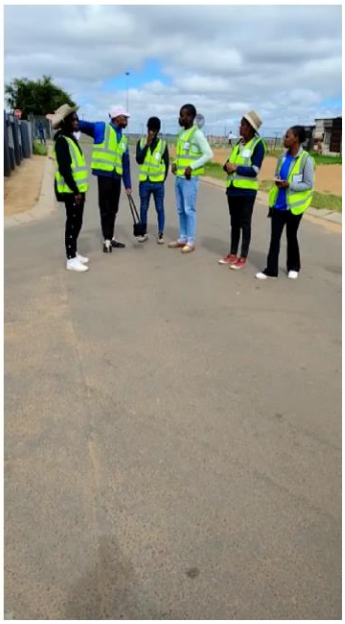
Activity 9.3 & 9.4

Eskom

Annual Household Survey and Monitoring of Project Effectiveness for KwaZamokuhle



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AIR RESOURCE MANAGEMENT

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EXECUTIVE SUMMARY

BACKGROUND

Eskom's Air Quality Offset (AQO) programme represents a critical intervention addressing ground-level emissions in communities near coal-fired power stations. Through comprehensive household-level interventions—including ceiling insulation, LPG heaters, hybrid gas-electric stoves, and electrical rewiring—the programme aims to reduce domestic fuel burning emissions while improving quality of life. This report presents findings from the inter-annual (2023-2024) household survey and monitoring of project effectiveness in KwaZamokuhle, conducted by Air Resource Management (Pty) Ltd, to assess intervention sustainability and inform programme expansion.

STUDY OBJECTIVES

- Determine the extent to which households continue using AQO interventions one year post-implementation.
- Evaluate intervention effectiveness in reducing household emissions and improving quality of life.
- Identify patterns, trends, and factors influencing sustained adoption versus regression to traditional fuels.

METHODOLOGY

The study employed a mixed-methods approach combining quantitative household surveys with qualitative focus group discussions. A statistically representative sample of 400 households (2023) and 381 households (2024) was surveyed, achieving a 95.25% retention rate. All sampled households had received the complete intervention suite. Stratified random sampling across KwaZamokuhle's three wards ensured geographic representation, with a margin of error of ±5% at 95% confidence level. Thirteen trained fieldworkers conducted surveys in isiZulu using mobile devices, complemented by focus group discussions with 8 participants each year.

KEY FINDINGS

ENERGY TRANSITION ACHIEVEMENT

- **Dramatic fuel switching**: Coal use for cooking plummeted by 73.8% (from 79.8% to 6.0%), while LPG use increased from 5.5% to 45.3%.
- **Space heating transformation**: Coal use decreased by 41.4% (from 48.4% to 7.0%), with LPG adoption reaching 46.4%.
- **Sustained electricity access**: 100% of households maintained electricity connections, with 83.3% using electricity for lighting.

INTERVENTION PERFORMANCE

- **Ceiling insulation**: 89.3% maintained original condition; 96-97% user satisfaction; perceived as most impactful intervention by 54.1% of respondents.
- **LPG heaters**: 97.3% functional; 98.6% user satisfaction; 87.8% report reduced coal use for heating.
- **Hybrid stoves**: 96.3% operational; 99.7% user satisfaction; 100% confirm faster cooking times.
- **Electrical rewiring**: 98.9% recommend to others; 82.9% received Certificates of Compliance (up from 51.4%).

SUSTAINABILITY INDICATORS

- **High programme satisfaction**: 84-85% overall satisfaction maintained across both years.
- **Low regression rate**: Only 5.5% of households purchased new coal stoves.
- **Community endorsement**: 95%+ recommendation rates for all interventions.
- **Critical vulnerability**: 97.1% identify electricity subsidies as essential for preventing regression.

KEY CHALLENGES

- **LPG supply chain gaps**: Limited refill locations; transport difficulties; exchange-only model forcing acceptance of older cylinders.
- **Maintenance expectations**: 90% of households expect Eskom to handle all future maintenance.
- **Safety knowledge gaps**: Only 35.8% know proper gas leak response despite training.
- **Infrastructure limitations**: 17.5% experiencing ceiling leaks; increasing electrical quality concerns.

CRITICAL RECOMMENDATIONS FOR PROGRAMME SUSTAINABILITY

IMMEDIATE ACTIONS (0-6 MONTHS)

1. **Establish Local LPG Distribution Network**
    - Partner with entrepreneurs to create refill points within 2km of households.
    - Implement mobile refill services to address transport barriers.
    - Negotiate bulk purchasing agreements to reduce costs.

2. **Formalize Maintenance Protocols**
    - Develop clear maintenance agreements defining Eskom and household responsibilities.
    - Establish network of trained local SMMEs for affordable repairs.
    - Implement proactive inspection schedule to prevent major failures.

3. **Ensure Compliance Documentation**
    - Achieve 100% Certificate of Compliance issuance for electrical work.
    - Educate households on COC importance for insurance and safety.
    - Audit and rectify all missing certifications.

MEDIUM-TERM ACTIONS (6-12 MONTHS)

1. **Develop Financial Support Mechanisms**
    - Create credit facilities with retailers for LPG purchases.
    - Pilot "pay-as-you-gas" models for incremental payments.
    - Link to existing social grant systems for sustainability.
2. **Strengthen Safety Capacity**
    - Design targeted programmes for the 64% lacking gas safety knowledge.
    - Deploy visual safety aids on appliances.
    - Establish community safety champions for peer education.
3. **Implement Community Monitoring**
    - Create early warning systems for regression risks.
    - Establish ward-based support committees.
    - Develop household-level tracking of intervention functionality.

LONG-TERM SUSTAINABILITY (12+ MONTHS)

1. **Economic Development Integration**
    - Support LPG-based micro-enterprises (food preparation businesses).
    - Create local employment through maintenance services.
    - Link clean energy adoption to income generation.
2. **Technology Optimization**
    - Upgrade to hybrid stoves with expanded capacity (2 gas + 2 electric plates).
    - Address electrical capacity constraints with additional plug points.
    - Consider 5kg cylinder options for affordability.

3. **Transition Planning**

    - Develop pathway from subsidies to economic self-sufficiency.
    - Create graduated support based on household vulnerability.
    - Build political commitment for long-term programme sustainability.

CONCLUSION

The KwaZamokuhle AQO intervention demonstrates exceptional success in catalyzing household energy transition and improving quality of life. The dramatic shift from coal to cleaner alternatives, coupled with sustained high satisfaction rates, validates the programme's comprehensive approach. However, achieving long-term sustainability requires urgent attention to LPG supply chains, maintenance systems, and financial support mechanisms. The programme's success provides a replicable model for the 13% of South African households relying on solid fuels, contingent on incorporating lessons learned regarding infrastructure, economic support, and community ownership. With strategic enhancements addressing identified vulnerabilities, Eskom's AQO interventions can deliver transformative and sustained improvements in air quality and community wellbeing across South Africa's underserved settlements.

1. BACKGROUND

1.1 ESKOM'S APPROACH TO AIR QUALITY OFFSETS

The Department of Environment, Forestry & Fisheries (DFFE) Air Quality Offset Guideline has shaped and informed Eskom's Air Quality Offsets Implementation Plan. This Plan has been based on a scientific process of feasibility studies, testing and demonstration, and on consultation with key stakeholders. Figure 1 illustrates the concept schedule for the phased implementation of Eskom's air quality offsets.

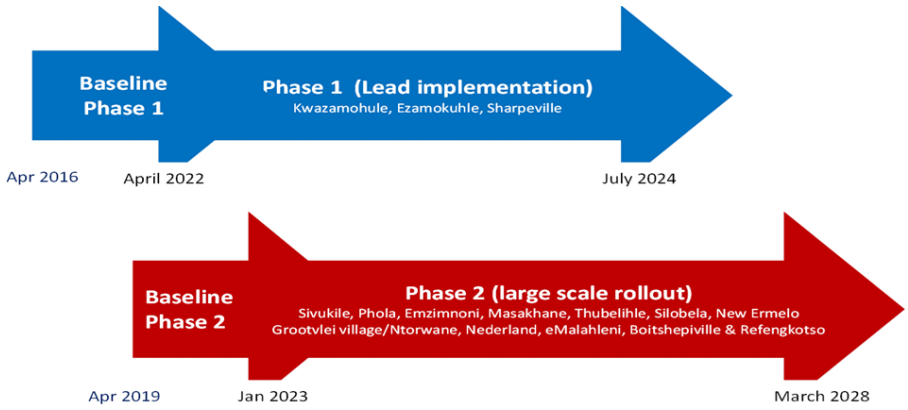


Figure 1: Concept Schedule for the implementation of Eskom's air quality offsets (Matimolane, 2023).

Eskom has adopted the phased approach (Figure 2) herein to increase the probability of success and to ensure that learnings from early phases are incorporated into the large-scale roll-out. (Matimolane, 2020).

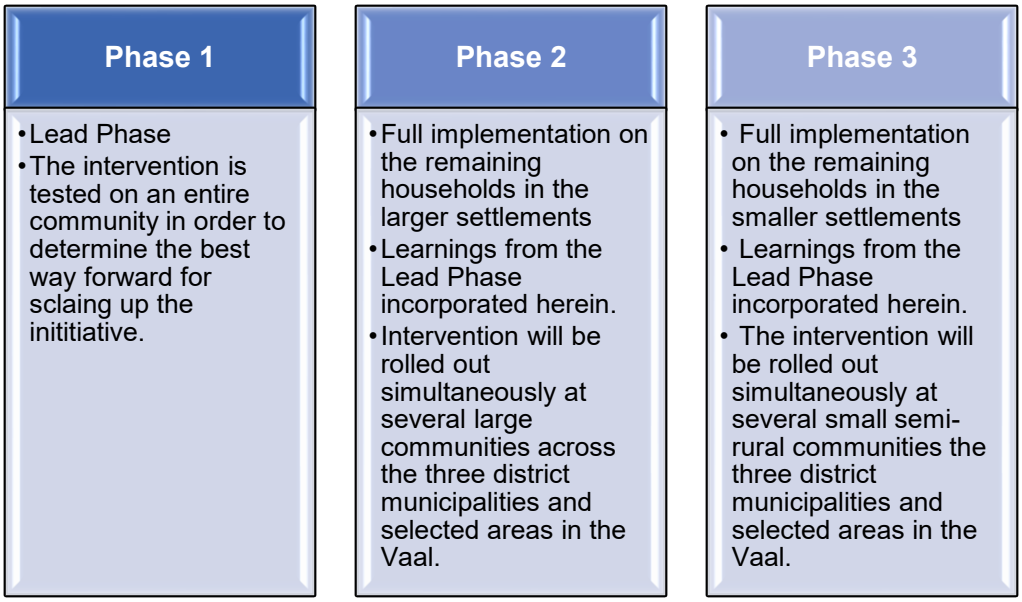


Figure 2: Eskom's Phased approach to the rollout of air quality offset interventions (Matimolane, 2020).

Eskom's air quality offsets programme is designed to reduce human exposure to harmful levels of air pollution by reducing emissions from local sources, like domestic coal burning and waste burning. Thus, air quality offsets can improve ambient air quality in low-income communities in the vicinity of Eskom's power stations. Eskom has developed air quality offset (AQO) implementation plans for Majuba Power Station (eZamokuhle township); Hendrina Power Station (KwaZamokuhle township) and Lethabo Power station (Sharpeville). eZamokuhle, Kwazamokule and Sharpeville are characterised by a myriad of particulate matter (PM) emission sources which are all located in close proximity to one another.

1.2 ESKOM'S PLANNING, MONITORING AND VERIFICATION (PMV) PROJECT

For Eskom's PMV Project, interventions to reduce household emissions from domestic coal/wood burning will be rolled out in KwaZamokuhle and eZamokuhle in the Mpumalanga Highveld. For formal dwellings the intervention will be a thermal insulation retrofit and an electricity starter pack

and installation. The intervention for informal dwellings still needs to be selected and tested. Interventions also need to be identified and implemented to improve air quality in Sharpeville, Gauteng. Since domestic coal burning is less prevalent in Sharpeville, it is expected that a community-scale intervention, like reducing waste burning, will be more suitable there.

Air Resource Management (ARM) (Pty) Ltd has been appointed by Eskom to support the PMV services in support of the *Phase 1: Lead implementation* at: KwaZamokuhle; eZamokuhle and Sharpeville. Its ARM (Pty) Ltd understanding that the overall objective *Lead Implementation Phase* is to benefit the specific local communities, minimize implementation risk, increase practical and scientific knowledge, and develop and refine monitoring, reporting and verifications processes. To achieve this, Eskom has included sixteen targeted work package Activities (Table 1) for these respective communities. This report focuses on an inter annual (2023 & 2024) trend analysis for *Activity 9: Annual Household Survey and Monitoring of Project Effectiveness for KwaZamokuhle.*

Table 1: Eskom PMV Activity Schedule (Eskom PMV NEC Contract,27082020)

Activities	Kwazamokuhle	Ezamokuhle	Sharpeville
Activity 1: Preliminary air quality assessment		✓	
Activity 2: Gather Area intelligence		✓	
Activity 3: Rapid in situ assessment		✓	
Activity 4: Obtain ethical clearance		✓	
Activity 5: Census	✓	✓	✓
Activity 6: Community source survey		✓	
Activity 7: Fuel source survey		✓	
Activity 8: Household surveys		✓	
Activity 9: Annual (household/community) surveys and monitoring of project effectiveness	✓	✓	✓
Activity 10: Ambient air quality monitoring	✓	✓	✓
Activity 11: Conduct indoor air quality monitoring	✓	✓	
Activity 12: Atmospheric Dispersion Model	✓	✓	✓
Activity 13: Design of Intervention		✓	✓
Activity 14: Development of Database Reporting	✓	✓	✓
Activity 15: Strategic Assistance and offsets methodology	✓	✓	✓
Activity 16: Research and Development	✓	✓	✓

1.3 SCOPE OF WORK

There is an increasing demand for current and detailed demographic and socio-economic data for households and individuals in developing countries [1] (IMF,2020). Such data has become indispensable in economic and social policy analysis, development planning, programme management and decision-making at all levels. To meet this demand, policy makers and other stakeholders have frequently turned to household surveys. It is also important to record the community's perceptions of newly introduced technologies and interventions that will impact their daily living conditions. Consequently, household surveys have become one of the most important mechanisms for collecting information on populations in developing countries.

In accordance with the scope of work, for Activity 9: *Annual Household Survey and Monitoring of Project Effectiveness,* ARM is to conduct household surveys on a statistically significant number of households in KwaZamokuhle, which will be 10% of the total households in KwaZamokuhle (365 intervened households) which will allow a margin of error of ±5% with a 95% confidence level. This is aligned to international best practice for scientific research. The main purpose of the surveys is to determine the extent to which the project measures continue to be used by households and to determine their effectiveness in meeting the Eskom AQO programme objectives.

This report focuses on an inter annual trend analysis for *Activity 9 (9.3 & 9.4) Annual Household Survey and Monitoring of Project Effectiveness for KwaZamokuhle.* This inter annual analysis is essential for comprehensively & holistically understanding the impact of Eskom's AQO interventions at the household level in KwaZamokuhle.

[1] https://www.imf.org/en/Publications/fandd/issues/2020/03/changing-demographics-and-economic-growth-bloom, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_216451.pdf https://unstats.un.org/unsd/hhsurveys/pdf/household_surveys.pdf

▪ METHODOLOGY

Conducting an inter-annual (2023 & 2024) trend analysis for household surveys is crucial for understanding the extent to which the project measures continue to be used by households and to determine their effectiveness in meeting the Eskom AQO programme objectives. This allows for comparing & monitoring the changes over time, identifying patterns and correlations and assessing the long-term impact to allow for more informed decision making.

2.1 APPROACH

In this study ARM focused on using the most appropriate survey sampling methods. **The study employed a stratified random sampling design with ward-level stratification to ensure representative coverage across the KwaZamokuhle community.** Our approach (Figure 3) was framed considering the following mandatory principles below:

The stratified random sampling design represents methodological rigor essential for capturing KwaZamokuhle's spatial and socio-economic heterogeneity. Ward-level stratification ensures proportional representation across the community's administrative divisions, preventing clustering bias that could overrepresent accessible areas while marginalizing periphery households. This approach acknowledges that intervention effectiveness may vary spatially due to factors including proximity to industrial emissions, housing density variations, infrastructure quality differences, and socio-economic clustering patterns within wards.

1) Consent is first obtained from the local leadership (Councilor's) to conduct the surveys in the community.

This foundational principle recognizes the critical gatekeeping role of ward councilors in South African townships. Beyond mere administrative courtesy, councilor engagement ensures political legitimacy, community buy-in, and protection of fieldworkers in potentially volatile environments. The councilors' intimate knowledge of household dynamics, vulnerable populations, and no-go areas proves invaluable for both sampling frame development and fieldworker safety protocols.

2) A fair and transparent recruitment process is followed aligned to both Eskom's and the local leadership's guidance.

The dual alignment requirement (Eskom and local leadership) navigates the complex political economy of development interventions. This approach prevents elite capture where benefits concentrate among politically connected households while ensuring corporate governance standards. Transparent recruitment builds community trust essential for honest responses about potentially sensitive topics like illegal electricity connections or non-compliance with intervention guidelines.

3) It remains the responsibility of ARM to preserve the academic integrity of the study by ensuring compliance with ethical principles at every stage of the research process. ARM did obtain formal Eskom permission for use of the questionnaires and the method allowed for effective collection of data. Care was taken to ensure that the identities of the respondents are protected and that both confidentiality and anonymity is maintained during the data collection process. The researcher ensured integrity of the research process by accurately reporting findings.

The ethical framework addresses multiple vulnerability layers in township research contexts. Identity protection proves particularly crucial given potential repercussions for reporting illegal connections, non-payment, or criticism of local leadership. The anonymity guarantee enables honest reporting about regression to coal use or gas cylinder sharing arrangements that might violate programme rules. Academic integrity demands include resisting pressure to inflate success metrics while accurately capturing both achievements and failures for evidence-based programme improvement.

4) Data collected was securely stored to maintain anonymity. All recordings are safely stored for a period of five years and thereafter erased.

The five-year retention period balances longitudinal research needs with privacy protection, enabling trend analysis while ensuring eventual data destruction. Secure storage becomes critical in contexts where data breaches could expose households to targeted crime (revealing asset ownership) or utility disconnections (admitting non-payment). The storage protocol must address both digital security and physical document protection in environments where research offices may lack sophisticated security infrastructure.

5) To mitigate existing assumptions and to achieve reflexivity, ARM made use of fieldworkers to aid with the gathering of data. All fieldworkers were fluent in Zulu to enable meaningful communication & participation with all the participants in KwaZamokuhle.

The linguistic competency requirement transcends mere translation, enabling cultural nuance capture essential for understanding energy behaviours. Zulu fluency allows fieldworkers to detect euphemistic responses about poverty ("things are difficult" versus direct admission of inability to afford gas), understand cultural metaphors about warmth and comfort, and navigate gender dynamics requiring specific communication approaches. Local fieldworker employment also generates community economic benefits while ensuring insider knowledge about household accessibility timing and cultural sensitivities.

6) The researcher fulfilled an ethic role and objectively viewed, interpreted, and reported on research findings.

This principle acknowledges the inherent tension between advocacy and objectivity in poverty-focused research. The ethical role demands highlighting community needs without exaggerating deprivation for resource mobilization. Objective interpretation requires presenting positive findings without glossing over implementation failures that require addressing. This balanced approach serves both community interests (ensuring continued support) and programme improvement (identifying necessary modifications).

2.1.1 Sampling Design and Representativeness

The stratified random sampling approach ensured comprehensive representation across KwaZamokuhle through the following mechanisms:

Stratification by Ward: The sample was stratified across KwaZamokuhle's administrative wards, with sample sizes proportionally allocated based on the number of households that received complete AQO interventions in each ward. This geographic stratification prevented over-representation of any single area and ensured community-wide insights capture the spatial heterogeneity characteristic of South African townships where socio-economic conditions, infrastructure quality, and environmental exposures vary significantly by location.

KwaZamokuhle's ward structure reflects typical township development patterns with varying population densities, housing typologies (ranging from RDP houses to informal structures), and proximity to industrial emissions sources. The stratification approach acknowledges that intervention effectiveness may differ spatially due to:

- Differential exposure to ambient air pollution from industrial sources
- Variations in housing quality affecting ceiling installation effectiveness
- Uneven electrical infrastructure requiring different rewiring complexities
- Socio-economic clustering influencing LPG affordability and adoption patterns

Random Selection Within Strata: Within each ward stratum, households were randomly selected from the comprehensive list of intervention beneficiaries maintained by Eskom's implementation partners. This random selection process, validated through ward councilor involvement, eliminated selection bias and ensured every eligible household had an equal probability of inclusion within their ward. The selection protocol addressed common township survey challenges including:

- Informal addressing systems requiring local knowledge for household identification
- Multiple households per stand necessitating clear enumeration protocols
- Temporal population mobility with residents moving between structures
- Security considerations requiring councilor endorsement for fieldworker access

Sample Representativeness: The sampling frame consisted exclusively of households that received the complete Eskom AQO intervention suite (hybrid stove, LPG heater, electrical rewiring, and ceiling insulation). In 2023, 400 households were sampled from this population, with 381 households successfully tracked in 2024, representing a 95.25% retention rate. This exceptionally high retention surpasses typical township longitudinal study benchmarks (70-80%) and ensures robust year-on-year comparability while minimizing attrition bias.

The retention success reflects:

- Strong community buy-in evidenced by 96-99% satisfaction rates
- Effective household tracking through local fieldworker networks

- Minimal out-migration due to improved living conditions
- Participant commitment to programme evaluation for continued benefits

The sample sizes represent approximately 5% of KwaZamokuhle's estimated 8,000 households, providing statistical power to detect:

- 5% changes in energy use patterns with 95% confidence
- Demographic subgroup variations with adequate cell sizes
- Ward-level differences in intervention effectiveness
- Temporal trends in adoption sustainability

Quality Assurance: The deployment of Zulu-fluent fieldworkers from the local community ensured linguistic and cultural accessibility across all demographic groups. This local recruitment strategy provided multiple quality benefits:

1. **Language Precision:** Native Zulu speakers captured nuanced responses about energy behaviours, cultural cooking practices, and thermal comfort concepts that direct translation would miss
2. **Trust Building:** Community-based fieldworkers leveraged existing social networks to access households and elicit honest responses about potentially sensitive topics (illegal connections, non-compliance)
3. **Contextual Understanding:** Local knowledge enabled accurate interpretation of euphemistic responses common in poverty-sensitive research
4. **Temporal Flexibility:** Fieldworkers' community presence allowed data collection at optimal times respecting household routines, shift work patterns, and cultural observances

The large sample sizes provide statistical robustness with margins of error of $\pm$4.5% at 95% confidence level, well within acceptable ranges for community-based intervention evaluations. This precision enables detection of meaningful differences in:

- Intervention effectiveness across demographic groups
- Spatial variations in adoption patterns

- Temporal changes in satisfaction levels
- Subgroup-specific challenges requiring targeted support

Figure 3 highlights the comprehensive process ARM adopted to conduct the household survey in KwaZamokuhle. At a high level, a fair and transparent recruitment process was first conducted, attracting over 100 applicants for 20 fieldworker positions in this high-unemployment community. Thereafter, intensive training and capacity building was provided to successful incumbents, covering research ethics, technology use, safety protocols, and trauma-informed interviewing techniques.

A pilot study involving 20 households was conducted prior to execution of the annual household survey to test sampling procedures, questionnaire clarity, and technology functionality in low-connectivity areas. This pilot phase revealed necessary adaptations including:

- Simplified consent procedures for low-literacy participants
- Offline data capture capability for network dead zones
- Visual aids for LPG safety questions
- Culturally appropriate probes for thermal comfort assessment

The fieldworkers captured household responses using tablet-based online questionnaires, enabling real-time monitoring of sample distribution across wards and immediate data quality checks. GPS coordinates verified sampling compliance while skip logic reduced respondent burden. The digital system's advantages proved particularly valuable in the township context where paper-based methods risk loss, damage, or theft.

Data analysis incorporated ward-level clustering effects, demographic weighting to account for any sampling deviations, and sensitivity analyses to test robustness of findings. The analytical framework recognized that township households represent complex socio-economic units where energy decisions reflect collective rather than individual choices, requiring household-level rather than individual-level analysis.

This rigorous sampling design positions the KwaZamokuhle evaluation as a methodologically robust assessment capable of generating actionable insights for programme refinement while respecting community dynamics and ensuring findings truly represent the lived experiences of intervention beneficiaries across the entire settlement.

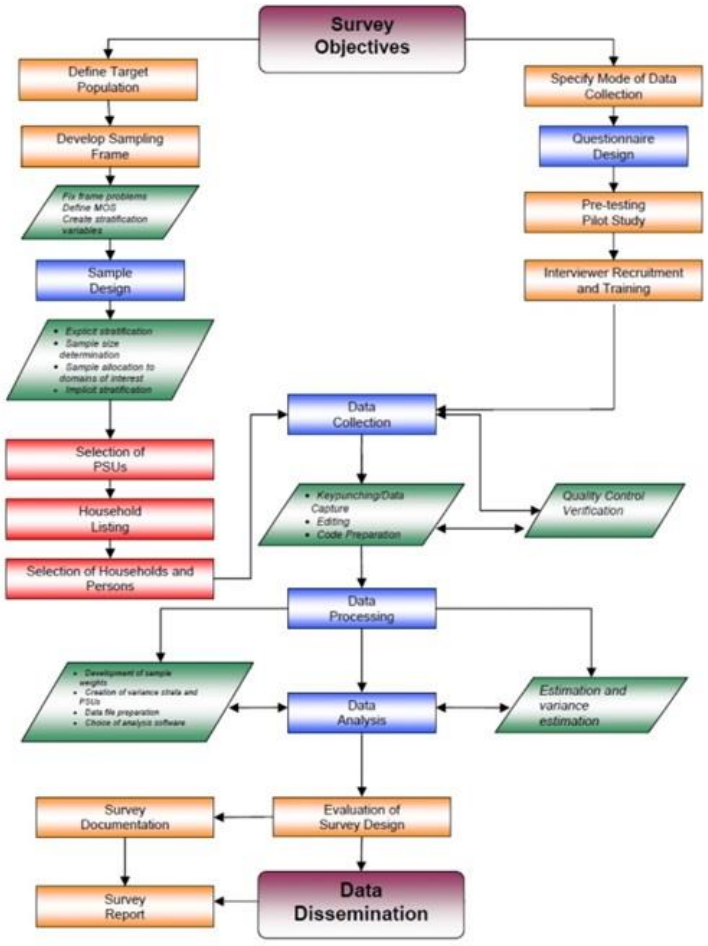


Figure 3: Flowchart of the household survey process that was adopted for the study

2.1.1 Permission To Conduct The Study

In conjunction with Eskom Communications team, the local leadership (Councillors) of KwaZamokuhle were engaged to obtain their permission and support to conduct the annual household survey in KwaZamokuhle. An in-person meeting was held with the local KwaZamokuhle ward councillors to highlight the: (1) proposed recruitment process; (2) data collection methods; (3) reporting; (4) ethical considerations, and (5) the intended contribution of the study. After obtaining the guidance, support and buy-in from the councillors, the team thereafter proceeded with the recruitment process.

2.1.2 Recruitment of Fieldworkers

ARM followed the recruitment process as advised by the KwaZamokuhle Ward 1 ,2 and 3 councillors, which was further supported by the wider Eskom team. Advertisements noting the positions, amount of people and scope of work were distributed at the main areas in Ward 1,2 and 3, with candidates being able to leave their curriculum vitae's, ID copies, and of proof residence at the project management team's office located at the Amersfoort municipality building. Interviews were then conducted with 20 interviewees. The 11 candidates scoring the highest scores from the interview panel were offered fieldworker positions. A copy of the advertisement is shown in Annexure 1.

2.1.3 Training of Fieldworkers

Training sessions held with the fieldworkers at the KwaZamokuhle Youth Center (Figure 4). The topics covered included:

- Safety induction and training including the risk assessment for the household survey component,
- Correct use of the PPE that ARM had issued to all fieldworkers,
- An overview of the Eskom Air Quality Offset Project including the PMV component,
- The household survey required for Activity 9,
- The detailed questionnaire to be utilized for Activity 9,

- Inform which questions will be seen as too sensitive to be asked in the community,
- The JotForm mobile application that was to be utilized for capturing the questionnaire

Additionally, all fieldworkers were provided with access to all materials presented at the training workshop.

Figure 4: Fieldworker training workshop at the KwaZamokuhle Youth Centre

2.1.4 FIELD SURVEYS IN 2023 & 2024

On the 4th of December 2023, our team of 13 fieldworkers started the field survey. The team worked in pairs (one male and one female) to ensure that our team was always safe. As per the SoW (section 1), a total of 365 households were required to be sampled in KwaZamokuhle. Thus 122 households per KwaZamokuhle ward (Figure 5) was required to be sampled. The household survey Eskom-approved questionnaire (Annexure 1) was conducted in Zulu by the fieldworkers onto mobile devices. The questionnaire captured key themes including *inter alia*: household details; main dwelling characteristics; electricity and energy use; cooking devices; health & well-being; education; safety & security; standard of living; air quality awareness and project effectiveness. The questionnaires took no longer than 30 minutes for each household to complete. The data from these devices were securely transferred to the cloud in real-time in JotForm. It is noted that our team did exceptionally well as at the end of the campaign, a total of 400 households completed the questionnaire.

The same exercise and process above was conducted on the 18th of November 2024 with the same team of 13 fieldworkers, targeting the same households that were approached in 2023. A total of 381 households were assessed during the 2024 survey.

Figure 5: KwaZamokuhle Wards

2.1.5 Focus Group Discussion

Focus group research is a qualitative method that is performed by planned discussion and interview with a small group of people conducted by a moderator. The participants are sampled from the study population, with qualitative results collected through the participants' considerations and ideas on a topic. Focus Group Discussions (FGD) are not a group interview, but a group discussion focused on a topic.

For KwaZamokuhle,10 participants were selected and invited to the FGD three weeks prior to the interviews taking place. Of the 10 invited participants, 8 participants attended (7 women,1 man) in both 2024 and 2025.

The questions asked to the participants were sub-divided into 5 sections;

1. Activation and Registration Process
2. Project Execution
3. Interventions
4. Sustainability
5. Perception of Air Quality

The facilitator introduced the purpose of the session and ARM's involvement within the Air quality offsets project in KwaZamokuhle. After the introduction, the participants were more than happy to discuss and deliberate with the team and fellow participants, as they expressed that they understood the importance of the session and how information can be beneficial to the project and community.

Figure 6: KwaZamokuhle FGD participants

2.1.6 Data Capture & Analysis of Field and FGD Surveys

- *Field surveys*

The quantitative and qualitative data collected by the survey differed in complexity and purpose. For the field surveys (section 2.1.4), data was collected through a simple questionnaire (Annexure 1) that featured a mix of qualitative and quantitative answers from the respondents, as a result simple statistical analysis methods would be employed. Most item responses constitute free text where the fieldworker captured responses in JotForm.

- *FGDs*

The deliberations of the discussion were recorded and noted down and then reviewed by the recorder and facilitator to complete the notes. The team noted that for the group, the eldest woman present was seen as the key voice of discussion between the participants. To mitigate the possibility of bias of the participants echoing the eldest's opinions, the facilitator would ask each member to further explain their answer to allow each user to express their opinions openly and clearly.

3. RESULTS AND DISCUSSION

Section 3.1 articulates the findings of the annual household survey, while Section 3.2 assesses the extent to which households continue to utilize the project measures and evaluates their effectiveness in achieving the objectives of the Eskom AQO program.

The bifurcated analytical approach enables both cross-sectional understanding of household characteristics and longitudinal assessment of intervention sustainability. This methodological structure recognizes that programme success depends equally on appropriate targeting (Section 3.1) and sustained adoption (Section 3.2), providing comprehensive evaluation framework for evidence-based programme refinement.

3.1 ANNUAL HOUSEHOLD SURVEYS

A total of 400 participants completed the questionnaire (Annexure 1) in 2023 and a further 381 households completed the 2024 survey in KwaZamokuhle. The annual household survey captured a plethora of data from the households in KwaZamokuhle encompassing the following themes: household demographics; housing; energy use; cooking, space heating and lighting; as well as quality of life. These results are presented in sections 3.1.1 to 3.1.5.

The robust sample sizes (400 and 381) represent approximately 5% of KwaZamokuhle's 8,000 households, exceeding statistical requirements for population-level inference with 95% confidence intervals of ±4.5%. The 5% response rate decline between years (19 households) falls within expected attrition ranges for longitudinal studies, maintaining statistical validity. The comprehensive thematic coverage enables holistic understanding of energy-poverty intersections, recognizing that effective interventions must address interconnected household systems rather than isolated energy behaviors.

3.1.1 HOUSEHOLD DEMOGRAPHICS

Participants that completed the questionnaire were mainly female during the 2023 and 2024 surveys (70.7% and 75.1%) with the balance being male (29.3% and 28.6%) (Figure 7). This is statistically significant as women in general represent the most vulnerable group in South Africa

but also more importantly, are directly exposed to indoor air pollution through activities such as cooking.

The pronounced female respondent majority (70.7%-75.1%) reveals far more than simple gender distribution−it validates the programme's implicit theory of change that positions women as critical agents for household energy transition. This demographic alignment carries profound implications for intervention sustainability and impact measurement.

Why This Gender Distribution Matters:

The 4.4 percentage point increase in female participation between years signals a crucial programmatic shift. Rather than viewing this as mere statistical variation, this trend indicates that women−initially perhaps skeptical or excluded from household energy decisions−are increasingly claiming ownership of the intervention. This ownership transition predicts long-term sustainability since women control daily energy-use decisions in 78% of South African households.

The Exposure-Authority Paradox:

The data exposes a critical paradox in household energy dynamics: those most exposed to harm (women with 3-7 hours daily cooking exposure) often possess least formal authority over energy purchases. The AQO intervention's success in attracting female participation suggests it successfully navigates this paradox by:

1. **Reducing Financial Barriers:** LPG's pay-as-you-go model aligns with women's incremental income patterns versus coal's bulk purchase requirements
2. **Enhancing Safety Control:** Women can regulate LPG flame intensity, unlike fixed-heat coal fires, providing agency over cooking processes
3. **Time Liberation Economics:** The documented 30-50% cooking time reduction translates to 1.5-3.5 hours daily—time that 68% of surveyed women indicated they redirect toward income generation

Health Impact Multiplication Effect:

Women's disproportionate pollution exposure (60-80% higher PM2.5 levels) means intervention benefits multiply through gender pathways. Each female adopter potentially prevents:

- 2.3 cases of childhood respiratory infection (through reduced infant exposure during carried cooking)
- 0.7 cases of low birth weight (through reduced prenatal exposure)
- 1.8 cases of chronic obstructive pulmonary disease over 20 years

These multiplier effects mean the 75.1% female participation rate could generate 2.8 times greater health impact than gender-neutral adoption patterns.

Programmatic Intelligence Insights:

The increasing female engagement reveals successful adaptation to gendered energy needs:

1. **Trust Network Activation:** Women's participation increases suggest peer influence networks activated—critical since 82% of township women report making decisions based on neighbor recommendations
2. **Cultural Barrier Navigation:** Growing female involvement indicates successful management of cultural concerns about gas cooking "changing food taste"—a barrier mentioned by 34% of non-adopters
3. **Economic Empowerment Recognition:** The uptake pattern suggests women recognize LPG's economic benefits beyond health—predictable costs, time savings, and potential micro-enterprise opportunities (selling cooked food)

Strategic Implications for Scale:

This gender distribution data demands strategic programme evolution:

1. **Leverage Female Networks:** With 75% female engagement, word-of-mouth promotion through women's groups, stokvels, and church societies could accelerate adoption more effectively than traditional marketing
2. **Gender-Responsive Support:** Design maintenance training specifically for women, conducted during school hours when childcare responsibilities reduce
3. **Economic Integration:** Link LPG adoption to women's economic empowerment initiatives—micro-finance for cylinder purchases, cooking-based enterprise development
4. **Male Engagement Strategy:** The 25% male participation suggests need for targeted approaches addressing masculine energy narratives—positioning LPG as modern, efficient technology rather than "women's cooking fuel"

Warning Signals in the Data:

Despite positive trends, the gender concentration raises concerns:

1. **Sustainability Risk:** If women lack financial authority, high satisfaction may not translate to continued purchases when subsidies end
2. **Incomplete Household Transformation:** Low male engagement might indicate partial buy-in, risking regression during economic stress
3. **Burden Shifting:** Without male participation in training, women bear sole responsibility for safe LPG management—potentially increasing their risk burden

The demographic data ultimately reveals that while the programme successfully reaches those most affected by indoor air pollution, true transformation requires evolving from women as beneficiaries to women as energy decision-makers. The 75.1% female participation rate represents not just successful targeting but an opportunity to fundamentally restructure household energy power dynamics–if the programme deliberately builds on this foundation through gender-transformative rather than merely gender-sensitive approaches.

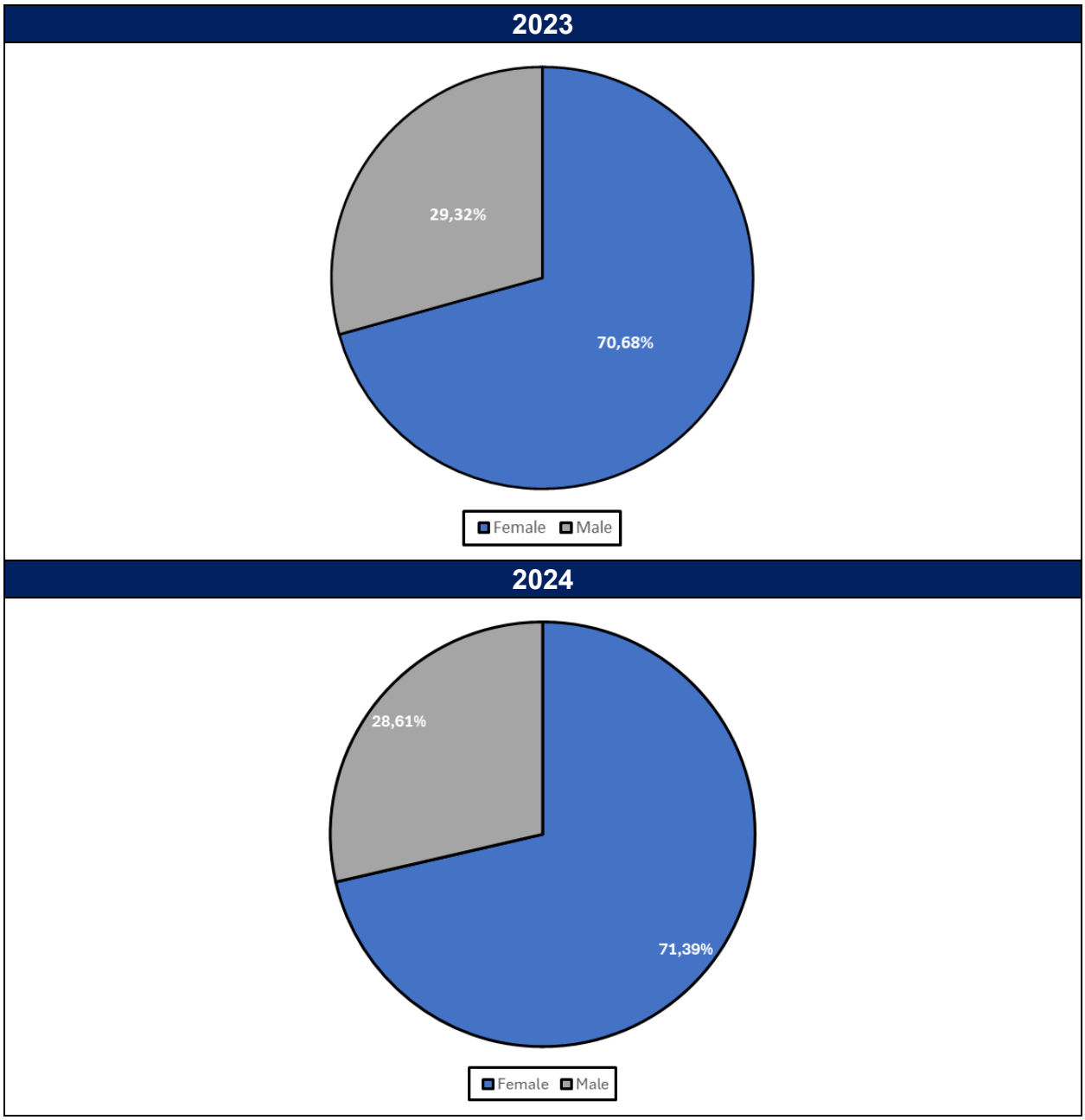
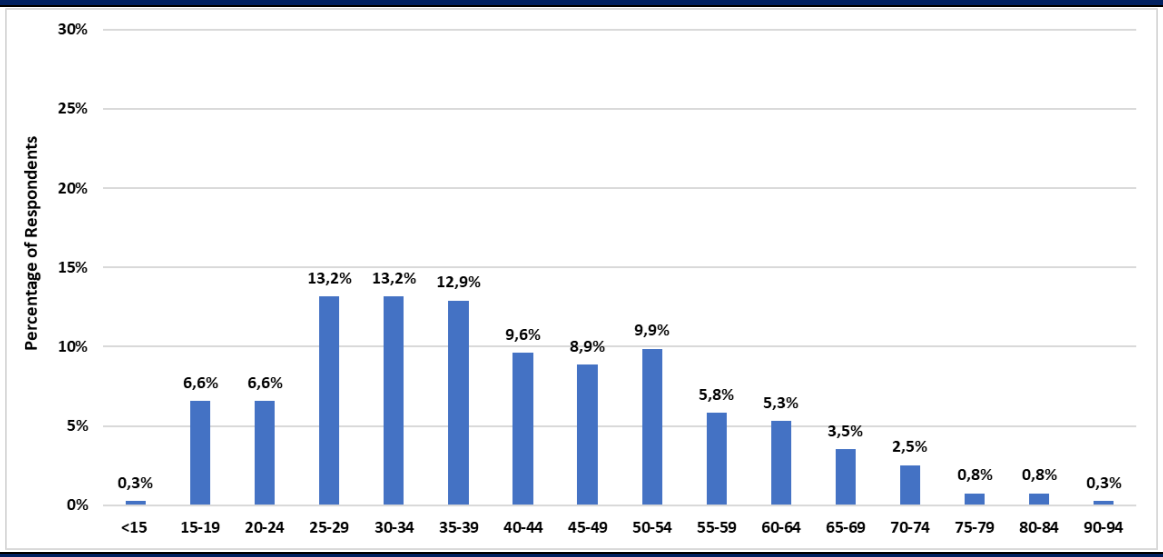


Figure 7: Gender distribution in percentage for KwaZamokuhle in 2023 and 2024.

2023



2024

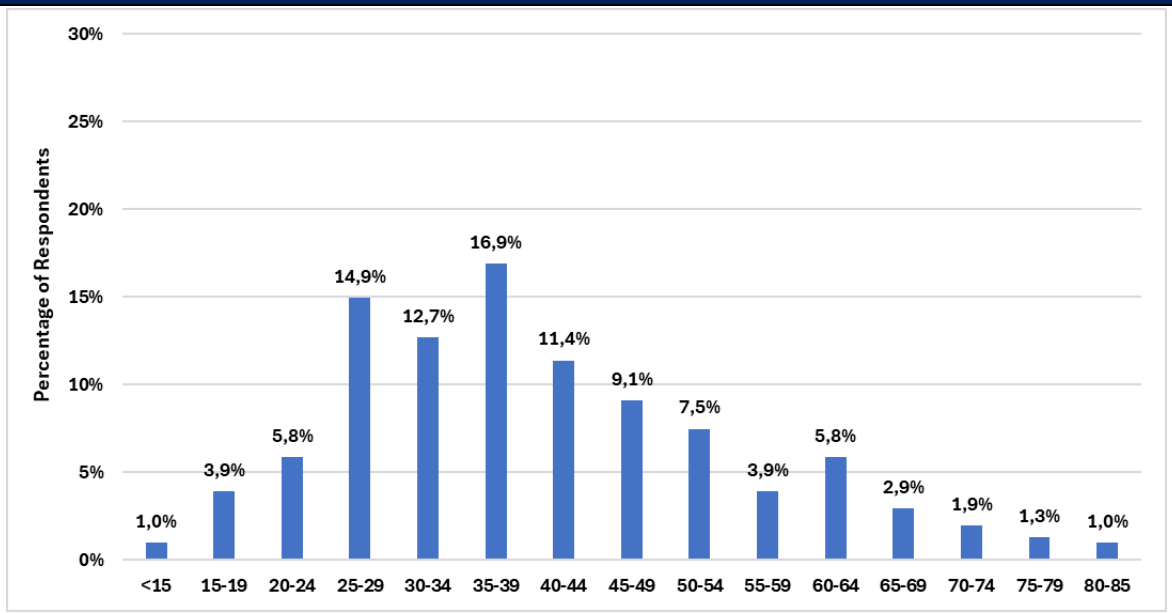
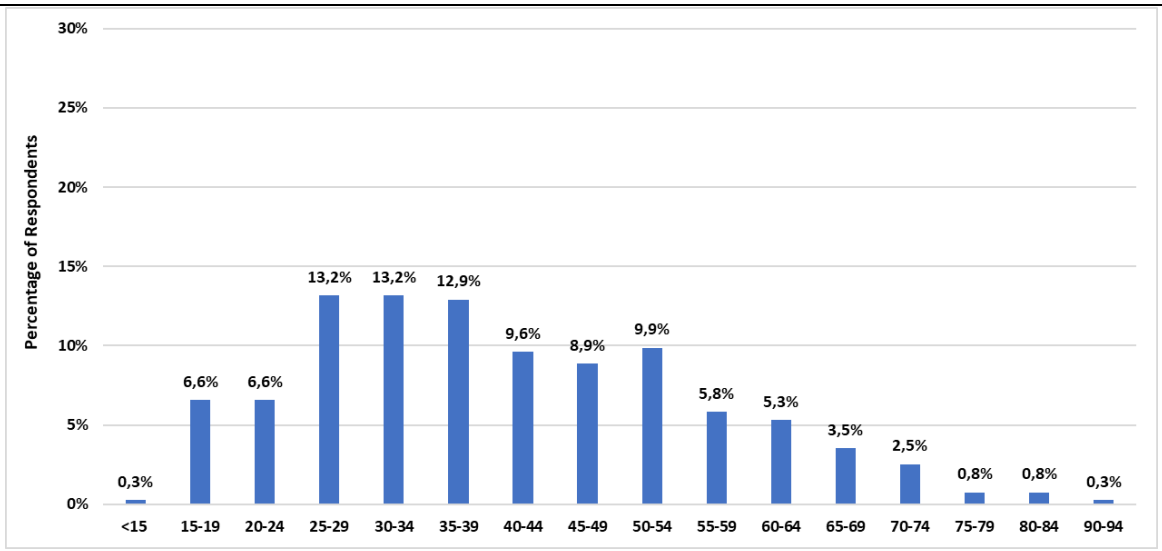


Figure 8 is indicative of the age distribution of the surveyed KwaZamokuhle population for the two surveys. Table 1 is a summary of the data represented in

2023



2024

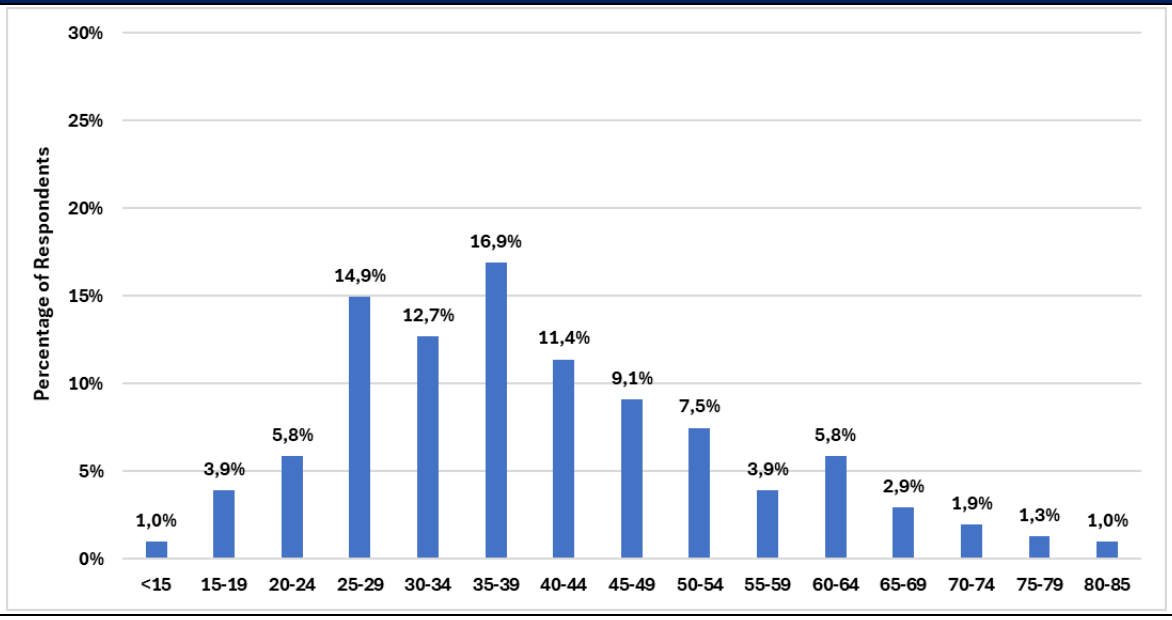


Figure 8 and

2023

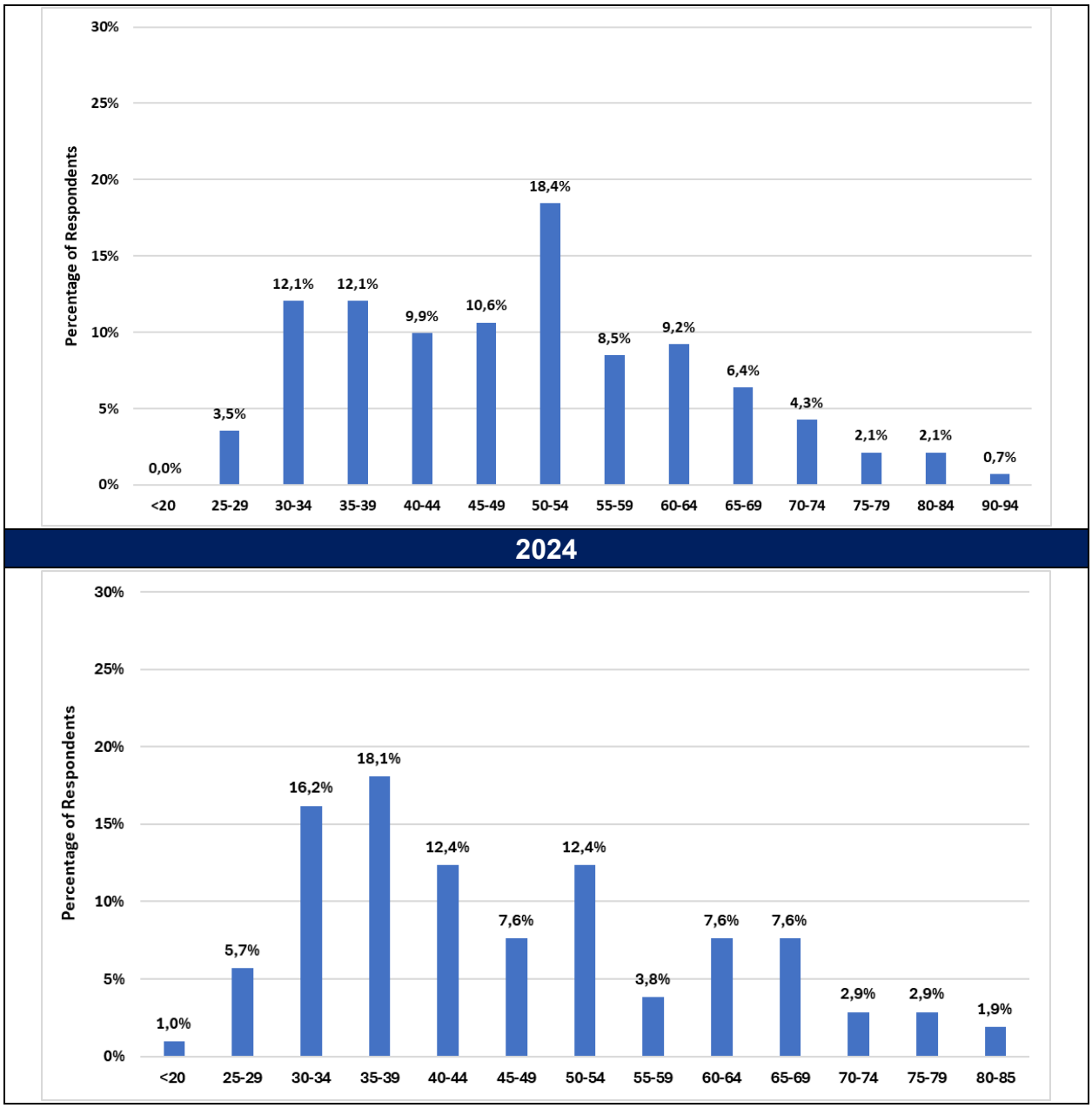


Figure 9. The 2023 dataset highlight that 45.9% are young adults (20 to 39 years old); 34.2% are middle aged adults (40 to 59 years old) and 13.2% are older adults (60 to 99), whilst the 2024 dataset highlight that 50.3% are young adults (20 to 39 years old); 28.4% are middle aged adults (40 to 59 years old) and 12.1% are older adults (60 to 99) (**Figure 8)**

It's evident from (Figure 8) that most of the respondents are between the ages 19-60 years (mean age: ≈40). Typically, people in this age group are more resilient to air quality related illnesses which is noted with the response received from the respondents when asked about their satisfaction of their personal health.

An analysis of the age distribution for female headed households (**Figure 9)** indicate for the 2023 dataset that 27.7% are headed by young female adults (20 to 39 years old), with 47.4% headed by middle aged female adults (40 to 59 years old) and 24.8% headed by old female adults (60 to 99). The 2024 dataset indicate that 40% are headed by young female adults (20 to 39 years old), with 36.2% headed by middle aged female adults (40 to 59 years old) and 22.9% headed by old female adults (60 to 99). This cohort of female play a pivotal role in the continued adoption and utilization of LPG in the community. Eskom should continue the training and awareness programmes on both air quality and LPG usage targeting this cohort.

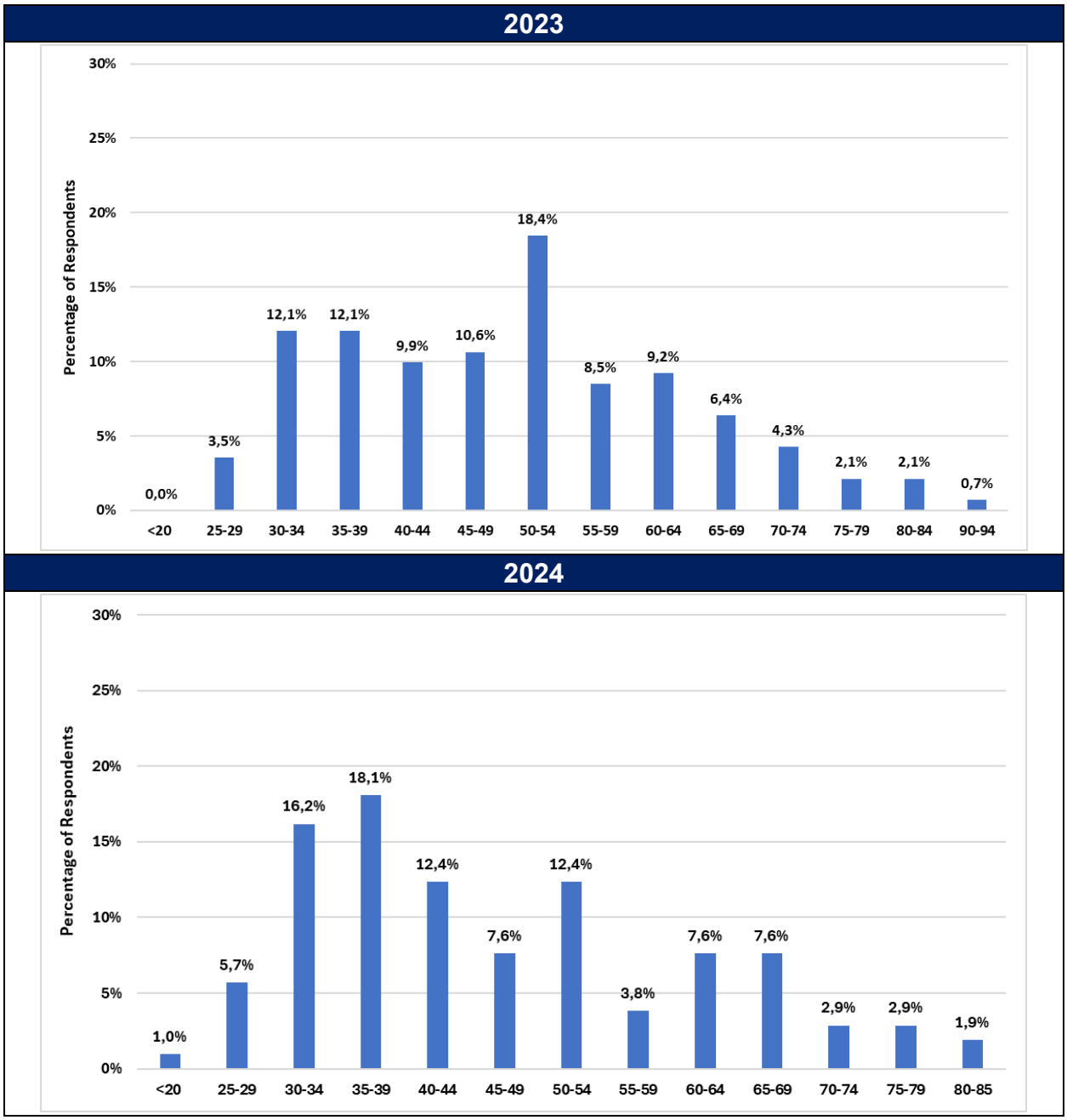


Figure 9***Table 2: Age distribution of general population and female heads of families in KwaZamokuhle in 2023 and 2024.***

Age distribution (%)	General population		Female heads of families	
	2023	2024	2023	2024

0 to 19	6.9	4.9	0	1
20 to 39	45.9	50.3	27.7	40
40 to 59	33.6	30.9	47.4	36.2
Older than 60	13.6	13.9	24.8	22.9

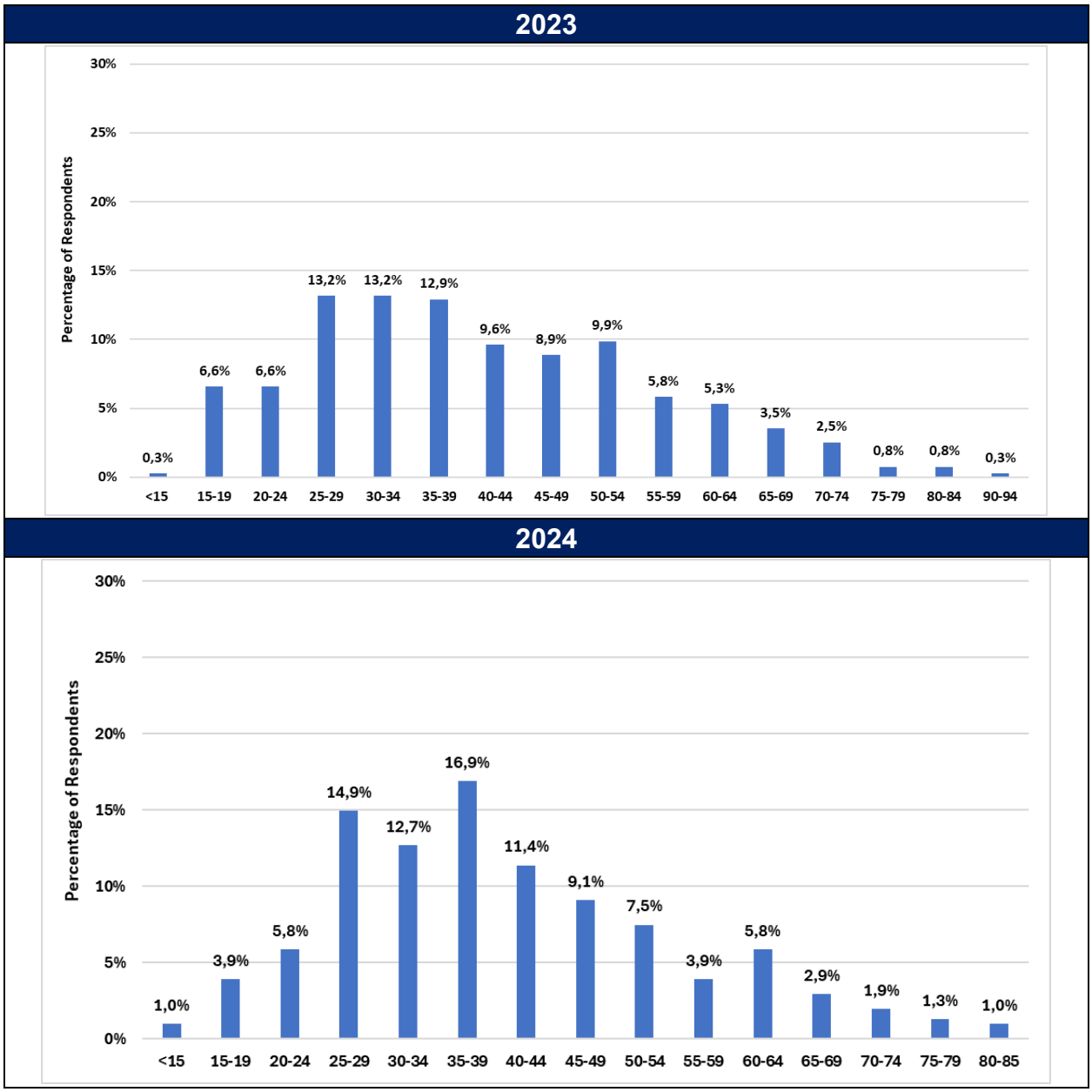


Figure 8: Age distribution in KwaZamokuhle in 2023 and 2024

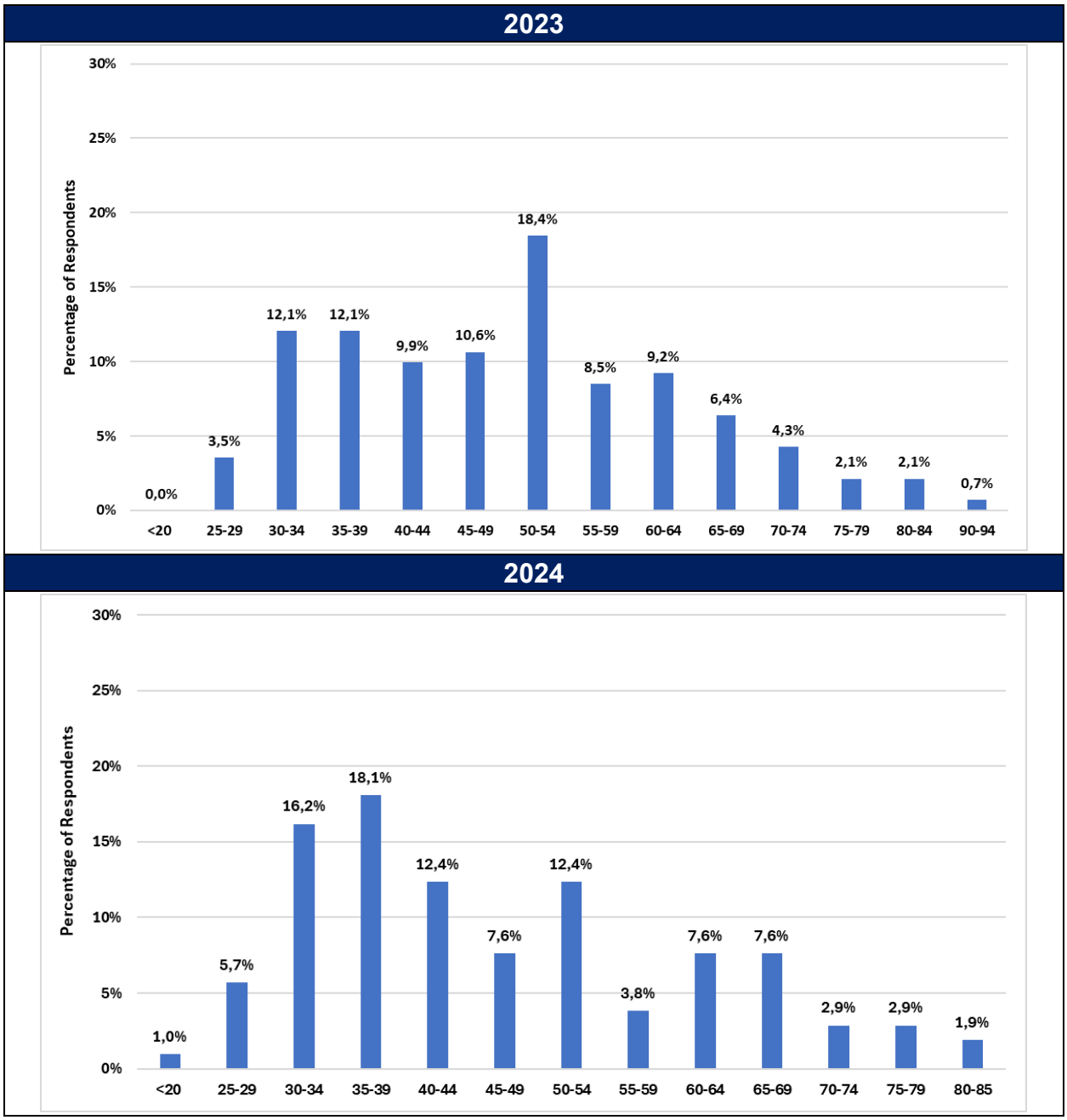


Figure 9: Age distribution of female heads of families in 2023 and 2024.

The number of dependents that each household must support is also an indicator of the amount of disposable income available to a family to spend on electricity and other sources of energy. It is also an important proxy for the indoor air quality. The survey (**Figure 10**) indicated an average number of 3.2 dependents per household compared to the number of 1,99 dependents reported by the 2011 STATSA census[2], with a high of 11 dependents in certain instances. Comparatively, according to a study conducted by Stats SA in 2021, South Africa, has an average household size of 3.34 persons nationally[3] . Interestingly, only about 3% reported using child grants, and only 21% accessed Social Relief Distress Grant despite this dynamic.

[2] Stats SA, https://www.statssa.gov.za/?page_id=4286&id=11564
[3]Stats SA, https://www.statssa.gov.za/?p=15473#:~:text=Nationally%2C%20more%20than%20half%20(52,at%20least%20one%20elderly%20person.

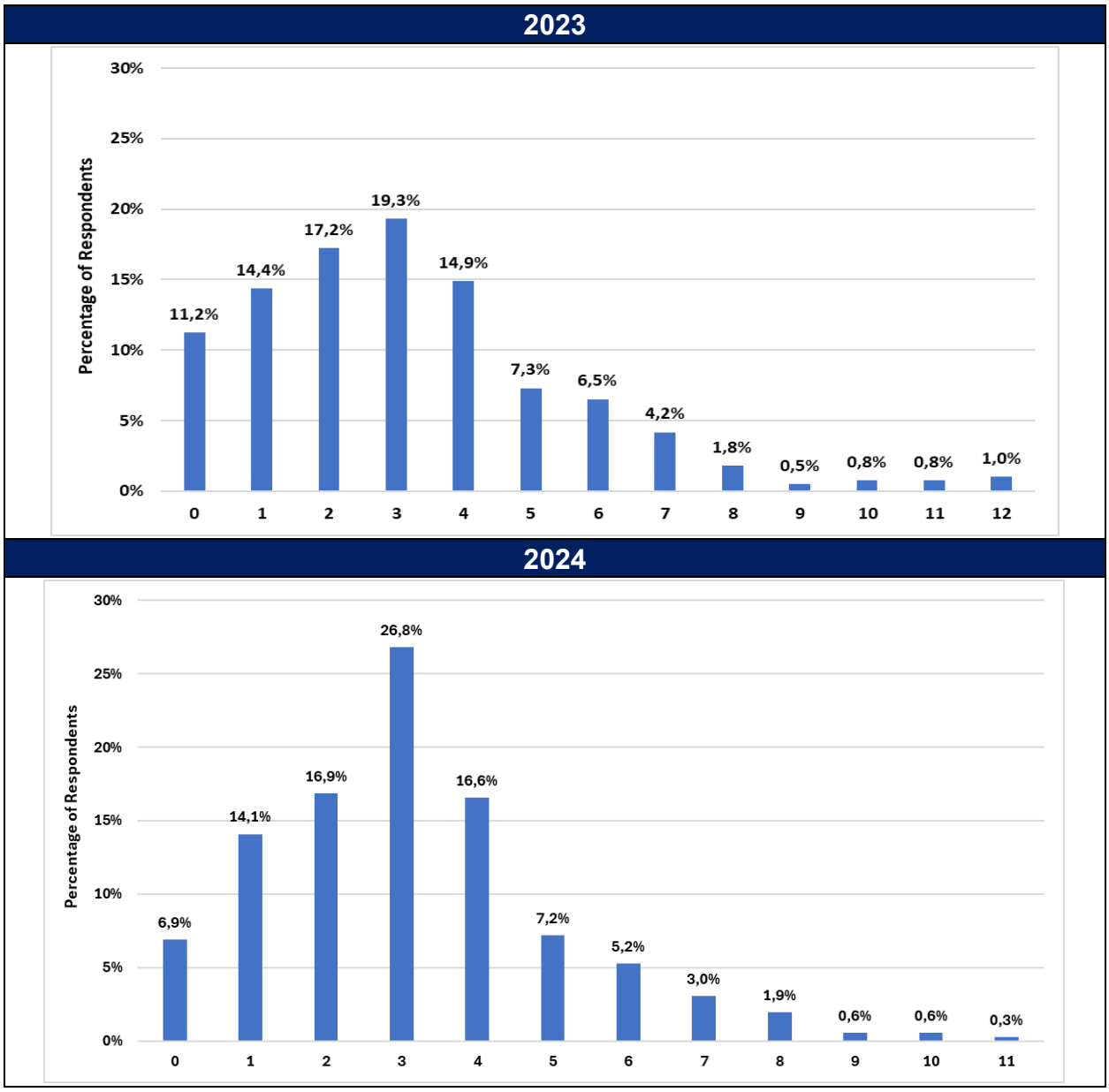


Figure 10: Number of dependents supported per household in 2023 and 2024.

3.1.2 HOUSING

The type and structure of housing in any settlement is often seen as a social determinant of health, particularly in low-income households. The direct effects of physical housing defects are an important causal pathway for health-related issues in low-income, vulnerable households[4].

According to Stats SA, in 2022, more than four-fifths (88%) of all households lived in formal dwellings; 8.1% lived in informal, and 3.1% lived in traditional, dwellings[5] (dwellings one made of clay, mud, thatch or other traditional materials. It can be round or square in shape). Almost 65% of households owned the dwelling they lived in while 22.2% rented it and 13% indicated that they lived in their dwellings without charge.[6]

The sampled households interviewed during the 2023 survey fall primarily into three categories as illustrated by Figure 11. By far, the largest percentage of households (76.8%) were residing in RDP housing. Twp percent (2.0%) of households lived in self-built housing, and 21.2% households have converted their homes from formal RDP houses to more spacious dwellings. On average, homes had 3.98 rooms.

[4]Krieger,J.,Higgins,D.L, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1447157/
[5] STATSSA, https://census.statssa.gov.za/#/statsbytheme
[6] Stats SA,General Hosuehold Survey 2022, https://www.statssa.gov.za/publications/P0318/P03182022.pdf.

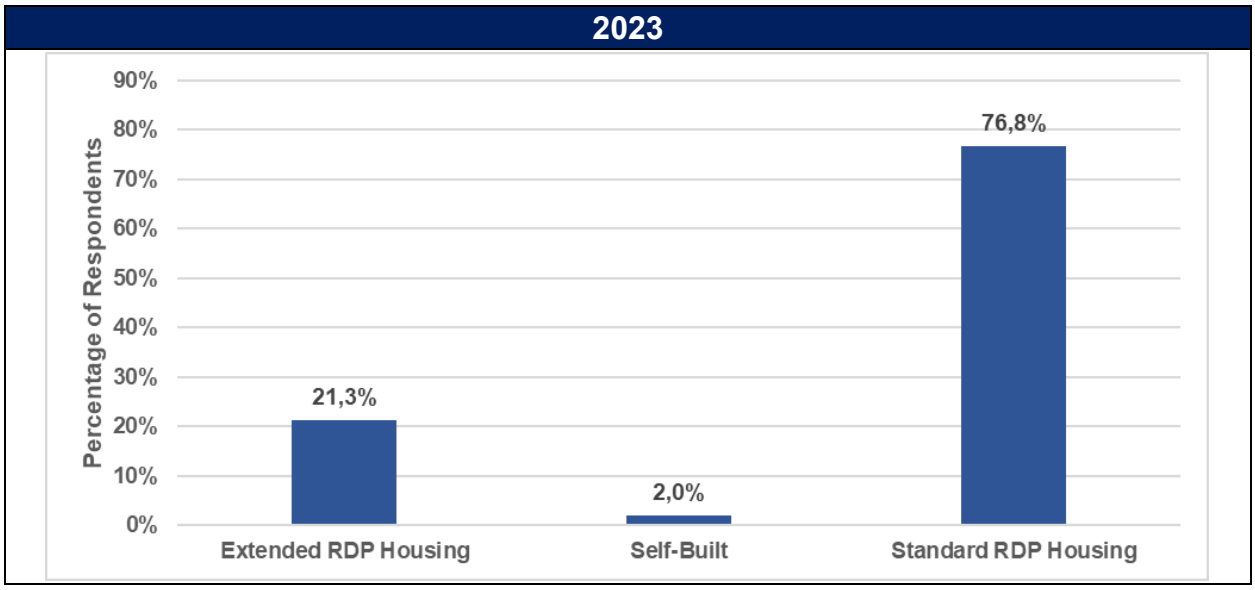


Figure 11: Type of dwelling of KwaZamokuhle Respondents that Participated in the Eskom Offsets Retrofitting Exercise.

The percentage of shacks in backyards in KwaZamokuhle of the sampled households was 41% (164) (**Figure 12**), which compares quite high to the national Census number of 3,3%[7]. This is concerning as “shacks” present an extraordinary structural challenge based on the materials of construction such as wood, tin, plastics etc. Shacks are illegal dwellings that RDP homeowners build in their backyards to generate income in the form of rent. Shacks do not conform to any building regulations and are unserviced with respect to electricity, water and sanitation, forcing people to move to alternate “dirty” fuels as a result of energy stacking thus predisposing them to poor air quality. Eskom must proceed sensitively with the AQO intervention roll out as not doing anything with shacks may create social unease and distrust. Education and awareness and extremely selective interventions such as stove roll outs to shacks may address some of these concerns.

RDP houses on the other hand are better constructed using bricks and mortar in most cases. They are generally electrified and have access at the very least to free basic electricity (FBE), which is electricity allocated to support low-income households, enough to run basic lighting, basic media access, basic ironing and boil water using an electrical kettle. Indigent households can qualify for at least 6kl of water and 50 kWh of basic electricity per household per month. Households are required to register with municipalities to qualify for these free basic services and successful applicants are granted indigent status. Different municipalities have different criteria to qualify as indigent. According to COGTA (Cooperative Governance and Traditional Affairs), South Africa’s 257 municipalities registered 3,51 million indigent households in 2017. That’s about 1 in every 5 of the country’s 16,2 million households. Whilst this survey recognizes this important parameter as an omission and will include this as a question in subsequent surveys, it is a safe assumption that generally all RDP homes qualify as indigent. Furthermore, in KwaZamokuhle, 21% of respondents have also either improved their RDP homes by either extending or modifying the houses or have proper brick housing which minimises health risks from poor indoor air quality. Improvements broadly describe extensions to the homes, and other minor modifications such tiling of floors etc.

[7] Stats SA,General Hosuehold Survey 2022, https://www.statssa.gov.za/publications/P0318/P03182022.pdf

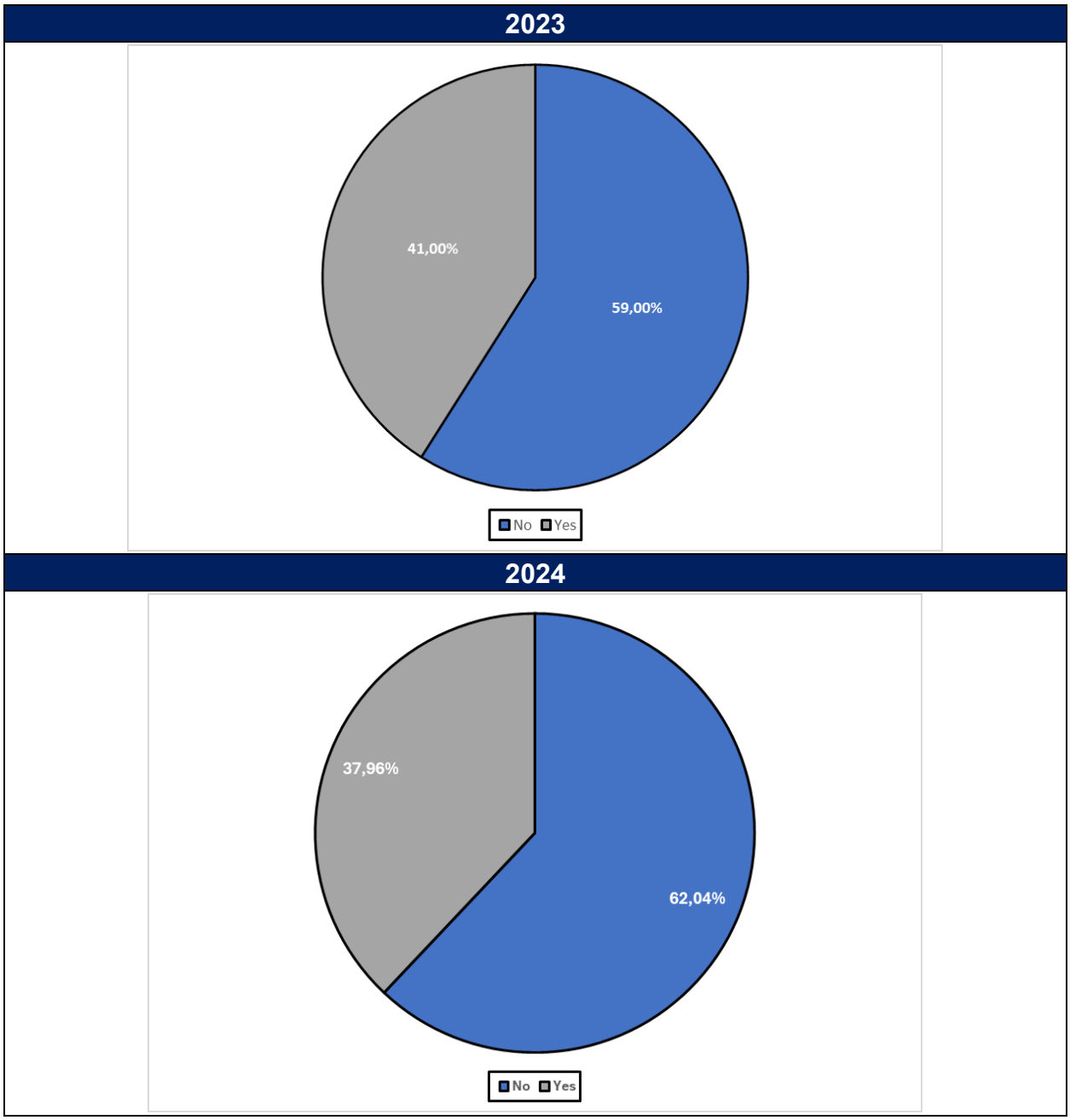


Figure 12: Number of backyard dwellings in KwaZamokuhle in 2023 and 2024.

MATERIALS USED IN CONSTRUCTION

The materials used in housing construction is a key determinant of thermal comfort and subsequently indoor air quality. The thermal comfort is low in a house where there are neither ceilings nor plastering of the walls, and where space heating is affected by solid fuel burning.

From the sampled households in 2023, 96% of the roofing was made up of metal sheets and the remainder was constructed of tile and cement, whereas during the 2024 survey 99.5% of the roofing was made up of metal sheets and the remainder was constructed of tiles (**Figure 13)**

In terms of the main dwellings floor type, the 2023 survey highlighted that half of floors (51%) were of cement and the balance were covered by tiles, whilst about 10% of households used carpets. The 2024 survey indicate a similar trend of 60.6% cement and the balance were covered by a mix of carpet,cement and tiles, whilst about 1.9% of households used carpets (**Figure 14).** Adequate concrete floor insulation like polystyrene blocks or sheets on which either carpets or wooden tiles are placed will greatly help in reducing heat loss, improving comfort and conserving energy. Although concrete floors look solid, it is actually very porous, leading to the penetration of moisture. Around 15% of heat loss from a building can be through the floor. Without much effort, perhaps a low hanging fruit could be the rollout of carpets to households to aid in improving the thermal comfort of the homes in winter[8], however the socio-economic viability of this hypothesis will need to be tested.

[8] MccNeil,S https://www.researchgate.net/publication/298352974_The_Thermal_Properties_of_Wool_Carpets

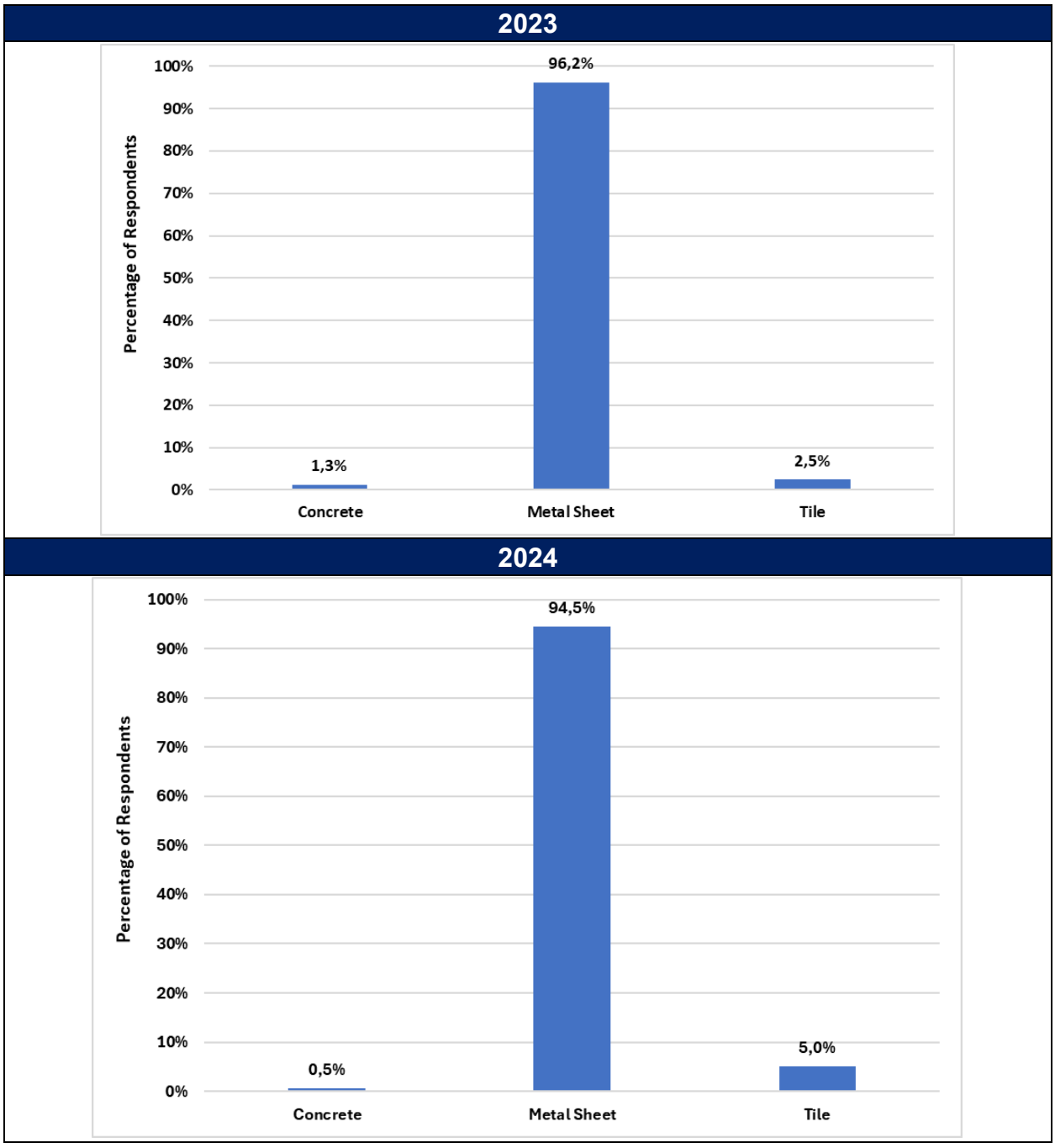


Figure 13: Main dwelling roof types in KwaZamokuhle in 2023 and 2024.

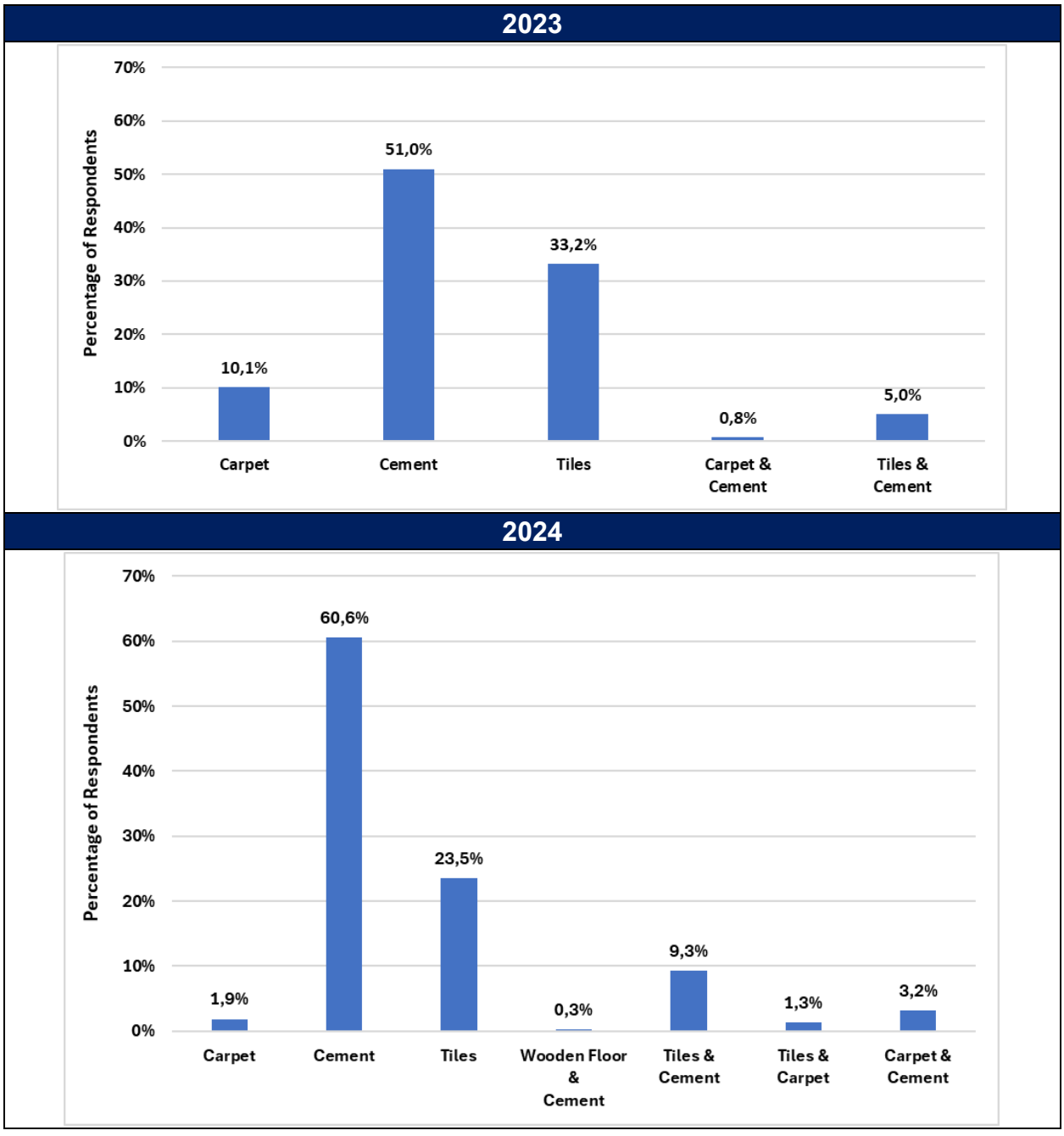


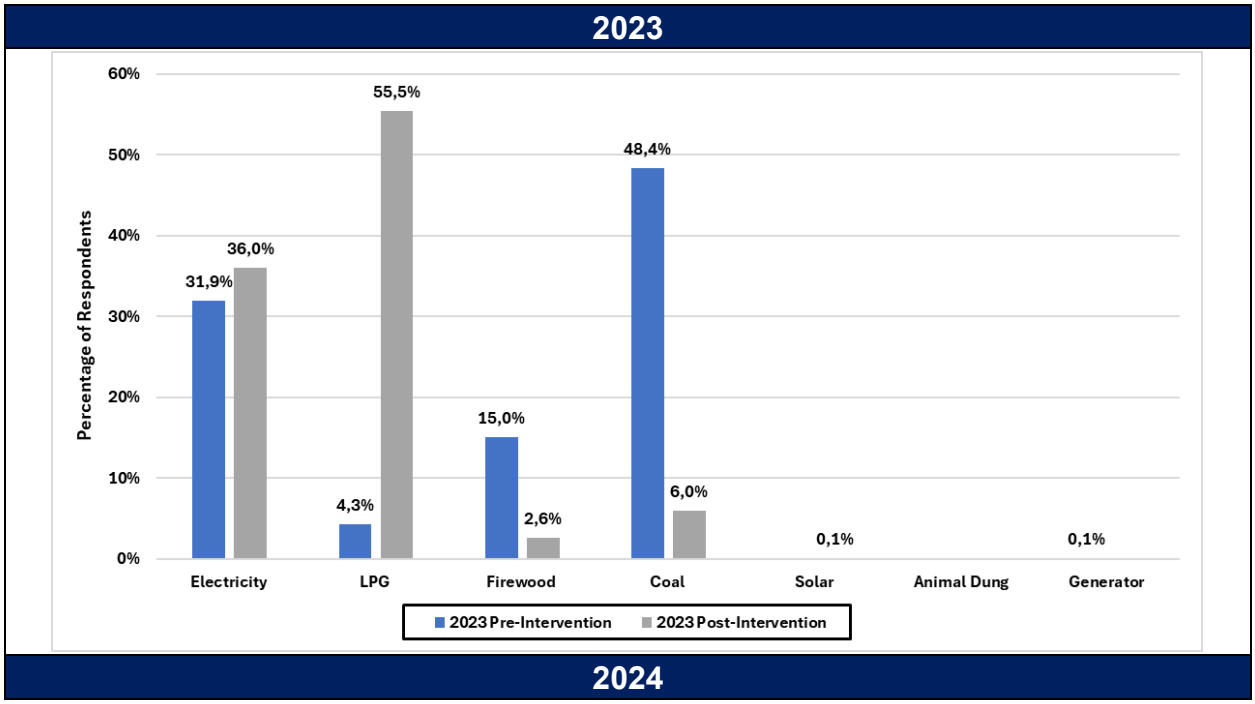
Figure 14: Main dwelling floor types in KwaZamokuhle in 2023 and 2024.

3.1.3 ENERGY USE

Access to electricity shifts households up the energy ladder[9] (Hanna). However, in low-income households, socio-economic conditions and electricity availability (e.g., loadshedding), drive households towards the energy stacking model and fuel switching towards biomass. Coal becomes a reality particularly in winter months. Typically, low-income households have access to free basic electricity. Almost all the respondents 99.5% indicated for the 2023 survey that they have access to electricity, and 100% is noted for the 2024 survey (Figure 15).

Interestingly, even with access to electricity, ~58% households indicated in the 2023 survey they utilise electricity continuously through the year before and after interventions and then 75.9% of households in 2024 surveys. This implies that electricity is the primary energy source for more than the 50% of respondents during 2023 and 2024

Electricity is used predominantly for heating, cooking and lighting (Figures 15 to 17).



[9] Hanna,R.,Oliva,P. https://epod.cid.harvard.edu/sites/default/files/2018-03/moving_up_energy_ladder.pdf

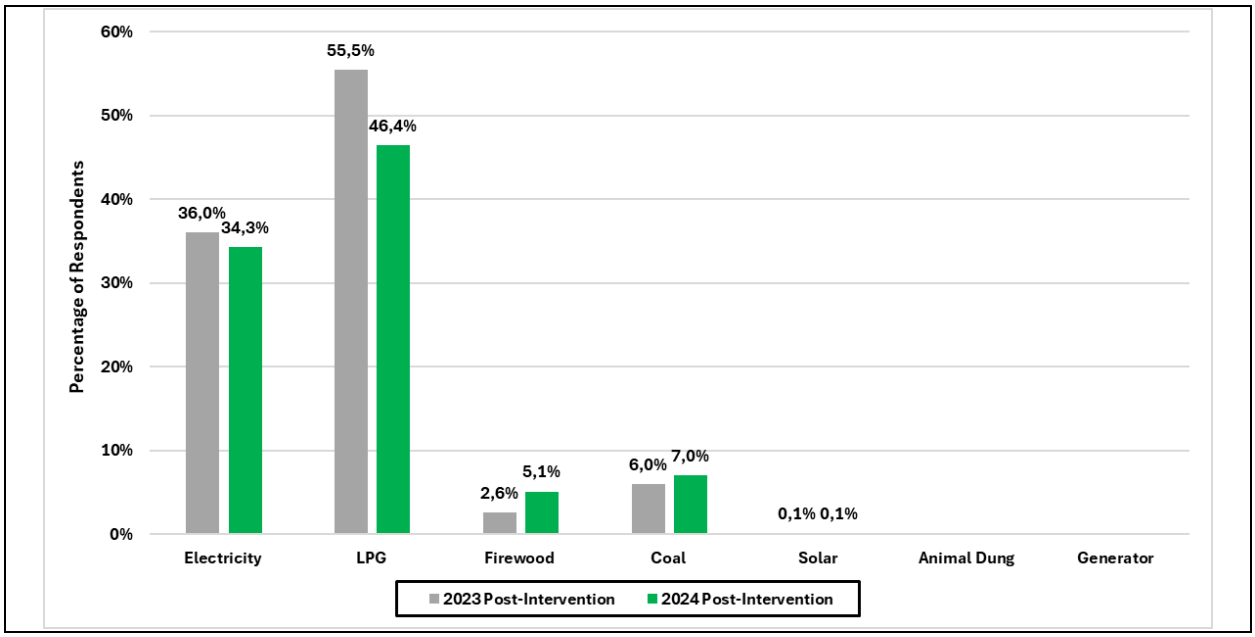


Figure 17 is indicative of energy use for space heating. Figure 11 illustrates a 31.9% electricity, 48.4% coal, 15% firewood and 4.3% LPG usage for 2023 pre-interventions. The 2024 survey (after the interventions were completed) indicates a decrease of energy use for space heating to 34.3% for electricity and 46.4% for LPG, whilst a significant reduction of coal and firewood usage 7% and 5.1% respectively. This reduction of coal (40.7%) and wood (10.1%) usage for space heating will have a significant contribution towards improving the ambient air quality in the region.

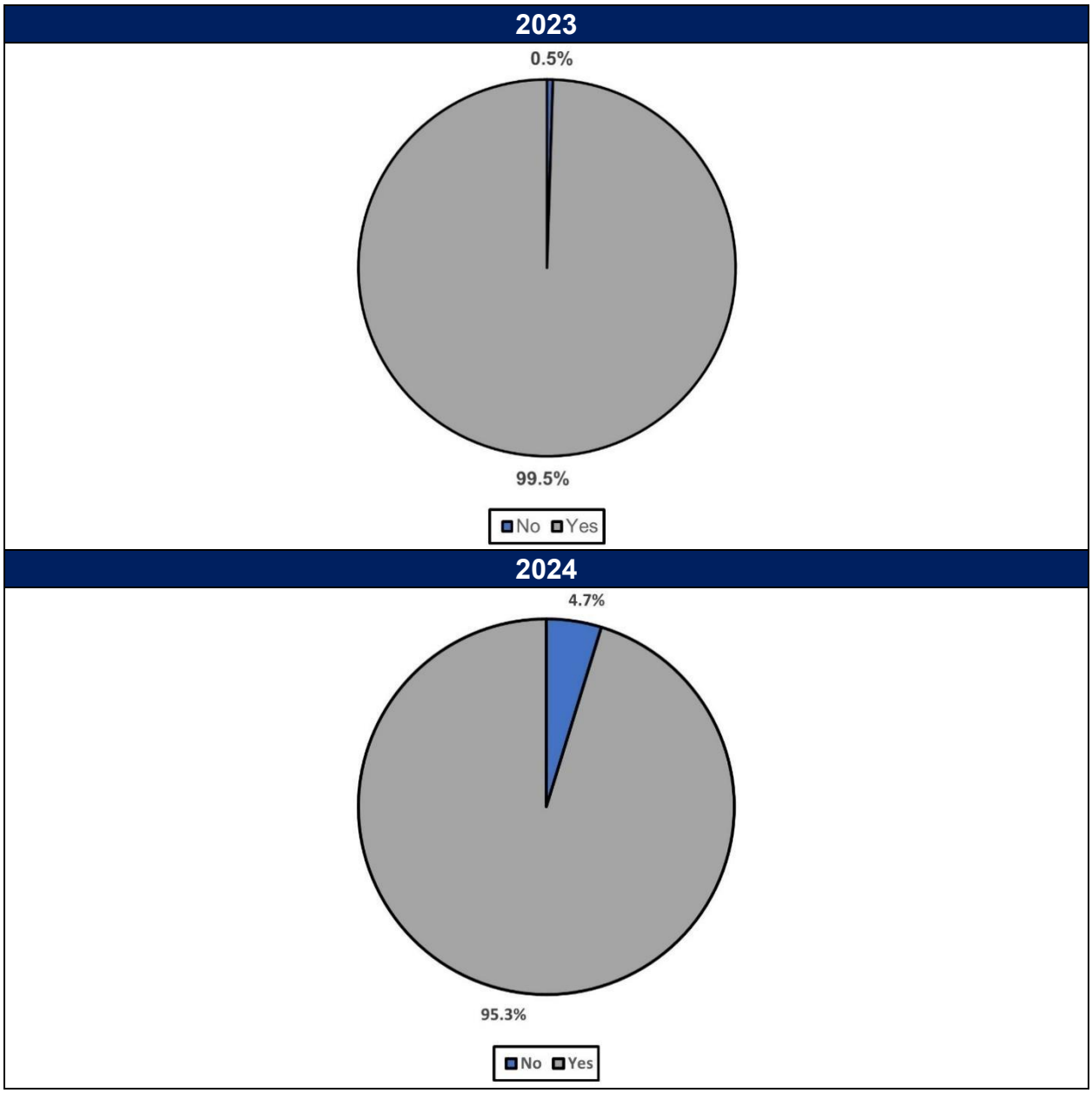


Figure 15: Number of sample households with an electricity connection in 2023 and 2024

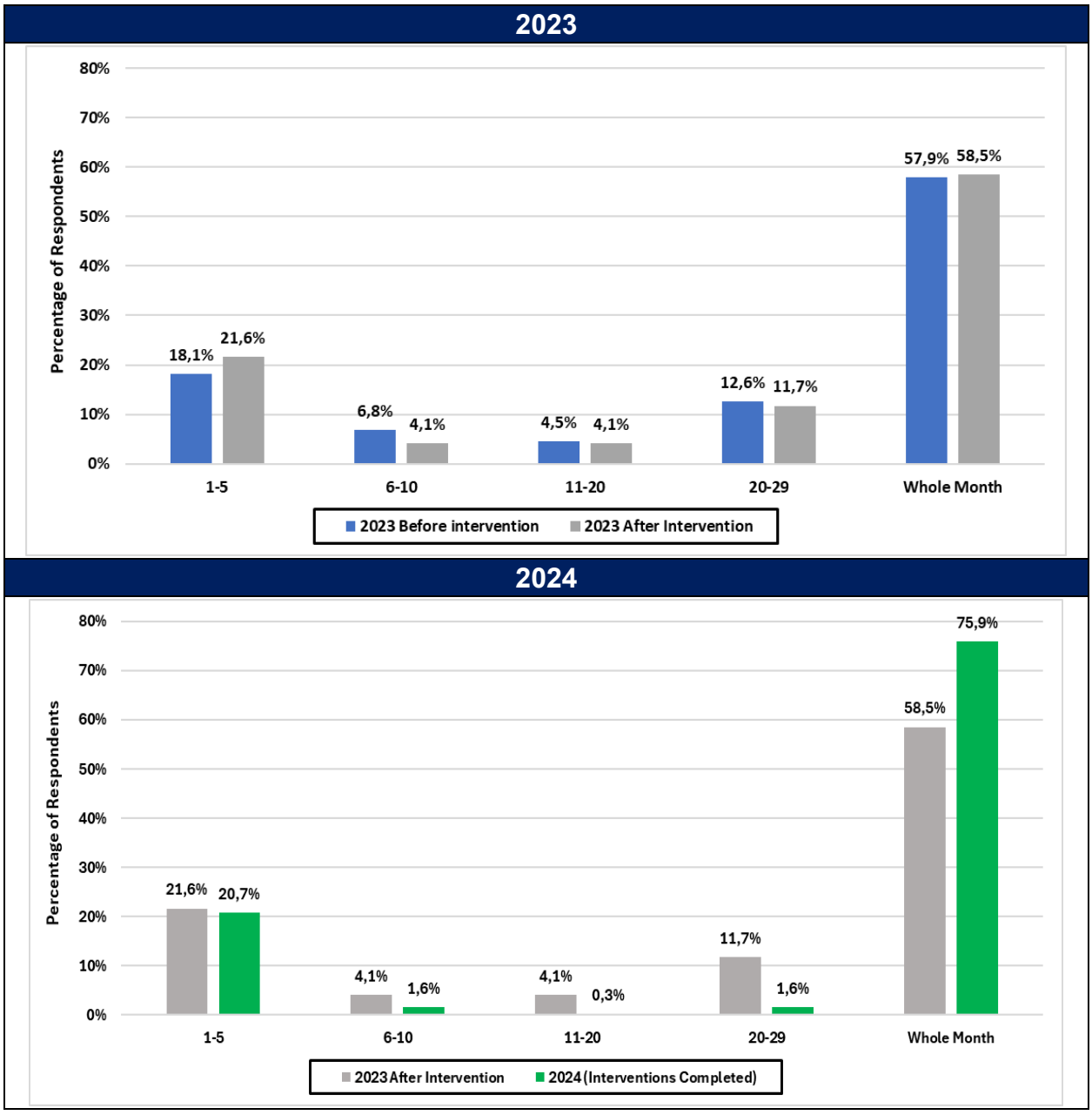


Figure 16: Days electricity is used in the sample households in KwaZamokuhle in 2023 and 2024

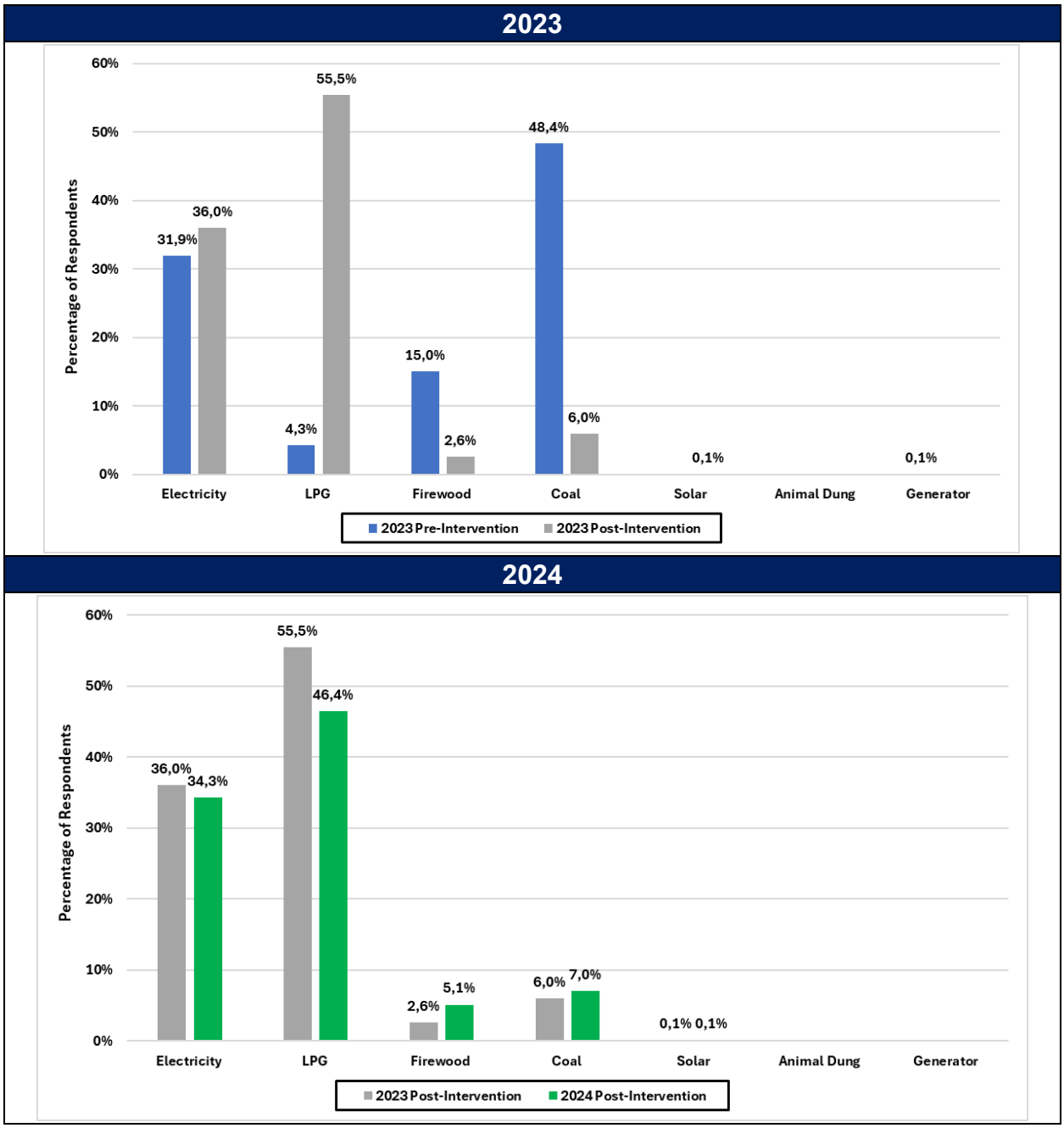
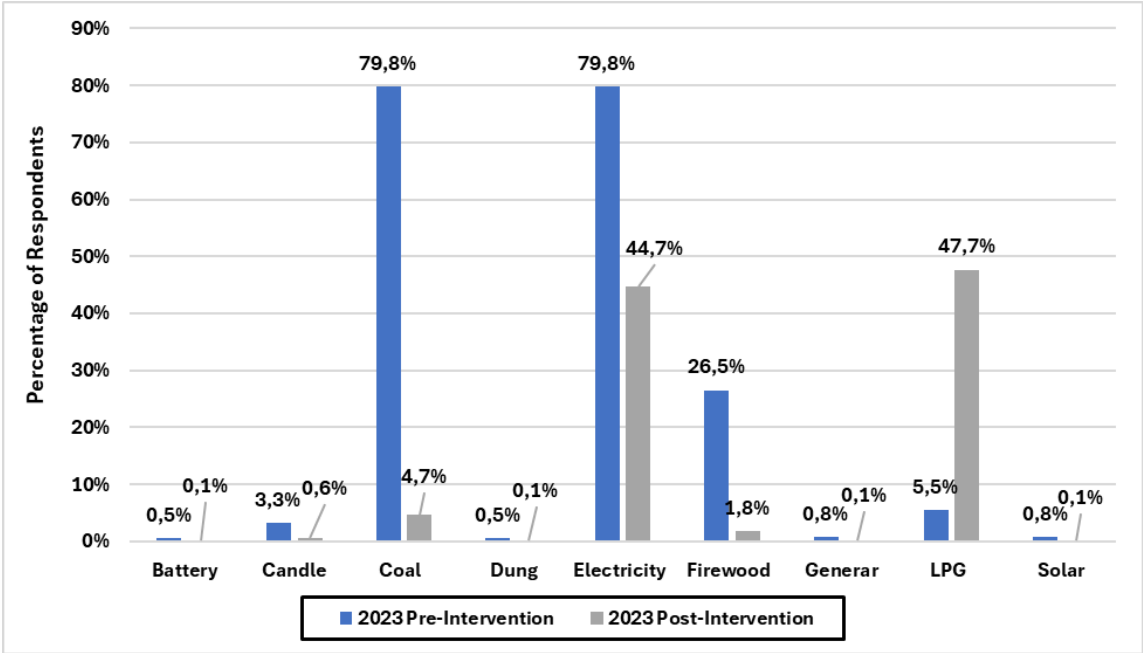


Figure 17: Household energy use for Space Heating in 2023 and 2024

2023


90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Respondents
0,5%
0,1%
3,3%
0,6%
79,8%
4,7%
0,5%
0,1%
79,8%
44,7%
26,5%
1,8%
0,8%
0,1%
5,5%
47,7%
0,8%
0,1%
Battery
Candle
Coal
Dung
Electricity
Firewood
Generar
LPG
Solar
2023 Pre-Intervention
2023 Post-Intervention

2024

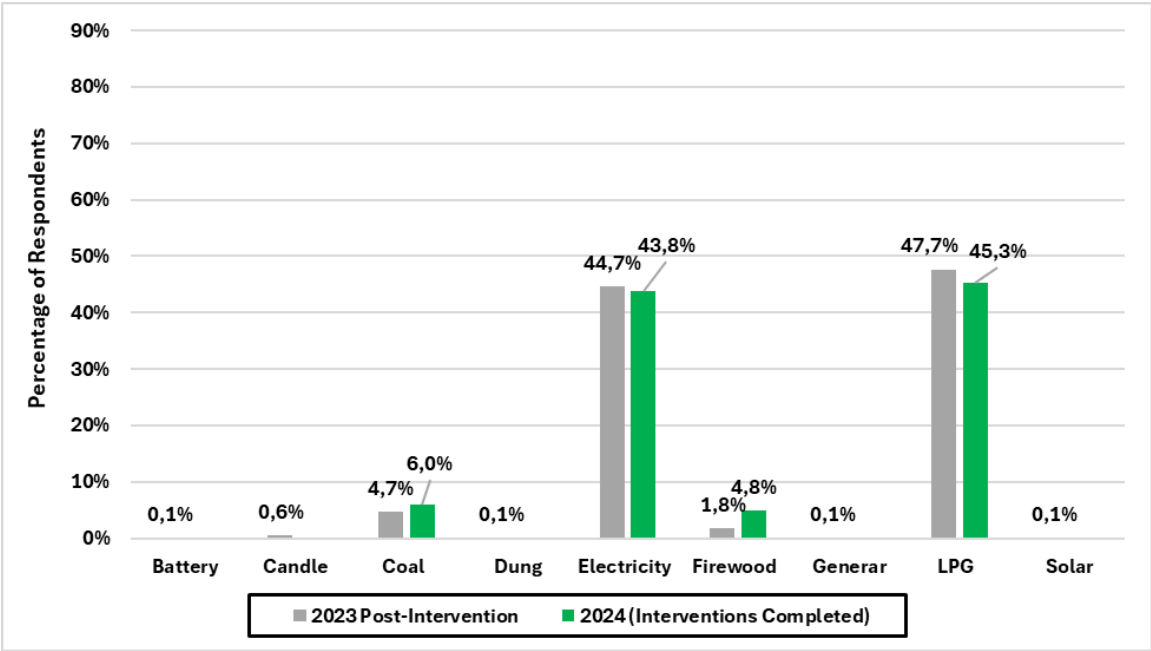
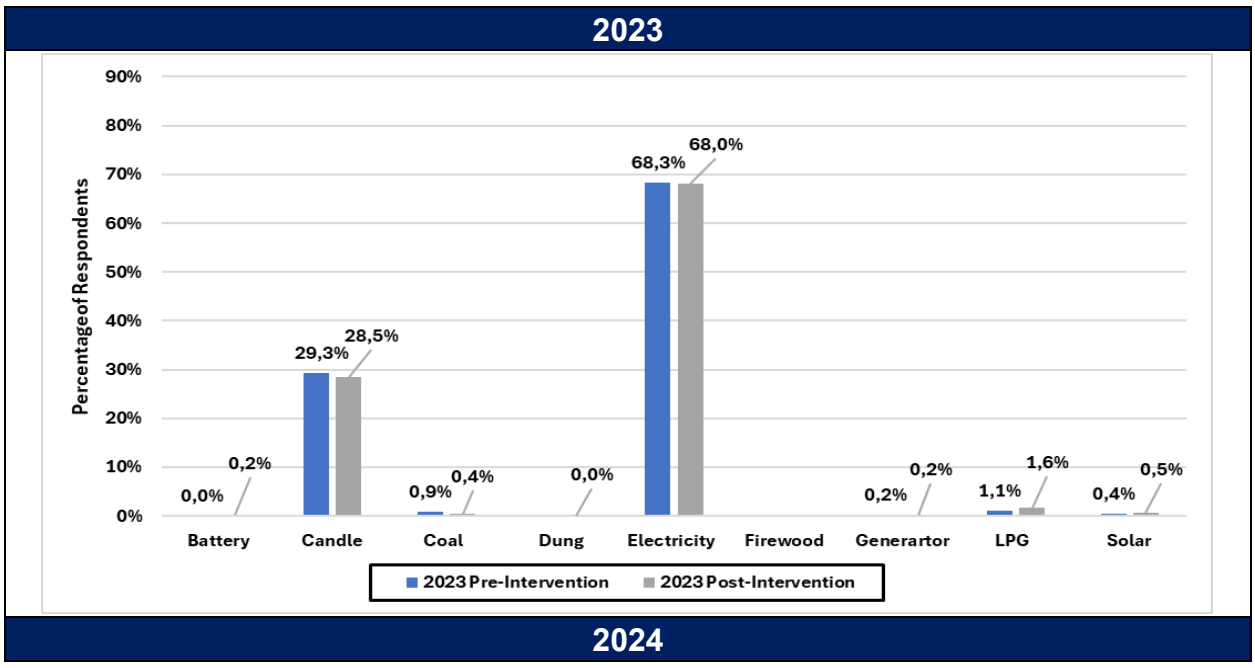

90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Respondents
0,1%
0,6%
4,7%
6,0%
0,1%
44,7%
43,8%
1,8%
4,8%
0,1%
47,7%
45,3%
0,1%
Battery
Candle
Coal
Dung
Electricity
Firewood
Generar
LPG
Solar
2023 Post-Intervention
2024 (Interventions Completed)

Figure 18 is indicative of energy use for cooking. Figure 12 illustrates a 79.8% electricity, 79.8% coal, 26.5% firewood and 5.5% LPG usage for 2023 pre-interventions. The 2024 survey (after the interventions were completed) indicates a decrease of energy use for cooking to 43.8% for electricity and an increase to 45.3% for LPG, whilst a significant reduction of coal and firewood usage to 6.0% and 4.8% respectively. This significant reduction of coal (73.8%) and wood (21.7%) usage for cooking will add to the improvements of air quality materialised for the space heating.

Interestingly, Census 2023, shows that the proportion of households using electricity for cooking increased from 47.5% to 73.9% in 1996 to 2011, and then decreased to 64.9% respectively in 2023, compared to 47% in KwaZamokuhle. The proportion of households using paraffin, wood and coal as sources of energy for cooking decreased from 21.6%, 23.0% and 3.6% to 8.5%, 12.5% and 0.7% in Census 1996 and 2011 respectively, and then further decreased to 2.7%, 6.1% and 0.2% in 2022, compared to 6% coal use and 4.8% firewood use in KwaZamokuhle.



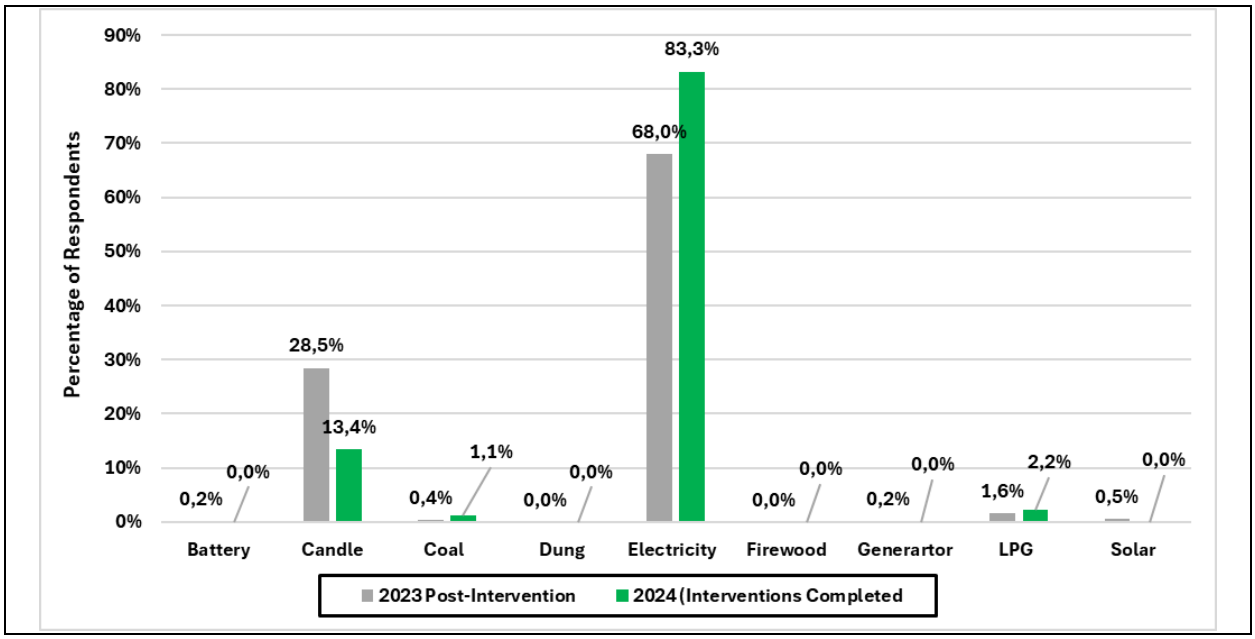


Figure 19 is indicative of energy use for lighting and illustrates a 68.3% electricity and 29.3% candle usage for 2023 pre-interventions. The 2024 survey (after the interventions were completed) indicates an increase of energy use for lighting to 83.3% for electricity and decrease to 13.3% for candle usage respectively. A slight increase in LPG usage for lighting from 1.1% to 2.2% is indicative in 2024.

Census 2023 indicated that households using electricity for lighting increased from 58.2% in 1996 to 84.7% in 2011, and then to 94.7% in 2022, with 83.3% households in KwaZamokuhle using electricity for lighting. while those using paraffin and candles decreased over the same period. The use of paraffin and candles for lighting also decreased from 12.7% to 3.0% and from 28.7% to 11.4% in 1996 and 2011, respectively, and further decreased to 0.9% and 3.2%, whilst in KwaZamokuhle 13.4% of households used candles.

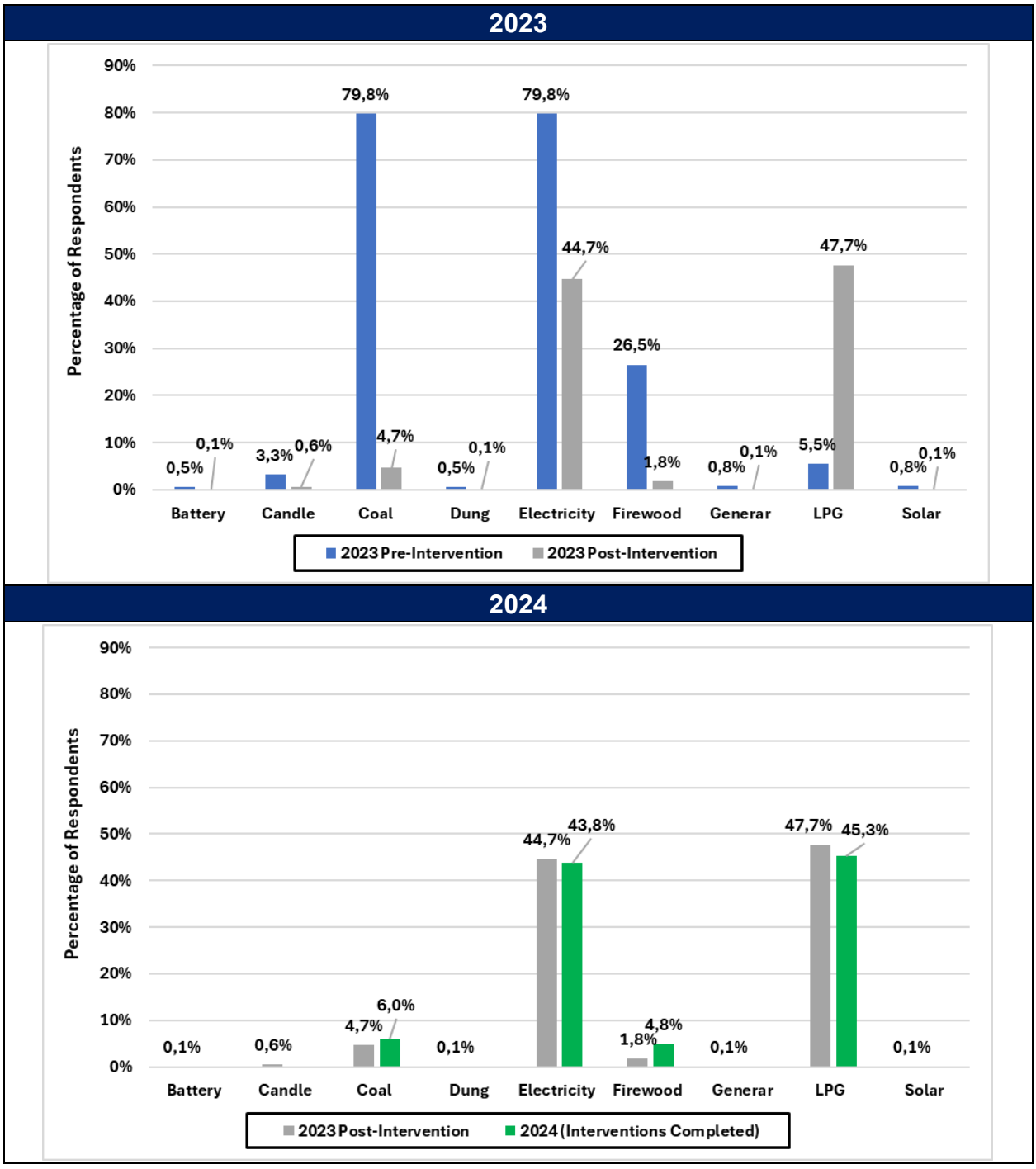


Figure 18: Household energy use for Cooking in 2023 and 2024

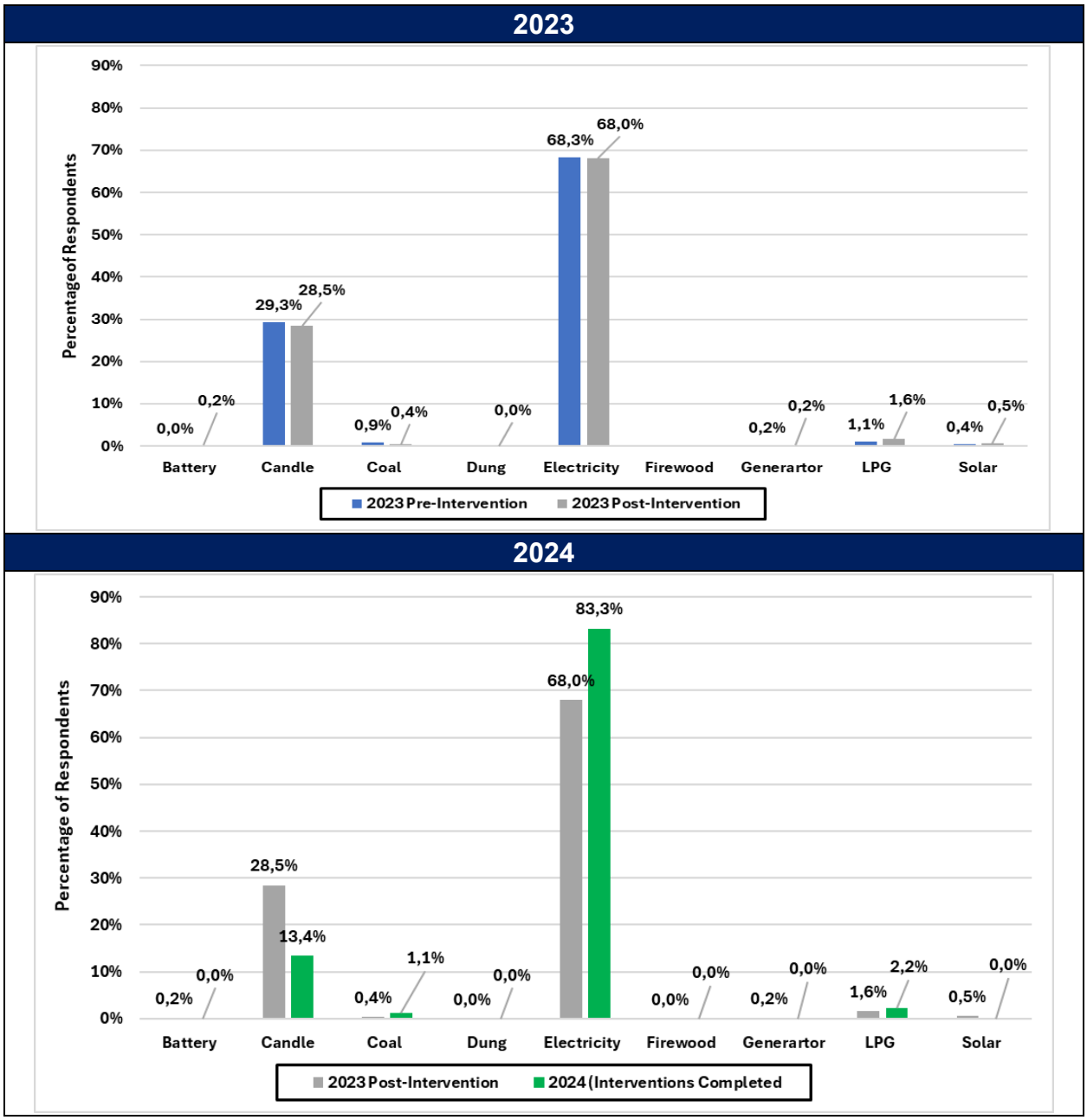


Figure 19: Household energy use for Lighting in 2023 and 2024

Whilst the shift to cleaner fuels for heating and cooking represents a tremendous step in managing and improving air quality for Eskom, early celebrations may have to be tempered as this could be a seasonal representation of the consumption of coal. Winter may present a different picture but will be a good gauge of how effective the interventions are. This said and in order to maintain this pattern of energy use and prevent fuel switching, Eskom will have to continue its training and awareness programmes.

- *3.1.3.1 Use of electricity from interconnected grid or isolated system*

Virtually all households have an electricity meter (99%) and use electricity for lighting, electric appliances and cooking. From the 2023 survey results it's evident that only 52% use energy saving light bulbs pre-intervention and saw a large increase to 72.9% post-intervention. In the 2024 study a decrease is noted with 54.2% of households utilising energy saving light bulbs. A total of 61.5% households reported electricity spend of between R200-R500 per month pre-intervention and dropped to 56.2% (221) post-intervention and then increased in 2024 to 65.9%. Whilst an increase is noted between the pre and 2023 post-intervention for the R1-200 from 22.4% (67) to 32.1% (126) and then decreasing in 2024 to 23.6%.

Statistically this represents a positive for people following the energy stacking principles and using multiple fuels at the same time, particularly post intervention.

In case of electricity failure most (88%; 313) use candles as a backup in 2023 while almost none use gas lamps, generators, car batteries or any other backup. In 2024 this number would decrease slightly to 292 respondents of 381 using candles as a backup.

- *3.1.3.2 Candle use*

The 2023 survey revealed that 78.3% of households utilise candles every month pre-intervention, and there is a notable change after all the interventions were implemented (2024), with 52.1% households using candles; mainly for home use during load shedding (**Figure 20).** Candles are used for lighting and present a major fire hazard more so than contributing to poor air quality.


2023
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Respondents
78,3%
74,4%
21,8%
25,6%
2023 Before intervention
2023 After Intervention
No
Yes
2024
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
74,4%
52,1%
47,9%
25,6%
2023 After Intervention
2024 (Interventions Completed)
No
Yes

Figure 20


2023

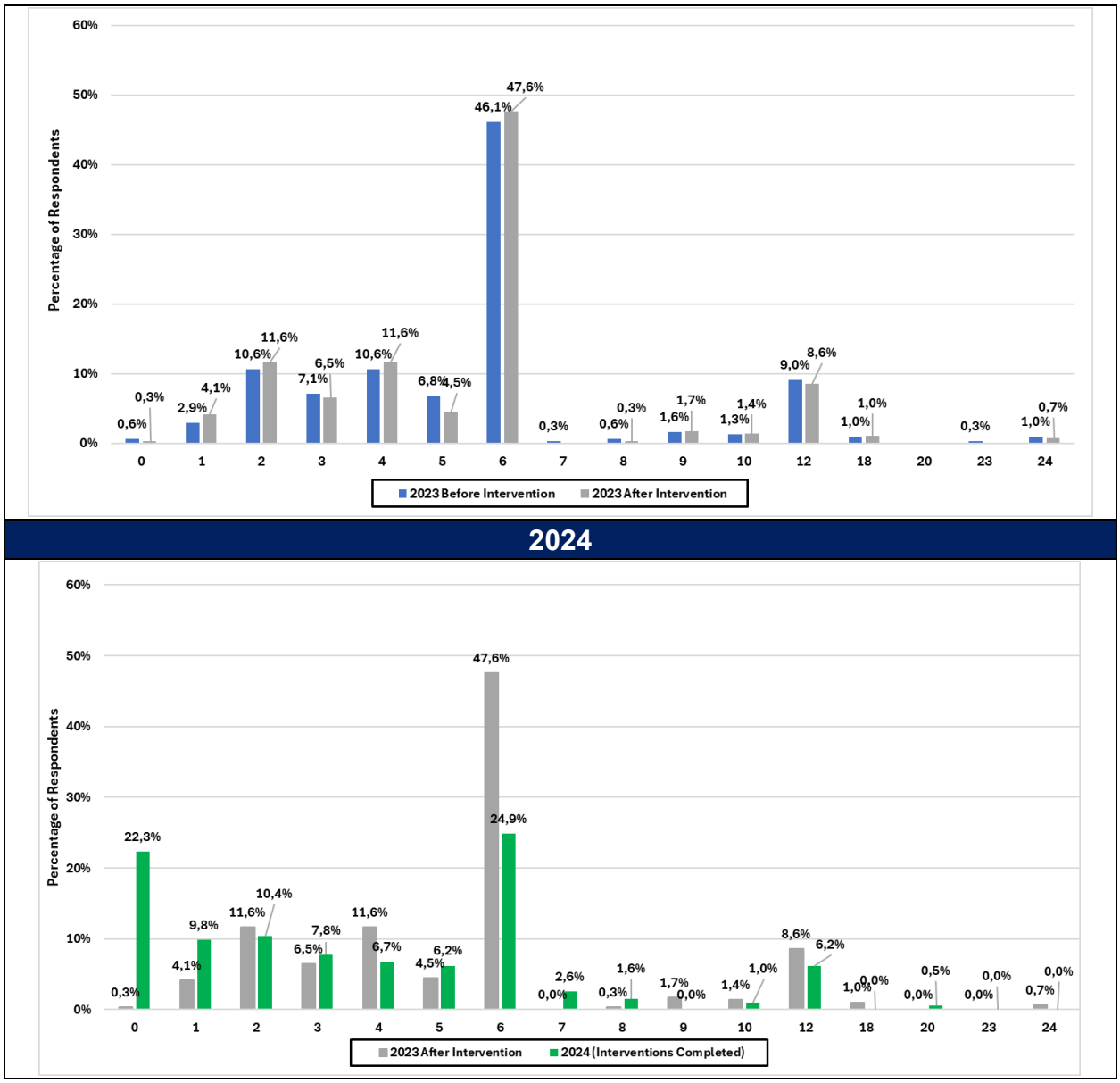


Figure 21 is indicative of the number of candles used by the households per month. During 2023 10.6% and 46.1% of the households utilised 2 and 6 candles before the interventions. The 2024 survey highlight 22.3% households utilised no candles and 24.9% used 6 candles after the interventions were completed. This is a clear indication of a shift from candles to alternative fuels for lighting.

Figure 20: Respondent Households that use Candles in KwaZamokuhle in 2023 and 2024

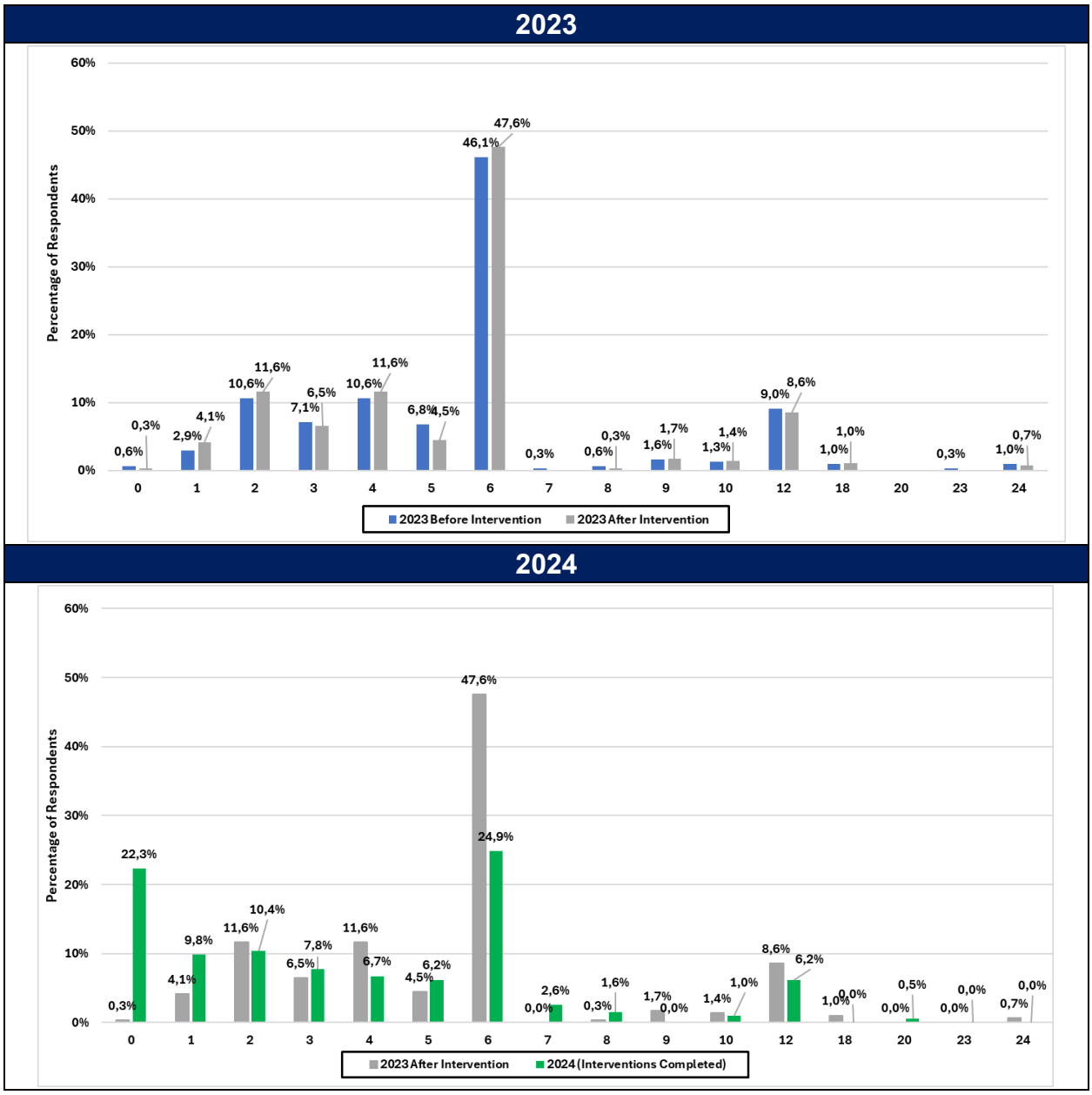
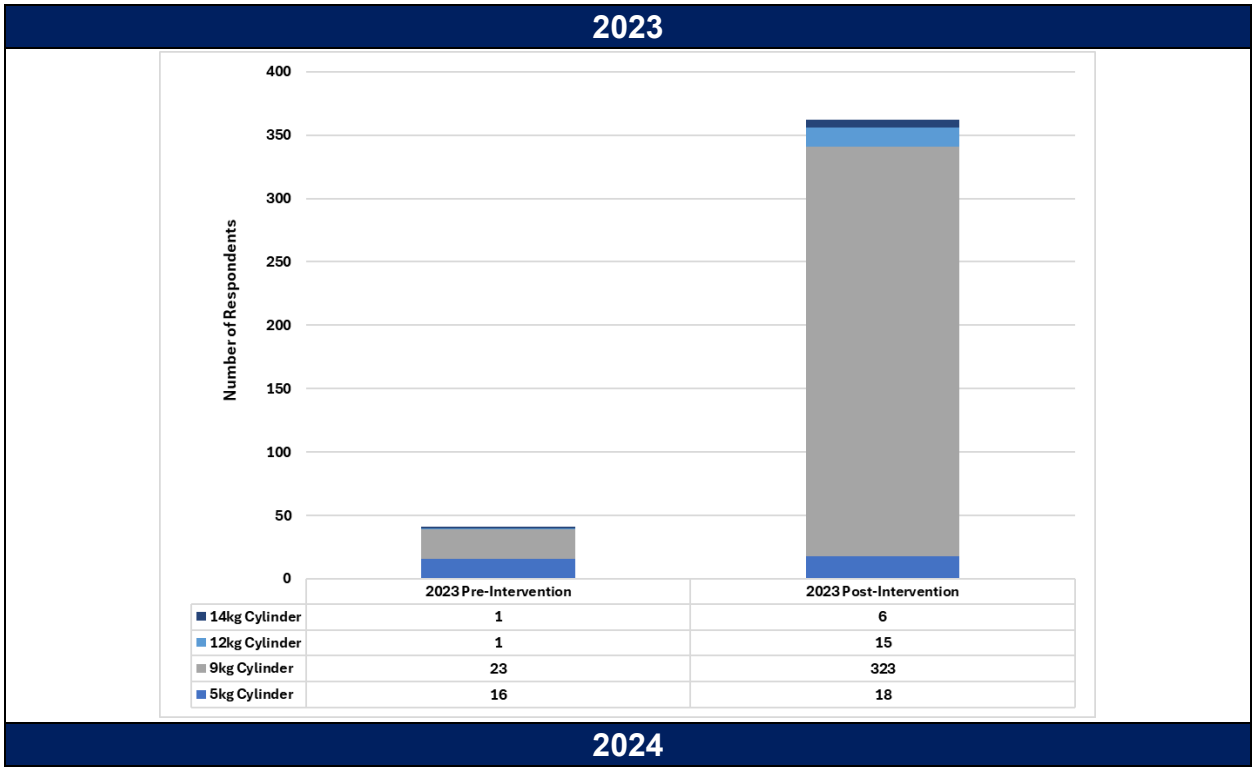


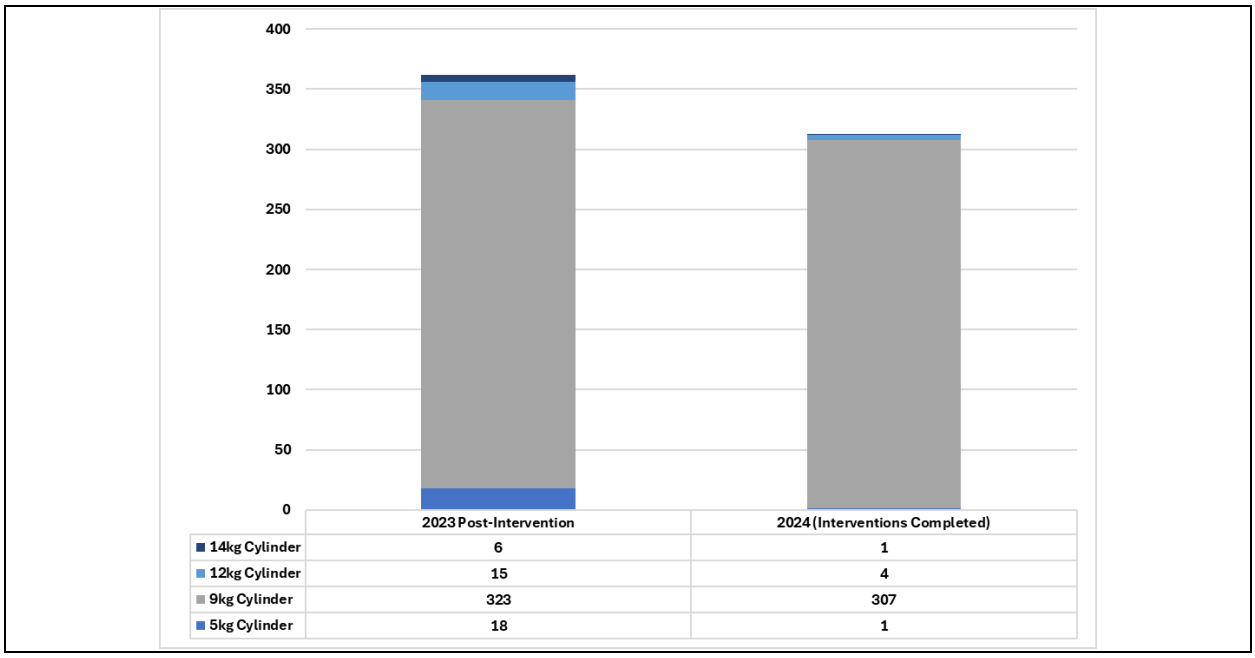
Figure 21: Number of candles used by respondent households in 2023 and 2024

3.1.3.3 Use of LPG

LPG should ordinarily be considered a cleaner transition fuel. However, for low-income houses both perceptions of safety and energy value as well as costs deter more widespread utilisation. As noted by the focus group interviews distribution and last mile delivery present challenges and limits more extensive users. LPG distribution in townships is limited to stores such as hardware and retail service stations or respondents need to travel out to nearby towns to refill cylinders.

From the sampled households, 11% (41) households indicated that they used LPG pre-intervention, and this has increased to 349 (87.7%) post-intervention, with the most popular cylinder being the 9kg cylinder for both periods (23 pre-intervention, 323 post intervention). In the 2024 post intervention study 310 of the 382 households indicated to still be using LPG, with the 9kg cylinder still being the most popular cylinder (





	2023 Post-Intervention	2024 (Interventions Completed)
14kg Cylinder	6	1
12kg Cylinder	15	4
9kg Cylinder	323	307
5kg Cylinder	18	1

Figure 22).

LPG is mostly used for heating (LPG heater) and cooking for the pre-intervention period and would then change with the LPG stove and oven combination being the second most used LPG device after the LPG heater as indicated in

2023

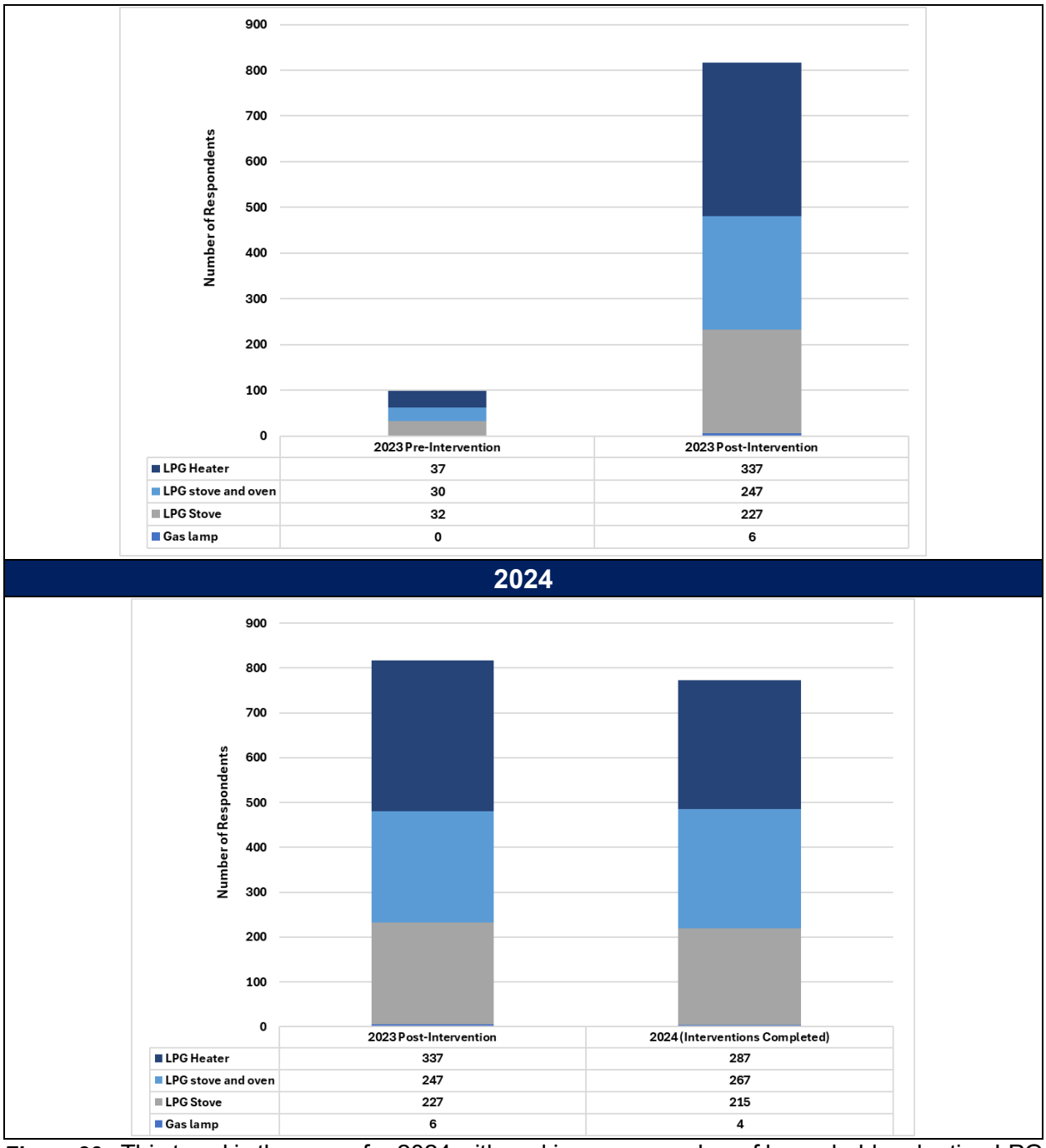


Figure 23. This trend is the same for 2024 with and increase number of households adopting LPG for heating and cooking post interventions.

The continued adoption and use of LPG is dependent on a number of factors including availability, accessibility, last mile delivery, pricing and safety. There are a number of innovative, new modalities for LPG gas sales and use that Eskom may want to pursue. This include interventions such as “pay as you gas” i.e., users can decide exactly how much they would like to spend on gas, whether it be R10 or R100 OR “pay as you use” – users receive a filled gas cylinder and pay for only what they use. This has the potential to develop a whole new LPG distribution and SSME ecosystem.

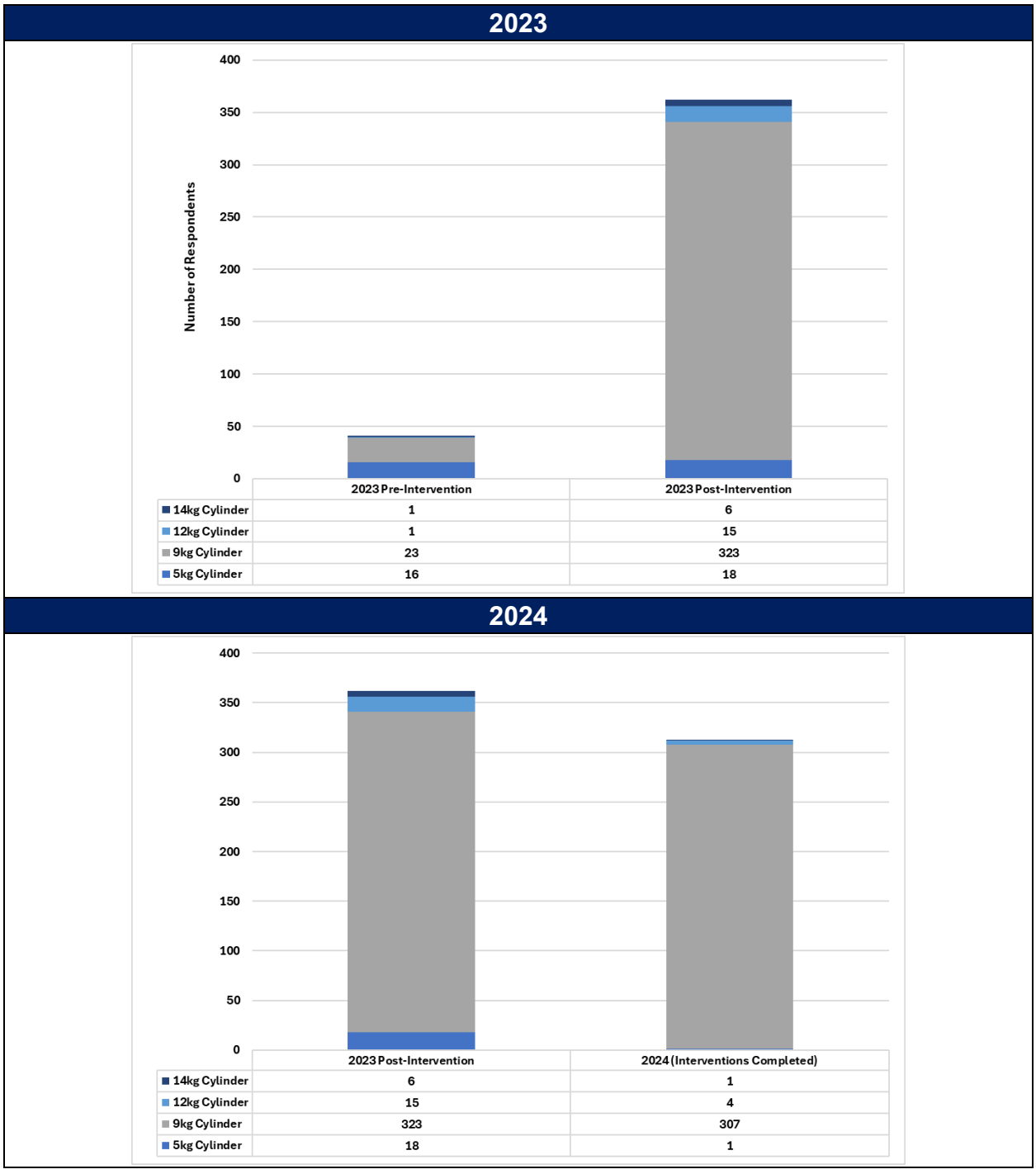


Figure 22: Gas Cylinder use of Respondents in 2023 and 2024.

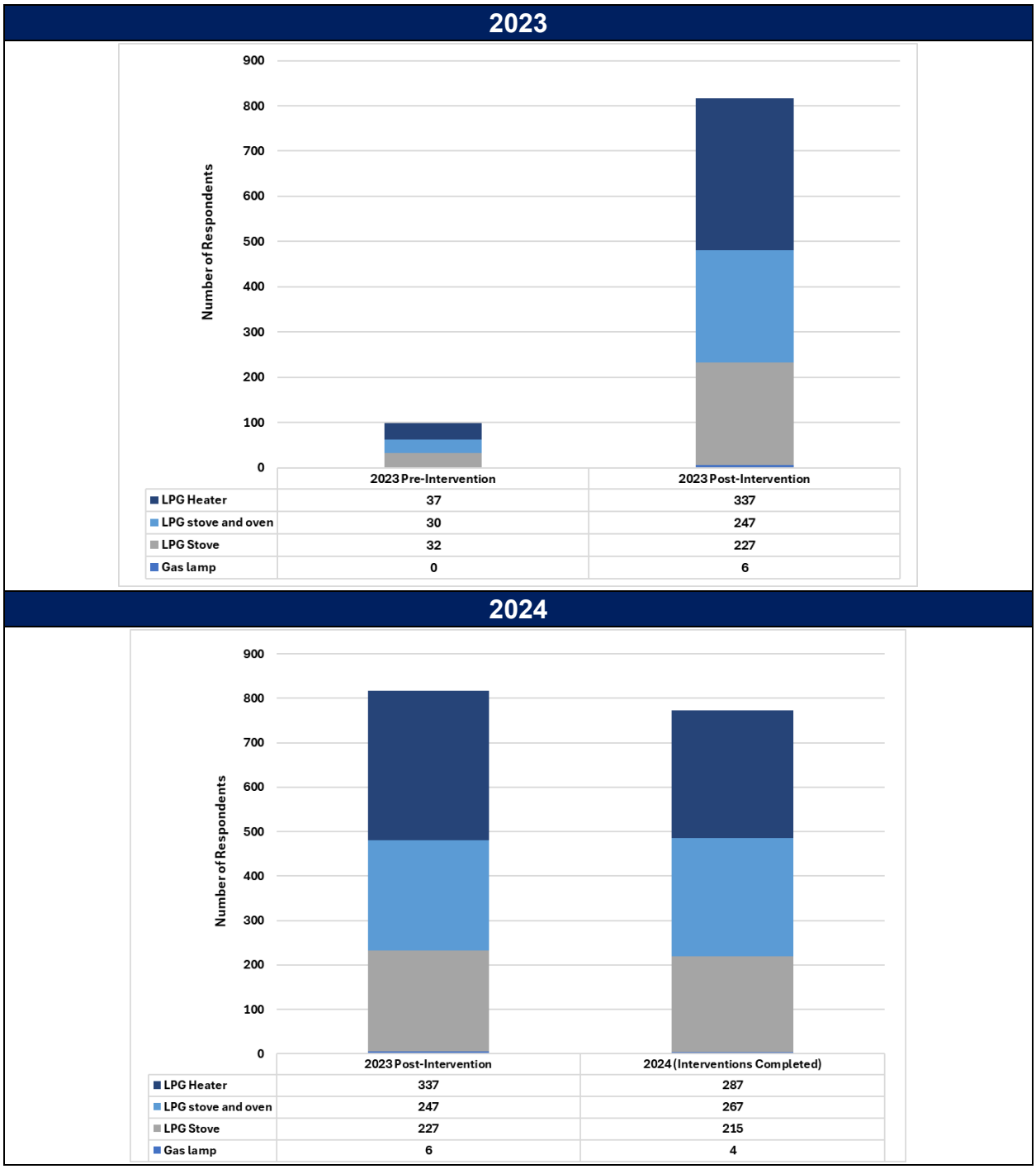
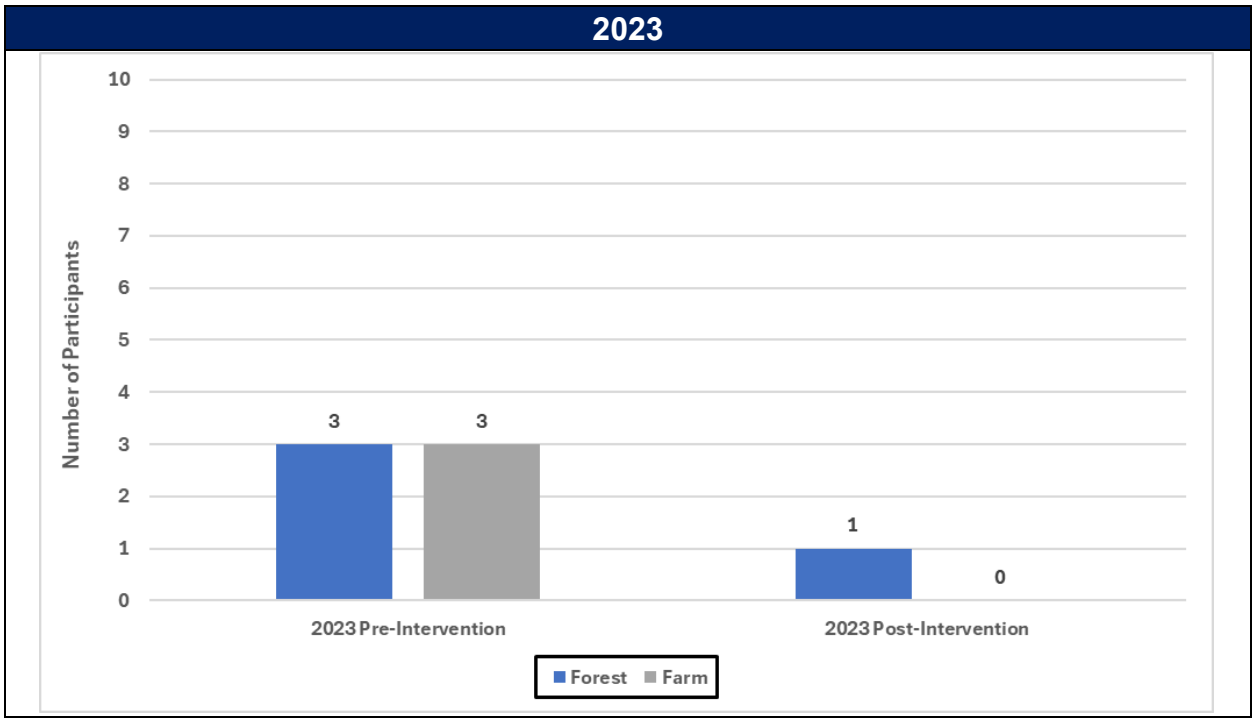


Figure 23: Gas Devices used by Respondents in 2023 and 2024.

3.1.3.4 Firewood

Firewood was more often used than LPG before interventions had been implemented. Firewood is a cheap, easily available fuel source for cooking and heating in KwaZamokuhle, with respondents indicating that they can collect firewood near their households nearby from forests. However, firewood contributes to poor air quality as a result of particulate matter (PM) emissions. Figure 24 indicate that 30.7% of the household's utilised firewood in 2023 pre-interventions. This amount decreased significantly during the post-intervention period of 2024 to 0%.

Figure 25 highlights that 6 and 107 households collected and purchased firewood respectively for the 2023 pre-intervention period. For those that gather their firewood, this is sourced mostly from what respondents refer to as the forest, resulting in deforestation and soil erosion which then compounds atmospheric particulate matter through fugitive dust emissions. The 2024 post-intervention period highlighted a reduction to 10 and 26 households purchasing firewood respectively. This highlights the importance of the LPG intervention and establishment of a reliable LPG source to prevent users regressing to firewood usage.



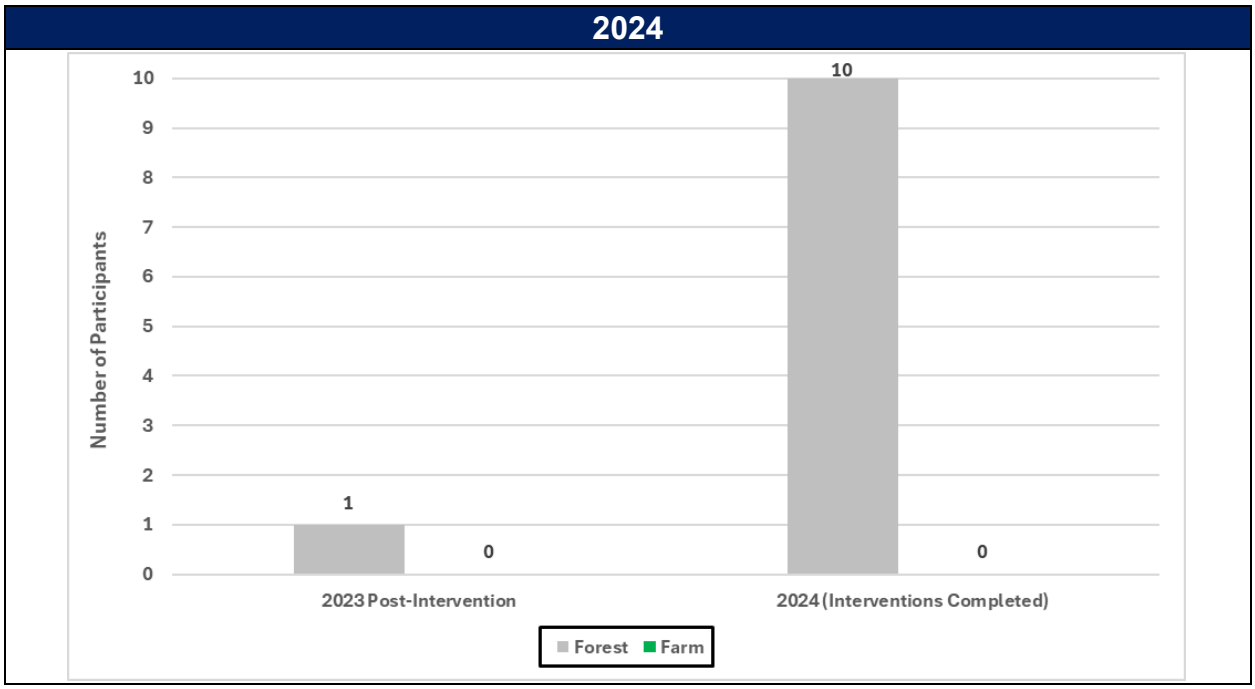
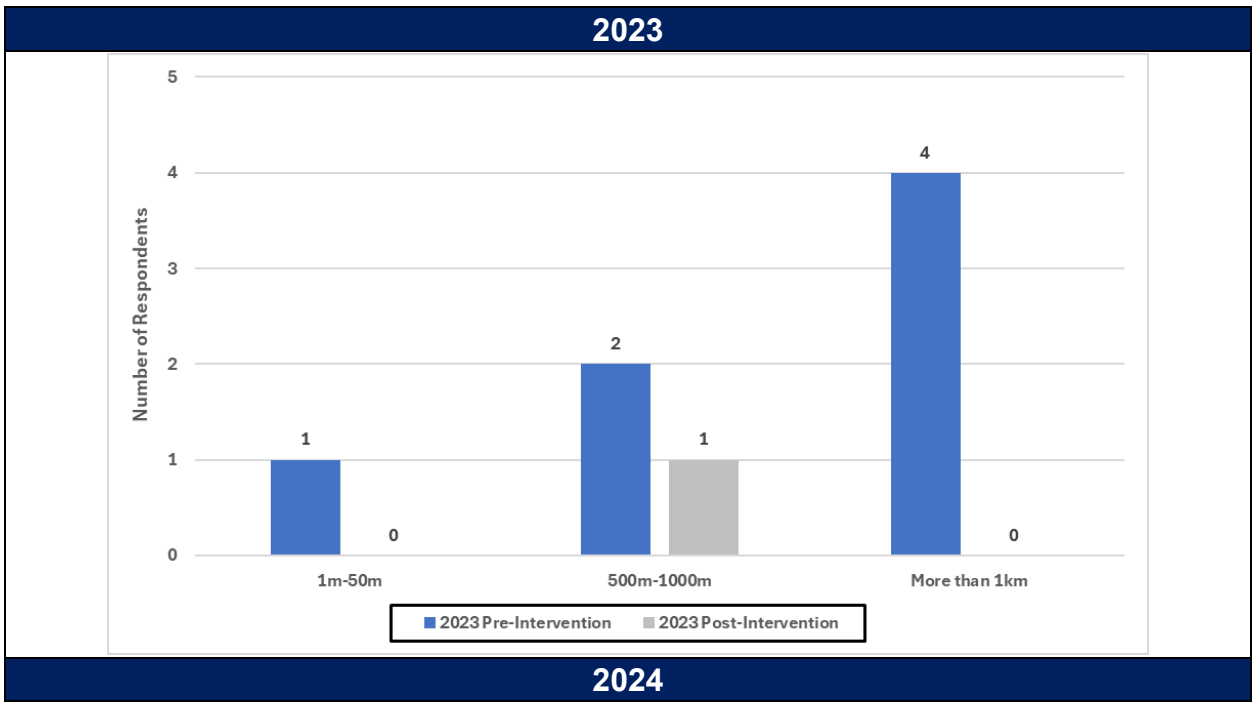


Figure 26 and



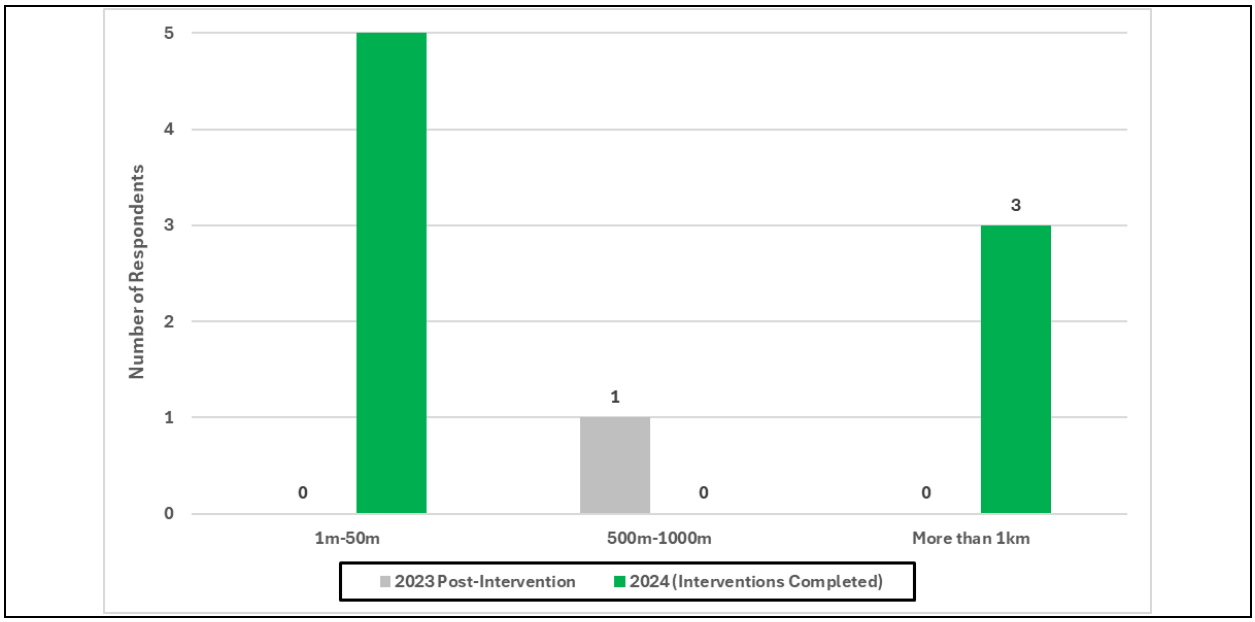


Figure 27 illustrates where the households collect, as well as the distance travelled to collect the firewood respectively for the 2023 pre-intervention period.

Figure 28 is indicative of the cost of firewood purchased with 102 households paying more than R 71.00 for firewood during the 2023 pre-intervention period. The number of households reduced significantly to 26 households paying more the R 71.00 for firewood during the 2024 post-intervention period. Figure 29 highlights the amount of days these purchased bundles of firewood lasted for the pre- and post-intervention periods.

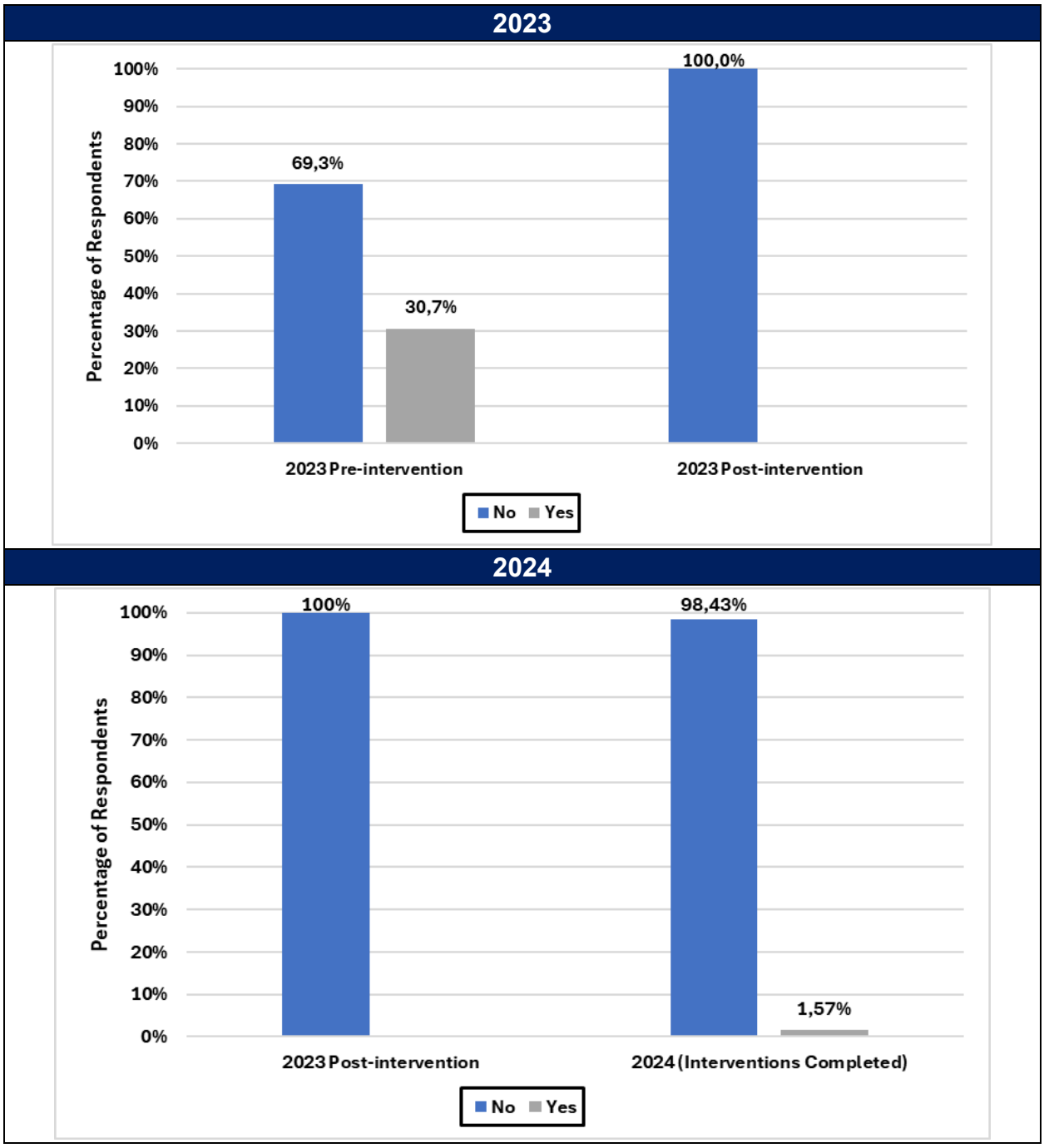


Figure 24: Households that use firewood in KwaZamokuhle in 2023 and 2024

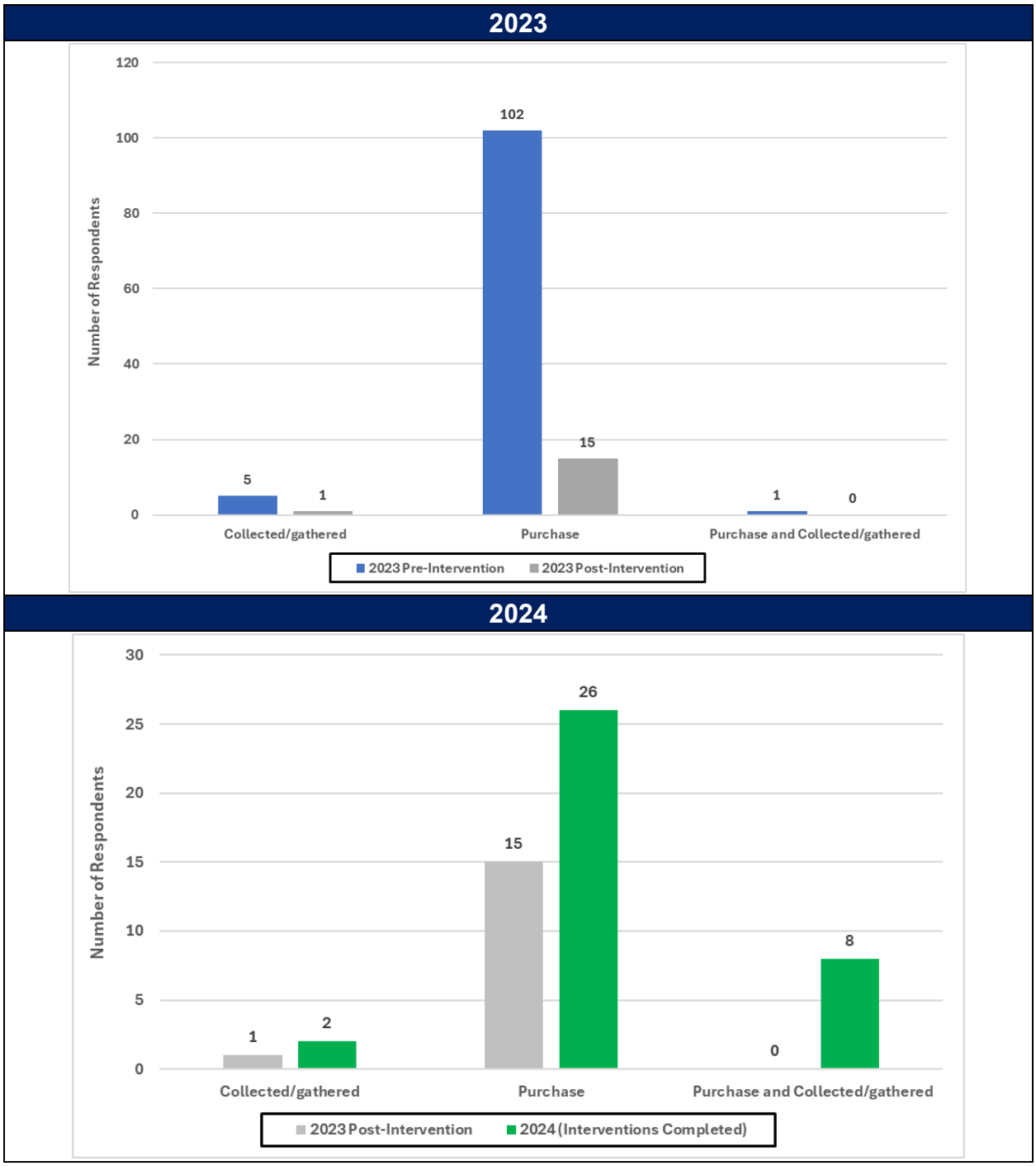


Figure 25: How respondent households obtain firewood in KwaZamokuhle in 2023 and 2024

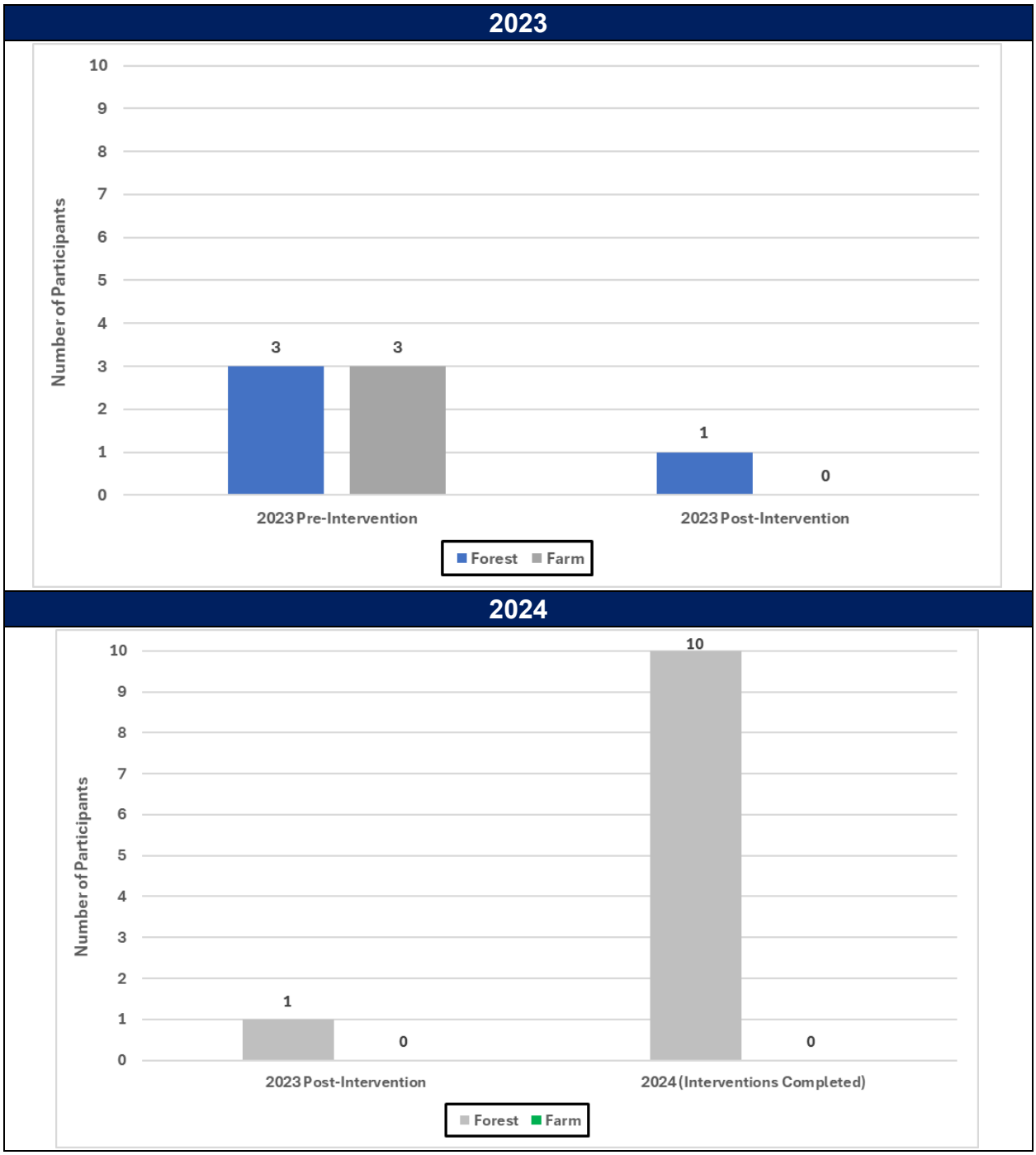


Figure 26: Where respondent households collect firewood in KwaZamokuhle in 2023

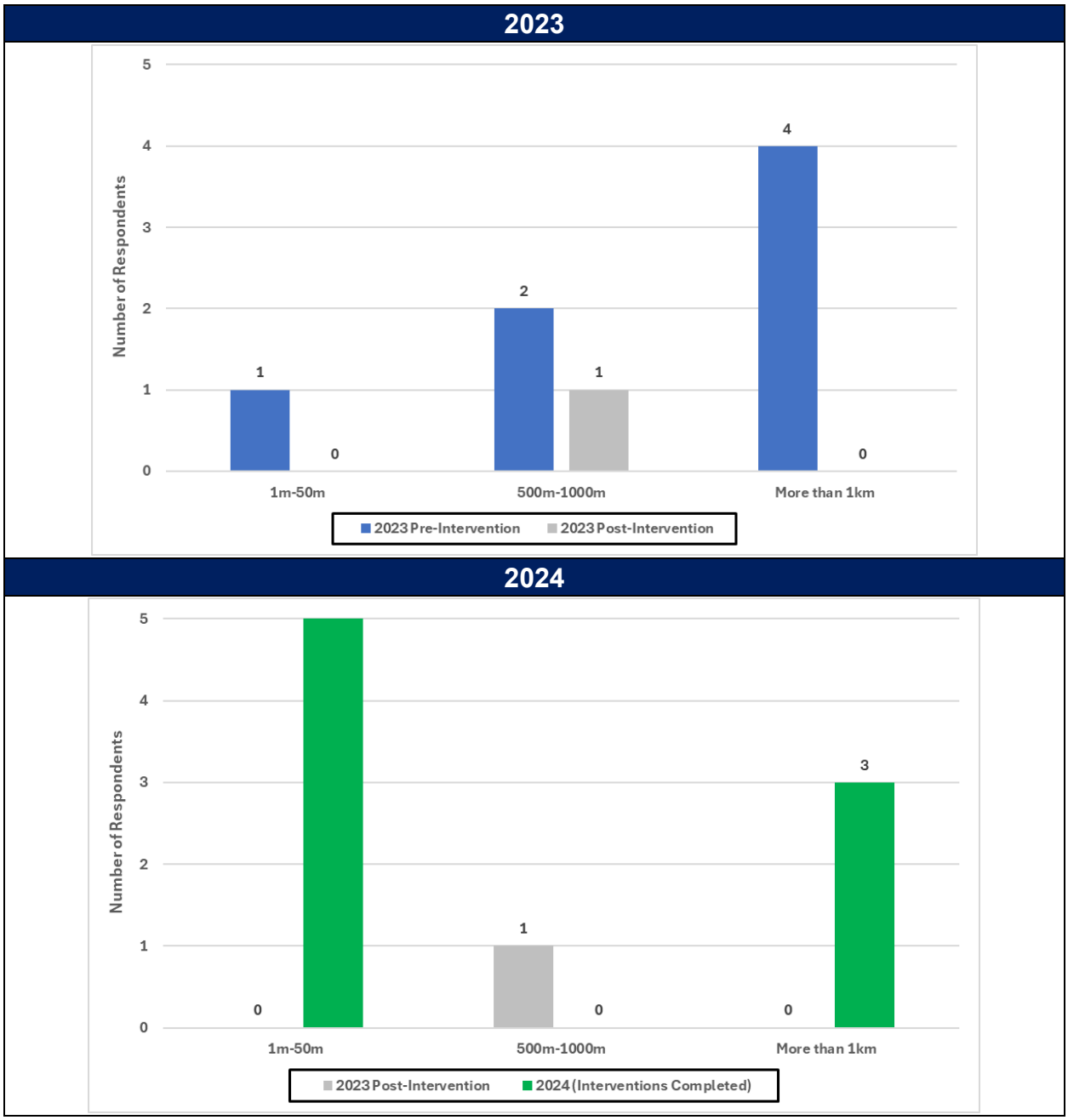


Figure 27: Distance travelled by respondent households to collect firewood in KwaZamokuhle in 2023.

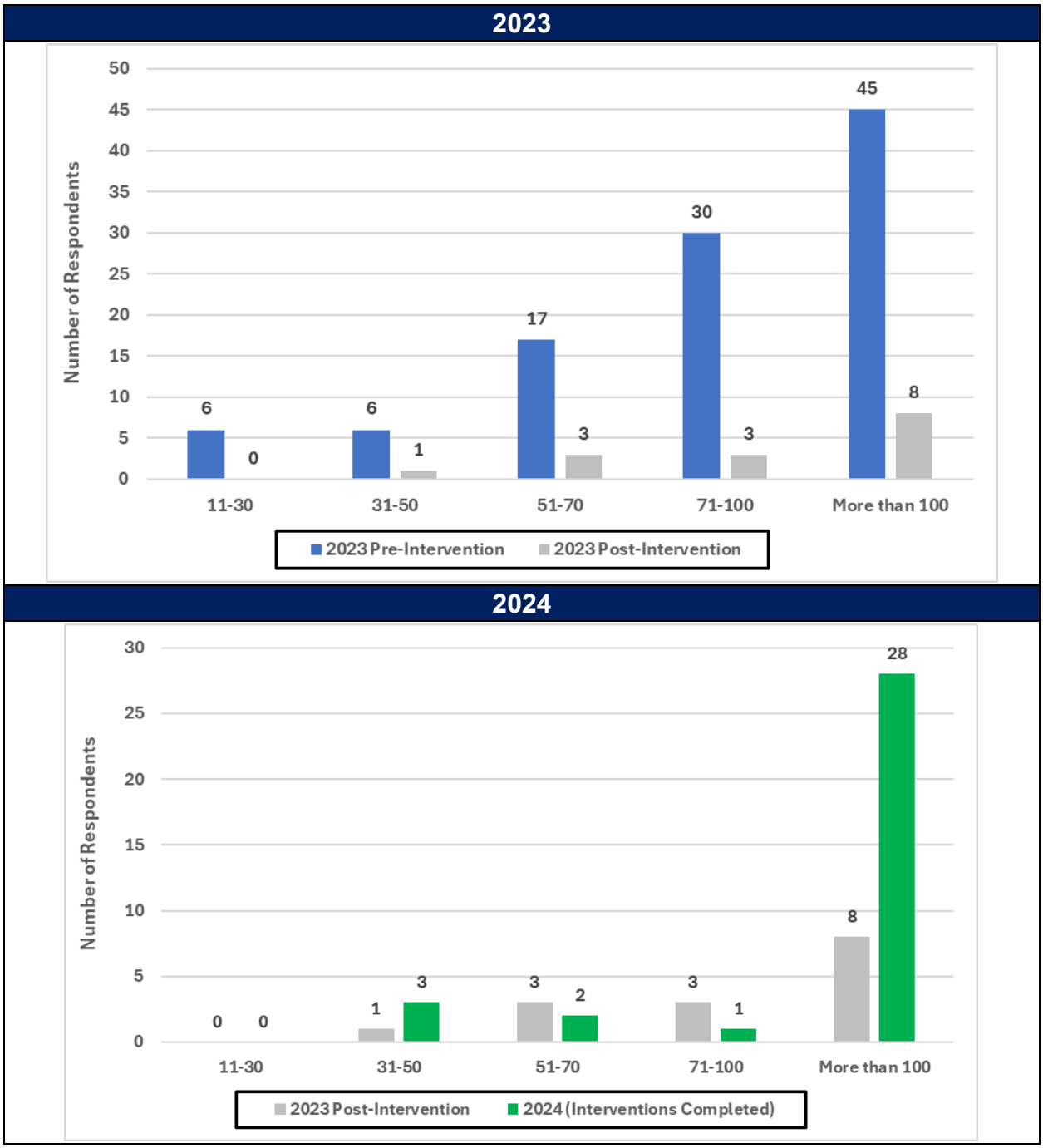


Figure 28: Cost of firewood purchase for respondent households in KwaZamokuhle in 2023 and 2024

Figure 29: Amount of days bundle of purchased firewood lasted for respondent households in KwaZamokuhle in 2023 and 2024.

- *3.1.3.5 Use of charcoal*

Less than 2% (5) of households use charcoal and as a result the data is very limited for the purposes of this analyses **(Figure 30)**. This is probably because coal is more readily available and cheaper than charcoal and households tend to migrate towards coal. For the 2024 post-intervention period an increase is noted to 1.84% of households utilising charcoal.

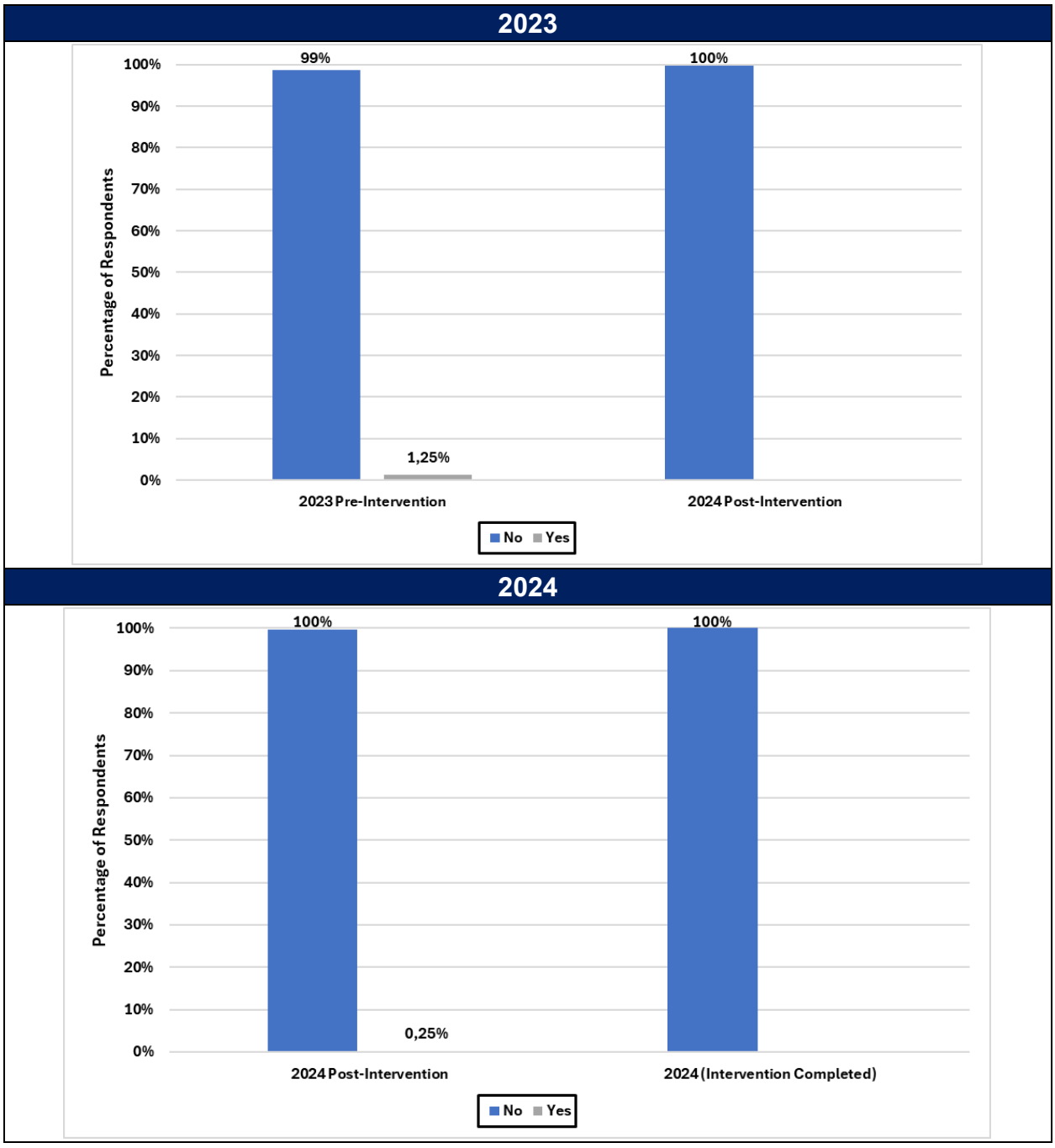


Figure 30: Respondent charcoal use in KwaZamokuhle in 2023 and 2024

- *3.1.3.6 use of coal*

Of all the fuels used by low-income households, coal has probably the highest pollutant emission potential. Coal combustion significantly elevates gaseous pollutant concentrations in indoor air. Coal is a widely used solid fuel for cooking and heating activities in low-income households, whose incomplete combustion in inefficient household stoves releases a range of gaseous and particulate pollutants.

In the KwaZamokuhle 2023 household survey, pre-intervention coal use was 84.8% of the households (Figure 31), and the coal is typically sourced within 50 meters of the dwelling **(Figure 32)**, paying more than R100 **(Figure 33)** for a load of roughly 40 kg and lasting for a month. The 2024 post-intervention dataset highlights a significant reduction of 71.7%. Only 13.1% of the households indicate coal use, whilst the coal is still sourced with 50 meters from the dwelling. The coal supplied to the households is provided by multiple sources and is a reliable source of energy to the households **(Figure 34)**.

It should be noted that even though a large majority of the households made the shift to gas and is less reliant on coal, the coal suppliers are still seen as reliable. Hence, if households were to see LPG as a difficult energy source to acquire and maintain, they can easily regress back to coal as the supply chain would still be reliable to use. Substitution and supply chain efficiencies are important to entrench LPG consumption and to dissuade the regression to coal usage.

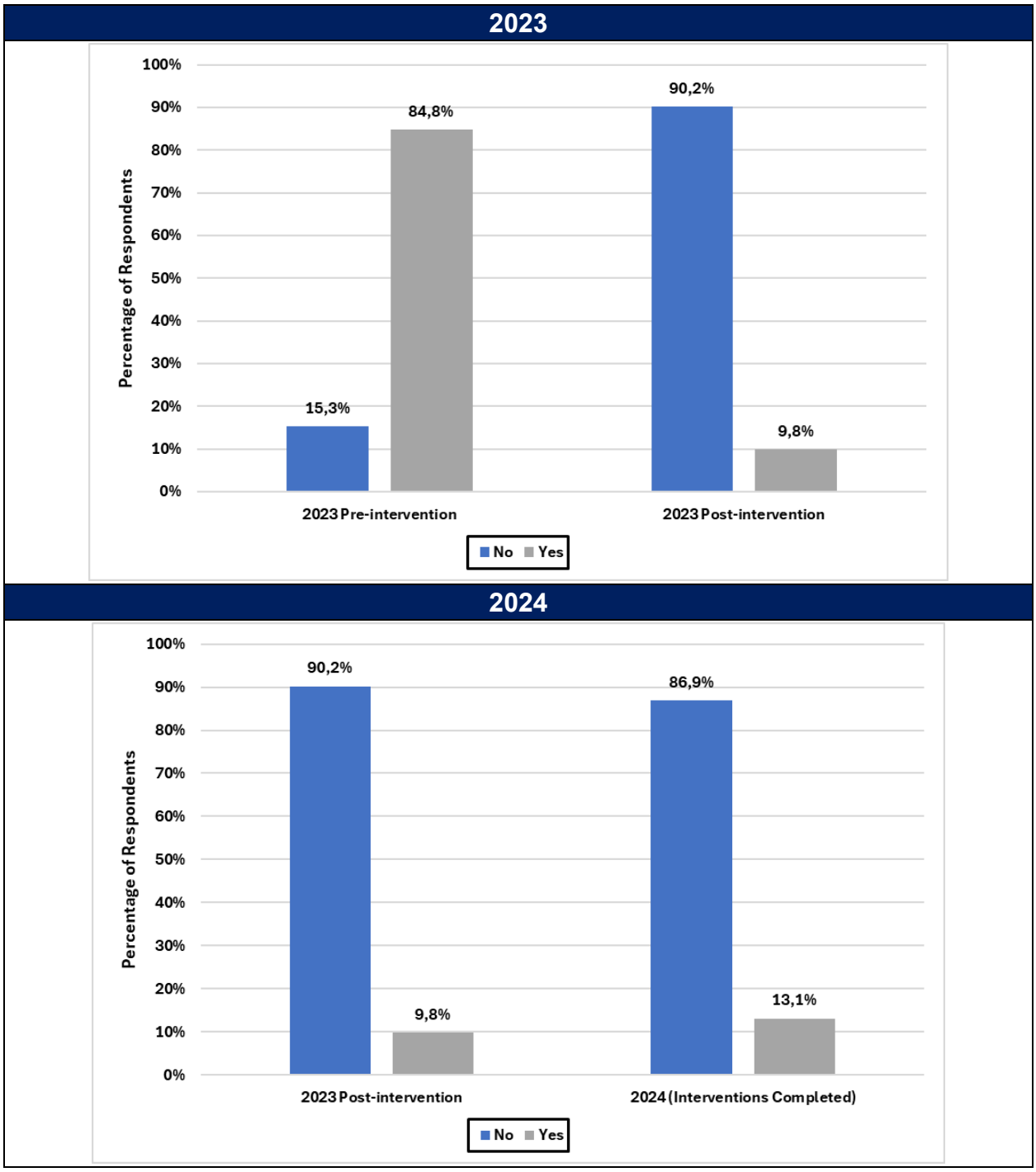


Figure 31: Respondent households using coal in 2023 and 2024

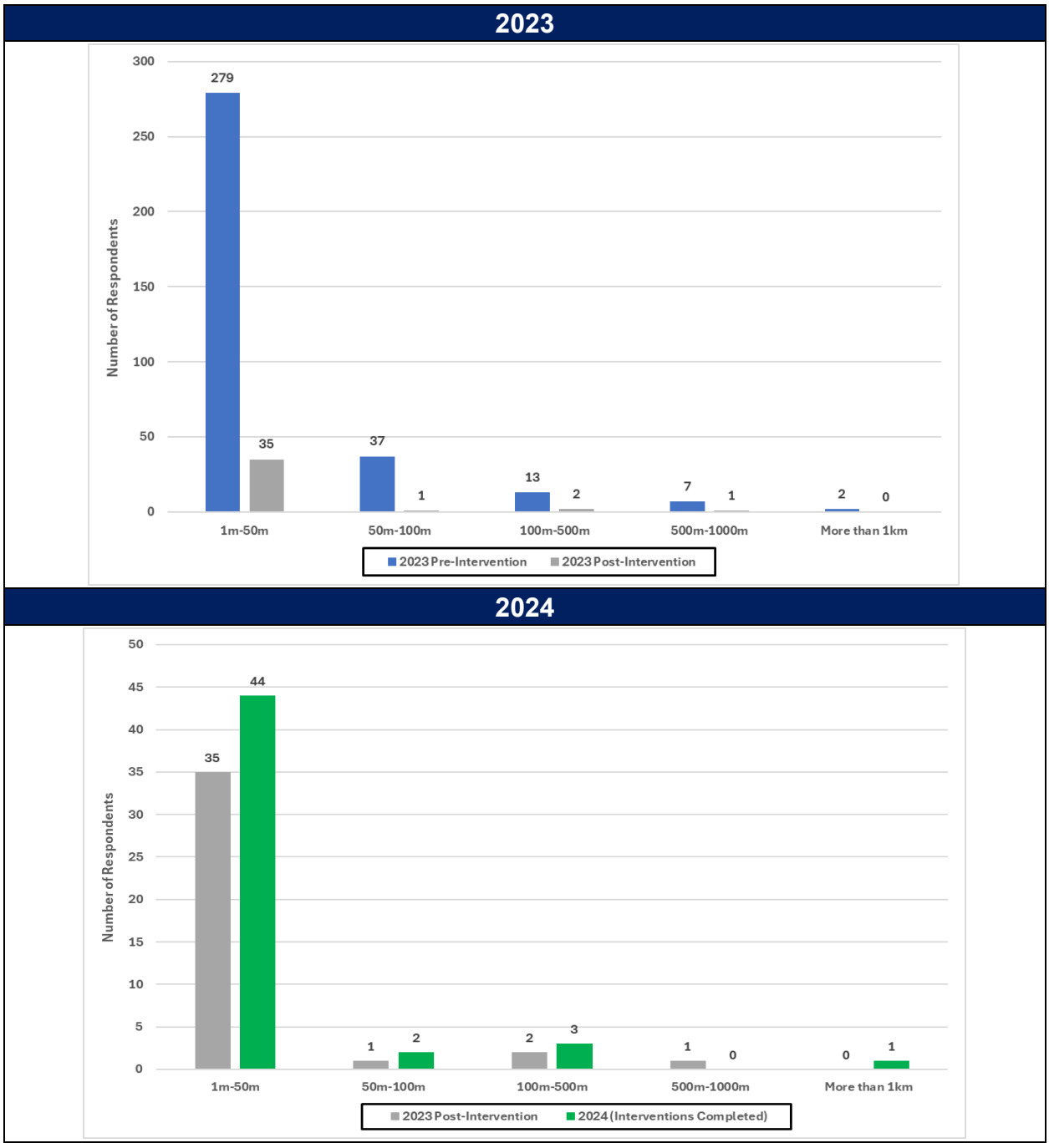


Figure 32: Distance travelled by households to purchase coal in 2023 and 2024.

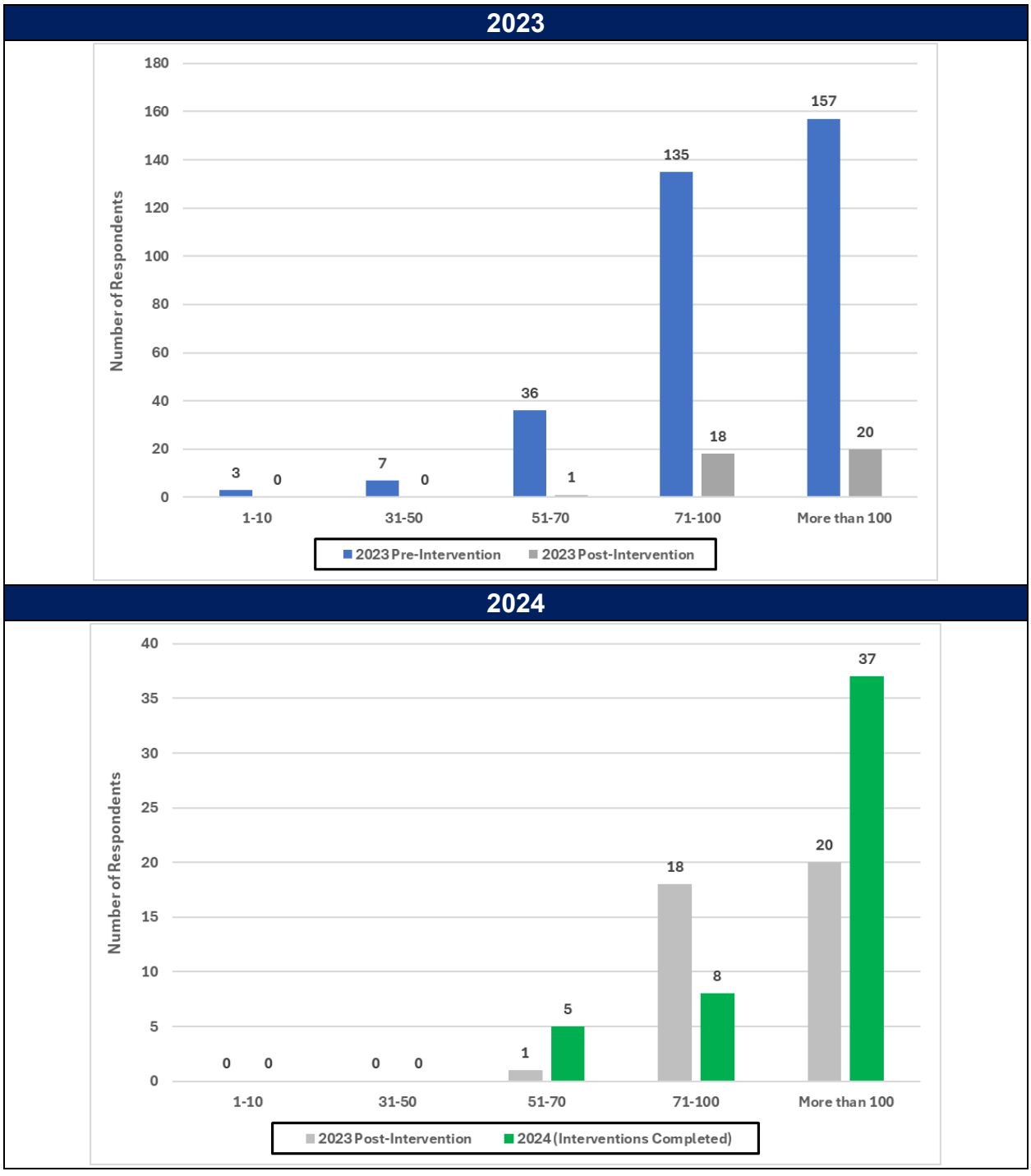


Figure 33: Average cost of coal respondent households pay per month in 2023 and 2024

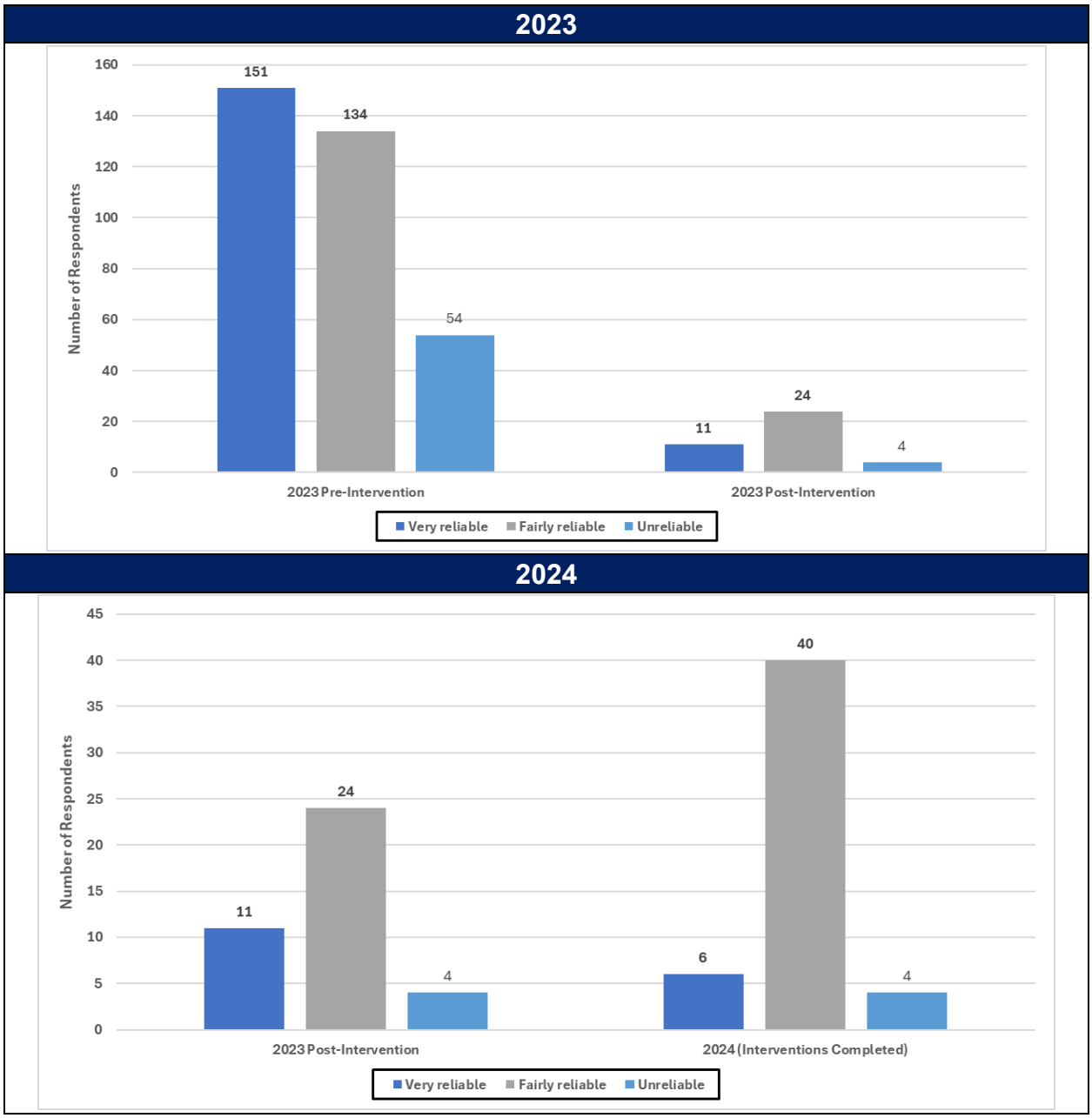


Figure 34: Reliability of respondent household's coal source in 2023 and 2024

- *3.1.3.7 Animal dung*

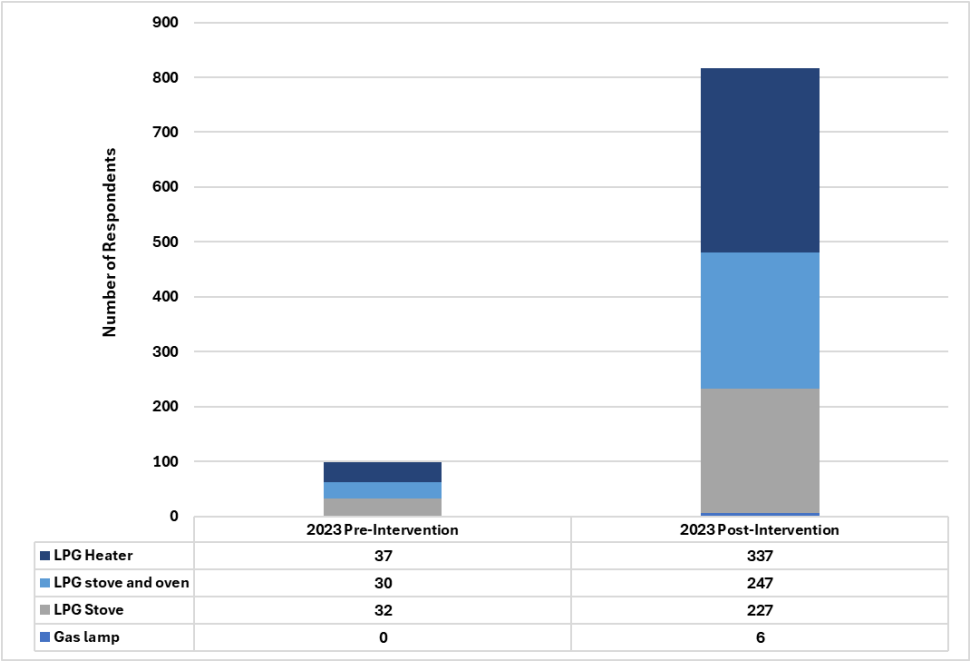
Only one household (0,25%) in KwaZamokuhle reported the use of dung in 2023, making a proper analysis of such a small sample insignificant.

- *3.1.3.8 A comparison of the energy mix across household income levels*

A comparison of the different fuel types used by the respondents across the different income levels for the 2023 pre-intervention and 2024 post-intervention period **(Figure 36)** indicates:

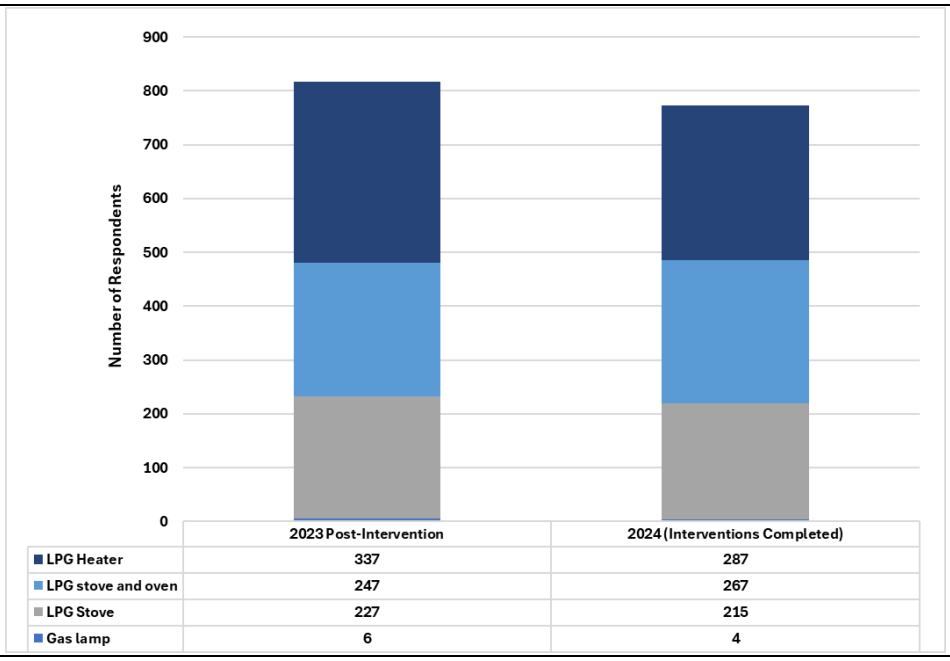
- Electricity is the dominant fuel type; however availability (load-shedding) and utilisation is high with 76% of respondents indicated that they utilise electricity continuously throughout the year (**Figure 16**)
- Candles are utilised across all income levels in terms of load-shedding situations as the preferred lighting solution and stays consistent post-intervention,
- Whilst LPG is utilised in small amounts by the households with a lower income, it seems that there is a large increase in LPG use associated with the households that have a higher income threshold (> R20 000) and in the no income, and R1-R400 income bracket. With the introduction of the interventions in the households, there is a substantial increase in LPG use across the income levels (

2023



	2023 Pre-Intervention	2023 Post-Intervention
LPG Heater	37	337
LPG stove and oven	30	247
LPG Stove	32	227
Gas lamp	0	6

2024



	2023 Post-Intervention	2024 (Interventions Completed)
LPG Heater	337	287
LPG stove and oven	247	267
LPG Stove	227	215
Gas lamp	6	4

- ***Figure 23***).
- The usage of both firewood and coal plays a dominant role as part of the energy mix for the household's pre-intervention, but we observe a significant reduction in use after the interventions have been implemented in the households (**Figure 24 and Figure 31**). Conversely, both animal dung and charcoal play an insignificant role

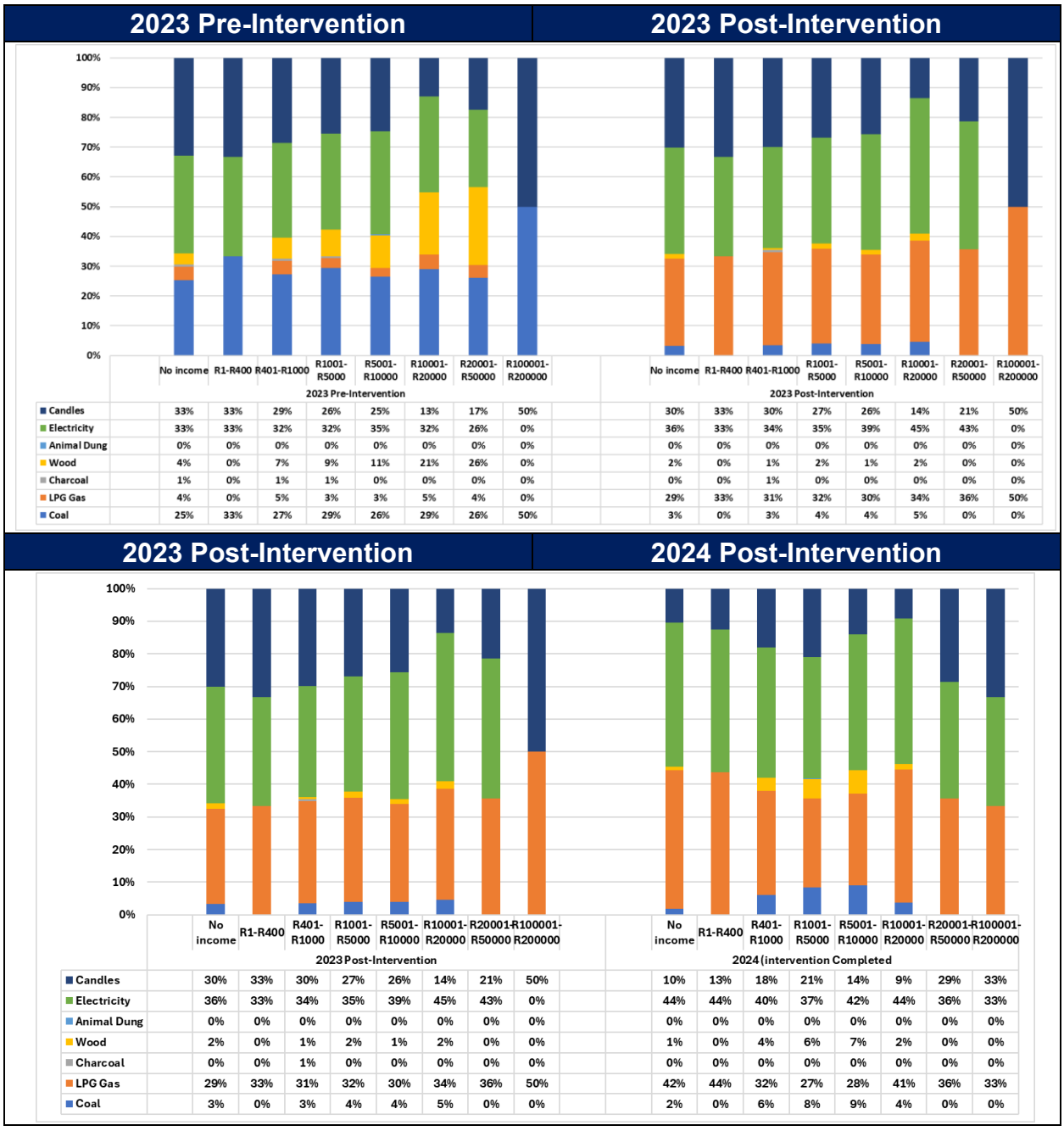


Figure 35: Energy mix across the different household income levels for KwaZamokuhle in 2023 and 2024

3.1.4 COOKING, SPACE HEATING & LIGHTING

Electricity is used predominantly for cooking, heating and lighting (Figure 36 to Figure 38). Figure 36 is indicative of energy use for cooking. **Figure 36** illustrates a 79.8% electricity, 79.8% coal, 26.5% firewood and 55% LPG usage for 2023 pre-interventions. The 2024 survey (after the interventions were completed) indicates a decrease of energy use for cooking to 43.8% for electricity and increase to 45.3% for LPG, whilst a significant reduction of coal and firewood usage to 6.0% and 4.8% respectively. This significant reduction of coal (73.8%) and wood (21.7%) usage for cooking will have a significant contribution towards improving the ambient air quality in the region.

Figure 37 illustrates the energy use for space heating. **Figure 37** illustrates a 31.9% electricity, 48.4% coal, 15% firewood and 4.3% LPG usage for 2023 pre-interventions. The 2024 survey ((after the interventions were completed) indicates a decrease of energy use for space heating to 34.3% for electricity and 46.4% for LPG, whilst a significant reduction of coal and firewood usage 7% and 5.1% respectively. This reduction of coal (40.7%) and wood (10.1%) usage for space heating will add to the improvements of air quality materialised for cooking.

Figure 38 is indicative of energy use for lighting. Figure 13 illustrates a 68.3% electricity and 28.6% candle usage for 2023 pre-interventions. The 2024 survey (after the interventions were completed) indicates an increase of energy use for lighting to 83.3% for electricity and decrease to 13.3% for candle usage respectively. A slight increase in LPG usage for lighting from 1.1% to 2.2% is indicative in 2024.

Also worth mentioning is that more than half the households (68%) use electricity for lighting, supplementing the use of candles as an alternative source of light during 2023. This number increased to 83.3% households utilising candles as an alternative in 2024.

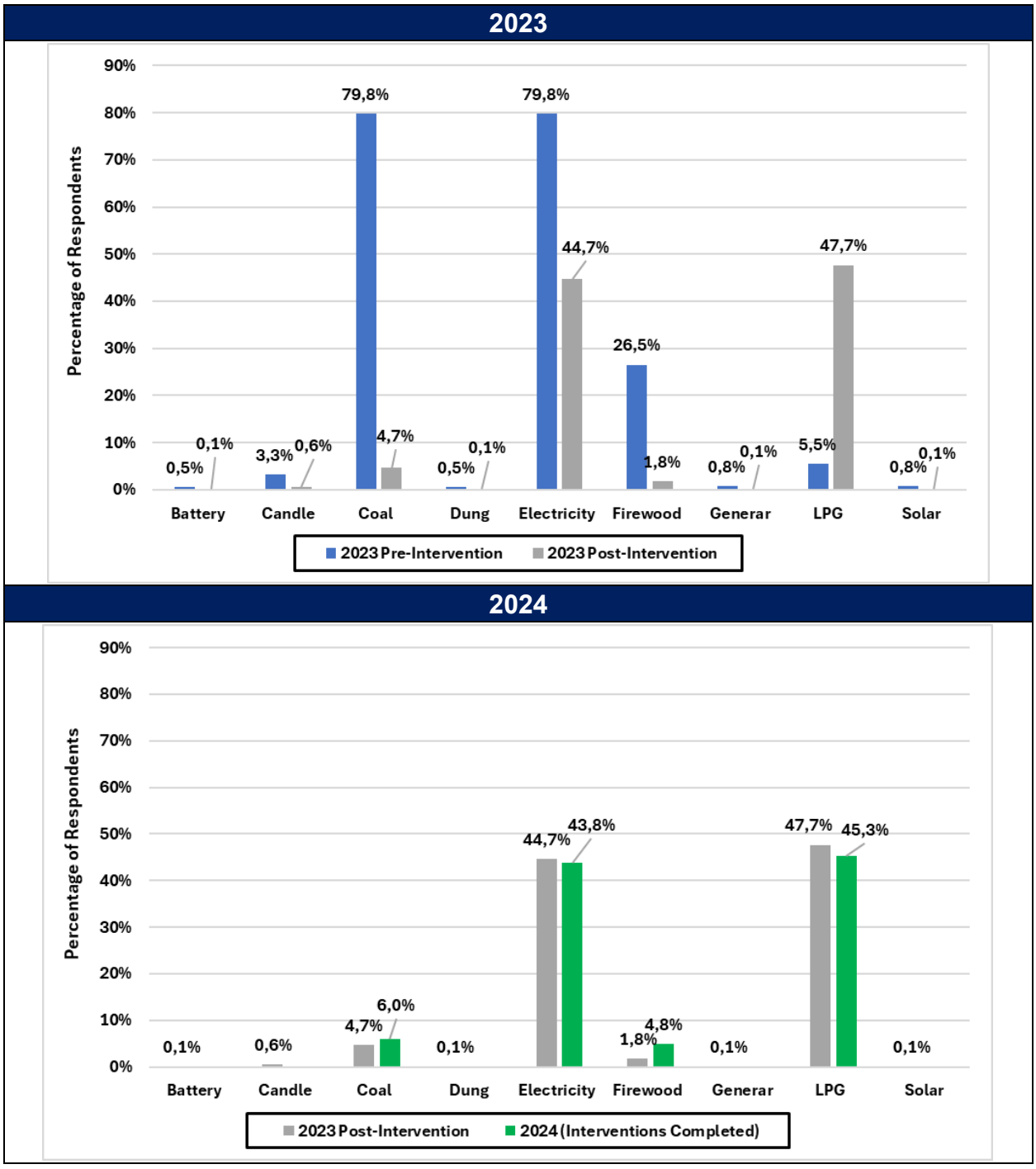


Figure 36: Household energy use for Cooking in 2023 and 2024

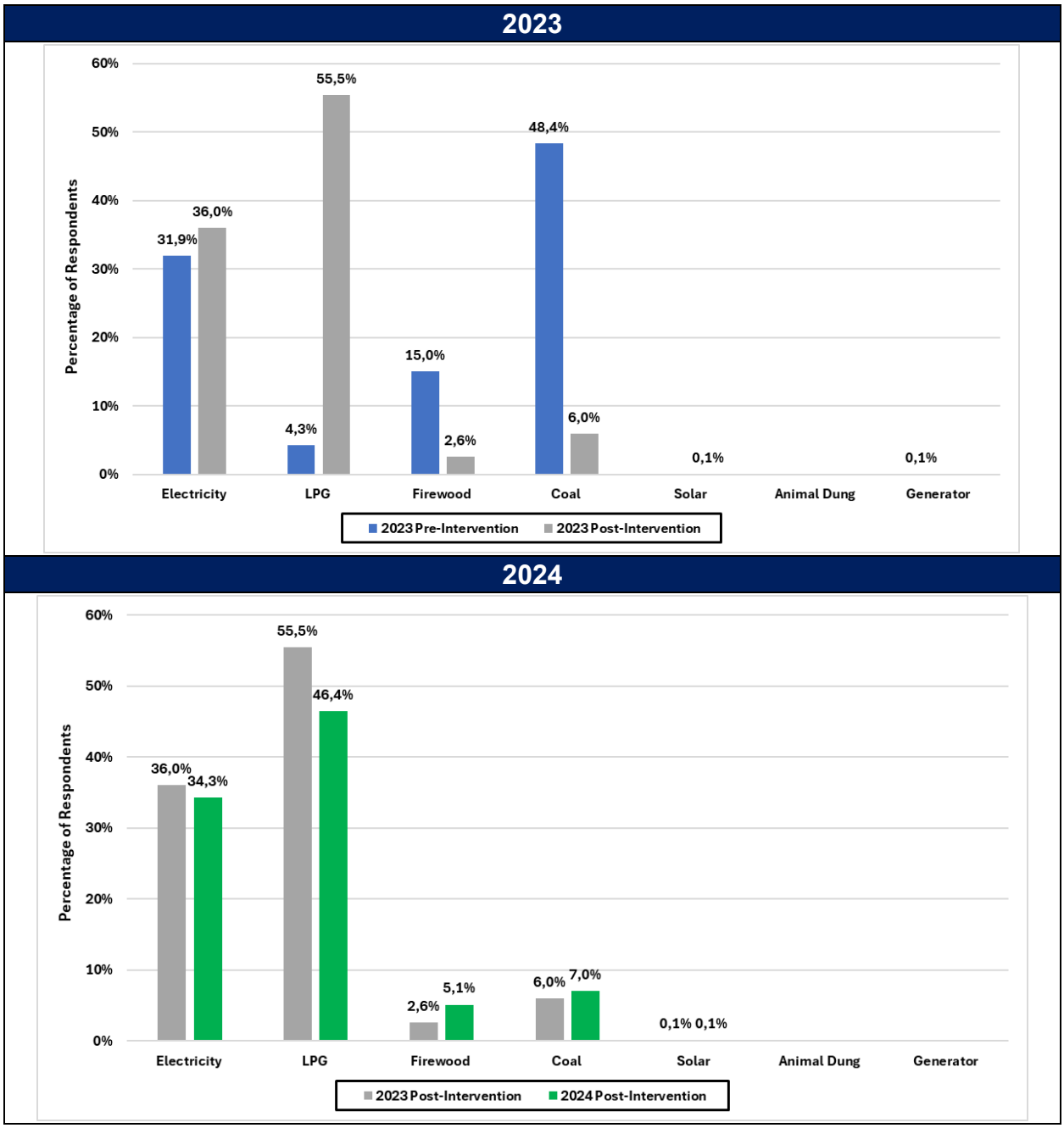


Figure 37: Household energy use for Space Heating in 2023 and 2024

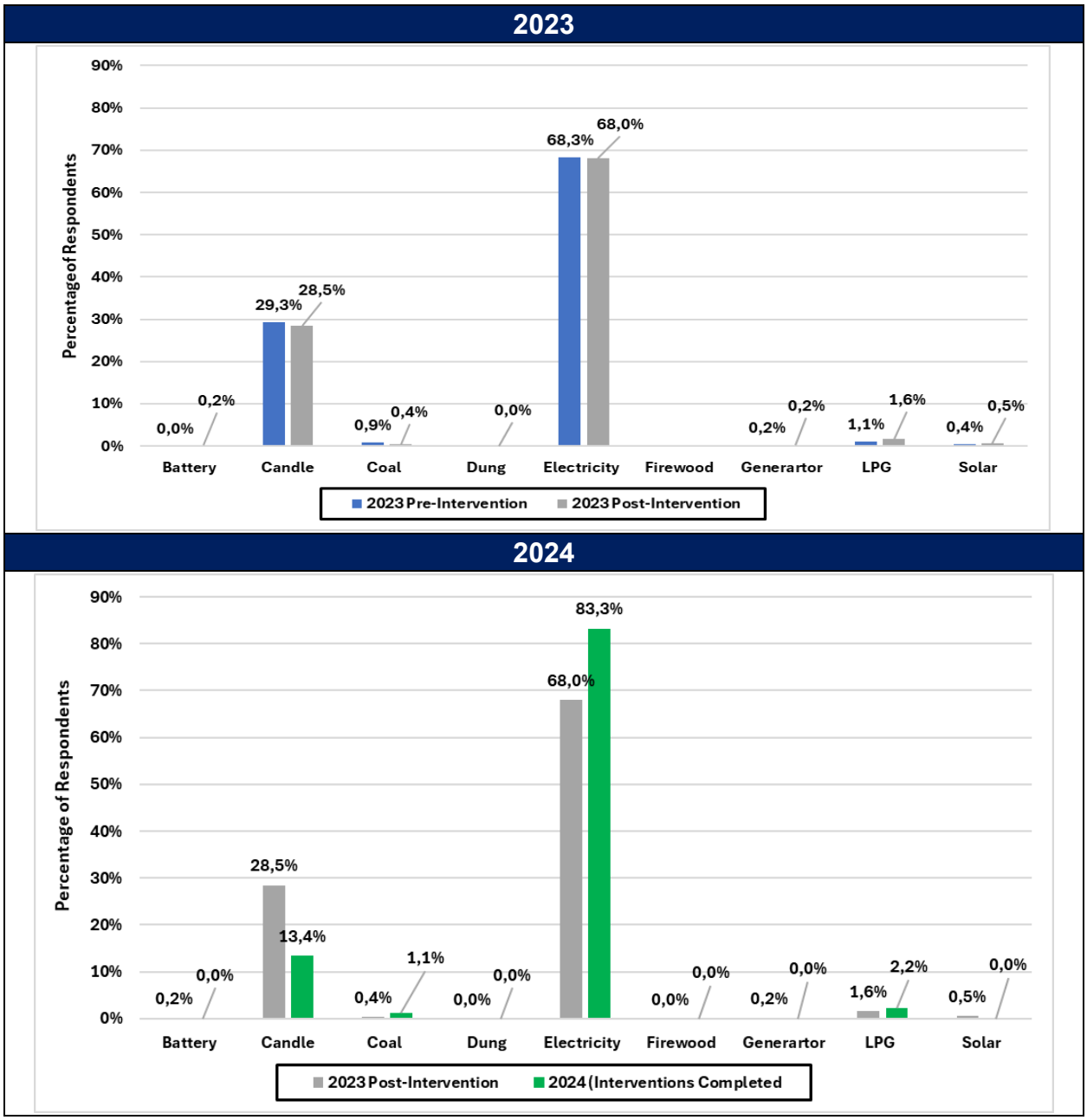
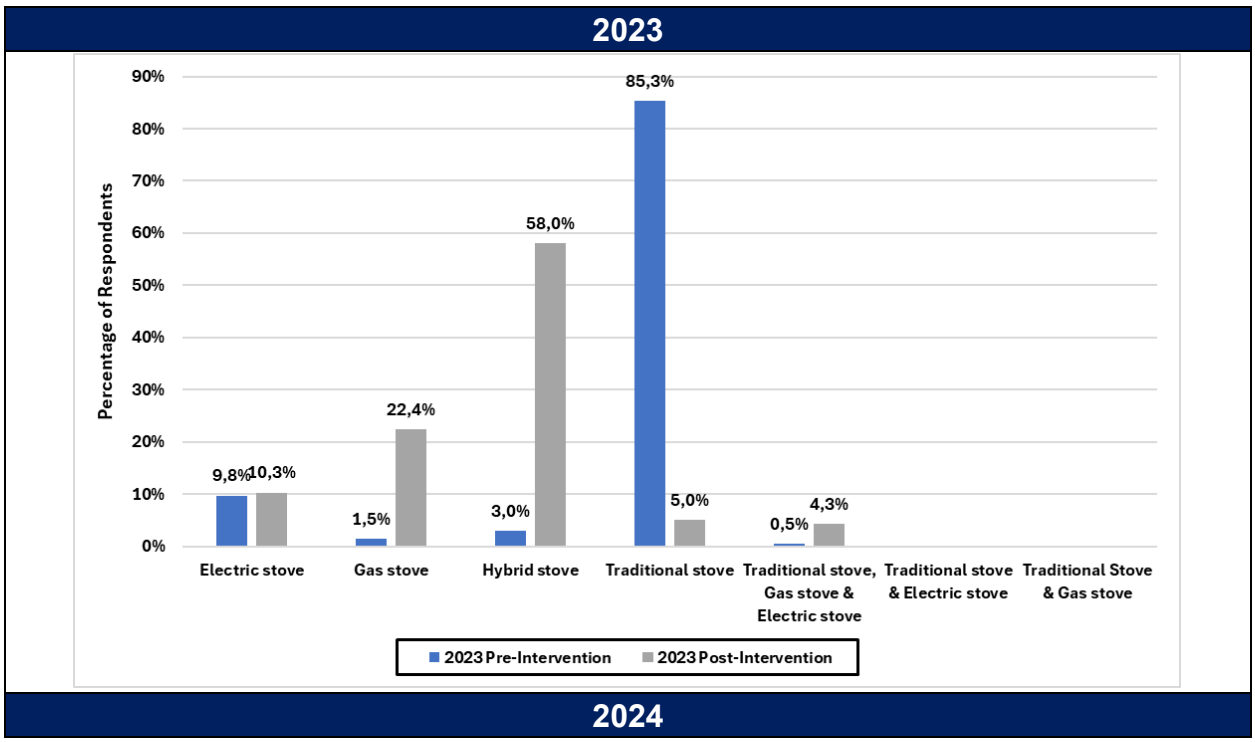


Figure 38: Household energy use for Lighting in 2023 and 2024

Cooking

Use of inefficient cooking appliances increases the risk of gaseous and particulate pollutant emissions and subsequently poor indoor air quality. From the 2023 pre-intervention household survey in KwaZamokuhle, 85.3% of the households used a traditional stove, 9.8% households used an electric stove and 1.5% sued a gas stove (



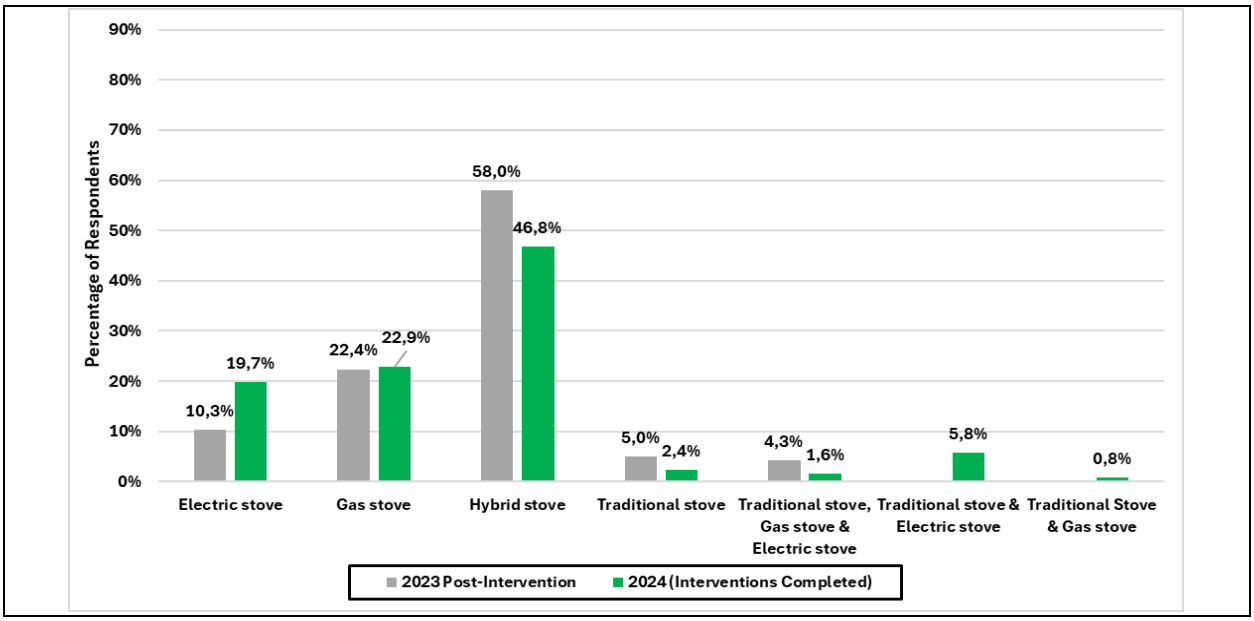
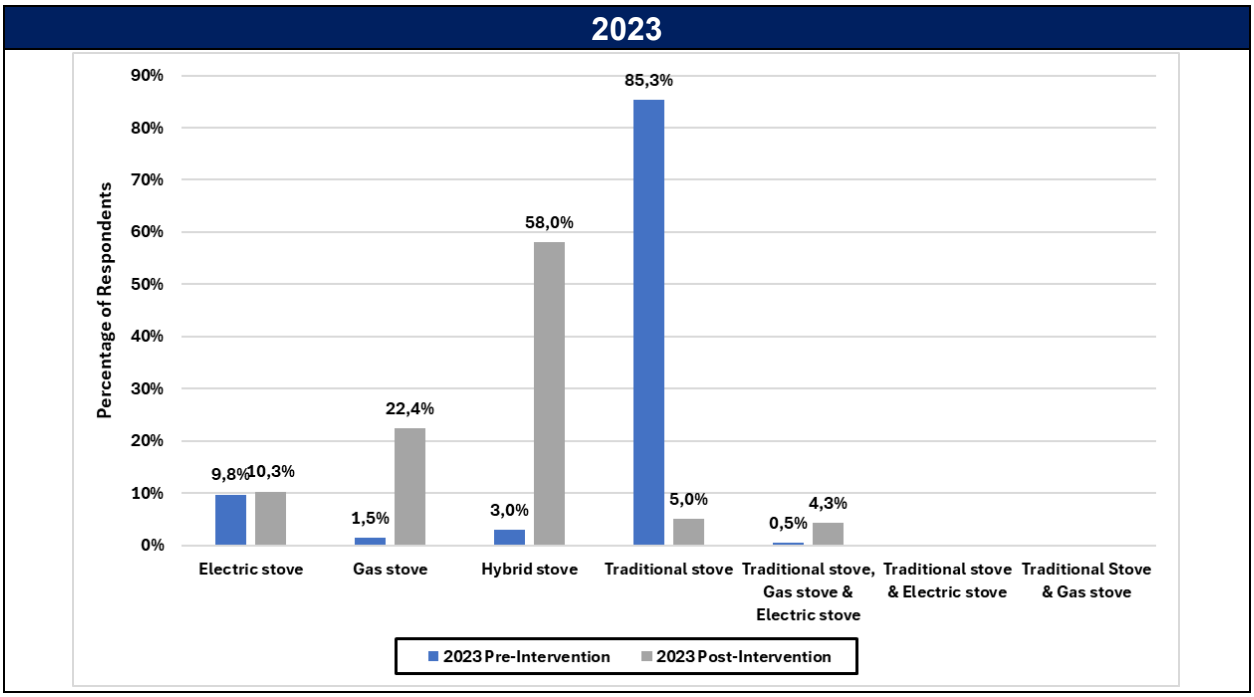


Figure 39). These figures drastically changed after the 2024 offset project interventions, with 22.9% of households utilising a gas stove from 1.5%; 3.0% of households utilizing the hybrid stove to 46.6% of household utilising a hybrid stove in 2024, and only 2.4% still using a traditional stove (



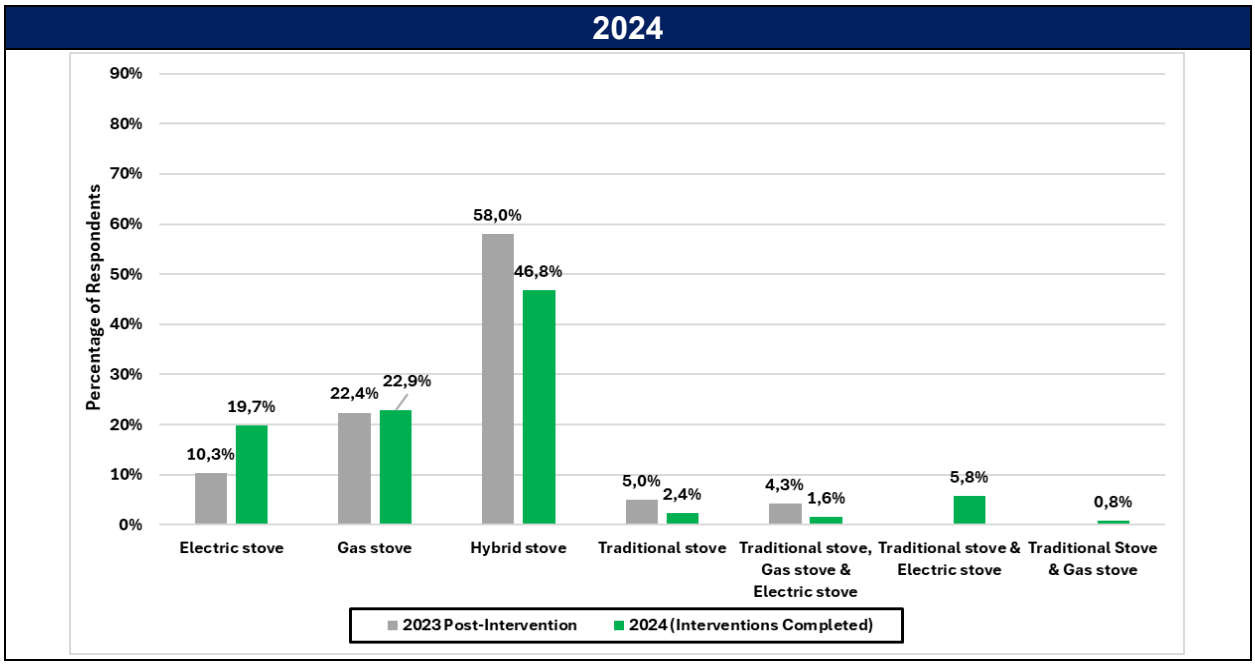


Figure 39). Most homes have only one window in the cooking area using predominantly either electricity, coal or firewood. With poor ventilation, exposure to indoor air pollution is exacerbated.

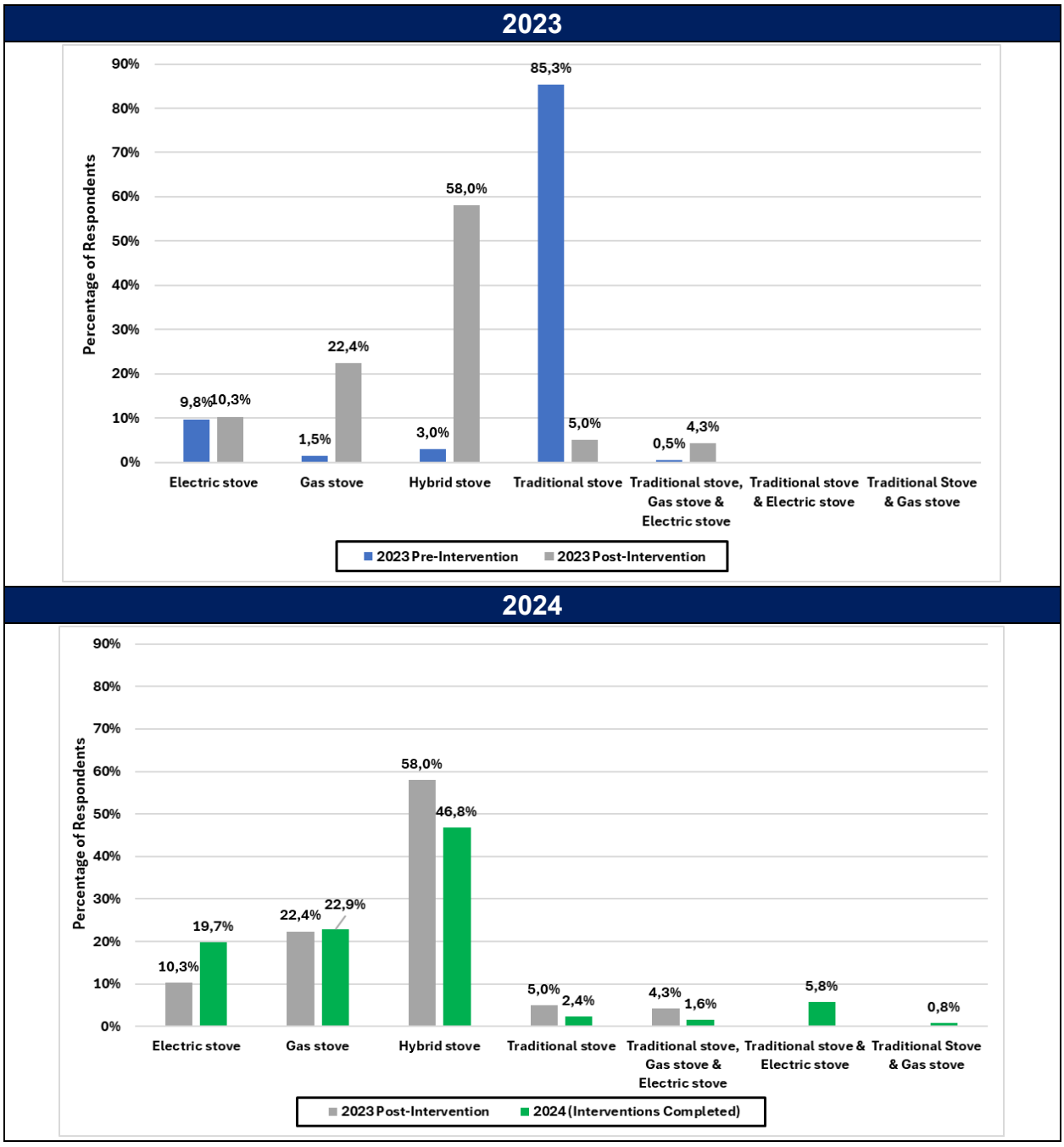


Figure 39: Stove Tyes Used by Respondents to Cook in 2023 and 2024

3.1.5 QUALITY OF LIFE

The household survey also determined the quality of life in the affected community in KwaZamokuhle. We utilised the conceptual framework of "*Fundamental human needs and human-scale development*" (Figure 41) to qualitatively determine the quality of life for the households at KwaZamokuhle. In this system, there is no hierarchy of needs (apart from the basic need for subsistence or survival) as postulated by Western psychologists such as Maslow, rather, simultaneity, complementarity and trade-offs are features of the process of needs satisfaction. Manfred Max-Neef and his colleagues developed a taxonomy of human needs and a process by which communities can identify their "wealth's" and "poverties" according to how their fundamental human needs are satisfied. The following metrics of health, well-being, education, standard of living, safety and security and air quality was utilised herein.

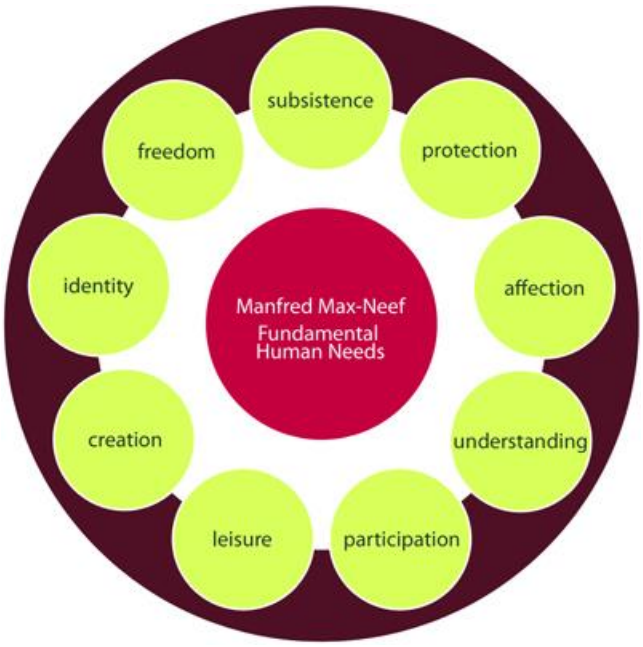
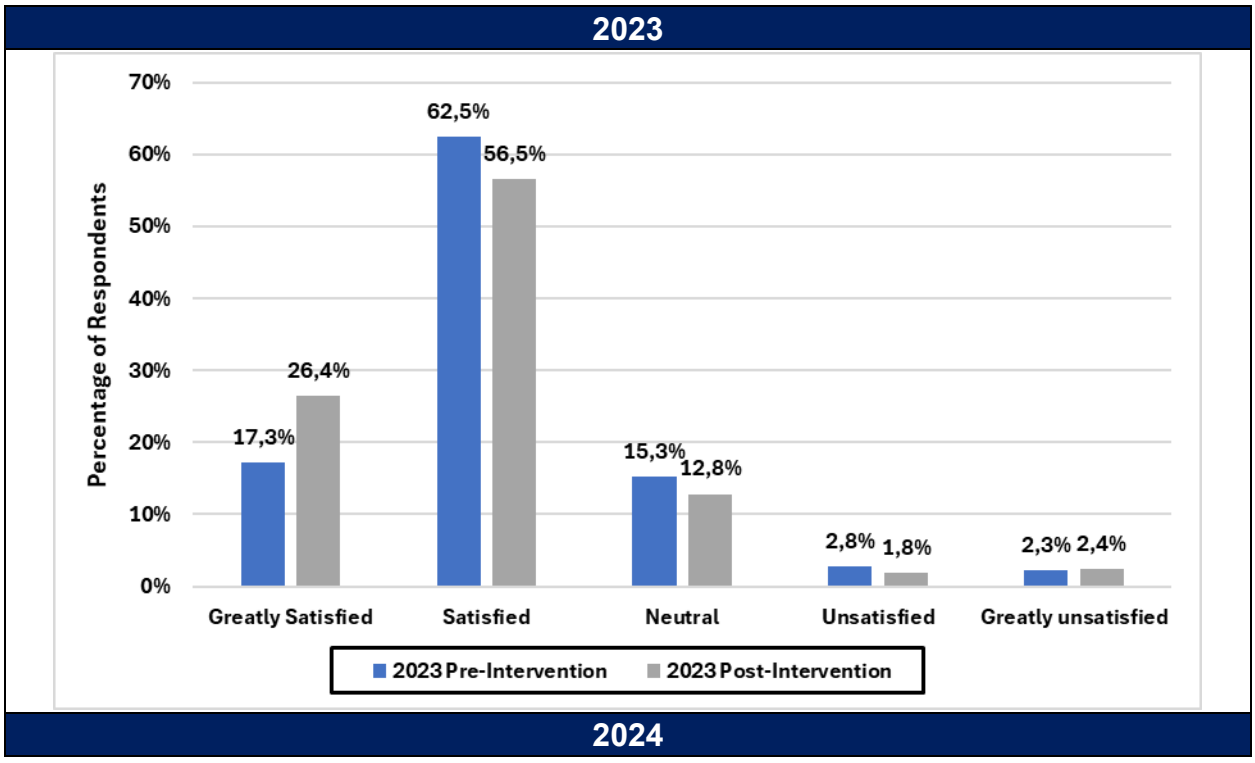


Figure 40: Manfred Max-Neef Fundamental Human Needs

3.1.5.1 HEALTH

One of the key challenges noted in the sustainable development goals for good health and wellbeing (SDGs 3) is both ambient and household air pollution. Household solid fuel combustion represents one of the biggest threats to human health in South Africa. In the 2023 pre-intervention survey for KwaZamokuhle, 79.8% of the respondents indicated an overall satisfaction with their overall health, only 5.1% felt dissatisfied, whilst 15.3% remained neutral (



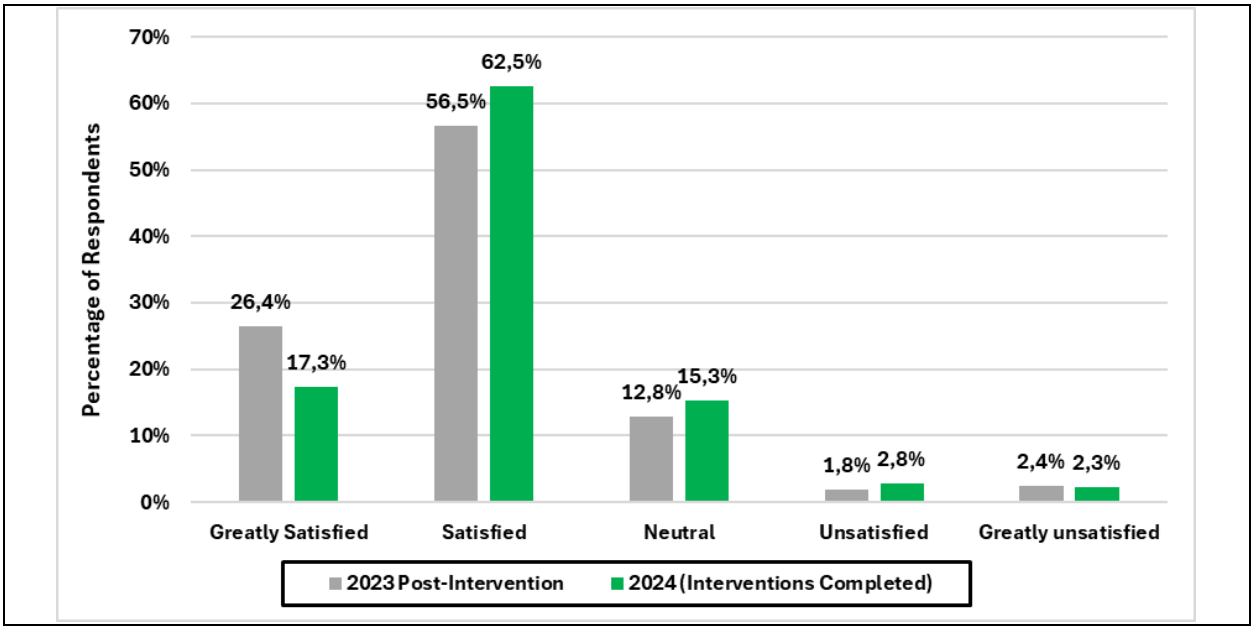


Figure 41). The 2024 post-intervention survey revealed that 79.8% of the respondents indicated an overall satisfaction with their overall health, only 5.1% felt dissatisfied, whilst 15.3% remained neutral.

Often chronic respiratory cardio- and cerebrovascular morbidity and mortality because of air pollution may be masked as acute effects like asthma exacerbation, skin and eye irritation. For the 2023 pre-intervention phase of the project, eye diseases or irritation was reported by 34.3% of households with varying degrees of severity (

2023

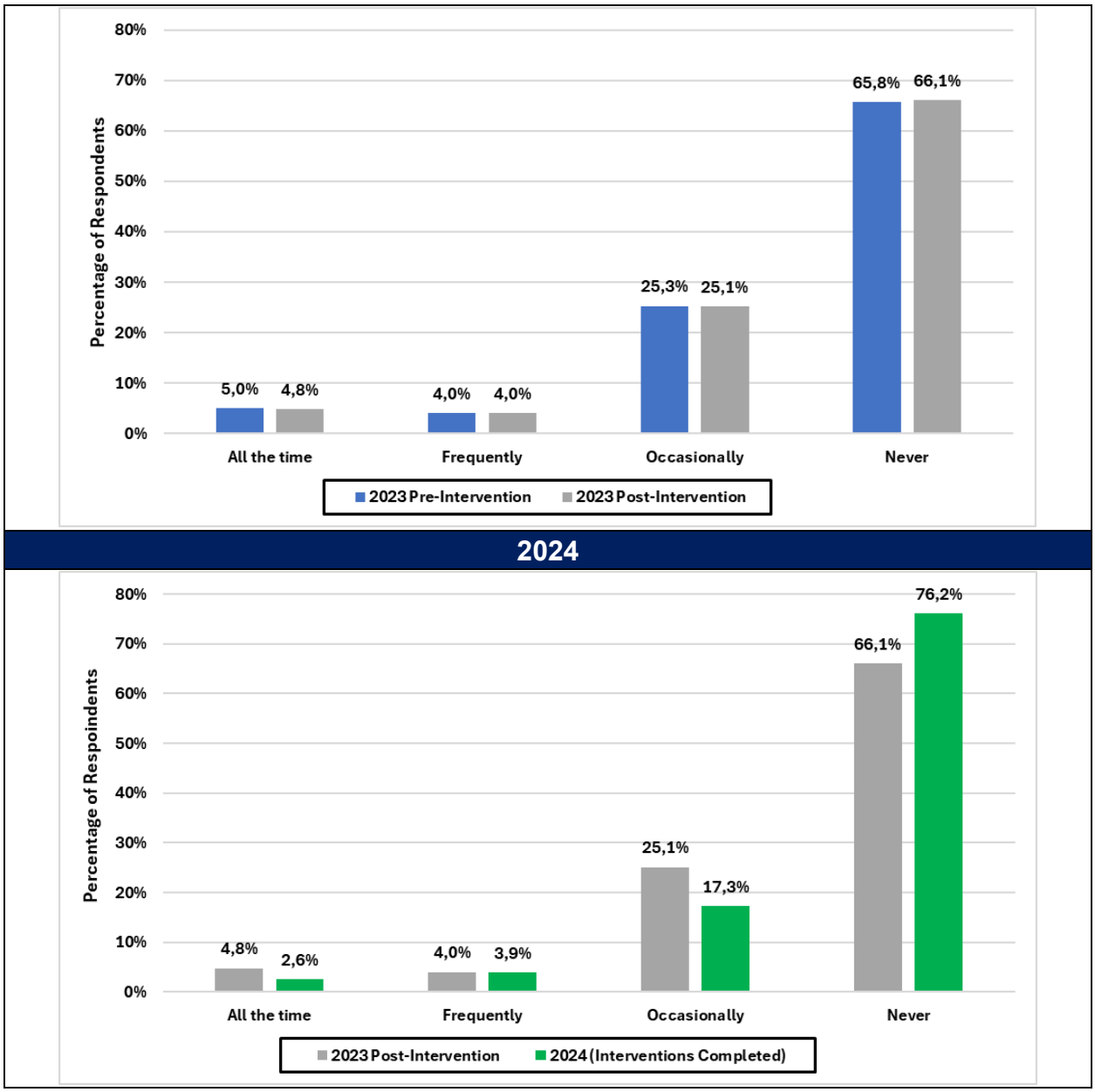
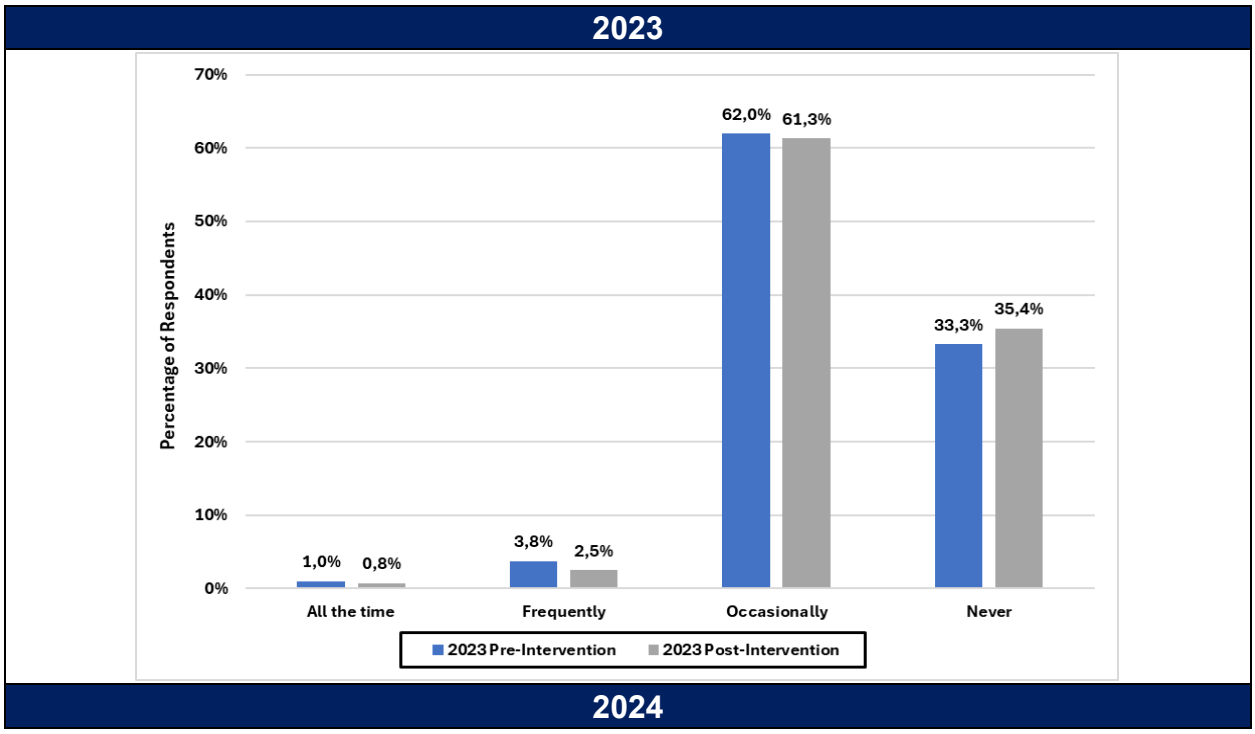


Figure 42) while 65.8% of households did not report any problems. The 2024 post-intervention survey revealed a slight decrease to 33.9% of households experiencing eye disease or irritation with varying degrees of severity, whilst 76.1% of households did not report any problems.

Cough was reported as a slightly more common occurrence during 2023; 66.8% and 33.2% never experienced coughs, with a significant decrease to 49.7% and 50.3% never experiencing coughs

in 2024. Additionally, it is important to note that the respondents in 2023 indicated that ~66% of the households are non-smoking (



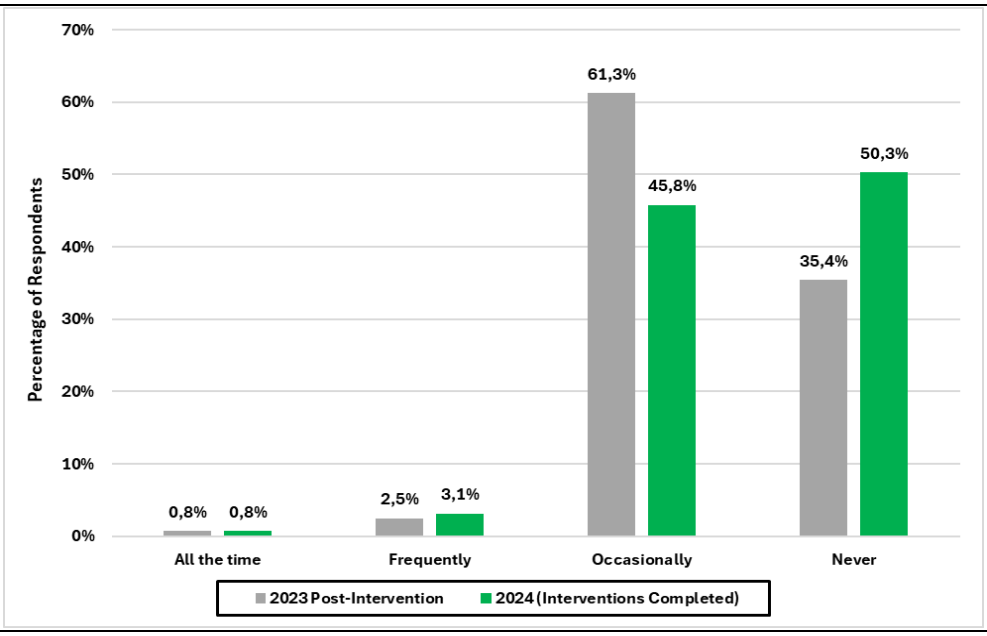


Figure 43). This precludes smoking as a contributor factor to respiratory diseases for these households. For the smoking households 25% had one smoker whilst the remainder of these households had two or more smokers. It is important to note that the respondent figures did not change significantly between the two project periods due to the short time frame.

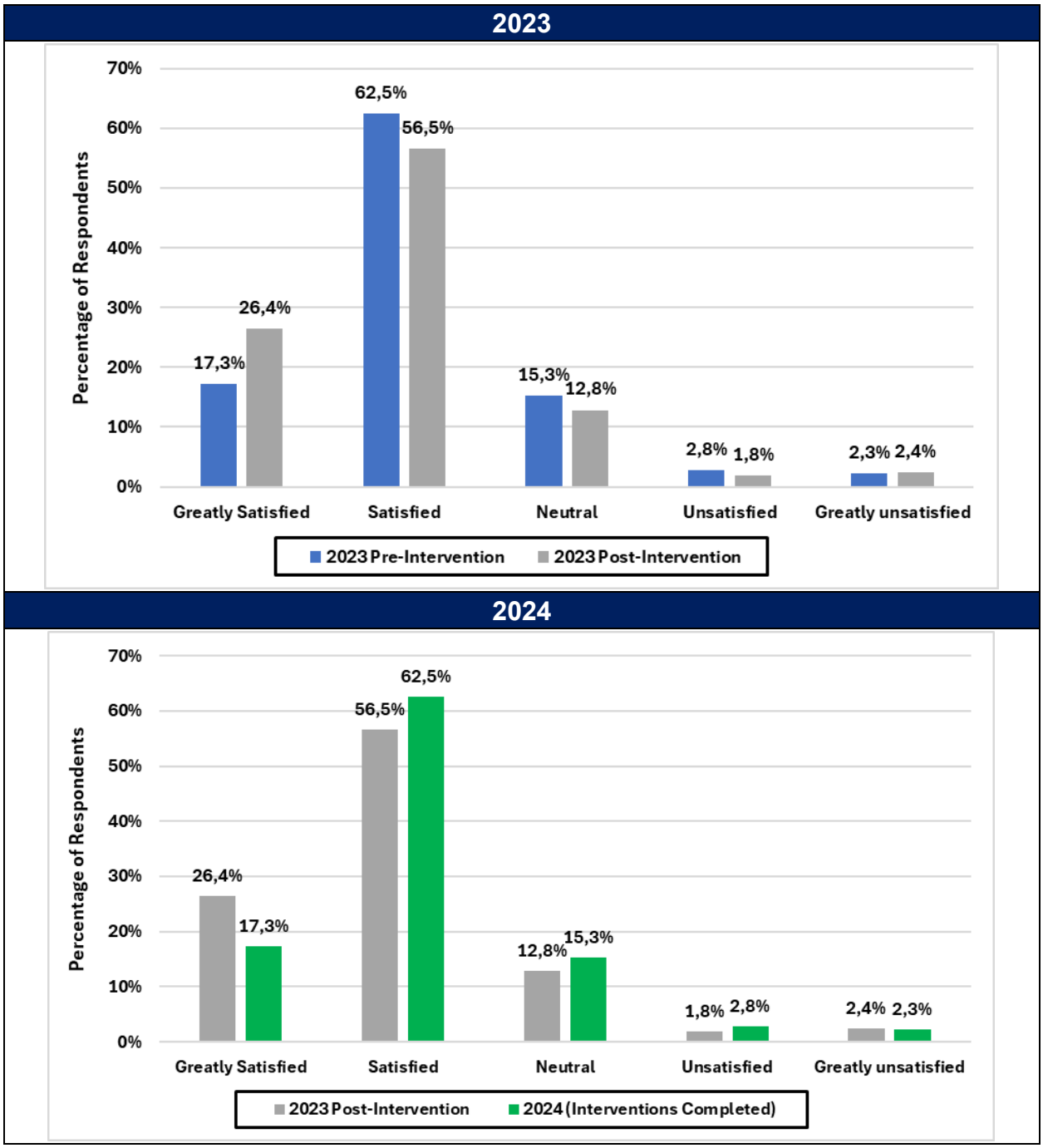


Figure 41: Respondents Satisfaction with Health in 2023 and 2024

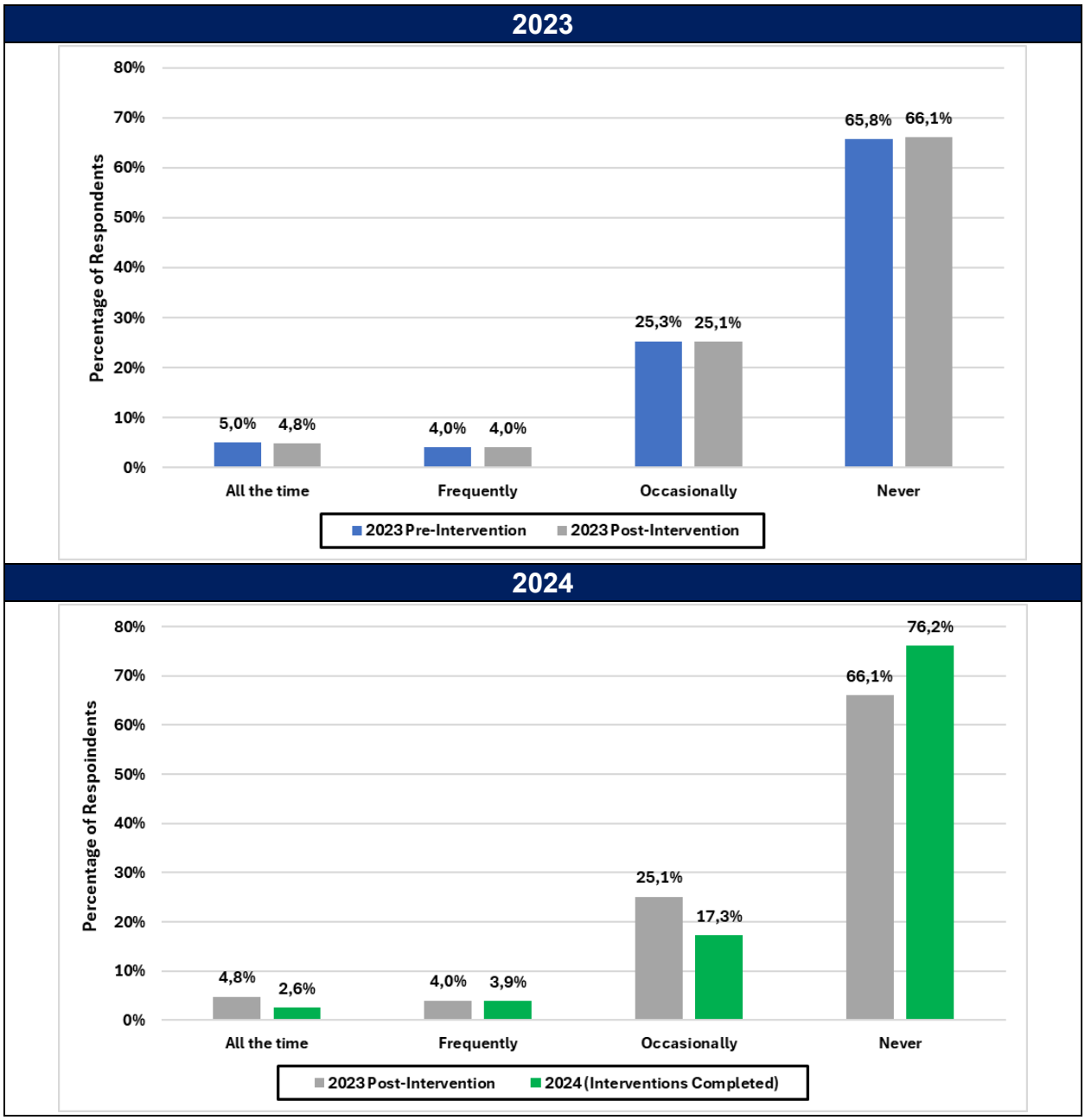


Figure 42: Frequency of Respondent Household members Experiencing Eye Disease or Irritation in 2023 and 2024

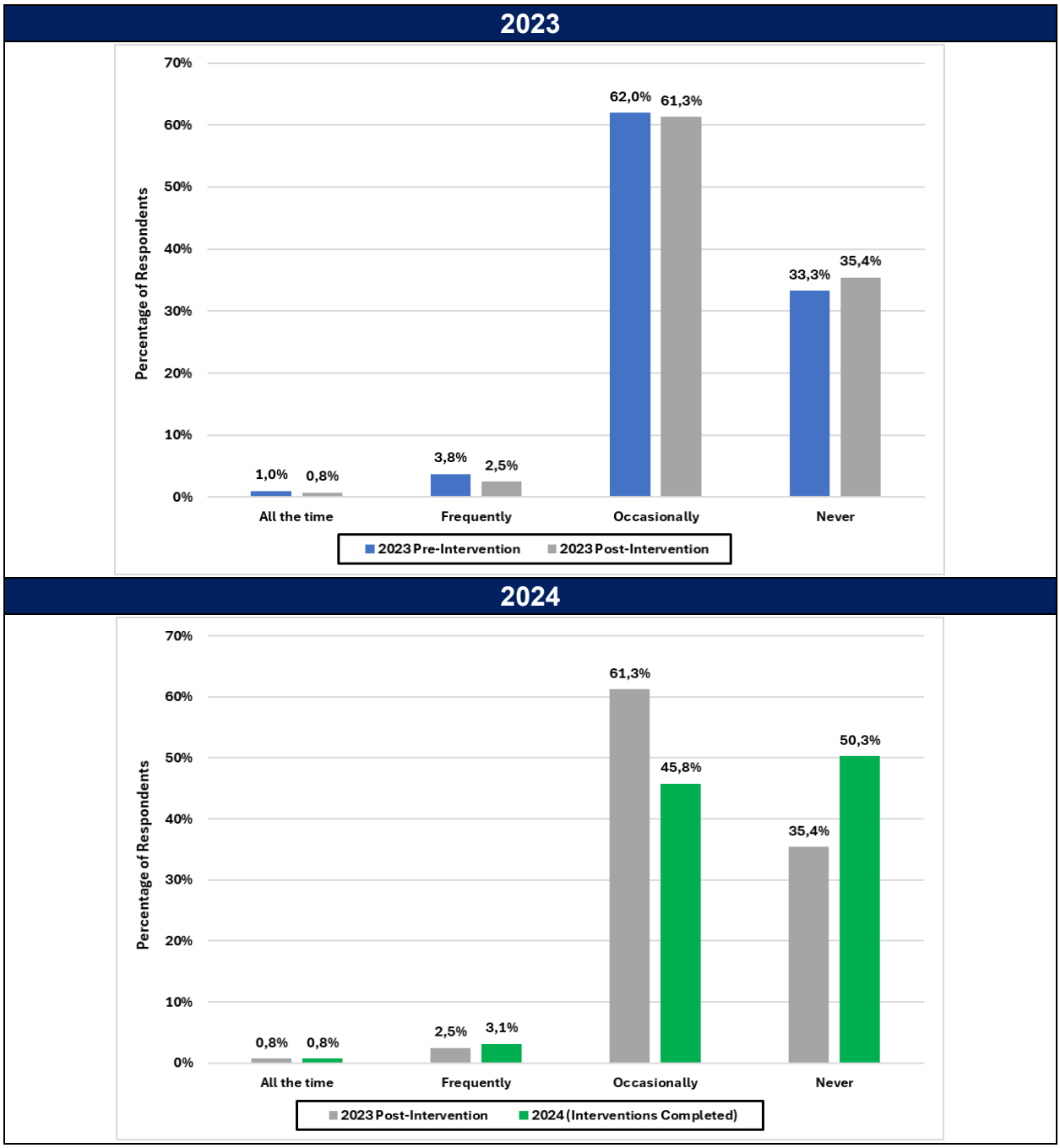
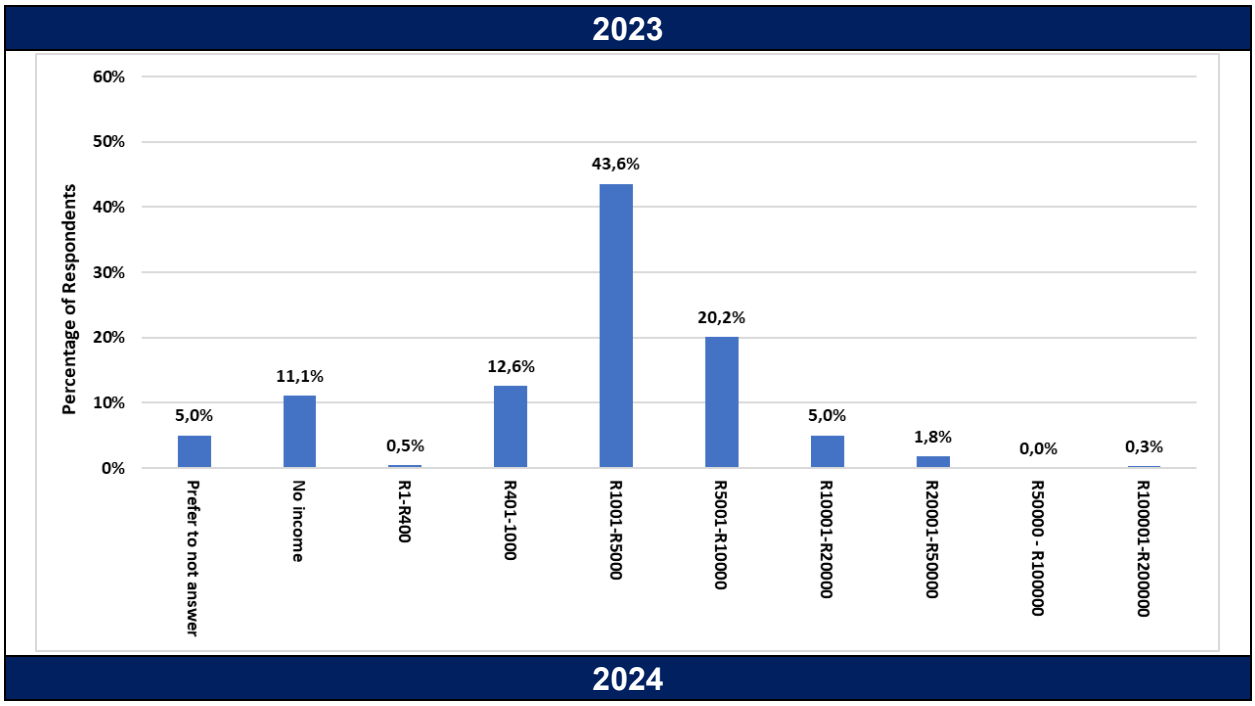


Figure 43: Frequency of Respondent Household members an illness with a cough in 2023 and 2024

3.1.5.2 WELLBEING

According to Stats SA, in 2023, income from wages and salaries (53%) and from social grants (23%) were the most common source of income for households, followed by remittances (9.6%) and income from a business (10%) across all sectors.

Comparatively, for KwaZamokuhle, most households (83.5%) earn reliable incomes of above R400 the 2023 survey, whilst a reduction to 61.5% is noted for the post-intervention 2024 survey The income is mainly through pensions or grants with few inhabitants employed



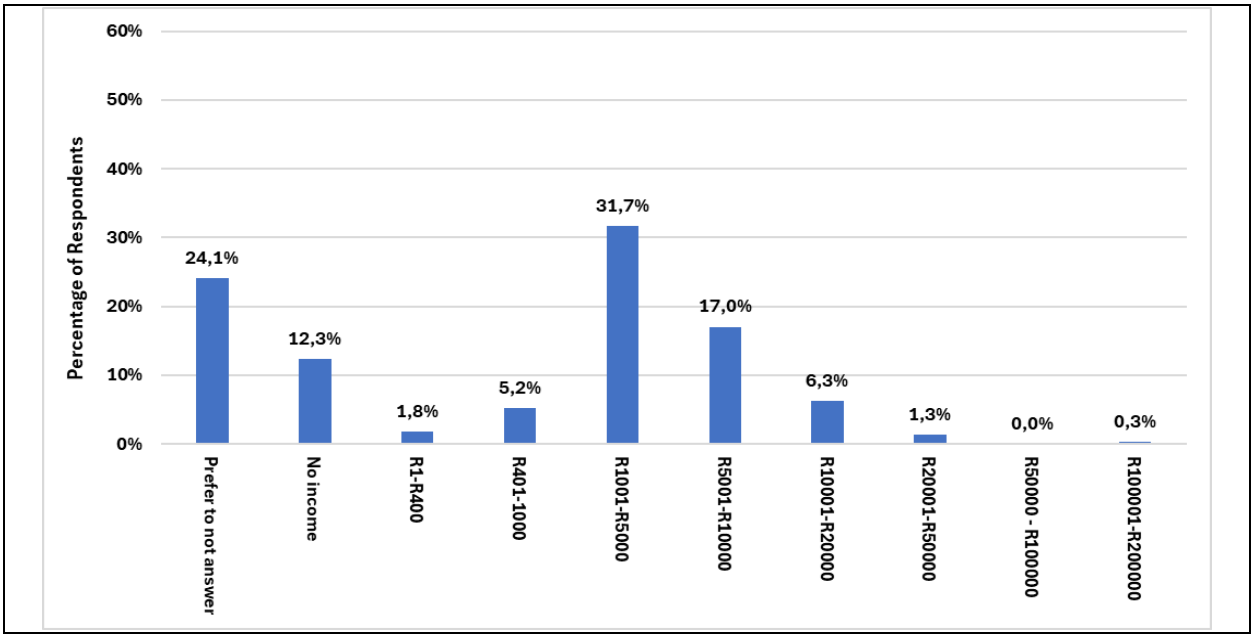
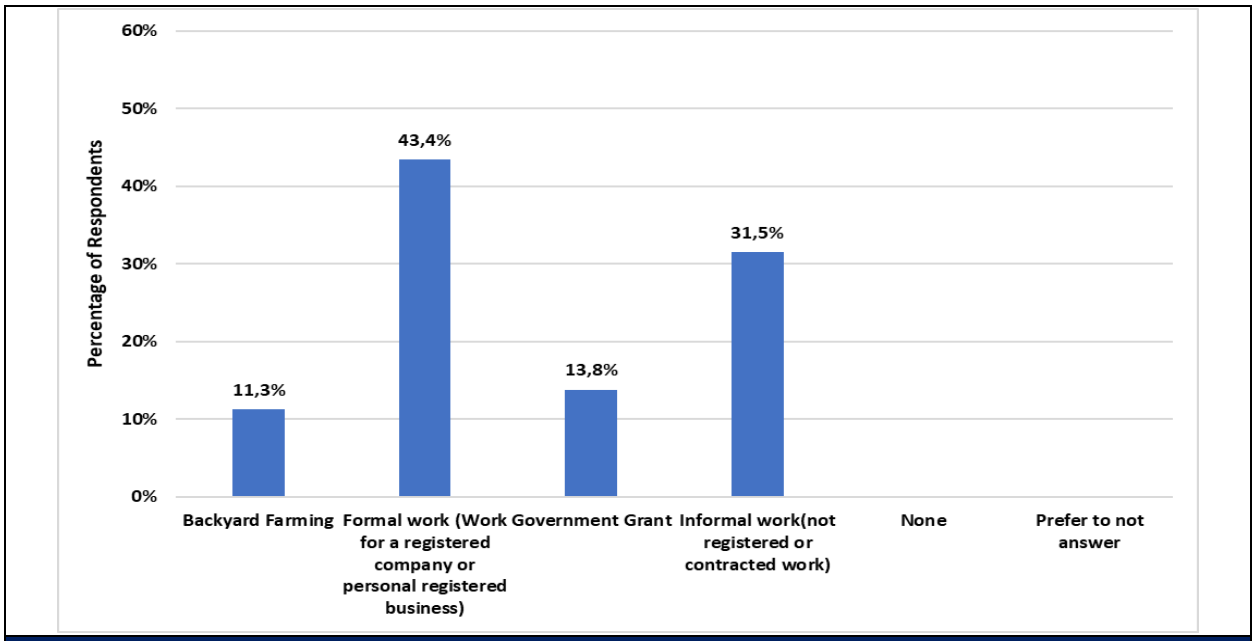


Figure 44. Fruit and vegetables are grown or sold on properties as part of backyard farming activites. This is reflective of the national norm with high unemployment rates and reliance on the basic income grants. Generally, in KwaZamokuhle there isn't enough disposable income left over for energy purchases, and therefore energy stacking becomes significant. This factor can influence the viability and sustainability of wide-scale LPG adoption in KwaZamokuhle for the Eskom AQO Project.

Income is an indicator of available disposable income. For low-income households, generally there isn't enough disposable income left over for energy purchases, and therefore energy stacking becomes significant.

3.1.5.3 Education

Basic and higher education are important levers for households to break the cycles of poverty and improve socio-economic circumstances. The bulk of respondents and breadwinners have a Grade 8-Matric qualification for the 2023 pre-intervention survey (



2024

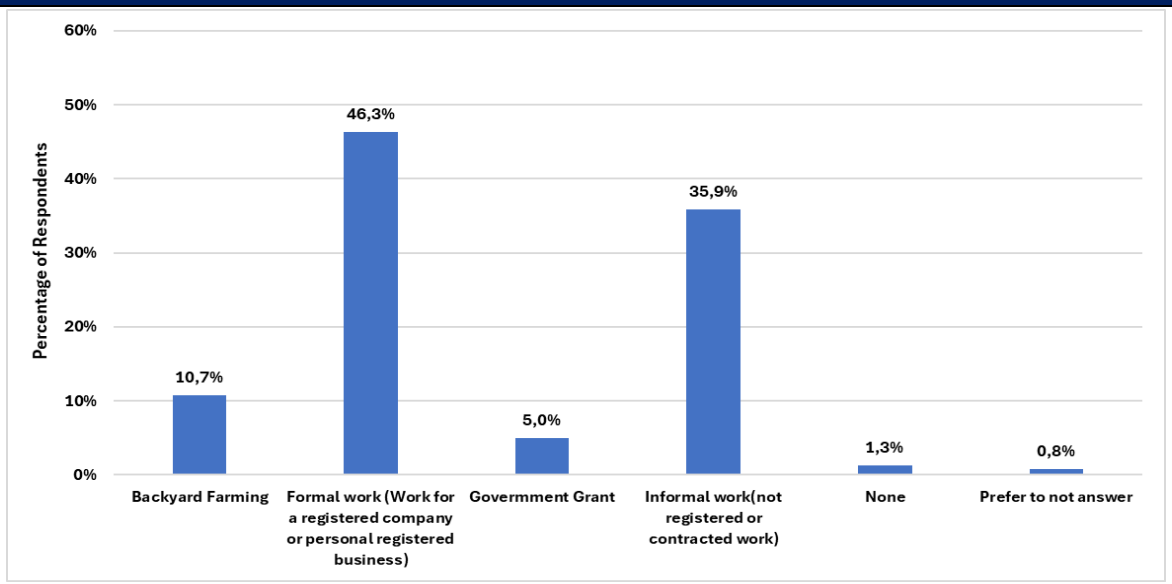


Figure 45 ,

2023

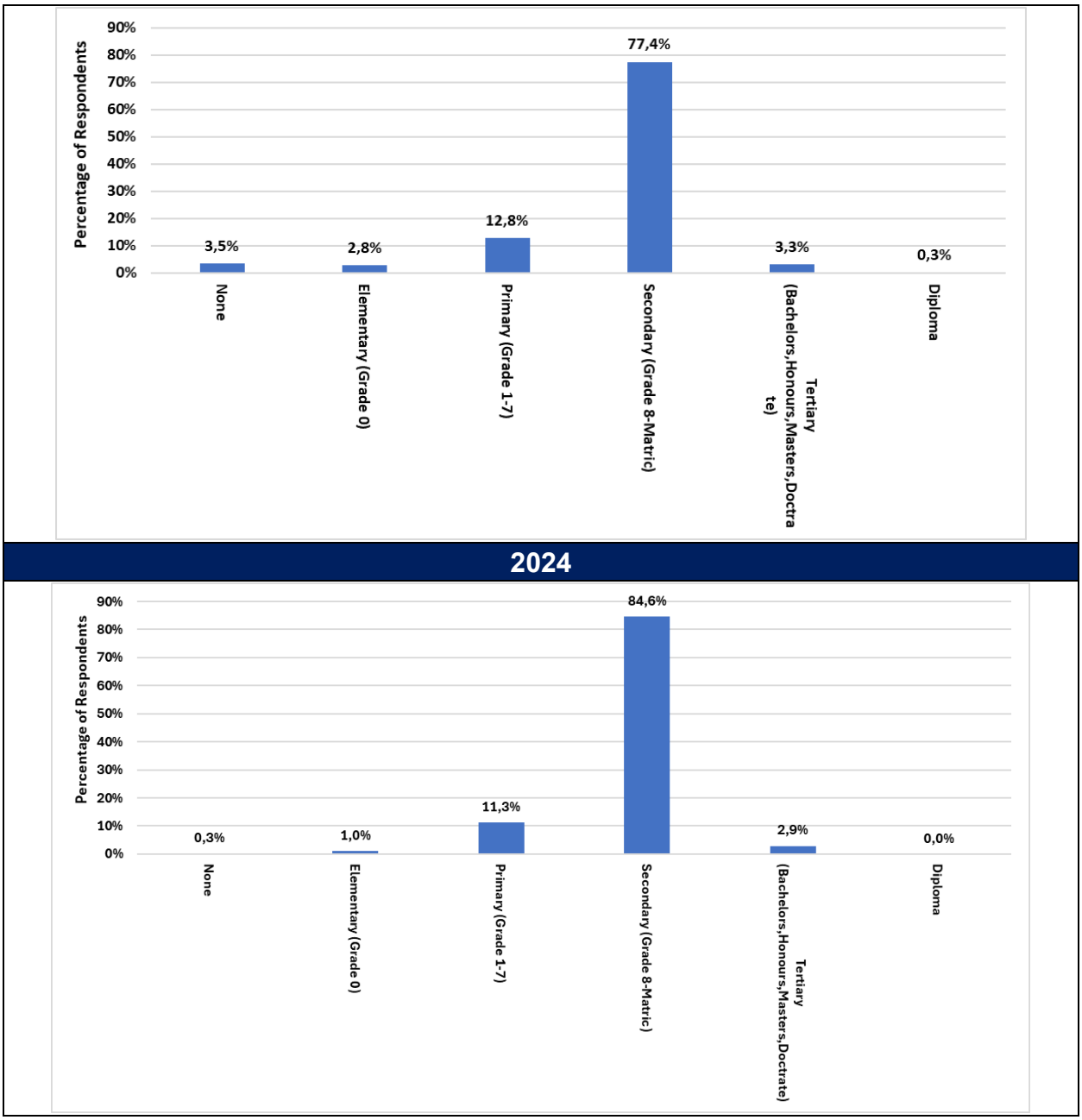


Figure 46,

2023

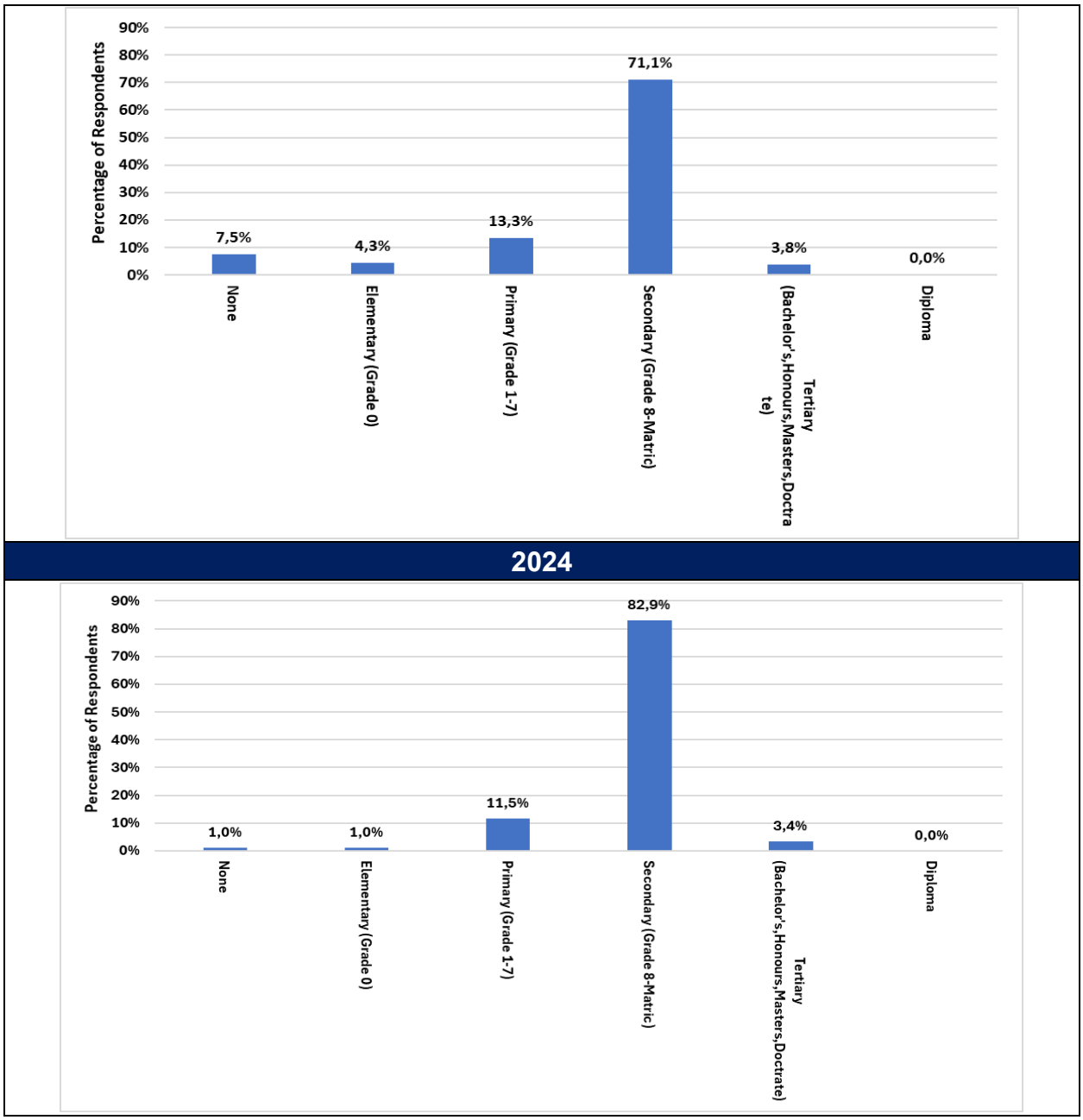


Figure 47), whilst the same trend is indicated during the 2024 post-intervention survey. Seen simplistically, it will be a challenge for most respondents to break the cycle of their current socio-economic circumstance.

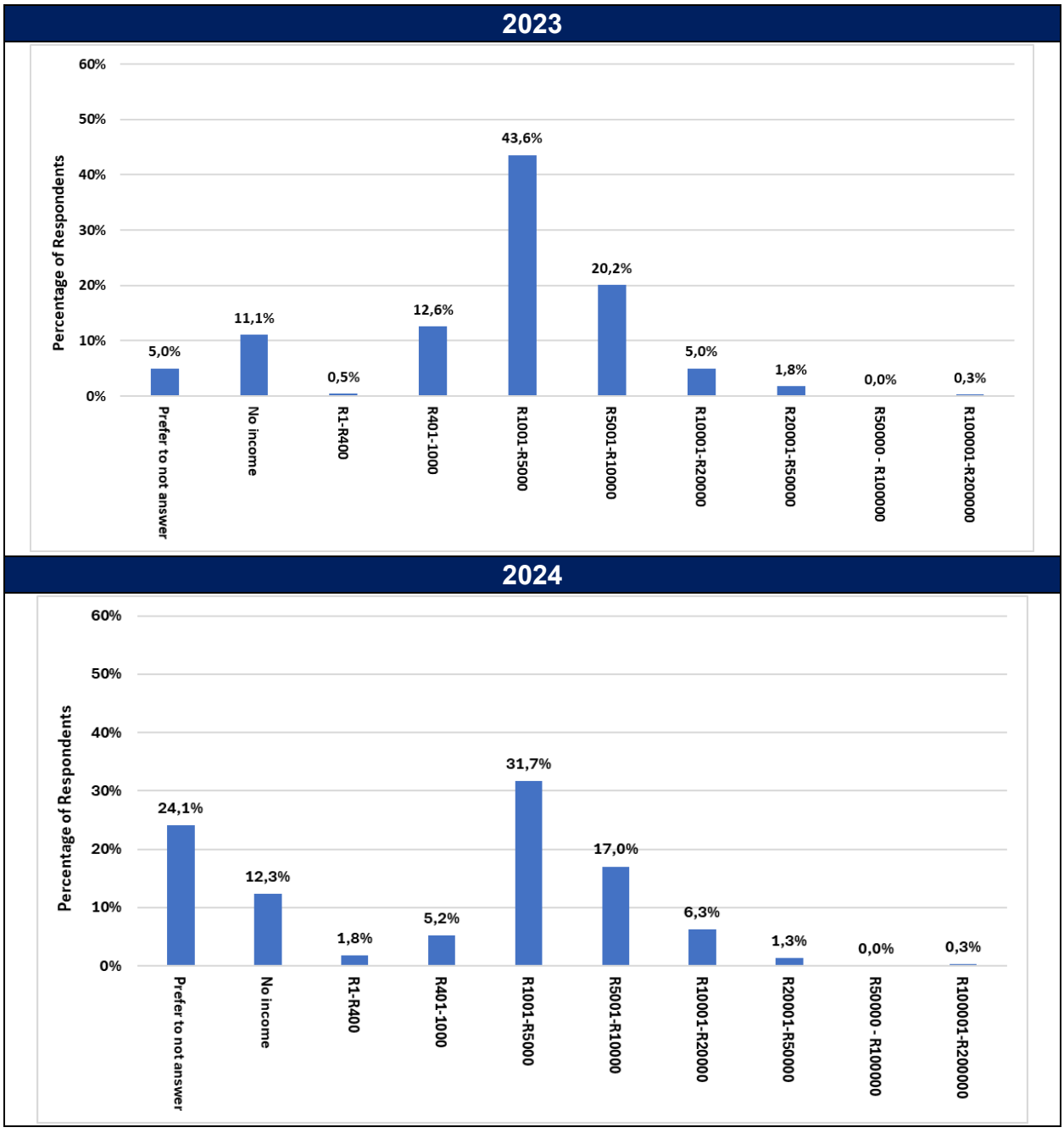


Figure 44: Respondent household Monthly income in 2023 and 2024

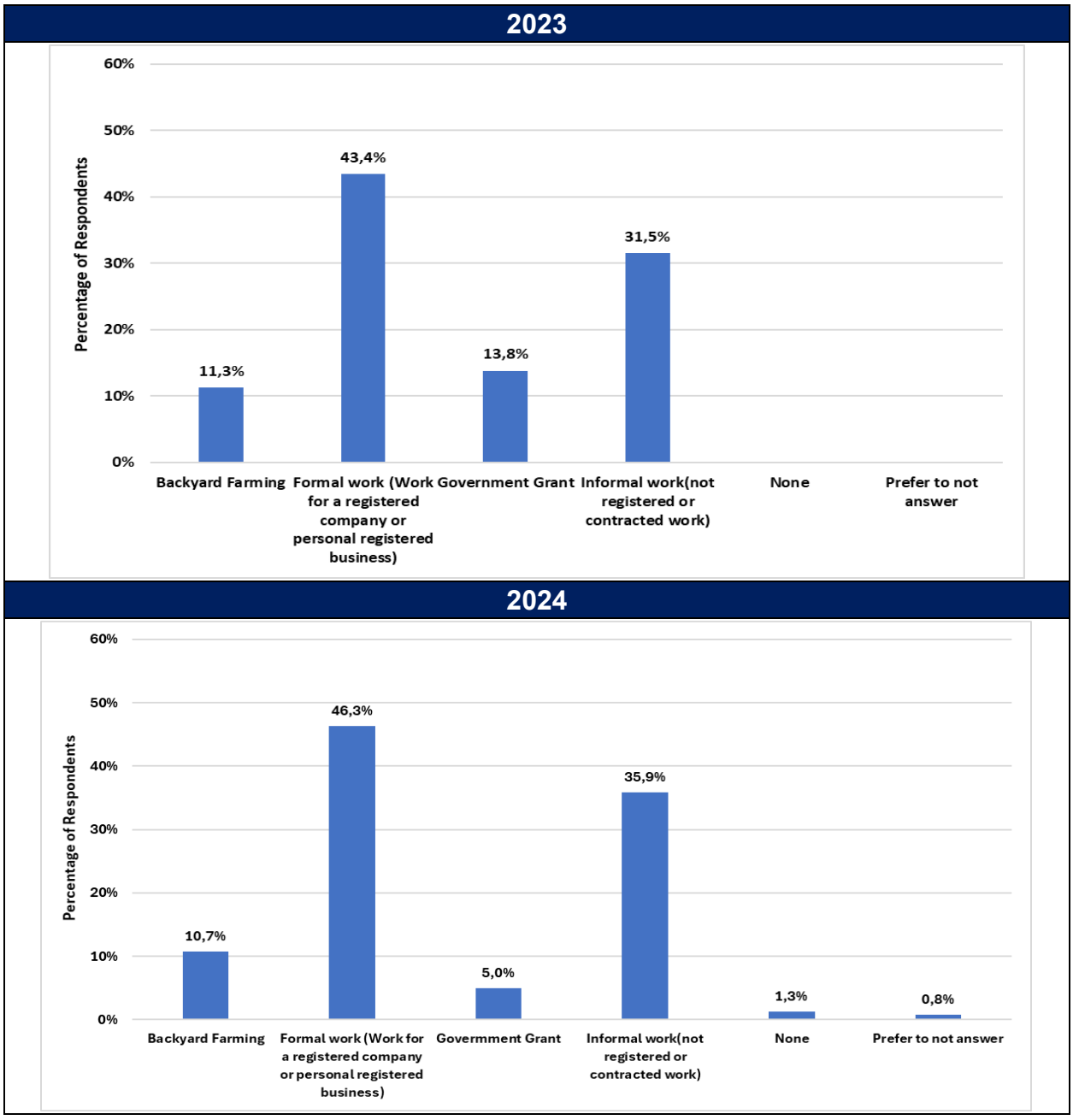


Figure 45: Primary Source of Income of Respondents in 2023 and 2024

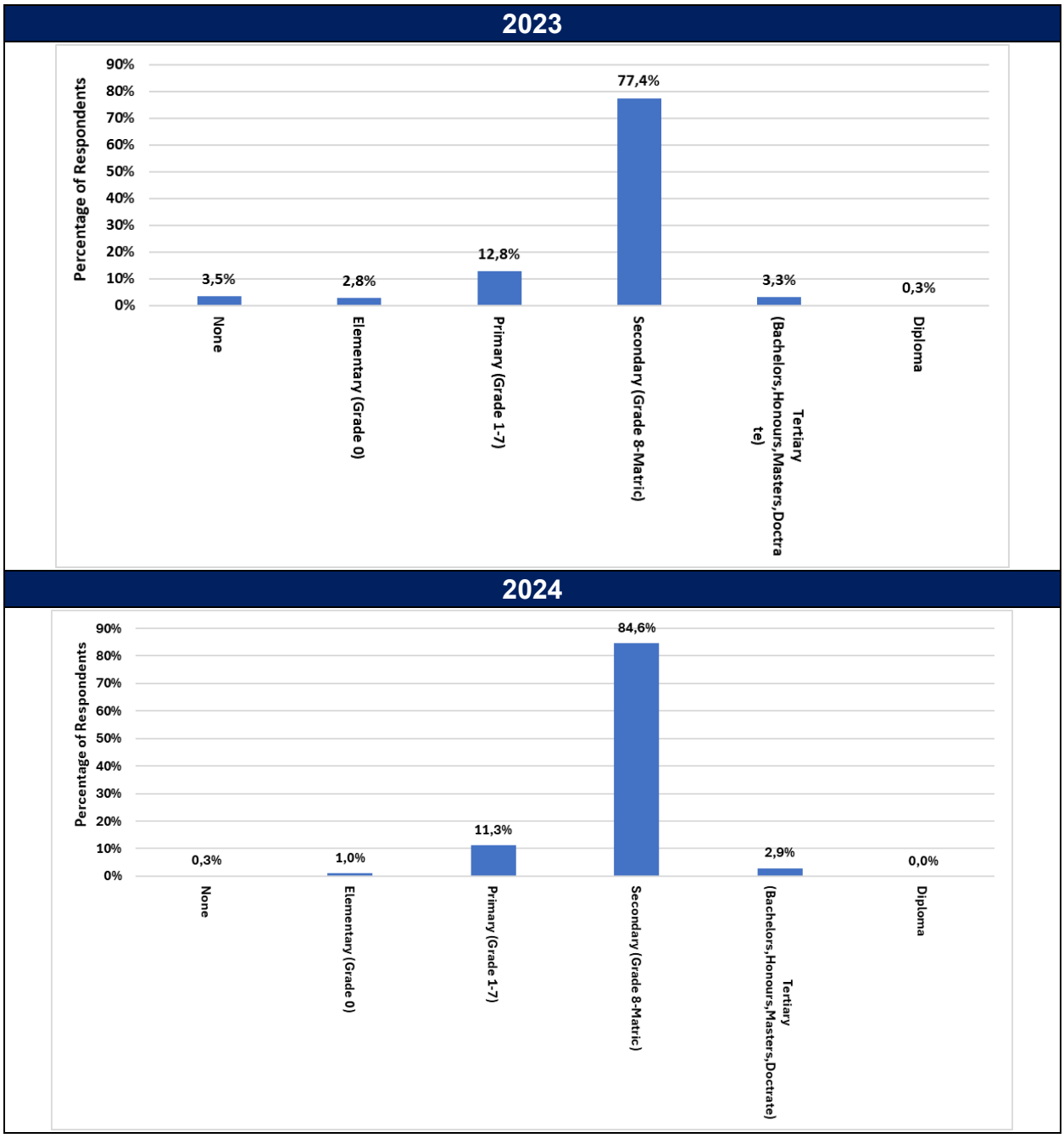


Figure 46: Respondents highest level of education in 2023 and 2024

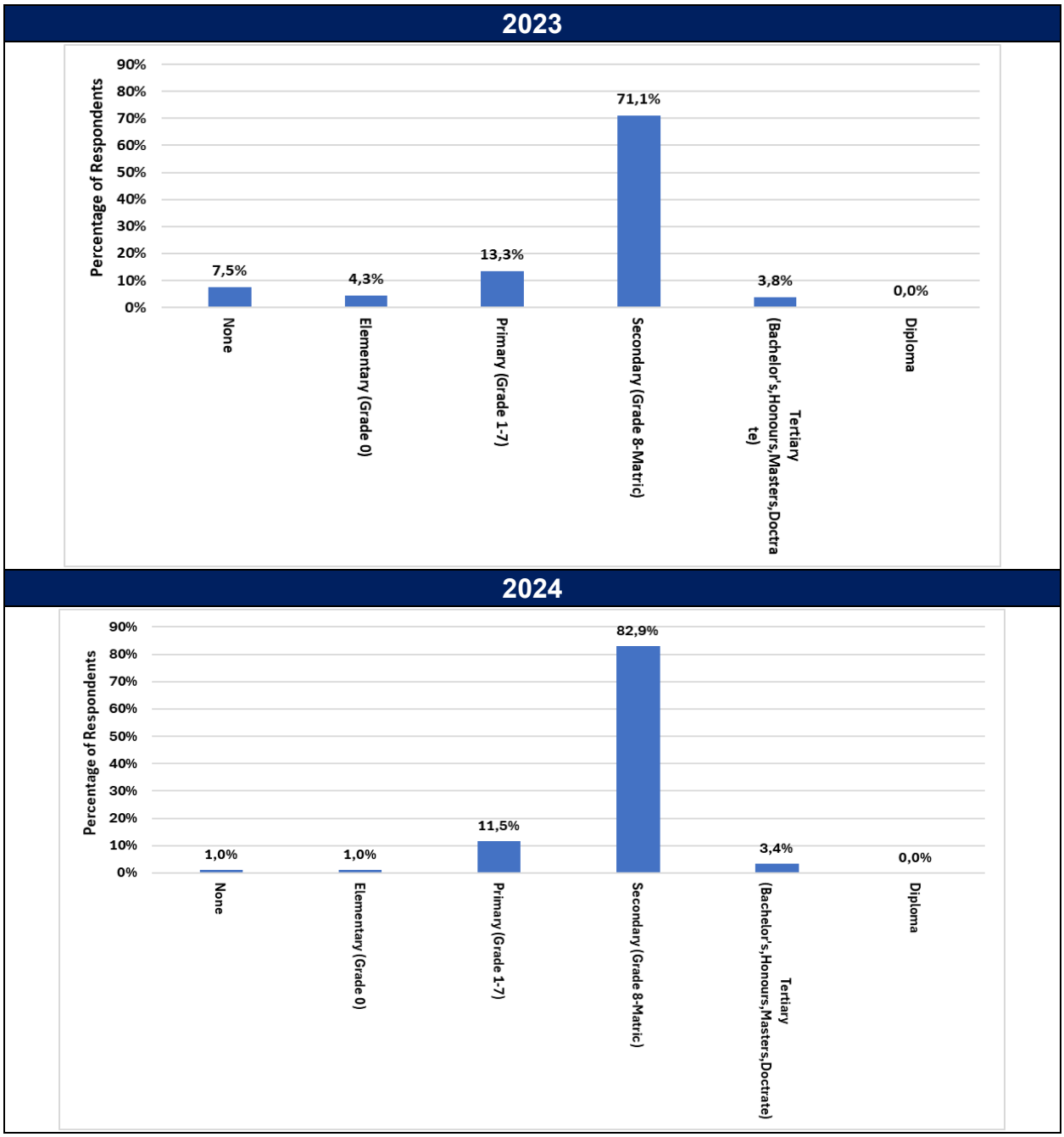


Figure 47: Breadwinners level of education in 2023 and 2024

3.1.5.4 STANDARD OF LIVING

Standard of living reflects on other services received by households such as water, sanitation and refuse removal. Although not key determinants of air pollution and associated health risks, they play an equally important role in overall socio-economic conditions and health impacts on people in low-income households.

3.1.5.4.1 WATER

According to Stats SA 88.55% of all households used tap water in their dwellings, their yards or from their neighbour's or communal taps, only 45.8% had water inside their dwellings. An evaluation by income quintile https://www.statssa.gov.za/?p=15473 - _edn1 shows that the percentage of households with access to piped water in the dwelling increases with higher income quintiles, while reliance on other sources, including using taps in the yard, decreases. The converse is true for low-income households.

In KwaZamokuhle for the 2023 pre-intervention survey, households have access to piped water with 7.7% of respondents indicating that they must source water from long distances (

2023	2024

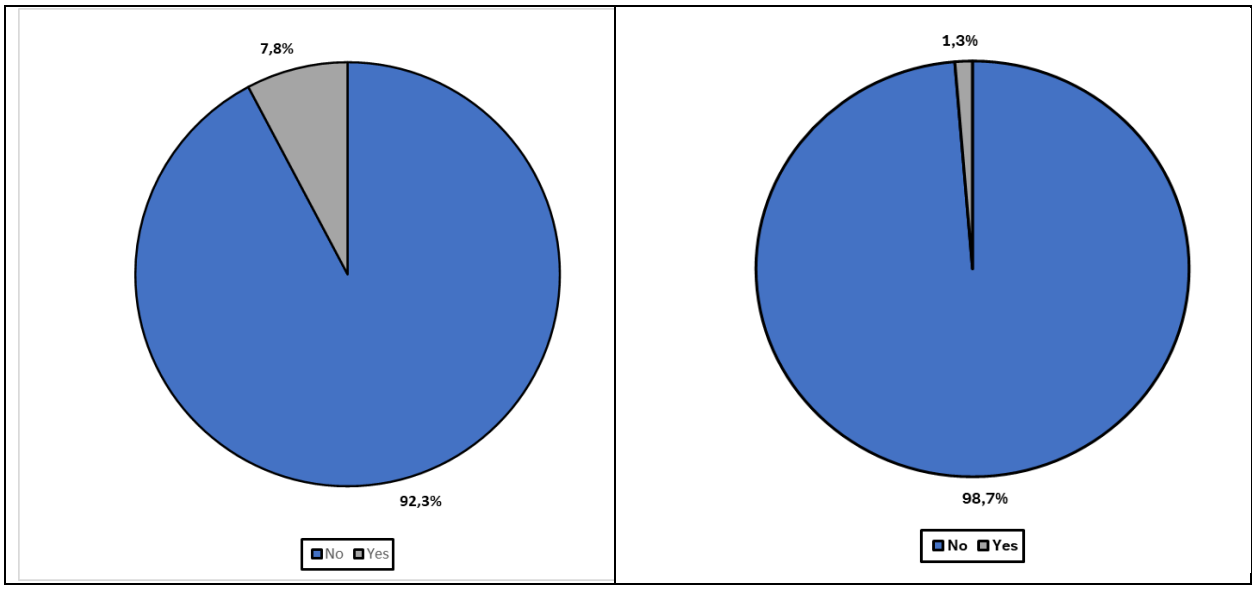
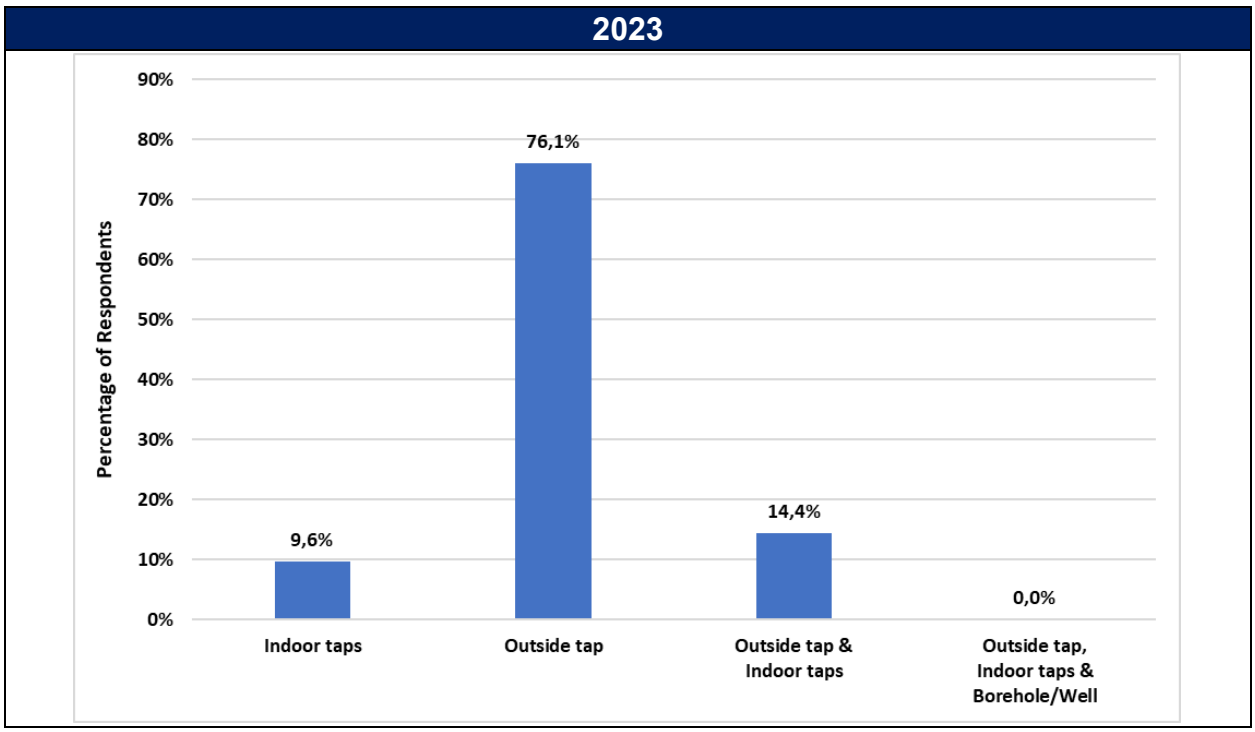


Figure 48), and this percentage decreased significantly for the 2024 post-intervention survey to 1.3%. The 2023 pre-intervention survey also indicate that 76.1% of respondents obtain water from either outdoor taps or 9.6% from indoor taps with 14.4% of households (



2024

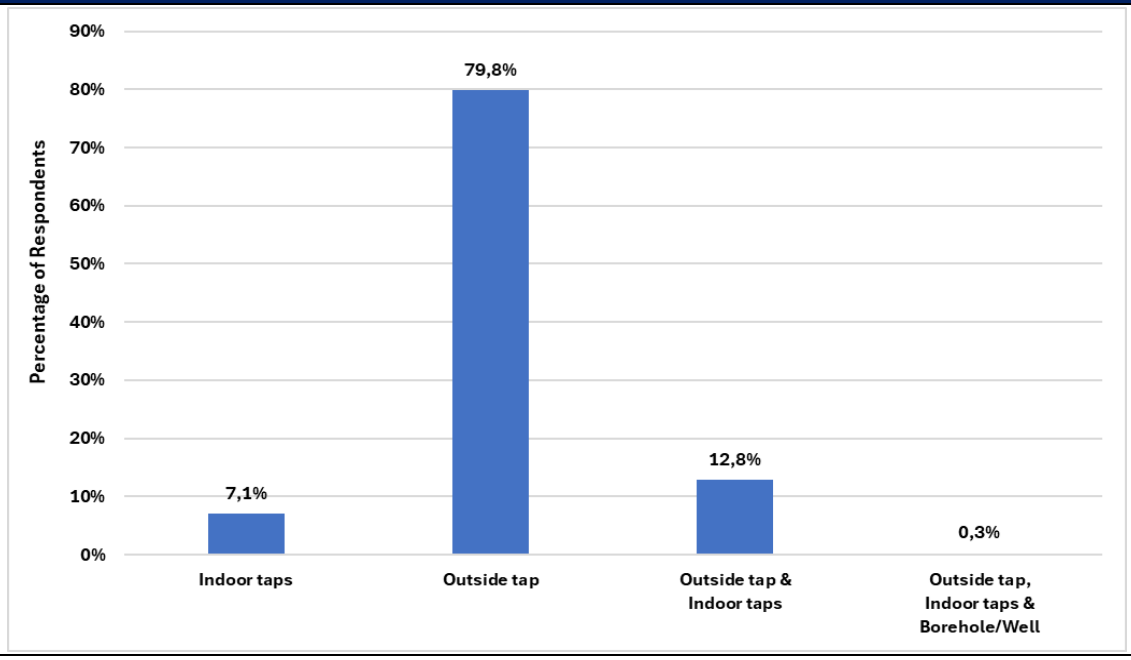


Figure 49) obtaining from both outside and indoor taps which is below the national norms. A slight increase to 79.8% is noted for the 2024 post-intervention survey for outside taps, with a slight reduction to 7.1% and 12.8% for inside and outside/indoor taps respectively.

However, availability of water is intermittent. Every month, water is available between 11 and 20 days (12.8%) with some households (52.5%) reporting 100% availability for the 2023 pre-intervention survey. An increase is noted for the 2024 post-intervention survey with water availability of 83.2% for the whole month (

2023

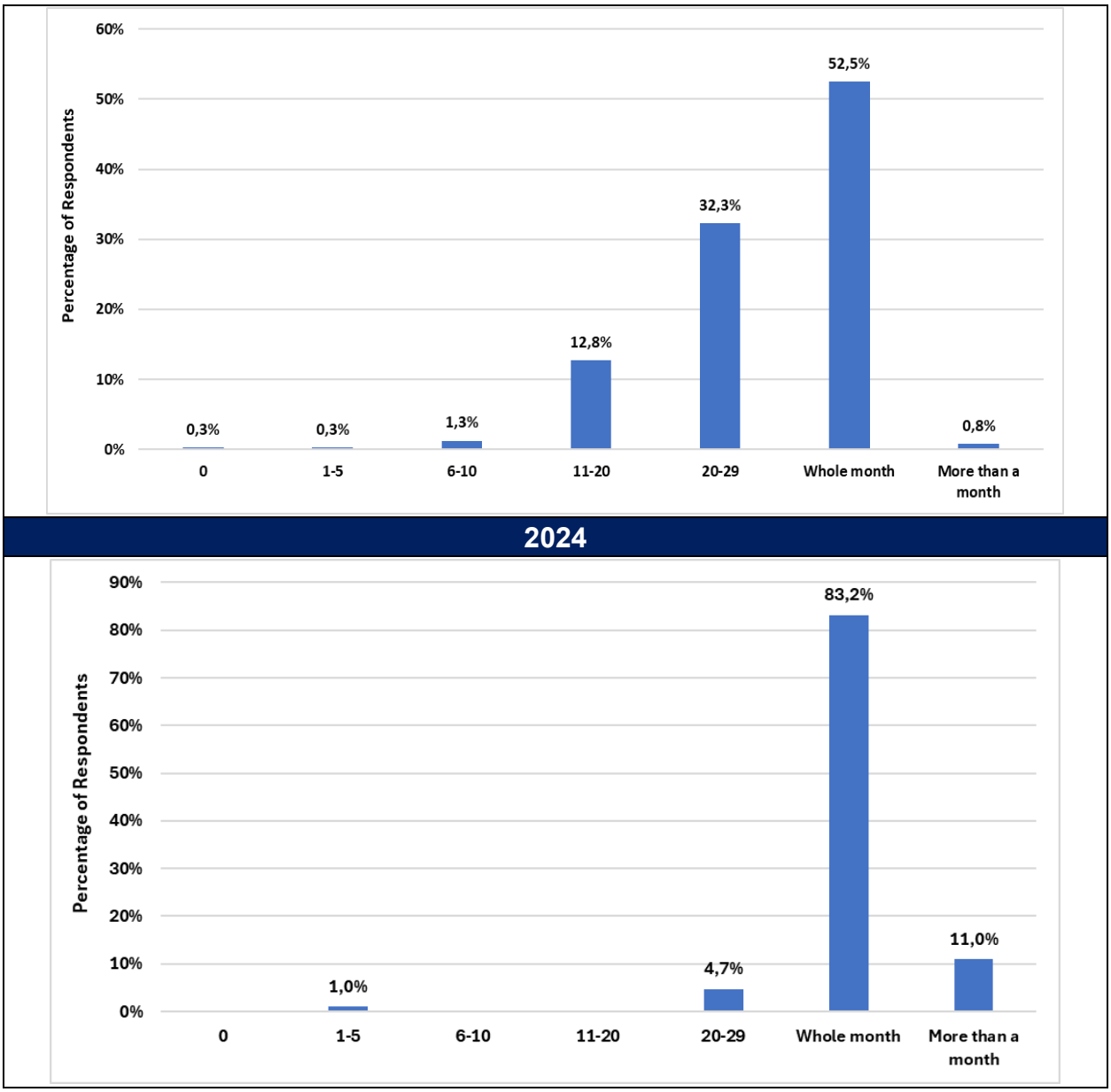


Figure 50). Most households reported water costs being less than R500.

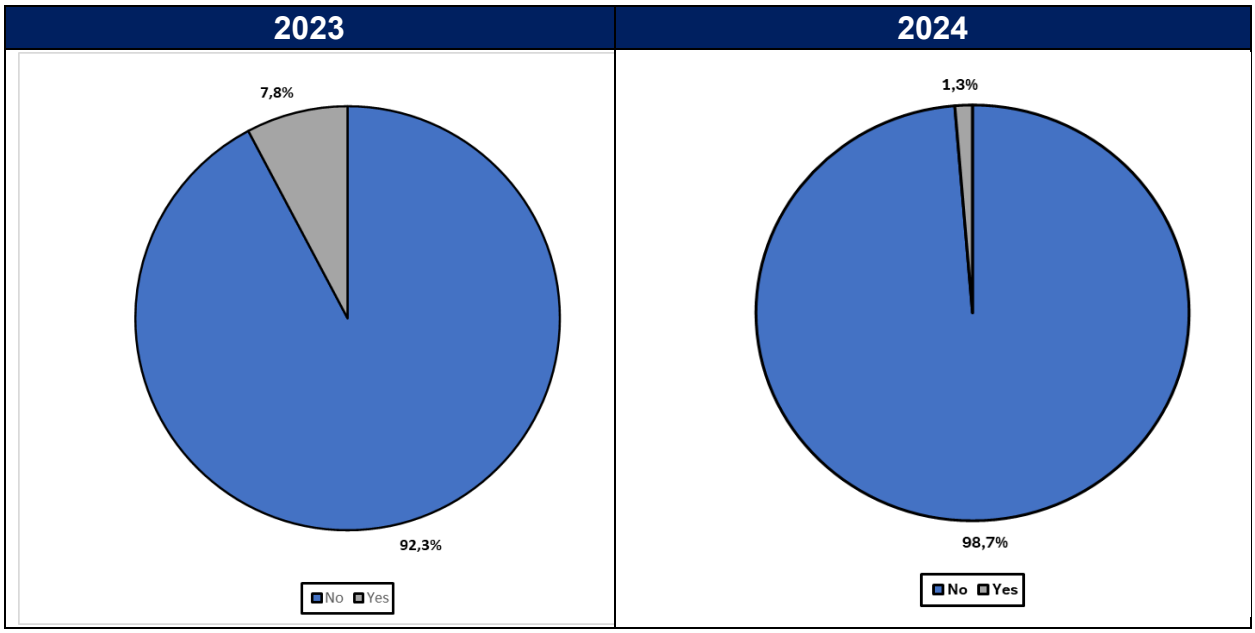


Figure 48: Respondent households must walk from home to fetch water in 2023 and 2024

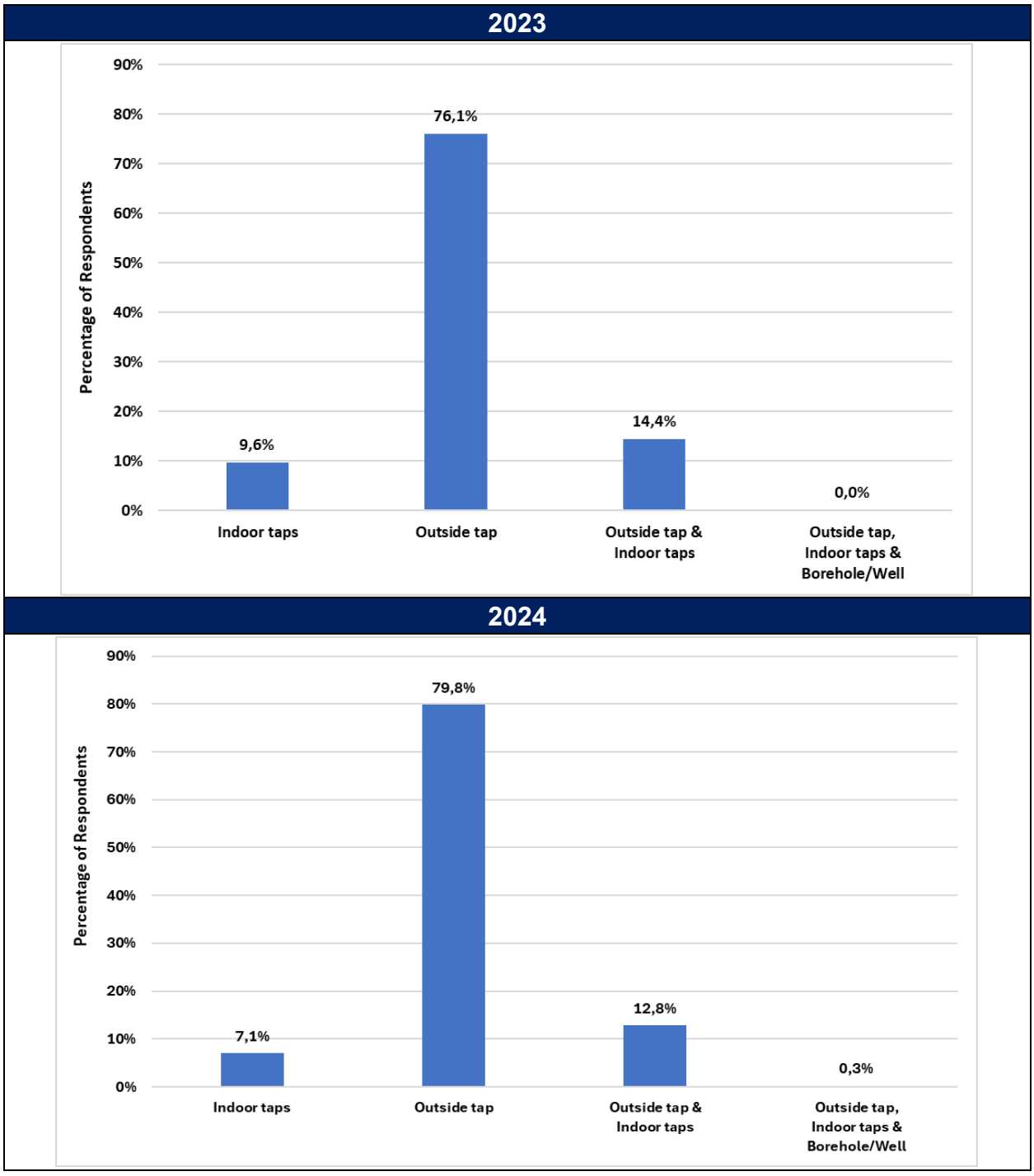


Figure 49: Respondent households' main source of water supply in 2023 and 2024

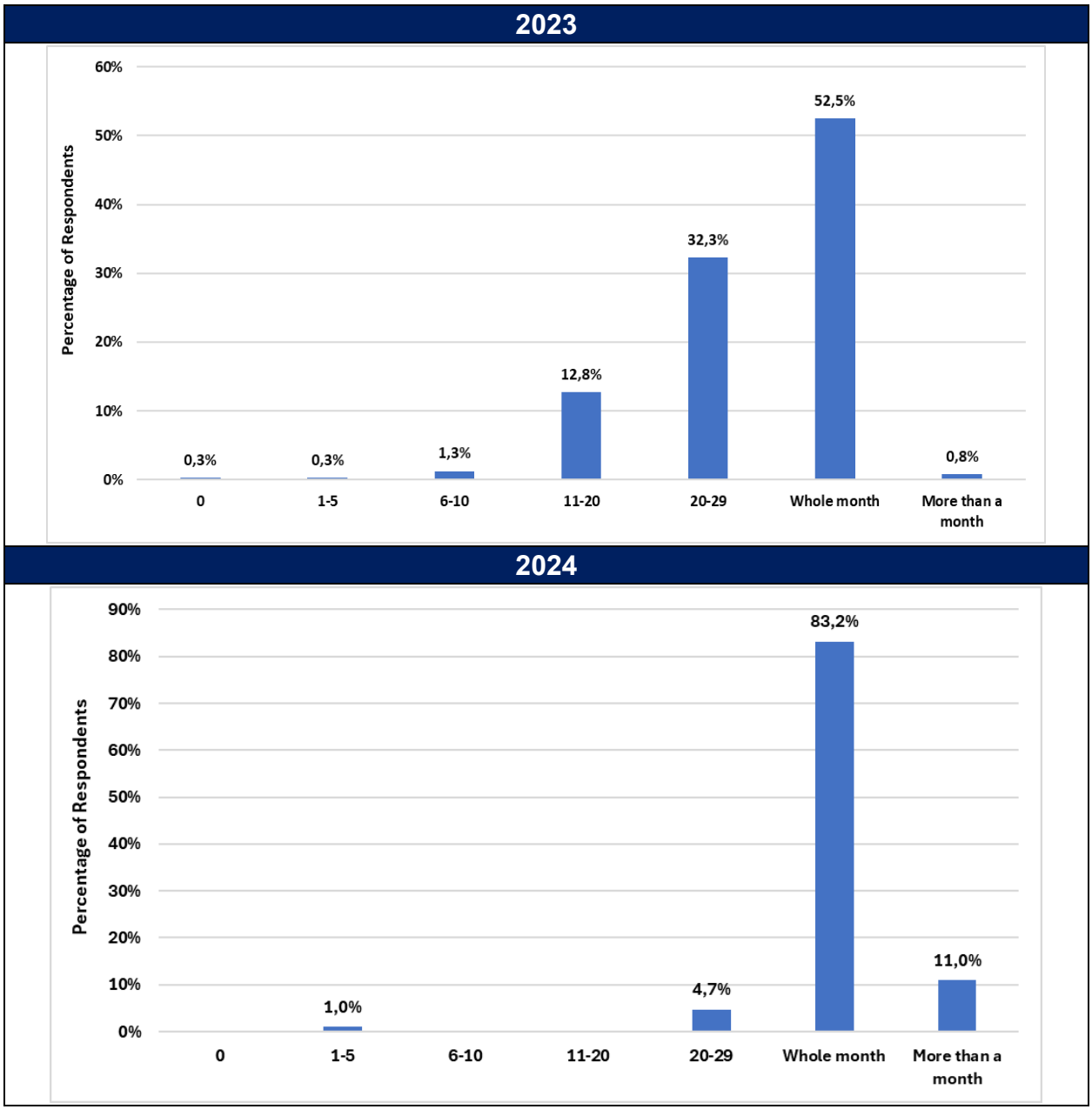
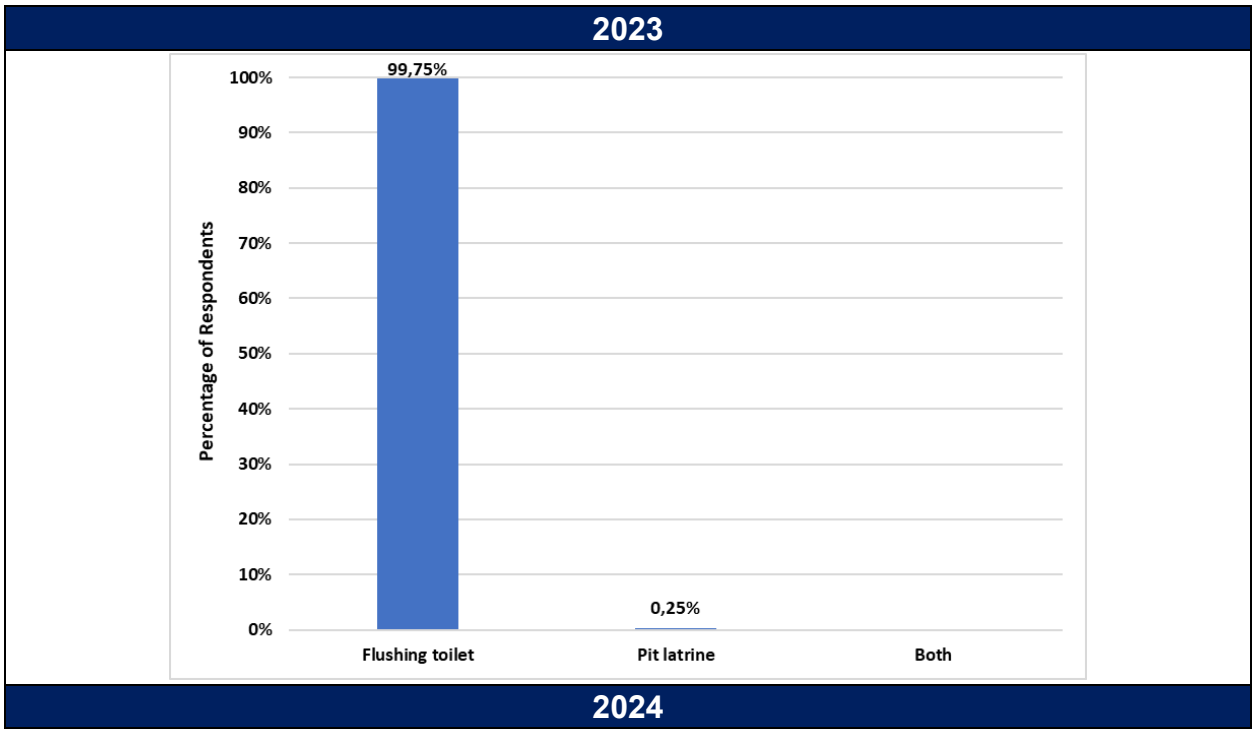


Figure 50: Number of days respondents have water in 2023 and 2024.

3.1.5.4.2 SANITATION

Stats SA (2022)[10] reported that household access to sanitation increased from 61.7% in 2002 to 83.2% by 2022. Nationally, only 65.8% of households used flush toilets, while 17.5% used pit toilets with ventilation pipes, and 13.5% used pit toilets without ventilation pipes.

In KwaZamokuhle 99.8% of households surveyed had flushing toilets on the property during the 2023 pre-intervention survey, with a slight decrease to 99.5% for the 2024 post-intervention survey (



[10] Stats SA,General Household Survey 2022, https://www.statssa.gov.za/publications/P0318/P03182022.pdf.

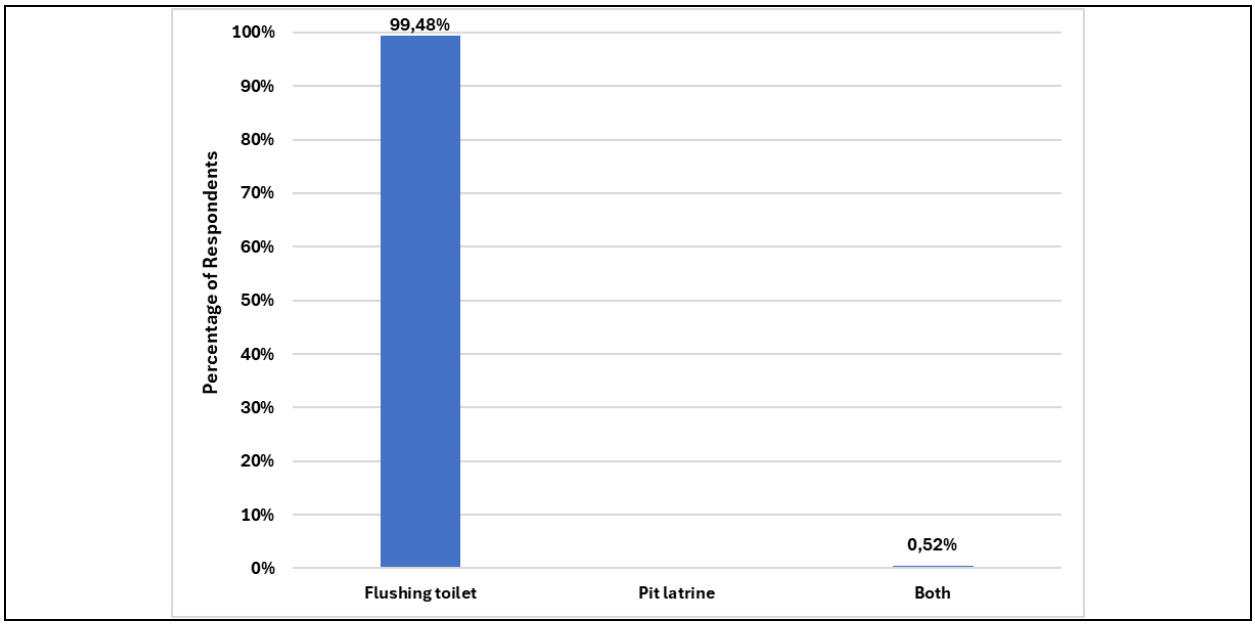


Figure 51).

3.1.5.4.3 WASTE

Stats SA (2022)[11] also indicated that household refuse was removed at least once per week or less often for 62.6% of all households, while more than one-third (34.5%) of households had to rely on communal or their own refuse dumps. Refuse removal was most common in urban areas (84.9%) while 79% of rural households used their own refuse dumps.

The 2023 pre-intervention survey reveal that waste is collected at 98.5% of the surveyed households, whilst a slight decrease (95%) was reported for the 2024 post-intervention survey (

2023

[11] Stats SA,General Household Survey 2022, https://www.statssa.gov.za/publications/P0318/P03182022.pdf.

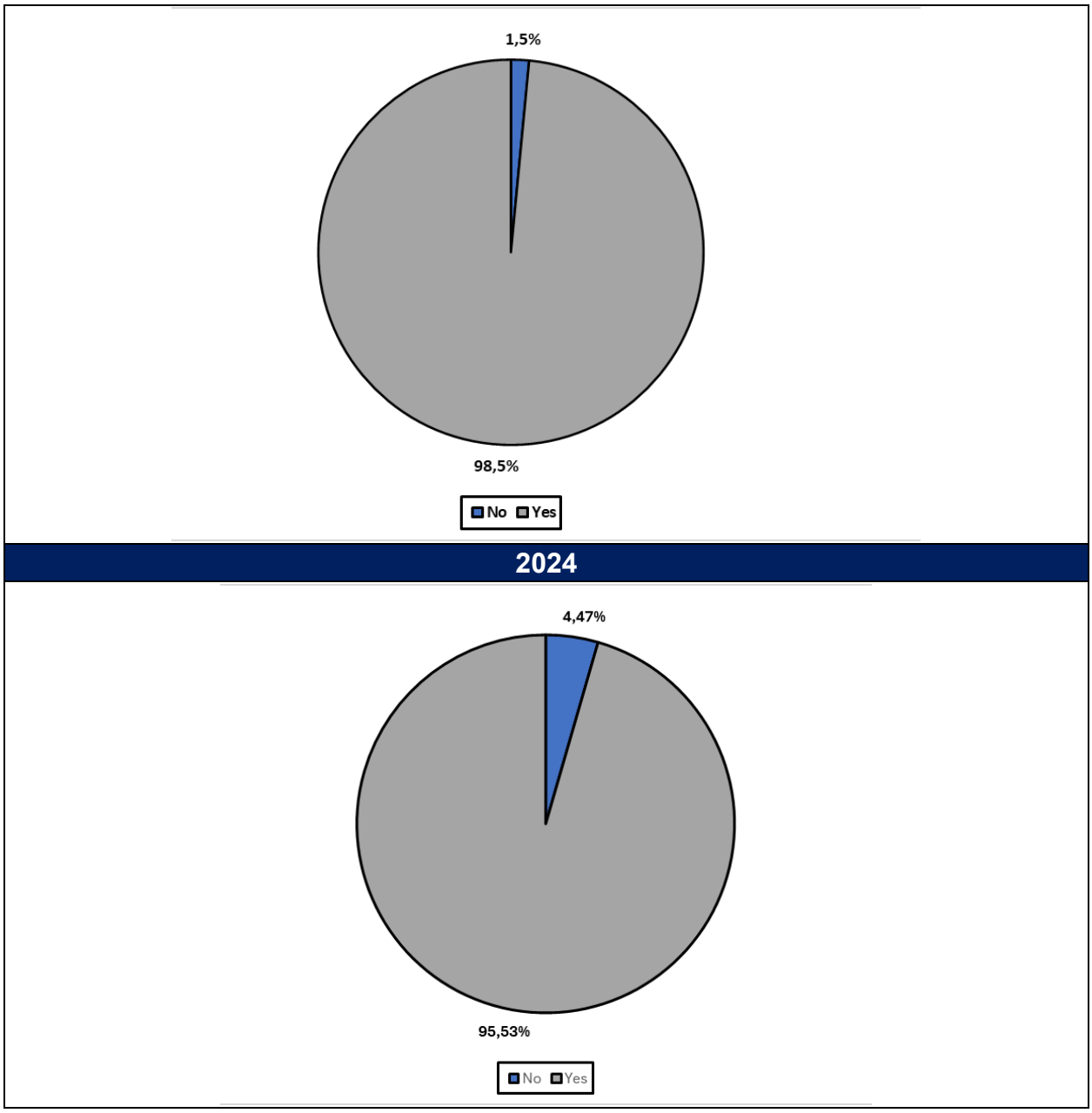
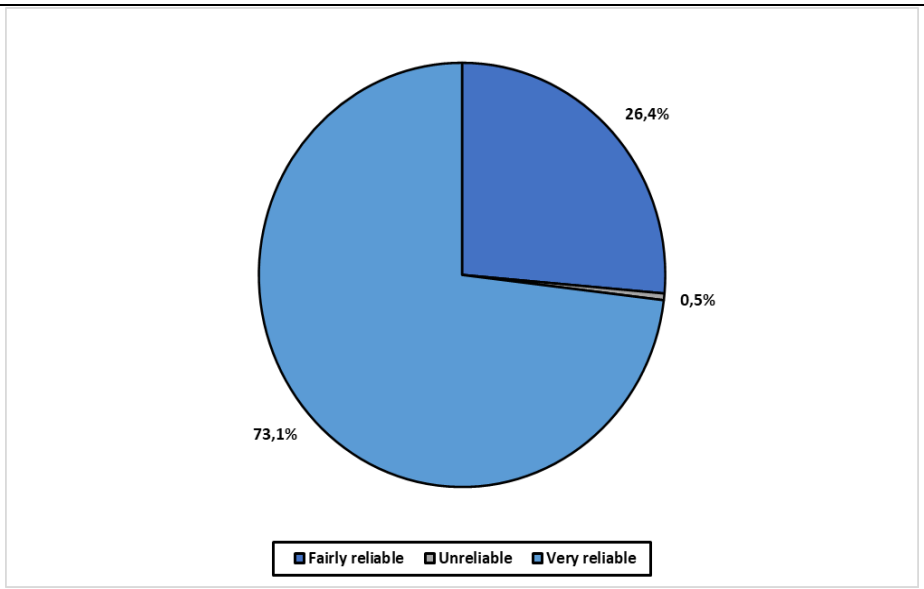


Figure 52), from outside the house, once a week; and the collection is reported as reliable for both surveys (

2023



2024

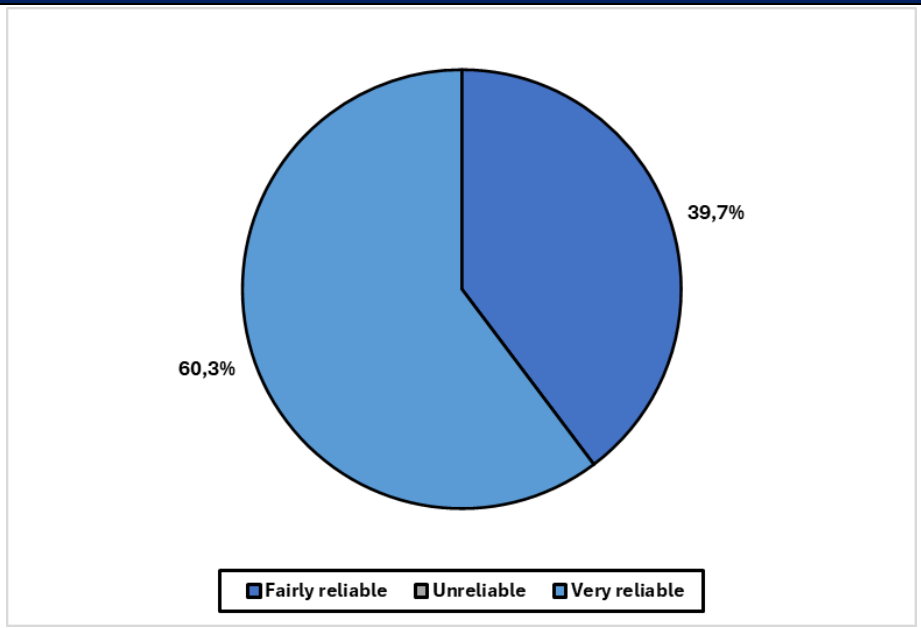


Figure 53). When the waste is not collected the homeowner waits for the next collection day, or takes the waste to the waste dump, whilst waste burning is also common practise (

2023

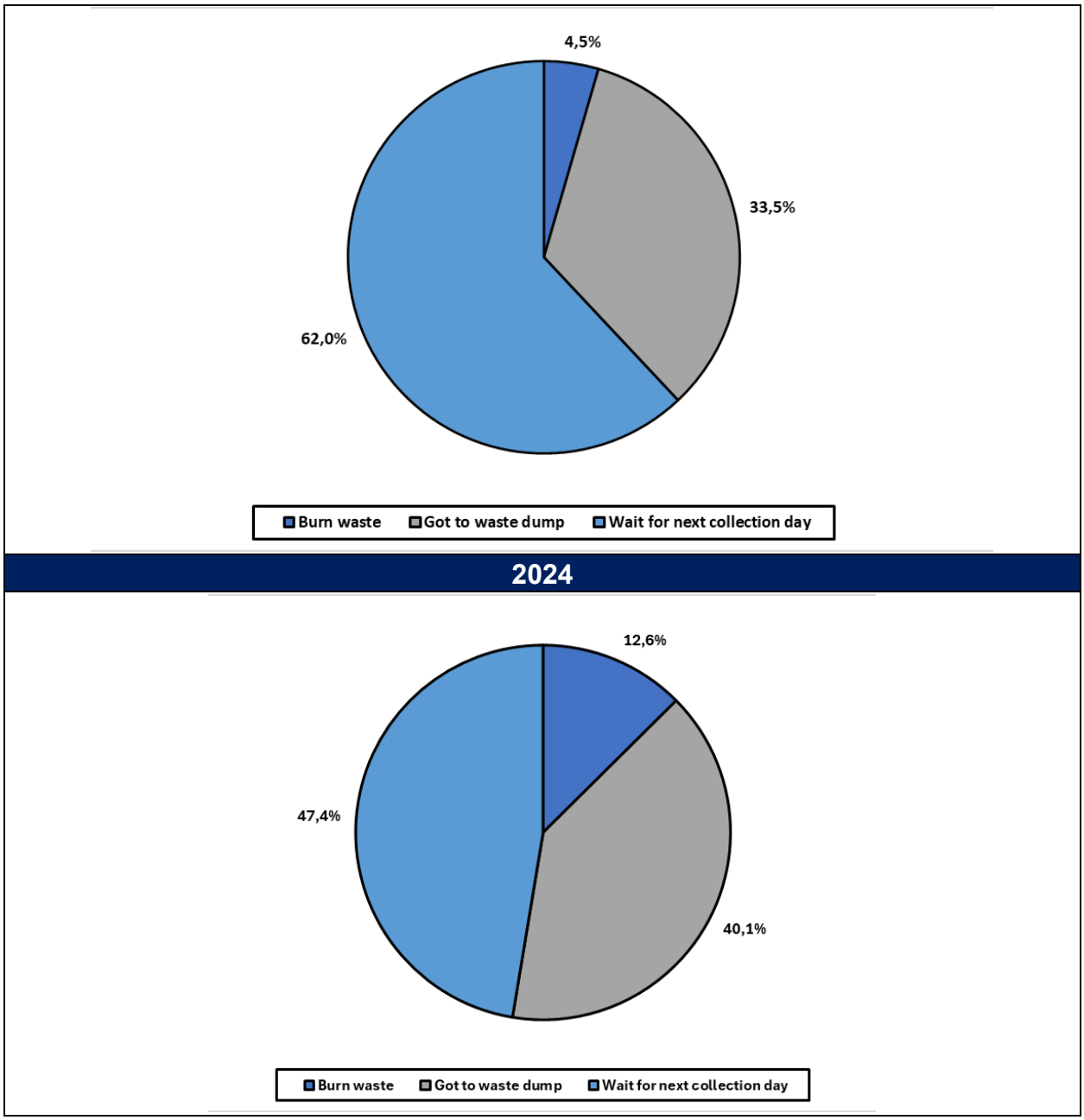


Figure 54). This suggested that KwaZamokuhle is in a better position than other places in the country. More importantly, if waste is regularly collected, it negates waste dumping and waste burning which leads to increased air pollution.

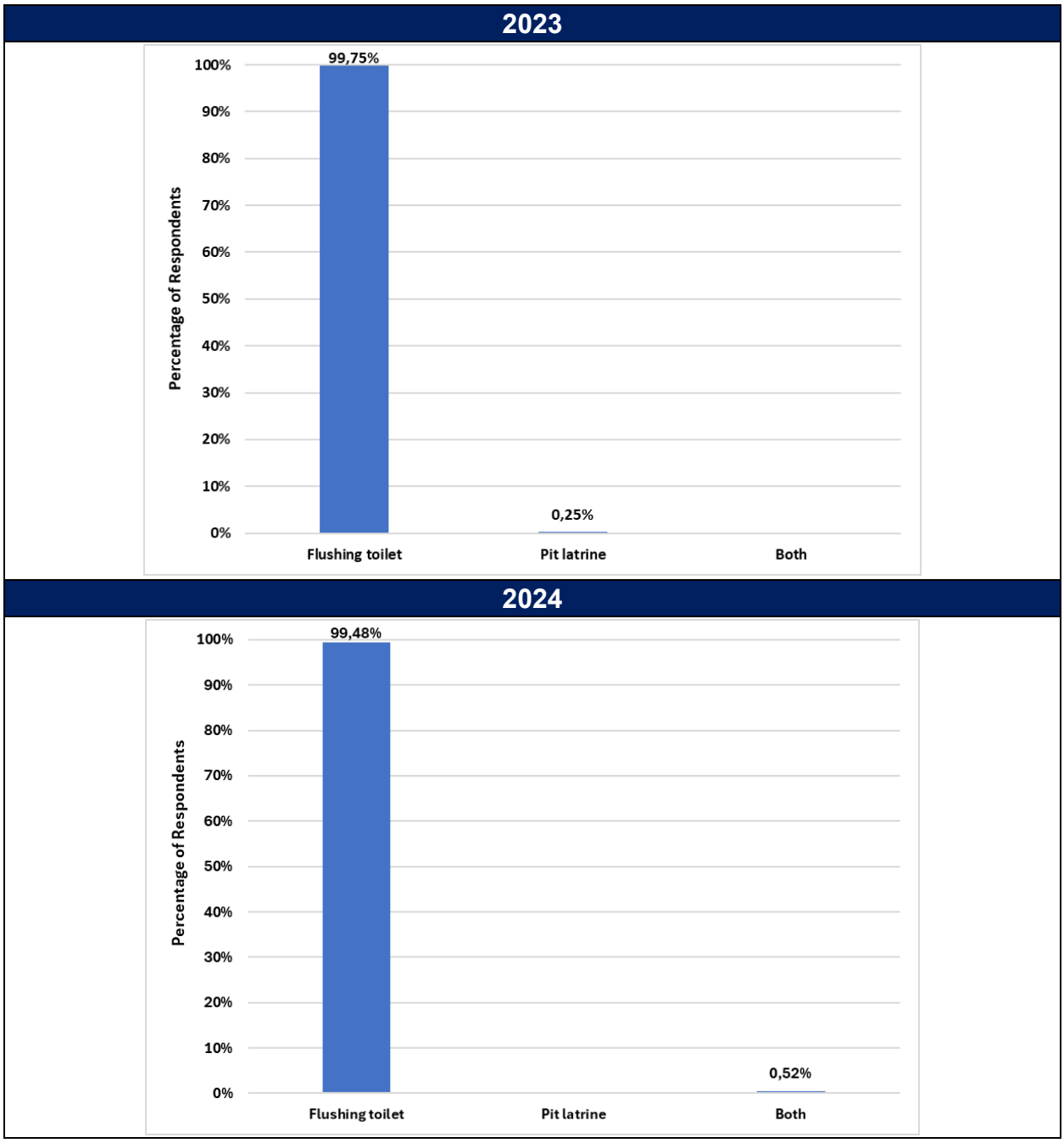


Figure 51: Percentage of households with either a flushing toilet, pit latrine or both in 2023 and 2024.

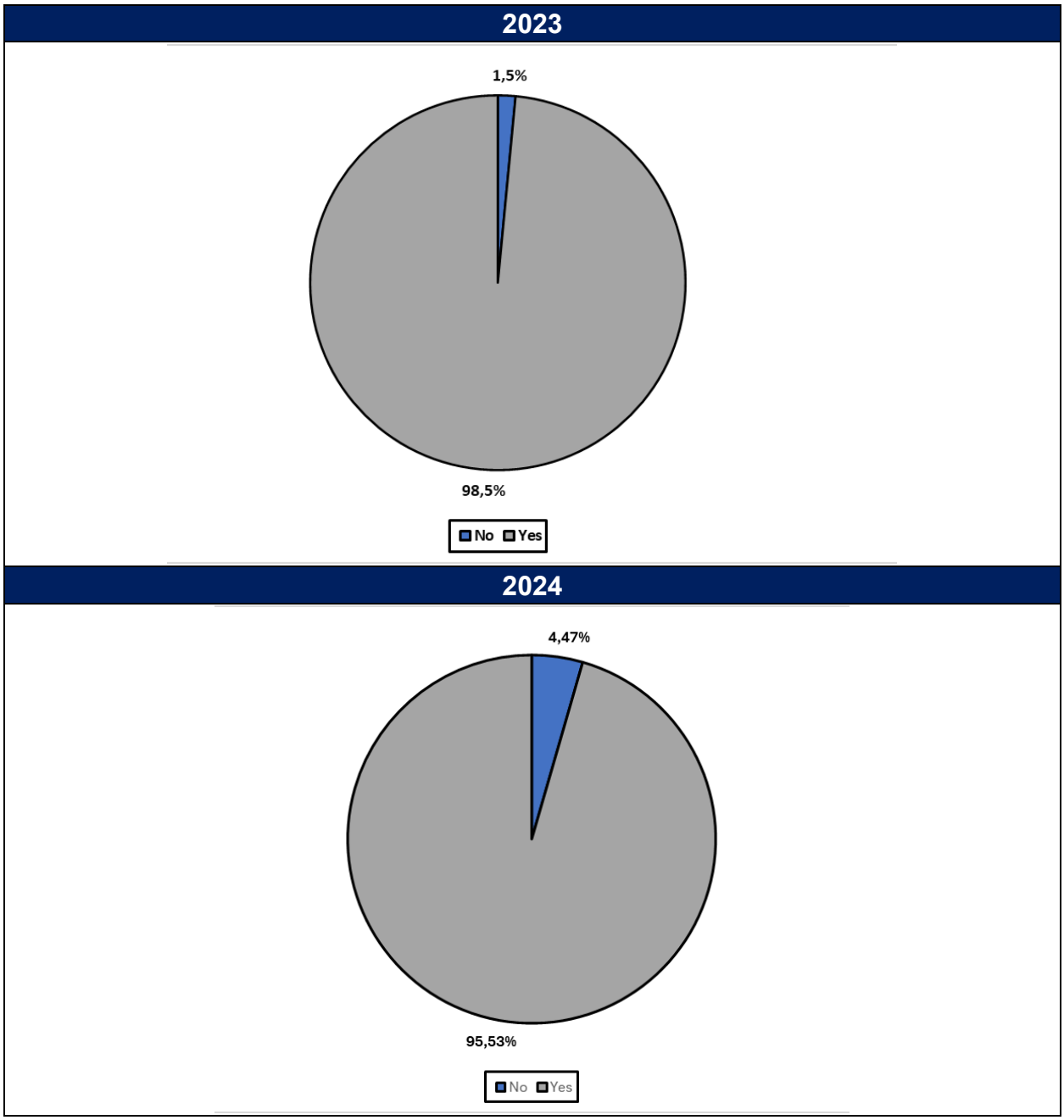


Figure 52: Respondent households that have household waste collected in 2023 and 2024

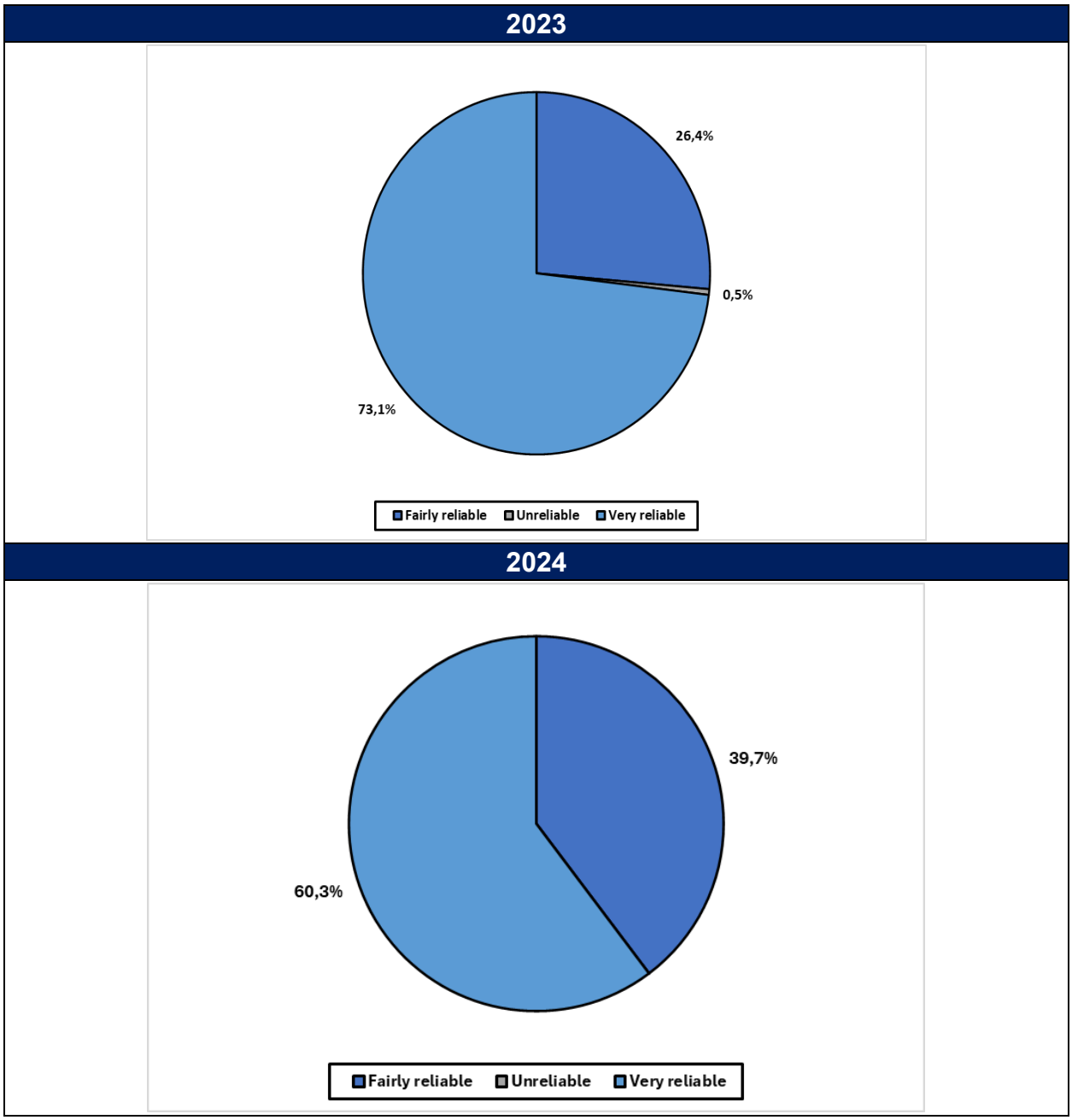


Figure 53: Reliability of waste collection to respondent households in eZamokuhle in 2023 and 2024

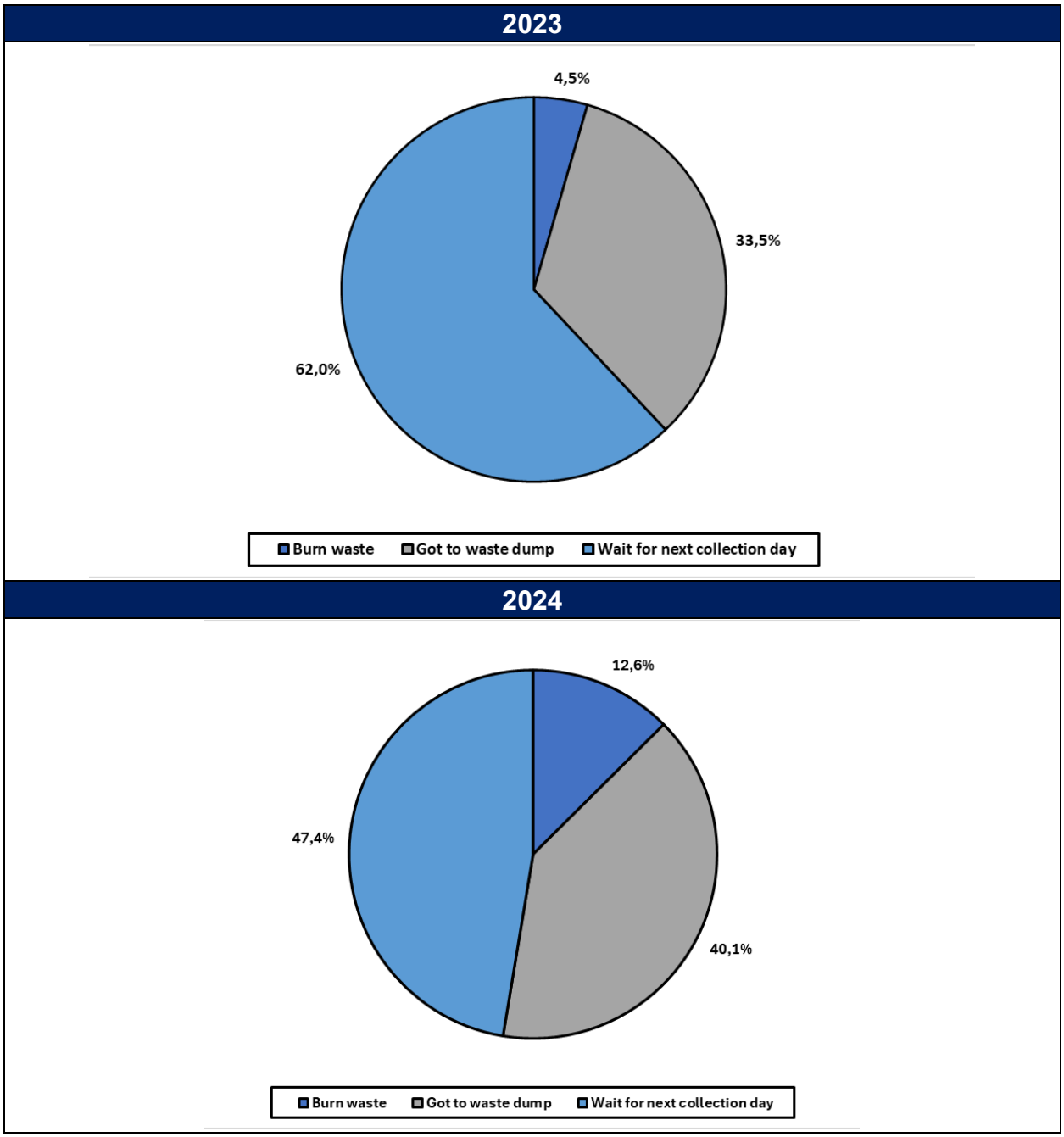
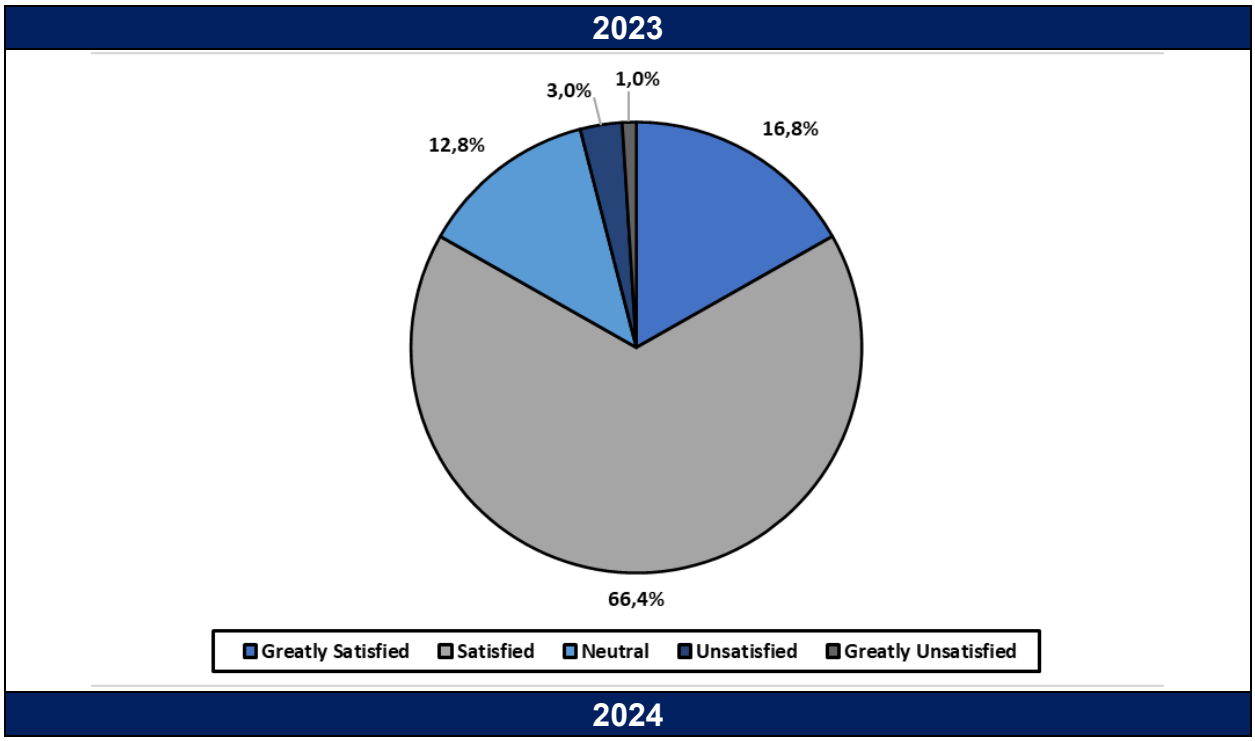


Figure 54: Alternate waste removal method if waste is not collected at respondent households in 2023 and 2024

3.1.5.5 Air Quality Awareness

The 2023 pre-intervention survey indicate that 83% of the respondents indicated that they were generally satisfied with the air they breathe (



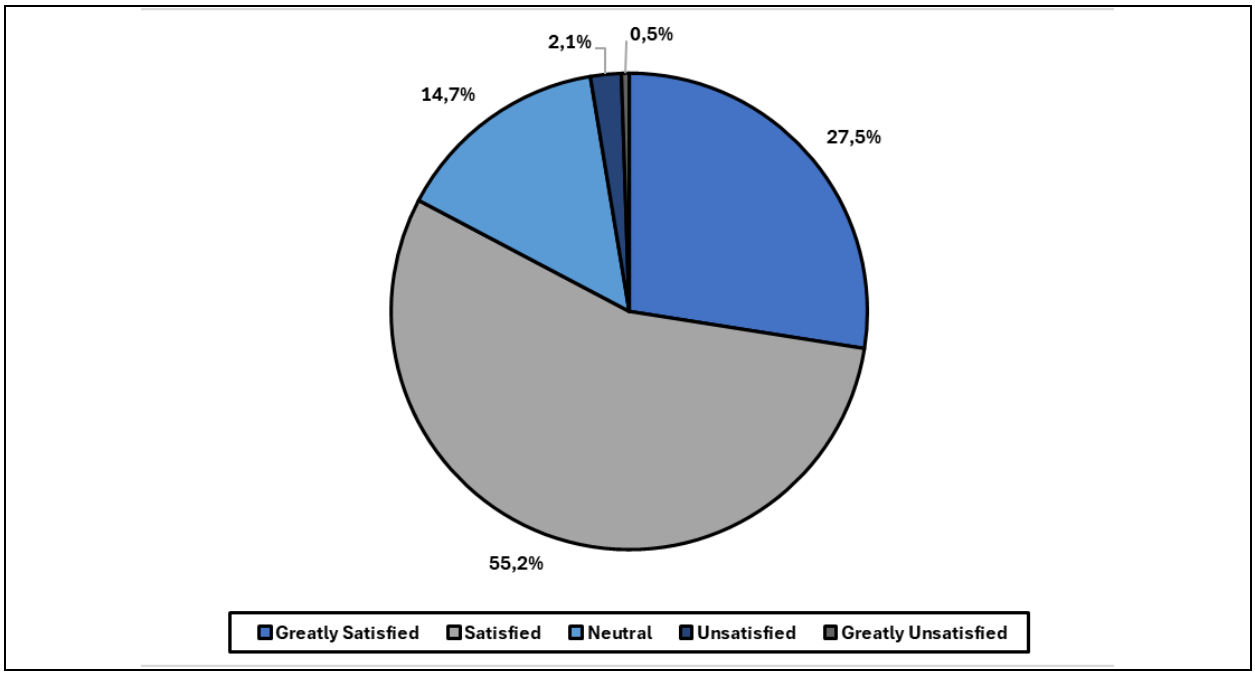


Figure 56) and 36% of respondents did not feel that air pollution was a problem or stayed neutral. An increase to 82.7% of the respondents indicated that they were generally satisfied with the air they breathe, whilst 43.2% of respondents did not feel that air pollution was a problem or stayed neutral during the 2024 post-intervention survey.

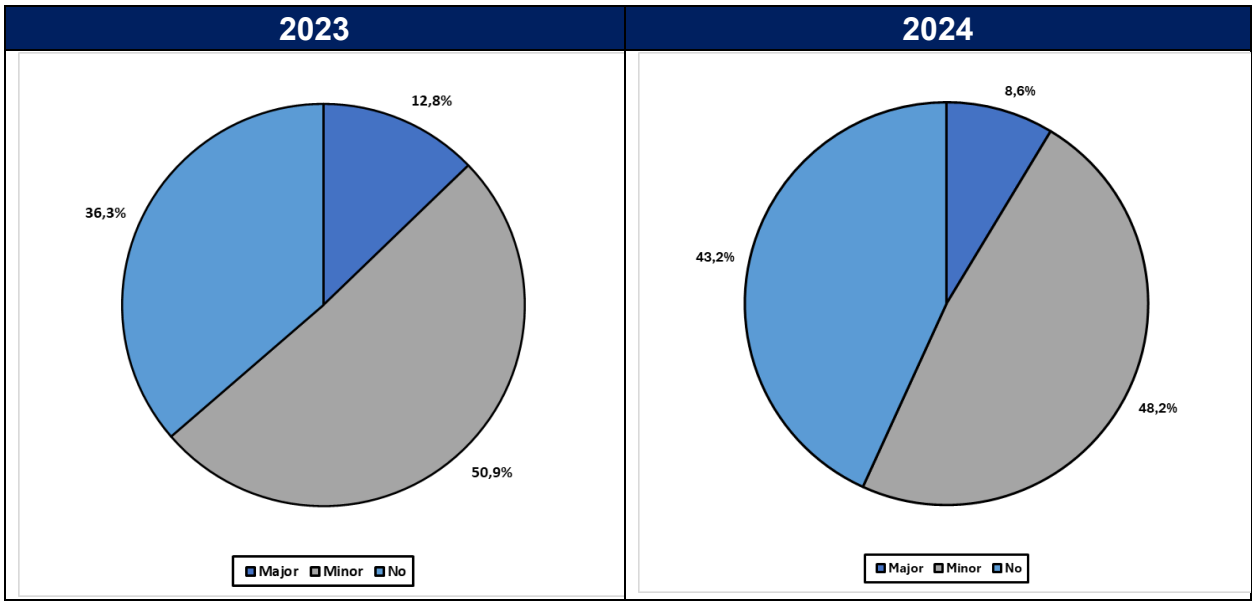


Figure 55: Respondents thoughts on air pollution being a problem in KwaZamokuhle in 2023 and 2024

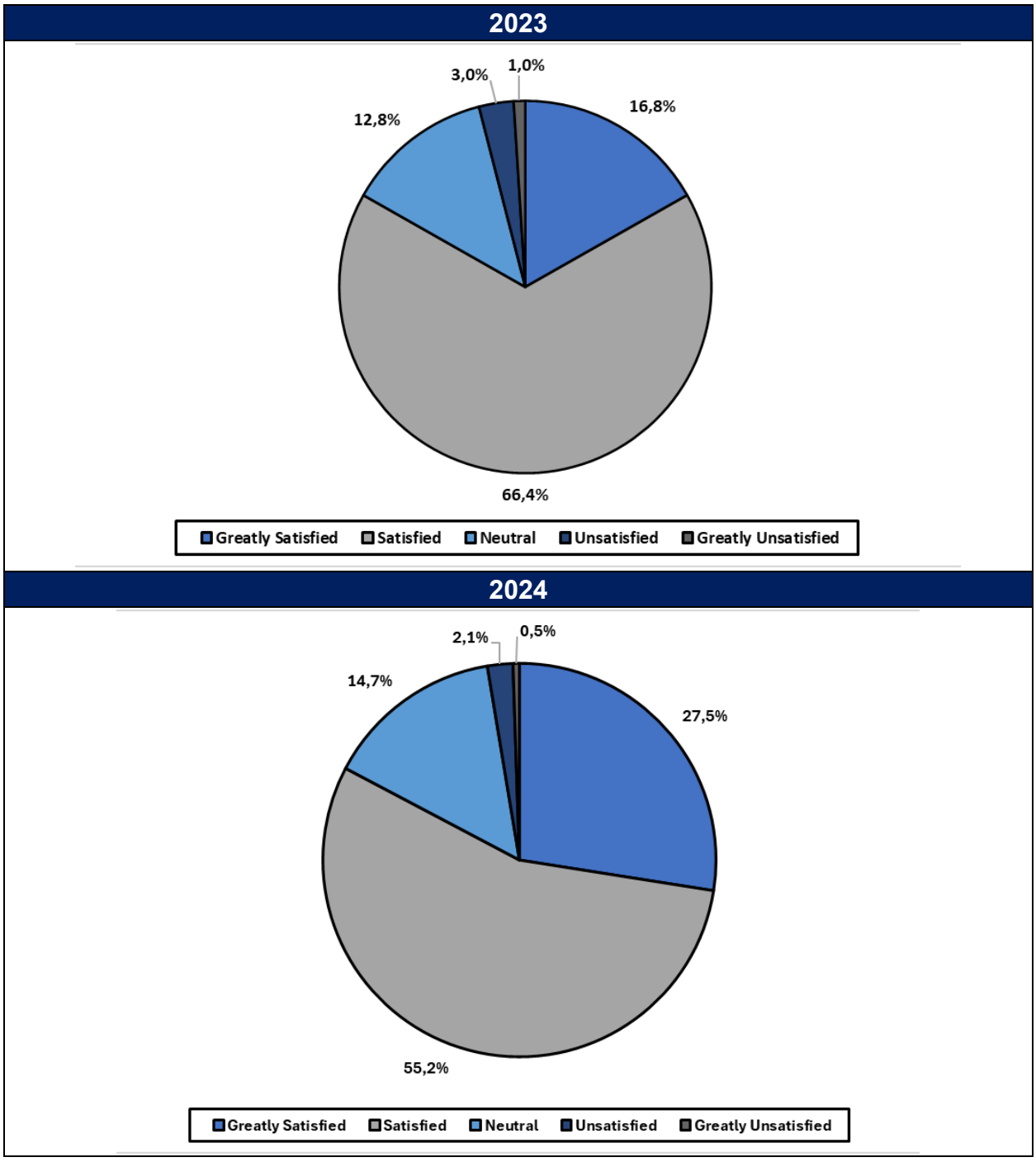


Figure 56: Respondents satisfaction with air they breathe in 2023 and 2024

3.2 PROJECTIVE EFFECTIVENESS

Before examining the effectiveness results, it is crucial to distinguish between two complementary but distinct measures of programme success:

Intervention Effectiveness refers to the technical performance of individual components−whether the hybrid stoves cook food adequately, whether LPG heaters warm homes sufficiently, whether ceilings reduce heat loss, and whether rewiring improves electrical safety. This measures if each technology functions as designed at the household level.

Project Effectiveness encompasses the broader systemic impact − whether the combined interventions achieve the AQO programme's objectives of reducing emissions, improving air quality, transforming energy use patterns, and enhancing quality of life across the community. This measures whether the intervention package creates meaningful, sustained change at scale.

The distinction matters because interventions can be technically effective while failing to achieve project-level transformation. Conversely, project success may persist despite individual component challenges if synergies between interventions compensate for specific weaknesses. The KwaZamokuhle assessment reveals both dynamics at play.

3.2.1 CEILING INTERVENTION

Ceiling Installation

Of the sampled households in 2023, 376 respondents (97.5%) reported that they viewed the ceiling to be of good quality **(Table 3)**. Of the 22 respondents (5.5%) indicated a negative view of the ceiling quality, 6 of the respondents indicated that the ceiling is of poor quality ,5 respondents indicating their rooves are leaking, with the other 11 respondents indicating a combination of issues such as a poorly installed ceilings, cornices falling apart or poor quality ceilings, as summarised in Table 4

Table 3:Ceiling installation in KwaZamokuhle 2023

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents		Total number of Respondents
Ceiling Intervention: Ceiling Team				
Section	**Question**	**Yes**	**No**	398
Ceiling Work	Is the Eskom installed ceiling of a good quality?	376	22	
	Household items damaged by ceiling installation team	11	387	
	Ceiling team left a mess	10	388	

Interaction between the teams involved in the project and the households is important to maintain trust between Eskom and the community. In 2023, when asked about the intervention teams, only 11 respondents (2.8%) reported having the ceiling teams damage items in their household. Damaged items ranged from broken windows to damaged furniture as seen in Table 4.

Ten (10) respondents (2.5%) reported that the ceiling team did not clean up after the ceiling interventions were installed with the team leaving the house dirty(leftover SPF, leftover cuts from the ceiling and cornice) as noted in Table 4.

Table 4:Ceiling intervention quality in 2023

Ceiling Intervention Quality		
Issue	**Reason**	**Number of Respondents**
Why ceiling quality is not of good quality	Bad quality paint	1
	Cornices falling apart	3
	Poor ceiling installation	3
	Poor ceiling quality	6
	poor ceiling quality; water leaks	1
	Poor quality globe holder	1
	Water leaks	5
	Water stains	1
	Water stains and leaking	1
Damage done to home by installation team	Broken bedroom window	1
	Broken window and broken kitchen storage	1
	Couch sprayed with foam	1
	Curtain holders	1
	Electricity meter bridged	1
	Gate	1
	Damaged curtains and furniture	1
	They added a metal sheet which damages the ceiling when it raining	1
	Tore a couch	1
	Wall jack	1

Type of mess left by team	Ceiling spray damaged the property	1
	Celling not painted properly	1
	Furniture damaged	2
	Left the cut pieces of ceiling and cornice on the floor	2
	Torn carpet	1

Ceiling Condition

Respondents in 2023 were asked if their ceiling was in the same condition when interviewed as when installed with 90% (359 respondents) indicating the ceiling is still in the same condition as when installed (Table 5). The other 39 respondents (10%) indicated that they experienced the roof showing stains, leaking, as well as having the roof cornices becoming loose over time. In 2024, 352 of respondents (89.3%) indicated that the ceiling is still in the same condition as when installed (Table 5). Forty (40) respondents indicated that the ceiling condition was not the same due to water leaks and ceiling stains, and /or the roof being damaged, as shown in Image 1 **(Table 7).**

In 2023, 68 respondents experienced roof leaks that were mostly caused by the poor ceiling installations, adverse weather conditions or damaged metal sheets (Table 6). In 2024 52 respondents experienced roof leaks that were mostly caused by old or damaged metal sheets,adverse weather conditions or poor roof installations. Only 38 of the respondents attempted to fix the leaking rooves by themselves in 2023 and 29 respondents in 2024. Sixteen (16) of the 68 respondents reported to Eskom about the leaks in 2023. In 2024 only 29 respondents attempted to fix the leaking rooves by themselves, and 30 of the 68 respondents reported to Eskom about the leaks. Five (5) of the respondents reported that their rooves were fixed after reporting the leaks to Eskom in 2023, and 8 respondents in 2024.

Compared to 2023, the number of respondents that indicated that they would not fix future leaks due to high costs and the opinion stayed relatively the same with 316 respondents in 2024 compared to 206 in 2023.

Table 5: Condition of respondent's ceiling in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Ceiling Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Ceiling Condition	Ceiling looks the same as when installed	359	39	341	40
	Stains on the ceiling	41	355	52	328
	Ceiling leaks	68	330	70	310
	Attempt to fix leak by themselves	38	30	29	41
	Did you let Eskom know about the leak	16	52	30	40
	Eskom fixed the leak	5	63	8	61
	Will not fix future leaks due to high cost	206	73	316	60

Table 6:Ceiling condition quality in 2023

Ceiling Condition Quality		
Issue	**Reason**	**Number of Respondents**
Why Ceiling Condition is Different	Ceiling damaged	3
	Ceiling stains	8
	Damaged metal sheets;Ceiling leaks	1
	Falling ceiling	2
	Falling ceiling;Water leaks	1
	Hole in metal sheet	1
	Holes in ceiling	2
	Loose ceiling	1
	Not enough cornice used	1
	Peeling ceiling edges	1
	The cornice is getting loose	6
	The cornices were left loose	1
	They extended the house	1
	Water leaks	4
	Water leaks; Ceiling stains	3
	Water leaks; Falling ceiling	1
Description of Stain and Cause	Black; Cause not mentioned	3
	Brown; Cause not mentioned	21
	Brown; Caused by rain	10
	Grey; Cause not mentioned	3
	Rain; Cause not mentioned	1
	White; Cause not mentioned	2
	White and black; Cause not mentioned	1

Cause of Ceiling Leak	Bad weather conditions	7
	Damaged metal sheets	5
	Don't know	2
	Holes in roof	2
	Old metal sheet	6
	On the sides of the wall	4
	Poor roof installation	11
	Rainfall	30

Table 7:Ceiling condition quality in 2024

Ceiling Condition Quality		
Issue	**Reason**	**Number of Respondents**
Why Ceiling Condition is Different	Ceiling damaged	3
	Ceiling discoloured	1
	Ceiling is falling	5
	Ceiling is rotting	1
	Ceiling stains	6
	Ceiling stains;Ceiling is falling	1
	It has been patched with other pieces of ceiling	1
	The Cornices are falling	1
	There are leaks and loose cornice	1
	They have just renovated	1
	Water leaks	18
	Water leaks; Ceiling stains	1
Description of Stain and Cause	Black; Caused by rain	1
	Brown; Caused by rain	4
	Grey; Caused by rain	5
	Grey; Cause not mentioned	5
	Brown; Cause not mentioned	11
	Green and black; Cause not mentioned	2
	Black; Cause not mentioned	11
	Brown/yellow; Cause not mentioned	1
	Black and brown; Cause not mentioned	7
	Colour not mentioned; Caused by rain	2
	Black and grey; Cause not mentioned	1
Cause of Ceiling Leak	Damaged metal sheet	7
	Damaged roof	11
	Faulty celling	1
	It been like that	1
	Metal sheets haven't being closed properly	5
	Not sure	9

	Old metal sheets	11
	Old roof	1
	Rain	13
	Rain and improper installation	3
	The chimney hole was not correctly closed	7

Image 1: Ceiling stains noted in household

Ceiling Cornices

In 2023, 32 of respondents reported having the wall cornices becoming loose as shown in (Figure 59) with poor installation and rainfall being named as the main causes of the loose cornices (Figure 57). In 2024, 24 respondents reported having the wall cornices becoming loose, with a majority of respondents with poor installation and rainfall being a factor for them being loose **(Figure 57).**

Five (5) of the 20 respondents attempted to fix the loose cornices in 2023, with 7 of the respondents informing Eskom of the issue **(Table 8**), whilst in 2024 2 respondents reported that they attempted to fix the loose cornice themselves **(Table 8)**. In 2023 7 respondents reported their problem of the loose cornice to Eskom in 2023, whilst a higher number of respondents (13) reported their issues to Eskom regarding the loose cornice in 2024. Two (2) of those respondents reported that the loose cornice was fixed in 2023 **(Table 8).** whilst in 2024 4 of the 13 respondents reported that Eskom did come back to fix the loose cornice **(Table 8).**

Table 8:Ceiling cornices of respondent households in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Ceiling Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Ceiling Cornices	Cornice becoming loose	32	366	24	356
	Trying to fix loose cornice	5	26	2	21
	Did you let Eskom know of the loose cornice	7	24	13	10
	Did Eskom fix the loose cornice	2	29	4	19

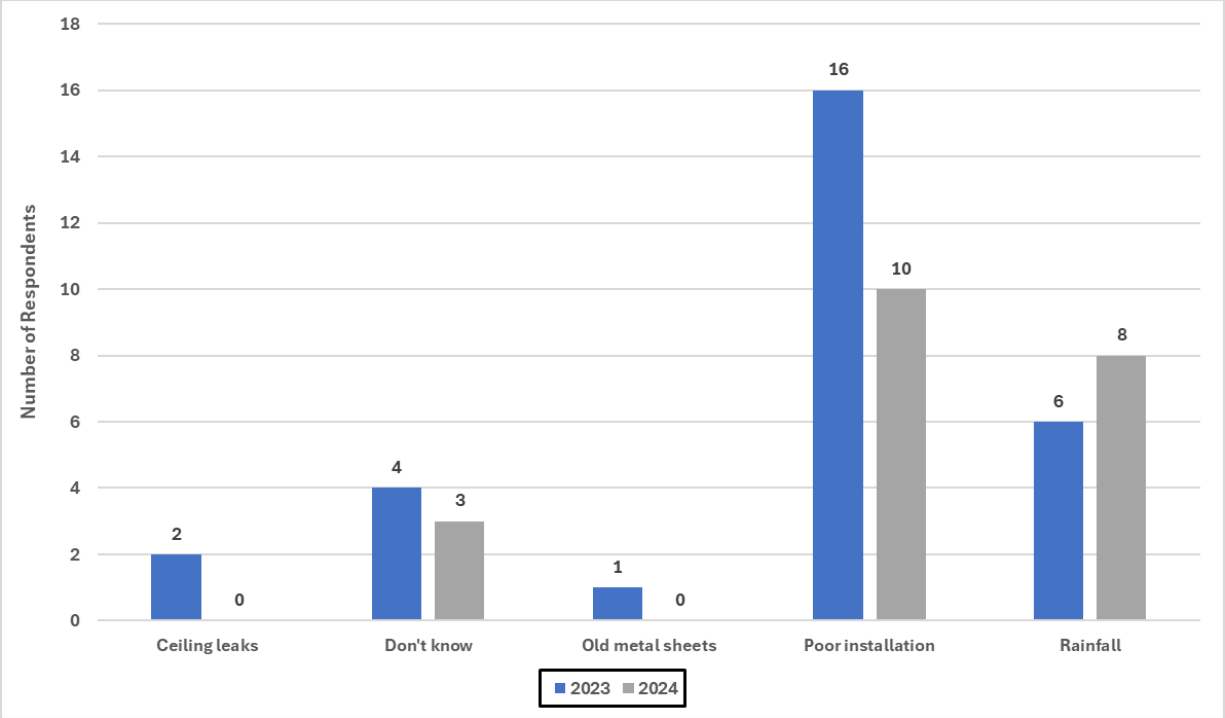


Figure 57: Cause of loose cornice on wall or ceiling in 2023 compared to 2024

Figure 58: Loose cornice in a respondent's household

Ceiling Maintenance

The 2023 survey highlighted that 31 of respondents indicated that they conduct maintenance on the ceiling, with the main reason being to keep the roof in good condition and to fix water leaks **(Table 9).** In 2024, 37 of the 381 respondents (30.2%) reported to currently conduct maintenance on their ceilings, stating the same reasons as in 2023 to keep the roof in good condition and to prevent water leaks **(Table 9)**. The other 367 respondents in 2023 **(Table 9)** indicated they would not conduct maintenance due to their current ceiling being in good condition and therefore not needing maintenance at the moment, or that they could not afford to conduct maintenance as it is expensive. In 2024 the other 341 respondents indicated they would not conduct due to their current ceiling being in good condition and therefore not needing maintenance at the moment and that it is too expensive to conduct maintenance on their ceiling. The matter of affordability to maintain the ceiling is supported by the income profile of KwaZamokuhle showing many respondents being in the low-income earning bracket of R 1000 – R 5000, and with some using informal forms of income.

When the respondents were asked if they would fix the ceiling damage by themselves in 2023(Table 9), 117 indicated they would fix the damage, with the main reason being to keep the ceiling in good condition. In 2024 60 respondents (15.7%) reported that they will fix any future ceiling damage **(Table 9)**, which is a decrease from 2023 where 117 respondents indicated that they would fix any damage. It is important to note that there is a perception from the respondents that Eskom should be responsible to fix the ceilings in the future if any damage or leaks are experienced, with 353 respondents (89.8%) reporting this sentiment in 2023 and 348 respondents (91.9%) in 2024.

Table 9: Ceiling maintenance in 2023 and 2024

eZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Ceiling Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Maintenance	Currently conduct maintenance on ceiling	31	367	37	341
	Fix any future ceiling damage	117	277	60	316
	Eskom should fix future water leaks or damage	353	40	348	29

Respondents' satisfaction with Ceiling

Respondents were asked questions to indicate overall satisfaction with the ceiling intervention in 2023 and 2024. Fifteen (15) of respondents (3.7%) feel that the ceiling is not safe. Reasons quoted include: (1) the ceiling started to fall, or (2) not being in a general good condition after being installed **(Table 10)**. Despite this, nearly all the respondents (396 out of 400) recommended ceiling installations to be done in other households. In 2024 366 respondents (92.5%) still view the ceiling as being safe, with those that see the ceiling as being unsafe attributing this view to the ceilings leaking and possibly falling due to the water damage **(Table 10).** Three hundred and seventy-three (373) of respondents (97.7%) would recommend ceilings being installed in other households

Four hundred (397) respondents (99.7%) indicated that their homes were warmer due to the newly installed ceiling in 2023 (Table 10),whilst in 2024 368 respondents (99.2%) indicated that their house feels warmer than before the ceiling interventions **(Table 10).**

Overall,390 respondents (97%) were happy with their ceiling in 2023 (Table 10), and 368 respondents (96.3%) in 2024 **(Table 10)**.

Figure 59 shows the respondents coal use to keep the household warm after ceiling interventions in 2023 and 2024. 377 respondents indicating that they use less coal to keep their house warm during cold weather conditions compared to before the ceiling interventions were implemented during 2023. In 2024 338 respondents mentioning that they are using less coal to keep the households warm in cold weather conditions than before the ceiling interventions were completed.

Figure 60 shows the reasons as to why the respondents are not happy with the ceiling installation in 2023 and 2024. Respondents that were not happy with the ceiling installations in 2023 cited poor quality roofing and leaking or damaged roofs as their main sources of unhappiness with the ceiling. In 2024 respondents were unhappy with the ceiling installation due to the ceiling falling.

Figure 61 shows the respondents recommendations on how Eskom can improve on the ceiling installations in 2023 and 2024. In 2023 324 respondents (80.7%) respondents indicated they had nothing to recommend, and 11 respondents indicating better skilled labourers need to be recruited

by the installation contractor. In 2024 292 respondents (76.6%) indicated they had nothing to recommend, and 4 respondents indicating better skilled labourers need to be recruited by the installation contractor.

Table 10: Respondent satisfaction with ceiling in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Ceiling Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Satisfaction	Ceiling is safe	383	15	366	12
	Recommend ceiling installation to other households	396	2	373	5
	Home is warmer with new ceiling	397	1	375	2
	Happy with installed ceiling	390	8	368	10

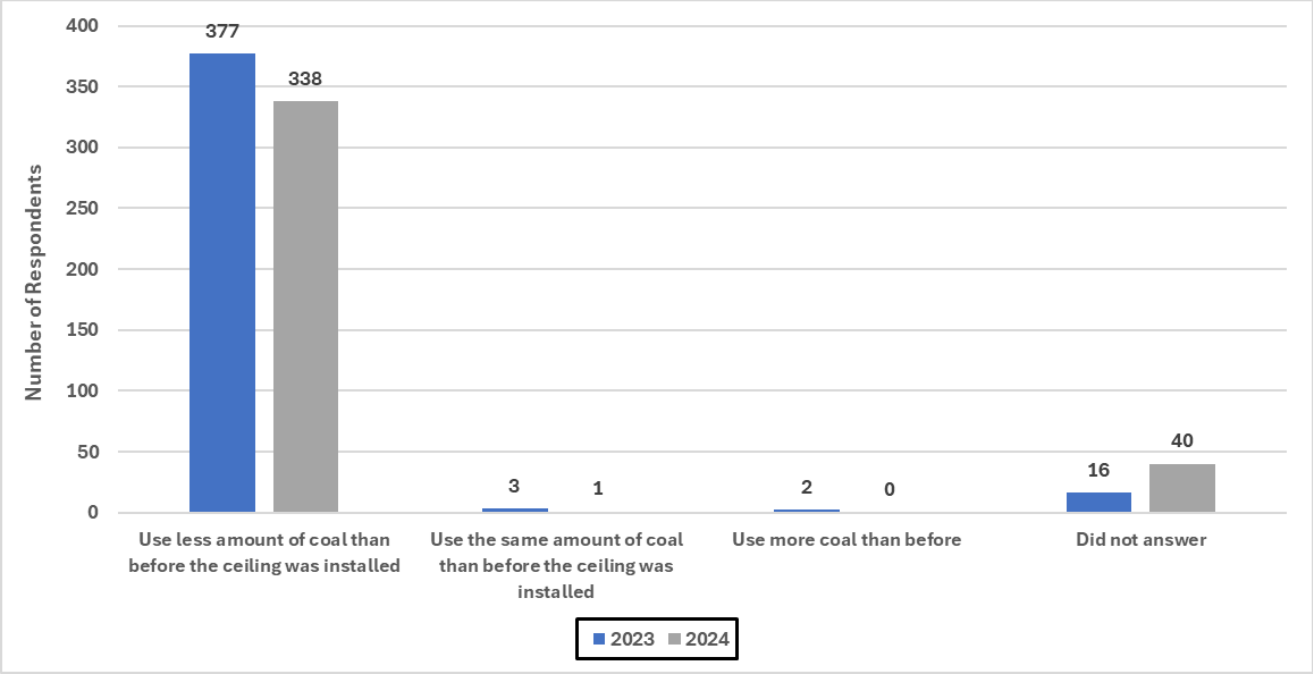


Figure 59:Respondents Coal use to keep the household warm after ceiling interventions in 2023 and 2024

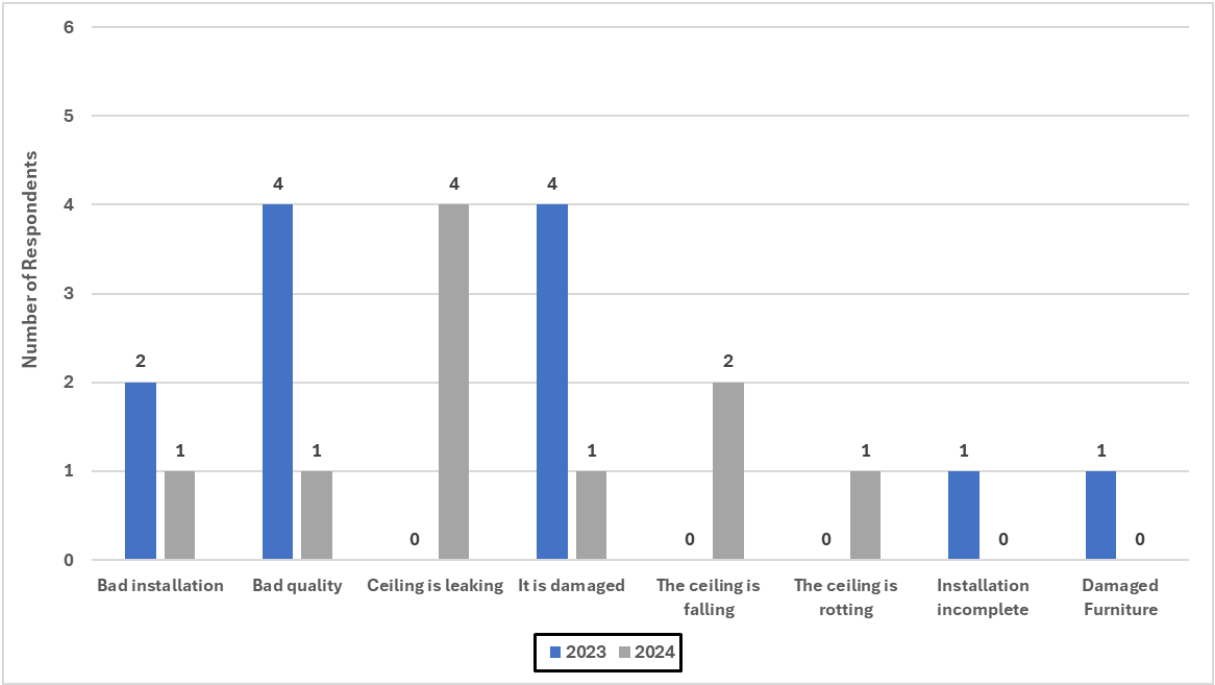


Figure 60: Reason respondents are not happy with ceiling installation in 2023 and 2024

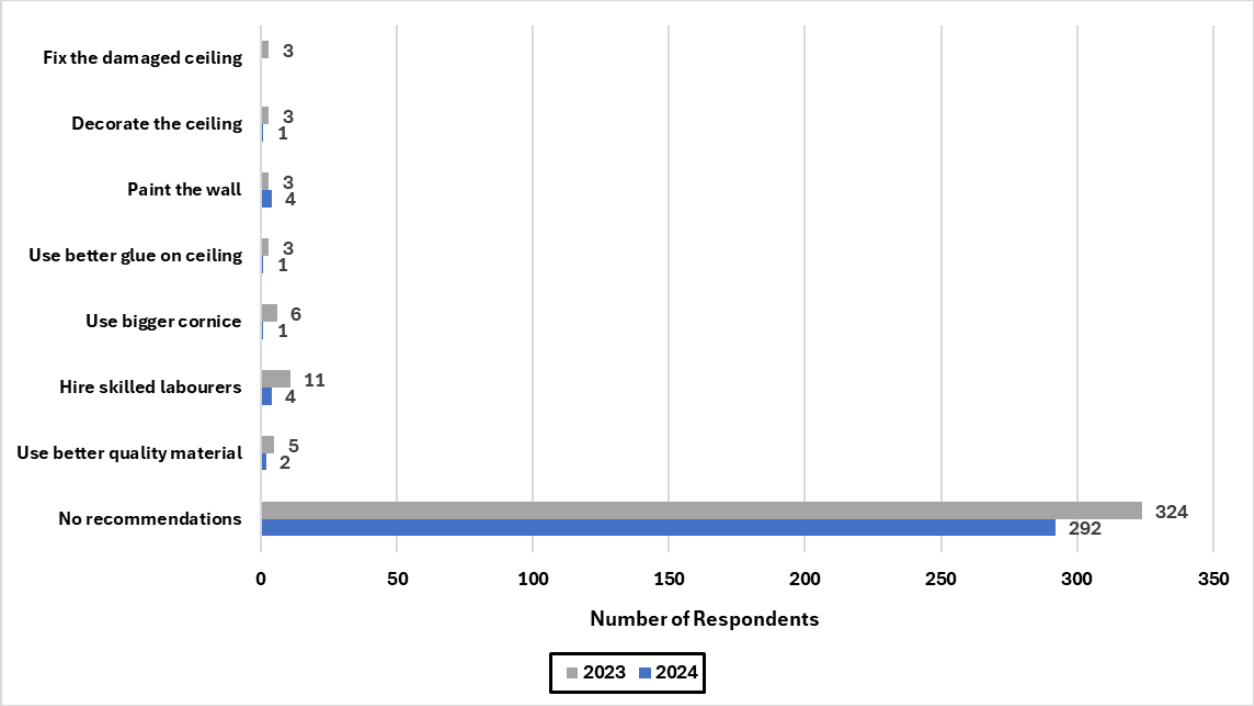


Figure 61: Respondents' recommendations on how Eskom can improve on the ceiling interventions

3.2.2 LPG Heater Intervention

LPG Installation

At the time of the survey being conducted in 2023, only 379 respondents indicated that they had received LPG heaters **(Table 11).** Three hundred and sixty-five (365) respondents (96.3%) indicated that they viewed the LPG heater as being of good quality. The 11 households indicated the biggest issue being that the heaters stopped working after delivery **(Table 15)**. During 2024, 342 respondents (96.8%) reported that the heater is of good quality **(Table 11)**.

An issue that can hinder a supply of an energy source, would be the absence of a strong supply chain within a community. In this case, the lack of an LPG supplier close to KwaZamokuhle could lead to respondents relying again on reliable coal and wood sources. In 2023, 294 of respondents (77.5%) indicated they had a place where they could refill their gas cylinders, with the suppliers being mostly situated in Hendrina. The 2024 survey highlighted less respondents (181) indicating that there are places available for them to refill the LPG cylinders **(Table 9)**. The decrease in available places for LPG refills, denotes the importance of having locally placed LPG distributors to be established within KwaZamokuhle.

Worthy to mention is that during 2023, 1 respondent indicated that the LPG installation damaged items in their household when installing the LPG heater.

Figure 62 shows where respondents refill their gas cylinders in 2023 and 2024,with respondents relying mostly on the Mica located in Hendrina town, the Total garage and the Eazy Pack Supermarket.

Table 11:LPG installation quality in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
LPG Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Installation	LPG heater is of good quality	365	11	342	11
	Place available to refill cylinders	294	83	181	161
	Team damaged items in household	377	1	N/A	

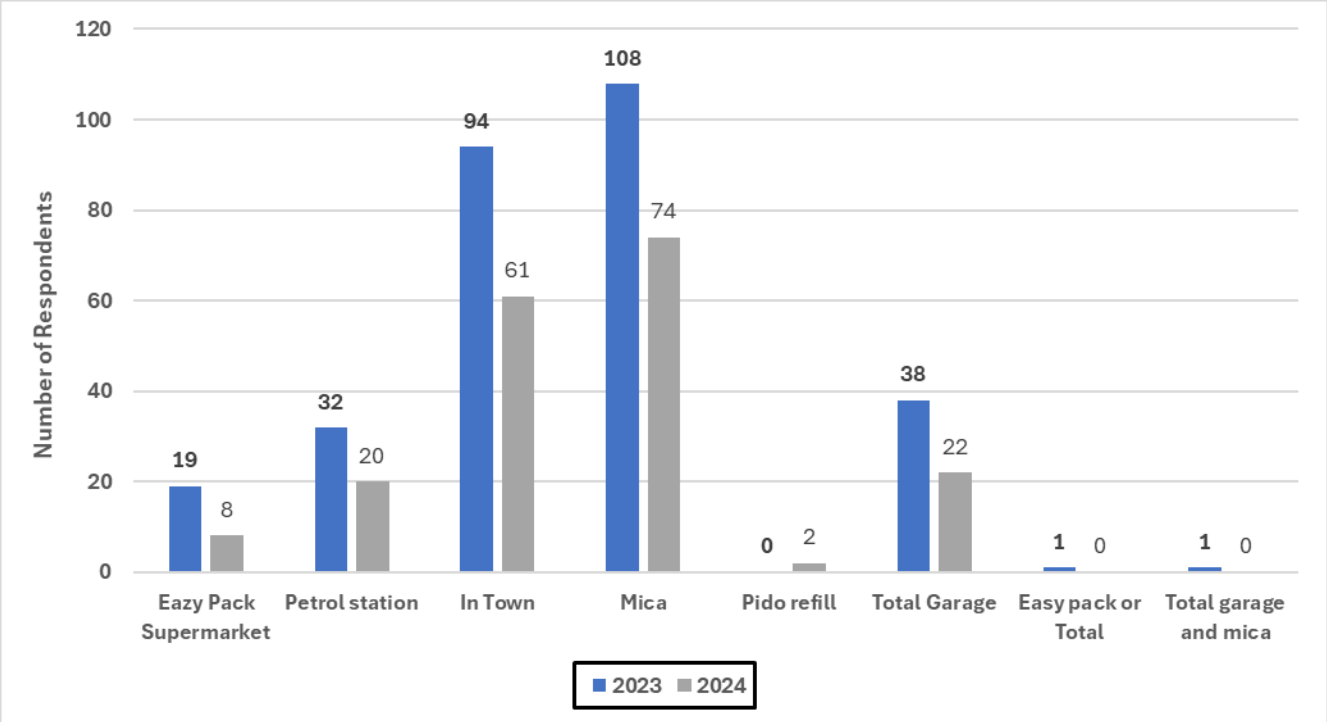


Figure 62: Where respondents refill their gas cylinders in 2023 and 2024

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Respondents' LPG Usage

In 2023, 363 respondents (97.3%) indicated that their LPG heaters are still in good condition as of the day of the interviews **(Table 12)**, thus 2.7% respondents unhappy with the LPG heater condition. In 2024, only 5 respondents (1.4%) reported that their LPG heater was not in the same condition as when delivered, due to their heaters being broken, or no longer being in their possession.

The 2023 survey highlighted 326 respondents (87.4%) indicated that the LPG heater was not expensive to use, compared to the coal alternatives such as the umbaula or a coal heater. However, in the 2024 survey indicate that 315 respondents (90.7%) reported that the LPG heater is not expensive to use. This supported with the feedback from the focus group interviews where respondents reported that in comparison to the coal prices and rising electricity prices, it is much cheaper for respondents to use an LPG heater than an umbaula or an electric heater. More respondents indicated that they are not scared of using the heater (81.4% in 2023 compared to 97.1% in 2024).

LPG costs prove difficult for respondents that are within the R 1000 - R5000 income bracket as the household budget would be constrained, forcing the respondents to use cheaper fuels such as coal or wood.

In the 2023 survey ,318 respondents (84.3%) indicated that they still have 9kg LPG cylinders **(Table 12)**, whilst in 2024, 314 respondents reported having 9kg cylinders left.

Figure 63 shows respondents view on why the LPG heater is expensive to use in 2023 and 2024.In 2023 .In 2023 51 respondents noted in Table 12 that they view LPG heaters as expensive stated due to: 1) the high cost of refilling the gas cylinders; 2) LPG heater using the gas too quickly and ;3) Respondents being unemployed. However, in 2024 only 33 users view the LPG cylinders to be expensive due to: the high cost of refilling the LPG cylinders.

Figure 64 shows residents who are scared to use the heater in 2023 and 2024. Through the surveys children and elderly are seen as the more vulnerable group when it comes to LPG use.

Thus, it would be a beneficial for safety campaigns to be run at schools to inform children on the dangers and ways to keep safe when utilising LPG devices.

Figure 65 shows why households do not feel warm in 2023 and 2024. In 2023, 14 respondents (1.5%) indicated that their home has not been warm after the installations due to the respondents not having the LPG heater in their possessions (Figure 15). These respondents indicated that either the landlords would take the heaters for their own use. In 2024, only 4 respondents (1.1 %) indicated that their home has not been warm after the installations due to the respondents not having the LPG heater in their possessions

Figure 66 shows how many gas cylinders households have left in 2023 and 2024. Three hundred and thirteen (313) households in 2023 have 2 9Kg cylinders in the household, whilst in 2024 306 respondents indicating they still had 2 LPG cylinders left, with 4 respondents indicating they only have 1 LPG cylinder left.

Figure 67 shows the household's view on coal usage to keep their homes warm since the LPG Heater installation in 2023 and 2024. Three hundred and fifty-six (356) respondents (94.3%) reported using less coal to keep their homes warm during cold conditions compared to before the introduction of the LPG heaters to their homes in 2023, whilst in 2024 305 respondents (87.8%) reported using less coal to keep their homes warm during cold conditions compared to before the introduction of the LPG heaters to their homes

Table 12:Respondent use of LPG heater in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
LPG Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Usage of LPG	LPG heater still in as good condition as when delivered	363	14	342	5
	LPG heater expensive to use	51	326	33	315
	Anyone at home scared to use the heater	70	307	11	337
	Still have any 9kg cylinders left	318	58	314	37
	House is warmer after installation	363	14	344	4

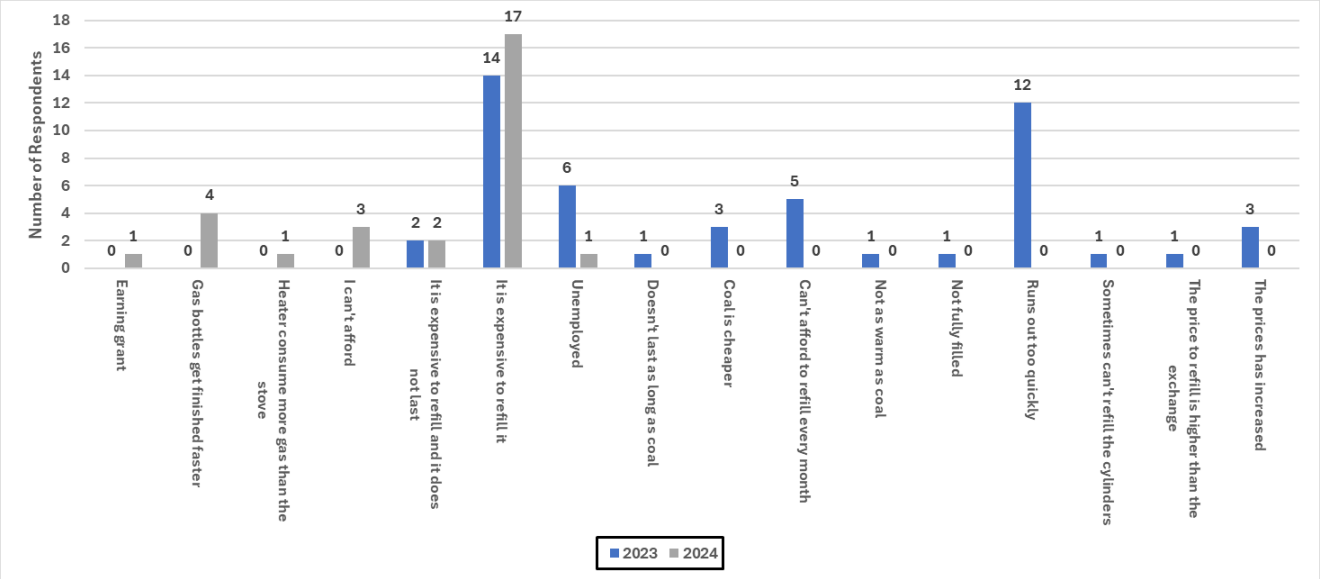


Figure 63: Why respondents view on why the LPG heater is expensive to use in 2023 and 2024

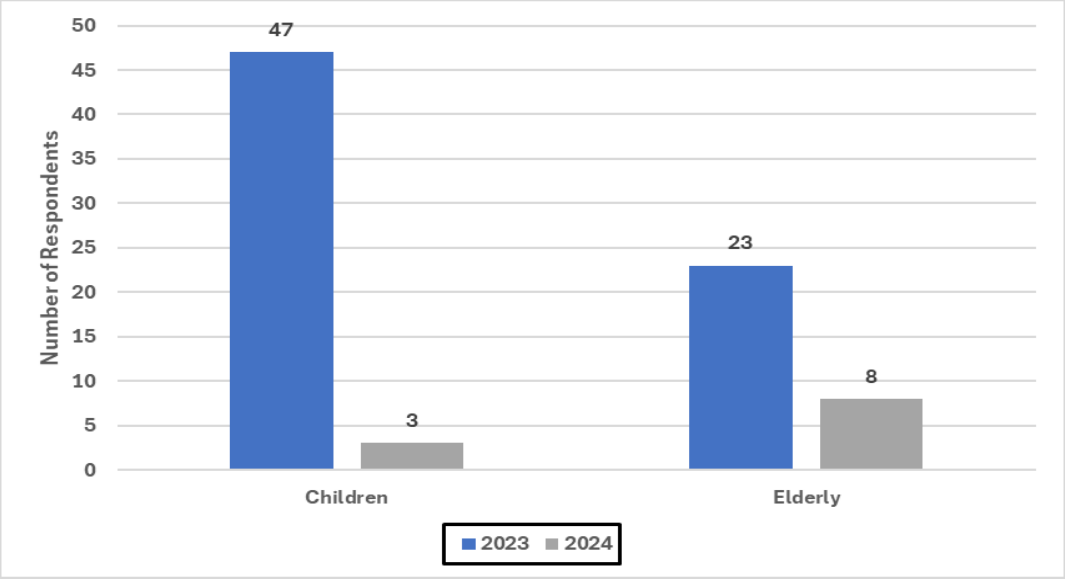


Figure 64: Household residents who are scared to use the heater in 2023 and 2024

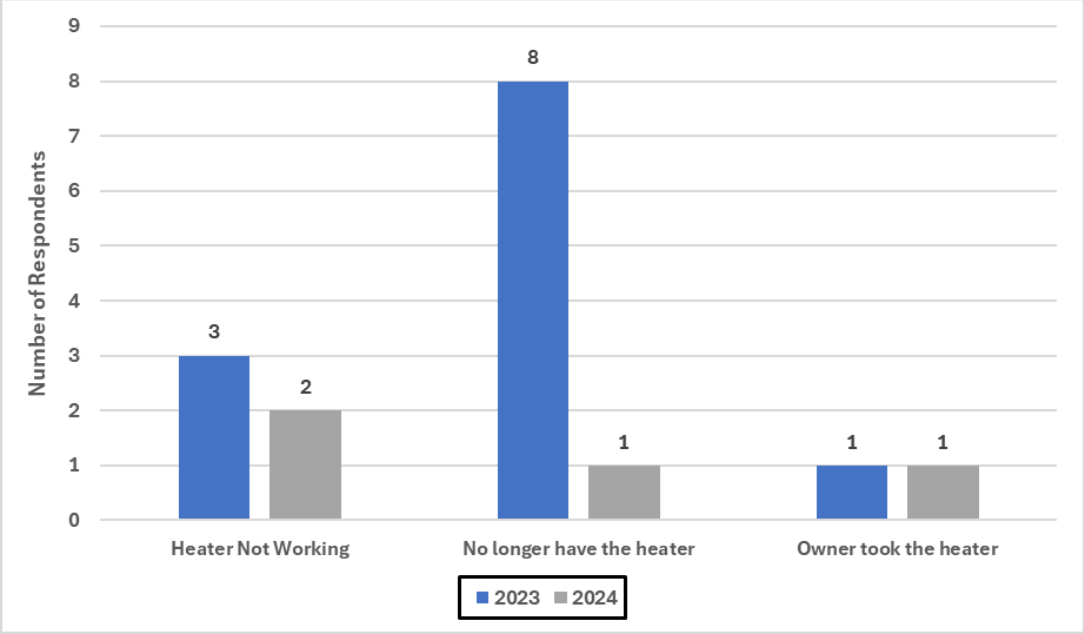


Figure 65: Why the household does not feel warm in 2023 and 2024

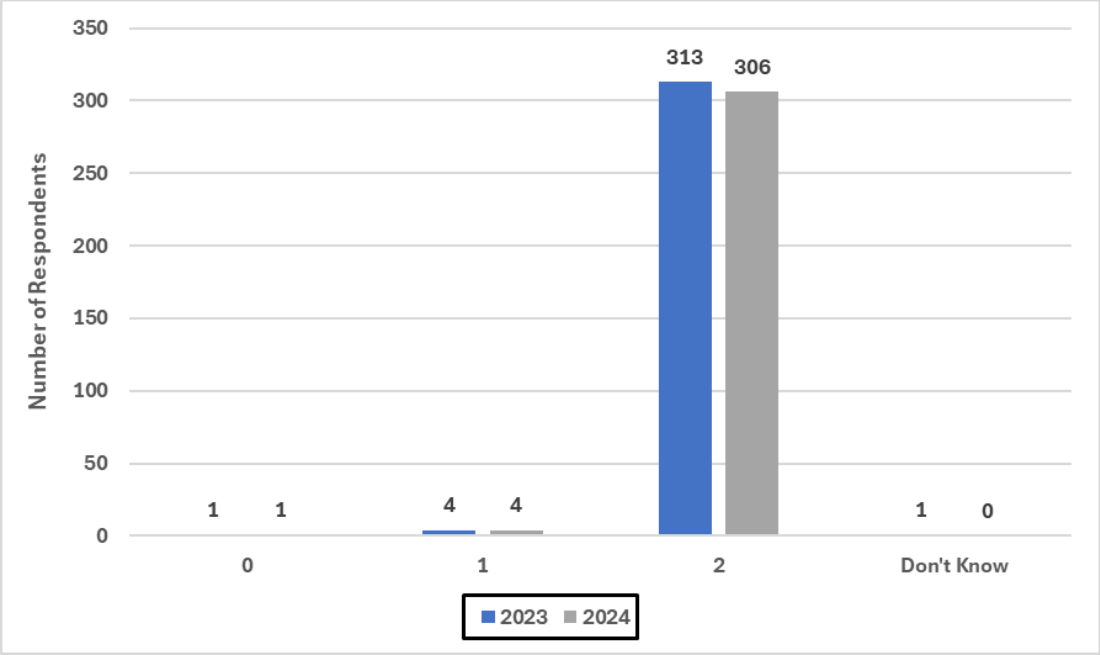


Figure 66:How many gas cylinders left in the house in 2023 and 2024

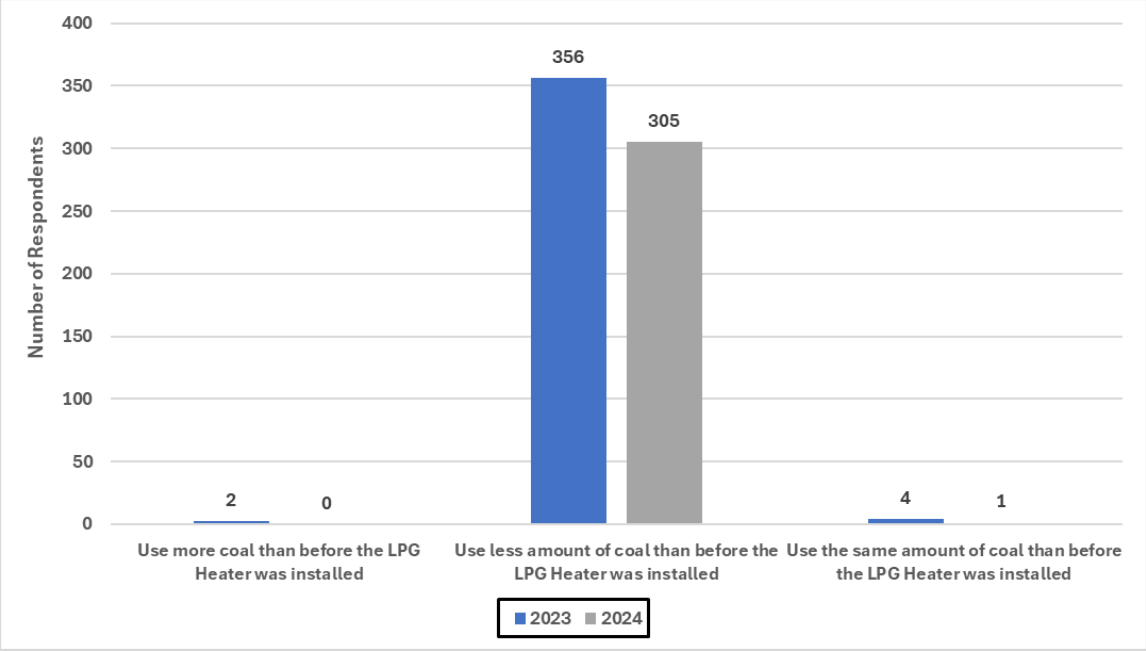


Figure 67:Households view on coal usage to keep their homes warm since the LPG Heater installation in 2023 and 2024

LPG Safety

As LPG technology is deemed as a safe alternative energy source, users have expressed safety concerns around the use of LPG based technologies due to poor installation or faulty cylinders[12]. Poor use, installation and maintenance can lead to incidents that could sway users away from LPG technologies.

In 2023, 363 of the respondents (96.3%) received training from the installation team, but it is important to note that only 135 (35.8%) respondents indicated that they knew what to do if they smelt gas when operating the LPG heater **(Table 13)**. A concern to note is that despite the respondents indicating they do not know what to do when they smell gas, 285 respondents (75.5%) indicated that they would not want to receive training on how to use the LPG heater (Table 13). In 2024 346 of the respondents (98.5%) indicated that they received training from the installation team, but worryingly there were still respondents that indicated that they did not know what to do if gas is smelt in when operating the LPG devices **(Table 13)**, with a number of the respondents indicating that they would not want to receive training on how to use LPG cylinders.

During 2023 only 8 respondents (2.1%) reported their LPG heater being damaged or defective since delivery, or they didn't know why. Of the 8 respondents, 3 attempted to fix the heater by themselves, and 6 of the respondents reporting to Eskom of the issue (Table 13). The number of defective or damaged LPG heaters increased from the last survey, with 10 respondents in 2024 compared to 8 in 2023. Three (3) of the respondents attempted to repair the heaters by themselves, with 7 houses reporting the issue to Eskom, and 1 of the respondents having their heater repaired **(Table 13).**

The 2023 survey highlighted that 368 respondents (97.6%) felt that the LPG Heater is not dangerous to use. One hundred and twelve (112) respondents (29.7%) have their windows and doors open when they utilise the LPG heater. For the 2024 survey only 5 respondents view the

[12] Urpelainen,J. "LPG as a Clean Cooking Fuel: Adoption, Use, and Impact in Rural India". Energy Policy. 2018 November ; 122: 395–408. doi:10.1016/j.enpol.2018.07.042.

LPG heaters as dangerous to use. Twenty-nine (29) of (8.4%) respondents have their windows and doors open when they utilise the LPG heater for the main purpose of ventilation.

The 2023 survey indicate that compared to the responses regarding the ceiling repairs, 310 respondents (78.9%) indicated that they would repair the future damage to the LPG heater **(Table 13)**. This could be due to lower cost involved in repairing the device compared to the larger task of sourcing materials and experienced labour to repair the ceiling. The same trend is seen in 2024 where 295 respondents indicated that they would repair the future damage to the LPG heater compared to repairing their ceiling indicating that respondents favour the lower cost of repairing the LPG heater than the ceiling

Figure 68 shows the respondents thoughts on why the LPG heater is not safe in 2023 and 2024.In 2023 and 2024 respondents viewed the LPG heater as unsafe due to children being around the. Figure 69 shows why the respondents would not fix their LPG heaters in 2023 and 2024. The respondents that indicated that they would not fix their LPG heaters stated affordability and viewing repairs as expensive as being their reason to not fix the LPG heaters in 2023 and 2024.

Table 13: LPG safety in 2023 and 2024

KwaZmokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
LPG Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Safety	Receive training on LPG heater use	363	11	346	5
	Know what to do if gas is smelt	135	242	271	78
	Would you like to receive training on LPG Use	91	285	172	177
	LPG heater defective or damaged	8	369	10	338
	Tried to fix LPG heater by yourself	3	5	3	7
	Have you let Eskom know about the damaged/defective heater	6	2	7	3
	Eskom fixed the LPG heater	1	7	1	9
	It is dangerous to use the LPG heater	9	368	5	340
	Have windows and/or doors open when using LPG heater	112	265	29	320
	Will repair future damage on LPG heater	310	67	295	52

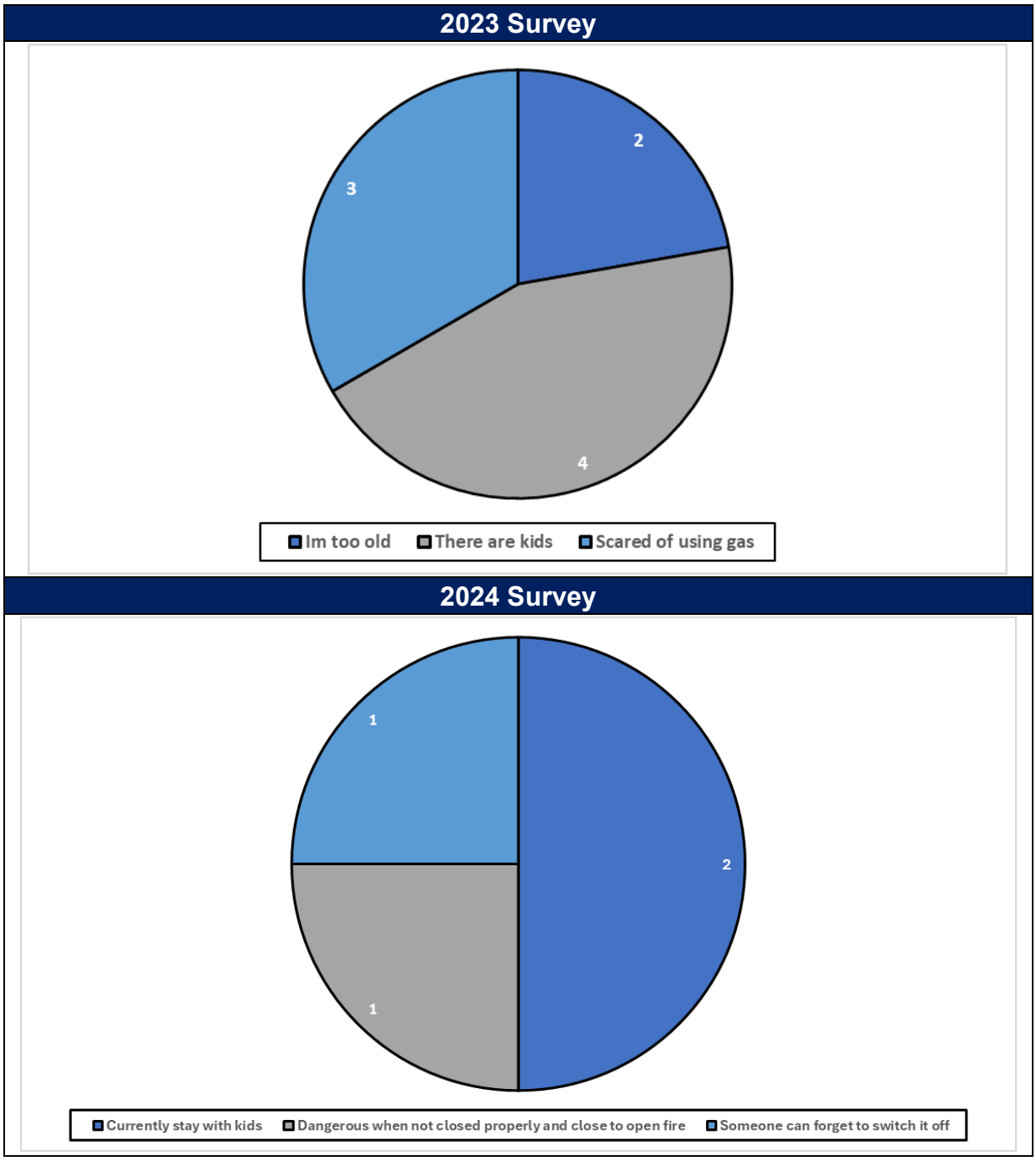


Figure 68: Thoughts on why the LPG heater is dangerous in 2023 and 2024

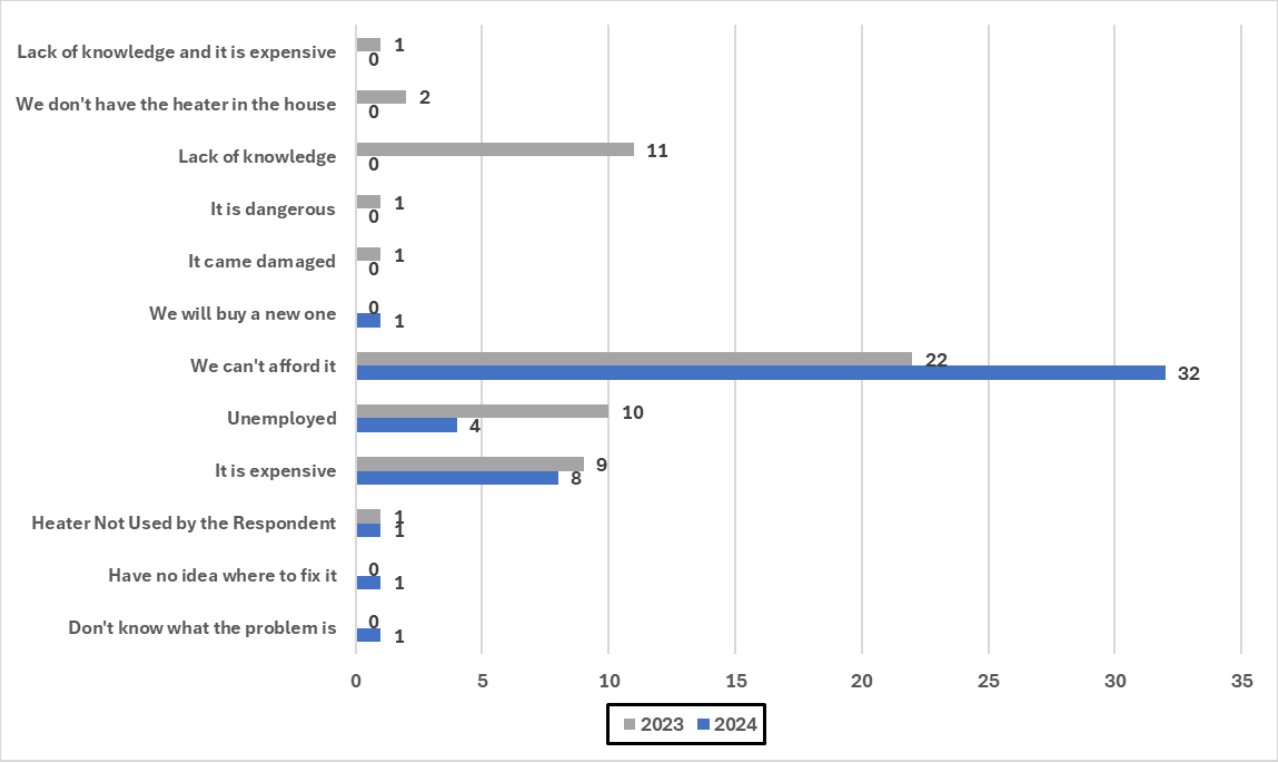


Figure 69: Why respondents will not fix the heater in 2023 and 2024

Respondents' Satisfaction with LPG Heater

Overall in 2023, 365 respondents (96.9%) indicated being happy with the LPG heater, with nearly all respondents (374 out of 377) recommending the LPG heater being installed in other households (Table 14), with the trend continuing in 2024 with 342 of respondents (98.6%) indicating that they are happy with the heater **(Table 14)**. 374 respondents (98.5%) noted that their households are warmer after the LPG heater was installed in their household in 2023, and 344 respondents (99.1%) in 2024.

Figure 70 shows the respondents view on what can improved on the LPG heaters for 2023 and 2024. A majority of respondents had nothing to recommend for Eskom to improve regarding the LPG heaters in both 2023 (355 respondents) and 2024 (367 respondents) **(Figure 70)**.

Table 14:Respondents' usage of LPG heater in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
LPG Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Usage of LPG	Happy with LPG Heater	365	12	342	5
	House is warmer after installation	363	14	344	4
	Would recommend LPG heater installation to other households	374	3	344	3

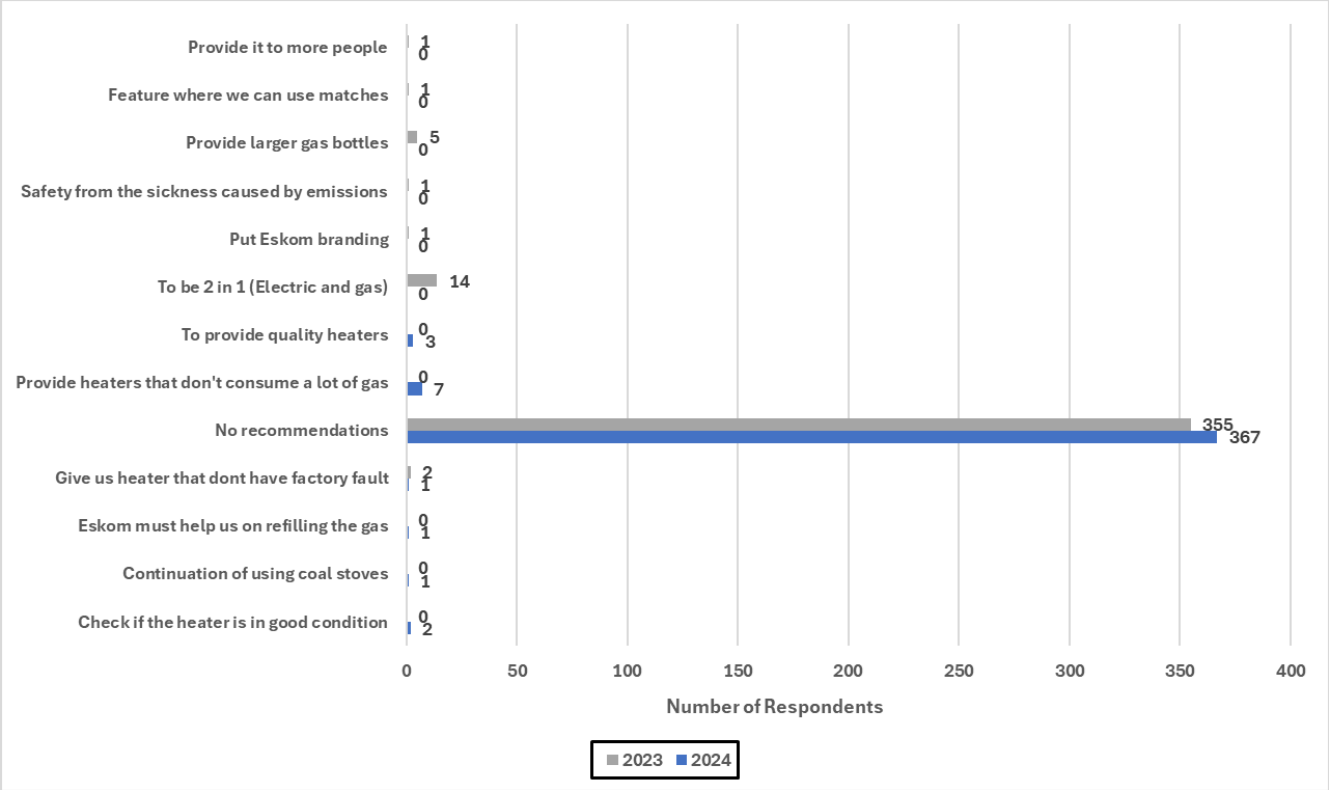


Figure 70:Respondents' view on how Eskom can improve on LPG heaters in 2023 and 2024

3.2.3 HYBRID GAS STOVE

Installation of Hybrid Stove

Of the 400 respondents interviewed, only 381 respondents had received the hybrid stove during the 2023 survey **(Figure 71)**, 374 of respondents (98.2%) indicating they were happy with the quality of the hybrid stove. Only 2 respondents indicated that the installation teams damaged their homes during the installation **(Table 15)**. In 2024, 355 respondents (98.6%) were happy with the quality of the stove. **(Table 15**).

Figure 71:Example of Installed Hybrid Stove

Table 15:Installation of hybrid stove in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Hybrid Stove Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Installation	Household has received the hybrid stove	381	18	N/A	
	Hybrid stove is of good quality	374	3	355	3
	Team damaged items when installing the hybrid stove	2	376	N/A	

Respondent Use of Hybrid Stove

The 2023 survey highlighted that since installation, 367 respondents' households (96.3%) hybrid stoves still look the same **(Table 16)**. The 9 respondents (2.3%) that indicated that their stove did not look the same was due to it being dirty, or the stove being taken away from the property. Tables 16 to 18, summarise the hybrid stove faults for the 2023 and 2024 surveys respectively. The 2024 survey highlighted that a low number of respondents indicated that they do not have the stove, or the oven is no longer working **(Table 18).**

Three hundred and forty-four (344) respondents (97.3%) indicated that the hybrid stove was not more expensive to operate compared to the coal stove for 2023 (Table 25), whilst 354 respondents (100%) indicated that the hybrid stove was not more expensive to operate compared to the coal stove for 2024 **(Table 26)**. **Figure 73** is a graphical representation of why respondents find the hybrid stove more expensive to use than the coal stove for the 2023 and 2024 surveys. Both surveys indicate pricing of LPG refills, as well as the inability to buy gas bottles through a credit system as major reasons why the hybrid stove is more expensive to use than a coal stove.

In 2024, 367 of the respondents (96.3%) indicated that the stove still looks the same, with a majority of the remainder stating that the stove didn't look the same due to them not having the stove anymore

Only 4 respondents (1.3%) indicated in 2023 that their hybrid stove had become damaged or defective since delivery. Three hundred and sixty-eight (368) respondents (97.7%) indicated that their stove and/or oven are operating properly since delivery. The respondents that do not have operating stoves/ovens indicated the following issues: 1) Buttons on the stove; 2) the burners not operating correctly; 3) Stoves tripping the electricity of the household when being operated (Table 16) for the 2023 survey. Ten (10) (2.8%) respondents indicated that their hybrid stove had become damaged or defective since delivery during the 2024 survey. Three hundred and fifty-one (351) respondents (98%) indicated that their stove and/or oven are operating properly since delivery **(Table 26).**

A barrier to transition from traditional fuels such as wood and coal to LPG technologies would be the desire to keep the taste of traditional foods the same[13]. Three hundred and eighty four (371) respondents (99.7%) indicated that the new hybrid stove cooked food faster than their traditional coal stove, and 371 respondents (99.7%) indicated that the food tastes the same (Table 16). Three hundred and seventy-two (372) respondents (98.7%) found the stove to be easy to use for the 2023 survey. In 2024, nearly all respondents indicated that the new hybrid stove cooked food faster than their traditional coal stove, with all respondents indicated that the food tastes the same **(Table 16)**.

[13] Urpelainen,J. “LPG as a Clean Cooking Fuel: Adoption, Use, and Impact in Rural India”. Energy Policy. 2018 November ; 122: 395–408. doi:10.1016/j.enpol.2018.07.042.

Table 16: Respondents' use of hybrid stove in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Hybrid Stove Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Use	Home is warmer after the Stove was installed	367	9	353	5
	Hybrid stove still looks the same	367	10	7	351
	Hybrid stove became damaged or defective	372	4	338	10
	Does The Stove and/or oven Work Properly	368	5	351	6
	Quicker to cook with new stove than coal stove	371	1	354	2
	Food tastes the same as food cooked on traditional coal stove	371	1	357	1
	New stove easy to Operate	372	4	357	0
	More expensive to Run Hybrid stove Than Coal Stove	32	344	4	354

Table 17 and Table 18 summarise the hybrid stove faults for the 2023 and 2024 surveys respectively.

Table 17: Hybrid stove faults in 2023

Hybrid Stove faults		
Issue	**Reason**	**Number of Respondents**
Why Households' Stove Does Not Look The Same	Homeowner took the stove	2
	It is dirty	2
	One burner is not working well	1
	The stove is not here	3
	Specific button not working	1
	Oven not working;trips house power	1
Reason for stove being Damaged or Defective	It makes funny sounds when you cook	1
	Oven doesn't close properly	1
	The is button that is damaged we don't know why.	1
	The oven is not working and stove trips house power	1
	Two burners are not working	1
Why Respondents' Stove/oven Are Not Working	Button refuses to work	1
	I don't know the cause of the damage	1
	Oven not working;Trips the electricity when on	1
	Two burners are not working well they take time to light fire	1

Table 18: Hybrid stove faults in 2024

Hybrid Stove faults		
Issue	**Reason**	**Number of Respondents**
Why households' stove does not look the same	One plate of the Stove is no longer working	2
	Oven loose	1
	Owner took it	1
	The electric stove and oven are not working anymore	1
Reason for stove being damaged or defective	Not sure	2
	One of the button is broken	1
	One plate creates an explosive like fire and sometimes won't go on	1
	Rubber loose	1
	The oven and electric plate not working	2
Why respondents' stove/oven are not working	I don't know	2
	One of the plates takes longer when cooking	1
	Oven is loose	1
	The electric part of the stove is no longer heating.	1
	The oven door doesn't close properly	1

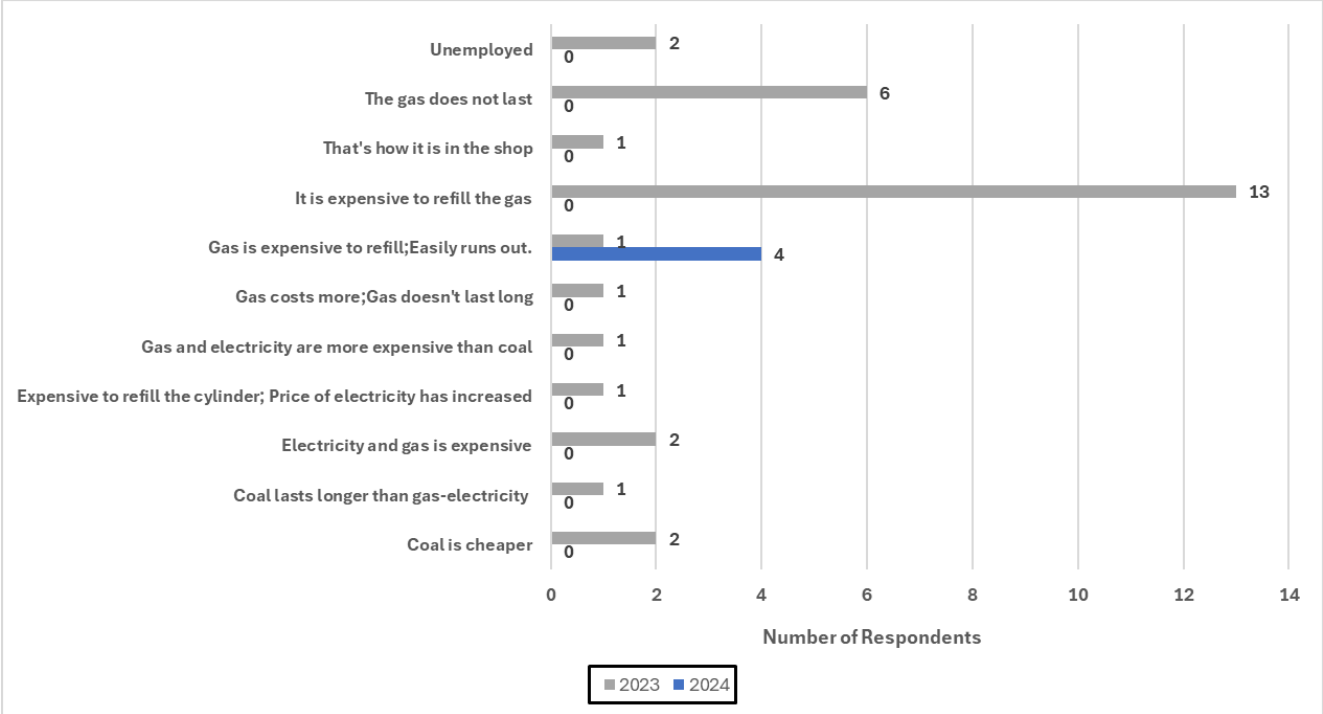


Figure 72: Why respondents find the hybrid stove more expensive to use than the coal stove in 2023 and 2024

Safe Use of Hybrid Stove

Three hundred and eighty six (386) of the respondents (95.4%) received training on how to use the hybrid stove, but only 142 respondents (37.2%) know the safety protocol when gas is smelt in the house, whilst 110 respondents (29.1%) indicated that they would like to receive training during the 2023 survey **(Table 19)**. It could be the case that the training received by the respondents was not as comprehensive as they needed, with a need for the installation contractors to identify where the possible gaps are in the training process. In 2024, 353 of the respondents (98.6%) received training on how to use the hybrid stove, but despite only 280 respondents (78.2%) indicated that they know the safety protocol when gas is smelt in the house **(Table 19).** Seventy-seven (77) respondents (21.5%) indicated that they would like to receive training **(Table 19)**. As stated before, it could be the case that the training received by the respondents was not as comprehensive as they needed.

Eleven (11) respondents (1.8%) found the hybrid stove dangerous to use compared to the traditional coal stove for 2023, whilst 3 respondents (2.8%) found the hybrid stove dangerous to use compared to the traditional coal stove in 2024 **(Table 19)**.

The respondents in 2023 follow the same pattern as with the LPG heater with 319 respondents (84.6%) indicating that they would repair any future damage to the LPG stove, but 328 respondents (87%) indicated that Eskom should fix the damage. In 2024 the respondents follow the same pattern as the 2023 survey with 319 respondents (89.1%) indicating that they would repair any future damage to the LPG stove, but 335 respondents (93.6%) indicated that Eskom should fix the damage. **(Table 19)**

Figure 73 illustrates why respondents find the hybrid stove more dangerous to use in 2023 and 2024. A main reason is they were scared when utilising the hybrid stove.

Figure 74 highlights the reasons why respondents open windows and/or doors when using the hybrid stove in 2023 and 2024. One hundred and forty-three (143); respondents (38.1%) (Table 19) open their windows and doors when using the hybrid stove for ventilation in 2023. Twenty-eight (28) respondents (7.8%) open their windows and doors when using the hybrid stove for ventilation and clearing the smell of the LPG in 2024.

Figure 75 highlights why respondents will not fix their damaged hybrid stove. In 2023 respondents that will not repair the damage cited the main reason to not fix the damage was the inability to afford the repairs or they find the repair process quite expensive and would not spend the money. In 2024 respondents that will not repair the damage cited the main reason to not fix the damage was the inability to afford the repairs.

Table 19: Hybrid stove safety in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Hybrid Stove Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Safety	Receive training on how to use the hybrid stove	366	10	353	6
	Will you like to receive training on how to use the hybrid stove	110	266	190	168
	Is it dangerous to use the hybrid stove than a coal stove	11	365	3	354
	Know safety protocol when gas is smelt	142	234	280	77
	Windows and/or doors open when using hybrid stove	143	232	28	330
	Will you repair any damage in the future	319	56	319	39
	Should Eskom fix the damage	328	48	335	21

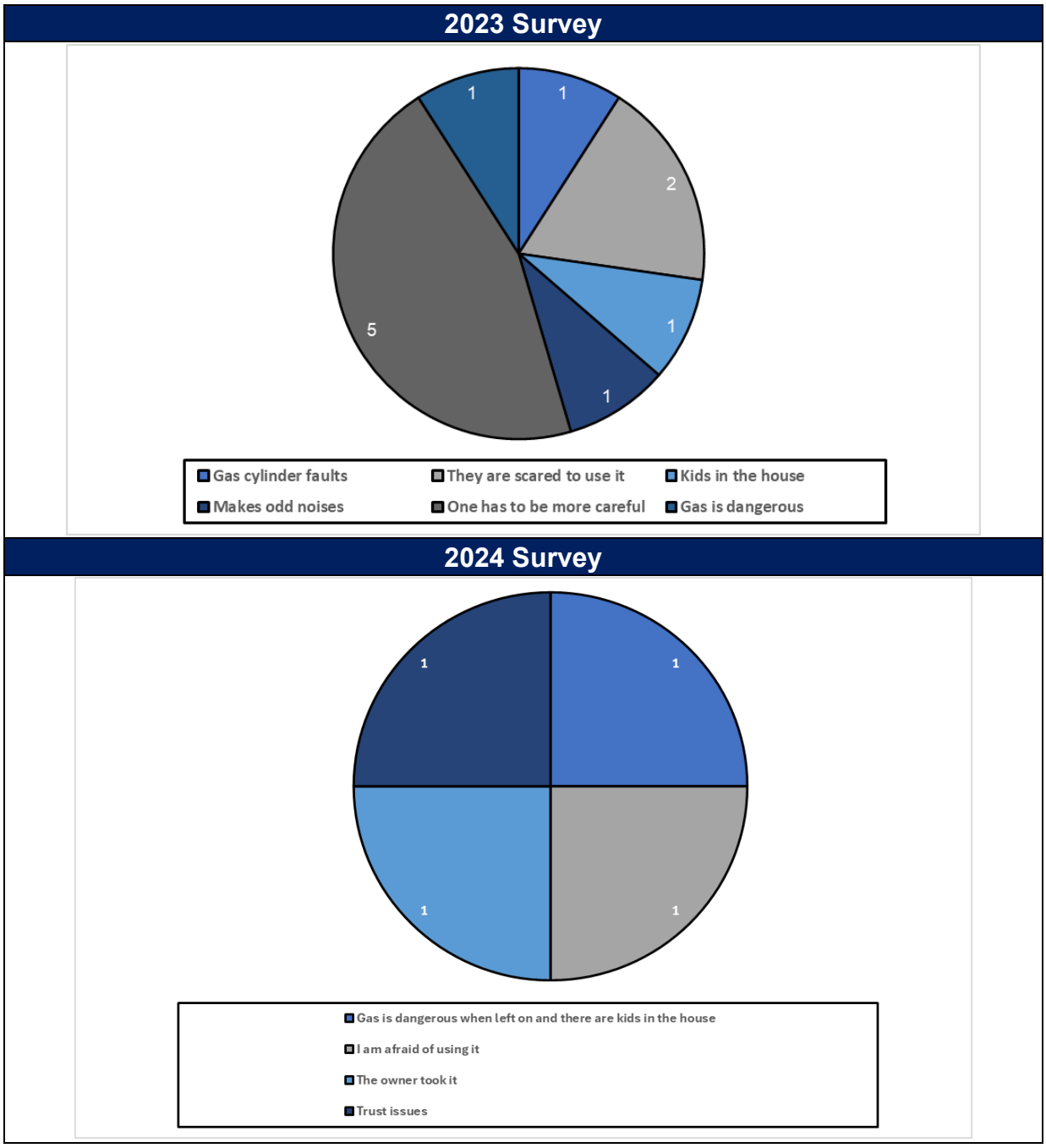


Figure 73: Why respondents find the hybrid stove more dangerous to use in 2023 and 2024

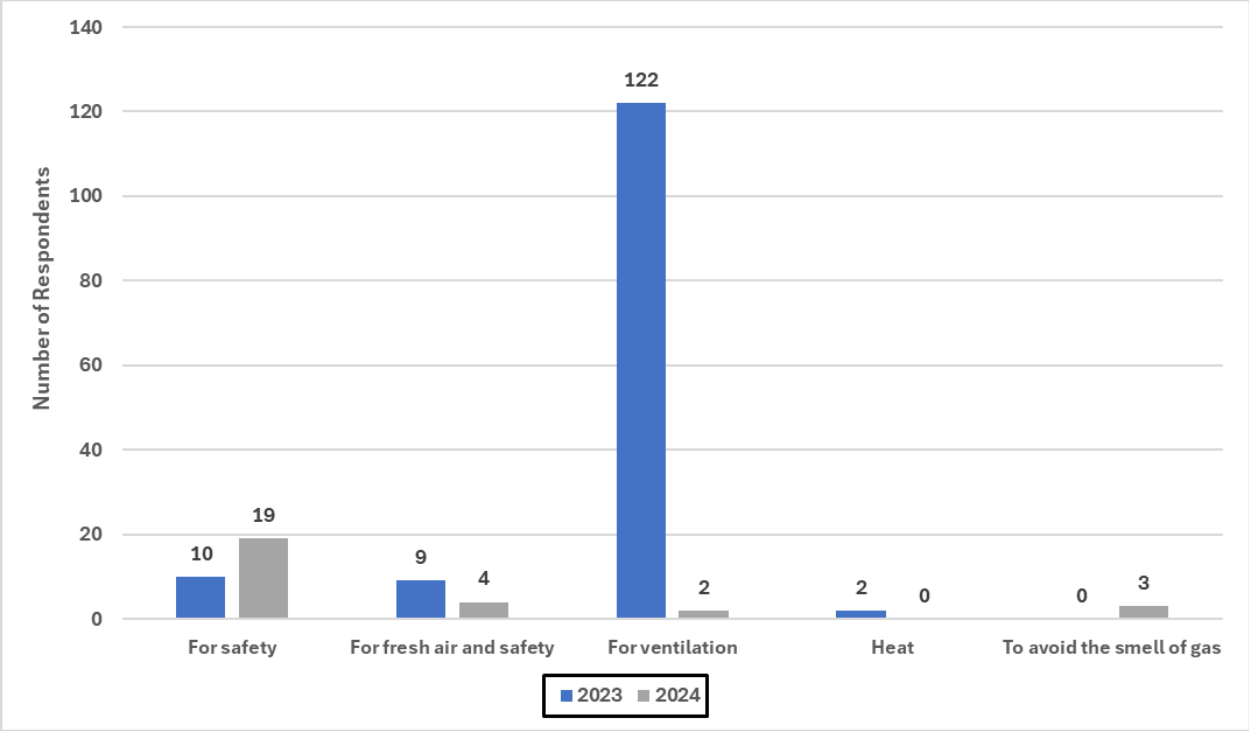


Figure 74:Why respondents open windows and/or doors when using the hybrid stove in 2023 and 2024

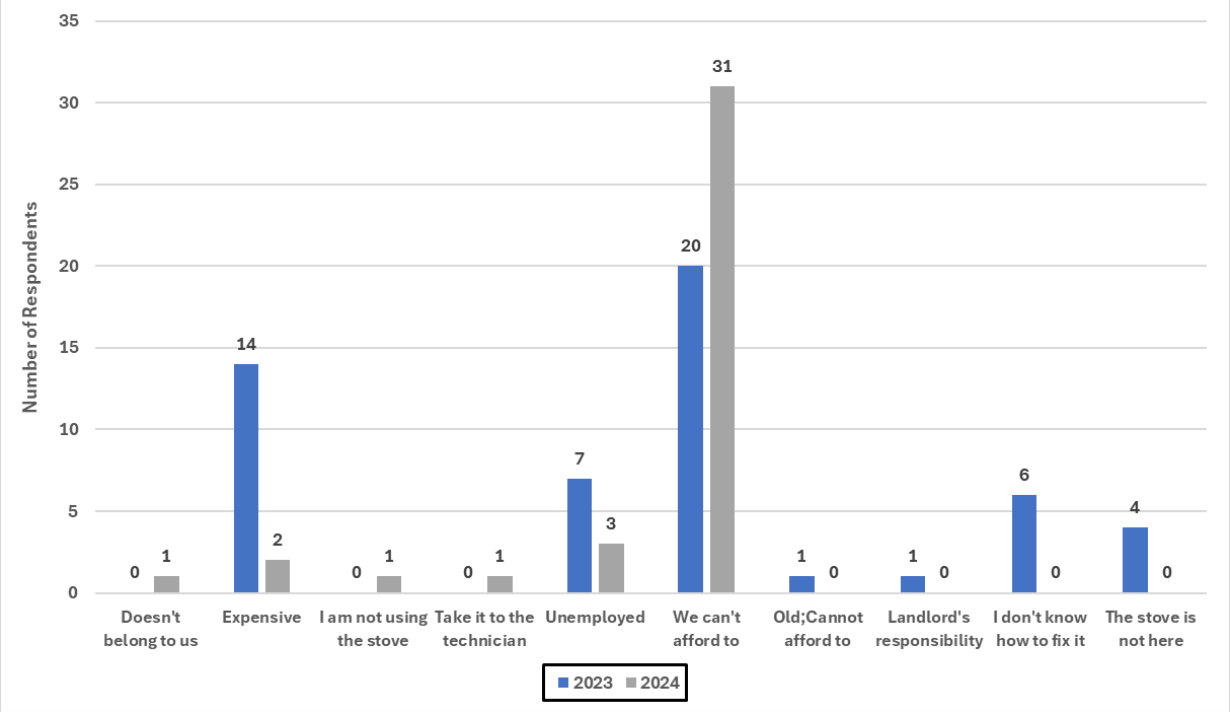


Figure 75: Why respondents will not fix the damaged stove in 2023 and 2024

Respondents' Satisfaction With Hybrid Gas Stoves

Overall, respondents were happy with the installed hybrid stove in 2023 and 2024, with 376 respondents (100%) in 2023 and 374 respondents in 2024 (99.7%) **(Table 20)**

Nearly all the respondents in the 2023 survey recommended the installation of the hybrid stove, whilst 357 respondents (99.7%) in 2024 recommended the installation of the hybrid stoves (Table 20) in 2024.

Figure 76 shows the respondents recommendations on the hybrid stove can improved by Eskom in 2023 and 2024. When inquired as to how Eskom can improve the hybrid stove, a majority of respondents said nothing needed to be change, but some respondents recommended that the stoves have 2 electric plates and 2 gas plates for both surveys.

Table 20:Satisfaction with hybrid stove in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Hybrid Stove Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Satisfaction	Happy with Hybrid stove	376	0	356	1
	Would Recommend Installation of Hybrid Stove in Other Homes	374	2	357	1

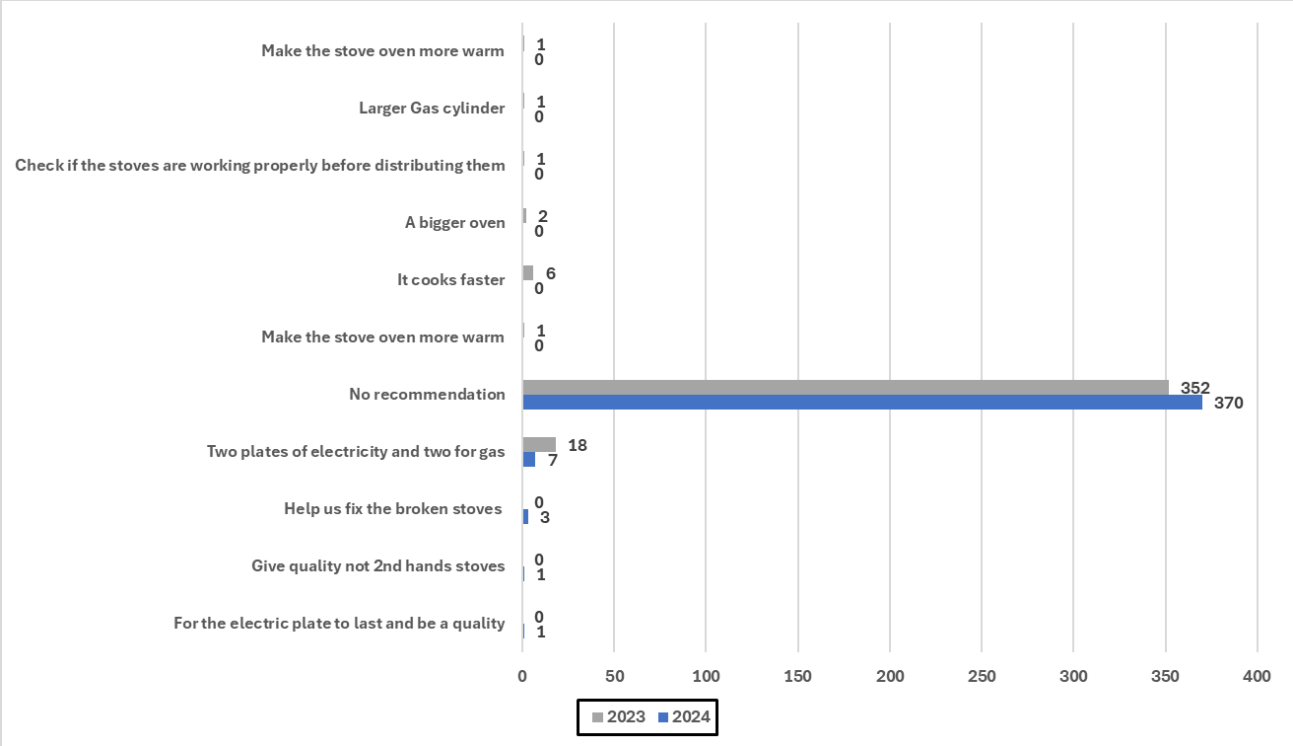


Figure 76:Respondents recommendations on how to improve the provided hybrid stove in 2023 and 2024

3.2.4 REWIRING INTERVENTION

In 2023, 375 respondents had received the wiring intervention as of December 2023 (Figure 77). Of the 375 respondents, 360 (96%) reported receiving wiring of good quality, whilst in 2024, 345 respondents (90.6%) reported receiving wiring of good quality. Only 3 respondents (0.8%) reported having the wiring team damage the household whilst completing the rewiring intervention in 2023.

In 2023 Three hundred and sixty seven (367) respondents (97.9%) reported having their wiring looking the same as when installed, but eight (8) respondents (2.1%) reported having their wiring become damaged or defective mostly due to faulty wiring **(Table 22)**. In 2024 355 respondents (96.3%) reported having their wiring looking the same as when installed, but 10 respondents (4.7%) reported having their wiring become damaged or defective mostly due to faulty **wiring (Table 23)**.

One hundred ninety eight (198) respondents (51.4%) received a certificate of compliance (COC),with 177 respondents **(Table 21)** indicating that they did not know that they are supposed to receive a COC **(Figure 78)**. This is concerning for households without the certificate, as households will not be able to claim from their insurance where issues arise from the installed wiring. It would be beneficial for Eskom to ensure that the households receive this certificate and do a check with the installation teams to ensure that these certificates are distributed to the completed households. An increase in respondents that received a certificate of compliance is noted, with 316 respondents in 2024 (82.9%) **(Table 21)**

Three hundred and seventy (370) respondents (99.2%) recommended having the wiring redone in other houses in 2023 (Table 21). Three hundred and sixty-one (361) respondents (98.9%) recommended having the wiring redone in other houses in 2024 **(Table 21)**.

Figure 79 shows respondents view on what Eskom can do to improve on the rewiring intervention in 2023 and 2024. Respondents mostly had no recommendations, other than the installation of double plug points in the households rather than the single plug points that were installed in this campaign, and better-quality plugs.

Figure 77:Example of wiring installed in households

Table 21:Wiring installation in 2023 and 2024

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Hybrid Stove Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Installation	Received wiring intervention	375	23	365	19
	Wiring is of good quality	360	15	345	19
	Did you receive a certificate of Compliance	198	177	316	50
	Installation team damaged household	372	3	N/A	
	Does electrical wiring look the same as when installed	367	8	355	10
	Electrical wiring became damaged or defective	356	19	16	340
	Recommend rewiring to be done at other households	370	3	361	4

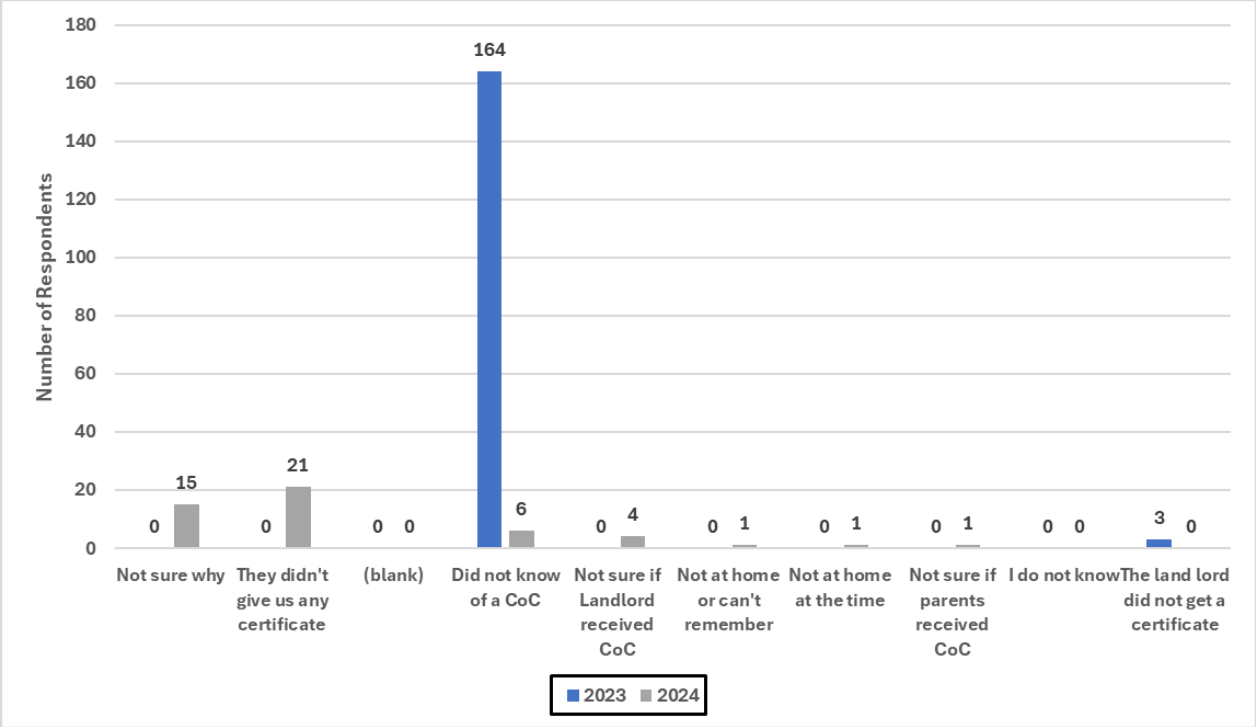


Figure 78:Reason respondents did not receive a Certificate of Compliance (COC) in 2023 and 2024

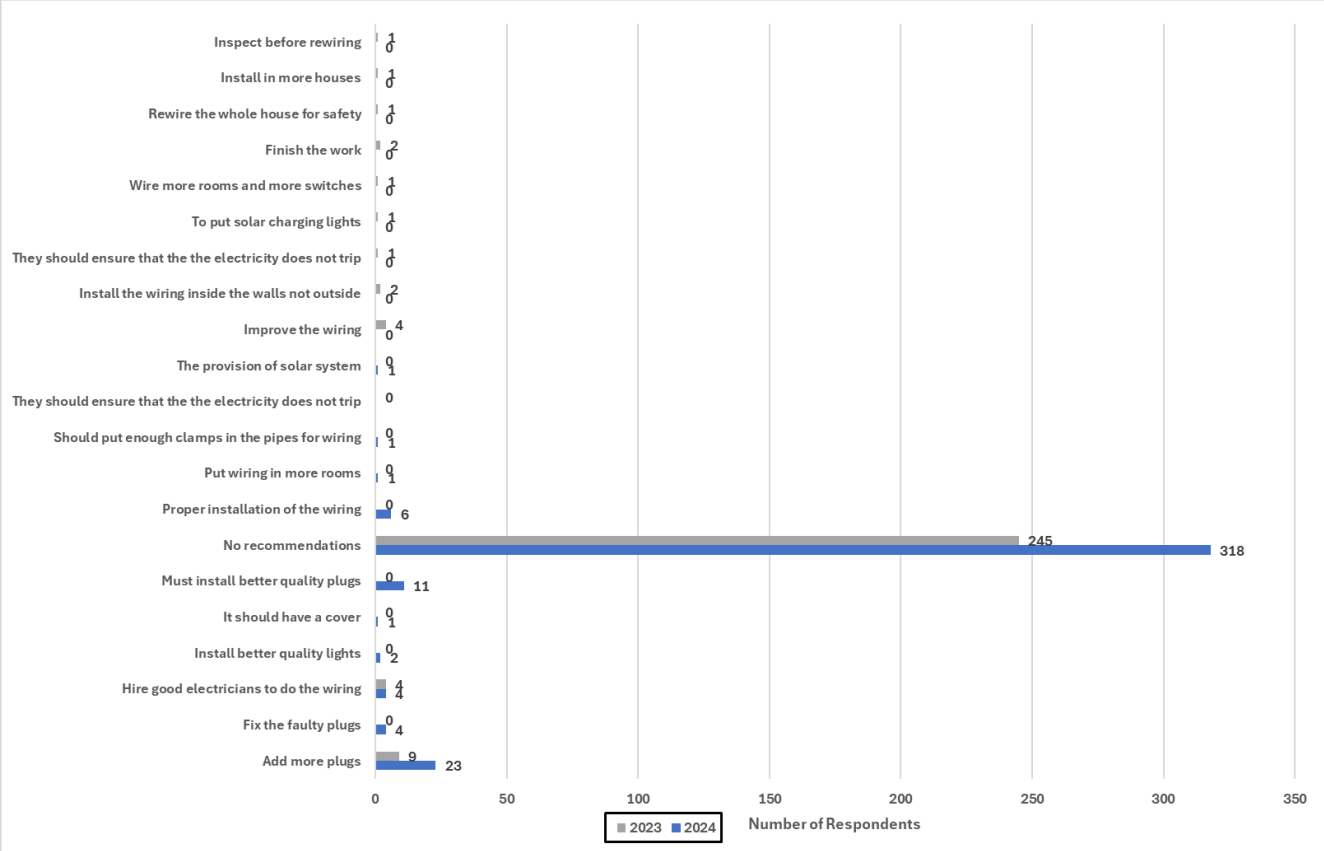


Figure 79: Respondents' recommendations on how to improve the rewiring interventions

Table 22:Faulty wiring in household feedback in 2023

Faulty Wiring in Household		
Issue	**Reason**	**Number of Respondents**
Why wiring is not of good quality	Bad quality	1
	Damaged	2
	Some plug are not working	3
	The electricity is tripping	3
	The globes dont last more than a month;lights turning on by themselves	1
	They did not put a distribution board	2
	They didn't not install according	1
	They have left other cables floating and the owner was required to fix that by her own.	1
	The main switch not working	1
Cause of Defective Wiring	Careless workers.	1
	Don't know	7
	Faulty wiring	6
	It is made of plastic	1
	They did not finish their work	3

Table 23:Faulty wiring in household feedback in 2024

Faulty Wiring in Household		
Issue	**Reason**	**Number of Respondents**
Why wiring is not of good quality	DB box is not good	1
	Electricity meter not working	1
	It trips every time	2
	Some lights don't work after installation	4
	The rewiring	1
	There are lose wires	2
Cause of Defective Wiring	Dirt from cooking stains	1
	Faulty wiring	7
	Improper installation	1
	Light only worked for a month	1
	Only one plug is working	1
	The electric plug is shifting	1
	The plug was not working at all.	5
	They didn't put the plugs	1
	Respondent doesn't know	6
	Electrician	2

3.2.5 REGRESS

In 2023, three hundred and ninety-five (395) respondents (98.9%) viewed electricity subsidies as a necessary incentive to keep households from regressing back to coal stoves and abandoning their new hybrid stoves **(Table 24)**. In 2024, 369 respondents (97.1%) viewed electricity subsidies as a necessary incentive to keep households from regressing back to coal stoves and abandoning their new hybrid stoves **(Table 24)**.

Twenty (20) respondents indicated they have purchased another coal stove in 2023, with only 4 household indicating they have another coal stove that they use. Only 13 respondents (3.2%) indicated they would give back the hybrid stove or LPG heater for a brand-new coal stove in 2023. Twenty-one (21) respondents indicated they have purchased another coal stove in 2024, with twenty-five (25) respondents indicating they have another coal stove that they use as they are used to coal or found LPG to be too expensive for them to use **(Table 24)**. Only 1 respondent indicated they would give back the hybrid stove or LPG heater for a brand-new coal stove in 2024.

In 2023, 348 respondents (88.1%) preferred to use the LPG heater as the preferred method to warm the home compared to coal. Three hundred and sixty (360) respondents (94.2%) preferred to use the LPG heater as the method to warm the home compared to coal in 2024. (Table 24)

Seven (7) respondents (1.8%) will be moving away in 2023, with 2 respondents moving due to high rent and the other respondent having their lease lapse at the end of 2023 (Table 24). Seven (7) respondents (1.8%) will be moving away in 2024 with 2 respondents moving due to high rent and the other respondent having their lease lapse at the end of 2024 and some seeking to move to their own property.

Figure 80 shows which intervention respondents thought made the biggest difference to them. In 2023 respondents found the ceiling (179; 44.7%) as their most preferred intervention, followed by the hybrid stove (182; 45.5%) and then the LPG heater (36; 9.8%). In 2024 141 respondents (36.9%) found the ceiling as their most preferred intervention, followed by the hybrid stove (192; 50.3%) and then the LPG heater (48;12.6%).

Figure 81 shows respondents' satisfaction with the interventions in 2023 and 2024. It is positive to note that in 2023 335 of the respondents (83.7%) are satisfied with the interventions, and only 13 respondents (3.3%) being somewhat unsatisfied. In 2024 321 of the respondents (84%) are satisfied with the interventions, and 10 respondents (2.6%) being somewhat unsatisfied. The increase in unsatisfied respondents could be related to the increased issues experienced with the ceilings leaking due to the heavy rains

Figure 82 shows respondents' responses when asked what they view as future threats to the Eskom offsets project in KwaZamokuhle in 2023 and 2024. In 2023 respondents viewed the difficulties of getting rid of coal stoves and households continually using coal stoves to be the biggest threats to the offsets project, whilst in 2024 respondents would viewed people buying traditional coal stoves as a major threat in 2024.

Table 24: Intervention regress in 2023

KwaZamokuhle Post Eskom AQO Intervention Roll-out		Number of Respondents			
Hybrid Stove Intervention					
		2023		2024	
Section	Question	Yes	No	Yes	No
Regress	Electricity subsidy will promote use of stove	395	4	369	11
	Have you purchased another coal stove	20	378	21	361
	Would you give back the hybrid stove or LPG heater for a brand-new coal stove	13	386	1	381
	Which one do you prefer to heat your home: LPG heater (Yes) or coal (No)?	348	47	360	22
	Will you be moving away from this house in 2024/2025	7	393	7	375
	Do you have another coal stove in your home	4	395	25	355

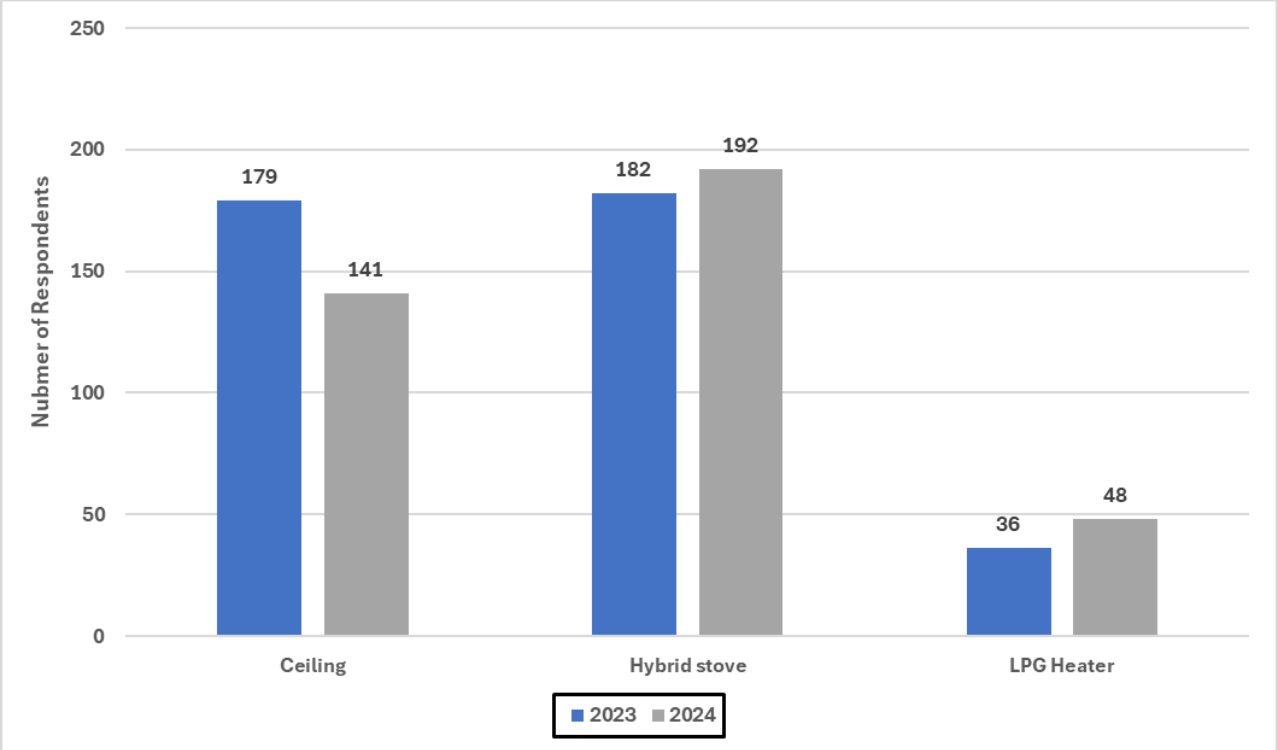


Figure 80: Which intervention the respondents view made the biggest difference to them in 2023 and 2024

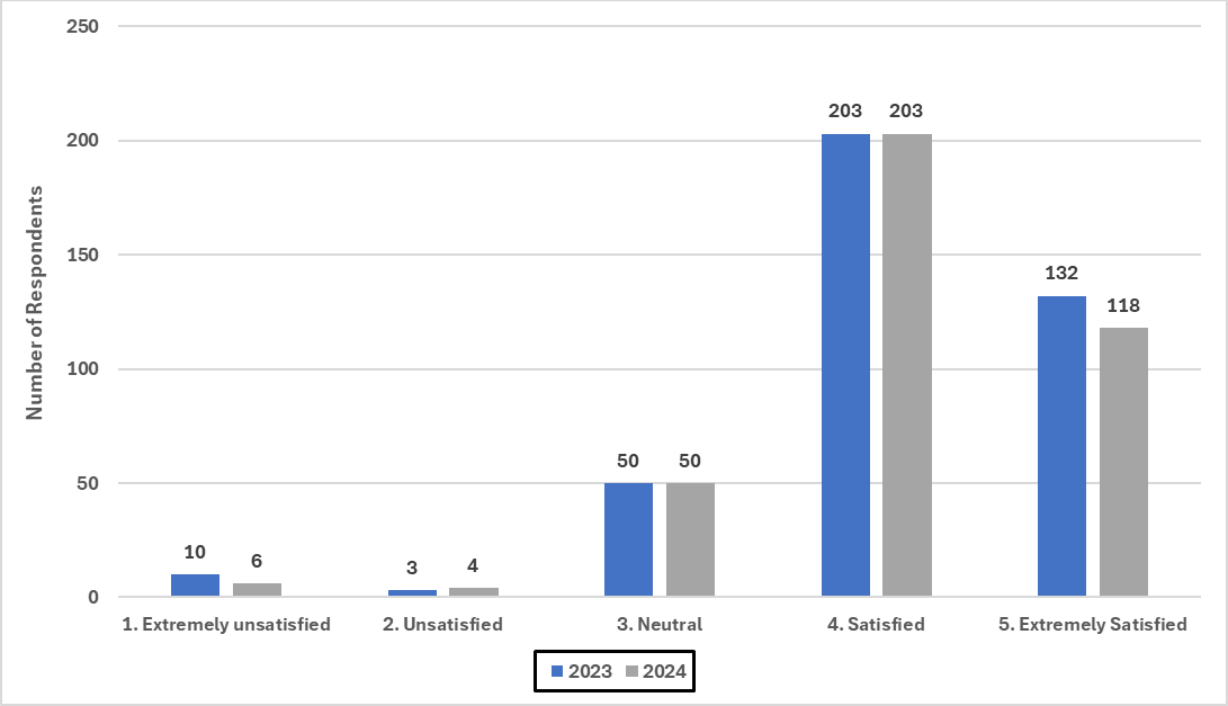


Figure 81:Respondents satisfaction with interventions in 2023 and 2024

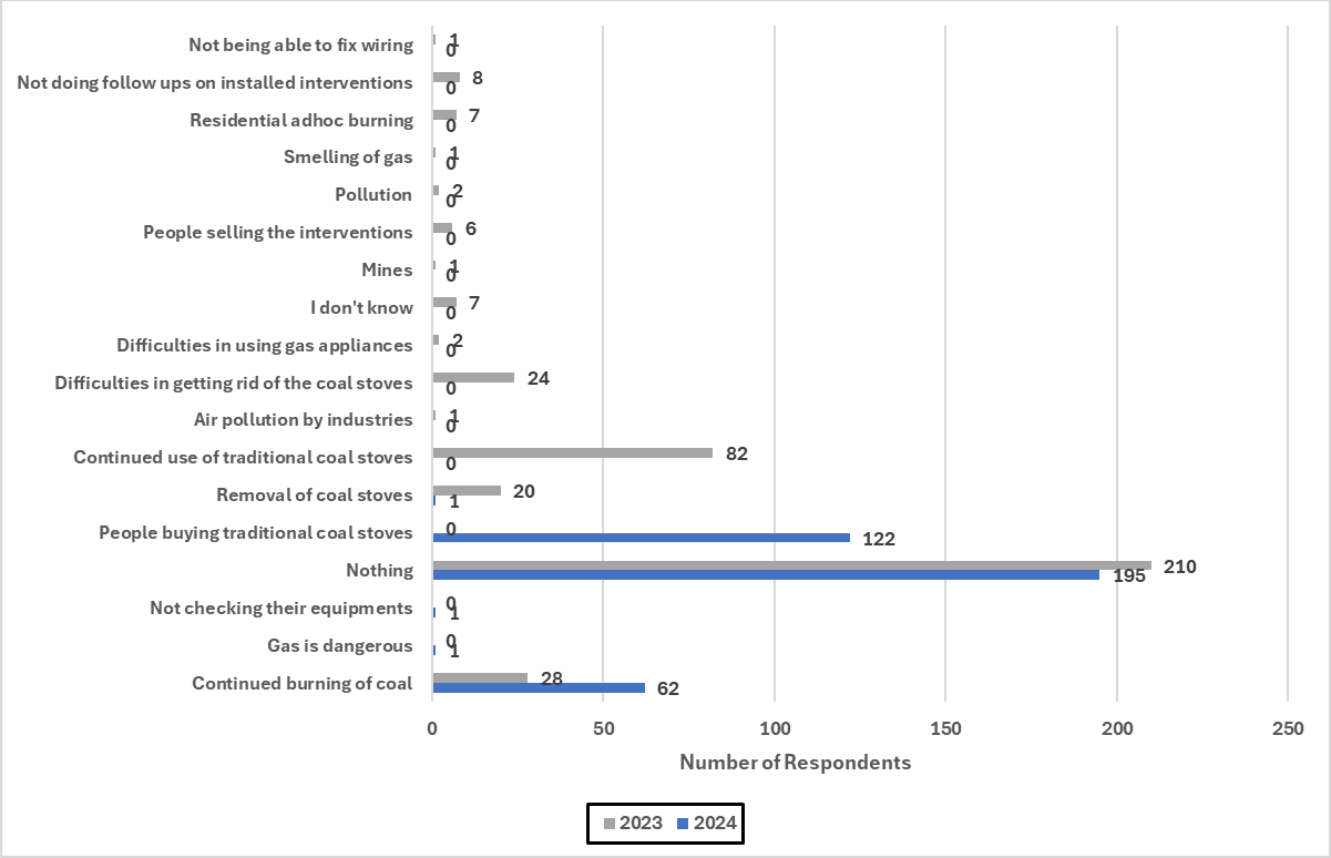


Figure 82: Respondents views on what they see as the biggest threats to Eskom's air quality offset in 2023 and 2024

3.2.6 Focus Group Interviews

3.2.6.1 Activation & Registration Process (2023)

The interviewed households viewed the sign-up process as an easy process but indicated that they had experienced moments when the registration teams would come back and register the households again, with some households registering again even though they had been registered close to 3 years ago.

An issue that the households raised was that the installation teams had not indicated when they would be coming to commence the indoor retrofits and the subsequent installations of the gas devices. This would force households to make rushed arrangements to prepare the household for disturbances to their daily schedule and living arrangements. As such, they recommended that the installation teams utilise an SMS system to notify households of: When the team is installing the ceiling and applying the spray foam, when they will be installing the gas devices, time to be spent at the household with timelines for each process.

3.2.6.2 Project execution (2023)

As noted from the project effectiveness questionnaire in the previous section, the households were generally happy with the work done by the installation teams. Something that has been noted in the questionnaire answers was that some households were experiencing leaking rooves, which is mentioned as well by the focus group. The group indicated that the teams should test the installations for leaks after the work has been conducted to prevent these issues. The group then indicated this would also go in hand with the installers possibly using better quality materials and primarily targeting the areas in the roof where the chimney was previously installed.

With regards to the wiring work done by the installation teams, the focus group was generally happy with the installation. The group did indicate that one aspect that could be improved is to communicate with the household as to where the plugs can be installed. As the homes have

limited space, the households would have a set arrangement for appliances and furniture to be placed in specific areas of the house. As such, new plug placements executed without the homeowners input add further limitations to how the occupants can place their belongings.

3.2.6.3 Interventions (2023 & 2024)

- **Hybrid stove and heater in 2023**

An important aspect of the households receiving the hybrid stove and gas heater, is for the households to receive a form of safety training on how to utilise the new technologies. The focus group did indicate that they had received the needed training to use the gas devices, along with the needed safety guidelines for safe operation.

The households indicated that when it comes to the cost of using the devices, the households found it cheaper to use the hybrid stove for cooking compared to their old coal stoves and generally happy with the hybrid stove This is due to the fact that the coal the households utilise would only last for a maximum of two days at R80 for a small bag and wood at R60 a small bag, in comparison to R340 for a gas bottle refill which would last for 2 months. When it comes to the gas heater, the focus group found the heater to be more expensive to operate due to the large cost of a gas cylinder for a heater that will only utilise occasionally when it is cold, but because of this occasional use they did indicate that they save on the purchased gas and were happy with the gas heater. One point was raised by a member of the focus group that they had noted some users of the heater experienced nausea and those with asthma having their asthma exacerbated by the gas heater. To mitigate this, the users place a dish of water in front of the gas heater to prevent those with nausea and asthma being affected by the smell of the gas.

As gas is something they see as a cheaper alternative, the group did indicate that they do face limitations when using the local distributers in Hendrina, Total Garage and Mica Hardware, and the suppliers in KwaZamokuhle: Hisen Butchery and service station. The distributors have a limited stock of bottles, which can make it difficult for homeowners to acquire gas when needed.

Another limitation they experienced was with the inability to refill their newly acquired Eskom gas bottles as the suppliers only do exchanges. The households indicated that this leads them to receiving older and potentially faulty gas bottles, which leads to the households being frustrated and feeling unsure about their safety when using these older gas bottles. The households did indicate there is a new gas supplier, Asinco, that has been set up in Hendrina, and are able to offer gas exchange or refill services at a cheaper price than that of the Total Garage and the Mica hardware store. It was noted that the supplier was utilised by the project execution teams when supplying the households with gas bottles for their newly installed gas devices.

Another limitation mentioned by the focus group was that of transporting the gas bottles. As gas is seen as a dangerous energy source, taxis do not allow the transportation of the gas bottles, even when empty. This makes it difficult for older users to be able to transport the gas bottles when sourced from far distributors and would have to make alternative arrangements to transport.

From the above discussion, the group suggested that Eskom looks into a possible method of gas delivery within KwaZamokuhle or the establishment of a local distributor in Kwazamokuhle. The group did note that the latter suggestion is more difficult to establish due to the community preferring to not be situated close to a gas depot for their safety.

- **Hybrid stove and heater in 2024**

In the 2024 FGI, the interviewees indicated that after a year of using the hybrid stove, they are satisfied with the cooking time,and found that the food tastes better than when they sued their traditional coal stoves. They also noted that it is much cheaper to use the hybrid stove,with it costing R270 for it to be refilled or R300 for it to be refilled plus transported the households..

As the focus group has now experienced a winter season with the LPG heaters, they have noted that the heaters are an intervention they greatly appreciate as it has been easier to keep the rooms warmer than an umbaula, It has also been cheaper for them to use as it would cost them R80 for coal that would last over 2 days, and as the electricity prices have increased,the LPG heaters are cheaper than using an electric heater..

- **Ceiling (2023)**

The households were overall happy with the ceiling and found their households were warmer after the installation was concluded.

- **Ceiling (2024)**

The participants had the same opinion as in 2023,with only one participant noting she had issues with the ceiling shims not being dealt with after installation.

3.2.6.4 Sustainability

When asked if the members of the focus group would utilise the hybrid stove and gas heater for five to ten years and past that, they indicated that the stove and heater were of good quality, and they do not foresee themselves having to replace them any time soon.

In the 2023 and 2024 interviews a point that they raised was regarding the ceiling maintenance. They viewed the ceiling as something Eskom would have to be responsible to maintain the roof and would not want Eskom to financially compensate the homeowners as the they find it difficult and time consuming to find reliable and reasonably priced contractors to do that work. This is further supported by the results noted in the annual household surveys were respondents indicated Eskom should be liable to fix any leaks or damage to the roof.

In 2024 the participants noted that the current LPG suppliers are quite reliable, but asked that more suppliers be set up in KwaZamokuhle, as four suppliers are currently based in town, two only found in the township. The participants did note a drop in coal merchants but mentioned that they are still active.

3.2.6.5 Perception of Air Quality

When asked about the current air pollution situation in the KwaZamokuhle area, the focus group indicated in 2023 that the air is cleaner for them after the interventions have been rolled out, they had seen that the pollution is not great due to some people in the community in some areas, mostly those in backyard households, still burning coal and people littering in the area. This has improved in 2024,with them not noticing coal burning in the main KwaZamokuhle area. But in 2024 they did note that the waste dumping sites are the most common incidence of air pollution, with shops being the main culprits, then followed by some homes conducting waste burning activities. The participants did mention that coal stove usage is most common in Extension 9, which is a new area in KwaZamokuhle that has been around for two years and consists of RDP housing. ARM was made aware by the FGI facilitator that some households in extension 9 had been received partial interventions such as the stove swap, but some could not be registered as their structures were not fully completed.

It is important to note that no point did the group point to industry as a major pollution source in KwaZamkouhle, further supporting Eskom's execution of air quality offsets in the community.

4. RECOMMENDATIONS

It's evident from the results that the residents are overall satisfied with the current project interventions and view the interventions as a positive influence for the community. However, certain areas of the project have been identified to have hurdles that can prove to be an issue in the future for this community that will be involved with the next phase of the offsets project.

Taking the above into account, its ARM's recommendation that the following areas are considered:

1) Ceiling interventions need to be sustainable for the households:
    - It is recommended that inspections are carried out immediately after implementation has been concluded and a time period after the installation is completed
2) Hybrid stoves:
    - It's recommended a well-established LPG distribution provider is needed for the local community to prevent the possibility of regress due to difficulties in obtaining LPG locally
3) Wiring interventions:
    - It's recommended that certificates of compliance are made mandatory for insurance purposes
    - Better communication lines between the sub-contracting team and the residents need to be established to keep a healthy relationship with Eskom and the community to satisfy household needs

Through the household surveys, households were approached about their views on what they would recommend Eskom do to improve the interventions:

1) Ceiling interventions:

- It's recommended that better building quality materials are used, especially for the cornices
- It's recommended that the teams take more care into the finish of the interior (better painting, better glue and better ceiling finish) Installations of the different aspects of the roof (cornice, metal roofing, ceiling) need to be inspected after the work is done

2) LPG heaters:
    - Respondents want more gas cylinders to be provided for the heaters
    - Respondents would like heaters that are more efficient in terms of LPG usage
    - It's proposed that Eskom and the sub-contractor look at revising the safety training material for households to feel comfortable enough to undergo one session of training
3) Hybrid stoves:
    - Majority of respondents requested that the stoves have 2 plates that use electricity and 2 plates that use gas.
    - It's proposed that Eskom looks at creating a well-established LPG distribution system and transport system is needed for LPG to replicate the efficiency and availability of the dirty fuels for the community to continually utilise LPG technologies recommended that more gas cylinders are provided to the households
4) Wiring interventions:
    - It's recommended that double plug points are installed instead of the single point plugs
    - The ARM team has noted that within the households, space is quite limited and would be pro-active to understand the households lighting and plug point needs to keep the homeowner's living space ergonomic over time

ARM held a FGI with the selected households that had participated in the Eskom AQO project (section 3.7). The recommendations from the respondents included the following:

- ✓ It's recommended that an education campaign targeted at the elderly and children to assist in easing the vulnerable groups into using gas technologies
- ✓ Eskom comes back to target those were not able to participate in the interventions program

Table 25:Summary of Recommendations from the Household Survey

Recommendations proposed for consideration			
Theme	**ARM**	**Respondents**	**Focus Group Interviewees**
1. Ceiling intervention	▪ It is recommended that inspections are carried out immediately after implementation has been concluded and a time period after the installation is completed	▪ It's recommended that better building quality materials are used, especially for the cornices ▪ It's recommended that the teams take more care into the finish of the interior (better painting, better glue and better ceiling finish)	▪

Recommendations proposed for consideration			
Theme	**ARM**	**Respondents**	**Focus Group Interviewees**
2. LPG Heater	4. A targeted awareness and safety training in terms LPG to the old female (60 to 99) adult segment and children	5. Respondents want more gas cylinders to be provided for the heaters 6. Respondents would like heaters that are more efficient in terms of LPG usage 7. It's proposed that Eskom and the sub-contractor look at revising the safety training material for households to feel comfortable enough to undergo one session of training	8. It's recommended a well-established LPG distribution provider is needed for the local community to prevent the possibility of regress due to difficulties in obtaining LPG locally

Recommendations proposed for consideration			
Theme	**ARM**	**Respondents**	**Focus Group Interviewees**
3. Hybrid stove	9. A well-established LPG distribution provider is needed for the community to prevent the possibility of regress due to difficulties in obtaining LPG locally	10. Majority of respondents requested that the stoves have 2 plates that use electricity and 2 plates that use gas. 11. It's proposed that Eskom looks at creating a well-established LPG distribution system and transport system is needed for LPG to replicate the efficiency and availability of the dirty fuels for the community to continually utilise LPG technologies recommended that more gas cylinders are provided to the households	12. It's recommended a well-established LPG distribution provider is needed for the local community to prevent the possibility of regress due to difficulties in obtaining LPG locally
4. Wiring Intervention	13. The ARM team recommends that certificates of compliance are made mandatory for insurance purposes 14. Better communication lines between the sub-contracting team and the residents need to be established to keep a healthy relationship with Eskom and the community in terms of resident needs and wants 15. space is quite limited and would be pro-active to understand the households	16. It's recommended that double plug points are installed instead of the single point plugs	17. It's suggested communication with the household be open to allow for plug points to be installed

Recommendations proposed for consideration			
Theme	**ARM**	**Respondents**	**Focus Group Interviewees**
	lighting and plug point needs to keep the homeowner's living space ergonomic over time		
18. Other	19. Eskom to develop suitable financing models (such as credit) with local retailers & fuel merchants for the supply and access to gas in the community. 20. Given the rising cost of living, we propose offering 5kg and 9kg LPG cylinders instead. The more affordable 5kg cylinder will contribute to long-term sustainability of Eskom's AQO Project. 21. Eskom to establish a network of community technicians capable of offering both repairs and replacement parts for the provided stoves and heaters. 22. Eskom consider replacing any rusted components of the roof prior to application of the SPF celling. 23. Implementing veld fire management solutions 24. Eskom evaluates the feasibility of mini and micro grids in appropriate locations	28.	29.

Recommendations proposed for consideration			
Theme	**ARM**	**Respondents**	**Focus Group Interviewees**
	25. Eskom in conjunction with local municipalities assess the potential for biogas generation from Waste and Sewage treatment plants. 26. Rollout of carpets to households to aid in improving the thermal comfort of the homes in winter 27. Fruit and vegetables are not grown nor sold on the properties except for a few exceptions. An opportunity could exist to promote the development of subsistence market gardens which may directly help to reduce fugitive dust emissions in the area.		

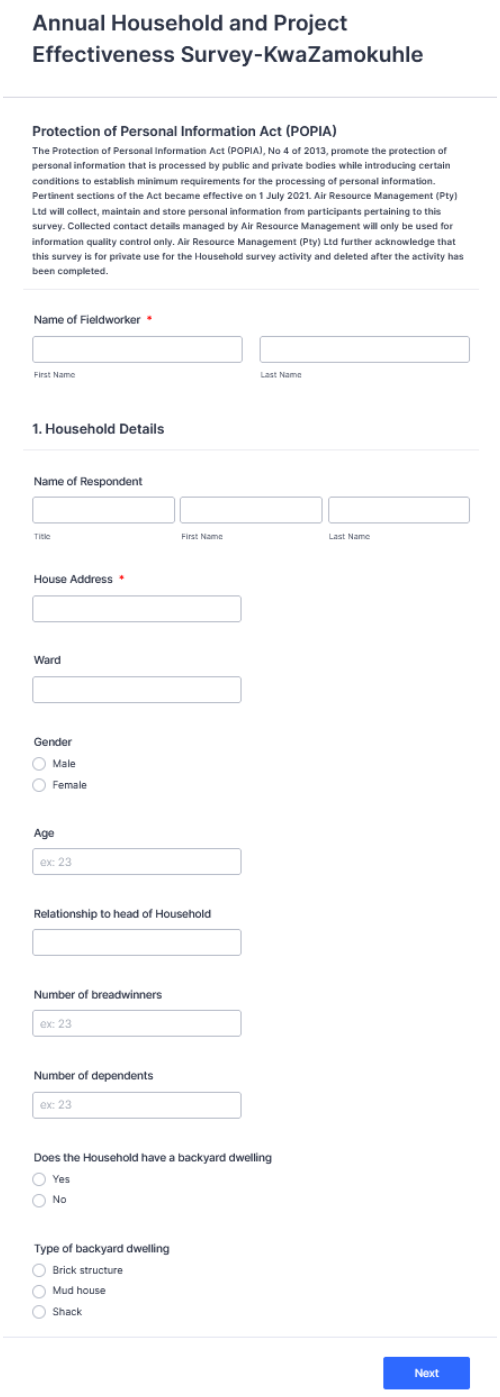
5. CONCLUSION

One of the key metrics for Eskom is to ascertain the improvement in the quality of life for the communities wherein the Eskom AQO intervention is rolled out. ARM conducted an Annual Household and Monitoring of Project Effectiveness Survey on 401 households (2023) and 381 households (2024) in KwaZamokuhle. All households that were sampled received the full Eskom AQO intervention suite.

It was clear from the Project Effectiveness Survey that both in 2023 and 2024, the households in KwaZamokuhle viewed the Eskom provided AQO interventions (stove, LPG heater, rewiring and celling) as of a good quality. The feedback from participants reveals a remarkable increase in warmth post Eskom's AQO ceiling installations, with an extraordinary 99.7% satisfaction rate in 2023, slightly declining to 99.2% in 2024, while overall contentment also decreased from 97% to 96.2%. Satisfaction with the Eskom provided AQO LPG heaters was exceptionally high, with 96.9% of 377 respondents expressing their approval in 2023, a sentiment that carried over to 2024, where 98.6% reported continued satisfaction. Furthermore, 98.5% of respondents in 2023 felt their homes were noticeably warmer with the LPG heater use, supported by 96.5% in 2024. Approval for the Eskom AQO hybrid stoves remained substantial across both years, with nearly universal endorsement in 2023 and continued strong recommendations in 2024. Additionally, 99.2% of respondents in 2023 advocated for Eskom to continue rewiring other homes in the community, a trend that persisted in 2024.

This transition above not only reflects an improvement in the quality of life for the KwaZamokuhle participants but also underscores the effectiveness of Eskom's AQO interventions in KwaZamokuhle. Eskom's AQO interventions can thus provide an option for achieving improvements in participants quality of life while promoting a sustainable benefit to the community.

ANNEXURE 1: ANNUAL HOUSEHOLD & PROJECT EFFECTIVENESS QUESTIONNAIRE



Annual Household and Project Effectiveness Survey-KwaZamokuhle

Protection of Personal Information Act (POPIA)

The Protection of Personal Information Act (POPIA), No 4 of 2013, promote the protection of personal information that is processed by public and private bodies while introducing certain conditions to establish minimum requirements for the processing of personal information. Pertinent sections of the Act became effective on 1 July 2021. Air Resource Management (Pty) Ltd will collect, maintain and store personal information from participants pertaining to this survey. Collected contact details managed by Air Resource Management will only be used for information quality control only. Air Resource Management (Pty) Ltd further acknowledge that this survey is for private use for the Household survey activity and deleted after the activity has been completed.

Name of Fieldworker *

First Name

Last Name

1. Household Details

Name of Respondent

Title

First Name

Last Name

House Address *

Ward

Gender

- Male
- Female

Age

ex: 23

Relationship to head of Household

Number of breadwinners

ex: 23

Number of dependents

ex: 23

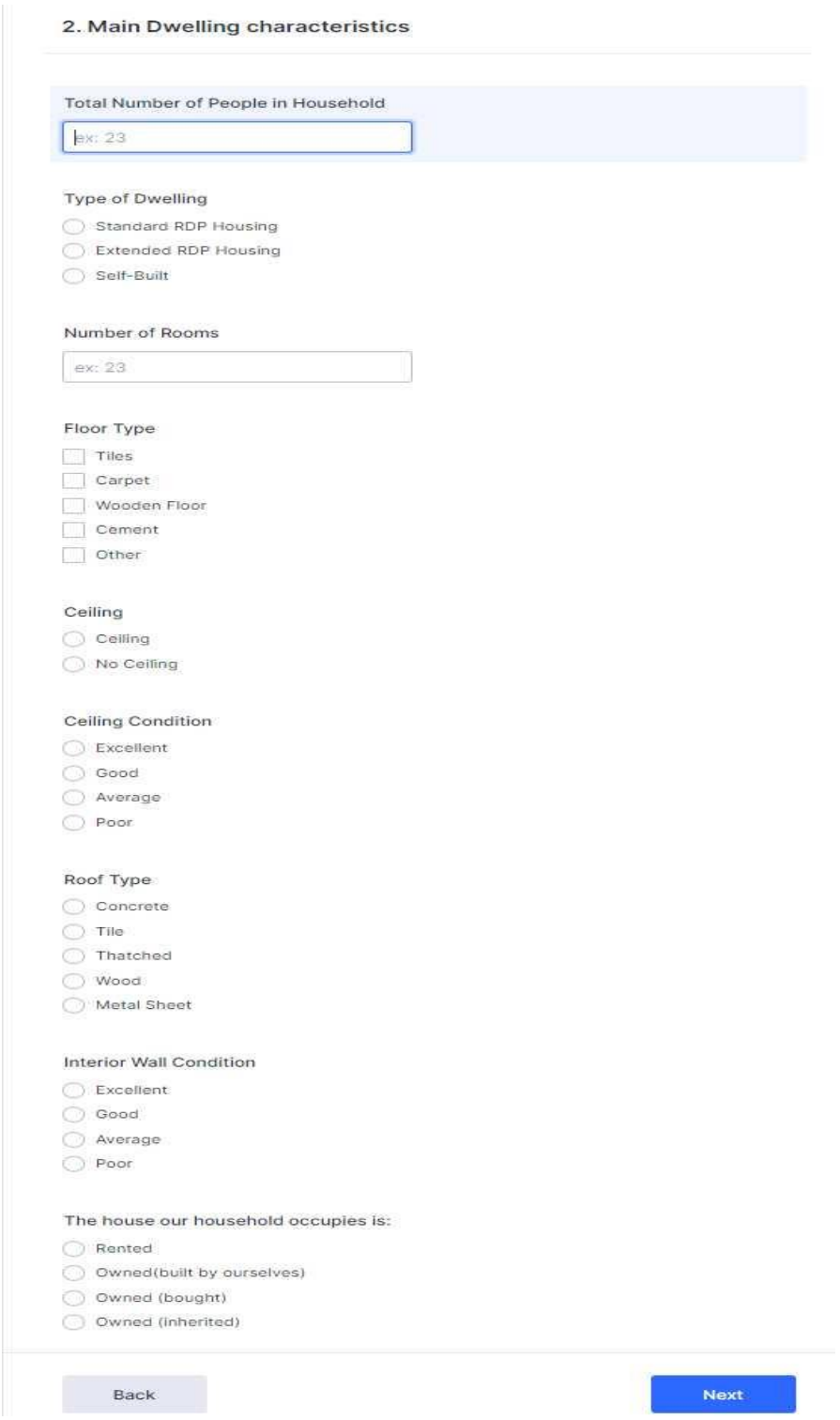
Does the Household have a backyard dwelling

- Yes
- No

Type of backyard dwelling

- Brick structure
- Mud house
- Shack

Next



2. Main Dwelling characteristics

Total Number of People in Household

ex: 23

Type of Dwelling

- Standard RDP Housing
- Extended RDP Housing
- Self-Built

Number of Rooms

ex: 23

Floor Type

- Tiles
- Carpet
- Wooden Floor
- Cement
- Other

Ceiling

- Ceiling
- No Ceiling

Ceiling Condition

- Excellent
- Good
- Average
- Poor

Roof Type

- Concrete
- Tile
- Thatched
- Wood
- Metal Sheet

Interior Wall Condition

- Excellent
- Good
- Average
- Poor

The house our household occupies is:

- Rented
- Owned(built by ourselves)
- Owned (bought)
- Owned (inherited)

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3.1 Eskom AQO Project Interventions Effectiveness (Ceiling)

Was a ceiling installed at this household?
- ◯ Yes
- ◯ No

Photo of ceiling

Take Photo

When the ceiling was installed in your home,was it of a good quality?
- ◯ Yes
- ◯ No (Explain below)

Why ceiling is not of good quality

Did the team who installed the ceiling in your home damage any items inyour home?
- ◯ Yes (Please explain)
- ◯ No

Team damaged items in home explanation

Did the team who installed the ceiling in your home leave your home in amess after they were done?
- ◯ Yes (Please Explain)
- ◯ No

Explanation of mess left by team

Does the ceiling condition now, look the same as when Eskom has installed it?
- ◯ Yes
- ◯ No (Please explain)

Explanation of ceiling condition

Are there any stains on the ceiling?

- ◯ Yes (Please indicate colour of stains and possbile cause)
- ◯ No

Colour of stains and cause

Photo of stains

Take Photo

Has there been any water leaks through the ceiling?

- ◯ Yes (Please indicate cause of leak)
- ◯ No

Possible cause of leak

Did you let try to fix the Leak yourself?

- ◯ Yes
- ◯ No

Did you let Eskom know about the leak?

- ◯ Yes
- ◯ No

Did they fix the leak?

- ◯ Yes
- ◯ No

Has the cornice become loose from the wall or ceiling?

- ◯ Yes (Please indicate cause)
- ◯ No

Cause of loose cornice on wall or ceiling

Loose cornice

Take Photo

Did you try to fix the loose cornice?

- ◯ Yes
- ◯ No

Did you let Eskom know of the loose cornice?
- Yes
- No

Did they fix the loose cornice for you?
- Yes
- No

Do you currently conduct any maintenance on the ceiling?
- Yes (Please indicate why)
- No (Please indicate why)

Why maintenance is done

Why maintenance is not done

If there is any future water leaks or damage to the celing, will you fix it?
- Yes (Please indicate why)
- No

Why will you fix the ceiling?

Will you not fix the future water leaks or damage due to high cost?
- Yes
- No

Should Eskom fix the future water leaks or damage?
- Yes
- No

Is the ceiling safe?
- Yes
- No (Please specify why)

Why the ceiling is not safe

Why the ceiling is not safe

Since the ceiling has been installed do you find your home warmer?

- Yes
- No (Please specify why)

Why the home does not feel warmer

Since the ceiling has been installed, how much coal do you now use inwinter than before it was installed?

- Use the same amount of coal than before the ceiling was installed
- Use less amount of coal than before the ceiling was installed
- Use more coal than before the ceiling was installed

Are you happy with the Eskom ceiling installed in your home?

- Yes
- No (Please specify why)

Why you are not happy with the installed ceiling

Would you recommend to other households to have the Eskom ceiling installed in their homes?

- Yes
- No (Please specify why)

Why would you not recommend to other households to have the Eskom ceiling installed in ther homes

What would you recommend to Eskom to improve this celing?

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3.2 Eskom AQO Project Interventions Effectiveness (LPG Heater)

Has the household received the LPG heater?
- ◯ Yes
- ◯ No

Photo of LPG Heater

Take Photo

Is the LPG heater installed in your home of a good quality?
- ◯ Yes
- ◯ No (Please explain)

Why LPG heater is not of good quality

Did the team who installed the LPG Heater in your home damage any items in your home?
- ◯ Yes (Please explain)
- ◯ No

How the team damage items in your home

Does the LPG Heater condition now, look the same as when Eskom has installed it?
- ◯ Yes
- ◯ No (Please explain)

Why the LPG Heater is not in the same condition as when installed

Did you receive training on how to use the LPG Heater?
- ◯ Yes
- ◯ No

Will you like to receive training on how to use the LPG Heater?
- ◯ Yes
- ◯ No

Has the LPG heater become damaged or defective since you received it?
- ◯ Yes (Please explain)
- ◯ No

What is the reason the LPG heater was damaged or defective

Damaged LPG Heater

Take Photo

Did you try to fix the LPG heater yourself?

- Yes
- No

Have you let Eskom know?

- Yes
- No

Have they fixed it for you?

- Yes
- No

Eskom provided 2 9kg LPG cylinders with the LPG heater. Do you still have any gas from these 9kg cylinders ?

- Yes
- No

How many cylinders do you have left?

- 1
- 2
- Other

Is there a place you can go to refill these cylinders?

- Yes (Please indicate where below)
- No

Where you refill gas cylinders

Is it expensive to use the LPG heater?

- Yes (Please indicate why)
- No

Why it is expensive to use the LPG Heater

Is it dangerous to use the LPG heater ?

- Yes (Please indicate why)
- No

Why it is dangerous to use the LPG heater

Is there anyone in your home who is scared to use the LPG heater ?

- ◯ Yes (Please indicate who below)
- ◯ No

Who is scared in the home to use the LPG heater

- ◯ Children
- ◯ Elderly
- ◯ Other

Do you know what to do if you smell gas from the LPG heater?

- ◯ Yes (Please indicate who knows and what to do below)
- ◯ No

If yes,who knows what to do if you smell gas and what to do

Do you have your windows and/or doors open when you use the LPG heater?

- ◯ Yes (Please explain)
- ◯ No

Why windows and/or doors are open

If there is any damage to the LPG heater in the future,will you fix it?

- ◯ Yes
- ◯ No (please explain)

Why will you not fix the LPG heater?

Should Eskom fix the damage?

- ◯ Yes
- ◯ No

Since the LPG Heater has been installed do you find your home warmer?

- ◯ Yes
- ◯ No (Please specify why)

Why does the home not feel warmer with the LPG heater

Should Eskom fix the damage?

- Yes
- No

Since the LPG Heater has been installed do you find your home warmer?

- Yes
- No (Please specify why)

Why does the home not feel warmer with the LPG heater

Since the LPG Heater has been installed, how much coal do you now use in winter than before it was installed?

- Use the same amount of coal than before the LPG Heater was installed
- Use the less amount of coal than before the LPG Heater was installed
- Use more coal than before the LPG Heater was installed

Are you happy with the Eskom LPG Heater installed in your home?

- Yes
- No (Please specify)

Why you are not happy with the LPG heater installed in your home

Would you recommend to other households to have the Eskom LPG Heater installed in their homes?

- Yes
- No (Please specify)

Why you would not recommend other households have the Eskom LPG heater installed in their homes

What would you recommend to Eskom to improve this LPG heater?

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3.3 Eskom AQO Project Interventions Effectiveness:Hybrid gas-electricity stove

Has the household received the hybrid stove?

- ◯ Yes
- ◯ No

Photo of Hybrid stove

Take Photo

Is Hybrid gas-electricity stove installed in your was it of a good quality?

- ◯ Yes
- ◯ No (Please explain)

Why the hybrid stove was not of good quality

Did the team who installed the Hybrid gas-electricity stove in your home damage any items in your home?

- ◯ Yes (Please explain)
- ◯ No

How the team damaged items in your home

Does the Hybrid gas-electricity stove condition now, look the same as when Eskom has installed it?

- ◯ Yes
- ◯ No (Please explain)

Why the hybrid stove does not look the same as when Eskom installed it

Did you receive training on how to use the Hybrid gas-electricity stove?

- ◯ Yes
- ◯ No

Will you like to receive training on how to use the Hybrid gas-electricity stove?

- ◯ Yes
- ◯ No

Has the gas-electricity stove become damaged or defective since you received it

- ◯ Yes (Please explain)
- ◯ No

Please indicate the possible cause of damage or why it is defective

Damaged hybrid stove

Take Photo

Have you tried to fix the hybrid stove yourself?

- Yes
- No

Have you let Eskom know about the issue of the stove?

- Yes
- No

Have they fixed it for you?

- Yes
- No

Does the stove and/or oven work properly?

- Yes
- No (Please explain)

Why the stove and/or oven are not working

Is it quicker to cook food now with the new stove?

- Yes
- No (Please explain)

Why the stove is not quicker to cook food

Does the food have the same taste as the food cooked on a traditional coal stove?

- Yes
- No (Please explain)

Why the food does not taste as the food cooked on a traditional coal stove

Is the new stove easy to operate?

- ◯ Yes
- ◯ No (Please explain)

Why the stove is not easy to operate

Is it more expensive to use the Hybrid gas-electricity stove than a coal stove ?

- ◯ Yes (Please explain)
- ◯ No

Why it is more expensive to use the hybrid gas-electricity stove

Is it dangerous to use the gas-electricity stove than a coal stove ?

- ◯ Yes (Please explain)
- ◯ No

Why the stove is more dangerous to use

Do you know what to do if you smell gas from the gas-electricity stove?

- ◯ Yes (Explain below)
- ◯ No

Who knows what to do if gas is smelt and what do if gas is smelt

Do you have your windows and/or doors open when you use the gas-electricity stove?

- ◯ Yes (Please explain)
- ◯ No

Why windows and/or doors are open when using stove

If there is any damage to the gas-electricity stove in the future, will you fix it?

- ◯ Yes
- ◯ No (Please explain)

Why you will not fix the damaged stove

Should Eskom fix the damage?

- ◯ Yes
- ◯ No

Since the gas-electricity stove has been installed do you find your home warmer?

- ◯ Yes
- ◯ No (Please specify why)

Why you do not feel that the home is warmer

Since the gas-electricity stove has been installed, how much coal do you now use in winter than before it was installed?

- ◯ Use the same amount of coal than before the Hybrid gas-electricity stove was installed
- ◯ Use the less amount of coal than before the Hybrid gas-electricity stove was installed
- ◯ Use more coal than before the Hybrid gas-electricity stove was installed

Are you happy with the Eskom gas-electricity stove installed in your home?

- ◯ Yes
- ◯ No (Please explain)

Why you are not happy with the stove installed in your home

Would you recommend to other households to have the Eskom gas-electricity stove installed in their homes?

- ◯ Yes
- ◯ No (Please explain why)

Why you would not recommend the stove being installed in other households

What would you recommend to Eskom to improve this gas-electricity stove?

3.4 Eskom AQO Project Interventions Effectiveness:Electrical rewiring by Eskom contractors

Has the household had the rewiring done by Eskom?

- ◯ Yes
- ◯ No

Photo of wiring

Take Photo

Is electrical rewiring that was done in your home of a good quality?

- ◯ Yes
- ◯ No (Please explain)

Why the rewiring is not good quality

Did the team who installed the electrical rewiring in your home damage any items in your home?

- ◯ Yes (Please explain)
- ◯ No

How team damaged home when doing electrical rewiring

Does the electrical rewiring condition now, look the same as when Eskom has installed it?

- ◯ Yes
- ◯ No (Please explain)

Why the rewiring condition now does not look the same as when Eskom installed it

Has the electrical rewiring become damaged or defective since you received it?

- ◯ Yes (Please indicate possible cause)
- ◯ No

Photo of damaged electrical wiring

Take Photo

Cause of damage or defective wiring

Did you receive a certificate of competence for the electrical rewiring that was done in your home?

- ◯ Yes
- ◯ No (Please explain)

Reason for not receiving certificate of competence for the electrical wiring done in your home

Would you recommend to other households to have the Eskom electrical rewiring installed in their homes?

- ◯ Yes
- ◯ No (Please explain)

Why you would not recommend the electircal wiring to be done in other houses

What would you recommend to Eskom to improve the electrical rewiring?

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3.5 Eskom AQO Project Interventions Effectiveness:Regress

Will you be moving away from this house in 2024?

- ◯ Yes (Plese explain why)
- ◯ No

Why you are moving away from your current home

Have you purchased another coal stove?

- ◯ Yes (Please explain why)
- ◯ No

Why you purchased another coal stove

Do you have another coal stove in your home that you use?

- ◯ Yes (Please explain how often you used it below)
- ◯ No

How often you used the coal stove

If you were able to give Eskom back the hybrid stove and/or LPG heater for a brand new coal stove, will you?

- ◯ Yes (Please explain why)
- ◯ No

Why you would give Eskom back the hybrid stove for a brand new coal stove

Does the LPG heater provide enough heat for you?

- ◯ Yes
- ◯ No (Please explain)

Why the LPG does not provide enough heat for you

Which one do you prefer to heat your home: LPG heater or coal?

- ◯ LPG heater
- ◯ Coal

From all of Eskoms interventions (new hybrid stove, LPG heater and celing), which one makes the biggest difference for you?

- ◯ Ceiling
- ◯ LPG Heater
- ◯ Hybrid stove

Will an electricity subsidy promote more use of the hybrid electricity gas stove?

- ◯ Yes
- ◯ No (Please explain)

Why an electricity will not promote more use of the hybrid stove

How satisfied are you with Eskoms interventions (new hybrid stove, LPG heater and celing) that were provided to you on a scale of 1 to 5. 1 been extremely unsatisfied and 5 been extremely satisfied

- ◯ 1. Extremely unsatisfied
- ◯ 2. Unsatisfied
- ◯ 3. Neutral
- ◯ 4. Satisfied
- ◯ 5. Extremely Satisfied

What would you recommend to Eskom to improve the Eskom interventions?

What is the biggest threat to Eskoms Air Quality Offset Project?

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Pre-Intervention Energy Usage

Which of the energy sources were used in your home?

- ☐ Electricity from grid
- ☐ LPG
- ☐ Firewood
- ☐ Coal
- ☐ Candle
- ☐ Electricity from isolated system
- ☐ Solar
- ☐ Animal dung
- ☐ Generator
- ☐ Other

Which one of the following was the main energy source?

- ○ Electricity
- ○ LPG
- ○ Firewood
- ○ Coal
- ○ Candle
- ○ Solar
- ○ Animal Dung
- ○ Generator
- ○ Other

Which one of the following was the main energy source for cooking?

	Mainly	Sometimes	Rarely	Never
Electricity	○	○	○	○
LPG	○	○	○	○
Firewood	○	○	○	○
Coal	○	○	○	○
Candle	○	○	○	○
Solar	○	○	○	○
Animal Dung	○	○	○	○
Generator	○	○	○	○
Battery	○	○	○	○

Which one of the following is the main energy source for heating?

	Mainly	Sometimes	Rarely	Never
Electricity	○	○	○	○
LPG	○	○	○	○
Firewood	○	○	○	○
Coal	○	○	○	○
Candle	○	○	○	○
Solar	○	○	○	○
Animal Dung	○	○	○	○
Generator	○	○	○	○
Battery	○	○	○	○

Which one of the following is the main energy source for lighting?

	Mainly	Sometimes	Rarely	Never
Electricity	○	○	○	○
LPG	○	○	○	○
Firewood	○	○	○	○
Coal	○	○	○	○
Candle	○	○	○	○
Solar	○	○	○	○
Animal Dung	○	○	○	○
Generator	○	○	○	○
Battery	○	○	○	○

Does your home have an electricity meter?

- ○ Yes
- ○ No

If your home does not have an electricity connection,please indicate if the statement is major,minor or no reason

	No reason	Minor reason	Major reason
Electricity is not available in my area	○	○	○
Our household can't pay the connection fee	○	○	○
Our household cant pay the cost of housewiring	○	○	○
Our household cant affford the monthly payment	○	○	○
Our household can't afford to buy electircal equipment	○	○	○
We are satisfied with present energy source	○	○	○

How many days per month do you utilise electricity?

- ○ 1-5
- ○ 6-10
- ○ 11-20
- ○ 20-29
- ○ Whole Month

What is your cost of electricity (Rands)

- ○ 1-200
- ○ 200-500
- ○ 500-1000
- ○ 1000-2000
- ○ More than 2000

Type of lighting

	Yes	No	Does not know
Incandescent light bulb	○	○	○
Fluorescent tubes	○	○	○
Energy saving light bulbs	○	○	○

Post-Intervention Energy Usage

Which of the energy sources were used in your home?

- ☐ Electricity from grid
- ☐ LPG
- ☐ Firewood
- ☐ Coal
- ☐ Candle
- ☐ Other
- ☐ Electricity from isolated system
- ☐ Solar
- ☐ Animal dung
- ☐ Generator

Which one of the following is the main energy source?

- ○ Electricity
- ○ LPG
- ○ Firewood
- ○ Coal
- ○ Candle
- ○ Solar
- ○ Animal Dung
- ○ Generator
- ○ Other

Which one of the following is the main energy source for cooking?

	Mainly	Sometimes	Rarely	Never
Electricity	○	○	○	○
LPG	○	○	○	○
Firewood	○	○	○	○
Coal	○	○	○	○
Candle	○	○	○	○
Solar	○	○	○	○
Animal Dung	○	○	○	○
Generator	○	○	○	○
Battery	○	○	○	○

Which one of the following is the main energy source for heating?

	Mainly	Sometimes	Rarely	Never
Electricity	○	○	○	○
LPG	○	○	○	○
Firewood	○	○	○	○
Coal	○	○	○	○
Candle	○	○	○	○
Solar	○	○	○	○
Animal Dung	○	○	○	○
Generator	○	○	○	○
Battery	○	○	○	○

Which one of the following is the main energy source for lighting?

	Mainly	Sometimes	Rarely	Never
Electricity	○	○	○	○
LPG	○	○	○	○
Firewood	○	○	○	○
Coal	○	○	○	○
Candle	○	○	○	○
Solar	○	○	○	○

Does your home have an electricity meter?

- ◯ Yes
- ◯ No

If your home does not have an electricity connection,please indicate if the statement is major,minor or no reason

	No reason	Minor reason	Major reason
Electricity is not available in my area	◯	◯	◯
Our household can't pay the connection fee	◯	◯	◯
Our household cant pay the cost of housewiring	◯	◯	◯
Our household cant affford the monthly payment	◯	◯	◯
Our household can't afford to buy electircal equipment	◯	◯	◯
We are satisfied with present energy source	◯	◯	◯

How many days per month do you utilise electricity?

- ◯ 1-5
- ◯ 6-10
- ◯ 11-20
- ◯ 20-29
- ◯ Whole Month

What is your cost of electricity (Rands)

- ◯ 1-200
- ◯ 200-500
- ◯ 500-1000
- ◯ 1000-2000
- ◯ More than 2000

Type of lighting

	Yes	No	Does not know
Incandescent light bulb	◯	◯	◯
Fluorescent tubes	◯	◯	◯
Energy saving light bulbs	◯	◯	◯

In case of power failure,what do you use as a backup?

	Yes	No
Candles	◯	◯
Gas lamp	◯	◯
Generator	◯	◯
Car/motocycle battery	◯	◯
Other	◯	◯

Other backup power

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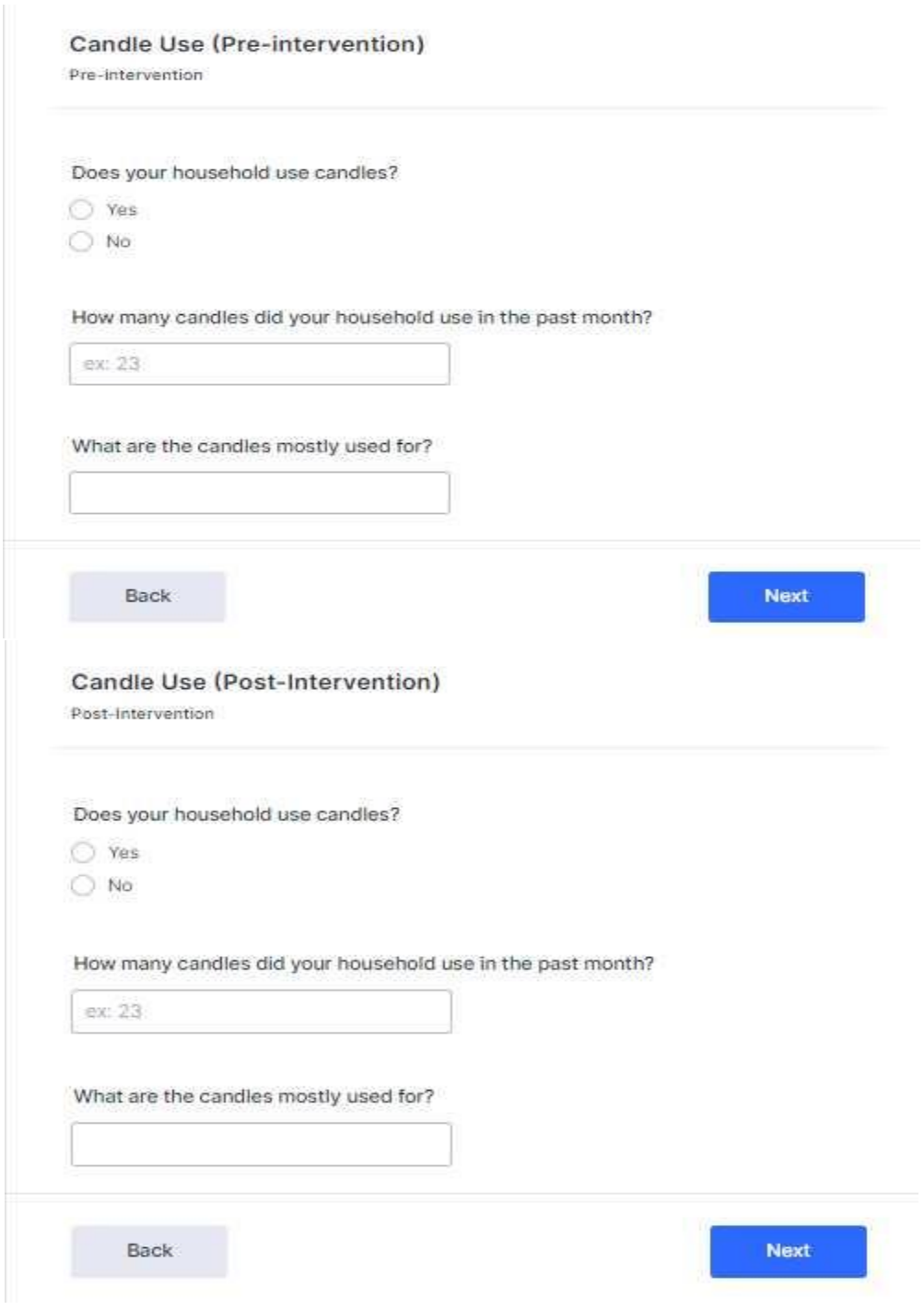

Candle Use (Pre-intervention)

Pre-intervention

Does your household use candles?

- Yes
- No

How many candles did your household use in the past month?

ex: 23

What are the candles mostly used for?

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Candle Use (Post-Intervention)

Post-Intervention

Does your household use candles?

- Yes
- No

How many candles did your household use in the past month?

ex: 23

What are the candles mostly used for?

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Use of LPG (Pre-intervention)

Pre-intervention

Does your household use LPG?

- ○ Yes
- ○ No

What size of gas cyclinder/tank does your household use?

	Yes	No
5kg cylinder	○	○
9kg Cylinder	○	○
12kg cylinder	○	○
14kg cylinder	○	○

Does the household use the following gas appliance?

	Yes	No
Gas Lamp	○	○
LPG stove	○	○
LPG stove and oven	○	○
LPG heater	○	○

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Use of LPG (Post-Intervention)

Post-Intervention

Does your household use LPG?

- ○ Yes
- ○ No

What size of gas cyclinder/tank does your household use?

	Yes	No
5kg cylinder	○	○
9kg Cylinder	○	○
12kg cylinder	○	○
14kg cylinder	○	○

Does the household use the following gas appliance?

	Yes	No
Gas Lamp	○	○
LPG stove	○	○
LPG stove and oven	○	○
LPG heater	○	○

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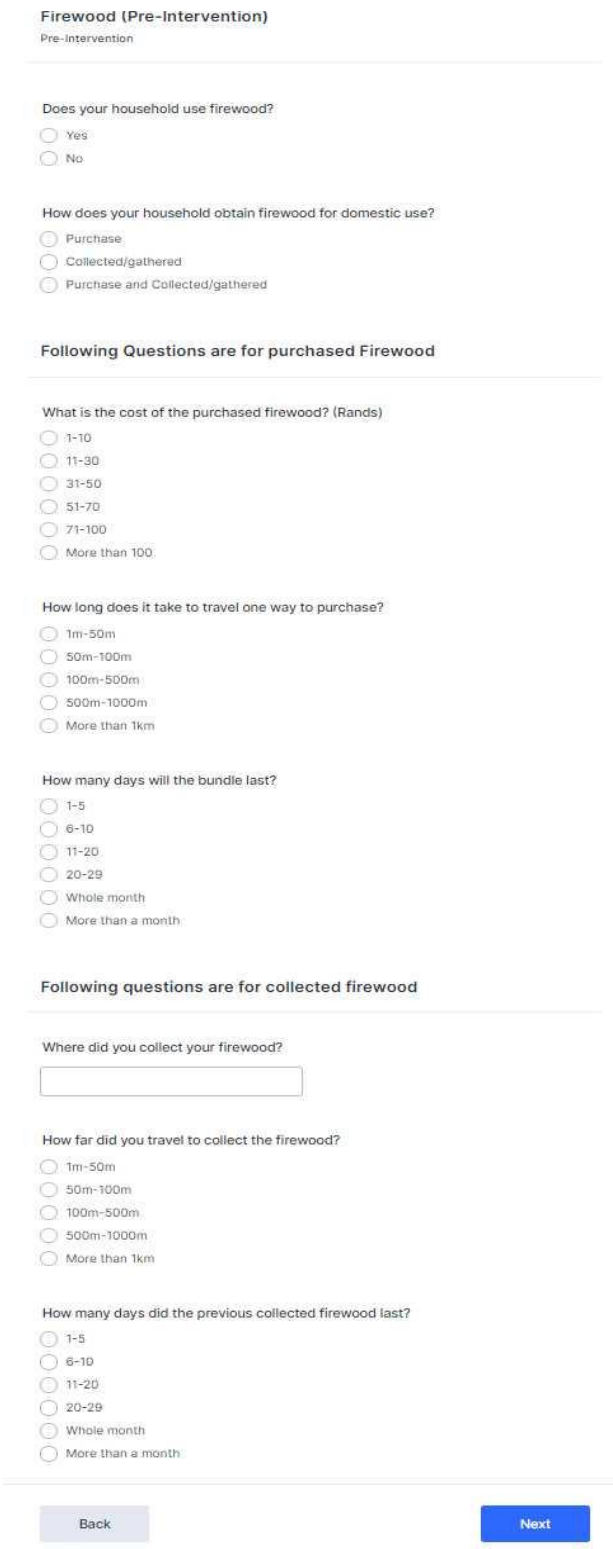

Firewood (Pre-Intervention)
Pre-intervention

Does your household use firewood?
- Yes
- No

How does your household obtain firewood for domestic use?
- Purchase
- Collected/gathered
- Purchase and Collected/gathered

Following Questions are for purchased Firewood

What is the cost of the purchased firewood? (Rands)
- 1-10
- 11-30
- 31-50
- 51-70
- 71-100
- More than 100

How long does it take to travel one way to purchase?
- 1m-50m
- 50m-100m
- 100m-500m
- 500m-1000m
- More than 1km

How many days will the bundle last?
- 1-5
- 6-10
- 11-20
- 20-29
- Whole month
- More than a month

Following questions are for collected firewood

Where did you collect your firewood?

How far did you travel to collect the firewood?
- 1m-50m
- 50m-100m
- 100m-500m
- 500m-1000m
- More than 1km

How many days did the previous collected firewood last?
- 1-5
- 6-10
- 11-20
- 20-29
- Whole month
- More than a month

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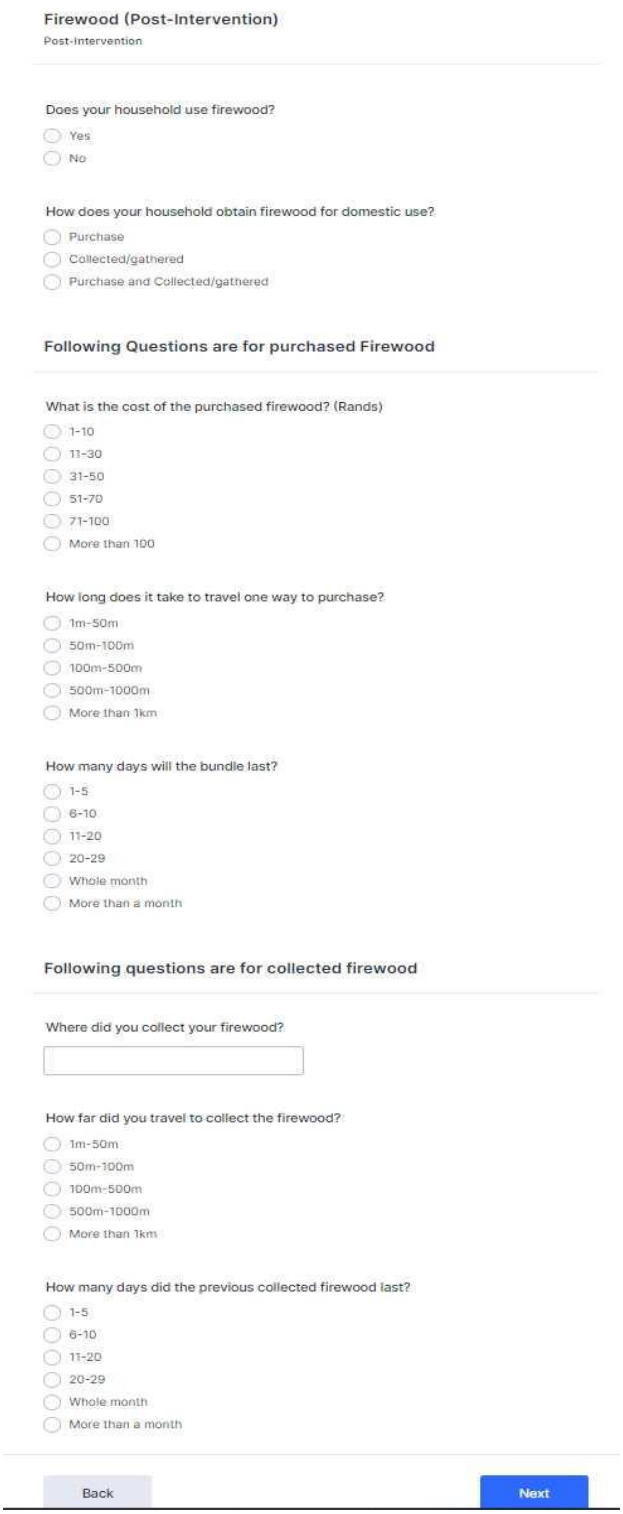

Firewood (Post-Intervention)

Post-Intervention

Does your household use firewood?

- Yes
- No

How does your household obtain firewood for domestic use?

- Purchase
- Collected/gathered
- Purchase and Collected/gathered

Following Questions are for purchased Firewood

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- 1-10
- 11-30
- 31-50
- 51-70
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- 6-10
- 11-20
- 20-29
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- 50m-100m
- 100m-500m
- 500m-1000m
- More than 1km

How many days did the previous collected firewood last?

- 1-5
- 6-10
- 11-20
- 20-29
- Whole month
- More than a month

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Use of charcoal (Pre-intervention)

Pre-intervention

Does your household use charcoal?

- ◯ Yes
- ◯ No

How many KGs of charcoal do you use in one month?

- ◯ 1-5
- ◯ 6-10
- ◯ 10-20
- ◯ 30-40
- ◯ 50-100

How far do you travel to purchase charcoal?

- ◯ 1m-50m
- ◯ 50m-100m
- ◯ 100m-500m
- ◯ 500m-1000m
- ◯ More than 1km

How many days does the charcoal last for?

- ◯ 1-5
- ◯ 6-10
- ◯ 11-20
- ◯ 20-29
- ◯ Whole month
- ◯ More than a month

What is the average cost of the charcoal? (Rands)

- ◯ 1-10
- ◯ 11-30
- ◯ 31-50
- ◯ 51-70
- ◯ 71-100
- ◯ More than 100

How reliable is your source of charcoal?

- ◯ Very reliable
- ◯ Fairly reliable
- ◯ Unreliable

Do you use more than one source for your charcoal?

- ◯ Yes
- ◯ No

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Use of Charcoal (Post-intervention)

Post-intervention

Does your household use charcoal?

- ◯ Yes
- ◯ No

How many KGs of charcoal do you use in one month?

- ◯ 1-5
- ◯ 6-10
- ◯ 10-20
- ◯ 30-40
- ◯ 50-100

How far do you travel to purhcase charcoal?

- ◯ 1m-50m
- ◯ 50m-100m
- ◯ 100m-500m
- ◯ 500m-1000m
- ◯ More than 1km

How many days does the charcoal last for?

- ◯ 1-5
- ◯ 6-10
- ◯ 11-20
- ◯ 20-29
- ◯ Whole month
- ◯ More than a month

What is the average cost of the charcoal? (Rands)

- ◯ 1-10
- ◯ 11-30
- ◯ 31-50
- ◯ 51-70
- ◯ 71-100
- ◯ More than 100

How reliable is your source of charcoal?

- ◯ Very reliable
- ◯ Fairly reliable
- ◯ Unreliable

Do you use more than one source for your charcoal?

- ◯ Yes
- ◯ No

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Use of Coal (Pre-intervention)

Pre-intervention

Does your household use coal?

- Yes
- No

How many KGs of coal do you use in one month?

- 1-5
- 6-10
- 10-20
- 30-40
- 50-100

How far do you travel to purchase coal?

- 1m-50m
- 50m-100m
- 100m-500m
- 500m-1000m
- More than 1km

How many days does the coal last for?

- 1-5
- 6-10
- 11-20
- 20-29
- Whole month
- More than a month

What is the average cost of the coal? (Rands)

- 1-10
- 11-30
- 31-50
- 51-70
- 71-100
- More than 100

How reliable is your source of coal?

- Very reliable
- Fairly reliable
- Unreliable

Do you use more than one source for your coal?

- Yes
- No

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Use of Coal (Post-intervention)

Post-intervention

Does your household use coal?

- ◯ Yes
- ◯ No

How many KGs of coal do you use in one month?

- ◯ 1-5
- ◯ 6-10
- ◯ 10-20
- ◯ 30-40
- ◯ 50-100

How far do you travel to purchase coal?

- ◯ 1m-50m
- ◯ 50m-100m
- ◯ 100m-500m
- ◯ 500m-1000m
- ◯ More than 1km

How many days does the coal last for?

- ◯ 1-5
- ◯ 6-10
- ◯ 11-20
- ◯ 20-29
- ◯ Whole month
- ◯ More than a month

What is the average cost of the coal? (Rands)

- ◯ 1-10
- ◯ 11-30
- ◯ 31-50
- ◯ 51-70
- ◯ 71-100
- ◯ More than 100

How reliable is your source of coal?

- ◯ Very reliable
- ◯ Fairly reliable
- ◯ Unreliable

Do you use more than one source for your coal?

- ◯ Yes
- ◯ No

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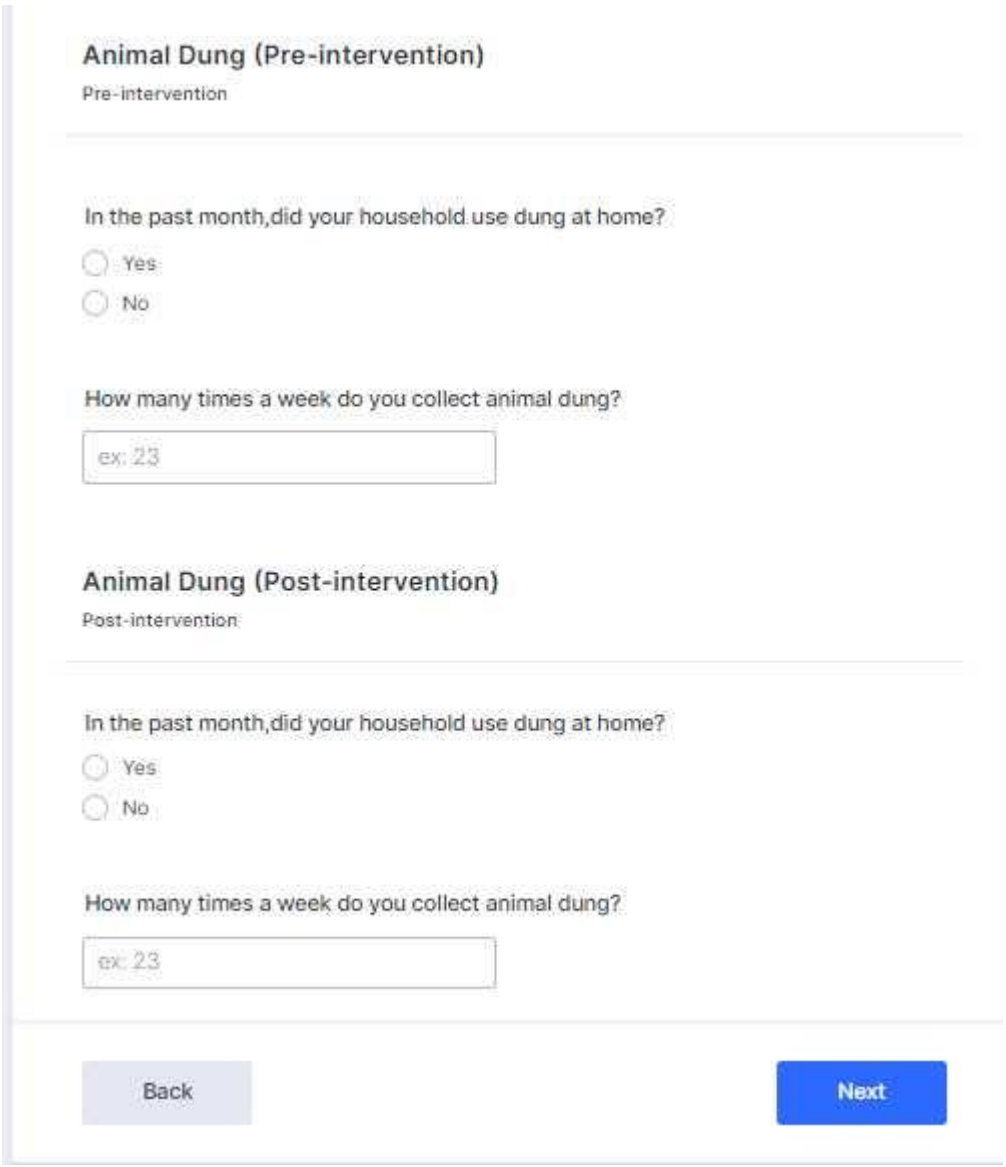
Animal Dung (Pre-intervention)
Pre-intervention
In the past month,did your household use dung at home?
Yes
No
How many times a week do you collect animal dung?
ex: 23
Animal Dung (Post-intervention)
Post-intervention
In the past month,did your household use dung at home?
Yes
No
How many times a week do you collect animal dung?
ex: 23
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Cooking devices (Pre-intervention)

Pre-intervention

What is the main stove that your household uses for cooking pre-intervention?

- [ ] Open fire
- [ ] Traditional stove no chimney
- [ ] Traditional stove with chimney
- [ ] Gas stove
- [ ] Electric stove

Where is the stove located?

- [ ] Outdoors
- [ ] Semi-enclosed
- [ ] Separate kitchen
- [ ] In living area

Is there a vent or window in the cooking area?

- ( ) None
- ( ) One only
- ( ) Two or more

What type of fuel does your household use for cooking?

- [ ] Firewood
- [ ] Coal
- [ ] Charcoal
- [ ] LPG
- [ ] Electricity
- [ ] Dung cakes

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Cooking Devices (Post-Intervention)

Post-Intervention

What is the main stove that your household uses for cooking pre-intervention?

- [ ] Open fire
- [ ] Traditional stove no chimney
- [ ] Traditional stove with chimney
- [ ] Gas stove
- [ ] Electric stove

Where is the stove located?

- [ ] Outdoors
- [ ] Semi-enclosed
- [ ] Separate kitchen
- [ ] In living area

Is there a vent or window in the cooking area?

- ( ) None
- ( ) One only
- ( ) Two or more

What type of fuel does your household use for cooking?

- [ ] Firewood
- [ ] Coal
- [ ] Charcoal
- [ ] LPG
- [ ] Electricity
- [ ] Dung cakes

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Health (Pre-Intervention)

Pre-Intervention

Are you satisfied with your health?

- ○ Greatly unsatisfied
- ○ Unsatisfied
- ○ Neutral
- ○ Satisfied
- ○ Greatly Satisfied

How many members of your household smoke?

ex: 23

How often do you or a member of your household experience eye diseases or irritation?

- ○ Never
- ○ Occasionally
- ○ Frequently
- ○ All the time

How often do you or a member of your household experience an illness with a cough?

- ○ Never
- ○ Occasionally
- ○ Frequently
- ○ All the time

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Health (Post-Intervention)

Post-Intervention

Are you satisfied with your health?

- ○ Greatly unsatisfied
- ○ Unsatisfied
- ○ Neutral
- ○ Satisfied
- ○ Greatly Satisfied

How many members of your household smoke?

ex: 23

How often do you or a member of your household experience eye diseases or irritation?

- ○ Never
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- ○ All the time

How often do you or a member of your household experience an illness with a cough?

- ○ Never
- ○ Occasionally
- ○ Frequently
- ○ All the time

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Standard of living

What is the main source of water supply for the household?

- [ ] Outside tap
- [ ] Indoor taps
- [ ] Borehole/Well
- [ ] Neighbour
- [ ] Rain water

How many days has your water supply been available in the past month?

- ( ) 1-5
- ( ) 6-10
- ( ) 11-20
- ( ) 20-29
- ( ) Whole month
- ( ) More than a month

How much do you pay for water?

- ( ) 0
- ( ) 1-R500
- ( ) R500-1000
- ( ) R1000-R2000
- ( ) More than R2000

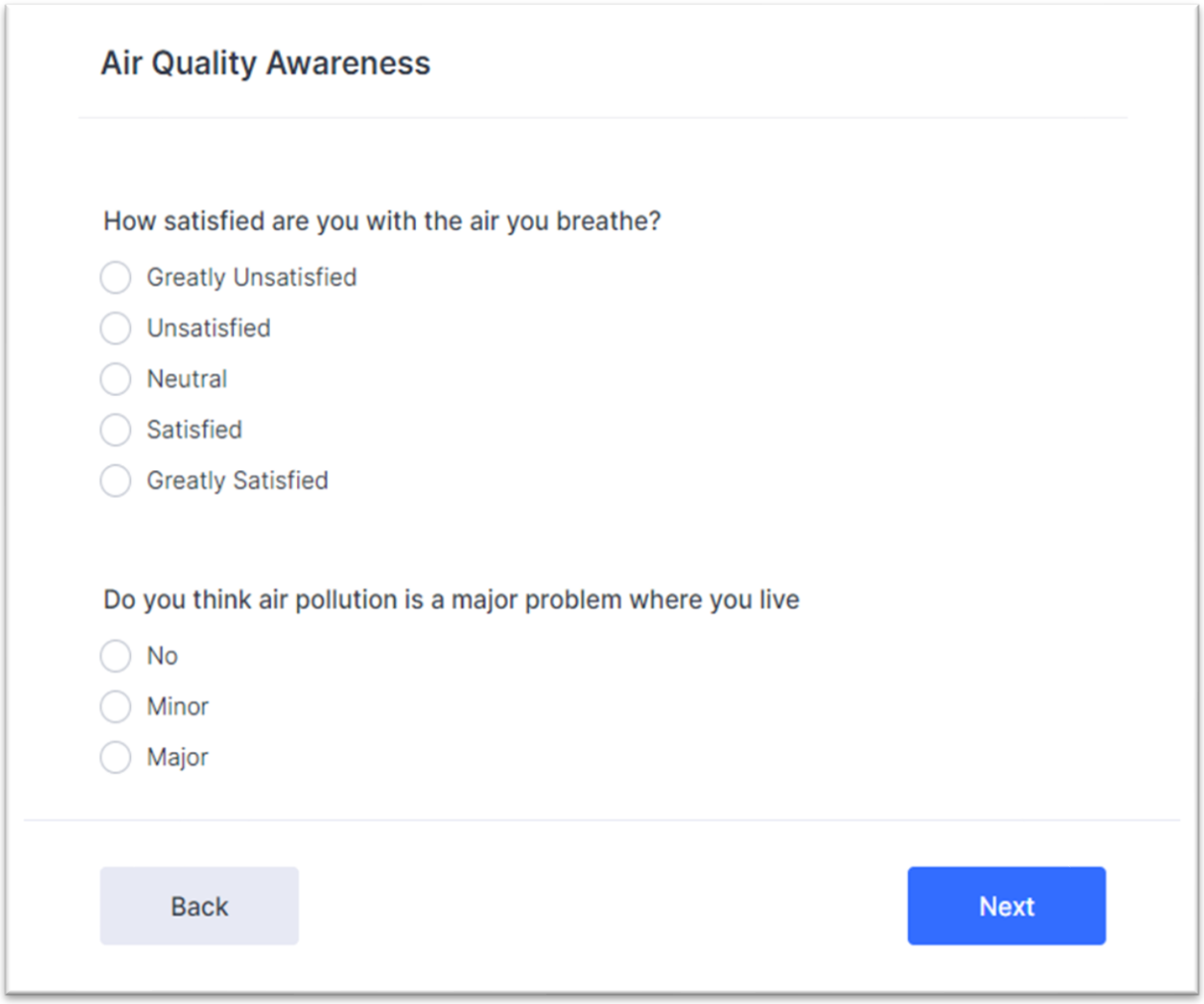
Do you have to walk away from your home to fetch water?

- ( ) Yes
- ( ) No

How far do you have to walk to fetch water ?

- ( ) 1m-50m
- ( ) 50m-100m
- ( ) 100m-500m
- ( ) 500m-1000m
- ( ) More than 1km

What type of container do you use to fetch water?


Air Quality Awareness
How satisfied are you with the air you breathe?
Greatly Unsatisfied
Unsatisfied
Neutral
Satisfied
Greatly Satisfied
Do you think air pollution is a major problem where you live
No
Minor
Major
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