

BeZero Carbon Final risk assessment report

5004

Transformative Cookstove
Activity in Rural Ghana

Commissioned by the Federal Office
for the Environment (FOEN)

London, December 2025



Project description

5004 uses carbon finance to subsidise the distribution of up to 180,000 improved cookstoves (ICS) to agricultural households across rural and peri-urban Ghana. Most ICS components are imported from China or India, with select parts manufactured and assembled locally. Stoves are sold via farming equipment hubs, with microfinance loans planned to be available to support uptake. The project is forecast to issue 1,593,560 million tCO₂e in emission reductions over its seven-year crediting period, averaging 230,000 per year and 1.3 per stove per year.

Table 1. Project details

| Particulars | Details |
|--------------------------------------|---|
| Project name | Transformative Cookstove Activity in Rural Ghana |
| Sector classification | Household Devices → Energy Efficiency → Cookstoves |
| Methodology | Adapted from Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC) v4.0 |
| Project proponent | Envirofit International |
| Location | Ghana |
| Project crediting period | 01/04/2023 → 31/12/2030 |
| Vintages assessed | 01/04/2023 → 31/12/2030 |
| Credits forecast (in rated vintages) | 1,593,560 tCO ₂ e |
| Year of first issuance | 2023 |

Imprint

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Contractor: BeZero Carbon

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The contractor bears sole responsibility for the content.

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Executive summary

For 5004, BeZero finds very high additionality, low likelihood of accurate carbon accounting and high permanence. Overall, our beyond carbon assessment for 5004 finds a risk tier of 2 (moderately low risk) ▾ and a benefits tier of 3 (moderate benefits) ▾.

Table 2. BeZero Carbon ex ante risk assessment summary for 5004, as of December 2025.*

| COMPONENT | ASSESSMENT |
|------------------------------------|-------------------------------------|
| Additionality | Very high additionality |
| Carbon accounting | Low robustness of carbon accounting |
| Permanence | High permanence |
| | |
| Project execution risk | Moderate ▾ |
| Beyond Carbon risk tier | 2 (moderately low risk) ▾ |
| Beyond Carbon benefits tier | 3 (moderate benefits) ▾ |

* The crediting period assessed includes verified vintages for 01/04/2023 to 31/03/2024 and ex ante vintages until 2030

Risk factor summaries

Table 3. BeZero Carbon ex ante risk factor summary for 5004, as of *December 2025*

| RISK FACTOR ¹ | |
|---|---|
| Additionality: Very high additionality | |
| ++ ▾ | Biomass consumption remains high in Ghana, with 2.8m rural households not using an ICS |
| ++ ▾ | Awareness gaps and stove repair barriers are targeted in this project |
| + ▾ | Project providing a 60% subsidy of the stove cost |
| - ▾ | End-user identification may not fully address the financial constraints of ICS adoption |
| - ▾ | Some policy support for ICS dissemination and LPG adoption |
| Carbon accounting: Low robustness of carbon accounting | |
| ++ ▾ | Underestimated fNRB and EF values in ER calculations |
| + ▾ | SUMs are used for usage rate monitoring, and a discount factor applied to account for reduced usage |
| - ▾ | Small sample size for all project surveys |
| -- ▾ | Overestimated baseline consumption values |
| Permanence: High permanence | |
| - ▾ | Minor risk that standing biomass is lost by other means |
| Project execution risk: Moderate ▾ | |
| ++ ▾ | First monitoring period has been completed, demonstrating the project's feasibility |
| + ▾ | ACT Commodities is one of the largest environmental commodities traders |
| + ▾ | Distribution company Farmerline is a well known company in Ghana for farming goods |
| - ▾ | Full funding has not been secured for the entire crediting period |
| - ▾ | Offtake agreement and loans have not been reviewed due to confidentiality |
| - ▾ | The project has only distributed a small number of stoves in comparison to targets |
| - ▾ | The micro-loan system has not been set up yet, potentially limiting the customer base |

¹ ++ ▾ = Major positive, + ▾ = Minor positive, = ▾ = Neutral, - ▾ = Minor negative, -- ▾ = Major negative

Table 4. Beyond carbon summary for 5004, as of December 2025.

| RISK FACTOR | RISK TIER | BENEFITS TIER |
|-------------------------------------|--------------------------------|------------------------------|
| OVERALL | 2 (moderately low risk) | 3 (moderate benefits) |
| Socioeconomic | Moderately low | Moderate |
| Land & Resource rights | Low | Moderate |
| Labour & Livelihoods | Moderate | Moderate |
| Diversity & Equity | Moderate | Moderate |
| Benefit-sharing | Low | NA |
| Stakeholder Engagement | Moderate | Moderately low |
| Health & Education | Moderately low | Moderately high |
| Environmental | Moderately low | Moderate |
| Ecosystems & Biodiversity | Low | Moderate |
| Natural Resources & Natural Hazards | Low | Moderate |
| Pollution | Moderately low | Moderate |
| Public Sentiment risk | Low | |
| Stakeholder commentary | Low | NA |
| Media coverage | Low | NA |

Structured risk feedback

The table below outlines steps the project could take to mitigate risks identified in our analysis. It includes the feasibility of executing these strategies and their potential impact, if successful, on the project's credit issuance and our rating of the project.

Table 5. Structured risk feedback

| COMPONENT | CURRENT RISK | POTENTIAL RISK | MITIGATION STRATEGIES | FEASIBILITY AND TYPE | ISSUANCE CHANGE |
|---|-----------------|-----------------|--|------------------------|-----------------|
| Additionality | | | | | 0% |
| <u>Barrier analysis</u> <i>Subsidy level above willingness to pay</i> | Low | Very Low | Increase subsidy levels to ensure cookstoves are within the WTP values of rural Ghana | Low Design | 0% |
| <u>Barrier analysis</u> <i>Income disparities in end-user groups</i> | Low | Very Low | Better identification of end-users based on income levels | Moderate Design | 0% |
| Carbon accounting | | | | | 50%+ |
| <u>Baseline scenario</u> <i>Uncertainty in fuel consumption determined from KPTs</i> | High | Low | Increase sampling size to cover a higher proportion of ICS and stratify by household income, location or education level to provide a more complete sample set for baseline consumption values | Moderate Accounting | 50%+ |
| <u>Project scenario</u> <i>Uncertainty in project consumption, usage rates and stove stacking due to the small sample size reducing representativeness</i> | Medium | Low | Increase the sample size and stratification used for determining project fuel consumption and usage rates. Increase SUM sampling time period. Install cookstoves directly to households. | Moderate Accounting | 5-20% |
| Permanence | | | | | 0% |
| <u>No amendable risks</u> | | | | | 0% |
| Project execution risk | Moderate | Very low | | | 0% |
| <u>Financial risk</u> <i>One third of total funding still needs to be secured</i> | Medium | Very Low | Ensure total funding is secured so that all ICS can be distributed | Moderate Financing | 0% |
| <u>Financial risk</u> <i>Highly leveraged financial structure</i> | Medium | Low | Diversify the funding base (e.g. access to a working capital facility) | Moderate Financing | 0% |
| <u>Financial risk</u> <i>Offtake and loan agreements are not disclosed</i> | Medium | Very Low | Mitigate information risk through the provision of MOPA and loan details, which outline the agreed credit price and interest rates | High Disclosure | 0% |
| <u>Technical risk</u> <i>The microfinance facility is not operational yet</i> | Medium | Low | Ensure an effective rollout of the microfinance facility | Moderate Design | 0% |

Key risk mitigation strategies

We have identified several key strategies the project could implement to reduce risk. These potential risk mitigation strategies span additionality, carbon accounting and beyond carbon risks. The indicated strategies can also help ensure the project meets the requirements outlined in the bilateral agreement between Switzerland and Ghana, the Paris Agreement, and the Swiss CO₂ ordinance.

Additionality

- The project provides a subsidy of 60% resulting in a cost to end users of USD 20. The willingness to pay is potentially less than this, with literature stating values around USD 15. An additional increase in the subsidy provided that reduced the stove cost to USD 15, would strengthen the project's ability to overcome financial barriers to stove adoption.
- Currently, it is not possible to determine the exact end-user profile due to the distribution hub model used. This increases the risk that the target end-user may not be reached in all cases, and instead users that could have afforded the stove at full price may obtain the stove. If the project were to improve end-user identification through the direct installation of ICS in the households, followed by a short survey, or increasing survey sample rates to cover a larger proportion of the population, this would decrease the risk to additionality.

Carbon accounting

- The highest driver of risk is high baseline consumption values, which likely over-estimate the overall emission reductions associated with this project. Stratified sampling would increase confidence in the results by explicitly capturing key sources of variability. Applying the higher confidence interval-based sampling methods outlined above to each strata, most notably cooking fuel type and ecological region, followed by household size, income level, and highest education level in the household, would improve representation of heterogeneity among end-users. While applying this approach across all strata would result in a complex and potentially unfeasible sampling matrix, prioritising the most influential strata would still provide high coverage of end-user variability. Larger and more stratified samples would also mitigate the risk identified in the project scenario by improving understanding of variation in continued usage and fuel consumption over the project period.
- Increasing the sampling size to cover a higher proportion of ICS would also provide a more accurate estimation of the actual baseline fuel consumption, however specific best practice sample numbers are challenging to determine, unless 100% monitoring is possible through techniques such as digital monitoring, reporting, and verification. The project currently applies a 90/10 confidence interval for sampling, however moving to a 95/5 confidence interval would improve confidence in results.
- To further increase confidence in project values, prolonged stove use monitoring times which cover all seasons (dry/wet/warm/cold) would again improve the understanding of usage throughout the project period. The seasons will be country-dependent; for example, Ghana's rainfall varies by region. In the south, the major rainy season runs from March to June, followed by a minor rainy season from September to November. In the north, the primary wet season is from May to September.
- The risk of stove stacking is somewhat addressed by the project through multi-fuel KPTs; however, due to the distribution methods, limited sample size, and stratification applied there is still risk of stacking in the end-user base. There are several mitigation strategies to follow, which can reduce the likelihood of stove stacking during project operations. It would be beneficial to install or deliver the cookstoves directly to the end users. If this were done through a project-financed operation, it could be possible to survey or collect customer information here. If performed by a third party, it may be possible to collect information when the customer

orders the ICS. One step further would be the installation of the ICS in the household, which would be put in place of the traditional stove, removing it from operation, again reducing the risk of potential stove stacking.

- Another consideration would be stove design or quantity. It is common for households to cook using traditional methods or for large households to have more than one stove. By only providing one stove or a stove with one burner, the risk of stove staking would increase. For example, if a household of 6 or 7 people needs to cook 3 meals a day, it is unlikely that they would be able to fulfil this need with one ICS. If instead an ICS which could accommodate 2 pots was provided, this would be more likely to fulfil the cooking requirements.

Socioeconomic Risks

Labour and livelihoods / Diversity and equity – microfinance and interest rates

- The project aims to utilise microfinance mechanisms, such as VSLAs and the Transformative Technology Access Fund, to support access to improved cookstoves. However, the effectiveness of these safeguards is currently limited, as interest rates and subsidy levels may remain misaligned with the ability to pay off lower-income or more vulnerable households. This creates a risk that uptake is skewed towards households with relatively higher purchasing power, thereby limiting livelihood benefits and weakening equity outcomes.
- If the project were to reduce interest rates and increase subsidy levels, particularly in lower-income or more remote locations, this would lower financial barriers to adoption and improve access for households that would otherwise be excluded. Such an adjustment would reduce the risk that microfinance mechanisms are insufficient to support livelihoods and diversity and equity objectives, and would strengthen the project's ability to deliver benefits to its intended target population.

Environmental Risks

Pollution – end-of-life management

- While the project delivers environmental benefits through reduced biomass use, no safeguards were identified for the management of cookstoves at end of life. In the absence of a repair, recycling, or disposal strategy, there is a risk that damaged or obsolete stoves contribute to unmanaged waste and secondary pollution impacts.
- If the project were to develop and implement an end-of-life management plan, including provisions for repair, reuse, and recycling, this would reduce the risk of pollution associated with stove disposal. The introduction of such measures would strengthen environmental safeguard coverage and reduce residual environmental risk related to pollution.

Analysis

Additionality:

5004 has a very high - likelihood of additionality. The project targets agricultural households in rural and peri-urban Ghana, where traditional biomass stoves are widely used and the adoption of improved cookstoves (ICS) remains low. Carbon finance is a major source of income and, when combined with project-provided microfinance, brings ICS within the willingness-to-pay threshold of the targeted end user. The project also supports uptake and continued use through awareness campaigns, training networks, and repair schemes. The project outcomes are therefore unlikely to have occurred in the absence of carbon finance, supporting a high likelihood of additionality.

Activity analysis

Common practice

ICS adoption remains low in rural Ghana, with widespread traditional biomass use indicating low additionality risk. Project 5004 aims to distribute two types of ICS – wood fuel and charcoal – to agricultural households in rural Ghana, excluding Greater Accra and Central Ghana. Biomass use remains widespread in these regions: recent estimates suggest 85%¹ of households rely on biomass, while Ghana's 2022 statistical survey found that 70% of rural households use wood fuel and 16% use charcoal². The project forecasts a distribution proportion of 60:40 woodfuel to charcoal stoves.

End users are primarily identified through interest surveys, designed to screen out urban respondents, though the number of surveyed households has not been specified, a 97% factor is applied to account for any potential urban households included. Alternatively, eligibility can be defined by households earning at least 20% of their income from agriculture. The cook stoves are also sold to HHs through farm hubs, which reduces the likelihood of urban households being included.

Ghana has a long history of ICS programmes, including the Ahibenso coal pot initiative and a 2002 intervention by Relief International and Enterprise Works, as well as several carbon-financed cookstove projects. In total, over 2 million ICS have been distributed nationally, though most dissemination occurred in urban areas. The 2019 Ghana Living Standards Survey sampled 14,000 households across ten administrative regions and recorded 3.2 million rural households nationwide, of which 12.5% used improved charcoal or wood stoves – around 400,000 ICS users compared with 2.8 million relying on traditional stoves³.

One major carbon-financed project distributed approximately 600,000 Gyapa cookstoves, targeting both rural and urban households. However, these stoves are considered to have lower performance and efficiency than those to be distributed by Project 5004. While ICS can be purchased commercially in Ghana, they are not easily accessible in most rural areas without project-based distribution or subsidies^{4,5}. Overall, although ICS use is moderately common in Ghana, Project 5004's focus on remote farming communities, improved stove quality, and distribution through agricultural hubs ensures it reaches an underserved population, thereby mitigating common-practice risks.

Alternatives to the proposed project

Rural LPG adoption in Ghana remains limited due to persistent barriers, suggesting very low additionality risk. Solid fuel use remains widespread: between 2010 and 2021, the number of households relying on firewood increased by 18% to 2.6 million, and charcoal use rose by 5% to 1.9 million. Ghana's population continues to grow at 2.1% annually, driving absolute increases in solid fuel demand. (Ghana Statistical Service, 2021a). While LPG is the most widely used cooking fuel nationally, rising from 6% in 2000 to 37% in 2021², uptake in rural areas remains low at just 14%⁶. Literature shows that when LPG stoves are distributed, less than 10% are used beyond 18 months⁷.

These trends indicate that, despite being a national policy priority, LPG is not yet a viable large-scale alternative for rural households due to persistent affordability and accessibility barriers. As a result, it is unlikely that widespread LPG adoption would have occurred in the absence of the project, supporting a low risk to additionality from alternative cooking technologies.

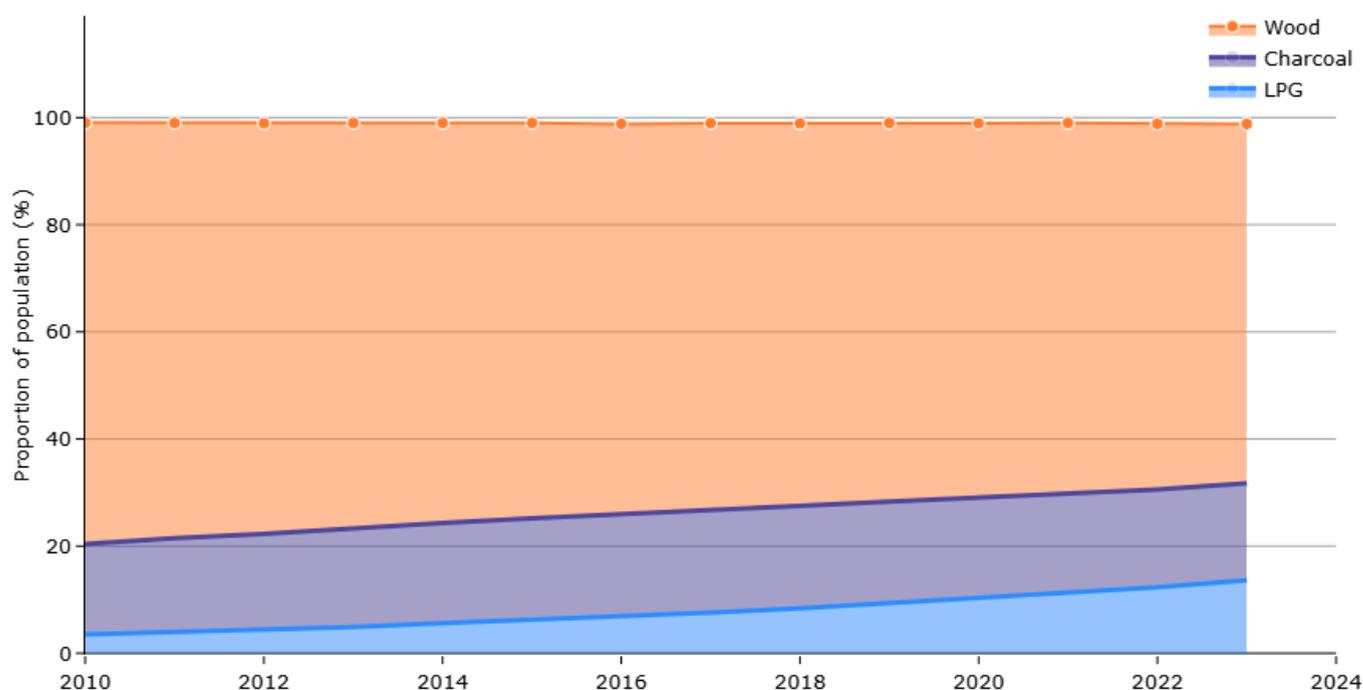


Figure 1. The proportion of the rural population of Ghana using each fuel type as their primary cooking method.

Financial analysis

Investment analysis

The project's financial dependence on carbon revenues drives a very low risk to additionality. Carbon finance covers the cost of stove subsidisation, end-user training, and repairs, enabling the distribution of improved cookstoves (ICS) at a subsidised price. The project stove is manufactured

for around USD 30 and has a retail cost of USD 49. It is sold to the end-user for USD 20, where carbon finance subsidises about 60% of the retail cost. At a carbon credit price of USD 6, which is the current average cookstove credit price on the market, carbon finance contributes 72% of total revenues across the crediting period. The project's financial model uses a carbon credit price of USD 15 for their forecasts. At this price, carbon finance would contribute 87% of total revenues across the crediting period. Without this revenue stream, the project would not be viable, as project revenues would only cover around one-third of the total costs. The current 60% initial subsidy is designed to taper as the project matures, while awareness-raising and training expenses are expected to decline as market familiarity grows. Overall, the project's strong reliance on carbon finance indicates a very low risk to additionality.

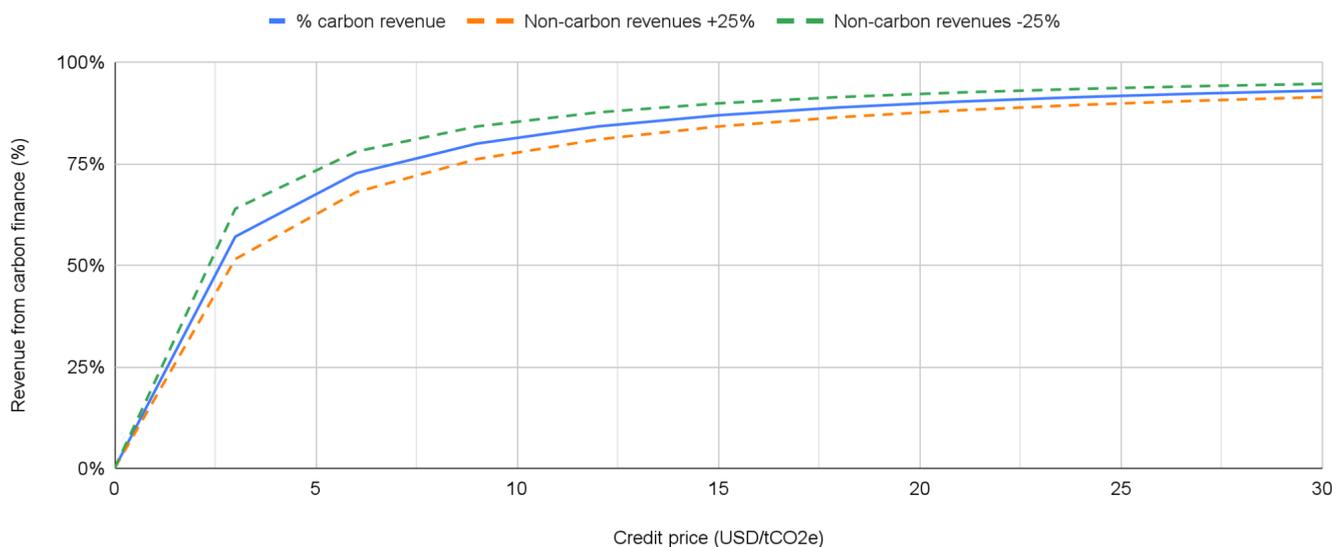


Figure 2. The contribution of carbon finance to project revenues from the sales of the ICS at the project's median forecasted credit price of USD15.

Barrier analysis

Project activities address general adoption barriers but leave some uncertainty over appropriate end-user selection. The project subsidises the ICS price by 60% from USD 49 to USD 20, substantially lowering upfront costs for rural and farming households. A microfinance option is also planned to close this gap further, offering small monthly instalments aligned with fuel savings; the estimated Annual Percentage Rate (APR) of ~130% is consistent with current microfinance rates in Ghana. However, this has not yet been implemented. While the subsidised price remains above the approximate WTP level of USD 15, which is likely to have increased with inflation in recent years, it is far closer to what many households can afford⁸⁻¹⁰.

Reports indicate that farm incomes can vary depending on location, size and job roles within the household¹¹. Reported per-capita farm incomes range from USD 804 to USD 4,356 per year. At USD 49, the stove would take around 70% of the poorest farmers' monthly income, the subsidised USD 20 accounts for roughly 30%. While the subsidy may not fully reach the very poorest households without additional support, it significantly lowers the financial barrier and broadens access relative to an unsubsidised scenario. There is some risk that wealthier households could still afford the stoves at a greater retail price than what the project is offering; however, the overall subsidy and planned financing support indicate a low financial risk to additionality, as affordability barriers would remain

significant without project intervention. Overall, the project's 60% subsidy and planned microfinance support substantially reduce affordability constraints, making financial additionality risks low despite income disparities and some residual targeting limitations.

ICS access risks are somewhat mitigated through the distribution of project devices through agricultural hubs. The project further overcomes some distribution barriers, as the target households are often underserved due to limited infrastructure¹²: Ghana's rural access index is 63%, meaning almost 40% lack access to an all-weather road. By distributing ICS to farmline hubs, the project brings devices closer to end-users; however, it does not undertake last-mile delivery. This introduces uncertainty around whether the intended households will reliably be reached, as any income group can technically purchase an ICS, and those with better access to distribution hubs may already have been able to obtain one. This risk could be further mitigated if stoves were delivered directly to end-users.

Project marketing and education activities address key informational and behavioural barriers. In rural areas with limited access to modern fuels, many households remain unaware of the health and time-saving benefits of improved cookstoves (ICS), and some underestimate the risks associated with traditional stoves. Additional barriers, such as limited distribution access and uncertainty over stove performance, may also inhibit uptake without continued support. The project targets these issues through education and marketing, with a per-unit budget of USD 5 (falling to USD 3), totalling roughly USD 720,000 for awareness activities if 180,000 stoves are distributed. Although documentation offers limited detail on the frequency or content of these interventions, user engagement is supported through a community network, repair hotline, and local distributor network that facilitates servicing through Envirofit Ghana, reducing the risk of stove disuse over time.

Legal and policy

Land and carbon rights

The license agreement signed by end-users ensures that all carbon / ITMO rights are formally transferred to the project, preventing any competing claims. Ghana's Nationally Determined Contribution (NDC) identifies the expansion of market-based cleaner cooking solutions as conditional on external support, such as carbon finance. The project therefore advances national NDC goals and generates mitigation benefits that would not materialise without such investment^{13,14}.

Policy support

Significant implementation challenges within policy targets limit the provision of clean cooking in Ghana. Ghana's NDC includes targets to increase liquefied petroleum gas (LPG) use in peri-urban and rural households from 5.5% to 50%, and to distribute 2 million improved cookstoves (ICS) by 2030⁷. These objectives are supported by the Country Action Plan (CAP), which outlines supportive measures such as reduced import duties, incentives for local stove manufacturing, and public awareness initiatives¹⁵. A government-led initiative also set out to distribute 500,000 ICS by 2020. Taken together, these policies signal sustained political intent to expand access to clean cooking across Ghana.

However, persistent implementation gaps undermine these ambitions. By 2023, only 38,000 ICS, less than 10% of the 2020 target, had been delivered. Government efforts to promote LPG have similarly struggled. The Rural LPG Promotion Programme planned to distribute 170,000 stoves by 2017, achieving 149,500 units. Yet, sustained adoption was poor: in five rural communities, 58% of households had never refilled their cylinders nine months after receipt, and only 8% were still using LPG after 18 months⁷. High refill costs and limited access to filling stations were key barriers. To address these issues, the National Petroleum Authority introduced the Cylinder Recirculation Model (CRM), shifting from consumer-owned to centrally owned cylinders exchanged at distribution points⁶. Implementation, however, has been slow and uneven due to safety concerns and logistical delays; pilot centres were only launched in 2024, and nationwide rollout will take time. As a result, achieving the 50% LPG penetration target in peri-urban and rural areas by 2030 remains unlikely¹⁵. Broader institutional issues, such as regulatory fragmentation, weak inter-agency coordination, and the absence of binding mandates, further constrain delivery.

We find a moderate level of international support risk, as growing donor and private-sector engagement could partially overlap with the project's intended outcomes. BURN Manufacturing's establishment of its first production facility outside Kenya, in Ghana (2022), reflects rising investor confidence and manufacturing capacity. In parallel, the UK's £74 million global clean-cooking initiative and the World Bank's USD 260 million programme for clean-energy and cooking access both include Ghana as a focus country. These initiatives may strengthen the enabling environment but could also produce similar outcomes through alternative channels. Nevertheless, most remain in early implementation with uncertain timelines.

Carbon accounting:

5004 has a low ▾ likelihood of accurate carbon accounting.

We find a low likelihood of accurate carbon accounting in 5004. Risk is mostly introduced through an overestimation of baseline consumption values compared to literature values. Further risk is identified from the usage surveys and kitchen performance tests (KPTs) conducted by the project, which are based on small samples that may not reflect the wider project population. The use of a conservative fNRB value and charcoal emission factor, however, limits the extent of overcrediting.

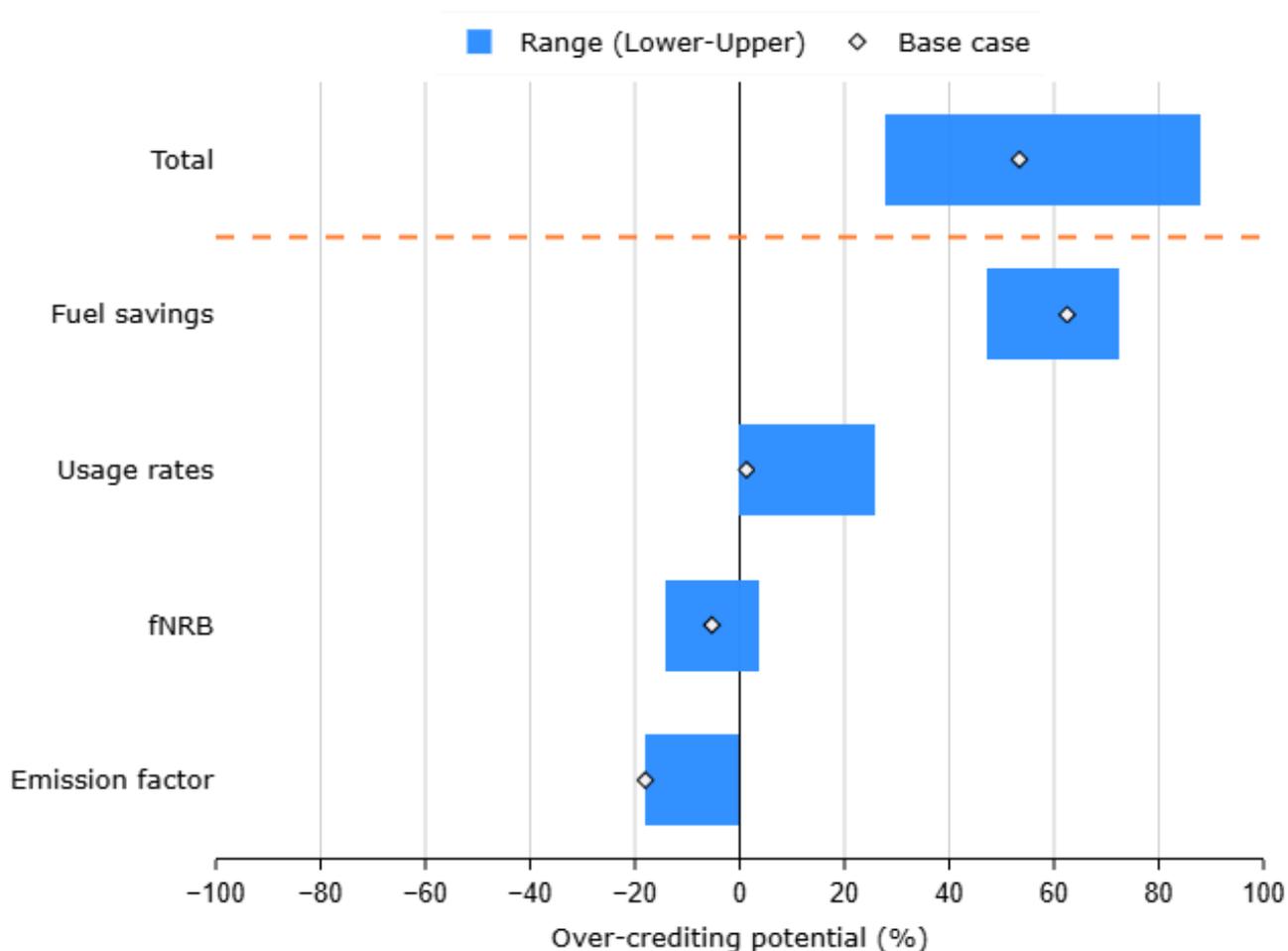


Figure 3. Carbon accounting scenarios. Diamonds represent approximate levels of over-crediting or under-crediting compared to the base case (or most likely alternative value) for parameters that feed into the project's emission reduction calculations. Bars demonstrate the range of crediting scenarios based on feasible alternative values for corresponding parameters. fNRB = fraction of non-renewable biomass.

Direct accounting

Baseline scenario

Baseline charcoal consumption appears overstated due to limited sampling. The project derives its baseline values from 66 in situ kitchen performance tests (KPTs) conducted before implementation, stratified by region according to stove sales. Although the project maintains up to

129 samples through a rolling quarterly update, this represents less than 0.1% of the 180,000 distributed stoves and is unlikely to capture the diversity of usage patterns across the wider end-user base.

The baseline KPTs record average charcoal consumption of approximately 1.7 tonnes per household per year. Data from a 2022 World Bank report indicate substantially lower rural household consumption of 0.64 tonnes per year for traditional charcoal stove users, suggesting that the project's baseline may overstate actual charcoal use. If applied directly, this discrepancy could lead to overestimations of emissions reductions by up to 60%. The assumed household size of 5.3 people used to scale per-person KPT results appears reasonable, given that rural agricultural households in Ghana are typically larger than the national average.

There is further uncertainty relating to wood fuel use, as the project has not yet conducted KPTs for its woodfuel stove cohort. While some wood-burning stoves have been distributed, they were not included in the monitoring report and therefore do not contribute to current baseline estimates. The project intends to incorporate wood stove testing in future sampling rounds; however, even with these additions, the total combined sample for charcoal and woodfuel users will remain below 0.2% of all deployed stoves. As a result, concerns regarding representativeness and the project's ability to capture heterogeneous fuel-use behaviours are likely to persist.

Overall, the baseline scenario introduces a material risk of over-crediting. The baseline consumption values do not align with current rural usage levels, and the limited, unrepresentative sampling and uncertainty in fuel-type assumptions compound this concern.

Project scenario

Sampling limitations materially constrain confidence in the project's estimates of fuel consumption. The project derives fuel savings from paired in situ kitchen performance tests (KPTs) undertaken quarterly, with an additional nine samples added each round. While quarterly sampling provides some seasonal coverage, the small samples remain insufficient to capture variation across Ghana's climatic zones. Although pairing helps to control for household-level variation, the total sample represents less than 0.1% of the improved cookstove (ICS) population and is unlikely to reflect the diversity of user conditions nationwide.

The project reports annual charcoal consumption of between 0.1 and 1.7 tonnes per household per year, with an average of 0.5 tonnes. Compared with the baseline, this implies average fuel savings of 1.2 tonnes per household per year, with savings calculated by multiplying the difference between baseline and project consumption per capita by the average household size.

Project-reported usage and stove-stacking rates introduce uncertainty. The project uses a separate household survey to estimate usage and reports a 93% usage rate, capped at 90% to comply with the methodology. However, this estimate is based on 100 surveys per monitoring period, covering fewer than 0.1% of the 180,000 distributed stoves. Time-series stove use monitors (SUMs) were also installed on KPT households for 30 days, with results indicating a 16% reduction in cooking duration after testing. The project therefore applied a 6% adjustment to emission reductions on top of the 10% buffer applied by the methodology. These SUMs increase confidence in the project's usage assumptions, but the short monitoring period and limited number of monitored stoves constrain the reliability of the findings. Independent studies from rural Ghana report average usage

rates of around 77%, suggesting that the project's applied discounts bring the usage rates in line with expected values reducing risk of over-crediting⁵.

Paired multi-fuel KPTs provide an indication of continued use of traditional stoves, but the small sample size limits the strength of this evidence. The distribution of only one ICS per household, with average household sizes of 5.3 people, may not meet the cooking needs of larger families and could encourage the concurrent use of baseline stoves, which are not removed by the project. Cultural preferences and cooking practices may also influence the extent to which the project stove is adopted for all dishes, particularly those requiring high heat or multiple burners. As stoves are collected from distribution hubs rather than delivered directly to households, visibility of baseline stove displacement is limited. Collectively, these factors increase the likelihood that traditional stoves remain in use alongside the project stove, elevating the risk of over-crediting.

GHG conversions

Conservative fNRB values were used for calculating emission reductions. The project currently applies a 30% fraction of non-renewable biomass (fNRB), based on a bilateral agreement between the Internationally Transferred Mitigation Outcomes (ITMO) host and buyer countries, Ghana and Switzerland. This is significantly more conservative than the originally proposed 76%, which was derived using the CDM Tool 30. In our view, Tool 30 simplifies the relationship between fuelwood use and deforestation and applies state-level averages to project instances, which may not reflect local realities.

In contrast, the MoFuSS (Modelling Fuelwood Savings Scenarios) framework represents best practice, as it integrates satellite data and geospatial modelling to estimate fNRB at finer spatial scales. MoFuSS modelling for Ghana finds a national average fNRB of 35%, with a range of 32–38%. For the specific project areas in which stoves have been distributed to date, MoFuSS reports an fNRB of 33% ± 5%. The 30% value used by the project is therefore slightly conservative and may result in undercrediting of up to 9%. The assessment of this risk factor is anchored in the current 30% fNRB value, which FOEN has identified as its preferred figure. While earlier forecasts included values as high as 76%, there is no indication that such increases are presently being pursued. Switzerland's recent move to permit higher country-specific fNRB values introduces some possibility of change, but any adjustment would require an agreed study with a strong link to MoFuSS. Any value exceeding the MoFuSS-derived figures used here would inherently carry greater risk.

Accurate and conservative values were used for emission factors for wood and charcoal, respectively. The values applied for wood stoves align with the methodology's defaults and established Intergovernmental Panel on Climate Change guidance. The project uses carbon dioxide and non-CO₂ emission factors of 112 tCO₂ per terajoule (TJ) and 9.46 tCO₂ per TJ for wood stoves, which are appropriate when assuming that only wood fuel is used in the baseline scenario. These values do not introduce material risk to the accuracy of reported emissions.

For charcoal, the methodology specifies a default carbon dioxide emission factor of 165.22 tCO₂ per TJ. Our analysis indicates that a higher value of 197.15 tCO₂ per TJ may better reflect the full emissions associated with charcoal production, including more realistic wood-to-charcoal conversion rates. Because a higher factor increases estimated baseline emissions, applying it would raise the credited emission reductions by up to 7.4%.

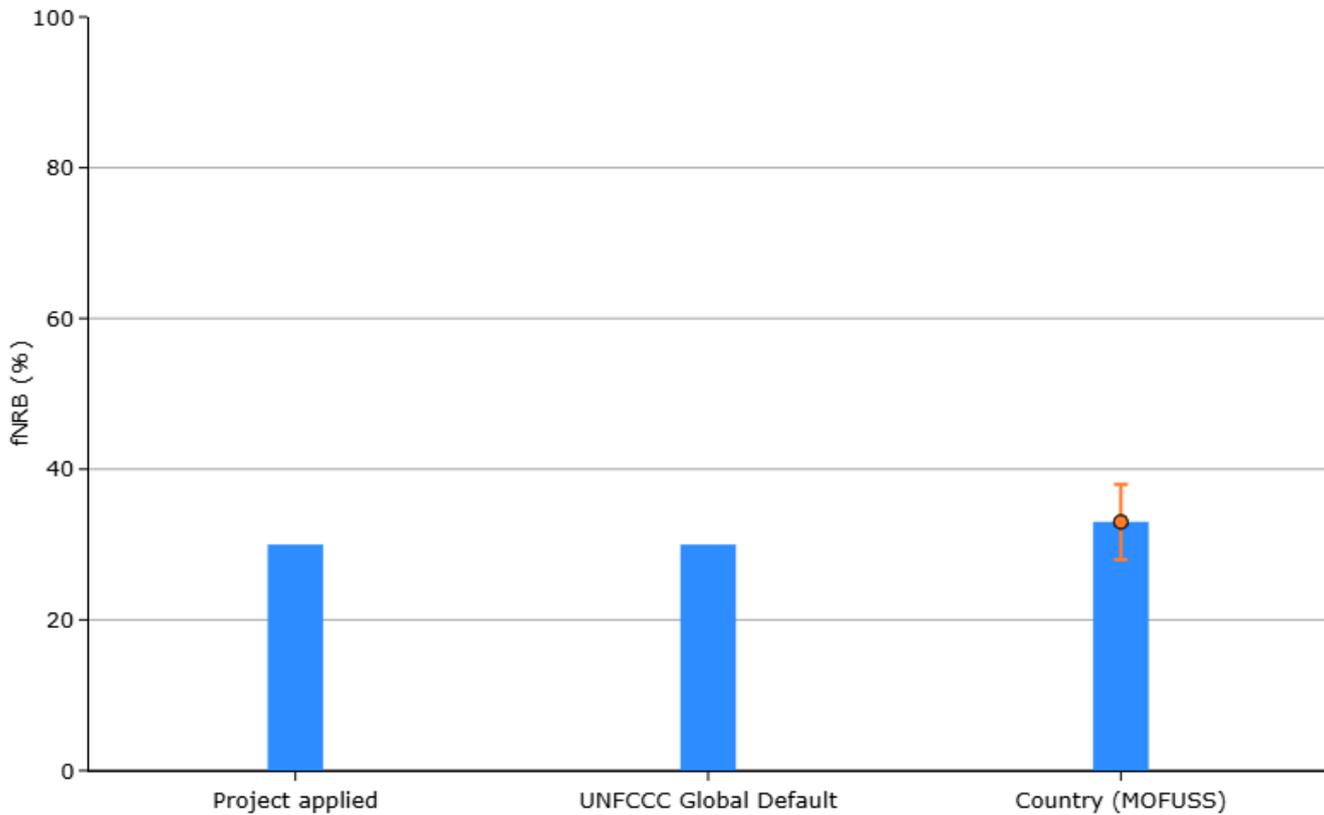


Figure 4. A comparison of average fNRB values that the project applies, compared to current best practice findings from the Modelling Fuelwood Saving Scenarios database in Ghana.

Leakage accounting

Activity displacement

Baseline devices are not likely to be moved outside of the project boundary, reducing leakage risk. According to the project, the baseline technologies are not removed from end-users who purchase an ICS. This is because the ICS are distributed through hubs, and therefore, the project does not visit the end-user households. However, the baseline technologies are traditional fires or low-value coal pots, and therefore, they are unlikely to be sold or moved outside of the project area.

Market leakage

There is some potential for market leakage due to national fuel dynamics in Ghana. The demand for charcoal in Ghana continues to rise, driven by urbanisation, household cooking and commercial food-service needs—despite growing concerns over deforestation¹⁶. Charcoal production is increasingly drawn from fallow lands and savannah woodlands, indicating supply constraints and environmental pressure. Because of this, any fuel savings from the project may be used outside of the project area. However, the likely project fuel savings are relatively small compared to the national charcoal market size and growth trajectory, and any reduction in demand linked to the project is unlikely to significantly shift charcoal supply or price structures. Therefore, the risk of leakage through broader market supply-demand feedback appears limited.

Permanence:

Credits issued by 5004 have a high ▾ likelihood of permanence. Some risk is introduced by the potential for fuel savings to be reversed as standing biomass is lost by other means; however, this is reduced somewhat by the distribution of charcoal stoves and woodfuel.

Technical risks

Carbon stock integrity

There is some uncertainty around biomass permanence due to various deforestation methods in Ghana. While it is not possible to specifically identify which forest areas supply the biomass fuel or which trees are being preserved by project activities, we recognise that there is a potential for reversal of carbon stock within this sector group. In Ghana, where over 60% of primary forest cover has been lost since 1950 and deforestation is driven mainly by cropland expansion (around 53%), with fuelwood and charcoal extraction contributing a smaller but still relevant share, the project's reductions in non-renewable biomass use occur within a landscape of persistent forest pressure.

Project execution risk: ‘ Moderate ▾ ’

5004 presents a ‘ Moderate ▾ ’ risk of failing to be fully implemented and reach operational stabilisation. We find that 5004 has a moderate risk of failing to be fully implemented and reach operational stabilisation. The project is currently in its implementation phase, with one monitoring report completed; however, it has only distributed 10,936 of the targeted 180,000 during the first year of the 8-year crediting period. Technical risks are low, and all legal and regulatory requirements are in place. While the project faces some delays and difficulties in scaling up its operations, proportionally lower costs at a reduced scale support the likelihood of successful implementation, even if the rollout remains below targets. While the project has already secured a buyer for the ITMOs, some financial risk related to funding, liquidity, and profitability uncertainties remains, in our opinion. The project managers, including ACT commodities, Envirofit and Klik, all have experience in previous carbon projects, hence supporting confidence in delivery and tempering the overall execution risk.

Technical risk

We find a moderate risk to execution associated with the project technology. The planned distribution of 180,000 stoves across 3 phases, each requiring a signed legal contract with beneficiaries, together with the subsequent monitoring and maintenance requirements, highlights the operational complexity of the project. By March 2024, the project had distributed around 11,000 charcoal stoves – just 6% of the planned 180,000. However, one monitoring report has been completed, demonstrating the effectiveness of the project technology. Some woodfuel stoves were distributed; however, this was late into the monitoring period and therefore did not contribute to the initial ITMO issuance. The baseline scenario covers only charcoal stoves, yet the project applies a 60:40 wood-to-charcoal ratio for stove use in the baseline. Recent rural data from the World Health Organization indicate a more realistic 80:20 split, which would reduce estimated emissions reductions from 1.6 million to 1.1 million tCO₂e over the crediting period. However, the project notes that the final distribution of improved cookstoves will reflect customer demand.

The early stage of the project implementation introduces some risk to full scale up. Cookstove distribution is still well underway, with a low percentage of stoves distributed so far. Moreover, the microfinance facility has not yet been fully set up, which potentially limits the number of new users. Yet, we see risks to reach full implementation to be partially tempered by the distribution and monitoring track record so far. Some additional risk stems from the project distributing ICS to distribution hubs rather than to the end-users directly, as it will be more difficult to determine what proportion of the ICS needs to be woodfuel or charcoal, potentially resulting in delays to manufacturing. Nevertheless, the assembly is locally based, and although the project stoves are bespoke models, they have already started distribution, and KPTs indicate they work as intended. Similar alternatives could likely be sourced from other local manufacturers if the current supply agreement were to fall through, hence tempering any potential supply replacement risk.

Legal and regulatory risk

There is a low risk to project execution related to legal or regulatory issues. The project developer has all the permissions and licences needed to undertake the project activities and is registered with

the Swiss Government to provide ITMOs under the Paris Agreement Article 6.2. The project's mitigation outcomes are calculated and monitored to align with the Gold Standard TPDDTEC v4.0 methodology, adapted to incorporate additional requirements of the Swiss government. In this case further project-specific requirements introduced include updated usage monitoring and fNRB requirements. This leads to a low accreditation risk in our opinion; however, given that the credits issued by this project are technically ITMOs, they will not be formally assessed by Gold Standard.

Carbon rights and contractual clauses are well defined, but withdrawal rates need to be closely monitored. All carbon rights are clearly assigned to the project proponents in contracts with beneficiaries. Moreover, the contract grants beneficiaries an indefinite licence to use the project stove, provided they comply with the licence terms. Ownership therefore remains with the developer, who retains the right to revoke the licence if contractual conditions are breached. This arrangement reduces risks to future cash flows, as unused stoves could be recovered and redistributed. However, if a high withdrawal rate is recorded in the future, we might see an increased risk to project execution, due to the operational difficulty of recovering a large number of stoves and the associated delays in finding new users.

The favourable regulatory framework lowers execution risk. Although Ghana ranks in the lower middle quartile of countries on Transparency International's Corruption Perceptions Index, we find no evidence of corruption directly affecting a specific carbon-offset project in the country. In our view, this suggests that the associated risk to project execution remains low. Moreover, Ghana has established a favourable policy and regulatory environment for Article 6.2 transactions, with clear frameworks for the authorisation and transfer of ITMOs. This supportive stance is likely to facilitate project implementation and enhance overall investment confidence. As such, in our opinion, there are no major legal or jurisdictional barriers that could significantly threaten project execution at this stage.

Financial risk

The project has not yet secured the total capital required to reach the full distribution targets in a timely manner. The total funding needed for full implementation is estimated at USD 11.3 million if stoves are distributed according to the plan and credits are timely sold at USD 15/tCO₂e. This would further increase to USD 12.5 million should credit prices fall to USD 10. According to the developer, approximately two-thirds of this funding requirement has been secured through an external loan, with the remaining third still to be finalised. However, this information has not been independently verified by BeZero due to confidentiality constraints, hence introducing some information risk. Moreover, given the existing delays in the project rollout, there is a possibility that the total financing needs could increase further, hence increasing financial risk.

The financial structure appears to be highly leveraged. The project's high reliance on debt financing introduces additional financial vulnerability. The financial model assumes in fact that the entire capital requirement will be funded through an amortising loan at an interest rate of around 25%, although further details on this remain unconfirmed. This structure implies that, in case of significant distribution, issuance, and/or commercialisation delays, debt interest and principal repayments may begin before meaningful carbon revenues are realised. Any relevant delay might therefore create a mismatch between cash inflows and the required debt service, which could

expose the project to potential liquidity pressure during the early years of implementation, especially in the absence of alternative financial buffers.

Significant uncertainties remain around the project’s profitability profile. The Mitigation Outcome Purchase Agreement (MOPA) with the buyer has been finalised and is understood to cover the full expected issuance volume; however, this contract was not made available for review due to confidentiality constraints, and further details were not disclosed. If the final offtake price is below USD 15/tCO₂e, which is a price level significantly higher than the current African cookstove market average of USD 6/tCO₂e, the project may be unable to break even within the eight-year crediting period, hence potentially introducing some debt repayment risk depending on the specific loan conditions. Our scenario analysis indicates that breakeven is not achieved under prices of USD 10/tCO₂e or in the case of an ITMO sale shortfall. This profitability risk might be partially tempered if the project becomes eligible for additional crediting periods; however, some further costs associated with the repair or replacement of cookstoves would be incurred in such a scenario.

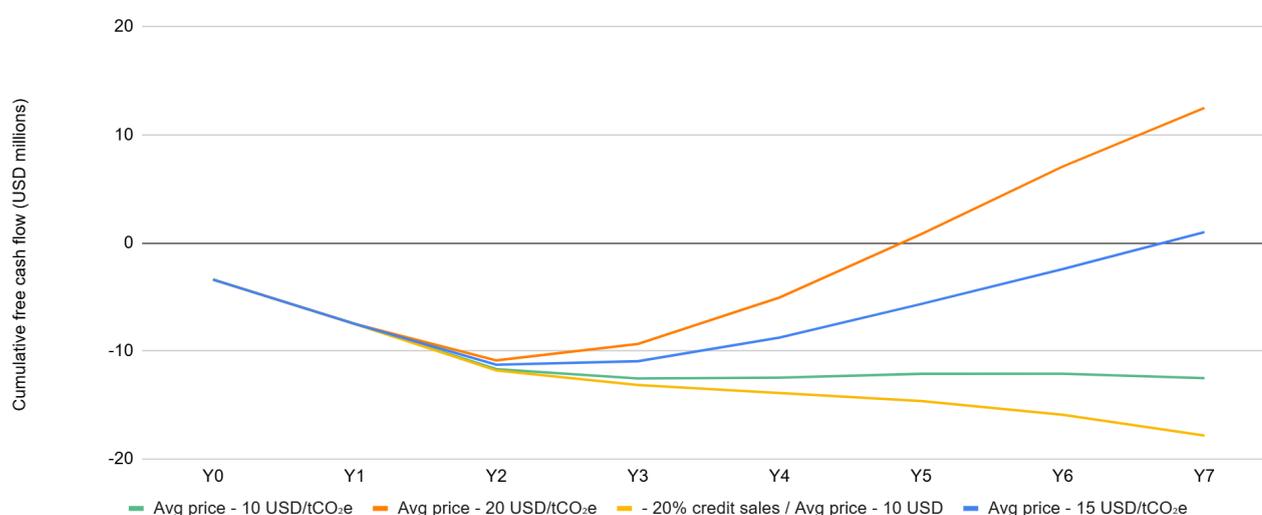


Figure 5. Scenarios of undiscounted cumulative cash flows over the first crediting period, based on data from the project-provided financial model and BeZero Carbon’s assumptions.

The rollout of the microfinance facility should be closely scrutinised. Further financial risk might arise from the project’s microfinance facility. While this is currently not operational, if in the future this becomes a reality and the uptake is high, the project may become exposed to borrower default risk. This is particularly relevant considering the high APR proposed and the income volatility among rural users.

Project proponent’s past experience risk

The project developer’s prior carbon-credit experience and strong partnerships result in low execution risk. Envirofit International Inc. has extensive experience in implementing large-scale clean cooking programmes, having distributed more than one million improved cookstoves across over 40 countries. The company has also demonstrated direct engagement with carbon markets, reporting the issuance and sale of more than one million carbon credits from its cookstove portfolio

as early as 2017. This establishes that Envirofit has prior experience in generating, verifying, and monetising emission reductions from clean-cooking activities. However, the historical credits appear to have been transacted through earlier voluntary-market mechanisms rather than under cooperative approaches like Article 6.2, meaning the Ghana activity represents an evolution in both scale and regulatory complexity.

The project developer teams up with experienced partners. Execution risk is further moderated by Envirofit's partnerships with ACT Commodities, which serves as the managing entity and brings deep carbon-market and compliance expertise, and with the KliK Foundation, a Swiss buyer with established Article 6.2 procurement experience. These partners complement Envirofit's proven technical and distributional capabilities and strengthen commercial delivery capacity. While this activity marks the company's first direct engagement in a government-to-government credit transfer framework, its earlier record of verified carbon-credit generation, combined with robust market partnerships, substantially reduces past-experience risk.

Operational risk

We find moderate operational risk at this stage in the project lifecycle. With distribution underway, but only a small portion of the intended stoves distributed, the remaining activities, such as stove distribution and monitoring, may result in some operational risk. However, although there have been significant distribution delays, the project may still reach its full deployment by the end of the crediting period. Moreover, even if full scale-up was not achieved, we do not see this as a material risk to the project's ongoing operations. In fact, once distribution is complete, even if at a smaller scale than initially planned, ongoing activities will primarily involve monitoring and maintenance, both of which are deemed low-risk in our opinion.

Beyond carbon analysis

Executive summary

The Transformative Cookstove Activity (5004), implemented by ACT Commodities in partnership with Envirofit and local distributors, promotes access to clean cooking in rural Ghana through the distribution of improved cookstoves (ICS). Operating across eight regions—including Western, Ashanti, Bono East, and Upper West—the project seeks to replace traditional wood and charcoal stoves with more efficient models. Carbon revenues are used to subsidise stove prices by up to 60 per cent and to capitalise a micro-loan fund administered through Village Savings and Loan Associations. While this financing mechanism enhances affordability and market reach, it may also introduce repayment and affordability risks for low-income households if credit terms are not carefully managed.

Assessment Conclusion

Overall, our beyond carbon assessment for 5004 finds a risk tier of **2 (moderately low risk)** and a benefits tier of **3 (moderate benefits)**. Its household-based design avoids land conversion and displacement, while supporting measurable improvements in fuel efficiency, air quality, and household welfare. However, due to weak enforcement of labour protections, limited monitoring coverage (≈ 1 per cent), and unverified long-term ecological and health outcomes. Sustained stove adoption and stronger data collection will be key to ensuring the project's enduring impact.

Table 6. Beyond carbon summary for 5004, as of December 2025.

| RISK FACTOR | RISK TIER | BENEFITS TIER |
|-------------------------------------|--------------------------------|------------------------------|
| OVERALL | 2 (moderately low risk) | 3 (moderate benefits) |
| Socioeconomic | Moderately low | Moderate |
| Land & Resource rights | Low | Moderate |
| Labour & Livelihoods | Moderate | Moderate |
| Diversity & Equity | Moderate | Moderate |
| Benefit-sharing | Low | NA |
| Stakeholder Engagement | Moderate | Moderately low |
| Health & Education | Moderately low | Moderately high |
| Environmental | Moderately low | Moderate |
| Ecosystems & Biodiversity | Low | Moderate |
| Natural Resources & Natural Hazards | Low | Moderate |
| Pollution | Moderately low | Moderate |
| Public Sentiment risk | Low | |
| Stakeholder commentary | Low | NA |

| | | |
|----------------|-------|------|
| Media coverage | Low ▾ | NA ▾ |
|----------------|-------|------|

Table 7. Risks safeguards table.

| DRIVER | SAFEGUARDS INCLUDED | SAFEGUARDS EFFECTIVENESS | POTENTIAL MITIGATION |
|---|--|--------------------------|---|
| Socioeconomic risk: Moderately low ▾ | | | |
| Land and resource rights | No use of land | N/A ▾ | Not applicable |
| Labour and livelihoods | Ghana's <i>Labour Act 2003 (Act 651)</i> Microfinance mechanism (Transformative Technology Access Fund) | Partial ▾ | Ensure enforcement of Labour Act through monitoring Increase subsidise according to the location's needs |
| Diversity and equity | Microfinance and VSLAs ACT Commodities' Human Rights Policy | Limited ▾ | Reduce interests rates and increase subsidise |
| Benefit sharing | Not applicable | N/A ▾ | Not applicable |
| Stakeholder engagement | Grievance Mechanism in place | Partial ▾ | More bottom up approach |
| Health and education | None found | Limited ▾ | ISO 19867 or similar to ensure safety of the devices |
| Environmental risk: Moderately low ▾ | | | |
| Ecosystems and biodiversity | Reduced pressure on use of biomass | Substantial ▾ | Not applicable |
| Natural resources and natural hazards | Alignment with national frameworks and reduction on pressure of natural resources | Substantial ▾ | Not applicable |
| Pollution | None found | Limited ▾ | End-of-life, repair and recycling plan for the ICS |

Table 8. Benefits table

| DRIVER | BENEFITS IDENTIFIED | BENEFITS | EVIDENCE QUALITY |
|---|--|-------------------|------------------|
| Socioeconomic benefits: Moderately low ▾ | | | |
| Land and resource rights | Reduced pressure on forests (resources) | Moderate ▾ | Partial ▾ |
| Labour and livelihoods | Job creation, fuel savings, and time for productive work (<i>SDG 1, SDG 7, SDG 8</i>) | Moderate ▾ | Partial ▾ |
| Diversity and equity | Gender equality through reduced unpaid labour & improved participation (<i>SDG 5, SDG 10</i>) | Moderate ▾ | Partial ▾ |
| Benefit sharing | Not applicable | NA ▾ | N/A ▾ |
| Stakeholder engagement | Community participation and grievance mechanisms (<i>SDG 16</i>) | Moderately low ▾ | Limited ▾ |
| Health and education | Reduced smoke exposure, improved well-being, potential educational gains (<i>SDG 3, SDG 4</i>) | Moderately high ▾ | Limited ▾ |
| Environmental benefits: Moderately low ▾ | | | |
| Ecosystems and biodiversity | Reduced deforestation and habitat pressure (<i>SDG 13, SDG 15</i>) | Moderate ▾ | Partial ▾ |
| Natural resources and natural hazards | Improved energy efficiency and sustainable resource use (<i>SDG 12, SDG 13</i>) | Moderate ▾ | Partial ▾ |
| Pollution | Reduced indoor and outdoor air pollutants (<i>SDG 3, SDG 13</i>) | Moderate ▾ | Limited ▾ |

Socioeconomic: Risks = Moderately low ▾ | Benefits = Moderate ▾

The socioeconomic risks of the projects are **Moderately low** ▾. This reflects its non-land-intensive, household-based design and the absence of displacement or direct community disruption. Key risks relate to weak enforcement of Ghana’s Labour Act, limited visibility into wage and safety conditions, potential exclusion from microfinance schemes, and information gaps in stakeholder engagement. However, risks are partially mitigated by the project’s small operational scale, documented grievance mechanisms, and locally managed assembly and distribution structure, which reduce the likelihood of severe social or economic harm.

Socioeconomic benefits are considered **Moderate** ▾. This is supported by plausible gains in livelihoods, health, and gender equality. Verified efficiency data and national clean-cooking research suggest measurable reductions in fuel costs, indoor air pollution, and time burdens—particularly for women. Expected benefits in employment generation and empowerment are credible but remain contingent on project scale-up, consistent stove use, and improved data transparency. Overall confidence is moderate, reflecting strong design alignment with Ghana’s clean-cooking objectives but limited verified outcomes to date.

Land and Resource Rights

Land and resource rights refer to the ownership, access, and use of land and natural resources, as well as any changes to how people live or make use of those areas.

RISKS: Low ▾

The activity does not require land acquisition or restrict community resource access, as it distributes Improved Cookstoves (ICS) directly to households. No evidence of displacement or Indigenous Peoples’ rights infringement. Thus, risks remain low given the project’s non-land-intensive design. In terms of resources, according to the Mitigation Activity Design Document (MADD), the biomass used in the cookstoves comes from the existing wood and charcoal supply that rural households already rely on. The project does not extract biomass but utilises current available biomass used for cooking, therefore risks to resource rights are deemed low as well.

BENEFITS: Moderate ▾

The project is expected to significantly reduce pressure on Ghana’s forests by cutting non-renewable biomass use by at least 55% compared to traditional stoves [OBJ]. This benefit is incremental, addressing households’ reliance on wood (70%) and charcoal (16%)¹⁷, linked to over 60% forest loss since 1950¹⁸. Reduced deforestation supports safeguarding communal lands from degradation, ensuring communities, particularly vulnerable groups like women and low-income households, can continue to rely on local ecosystems for their basic needs without overexploitation.

Benefits are likely to persist as stoves align with local cooking practices, deliver rapid fuel cost savings, and are supported by CRM-linked follow-up and a micro-loan fund for replacements. Monitoring via Kitchen Performance Tests (KPTs) and Article 6.2 verification strengthens confidence that benefits are real and measurable.

Labour and livelihoods

Labour and livelihoods refer to the conditions under which people work and the ways they sustain their income, including how these may be affected by changes in employment or economic activity.

| RISKS: Moderate ▾ | BENEFITS: Moderate ▾ |
|--|--|
| <p>The project expects to generate approximately 285 direct jobs in Ghana through local assembly of improved cookstoves, distribution via agricultural input shops, and sales and marketing activities. Further indirect employment is anticipated through supply chains and Village Savings and Loan Associations (VSLAs). The project provides limited visibility into labour conditions and wage structures for assembly, sales, and distribution workers. It does not outline how Ghana's <i>Labour Act 2003 (Act 651)</i> requirements on fair pay, workplace safety, and non-discrimination are implemented or monitored among implementing partners¹⁹. Weak oversight mechanisms could result in inconsistent application of worker protections.</p> <p>A microfinance mechanism (Transformative Technology Access Fund) is designed to improve stove affordability, but it introduces some financial-exposure risk for low-income households with an interest rate of 130% annually. Even with a 60% subsidy, the remaining stove cost may equal around 25% to 30%²⁰ of a rural household's monthly income, according to BeZero's financial analysis. If repayment terms or interest rates are not managed carefully, some borrowers may face short-term repayment pressure that affects disposable income or household cash flow.</p> <p>Overall, labour and livelihood risks are assessed as moderate, reflecting material uncertainties around fair wages and safe working conditions. Although Ghana's Labour Act 2003 (Act 651) sets out clear employer duties and inspection powers to ensure safe workplaces, evidence suggests enforcement remains weak in Ghana — one analysis noted that the law 'is only enforceable in</p> | <p>The project claims to generate meaningful labour and livelihood benefits in Ghana, contributing to SDG 1 (No Poverty), SDG 7 (Affordable and Clean Energy) and SDG 8 (Decent Work and Economic Growth). These benefits are assessed as feasible but contingent on successful scale-up of stove distribution and continued local assembly and sales operations.</p> <p>Approximately 285 direct jobs are projected through local assembly, distribution, sales, and monitoring, alongside additional indirect opportunities through supply chains and VSLAs. At the time of validation, these positions had not yet been created, though local assembly capacity and institutional partnerships between Envirofit Ghana, ACT Commodities, and the Klik Foundation were in place to enable employment growth as distribution expands. The moderate project-execution risk—linked to slower-than-expected stove roll-out—introduces uncertainty around the timing and scale of job creation.</p> <p>For end-users, improved cookstoves are expected to reduce household fuel expenditures and free time for productive activities, supporting incremental livelihood gains. According to the project design, stove users can save GHS 30–40 per month on fuel, achieving payback within four to six months. These assumptions are consistent with Ghana-based research showing that clean-cooking interventions reduce firewood-gathering time by 35–53 minutes per day,²² enabling reallocation of labour toward income-generating work. However, the extent and durability of these benefits depend on continued stove use and avoidance of</p> |

the formal sector which employs a little over a million out of a workforce of over 10 million.²¹

Limited visibility into employment terms, wage structures, and occupational safety standards raises the potential for inconsistent worker protection or exploitation. In addition, the microfinance mechanism introduces affordability and repayment risks that could strain low-income households' finances if credit terms are poorly managed. Without clear oversight and mitigation measures, these factors could contribute to economic vulnerability or displacement among affected groups.

stove-stacking, and the project has not yet provided verified household expenditure baselines to confirm the GHS 30–40/month figure.

Overall, the likelihood of realising labour and livelihood benefits is moderate, supported by credible implementation structures and plausible evidence on fuel and time savings, but moderated by execution delays, limited verification data, and behavioural risks that may constrain the scale and permanence of these gains.

Diversity and Equity

Diversity and equity refer to the inclusion, representation, and fair treatment of different social groups, including Indigenous Peoples and Local Communities (IPLCs)—are represented, included, and treated, as well as how fairly impacts and opportunities are distributed.

RISKS: Moderate ▾

The project primarily operates across regions of Ghana where most households rely on small-scale farming and biomass fuels. In the Upper West, Sissala, Dagaaba, and Wala communities face high poverty and low literacy, while in Ashanti and Bono East, Akan and Zongo populations engage in more commercial farming and trade.

Although the project targets women and rural households, it is unclear whether marginalised groups—including ethnic minorities, migrants, persons with disabilities, or the poorest households—can participate equitably. Reliance on microfinance and VSLAs may exclude those without credit history or formal membership, particularly in remote areas. While ACT Commodities' Human Rights Policy prohibits discrimination, no demographic monitoring or inclusion mechanism has been disclosed to ensure representation in decision-making.

Engagement seemed to have had limited adaptation for low-literacy or non-Twi-speaking communities, which may reduce accessibility

BENEFITS Moderate ▾

The project aligns with its claimed SDG 5 (Gender Equality) by aiming to reduce women's unpaid domestic work and enable time reallocation toward paid or skill-building activities. It also contributes indirectly to SDG 10 (Reduced Inequalities) by enhancing women's participation in economic life.

Evidence from Ghana's national clean-cooking sector supports the project's SDG claims. The Ghana Country Action Plan for Clean Cooking²³, the Clean Cooking Alliance (2022)²⁴, and the UNDP Ghana Human Development Report²⁵ all link improved cookstoves to reduced time spent on fuel collection, improved health, and increased capacity for income generation. Empirical studies, such as Asante et al. (2018, Energy for Sustainable Development)²⁶, confirm that women's involvement in stove design and decision-making increases adoption and sustained use.

Within this project, potential empowerment benefits remain largely inferred. No

and comprehension of programme terms. As women are the main stove users, they also bear the risk if the technology fails or changes cooking practices in ways that increase workload.

Overall, diversity and equity risks are assessed as moderate, reflecting positive gender intent but persistent uncertainty over equitable access, cultural and linguistic inclusion, and participation of vulnerable groups.

gender-disaggregated, socio-economic, or ethnicity data have been disclosed, and there are no indicators to measure women’s decision-making power, financial control, or representation in project governance. Participation through VSLAs may improve financial access, yet the poorest or unbanked households could remain excluded, as shown by poverty data from the Ghana Statistical Service (Sissala West District Fact Sheet)²⁷ and energy access reviews by Modern Energy Cooking Services (MECS) reviews²⁸.

Overall, diversity and equity benefits have a moderate likelihood of realisation, supported by credible national evidence but constrained by data gaps and limited direct monitoring of empowerment outcomes within the project.

Benefit Sharing

Benefit sharing considers risks concerning sharing project revenues and/or other benefits (e.g., additional non-carbon revenue) with stakeholders impacted or involved in the project.

RISKS: Low ▾

BENEFITS: NA ▾

The Transformative Cookstove Activity in Ghana does not use communities’ land, territories, resources, or activities directly involved in generating credits. Emission reductions arise from household-level stove adoption. Therefore, benefit sharing is not applicable to this project and presents low risk.

Stakeholder Engagement

Stakeholder engagement relates to how stakeholders are identified, informed, and involved in decision-making during both the planning and operational phases of a project.

RISKS: Moderate ▾

BENEFITS: Moderately low ▾

The Ghana ICS project outlines a two-tier engagement process, consulting both institutional stakeholders — including Ghana’s Environmental Protection Agency (EPA) and relevant ministries — and future beneficiaries. Formal consultation with national authorities was completed prior to project approval,

The project’s stakeholder engagement process aims to benefit communities by improving transparency, participation, and access to grievance redress. Consultations, feedback forms, and a multi-level grievance mechanism linking Farmerline, Envirofit, and regulatory bodies are designed to give beneficiaries a voice

substantiated by an EPA approval letter dated April 2022. Beneficiary engagement is planned on a sampling basis through non-technical summaries and feedback forms distributed to participating households. The project embeds an ongoing feedback mechanism and establishes a multi-level grievance system managed by Farmerline and Envirofit Ghana, with escalation routes to Envirofit HQ, KliK, Ghana EPA, and BAFU. This structure demonstrates a clear procedural pathway for issue resolution; however, the absence of reported grievances and limited information on response timeframes or resolution outcomes suggests potential weaknesses in accessibility or user awareness of the system.

While engagement processes are documented, evidence of early, inclusive, and locally adapted consultations remains limited. There is no indication that materials have been translated into local languages or adjusted for low-literacy audiences, nor that marginalised or vulnerable groups were specifically identified or consulted. Moreover, stakeholder influence appears largely consultative rather than participatory, as community input does not appear to inform governance or decision-making structures.

Overall, stakeholder engagement mechanisms are formally established but appear top-down and compliance-driven rather than fully participatory. The grievance procedure and ongoing feedback channels reduce the likelihood of severe conflict; however, the lack of inclusive outreach, limited documentation of beneficiary consultations, and low transparency on grievance outcomes contribute to a moderate stakeholder engagement risk.

and ensure accountability. These structures have the potential to enhance trust, responsiveness, and local awareness of project activities. However, evidence of these benefits being realised is limited—no records of consultations, grievance data, or examples of adaptive management have been provided. While the framework is well defined and could sustain engagement over time, its impact remains largely qualitative and unverified. Overall, community benefits appear plausible but weakly evidenced, with low measurability and moderate durability.

Health and Education

Health and education relate to the potential effects a project may have on people's physical wellbeing and the educational services available to the community.

RISKS: Moderately low ▾

BENEFITS: Moderately high ▾

The project does not introduce significant new health or education risks. However, limited oversight of occupational health and safety during stove assembly, transport, and distribution may present minor worker risks, including burns, strain injuries, or dust inhalation. While Ghana's Labour Act 2003 (Act 651)¹⁹ establishes clear duties for safe working conditions and employer supervision, weak national enforcement mechanisms²¹ and the absence of project-level evidence on implementation create uncertainty over how these protections are upheld for local staff.

For beneficiary households, health risks primarily relate to improper use, poor maintenance, or absence of standardised stove-safety measures, which could increase the likelihood of burns or re-exposure to smoke, particularly for children. The project has not indicated compliance with any ISO cookstove safety standards, and no formal monitoring currently verifies safe operation or sustained indoor-air-quality improvements. Educational risks are negligible, and time savings from reduced fuel collection may support improved school attendance, particularly for girls.

Overall, health and education risks are assessed as moderately low, reflecting limited inherent hazards but information and management gaps around stove maintenance, household safety, and occupational oversight, which constrain confidence in sustained health outcomes.

The project claims to support SDG 3 (Good Health and Well-being), which is to ensure healthy lives and promote well-being for all at all ages. The project's cookstoves are expected to reduce smoke and PM exposure, leading to fewer respiratory illnesses and medical visits.

The MADD reports that Envirofit Super Saver stoves can reduce toxic emissions by up to 82% for firewood models and 56% for charcoal models. These reductions are based on manufacturer laboratory testing rather than Ghana-specific field data. While the project anticipates significant health benefits from cleaner combustion, no baseline air-quality monitoring, health impact assessments, or in-country verification of exposure reductions have been undertaken. Existing monitoring focuses on fuel efficiency (via KPTs) rather than pollutant levels or medical outcomes. The expected benefits align with global evidence on clean-cooking interventions, yet confidence in their magnitude remains moderate until local exposure measurements, independent health studies, and longitudinal stove-use monitoring confirm that these improvements are real and sustained.

The project may indirectly advance SDG 4 (Quality Education) by reducing domestic burdens and freeing up time that could support increased school attendance, particularly for girls. However, these potential education benefits remain unquantified, as the project does not claim or monitor educational outcomes and has not engaged directly with educational institutions.

Environmental: Risk = Moderately low ▾ | Benefits = Moderate ▾

The project has ‘ Moderately low ’ environmental risk. This is driven by its non-land-intensive design, absence of habitat disturbance, and contribution to reducing biomass extraction through efficient cookstove adoption. Activities do not involve land conversion or infrastructure development and are therefore unlikely to introduce pollution, natural-hazard, or ecosystem risks. Verified monitoring supports fuel savings and reductions in toxic emissions, supporting the project’s alignment with Ghana’s strategy. Risks are mitigated by the project’s household-level scope and small-scale, with some of it being locally assembled but constrained by limited data coverage (~1%), absence of ecological or end-of-life monitoring, and uncertainties around stove adoption and durability.

Environmental benefits are assessed as ‘ Moderate ’. This is underpinned by credible fuel-efficiency data and policy consistency, yet confidence remains moderate due to reliance on proxy indicators rather than direct measurement of forest, air-quality, or resource outcomes.

Ecosystems and Biodiversity

Ecosystems and biodiversity refer to the characteristics of native habitats, species, and ecological connectivity within and around the project area.

| RISKS: Low ▾ | BENEFITS: Moderate ▾ |
|--|---|
| <p>The project operates across rural and peri-urban regions, where deforestation is a major environmental concern. Independent national assessments, like the Ghana Forestry Commission’s Modified Forest Reference Level (UNFCCC, 2017)²⁹ and the UNEP Global Forest Database,¹⁸ corroborate the project’s claim that Ghana has lost over 60% of its primary forest cover since 1950, equivalent to about 2.7 million hectares. According to Ghana’s REDD+ data²⁹, conversion to cropland accounts for around 53% of deforestation, while fuelwood and charcoal extraction represent a smaller but still significant share (estimated at under 20%, often aggregated with logging and wood-harvesting activities).</p> <p>Project activities do not occur within protected or high conservation value (HCV) areas, and the project does not cause land-use change, as improved cookstoves are distributed directly to households. The project reduces pressure on forests by lowering demand for non-renewable biomass, aligning with Ghana’s Clean Cooking Action Plan²³, which identifies efficient cookstoves as a key measure to curb wood-fuel</p> | <p>While the project does not claim SDG 15 (Life on Land), which would be the closest SDG related to ecosystems and biodiversity, it does claim SDG 13 (Climate Action) by contributing to greenhouse gas emission reductions through the replacement of non-renewable biomass with cleaner, more efficient cookstoves. By lowering fuelwood and charcoal demand, this climate-mitigation outcome can generate secondary benefits for forest ecosystems and biodiversity.</p> <p>According to the MADD and 2023–2024 Monitoring Report, the project’s fuel efficiency—up to 58% for charcoal stoves—is expected to reduce household reliance on unsustainably harvested wood and charcoal, thereby lowering deforestation and forest-degradation pressures. These anticipated benefits align with national strategies such as the Ghana Clean Cooking Action Plan²³ and REDD+ programmes (e.g., Ghana Cocoa Forest and Shea Landscape Initiatives),³² which identify efficient cookstove dissemination as a complementary pathway for</p> |

dependence. While national and global studies support this mitigation rationale, they also highlight persistent adoption and affordability barriers to realising full biomass-reduction benefits. Field research in Ghana’s Volta Region³⁰ found that “climate-smart” stoves did not consistently lower fuelwood use, showing results depend on design and sustained use. Furthermore, there are many studies³¹ which similarly report that uptake of ICS can be constrained by upfront cost, supply-chain reach, and behavioural preferences. This project partially mitigates these barriers through a 60% consumer subsidy and access to microfinance via the Transformative Technology Access Fund, which expands affordability for low-income households. However, sustained use will determine whether forest-pressure reductions materialise over time.

The project poses no direct habitat or biodiversity risks and, if stove adoption is maintained, could help moderate biomass extraction. Consequently, ecosystems and biodiversity risks are rated low, with moderate confidence given uncertainties around long-term adoption and use patterns.

emission reduction and forest conservation.

While the project quantifies fuel-use and non-renewable biomass reductions, it does not measure avoided deforestation or biodiversity outcomes. Evidence of forest impact is therefore inferred from reduced wood consumption rather than observed through ecological monitoring, consistent with wider literature showing that improved cookstoves can lessen woodfuel demand but rarely demonstrate measurable forest-cover change.

Natural Resources and Natural Hazards

Natural resources and natural hazards relate to how resources—such as water—are accessed and managed, and to the natural events or conditions, including fire, drought, and flooding, that may affect the project area.

RISKS: Low ▾

The Ghana ICS Project operates in regions such as Ashanti, Bono East, and the Upper West, which experience seasonal droughts and intermittent flooding (World Bank, 2024³³, NADMO, 2023³⁴, Omics Online, 2020)³⁵. Project activities are household-based and do not involve land conversion, biomass extraction, or infrastructure development that could exacerbate or increase exposure to such hazards.

By promoting efficient cookstoves, the project

BENEFITS: Moderate ▾

The project claims to support SDG 12 (Responsible Consumption and Production), by reducing household fuel consumption through the adoption of ICS, thereby lowering domestic material use and promoting more efficient resource utilisation. Verified monitoring data from the 2023–2024 Verification Report show that Envirofit models do indeed achieve up to 58 % fuel savings and 56 % thermal efficiency, confirming measurable reductions in biomass demand and energy intensity at the household

aims to reduce unsustainable fuelwood and charcoal consumption, a major driver of forest degradation in Ghana. Verified stove efficiency (up to 58% fuel savings) indicates reduced pressure on local biomass resources, indirectly supporting soil stability and watershed health. The project aligns with national frameworks such as Ghana’s Clean Cooking Action Plan and the REDD+ Strategy (2016–2035), which promote sustainable resource use. Therefore, risks to natural resources and hazards are deemed as low, with moderate confidence, as the reduction is supported and consistent with national data, but not directly verified through project-specific environmental monitoring.

level. These verified outcomes lend moderate likelihood to the project’s claim of fostering more sustainable consumption patterns.

As an unclaimed co-benefit, improved resource efficiency may indirectly support soil and watershed health, since reduced wood extraction can limit erosion and vegetation loss in fuelwood-sourcing areas. Cleaner combustion could also reduce household water contamination from soot and ash residues. These pathways align with Ghana’s Clean Cooking Action Plan and the REDD+ Strategy (2016–2035), which promote efficient energy use as part of sustainable natural-resource management.

However, behavioural variability—particularly stove-stacking and inconsistent adoption—may limit the durability of these benefits. Given that fuel-use data cover only ≈ 1% of users, confidence in the scale of natural resource benefits remains low.

Pollution

Pollution refers to how project activities affect environmental attributes such as air, soil, water, and noise, including where pollution is reduced, remains, or is created, and the associated potential risks and benefits.

RISKS: Moderately low ▾

The Ghana ICS Project aims to distribute 180,000 improved cookstoves across multiple regions, with no land or industrial activities that could generate large-scale emissions or effluents. According to the 2023–2024 Verification Report, Envirofit’s Super Saver Firewood and Charcoal models achieve up to 82% reductions in toxic emissions, indicating substantial air-quality benefits. However, the results are based on a 1% performance sample, which is too small to be representative given regional and behavioural variability; broader sampling would likely reveal greater performance dispersion.

BENEFITS: Moderate ▾

The Ghana ICS Project claims pollution-related benefits through reductions in indoor and outdoor air pollutants. By replacing traditional three-stone fires and inefficient charcoal stoves with Envirofit Super Saver Firewood and Charcoal models, the project aims to decrease exposure to particulate matter (PM_{2.5}) and carbon monoxide (CO) emissions. Laboratory and field testing cited in the MADD and 2023–2024 Verification Report report up to 82% reductions in toxic emissions and 56–58% fuel savings compared with baseline stoves, suggesting meaningful improvements in combustion efficiency and household air quality.

At the production stage, most components are manufactured abroad, while local activities are limited to small-scale, non-industrial assembly, packaging, and distribution, posing minimal pollution or occupational exposure risks. The primary gap concerns end-of-life management: although stoves have a 7-year lifespan and can be repaired locally, there is no formal take-back or recycling plan. Full deployment could eventually generate 1,000–1,800 tonnes of metal waste, increasing over the project’s replacement cycles. While Ghana’s informal scrap-metal sector may recover some parts, unregulated disposal could lead to localised waste accumulation.

Overall, pollution risks are moderately low, supported by verified indoor air-quality gains but limited by small sample representativeness and absence of structured end-of-life management. Confidence is moderate.

potential.

However, these benefits are not measured at scale in Ghana. The KPTs—used to verify fuel efficiency and emission performance—were conducted on a very limited and not representative sample (approximately 1%), and focused primarily on fuel consumption rather than pollutant concentrations. Results therefore, reflect technical potential for pollution reduction, not verified population-level impacts. Additionally, there is no ambient air quality or exposure monitoring to quantify local pollution reductions. Overall, pollution benefits are moderately likely—supported by verified efficiency gains—but empirically weak, relying on small, non-representative samples and manufacturer-based emission data. Confidence in realised air-quality improvements is therefore low to moderate.

Public Sentiment: Risk = Low ▾

The project's 'Low ▾' public sentiment risk results from limited negative commentary and the absence of grievances found as of today.

Stakeholder Commentary

Media coverage refers to coverage by news organisations, either online or in print, and not television or social media.

| RISKS: Low ▾ | BENEFITS: NA ▾ |
|---|-----------------------|
| Stakeholder commentary refers to the risk associated with public support for and/or opposition to the project. In this context, 'stakeholders' include people who may live in or near the project area or may be impacted by project activities (e.g., downstream of water quality impacts). To date, there is no evidence of any negative stakeholder commentary, formal grievances, or protests specifically associated with the project. | |

Media Coverage

Media coverage refers to coverage by news organisations, either online or in print, and not television or social media.

| RISKS: Low ▾ | BENEFITS: NA ▾ |
|--|-----------------------|
| Media coverage refers to coverage by news organisations, either online or in print, and not television or social media. To date, the project has been covered in the media mostly through public-relations features highlighting its launch and investment activities. The only substantive non-PR publication is an article by Alliance Sud, which raises methodological concerns but has not been echoed by mainstream news outlets. Overall, current media coverage remains limited. | |

Negative media coverage

<https://www.alliancesud.ch/en/schweizer-CO2-Kompensation-in-Ghana>

Positive media coverage

[Ghana's cookstoves fuel Africa-first carbon offset deal](#)

References

1. Abokyi, E., Appiah-Konadu, P., Oteng-Abayie, E. F. & Tangato, K. F. Consumption of clean and dirty cooking fuels in Ghanaian households: The role of financial inclusion. *Clean. Responsible Consum.* **13**, 100187 (2024).
2. Bank, T. W. *Analysis of the Woodfuels Sector in Ghana*.
<https://documents1.worldbank.org/curated/en/099200001102313104/pdf/P1759890f23a9900409192073be0b5c18b4.pdf#:~:text=also%20evident%20from%20the%20most,in> (2022).
3. ANNIM, S. K. *GHANA LIVING STANDARDS SURVEY*.
https://www.statsghana.gov.gh/gssmain/fileUpload/pressrelease/GLSS7%20MAIN%20REPORT_FINAL.pdf (2019).
4. Mawusi, S., Shrestha, P., Nukpezah, D. & Kemausuor, F. Clean cooking transition in Ghana: Challenges, opportunities, and strategic pathways for sustainable development. *Energy Sustain. Dev.* **87**, 101727 (2025).
5. Adams, A., Jumpah, E. T. & Dramani, H. S. Dynamics of Clean and Sustainable Households' Energy Technologies in Developing Countries: The Case of Improved Cookstoves in Ghana. *Sustain. Futur.* **5**, 100108 (2023).
6. Adjei-Mantey, K., Takeuchi, K. & Quartey, P. Impact of LPG promotion program in Ghana: The role of distance to refill. *Energy Polic.* **158**, 112578 (2021).
7. Asante, K. P. et al. Ghana's rural liquefied petroleum gas program scale up: A case study. *Energy Sustain. Dev.* **46**, 94-102 (2018).
8. Obeng, G. Y., Mensah, E. & Opoku, R. Fabricators and End-Users of Single-Pot Biomass Stoves: Conceptualizing, Hypothesis and Performance Metrics for Developing Energy Sustainability Framework. *Sustainability* **13**, 7098 (2021).
9. Cookstoves, G. alliance for C. *STUDY AND MAPPING OF CONSUMER FINANCE MODELS FOR CLEAN COOKSTOVES GHANA FINAL REPORT*. <https://cleancooking.org/wp-content/uploads/2021/07/420-1.pdf> (2015).
10. Adjei-Mantey, K., Takeuchi, K. & Quartey, P. Impact of LPG promotion program in Ghana: The role of distance to refill. *Energy Polic.* **158**, 112578 (2021).
11. Lu, W. & Horlu, G. S. A. Economic well-being of rural farm households in Ghana: A perspective of inequality and polarisation. *J. Rural Stud.* **55**, 248-262 (2017).
12. Transparency International. *Corruption Perceptions Index 2024*. (2025).
13. Office, G. C. M. *Ghana's Framework on International Carbon Markets and Non-Market Approaches*.
https://cmo.epa.gov.gh/wp-content/uploads/2022/12/Ghana-Carbon-Market-Framework-For-Public-Release_15122022.pdf (2022).
14. Innovation, M. of E. S. T. and. *Updated Nationally Determined Contribution under the Paris Agreement (2020 - 2030)*.
https://unfccc.int/sites/default/files/NDC/2022-06/Ghana%27s%20Updated%20Nationally%20Determined%20Contribution%20to%20the%20UNFCCC_2021.pdf (2021).
15. Global. *Ghana Country Action Plan for Clean Cooking*.
https://cleancooking.org/wp-content/uploads/2021/07/334-1.pdf?utm_source=chatgpt.com (2021).
16. Ablo, A. D., Osei, L., Jarawura, F. X. & Yaro, J. A. Sacrificing the savannah woodlands for energy and livelihoods? Charcoal production in Ghana. *Energy Sustain. Dev.* **70**, 549-559 (2022).
17. World Bank. *Analysis of the Woodfuels Sector in Ghana: With Options for Demand Reduction, Supply-Side Measures, Fuel Switching and Governance Changes*.
<https://documents1.worldbank.org/curated/en/099200001102313104/pdf/P1759890f23a9900409192073be0b5c18b4.pdf#:~:text=also%20evident%20from%20the%20most,in> (2022).
18. Interactive Country Fiches. Forest. <https://dicf.unepgrid.ch/ghana/forest>.
19. Parliament of the Republic of Ghana. Labour Act, 2003 (ACR 651). Preprint at <https://www.gipc.gov.gh/wp-content/uploads/2023/05/LABOUR-ACT-2003-ACT-651.pdf> (2003).
20. Group, W. B. Ghana. <https://data.worldbank.org/country/ghana>.
21. The Republic of Ghana. National Employment Policy (2012-2016). Preprint at <https://faolex.fao.org/docs/pdf/gha163036.pdf> (2012).
22. Prah, R. K. D. et al. Time Use Implication of Clean Cookstoves in Rural Settings in Ghana: A Time Use Study. *Int. J. Environ. Res. Public Heal.* **18**, 166 (2021).
23. Cookstoves, E. commission of G. and the G. alliance for C. *Ghana Country Action Plan for Clean Cooking*.
<https://cleancooking.org/wp-content/uploads/2021/07/334-1.pdf> (2021).
24. Clean Cooking Alliance. 2022 Annual Report. Preprint at <https://cleancooking.org/wp-content/uploads/2023/03/CCA-2022-Annual-Report.pdf> (2022).
25. United Nations Development Programme (UNDP). The Future Value of Work in Ghana: Pathways to sustainable jobs.

- Preprint at <https://www.undp.org/ghana/publications/2023-ghana-national-human-development-report> (2024).
26. Gugul, G. N., Koksai, M. A. & Ugursal, V. I. Techno-economical analysis of building envelope and renewable energy technology retrofits to single family homes. *Energy Sustain. Dev.* **45**, 159–170 (2018).
27. Statistical Service Ghana. Sissala West District Multidimensional Poverty Fact Sheet. Preprint at <https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/Sissala%20West.pdf>.
28. Bawakyillenuo, S. et al. The landscape of energy for cooking in Ghana: A review. (2021).
29. National REDD+ Secretariat. Ghana's National Forest Reference Level. Preprint at https://redd.unfccc.int/files/ghana__modified_frl_november_10_2017_clean.pdf (2017).
30. Mawusi, S. K. et al. Reduced Indoor Air Pollution but Increased Cooking Time and Fuelwood Consumption of Improved Local Cookstoves in Asuogyaman, Ghana: Implications for Appropriate Stove Design. (2024).
31. Kapfudzaruwa, F., Fay, J. & Hart, T. Improved cookstoves in Africa: Explaining adoption patterns. *Dev. South. Afr.* **34**, 548–563 (2017).
32. Republic of Ghana. Ghana REDD+ Strategy. (2016).
33. Desjonquieres, C., Zhao, H., Kosmidou-Bradley, W. & Corral, P. Ghana's climate vulnerability profile. Preprint at <https://documents1.worldbank.org/curated/en/099060524110782274/pdf/P1798581bdf02b0ff1805e1c1c6a5189eb0.pdf> (2024).
34. National Disaster Management Organisation. Drought disaster profile. <https://nadmo.gov.gh/nadmo/index.php/component/content/article/drought-disaster-profile-ghana?catid=9>.
35. Fagariba, C. J., Adjuik, R. Y. & Mohammed, A. S. Analyzing impact of climate change on sustainable livelihood and water resources in Wa West District, Upper West Region- Ghana. *Journal of Earth Science & Climatic Change* (2023).

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