

## THE ROLE OF CBSP IN RESPONSE TO CLIMATE CHANGE: THE CASE OF ASPIRATION TO THE YOUTH CBSPO IN VHEMBE DISTRICT OF SOUTH AFRICA

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### ABSTRACT

*Universal social protection is increasingly recognised as a critical mechanism for reducing poverty, inequality, and vulnerability, particularly in climate-sensitive contexts. Community-based social protection organisations (CBSPOs) offer a promising pathway to support just transitions by fostering resilience, local innovation, and social equity. This study surveys the role of CBSPOs in promoting climate adaptation and sustainable energy use in South Africa's Vhembe District, focusing on biogas digesters implemented in Tshikuyu and Dovho Primary Schools. The study synthesises evidence on community-driven social protection, climate adaptation, and renewable energy adoption, using a semi-systematic literature review guided by PRISMA principles. Findings highlight the multifaceted benefits of biogas technology, including enhanced health outcomes, reduced dependence on firewood, improved food production, income generation, skills development, and strengthened community participation. The study underscores the potential of CBSPOs to operationalise just transition objectives at the grassroots level and provides practical recommendations for scaling sustainable energy interventions in rural schools and communities.*

**Keywords:** Community-Based Social Protection (CBSP), Just Transition, Biogas Technology, Climate Adaptation, Renewable Energy, Rural Development, Vhembe District.

### 1. INTRODUCTION

Universal social protection is increasingly recognised as a cornerstone of inclusive and sustainable development at both national and global levels. It is not only a human right but also an essential mechanism for reducing poverty and inequality, fostering social cohesion, and facilitating human development [1]. Beyond providing immediate safety nets, social protection enhances productivity and employability by improving human capital, enabling households to invest in productive assets, raising incomes and consumption, and strengthening resilience against shocks and structural transformations [2]. These benefits have positioned universal social protection at the heart of global development debates, with international organisations such as the International Labour Organisation (ILO), the World Bank, and United Nations agencies promoting its integration into national policy agendas [3].

Countries in the Global South have seen concerted initiatives by governments and development partners to enhance and institutionalize social protection systems. However, as Devereux et al. [4] note, the policy processes shaping these systems are often poorly understood, especially regarding the role of civil society actors. Despite their proximity to vulnerable groups, community-based organisations remain underexplored regarding their contribution to the design, delivery, and monitoring of social protection measures. This raises critical

questions about the contribution of community-based social protection (CBSP) initiatives to broader development goals, especially in contexts marked by climate vulnerability and socio-economic inequality [5].

The emergence of the just transition (JT) framework provides an additional lens through which to analyze the evolving role of social protection. A just transition refers to the shift toward a post-carbon society conducted in a fair, inclusive, and equitable manner [6]. It emphasizes linking environmental, energy, and climate justice with social fairness, so that the costs and benefits of decarbonization are shared equitably [7]. Although the global energy transition moves toward renewables and away from fossil fuels [8], it also carries risks of job losses, economic disruption, and greater inequality. Consequently, especially when rooted in community structures, social protection becomes a vital instrument for mediating these transitions, protecting livelihoods, and supporting vulnerable groups in adapting to new realities [9].

In South Africa, the urgency of linking social protection with climate action is particularly acute. The country's energy system remains heavily dependent on coal, yet international and domestic pressures for decarbonization are intensifying. The government, through initiatives such as the Just Transition Transaction (JTT) and the Presidential Climate Commission, has emphasised the importance of managing this shift in ways that are socially just and economically viable [10]. South Africa's vulnerability to climate change further amplifies this need. The Intergovernmental Panel on Climate Change (IPCC) [11] reports that the country faces rising temperatures, increasing droughts, floods, and other extreme weather events. These climate shocks disproportionately affect rural communities dependent on agriculture, such as those in Limpopo's Vhembe District, undermining livelihoods, exacerbating poverty, and compounding pre-existing inequalities [12].

The triple challenges of poverty, unemployment, and inequality already weigh heavily on South Africa. The unemployment rate surpassed 35 percent in 2022, while inequality levels remain among the highest globally (13). Moreover, burning fossil fuels, a driver of climate change, contributes to severe public health burdens, especially among poorer communities who are most exposed to environmental risks [14]. In this context, a well-managed just transition is not only an environmental imperative but also an essential economic and social priority. Policies must focus on people, especially marginalized and vulnerable groups, ensuring that climate actions support livelihoods, advance equity, and protect human development [15].

Community-based social protection organisations (CBSPOs) provide a promising yet underexplored pathway for achieving these objectives. By operating at the grassroots level, CBSPOs are uniquely positioned to address local vulnerabilities, mobilise collective action, and empower communities to adapt to climate-related challenges. Initiatives such as those undertaken in South Africa's Vhembe District, where CBSP approaches have been applied to renewable energy provision, sustainable cooking solutions, and livelihood support, demonstrate how local innovation can align with national just transition goals [16]. Yet, despite their potential, the contributions of CBSPOs to climate adaptation and just transition remain marginal in academic discourse. Several studies have focused on macroeconomic or policy-level analyses of just transition [17], overlooking how community-driven responses operationalise these frameworks on the ground.

This study, therefore, aims to fill this gap by examining the role of community-based social protection in fostering resilience to climate change within the context of South Africa's just transition. By focusing on the case of Vhembe District, where biogas digesters have been deployed in schools as part of a broader CBSP initiative, the study situates community-driven innovation within the larger discourse of climate justice, energy transitions, and social equity. In doing so, it contributes to an emerging body of knowledge on how grassroots actors shape, sustain, and localise the goals of a just and sustainable transition.

## **2. METHODOLOGY**

This study adopts a semi-systematic (narrative) literature review as its primary research method. The semi-systematic review approach is particularly suitable for topics that have been conceptualized differently and

studied across multiple disciplines, where a fully systematic review may be impractical or overly restrictive [18, 19]. Unlike conventional systematic reviews, which prioritize exhaustive literature coverage and strict inclusion criteria, semi-systematic reviews allow for a more flexible exploration of how a topic has evolved, how it has been conceptualized across diverse research traditions, and how scholarly debates have developed over time [20].

The approach is especially useful for identifying key themes, theoretical perspectives, recurring issues, and research gaps, and for constructing a historical overview or timeline of developments within a field [21, 19]. For this study, the semi-systematic review enabled a structured examination of research on community-based social protection (CBSP), just transition frameworks, and climate change adaptation in the Global South, with a specific focus on South Africa's Vhembe District.

#### ***Data Sources and Search Strategy***

A comprehensive search was conducted across multiple academic databases, including Scopus, Web of Science, ScienceDirect, JSTOR, and Google Scholar, to identify relevant studies published between 2000 and 2025. Keywords and search strings included combinations of: “community-based social protection,” “just transition,” “climate change adaptation,” “renewable energy,” “youth empowerment,” and “South Africa.” The search strategy was guided by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines [22] to ensure transparency, replicability, and methodological rigor.

#### ***Inclusion and Exclusion Criteria***

Studies were included if they:

- Focused on social protection, just transition, or climate change adaptation.
- Examined community-based interventions, particularly in developing country- contexts.
- Peer-reviewed journal articles, books, or authoritative reports were published between 2000 and 2025.
- Written in English.

Exclusion criteria included studies that were purely conceptual without empirical grounding, non-English publications, or studies unrelated to social protection, climate change, or just transition.

#### ***Data Screening and PRISMA Flow***

The initial search yielded 842 articles. After removing duplicates, 701 articles remained for screening based on title and abstract relevance. Full-text reviews were conducted on 164 studies, resulting in 78 articles meeting the inclusion criteria. The PRISMA flow diagram was employed to document the selection process, ensuring transparency and reproducibility.

#### ***Data Extraction and Synthesis***

For each included study, data were extracted on key characteristics, including:

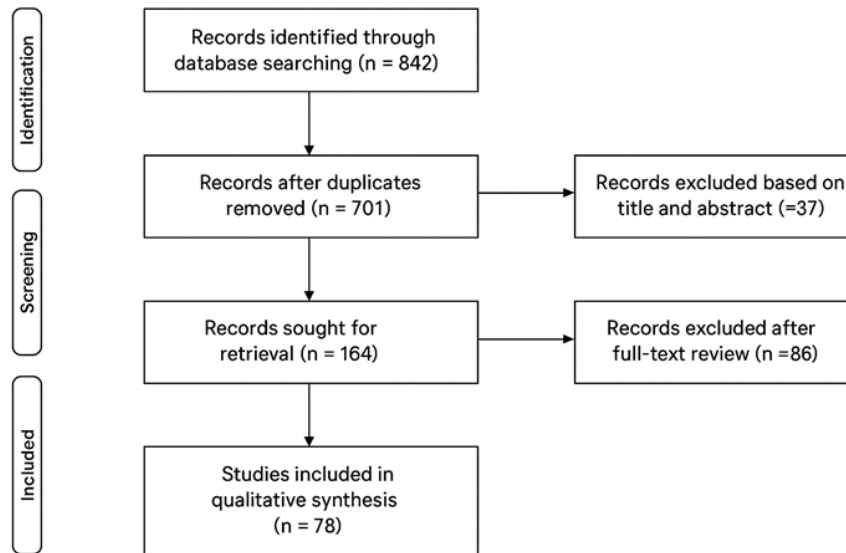
- Author(s) and year of publication
- Geographic focus
- Type of social protection or climate adaptation intervention
- Study design and methodology
- Main findings and thematic focus

A thematic content analysis was conducted to identify recurring themes, theoretical frameworks, and methodological trends [23, 19]. This involved coding the data into categories such as social protection mechanisms, youth empowerment initiatives, renewable energy adoption, and community resilience outcomes. Patterns and relationships across studies were synthesized to provide insights into the contribution of CBSP initiatives to climate adaptation and just transition processes

#### ***Methodological Rigor***

The semi-systematic approach, combined with PRISMA-guided data management, ensured methodological rigor while maintaining flexibility to capture the diversity of research perspectives. By

integrating both qualitative synthesis and structured data extraction, the study provides a comprehensive and nuanced understanding of the existing evidence base, identifies research gaps, and informs policy and practice for community-based social protection and climate resilience.



**FIGURE 1**  
**EMERGING THEMES**

The study on the aspirations of youth in community-based social protection organizations (CBSPOs) highlighted several key aspects related to the implementation of biogas technology in Tshikuyu and Dovho Primary Schools. The findings are organized under site selection, design and construction, operation and maintenance, community-based social protection, and project implementation.

#### ***Site Selection and Assessment***

- **Convenience:** The kitchens at Tshikuyu and Dovho Primary Schools are strategically located for biogas usage, with easy access to potential feedstock sources.
- **Water Access:** Both schools have reliable water supply through boreholes, essential for the digester operation.
- **Feedstock Availability:** Sufficient cow dung is available from local farmers and the community to sustain biogas production.
- **Technical Feasibility:** Assessment of available technology and skilled labor indicates that the project is technically viable.

#### ***Design and Construction of Biogas Digesters***

##### ***Design Considerations***

- Each school requires biogas to cook meals for 220 learners daily. The cooking duration is approximately one hour, using three burners simultaneously. Adjusted for losses, this corresponds to a daily requirement of 3 m<sup>3</sup> of biogas.
- Cow dung is the primary feedstock, with approximately 1 kg producing 0.04 m<sup>3</sup> of biogas. Therefore, 75 kg of cow dung, mixed 1:1 with water, is needed per day.

- Digesters are designed with a hydraulic retention time (HRT) of 60 days. The setup includes an 8 m<sup>3</sup> plant (7.5 m<sup>3</sup> reactor chamber, 0.5 m<sup>3</sup> embedded gas storage) and a 5 m<sup>3</sup> external balloon gas bag for weekends and school holidays.
- Feedstock composition, gas production rate, and optimal temperature range were tailored to local conditions.

#### ***Construction***

- Local labor and materials were employed to enhance community ownership and sustainability.
- Community members received training in construction techniques, quality control, and safety measures.
- Best practices were followed, including proper sealing, insulation, and safe gas handling systems.

#### ***Operation and Maintenance***

##### ***Training:***

School staff and students were trained in digester operation, maintenance, feedstock management, and safety procedures.

##### ***Monitoring and Evaluation:***

A monitoring system was established to track gas production, energy use, and environmental impact.

Regular inspections and maintenance ensure optimal digester performance.

#### ***Community Engagement***

Active participation of the community in operations is encouraged.

User groups were formed to share knowledge, experiences, and support.

#### ***Community-Based Social Protection Benefits***

##### ***Economic Empowerment:***

- Surplus biogas or organic fertilizer can generate income for the community.
- Local employment opportunities, particularly for youth, are created through project activities.

##### ***Health and Environmental Benefits:***

- Indoor air quality improves by reducing exposure to smoke from traditional cooking fuels.
- Demand for firewood and charcoal decreases, mitigating deforestation and soil erosion.

##### ***Education and Awareness:***

- Biogas technology is integrated into the school curriculum to promote environmental awareness and STEM education.
- Workshops and training programs educate the community on the benefits of biogas technology.

#### ***Project Implementation***

##### ***Site Preparation***

- Construction sites were cleared and foundations prepared.
- Adequate water supply and drainage were ensured.

##### ***Construction Phase***

- Eight-cubic-meter fixed-dome digesters, gas holders, and pipeline systems were installed.
- Safety equipment, including flame arresters and pressure relief valves, was fitted.

##### ***Commissioning and Training***

- Digesters were filled with feedstock, initiating biogas production.
- Community members were trained in operation, maintenance, and safety procedures.

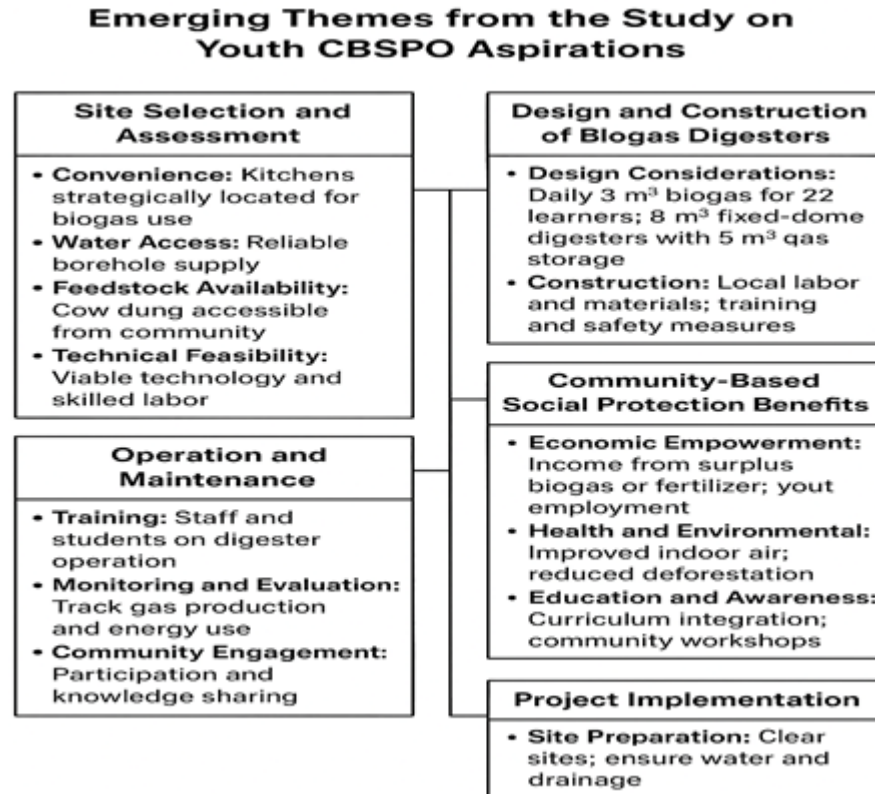
##### ***Monitoring and Evaluation***

- Gas production, energy consumption, and environmental impacts were monitored.
- Regular maintenance and repairs were conducted to sustain performance.

### Community Engagement

- Meetings were organized to communicate project benefits and address concerns.
- Active community participation in digester operations was promoted.

By following this comprehensive approach, the project was envisioned to enhance the climate resilience of Vhembe District, improve livelihoods of vulnerable communities, and foster sustainable development. The 8 m<sup>3</sup> biogas digesters provide a viable and sustainable solution to energy and environmental challenges faced by Tshikuyu and Dovho Primary Schools.



### 3. RESULTS

The biogas technology project at Dovho and Tshikuyu Primary Schools, located in Masisi Village, Musina Local Municipality, Vhembe District, Limpopo Province, was successfully implemented as an integrated waste-to-energy and water-use efficiency solution. The project also contributed to reducing environmental degradation, waste accumulation, and climate-related challenges, affecting South Africa.

Before the installation, four women at each school cooked meals using firewood, exposing them daily to smoke and associated health risks, including respiratory problems, eye irritation, headaches, and potential lung disease. The biogas digesters significantly mitigated these risks, providing cleaner, safer energy.

#### Energy and Resource Efficiency

- The schools previously consumed ~10 tons of firewood annually at R1,500/ton (R15,000/year). The biogas digesters allow this demand to be met using ~12 tons of cow dung per year, requiring ~12 cows to be kraaled overnight.

- Electricity savings were also observed. Assuming electricity costs of R2.50/kWh, and cooking for 3 hours daily on a 3 kW plate, annual consumption would be 1,500 kWh (~R4,500/year).

#### **Integration with Food Gardening**

Dovho and Tshikuyu Schools integrated biogas digesters with food gardens, using garden waste as feedstock and waste pit water as bio-fertilizer. This synergy enhanced soil fertility, vegetable production, and overall sustainability.

#### **Outcomes and Impacts**

The project achieved the following:

- Created employment and skill development opportunities for youth and women.
- Reduced school operational expenses.
- Replaced chemical fertilizers with digester by-products (sludge), improving crop yields.
- Enhanced knowledge of waste management and biogas construction.
- Reduced cooking time, freeing time for study.
- Improved health through cleaner, smoke-free energy.
- Reinforced community willingness to support local development projects.
- Empowered the community to participate in decision-making processes with lasting impact.

#### **Contributions To The Field**

Biogas production demonstrates notable benefits in environmental health and management. It transforms biodegradable waste, previously a public health concern, into a sustainable energy source and organic fertilizer. Such initiatives contribute to a just transition to a low-carbon economy, promoting economic growth, job creation, energy security, and climate change mitigation [24].

#### **Recommendations**

Based on the findings, the study suggests the following:

1. Implement periodic monitoring of biogas systems to evaluate social and environmental sustainability, particularly in schools with active food gardens.
2. Explore commercialization opportunities, such as selling bio-fertilizer to local farmers and collecting excess biogas during weekends and holidays.
3. Provide continuous training and refresher courses for school staff and community members.
4. Involve local farmers and communities in digester maintenance and biogas production.
5. Promote biogas adoption at the village level and within rural cooperative farms to facilitate dissemination and integration with local economic activities.

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