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Green Jobs Report

Case Studies of Green Jobs in Renewable Energy Projects in Zimbabwe

NAOME CHAKANYA

A RESEARCH REPORT

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Acronyms

COP	Conference of the Parties
EU	European Union
GDP	Gross Domestic Product
GHGs	Greenhouse gases
ILO	International Labour Organisation
IRENA	International Renewable Energy Agency
MW	Megawatt
NDC	Nationally Determined Contribution
PA	Paris Agreement
PV	Photovoltaic
RE	Renewable energy
REFIT	Renewable Energy Feed-In Tariff
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

1. Introduction and Background

1.1 Introduction

Climate change is the defining challenge of today. The call to reduce greenhouse gas (GHG) emissions that are responsible for global warming and the eventual shift in climate is at the centre of addressing climate change. One of the strategies towards the reduction of emissions has been the uptake of renewable energy (solar, hydro, biomass, biofuel, wind, geothermal) which produces less carbon emissions than traditional fossil fuels such as coal and oil. Investment in renewable energy has quadruple benefits namely the reduction in GHGs, improving energy security especially in rural areas, job creation and environmental preservation. Jobs created through the deployment of renewable energy are termed 'green jobs'. Ultimately, the creation of green jobs fulfills multiple objectives which include addressing climate change, moving towards a low-carbon economy, tackling the high unemployment, especially among the youths, ensuring energy access and sustainable socio-economic development.

The United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) both contend that the creation of green jobs is an opportunity to address the employment challenge and support the transition of countries to green economies. Additionally, IRENA reconfirmed that, 'Accelerating the transition to a renewables-based energy system represents a unique opportunity to meet climate goals whilst fuelling economic growth, creating new employment opportunities and enhancing sustainable human development'. (IRENA, 2016). However, the magnitude of the impact of renewable energy on Gross Domestic Product (GDP) and employment depends on the economic structure of the country, the costs of alternative energy sources (e.g. fossil fuel prices, energy technology costs) and whether the equipment and required services are imported or sourced locally. There is a more significant positive effect if the technology is produced locally under the right conditions (e.g. market potential, skills availability) (ibid). Thus, investment in green skills is crucial to achieving the full employment potential of green initiatives. Workers require green skills to design, manufacture, install, operate and maintain a variety of renewable energy including energy efficiency technologies.

As the green jobs case gains momentum in the renewable energy discourse, more countries have increased their reporting on green jobs creation as indicated in the IRENA's annual reports. As reiterated by IRENA, sound, quality data and analysis, insights and information on the status and trends of employment in the renewable energy sector is critical to enable informed policy choices, monitoring policy effectiveness and supporting policy makers communicating the benefits of these policies to the wider public using reliable facts and figures (IRENA, 2013).

In Zimbabwe, the discourse of green jobs and green skills is still in its infancy. Whilst other countries have started reporting on green jobs created, sadly, Zimbabwe has lagged. Zimbabwe needs to catch up with international developments on renewable energy and creation of green jobs and investment in green skills. It is widely recognised that up-to-date data is key to inform policy direction. It is therefore critical for Zimbabwe to continually conduct comprehensive studies of green initiatives country-wide and document, generate, record and analyse data on green jobs and green skills to inform policy. It is for this purpose that this research was conducted.

1.2 Rationale for the Research

In Zimbabwe, it has been recently acknowledged that renewable energy plays a significant role in increasing the security of energy supply, mitigating climate change and economic development, hence the Government's initiative to develop the Renewable Energy Policy through the Ministry of Energy. Whereas the need for such an initiative is undisputed, there is, however, a dearth of information on the impact of renewable energy deployed thus far on employment (jobs) by the government, NGOs and independent power producers (IPPs). Contrary to conventional industries (agriculture, mining, manufacturing etc.) where employment data tends to be well captured in government and other statistics, the same has not yet applied to the renewable energy sector in Zimbabwe, and yet various and good practices of renewable energy initiatives exist throughout the country.

Accordingly, this research aimed to assess:

- The quantitative engendered evidence of green jobs in established RE projects and initiatives
- The types of green jobs created through renewable energy deployment
- The industrial, occupational, and geographic distribution of the jobs created
- The wages and conditions of the workers in these jobs
- The requisite education, training and skills development to sustain renewable energy deployment in Zimbabwe
- The potential growth and investment opportunities for renewable energy deployment and green jobs creation

The research findings will also be useful in meeting the information needs of policymakers (micro-, meso- and macro-level). The research findings will provide information for renewable energy policy development initiatives, design of relevant renewable energy projects, programmes and strategies including their labour market impact.

1.3 Research Methodology

The study included both quantitative and qualitative approaches. Questionnaires were developed for interviewees, and face-to-face interviews with key informants were conducted. Questionnaires were distributed to key informants across geographical locations who could not be reached physically due to distance.

Site visits and face-to-face interviews were organised for Manicaland, Chiredzi and Harare. The interviews were held with company management and workers.

The research applied a case study approach focusing on the various renewable energy projects in solar, hydro-energy, biofuels and biomass in the identified geographical areas. The research is

a 'snapshot' analysis of jobs created during and after the installation of the renewable energy technologies. The study focused more on the direct jobs created, although there were some cases of certain inferences of indirect jobs.

Interviews were conducted with the following institutions:

- State enterprises in RE which included the Zimbabwe Energy Regulatory Authority (ZERA) and the Rural Electrification Agency (REA). Both were responsible for populating the number of operational renewable energy projects registered by the authority by type of renewable energy, geographical location, operation status and RE generation capacity
- IPPs – IPPs were critical informants in the research. Some of the IPPs' projects were running whereas others were at various administrative stages
- NGOs – the NGOs in Zimbabwe which implemented renewable energy projects included Practical Action, Oxfam, the Deutsche Gesellschaft fur International Zusammenarbeit (GIZ) and Plan International
- District Councils – Mutare District Council provided insights into renewable energy projects operational in Mutare District
- Councillors – the researcher engaged Councillor A.F. Khan, Ward 22 Mpudzi, Mutare where the Chipendeke and Himalaya mini-hydro schemes are found
- Business associations – Renewable Energy Association of Zimbabwe (REAZ) which populated the number of private companies operating renewable energy projects by type of renewable energy, geographical location and RE generation capacity
- Informal business operators in the renewable energy sector
- Trade unions
- Academia – lecturers from universities

1.4 Limitations of the Research

The research encountered the following challenges:

- Limited time and financial resources which limited the geographical coverage – the research (interviews and site visits) covered renewable energy projects in selected geographic areas. Areas covered included Harare, Manicaland Province (Mutare, Honde Valley, Chipinge, Chimanimani and Eastern Highlands) and Chiredzi. The desk review revealed that most of the renewable energy projects were located in rural areas which meant that additional financial and time resources were required.
- Methodology in the calculation of the green jobs – the research did not use scientific quantification of green jobs generated by a renewable energy project which includes measurements of green jobs by calculating the number of jobs per unit of energy (electricity generated). Other case studies have concentrated on the net economy-wide effect of renewable energy on employment, considering the direct, indirect and

induced effects from interactions throughout the economy. These scientific approaches are founded on solid empirical data sets which, in the case of Zimbabwe, are not comprehensive and not adequately available since renewable energy is a relatively new sector. Therefore, this research focused more on the number of workers engaged at each stage of a renewable project (from construction to installation and operation and maintenance) – direct green jobs. As this research is the first of its kind and on a small scale, it sought to assess the intensity of employment for each renewable energy project.

- Focus on formalised companies and institutions – the research focused on formalised companies, entities, and institutions. Whereas there are a variety of players in the renewable energy industry, analysis revealed that the majority of them especially those in the solar energy (solar energy entrepreneurs in trading and installations) sector were informal and were varied in size (micro, small to medium) and thus required more resources to incorporate them in the research.
- Slow and low response rate from the questionnaire survey – the questionnaire response rate from some of the targeted service providers in the renewable energy sector was slow and lower than expected. The reason for this response rate might have been because the majority are informal companies or entities in a relatively new sector and were sceptical and feared exposure to official follow-ups by regulatory authorities.

2. Conceptual Framework: Defining and Measuring Green Jobs

2.1 Defining Green Jobs – Existing Knowledge

The definition of green jobs has evolved. In 2008, UNEP defined green jobs as 'work in agriculture, industry, services, administration research and development (R&D) that contributes to preserving or restoring the quality of the environment'. It also defined green jobs as jobs in installation, maintenance, scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, the definition includes jobs that:

- help to protect ecosystems and biodiversity
- reduce energy, materials, and water consumption through high-efficiency strategies
- de-carbonise the economy
- minimise or altogether avoid generation of all forms of waste and pollution

The International Labour Organisation (ILO) further refined the definition to include jobs that help reduce environmental impact, and lead to environmentally, economically and socially sustainable enterprises and economies. The ILO went on further to explain the definition of the green jobs:

- Improve energy and raw material efficiency
- Limit GHGs

- Minimise waste pollution
- Protect and restore ecosystems
- Support climate change adaptation

The ILO also provided two dimensions of green jobs highlighted in Figure 1.

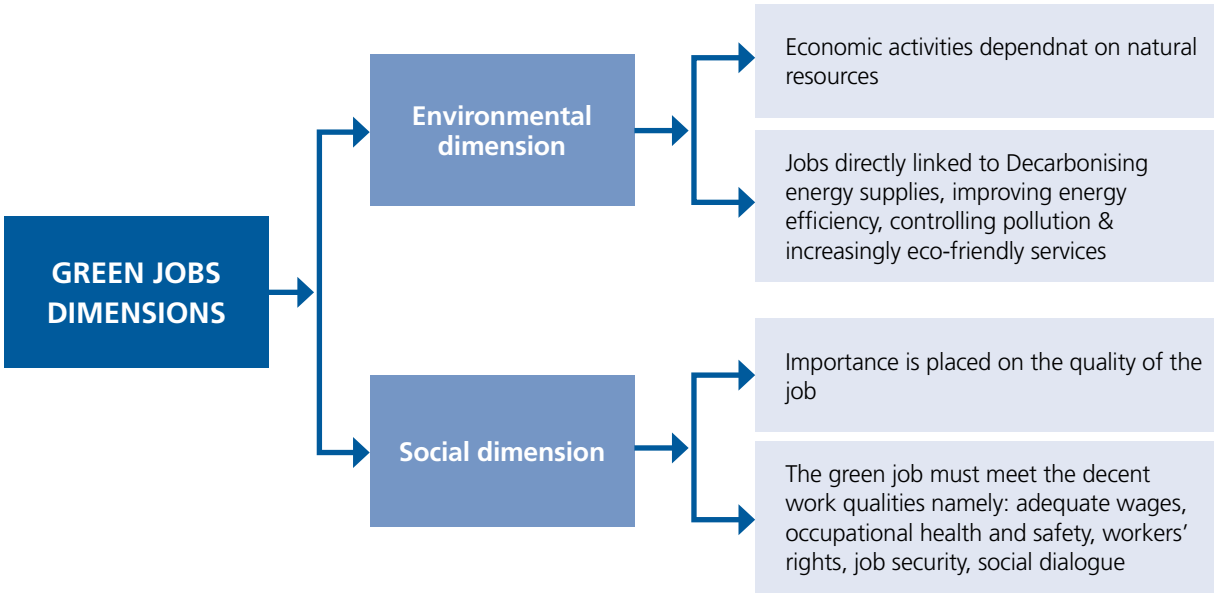

Figure 1: The two dimensions of a green job

According to the ILO, a job is only green if it meets the conditions of decent work as stipulated in the various ILO Conventions. UNEP also argued that green jobs also need to be 'good' jobs that meet longstanding demands and goals of the labour movement, i.e., adequate wages, safe working conditions, and worker rights, including the right to organise labour unions.

Whilst there exists a variety of definitions, the common denominator is preservation and restoration. For this research, both the UNEP and ILO definitions were considered as they complement each other and fit well within the context of Zimbabwe's economy.

2.2 Measuring Green Jobs – Existing Knowledge

According to the ILO, most studies attempted to measure green jobs based on the following:

- Products and services that meet one of several criteria for a green economy
- Processes by which these products and services are produced
- Environmental protection and or on sectors of the economy such as forestry and renewable energy
- The different occupations and how they contribute to the greening of the economy

Furthermore, in 2013, the ILO developed a policy brief setting out the different methodologies available to assess employment potential of green policies to guide policy choices. The policy brief stated that the selection of methods was dependant on factors such as available budget and the type, quality and consistency of available data. The ILO identified three types of methods namely:

- Inventories and surveys
- Input-output analysis and Social Accounting Matrices
- Computable General Equilibrium models

A comparison of the three methodologies is provided in Table 1.

Inventories and surveys	Input-output analysis and social accounting matrices	Computable general equilibrium models
• Relatively simple to carry out. • Provide a useful snapshot of the current employment situation and a basis for further assessment using more complex models. • Allows a simple extrapolation from existing employment ratios on short-term employment effects of increased activity in one or the other sector.	• They are geared to estimating potential employment effects over short to medium term. • They are relatively fast to construct and both flexible and practical. • Provides a high degree of accuracy as they use data from national accounts. • Most models offer only a short to mid-term 'snapshot' and cannot provide predictions for a long-term period. • Many computable general equilibrium and Related models are built upon I-O analysis or SAMs but include additional assumptions to offer more comprehensive, dynamic and long-term analysis of employment effects. *Example* A study in Germany focused on the number of jobs financed by environmental expenditures, rather than the amount of jobs with green activities (EU, 2010)	• They can create a comprehensive picture of an economy and allows the analysis of long-term employment effects • The models require time, resources and a high level of expertise. • Models need numerous assumptions and simplifications to be made on how an economy operates over time. • Some models assume that markets always clear (demand for a product will equate to supply of that product) or do not include unemployment. Such assumptions will ultimately influence the model outcomes and limit their explanatory capacity.

Table 1: Comparison of green jobs assessment methodologies

Source: ILO (2013)

Overall, given that the renewable energy sector is relatively new in Zimbabwe, the researchers applied the ILO inventory surveys approach where it focused on jobs in project development, construction,

installation of the technology, operation and maintenance. The study also recorded indirect jobs created as a result of the establishment of renewable energy projects such as agricultural jobs in the irrigation, jobs in peanut butter making and grinding mills, where available. However, in future research, there will be scope to apply the input-output analysis, social accounting matrices and computable general equilibrium models.

3. Key Players In Renewable Energy In Zimbabwe

Various institutions are actively involved in the renewable energy sector in Zimbabwe. These include the Government Ministries (Ministry of Energy and Power Development, Ministry of Water Resources Development and Climate; the ZERA, REA, IPPs, NGOs and renewable energy sector service providers which include manufacturers, retailers and service consultants. This section deals with those institutions that had a crucial role in the research process.

3.1 Ministry of Energy and Power Development

The Ministry has been instrumental in the development of the Renewable Energy Policy which underwent a stakeholder's validation process in 2017. Literature has widely acknowledged the role of a sound policy framework in the promotion of renewable energy investment, deployment and job creation. For instance, REN21 reported that 146 countries had renewable energy support policies in place as of year-end 2015. However, the Zimbabwe renewable energy policy falls short of articulating and integrating the employment (job) targets of the various policy measures. It is always critical to embed and link green jobs and employment strategies in climate change, renewable energy and environmental policies. It means complementing measures to protect the climate and environment with plans to increase employment and skills in the green economy, and vice versa.

3.2 The Zimbabwe Electricity Supply Authority (ZESA)

ZESA is responsible for the electricity sub-sector. Its subsidiaries the Zimbabwe Power Company (ZPC), and the Zimbabwe Electricity Transmission and Distribution (ZETD) are accountable for the power generation and the transmission and distribution network, respectively.

3.3 The Zimbabwe Energy Regulatory Authority (ZERA)

ZERA is a statutory body corporate established in terms of the Energy Regulatory Authority Act [Chapter 13:23] of 2011 read together with the Electricity Act no 4 of 2002 [Chapter 13:19], the Petroleum Act [Chapter 13:22] of 2006 and subsequent amendments.[1]

1 http://www.zera.co.zw/

ZERA is mandated to regulate the entire energy sector in Zimbabwe in a fair, transparent, efficient and cost-effective manner for the benefit of the consumers and energy suppliers. It is also responsible for licensing all electricity and petroleum companies in Zimbabwe. ZERA regulates any person or private company that operates an electricity undertaking which generates, transmits, distributes or retails electricity for commercial purposes over 100 kilowatts (kW). ZERA also extends light-handed regulation to community-based mini-grids and solar PV systems whose generation capacity is below the 100kW threshold (ZERA, 2016). It provides support and oversight in the form of monitoring and ensuring technical compliance to safety standards, power quality and energy efficiency standards.

The authority has six broad categories namely:

- Regulation and Licensing
- Research and Development
- Market reform and competition
- Energy access and security of supply
- Energy efficiency and environmental protection
- Key stakeholder advisory

3.4 Rural Electrification Agency (REA)

The Rural Electrification Agency mandate is to spearhead rapid and equitable electrification of rural areas in Zimbabwe. The agency manages the Rural Electrification Fund (REF) which provides funding for the programmes through levies, loans, fiscal allocations, grants and donations. According to the Ministry of Energy and Power Development, the renewable energy programmes are primarily funded by a 6% levy, levied on all electricity consumers as well as fiscal allocations. More recently, the fund has been used for renewable energy projects in solar and biogas. Table 2 illustrates renewable energy projects implemented by the Renewable Energy Fund in 2015 and 2016.

Year	Number of electrified institutions	Type of energy		
		Solar PV mini grids	Biogas digesters	Other
2015	429	14	18	397
2016	429	1	6	422

Table 2: No. of RE projects under the Rural Electrification Fund, 2015-16

Source: ZERA 2016 Annual Report

Table 2 indicates that the proportion of renewable energy projects in the REF is still deficient and it requires more effort to increase the amount of renewable energy in the energy mix. It was not possible to ascertain the actual green jobs created and the skills sets.

3.5 Independent Power Producers (IPPs)

Zimbabwe is in the process of finalising the IPP Policy Framework. The framework provides for the procurement of power from the private sector and includes incentives that are offered to such investors. However, one of the significant challenges faced by the IPPs has been the inability to raise the necessary long-term financing at reasonable costs to develop the projects (ZERA, 2016 Annual Report). Table 3 indicates the state of IPPs in Zimbabwe.

Stage of development	Licensed companies	Total capacity (MW) as per licence
Stage 1 - Concept/ Pre-feasibility stage (completion of all activities required to define projects for full feasibility)	• Great Zimbabwe Hydro • Manako Power • H T Gen • Yellow Africa • De Green Rhino Energy • Shilands Enterprises • Lueven investments • Sinogy Power • Centragrid Private Limited • Utopia Power Company • SolGas Private Limited • Richaw Solar Tech	680.8
Stage 1 (b) Feasibility and technical studies	• Sengwa Power Station • Geobase Gwanda Solar • Gairezi • Plum Solar • Immaculate Technologies • Riverside Power Station	989.2
Stage 2- Feasibility/Proof of bankability (Completion of all activities to prove project bankability including EPC contract and PPA approval)	• Southern Energy • China Africa Sunlight Energy	1,200
Stage 3 – Funding (Completion of all activities leading to financial close and fulfilment of conditions precedent)	• Hwange Expansion Project • Lusulu	2,600
Stage 4 – Construction (Completion of all activities to project commissioning	• Kariba Expansion Project • Hauna Power Station	302.3
Stage 5 – Operational (Commercial operation)	• Border Timbers • Duru • Nyamingura • Pungwe A • Pungwe B • Pungwe C Power Station • Hippo Valley Estates • Triangle Estates • Green Fuel • Kupinga Renewable Energy • Hauna Power Station	125.72
	TOTAL	**5,898.02**

Table 3: The state of Independent Power Producers – RE projects

Source: ZERA 2016 Annual Report

3.6 Non-Governmental Organisations (NGOs)

The role of NGOs in renewable energy is increasingly being recognised. Most NGOs implement sustainable livelihoods projects reaching out to the poor and remote communities and mobilising and capacitating them to carry out projects more efficiently and at lower costs, and renewable energy fits in well with their aims. Some of the NGOs that have been implementing and promoting renewable energy projects such as off-grid and community based renewable energy projects include Practical Action, Oxfam, GIZ, SNV and Plan International. However, only SNV could not be reached to provide data and information on some green jobs created by their initiatives. Details of the renewable energy projects and their job creation impact will be discussed in Section 5.

3.7 The Renewable Energy Association of Zimbabwe (REAZ)

REAZ is an independent, non-governmental and non-profit making organisation formed in response to the growth of industry players in renewable energy and the increased uptake of renewable energy technologies in Zimbabwe. REAZ is membership based and covers corporates, associates, professionals and individuals working in the renewable energy sector. The mandate of REAZ is to facilitate sustainable development and the uptake of RETs to the benefit of its members, stakeholders and consumers.

3.8 Private Sector

Private sector players are active in the renewable energy sector. They are active throughout the renewable energy development value chain (manufacture, importation, distribution, wholesale, retail, installation and maintenance of renewable energy installations). Some provide distributed renewable energy (DRE) systems which include power, cooking (clean stoves for cooking), heating and cooling systems that generate and distribute services independently of any centralised system, in urban and rural areas.

4. Strategies to Promote Renewable Energy and Green Jobs in Zimbabwe

This section provides as overview of some of the strategies to promote renewable energy and green jobs in the country.

4.1 Renewable Energy Feed-In Tariff (REFIT)

According to ZERA, the REFITs were reviewed in 2016 but have yet to be approved (Table 4). They were reviewed to incorporate the declining capital costs of renewable energy technologies such as solar and wind.

Technology		Tariff (US$ per kWh) 2013	Tariff (US$ per kWh) 2016
Hydro	100 kW ≤≥ 1 MW	0.153	0.146
Hydro	1 < ≥ 5 MW	0.134	0.134
Hydro	5< ≥ 10 MW	0.118	0.121
Biomass	100 kW ≤≥ 10 MW	0.137	0.123
Bagasse	100 kW ≤≥ 10 MW	0.111	0.102
Biogas	100 kW ≤≥ 10MW	0.127	0.114
Solar PV	100 kW ≤ ≥1 MW	0.186	0.140
Solar PV	1 MW < ≥ 5 MW	0.178	0.132
Solar PV	5 MW < ≥ 50 MW	N/A	0.123
Wind	100 kW ≤≥ 5 MW	0.148	0.112

Table 4: Renewable Energy Feed-In Tariffs (REFITs)

Source: ZERA, 2016 Annual Report

Generally, there are some barriers to investment and financing in renewable energy including low REFITs which are not cost reflective. There are no adequate incentives to promote new renewable energy investments and creation of jobs. The 2016 SADC Energy Yearbook bemoaned of the lack of regional guidelines and models to analyse the potential impacts benefits of incentives such as REFITs, which were seen as a panacea of introducing renewable energy into the tariff structure of the national electrical system. The report revealed that whilst some countries had introduced REFIT, as yet, there has not been a success story. In 2011, South Africa switched from a REFIT programme to competitive auction to enable more competition in its procurement of utility scale renewable energy (Government of Namibia, 2017). The auction is reported to have successfully helped reduce costs for new projects especially solar PV and wind (ibid).

4.2 Approval of RE licences

ZERA is responsible for approving licences for renewable energy. The growth of licences is considered as a catalyst to unlock the green jobs potential. Table 5 shows the number of renewable energy licences that are approved by ZERA annually from 2014 to 2016.

Year	Number of new approved renewable energy licences	Total capacity (MW)	Type of renewable energy	
			Solar	Mini-hydro
2014	5	110	3	2
2015	5	63.62	2	3
2016	9	289.8	8	1
Total	**19**	**463.42**	**13**	**6**

Table 5: Number of new approved renewable energy licences by ZERA, 2014-16

Source: ZERA 2016 Annual Report

Table 5 shows that there was a significant increase in the number of renewable energy licences approved in 2016 as compared to 2014 and 2015, both regarding the number of projects and renewable energy capacity. Solar licences were higher than mini-hydro, accounting for 68% of approved licences between 2014 and 2016 and 97% of renewable energy capacity (Figure 2).

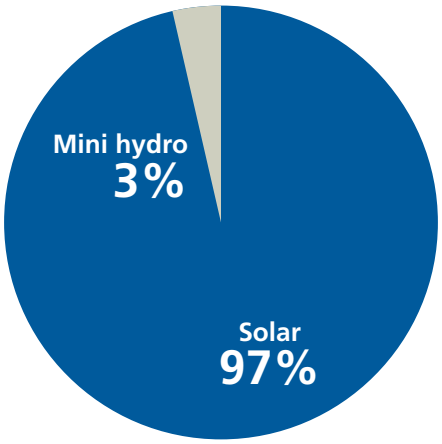

Figure 2: Percentage allocation of renewable energy capacity in new approved renewable energy licences between 2014 and 2016

Source: ZERA 2016 Annual Report

Operationalisation of these licences presents an opportunity for the creation of green jobs in the solar and mini-hydro industries. However, the information relating to the number of green jobs created for the specific RE initiatives could not be retrieved.

Table 6 shows that out of the 35 licensed IPPs, only 11 (31 %) were operating on a commercial basis. Sadly, the 11 IPPs in operation generate only 2% of the potential 5,898.02 MW. This lag in the operationalisation of the renewable energy projects also means delays in the creation of green jobs to address the high unemployment situation in the country. Table 6 further highlights renewable energy generation by selected IPPs from 2012 to 2016.

Producer	Technology	Production (GWh)				
		2016	2015	2014	2013	2012
Nyangani Renewable Energy (Pungwe, Nyamingura and Duru)	Mini-hydro	69.83	51.4	28.8	14.2	2.6
Hippo Valley Estates	Biomass	53.1	34	50	70.2	55.2
Triangle Limited	Biomass	180.8	87.5	94.2	95.6	111.4
Border Timbers	Biomass	0	0	0	0.2	-
Chisumbanje	Biomass	2.72	6.5	-	-	-
Total		**306.36**	**179.4**	**173**	**180.2**	**169.2**

Table 6: Selected IPPs RE production, 2012-2016

Source: ZERA, 2016 Annual Report

Table 6 reveals that renewable energy generation since 2012 has been more stable in mini-hydro projects than biomass, which raises questions on the consistency and reliability of the biomass technologies. The green jobs created by each renewable energy project are reflected in Section 5.

5. Sectoral Case Studies of Renewable Energy Projects and Green Jobs

This section covers case studies of green jobs in renewable energy projects. The section will be sub-divided by the type of renewable energy (micro-hydro, solar, bio-energy: biomass and biofuel). For each case study, the research reveals the kind of renewable energy, number of green jobs created from the commencement of the project to the operational status, green skills development programmes embedded in the projects and the working conditions of workers.

5.1 Case Studies in Micro-hydro Projects

The micro-hydro projects covered in the research include Chipendeke, Himalaya, Nyangani Renewable Energy, Claremont and Nyafaru in Manicaland province.

5.1.1 Chipendeke Micro-hydro Scheme

Description of the project: Chipendeke Scheme is an off-grid scheme implemented between 2008 and 2010 and has a capacity of producing 25 kW. It was co-financed by the EU and Practical Action which collaborated with the Ministry of Energy and Power Development, Mutare Rural District Council and the Chipendeke community. The scheme's life span is 20 years and is a community based project. The community developed a constitution which guides management of the scheme.

The power generated by the scheme supplies Chipendeke's Primary School, Chipendeke Clinic, Chipendeke business centre with seven shops and the community households where 44 households are connected to electricity generated by the scheme. The potential number of households that can be covered by the scheme is 50. According to the councillor of the ward area, Councillor Khan, the design limit was for 200 households in villages 1B, 3 and 6, and was expected to supply lighting, consumptive appliances, entrepreneurial businesses which include grind milling, sterilisation businesses, welding and peanut butter making. However, due to electricity generation deficits, households were using the electricity for lighting and refrigeration only.

According to Councillor Khan, the current plan seeks investments to:

- Upgrade the electro-mechanical equipment to a potential capacity of 100 kW power output to supply a cottage industry able to use lighting engineering machines such for welding, grinding mills, bakery, woodwork, hairdressing saloons, and peanut butter and oil pressing
- Replace the Pelton turbine with a flow turbine
- Expand the grid to villages in 2A, 2B, 4 and 5

Green jobs creation: A total of about 252 workers were engaged for the entire development phase with about 65% being women. The research revealed that the workers offered their services on a volunteer basis. Information also showed that the women were more motivated to volunteer their services than men. The women believed that electricity generation would benefit them more than men due to their triple role of (i) care work (use of electricity for cooking and electrified hospital); (ii) reproduction (through electrification of the clinic and the maternity section – 24/7); and (iii) production (electrified irrigation scheme, market production and business entrepreneurship. These elements translate into income generation for household use, school fees for children, medical costs amongst others). The majority of workers were general workers with a few skilled workers (Table 8). Since it was voluntary community development work, workers were engaged at different intervals and times at various stages depending on their time availability for work which however competed with other domestic chores and work primarily for women. Table 7 provides an analysis of the jobs and capacity development programmes related to the project.

Type of workers	Number of workers	Training undertaken	Remuneration or incentives
Builders	10	On-site training	No wages were given to workers. Incentives included: (i) were given tools of trade they used after completion of the Scheme; and (ii) reduced electricity tariff rate.
Assistant Builders	10	None	No wages were provided but they pay reduced electricity tariff rates.
Electricians	7	Kwekwe Polytechnic for one week	
General hand	223	None	
Machine operators	2	On-site training	Expected to be paid through income generated from the scheme.
Total	**252**		

Table 7: Chipendeke Green Jobs

Source: Chipendeke Project Records

Other capacity development programmes undertaken for the community included training for transformation and leadership training.

Overall, the project created jobs (about 252) but they were not green and decent according to the ILO definition. Nonetheless, the project was applauded for creating indirect jobs and sustaining decent livelihood in the community, although the jobs were not wholly green jobs. The indirect jobs created included:

- 47 farmers in the irrigation scheme programme some of whom have commercial contracts with the National Seed Company and Caines Company (agriculture supply chain)
- Two Agritex officers
- Three nurses for the Chipendeke Clinic
- 16 qualified teachers for the Chipendeke schools of whom ten teachers are female
- Seven general dealers at the Chipendeke business centre

Salient green job features of the scheme are:

- Each household was required to pay US$1 as food contribution for the workers;
- No child labour was engaged in the construction process; and,
- School enrolment improved from 300 to 600 between 2010 and 2017 due to access to electricity.

5.1.2 Himalaya micro-hydro Scheme

Description of the project: The Himalaya Micro-hydro Scheme was commissioned in 2005. The scheme was co-founded by the EU (through the ACP-Energy Facility), Oxfam (through supporter marketing) and Practical Action.2 It is a community based RE scheme and provides the Himalaya community with modern, affordable, and sustainable renewable energy services. The scheme was designed to provide power to the energy centre, irrigation scheme, grinding mill, sawmill and households.

Green jobs creation: Sadly, during the site visit, there was a shortage of data on actual jobs created as the key person had recently died. However, by the time of the research, the scheme was not functional as infrastructure such as poles for electricity line connections were damage by a cyclone. The villagers also highlighted that the poles were of poor quality due to a sub-standard pole treatment process which resulted in the poles being vulnerable to termites and their ultimate destruction by cyclones.

Himalaya Energy Centre – it remains empty due to the non-availability of electricity from the scheme.

2 https://www.facebook.com/OxfamZim/posts/958766810834203

5.1.3 Nyangani Renewable Energy (NRE)

Description of the project: NRE is an IPP which operates micro-hydro stations in the Eastern Highlands. At the time of the study, NRE was running six micro-hydro power stations on a commercial basis, supplying electricity to the national grid. The six micro-hydro schemes are listed below:

- Pungwe A micro-hydro
- Pungwe B micro-hydro
- Pungwe C micro-hydro
- Duru micro-hydro
- Nyamhingura micro-hydro
- Hauna micro-hydro

Construction work at NRE's micro-hydro Scheme

Construction work at NRE's micro-hydro Scheme
Source: NRE, 2017

Green jobs created: Table 8 illustrates the breakdown of the jobs created from the construction phase to the operations level.

Name of micro-hydro	Project	Project phase	No. of	Description of jobs	Training provided by NRE	Training institutions involved
Pungwe A 2.73MW	N/A	Construction	N/A	• Builders • Welders • Drivers • Mechanics • Mechanical engineers • Construction managers • Plant managers • General workers	• First aid training • Occupational Safety, Health and Environment (OSHE) – undertaken in collaboration with NSSA • Tool box talks • Switch gear training • Installation training • Mechanical and electrical training	• Kukwanisa Training College • Kafue Gorge Regional Training Centre (Zambia)
		Operations	13			
Pungwe B 15MW	1.5 years	Construction	700			
		Operations	24			
Pungwe C 3.75MW	9 months	Construction	302			
		Operations	13			
Duru 2.20MW	9 months	Construction	N/A			
		Operations	13			
Nyamhingura 1.10MW	N/A	N/A	N/A			
		Operations	13			
Hauna 2.30MW	N/A	Construction	263			
		Operations	13			

Table 8: NRE's Micro-hydro Schemes

Source: NRE records & Interviews

In total, there were 1,265 recorded jobs from the six projects. The jobs were in the construction phase, and there were about 89 in the operations phase giving a total of about 1,354 jobs. Whilst the construction jobs were for the short-medium term, only those in the operations are permanent as the schemes require daily monitoring, operation and maintenance.

Working conditions of workers: Table 9 explains the conditions of work.

Decent work aspects	Assessment
Hours of work	Workers were engaged on decent and regulated 8 hour-based shift.
Employment contracts	The majority of workers signed one-year contracts unless the job required otherwise. This was because the jobs were project based hence no requirement for permanent workers. Nonetheless, such fixed term contracts translated to precarious work and job insecurity.
Skills development	Skills development and transfer opportunities were provided.
Wages	A minimum rate of US$1,63 per hour was paid by NRE which was slightly above that of the construction sector National Employment Council (NEC) rates (Table 10). Given that workers were on an 8 hour shift meant a daily rate of about US$13 per day and US$65 per week and approximately US$260 per month. These rates fell short of the Poverty Datum Line (PDL) which ranged from US$450-US$500 between 2009 and 2015 when most of the projects were completed, rendering the majority of workers 'working poor' according to the ILO standards. However, the wages were above the Food Poverty Line (FPL) which ranged between US$136 to US$155 between 2009 and 2015.
OSHE	Personal Protective Clothing and Equipment was provided for workers during the construction and operational phases. Occupational health and safety training was undertaken. Adequate and clean restrooms with solar geysers were provided whilst first aid kits remain openly displayed.
Trade union and unionisation	The majority of the workers were not unionised at first. The research revealed that initially there were tensions between NRE management and the Zimbabwe Construction and Allied Trade Workers Union (ZCATWU) due to misunderstanding regarding the role of the trade union. These were later resolved through social dialogue and a cordial working relationship exists.

Table 9: Working conditions in NRE Projects

Table 10 indicates the NECs agreed rates since 2013.

Worker's grade	Job descriptions	NEC minimum hourly rate
1	Assisting skilled and approved classes of workers in the execution of their duties, carrying and loading, cleaning, digging, driver's assistant, general labouring, office cleaners, placing concrete, mortar or other materials into moulds or machines, preparation of surfaces for plastering or other coating etc.	$1. 47
2	Concrete mixer, crane operator, operators of mechanically driven tools, machines and apparatus etc.	$1. 47
3	Clerical workers such as site clerks, storeman, checker, wages clerk, concrete mixer, operators mixers, drivers of vehicles etc.	$1. 52
4	Civil works, clerical work, grader operators, welders etc.	$1. 53
Watchman		$1. 52

Table 10: NEC Construction Sector Hourly Wage Rates, 2013

Source: Zimbabwe Construction and Allied Trades Workers Union (ZCATWU)

5.1.4 Claremont Micro-hydro Scheme

Description of the project: The scheme is one of the oldest schemes in the Manicaland province. The scheme was operational from 1962 to 2008 and was established to provide Claremont Estate with electricity for its agricultural production. Historical data for the green jobs created during the construction was not available due to time lapse.

Green jobs created: There was a dearth of information on the jobs created during the establishment of the scheme.

Indirect jobs created: The scheme supports indirect jobs in the agriculture sector (jobs being supported by the electricity production from micro-hydro). At its peak between 1990 and 2006, the estate employed a total of 1,200 workers. However, at the time of the research the estate employed only 450 workers. Table 11 indicates the number of indirect jobs supported at the estate by the electricity from the micro-hydro scheme.

Department	Male	Male	Female	Female	Totals
	Permanent	Fixed-term contract	Permanent	Fixed-term contract	
Workshops	5	11	1	2	19
Orchards	12	76	22	40	150
Potatoes	3	12	9	6	30
Finance	5	1	2	0	8
Security	5	16	1	0	22
Admin	2	8	6	2	18
Grading/packing	3	9	10	48	70
Totals	35	133	51	98	317
Task workers		37		96	133
Grand total	**35**	**170**	**51**	**194**	**450**

Table 11: Indirect jobs at Claremont Estate

Source: Claremont Estate Database, 2017

From the Table 11, a total of 54% of the total workers were female. A total of 81% were non-permanent workers with the majority being females (53%). The high level of non-permanency of workers represents the high prevalence of precarious jobs – jobs which suffer from decent work deficits as they lack job security and income security. Table 12 shows the monthly wages paid to workers by the estate.

Grade	Minimum wage per month (US$)
A1	90.00
A2	97.00
A3	105.00
B1	113.00
B2	122.00
B3	132.00
B4	142.00
B5	153.00
C1	166.00
C2	179.00

Table 12: Wage rates at Claremont Estate

Source: Claremont Estate Database, 2017

OSHE: Claremont Estate tries to adhere to good standards of OSHE. Below is an OSHE motivational message in one of the factory grading and packing sheds.

Claremont Estate

5.1.5 Nyafaru Micro-hydro Scheme

Description of the project: The scheme is located in Nyanga, and it provides electricity to Nyafaru Primary and Secondary Schools. It was established in 1994 and is a community based project. The scheme was developed by Practical Action.

Green jobs created: The breakdown of the jobs created is indicated in Table 13.

Project phase	Number of jobs	Wages	Duration	Training	Duration of training
Construction	33 (45% females)	Volunteers	50 days	None	None
Operation and maintenance of power facilities	2	US$150 per month	Ongoing	• Electrical training • Maintenance training	two weeks
Total	**35**				

Table 13: Green jobs at Nyafaru micro-hydro scheme

Source: Questionnaire Survey

A total of about 35 green jobs were created through this scheme. As in the case of Chipendeke and the Himalaya micro-hydro scheme, services during construction phase were rendered on a volunteer basis. However, the monthly wage for workers in the operation and maintenance of the power facility (US$150) falls short of the national FPL and the PDL which stood at US$164.15 and US$501.09 respectively, as at June 2017, rendering the jobs green but not decent according to the ILO definition.

5.2 Case Studies in Solar Projects

This section analyses green jobs in selected solar projects. It provides the project description and the number and nature of green jobs created.

5.2.1 GIZ's Solar Powered Pumps

Description of the project: The Deutsche Gesellschaft fur International Zusammenarbeit (GIZ) is a German-based International NGO which also operates in Zimbabwe. It provides international cooperation services for sustainable development and international education work. In the area of renewable energy, it has been replacing the bush pumps and generators which were being used at schools with solar pumps. GIZ provides each installed solar pump with a 5,000 water tank and drip kits. The solar pumps were being installed at primary schools mainly for the nutritional gardens following the new education curricular that made agriculture a compulsory practical subject from grade three onwards. Drip kits are water saving mechanisms and therefore fit into the definition of 'green' technologies.

Green jobs created: Table 14 shows the geographical locations of the installed solar pumps and the jobs created through this initiative.

Name of area	Number of schools with solar pumps	Number of jobs per installation		Job description – skilled jobs
		General worker*	Skilled jobs	
Mutare district	2	10	3	Electric Engineer Welder Drip kit installer
Mutasa district**	2	10	3	
Masvingo – Zaka Province	2	10	3	
Masvingo District**	2	10	3	
Chiredzi district	2	10	3	

Table 14: Green jobs through solar pumps installation

Notes: * General workers were selected from the community by the school development committee (SDC) and were paid by the SDC. These workers were responsible for digging trenches, joining pipes, digging holes, mixing concrete and assisting welders and the job was usually done in 3-4 days. The parents were responsible for taking turns to cook for the workers.

** Solar pump yet to be installed.

It is clear from Table 14 that each installation created 13 jobs. Although it is a small number of jobs, more can be created by repeating these projects in other areas. The majority of the jobs (general workers) although precarious (three days) were drawn from the local area which creates jobs for the local people and ensures the sustainability of the solar projects. Information on the wages was not available.

5.2.2 Expected Mega-solar Projects

Other expected solar energy projects include the following:

- Green Rhino Energy – is developing a 50 MW solar photovoltaic power station in Marondera. The solar PV station is expected to provide electricity for 80,000 people.
- Oxygen Energy in collaboration with Old Mutual Zimbabwe – will partner on a 20 MW commercial rooftop solar project spread across its entire property portfolio of commercial and industrial buildings at a cost of US$28 million.[3]

5.3 Case Studies in Biofuel Projects

Liquid biofuels (ethanol and biodiesel) are one of the main entry points for renewable energy in the transport sector. Zimbabwe has a history of using ethanol/petrol blends of up to 20%,

3 https://www.forbes.com/sites/mfonobongnsehe/2017/12/21/meet-the-32-year-old-entrepreneur-who-is-building-zimbabwes-largest-solar-company/#4221708c63f7

the ethanol being produced from sugarcane (Netherlands Enterprise Agency, 2017). The blend ratio has varied depending on the availability of ethanol. The primary biofuel production in Zimbabwe is by two companies, Green Fuel and Triangle both located in Chiredzi, which is the hub of sugarcane plantations, a critical feedstock for biofuel production. With the completion of a significant irrigation dam (Tokwe-Mukosi) at the end of 2016, sugar cane production in the Zimbabwean lowveld is expected to receive a boost, and Zimbabwe could become a hub for bioethanol, supplying the region (ibid). Figure 3 shows the ethanol production by Green Fuel and Triangle between 2013 and 2016.

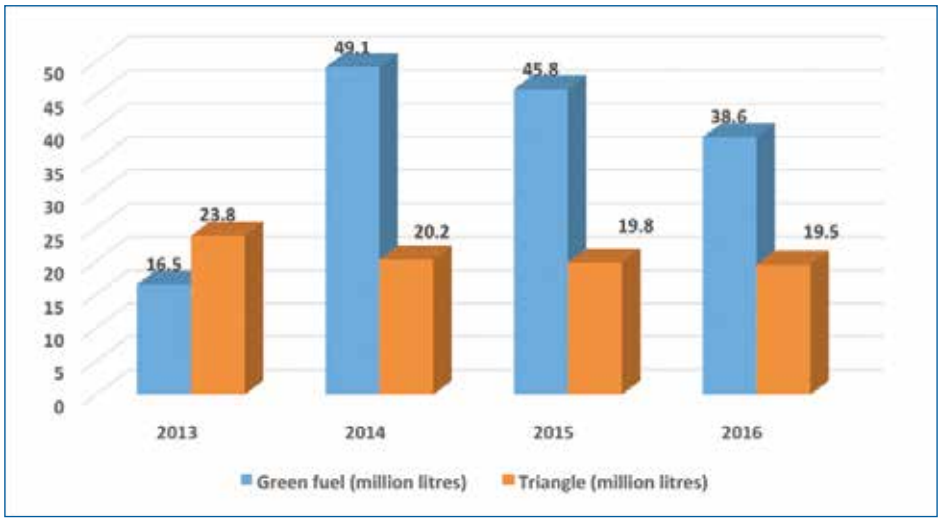

Figure 3: Ethanol Production, 2013-16

Source: ZERA, 2016 Annual Report

Figure 3 indicates that ethanol production for Green Fuel has been higher than from Triangle, although output is more stable in Triangle than Green Fuel. Figure 4 shows a comparative analysis of average ethanol prices for 2016 for selected countries.

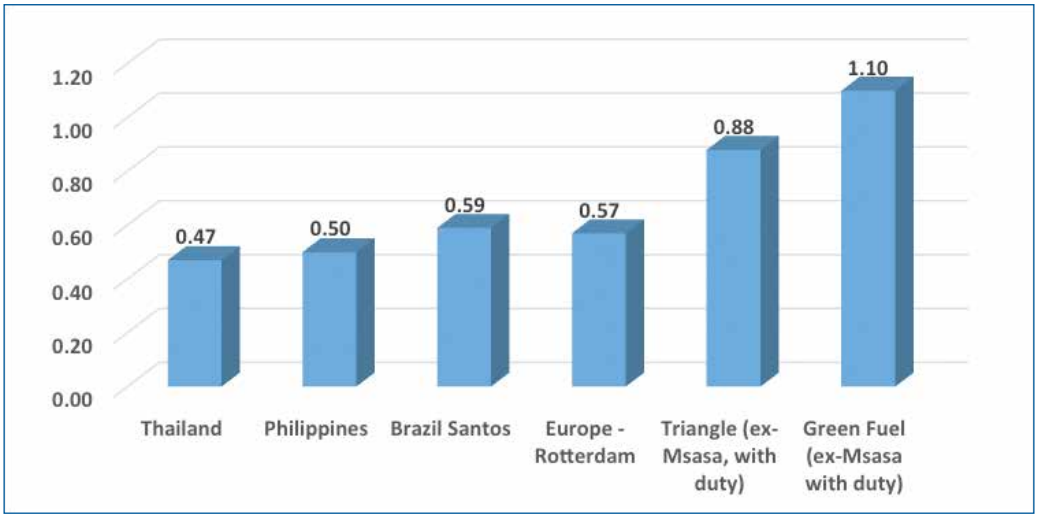

Figure 4: Comparative Analysis of Average Ethanol Prices, 2016

Source: ZERA 2016 Annual Report

Figure 4 shows that the biofuels industry in Zimbabwe has been exhibiting the highest prices as compared to other ethanol producing countries in the world.

Box 1: Co-generation Using Bagasse –Triangle Hippo Valley and Green Fuel

Co-generation units using bagasse from sugarcane waste have been installed at Triangle, Hippo Valley and the Green Fuel Plant at Chisumbanje in the south eastern part of the country.

The power plants at Triangle and Hippo Valley have a combined installed capacity of 81.5 MW electricity. The power generated is for their own use and for feeding into the grid.

The Green Fuel plant has an installed cogeneration capacity of 18 MW and will export 10 MW of electricity to the national grid during operational months.

Source: Netherlands Enterprise Agency, 2017

Green jobs created: Table 15 indicates the green jobs at Green Fuel where a total of 1,368 workers were employed at Green Fuel as at September 2017.[4] Only about 16% were females. The breakdown of the workers by departments is indicated in Figure 5, showing that the majority of the workers were found in the field sections 475 (35%), followed by cane haulage 290 (21%), land development 249 (18%) and security and loss 121 (9%). These figures indicate that biofuel projects are more labour intensive as compared to other renewable energy sources. This is because some workers are required to produce the feedstock and in this case sugarcane in the fields. Table 15 also indicates the wages by grades. Using the ILO's definition of a green and decent job, it is clear that all jobs are green but not decent as they fall below the national FPL which stood at US$164.15 and also fall far below the national Poverty Datum Line of US$501.09 as at June 2017. These poverty wages are typical of the poverty wages paid to workers in the traditional agriculture sector.

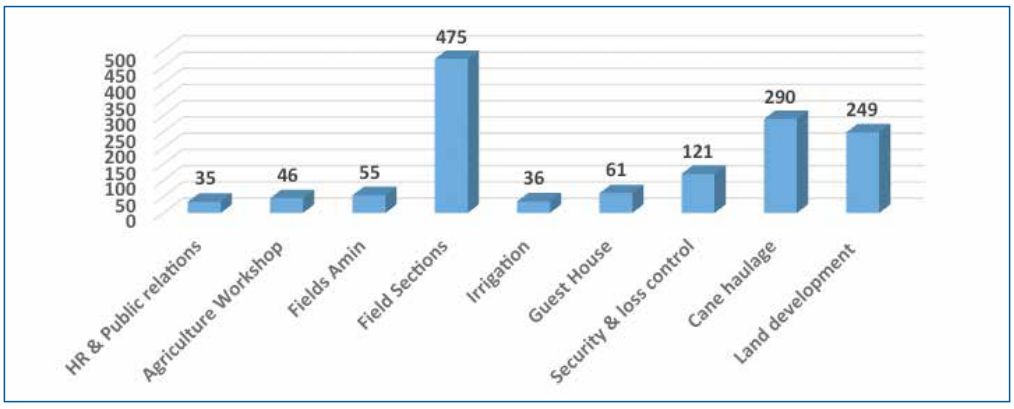

Figure 5: Green Jobs at Green Fuel, 2017

Source: Primary data collection

4 Data was difficult to get from the Management. Hence, the researcher has to search for alternatives ways of gathering the data.

DEPARTMENTS	GENDER	GRADES & RATES										
		A1	A2	A3	B1	B2	B3	B4	B5	C1	C2	TOTAL
		75.00	81.00	88.00	95.00	101.00	110.00	119.00	128.00	139.00	150.00	
H . R, Welfare & F	FEMALE	2	4	-	3	1	-	1	1	1	1	14
	MALE	7	5	-	4	1	1	-	2		1	21
Agric Workshop	FEMALE	-	-	-	-	-	-	-	-	-	-	-
	MALE	6	4	2	2	2	7	5	1	-	17	46
Fields Admin	FEMALE	3	-	-	1	-	-	-	-	-	1	5
	MALE	32	-	-	14	1	-	-	2	-	1	50
Field Sections	FEMALE	5	-	114	5	7	-	-	-	-	-	131
	MALE	5	27	265	42	5	-	-	-	-	-	344
Irrigation	FEMALE	-	-	-	-	-	-	-	-	-	-	-
	MALE	-	23	-	5	-	3	-	1	1	3	36
Guest House	FEMALE	14	-	7	1	-	1	-	-	-	-	23
	MALE	22	-	5	10	-	1	-	-	-	-	38
Security & Loss co	FEMALE	-	12	-	-	-	-	-	-	-	-	12
	MALE	39	68	-	2	-	-	-	-	-	-	109
Cane Haulage	FEMALE	1	-	-	2	-	4	-	-	-	-	7
	MALE	14	18	8	1	6	174	15	10	-	37	283
Land Developmen	FEMALE	25	-	-	-	-	-	-	-	-	-	25
	MALE	49	38	-	12	1	115	3	1	-	5	224
TOTAL HEADCOUNT/GRADE		224	199	401	104	24	306	24	18	2	66	1,368

Table 15: No. of Green Jobs at Green Fuel

5.4 Case Studies in Biogas Projects

Globally, the COP21 climate negotiations and discussions in Paris in 2015 emphasised the important role of municipalities and local authorities in local-level climate-based commitments and promoting deployment of renewable energy technologies. Municipalities globally are encouraged to establish green cities by, for example, generating biogas from sewage waste and general waste. The research indicated that the Harare City Council is working on ensuring that by 2025, 25% of the city's energy mix comes from renewable energy with expected funding by private public partnerships (Newsday, June 7, 2017).[5]

5.4.1 Harare City Council Mbare Biogas Plant

Description of the project: The Harare City Council has been working on biogas projects for about 15 years and is currently working on a commercial biogas plant of 30 cubic metres in Mbare with an expected generation capacity of 100 kW with prospects for future expansion. The project converts waste to biogas. The waste is collected and generated at Mbare musika which is the largest informal market in Harare. The gas produced would be used to power a generator, which would in turn supply electricity to a national grid line adjacent to the Mbare Matapi flats. A council official indicated in an interview that electricity will be connected to the geysers in the flats to provide hot showers to households living in the flats 'Matapi community'. A 'Bus Plan' approach would be applied where the community brings pre-separated waste to the plant. The council will undertake a training

5 Newsday, 7 June 2017, *HCC eyes 25% in renewable energy by 2025* https://www.newsday.co.zw/2017/06/hcc-eyes-25-renewable-energy-2025/

programme on pre-waste separation skills for the community. At the time of the research, the council was in the process of finalising the REFIT.

Green jobs created: Table 16 indicates the breakdown of the jobs created through the project.

Project level	Number of workers	Type of job	Job description	Duration of employment	Minimum educational requirements	Skills training
Construction stage	20	Manual	General worker	18 months	N/A – identified from Mbare community	No
	5	Skilled	Builder, carpenter, civil works	N/A	two years' experience with post-graduation certificate	No
Installation	20	Manual – continuous from construction stage	General worker	N/A	N/A – identified from Mbare community	No
	5	Skilled	Builder	N/A	two years' experience with post-graduation certificate	one month training
			Carpenter	N/A	2 yrs. experience with Post graduation certificate	
			Electrician	N/A	Class one National Certificate	
Operations & maintenance	7	Skilled	1 Plant Supervisor, three Operators, 3 General hands	Biogas life span	Building – masonry skills Electrical engineering Mechanical engineering	To be trained on feed stock requirements,
Total	**57**					

Table 16: Green Jobs at the Mbare Biogas Plant

The project created about 57 green jobs. However, information regarding wages could not be obtained to ascertain decency of the jobs.

5.4.2 Pomona Waste Management System

Description of the project: at the time of the research, the Harare City Council was planning to establish a biogas plant at Pomona which is the biggest landfill in Harare. The plant is expected to generate about 25 MW for a life span of 30 years.

Green Jobs created: Table 17 shows the breakdown of the expected number of jobs and skills requirements.

Project Level	Expected no. of jobs	Duration of employment	Occupations
Construction stage	200	18 months	• General hand • Catering for the site canteens • Engineers • Project managers • Builders – masonry • Artisans
Production, operations and maintenance	100	30 year life span	• Production site managers • Chemical engineers • Mechanical engineers • Electrical engineers • Finance managers • Artisans
Total	**300**		

Table 17: Proposed Green jobs at Pomona Waste Management System:

The Pomona Project is expected to create about 300 jobs of which about 200 workers will be engaged for an anticipated period of 18 months during the construction stage. This project reinforces the labour intensive nature of biogas projects during the construction phases.

5.4.3 Charter Sawmill – Biomass Driven Sawmill

Description of the project: The sawmill is located in Chimanimani and was completed in 2009 as part of Border Timbers Company. A steam powered generator runs it. The steam engine is driven by combined heat and power. The sawmill produces 0,5 MW of electricity and 5 MW of process heat. The feedstock for the steam engine comes from the waste wood and sawdust that is produced at the sawmill and is the heat source for the boilers, which then produce steam that is turned into electricity.

The project was successfully connected to the national grid in June 2011. However, the research revealed that the steam had been not functional since 2015 owing to technical breakdowns. At the time of the research, spare parts were being imported from a Germany-based company.

Charter Sawmill Steam Generator

The management indicated that at the time of its peak years, before the Fast Track Land Reform (FTLR) of 2000, the company used to employ more than 1,500 workers who were supported directly and indirectly by electricity from the sawmill. However, following the FTLR, the company lost some of its forestry land resulting in a decline in production and feedstock for electricity generation. The research also revealed that the company now employed a total of only 198 workers. Of these, 162 workers were employed at the sawmill (classified as direct green jobs as they are using electricity from a renewable source) and 36 workers were in the estate (indirect jobs supporting the mill). Table 18 shows the number of green jobs generated and sustained by the bio-electricity process.

Skills level	Number of jobs	Job description	Linkage with universities or colleges
Unskilled and semi-skilled	74	N/A	• ZESA National Training Centre • Attaches are sourced from: - Masvingo Polytechnic College - Zimbabwe College of Forestry - Mutare Polytechnic College
Highly skilled	88	• Engineers • Production line manager • Grader • Supervisor • Machine operator • Auto-electronics	
Total	**162**		

Table 18: Green Jobs at Charter Sawmill

5.4.4 IPPs Waste Management in Mutare and Masvingo

An interview with one IPP indicated prospects of electricity generation from municipal waste in the cities of Mutare and Masvingo. The research revealed that the municipalities already had large structures for renewable energy projects but the infrastructure was lying idle. There was the prospect of the creation of green jobs if investments could be found to kick-start the generation of energy from the waste process.

One of the municipality biogas plants which is not operational but is to be used by an IPP in collaboration with the municipality.

Green job creation: Table 19 shows the estimated number of green jobs expected for each project. Table 19 shows that each waste management project is expected to generate 14 jobs with more workers being general workers.

City of Mutare		Job description
Total number of workers per plant	14	
Unskilled workers	10	General workers
Skilled workers	4	Engineers for daily operations
City of Masvingo		
Number of workers per plant	14	
Unskilled workers		General workers – waste pickers, separators and waste cleaners
Skilled workers	4	Draftsman, project managers, financial administrators

Table 19: Proposed Green Jobs at the Mutare City and Masvingo Councils

Source: Interviews

6. Case Studies on Green Skills Development

Whilst the above section focused on green jobs; this section focuses on the green skills dimension. For the country to fully harness the green energy and green jobs potential, it is imperative that it is also 'green skills-ready'. Accelerated renewable energy deployment needs to be accompanied by the development of green skills in various educational institutions. Therefore, this section assesses the local formal academic institutions and other players that are either providing programmes directly related to or are linked with the existing renewable energy players.

6.1 Green Skills Development Programmes at National Educational Institutions

Zimbabwe has 16 universities but only four (25%) have programmes directly linked to renewable energy. Table 20 shows the universities and the names of the courses or degree programmes that have courses on renewable energy.

University	Name of degree or course
University of Zimbabwe (UZ)	• BSc Eng. Hons with specialisation in Civil Engineering, Electrical Engineering, Mechanical Engineering • MSc in Renewable Energy • UZ is part of the Solar Thermal Training and Development Initiative (SOLTRAIN)
Chinhoyi University of Technology	• B.Eng. (Hons) in Renewable Energy
Great Zimbabwe University	• BSc Science Special Honours Degree in Physics – Module on Energy Physics • BSc Renewable energy (upcoming)
National University of Science and Technology (NUST)	• NUST is the country partner of the SOLTRAIN Initiative • Training courses on solar water heater systems in 2017 and 2018

Table 20: Universities offering renewable energy-related programmes and courses

Polytechnic colleges that offer green skills training related to construction, installation, operation and maintenance of the renewable energy technologies include:

- Mutare Polytechnic
- Gweru Polytechnic
- Kwekwe Polytechnic

One vocational training centre (VCT) identified in the research was Kukwanisa Training College.

Box 2: The Solar Thermal Training and Development Initiative (SOLTRAIN)

SOLTRAIN is a Southern African demonstration initiative established in 2009 and in cooperation with six SADC countries – Botswana, Lesotho, Mozambique, Namibia, South Africa and Zimbabwe. SOLTRAIN focuses on four main areas: raising awareness of the potential in solar thermal technology, building competence in solar thermal technology, creating solar thermal technology platforms and demonstrating that solar thermal technology works.

NUST is SOLTRAIN's partner in Zimbabwe. In 2017 and 2018, two training programmes on installation of thermosiphon solar water heating systems were held, and in 2018, 15 trained installers were awarded certificates.

Source: www.soltrain.org

6.2 Green Skills Development Programmes by Other Organisations

Other organisations that provide practical green skills training at micro-scale include:

- ILO
- Oxfam
- Plan International
- SNV
- Practical Action
- Hivos
- Boost fellowship – bridging the gap between schools and the corporate world

Table 21 indicates some of the critical professions and academic qualifications required by Practical Action for their micro-scale renewable energy projects.

Box 3: ZERA Solar PV Training

ZERA partnered with the Energy Technology Institute of the Scientific and Industrial Research and Development Centre (SIRDC) to provide training to build local capacity in Solar PV System Design and Installation. The first training was carried out in Harare in 2016. Thirty (30) participants were trained and examined and a 67% pass rate was attained. The training course outline covered the following:

- Introduction to photovoltaic systems and its components
- Solar radiation
- Solar panels, batteries, inverters and solar charge controllers
- Site survey and solar PV system sizing, solar irrigation
- Electrical and mechanical integration of solar PV systems
- System commissioning and trouble shooting
- Financial appraisal of solar PV system
- Solar PV system design software

Trainings in other provinces which include Bulawayo, Mutare and Masvingo were expected to be conducted in 2017.

Profession	Specialisation	Academic qualification
Electrical Engineering	Electrical Power Engineering, Renewable Energy, Solar Energy Conversion	MPhil Electrical Engineering/Renewable energy
Electrical Engineering	Electrical Power Engineering,	BSc (Hons) Electrical Engineering
Electrical Engineering	Electrical Power Engineering,	Diploma in electrical engineering & Journeyman certificates in Electrical engineering
Civil Engineering	Water Resources Engineering	Masters/B Tech in Water Resources or Civil Engineering Degree
Advocacy	Gender and energy access	BSc (Hons) Degree in Development studies
Advocacy	Media studies	Degree/Diploma in Journalism

Table 21: Professions and academic qualifications on demand for micro-scale renewable energy projects

Source: Questionnaire Survey

The research revealed that the qualifications that are critical and difficult to find are for highly skilled personnel like certified electrical engineering journeymen. This qualification is vital for those that work directly with communities were micro-grids are established.

7. Synthesis Of The Research Findings

This section provides a synthesis of the research findings. Section 7.1 outlines the benefits of green jobs whilst 7.2 summarises the challenges in leveraging the full potential for green and decent job creation.

7.1 Green Jobs – Benefits

The research established that various green jobs are being created by renewable energy projects nationwide, both direct and indirect (Table 22). However, for most of the renewable energy projects there is a lack of data on how many jobs were created during the construction of the project which indicates that when most of these projects were implemented there were no clear measurable targets for assessing the impact on job creation. Instead, it seemed the primary focus or objective was energy accessibility.

Nonetheless, the research was able to draw the following conclusions:

- Most of the direct green jobs created were found in the construction stages of renewable energy projects, for example, in micro-hydro projects. However, whilst most of the jobs were green, they fell short of the ILO standards of green and decent jobs mainly because wages fell below the FPL and the PDL, workers lacked protective clothing and the jobs were short-term contracts, and some were community-based and therefore voluntary.

- Bio-energy projects were more labour intensive than other forms of renewable energy projects and the jobs were more long-term since workers were always required to work in the fields. Examples include Green Fuel and Triangle estates.
- Whilst the renewable energy projects generated direct green jobs, the significant impact was on more indirect jobs. For instance, through the establishment of community micro-hydro schemes in Chipendeke and Himalaya, and Claremont Estates, more indirect jobs were created through irrigation schemes and access to electricity at the growth points. Examples of indirect jobs include general dealers' shops at growth points, community energy centres, small and informal businesses which used electrical appliances in the production of goods (e.g. grinding and sawmills) and farmers' access to irrigation schemes. The study established that reliable electricity supply is critical for the sustainable development of rural communities.
- After the construction of a renewable energy project, most workers ended up with new skills gained during the construction phase but with nowhere else to use them as most of the projects were once-off except for the NRE company. Skills mostly included building, welding and carpentry. Ultimately, at the end of project construction and installation, most workers either became redundant or returned to their subsistence agriculture farming activities primarily in the rural areas. There was no tracking system to assess the positive externalities generated by the skills gained through renewable energy project construction and installation.
- There is scope for further collaboration between the renewable energy projects and the educational institutions in the areas of green skills development. The role of universities, polytechnic colleges and VCTs came out clearly regarding contributing to green knowledge generation and green skills education and requires scaling up.
- Green jobs in installation, operation, and maintenance renewable energy systems are better managed when workers are sourced from the local communities. The transfer of knowledge and skills to local communities is critical for the sustainability of the renewable energy projects.

		Direct green jobs			Indirect jobs	
Name of Project or Institution	**Type of renewable energy**	**Total Green Jobs**	**Construction and installation Jobs**	**Operation and maintenance jobs**	**No. Indirect (induced) jobs**	**Type of indirect jobs**
Chipendeke	Micro-hydro	252	250	2	N/A	General Dealers, teachers, nurses, energy centre entrepreneurs
Himalaya		N/A	N/A	N/A	N/A	General Dealers, energy centre entrepreneurs
Nyangani Renewable Energy (NRE)'s six projects		1 354	1 265	89	N/A	Teachers, gravel road constructors
Claremont		N/A	N/A	1	450	Agriculture workers
Nyafaru		35	33	2	N/A	Teachers
GIZ – five Projects	Solar pumps	65	N/A	N/A	N/A	N/A
Green Fuel	Biofuel	1 368	N/A	N/A	N/A	N/A
Harare City Council (Mbare Project)	Biogas	57	50	7	N/A	N/A
Harare City Council (Pomona Project) – not yet initiated		300	200	100	N/A	N/A
IPP (Mutare)		14	Infrastructure already available	14	N/A	N/A
IPP (Masvingo)		14		14	N/A	N/A
Charter Sawmill	Biomass	162	N/A	N/A	36	Agriculture workers

Table 22: Summary of Green Jobs

7.2 Challenges

Whilst the above section pointed to a positive scenario of green jobs creation; there are also challenges that inhibit the full growth of green jobs. These are highlighted below.

- **Limited data collection of green jobs created in the renewable energy projects**

The research found it challenging to obtain the actual numbers of jobs created by the existing renewable energy initiatives. The only adequate data was available at Chipendeke and NRE. Most of the projects concentrated on ensuring energy access without focusing on creating and maintaining a database of how many workers were engaged in the development phase of the renewable energy project. Some of the renewable energy projects were constructed before independence such as Claremont micro-hydro and records of workers employed during the construction phase could not be obtained. Some of the statistics on the impact of the green jobs were based on estimates and extrapolations from the key informants.

- **Absence of integrated reporting guidelines on green jobs impact in the renewable energy licensing agreementst**

The dearth of information on green jobs can be attributed to the absence of an integrated system to report on green jobs in the IPPs licensing structure. There are no incentives for players in the renewable energy sector to commit to reporting on green jobs created.

- **Financing**

It became clear during the research that out of the 25 licensed IPPs by ZERA, only 11 (44%) were operational. One of the main challenges was the lack of financing due to the liquidity challenges. Most of the renewable energy projects require medium to long-term funding which is not available on the domestic financial markets. The IPPs bemoaned that the financial sector players took too long to understand and appreciate the operations of the renewable energy sector and excluded renewable energy projects from their investment portfolios. Others indicated that the financial sector lacked the expertise in calculating the cost and benefit analysis of the renewable energy sector as it is a relatively new and emerging sector. As a result, the potential for job creation remains hindered through the lack of funding for IPPs.

- **High initial investment costs for micro renewable energy projects**

The renewable energy players bemoaned the high charges by the Zimbabwe National Water Authority (ZINWA) and Environmental Management Agency (EMA), especially the non-consumptive water charges for hydropower projects and environmental impact assessment (EIA) costs for small scale projects. Also, interest rates from local banks capped at around 12% per annum with some microfinance institutions ranging as high as 30% per annum become punitive for potential local investors. As a result, the majority of the renewable

energy players get stuck. They are unable to meet these high initial investment costs, bearing in mind that some of the new players are youths from universities and colleges and have no collateral or alternative source of substantive financing (besides the few savings if they are fortunate), dis-incentivising the youths and women.

- **'Pilotism' nature of the micro renewable energy projects**

It was clear from the research that the majority of the renewable energy projects did not graduate from being pilot projects. Thus, green jobs creation remain small and limited with less employment intensity capacity as the renewable energy projects were not being up scaled or repeated in other areas. Accordingly, the case for green jobs remains very weak.

- **Absence of green jobs targets in national policies**

The key national policies and strategies namely; the National Renewable Energy Policy, Climate Change Policy, Biofuels Policy and the National Response Strategy on Climate Change lack clear targets for green jobs creation in their implementation plans. As a result, it becomes difficult to monitor and evaluate the effectiveness of policy implementation when it comes to green jobs creation.

- **Unfavourable investment climate**

Whilst the government has been making efforts to reduce the bureaucratic procedures to ease doing business, there is still a lot that needs to be done. In the 2017 World Bank Ease of Doing Business Index, Zimbabwe was ranked 161 out of 190, an indicator which is in the negative and requires redress. During the research, IPPs bemoaned the lengthy and cumbersome bureaucratic process with some IPPs failing to meet requirements from as far back as 2015 when they were issued licences. Corruption and delays in securing approvals that put a premium on costs were highlighted as the major constraints for RE business and green jobs growth.

8. Recommendations for Upscaling Green Jobs in Zimbabwe

Growth of the green jobs depends on a wide range of factors and actors. The government, NGOs, academia and the private sector have critical roles to play in boosting the green jobs potential that exists in the country. The research revealed that there are various renewable energy initiatives and more can be developed as the country has the climatic and geographical locations conducive for upscaling deployment and in the process creating the much needed green jobs. The following recommendations are provided.

- **Systemic collection and analysis of green jobs**

There is need for a systemic collection of green jobs being created by renewable energy

projects in Zimbabwe. Given that renewable energy is a relatively new sector in Zimbabwe's economy, national statistics have not yet included it as an individual sector in national reporting (as is the case for manufacturing, agriculture, mining, health etc.). Additional steps are needed to estimate the number of jobs directly attributable to renewable energy and indirect jobs to adequately inform policy direction and choices. ZIMSTAT needs support for data collection and the development of environmental accounting, quantitative modelling tools which allow for a more detailed analysis of the impact of renewable energy deployment on the labour market.

ZIMSTAT is a key player for this role but, the private sector, business associations and trade unions should also play a crucial role at a micro-level such as undertaking structured job surveys and profiles especially given the increasing informalisation of the economy. Furthermore, the definition of green and decent jobs has to be further interrogated. ZIMSTAT can further learn from other countries about in-depth modelling and econometric analysis, not just those related to direct green jobs, but also those that are related more indirectly. The data should also be disaggregated by gender to assess and ensure equality of opportunities for women and men for green jobs. Lessons can also be drawn from the ILO that have undertaken several initiatives on methodologies for calculating green jobs and have undertaken studies to assess green jobs in selected renewable energy initiatives at a global level.

- **Favourable investment climate**

The current investment climate is negative and disincentivises investment by local and international players. An investment-friendly environment is essential to overcome financing barriers and attract investors. As indicated above, the domestic financial sector currently has limited knowledge to assess risk and design financing products that are well suited to renewable energy technologies. Actual and perceived risks continue to slow down investment growth in renewable energy, especially in new markets. Policy makers, domestic financial institutions must deploy the right policy and financial tools to address these risks and mobilise private sector investment. Whilst there have been calls by the Ministry of Energy and Power Development to create a renewable energy fund with renewable energy incentives, the process remains very slow.

- **Relevance of the green jobs in the informal economy**

Given the growth of the informal economy being the mainstay of the Zimbabwe's economy, the creation of green jobs is critical as there are opportunities for green production process in this economy. Already many of the renewable energy technology players and installers are in the informal economy, but they lack the substantive capital to upgrade their businesses. Part of the national formalisation strategy of the informal economy should entail support and guidance to the informal economy and SMEs to bridge the green skills gaps. Comprehensive green business incubation accompanied by cheaper credit for investments in green technologies, tax concessions and the provision of knowledge sharing platforms

to ensure technology transfer should be a critical element of the formalisation strategy to assist the informal economy and SMEs to become greener and have more energy efficient tools. The informal economy associations also need to take a more active role in the green jobs forums and discourses and inform their members of the benefits of going green whilst simultaneously creating green and decent jobs.

- **Enhanced integration of green skills in the education curricular**

Accelerated renewable energy deployment will create various employment opportunities and it will also demand a wide range of green skills and workforce capabilities. The current number of educational institutions providing renewable energy-related programmes is inadequate. More educational institutions (universities, polytechnic colleges and VCTs) have to incorporate green skills education and training programmes, promote green entrepreneurship and introduce innovative green technology. Introduction of distance learning schemes is also critical. As articulated in IRENA (2016), skills development through education and training is essential to support the expansion of the renewable energy sector and meeting the job demands of a green economy. The IRENA 2016 report emphasised the following issues which Zimbabwe can tailor to suit its context:

  - Systematic access across all layers of the society to education and training in relevant fields, including engineering, economics, science, environmental management, finance, business and commerce.
  - Professional training, as well as school or university curricula must evolve adequately to cover renewable energy, sustainability and climate change.
  - Vocational training programmes can also offer opportunities to acquire specialisation and take advantage of the growing renewable energy job market.
  - The elaboration of specific, certified skills and the categorisation of trainees based on their level of experience and training is recommended.
  - Support policies that incorporate renewable energy into technical and tertiary curricula, develop training institutes and centres of excellence and provide dedicated financial support. These policies should be accompanied by continued collaboration between industry and policy makers from the energy and education sectors.
  - R&D to stimulate technological breakthroughs, improve products and services, and increase the applicability of technologies to local conditions. These can accelerate deployment, reduce costs and address country-specific issues.
  - Climate-focused education models at graduate and post-graduate levels that foster climate-related entrepreneurship.

- **Enhanced social dialogue at all levels**

It is globally accepted that the success of any investment strategy will rely on the active

participation of a broad spectrum of private and public actors, including development finance institutions, climate finance institutions, private equity funds, institutional investors, export credit agencies and commercial banks, employers and workers organisations (IRENA, 2016). Thus, social dialogue and action must take place at (i) national level; (ii) industry or sectoral level; and (iii) company level. There is a need for the relevant ministries to create multi-stakeholder social dialogue platforms at national and sectoral level to spearhead information and knowledge generation required to upscale the deployment of renewable energy deployment and green jobs creation.

At company level, training and skill enhancement programmes are critical to prepare the workforce for a green economy transition. Thus, social dialogue at company level should include retraining and reskilling workers in green technologies and integrating these issues in collective bargaining agreements that help the transition to green industries and which stimulate eco-friendly investments.

- **Integrating 'decency' into green jobs**

To ensure that the deployment of renewable energy leads to green and decent jobs, the pillars of the ILO Decent Work Agenda which include workers' rights (including decent wages), social protection and social dialogue need to be considered. It is not only the quantity of green jobs created that matters but also the quality of jobs created. Without incorporating decent work aspects, the green jobs that are created will only perpetuate poverty rather than alleviate poverty. Thus, the ILO and the trade unions have to be engaged at the onset of the project development and throughout the development stages. A good example of an IPP which has a cordial relationship with the construction trade union is NRE. Such a model should be used in future renewable energy projects.

- **Policy coherence and clear green jobs measurable targets**

The greening of economy and creation of green jobs is a cross-cutting exercise, which traverses a range of policy streams. Currently, most government policies are exclusively sectoral in approach and are implemented by ministries focusing solely on their specific mandates. Hence, there is a critical need to ensure policy coherence of the climate change, environmental and renewable energy policies with the employment and skills policies. For instance, the National Climate Change and the National Renewable Energy Policies and employment policy should have complementary measures that protect the environment and which increase jobs and skills in the green economy. More importantly, these policies need to incorporate measurable green jobs targets that provide a clear basis for tracking progress and which inform future policies.

- **Further research on green jobs**

Research and analysis of green jobs in Zimbabwe is limited. This research could not cover a wider geographical area especially on existing informal economy green initiatives and the different examples of green job creation. The research also revealed that there are prospects

for more renewable energy projects and green jobs across the country. Therefore there is scope for further research in the following areas:

- Estimates of employment opportunities created by clean energy as compared to carbon intensive jobs;
- Formal and informal economy players and SMEs providing DRE systems which include power, cooking (clean cook stoves), heating and cooling systems that generate and distribute services independently of any centralised system, in both urban and rural areas. DREs in Zimbabwe are offering huge co-benefits which include job-creation, improved health (through the displacement of indoor air pollution), improved education, improved communications, contributions to climate change mitigation, as well as positive effects on income growth, women's empowerment and distributive equity;
- Defining, understanding and quantifying green jobs;
- Linkages between the existing growth and employment policy interaction with policies to promote greening of industries and creation of green jobs; and,
- Indirect jobs created through the green projects.

- **Fostering backwards and forward linkages with local suppliers and customers in RE Projects**

It is critical to promote backward and forward ties with local suppliers to unlock the green jobs potential as was the case in the community based micro-hydro schemes discussed above. The research revealed that for micro-hydro schemes, the technology is sourced internationally (mostly Germany or the United Kingdom). However, where opportunities exist for securing of spares, components, inputs locally, they should be maximised. It also reduces transportation costs, and the proximity to suppliers potentially reduces the need to stock for inventories as just-in-time controls may be used in the deployment of the renewable energy technologies.

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About the Author

Naome Chakanya is a Development Economist and Senior Researcher at the Labour and Economic Development Research Institute of Zimbabwe (LEDRIZ). She has 15 years of work experience in areas of policy research, training and capacity building, advocacy and engagement and monitoring and evaluation of projects. She has been engaged in a number of socio-economic policy analysis and research, policy formulation at the national level. Her areas of focus include Climate Change and Green Jobs, Employment and Decent Work, Socio-economic Rights and Gender.

Founded in 1925 as the first German political foundation, the Friedrich-Ebert-Stiftung (FES) is a private, non-profit organisation committed to the value of social democracy. The Foundation bears the name of the first democratically elected President of Germany, in 1918, Friedrich Ebert, and seeks to preserve his political legacy: the promotion of freedom, solidarity and social justice. The Foundation pursues these aims through its programmes of political education, international co-operation, scholarships and research in Germany and abroad.

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