



THE SOCIAL AND ECONOMIC RELATIONSHIP BETWEEN RENEWABLE ENERGY (SOLAR) AND GENDERED LABOUR

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By
Julia Taylor
Student No: 2390234

Supervised by Professor Lyn Ossome

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Abstract

The world faces a climate crisis due to the extraction and burning of fossil fuels which has supported industrialisation and capitalist expansion. One of the solutions to the climate crisis is to reduce carbon emissions by transitioning from a fossil fuel-based energy system to one based on renewable sources such as solar or wind energy. The just energy transition promises to address unemployment and poverty while reducing the carbon intensive nature of the energy system. However, this energy transition is complex and holds uncertainty and risk for many people, particularly workers and communities who depend on the coal value chain. This research report adopts a feminist political economy lens to explore the relationship between the development of renewable energy and gendered labour. This approach highlights the importance of the economy, the household and the state in the process of social reproduction. It is relevant to debates about a just energy transition because it highlights gender and racial inequalities and the undervalued and unpaid work required for social reproduction which should be addressed in any effort to achieve justice. By analysing the impact of the development of solar power plants on the workers and communities in three towns in the Northern Cape, and focusing on the three components of social reproduction, I find that the energy transition in its current form will not deliver justice for the poor and working classes.

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List of Abbreviations

COSATU	Congress of South African Trade Unions
CPA	Communal Property Association
FBE	Free Basic Electricity Subsidy
IPP	Independent Power Producers
IPCC	Intergovernmental Panel on Climate Change
IRP	Integrated Resource Plan
IPPO	Independent Power Procurement Office
MACUA	Mining Affected Communities United in Action
MEC	Minerals-Energy Complex
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme

1. Introduction

The world faces a climate crisis due to the extraction and burning of fossil fuels which has supported industrialisation and capitalist expansion. One of the solutions to the climate crisis is to reduce carbon emissions by transitioning from a fossil fuel-based energy system to one based on renewable sources such as solar or wind energy. However, this energy transition is complex and holds uncertainty and risk for many people. This is particularly the case in South Africa which is heavily dependent on coal for electricity. People in regions such as Mpumalanga are dependent on this value chain for jobs, livelihoods and even basic services.

The energy transition is argued to hold much opportunity, with certain developmental agencies arguing for a ‘just energy transition’ which promises to address inequality and poverty while reducing carbon emissions from power generation (Hirsch, et al., 2017). This shift to renewables has support across different stakeholders, as “[l]ow-carbon sources of energy are often framed as more equitable, egalitarian, and just than their fossil-fuelled or carbon-intensive counterparts” (Sovacool, 2021, p. 1). However, workers are wary of this transition as it is not clear what it would mean for livelihoods of communities dependent on the coal value chain, and the nature of work on renewable energy power plants is relatively unknown. There is uncertainty about the opportunities available in the energy transition, particularly if the renewable energy technology is imported and installed through globalised production networks.

One of the challenges in the energy transition is the nature of the coal value chain and how it has shaped and forms the basis of the economy in coal towns. Coal fuels the bulk of South Africa’s electricity generation and is an important input for various industries including liquid fuels and petrochemical production. The coal value chain is estimated to employ 125 000 people, with the majority in mining (87 000), followed by those working at Sasol (26 000) and those working in coal-fired power plants (12 000) (Makgetla, et al., 2019).

Coal mines are concentrated in two provinces in South Africa, Mpumalanga and Limpopo, and many of the towns in those provinces were established because of the coal resources. Therefore, coal towns are often reliant on the income from coal mine workers or power station workers who live there, and, in some cases, the mining company owns and runs waste management and other services usually provided by the state (SAHRC, 2016). If the coal value chain is shut down without considered planning and economic diversification, whole towns in coal regions could become ghost towns.

Another challenge in this transition is the uncertainty around what jobs and livelihoods look like in the renewable energy value chain. Modelling exercises conducted by academics and private companies conclude that the energy transition will lead to a net gain in jobs (IASS & CSIR, 2019). However, upon closer scrutiny of these models, it becomes apparent that most jobs created are in the construction of the power plant, not the operation and maintenance. This means that most of the jobs created will be short-term jobs and provide lower pay compared to the mining industry. If South Africa could develop manufacturing of renewable energy technologies, there could be higher numbers of long-term jobs. But this is uncertain when global production networks mean that established manufacturers dominate the industry with low costs and control over intellectual property (Baker & Sovacool, 2017).

An important dynamic within this question is the gendered division of labour in these different value chains and how energy generation and access relates to social reproduction. The mining sector in South Africa has been shaped by colonial extraction of minerals and exploitation of Black workers and the unpaid labour of Black women. This is because in the 19th century when settlers wanted to mine gold for profit, they required large amounts of energy and labour. In order to create a source of labour, land dispossession and taxation were implemented which forced Black men who were otherwise outside of the monetary system to work to pay these taxes. Mining companies were then able to pay Black men low wages because the social reproduction of labour was subsidised by the ‘family’, essentially Black women, whose unpaid care work and reproduction of labour allowed for profit making of mining corporations (Wolpe, 1972).

Women comprise just 13% of workers in coal and gold mining (Makgetla, et al., 2019). This number is very low compared to other economic sectors. One of the reasons for the low numbers of women is the fact that women were banned from working in mines in South Africa until 1991. Other reasons include bias against females in the design of tools, tests and protective gear, as well as the prevalence of sexual violence underground (Valiani & Ndebele, 2018). There were also superstitions about the presence of women underground causing accidents (Benya, 2017). There is a continued reliance on women’s work which supports the social reproduction of the workforce for mines, even though this role is not widely acknowledged. The activist organisation, Mining Affected Communities United in Action (MACUA) has conducted research to understand whether women experience any benefits from mining activities. They found that only 17% of women have benefitted from mining activities and that most women rely on social grants as their main source of income (MACUA, 2020).

Although women are legally allowed to work on mines, there remains a prejudice towards their ability to carry out manual labour. Women are often informally re-allocated to more ‘feminine’ roles such as carrying water or cleaning on mines, which makes them less likely to receive a bonus and thus increases the gender pay gap (Benya, 2017). Typically, once a woman gets a job on the mine, her husband stops providing financial support to her and the children, leaving her to take responsibility for the financial needs of the household. This puts women mineworkers under significant financial pressure as households are often multi-generational with up to 14 people. As a result, some of these women take out very high-interest loans or supplement their income through selling products such as Tupperware, Avon or clothing. Unfortunately, unions do not see women’s issues as relevant and so do not include their needs in wage negotiations. These issues show that women continue to be marginalised in mining and so mining remains male-dominated (Benya, 2017).

Renewable energy is held up as the answer to climate change, but the social dimensions of renewable energy workers’ lives and local communities is less understood. This research report provides perspective on the interactions between gendered labour and solar energy, the nature of the solar energy value chain, as well as the experiences of workers and communities who live near the solar power plants. The approach focuses on the economic and social relationship between solar power and gendered labour. The aim is to contribute to the literature on the energy transition by exploring how solar power development within the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)¹ relates to gendered labour in three towns in the Northern Cape and provide insight into the potential impacts of the larger scale energy transition for workers and communities. This research is unique due to the feminist political economy approach that highlights the relationship between the energy transition and gendered labour, including understanding whether and how it shifts the conditions of reproductive and productive labour. This approach is relevant to debates about a just energy transition because it highlights gender and racial inequalities and the undervalued and unpaid work required for social reproduction which should be addressed in any effort to achieve justice.

The findings indicate that workers and communities are justified in their scepticism of the just energy transition. In the framework of social reproduction and gendered labour, a real shift

¹ REIPPPP was launched in 2011 as a public-private partnership that allowed private companies to bid for development of renewable energy power plants and entry into power purchase agreements with Eskom, the state energy utility. Bids are scored based on price, as well as social and economic development of local communities (Baker & Sovacool, 2017).

would only happen if solar plants affected one or all of the three components: wages in the economy; grants through the state; or subsistence within the household, on which the communities depend for survival. The experiences of the working classes and surplus populations in three towns in the Northern Cape show that this shift has not materialised as the jobs and livelihoods surrounding solar power plants have not improved their ability to survive or even their access to electricity.

In terms of the wages in the **economy**, the REIPPPP programme is dominated by European firms who hire local workers temporarily through subcontractors who use exploitative practices during construction of the solar plants and thereafter create little opportunity for jobs in local communities. **Households** are partially integrated into capitalist accumulation through other processes, often through mining, and utilise various strategies to survive, including petty commodity production, made more difficult by the lack of access to communal land, energy and water services. The attitude towards the **state** and the local government is cynical and there is little hope that government will provide services, let alone address future environmental crises associated with climate change. In this despair, the only comfort is that communities are starting to work together to mobilise against exploitation and a lack of service provision.

The literature review in section 2 provides the grounding and context of the social problem by discussing gendered labour, social reproduction, energy transitions and energy value chains. In section 3, I outline the research methodology including the interview process to collect primary data, the data analysis tools, and I discuss how my positionality has affected the research. Section 4 details the three case study towns, Kuruman, Kathu and Upington, including the reason for their establishment, their economic profile and demographics of the population. Section 5 presents the findings from the data collection process and includes a discussion about how these findings provide insight into the social problem identified. Finally, the conclusion summarises the key argument and suggests areas for future research.

1.1. Research questions

Main research question: How does the lens of gendered labour modify our understanding of the impact of the shift from fossil fuels to solar power on workers in the energy sector, and local communities?

Sub-questions:

- What is the nature of the solar value chain and who are the winners and losers within this value chain?
- What is the gender and racial composition of workers in the solar power industry and what is their experience of the workplace – safety and health?
- What have been the socio-economic outcomes of the solar power projects and how have communities and workers experienced these outcomes?
- What is the role of the state in the shift to renewable energy?

Social groups: solar photovoltaic (PV) workers, communities around these power stations, solar plant developers, and government departments.

2. Literature Review

This research provides a unique contribution by exploring the relationship between the energy transition and gendered labour. This will draw on literature on various themes. The first theme is gendered labour through a feminist political economy lens. Second is the features of social reproduction in the South African context. Third is a history of the just energy transition. Fourth is the literature which takes a gendered perspective on energy transitions. The fifth theme is that of global production networks, and particularly how these networks operate in renewable energy technology in the South African context. Finally, there is a discussion of opportunities within the just energy transition to alleviate the crisis of social reproduction. The discussion of this literature provides the context and framing for the discussion of the findings from interviews with key groups presented in Section 5.

2.1. Gendered labour and social reproduction

A feminist political economy approach to gendered labour uses the concept of social reproduction to address the gaps in political economy's understanding of the reproduction of capitalist social relations. Political economy has focused almost exclusively on the productive sphere of the economy, where the owners of capital purchase commodities and labour power to convert the commodity into a higher value product, thus creating surplus value. The processes to produce the unique and vital commodity which is labour power were not well theorised within political economy (Dickinson & Russell, 1986).

Feminist political economy approaches highlight the unpaid care work and other types of work conducted in the household which are required to reproduce and maintain labour power. This unpaid work has over time and through historical processes been socially constructed to be women's work which is naturalised and undervalued (Federici, 2004).

Federici (2004) provides a detailed and historical analysis of social reproduction as a product of capitalism. In the European history of the degradation of women as a tool for capitalist expansion, women were initially banned from working as artisans and thus became dependent on their husbands or families for financial support, as land had already been expropriated (Federici, 2004). Not only were women used as a tool for capitalist expansion, but the exploitation of the female body was a necessary condition for the reproduction of capital. Capitalism also devalued reproductive labour through gender hierarchies so that women's work was naturalised and not acknowledged, despite being vital to the reproduction of labour power and thus capital accumulation. According to Federici (2004), the state adopted the role of

manager of class relations and supervisor of the reproduction of labour in the transition to capitalism.

The state forms part of the institutional realm which maintains social reproduction, alongside the economy and the household. This institutional arrangement can be described as:

three major components in the production-reproduction system: the economy, which in its productive consumption of capital, generates employment and wages, the first form of proletarian subsistence; the family-household, the main institution for self-managed reproduction on the basis of individual consumption; and the state, the locus of collective consumption programs and policies directed towards securing reproduction of labour at the collective or class level. (Dickinson & Russell, 1986, p. 11)

This institutional arrangement is useful to analyse the production-reproduction system. However, it is important to acknowledge that these institutions are not distinct and are co-constituted. The household is the main sphere of social reproduction but can also be the site of production. The state supports collective efforts to reproduce labour in order to retain state legitimacy and political power² and is fundamental to the organisation of the market and economy. These institutions all sustain social reproduction, production and the social relations of capital in different ways. Gendered labour describes the arrangement of reproductive work where women often carry the burden of work, but not exclusively, as men and children also participate. Gendered labour follows divisions based on gender, race, ethnicity and sexuality which creates opportunities for exploitation which are experienced differently by women and men.

These three institutions are used as a framework to understand the relations between the energy transition and gendered labour in this research report. The three institutions frame the questions asked about the impacts of the solar power plants for local communities in terms of the economy (waged work/jobs), the household (social and environmental outcomes), and the state (social provisioning).

² State intervention is required because income from wages is not sufficient to meet minimum consumption needs and the state would struggle to govern legitimately if there is widespread hunger. Thus, state intervention in social reproduction is a form of political pragmatism.

2.2. Social reproduction in the South African context

This section will review the South African literature on social reproduction and in particular the relation of wage labour and capital as established through the mining industry which has shaped South Africa's political economy. In South Africa prior to 1991, women were banned from working on mines, similar to the restriction of women's activities as told by Federici (2004). This contributed to the delegation of women to social reproduction in order to subsidise wages of the mining workforce (Valiani & Ndebele, 2018).

In the South African context, Wolpe (1972) argues that the South African state "has been utilised at all times to secure and develop the capitalist mode of production" (p. 429). And in fulfilling this role, the state institutes apartheid to manage the competition between white workers and Black workers which arose in South Africa. This is again aligned to Federici's (2004) argument that European colonisers created racial segregation to prevent coalitions between the white and Black working classes.

The nature of social reproduction in the Global South is somewhat different to that in the Global North. Ossome and Naidu (2021) argue that the conceptualisation of social reproduction should be different in the Global South because in Asia, Africa and Latin America, the agrarian transition is incomplete and large parts of society are still reliant on non-capitalist production for survival. "In advanced capitalist countries, women's responsibilities for reproductive work have tended to be in the context of care work as the welfare state socialised others aspect of reproductive labour" (Ossome & Naidu, 2021, p. 65). In the Global South, women's labour is not restricted to care work, but includes participation in non-capitalist forms of production required for survival. Therefore, social reproduction includes subsistence farming and petty commodity production, particularly in many African countries (Ossome & Naidu, 2021).

Social reproduction in South Africa is closely linked to circular migration and mining labour. Cousins et al. (2018) discuss social reproduction in rural areas of South Africa but hold the assumption that social reproduction is something that is needed. For example, they state that "formal employment by itself is not able to satisfy the social reproduction needs of the majority" (p. 1071). However, the meaning of this quote could be that formal employment does not satisfy needs of survival, and that gap between what the wage affords and what is needed for consumption is filled by social reproduction. This links to Naidu and Ossome's (2016) argument that social reproduction is not necessarily self-exploitation, and petty commodity

production is not ‘mini-capitalism’ - as argued by Cousins et al. (2018) - but rather what is required for survival.

Cousins et al. (2018) provide useful case studies of social reproduction in rural communities in Msinga and Besters, KwaZulu Natal. They highlight the crisis of social reproduction which has been exacerbated in the financialised capitalist era where investments in the productive economy are low, financialisation and globalisation has led to capital flight, increased debt and austerity (Fraser, 2016). These conditions have increased unemployment, poverty and inequality in South Africa, which are particularly acute in rural areas and areas that were previously designated ‘homelands’ during apartheid. In this context, social grants and other forms of public provision have been vital for the survival of the working classes and surplus populations, and their continued social reproduction (Cousins, et al., 2018).

The provision of social grants by the state in this context represents what Fraser (2016) would call a stabilising force in the crisis of social reproduction. The crisis of social reproduction is an under-appreciated strand of the current general crisis in economy, politics and the environment. Capitalism holds various contradictions, and the crisis of social reproduction is a contradiction in the relation between capital accumulation and the requirements of reproduction of labour power. Simply put, the crisis exists because, “on the one hand, social reproduction is a condition of possibility for sustained capital accumulation; [and] on the other, capitalism’s orientation to unlimited accumulation tends to destabilize the very processes of social reproduction on which it relies” (Fraser, 2016, p. 100).

Fakier and Cock (2009) highlight characteristics of rural towns and villages that exacerbate the crisis of social reproduction. They describe very high rates of poverty and unemployment as well as the prevalence of short-term contract work in a small town called Emnambithi in Kwa-Zulu Natal. Unemployment rates are highest for Black women and if they do get work it is often in low-paying sectors such as domestic work and retail. They also find that, while men were the main participants in paid work in the 1990s, by the 2000s women had also joined the migrant workers (Fakier & Cock, 2009).

The increase in women also migrating away from rural areas for work relates to Fraser’s (2016) argument that the current financialised capital era requires a ‘two-earner household’ which then requires that childcare and household maintenance must be contracted. It also supports Fraser’s argument that there is an increased crisis of care and a care gap because the two-earner household must then pay for childcare – usually provided by a poor Black woman who may

have migrated from her own home to provide that service, leaving behind her own children to be cared for by a still poorer family member. Fraser (2016) calls this a global care chain, which seemingly has no end. These crises play out in the institutions of the economy, where there are not enough jobs, and the jobs are short-term or precarious and, in the household, where the care gap grows due to the need for a two-earner household.

The responsibility for social reproduction in the household often falls on the women in the household, which is shown by the fact that women spend more time on household maintenance and care work than men in South Africa (Casale, et al., 2021). More than 42% of households in South Africa were headed by women in 2021 and the numbers of women-headed households were higher in rural areas (STATS SA, 2022). This can be attributed to labour migration and the low rates of marriage in South Africa. The ‘two-earner’ household may be relevant in urban households where most households (45.6%) comprise a nuclear family. However, it may be less relevant in rural areas where most households (44.1%) are comprised of extended family (STATS SA, 2022).

These difficulties are then compounded when the institution of the state fails to create stability in the process of social reproduction. This is argued to be the case because of inadequate social grants which do not provide enough money to avoid hunger. In addition, the public services provided by the state are not sufficient to address health crises such as the HIV/AIDS pandemic which then meant that the burden of care for the elderly and sick in the household was increased (Fakier & Cock, 2009). Finally, Fakier and Cock (2009) hold the view that “it is women who carry the burden of ensuring households have basic necessities such as water, adding to household responsibilities when these utilities are not delivered adequately” (p. 366). Necessities such as access to water and electricity are important requirements for hygiene, cooking and cleaning in the home and thus social reproduction.

Cousins et al. (2018) highlight other issues for social reproduction in rural South Africa, including a lack of income from small-scale agriculture and a reliance on purchased food due to unequal access to land. This results in the need to diversify livelihood strategies. They identify the importance of the role of custom and tradition in social reproduction due to their influence on land allocation. Their comments about land align to the arguments raised by Naidu and Ossome (2016) in respect of the role of access to land, including private property and the commons for survival and petty commodity production.

The above literature review on the crisis of social reproduction in rural areas of South Africa provides the context of the conditions within the case study towns. It also outlines the key issues present within each of the institutions that shape social reproduction, which provides guidance on the key issues which should be shifted if a just energy transition is to improve conditions for workers and communities. The availability of well-paying and stable jobs is an issue in the economy. Conditions of housing, access to land and other services such as electricity and water are also important, as well as the capacity of the state to provide support in the form of healthcare, education and grants. That is why I have addressed these topics in interviews with communities and workers in the Northern Cape in order to understand the relationship between gendered labour and the energy transition.

2.3. The history of the just energy transition

The just energy transition has emerged more recently as a combination of the just transition – a concept established by unions in polluting industry in the US – and the need to decarbonise energy generation. The concept is particularly relevant to South Africa because of our reliance on coal-fired power stations for electricity which makes our economy carbon intensive. The concept is seen as a solution to the climate crisis. This section will detail the history of the idea and the key stakeholders who wield it.

The first Intergovernmental Panel on Climate Change (IPCC) report was produced in 1990. It highlighted the risks of climate change and the key steps to be taken to mitigate these risks. In 1992, the United Nations Rio Conference on Environment and Development placed climate change onto the international political agenda (Power, 2009). There has been international agreement on the need to reduce greenhouse gas emissions in order to address climate change, but there has been a lack of commitment to targets and hesitance from the large, industrialised countries to take on responsibility for their role in emissions. Furthermore, as the climate impacts have mostly been experienced by countries in the Global South there has been less urgency to address climate change for countries in the Global North (Abimbola, et al., 2021).

As the energy sector is the largest culprit for greenhouse gas emissions and climate change has been seen as a technical problem rather than a systemic social issue, alternative less carbon-intensive energy production technologies have been held up as the solution to climate change (Somerville, 2020). Therefore, a swift transition to renewable energy has been proposed by various actors internationally. However clear the solution seems, it holds difficult decisions and processes as one gets closer to the details of the transition, particularly regarding the risk

that many workers in the fossil fuel industry will lose their livelihoods (Power, 2009). This has therefore led to a combination of the energy transition with the concept of a just transition to form the just energy transition.

The notion of a 'just transition' was first established in North America in the 1970s by trade unions in polluting industries. It emerged when workers, like Tony Mazzocchi of the Oil, Chemical and Atomic Workers' Union, acknowledged that the industries they worked in were causing environmental harm and health problems and wanted to ensure that policies were implemented which improved environmental conditions, occupational health and safety and did not leave workers without jobs. At the time, conservative forces used the concept to suggest that there was a trade-off between jobs and environmental regulation. Unionists had to emphasize that it was not a trade-off, but a matter of having both or neither (Just Transition Research Collaborative, 2018).

The concept spread amongst trade unionists in North America and a Just Transition Alliance was set up in 1997 between environmental groups and trade unions. International trade unions started to adopt the language of the just transition and for the first time associated it with climate change at COP3 in Kyoto in 1997. When the International Trade Union Confederation was formed in 2006, it prioritised environmental concerns and the just transition. In the lead up to COP21 in 2009 they presented just transition as a tool to ensure decent jobs and livelihoods for all in the shift to a more sustainable society. It highlighted important gaps in climate policy around social impacts but was also wielded by the fossil fuel lobby to bolster opposition. Between 2010 and 2018 the just transition language entered mainstream climate policy discourse with various stakeholders making use of it, from governments and NGOs to large European funders. This mainstreaming is argued by some to dilute its radical potential as there are now various approaches to a just transition ranging from reformist to transformative and many different definitions. Interestingly, South Africa is one of the only countries in the global South that has adopted the concept (Just Transition Research Collaborative, 2018).³

There are various stakeholders in South Africa who make use of the concept of the just transition. The Confederation of South African Trade Unions (COSATU) brought the language into South Africa through their Climate Change Policy Framework and it was also incorporated

³ The reason that South Africa has been an exception in taking on the idea of the Just Transition is not obvious. It was brought to South Africa by the trade union movement around 2010 which gained momentum due to South Africa hosting the Conference of the Parties (COP)17 for the United Nations Framework Convention on Climate Change in 2011.

into the National Development Plan in 2012. In 2018, the National Planning Commission conducted a series of stakeholder dialogues on a vision and pathways for a just transition to a low carbon, climate resilient economy and society (NPC, 2019). Since then, the private sector has taken the concept on board and are conducting various large-scale research projects to inform and influence how the just transition occurs in South Africa. For example, the National Business Initiative in partnership with Business Unity South Africa has undertaken extensive modelling of just transition pathways by sector (NBI, 2022).

The just energy transition is considered to be a part of the just transition. The energy transition has largely been supported by scientists, particularly those in the United States who have been part of the IPCC and have recommended mitigation as the primary response to climate change over the past 30 years. Scientists have then informed government climate policy. As renewable energy businesses have grown there has also been greater interest from the private sector due to potential profits. The government policy that supports an energy transition to date in South Africa is the REIPPPP and the carbon tax. The just energy transition may hold opportunities to address inequality and poverty, but the concept is contested (García-García, et al., 2020).

COSATU is supportive of the need for a just transition and has a particular focus on job creation and social protection for those working in the vulnerable sectors of the economy. However, their recently published Just Transition Blueprint for Workers includes broad demands for public transport, energy access and the creation of a caring economy which prioritises well-being (COSATU, 2022). Environmental activist organisations are also supportive of a just transition but have a strong emphasis on the speed of the transition to achieve decarbonisation. Private sector interests have only recently joined the call for a just transition and may have been spurred by the planned implementation of a carbon border tariff which would make South African exports less competitive in international trade (Abnett & Twidale, 2021).

The just transition is also becoming more of a focus for government, with the Presidential Climate Commission putting a Just Transition Framework out for comment in February 2022. Government and unions seem most focused on jobs although unions have raised certain issues relevant for gendered labour, while the private sector is interested in new opportunities for capital accumulation through ‘green’ capitalism – focusing on electric vehicles and renewable energy. A small interest group named Energy Governance South Africa and an economic think tank, Trade and Industrial Policy Strategies, have highlighted issues around energy poverty (Ledger, 2022; Mohlakoana & Wolpe, 2021). Therefore, some groups highlight aspects of the

energy transition relevant to gendered labour such as energy access and support for care work, but these are overshadowed by the focus on the technology and jobs associated with the energy transition. This research can fill the gap by bringing together a coherent framework on just energy transitions from a feminist political economy perspective.

2.4. Gendered approaches to the energy transition

The literature which addresses gendered issues within the energy transition focuses largely on the experience of women in adopting new technologies in the household (Johnson, et al., 2019) or on the representation of women in decision-making processes on national energy transitions (Lieu, et al., 2020). The first approach focuses on the implications of the energy transition from coal, kerosene, and gas to electricity in rural areas of Africa. The research addresses how energy consumption can be gendered, which is a valuable perspective but fails to question the implications of the energy transitions for gendered labour in the production of energy (Johnson, et al., 2019). These perspectives both focus on women only, rather than both women and men who might be involved in social reproduction (Rodríguez-Rocha, 2021).

The article by Lieu et al. (2020) is an interesting example of research that focuses on representation of women in decision-making on energy transitions. The authors confess to not initially thinking about the gender perspective when they conducted the fieldwork but then deciding to write about gender after the fact, in a clear example of ‘add women and stir’. This approach is similar to gender mainstreaming approaches of the ‘Women in Development’ era which approached gender inequality with a focus on women as individuals, aiming to improve their access to education, employment or leadership. This approach was criticised for its failure to address gendered social norms and structural discrimination of women and other groups based on race, class or ethnicity (Chant & Sweetman, 2012).

Lieu et al. (2020) argue that energy transitions have mostly been discussed from a technocratic perspective, which avoids critical economic and political questions around transitions. They explain how literature on women in energy transitions either positions women as victims who are worst impacted by energy poverty or as saviours who have the potential to solve the crisis if given the platform. This is similar to conceptions of women in climate change and oversimplifies gendered dynamics as well as perpetuating stereotypes. Instead of this approach, Lieu et al. (2020) focus their analysis on gender equality in work, well-being, access to resources, participation in policymaking and entitlement to human rights.

Energy access is an important concept when thinking about energy transitions although it is not often a focus in the research and analysis on just energy transitions. A review of the literature on just energy transitions finds that most analysis focuses on employment outcomes of the transition and does not consider other variables which are relevant for the concept of 'justice' (García-García, et al., 2020). Key variables central to justice would include energy prices, income inequality, job quality and conditions and gender inequality. However, there is a dearth of literature on these aspects of just energy transitions. Research that does exist on energy prices in Germany found that prices have doubled, thus worsening energy poverty. García-García et al. (2020) particularly highlight that "while the ILO (2018) states that gender is an important variable for just energy transition analysis, as it could widen inequalities, gender worries are hardly present in the research" (p. 12).

Models based on European countries that compare a green growth approach to social equity policies and degrowth find that green growth increases inequalities and that social policies and degrowth scenarios improve equality but cause greater public budget deficits (García-García, et al., 2020). If these issues arise in European countries that have higher levels of social provisioning than most countries in the Global South, the distributional consequences of the energy transition for South Africa, which has the highest level of inequality in the world, require investigation. Social provisioning acts as a stabiliser in the crisis of social reproduction, as discussed earlier, and despite South Africa's significant grant system, there are gaps in social provisioning around housing, healthcare, and access to water and electricity among others (Fakier & Cock, 2009).

Energy poverty levels in South Africa are fairly high and there is a lack of focus on these issues within the just energy transition debates. Energy poverty can be defined as a lack of access to energy or not being able to afford energy and relying on traditional fuels. While South Africa's access to electricity is high compared to its neighbours at 86%, there are 1.5 million households not connected to the grid and even more households who might have a connection but cannot afford to pay for the electricity (Israel-Akinbo, et al., 2018). Energy poverty is measured based on the proportion of income spent on energy in the household. In 2012, the energy poverty rate in South Africa was calculated to be 47% (Israel-Akinbo, et al., 2018). South Africa's energy prices have risen significantly over the past 10 years and are set to increase further due to the need for grid improvements and the energy transition. The implications of this for energy poverty are not well understood and require further research. A feminist political economy perspective highlights the importance of energy access as a form of social provisioning which

affects health and petty commodity production. Energy poverty increases the reproductive burden on households due to the inability to use electric appliances for cooking, cleaning and heating. Many households have to revert to wood, coal or paraffin which can take more time to collect, can be dangerous and may have negative effects on health (Sustainable Energy Africa, 2017). As outlined by Mohlakoana and Wolpe (2021):

Energy poverty can cause malnutrition and other health-related issues (especially among women), such as respiratory diseases (due to smoke inhalation while cooking on open fires) and skeletal deformity (due to constant carrying of heavy firewood loads on their heads) (Aklin et al., 2018; Appleton et al., 2019; Clancy et al., 2016; Nkosi et al., 2021). Energy poverty also limits income-generation activities, such as those in the informal food sector where people earn a living by selling cooked food on the side of the road (Mohlakoana et al., 2018). (p. 3)

South Africa's democratic government has made significant progress on increasing connection to the electricity grid since 1994. However, this does not guarantee access for many South Africans because of energy affordability. Policy measures to improve access include the Free Basic Electricity Subsidy (FBE) implemented in 2003 and the Free Basic Alternative Electricity Subsidy implemented in 2007. The FBE has important potential but has not been implemented very successfully, with many arguing that the 50-kWh provided is not enough for basic needs and the criteria for eligibility in practice excludes many households in need (Mohlakoana & Wolpe, 2021). A report by Sustainable Energy Africa (2017) argues for further understanding of the energy requirements for men and women, and particularly for female-headed households.

The call for energy poverty to be addressed by civil society groups within the just energy transition has only recently found a voice in South Africa and whether it will gain traction is uncertain. A feminist political economy perspective illustrates how energy access in the household is an important struggle for the unpaid workers involved in social reproduction, whose needs and conditions of work should be as important as paid labour in the conceptualisation of the just energy transition.

2.5. Energy value chains and global production networks

South Africa's economic structure has been informed by the Minerals-Energy Complex (MEC), a system in which cheap labour and abundant coal resources led to an energy intensive economic structure which has been held in place by vested interests (Fine & Rustonjee, 1996). Baker (2015) argues that a transition to renewable energy might not shift the MEC structure of the economy, particularly if renewable energy is privatised and the local developments are dominated by multinational corporations, as has been the case with the REIPPPP. The MEC might be shifted and the potential for decent jobs might be greater if the just energy transition included the local manufacturing of renewable energy technologies.

The vision that green industrialisation⁴ will drive economic growth and job creation in South Africa faces significant challenges. Firstly, the REIPPPP included local content requirements to try to boost local manufacturing, but solar PV developers found loopholes and imported their equipment (Baker & Sovacool, 2017). Secondly, the question of whether South Africa can achieve green industrialisation driven by the renewable energy industry must be viewed in the context of international global production networks and a labour regime in the era of “neoliberal globalisation – in which labour become subordinated to the interests of expansive capital accumulation in a process of competitive undermining of labour standards and salaries” (Baglioni, et al., 2022, p. 5). South Africa is a commodity dependent country and therefore faces multiple barriers to enter highly competitive global value chains, such as renewable energy technologies, which have become more concentrated due to financialisation (Newman, 2009).

Third, the intellectual property required to establish competitive solar power manufacturing does not currently exist in South Africa. Fourth, the amounts of solar PV planned in the REIPPPP has not been enough to stimulate development of a local industry. Lastly, in applying for loans, banks require that companies have experience in the solar industry so it is harder for local companies to prove experience and access the necessary finance (Baker & Sovacool, 2017).

This literature highlights that the likelihood of South Africa developing local manufacturing capacity is very low. This is relevant to the just energy transition because renewable energy

⁴ Industrialisation based on ‘green’ technologies such as renewable energy.

proponents argue that manufacturing will provide the better-quality jobs than those short-term construction jobs offered in the installation of solar power plants.

In terms of gendered labour in renewable energy value chains, available literature focuses on the number of women in leadership, employed by companies or working as vendors. A report on gender mainstreaming in South Africa's renewable energy industry found that it is a male-dominated industry with few women. Women also tended to work on socio-economic development or environmental assessment. A survey of IPP companies and solar PV companies by GreenCape in 2017 found that women comprised only 33% of staff on average (Parshotam & van der Westhuizen, 2018). Therefore, even if local manufacturing of solar power technologies was established in South Africa, it is likely to be biased against women, similar to the mining industry.

A key gap in existing research identified by Baker is "the nature of national and international supply chains for renewable energy technology in South Africa" (Baker, 2015, p. 257). This research report will unpack the nature of the solar value chain for a group of REIPPPP projects in the Northern Cape and provide the views of solar plant developers on the potential for local manufacturing in order to ascertain whether the just energy transition could hold the potential for well-paying and stable jobs in South Africa.

2.6. The nature of the social reproduction crisis and opportunities within a just energy transition

This literature review provides the context for the research questions as well as some indication of the key challenges which South Africa faces in trying to achieve a just energy transition. In summary, South Africa's economic development has been defined by a labour regime which exploits racial and gendered difference as well as a MEC, which are both structures that have been created and supported by the state. The key question is whether it is possible to shift the exploitative nature of these regimes through a just energy transition. The literature indicates that the barriers to a just energy transition exist firstly in the structure of the economy which supports the MEC and the limitations on green industrialisation (and thus stable and well-paid job creation in the economy) posed by global production networks. Secondly, the ability for households to access resources such as electricity and water required for survival. And thirdly, the role of the state and its social provisioning. These three components present the challenges which contribute to a potential crisis of social reproduction. The sections that follow will use

evidence from three towns in the Northern Cape as case studies to assess the implications of the energy transition for the working classes in South Africa.

Section 5 will show that the exploitative nature of the current labour regime is unlikely to be shifted by the energy transition in its current form. There are various views relating to possible alternative measures to address the energy transition without increasing the crisis of social reproduction. One is the ideal of a just energy transition driven by the state through the generation of publicly owned renewable energy. This is aligned to the socialisation of reproductive labour, implemented through an increase in social provisioning by the state, as proposed by Kassa (2020).

Yet another view proposes a movement for global mobilisation of working classes in order to improve labour conditions internationally (Rodríguez-Rocha, 2021). Mezzadri (2019) argues that mobilisation and solidarity between the waged and unwaged workers who both create value and are subordinated to the capitalist relation, holds potential to shift exploitative labour regimes. Perhaps then an alliance between waged and unwaged workers internationally would support a just transition, more broadly, not limited to the energy sector.

3. Research Methodology

3.1. Approach

I have adopted a feminist political economy approach to the social problem outlined in the introduction. This approach highlights the importance of understanding gender and race in addition to class in economic analysis and brings the household into focus as a site of struggle and an important sphere of reproduction (Armstrong & Connelly, 1989). The concept of social reproduction has also emerged from feminist political economy approaches and provides a framework through which to understand the reproduction of the labour force. Social reproduction takes the relationship between wage labour and capital and considers key institutions which reproduce it. These key institutions are the family/household, the economy and the state (Dickinson & Russell, 1986).

This approach aids my analysis of the relationship between the energy transition and gendered labour by providing the framework of social reproduction and the three institutions to fully contemplate how workers in productive and reproductive processes relate to the energy transition. I have been able to assess how the energy transition has affected paid workers in the economy and unpaid or informal workers in the household, and lastly how it affects state provisioning.

I have incorporated three key features of feminist methodology in my approach as outlined by Harding (1987). Firstly, I have tried to identify the social problem in terms of a political struggle experienced by key groups, particularly workers in the energy sector, and communities who live around the power plants. Secondly, the purpose of the research is for these social groups to understand the trends in the shift from fossil fuels to renewable energy and its impact for them. Lastly, I aim to locate myself within the same critical plane as the overt subject matter. As a white woman who has grown up in Johannesburg with an upper-class education and lifestyle, I am aware of my experience of South Africa which has been possible due to the racist, exploitative and extractive power sector and economy. Engaging in reflection on my position throughout the research process is important.

The literature reviewed above has used South Africa as the context due to the national nature of the economy and certain dynamics of labour and extractivism. In order to answer the research questions, I conducted a literature review of secondary sources as discussed in the previous section. In addition to a focus on South Africa, I have used case studies of three small towns in South Africa to better understand what a ‘solar town’ could look like in South Africa

and compare this to characteristics of ‘coal mining towns’. Adopting a case study approach allows for deep understanding of gendered labour in these towns and provides a basis for comparison (Mabry, 2008). I have selected towns which are situated close to solar power plants. As there is more existing literature on the history of coal mining towns in South Africa and the nature of gendered labour in these towns, and due to funding and time constraints for this research, I will look at literature on coal mining towns and focus on fieldwork and interviews on solar towns, which are less known.

3.2. Interview Process

To inform the case studies of these towns, I collected primary data in the form of key informant interviews. I planned to interview four groups of informants who can provide different views on the social problem. The first group was supposed to be solar power plant workers, the second group was community members who live near the solar power plants, the third group was managers of solar power plants and the fourth group was government officials who work in the Independent Power Procurement Office (IPPO). I received ethical clearance to interview people and followed the appropriate procedures for consent of participants. I have not used the real names of any interview respondents in order to protect their anonymity.

My strategy to identify the respondents who worked at power stations and lived near power stations was to reach out to people I knew who worked or lived in these towns as well as non-governmental organisations in the towns and see if they could connect me to workers and community members. My contacts in the towns struggled to find people who were currently working at the power stations.

I managed to contact the local branch of MACUA, an organisation which supports communities around mines to hold government and mines accountable for proper processes of community consultation and local development, among other campaigns. I was able to hire one of their organisers as a Research Assistant who then identified interview respondents. His name was Boitumelo Tshetlho. Interestingly, Boitumelo found it difficult to identify people currently working on the solar power plants but was able to identify several people who had previously worked on a solar plant in the area. This meant that the second group of solar power plant workers was actually a group of ex-solar power plant workers. This dynamic is indicative of what is later discussed in the findings, that many of the jobs in the solar power plants are short-term contracts. Boitumelo was my Research Assistant in Kuruman and Kathu, and Deon Bezuidenhout was my Research Assistant in Upington. The Research Assistants identified

interview respondents in group one and two and supported with translation during the interviews where needed.

In order to contact groups three and four, I emailed the solar power plant companies and the IPPPO to request interviews. Of the six solar power companies I reached out to, three responded and agreed to allow me to interview their employees but only referred manager level workers, no general workers. Most of the general workers I spoke to had been short-term workers which may mean that I heard from those who had a more negative view on the solar plants. However, this was probably offset by the interviews with the managers of the plants. It is also worth noting that the solar plant developers were not interested in referring general workers with whom I could speak, which could represent guardedness. I was only able to visit one of the solar power plants because the other companies did not get back to me during my time in the field.

I managed to conduct a total of 22 interviews using a semi-structured interview style to allow for consistent data but also have flexibility in probing themes that may emerge. Despite aiming to interview equal amounts of women and men, or more women, if possible, I interviewed ten women and 12 men. Ten of the interview respondents were Black African, eight were Coloured, three were white and one was Indian. Figure 1 shows the final numbers of interview respondents per group. There was only one person who was a ‘consultant at a solar plant’ who had worked on solar power plants and expected to be hired as an independent consultant again. See Appendix A for the interview questionnaire guideline for each target group.

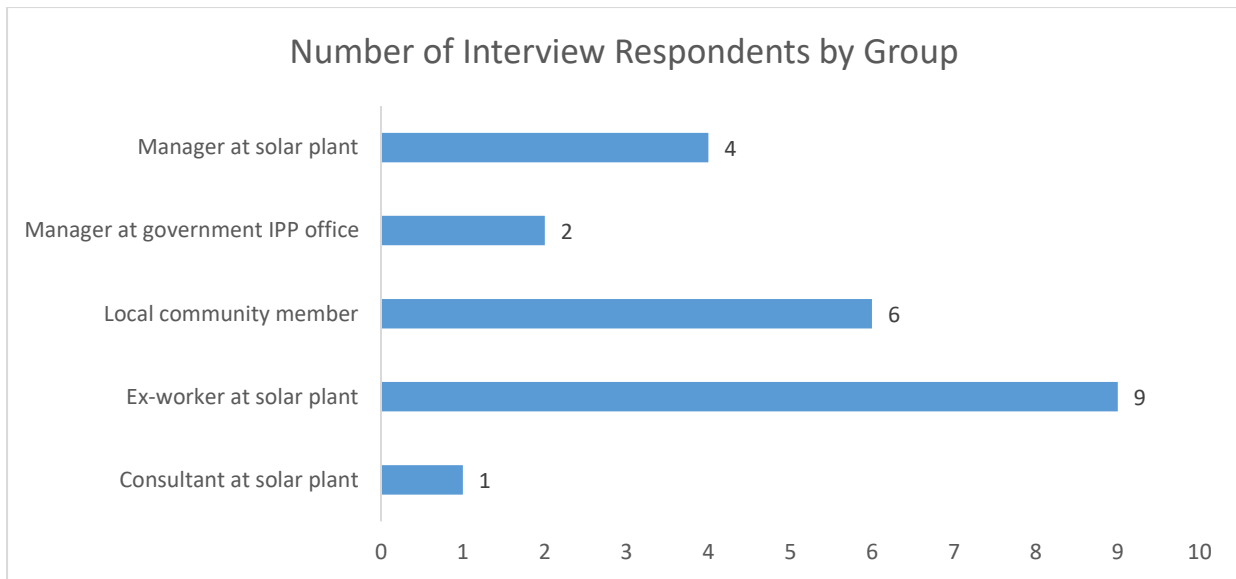


Figure 1: Interview Respondent Numbers by Group

I planned to interview larger numbers of workers and community members as these are the key affected social groups whose livelihoods are at risk in the energy transition. I worked with MACUA to identify interviewees. As MACUA is an activist organisation which supports local community struggles against mines and other employers, the interviewees are likely to be critical of the roles of mines and potentially other large corporates. However, I did try to speak with other local organisations, but I was unsuccessful in reaching them. If there was more budget and time for this research, I would have pursued this further. The managers in solar plants and government whom I interviewed were mostly not based in the case study towns (apart from one person), but lived in either Gauteng or Cape Town, had higher levels of education and were secure in employment contracts. This means that they are more likely to take a positive view of the transition, particularly as they are working on bringing it about, and may be less familiar with local social and environmental issues.

3.3. Analysis

The interviews were recorded and transcribed and then I used a qualitative research analysis software called Dedoose to analyse the interview transcripts using thematic coding. I used Dedoose because it was the cheapest software that had good ratings and allowed a one-month licence purchase. I focused on thematic coding around the key concepts of gendered labour, the solar power value chain, electricity access and climate change. I also coded recurring themes outside of my research questions which represent emergent issues. I was able to use weighted codes to capture the sentiment about certain key issues and track key data points on numbers of women in the workplace. I use weighted coding for three codes: the community

impact of the solar plants, the environmental impact of the solar plants and the ratios of women in the workplace. These weighted codes will be further explained in the analysis of the findings. I have included the list of codes in Appendix C.

3.4. Positionality

Working with Research Assistants to conduct the interviews and support with translation where necessary in the case study towns was useful to speak to the right people and to be less of an outsider or foreigner in the interview respondent's eyes. However, I think that the fact that the interview was mostly conducted in English may have detracted from the free flow of conversation and openness of interview respondents. If time and budget had allowed, it would have been optimal to train the research assistants to conduct the interviews in the preferred language for interview respondents and then translate the transcriptions.

4. Case Study Towns



Figure 2: Location of case study towns on the map of South Africa, Source: Google Maps

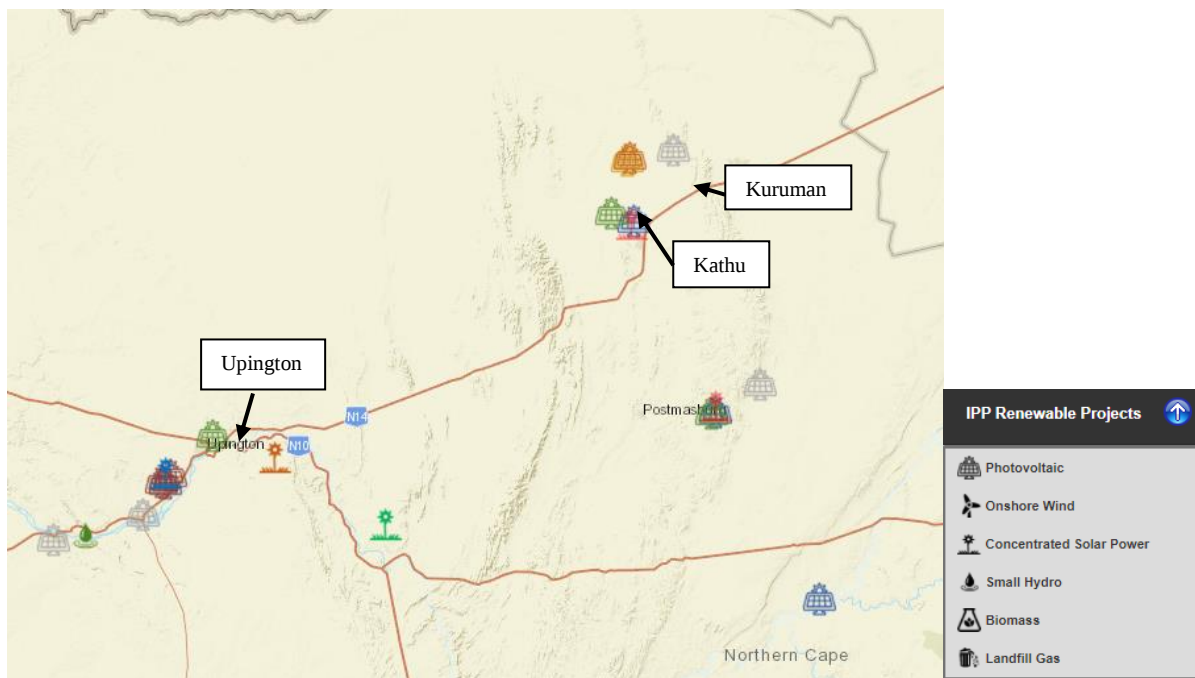


Figure 3: Map of case study towns and locations of renewable energy power plants near to the towns, Source: IPP Office, 2022

Figure 2 shows the three towns identified for the case study on the map of South Africa, namely Upington, Kathu and Kuruman. These towns are situated in the Northern Cape and are surrounded by at least two solar power plants each, installed through the REIPPPP between 2010 and 2020 (DMRE, 2021). These towns were selected because of the number of solar power plants which have been developed around them, as shown in Figure 3.

Upington was established in the 1870s along the banks of the Orange River. In the 18th century, the area was inhabited by Khoikhoi herders and San hunter-gatherers, also known as Nama people. Tswana farmers also lived in this area. European settlers moved into the area and migrant workers in the railways and mines arrived in the early 20th century (Lange, 2006). The Upington economy is based mostly on retail, trade and agriculture; particularly grape farms (EOH, 2017). Upington is situated in the Dawid Kruiper Municipality which spans the area between Upington and the Northern border of the country. According to the 2016 Community Survey the population of the Dawid Kruiper Municipality was 107 162. The population is 68% Coloured, 21% Black African, 11% white and 1% Indian or Asian and 51% female (STATS SA, 2016).

Kuruman and Kathu are neighbouring municipalities within the John Taolo Gaetsewe District. Kuruman is a town in the Ga-Segonyana Municipality formally established in 1887 and named after Chief Kudumane. It was established because of a spring called the Gasegonyane by the Batswana, which means ‘little water calabash’ (Marais, 2021). It became a missionary station in 1821 when Robert Moffat moved there and then built the Moffat Church (South African History Online, 2019). Kuruman’s economy is largely based on mining and agriculture. Minerals including manganese ore, iron ore, tiger’s eye and crocidolite are mined in the area (SA Places, 2021). The Ga-Segonyana Municipality has a population of 104 408 and the racial breakdown is 91% Black African, 5% Coloured and 3% white, while 52% of the population are female (STATS SA, 2016).

Kathu is a more recently established town in comparison to Kuruman and Upington. It is a mining town, like Kuruman, and was first formed to house workers for a new mine which was started in 1973. It is home to several iron ore mines. There are a few versions of the story behind the name Kathu, one says that the name means ‘town under the trees’ because it is also home to a camel thorn tree forest. Another story goes that it comes from the porridge brewed from the powder of the camel thorn tree pods. Kathu is one of the fastest growing towns in the Northern Cape (Kathu, Accommodation, Business and Tourism Portal, 2022). It is part of

Gamagara Municipality which has a population of 53 655. The population of Gamagara is 49% Black African, 33% Coloured, 18% white and 1% Asian or Indian with 56% male (STATS SA, 2016).

Table 1: Comparison of demographic and economic data of the municipalities in which the case study towns are situated

Metric	Ga-Segonyana (Kuruman)	Gamagara (Kathu)	Dawid Kruiper (Upington)	Source
Population	104 408	53 655	107 162	(STATS SA, 2016)
Percentage female	52%	44%	51%	(STATS SA, 2016)
Most spoken language	Setswana	Afrikaans	Afrikaans	(STATS SA, 2016)
Percentage born in Northern Cape	91%	82%	88%	(STATS SA, 2016)
Percentage of households that are informal dwellings	9.5%	17.4%	25.8%	(STATS SA, 2016)
Percentage without access to electricity	7.9%	7.8%	3.1%	(STATS SA, 2016)
Percentage with female head of household	42%	22%	40.2%	(STATS SA, 2016)
Average household size	3.2	3.4	3.7	(STATS SA, 2016)
Average annual household income (median)	R29 400	R57 300	R29 400	(STATS SA, 2011)
Employment rate	33.7%	53.6%	40.8%	(STATS SA, 2011)
Employment in the formal sector	75%	79%	71%	(STATS SA, 2011)
Employment in the informal sector	9%	10%	16%	(STATS SA, 2011)
Employment in the private household	14%	9%	10%	(STATS SA, 2011)

Table 1 shows the demographic and economic data on the three towns which allows for some comparison. Kathu stands out from Kuruman and Upington in the racial and gender make-up, with much fewer women and higher proportion of Coloured and white people. Only 82% of the population were born in the Northern Cape, which is lower than Kuruman and Upington, and combined with the racial and gender make-up support the fact that this is a newer, faster

growing town with higher levels of male migrant workers (STATS SA, 2016). The employment rate in Gamagara is also higher than both Kuruman and Upington, showing the potential for jobs there.

Interestingly. Although Upington is an older town, it has a higher proportion of informal housing (25.8%) than both Kuruman (9.5%) and Kathu (17.4%), but the lowest percentage of people without access to electricity (3.1%). Although housing in Kuruman is mostly formal, they have the highest percentage of people without access to electricity. This indicates a lack of social provisioning by the state in all areas, whether it be in housing or electricity access.

4.1. A social characterisation of mining towns in South Africa

Understanding the social characterisation of mining towns in South Africa is relevant to this research because I compare the new ‘solar towns’ to coal mining towns in order to understand how the energy transition will affect local communities. A social characterisation includes understanding the conditions under which people live and their activities. This contributes to the analysis because it provides depth and richness beyond just understanding the number of jobs that will be lost or gained in the energy transition. The initial research design included interviews with workers and communities living in coal mining towns in Mpumalanga but funding and time constraints prevented this. Further, two of the case study towns where solar power has been developed were originally developed as mining towns – Kathu and Kuruman.

The mining towns of South Africa are characterised by rapid population growth due to significant migration at the start of mining operations. New informal settlements have grown around the demarcated labour dormitories established during apartheid. These towns have been defined by racial segregation and migrant labour. A study by Cole and Broadhurst (2020) found that mining host communities comprised 5.4 million people, 44% of which were located near coal mines, 24% around gold, 16% around platinum group metals, 9% around diamonds and the last 7% around copper, iron ore and others. Of the 84 mining communities assessed in their study, only eight are cities which have diversified local economies. The rest are largely dependent on mining activity for jobs, income and even public services (Cole & Broadhurst, 2020).

A report by the South African Human Rights Commission on the conditions of mining-affected communities in 2016 found many concerning trends in the effects of mining on local communities. First, in terms of land, proper processes of consultation for mining licence allocation and compensation for relocation were not being followed. This can be seen as the

continuation of the dispossession of land from Black people for the purposes of capital accumulation. Second, in terms of housing, mining companies were not planning in partnership with government for the expansion of housing and infrastructure, which has led to issues with access to housing and other services in mining towns. Third, a proper assessment of water requirements is not done which has led to water insecurity in many mining communities. Fourth, environmental impacts have not been properly assessed as they have been granted by the Department of Mineral Resources who do not have the expertise to do this or to monitor what is done in practice. Environmental concerns include air pollution and blasting, as well as various issues arising when mines are abandoned and not properly rehabilitated (SAHRC, 2016).

These towns are at the centre of the just energy transition because they are the homes of thousands of coal mine workers and their families who may lose their livelihoods in the transition. They are also the rural towns where new renewable power stations are being set up in the Northern Cape which provide the backdrop for two of the towns in this case study, Kathu and Kuruman.

4.2. Household composition

As I focus on the household as an important sphere of social reproduction, I will outline some of the details of household composition of interviewees. The average household size was 3.8, slightly higher than the average in the case study towns which ranged from 3.2 to 3.7. The average household size for manager groupings was lower at 2.8, while ex-solar plant workers was 4.3 and community members was 4.1. This represents larger households amongst lower income interviewees. Further, the manager grouping had an average of 1.6 earners in the household, which is about half of the household, while ex-solar plant workers had an average of 1.2 earners per household and community members had 1.8, both representing a smaller ratio of earners in the household.

Because consistent paid work was in short supply for most community households, most people were compelled into other modes of livelihood in order to survive. Of 16 workers and community members, 10 were growing food or farming animals. Most households (16 of 22) had children as part of the household, and five of them had an elderly member who required care. As will be discussed in the following section, survival in the household requires a combination of incomes including piece work and grant income as well as contribution to

household maintenance by all household members, even children who were involved in childcare, cleaning and growing food.

5. Findings

A gendered labour lens is useful in thinking about the energy transition because it requires an understanding of working and living conditions of the working classes in these towns and workers in these industries, using the framework of the three institutions of the economy, the household and the state. Indeed, the blanket statement that renewable energy creates more jobs and cheaper electricity does not seem to resonate with the experiences of those who have worked on the solar plants built in and around these three Northern Cape towns.

Interviews conducted in these towns found that the experience of general workers, receptionists and others who worked for solar power plant companies in the Northern Cape is that the job was fine while it lasted but was largely short-term, underpaid, and did not equip them to move on to find further employment. The establishment of the solar power plants in these towns has not improved access to energy or affordability of electricity. Therefore, the development of solar power stations that hire through subcontractors and do not pay enough, may have worsened the burden of social reproduction as it has reduced the amount of time spent on household work and not provided sufficient pay. It has also increased the presence of private companies who are obliged to carry out social and economic development projects but do this based on limited information and engagement at the local level.

I have detailed the findings of the interviews using the key research questions set out in the Introduction. The first section answers the question about the structure of solar power value chains, who the winners and losers are in these processes and how this relates to social reproduction. The second section describes the nature of gendered occupations in the solar power industry in terms of waged work at the solar power plants as well as petty commodity production in the case study towns. The third section provides an overview of the attitudes towards the solar power plants, their social and environmental impact and how this relates to household reproductive activities. Lastly, the role of the state in the energy transition is discussed.

5.1. The structure of the solar power value chain - who are the winners and losers?

The coal industry is very concentrated, particularly in South Africa where coal is mined in Mpumalanga and is transported to a coal power station – in some cases via conveyor belt due to the proximity of the power station. Coal-fired power generation requires ongoing operational capacity and large amounts of labour. The nature of the mining industry and work as a miner is difficult but major gains have been made since the end of apartheid to improve worker pay

and conditions of employment. In comparison, solar energy is distributed and entails importation of equipment from other countries. It requires upfront labour for construction but then requires very little operations and maintenance capacity. Thus, the majority of the jobs in the solar power industry in South Africa are short term construction roles. Further, the expertise in the solar power sector lies in the hands of a few large European firms who have presided over South Africa's solar power installations and returned to Europe thereafter (Baker & Sovacool, 2017).

The dominance of these European firms was clear from the interviews conducted with those working at solar developer companies and those who had worked on short term contracts for the plants. For the workers involved in construction of the plants, explanations of how the construction was managed included the fact that a European company was usually in charge and managed the process, they were usually Spanish, Italians, Germans or French. However, it was rare that the workers were employed directly by the European companies. Most commonly there were various local subcontractors involved at all stages of the process.

This was the case both with workers involved in construction as well as those who might have worked on the plant after construction on cleaning or security. Interviewee 4 was working as a cleaner through a subcontractor and happened to discover that she was being underpaid (she saw documents on a desk while working) because the subcontractor was taking an unfair cut of the profits of her work. She was suspended by the subcontractor but was then approached by the Spanish company directly to work for them and she was paid a good salary for the duration of her six-month contract. However, she has struggled to find permanent work since then and is currently working on construction of a road near Kathu [Interviewee 4, 25 January 2022]. The prevalence of subcontractors is seen as a problem by the workers who faced various issues with working conditions.

Key problems related to working conditions while working on the solar plants included wages being too low and the subcontractors not being open to wage negotiations. They would pass the blame to the main contractor. For example, one interviewee shared that "our company was a subcontractor and then the main company becomes a problem...they don't want to assist us where we are complaining about something every time the problem with rates or money" [Interviewee 2, 24 January 2022]. Safety issues when working on the solar plants were also raised. These problems have led to strikes at various solar plants by workers due to issues with low wages or payment of bonuses. I heard of five strikes based on interviews with just nine ex-

workers in three towns. Interviewee 5 explained that white people were pushing the workers to complete the construction of the solar power plant ahead of schedule but did not pay any overtime. These findings show that the conditions of work in the solar power industry are exploitative, expecting longer hours of work and not paying a fair wage, which reduces the ability to support the household, thus exacerbating the crisis of social reproduction. This contradicts the assumption that low-carbon energy is more equitable and just than the fossil fuel industry and calls into question the possibility of a just energy transition (Sovacool, 2021).

The response to the above criticism of renewable energy jobs by renewable energy proponents is the argument that localisation of manufacturing is where the good jobs are, so this is what South African policy should support to ensure a just energy transition. As outlined by Interviewee 20;

if you transition from coal to renewable there is a dramatic decrease in the number of operating staff etc. required because, you know, there's not it's not as mechanical or complex a technology, a lot of things are automated, you know. On a coal plant, because it's coal, there's the processing of coal, transportation of coal, a lot of mechanical elements, piping, all of that. Whereas, on the PV and wind plant, it's just you know, the wind must be present and a turbine sort of spins or like sun is present in the module, you know, does its thing, there's no real mechanical intervention required. So operationally, it's a lot less people. So, the job creation will have to come in the supply chain. [Interviewee 20, 4 February 2022]

The views of solar power developers on the potential for local manufacturing will now be discussed. Most of the components in the value chain for solar power plants are manufactured elsewhere in the world and are imported. Interviewee 18, who is a manager at a solar developer company, gave a full breakdown of key components and where they come from: “The PV panels are from China, tracking systems are Spanish, metal and torque tubes are local, inverters are imported by SMA – I think they are American? – RT Transformers are from South Africa and the substations are locally built” [Interviewee 18, 24 February 2022].⁵ This supports the

⁵ SMA is a German company.

literature which outlines the prevalence of foreign countries in the manufacturing of various renewable energy technologies (Baker & Sovacool, 2017).

The interviews highlighted several barriers to developing significant local manufacturing capacity for solar energy technologies. First, there have been issues on the demand side due to delays in the bidding rounds of the REIPPPP and delays in the updates of the Integrated Resource Plan (IRP) which outlines the future energy mix that will be required by Eskom. Increasing manufacturing capacity is difficult when “there's no consistency from government in terms of the tendering process for us to sort of start manufacturing. Because then we don't know if for the next five years, we have a facility but no orders” [Interviewee 20, 4 February 2022]. Second, manufacturing of these technologies requires skills and expertise, or intellectual property, which South Africa does not yet have. Third, the national transmission grid faces limitations in terms of how much additional capacity can be added without significant grid upgrades. At present the Northern Cape grid is at capacity and would not be able to add additional renewable energy to the grid until there has been grid maintenance and upgrading in certain instances [Interviewee 20, 4 February 2022].

While there is interest in developing these skills and potential increased demand from government, the fact that the IPP bidding process was delayed for five years, which meant that many manufacturers had to close, does not give investors the confidence to start new manufacturing capacity. There is an effort to support manufacturing capacity in the country – Interviewee 21, who is in government at the IPPO, said that they are part of a task team with the Department of Trade, Industry and Competition which meets every two weeks and there is work being done as part of the South African Renewable Energy Masterplan. However, as outlined in the literature review, the prevalence of concentrated global production networks and trade liberalisation will make it very difficult for South Africa to set up local manufacturing (Baker & Sovacool, 2017).

Modelling may show that more jobs will be created by renewable energy, but if these jobs are short term, they do not represent a steady income. Furthermore, there can be projections and visions of green industrialisation, but at present localisation has not been successful and workers are justified in their concerns for their livelihoods in the energy transition. The impacts of the development of solar power plants have therefore exerted greater pressure on household provision due to the low paying, short-term and exploitative nature of the work. I will now focus specifically on the gendered segregation of labour within the solar power industry.

5.2. Gendered occupations in the solar power industry

The representation of women working on the solar plants based on the interviewee recollection was 24.13% on average. This is much lower than the representation of women in the managerial roles of the solar power companies which was around 40%. The representation of women at the government IPPPO was higher at 55%. These numbers, however, are all higher than the representation of women in the coal value chain which is around 13% (Makgetla, et al., 2019). These differences in women in the workplace illustrate that women are less represented in the lower skilled jobs, whereas the managerial level has a higher proportion of women.

This finding contradicts much feminist economics literature on gender representation at different levels which finds that women usually work in lower-wage and lower-skilled work (Beneria, et al., 2016). In South Africa, 38% of women work in low-skilled jobs compared to 29% of men (Casale, et al., 2021). This anomaly could be because lower skilled jobs in the solar industry are mostly in construction which faces similar bias against women as the mining sector. Interviewee 17, who is a manager at a solar company, shared that he has noticed less women in low skilled work in renewable energy, but finds that if the role requires an academic qualification, you will find more women in those roles, but still not 50% [Interviewee 17, 26 January 2022].

Interviewee 20 shared that she thinks the fact that renewable energy is newer means that more young people are in the industry who are less constrained by gender roles:

there's more balance coming through with the change to renewables. So, I do see a difference that people involved in renewables are typically... there's a better gender balance, but also its younger people. You know, a lot of the older people are, you know, sort of experts in coal or gas technology. And they I think they just struggle a bit to transition in terms of technology and knowledge base and you know, over the last, let's say, 10/15 years renewables has really come up. And the knowledge base sits with the younger people rather than older people. [Interviewee 20, 4 February 2022]

Therefore, renewable energy may be more 'gender equal' in higher positions because of the younger professionals involved in the industry or because women have performed well in education and thus have the requisite qualifications. However, there may be a class element

here where women in two-earner households in middle or upper classes are able to work in the renewable energy sector as they have privatised their childcare. As the data collected here is not a representative sample, it may not represent the solar power industry. The women I interviewed who worked in managerial roles all paid a domestic worker or child carer (in one instance both) [Interviewee 18, 24 February 2022].

In terms of the roles that women hold in the workplace, there remains an occupational segregation in many cases, but not all. Women were described as working in the office mostly, not on the ground doing hard labour. There was a view that women are not strong enough to lift PV panels on their own [Interviewee 5, 28 January 2022]. There were also reported instances of sexism and racism by those working on the solar power plants. Interviewee 9 described a situation where a male safety officer was discriminatory towards coloured women, and it was reported but there were no consequences for him [Interviewee 9, 26 January 2022]. The practice of the exchange of sex for a job or a promotion as a woman was referenced by Interviewee 6, a community member, but not directly related to jobs at the solar power plants. This has been associated with mining towns as highlighted by Valiani and Ndebele (2018). Interviewee 6 said that she refused to have sex for a job and she was told that “she would be unemployed for her whole life” [Interviewee 6, 25 January 2022].

There were also reports of racism at the solar plants. White people would not do any hard labour, they would work in the offices and even if you were doing the same job as a white person, you would get paid less if you are Coloured or Black [Interviewee 10, 26 January 2022]. There were comments that apartheid still exists in these towns, particularly in Kathu and Upington [Interviewee 6, 25 January 2022]. This was explained with reference to how people behave – the white farmer drives the bakkie and the Black workers sit in the back, they don’t sit in the vehicle with him [Interviewee 10, 26 January 2022]. Another example was given that if you are Black, you are not allowed to speak up in the workplace if there are problems, you are silenced [Interviewee 6, 25 January 2022]. It was also explained through the structure of the towns in that the spatial planning of apartheid has not changed, residential housing remains segregated by race and services have not been upgraded since apartheid [Interviewee 16, 27 January 2022].

The low numbers of women in the workforce, particularly in lower-skilled roles and gendered occupational segregation are indicative of the role of women as ‘home-makers’. These towns have been home to migrant workers and the labour structures around mining seem to remain

entrenched. I will now describe the interview responses on the responsibilities of workers and community members in the household which also support the fact that unpaid care work and household maintenance is carried by the working poor, underclass and others as categorised by Cousins et al. (2018) or the surplus population as described by Ossome and Naidu (2021).

When asked about responsibilities in the home, five of the six managers who I interviewed paid a domestic worker or a nanny for housework and one had a wife who conducted unpaid care work. Of the workers and community members (16 people total), 11 described unpaid care work in the home being conducted by women – either themselves, a sister, a mother, a spouse, or child. This does not mean that men did not also carry out housework, some said that they did. Men mentioned financial support as their main responsibility in the home more often than women – seven men mentioned financial support, compared to two women. This data indicates that the woman as homemaker and man as breadwinner division of labour is present in these households. An additional feature of the housework mentioned by four interviewees was the presence of an elder family member (a parent or uncle) who had a disability and required additional care. This put significant strain on Interviewee 6, who lives with her mother, her two siblings, her two children and her sister's two children. She said, “My life is stuck because my mom is sick. [It]’s like I have to stop everything, I can't do anything” [Interviewee 6, 25 January 2022].

Of the ten interviewees who had previously worked at a solar plant, three are employed in other jobs, two are earning through doing piece jobs (working in gardens and repairs), one is driving a taxi and four are unemployed. Of the four who are unemployed, only one is a man. Of the interviewees who are community members, none are formally employed but all six of them are doing something to earn money. Two operate as consultants, one has a part-time job, two are selling (food and perfume) and the last is driving a taxi. The fact that people had to be available for the interviews might have influenced the sample as those in full-time employment are less likely to be available for an interview. While all interviewees were making ends meet somehow, almost all expressed that the major challenge in their lives at present was not having a job.

All interviewees but two have children they are responsible for. The above analysis of employment of the group of community members and ex-solar workers shows a picture of precarious or informal work and limited integration into waged work. As this was somewhat expected due to the structure of many rural towns in South Africa, I also asked interviewees

about any petty commodity production that they might be engaged in for survival. The poor and working-class households have to depend on at least two realms of income for their social reproduction: wages from the market and subsistence farming within the household (Cousins, et al., 2018).

Of the 16 workers and community members, ten said they were growing food or farming animals. Seven interviewees only have access to a shared public tap which can be as far as 500m from their homes, so some said they weren't able to grow any food because of a lack of access to water. Five of them were farming just for subsistence, not for sale, while the other five were selling from their farming activity and in one case they were keeping cattle, sheep and goats as an investment [Interviewee 7, 25 January 2022]. Four of the five who are farming and selling their produce have access to land to do so. Interviewee 4's mother was allotted land to use by the village Chief during lockdown so that she could start a community garden and supply a feeding scheme she ran with a friend of hers. Her mother also keeps sheep and she pays someone to help with the community garden during the day [Interviewee 4, 25 January 2022].

Interviewee 7 is part of a Communal Property Association (CPA) which was the result of a land claim where 380 households were allocated land on a farm through a land redistribution scheme. While they have faced challenges with services like water and electricity, they have been able to keep livestock including cows, sheep and goats [Interviewee 7, 25 January 2022]. This petty commodity production has been possible because of access to communal land.

Interviewee 3 inherited land from his parents in Kuruman and is farming it with his siblings. They hire someone to look after the farm and livestock. They sell the produce to grant recipients on pension day [Interviewee 3, 25 January 2022]. Interviewee 10 explains:

[my] twin boys are currently on [the] family farm. Okay, about 120kms from Upington.

Ja, so they are actually helping my uncle. They're out now. The flock where you know the goats and with the cows... [I]t's from our great-great-great-grandfathers from France. [Interviewee 10, 26 January 2022]

In these two cases, land was inherited from elders, is shared amongst siblings and provides an opportunity for petty commodity production to support survival of the household.

The petty commodity production, short-term contracts as general workers, grant income and other family members working on a mine or a solar plant allows this group of people to survive. The short-term contracts are part of the market sphere, petty commodity production occurs in the household and grant income is accessed through the state. The presence of solar plants has not shifted this existence or dramatically changed the prospects for those who worked on the plants. As translated for Interviewee 1 by Boitumelo Tshetlho, my Research Assistant;

They overhear that this solar plant, is for Italian, you know, they're in charge. So, who is benefiting from that? And then government - she wish that government can intervene into this issue of unemployment [...] to help the locals to get our jobs. And then the other thing is that the issue of skills, [...] they go to Joburg or somewhere to look for people to come and they don't give us the training, proper training, for example. Now she's just left the job. She got nothing certificate, you know, to show that, that I was working there, you know, so that he can be able to upgrade yourself to go somewhere.

[Interviewee 1, 24 January 2022]

This quote outlines some of the issues experienced by those who worked on the solar plants such as the feeling that the international companies are reaping the benefits of the solar plants, the local people are not being given proper training and jobs are short term. The conclusion in this respect is that the market opportunities created by the solar power plants are exploitative and state support is insufficient such that poor and working-class households must constantly identify other sources of subsistence and income in order to survive. The next section will further detail the attitudes towards the impact of the solar power plants on households in the three case study towns.

5.3. Perspectives on the impact of solar power plants on the environment and the local community

The perspectives of workers and the local community on the impact of the solar power plants is a focus of the research because of the broadly positive and uncritical view taken on the REIPPPP programme by those involved in climate change activism. The REIPPPP is widely seen as very successful (Parshotam & van der Westhuizen, 2018). This narrative is then used to argue for an expansion of the REIPPPP which essentially means more privatised renewable

energy for the country. If the shift to renewable energy continues to be driven by the private sector it has implications for workers and communities in terms of work and energy access. While renewable energy is widely praised for being cheaper than coal, that assessment is based on the modelled levelized cost of electricity which does not account for grid maintenance or improvements, or the 20-year power purchase agreements Eskom is tied to with IPPs who are charging prices determined when the solar was first installed. Therefore, while South Africa's renewable energy generation has increased, our electricity generation woes are significant and prices are set to increase three-fold (Kamanzi, 2021).

Two codes were used to gauge perspectives on the impact of solar power. One focused on the impact of solar power plants for the surrounding communities and the other focused on the impact of solar power plants on the environment. Each comment about these impacts was weighted zero if it was a negative impact, 50 if it was a neutral impact or no impact and 100 if there was a positive impact. The average weighting of the impact of solar power plants on the local community was 68.3. This suggests that the overall view is that solar power plants have either a neutral or a positive impact on communities. Only one comment showed a negative view on the impact of the solar power plant on the community, while 38 comments were neutral about the impact and 24 comments were positive. The one negative comment stated that solar power plants are worse than coal power plants because there was frustration that the solar power plant has not improved access to electricity for the local community. The respondent, who was someone who had previously worked at a solar power plant said; "What is the use of the solar if it is not helping the community with electricity?" [Interviewee 4, 25 January 2022].

If I disaggregate the perceptions by grouping and analyse the attitudes towards the impact of solar from the group who had previously worked at a solar power plant, of the 25 comments on the impact, 17 were neutral while seven were positive. Similarly, of the local community grouping, 17 comments were neutral while five were positive about the impact on the community. On the other hand, looking at the comments from the group who are managers at solar plants, eight of 11 comments are positive about the impact of solar on the community and the other three are neutral. Lastly, the comments from the IPPs were all positive. Therefore, there seems to be a trend that the managers of the solar plants and at the IPPs assume that the impacts of the power plant are positive for the local communities while the community and those who worked on the solar plants mostly feel that there is very little impact on the community.

Reasons for the feeling that solar has a positive impact for the community included the fact that they create jobs, support local businesses, and provide bursaries, solar geysers and food hampers as part of their social development obligations contained within the REIPPPP implementation agreements.

However, many of the ex-workers at the solar plants questioned who benefits from the solar plant because there are communities in the surrounding areas that still do not have access to electricity, there is still loadshedding and the price of electricity has gone up. There is a suspicion that the mines actually benefit from the solar power plants. And this might be the case, particularly on a solar power plant near Kathu where the plant connects to a substation which was built for a manganese mine. When I asked the solar developer about this, they stated that the mine might be able to access power during loadshedding, but they were not sure. See below Figure 4 which shows the solar plant with the manganese mine in the background.

The collaboration between the solar power plant and the mine is similar to the relationship of mines and coal power in the MEC. It represents a partnership between the state and the private sector in processes of capital accumulation while leaving the working classes to reproduce themselves without the benefit of access to electricity. It highlights how infrastructure and state services are built to support the accumulation of capital rather than reproduction of labour, which is left to be managed and supported by women in most cases.



Figure 4: A solar power plant opposite a manganese mine near Kathu, Northern Cape.

In terms of the impact of the solar power plants on the environment, there were fewer comments here but slightly more controversy than the impact on the community and an average weighting of 52.63 which is very close to neutral. This is interesting because it means that the comments about the impact of solar power plants on the environment was less positive than those about the impacts on the community. Overall, seven comments were negative about the impact of solar power plants on the environment, four were neutral, and eight were positive. While most comments were positive, the fact that attitudes were so mixed was surprising in the context of a strong pro-renewable energy civil society environment.

In the ex-worker grouping, four comments showed a negative sentiment about the impact of solar power stations on the environment, while one was neutral and three were positive. The local community grouping had a similar distribution with two negative comments, two neutral comments and one positive comment. The managers at solar power plants had one negative comment, one neutral comment and three positive comments. Interestingly, the negative comments mostly referred to the feeling that the solar power plant actually causes atmospheric warming as the main concern, and some also mentioned that birds were killed on occasion. Those who felt it was neutral to the environment felt that there was potential pollution from the production of the solar panels or from the fact that recycling of panels is not done. In some cases, there was a feeling that the role of solar in reducing carbon emissions was not fully understood or just did not seem important. Some even said that coal is better than solar because coal jobs pay more than solar jobs. The issue of the volatility of solar power due to bad weather was raised. However, there was an expectation that solar should make electricity cheaper too.

Perspectives on the impact of the solar power plants were overall negative or indifferent. This was because most people had not seen or experienced any positive social impacts and the view that solar power plants were not actually good for the environment was prevalent. These attitudes towards solar power are starkly different from the views of environmental activists, government and the private sector on the potential positive impacts of solar power for South Africa. These views come from the poor and working classes who are struggling to survive. It is therefore understandable that their interest in solar power would relate to how it can support their income generation in the market or unpaid work to maintain the household. As the solar power plants have not created stable incomes or improved time use and efficiency in the household through electricity access, they are understandably indifferent towards them.

5.4. The role of the state in the shift to renewable energy and social provisioning

The overall attitude of the interviewees towards the state were negative. Interviewees expressed frustration that the government makes promises and then does not keep them [Interviewee 3, 25 January 2022; Interviewee 1, 24 January 2022]. There were also several mentions of corruption in government at the municipal level and at the Department of Mineral Resources and Energy. The sense is that the state does not follow proper processes on projects in terms of community consultation and tenders. The question of who is benefitting was asked repeatedly around these concerns and the implication was that government officials are keeping money for themselves.

The role of the state in the Global South has a different level of social provisioning compared to the Global North. Countries in the Global South had to deal with decades of colonial exploitation and as decolonisation was achieved, for many Global South governments, Structural Adjustment Policies were implemented which led to decreased spending on public goods and increased privatisation (IEJ, 2021). This is evidenced by the issues with access to basic services in these towns. I focused on two key services during interviews; access to electricity and access to water. Access to electricity is relevant because of the focus on the energy transition in this paper, the struggle with energy poverty for many South Africans and its influence on unpaid domestic work or petty commodity production. Access to water is relevant for sanitation, health (especially during times of pandemic) and for farming and petty commodity production – all activities significant to the social reproduction of the household.

A significant theme which emerged during interviews is the view that the municipality benefits from the provision of electricity and that electricity is too expensive. Many interviewees stated that the problem with access to electricity is that it is not coming straight from Eskom [Interviewee 3, 25 January 2022]. There was a belief that if the electricity came from Eskom it would be cheaper. Of the 16 interviewees living in the case study towns, only three did not have access to electricity at home and they were all living in Kathu in the newer informal settlements that have expanded due to migration into Kathu. Interviewee 7 lives on a CPA less than five kilometres away from one of the new solar power plants and they do not have electricity. As an important dimension of electricity access is affordability, and solar power is promised to make electricity cheaper, interviewees are understandably frustrated that electricity prices are only increasing. This contributes to their feeling that the solar power plant is of no use to them.

The state of public service provision in these towns reflects the decreased spending on public goods, a characteristic of neoliberal capitalism. Interviewees reported that mining companies were stepping into the gap to provide water and road infrastructure, representing the privatisation of these services. Similarly, solar power plants are expected to contribute towards the social and economic development of local communities based on the requirements of the REIPPPP. However, the social reproduction crisis prevails in these towns as wages from the market, subsistence farming in the household and social grants from government still fail to support the reproduction of labour power.

There were some suggestions that alternative models of solar might be more beneficial for the community, such as smaller scale microgrids, solar geysers or even certain solar-powered appliances [Interviewee 16, 27 January 2022]. These types of power seem more useful and practical to support unpaid household and care work.

Despite the jaded view of the government, interviewees did provide input on what they feel government should be doing about climate change and service provision. There was some hope expressed in the local activism which has increased over the past few years with local organisations contesting local elections and plans to form a new labour union [Interviewee 16, 27 January 2022]. For these communities, local activism is their main hope to improve conditions. A feminist political economy approach argues that the incorporation of unpaid workers or surplus populations as working classes can create greater grounds for solidarity and mobilisation and this could be the case in these Northern Cape towns where ‘informal’ and unpaid work is vital to survival.

6. Conclusion

Adopting a gendered labour lens to understand the impact of the shift from fossil fuels to solar power on workers and communities provides a unique view and a useful framing to think about a just energy transition which accounts for both the productive and reproductive spheres. It also considers inequalities in gender and race in the capitalist relation which should be relevant in achieving justice. The gendered labour lens makes use of social reproduction theory and three major components - the economy, the household and the state – which are usually not considered together in standard economic analysis. In the framework of social reproduction and gendered labour, the real shift would happen if solar plants affected one or all of the three components on which the communities depend for survival: wages in the economy; grants or social provision through the state; or subsistence within the household.

In terms of the wages in the **economy**, the REIPPPP programme is dominated by European firms who hire local workers temporarily through subcontractors who use exploitative practices during construction of the solar plants and thereafter create little opportunity for jobs in local communities. Furthermore, the creation of more jobs and better working conditions through local manufacturing of solar power technologies is unlikely due to the state of international trade liberalisation and global production networks. These findings show that the conditions of work in the solar power industry are exploitative, which reduces the ability to support the household, thus exacerbating the crisis of social reproduction.

Households are partially integrated into waged work through processes, such as mining, and utilise various strategies to survive, including petty commodity production, made more difficult by the lack of access to land, energy and water services. The failure of the solar power plant development to provide access to electricity or simply reduce the prices of electricity makes households indifferent to them. Access to services like electricity and water are fundamental for unpaid care work and should thus be considered as equally important to a just energy transition as the number of jobs created.

Attitudes towards the **state** and the local government are cynical and there is little hope that government will provide services, let alone address future environmental crises associated with climate change. However, interviewees expressed hope in the increase in activism in communities. Two examples include local organisations challenging local government elections and the organisation of activists with the intent to form a new labour union to counteract exploitation of rural workers.

Therefore, workers and community members who rely on the coal value chain should be wary of the transition to renewable energy and the just energy transition narrative. This research has focused on solar power generation and the impacts of the solar power plants on workers and communities in the Northern Cape. If we use this as a case study of what a larger scale energy transition could look like, there is indeed cause for concern, as the energy transition in its current form promises further exploitation and exacerbation of the crisis of social reproduction, not justice at all.

Areas for future research include exploration of the prevalence of subcontractors on the well-being and working conditions of solar power plant workers, further understanding the experiences of racism in the renewable energy industry, and lastly, how land procurement for renewable energy projects interacts with local livelihoods.

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Appendix A: Interview questions guidelines

Interview Group 1 – Solar power plant worker

1. Life experience
 - 1.1. Age/gender/married/employed/ children?
 - 1.2. What is your experience of living here? Were you born here or did you move here? (family history)
 - 1.3. What have been the changes in your local environment while you lived here?
 - 1.4. What are the major challenges in your day to day life?
 - 1.5. Do you own the land/house where you live?
2. Work
 - 2.1. What kind of work do you do?
 - 2.2. Do you have responsibilities at home?
 - 2.3. How are the conditions of your work? (Health and safety)
 - 2.4. Have you experienced racism or sexism at work?
 - 2.5. What is the division of work depending on gender like at work?
 - 2.6. What Is the division of work depending on gender like at home?
 - 2.7. How does your family meet their basic needs?
3. Solar power plants
 - 3.1. What is your relationship to the solar power plant in this area?
 - 3.2. What has been the impact of the power plant on your community?
 - 3.3. In what way are renewable energy technologies more environmentally sustainable than other power sources?
 - 3.4. What effect does building renewable energy power plants have for South Africa?
4. Access to energy resources
 - 4.1. Do you have safe access to energy in your home?
 - 4.2. What sources of energy do you use to cook, heat your home and for lighting?
 - 4.3. What is the role of the state/government in this?
 - 4.4. How has this power plant affected energy access in this community?
5. Climate change
 - 5.1. Have you noticed any changes in climate since you lived here and how has this affected you?
 - 5.2. What is the role of the state in managing climate change?

Interview Group 2 – Community member

1. Life experience
 - 1.1. Age/gender/married/employed/ children?
 - 1.2. What is your experience of living here? Were you born here, or did you move here? (family history)
 - 1.3. What have been the changes in your local environment while you lived here?
 - 1.4. What are the major challenges in your day to day life?
 - 1.5. Do you own the land/house where you live?
2. Work
 - 2.1. Do you have a job?
 - 2.2. What kind of work do you do?

- 2.3. What responsibilities do you have at home?
- 2.4. How are the conditions of your work? (Health and safety)
- 2.5. What is the division of work depending on gender like at work?
- 2.6. What Is the division of work depending on gender like at home?
- 2.7. How does your family meet their basic needs?
3. Solar power plants
 - 3.1. What is your relationship to the solar power plant in this area?
 - 3.2. What has been the impact of the power plant on your community?
 - 3.3. In what way are renewable energy technologies more environmentally sustainable than other power sources?
 - 3.4. What effect does building renewable energy power plants have for South Africa?
4. Access to energy resources
 - 4.1. Do you have safe access to energy in your home?
 - 4.2. What sources of energy do you use to cook, heat your home and for lighting?
 - 4.3. What is the role of the state/government in this?
 - 4.4. How has this power plant affected energy access in this community?
5. Climate change
 - 5.1. Have you noticed any changes in climate since you lived here and how has this affected you?
 - 5.2. What is the role of the state in managing climate change?

Interview Group 3 – Solar power plant manager/developer

1. Life experience
 - 1.1. Age/gender/married/employed/ children?
 - 1.2. Where do you live?
 - 1.3. What is your experience of living here? Were you born here or did you move here? (family history)
 - 1.4. What have been the changes in your local environment while you lived here?
 - 1.5. What are the major challenges in your day to day life?
 - 1.6. Do you own the land/house where you live?
2. Work
 - 2.1. What work do you do for the solar energy developer?
 - 2.2. Do you have responsibilities at home?
 - 2.3. How are the conditions of your work? (Health and safety)
 - 2.4. What is the division of work depending on gender like at work?
 - 2.5. What Is the division of work depending on gender like at home?
 - 2.6. How does your family meet their basic needs?
3. Solar power plants
 - 3.1. What do you think about the opportunities for jobs in the renewable energy sector?
 - 3.2. How could SA become a renewable energy manufacturer?
 - 3.3. What does the value chain for this solar plant look like? Where do components come from?
 - 3.4. In what way are renewable energy technologies more environmentally sustainable than other power sources?
 - 3.5. What effect does building renewable energy power plants have for South Africa?
 - 3.6. What has been the impact on the local community?

4. Access to energy resources
 - 4.1. Do you have safe access to energy in your home?
 - 4.2. What sources of energy do you use to cook, heat your home and for lighting?
 - 4.3. What is the role of the state/government in energy access?
 - 4.4. How has this power plant affected energy access in this community?
5. Climate change
 - 5.1. Have you noticed any changes in climate since you lived here and how has this affected you?
 - 5.2. What is the role of the state in managing climate change?

Interview Group 4 – Government Official

1. Life experience
 - 1.1. Age/gender/married/employed/ children?
 - 1.2. Where do you live?
 - 1.3. What is your experience of living here? Were you born here or did you move here? (family history)
 - 1.4. What have been the changes in your local environment while you lived here?
 - 1.5. What are the major challenges in your day to day life?
 - 1.6. Do you own the land/house where you live?
2. Work
 - 2.1. What work do you do for the government dept?
 - 2.2. Do you have responsibilities at home?
 - 2.3. How are the conditions of your work? (Health and safety)
 - 2.4. What is the division of work depending on gender like at work?
 - 2.5. What Is the division of work depending on gender like at home?
 - 2.6. How does your family meet their basic needs?
3. Solar power plants
 - 3.1. What do you think about the opportunities for jobs in the renewable energy sector?
 - 3.2. How could SA become a renewable energy manufacturer?
 - 3.3. What does the value chain for solar plants look like? Where do components come from?
 - 3.4. In what way are renewable energy technologies more environmentally sustainable than other power sources?
 - 3.5. What effect does building renewable energy power plants have for South Africa?
 - 3.6. What has been the impact on the local community?
4. Access to energy resources
 - 4.1. Do you have safe, reliable and affordable access to energy in your home?
 - 4.2. What sources of energy do you use to cook, heat your home and for lighting?
 - 4.3. What is the role of the state/government in energy access?
 - 4.4. How has this power plant affected energy access in the Northern Cape and SA?
5. Climate change
 - 5.1. Have you noticed any changes in climate since you lived here and how has this affected you?
 - 5.2. What is the role of the state in managing climate change?

Appendix B: Anonymised List of Interviews

Interview number	Gender	Race	Home language	Role at solar plant	Grouping	Location	Date of interview
1	Woman	Black	Tswana	General Worker	Ex-worker at solar plant	Kuruman	24-Jan-22
2	Man	Black	Tswana	Maintenance	Ex-worker at solar plant	Kuruman	24-Jan-22
3	Man	Black	Tswana	Safety Rep	Ex-worker at solar plant	Kathu	25-Jan-22
4	Woman	Black	Tswana	Cleaner	Ex-worker at solar plant	Kathu	25-Jan-22
5	Man	Black	Tswana	Team leader	Ex-worker at solar plant	Kuruman	28-Jan-22
6	Woman	Black	Tswana		Local community member	Kathu	25-Jan-22
7	Man	Black	Tswana		Local community member	Kathu	25-Jan-22
8	Woman	Black	Tswana		Local community member	Kuruman	28-Jan-22
9	Woman	Coloured	Afrikaans	General Worker	Ex-worker at solar plant	Upington	26-Jan-22
10	Woman	Coloured	Afrikaans	Receptionist	Ex-worker at solar plant	Upington	26-Jan-22
11	Man	Coloured	Afrikaans	General Worker	Ex-worker at solar plant	Upington	26-Jan-22
12	Man	Coloured	Afrikaans	General Worker	Ex-worker at solar plant	Upington	26-Jan-22
13	Man	Black	Zulu	Specialist	Consultant at solar plant	Upington	26-Jan-22
14	Man	Coloured	Afrikaans		Local community member	Upington	27-Jan-22
15	Man	Coloured	Afrikaans		Local community member	Upington	27-Jan-22
16	Man	Coloured	Afrikaans		Local community member	Upington	27-Jan-22
17	Man	Black	Tswana	Manager	Manager at solar plant	Hotazel	26-Jan-22
18	Woman	White	English	Manager	Manager at solar plant	Cape Town	24-Feb-22
19	Woman	Coloured	Afrikaans	Manager	Manager at solar plant	Cape Town	03-Feb-22
20	Woman	Indian or Asian	English	Manager	Manager at solar plant	Kuruman	04-Feb-22
21	Man	White	Afrikaans	Manager	Manager at government IPP office	Pretoria	03-Feb-22
22	Woman	White	Afrikaans	Manager	Manager at government IPP office	Pretoria	03-Feb-22

Appendix C: List of Codes used in Analysis

Main Codes	Code Count
Access to electricity	30
Access to water	18
Changes in community	4
Characteristics of Mining towns	3
Climate change	17
Communal provision	2
Community challenges	51
Community consultation	7
Conflict between locals and people from other provinces	3
Covid response	3
Demographic info	41
Expensive property in Kathu	2
Farming	5
Future energy mix	8
GBV	3
Gendered occupations	24
Government role	51
Income source	19
Migration	10
Mine impact	6
Misdirected targeting of development programmes	4
Reasons for labour exploitation in NC	2
Responsibilities at home	33
Solar industry	59
Strike	8
Subsistence farming	5
Threat to transition	3
Training	3
Views on Solar plants	94
Water pollution	4
Women in workplace	18
Working conditions	34
Xenophobia	8