Prosocial motives of solar entrepreneurs combating energy poverty in South Africa

BY

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Abstract

Purpose: This study seeks to examine prosocial motives of solar energy entrepreneurs as they generate energy to combat energy poverty in South Africa.

Design/Methodology/Approach: Using a qualitative research method, data, in *words* of survey participants, were collected from social purpose and profitable solar energy businesses using a semi-structured interviews technique. These represent the reality of the interviewed Social Entrepreneurs because their societal world deals mainly with socially constructed issues. A pre-developed 'codebook' forms the basis to build categories of social issues and to consequently amalgamate codes into umbrella themes that enable researchers carry out structured and systematic contextual analysis.

Findings: Motivated by innate feelings of compassion, empathy and extrinsic concerns for the environment, solar entrepreneurs embark on social venturing to collaborate with municipalities to deliver public services, to the group of vulnerable energy poor South Africans gain access to public benefits, like access to clean energy, which are frequently out of reach of township as well as slum dwellers operating mainly in the informal sector.

Originality: This study contributes to our understanding of how solar energy entrepreneurs operate and adapt to the complexity of public energy service delivery venture in South Africa.

Keywords: Energy poverty, complex business models, public service delivery, social entrepreneurship.

1. Energy poverty in South Africa.

There are different approaches to defining energy poverty, though it is typically taken to describe the situation of a lack of access to energy or fuel resources necessary to create a good life (González-Eguino, 2015; Jenkins et al., 2016). When defined to include the lack of access to safe, clean and reliable energy services, spending more than 10% of disposable income on energy[1], and experiencing thermal inefficiency, such as not having a dwelling ceiling, between 43% (DoE, 2013) and 47% of South Africans are deemed to be energy poor. As such, people who are members of households experiencing difficulties in meeting various types of energy needs are considered energy poor. This applies not only to problems with access to electricity, but also to heating and hot water (Tundys, et al., 2021).

[1] which the poor do compared to middle to high income households who spend on average 2-3%.

Prior to 1994, electrification rate in south Africa was low, at around 36%. Democratic South Africa prioritized universal energy access such that by 2004 national electrification rate increased to around 66% (Bekker et al., 2008), reaching 90% in 2018 (Essex & de Groot, 2019). For the energy poor, this is just sufficient for lighting, and powering black-and-white television and radio, as well as for occasional basic cooking.

The energy-poverty nexus is complex and reflects configurations of socio-energy systems that create extractive feedbacks, over time, between elements of poverty that reinforce or exacerbate energy insecurity, on the one hand, and economic insecurity (Sovacool, 2012). The situation is partly the outcome of disadvantaged personal circumstances that reflect the legacy of income inequality[2] and low socio-economic conditions (Nguyen & Nasir, 2021; Recalde et al., 2019), perpetrated by the previous apartheid system which segregated Blacks, and other racially disadvantaged groups to poor older infrastructure and resource neighbourhoods where structurally deficient houses, with poor energy infrastructure, also required relatively more energy to cool or heat, thus resulting in higher energy expenditures and eventual energy poverty (Lewis et al., 2020).

State utility company, Eskom, is poorly maintaining its power stations, incurs huge operational costs, is massively overspending on building new plants, and is struggling to combat its supply chain management corruption (David, 2015; Stone, 2021). Thus, Eskom's crisis is both financial and operational, requiring on-going state bailouts, US$ 3 billion both in 2019/20 and 2021/21 financial years, that places a strain on government budget (Curran & Ahmed, 2020), to repay otherwise unserviceable debt[3]. Many of Eskom's problems are a consequence of underinvestment, the halting of grid extensions, linked to a significant loss of vital skills to the private sector (Botha, 2019; Lenferna, 2021), leading to increased energy poverty. A hefty chunk of Eskom debt – some $3.75-billion from the World Bank – went towards the construction of two massive new coal- fired power stations, Medupi and Kusile, which have been plagued by construction delays, cost overruns and endemic corruption. Initially priced at $4.7-billion each, they have since 2008 cost Eskom nearly double that at $17.5-billion in total. As of 2023, neither is fully operational yet (Zulu, 2023). Municipalities also owe Eskom just over R25 billion, which is increasing rapidly (Styan, 2019), aggravating Eskom's financial challenges.

[2] one of the highest inequality rates in the world, with the poorest 20% of South Africans consuming less than 3% of total expenditure, whereas the wealthiest 20% consuming 65% of total expenditure (World Bank 2017).
[3] the utility is technically bankrupt with liabilities totalling R387 billion in March 2018 and growing exponentially (Styan, 2019).

Eskom lacks sufficient generating capacity (South Africa produces around 47,000 MW against an installed generation capacity of 52,000 MW) and is struggling to satisfy growing demand for electricity in the country (Makgopa & Mpetsheni, 2022). The result is a purposeful rotation of electricity outage, called loadshedding, following accurate prediction of the system's decay, used to ease strain on Eskom whenever consumption exceeds availability (Makgopa & Mpetsheni, 2022). With loadshedding going on for the past 15 years, Eskom's power reliability was at its all-time lowest in 97 years (Brown, 2020) disrupting and closing businesses and negatively impacting on households, costing the economy between R60-billion and R120-billion in 2019, when the country experienced 530 hours of outages, amounting to 1 353 GWh.

In 2018, South Africa was generating only 5% of its electricity from natural gas (DoMRE, 2019). The country has introduced a gas independent power producer's procurement programme aiming to acquire an extra 3.7GW (Ting, 2019) to bring natural gas contribution to about 10%, to reduce carbon emissions. Also, as South Africa's solar resources are the third largest internationally (Semelane et al., 2021), municipalities are embracing solar photovoltaic (PV) systems to provide access to 'affordable clean energy' (SDG 7) and adding to 'climate action' (SDG13), in relation to providing solar energy off-grid solutions (Kabir et al. 2018) with minimal Green House Gas emissions, aiming to provide affordable and universal electricity access by 2030, for peace, prosperity, people, and planet (UN, 2019), and reduced gender inequality (Dinkelman, 2011).

This has culminated in a country-wide rollout of national small-scale embedded generation (SSEG) (mostly solar PV for commercial and industrial businesses) and private sector large-scale projects for energy intensive users, such as mines, to generate solar power, alongside solar-diesel hybrid power or battery energy storage systems for overnight operations (GreenCape, 2022).

As such, social entrepreneurs (SEs) are now involved with municipalities in SSEG or distributed generation, a viable option for businesses and high-income consumers. The 2019 South Africa's integrated resource plan (IRP) envisions solar energy contributing 21% to the country's electricity grid by 2030 including those provided by independent power producers. IRP allocates 500 megawatts (MW) of annual capacity to distributed electricity generation from 2023 to 2030, and up to 4,000 MW which can be fed onto the grid[i].

In September 2020, government issued a section 34 determination for the procurement of a further 11 813 MW of renewable energy (RE) between 2022 and 2027, of which 6 800 MW was allocated to wind and solar PV; of this 513 MW was allocated to capacity generated from storage in 2022 and 2 088 MW by 2030. Combined with changes to the Electricity Regulation Act, this was to herald a freer, more 'liberalized' electricity market, in which municipalities and

end-users would be more empowered in their energy choices, further enabling the potential to harness the development of 30 GW of CSP, 40 GW of solar PV and 4 GW of solar thermal, by the year 2050 (Shilpi, Jain & Iliso, 2017).

Socially and environmentally inclusive renewable energy (RE) social enterprises are catalysts in creating socio-economically innovative local/regional ecosystems for RE in emerging economies. The complexity of SEs' energy generation business models is reflected in the context that includes public-private partnerships and the outsourcing of government public service delivery functions (Bollecker & Nobre 2010) or corporate-NGO collaboration (Dahan et al. 2010). SEs do strive to meet the need of economically, historically disadvantaged or socially deprived communities (Seelos & Mair, 2005), as they take tangible steps to overcome social problems (Johnson, 2000) and to tackle the stubborn levels of inequality, operating in the clean and RE space, to improve access of the energy poor while addressing issues such as poverty or pollution.

This paper contributes to the growing number of studies focussing on SEs in Africa that examine the motivations and intentions to start a social enterprise (Ghalwash et al., 2017) and antecedents to become a social entrepreneur (Elliot, 2019). SEs foci consist of multiple activities, from the exploitation of opportunities to build social wealth (Sarif, Ismail, & Sarwar, 2013) to entrepreneurial activity based on communal or environmental initiatives (Canestrino et al., 2020). Our study focuses on solar SEs' social, environmental and compassionate motives for starting their ventures, an area that is under-researched in the context of Africa. Research is very limited on the complex challenges confronting social entrepreneurs (SEs) as they provide solar energy to combat energy poverty. An exploratory study that looks at complex issues confronting SEs as they generate solar energy for eventual public service delivery is therefore warranted.

There are significant challenges in affectively reaching vulnerable populations, such as people in extreme energy poverty and in remote regions of South Africa, or the underserved dwelling in townships and informal settlements. Whilst solar energy technologies are becoming increasingly affordable and accessible to the bottom of the pyramid (Agarwal et al., 2018), their uptake remains remarkably low in South Africa due to reasons of the appeal to connection to the national electricity grid. SE provides an alternative dissemination method that can benefit the entire value chain whilst concurrently providing access to basic technologies, self-regulated by free market choice (Shrimali et al., 2011). This paper consists of six sections. Following an introduction, section two reviews salient literature on the motives of social entrepreneurs in combatting energy poverty; it also highlights the study conceptual framework,

while the third section describes research methods. Results are presented in section four which are discussed in the fifth section. The last section concludes the paper.

1.1 South Africa's energy policy development.

Energy policy development in South Africa covers political interventions to address the issue of inefficient, old buildings and a lack of adequate heating systems in residential buildings. As the energy poor tend to have little or no incomes, some policies are directed at providing income-based financial assistance allowing households to access basic units of electricity that meet household's basic energy consumption per month. In this regard, South African municipalities must provide free basic electricity (and other services) to many poor households as a matter of constitutional right, despite their inability to pay.

Four main energy policy objectives confronting South Africa relate to "ensuring energy availability", "maintaining profitability of the coal sector", "environmental and climate protection" and "reducing income inequalities and employment insecurity" (Hanto et al, 2022). The post-1994 democratic dispensation prioritized improving energy access founded on the realization that energy poverty deepens general poverty and contributes to eroding health and education outcomes (RSA, 1998), to morbidity, political unrest, and environmental instability (Sovacool 2014). Government hence instructed Eskom to extend energy access to all South Africans as a critical public service delivery item.

Eskom has a policy of below-cost pricing of energy public service delivery, necessary to achieve ameliorating high energy poverty incidence. This is because between 20% and 25% (Wolpe & Reddy, 2015) of electricity generated in South Africa is consumed by low-income earners, rising to 31% in major cities (Wolpe & Reddy, 2015). Hence, energy public service delivery affordability challenges are daunting. The poorest spend 27%, while poorer urban homes spend between 12% and 20%, of their monthly household income on energy (Joubert, 2016). With customers' living in poverty, only a fraction of the costs of electrification gets recovered through electricity payments by users as Eskom can only increase electricity tariffs slowly with regulatory approval.

Electricity is deemed as "the most flexible and convenient form of energy" (Armaroli & Balzani, 2016: 48). Extending the grid to every South African household is financially, organizationally and technically challenging to the government. Even after being connected to the national grid, many poor South Africa households could not use electricity because they were not able to afford it, and hence continued to cook with kerosene and wood. Therefore, electricity consumption rate among the poor therefore remained extremely low.

Swilling et al. (2021) advocated for South Africa to replace its ageing coal-dependent power stations, so as to trigger an upstream industrialization that will catalyze the re-industrialization, creating an estimated 50,000 jobs per annum in construction and operation of wind and solar plants. This is in line with government policy of planned decommissioning about 5,400MW, 10,500MW and 35,000MW of coal generation in 2022, 2030 and 2050, respectively, to create an unprecedented challenge to maintain and improve power supply(DoME, 2019).

2. Literature review

2.1 Meaning of entrepreneurship

The term entrepreneurship is defined as a multidimensional concept (Verheul et al., 2002), that encompasses a range of business activities from the process of “creative destruction” (Schumpeter, 1934) to innovative creation of additional value for an existing or “new organization” (Harbi & Anderson, 2010). Entrepreneurship is also described as an attempt at new business or venture creation, such as self-employment, new business organization, or the expansion of an existing business, by an individual, a team of individuals, or an established business. An entrepreneur is willing to engage in a risk acceptance provided by self-employment. The engagement can vary from survival to growth-oriented activities. Recently, entrepreneurship is seen as a pathway to reducing poverty and conflicts in developing countries (Bruton et al., 2013; Tobias et al., 2013). However, only 35% of individuals studied in South Africa perceive entrepreneurial opportunities and also have the intentions of starting a new business, within the next six months, below the average of 70% for sub-Saharan Africa.

2.2 Reducing energy poverty as a social issue

The energy poor fall into two categorized of people. The first are those that are highly vulnerable to energy poverty, comprising over 1.4 billion people living on less than $1.15/day, without access to safe, reliable and efficient energy sources for domestic use (cooking and lighting) and/or for mechanical use. The second group comprises over 3 billion people (nearly 50% of the World’s population) who depend on the use of harmful energy sources such as biomass-generated energy for cooking and heating (UN-Energy, 2010).

Reducing energy poverty is recognized as a social issue (Awaworyi et al., 2020; Llorca et al., 2020) that is taken as part of sectoral policies conducted by countries as an element requiring political interventions and sixty-eight percent of SEs in Nigeria support poor people (British Council, 2023).

2.3 Motivations of social entrepreneurs

Social entrepreneurship, as a field of research, has been focusing on the role and interactions between government, non-governmental organizations (NGOs) and profit-focused businesses (Guo et al., 2020). This is because diminishing government support encourages entrepreneurs to tackle emerging societal problems in an innovative and sustainable manner (Lubberink, 2020).

Motivations and expectations (expected social, economic or environmental effects) are the principal factor which differentiates those successful nascent entrepreneurs from those who fail to achieve business success (Renko *et al.,* 2012:667). Chandra and Shang (2017) found that motivations can be traced back to a social entrepreneur's past. As such, SEs usually have the intention to do so from the beginning. This is followed by events that trigger their intention to start the business which invariably culminate in opportunity identification. In this context, individuals' intentions are the results of their attitude, subjective norms and perceived behavioural control (Ajzen, 1991). Once SEs' intentions are triggered by events, SEs knowledge of status quo, community influence, entrepreneurship, social problems, political problems, personal factors, situational factors, etc. are also triggered (Ebrashi, 2013). It is these triggering occasions that direct the connection between SEs intentions and behaviours and build the consistency of intentions to frame SEs behaviour.

2.3.1 SEs' social concerns as business motive

Stephan and Drencheva (2017) as well as Bartha et al (2019) show that SEs differ from traditional entrepreneurs by having more "social concerns," a greater sense of moral obligation and a higher degree of empathy (Ruskin et al., 2016; Lubberink, 2020). South Africans could be socially excluded as they suffer from unemployment, have poor skills, low incomes, and are unfairly discriminated against. Given this context, SEs may consider it very crucial to 'tie together' territorially disjoined or isolated rural areas and townships, by providing a physical infrastructure such as electricity to increase social resilience as well as facilitate direct social production processes (Mueller, 2001). As such, prosocial motivation enables SEs to develop socially-oriented situational factors that push individuals to act outside the laws and regulatory guidelines in society (Minola et al., 2016), using culturally prescribed aspirations in the realization of SE desires. SEs are characterized by creating social value, but that does not imply that all social value creating organizations are SEs (Dwivedi & Weerawardena, 2018). This is due largely to the fact that increasing number of commercial organizations create social value, but their motive remains profit-oriented.

2.3.2 SEs' compassion as a business motive

SEs subscribe to the notion that social change shall not happen without focusing on people, as they are the primary assets, benefactors, and beneficiaries of any investment in the community (Di Domenico, Haugh, & Tracy, 2010). Compassion as an intrinsic motivation (Nhemachena & Murimbika 2018) for SEs is defined as a multi-stage social process of alleviating someone else's suffering (Kanov et al., 2004) that starts when someone notices another person's pain, an event called the pain trigger (Dutton et al., 2006). There is the reality of widespread poverty in South Africa, heightened by mass unemployment and a stagnant economy compromising individuals' ability to afford Eskom's electricity bills. It is the process of noticing someone else's pain, empathetically understanding it, through two complementary mechanisms: self-efficacy and social worth (Bacq & Alt, 2018), and responding in some way designed to alleviate it (Frost et al., 2000; Kanov et al., 2004). The impulse to be compassionate is innate (Frost et al., 2006), in that people are intrinsically moved to help when they see other people in pain by a prosocial motivation that produces empathy for a suffering individual or community (Goetz et al., 2010; Nussbaum, 1996). SEs' social businesses, in this context, are those whose benefit goes to a localized and weak section of the society (such as the poor, long-term unemployed, disabled, discriminated, socially excluded, etc.), a group that is often neglected by the government (Seelos & Mair, 2005; Certo & Miller, 2008). This motivation is key to social entrepreneurship (Miller et al., 2012), because it enhances awareness of vulnerable circumstances and leads to an understanding of the significance of suffering and the issues contributing to it (Nussbaum, 2003), shifting cost/ benefit analysis and the risks associated with SE venture, making them become more palatable.

2.3.3 SEs' local environmental concerns as a motive

Clausen and Rudolph (2020) emphasized the environmental motivation in the political economy of RE technologies planning and development as SEs, policy makers and other stakeholders link RE technologies to the decarbonization of the energy sector. In this context, climate variability, climate differences in a local context (Castaño-Rosa, et al, 2021), and socio-demographic factors are important for the occurrence (increase or levelling) of fuel poverty. Systems that are less carbon intensive and vital for advancing human development, resolve energy access and energy poverty issues in rapidly growing countries like Vietnam, Brazil, India, South Africa, and poorest countries transitioning from agrarian to industrial societies (Dasgupta & Roy, 2017; Mark et al., 2017). The geographical area and degree of urbanization of municipalities can be critical factors in the context of analyzing and addressing energy poverty (Barrella, et al., 2021). In addition, local, social or lifestyle motivation/orientation contributes to greater local embeddedness of business initiatives (Korsgaard, Ferguson & Gaddefors, 2015; Morrison, Ramsey & Bond, 2017). Local traditions and SEs community roots

also work as a trigger to start a social business. Indigenous traditions work as a foremost factor in social entrepreneurship (Widjojo & Gunawan, 2019). Skills and knowledge that come from within the local community, supported by the active participation of local people, help SEs to reach multiple goals. Ayeni et al., (2021) talked about the desire of African people to gain social acceptance, respect and recognition by enhancing their economic status through SEs, formal or informal.

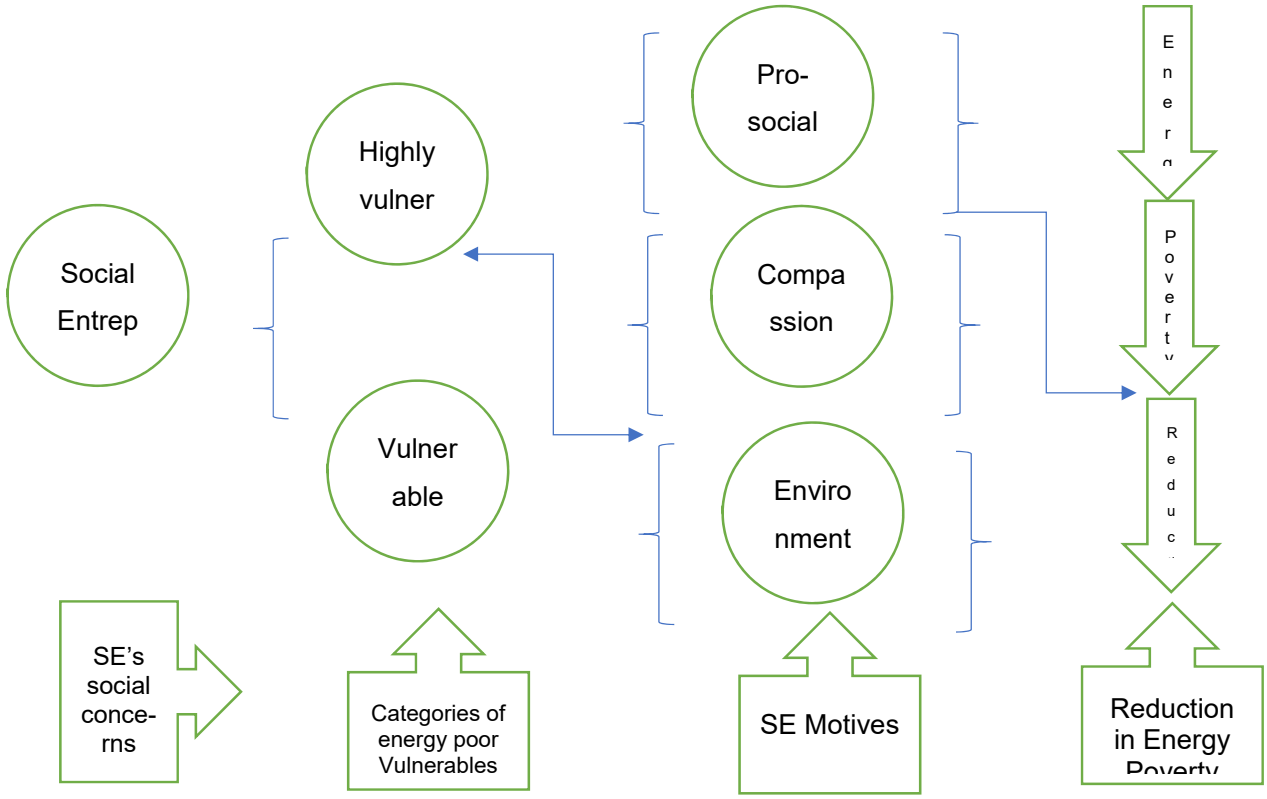
Overall, while the commercial entrepreneur seeks to create private value, SEs prime motivator is to create societal value (Mair & Noboa, 2003; Santos, 2012), so as to do something for mankind (Ghalwash, Tolba, & Ismail, 2017).

2.4 Conceptual framework of social entrepreneurship and energy poverty

While SEs are an effective way to solve social problems, there is very little theoretical guidance on how they can assist in reducing energy poverty especially in townships, informal settlements, and slums in South Africa. Understanding the role of SEs in addressing energy poverty through a theoretical realm will provide a guiding framework to undertake systematic empirical investigation. Therefore, using a constructivist grounded theory method (Charmaz, 2016), a conceptual framework is presented in Figure 1, based on several scholarly contributions in the fields of SE motivation, and how the concepts of the literature review relate to each other and to the themes developed in the paper, assisting us in data gathering and eventual analysis. The purpose is to expand the discussion on the role of social enterprises in combating energy poverty by looking at the motives that underpin their business venture. Our pro-social motives encapsulate compassion for the plight of others, social as well as environmental motivations though some authors find this distinction blurring (Mirvis, 1994). This is because authors like Anderson (1998) purport that entrepreneurship and environmentalism are both similarly founded on value. Overall, the main motives of SEs are the promotion of social welfare and value creation through the display of innovativeness, leadership, and risk management of business.

The two categories of South Africans who are highly vulnerable and vulnerable to energy poverty are the millions of individuals who simply cannot afford the electricity Eskom sells (Zulu, 2023). The first group experiences financial difficulties in meeting their energy bills. The other group consists of the poor (low-income) households who have no difficulty paying their energy bill but are energy poor because of their residence in remote, under-served communities. Social entrepreneurs draw on their innate compassion, borne out of empathy, to set up business ventures through which they adopt innovative practices to improve energy access of these individuals to environmentally friendly energy sources such as solar energy.

Figure 1: Conceptual framework of SEs pro-social motives for combatting energy poverty



Source: Authors adaptation.

3. Research method

Our study is inspired by the previous research such as that of Nhemachena and Murimbika (2018) who used a quantitative method to examine the motivations and impact of sustainable entrepreneurship on enterprise performance in the Gauteng province of South Africa. However, the research question which inspired our study is the following: What are the motives of solar entrepreneurs as they combat energy poverty in South Africa? Centered on a real problem (Carboni et al., 2019), neglected problems with positive externalities (Santos, 2012), and following the suggestions of Dudovskiy (2019), Benoot et al (2016), Jacques-Aviñó and Lopez (2019), among others, the study is qualitative in design, focusing on purposefully selected formal hybrid SEs who have been sourced from their professional networks, involved in solar energy public service delivery, in collaboration with local municipalities, and whose clients are also business beneficiaries and have automatic value spill overs. These hybrids have low risk of mission drift and the achievement of financial sustainability is relatively easy.

3.1 Study context

To combat energy poverty, as of 2018, 22 Municipalities in South Africa were providing free solar systems to 113, 200 indigene households (Stats SA, 2018). Also, in 2020, South Africa installed an estimated capacity of 330 MW from approximately 13,000 SSEG projects. In addition, the City of Cape Town in 2022 launched its own programme to procure about 200 MW of installed power capacity from IPPs, targeting low carbon projects greater than 5 MW (GreenCape, 2022). Low carbon power sources lend themselves to decentralized solutions that can be quicker and cheaper to build. Conveniently, the sampled SEs were specifically selected from the country's most economically active municipalities, which are vigorously pursuing a programme of purchasing electricity directly from IPPs of RE. This is to further strengthen the validity of the research findings.

3.2 Sampling technique

One important criterion of Yin (2018) advises to select participants equitably, so that the right people who understand the phenomenon should be selected. The study participants consisted of ten solar energy business managers/owners who served in a leadership role in solar energy companies and who understood the phenomenon under consideration. Conveniently, the sample group was specifically selected from three different geographic locations, namely Pretoria, Johannesburg and Cape Town, which are vigorously purchasing electricity directly from independent power producers (IPPs) of RE. This is to further strengthen the validity of the research findings.

Using a theoretically-based construct, a semi-structured interviews technique was adopted. We scheduled face-to-face interviews, at their preferred locations, with a purposively selected group of 10 social entrepreneurs (Patton, 2002), who were senior managers or executive management individuals within the sampled organisations, who identified their organizations as SEs. A pre-developed 'codebook' formed the basis to further build the categories that could consequently be amalgamated into umbrella themes to enable the researcher carry out structured and systematic contextual analysis. Also, following Ciambotti et al (2020), the main themes follow predetermined questions that we asked in varied chronological order. Within them, participants were encouraged to speak freely about their perceptions and experiences. To generate many new codes from open-ended questions, researchers probed participants further until data saturation was reached after 12 interviews were conducted (Guest et al., 2006). Interviews data collected are in *words* of survey participants, representing the reality of the SEs interviewed because much of what their societal world deal with is *socially constructed* (Gioia et al. 2013). Data were supplemented by audio recordings of interviews which were

transcribed and uploaded to ATLAS.ti for data analysis by performing a thematic narrative analysis (Czarniawska, 2004).

3.3 Description of Participants and Context

Shown in Table 1, the 10 respondents were managers/owners of SEs operating in Gauteng and Western Cape provinces in Pretoria, Johannesburg and Cape Town, whose ventures are aged between 2 and 40 years. Older companies are concentrated in Johannesburg where the two youngest companies are also based.

Table 1I *– Survey Participants and Context*

Participant's Pseudonym	Industry	Company Age	City
Participant 1	Solar & Renewable Energy Company	17	Pretoria
Participant 2	“”	3	Johannesburg
Participant 3	“”	17	Pretoria
Participant 4	“”	2	Johannesburg
Participant 5	“”	16	Cape Town
Participant 6	Solar products, devices; Operation and maintenance	40	Johannesburg
Participant 7	“”	10	Pretoria
Participant 8	“”	36	Johannesburg
Participant 9	“”	9	Cape Town
Participant 10	“”	33	Johannesburg

4. Findings

Deductive and abductive methods were combined for the data analysis. Four thematic vignettes emerged from our data, which have been drawn to mirror Hanto et al (2022)'s four policy complex challenges confronting South African energy sector. These thematic vignettes are our own elaboration of the original data and can be considered as a synthetic representation of the most relevant themes emerging from the data analysis (Alvesson & Sköldberg, 2018). Drawing from Alexander and Becker (1978: 94), “vignettes are short descriptions of a person or a social situation which contain precise references to what are thought to be the most important factors in the decision making processes of interviewees.”

4.1 Thematic Vignette No.1: Ensuring energy availability.

SEs are acutely aware of the regulatory and social environments (Aure, 2018). SEs have a deeper commitment to providing for communities (Bakker & De Vreese, 2011). SEs expressed

their views on overall energy availability, beginning with their views on public sector energy service delivery.

4.1.1 Public service delivery challenges of municipalities/Eskom.

> "*In my view, people have to talk to Eskom to let them know that there is space for others to play in this space; Eskom must accept that every institution, together and separately, has a responsibility to address energy poverty by generating and/or distributing electricity… Though Eskom is really big in this business, they cannot tackle the problem single-handedly."*
>
> ---------- Participant 6

Raza et al. (2020) found that power outages impacted negatively on enterprises' overall expenditure; business quality of service suffers as a goods expire and devices malfunction. SEs expressed the view that the inefficiency of Eskom is everybody's problem:

> *"Some people think that Eskom's problem is a central government's problem only. Frankly speaking, this is a narrow view! Power is an essential utility for everyone. But because Eskom is not a private enterprise, SEs have to operate in the sector with the ultimate aim of ensuring energy need sufficiency for the country, for sustainable economic growth.''*
>
> – Participant 2

SEs do not trust Government to provide public service, citing lack of funding and a lack of political will:

> "Government does not see *Eskom as driving this economy. Eskom is seen as a toy to be played with."* – Participant 09

4.1.2 Perception of Eskom's service delivery challenges

SEs also discussed their perception of Eskom/Municipal energy public service delivery challenges in the country as follows:

> *"If you look at a township, for example; it costs Eskom or the municipality close to R16,000 - R20,000 to establish an electricity connection point per site, to get electricity to the stand; service delivery becomes challenging to government when the users at those stands are buying the barest minimum usage of electricity. You know, the first units of power used by township dwellers are free of charge, and then Eskom can only charge some money after a certain unit of electricity usage."* – Participant 3

4.1.3 SEs innovate through collaborations with energy regulators

In the Western Cape Province, 22 out of 25 municipal electricity distributors allow SSEG to connect to the grid, and 17 have varying tariffs (GreenCape, 2020). SEs achieve success of the regulatory framework through innovative collaboration:

> *"We were among the first few companies to register with the country's electricity regulators (NERSA). We went through the whole process and obtained a registration certificate. We have hence been told, by NERSA, that we have shown others the way and have helped to establish the functionality of the process."* – Participant 3

4.2a Thematic Vignette No.2: Doing profitable solar business by satisfying community energy needs

SEs have to consider what energy "needs" of the community are as they seek to address them. SEs then *configure* the forms of already-designed energy product whose service to implement to provide energy access. The most frequently cited code group was the relationship with communities and beneficiaries.

> *"I've got the community and they support our business implementation plan and the solar product offering. And they support me as a friend which goes for a lot."* – Participant 3

> *"Given the market environment, our main strategy is to simply ensure that our installations are compliant with regulations." – Participant 8*

> *"I think the most important strategy, at the moment, is getting customers to patronize our business, and getting them involved in the whole process. And, you know, asking them questions, what their needs are, telling them about our solar solutions to their energy needs."*
>
> *– Participant 7*

SEs highlight the importance of trustworthy third-party solar panel installers:

> *"A big issue, in terms of the business model, is that we rely on third party installers. These are not always reliable. The problem, at the moment, is that we cannot just trust any Tom, Dick and Harry installer."*
>
> – Participant 1

"I mean that instead of deploying an engineer to do designs, for example, we have got a reputable company that we contract with."

------ Participant 3

4.2b Maintaining profitable solar energy business

Related to local realities of regulations and grid capacity (Naber et al 2020), and the sophistication of SEs interventions required (Abrams et al., 2022), SEs engage in complex relational value chains and interact with mutually dependent buyers and sellers, where mutual trust, family ties, and ethnic ties support the function of these chains.

4.2.1 Passion as SE motive

"*I work very hard. I work seven days a week, 10 to 16 hours a day. My weekends are my favourite days as nobody's bothering me during the weekend. And I can just get my work done. For me, it was being all about being able to work with other people and bringing everyone together… And honestly, I'm not doing it for the money*" – Participant 9

"*I built the business because of passion. I didn't make any money during the first three years*" – Participant 4

4.2.2 Building sustainable venture

SEs were however preoccupied with the notion of creating a sustainable solar energy venture:

"And I want people to choose me because they know that if they saw me in five years, I'm still going to be doing this." – Participant 7

"My ideal scenario is where everyone would be working for free, including myself; and the suppliers would donate the equipment to us. But that is very unsustainable; Maybe it will only get one solar panel up on one roof. The reality is that I need to be paid and I need people around me need to make money as well." – Participant 3

4.2.3 Business volume

A large factor in SE consideration is that of the profitability of solar panels, as well as the willingness to invest (Naber et al., 2020). Some interviewees expressed a sense of urgency in solving market failures. This is sometimes as a result of the perceived viability of alternative solutions:

“All these alternatives need a certain amount of volume for them to work. So, if you're already set with yours, just make your decision quickly.” – Participant 2

4.2.4 Product Value

Solar energy opportunities bring in differentiated economic value, or profit potential of introducing new goods, services, raw materials and organizing business methods (Long & McMullan, 1984). As such, solar product value is among those elements that are deemed important to our interviewees.

> “……We understand our business success by the sale of our solar product. We determine that a particular brand is in demand because more and more people are asking for it. As social entrepreneurs, this means that we are satisfying the social needs of this community with this particular brand. It takes time to restock with the popular brand which we have identified because it is the brand that meets the social need.” ---Participant 10

SEs emphasized the importance of solar product affordability:

> “*I just like to make it more affordable to people in in all areas of South Africa. I make it possible for people to be able to afford solar. So, I keep our packages well priced and competitive.”*
>
> – Participant 6

Furthermore, product value is also more than just about quality; it is about receiving value for money in addition to its affordability.

> “*Suddenly, we see that people are squandering so much of these massively valuable cash flow annuities on Eskom. So, instead of just giving them very valuable assets, the aim is also to give them value for money... Honestly, I want to give people the best value for their money.”*
>
> ------- Participant 4

Interviewees indicated that a product has to be reliable and sustainable:

> *“We aspire to be the Rolex watch of the solar energy industry. We are not cheap. This is because we don't want to go back and fix our systems later.”* -------Participant 5

"*We are differentiated more in terms of having a relationship with our clients that is based on mutual trust; We are offering products they can actually believe in."* – Participant 2

There is also SE cognizance of the implication of trading poor products and services:

"Currently, if something goes wrong with your product, there's no maintenance support… So, I decided to offer good quality solar products because other companies are offering just about anything, any product at all, irrespective of quality."

--------- Participant 8

"Competitors put on a lot of mark-ups on their products; and I feel for people because especially in South Africa, many people don't have the money to go solar" – Participant 1

"We don't like the solar products that others are offering."

– Participant 2

SEs stress the importance of having a simple and understandable product offering to reduce confusion in the market:

"*It's product they can understand, it's product that does what it is supposed to. It's simple."* – Participant 5

"We don't have sentimental attachment to any particular complex brand that is not identified by the community as satisfying their needs."

-- Participant 6

"*And the thing about our network is that it is simple, and it's the most critical thing."* – Participant 4

SEs also emphasise the need for products to be modular and scalable, which enables them to provide a more affordable product:

"*We will start with a scale system and a larger inverter; then we add panels. As we go on, we build it up using a modular approach."*

– Participant 5

4.3 Thematic Vignette No.3: Environmental and climate protection.

SE activities could also be based on communal or environmental initiatives (Canestrino et al., 2020). In line with South Africa's commitment to reduce its CO_2 emissions to 34%, below a business-as-usual scenario by 2020, and below 4% by 2025 (Eberhard et al., 2014), REIPPP projects have now generated 6 422 MW of energy and contributed to "a reduction of 33.2 million tonnes of CO_2 (IPP Office, 2021:9). SEs interviewed aim to address social issues such as contributing to climate change sensitivity, being socially and politically active and shaping the status quo (Bliuc et al., 2015) and also being motivated by personal benefits, feeling good about their actions, or being part of a greater cause. SEs highlight the importance of creating climate change awareness through education and marketing, and how RE could improve their lives if a possibility is present and can be taken advantage of (UN, 2010).

"*People are very unaware of their carbon footprint."* – Participant 4

Environmental concerns, as a mission of SEs, is also validated by the following interviewee:

> "*I thought that if I didn't start a company that was reducing carbon dioxide, that I was part of the problem and not part of the solution. So, it was a moral decision for me to identify this niche market.*"
>
> – Participant 10

SEs measure their impact in terms of their business operations reducing their carbon footprint:

> *"I decided that I was going to start planting trees to contribute to climate change awareness. That was my first choice, CO_2 reduction by planting trees... So, I started planting trees; but it was taking close to 70 years to reduce 3.7 tons of CO_2. Since the whole point was removing CO_2, and to mitigate CO_2 was my goal; so, I looked at Solar Geyser business; It costs about R40,000 and about three hours to install. The minute it is installed, it mitigates 3.7 tons of CO_2 forever."*
>
> ------ Participant 5

4.4a Thematic Vignette No.4: Compassion to reduce Inequality and ensure employment security

SEs foci consist of multiple activities that build social wealth (Sarif, Ismail, & Sarwar, 2013) in the community. Employment security is perceived by SEs through the lens of solar energy system value delivery. The value of having a trusting and supportive relationship with suppliers was emphasised.

4.4.1 Opportunity identification and evaluation

The first step in the creation of any new venture is opportunity recognition, where a potential entrepreneur spots an unmet need or uncovers patterns that results in a new venture (Davidsson, 2015). Arising from prior knowledge or mentorship (Ozgen & Baron, 2007), opportunity discovery is related to entrepreneurial passion as positive feelings are sustained with business maturity and these feelings lead to the creation of additional ventures (Collewaert et al., 2016).

SEs try to combat energy poverty by identifying opportunities for intervention and carefully evaluating them.

> *"It actually becomes much more than a social economic issue. It's a fed-up issue… the problem is stupidity! we are going beyond problem solving."* ----- Participant 5

Opportunity recognition could come naturally (Corner & Ho, 2010) and moderate the relationship between socio-political activity and SE intention by giving the entrepreneur an increased awareness of social business opportunities. The existence of solar energy public market failure creates these opportunities for SEs which they explore in marketing household's electricity systems that can support varying bundles of LED lights, mobile phone chargers, radios, fans and/or high-efficiency televisions (SEforALL, 2018) and clean cooking solutions. This leads the analysis to the social needs for solar energy.

Joubert (2019) and Villiers (2019) highlight that loadshedding creates a conducive environment for criminal activities. As such, SEs specifically voice a number of concerns relating to social needs that are a result of unreliable power utility services:

> *"Consider a colleague of mine in the office, his family was tied up with this last unscheduled load shedding, with whole bunch of alarms, giving false positives and the batteries are flat and we're seeing a scenario where security alarm companies don't respond; and cell phone towers are down; so, he wants you to call for help; but you can't. The criminals know how the burglar alarm operates and they know how to strike."* ------*Participant 4.*

The social needs are not limited to the wealthy:

> *"Most people can't really afford backup power systems such as generators. It is only people at the top end of the market that can afford backup generators. And that's how, effectively the low end of the South*

African market is hit the hardest by energy poverty. This stops them from becoming successful entrepreneurs."

– Participant 3

"And our company has no access to other sources of electricity, no security cameras or guards at these big complexes. Security guards don't undertake regular business patrols. Going by previous experiences, their security Guards lost their lives in some previous attacks." – Participant 4

However, the opportunity evaluation process is not limited to market failures and just identifying social needs, but it also extends to identifying economic opportunities especially in neglected market segments:

"The problem with normal solar installations is that everyone does industrial, commercial strip malls, shopping centres, and so forth where the volume is higher. In South Africa, industry uses 40% of electricity volumes, while residential users pick up about 36%."

– Participant 4

"Constant increases of electricity prices are problematic. Electricity tariffs went up by about 300% in the last few years. During crises situations, they charge high tariffs; In a way, government can help companies to save on the bottom line in terms of electricity costs."

– Participant 3

4.4.2 Solar energy value capturing for comparable energy service delivery

The process of value capturing was regarded as a highly important category. The strategy of solar SEs is to keep solar energy service at a price that is close to what people currently pay for lower quality energy service like kerosene or batteries (UNF, 2003). Interviewees explained that brand equity was the most valuable construct of value capturing as their business activities have a strong influence on the reputation of their companies:

"You need to drive investment into this new sector, the solar energy sector, for it to be viable and that's one of the problems we're trying to solve… to create value for everyone. Otherwise, it won't be sustainable." – Participant 2

"*Although we are not actively marketing it, the word of mouth of your social impact initiatives feeds back into your business by creating a reputation that's desirable for the markets... my customers create customers for me."* – Participant 1

4.4b Compassion to reduce energy access inequality: complexity of ecosystem sensing mechanism

SEs gave insights into how they perceive the possibility of improving energy access through ecosystem sensing mechanism. SEs have to have adaptive capability to be informed and aware of changing technology, regulations, market needs, customer needs, competitors, and changes in the industry. SEs discussed various narratives about the complexity of the ecosystems. SEs in Western Cape are implementing a number of off-grid energy solutions for low-income households to facilitate community led energy provision for areas that are unserviced or unserviceable by the main grid (GreenCape 2020).

4.4b.1 Evolving technology

SEs use business principles of understanding customer needs to subsequently adapt solar energy market offerings to gain competitive advantage (Agarwal et al., 2018: 235).

"Every day, there's new technology, there's new things… it's evolving rapidly, Yes, solar technology is evolving every day." – Participant 1

4.4b.2 Emergent change

"You don't have to be a mathematician to understand that there is always going to be at some point what Malcolm Gladwell describes as a tipping point." – Participant 5

Interestingly, a high level of competitive tolerance was found in the data. As SEs emphasise having a trusting relationship with competitors:

"In the solar industry I'm not threatened by anybody… To be quite honest. People think they're competing with me." – Participant 1

An attuned leadership enable SEs to gain insight and awareness of the ecosystem.

"You know, we've got first-hand knowledge and experience of what is actually going on." – Participant 3

"We have to keep in touch, and to keep up to date with our network on certain products, and of changes to legislation."

– Participant 1

> *"Relationships enable SEs to be adaptive. You know that there is a legislation or new notice coming out that will impact on SE operations. Okay, we have to be sure of it keep track of what is happening in the market."* – Participant 3

This view was supported by the necessity of creating a broader learning environment from a social enterprise perspective.

> *"Everybody in the industry is always learning."* – Participant 1

Within the context of being attuned to the business ecosystems and creating a learning environment for greater business awareness, SEs alluded to the need to engage women's SE competence. It is suggested that women have a more empathetic approach to business which enables SEs, and their network in general, to have greater business sensing capabilities:

> *"it seems like in the industry there is a need for a more empathetic approach."* – Participant 1

4.4b.3 Possibility of feeding into the grid

Some SEs are motivated by the desire to feed energy back to the grid to generate extra revenue after meeting (a part of) their energy needs. In Cape Town 18 commercial enterprises and 42 homes are now generating their own electricity from rooftop solar PVs and feeding excess into the national grid (Cloete, 2016). While benefiting individual consumers feed-In-tariff (FIT) policies that make households net energy generators, are known to threatens the financial viability of state utilities. As such, Baker and Phillips (2019), Lemaire (2018) and others, believe that the policy makers' preference given to grid connection is associated with the influence of political and trade union (COSATU, 2018) in energy policy making. In South Africa, between 40% and 53% increase in small, medium and micro-enterprises energy uptake is attributable to the grid rollout (Prasad & Dieden, 2007).

5. Discussion.

To address energy poverty in the long term, South Africa could use its reserves of shale gas in the semiarid Karoo region, estimated at 13 trillion cubic feet of shale gas reserves (US Energy Information Administration, 2013). Also, among the initiatives being proposed to solve the problem of poor access to new sources of energy in many developing countries, is the introduction of advanced hybrid technologies such as electrical heat pumps powered by photovoltaic panels, which are considered economically and environmentally efficient. The World Bank (2017) hence noted the existence of significant basic services market opportunities for SEs in South Africa that can make energy products and services more affordable to populations that already have access but are often unable to make use of such,

due to competing household cash flow pressures. A small number of SEs are hence currently operating in the energy sector, complementing government provision of free energy services, whose everyday ethics, are frequently marked by 'plurality and complexity, idiosyncrasy if not inconsistency' (Smith & High 2017: 2-3), where such SEs hold the promise that for-profit businesses can 'do well by doing good', targeting solar energy poverty as legitimate arenas for entrepreneurship and corporate activity (Elyachar, 2012).

SEs are hence involved with South African municipalities in small scale embedded energy generation (SSEG) or distributed generation are reducing energy access inequality by feeding excess energy they generate into the national grid. In so doing, SEs are alleviating service delivery pressures on local government by creating alternative service delivery models, especially in the terrain of electricity distribution. Their success in this terrain is due to their innovative ability in creating strong ties and trust with energy poor customers (Shrimali et al, 2011).

The main results of the study indicate that socioeconomic and political motivations underpin solar energy developments in South Africa, including a high incidence of poverty (Fraser 2020a), and a large share of an ethnic/racial group that faces discrimination or political marginalization (Matisoff 2008, Manyaka-Boshielo, 2017, World Bank, 2020).

Cities with large populations might also choose to host solar energy as high population inevitably triggers high electricity demand (Vajjhala 2020) or local environmental and employment benefits (Lyon & Yin 2010). It is hence not surprising that the Gauteng as well as Western Cape provinces of South Africa are embracing solar technology to combat energy poverty. Globally, growing energy use and the degradation of ecosystems have been two important challenges in recent decades (Lei et al. 2021). Environmental challenges such as climate change and carbon emissions have boosted environmental consciousness, and many individuals now prefer to buy with ecological considerations in mind. One of the main strategies for achieving this goal is to use RE sources such as wind, solar photovoltaic, small hydro, biomass, and geothermal, although these alternate energy sources will indeed meet rising energy demand while also improving environmental quality (Gómez-navarro & Ribó-pérez 2018). This hence invokes passion of SEs to build sustainable ventures by considering volumes and prices. SEs do so being cognizant of differential solar energy opportunities as they bring differentiated economic value, or profit potential of introducing new goods, services, raw materials and organizing business methods (Long & McMullan, 1984).

South Africa is currently experiencing a residential solar installation boom, with households importing over R2.2 billion (US$123 million) worth of solar photovoltaic (PV) panels in the first five months of 2022 alone. With solar now becoming a regular feature for businesses of all

shapes and sizes, residential users are investing in solar installations, and this growth is being accelerated due to prolonged load shedding (BusinessTech, 2023). The solar energy sector is, however, characterized by the existence of captive value chains whereby smaller SEs depend to a great extent on collaborating with large clients (the municipalities) as changing to other buyers would induce prohibitive costs (Hein & Kappel, 2014).

Regarding SEs compassion to reduce income inequality and ensure employment security, solar energy farms set-up, in a particular South African locality, utilize local labour, local material, and business, and they also use local banks (Kumar, 2019), which all provide income for community dwellers across many sectors. Solar energy roof installations also provide an additional source of income for land property owners (Renewable Energy Magazine, 2019) and reduced electricity bill for solar energy users (Manufacturers' Monthly, 2019). Also, SEs include farmers in the value chain, mobilize people to actively participate in poverty alleviation, and combine local external and internal resources to improve local-level predicaments in education, employment, medical care, and green energy. This will have long-term rather than short-term positive impacts on many aspects of the local economy, society and ecology, and in the end fulfill the mission of solving energy and overall poverty (Zhang et al 2022).

Energy sector complexity also highlights the strategic importance of business model flexibility. This is especially true in emerging markets where product saturation can become a significant issue after several smaller businesses flock to supply a certain product. When solar energy companies in both India and Uganda found that the pico solar market was becoming saturated, they became innovative to adjust their business model to either find a new market with high demand or pivot to a new product (Abrams et al., 2022).

The solar energy sector is characterized mainly by the existence of captive value chains whereby smaller suppliers depend to a great extent on large clients (e.g., municipalities). In such a situation, changing to other buyers would induce prohibitive costs (Hein & Kappel, 2014). SEs also partner with public organizations to empower local people. SEs fund their hybrid businesses to help energy poor South Africans gain access to public benefits, such as access to clean energy from solar sources, that are frequently out of their reach.

SEs business design has to recognize the complexity of solar product's affordability (Gorevaya & Gorevoy, 2016; Wakeford, 2018), adequacy, reliability, quality and relevance for basic needs when assessing energy access of the community (Kanagawa & Nakata 2008; Winkler et al., 2011), as well as the total initial cost of solar energy implementation. Currently low-income earners are not well incentivized to adopt solar panels in South Africa, the primary obstacle being their income poverty. The cost to consumer to install Eskom regulator approved home solar system before the purchase of any of the equipment is very expensive for households

with strained budgets (Makhabane, 2023). For the lower earning households, the tax incentives may be beneficial if the Government could reduce the regulatory barriers and costs associated with using home solar panels.

SEs provision of solar lanterns is recognized as prioritizing community's lighting needs for education and commercial activities (Kumar, 2018). Solar Home systems, on the other hand, are flexible enabling usage for different kinds of energy service, like watching television or charging batteries for other uses (Schot, Kanger & Verbong, 2016).

As of 2020, 112 REIPPP projects had been awarded in South Africa, representing an installed capacity of 4,459 megawatts in which the private sector commitment of investment totalled $14.4 billion from large international players partnering with emerging local players and creating over 55,000 jobs, with local content spending of about $4 billion (McKinsey & Company 2021).

6. Conclusion

In South Africa, Eskom the state-owned power utility company is failing to expand energy generation and supply infrastructure fast enough to meet the burgeoning energy demand. As revenue streams narrow, Eskom cannot maintain its power stations or build new energy generation capacity. Nor can it service its growing debt. Currently, Eskom's total debt stands at $22-billion (Zulu, 2023).The most important obstacle to expanding grid-based electrification and access are those related to the lack of sufficient generation capacity, poor transmission and distribution infrastructure, regulation imposed low tariffs charged by Eskom, the high costs of supply to rural and remote areas, the inability of low-income households to pay high connection charges, and the weak financial state of the utilities (World Bank, 2017). However, the South African government is promoting the supply of clean energy through private sector investment, of which the RE Independent Power Producer Procurement Programme (REIPPPP) programme is designed to contribute to job creation, social upliftment, and economic transformation, primarily through broader economic ownership (Nomjana, 2020).

Two different types of measures often used to help energy poor households are: 1) renovation measures to improve a home's energy efficiency (such as insulation), and 2) small energy-saving measures and energy-saving advice (van Ooij, et al 2023) to improve the mental well-being of households, as well as having esthetic physical effects. Along these lines, municipalities in South Africa's Western Cape and Gauteng are promoting collaborative engagement with the private sector so as to achieve energy poverty alleviation especially in under-served communities. Examples of interventions they are promoting include the application of appropriate design principles and construction techniques to promote thermal efficiency in informal and formal dwellings and effective education and awareness raising for

low-income energy users, including information about energy efficiency, safety, tampering and theft. Also, solar mini-grids delivered through REIPPPs are being promoted to improve energy storage efficiency of poor households by centralizing the generation and storage of solar electricity and distributing the metered electricity to clusters of households (Conway et al., 2019), and smart grid functionality.

Also, focusing on informal settlements in particular, municipal interventions seek to advance the use of shack-mounted outdoor solar lighting as well as indoor solar lights for households that are not connected to grid electricity and the use of smart cookers and cost-saving as well as energy saving wonder bags with cooking pots (CoCT, 2021). Poverty-alleviation programmes using solar energy (PAPSE) projects are generally structured along the lines similar to community solar programmes and other jointly owned, RE generation projects developed in the United States and Europe. Traditional projects have sought to benefit low-income households by addressing energy poverty and/or by selling the electricity generated to the grid company. Such programmes have been established in sub-Saharan Africa, including Nigeria, Kenya, Ghana, and Uganda (Zhang et al., 2022). As such, a study by Kooijman-van Dijk and Clancy (2010) finds that access to electricity boosts self-employment in home businesses. This could serve as a strong motivation energy justice motive in South Africa where unemployment rate is very high.

6.1 Recommendations

Solving South Africa's energy crisis requires the total rejuvenation of Eskom as a socially owned, publicly funded utility. Undertaking this transformative project necessitates building new generation capacity and maintaining current infrastructure while beginning a substantial transition to renewable energy and a low-carbon economy (Zulu, 2023).

However, where systems are limited, either by the configuration, devices or batteries deployed, solar energy provides for only some of the services upon which people depend. In short, access to solar energy does not replace existing traditional energy use, but operates somewhat intermittently alongside these alternative forms (Cheng & Urpelainen, 2014). For example, solar hot water heating in South Africa provides a specific service alongside other forms of energy provision (Luque-Ayala, 2018; Crousillat, Hamilton & Antmann 2010). Solar is often rather awkwardly positioned in relation to these other forms of energy provision, seen by many participants in our case-study research as inflexible and difficult to budget for

compared to alternative sources that can be consumed in smaller units on a 'pay as you go[4]' basis, like litres of kerosene or bundles of wood.

Electricity load shedding is 'a premeditated power outage in some load zones when it is expected that the power supply cannot meet the demand' (Maqsood et al., 2018). Previous studies reveal that load shedding and its impacts are strongly associated with people's socio-economic class (Cobbinah & Adams, 2018). As a result, residents of low-income areas experience longer hours of load shedding compared to their counterparts in high-income areas. Low-income residential areas also have limited affordable energy options due to their low income and are thus more adversely affected by load shedding (Musademba et al., 2012). Government should consider waiving or subsidizing fees for lower capacity generation solar systems (i.e. 3kva and below) which will allow low-income households to install generating capacity to be able at the very minimum power their lights and fridges.) (Makhabane, 2023).

Also, integrating intermittent generation sources requires back-up generation capacity and storage, flexible transmission and distribution infrastructure, and advanced grid management capacity based on automated or smart controls (Denholm, et al., (2015); World Bank ESMAP (2019). Most crucial are new micro-storage technological solutions for storing energy for low-income households.

Also, more and more research is needed on how different characteristics of energy poor households may interact and reinforce each other in ways that contribute to more adverse living situations (van Ooij et al, 2023).

6.2 Implications for business practice

Effective June 2021, IPPs can now generate 1-100 MWs of electricity, without a licence and are allowed to use the grid to transmit their electricity (GreenCape 2022). It is estimated that RE market opportunity has a future market value of R50 billion/year (approximately 2600 MW of wind and solar/annum) (GreenCape, 2022).

Different solar energy products have different kinds of complexities that translate into a number of complex supply chain routes. SEs must ensure that their solar products are of high enough quality to compete with other energy products of other enterprises. The demand for solar energy products is also volatile, and it is to this that SEs product supply has to respond.

4 More recently solar projects have adopted smart metering technologies to enable pay-as-you-go systems but none of our case studies use such systems.

Solar energy demands a lot of space for installations of solar PV to generate electricity on commercial scale (Deekshant, 2018). It takes over 40 hectares of land to generate about 20 megawatts of energy (Gaille, 2018), making the per kilowatt cost of solar electricity more expensive than that of fossil fuel (Hernandez et al., 2014).
The uptake of South Africa's energy storage market could also be developed to attract investments (GreenCape, 2022), especially on-site SSEG electricity storage using solar battery backup system to combat loadshedding.

SEs also have to solve problems about the time of electricity generation or use. Typically, owners of SSEG, prefer to sell their excess electricity during the day when overall demand is low and Eskom electricity is currently cheapest. Incentivizing these sales could effectively subsidize mid- to high-income households but reduce revenue available to assist low-income households (Fin24, 2016).

There are business opportunities, in the service industry, to maintain and repair energy technology for the energy poor, such as solar home systems, water heaters etc. The SE market in this area needs to be developed in South Africa's urban townships and informal settlements. This could be an important avenue to address the current incidence of high unemployment especially among the youth.

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Appendix A: INTERVIEW GUIDE FOR CONCEPTUALIZING SOCIAL ENTREPRENUERS' BUSINESS MOTIVATION FOR COMBATING ENERGY POVERTY IN SOUTH AFRICA

Semi Structured Interview Questions

A) Why did you decide to start this business?

……

B) Can you please explain how the idea and your business model emerged?

……

C) Context

- What is the Mission of your organization?
- What in your view is the role of institutions in addressing the identified social issue?
- How did you involve potential stakeholders into the design of your business model?

D) Social Entrepreneur

- Do you see yourself as a social entrepreneur?
- What are your values?
- What motivates you?
- What are your ambitions?

[i] Located in the town of Loeriesfontein, Solar Capital connected an 86 MW solar PV plant to the grid in South Africa's Northern Cape in 2023 (Meza, 2023).