According to Hirsch, Smalley, Selby-Nelson, et al. (2018), communities can benefit from the following. First, they can be educated about RE to create a sustainable low carbon future. Second, if people are capacitated to participate in, and make decisions about, RE initiatives in their community, this can result in empowerment and resilience. Finally, community involvement in RE projects can build a base of champions, ultimately making people in these communities an investor base. A typical project is one where community members are the key drivers in a community-based project in a village. The project is situated in the German state

of Saxony-Anhalt with a connected capacity of 66 MW from the wind (Germany, Federal Ministry for Economic Affairs and Energy 2016).

The German project is organised as GmPH and co. Kg but with only residents as partners (German Federal Ministry for Economic Affairs and Energy 2016). The revenues are also paid to a local charitable association *Födervereim Stadt Dardesheim e.v,* for use in local infrastructure and social projects of cultural events. Hirsch et al. (2018) share ideas on developing local entrepreneurs stating that the project developer must identify and recruit active community members and educate them about RE and supporters' databases. First, community ownership of RE is most common and well established in Europe, and wind power is the most used technology. Second, there are many other technologies such as hydropower[8], biomass, solar PV and anaerobic digestion. Finally, countries like Denmark, Germany, and the United Kingdom are developers in green energy and policy approaches that ensure genuine prospects for autonomous control, public involvement and fiscal contribution.

2.2.4 Gross domestic product and welfare

According to the International Renewable Energy Agency (IRENA), reducing carbon emission would enhance the GDP by 0.8% in 2050 compared to advancement of welfare, according to analysis submitted under German G20 as per the Paris Agreement (Ferroukhi et al. 2016). This translates to a gain of USD 19 trillion, approximately comparable to all businesses registered under the New York Stock Exchange (IRENA 2017). In China's case, the effect of green energy source consumption on the GDP led to 0.162% growth, 0.44% for rural households and 0.368% for urban households (Ntanos, Skordoulis, Kyriakopoulos, et al. 2018). A separate study from China shows the connection in the long run between green energy consumption and GDP (Ntanos et al. 2018). The outcomes revealed that China's growing economy is favourable for the RE sector's growth, promising aids to further economic growth. However, the GDP alone cannot capture the full spectrum of human welfare gains.

2.2.5 Renewable energy: climate-mitigation option

RE is regarded as a sustainable clean energy production mechanism to replace coal. The world's wealthiest countries support this move (herein referred to as G7[9] countries), who are taking a

[8] Hydro-power plants use flowing water energy to produce power.
[9] The United Kingdom, the United States, the European Union, France, Italy, Germany and Canada.

big step in phasing out the dirtiest fossil fuel by ending their financial aid for coal development overseas (Harvey 2021). This move was adopted at a mid-year two-day robust meeting of the G7's Energy and Environmental ministers, where the countries reiterated their commitment to reducing global heating to 1.5°C[10]. The move is intended to decarbonise their energy sector and the phasing out of coal by the 2030s. The International Energy Agency indicated in the week of the G7 meeting that the move has to be an end of fossil fuel development, and this must happen before the end of 2021. The International Energy Agency concluded that the move would give the world an excellent opportunity to keep up with the 1.5°C limits.

Two of the world's most significant coal sources (Japan and China) agreed to stop assistance pending the last phases of a two-day virtual conference. The Australian Science Media Centre (2021) reported on the following expert reactions: First, the Australian climate experts applauded the move by the G7 countries, stating that coal development could potentially be reduced to an outdated energy generation system. RE will therefore be regarded as an alternative solution. Finally,[11]Professor Bill Lawrence stated that the move would cause developing nations to be reluctant to pursue alternative energy sources if major funders like Japan and China[12] continue to push coal-fired plants.

2.3 Local adverse effects of renewable energy on socio-environmental factors

RE has an adverse impact on the following socio-environmental issues:

2.3.1 Environment

About 99.7% of human food is gained from the global environment, while 0.3% is from the aquatic domain (Owusu and Asumadu-Sarkodie 2016). Owusu and Asumadu-Sarkodie (2016) state that the utilisation of bioenergy depends on the food products to provide fuel. These cause a worry to the public in general as there are cases of food aid needed worldwide in deprived communities (Owusu and Asumadu-Sarkodie 2016). The environmental impact of hydropower is enormous, and it can change the movement paths of wildlife, plants, natural watercourses and ecosystems (Vezmar, Spajic, Topic, et al. 2014). Vezmar et al. (2014) state that another

[10] According to the scientists the reduction of global heating will require halving greenhouse gas this decade as well as net zero emissions by 2050 (Harvey 2021).
[11] Distinguished professor of the Tropical Environmental and Sustainability Science Centre at James Cook University (Australian Science Media Centre 2021).
[12] China is remarkably insincere in encouraging other nations to continue burning large amounts of coal while at the same time lowering down on its domestic air pollution activities.

problem is that water is always needed in the bed during dry periods. The biggest socio-political impact challenge is relocating people from flooded areas (Vezmar et al. 2014). According to Tajne (2015), the most damaging effect of hydropower is the flooding of an area, causing the river downstream to flood, destroying agricultural land, forest wildlife and land (Tajne 2015). Tajne (2015) shares an incident in India regarding the Dhauliganga Hydroelectric Station that led to extraordinary flash flooding, triggering the collapse of powerhouses.

With regards to wind energy, concerns have been raised, citing its adverse impact on well-being, human health and quality of life, for example, noise from the wind turbines and the fact that acoustic contamination is associated with health issues such as sleep disturbances and stress (Leiren, Aakre, Linnerud et al. 2020). Leiren et al. (2020) noted that Knopper and Ollson indicated that they have revised the literature on the possible effects and arrived at a conclusion that no peer-reviewed systematic periodical articles illustrate a connection between individuals residing in proximity to wind turbines, the noise (audible, low-frequency noise) they discharge resulting in physiological health effects. One of the ecological problems is the impact on bird populations where the birds are injured or killed; however, the current evidence poses only a minor threat (Boggio et al. 2008). Tajne (2015) corroborated the above statement indicating that current findings by the National Wind Coordinating Committee found that collision with wind turbines and air pressure resulted in several birds and bats injured by the turbines.

The construction of solar energy plants requires a large land area, affecting the current land use (Tajne 2015). It can result in soil compaction, erosion and change in drainage channels because of the clearing and grading of the land (Tajne 2015). Moreover, solar energy systems can affect land in material extraction, manufacturing, exploration and disposal (Tajne 2015). Additionally, solar energy's potential impact on the environment is associated with loss of habitat, land use and hazardous materials in manufacturing (Usman, Ameta, Tukur, et al. 2020).

2.3.2 Crime

Because of industrialisation growth and fast social alteration, crime increases due to energy development projects (Jones and Mayzer 2021). Additionally, the community is concerned about the energy resource development that causes an influx of "man camp" that potentially increases the rate of violence, sexually transmitted diseases, sexual assault and the increase in illicit drugs (Hirsch et al. 2018). People such as registered sex offenders or convicts are hired more easily as boomtown employers hire quickly and do not require much experience (Jones

and Mayzer 2021). The social disruption[13] theory presents an argument that as division leads to deteriorated trust and escalating perceptions of insecurity, the boomtown residents may escalate fear of crime (Rhubart and Brasier 2019).

The energy resource development also contributes to sex trafficking and prostitution in the community(Hirsch et al., 2018). Hirsch et al. (2018) concluded that such threats, whether perceived or actual contribute to injuries on the well-being of a community and collective emotions and should not be undermined. Additional clarification is that higher wages and income generated due to resources extraction activities may lead to more significant crime opportunities (Rhubart and Brasier 2019).

Park and Stowoski (2011) share the relationship between fast development and crime rate in Colorado's tourism community, leading to boomtown: First, the study endeavoured to understand the relationship between growth from the social disruption theory levels and crime rates in rural tourism towns. Second, according to the social disruption theory, rapid growth is likely to produce an uneven increase in crime beyond population increase. The study hypothesised that average crime rates would differ from tourism counties with different growth levels; high growth tourism counties would experience the most significant crime rates. There are two different hypotheses according to the social disruption theory (Park and Stokowski 2011):

- *Hypothesis 1*: This stage states that there will be a difference in index crime (property and violent crime) from various growth levels. Across the three levels (low, medium and high), the index crime rates in tourism places undergoing high growth will be significantly higher than those with low growth levels.
- *Hypothesis 2*: There will be a difference in arrests for places with different growth levels. The arrests rate will be higher across the three levels of growth (low, medium and high) than the arrests in places with high growth levels.

[13] This perspective was decisively implemented in most of the boomtown's research done in 1970s. The methodological limitations and noncritical acceptance of certain assumptions were subjected to substantial criticism in the literature presented in the early 1980s (Smith, Krannich and Hunter 2001). The boomtown research in the 1980s provided mixed evidence on the "social disruption" hypothesis (Smith et al. 2001). In the 1990s, on balance the disruptive repercussions take place under some circumstances and this was suggested by literature addressing the consequences of boom growth (Smith et al. 2001). Even though the social disruption theory has been criticised as very general and specific, what makes it more attractive is its generality (Lagercrantz and Khabbaz 2019). The generality makes it easier to compare the results of the study within a more generalised context of boomtown as it has been applied in different places (Lagercrantz and Khabbaz 2019).

In support of the latter, Gourley and Madonia (2018) mentioned that an increase in property and violent crime arrests resulted from development in Colorado (Rhubart and Brasier 2019).

2.3.3 School infrastructure

The school systems will continue to face problems extending from overcrowding in primary schools to completion rates in high school and finding housing for teachers (Fitzgerald, Muske, Haynes and Lee 2016). Fitzgerald et al. (2016) state that this is caused by prosperity and growth in the community. On the other hand, Freudenburg's (1994) study reported that adolescents attending high school experienced more isolation in a community undergoing rapid growth than those in communities anticipating growth (Heitkamp and Mayzer 2018). The study also reported hostility at school and more emphasis on apparent dishonest characteristics regarding peer reception.

What about school overall performance? Overcrowded classrooms are believed to be contributing to high noise levels, unpleasant air, and a shortage of space. This leads to the following (Jacquet and Stedman 2014): First, the latter will result in schools experiencing poor learning conditions, lack of attention and even lack of attention to the learners. Finally, Marais (2016:2) and Cortes, Mousa and Weinstein (2012:25), as cited in Jacquet (2009), were quoted indicating that teachers' inability to pay enough attention to each learner's educational needs and instructive neglect results from overcrowded classrooms. Jacquet (2009) indicates that this overcrowding creates a mixed impact on youths as they may obtain better job prospects and deal with crime in their community and school congestion. Jacquet (2009) emphasised that some lessons propose that boomtown students are more likely to move away after high school than in contrasting societies.

2.3.4 Housing

As existing houses fill up fast and housing development takes years to materialise, this results in a severe lack of housing in boomtown communities (Jacquet 2009). Jacquet (2009) states that severe housing scarcities will continually lead to the escalation of housing prices. This can significantly help prevailing residents willing to take advantage of this valuation by either marketing or leasing houses. Nevertheless, while the investors appreciate a rise in rental prices, it is a different "ball game" for the renters, especially low-income earners or the recipients of

government grants (Ennis, Finlayson and Speering 2013; Ennis, Tofa and Finlayson 2014; Rhubart and Brasier 2019).

Jones and Mayzer (2021) corroborated that the boom situation in the Bradford and Lycoming areas caused strain on housing availability. A Bradford resident responded that rental rates and housing prices have drastically increased in Bradford County (Jones and Mayzer 2021). However, increased residential values can challenge existing residents who are not homeowners or plan to remain owners or occupiers of their properties (Jacquet 2009). Housing in Sublette County has also been affected. The number of permanent housing has increased by 22% between 2000 and 2008; however, the permanent population increased approximately 34% during the same period (a number that does not include temporary residents), and the 12% gap in housing units per capita created significant demand (Jacquet 2009). Between 2000 and 2007, the combination of high demand, short supply, high earnings, and easy access to debts nationwide has resulted in over 150% escalation in housing prices (Jacquest 2009).

The adverse effects on health and wellbeing are perceived to be caused by housing stress. The people are less likely to spend their money on health care treatment due to high rental and housing expenses (Ennis, Finlayson and Speering 2013). It is most likely young adult citizens, women and indigenous people who relocate during housing shortages and high period rentals (Ennis, Finlayson and Speering 2013).

2.3.5 Mental and sexual health

Multiple authors maintain that large-scale industrial development harms community members' mental health and psychosocial wellbeing (Weinstein 2014). The construction workers and their families are forced to relocate to isolated areas leaving their hometown lives behind. The partners of newcomers face mental and health barriers. This relocation detaches women from social circles and traditional support systems back home (Charman 2019). For example, Asian women suffered increased loneliness due to parting from their familiar culture and language rituals and facing limiting new social settings (Charman 2019). Also, common findings indicate increased rates of suicide attempts and suicide (Weinstein 2014).

Moreover, the researchers exploring mental health caseloads reported an almost 200% increase in the community mental health centre caseload in a Colorado boomtown. The caseload increased at the height of the boom and was significantly higher than the population growth experienced in the area (Jones and Mayzer 2021). The authors determined that newcomers

contributed to the increased use with established community members (Jones and Mayzer 2021). Jacquet (2009) states that the people in the most disadvantaged position are the state officers and local public servants who are often the least likely to receive a pay increase, yet they must provide a larger volume of services than before the boom. They are also required to make decisions in extreme uncertainty, which leads to higher stress and poor working conditions among these groups (Jacquet 2009).

On sexual health, human population movements are arguably contributing to high sexually transmitted infection (STI) rates. The population increase dominates the discussions amongst the policymakers, non-governmental organisations and private sectors as a theme contributing to infectious disease (Goldenberg, Strathdee, Perez-Rosales and Sued 2012). The influx of males leaving their families behind can contribute to HIV/AIDS and other STIs, escalated by prostitution and drug use. The workers who visit prostitutes contribute to high incidences of HIV/AIDS as they engage in unprotected sex (Eftimi, Heller and Strongman 2009). The lack of sexual health education programmes could contribute to this as most of these workers are employed younger. These STIs spread quickly, leaving sex workers at enormously high risk when the workers or newcomers purchase sex without being tested or engaging in unprotected sex (Charman 2019).

2.3.6 Population growth

The rapid increase in population can negatively impact communities in various ways (Fitzgerald, Muske, Haynes and Lee 2016). The new residents tend to occupy the available new jobs leaving the long-term residents unemployed. Also, long-term residents can have difficulty in facing social change. On the other hand, the newcomers are also impacted negatively. Ryneski (2015) states that newcomers are influenced by these relocations, stating that they face several social adversities, with inferior living environments and pressure from unfriendly long-time residents to move to the odd and inaccessible public facilities. Women often face increased adversities when they arrive at a boomtown when accompanying their spouses when newly employed (Jaquet 2009; Krannich 2012). The female counterparts of the newcomers are confronted by social isolation in a new and often inferior housing site, being the primary caregiver for their household (Jaquet 2009; Krannich 2012).

The relocation of female workers to the boomtown results in various social disruptions (Ryneski 2015), such as concerns for safety at night, gender inequality in the workforce, sexual

aggravation, prostitution, and rape, leading to an uneven gender ratio and many women's issues. Also, a large group of strangers cause a decline in the sense of community when they attempt to interact. Hostility can be created by the tensions between newcomers and long-time residents. The newcomers can feel unaccepted, and on the other hand, the local people feel like their home-based ground is being taken over.

2.3.7 Social structures

Sudden population influx disturbs the community's solidity (England and Hooper 1980). England and Hooper (1980) state that as the population changes and community size increases, the rural community's structure changes, but the old community is still recognisable. Simultaneously, the rapid changes that disrupt pre-existing social arrangements in many ways can contribute to changes in the roles of established community members (Brasier, Filteau, McLaughlin et al. 2011).

The possibility is that most people in the community can adapt more or less successfully to the levels of challenges brought by rapid growth (Krannich 2012; Rhubart and Brasier 2019). Lower success levels lead to the following (Krannich 2012; Rhubart and Brasier 2019). Structural shift leads to a decline in friendship levels. Rapid growth can also have adverse or extensive repercussions on the mainly informal local social process contributing to the community's functioning. Conflicts often erupt due to the difference between new and long-term community members and pre-existing social structures (Brasier et al. 2011). Brasier et al. (2011) state that it is maintained that informal social control is diminished to allow social ills to flourish due to the disruption of established community networks.

2.3.8 Community division and social change

While the newcomers may be in a more advantaged position than residents due to jobs they possess in the industry, they may experience difficulties in boomtowns (Rhubart and Brasier 2019). These difficulties include poor housing conditions and isolation. Rhubart and Brasier (2019) state that the influx of new newcomers may create divisions. There might be a division between long term residents and newcomers who leased housing later for a more considerable amount. Traffic, roads, and public safety concerns may prompt these divisions between long-term residents and newcomers. In addition, these divisions can erode trust, community solidarity and security.

The stages of attitudes that the residents go through when confronted by rapid change in the community identity also play a role (Jacquet and Stedman 2014; Taylor and Winter 2013). The community can develop interests in the focus on income generation and job creation. It might also lead to hesitation as a result when the town starts to grow. Also, the community can start to panic about the possible change in their historic way of life and dramatic change in their lifestyle. Finally, it is about "adaptation", some community members may move away, others begin to accept the reality of the situation at hand, and others may feel a sense of progress.

On the other hand, there is a possibility of a decline in trust in others in areas undergoing rapid growth, caused by an increased number of newcomers and unfamiliar faces (Smith et al. 2001). According to the social disruption theory, the following social issues can erupt due to rapid growth (Hirsch et al. 2018). First, the erosion of social norms. Second, negative impact on and change of collective memories. Finally, the collective meaning-making for community members can be negatively influenced. Hirsch et al. (2018) concluded that the latter could have a long term effect, shocking the next generation and continuing even after the boom.

2.3.9 Municipal services

The sudden growth in population puts much pressure on local government in terms of municipal services. The local government is confronted with new demand levels while experiencing underfunding (Taylor and Winter 2013). The latter also leads to a limited flow of information between a community, a company and government (Taylor and Winter 2013). Boomtown growth rate (10–15%) generally emanate from one or more industries entering the underpopulated area simultaneously (Zillman and Solomon 1983). Comparatively, small rural communities cannot absorb more considerable demands upon their municipal services. This means that the boomtown phenomenon will be observed in communities the least developed to cope with it. The influx of the shadow population is not counted in the municipal census, which creates a lack of affordable and subsidised housing (Charman 2019). Therefore, people are forced into unbearable living conditions, and affordable housing investments are often not considered (Charman 2019). In addition, it can be argued that this rapid growth of population will create a sense of weakened jurisdictional control of the local authority (Taylor and Winter 2013).

2.4 Conclusion

This chapter has established a foundation for understanding how RE can affect communities from a global perspective. It described how RE projects reflect the shift in thinking from a business-as-usual approach to energy provision to an approach that considers the green economy's SED. A shift to a green economy involves establishing infrastructure and institutions towards creating new economic opportunities, green jobs, eradication of energy poverty, and, most importantly, community empowerment. Lastly, this chapter indicated that renewable energy is not always green as people might think. On the adverse side of RE, especially during construction, social disruption occurs typically. There has been a mention of the social ills and other disruptions due to the boomtown effect caused by RE constructions. The next chapter looks at the state of RE coupled with socio-economic development policy and operational imperatives in South Africa.

Chapter 3
Renewable Energy in South Africa

3.1 Introduction

South Africa made history in 2014 when the national grid received electricity generated through REIPPPP[1] (Wlokas 2017). The programme was made possible by the 1998 White Paper on Energy Policy, amended in 2003 to promote RE technologies and set a target of 4% of electricity from using small-scale hydro, solar, wind and biomass projects by 2030 (DOE 2016). REIPPPP is the South African government's leading climate change programme (McDaid 2016; Wlokas 2017).

The REIPPPP must contribute to broader national development objectives of social upliftment, increase opportunities for economic ownership, local industry development and job creation (IPP 2020; Nkoana 2018; Pahle, Pachauri and Steinbacher 2016; Shaw 2017; South African Photovoltaic Industry Association [SAPVIA] 2020; Wlokas 2017). Wlokas (2017) says that the REIPPPP requires private companies to alleviate local socio-economic needs. The REIPPPP's objectives in South Africa are twofold (Shaw 2017; Wlokas 2017). It needs to procure additional electricity generating capacity to ensure energy security, and it contributes to economic development(ED) through various measures.

Against this background, this chapter outlines the REIPPPP in South Africa and the relevant legislative frameworks. First, I discuss the critical role players in the implementation of the programme. Secondly, the focus will be on the overview of SED and EnD related to corporate social investment. Finally, the research also seeks to share the literature on SED and EnD in the REIPPPP.

3.2 An overview of the Renewable Energy Independent Power Producers Procurement Programme

By 2010, an electricity supply challenge confronted South Africa. In addition, the country was under pressure to respond to worldwide commitments to climate change mitigations (Davies 2021). Against this background, the South African government initiated a policy framework to procure RE at a larger scale (Davies 2021). This resulted in the launch of the REIPPPP in 2011.

[1] The REIPPPP's geographic distribution projects follows the availability of hydro, wind, solar and biomass to produce clean energy (Eberhard and Naude 2017; Wlokas 2017).

The Department of Energy (now the Department of Mineral Resources and Energy [DMRE]) implemented the REIPPPP in its regulatory framework. Representatives from the National Treasury, Public Enterprises, Environmental Affairs (currently the Department of Environment, Fisheries and Forestry and the National Energy Regulator embraced the REIPPPP (Relancio, Cuellar, Walker and Ettmayer 2016; Wlokas 2017).

The REIPPPP is the strategy flagship of the government to endorse RE (Pollet, Staffell and Adamson 2015). Fraser (2021) states that observers laud the programme as an enabler of policy that considers the transition towards clean energy and contribution to socio-economic upliftment. Therefore, it has become obligatory that bids' awarding and assessment consist of a 70:30 split: 70 points represent the price, and 30 points represent ED as discussed under the problem statement (Morris, Robbins Hansen and Nygaard 2020; Pahle et al. 2016). In section 3.4.5, I discuss the implications of these splits in detail. The REIPPPP is a procurement bid where the government invite prospective developers to enter into a power purchase agreement with the energy distributor guided by the government's determination as outlined in the IRP (Pahle et al. 2016).

These bids are submitted to the IPP office by the developers in reply to the closed submission process. The renewable technologies mentioned above can include PV, CSP, biomass, hydro and wind (Davies 2021; Pollet et al. 2015). A total of 70 points is allocated to the lowest bid and then adjusted downwards for all other bids (Davies 2021).

3.2.1 Policy development

The South African government promulgated plans and legislative frameworks that support the vision of a more sustainable and greener economy (Msimanga and Sebitosi 2014). This idea is preserved in the South African constitution under section 24 of the Bill of Rights, stating that everyone has a right to secure ecologically maintainable use and development of natural resources while promoting viable SED (Msimanga and Sebitosi 2014; Nkoana 2018). The following policies took shape in a phased manner to support the government's vision of a greener and more sustainable economy:

3.2.1.1 Phase 1 (1998–2007)

In 1998, the South African government introduced the white paper to reduce the environmental energy-related impact (Lawrence 2020; Mirzania, Balta-Ozkan and Marais 2020). The white

paper focussed on clean energy generation, independent power distributors, transmission and generation companies (Pan and Dinter 2017). In 2002, the government designed an integrated national resource plan to enable the country to optimise the provision of electricity. In 2003, the government reviewed the renewable energy targets of the 1998 white paper. The target was to develop 4% of electricity by small-scale hydro, solar, wind and biomass projects at a capacity not exceeding 10 000 GWh by 2013 (Thopil et al. 2018).

3.2.1.2 Phase 2 (2008–2010)

In 2008, the government promulgated the National Energy Act (Act no. 34 of 2008) to implement the Integrated Energy Plan (IEP) of 2008 (DOE 2016). The IEP regulates the present and future energy services needed socially efficiently while minimising the energy sector's adverse environmental impact (Lawrence 2020; Mirzania et al. 2020). South Africa is a party to the Copenhagen Conference of Parties. In 2009, the country committed at this conference to reduce its carbon emission by 2020, further dropping by 8% by 2025 (Thopil et al. 2018).

In 2009, the government introduced the RE feed-in-tariffs used as an instrument to implement the commitments by supporting the 4% of the RE target the country had agreed on six years earlier. In 2010, the government introduced the IRP to steady the shift towards a more cost-effective and sustainable resourceful energy policy (Lawrence 2020; Mirzania et al. 2020). This document is the overarching framework for energy policy to reduce emission targets (Bloem, Swilling and Koranteng 2021). In terms of the targets, renewables had to produce 17.8 GWh of electricity by 2030 (Lawrence 2020; Mirzania et al. 2020; Ntuli, Helgenberger and Jacobs 2017). The 17.8 GWh comprises 8.4 GWh of solar PV, 8.4 GWh of wind and 1 GWh of CSP (Ntuli et al. 2017). The government achieved the target only in 2015 instead of 2013 (Giglmayr, Brent, Gauché and Fechner 2015). The main contributing factor to this backlog was that the tariffs were not competitive with electricity produced from coal, as they were too high (Thopil et al. 2018).

3.2.1.3 Phase 3 (2011 to date)

The REIPPPP replaced the renewable energy feed-in tariff in 2011, a programme designed to enable the IPPs to participate in viable bids to construct and maintain large RE projects (Lawrence 2020; Mirzania et al. 2020). The programme created a stage for Eskom to enter into power purchase agreements with the IPPs (Thopil et al. 2018). As discussed in the previous

chapter, the programme enables both the private and public sectors to generate electricity and contribute to job creation, industrial policy and energy security (Pahle et al. 2016).

In August 2018, the government published a revised version of the IRP 2010. The IRP 2018 version altered the target of the volume allocated to RE and excluded CSPs. In 2019, the government reviewed the IRP to provide South Africa's long-term plan for electricity generation. South Africa has to minimise the supply cost and reduce greenhouse gas emissions while supporting SED following the policy adjustments (IPP 2020).

It is a development plan emphasising electricity infrastructure based on the affordable supply of electricity that considers the environment and the security of supply that minimises water usage and harmful emissions, as discussed in the previous chapter (DMRE 2019). The IRP document has set several targets (DMRE 2019; IPP 2019) (Table 3.1). First, the already committed capacity of coal from 2019 to 2022 is a total of 5732 MW. The IRP plans a total of 1000MW new additional capacity of coal from 2023 to 2024. Second, no nuclear procurement under IRP 2019. A total of new additional 2500 MW of hydro has been procured. In terms of PV, 814 MW of PV has been planned from 2020 to 2022 and 5670 MW new additional capacity from 2025 to 2030. Only 300 MW of CSP has been already committed. Last, the IRP foresee procuring an additional 8100 MW of gas or diesel from 2026 to 2029.

Table 3.1 Renewable energy capacity

Targets Year	Coal	Nuclear	Hydro	Storage (Pump Storage)	PV	Wind	CSP	Gas/ Diesel	Other (CoGen, Biomass)	Embedded (Generation)
2018	39126	1860	2196	2912	1474	1890	300	3830	499	Unknown
2019	2155					244	300			200
2020	1433				114	300				200
2021	1433				300	818				200
2022	711				400					200
2023	500									200
2024	500									200
2025					670	200				200
2026					1000	1500		2250		200
2027					1000	1600		1200		200
2028					1000	1600		1800		200
2029					1000	1600		2850		200
2030			2500		1000	1600				200
Total installed	33847	1860	4696	2912	7958	11442	600	11930	499	2600
Installed capacity mix(%)	44.6	2.5	6.2	3.8	10.5	15.1	0.9	15.7	0.7	

	Installed capacity
	New additional capacity
	Committed/already contracted capacity

Source: DMRE (2019); IPP (2020)

3.3 Socio-economic development and enterprise development in the Renewable Energy Independent Power Producers Procurement Programme

The REIPPPP contributes towards a low carbon development path (Davies 2021; Deloitte 2019). Davies (2021:9) states that the REIPPPP connected the operational conversion of the state's radical economy and decarbonisation. The programme was lauded as a resourcing success for stimulating foreign and local investment in South Africa (Deloitte 2019). However, energy supply and policy are not only about carbon technologies. The socio-energy system's design depends on broader socio-economic, organisational, and political life (IPP 2020).

A central emphasis of the REIPPPP is to ensure that the communities near the IPPs benefit from the investments (IPP 2020; SAPVIA 2020). Therefore, IPPs must commit a portion of their revenue towards community development (IPP 2020; SAPVIA 2020). The IPP (2020) and SAPVIA (2020) state that these contributions must focus on education, housing and

infrastructure, healthcare, and other community development objectives. RE projects increasingly drive community development and local economic development (Marais, Wlokas, de Groot, et al. 2018). The REIPPPP is the primary contributor to this change. The government expects independent power producers to stimulate local economic development following the current green economy thinking (Marais et al. 2018).

They are required to do so because most of the projects are in remote areas of South Africa. The programmes focus on regional development treaties, small-town regeneration and sustainable rural development (Davies, Swilling and Wlokas 2018). The IPPs must contribute to local development in such a manner that 40% of the shareholding must go to South African BBBEE companies, and a fraction of the profit must be disbursed in the SED programmes in communities residing within the 50 km radius from the project, and this 1% can be spread over a 20-year project operational life (Bloem et al. 2021).

A central question is what the REIPPPP's has contributed to SED, EnD and investment (IPP 2020; SAPVIA 2020)? First, the programme contributed R207.9 billion worth of investment attracted and created 52 603 jobs. Secondly, the SED contribution of R1.2 billion and R400 million of EnD was spent at the end of June 2020. Thirdly, 50% of R57 billion representing the total project value spent to date was on local content from the end of June 2020. Finally, the 33% shareholding by black South Africans materialised, and local communities' shareholding amounted to 9%.

3.4 Current research in socio-economic development and enterprise development

Among other issues to note, most of the research on the REIPPPP has focused on the SED and EnD, on both the positive and adverse effects. Since the evolution of the REIPPPP in South Africa, the researchers have produced several research findings on SED and EnD:

3.4.1 Fifty-kilometre radius

IPPs are required in the implementation agreement to ensure that the project company implements particular yearly public development obligations to the community near the project as set out by the REIPPPP (McEwan 2017; Swartz 2019). The locations of the community are

within a radius of 50 km[2], as discussed in Chapter 1 (Wlokas, Westoby and Soal 2017). These IPP plants are in areas with prosperous wind or solar resources (Morar 2019) but with relatively high poverty levels. In terms of this, the developers are obliged to agree on beneficiaries of EnD funds within the 50 km range. The 50 km radius is a strategy to avoid favouritism of designated recipients (Swartz 2019).

This could be any individuals, informal settlements, certain villages within the areas, as long as beneficiaries are classified as "previously disadvantaged" following black economic empowerment legislation (Morar 2019). The community development obligations are whereby the IPPs must spend 1% of their annual income in a community within a 50 km radius of a project site (Swartz 2019).

The 50 km radius entails several decisions by the developer (Wlokas et al. 2017). Who are the actual beneficiaries in that radius, how will the community's needs be assessed, the potential community development contributions and how is the operation capacity guaranteed through community structures or institutionally? However, the project stakeholders struggle to implement sustainable development initiatives (Wlokas et al. 2017). The 50 km radius creates several problems. It excludes communities residing outside this radius (Ntuli et al. 2017).

Moreover, this radius approach can result in overlapping beneficiary areas and projects, thus leading to uncertainty over where the community projects are developed and who (Swartz et al. 2019). The other challenge is around identifying the needs and priorities of the communities. Some communities received benefits from more than one project due to the radius approach (Marais et al. 2018). Such situations result where the projects are clustered around suitable areas for wind and solar. As a result, the SED and EnD funds may be spent on specific areas while other communities within the same municipality might not receive benefits. These projects are unequally distributed across the nine provinces of South Africa (Marais et al. 2018).

Furthermore, three more challenges have emerged (Morar 2019). First, the radius in certain instances conflicts with prevailing borders, such as municipal, tribal or borders of towns or villages running the risk of separating the communities. Second, the radius is also considered illogical in terms of equitable distribution. This means that the needy communities that reside

[2] Communities that reside within the 50 km radius are entitled to obtain socio-economic benefits from the RE project (Swartz et al. 2019).

outside the border of the radius do not benefit. Last, a good example is in the Northern Cape Province, which has the most IPPs. The Northern Cape is sparsely populated (just three people per square kilometre, translating to 2% of South Africa's population). Tait et al. (2013) warn that the 50 km radius may have implications for fight or relocation.

3.4.2 Collaborative planning

The REIPPPP is arguably regarded as a form of advanced, concerted authority as it functions within several enclosed contexts of legal, socio-economic, environmental, political and other effects (Shaw 2017). Unstructured planning and lack of integration between provincial and local government authorities contribute to insufficient coordination between the government and IPPs (Davies et al. 2018). This lack of coordination is visible in the lack of IPPs ED strategies that do not align to the national, provincial, district and local spheres' plans, let alone the IPPs (Davies et al. 2018).

Collaboration is still lacking at a local level. The REIPPPP seems to have ignored the local government, and their role in the programme was unclear beyond initial essential support to IPPs (Morar 2019). An example is the municipality's role in land rezoning, electricity, water and refuse removal from the project sites. On the other hand, the local municipalities' expectations of the RE industry and coordination can make relationships difficult (Shaw 2017). A further concerted approach to building municipal and present development projects could create better collaborations (Morar 2019).

The communities are still treated as a mere "beneficiary" of the ED requirement even though the REIPPPP regards them as critical stakeholders (Shaw 2017). Therefore, the communities do not become co-producers of their development as they do not get an opportunity to direct, influence, control and own the development process (Shaw 2017). Collaboration between IPPs and communities is critical. Lack of collaboration will result in millions of monies directed to one community. This emanates from the various issues (Morar 2019). First, the developers must submit their own confidential ED plans. Second, the project developers submit their plans separately, thus creating confusion amongst communities. Lastly, there is a likelihood that the IPPs might experience wasted efforts due to this uncoordinated approach.

In addressing the gaps, there have to be social networks between stakeholders to improve alignment and coordination. The social networks result from informal and formal platforms, including government and communities (Mirzania et al. 2020). There has to be participation

between various stakeholders, including investors, users, policymakers and regulators. Such a move will ensure better coordination between them. It is essential to motivate the stakeholders to adapt to the social context in which the project is adopted. Learning can also enable change in the perceptive model.

3.4.3 The role of socio-economic development and enterprise development

ED's role is adequately outlined in the draft IRP, specifying the aim to accomplish a reasonable price of electricity to support a more efficient and affordable global competitive economy (Matsuo and Schmidt 2019). Matsuo and Schmidt (2019) state that is creating local jobs and meeting the climate objectives critically added to the latter. REIPPPP can illustrate how to align socio-economic objectives with policy design. Pahle et al. (2016) state that job creation is of particular concern in South Africa, making a classical case for renewable energy. Pahle et al. (2016) state that the first report showed the over-creation of jobs promised by the developers. This over the creation of jobs has created a political will to implement the respective green policies in the first place (Matsuo and Schmidt 2019; Pahle et al. 2016).

South Africa has set ED requirements to rely on the RE industry to address the ED objectives, create a local renewable industry, and lower generation costs (Matsuo and Schmidt 2019). The outcome has resulted in competition on SED objectives and prices. The results enforced strict bid qualification criteria, including local content. The SED requirements on community ownership and black enterprise made local understanding valuable to some developers. This was made possible by the involvement of the local project developers who understand the dynamics of local areas. SED and ED can bring a sense of ownership to the community. In addressing the latter, the communities receive representation in community trusts that takes a minimum of 2.5% in the project (Davies et al., 2018). In addressing the policy alignment of the programme as discussed above, Rennkamp, Haunss, Wongsa, et al. (2017) concluded that the SED consideration in the REIPPPP motivated the principal discussions around the support of renewable energy.

3.4.4 Community development requirements: social license to operate

It is possible to describe the community development requirements as the social licence to operate (SLTO). SLTO as a concept found its place as a measure to address the challenges faced by significant operations like RE and mining companies (Stephens and Robinson 2021).

Stephens and Robinson (2021) state that the SLTO comprises approval from the affected stakeholders, including the communities. Marais et al. (2018) add that the concept is present in the social and labour plans legislative framework following the Minerals and Petroleum Resources Development Act no. 28 of 2002, subsection 4 (a, b and c)[3]. Fraser (2021) refers to SLTO as the social resource (herein referred to as "social capital[4]") that might have a positive impact on the adoption of the solar project.

SLTO became relevant for two reasons (Stephens and Robinson 2021). First, identifying the project location depends on the environmental authorisation. Second, how resource attraction takes place must attract local support. Finally, the nature of the damage by the industries means that the local approval will not be secured easily. The Minerals and Petroleum Resources Development Act compel the mining companies to contribute a share of their profits to local economic development initiatives.

3.4.5 Socio-economic development and economic development in line with broad-based black economic empowerment framework guidelines

The REIPPPP's uniqueness in South Africa is that the projects must assemble the local communities into equities and contribute to ED criteria (Baker and Wlokas 2015; Shaw 2017). The ED targets guide the bidders, aligning with the country's BBBEE legislation and containing seven criteria that the developer must follow. The minister issued an exemption from the 90/10 split that defines how tenders are assessed, where 90% is based on price and 10% on the scorecard-base bidders' BBBEE status (Morris et al. 2020; Wlokas 2017). The REIPPPP has received recognition for the critical place to the socio-economic objectives (Pahle et al. 2016). The ministerial determination allowed the policy members to write a 70/30 split into the REIPPPP, where 70% is the price of project construction and 30% is the ED guided by BBBEE (Davies 2021; Eberhard and Naude 2017; Pahle et al. 2016; Wlokas 2017).

In an attempt to maximise the socio-economic goals, the REIPPPP had advanced a greater proportion to 30% of ED consideration (Baker and Wlokas 2015; Montmasson-Clair and Das Nair 2015; Stands 2015). The 30 points and different components receive the following

[3] The objectives of social and labour plans are to: First, to advance the socio-economic welfare and promote employment of all South Africans. Second, to contribute to the transformation of the mining industry. Last, to ensure that there is a contribution towards the SED of the areas in which the license holders operate (South Africa 2002).

[4] The social interaction in the community that builds a collective trust, action, mutuality and the appeal of the state officials to achieve a good government outcome (Fraser 2021).

weighting: 5% of the 30 points are for ED; 5% for management control; 10% for SED; 10% for preferential procurement; 15% for ownership; 25% for local content; and 25% for job creation (Table 3.2). Eberhard and Naude (2016) add that the bidders must exceed or meet any requirement in any minimum threshold stipulated in the ED scorecard and provide supporting documentation. The ED targets are a form of maintaining an SLTO of these IPP developments in areas where these IPPs operate, as discussed under section 3.4.4 (Davies 2021).

Table 3.2 Economic development criteria and set targets for bid window 3

Economic development element	Description	Qualification threshold	Target
Job creation	Jobs for citizens.	50%	80%
	Jobs for black citizens.	30%	50%
	Jobs for skilled black citizens.	18%	30%
	Jobs for local communities.	12%	20%
Local content	Value of local content as a percentage of the total project value.	40% or 45% depending on the technology	65%
Ownership	Shareholding by black people in the project company.	12–20%	30–40%
	Shareholding by local communities in the project company.	2.5%	5%
	Shareholding by black people in the engineering, procurement and construction contractor.	8%	20%
	Shareholding by black people in the operations contractor.	8%	20–40%
Management control	Black top management	n/a	40%
Preferential procurement	BBBEE	n/a	60%
	Qualifying small enterprises and EME procurement (up to R35 million in turnover)	n/a	10%
	Women owned vendor procurement (businesses +50% owned by women).	n/a	5%
ED	ED contributions	n/a	0.6%
	Adjusted ED contributions (local communities.	n/a	0,6%
SED	SED contributions	1%	1.5%
	Adjusted SED contributions	1%	1.5%

Source: Montmasson-Clair and Das Nair (2015:17)

In addressing the research question, these criteria stipulated in Table 3.2 must occur within a 50 km radius of the project, referred to by the REIPPPP as the local community (Baker and Wlokas 2015). Shaw (2017) expand on the latter stating that the local economic development associated with enterprise development, preferential procurement, ownership, management control, and local content such as manufacturing emanates from the BBBEE targets.

3.4.6 Lessons from the mining sector

The REIPPPP can also draw some lessons from the mining sector. Louw and Marais (2018) state that the mines make local investments called "social and labour plans". These social and

labour plans and IDPs must align. Louw and Marais (2018) state that, though the idea of collaboration has been good, the consequences have been disappointing due to local strategies, minimal focus on planning, post-mining activities and the inability of the municipalities and mines to work together. Several factors contribute to this (Louw and Marais 2018:280). First, the municipal response to a probably uncertain future has been slow due to the Gamagara mines dependence on China's demand for iron ore. Second, the Gamagara Municipality's substantial property rates increase came just as the sudden drop in iron ore prices happened. Last, the resulting problem originated from the municipality's lack of long-term planning capacity.

To secure a licence to operate, the mining companies have committed massive investments in establishing an industry of community development workers. Many mining companies play a central role in creating employment and local development in several mining settlements. Although the role of IPPs is likely to be less noticeable, there is no doubt that local communities will pressure the companies to contribute to local development and provide jobs to the local people. The connection between mining and energy, commonly stated as mineral's energy complex, plays a role.

3.5 Conclusion

This chapter has established an understanding with regards to the state of the REIPPPP in South Africa. It established an understanding that the Northern Cape (the host province of the study) occupies the central debates in terms of RE. Most importantly, the province played a crucial role in ensuring that the IRP targets were achieved overall in the bid windows. Of critical to note is the policy developments that played a critical role in implementing RE.

This policy development created a stable capacity on government, parastatals involved, private sector, funders and all other stakeholders to ensure sustainable implementation of the REIPPPP. Most importantly, the research findings presented in this chapter also provided a better understanding of the SED and EnD implementation frameworks. The next chapter outlines the state of RE in the Northern Cape, analysing the secondary data with emphasis on the effect of RE in the Upington area.

Chapter 4
Research Findings

4.1 Introduction

Chapter 2 provided an overview of the international literature on the impacts of large infrastructure projects in remote locations. The most recent literature emphasises that large infrastructure projects have both positive and negative consequences. Often these impacts are complex and contradictory. Chapter 3 presented an overview of RE policy in South Africa with specific reference to the REIPPPP. Projects implemented under the REIPPPP do create local consequences. The REIPPPP policy framework largely views these as positive outcomes, focusing on the creation of local jobs. Nevertheless, the REIPPPP could have adverse local effects.

The focus group interviews and critical informants indicate that the benefits and adverse social effects encountered in Upington emanate from the following: job creation, climate change mitigation and the environment, economic growth, population growth, housing, energy supply, social disruption and municipal services. The literature mentions several adverse social effects of RE projects on the community. The research participants also thought that although RE is beneficial, there are adverse social effects. This chapter discusses the empirical evidence from the interviews.

4.2 Crime

The construction period of RE projects contributes to increased crime (see Chapter 2). This is often the result of the in-migration of people from elsewhere. The participants believe that the construction workers are somehow to be blamed for availing cash for the locals. The locals again use this cash to buy drugs and alcohol. Increased alcohol consumption and driving under the influence also concerned the participants.

4.2.1 Drug and alcohol-related crime

Most respondents said that there had been an increase in crime. Respondents mentioned a substantial rise in drug-related crimes. Most participants argued that although Upington had a drug problem before, the situation worsened. Some of the participants felt that the drugs

compromise the safety of people in general. The following two quotes capture the opinions around drug-related crime:

> *This means that there was more money in circulation and the illegal traders saw a market where they could operate. We had an increase in our communities, especially in the use and abuse of Tik. That happened in our communities* ***(Participant 6)***

> *But also have the drug problem because the peddlers come to those areas and then sell drugs because there is more money, and they target the youth, unfortunately* ***(Participant 11)***.

The quotes show that the construction phase contributed to increased levels of drug use. The increase in people and money circulating in the town have been the main contributing reasons. Although there were drug problems before, most respondents indicated a rapid growth in drug-related problems. The targeting of young people, as the second quote above shows, is highly problematic. Participants felt that the future of the youth would be doomed until there is a concerted effort amongst critical stakeholders to address this problem. All the key stakeholders have to understand possible adverse effects and engage in collaborative planning. The collaboration would have empowered the role players to manage the scourge of drugs in the area.

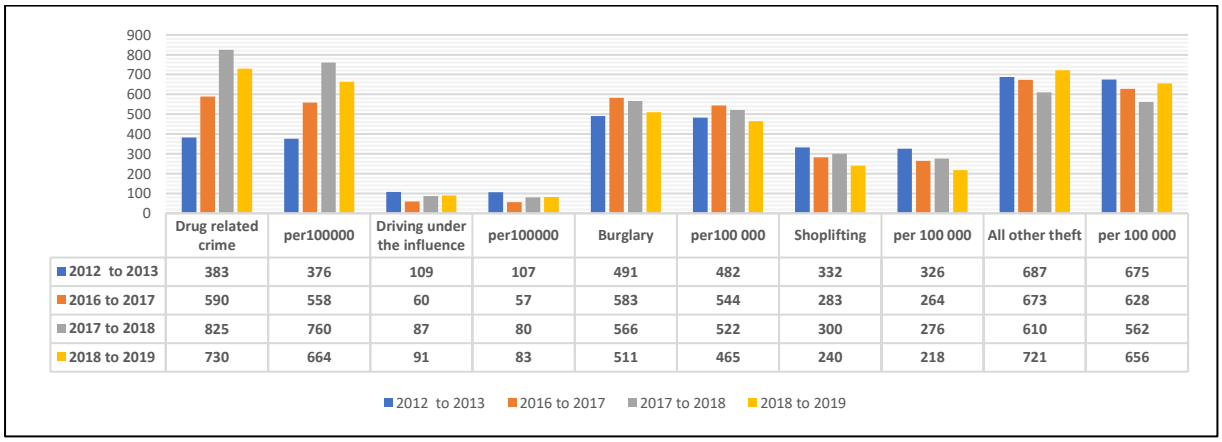
The second social ill mentioned during the interviews is driving under the influence of alcohol. Participants indicated that many accidents on the road were caused mainly by speeding because of alcohol. One participant said:

> *Quite many accidents happen on the road because these people drive on the wrong side of the road. Some people died. They speed like maniacs. They buy cars and …well, yes, like that. It was like hooligans were let loose amongst the normal people.* ***(Upington: Interviewee 6)***

Although driving under the influence of alcohol does not necessarily lead to crimes, it contributes to road accidents and even death. The participants' experience taught them that most accidents result from speeding and not obeying the road rules. Driving under the influence of alcohol could have contributed to some of these accidents.

4.2.2 Crime data[5]

In addition to the responses during the interviews, I analysed the crime data for Dawid Kruiper. The literature review stated that petty crime increases with large infrastructure projects. Increased drug abuse, discussed above, might contribute to these crimes. Figure 4.1 compares crime data before and after the construction period. I compare crime rates for selected crime categories for 2012/13, 2016/17, 2017/18 and 2018/19 (Figure 4.1). In addition to providing the raw figures, Figure 4.1 portrays the crime rates per 100 000 of the population.



	Drug related crime	per100000	Driving under the influence	per100000	Burglary	per100 000	Shoplifting	per 100 000	All other theft	per 100 000
2012 to 2013	383	376	109	107	491	482	332	326	687	675
2016 to 2017	590	558	60	57	583	544	283	264	673	628
2017 to 2018	825	760	87	80	566	522	300	276	610	562
2018 to 2019	730	664	91	83	511	465	240	218	721	656

Figure 4.1 Dawid Kruiper crime data

The most notable increase is for drug-related crimes detected by the police. Drug-related crimes differ from other crimes because it depends on police action. Therefore, although these drug-related crimes have increased, it could be attributed to improved policing. In 2012/13 drug-related crime was 376 cases per 100 000 of the population. By 2018/19, this figure was at 664 cases per 100 000 of the population. Burglaries are often associated with drugs. There is a slight increase in the raw numbers of burglaries but not in respect of shoplifting. However, when comparing the data using the cases per 100 000 of the population, the figures remain stable and even decline. The data shows no increases for shoplifting, and the overall crime rates remain relatively stable.

The respondents in the study mentioned that the RE project increased the cases of driving under the influence of alcohol. However, it has declined, not corroborating the qualitative interviews. One should consider that catching someone driving under the influence is the result of police actions. There was no evidence whether police action in detecting driving under the influence

[5] These types of crime provided by the data on Table 4.1 will be motivated by people lacking money to buy drugs.

has stayed the same. The literature of this study states that crime increases in areas undergoing industrialisation growth and speedy social changes due to energy development projects (Jones and Mayzer 2021). Additionally, in areas where higher wages and income are generated due to resource extraction activities, it may lead to more significant crime opportunities (Rhubart and Brasier 2019). In the Colorado tourism community study, Rhubart and Brasier (2019) argued that an increase in property and violent crime arrests resulted from these types of developments.

4.3 Social disruption[6]

The respondents often mentioned the increase of various social problems because of the RE investments and the influx of people. The social issues that emerged are prostitution, teenage pregnancies and health issues.

4.3.1 Prostitution

There was a specific reference to prostitution that emerged in the area due to the influx of people. The respondents often related the prostitution to newcomers (especially males and Spaniards) that the developers employed in constructing the CSP plant. The following two quotes capture prostitution as a social ill that emerged in the area:

> *Yes. Look, many people came from outside, except that people came from abroad people also came from other provinces to work here, and some stayed in our communities. Which automatically means there was a bunch of strangers. Social problems will develop in drug and alcohol abuse, and there was also an issue in some communities with prostitution….* ***(Interviewee 6: municipal official****).*

> *I am saying people are aware that there is more money because there are more people employed. So, whoever sees a business opportunity comes down, including those who are bringing social ills. It is like Joburg before the gold discovery. So, once gold was discovered, you had all sorts of social ills; prostitution and all that* ***(Interviewee 11)****.*

The comparison with social ills in Johannesburg is exciting and probably indicate the disruption of a small town in the rural parts of the Northern Cape Province. RE projects attracted prostitution activities in the area. This social ill can harm the image and change local people's social behaviour. This type of social ill will cause severe tension between the locals and the

[6] It is important to indicate that although the type of crime mentioned under 4.2 above are also examples of social disruptions.

foreigners due to the change in the social pattern brought by RE. The increase of prostitution associated with large infrastructure projects essentially confirms the literature in Chapter 2.

4.3.2 Teenage pregnancy

Most of the participants mentioned the role of foreigners impregnating local teenagers. The participants stress that there has been an increase in the number of babies born and some of those babies are a result of a sexual encounter between local teenagers and foreign male counterparts. The foreigners leave these babies behind after completing construction work, causing a burden on their mothers. The following two quotes capture teenage pregnancy as a social ill that emerged in the area.

> *There is also the social impact of more babies being born, you know, because the people from outside the province did not have their wives or girlfriends with them, so many babies are coming* ***(Interviewee 13)****.*

> *It is not just something in our community. I know Pofadder also had a massive problem with the Spaniards, and they impregnated quite a lot of local girls (not that they were unwilling) [laughs], and those children are here now! I mean, the Spaniards are gone now; they work in different countries now. So, that legacy … and I must say, I have developed a bitter feeling towards Spaniards in general. I am biased, which I know is wrong, but that is my experience with them* ***(Upington: Interviewee 1)****.*

The two quotes confirm the role of foreigners in impregnating local women. The main repercussion of this is the families of these teenagers who end up taking full responsibility as the construction workers have left. The second quote shows tensions between the local community and the foreigners, stating that the participant developed a "bitter feeling towards Spaniards". According to the respondents, the problem is that the local women and the government are now responsible for the children, with the fathers not contributing. The government's social grant programme will carry a substantial cost. It was impossible to verify these respondents' opinions with statistical information on births in the area.

4.3.3 Health

Many respondents said that there had been an increase in the prevalence of HIV/AIDS in the area. The participants also mentioned other health challenges resulting from drugs and alcohol

abuse: foetal alcohol syndrome, HIV/AIDS and sexually transmitted diseases. The following two quotes captured health as a social problem.

> *Socially, I would say, I mean from what my knowledge is, I cannot say how many, but there were some of the Spaniards, for instance, that worked here, they contracted HIV that would have to be sent home because they would have regular HIV test done by the company* ***(Interviewee 12: Business Chamber)***.

> *I can think of a social matter of teen pregnancy and mothers who drink during pregnancy* ***(Louisvale: Interviewee 5)***.

The above quotes suggest that the foreigners are not necessarily the ones contributing to the prevalence of HIV/AIDS in Upington; they can contract the disease from the locals and spread it further. As Goldenberg et al. (2012) articulated in Chapter 2, the human population arguably contributes to high STI rates. Again, the influx of males leaving their families behind can contribute to an increased incidence of HIV/AIDS and other STIs. Literature confirms this finding, stating that these male newcomers can contract and spread HIV/AIDS by engaging in multiple unprotected sexual encounters (Eftiemie et al., 2009). In terms of foetal alcohol syndrome, Upington is one of the epicentres of the syndrome. The quotes show that an increase in alcohol consumption will further contribute to the prevalence of foetal alcohol syndrome. This syndrome will have a negative long-term effect on the next generation born under the syndrome. The repercussion of this might result in children who have a mental disorder and not coping at school.

4.4 Environment and climate mitigation

The evidence from the respondents shows that RE plants have negative local environmental consequences. Most of the participants shared their views stating that RE harms the environment. The positive impact that the participants shared is on climate change. These findings are significant as it contradicts the intention of renewables to be environmentally friendly as it reduces CO^2 emissions.

4.4.1 Environment

It is evident from the interviews that RE, significantly CSP technology, harms the ecosystem. Some participants argued that the CSP developments did not consider all the effects before installing the RE plant. The majority of the participants thought that it kills birds. Another

negative impact that the participants mentioned was on other species like the *meerkat*. The participants believed that many animals had lost their habitat during the construction of the RE plant. Participants also mentioned the visibility of the motorists or people walking in the vicinity of the CSP. Finally, the lack of designated areas for the disposal of damaged mirrors can potentially cause harm to the environment. The following two quotes capture the negative impact of CSP on the environment:

> *I know the birds that fly through the sun rays, now and again; they get scorched quite quickly. That is the only impact, and then naturally your ground animals, like meerkats and so on, but I do not know if anything happens to them. I just know the guys have pretty strict monitoring of animals on the premises. If an animal or a snake gets hit by a car, a team removes the animal and writes a report. So. there are processes to try and minimise the impact on the environment* ***(Interviewee 5)***.

> *All I can say is that many animals lost their habitat due to this: Rabbits, snakes, meerkats, lizards and so on* ***(Louisvale: Interviewee 2)***.

The above quotes show that RE plants can harm the environment. With specific reference made to CSP, the first quote indicate that the birds will be killed when they fly across the CSP tower. The first quote shows that the environmental impact assessment was done, but the main question is, are they comprehensive and addressing all the environmental aspects? RE developers must conduct thorough environmental impact assessments. This idea is preserved in the South African constitution under section 24 of the Bill of Rights, stating that everyone has a right to a particular ecologically maintainable use, as indicated in Chapter 3 (Msimanga and Sebitosi 2014; Nkoana 2018).

The second quote reflects that if the environmental impact is not addressed, the ecosystem will be permanently disturbed, creating an unreceptive situation between the RE sector and environmental advocacy groups. It is evident in terms of the research findings and Chapter 2 that RE systems can affect land in material extraction, manufacturing, exploration and disposal (Tajne 2015). Additionally, solar energy's potential impact on the environment is associated with habitat loss (Usman et al. 2020).

4.4.2 Climate change mitigation

It is evident from the interviews and literature that contrary to coal, RE has a positive effect on climate change. The majority of the participants stated that RE is clean with zero carbon emissions. Therefore, it is the view of the participants that people must be environmentally sensitive by considering RE as an alternative source of energy. The following quotes capture the positive effect of RE on climate:

> *In the first place, if one looks at how things are going at Eskom, then you will get to know further regarding generation in the first place. Secondly, you have green energy. With Eskom, you are sitting with fossil fuels that contribute to pollution and all these things. So, and this, let me say solar power is green energy that has, in my opinion, almost no impact on the environment and provides you with energy* ***(Interviewee 2)***.

> *It is the cleanest type of energy we can produce. It is not like coal and does not affect air pollution* ***(Keimoes: Interviewee 1)***.

The above quotes justify the world's quest to spread the message on RE's importance on climate change. The above quotes reflect how society supports the government's initiative to minimise carbon emissions. As Harvey (2021) presented in Chapter 2, it is evident that the respondents regard RE as a sustainable clean energy production mechanism to replace coal. Harvey (2021) continued to say that the world's wealthiest countries support this move in phasing out the dirtiest fossil fuel by ending their financial aid for coal development overseas. The quotes highlight that RE is the best climate change mitigation option to save the environment from carbon emissions. Unlike coal-powered generation projects, RE has a zero effect on air pollution. Again, according to Chapter 2, the G7 countries' meeting concluded that the move would give the world an excellent opportunity to keep up within the 1.5°C limits. One can further argue that this quote implies that continuous investment in RE will ensure that South Africa delivers on its RE commitments to the Paris Agreement. South Africa is a party to the Copenhagen Conference of Parties, as outlined in Chapter 3. In 2009, the country committed at the Copenhagen Conference of Parties to reduce its carbon emission by 2020, further dropping by 8% by 2025 (Thopil et al. 2018).

4.5 Jobs

RE has a positive effect on the community in terms of job opportunities. The study, therefore, classified these jobs into construction and permanent jobs. The participants had varying input regarding the number of jobs that are created during construction and operation.

4.5.1 Construction jobs

It is evident from the interviews that RE can create many jobs during the construction phase. However, these jobs are unsustainable because of the shorter construction period. According to the participants, the construction of the CSP plant created up to 3 500 jobs, and the PV construction created 2 000 jobs. The participants indicated that the bulk of the construction workers were local people and few from outside their communities. Participants describe these few people as individuals with specialised skills due to limited capacity in the area. The following quotes capture the respondent's reaction to the extent of construction jobs as a result of RE:

> *Our young children lying around at home got jobs, and we as parents used to support them. Many of them finished school two or three years ago, and they could not find work, but this solar panel helped a lot in the community* ***(6 Raaswater 2: Interviewee 3)***.
>
> *When we look at the unemployment rate of the Northern Cape at that point, it was the highest. Even though it is still one of the highest-rated unemployed provinces in the country, it was a significant relief for us.* ***(Louisvale: Interviewee 1)***.

The first quote shows that RE created many jobs for the local people during construction. The literature shows that the sector creates a substantial number of jobs during construction. Given the multitude of quotes, most respondents stated that this sector contributed immensely to employment in the area. It is evident in Chapter 2 that the existing studies indicate that continuous investment in RE contributes to job creation depending on a given country's policy structure, and employment could increase to under a million in 2030 (Edenhofer 2021). The quotes reflect that the majority of the unemployed youth had the opportunity to get jobs from the RE sector. As reflected in Chapter 3, the REIPPPP enables both the private and public sectors to contribute to job creation, industrial policy and energy security (Pahle et al. 2016).

The sector had brought changes to the community by improving their standard of living, especially the youth. The second quote in particular shows that the sector contributed to the employment figures in the province.

4.5.2 Operation and maintenance jobs

The majority of the participants argued that RE has minimal job creation during operation and maintenance. During this phase, few local people are employed, with the majority being people from outside Upington. This is due to the nature of the jobs that require people with relevant expertise. In terms of the number of positions, the majority of the participants indicated that the sector could employ from 20 to 70 people. Of this number, a few people are local. The following quotes capture the respondent's reaction to the extent of operation and maintenance jobs as a result of RE:

> *…, but in terms of the operation of these facilities, they are not manpower-driven, so some minimal people benefit in terms of job-creation on-site* ***(Interviewee 13)***.
>
> *Local municipalities, provincial government, national government, everyone was aware the whole time, or permanent job creation capacity of such a plant is maximum 20 to 70. You can only have so many engineers on-site who are maintaining and monitoring* ***(Interviewee 3)***.

The above quotes imply that RE is not a significant employer as it is more capital than labour intensive. During the operation and maintenance phase, the number of jobs is reduced severely as the construction phase ends, and the community will be out of jobs again. It is evident in Chapter 2 that RE can positively impact job creation, although the literature available differs in terms of the magnitude of net employment (Edenhofer 2011). Although the respondents stated that the jobs during operation and maintenance are minimal, the sector can increase permanent jobs through value chain processes. As stated in Chapter 2, the RE value chain sector is more labour intensive. The quotes show that most people employed during operation and maintenance are people outside the province, as this phase requires specialised skills that the local people do not possess.

4.6 Economic growth

The participants believe that the effect of RE on local economic development, especially during construction, has been very beneficial. The participants indicated that businesses such as retail

stores, restaurants, hotels, housing (property purchasing and rentals), transport and the aviation industry benefited from RE. The participants highlighted RE procurement opportunities for the small, medium and micro-enterprises (including catering, security and cleaning services). What has been mentioned as a point of concern is that these benefits cover a shorter period, and there will be a point where economic growth declines. The following quotes confirm the views of the respondents:

> *...at one point, there were about 7 000 in town, which impacted the town's economy. They get salaries and spend money. Everyone that comes in buys a toaster and a fan, and other appliances, so they increased our economy* ***(Upington: Interviewee 1)***.

> *While the impact was there …the guest houses, the rental cars … the post-mortem, I have a business begging me for more projects after the construction phase. The rental car companies had to sell some of their cars. Guesthouses and hotels had fewer bookings* ***(Interviewee 24)***.

The above quotes show that RE supports many industries and business outlets in the area. Most benefitted greatly from RE due to the high number of people during the construction peak. As articulated in Chapter 2, it is evident that the accelerated investment in RE can influence the world's economy through investment, trade and electricity prices (Ferroukhi et al. 2016). Amongst other considerations, the level of impact of RE on GDP will depend on the country's economic structure (Ferroukhi et al. 2016). As is in the case of China, South Africa must, through its IRP document, ensure that there is a favourable investment environment for the RE sector to grow (Ntanos et al. 2018). The quotes in the preceding sections show that the construction of RE is over a short period. Its impact on the economy is over a shorter period. The business growth will decline after the construction phase, and as expected, businesses like car rental companies had to close down due to less demand for their vehicles.

4.7 Energy supply

The participants identified the various benefits of RE. It can boost Eskom to meet the constant energy supply because it is renewable and does not diminish compared to non-renewable sources. This type of energy will somehow help Eskom to address the load-shedding that the utility is currently facing. It is also very convenient because it can provide electricity to areas without grid access or far from the grid. Lastly, it is a cheap energy source in the long run but

expensive to establish depending on the extent of usage. Echoing the above, the participants state that:

> *These things are beneficial! In the beginning, the costs scared everyone, but the prices decreased. I know of many farms that are off the grid. The whole house has panels and a gas stove, which is off the grid* ***(Keimoes: Interviewee 2)***.
> *Someone else in the Kennard district told me that he paid R120 000 for these solar panels, and I have already been using them for ten years. He further states that it has been ten years that Eskom cannot ask him anything, and for ten years, they have not been a problem to him….****(Interviewee 22)***.

The above quotes reflect that RE is sustainable and could ultimately provide a long-term solution to the power utility in addressing load-shedding. The quotes show that although it is expensive to establish a RE project, there will be a point where the establishment costs are recovered, and consumers will start to enjoy free electricity. The above quotes imply that the communities that do not have access to electricity due to their long distance from the grid can enjoy the same benefits as people connected to the grid.

It, therefore, means that people without grid access can install solar panels on their house roofs to provide uninterrupted electricity. RE can provide reliable and cheaper energy over an extended period. These quotes confirm the literature in Chapter 2 that RE, especially solar PV, can deliver energy to various areas for which the connecting fee to the primary grid is unaffordable. RE can advance people's lives (Edenhofer 2011). Terrapon-Pfaff et al. (2014) argue that reducing energy poverty in developing countries is critical as it provides access to sustainable and affordable energy services. These quotes confirm the programme of the REIPPPP as an enabling policy to address energy security.

4.8 Population growth

The study found that the period of construction of RE projects contributed significantly to an increase in the population of Upington. The participants argued that the traffic congestion has increased, and to some extent, there has been some strain on the school infrastructure.

4.8.1 Roads and schools' infrastructure

The majority of the respondents mentioned that the road infrastructure was insufficient to accommodate the increased traffic volumes. Almost all the participants mentioned traffic

congestion between Upington and neighbouring towns. As with road infrastructure, the participants felt that their school infrastructure is not adequately planned to accommodate many students. This resulted in some of their schoolchildren struggling to get admission at English medium schools. The following quotations confirm the response from the respondents as quoted below:

> *The negative influence is that the construction of this solar farm has caused much traffic. Our roads are not built for that. If you cannot negotiate to maintain some of the original roads, we will have much worse gravel roads after construction* ***(Interviewee 20)****.*
>
> *….Remember that a lot more people live and work here now. They have families, which influences the schools. My children are in an English medium school. They do not plan schools according to all the children who are here anymore. I struggled to find spots in an English school for my children. There are many Spaniards who came with their children, but our schools are not planned accordingly. So, now, the other kid might have a school place, but your local kid cannot find a spot. Things like that* ***(Keimoes 1: Interviewee 3)****.*

The above quotes show that high population growth due to RE strains the road infrastructure due to high traffic volume. Chapter 2 confirms that the influx of newcomers may create traffic on road infrastructure, prompting safety concerns (Rhubart and Brasier 2019). Additionally, the schools are affected, as they cannot accommodate more learners. As stated in Chapter 2, Fitzgerald et al. (2016) state that the school systems will continue to face problems extending from overcrowding in primary schools to completion rates in high school and obtaining housing for teachers. Despite knowing that the construction period will attract migrants, no prior planning to avoid strain on roads and school infrastructure occurred. Unlike mining that requires engaging with municipalities as guided by their social plans, RE has community development policies. The contractual agreement in RE does not require engagement with stakeholders to build infrastructures like roads and schools. It is impossible to blame the RE companies, as it is within their contractual obligation or agreement not to engage with the stakeholders when registering their plans on the municipality's integrated development plan. Local stakeholders should coordinate these plans to ensure collaborative planning between the provincial government and RE companies.

4.8.2 Municipal services

The last population growth subtheme that the participants identified is municipal services. In terms of this subtheme, the participants have not mentioned much, except that local people migrate to neighbouring towns to avoid high tax rates in Upington because of mounting municipal services. The following quotes confirm the above narrative:

> *I have not seen it go up that much. It is only during construction we saw, because of the nature of this project. Any big project attracts lots of people, there is more population exposure around that area, because people are working there, they need specific services* ***(Interviewee 23)****.*
>
> *…and the people run away from Upington for tax reasons, and they live in smaller towns. So many people working in Upington lives in Keimoes, so we have lines and lines of traffic in the afternoons when people come off at work* ***(Keimoes 1: Interviewee 5****).*

The above quotes reflect that high population growth contributes to an increase in municipal income and harms middle-income people. The quotes imply that more demand for services means that the municipality will increase the municipal rates to address the needs. The middle-income earners are the individuals who always suffer the consequences of an increase in municipal services. Chapter 2 provides evidence that the sudden growth in population puts much pressure on local government in terms of municipal services. As a result, the local government is confronted with new demand levels while experiencing underfunding (Taylor and Winter 2013). Taylor and Winter (2013) added that this rapid population growth would create a sense of weakened jurisdictional control of the local authority. The municipal census data do not account for the influx of the shadow population resulting in the inability to plan for housing (Charman 2019). This finding again calls for collaborative planning where the critical stakeholders, like the municipalities, participate in project construction planning phases. Such collaboration will ensure that municipalities and other key stakeholders work together with the IPPs to mitigate the possible strain in municipal services. The idea would have been to adjust the integrated development plan to avoid municipal services gaps. The negative impact of this causes people to leave Upington to settle in neighbouring towns where the services are affordable.

The question is whether the municipality has benefitted from increased incomes from selling services. I compared municipal finance data for ten years (2009–2018). Compared to the

average inflation of 4.75% per annum, income from electricity increased by 11.6% per annum and water by 7.1% per annum. The average annual inflation on electricity for the same period was 9%. These figures suggest that the municipality did indeed benefit from these developments.

4.9 Housing

The increase in the population of Upington had an impact on the housing situation. It is evident from the interviews and literature that an increase in migrant labour affected the housing market and could negatively affect local people. The respondents identified several issues emanating from high housing demand due to RE. The housing and rental prices escalated unrealistically high due to RE. The homeowners benefit economically, but the locals who rent suffer as they cannot compete with the construction workers or newcomers. Also, because the construction of RE projects is over a shorter period, many houses become empty, and homeowners and property agents experience a severe shortfall after construction. Following the above narrative, the following significant statements capture the effect of RE on the housing market:

> *When the Spaniards arrived in the town, many things changed; for example, the price of houses went sky high, the cost of accommodation increased. …Those is some of the things that happened in our town with the erection of the solar plant and yes* ***(Interviewee 6)***.
>
> *The Spaniards are gone, and now they have to lower the value of the houses when it comes to renting…* ***(Interviewee 1)***.

The above quotes indicate that the housing market was affected by an influx of people due to construction related to RE. The majority of the respondents mentioned the prices that went up unrealistically high because of RE. This, on the other hand, had an impact on the local people, as they could not afford these high housing prices. These narratives are confirmed by Chapter 2, stating that as existing houses fill up fast and housing development takes years to materialise, this results in a severe lack of housing in boomtown communities (Jacquet 2009). Jacquet (2009) further states that severe housing scarcities will continually escalate housing prices. In comparison, Jones and Mayzor (2021) share a Bradford county situation saying that rental rates and housing prices have drastically increased due to boom growth in the area that caused a strain in housing availability. The continuous trend in high housing prices and rental fees will create a situation where the locals leave Upington for the neighbouring towns.

In addition to the responses during the interview, as is the case with the municipal services, I compared property rates over ten years (2009–2018). Over this period, property rates increased on average by 13.5% per annum. The average inflation for the same period was 4.75% per annum. These figures show that the municipality has indeed benefitted from RE. However, these increases have become a burden on local people as the end of the construction period means that they do not receive large rental incomes anymore.

4.10 Conclusion

This chapter identified the findings of the effect of RE on the community. The evidence showed that RE has benefits. Regarding job creation, the majority of the respondents mentioned that the RE programme could employ 400 to 1 900 people during the construction phase. When it comes to permanent jobs, the number reduces drastically, to as little as 70 people. In terms of the local economic development, there has been evidence that most retail stores, hospitality services, aviation and rentals have grown remarkably. Most respondents mentioned that these growths were not over long as the construction period takes a shorter timeframe to complete.

There has been a mention of the importance of RE in climate mitigation. South Africa is a party to the Paris Agreement, which compels parties to reduce their reliance on coal by introducing RE projects. South Africa's commitments are made possible by the 1998 White Paper on Energy Policy (amended in 2003) to promote RE technologies and target 4% of electricity from small-scale hydro, solar, wind and biomass projects by 2030. South Africa has launched the REIPPPP (guided by the IRP document) as its leading climate change programme in implementing the commitments.

On the other side is the social disruption that these RE projects could create in the community. The evidence shows that RE can harm the population growth that will harm the following: school infrastructure, health issues and services, crime, environmental aspects, municipal services and housing. The majority of the respondents raised their concerns, especially the social ills brought by RE. What came out strongly from the respondents is the issues of teenage pregnancy, drugs and alcohol abuse. The majority of the respondents stated that they have to deal with the consequences of the social ills.

Because of the above, it is evident that there has not been collaborative planning amongst the critical role players to mitigate the adverse social effects of RE on the community. As discussed, what led to the lack of collaborative planning is the nature of the contractual

agreement that the IPPs has entered into that does not allow them to collaborate with key stakeholders. It is, therefore, a conceptual approach that needs to be driven by key stakeholders to implement collaborative planning.

Chapter 5
Conclusion and Recommendations

5.1 Introduction

This chapter presents the recommendations and conclusion of the study. The study investigated the effect of RE on the community of Upington in the Northern Cape Province, South Africa. RE has both positive and negative effects on socio-economic and environmental aspects. The study used a qualitative methodology where the respondents were selected to tell their stories regarding the effects of RE on the community. The main reason for choosing the qualitative method is that the topic, problem statement, aims and objectives analyse the respondents' views concerning the effects of RE.

5.2 An overview of the chapters

This section summarises the chapters. Chapter 2 discusses the state of RE from a global perspective. The chapter emphasised that RE has contributed to the socio-economic status through jobs and economic growth. The international communities laud RE as an alternative source of energy to mitigate climate change. However, it can also harm the environment, disturbing the ecosystems and causing social disruptions in host communities.

In Chapter 3, the state of RE in South Africa has been discussed. The principal issues have been around the RE legislation to achieve the IRP targets through the REIPPPP. The 1998 White Paper on Renewable Energy (as amended in 2003) shares South Africa's aspirations to reduce the environmental energy-related impact. Subsequently, The National Energy Act, no. 34 of 2008, was promulgated to implement the IEP. The IEP regulates the present and future energy services needs while minimising the energy sector's adverse environmental effects. Finally, this chapter also presented the body of literature around SED and EnD in the REIPPPP. I discussed the following issues: First, the chapter refers to the 50 km radius where the IPPs must develop communities near the project. The chapter has cited the lack of collaboration amongst the stakeholders in the REIPPPP to share responsibilities on community development. Second, the role of SED and EnD in the REIPPPP was discussed. South Africa has set ED requirements to rely on the RE industry to address the ED objectives to create a local renewable industry and lower generation costs. Third, SLTO as a concept found its place as a measure to address the challenges faced by significant operations like RE and mining companies. This

concept is common in mining in the social and labour plans legislative framework following the Minerals and Petroleum Resources Development Act no. 28 of 2002, applicable to RE. Last, the bidders are guided by the country's BBBEE legislation that contains seven criteria that the developer must follow. The minister issued an exemption from the 90/10 split (of the BBBEEE) and introduced a 70/30 split into the REIPPPP, where 70% constitutes the price of the project construction, and 30% constitutes the ED.

Chapter 4 discussed the empirical evidence gathered during the interviews with 46 participants from six focus groups and 16 key informants. All the participants from the focus group originated from Upington, Raaswater, Louisvale and Keimoes. The key informants are from various disciplines, some local and others from outside Upington. The following eight themes emerged: crime, social disruption, environment and climate mitigation, jobs, economic growth, energy supply, population growth and housing. The construction period of RE projects contributes to increased crime. The study found that this often results from the in-migration of people from elsewhere, with some illegal operating businesses.

Regarding social disruption, the respondents mentioned the increase of various social problems because of the RE investments and the influx of people. The social issues that emerged were prostitution, teenage pregnancies, health problems (HIV/AIDS and other STIs). The respondents often related these social ills to newcomers (especially males and Spaniards) that the developers employed in constructing the CSP plant.

Regarding environment and climate change mitigation, the evidence from the respondents shows that RE plants can also have negative local environmental consequences. On the positive, RE sources can protect the planet from carbon emissions. In terms of jobs, most participants stated that the sector contributed to many job opportunities, especially during construction, whilst on the other hand, these jobs declined during the operational and management phase of the project. Regarding the economic growth, the respondents lauded RE as a significant boost to the economy of Upington. On the other hand, economic growth will decline due to the short duration of the construction period. Concerning the supply of energy, the participants identified RE as a sustainable source of energy. In terms of population growth, the participants stated that the construction period of RE projects contributed significantly to an increase in the population of Upington, which put a strain on road and school infrastructure. The population growth also affected the municipal services negatively. Finally, another

negative effect of RE was that the housing and rental prices escalated unrealistically high, affecting locals negatively as they could not afford such price hikes.

5.3 Main findings of the study

In this section, I discuss seven main findings:

5.3.1 Evidence of increased social disruption and crime

The global body of literature shows that crime increases in areas due to industrialisation and rapid economic and population growth change the social fabric (see Chapter 2). South African policy proposals are silent about the possible adverse effects and do not provide guidelines to counter this reality (Chapter 3). Participants quickly pointed to increased social disruption and crime because of the new renewable plants (especially the construction period). Nevertheless, available data do not corroborate all these perceptions. The evidence in Chapter 4 shows slight increases in one or two selected crimes (drug and alcohol-related crimes) but no immediate increase in shoplifting and burglary. Participants were also quick to highlight what they perceived as social ills and adverse effects on participants' lifestyles. Prostitution and migrant workers impregnating local women were high on the list during the interviews. These behaviours have also created tension between the locals and the foreigners. The concern about this is the local women and government taking a burden for the children without fathers. Last, the respondents mentioned an increase in HIV/AIDS and other STIs. Respondents felt Upington had the problem of HIV/AIDS and other STIs before, but the issues are the rate at which it increased during the boom period. The issue raised by the participants is that the foreigners will engage in unprotected sex with the prostitute or local women and spread it further. The evidence shows that construction (especially of multiple projects) can increase crime, contribute to social disruption, and create tensions between local and migrant workers.

5.3.2 Environment and climate mitigation value of renewables are locally recognised, but there must also be an acknowledgement of the local environmental impacts

RE is clean alternative energy to replace coal. The G7 countries are taking steps to phase out fossil fuels by ending their financial aid for coal development overseas (Chapter 2). The South African government introduced the IRP to shift towards a more cost-effective and sustainable resourceful energy policy to reduce carbon emissions (Chapter 3). Despite the environmental benefits of renewables (which participants highlighted), there are local environmental concerns

(Chapter 4). The participants indicated that renewable energy, significantly CSP technology harms the ecosystem. There was mention of the birds that instantly die when they fly across the CSP tower and many animals (like meerkats) that lost their habitat during construction. It is worth noting that RE has potential benefits from climate change. On the other hand, the main concern is the harmful effect of it primarily on the environment.

5.3.3 Renewables create large scale construction jobs, but long term employment is limited

Chapter 2 of this study discussed how RE could impact job creation in the local communities. Chapter 3 reflected on the white paper on RE, the IRP and the REIPPPP, which support the investors to implement projects to contribute to job creation, especially in the local communities. The participants indicated that RE contributed to employment creation in the province. However, the findings show that the bulk of employment is during construction and that only a small number of people are employed during operation and maintenance. Due to the insufficient capacity of the local people, the employment during operations and maintenance is through people who come in, as they are required. Operations and maintenance require people with specialised skills that the local people do not possess.

5.3.4 Renewable energy contributes to the host town's local economic growth, but the impact is over a shorter period

Chapter 2 emphasised the importance of RE on local economic development. Among other things, RE's impact will depend on South Africa’s policy reform to ensure that the sector contributes immensely to economic growth. The IRP informs the REIPPPP of the country's targets to contribute to ED (Chapter 3). The findings point to the positive effect of RE on local economic development, especially during construction, which has been very beneficial to the local sector of the economy. The following sectors benefited from renewable power: retail stores, restaurants, hotels, housing (property purchasing and rentals), transport and the aviation industry. The point of concern is that these benefits are over a shorter period, and there was a point where the economic growth declined.

5.3.5 Unlike coal power generation, renewable energy is a sustainable source of energy

Chapter 2 of this study has shown the importance of RE in grid options to support the reduction of energy poverty in remote areas of South Africa. Chapter 3 states that reducing energy

poverty in rural areas is critical for sustainable and affordable energy services. On that note, the government introduced the IRP to enable the country to optimise the provision of electricity. The idea is preserved in the South African Constitution under section 24 of the Bill of Rights, stating that everyone has a right to secure ecologically maintainable use and develop natural resources to produce sustainable energy. The outcome of the interview reveals the importance of RE to supply uninterrupted power.

The participants showed how RE is critical to addressing the shortage of electricity in South Africa. South Africa is currently experiencing the scourge of load-shedding. The participants stated that RE could boost Eskom to meet the constant energy supply because it is renewable and does not diminish compared to conventional energy. RE is essential in remote areas without grid access as they can rely on solar energy to produce electricity. Because it is affordable, it is an ultimate and long-term solution for energy shortage-stricken areas and incredibly remote rural areas.

5.3.6 There is evidence of population growth causing strain on the road and school infrastructure

Chapter 2 of this study states that an influx of newcomers in an area undergoing growth and prosperity strains road and school infrastructure. The strain on the infrastructure suggests that the key stakeholders (all the affected stakeholders in RE, including government departments) are not part of the municipality's integrated development plan. The fact that the municipality's integrated development plan is not used to plan and implement infrastructure projects will lead to continuous strain on the road and school infrastructure. The empirical evidence of this study showed that the construction period of RE projects contributed significantly to an increase in the population of Upington. The respondents articulated how RE influenced their traffic congestion negatively. The road infrastructure was not good enough to accommodate the traffic, and participants indicated that they experienced heavy traffic on their roads. Overcrowded classrooms are believed to be contributing to the shortage of space. The participants also mentioned the issue of the school infrastructure, citing that their schools cannot accommodate a large volume of students.

5.3.7 There is evidence of an increase in property and municipal rates due to high demand during the period

Chapter 2 emphasised that the area undergoing boom experienced a severe lack of housing due to high demand. Severe housing scarcities lead to the escalation of housing prices. Chapter 4 has shown that an increase in the high demand for housing due to a high influx of people leads to high housing prices. The respondents stated that the housing prices and the rental prices escalated unrealistically due to the high population growth. The Dawid Kruiper municipal finance provides evidence of how the municipality benefited from this. From 2009 to 2010, Dawid Kruiper recorded average municipal services growth rates of 55.41% to 55.77%, respectively, higher than the annual average growth of 9.1% over ten years and more than that 4.75% of annual growth. In 2013, there was a sharp increase of 90.06% higher than the annual and 10-year growth and 4.75% annual growth rate. Surprisingly, in 2014, the municipality recorded a sharp decline in municipal services at an average of 34.04%, still higher than the ten-year annual increase and yearly growth. These property price hikes were an economic boost to the property as they benefitted economically from this trend. On the other hand, it negatively affects the local people, as they cannot afford the high rentals and housing prices. Because RE is developed over a shorter period, many houses become empty, and homeowners and property agents experience a severe shortfall after construction.

5.4 Recommendations

The following recommendations of this study emanate from the research:

5.4.1 Evidence of increased social disruption and crime

The participants spoke about the newcomers who were blamed for causing the social ills and tensions in the community. Social integration can play a central role in mitigating the social ills in the host communities. Social integration means that the newcomers must be integrated into the host society. The failure of RE projects to arrange a series of social integration workshops to welcome newcomers to society are perceived negatively. The workshop's objective is to understand each other's culture, social values, and lifestyle to prepare both societies to develop a common approach in managing the social ills. The existing structures in the community can play an integral role to coordinate the social integration workshops. In that way, the local people, including newcomers, will feel safe in the unified society.

5.4.2 The environment and climate mitigation value of renewables are locally recognised, but there must also be an acknowledgement of the local environmental impacts

Although there are good intentions to implement RE to mitigate climate change, there are also negative impacts on the environment. The adverse effects of RE on the environment poses a severe concern for the ecosystem. There has to be a balance between the benefits and the negative impact on the ecosystem. It is critical, therefore that that proper environmental planning be conducted before starting with the construction. This must be done so that the detrimental effect of RE is avoided at all costs.

5.4.3 Renewables create large scale construction jobs, but long term employment is limited

Skills development has been identified as a significant concern for the local people. The skills gap is one major issue that limits the local people from taking up opportunities or decent jobs in the sector. The respondents mentioned that most local people are employed during construction, and a considerable percentage lose jobs after a short period. RE hires fewer people during the operation and management phase, as this process requires people with specialised skills that the local people do not possess. It is only fair to say that the RE programme was introduced suddenly in the province without preparing the local people to participate in the sector. RE is the future clean energy producer for the world, and it is a lifelong investment. The capacity building programme must start now, and the rural Technical Vocational Education and Training colleges in the Northern Cape must be capacitated to offer courses that will empower the local people to get decent jobs in RE. The Department of Higher Education and Training must play a key role in ensuring that the rural Technical Vocational Education and Training college's curriculum is upgraded to offer RE courses.

5.4.4 Renewable energy contributes to the host town's local economic growth, but the impact is over a shorter period

In Upington, most businesses benefited hugely from RE, but the main concern is that such growth lasted for a short period. To ensure that there is a consistent boost to the area's economy, there is a need for the community members to be capacitated to establish sustainable businesses. The corporate social investment earmarked for the community development through the trust must be ideally utilised for such a purpose. Therefore, it is crucial to create

sustainable businesses in the community to create employment and boost the area's economy over a more extended period.

5.4.5 Unlike coal-powered generation, renewable energy is a sustainable source of energy

Load-shedding is still an enormous challenge, and the remote areas that do not have access to electricity in any way. Through the DMRE, the government must embark on a drive to encourage communities and businesses to invest in RE, especially the off-grid rooftop solar initiatives. The government must also ensure that the REIPPPP is fully supported to address the IRP targets to improve the capacity of the Eskom grid. The government must also be consistent in the bids roll out to ensure clean energy generation.

5.4.6 There is evidence of population growth causing strain on the road and school infrastructure

It must be admitted that RE was introduced without involving all the key stakeholders, especially the local roll players. These key stakeholders are not limited to municipalities, communities, the provincial government and community development fora. Because RE is a national competency, it automatically excluded the local stakeholders during the project planning processes. During the interviews, it became clear that there was no collaborative planning before constructing the projects in the study area. Collaborative planning would have been ideal for all key stakeholders to collaborate to ensure a conducive environment (without harming the local resources and infrastructure) for RE. This was due to unexpectedly high population growth, the strained school and road infrastructure, health issues, municipal services and crime.

The central player in this regard is the municipality. The municipality's integrated development plan, as in mining, although there are challenges about it, can assist in driving the collaboration process. There is a need to get all the stakeholders comprising of IPPs to lay down the proper terms of reference to address the challenges on the ground. All the needs must be tabled, and a concerted effort must be developed to implement programmes to address the challenges. As the host entity, the municipality must take ownership of the project by coordinating all the planning forums. At the Office of the Premier level, the province must appoint a provincial steering committee responsible for oversight.

5.4.7 There is evidence of an increase in property and municipal rates due to high demand during the renewable energy construction period, and these increases harm the local people

The fact that the IPPs are not talking to the key stakeholders creates a problem. Key stakeholders like the Department of Human Settlements are not brought on board. The Department of Human Settlement's mandate is to ensure that everyone has a right to have access to adequate housing. The local people spoke about foreigners who influence housing prices to escalate. The local people can feel the pressure, as they cannot afford to buy or rent expensive houses.

On the other hand, youth in the community get employment in RE, and as a result, they opt to move out of their family houses to live independently. The inclusion of the Department of Human Settlements to assist with constructing low-cost housing is critical to address (Table 5.1).

Table 5.1 illustrates the main findings from the study and links to possible policy recommendations that could be adopted by the Northern Cape Provincial Government and the Dawid Kruiper Local Municipality.

Table 5.1 Main findings and recommendations

Main findings	Recommendations
➢ There is evidence of increased social disruption and crime.	➢ RE must engage in social integration workshops to mitigate social disruption and crime. ➢ This implies that both the local people and newcomers must integrate to adopt a common approach to addressing social ills.
➢ The environment and climate mitigation value of renewables are locally recognised, but there must also be an acknowledgement of the local environmental impacts.	➢ Proper environmental planning needs to be conducted before starting with the construction of RE projects. ➢ This will minimise the harmful effect of RE on the ecosystem.
➢ Renewables create large scale construction jobs, but long term employment is limited.	➢ The provincial government must ensure that the local people can take decent jobs at the RE plants by capacitating them. ➢ The Northern Cape TVET college in Upington to be capacitated to offer RE-related courses.
➢ RE contributes to the host town's local economic growth, but the impact is over a shorter period.	➢ The corporate social investment budget of the IPPs is to be used to create community businesses. ➢ This will lead to the creation of decent jobs in Dawid Kruiper Local Municipality.
➢ Unlike coal-powered generation, RE is a sustainable source of energy.	➢ There is a need for the provincial government and Dawid Kruiper Local Municipality to support the REIPPPP, including the municipal off-grid initiatives consistently.
➢ There is evidence of population growth causing strain on the road and school infrastructure.	➢ There is a need for collaborative planning amongst the key stakeholders to address the challenge of infrastructure.
➢ There is evidence of an increase in property and municipal rates due to high demand during the RE construction period, and these increases harm the local people.	➢ The provincial government prioritise housing developments, especially in areas undergoing growth.

5.5 Future research

The following recommendation emanates from the research:

This study aimed to investigate the effect of RE in the community of Upington (Northern Cape Province). The lack of collaborative planning has been identified as the main challenge. None

of the respondents mentioned any structure developed to collaborate or address the negative effect of RE on society. Against this background, the following topic is recommended for future research.

"A perspective on how renewable energy can be successfully implemented: A matter of collaborative approach."

The above topic suggests that future research will share the excellent practice in successfully implementing RE.

References

Alhojailan, M.I. 2012. Thematic analysis: A critical review of its process and evaluation. *West East Journal of Social Sciences,* 1(1):39–47. Available from: http://westeastinstitute.com/journals/wp-content/uploads/2013/02/4-Mohammed-Ibrahim-Alhojailan-Full-Paper-Thematic-Analysis-A-Critical-Review-Of-Its-Process-And-Evaluation.pdf

Australian Science Media Centre. 2021. *Expert reaction: Richest nations agree to end support for coal production overseas*. Scimex: Breaking Science News for Australia and New Zealand. [Online]. Available from: https://www.scimex.org/newsfeed/expert-reaction-richest-nations-agree-to-end-support-for-coal-production-overseas [Accessed on 10 July 2021].

Baker, L. & Wlokas, H.L. 2015. *South Africa's renewable energy procurement: A new frontier?* Cape Town: Energy Research Centre, University of Cape Town. Available from: https://media.africaportal.org/documents/SAs_Renewable_energy_procurement.pdf

Bloem, S., Swilling, M. & Koranteng, K. 2021. Taking energy democracy to the streets: Socio-technical learning, institutional dynamism, and integration in South African community energy projects. *Energy Research & Social Science,* 72:2214–6296. https://doi.org/10.1016/j.erss.2020.101906

Boggio, A., Zignol, M.,Jaramillo, E., Nunn, P., Pinet, G. & Raviglione, M. 2008. Limitations on human rights: Are they justifiable to reduce the burden of TB in the era of MDR- and XDR-TB? *Health and Human Rights*, 10(2):121–126.

Brasier, K.J., Filteau, M.R., McLaughlin, D.K., Jacquet, J., Stedman, R.C., Kelsey, T.W. & Goetz, S.J. 2011. Residents' perspections of community and environmental impacts from development of natural gas in the Marcellus Shale: A comparison of Pennsylvania and New York cases. *Journal of Rural Social Sciences*, 26(1):32–61.

Bryman, A. 2012. *Social research methods.* 4th edition. Oxford: Oxford University Press.

Cernea, M.M. 2004. *Social impacts and social risk in hydropower programs: Preemptive planning and counter-risk measures*. (Keynote address: Session on Social Aspects of Hydropower Development. United Nations Symposium on Hydropower and Sustainable Development, Beijing, China, 2004). Available from:

https://www.un.org/esa/sustdev/sdissues/energy/op/hydro_cernea_social%20impacts_backgroundpaper.pdf

Charman, M. 2019. *Gendered boomtown impacts: A social service perspective on the experience of women in resource extraction communities*. (Thesis). Ontario Tech University, Ontario, Canada. Available from: https://ir.library.dc-uoit.ca/bitstream/10155/1112/1/Charman_Madison.pdf

Costa, R. 2019. *The importance of renewable energy in developing countries*. The Borgen Project. [Weblog]. Available from: https://borgenproject.org/renewable-energy-in-developing-countries/ [Accessed on 10 May 2021].

Davies, M.L. 2021. *South Africa's contested transition to energy democracy: Lessons and struggles from the Renewable Energy Independent Power Producer Procurement Programme.* (Thesis). University of Stellenbosch, Stellenbosch.

Davies, M., Swilling, M. & Wlokas, H.L. 2018. Towards new configuration of urban energy governance in South Africa's renewable energy procurement programme. *Energy Research and Social Science*, 36:61–69. https://doi.org/10.1016/j.erss.2017.11.010

Dawid Kruiper Local Municipality. 2017. *Profile of the Dawid Kruiper Local Municipality*. [Online]. Available from: https://dawidkruiper.xyz/profile-of-the-dawid-kruiper-municipality/ [Accessed on 4 October 2021].

Deloitte. 2019. *Renewable energy in South Africa: Valuation insights.* Deloitte. Available from: https://www2.deloitte.com/content/dam/Deloitte/za/Documents/finance/za_renewable_energy_south_africa_valuation_insights_march2019.pdf

Eberhard, A. & Naude, R. 2016. The South African Renewable Energy Independent Power Producer Procurement Programme: A review and lessons learned. *Journal of Energy in Southern Africa*, 27(4):1–14. https://doi.org/10.17159/2413-3051/2016/v27i4a1483

Eberhard, A. & Naude, R. 2017. *The South Africa Renewable Energy IPP Procurement Programme: Review, lessons learned and proposals to reduce transaction costs.* Cape Town: the University of Cape Town, Graduate School of Business. Available from: https://www.gsb.uct.ac.za/files/EberhardNaude_REIPPPPReview_2017_1_1.pdf

Edenhofer, O. 2011. *Renewable energy sources and climate change mitigation: Summary for policymakers and technical summary: Special report of the intergovernmental panel on climate change*. New York: Cambridge University Press.

Eftimi, A., Heller, K. & Strongman, J. 2009. Gender dimensions of the extractive industries: Mining for equity. *Extractive industries and development series, no. 8.* Washington, DC: World Bank. http://hdl.handle.net/10986/18236

Energy blog. 2021. *Utility-scale renewable energy generation sites: South Africa*. [Online]. Available from: https://www.energy.org.za/map-south-african-generation-projects [Accessed on 10 October 2021].

England, J.L. & Hooper, D.A. 1980. *Catastrophe models: Some illustrations and potential for social impact assessment*. Utah: Brigham Young University. Available from: https://files.eric.ed.gov/fulltext/ED214691.pdf

Ennis, G., Finlayson, M. & Speering, G. 2013. Expecting a boomtown?: Exploring potential housing-related impacts of large scale resource development in Darwin. *Human Geographies,* 7(1):33–42. https://doi.org/10.5719/hgeo.2013.71.33

Ennis, G., Tofa, M. & Finlayson, M. 2014. Open for business, but at what cost? Housing issues in 'boomtown' Darwin. *Australian Geographer,* 45(4):447–464. https://doi.org/10.1080/00049182.2014.953732

Ferroukhi, R., Lopez-Pena, A., Kieffer, G., Nagpal, D., Hawila, D., Khalid, A., El-Katiri, L., Vinci, S. & Fernandez, A. 2016. *Renewable energy benefits: Measuring the economics.* Abu Dhabi: IRENA. Available from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_Measuring-the-Economics_2016.pdf

Fitzgerald, M.A., Muske, G., Haynes, G. & Lee, Y.G. 2016. Opportunities and challenges in energy-related boomtowns: Implications for family and consumer science professionals. *Family and Consumer Sciences Research Journal,* 44(4):394–411. https://doi.org/10.1111/fcsr.12161

Flick, U. 2013. *The SAGE handbook of qualitative data analysis.* Berlin: SAGE.

Fraser, T. 2021. Does social capital boost or block renewable energy siting? South African solar politics in comparison. *Energy Research & Social Science*, 71(101845). https://doi.org/10.1016/j.erss.2020.101845

German Federal Ministry for Economic Affairs and Energy. 2016. *Community based renewable energy models: An analysis of existing participation models and best practices for community-based renewables deployment in Germany and internationally.* Berlin: Federal Ministry for Economic Affairs and Energy. Available from: https://arepoconsult.com/wp-content/uploads/2019/11/2016_giz-thailand_community-based-renewable-energy.pdf

Giglmayr, S., Brent, A.C., Gauché, P. & Fechner, H. 2015. Utility-scale PV power and energy supply outlook for South Africa in 2015. *Renewable Energy*, 83:779–785. https://doi.org/10.1016/j.renene.2015.04.058

Gioutsos, D. & Ochs, A. 2017. *The employment effects of renewable energy development assistance*. [Online]. Brussels: European Union Energy Initiative. Available from: https://www.researchgate.net/publication/321398329_The_Employment_Effects_of_Renewable_Energy_Development_Assistance

Gkatsou, S., Kounenou, M., Papanagiotou, P., Seremeti, D. & Georgadellos, D. 2014. The impact of the green economy on employment: A preliminary analysis. *International Journal of Business and Social Science*, 5(1):29–41. Available from: https://ijbssnet.com/journals/Vol_5_No_1_January_2014/4.pdf

Goldenberg, S.M., Strathdee, S.A., Perez-Rosales, M.D. & Sued, O. 2012. Mobility and HIV in Central America and Mexico: A critical review. *Journal of Immigrant and Minority Health*, 14:48–64. https://doi.org/10.1007/s10903-011-9505-2

Guest, G., MacQueen, K.M. & Namey, E.E. 2012. *Applied thematic analysis.* Thousand Oaks, Calif.: SAGE.

Harvey, F. 2021. *The richest nations agree to end support for coal production overseas*. [Online]. The Guardian, 21 May 2021. Available from: https://www.theguardian.com/environment/2021/may/21/richest-nations-agree-to-end-support-for-coal-production-overseas [Accessed on 21 May 2021].

Heitkamp, T. & Mayzer, R. 2018. Implications for practice: Risks to youth in boomtowns. *Child Welfare,* 96(4):47–71.

Hernandez, R.R., Easter, S.B., Murphy-Mariscal, M.L., Maestre, F.T., Tavasolli, M., Allen, E.B., Barrows, C.W., Belnap, J., Ochoa-Hueso, R., Ravi, S. & Allen, M.F. 2014. Environmental impacts of utility-scale solar energy. *Renewable and Sustainable Energy Reviews,* 29:766–779. https://doi.org/10.1016/j.rser.2013.08.041

Hirsch, J.K., Smalley, K.B., Selby-Nelson, E.M., Hamel-Lambert, J.M., Rosmann, M.R., Barnes, T.A., Abrahamson, D., Meit, S.S., GreyWolf, I., Beckmann, S. & LaFromboise, T. 2018. Psychosocial impact of fracking: A review of the literature on the mental health consequences of hydraulic fracturing. *International Journal of Mental Health and Addiction,* 16:1–15. https://doi.org/10.1007/s11469-017-9792-5

Independent Power Producers (IPP). 2019. *Renewable Energy Independent Power Producers Procurement Programmes (REIPPPP): ESMAP Conference*. [Powerpoint slides]. Presented at the ESMAP Conference, 5 February 2019. Available from: https://esmap.org/sites/default/files/events-files/2_Presentation%20ESMAP%205%20Feb%202019.pdf

Independent Power Producers (IPP). 2020. *Independent Power Producers procurement programme.* [Online]. Centurion: Independent Power Producer Office. Available from: https://ipp-projects.co.za/Publications [Accessed on 8 October 2021].

Independent Power Producers (IPP). 2021a. *Independent Power Producers Procurement Programme (IPPPP): An overview.*Centurion: Independent Power Producers Office. Available from: https://ipp-projects.co.za/Publications

Independent Power Producers (IPP). 2021b. *REIPPPP focus on Northern Cape: Provincial report volume 1*. Centurion: Independent Power Producers Office. Available from: https://ipp-projects.co.za/Publications

International Labour Organization (ILO). 2014. *Green jobs and renewable energy: low carbon, high employment*. Geneva: International Labour Organisation. Available from: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_250690.pdf

International Renewable Energy Agency (IRENA). 2017. *Renewable energy benefits: Understanding the socio-economic benefits.* [Online]. Abu Dhabi: IRENA. Available from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Nov/IRENA_Understanding_Socio_Economics_2017.pdf?la=en&hash=C430B7EF772BA0E631190A75F7243B992211F102

Islam, M.N. 2016. *Community-led renewable and its impact on rural development: A content analysis.* Canada: Environmental Policy Institute, Memorial University of Newfoundland. Available from: http://rplc-capr.ca/wp-content/uploads/2019/02/Final-Literature-Review-Community-Based-Renewable-Energy.pdf

Jacquet, J.B. 2009. *Energy boomtowns and natural gas: Implications for Marcellus Shale local governments and rural communities*. [Online]. Pennsylvania: Northeast Regional Center for Rural Development, Pennsylvania State University. Available from: https://aese.psu.edu/nercrd/publications/rdp/rdp43/view [Accessed on 12 May 2021].

Jacquet, J.B. & Stedman, R.C. 2014. The risk of social-psychological disruption as an impact of energy development and environmental change. *Journal of Environmental Planning and Management,* 57(9):1285–1304. https://doi.org/10.1080/09640568.2013.820174

Jones, F.M. & Mayzer, R. 2021. A fifth wave? The changing nature of boomtown research. *The Extractive Industries and Society*, 8(2):100893. https://doi.org/10.1016/j.exis.2021.02.013

Kabel, T.S. & Bassim, M. 2019. Literature review of renewable energy policies and impacts. *European Journal of Marketing and Economics,* 2(2):28–41.

Kabir, S.M.S 2016. *Basic guidelines for the research: An introductory approach for all disciplines.* Chittagong: Book Zone. Available from: https://www.researchgate.net/profile/Syed-Muhammad-Kabir/publication/325390597_BASIC_GUIDELINES_FOR_RESEARCH_An_Introductory_Approach_for_All_Disciplines/links/5b0a89094585157f8719626c/BASIC-GUIDELINES-FOR-RESEARCH-An-Introductory-Approach-for-All-Disciplines.pdf

Krannich, R.S. 2012. Social change in natural resource-based rural communities: The evolution of sociological research and knowledge as influenced by William R. Freudenburg.

Journal of Environmental Studies and Sciences, 2:18–27. https://doi.org/10.1007/s13412-011-0051-y

Kumar, M. 2020. Social, economic, and environmental impacts of renewable energy resources. In: Okedu, K.E., Tahour, A. & Aissaou, A.G. (Eds). *Wind solar hybrid renewable energy system*. London: IntechOpen.

Lagercrantz, H. & Khabbaz, S. 2019. *The platinum boom in Rustenburg and the bust of the community: A case study of the natural resource curse in South Africa.* (Thesis). Linnaeus University, Sweden.

Lawrence, A. 2020. Energy decentralization in South Africa: Why past failure points to future success. *Renewable and Sustainable Energy Reviews,* 120:109659. https://doi.org/10.1016/j.rser.2019.109659

Leiren, M.D, Aakre, S., Linnerud, K., Julsrud, T.E., Di Nucci, M-R. & Krug M. 2020. Community acceptance of wind energy developments: Experience from wind energy scarce regions in Europe. *Sustainability,* 12(5):1754. https://doi.org/10.3390/su12051754

Louw, H. & Marais, L. 2018. Mining and municipal finance in Kathu, an open mining town in South Africa. *The Extractive Industries and Society,* 5(3):278–283. https://doi.org/10.1016/j.exis.2018.05.005

Marais, L., Wlokas, H., de Groot, J., Dube, N. & Scheba, A. 2018. Renewable energy and local development: Seven lessons from the mining industry. *Development Southern Africa,* 35(1):24–38. https://doi.org/10.1080/0376835X.2017.1389260

Matsuo, T. & Schmidt, T.S. 2019. Managing trade-offs in green industrial policies: The role of renewable energy policy design. *World Development,* 122:11–26. https://doi.org/10.1016/j.worlddev.2019.05.005

Mbuli, N., Matshidza, D., Pretorius, J.H.C. & Xezile, R. (2011). *Network studies for the interconnection of a concentrating solar power plant in a weak distribution network in the Upington area*. (Paper presented at the IEEE Africon ’11 Conference, 13–15 September 2011). https://doi.org/10.1109/AFRCON.2011.6072024

McDaid, L. 2016. *Renewable Energy Independent Power Producers Procurement Programme review 2016: A critique of process implementation of socio-economic benefits including*

job creation. Cape Town: Alternative Information and Development Center. Available from: https://aidc.org.za/download/climate-change/Renewable-Energy-Where-are-the-Jobs.pdf

McEwan, C. 2017. Spatial processes and politics of renewable energy transition: Land, zones and frictions in South Africa. *Political Geography*, 56:1–12. https://doi.org/10.1016/j.polgeo.2016.10.001

McGinn, A. & Schneer, K. 2019. *Fact sheet: Jobs in renewable energy, energy efficiency and resilience.* Environmental and Energy Study Institute. [Online]. Available from: https://www.eesi.org/papers/view/fact-sheet-jobs-in-renewable-energy-energy-efficiency-and-resilience-2019 [Accessed on 23 July 2019].

Meyer, I. & Sommer, M.W. 2014. *Employment effects of renewable energy supply: A meta-analysis.* Vienna: WWWforEurope. Available from: https://www.econstor.eu/bitstream/10419/125639/1/WWWforEurope_Policy_Paper_012.pdf

Mirzania, P., Balta-Ozkan, N. & Marais, L. 2020. One technology, two pathways? Strategic Niche Management and the diverging diffusion of concentrated solar power in South Africa and the United States. *Energy Research & Social Science,* 69:101729. https://doi.org/10.1016/j.erss.2020.101729

Mohajan, H.K. 2018. Qualitative research methodology in social sciences and related subjects. *Journal of Economic Development, Environment and People*, 7(1):23-48.

Montmasson-Clair, G. & Das Nair, R. 2016. *The importance of effective economic regulation and coordinated institutions for inclusive growth: Lessons from South Africa's renewable energy programmes in the electricity supply industry.* Johannesburg: Centre for Competition, Regulation and Economic Development, University of Johannesburg. https://dx.doi.org/10.2139/ssrn.2869060

Morar, J. 2019. *The development impact of the Renewable Energy Independent Power Producer Procurement Programme on South Africa's small towns.* (Thesis). Stellenbosch University, Stellenbosch.

Morris, M., Robbins, G., Hansen, U.E. & Nygaard, I. 2020. Energy and industrial policy failure in the South African wind renewable energy global value chain: The political economy

dynamics driving a stuttering localisation process. *PRISM Working Paper 2020-3*. Cape Town: Policy Research on International Services and Manufacturing.

Msimanga, B. & Sebitosi, A.B. 2014. South Africa's non-policy driven options for renewable energy development. *Renewable Energy,* 69:420–427. https://doi.org/10.1016/j.renene.2014.03.041

National Committee for Research Ethics in the Social Sciences and the Humanities (NESH). 2019. *Guidelines for research ethics in the social sciences, humanities, law and theology*. [Online]. Oslo: Norwegian National Research Ethics Committees. Available from: https://www.forskningsetikk.no/en/guidelines/social-sciences-humanities-law-and-theology/guidelines-for-research-ethics-in-the-social-sciences-humanities-law-and-theology/ [Accessed on 6 October 2021].

National Renewable Energy Laboratory. 2018. *Wind energy*. [Online]. Open Energy Information. Available from: https://openei.org/wiki/Wind_energy [Accessed on 13 October 2021].

Nkoana, E.M. 2018. Community acceptance challenges of renewable energy transition: A tale of two solar parks in Limpopo, South Africa. *Journal of Energy in Southern Africa,* 29(1):34–40. http://dx.doi.org/10.17159/2413-3051/2018/v29i1a2540

Ntanos, S., Skordoulis, M., Kyriakopoulos, G., Arabatzis, G., Chalikias, M., Galatsidas, S., Batzios, A. & Katsarou, A. 2018. Renewable energy and economic growth: Evidence from European Countries. *Sustainability,* 10(8):2626. https://doi.org/10.3390/su10082626

Ntuli, P.N., Helgenberger, S. & Jacobs, D. 2017. *Scoping the assessment of co-benefits of renewable energy in South Africa.* (Paper presented at WindAc Africa 2017: Wind Power Without Borders, 14–15 November 2017, Cape Town, South Africa). Available from: https://researchspace.csir.co.za/dspace/handle/10204/11028

O'Connor, H. & Gibson, N. 2003. A step-by-step guide to qualitative data analysis. *Pimatiziwin: A Journal of Aboriginal and Indigenous Community Health*, 1(1). Available from: https://journalindigenouswellbeing.com/media/2018/10/5_OConnor-2.pdf

Owusu, P.A. & Asumadu-Sardokie, S. 2016. A review of renewable energy sources, sustainability issues and climate change mitigation. *Cogent Engineering*, 3(1):116799. https://doi.org/10.1080/23311916.2016.1167990

Pahle, M., Pachauri, S. & Steinbacher, K. 2016. Can the green economy deliver it all? Experiences in renewable energy policies with socio-economic objectives. *Applied Energy*, 179:1331–1341. https://doi.org/10.1016/j.apenergy.2016.06.073

Pan, C.A. & Dinter, F. 2017. Combination of PV and central receiver CSP plants for baseload power generation in South Africa. *Solar Energy*, 146:379–388. https://doi.org/10.1016/j.solener.2017.02.052

Park, M. & Stowoski, P.A. 2011. Casino gaming and crime: Comparisons among gaming counties and other tourism places. *Journal of Travel Research*, 50(3):289–302. https://doi.org/10.1177%2F0047287510363616

Pollet, B.G., Staffell, I. & Adamson, K. 2015. The current energy landscape in the Republic of South Africa. *International Journal of Hydrogen Energy*, 40(46):16685–16701. https://doi.org/10.1016/j.ijhydene.2015.09.141

Pratiwi, S. & Juerges, N. 2020. Review of the impact of renewable energy development on the environment and nature conservation in Southeast Asia. *Energy, Ecology and Environment*, 5:221–239. https://doi.org/10.1007/s40974.020-00166-2

Punch, K.F. & Oancea, A.E. 2014. *Introduction to research methods in education*. 2nd edition. Los Angeles: SAGE.

Ram, M., Aghahosseini, A. & Breyer, C. 2020. Job creation during the global energy transition towards a 100% renewable power system by 2050. *Technological Forecasting and Social Change*, 151:119682. https://doi.org/10.1016/j.techfore.2019.06.008

Relancio, J., Cuellar, A., Walker, G. & Ettmayr, C. 2016. South African CSP projects under the REIPPPP Programme: Requirements, challenges and opportunities. *AIP Conference Proceedings*, 1734:110002. https://doi.org/10.1063/1.4949199

Rennkamp, B., Haunss, S., Wongsa, K., Ortega, A. & Casamadrid, E. 2017. Competing coalitions: The politics of renewable energy and fossil fuels in Mexico, South Africa and Thailand. *Energy Research & Social Science*, 34:214–223. https://doi.org/10.1016/j.erss.2017.07.012

Rhubart, D.C. & Brasier, K.J. 2019. Arrest rates during natural resource development: Drilling, drinking and disorderly conduct in the Marcellus Shale Region. *Society & Natural Resources: An International Journal,* 32(6):675–692. https://doi.org/10.1080/08941920.2019.1574046

Ryneski, H. 2015. *Basins: Boomtown social effects*. Fossil Fuel Connections. [Online]. Available from: http://www.fossilfuelconnections.org/boomtown-social-effects [Accessed on 5 May 2021].

Shaw, J. 2017. *Assessing the sustainability of an independent power producer's social investment in a community: A case study of Scatec Solar.* (Thesis). Stellenbosch University, Stellenbosch.

Smith, M.D., Krannich, R.S. & Hunter, L.M. 2001. Growth, decline, stability, and disruption: A longitudinal analysis of social well-being in four western rural communities. *Rural Sociology,* 66(3):425–450. https://doi.org/10.1111/j.1549-0831.2001.tb00075.x

South Africa. 2002. *Minerals and Petroleum Resources Development Act 28 of 2002*. Government Gazette No. 23992, 10 October 2002. Cape Town: Government Printer. Available from: https://www.gov.za/sites/default/files/gcis_document/201409/a28-020.pdf

South Africa. Department of Energy (DOE). 2016. *Integrated energy plan.* Pretoria: Department of Energy. Available from: http://www.energy.gov.za/files/IEP/presentations/Integrated-Energy-Plan-22-Nov-2016.pdf

South Africa. Department of Mineral Resources and Energy (DMRE). 2019. *Integrated resource plan (IRP2019).* Pretoria: Department of Mineral Resources and Energy. Available from: http://www.energy.gov.za/IRP/2019/IRP-2019.pdf

South African Photovoltaic Industry Association (SAPVIA). 2020. Understanding the REIPPPP RfP. [PowerPoint slides]. Presented on 17 September 2020. Available from: https://sawea.org.za/wp-content/uploads/2020/09/UNDERSTANDING-THE-REIPPPP-RfP-WEBINARFinal.pdf

Stands, S.R. 2015. *Utility-scale renewable energy job creation: An investigation of the South African Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)*. (Thesis). Stellenbosch University, Stellenbosch.

Stephens, S. & Robinson, B.M.K. 2021. The social license to operate in the onshore wind energy industry: A comparatives case study of Scotland and South Africa. *Energy Policy,* 148(B):111981. https://doi.org/10.1016/j.enpol.2020.111981

Swartz, K. 2019. *Addressing community energy challenges with utility-scale: A case study of Hopefield Wind Farm.* (Thesis). Stellenbosch University, Stellenbosch.

Tajne, P. 2015. *The dark side of renewable energy: Negative impacts of renewables on the environment*. Altenergymag.com. [Online]. Available from: https://www.altenergymag.com/article/2015/08/the-dark-side-of-renewable-energy-negative-impacts-of-renewables-on-the-environment/20963 [Accessed on 7 May 2021].

Taylor, A. & Winter, J. 2013. *Welcome to the Boomtown! Darwin and the 'Boomtown Syndrome'*. Darwin: Charles Darwin University. Available from: https://www.cdu.edu.au/sites/default/files/research-brief-2013-3.pdf

Taylor, S.J., Bogdan, R. & DeVault, M.L. 2015. *Introduction to qualitative research methods: A guidebook and Resources*. Hoboken, New Jersey: Wiley.

Terrapon-Pfaff, J., Dienst, C., Konig, J. & Ortiz, W. 2014. A cross-sectional review: Impacts and sustainability of small-scale renewable energy projects in developing countries. *Renewable and Sustainable Energy Reviews,* 40:1–10.

Thopil, M.S., Bansal, R.C., Zhang, L. & Sharma, G. 2018. A review of grid-connected distributed generation using renewable energy sources in South Africa. *Energy Strategy Reviews,* 21:88–97. https://doi.org/10.1016/j.esr.2018.05.001

Turgeon, A. & Morse, E. 2012. *Geothermal energy*. [Online]. Washington, D.C.: National Geographic. Available from: https://www.nationalgeographic.org/encyclopedia/geothermal-energy/ [Accessed on 2 November 2021].

United States Energy Information Administration. 2021. *Biomass explained: Biomass: Renewable energy from plants and animals*. [Online]. Washington D.C.: U.S. EIA.

Available from: https://www.eia.gov/energyexplained/biomass/ [Accessed on 2 July 2021].

Usman, A., Ameta, S.K., Tukur, A., Danjuma, M.S., Yusuf, T.U., Hamza, Y.G. & Bolya, K. 2020. An overview of the adverse effects of renewable energy sources. *International Journal for Research in Applied Science & Engineering Technology,* 8(VII):477–486.

Van der Walt, M., Van den Berg, J. & Cameron, M. 2017. *State of renewable energy in South Africa 2017.* Pretoria: Department of Energy. Available from: http://www.energy.gov.za/files/media/Pub/2017-State-of-Renewable-Energy-in-South-Africa.pdf

Vezmar, S., Spajic, A., Topic, D., Sljivac, D. & Jozsa, L. 2014. Positive and negative impacts of renewable energy sources. *International Journal Electrical and Computer Engineering Systems,* 5(2):47–55.

Weinstein, A.L. 2014. Unconventional oil and gas development's impact on state and local economies. *Choices,* 29(4):1–7. http://www.jstor.org/stable/choices.29.4.06

Wlokas, H. 2017. *Implementing community renewables: Institutional work in South Africa's renewable energy procurement programme.* (Thesis). University of Cape Town, Cape Town.

Wlokas, H.L., Boyd, A. & Andolfi, M. 2012. Challenges for local community development in private sector-led renewable energy projects in South Africa: An evolving approach. *Journal of Energy in Southern Africa,* 23(4):46–51.

Wlokas, H.L., Westoby, P. & Soal, S. 2017. Learning from the literature on community development for the implementation of community renewables in South Africa. *Journal of Energy in Southern Africa,* 28(1):35–44. https://doi.org/10.17159/2413-3051/2017/v28i1a1592

World Health Organization (WHO). 2009. *Research ethics committees: Basic concepts for capacity building.* Geneva, Switzerland: World Health Organization.

World Wide Fund for Nature (WWF). 2017. *Renewable energy: Facts and futures.* Cape Town: WWF. Available from: https://wwfafrica.awsassets.panda.org/downloads/WWF_Energy_Facts_and_Futures_Final_Version.pdf?21841/Renewable-Energy-Facts-and-Futures

Wrinkler, H. 2005. Renewable energy policy in South Africa. *Energy Policy*, 33(1):27–38. https://doi.org/10.1016/S0301-4215(03)00195-2

Yelland, C. 2020. South Africa's energy policies: Are changes finally coming? Édito Énergie, Ifri, December 16, 2020. Available from: https://www.ifri.org/sites/default/files/atoms/files/yelland_south_africa_energy_policies_2020.pdf

Zillman, D.N. & Solomon, S. 1983. The impact on communities and legal problems of major energy development in the United States. *University of Western Australia Law Review*, 5(15):64–84.

Annexure A
Ethical Clearance

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

02-Aug-2021

Dear Mr Modirapula Mabele

Application Approved

Research Project Title:
Effect of renewable energy on communities: Upington, Northern Cape Province.

Ethical Clearance number:
UFS-HSD2021/1019/21

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Dr Adri Du Plessis
Chairperson: General/Human Research Ethics Committee

Adri du Plessis
Digitally signed by Adri du Plessis
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Annexure B
Main Proposal

Local impacts of Concentrated Solar Powerplant

Funding:

Main contract: The project is funded by the European Community Horizon 2020 program (H2020-LCE-11-2017, Project number 792103, SOLWATT – "Solving Water Issues for CSP Plants)[7]

Contract with UFS: Sub-contracted by Cranfield University in the UK

Aim:
To investigate the Community acceptability and livelihood impact of Concentrated Solar Power (CSP) plants on local communities.

Objectives:

- To establish the socio-economic consequences of locating CSP plants in South Africa, China, India, Kuwait, and Spain. (This application is only for the South African leg of the research).

- To investigate a CSP plant's livelihood and sustainability impacts local communities close to plants using focus groups and semi-structured interviews across mentioned countries.

Background:
Globally, renewable energy plants are becoming the norm, and CSP plants are common. However, global research on the local impacts remains limited. This research is interested in the effect of a CSP plant's construction, operation, maintenance, and decommissioning on different stakeholders like communities, policymakers, and utilities. The focus is on the local economy and environment. Despite the expected social, economic, environmental, and even geopolitical benefits of CSP plants at the macro level, there is a lack of evidence on whether those benefits trickle down to local communities and how they influence livelihoods. The reductions in the costs of CSP plants due to technological advancement may create risks for a 'race to the bottom' whereby international private investors search for countries and locales with the least stringent environmental and social standards for project development. Such risks highlight the importance of addressing these knowledge gaps around how CSP plants influence local communication across social, economic, environmental, and livelihood aspects, emphasising water consumption.

Building on existing livelihood and environmental impact assessment frameworks, the project focuses on the effect of installing large scale plants. Given early stages in the operations of CSP plants, we will aim to draw lessons from other industrial experiences, for example, in mining, chemical processing, and forestry, as well as analysing the relevance of different analytical frameworks around vulnerability and resilience of communities, water resources and

[7] For more information about the project please see https://solwatt.eu

ecosystem services in a changing. The review will cover both academic and practitioner sources. However, specifically in the area of CSP, there is much highly relevant expertise to be found in the work of GermanWatch, and the many Institutes with which the project partners are connected, such as ENIT (Tunisia), MASEN (Morocco), CDER (Algeria), CSERS (Libya), MASDAR (Abu Dhabi), and ASRT (Egypt).

Merely "engaging" with the local community will not lead to local acceptance. The research will focus on the barriers (whether cultural, social, economic, gender-related or ethical) to implementation. In doing this, we will aim to build on insights from energy studies literature on lack of public trust towards utilities, the importance of place attachment, community ownership and community benefits on public acceptability of renewable energy projects. In uncovering these issues, we will focus on long term impacts.

Site and participant selection and recruitment

This project investigates the impact of a CSP plant on local communities using an empirical and bottom-up approach. The research team selected five global locations: South Africa (Upington), India, Spain, Kuwait, and China. The sites were also chosen to represent communities that are facing water shortages or water stress. The three specific localities in South Africa are Raaswater, Keimoes and Upington. These were selected based on their distance from the CSP plants.

The project will use two research methods. First, we plan to analyse the importance of these issues within the broader context of the national economy and regional or local policy frameworks using semi-structured interviews with key informants (N=15-25). These interviews will target utilities, policymakers, project developers, planners, CSP operators, government organisations, and academia. They will be guided via an open-ended interview schedule and carried out either by phone or face-to-face. The focus will be on creating opportunities to seek clarification and more in-depth information. The interviews will be recorded and translated into English (if necessary). For these interviews snowballing methods will be used to

The second method includes focus group meetings. We shall three focus groups with 6-8 people in each of the three areas (Raaswater, Upington and Keimoes) (N = 54-72). The interviews will determine the impacts of CSP plants on socio-economic development and the livelihoods of local communities. In organising these workshops, we will consider local culture and traditions in terms of having mixed-gender groups, even though ideally, we would like to have a mix of gender, income and age groups. In particular, we are interested in the perceptions of the costs and benefits of CSP plants by surrounding residents, the impacts of CSP plants on the availability of water resources and any changes impinged upon their daily lives. In doing this, we will aim to build on insights from energy studies literature on lack of public trust towards utilities, the importance of place attachment, community ownership, community benefits on public and acceptability of renewable energy projects. For recruitment, we shall work with a combination of ward councillors, appoint local recruiters and a pamphlet inviting people to participate.

All interviews and focus groups data will be analysed using thematic coding. The output of this task is a report on the socio-economic impact of CSP plants in arid locations.

Annexure C
Interview Profile

Profile

Interview number	Name of interviewer	Capacity of interviewer
1	Phia	Businessperson: the transport industry
2	Phia	Politician (Councillor) and business person
3	Phia	Community Liaison: solar plant
4	Phia	Businessperson: construction
5	Phia	Engineer
6	Phia	Local Municipality
7	Jan	Social worker
8	Jan	Estate Agent
9	Jan	NGO
10	Lochner	13 January?
11	Lochner	17 January 3:30?
12	Lochner	17 January 4:31?
13	Phia	Department of Environmental Affairs
14	Phia	Department of Environmental Affairs
15	Phia	Businessperson and contracts with CSP plant
16	Jan	Businessperson
17	Lochner	5 Februarie?
18	Lochner	16 January (1)?
19	Lochner	27 January (1)?
20	Lochner	27 January (2)?
21	Lochner	16 January (2)?
22	Anita	National African Farmers Union (would like to be updated on research results)
23	Anita	Industrial Development Corporation (would like to be updated on research results)
24	Phia	Department of Economic Affairs

Annexure D
Focus Group Interview Schedule

Community Acceptability & Livelihood Impact

Interview Schedule

Welcome **TBC.** **[15 mins] ALL**	• As participants arrive, welcome them, tell them the location of toilets, invite them to help themselves to tea, coffee and biscuits. [A PowerPoint slide will be displayed detailing the Workshop agenda] • Tick off their name on the participant list and give them a name label (also categorised as 'A' ', B' or 'C' according to a broad age range. • Give them an information sheet • Give them the 'entry' questionnaire • Give them a consent form • Give them a pen and encourage them to take a seat to read and fill in the forms. • **One of the facilitators/institution hosts presents the prepared PowerPoints:** A PowerPoint slide will be displayed detailing the Agenda of the session also to give an overview of the projects and to give more insights to participants about CSP plants **Note**: Any latecomers will presumably be directed to the main room. The facilitator (or helper if we have one) based in the main room will take them to their assigned group, tick them off the participants' list and ask them to fill in their forms while sitting in their designated sub-group (to minimise interruption). **Funding**: If anyone asks about funding, this is funded by the 'European commission-H2020.'
TBC. **GROUPS**	• Introduce yourself, observer (if applicable) and that you are from Cranfield University and the University of the Free State • **About the research:** o Welcome: Thanks very much for coming today. I hope you have had a chance to look at the Information Sheet [hold up sheet]. The Workshop is about 'investigating the livelihood impact of a CSP plant on local communities, across five different countries across the globe. This is our Workshop here in Keimoes/Raaswater en Upington. Workshops are also being/will held/hold China, Kuwait, Span and India, so we can also compare people's views in different countries about Concentrated Solar Power Plants. • **About today's discussion:** o There are no right or wrong answers, and this is not a test – hopefully, you might enjoy it!

	○ The aim is to understand the impact of Concentrated Solar Power Plants on your day to day life. ○ Everyone should express their views, so please speak up (All your opinions will remain confidential, and we will not disclose any names). ○ However, please, try not to speak while someone else is busy talking. ○ We have quite a lot to cover, so I may have to cut off the discussion at specific points to move on to the next topic. ○ Everything you say will be kept confidential, and all information gathered today and used in the report will be anonymised – that is - you will not be identified. ○ What you say may be used in project documents and published reports. ○ We want to record the discussion. The recording will assist us to write about the interview accurately. Is that okay? ○ The Workshop will finish at ……. ○ Lastly, please turn off your mobile. • **Any questions?** • May I take your completed consent forms and questionnaires? • Please keep hold of your Information sheet. Our contact details are on the bottom, so if you want to contact us for any reason after the Workshop, then please feel free to do so. • I will also be around at the end of the Workshop if you have any comments or questions. [Hand out post-it notes] As the discussion progresses, feel free to write anything that comes to mind on your post-it notes – as well as contributing to the specific. [TURN ON DIGITAL RECORDER]
Introductions + warm-up	• To start with, if you could briefly tell us: ○ what you do – if you are working or studying, for instance
Time: TBC **General Awareness and Acceptance** **[Flipchart]** **[25 mins]**	**STAGE 1:** **General Awareness and Acceptance** 1. Can you explain what you do know about renewable energy? 2. How do you think having the concentrated solar thermal plant in your town/city changed your interest in renewable energy and environmental issues! 3. What is your opinion about the concentrated solar thermal project in your town!

	4. Will you support the construction of more concentrated solar thermal plants in your town? Why! 5. How did you find out about concentrated solar thermal development in your neighbourhood! 6. **2. Advantages and Disadvantages** 1. Can you tell us about any positive impacts that concentrated solar thermal had on your town? a. How significant are these impacts? b. How long do these impacts last? 2. Can you tell us about any disruptions/issues that the CSP project caused in your local area? Do you know in what phase of the project this happened? c. How significant were/are these disruptions? d. How long do these impacts last? 3. Overall, do you have any concerns about the impact of these projects in the future!
Time: TBC. approx **Social Capital** **Time: TBC. approx** **[15 mins]**	**Social Impact** **1.** What is your opinion about the impact of the Khi Solar One plant on the cultural identity and regional reputation of your town/city? (Such as changes in economic profile and revenue characterisation of your town/city)! a. How significant are these impacts? 2. Can you tell us about any changes that the concentrated solar thermal plant (Khi Solar One) has made to the social structure (such as population size, social inequality) of your town! a. How significant these changes are/were? b. How long these changes last!…
Financial **Time: TBC approx** **25 Mins**	**Financial** Can you tell us about the main economic benefits of concentrated solar development thermal (Khi Solar One) in your town? a. How significant these benefits are! 1. Can you tell us the main economic disadvantage of developing the concentrated solar thermal plant (Khi Solar One) in your town? a. How significant they are!

	2. What do you think about the impact of the Khi Solar One plant on your town's living standard and lifestyle! a. How significant are these impacts? 3. What is your opinion on the impact of concentrated solar thermal (Khi Solar One) on local jobs? Do you think the project creates/creates more jobs in your area? a. How significant are these impacts? (Very low, low, medium, high) 4. What is the industry and income of your town? Can you tell us about any issues/changes the concentrated solar thermal project (Khi Solar One) made to your town's primary activities/ industry? a. How significant these impacts are! 5. How do you think the concentrated solar thermal development (Khi Solar One) has changed your town's economic activities (e.g. purchasing, or selling goods or services) of your town! a. How significant these impacts are! b. How long these changes last!
Welcome back **5 mins**	**STAGE 2:**
Natural Impact **[20 mins]**	1. Tell us about any environmental impacts (e.g., noise pollutions, air pollutions) that concentrated solar (Khi Solar One) had/have in the neighbourhood. a. How significant are these impacts? b. How long do these issues last? 2. Tell us about any disruption that the concentrated solar thermal (Khi Solar One) caused on the wildlife in your region? a. How significant was/is the issue? b. How long did the issue last? 3. Since installing the Khi Solar One plant, have you encountered any issue accessing water for your day-to-day life (drinking, agriculture)! Have you had this issue before? a. How significant was/is the issue? b. Is this issue still there, or it was temporary? 3. What is your opinion about the impact of concentrated solar thermal (Khi Solar One) on agriculture activates? a. How significant they are!

	b. How long these changes last! 4. To what extent do you think the concentrated solar thermal project (Khi Solar One) has hurt the land value of its surrounding land for agriculture activities! 5. In your opinion, what is the impact of the concentrated solar thermal plant (Khi Solar One) on the water access or water security of on local area around the plant! a. How significant they are! b. How long these changes last!
Human and Physical Impact 25 min	• **Human Impact (Discuss following in 25 mins)** 1. Are you aware of any issue that the concentrated solar thermal (Khi Solar One) workers (e.g. health and safety issues) come across during their time working there! a. If yes, how significant these issues are? 2. Can you think of any changes in the wellbeing and health of people living around plants due to the development of a concentrated solar thermal plant (Khi Solar One) in your area? 3. Can you tell us about any changes to your working conditions (such as wages) due to the developments of this project (Khi Solar One) in your town/city! 4. To what extent concentrated solar thermal development (Khi Solar One) in your town change local knowledge and skills? (For example, any training for workers in the concentrated solar thermal field? **Physical:** Can you tell us about any improvements made in your community infrastructure (such as access to clean water and health care facilities) due to concentrated solar thermal development (Khi Solar One) in your town/city?

Closing all	The facilitator summarises the key themes of the session. Participants have the opportunity to raise: Differences? Similarities? Conclusions Thank you very much for coming. Let us know if you have any further questions/comments. Alternatively, you can contact us - details on your Information Sheet – if anything comes to mind at a later date. Thank you again, answer any questions, and listen to any comments.

Annexure E
Key Informants

Interview Topic Guide: Investigating Community Acceptability & Livelihood Impact

About the research:

Thank you very much for accepting to talk to us today. This research aims to 'investigate the livelihood impact of a CSP plant on local communities. This study is also held in China, India, Kuwait, and Spain to compare the views of experts about CSP plants in different countries. I want to learn more about your views and perception about the Concentrated Solar Power plant in the Upington, Keimoes and Raaswater area.

General Questions

1. What is your opinion about concentrated solar thermal power plants (Khi Solar One)?
2. How did this project come about! What was/ is the primary driver of the development of this project Khi Solar One?
3. What were the main challenges/barriers that the Khi Solar One plant has faced during its development?

a. Are you aware of any public opposition the Khi Solar One project faced during its development? If yes, do know you what the cause was?

b. In; overall, what do you see as the main barriers to CSP development (Khi Solar One) in your country!

4. What is your opinion on the most prominent benefits of the Khi Solar One plant in your town/city?
5. Can you tell us about any issues/disruptions that CSP (Khi Solar One) has caused to the day-to-day lives of local people in the town during its construction or operation! How significant were these disruptions?

Physical (Regional Infrastructure)

6. What are the impacts of the Khi Solar One on energy infrastructure and energy access of your town/city! How significant were/are these impacts?

Financial

7. What is your opinion about the impact of concentrated solar thermal (Khi Solar One) on other economic activities such as agriculture or……?

8. To what extent do you think the CSP project (Khi Solar One) has/hurt the land value of its surrounding land for agriculture activities!
9. Can you tell us about any issues/changes the CSP project (Khi Solar One) has made to your town's primary activities/ industry? How significant they are! How long these changes last!
10. What is your view on the impact of concentrated solar thermal (Khi Solar One) on local businesses and SMEs?
a. What is your opinion on the effect of the CSP plant (Khi Solar One) on the employment opportunities in …. City/town? How significant are these impacts? (Very low, low, medium, high)?
11. What is your view of the effects of the Khi Solar One plant on the living standard and economic situation of the local community around the plant! How significant are these impacts?

Social

12. Can you tell us about any changes that the CSP plant (Khi Solar One) has made to your town's social structure (such as population size, social inequality) of your town! How significant these changes are/were? How long these changes last!
13. What is your view on the impact of the Khi Solar One plant on the cultural identity and regional reputation of your city/town!

Natural

14. What is the impact of the CSP plant (Khi Solar One) on the water access/ water security of on local area around the plant!

15. Can you tell us about any changes that the CSP plant (Khi Solar One) has made to the local landscape and wildlife of the region? How significant these changes are/were? How long did these changes last!

Annexure F
Final Expert Interview

Interview Topic Guide: Investigating Community Acceptability & Livelihood Impact

Research Brief:

Thank you very much for accepting to talk to us today. The aim of this research is to 'investigate the livelihood impact of a Concentrated Solar Power (CSP) plant on local communities. This study also will be held in four other countries so we can also compare the views of experts about CSP plants in different countries. I would like to find out more about your views and perception about the existing CSP plants in South Africa.

A. General Questions

1. What roles can Concentrated Solar Power (CSP) plants play in South Africa energy system? What are the main drivers of CSP developments in South Africa?
2. What were the main challenges/barriers that generally CSPs in South Africa have faced during their development?
    a. Are you aware of any public opposition that any CSP project faced during their development? If yes do know you what was the cause?
    b. Overall what do you see as the main barriers to CSP development in your country!
3. What's your opinion on the most prominent benefits of the development of CSPs on your country?
4. Can you tell us about any issues/disruptions that CSPs have caused to day to day life of local people around the plant? In what phase construction or operation?! How significant were these disruptions?

B. Regional/National Infrastructure

5. What are the positive/negative impacts of the CSPs on energy infrastructure and energy access of South Africa?! How significant were/are these impacts?

a. What was the impact of these projects on load shedding?

b. How do investments in CSP plants contribute to meeting South Africa's energy needs and its export capabilities?

c. Financial

6. What is your opinion about the impact of CSPs on economic activities such as agriculture?

7. In what extent do you think the CSP project has/ had a negative impact on the land value of its surrounding land for the agriculture activities!

8. Can you tell us about any issues/changes that the CSP project has made to the main activities/ industry around the plants? How significant they are! How long these changes last!

9. What's your view on the impact of CSP on local businesses?

   a. What is your opinion about the impact of the CSP plant on the employment opportunities of the local community around the plants?! How significant these impacts are?)? How did they change during the construction of the plant?

10. What is your view on the impact of CSPs on the living standards and living style of the local community around the plant! How significant these impacts are?

d. Social

11. Can you tell us about any changes that CSP plant has made to the social structure (such as population size by immigration) of local communities around the plant! How significant these changes are/were? How long these changes last!

12. What is your view on the impact of the CSPs on community atmosphere and culture of local community around the plants?

13. Can you tell us how local people have been informed about CSP projects? And how did that develop over the course of the project? In what phase of project development?

e. Natural

14. What's the Impact of the CSP plant on the water access/ water security of on local area around the plant!

15. Can you tell us about any changes that CSP plant has made to the local landscape and wildlife of the region? How significant these changes are/were? How long these changes last!

Extra Question (Please ask this only from CSP developers and CSP operators and other related people)

16. What do you do with broken mirrors how you dispose them!

Annexure G
Approval Letter to Secondary Data

UFS·UV

26 June 2021

To whom it may concern

Local impacts of Concentrated Solar Powerplant: UFS-HSD2019/1690

I, hereby, give Mr Mabele access to the data for the project mentioned above.

Professor Lochner Marais

Annexure H
Plagiarism Report

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This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

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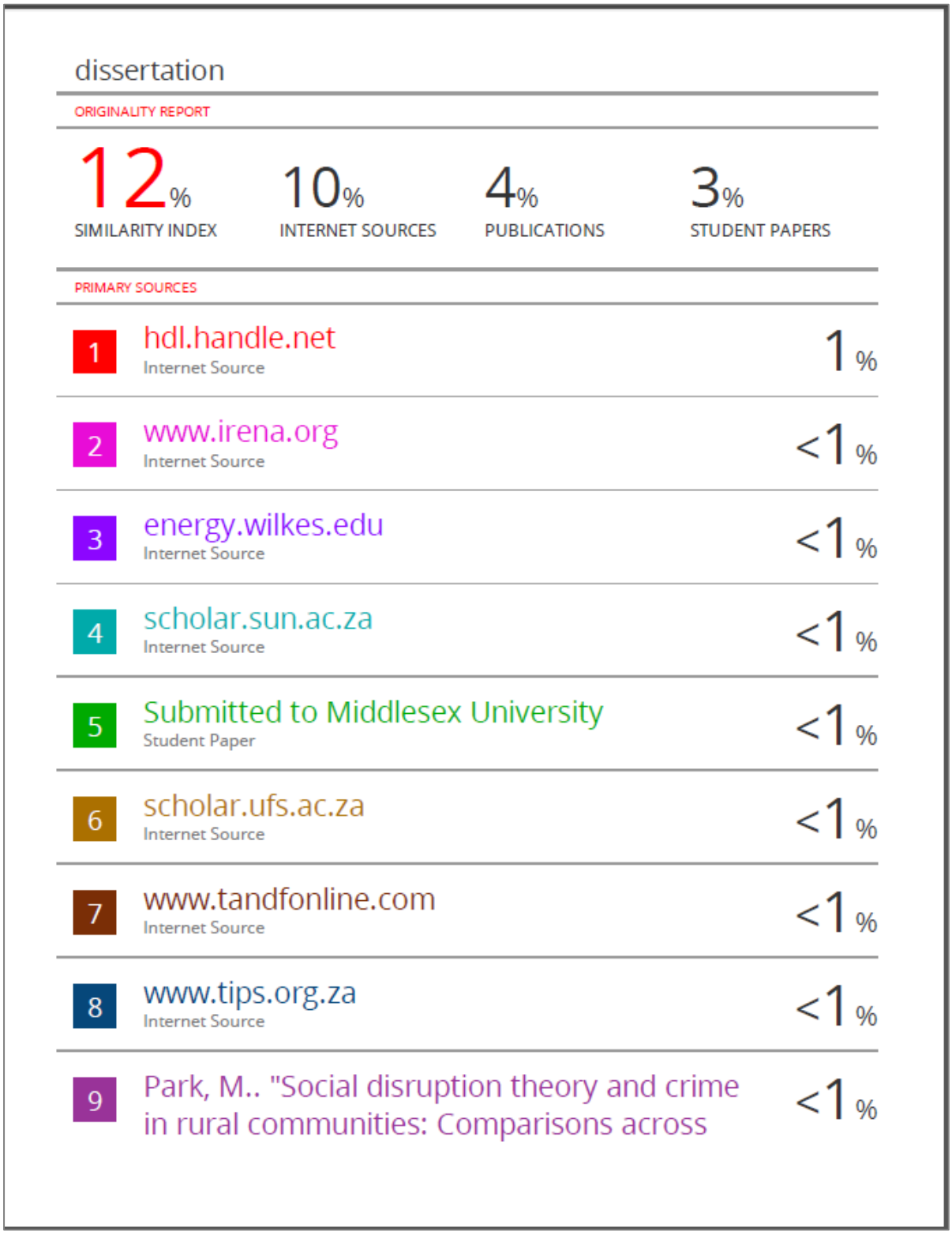
EFFECT OF RENEWABLE ENERGY ON COMMUNITIES: UPINGTON IN THE NORTHERN CAPE, SOUTH AFRICA

BY

MODIRAPULA BERNARD MABELE



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Annexure I
Confirmation of Editing

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Proofreading | Technical Editing | Metadata Specialist | Indexing

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8 November 2021

CONFIRMATION OF EDITING

I hereby confirm that I have done the technical layout and editing for the following thesis:

Student:	Modirapula Bernard Mabele
Title:	Effect of renewable energy In Upington, Northern Cape South Africa
Degree:	Masters of Development Studies (MDS)
Department:	Centre for Development Support, Faculty of Economic and Management Science

My work for the student included the technical layout of the document, as well as language editing for grammar, punctuation, spelling, and sentence structure. I tried to keep as much as possible of the student's own writing style while making sure that the student's intended meaning was not altered in the editing process. I also checked the list of references making sure that dates, spelling, and names used in the text are consistent with those listed in the reference list.

I have a B.Bibl. (Hons.) Degree and have been working as a cataloguer, metadata specialist and librarian for 29 years. I am an expert in the field of bibliographic information and resources. I have also completed a 10-week Copy-Editing course at the University of Cape Town.

Disclaimer: The ultimate responsibility for accepting or rejecting the changes and recommendations rests with the student and I cannot be held responsible for any layout or language issues that might have emerged as a result of subsequent amendments to the text.

Yours sincerely,

Nicolene Barnard