PROFESSIONAL PLANNING
& DEVELOPMENT SERVICES
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# MONITORING, EVALUATION, ACCOUNTABILITY, AND LEARNING:

## A Case Study on the Cayman Islands Government's Residential Building Energy Efficiency Programme

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Ministry of Sustainability & Climate Resiliency and Wellness
Cayman Islands Government
resembid
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## Glossary

| | |
|---|---|
| BCU | Building Control Unit |
| CARICOM | Caribbean Community and Common Market |
| CCREEE | Caribbean Center for Renewable Energy and Energy Efficiency |
| CHEER | Cayman Home Energy Efficiency Retrofit Programme |
| CIG | Cayman Islands Government |
| CSR | Corporate Social Responsibility |
| CUC | Caribbean Utilities Company |
| EDF | European Development Fund |
| EE | Energy Efficiency |
| EPU | Energy Policy Unit |
| EU | European Union |
| FIT | Feed-In-Tariff |
| GHG | Greenhouse Gas |
| GDP | Gross Domestic Product |
| MEAL | Monitoring, Evaluation, Accountability, and Learning |
| MSCRW | Ministry of Sustainability & Climate Resiliency and Wellness |
| NEP | National Energy Policy |
| NHDT | National Housing Development Trust |
| OCTs | Overseas Countries and Territories |
| PSBEEP | Public Sector Buildings Energy Efficiency Programme |
| PV | Photovoltaic |
| RBEEP | Residential Buildings Energy Efficiency Programme |
| RESEMBID | Resilience, Sustainable Energy, and Marine Biodiversity |
| SDGs | Sustainable Development Goals |
| UN | United Nations |

## Foreword

*Energy efficiency is no longer just an option for the Cayman Islands—it is a necessity. Our reliance on imported fossil fuels places us at the mercy of volatile energy prices, while the impacts of climate change grow ever more evident. As a nation, we must take bold steps to reduce energy demand, lower our greenhouse gas emissions, and ensure that every household benefits from a sustainable future.*

*The Residential Buildings Energy Efficiency Programme (RBEEP) is a testament to what can be achieved when we put people, communities, and the environment at the heart of progress. This pilot programme is more than a series of retrofits or energy audits; it is a model for change—a starting point for creating homes that are more efficient, affordable, and resilient.*

*Through this initiative, we have witnessed how small changes can deliver significant results, from reducing energy consumption to lowering monthly bills for families who need it most. Importantly, the programme has also laid the groundwork for future efforts by providing lessons, building local capacity, and raising awareness about the role each of us can play in achieving our national energy goals as set out in the National Energy Policy 2024-2045.*

*Programmes like RBEEP demonstrate that achieving progress requires persistence, collaboration, and a collective commitment to building a sustainable future. I would like to extend my gratitude to our partners at RESEMBID and Expertise France for their leadership in implementing the programme, and to the European Union for their generous funding and unwavering support. A special thank you goes to the dedicated project team, whose hard work and expertise brought this initiative to life, and to the many residents whose trust and active participation were integral to it success.*

*This case study can serve as inspiration—not just for what has been achieved so far, but for the possibilities that lie ahead. Together, we can build a greener, more sustainable Cayman Islands—one step at a time.*

**The Honourable Dwayne Seymour, JP. MP**

**Minister for Sustainability & Climate Resiliency, and Wellness**

**Cayman Islands Government**

## Message

*As a Caymanian, I take immense pride in seeing our islands take meaningful steps toward a more sustainable future. The Residential Buildings Energy Efficiency Programme (RBEEP) is a pioneering initiative that has brought energy efficiency to the forefront of our national conversation. This programme represents a critical first step in addressing energy challenges at the household level, particularly for those most vulnerable to rising energy costs.*

*The success of this pilot programme is not just in the homes that were retrofitted or the energy saved, but in the lasting legacy of the knowledge, skills, and awareness it has created. By prioritising collaboration, equity, and practical solutions, we are helping to build capacity within our people and demonstrate the value of energy efficiency for generations to come.*

*I am particularly inspired by the dedication of the project team, stakeholders, and participants who made this initiative a reality. The journey has not been without its challenges, but the valuable lessons learned will guide us as we scale these efforts to ensure that all Caymanians benefit from cleaner, more affordable energy.*

*To the families who opened their homes to this project: your participation has laid the foundation for change, proving that even small adjustments can make a significant impact. To our future generations: this work is for you. It is a promise that we will continue to strive for a Cayman Islands that is resilient, sustainable, and inclusive.*

*Together, we are shaping a brighter, greener future for our islands—one where our people thrive, and our environment is protected.*

**Nellie Pouchie, Cert. Hon**

**Chief Officer for the Ministry of Sustainability & Climate Resiliency and Wellness**

**Cayman Islands Government**

## Executive Summary

The **Residential Buildings Energy Efficiency Programme** (RBEEP), supported by the RESEMBID initiative, represents a landmark effort by the Cayman Islands to enhance energy efficiency in the residential sector. Through a comprehensive approach combining retrofitting measures, capacity building, public outreach, and policy alignment, RBEEP advances the country's **National Energy Policy** goals. This pilot programme focused on ten financially vulnerable households, of which **80% were female-led**, ensuring that socioeconomic equity was at the forefront of its design and delivery.

The programme achieved notable gains in energy efficiency, with several households surpassing the ambitious target of a 40% year-on-year reduction in electricity consumption, greenhouse gas (GHG) emissions, and energy expenditure. Exceptional reductions—such as Client 9's **65.2% drop** in energy bills and **67.4% reduction** in GHG emissions—underscore the transformative potential of integrating energy monitors, spray foam insulation, and high-efficiency air conditioning units. These successes highlight the compounding benefits of layering interventions and the value of targeting high-consumption households.

The programme also prioritised capacity building, equipping public sector professionals with foundational knowledge of **energy efficiency** practices and fostering Corporate Social Responsibility (CSR) engagement. Public awareness campaigns further complemented these efforts, raising the profile of energy efficiency benefits through media, events, and digital platforms. Despite these achievements, several challenges emerged:

- **Delays in Procurement and Approvals:** Issues with contractor onboarding and procurement timelines delayed implementation and restricted the full realisation of retrofit benefits within the intended timeframe.
- **Incomplete Solar Integration:** The delay in connecting solar PV systems limited the programme's ability to achieve even greater energy and cost savings.
- **Behavioural and Communication Barriers:** Homeowner surveys revealed a strong focus on financial savings, with limited awareness of broader environmental benefits. In addition, gaps in public engagement strategies curtailed the reach of awareness efforts, particularly on digital platforms.

These challenges provide valuable lessons for scaling future initiatives. Improved procurement processes, tailored homeowner training, and a cohesive **communications strategy** will be vital to optimising future efforts. Integrating **financial incentives**, such as low-interest loans or subsidies, alongside energy-efficient planning guidelines and building code, will further ensure accessibility and long-term impact.

RBEEP's pilot phase has set a **replicable foundation** for advancing residential energy efficiency in the Cayman Islands and beyond. By addressing technical, financial, and behavioural barriers, the programme offers a model for fostering **equitable**, sustainable energy transitions across small island jurisdictions. As the Cayman Islands move toward broader implementation, the insights and successes of RBEEP position the nation as a **leader** in regional energy efficiency innovation, advancing both environmental resilience and economic equity for its residents.

# 1 Introduction

## 1.1 Overview

The Residential Buildings Energy Efficiency Programme (RBEEP) is a flagship initiative through the Resilience, Sustainable Energy, and Marine Biodiversity (RESEMBID) Programme which supports sustainable human development efforts in 12 Caribbean Overseas Countries and Territories (OCTs):


**Figure 1: The 12 OCTs supported by RESEMBID**
*Source:* RESEMBID (2024)

RESEMBID is a partnership between the Caribbean OCTs financed through the 11th European Development Fund (EDF) Caribbean OCT Regional Programme and the Cayman Islands is one of the OCTs.

The RBEEP represents the first major effort by the Cayman Islands Government (CIG) to address energy efficiency (EE) in homes. In 2021, the Cayman Islands secured a €1.2 million RESEMBID grant to fund two complementary initiatives: the RBEEP and the Public Sector Buildings Energy Efficiency Programme (PSBEEP). The RBEEP programme is part of a larger effort to enhance resilience, sustainability, and energy efficiency across the Cayman Islands. Led by the Ministry of Sustainability & Climate Resiliency and Wellness (MSCRW) the programme aims to reduce energy consumption, greenhouse gas emissions, and electricity costs through a twofold strategy:

(i) Retrofitting homes with energy efficient and renewable energy technologies.

(ii) Building capacity for sustainable energy practices.

Like many Caribbean countries, the Cayman Island's place heavy reliance on imported fossil fuels for electricity generation, resulting in an energy landscape which is particularly sensitive to price volatility and environmental concerns. To mitigate these challenges, the programme focuses on retrofitting ten pilot homes from the National Housing Development Trust (NHDT) portfolio of affordable houses. These homes were selected following a socioeconomic analysis to ensure the benefits are directed to the most vulnerable households. The retrofits include advanced energy-efficient appliances, lighting systems, and photovoltaic (PV) installations, integrating both energy efficiency and renewable energy solutions.

Beyond the physical retrofits, the programme incorporates a comprehensive training initiative, equipping participants with skills in energy auditing and sustainable energy practices. This dual approach ensures immediate energy savings

for participating households while building long-term capacity to support broader energy transitions within the residential sector.

Aligned with the updated National Energy Policy (NEP) 2024–2045, the programme also features a public awareness campaign led by the MSCRW's Energy Policy Unit (EPU). This campaign is designed to encourage the adoption of energy-efficient practices across the wider community.

As a pioneering initiative, the RBEEP provides a scalable model for similar programmes across the Caribbean, demonstrating how targeted interventions can deliver tangible household benefits while addressing broader environmental and socioeconomic goals.

## 1.2 Purpose of the Case study

The purpose of this case study is to document and analyse the implementation, outcomes, and lessons learned from the RBEEP. By capturing the journey of this initiative, the case study aims to provide a detailed account of its strategies, successes, and challenges, offering insights that can inform similar efforts in other regions.

This document is designed to:

(i) **Provide a Comprehensive Overview:** Outline the programme's objectives, key components, and alignment with the Cayman Islands' NEP 2024–2045.

(ii) **Highlight Achievements:** Showcase the measurable impacts of the programme, including reductions in energy consumption, greenhouse gas emissions, and electricity costs, as well as advancements in public awareness and capacity building.

(iii) **Document Lessons Learned:** Capture key takeaways from the programme's design and implementation phases, including stakeholder engagement, challenges in execution, and adjustments made to achieve desired outcomes.

(iv) **Support Knowledge Sharing:** Serve as a resource for governments, policymakers, and stakeholders across the Caribbean and beyond, offering practical insights for designing and executing residential energy efficiency programmes.

(v) **Promote Scalability:** Provide a replicable framework and evidence-based recommendations to facilitate the adaptation of similar initiatives in other contexts, supporting global efforts to enhance sustainability and resilience.

This case study is not only a reflection on the Cayman Islands' first major effort to improve energy efficiency in homes and build capacity for sustainable energy practices but also a tool to inspire and guide other similar jurisdictions in tackling the pressing challenges of energy efficiency, climate resilience, and sustainable development.

# 2 Context and Background

## 2.1 Energy Challenges in the Cayman Islands

The Cayman Islands' energy sector faces significant challenges due to its reliance on imported fossil fuels, which account for over 97% of electricity demand (Government of the Cayman Islands, 2024). This dependency leads to volatile energy prices, high electricity costs, and substantial greenhouse gas emissions. Additionally, the islands are highly vulnerable to the impacts of climate change, including rising sea levels and extreme weather events, underscoring the urgent need for a transition to more sustainable and resilient energy practices.

## 2.2 National Energy Policy: A Revised Roadmap for Change

In 2024, the Cayman Islands Government updated the NEP to reflect the evolving energy landscape and incorporate lessons learned since the original 2017 policy. The revised NEP, covering the period 2024–2045, provides an enhanced roadmap for achieving energy security and sustainability. The updated policy establishes more ambitious targets, including 100% renewable energy by 2045, and expands its focus to include energy resiliency and equity. The NEP emphasises renewable energy, energy efficiency, and conservation, setting the foundation for government-led initiatives like the RBEEP.

This programme represents a direct implementation of the NEP's objectives, addressing the residential sector's energy challenges through practical interventions while contributing to the Cayman Islands' broader environmental and socioeconomic goals.

## 2.3 Role of RESEMBID and the Grant Award

The RBEEP is supported by RESEMBID, funded by the European Union (EU) through an initial allocation of €878,300. This funding provided essential resources to implement energy efficiency measures while promoting regional collaboration and knowledge sharing. It enabled the Cayman Islands to align its efforts with the United Nations (UN) Sustainable Development Goals (SDGs) and the regional energy objectives set by the Caribbean Center for Renewable Energy and Energy Efficiency (CCREEE), an institution of the Caribbean Community and Common Market (CARICOM), of which the Cayman Islands is an associate member. By doing so, the Cayman Islands is setting a practical example for other Caribbean nations.

In addition to funding, RESEMBID provided project oversight through robust reporting mechanisms. These included quarterly Monitoring, Evaluation, Accountability, and Learning (MEAL) reports and financial monitoring reports, which ensured transparency, accountability, and continuous progress tracking for the RBEEP team.

## 2.4 Socioeconomic Considerations

The RBEEP prioritises equity by targeting vulnerable households managed by the NHDT. These households often face disproportionately high energy costs relative to their income, making them ideal beneficiaries for energy efficiency upgrades. A comprehensive socioeconomic analysis guided the selection of ten pilot homes, ensuring the programme delivered maximum impact by addressing the unique needs of low-income residents.

The retrofits include advanced energy-efficient appliances, foam insulation, and photovoltaic (PV) installations. By focusing on the NHDT's portfolio, the programme aligns with national and international priorities for sustainable development and social equity.

# 3 Programme Rationale and Implementation

## 3.1 Aim

The vision outlined in the NEP 2024-2045 is well-defined and forward-looking:

> **"Enhancing and embracing a sustainable lifestyle through responsible, affordable, and innovative energy supply and consumption."**

This vision is supported by four distinct goals, each designed to drive progress toward sustainability by 2045:

1. Knowledge and Education
2. Innovation
3. Energy Security
4. Socioeconomic and environmental sustainability

The NEP also outlines strategies that guide the realisation of these goals, three of these are particularly relevant to the RBEEP:

**NEP Strategy 3.1.1:**

Establish public awareness programmes to influence public behaviour and choices regarding sustainable energy, energy consumption, conservation, efficiency and related new technologies.

**NEP Strategy 3.3.8:**

Provide a framework and incentives promoting the implementation of energy efficiency measures in facilities and major renovations.

**NEP Strategy 3.3.9**

Support Energy Efficiency and conservation retrofits of existing facilities.

These guiding principles form a cohesive thread that runs through the RBEEP, reflecting the programme's core aim to:

**Contribute to the reduced energy consumption in the residential sector of the Cayman Islands**

## 3.2 Logical Framework

Achieving the programme's energy reduction goal hinges on a clear, measurable approach. The overarching objective is to drive down energy consumption through:

**Increased energy efficiency and use of renewable energy within pilot homes in the Cayman Islands**

A logical framework was developed to track progress and ensure the programme remains on course. This framework includes specific, measurable targets aimed at demonstrating success:

1. A **40% reduction** in electricity consumption year-on-year (2024 vs. 2023).
2. A **40% reduction** in GHG emissions year-on-year (2024 vs. 2023).
3. A **40% reduction** in energy bill expenditure (2024 vs. 2023).

The framework also outlines six key activity components, each with defined outputs, indicators, and targets. These are detailed in the accompanying table, which serves as a tool for systematic monitoring and evaluation of the

project's progress. As a dynamic and adaptable tool, the logical framework accommodates changes in the programme of works, ensuring alignment with project objectives.

| Activity | Indicator | Target |
|---|---|---|
| Output 1<br>Socioeconomic segmentation report on NHDT residents and structural analysis of selected homes produced. | Status of socioeconomic segmentation report | Socioeconomic segmentation report produced by **October 2023** |
| Output 2<br>ASHRAE Level 2 energy audits and associated retrofits of ten pilot NHDT homes implemented to demonstrate what can be achieved with additional energy efficiency measures. | Number of energy audits conducted | **10** NHDT energy audits conducted by **December 2023** |
| | Number of NHDT homes provided with retrofits | **10** NHDT retrofits installed |
| | Number of female-headed homes provided with retrofits | **50%** of households targeted are female-led |
| Output 3<br>A training and apprenticeship programme for energy auditing and implementation of energy efficiency measures developed and implemented. | Status of training and apprenticeship programme for energy auditing and implementation of EE measures | Training and apprenticeship programme developed and implemented by **January 2023** |
| | Number of individuals trained under the training and apprenticeship programme | **15** (Minimum) Students/Facility Managers trained by **January 2023** |
| Output 4<br>Incentives and financial programmes developed to increase the uptake of energy efficient measures throughout the wider residential sector | Number of incentives and financial programmes developed to support residential solar and EE investments, by type | **1** EE financing scheme available by **June 2024** |
| Output 5<br>A residential energy efficiency policy, strategy and governance framework developed to enforce minimum energy efficient requirements for homes using the findings from the pilot project. | Existence of EE policies within the NHDT framework | EE policies included in NHDT framework by **June 2024** |
| Output 6<br>Communications campaign implemented to drive improved public awareness of energy efficiency in the residential sector and increased nationwide action in undergoing energy efficiency measures. | Number of public education and communications products and/or tools developed and deployed | Public education and communications products and/or tools developed and **deployed** |
| | Level of public awareness of EE and financing and incentive mechanisms | Greater awareness of EE and enabling policies to be measured by using **feedback survey** |

**Table 1: Overview of the RBEEP Logical Framework**

*Source:* Amended from the internal project Logframe, RES05 CAY (26th June 2024)

By integrating the updated NEP's vision and strategies, Table 1 demonstrates this programme exemplifies how policy can drive action. It represents the Cayman Islands' commitment to transforming its energy landscape and serves as a scalable model for other jurisdictions seeking to address similar energy challenges.

Building on the goals outlined in the RBEEP, the implementation strategy was designed to address immediate energy savings while fostering long-term sustainability. Guided by the revised National Energy Policy 2024–2045, the programme combined targeted retrofits, capacity-building initiatives, and strategic oversight to create a replicable model for energy efficiency in residential homes.

## 3.3 Core Components

The programme's design centred around four core components:

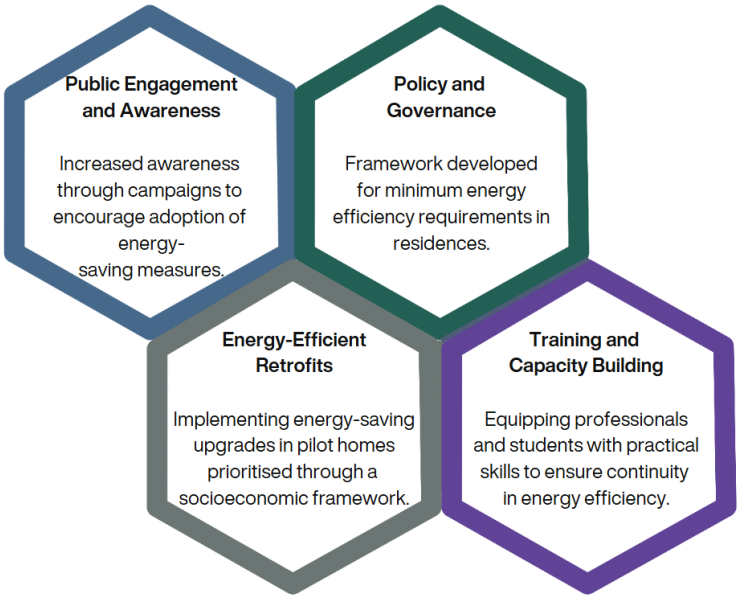


**Figure 2: Core Programme Components**

These components reflect a holistic approach, combining immediate retrofitting measures with long-term capacity building and awareness campaigns. The integration of policy frameworks ensured that the programme laid the groundwork for systemic change, while addressing the energy needs of vulnerable households through targeted retrofits.

## 3.4 Strategic Execution

The programme's implementation was guided by:

- **Policy Alignment**: Ensuring every activity supported the objectives of the NEP.
- **Expert-Led Approaches**: Leveraging the diverse skills and expertise within the project team to adapt strategies and address technical challenges effectively.
- **Stakeholder Collaboration**: Engaging key actors, including the NHDT, contractors, and electricity provider, to streamline execution and ensure effective delivery.

These strategies provided a strong foundation for achieving measurable outcomes while capturing lessons to inform future programmes. By addressing the nuances of implementing energy efficiency in a small island context, the pilot design successfully demonstrated pathways for enhancing sustainability, inclusivity, and resilience across the residential sector.

# 4 Methodology

The methodology for this case study employed a mixed-methods approach, integrating primary data collected directly through interviews, surveys, and energy consumption data with secondary data from project reports and external analyses. This multi-faceted approach ensured a comprehensive evaluation of the RBEEP's design, implementation, and outcomes.

## 4.1 Data Collection

### *4.1.1 Primary Data*

1. **Interviews**

   Semi-structured interviews were conducted with RBEEP project team members, providing qualitative insights into the programme's challenges, achievements, and strategic decisions.

2. **Homeowner Surveys**

   Surveys administered to residents of the ten pilot homes sought to establish various aspects, to include installation dates of the various EE features and measure changes in knowledge, experiences, and perceptions of energy-saving measures. Participants were asked to reflect on their pre-programme and post-programme understanding and behaviours and then rate their current knowledge and experiences using a scaled approach (1 to 5). This method provided measurable data on shifts in awareness and attitudes, enabling comparisons that highlighted the programme's impact over time.

3. **Energy Consumption Data**

   The project team provided primary data consisting of monthly energy consumption in kWh and energy audits which included GHG emissions expressed as $tCO_2$/year. However, to assess the monthly impact, additional in-house calculations were required. These involved:

   - Calculating monthly electricity costs using standard tariff rates for energy charges, fuel duty, and fuel cost multipliers from Caribbean Utilities Company (CUC) bills.
   - Establishing the emission factor from the annual GHG emissions included on the energy audits and converting to a monthly emission factor to obtain monthly GHG emissions $tCO_2$/month.
   - Applying these calculations to monthly kWh consumption data to estimate electricity bills and GHG emissions trends.

   This manipulation enabled more detailed monthly comparisons to demonstrate the programme's impact and assess success against programme objectives.

### *4.1.2 Secondary Data*

1. **Socio-Economic Analysis**

   A consultant's socioeconomic segmentation report established a framework for selecting pilot homes, prioritising vulnerable and financially constrained households.

2. **Energy Audits**

   ASHRAE Level 2 energy audits provided a technical basis for identifying appropriate energy efficiency measures, baseline greenhouse gas emissions, and potential energy savings.

3. **Financial Review**

   A financial consultant's report examined the cost implications, scalability potential, and key barriers to broader adoption of energy-efficient measures.

4. **Progress Reports**

   Quarterly MEAL reports offered a chronological account of programme implementation, challenges encountered, and adaptations made throughout the project lifecycle.

## 4.2 Analytical Framework

1. **Data Triangulation**

   Findings from primary interviews, homeowner surveys, and energy consumption data were cross-referenced with secondary data sources (e.g., socioeconomic reports, financial analysis) to validate insights and identify patterns.

2. **Thematic Analysis**

   Qualitative data from interviews and surveys was analysed to identify recurring themes, such as the effectiveness of energy-saving measures, project implementation challenges, and homeowner experiences.

3. **Comparative Analysis**

   Quantitative energy data (pre- and post-retrofit) was compared to baseline energy consumption to assess reductions in energy costs, kWh usage, and greenhouse gas emissions. In-house calculations ensured consistency and facilitated detailed monthly comparisons, overcoming data availability challenges.

## 4.3 Limitations

1. **Timing**

   Delays in procurement, contracting, and equipment supply logistics restricted the rollout of retrofitting measures and reducing the ability to conduct comprehensive year-on-year comparisons.

2. **Limitations in Data Precision**

   The absence of actual CUC bills from homeowners required reliance on standard tariff rates and in-house calculations to estimate electricity costs and GHG emissions. While this approach allowed for detailed monthly comparisons, it also introduced the potential for minor inaccuracies due to human error in the calculation process.

3. **Sample Size**

   The small number of pilot homes limits the generalisability of findings but provides critical learnings for scaling future programmes.

## 4.4 Contribution to the Case Study

This robust methodology integrates diverse data sources and innovative analysis to deliver a balanced, evidence-based evaluation of the RBEEP. By combining qualitative insights with quantitative assessments, the case study identifies key lessons learned and highlights successes, challenges, and opportunities for refining future energy efficiency initiatives.

The inclusion of primary data, such as homeowner surveys and interviews with project team members, alongside secondary sources such as socioeconomic and financial reports, ensures the findings reflect real-world complexities. Moreover, the in-house calculations for GHGs and monthly energy costs address data gaps, providing a detailed understanding of the programme's impact on energy savings and household expenditure. This approach not only captures the programme's achievements but also contributes valuable insights for scaling similar initiatives in small island contexts, enhancing their design, implementation, and effectiveness.

# 5 Findings

## 5.1 Output 1: Socioeconomic segmentation report on NHDT residents and structural analysis of selected homes produced

### *5.1.1 Critical Analysis: Socioeconomic Segmentation Report and Structural Analysis*

The socioeconomic segmentation report on NHDT properties, combined with the structural analysis of selected homes, formed a pivotal element of the Cayman Islands Residential Energy Efficiency Programme. This output aimed to identify ten pilot homes for retrofits, ensuring fair access and providing essential data for technical and policy-related decision-making. While the project encountered some challenges, it also delivered important results that set a solid foundation for the programme.

### *5.1.2 Scope Definition and Alignment*

The segmentation report sought to examine the socioeconomic circumstances of NHDT residents, using variables such as financial vulnerability, household size, and gender equity to guide the selection of pilot homes. These factors were critical in ensuring the equitable selection of ten pilot homes for retrofitting. Complementing this, the structural analysis evaluated the technical feasibility of retrofitting selected properties. Together, these components provided a balanced framework that prioritised both fairness and practicality.

This dual focus aligned with the programme's objectives of promoting energy efficiency in low-income housing while addressing the unique requirements of retrofitting NHDT properties in Cayman. The clear targeted goals established in the logical framework ensured the alignment of this output with the broader aims of the programme.

### *5.1.3 Methodology and Execution*

The methodology for this output combined stakeholder engagement, data collection, and technical analysis to produce the socioeconomic segmentation report and structural and energy audits.

1. **Socioeconomic Segmentation**

NHDT's strong understanding of its resident base played a pivotal role in developing an effective outreach strategy, which achieved a 50% response rate to the survey. The socioeconomic segmentation report captured key baseline information, including income levels, age, and disability status, enabling a fair and transparent selection process.

The data revealed that many participants belonged to income brackets significantly below the Cayman Islands' Gross Domestic Product (GDP) of KYD70,024.20 (ESO, 2023). This insight ensured the retrofits were targeted towards households most vulnerable to energy insecurity and financial pressures.

The report also identified participants with additional vulnerabilities, such as older adults and individuals with disabilities, further demonstrating the programme's commitment to ensuring equitable access to energy efficiency benefits for those most in need.

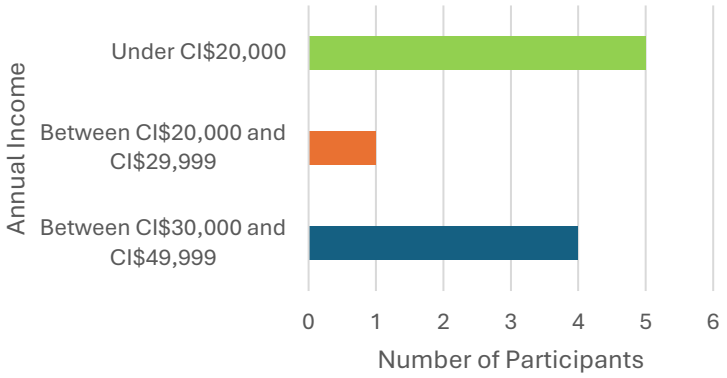


**Figure 3: Annual Income of Selected Participants**
*Source:* Adapted from Atom (2023)

The income data highlights that selected participants fall below national averages, reflecting the programme's focus on households with limited financial capacity to implement energy efficiency measures independently.

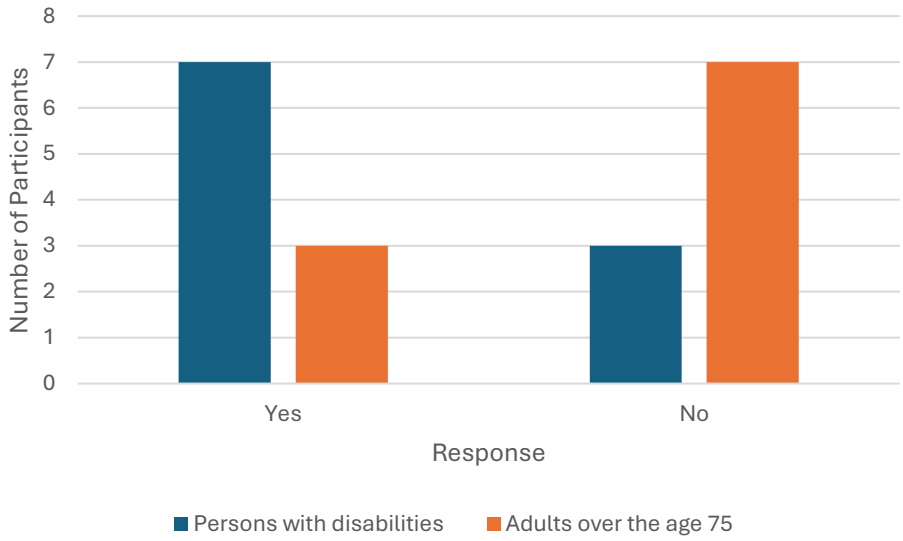


**Figure 4: Vulnerability of Participants**
*Source:* Adapted from Atom (2023)

Further, the inclusion of older adults and individuals with disabilities ensured that the programme prioritised households facing additional challenges, enhancing its equity outcomes.

While the survey effectively captured critical socioeconomic attributes, the questionnaire could have included further questions to explore residents' knowledge and perceptions of energy efficiency, see Appendix A for questions included in the survey. Topics such as household energy consumption, costs, and the perceived link to environmental impact would have enriched baseline data and created opportunities to measure behavioural changes later in the programme. Primary research undertaken through this study, specifically the homeowners surveys sought to fill this gap by asking reflective questions.

2. **Structural and Energy Audits**

Following the socioeconomic segmentation, structural and energy audits were conducted to evaluate the technical feasibility of retrofitting the selected homes. The structural assessments ensured that each property could safely accommodate energy-efficient upgrades, while the energy audits identified specific measures aimed at reducing energy consumption and lowering costs for residents. These assessments were essential to aligning the retrofits with both equity and practicality, ensuring that technical measures were implemented effectively while prioritising households with the greatest need.

The questionnaires and audits facilitated the equitable selection of pilot properties across Grand Cayman, ensuring fair representation among NHDT residents:


**Figure 5: Equitable distribution of selected homes**
*Source:* Adapted from www.caymanlandinfo.ky (2014)

Properties from the NHDT portfolio have been selected as follows:

- Two from West Bay.
- Three from George Town.
- Three from Bodden Town.
- Two from East End.

The geographic distribution of the ten selected homes, as shown in Figure 5, reflects the programme's commitment to ensuring fair representation across Grand Cayman, with equitable access to energy efficiency benefits for NHDT residents. This selection process, supported by a robust methodology and stakeholder engagement, provides a solid foundation for the implementation of energy-efficient measures in the pilot homes.

### *5.1.4 Logical Framework Performance Summary*

A critical component of Output 1 was ensuring that the identified activities – the socioeconomic segmentation report and structural and energy audits - were implemented effectively within the project's timeline. However, delays required adjustments to planned dates. Table 2 provides a summary of the original and revised timelines, along with the final target status:

| Activity | Original Planned Date | Amended Planned Date | Implementation Date | Target Status |
|---|---|---|---|---|
| Socioeconomic segmentation report | February 2023 | October 2023 | June 2023 | Target Met |
| Structural and technical assessments | March 2023 | October 2023 | October 2023 | Target Met |

**Table 2: Output 1 Activities - Planned vs. Implementation vs. Target Status**

The adjustments to timelines ensured the project team successfully met the key targets under Output 1. This adaptability demonstrates the team's ability to address challenges and maintain focus on achieving critical programme milestones.

### *5.1.5 Achievements and Progresses*

Despite these challenges, the project achieved notable successes:

- **Inclusive Engagement**:

  Leveraging NHDT's local expertise ensured meaningful participation, particularly among vulnerable groups, demonstrating a commitment to equity.

- **Robust Selection Criteria**:

  The development of transparent criteria ensured fairness in the selection process while meeting the technical requirements for retrofits.

- **Foundational Insights**:

  The data collected during this phase provided a strong starting point for future programme evaluations, including those related to public awareness in Output 6.

### *5.1.6 Challenges in Implementation*

The following challenges are rooted to the amended activity completion dates in Output 1:

1. **Delayed Funding Disbursement**

   Initial funds were received later than expected, with the second MEAL report noting funds became available only in November 2022. This delayed the appointment of consultants and subsequent initiation of the data-gathering processes.

2. **Procurement and Recruitment Delays**

   The procurement process for both the socioeconomic consultant and energy auditors faced extended reviews and approvals, reflecting the intersection of RESEMBID's streamlined processes with local government protocols. The Request for Proposals (RFP) for the socioeconomic consultant, originally planned for February 2023, was finalised in May 2023.

3. **Dependencies and Activity Sequencing**

   The socioeconomic report was a necessary precursor to the structural and technical assessments. This dependency created a sequential delay—once the socioeconomic segmentation was delayed, the subsequent audits could not proceed until June 2023.

4. **Approval Timelines**

   Internal government reviews and multi-level sign-offs added additional time to the process, which had not been fully anticipated in the original work plan. While these approvals ensured compliance, they extended the overall timeline for activity delivery.

5. **Resource Availability and Onboarding Delays**

   Recruitment challenges impacted the early stages of the programme. Several project team members joined later than expected, with some not onboarded until January 2023. This contributed to an initial learning curve as team members familiarised themselves with RESEMBID processes and local project requirements. Intensive training and support helped mitigate this issue over time.

### *5.1.7 Lessons Learned*

1. **Expanded Baseline Questionnaires**

   Future programmes should design more comprehensive baseline surveys to capture detailed information on homeowners' knowledge, perceptions, and attitudes toward energy efficiency.

2. **Flexible Planning**

   Accounting for interdependencies between activities and building flexibility into timelines can help minimise delays and streamline workflows.

3. **Leveraging Local Expertise**

   The success of NHDT-led engagement highlights the importance of integrating local knowledge to ensure inclusivity and relevance in programme delivery.

### *5.1.8 Conclusion*

The socioeconomic segmentation report and structural analysis achieved their primary objectives, facilitating the fair and transparent selection of pilot homes for retrofitting. Despite delays caused by procurement challenges and activity sequencing, the time extension enabled the revision of the Logical Framework target date, allowing the project team to complete this output effectively. While the initial homeowner questionnaire could have explored baseline data in greater depth, the resulting insights provided a strong foundation for programme implementation. The project team's commitment and adaptability were instrumental in overcoming these challenges, and the lessons learned will support the planning and delivery of future energy efficiency initiatives in Cayman and beyond.

## 5.2 Output 2: ASHRAE Level 2 energy audits and associated retrofits of ten pilot NHDT homes implemented to demonstrate what can be achieved with additional energy efficiency measures

### *5.2.1 Critical Analysis: ASHRAE Level 2 Energy Audits and Associated Retrofits*

The ASHRAE Level 2 energy audits and retrofitting of ten NHDT pilot homes represented a core component of the Cayman Islands Residential Energy Efficiency Programme. These activities were directly aligned with achieving three key targets in the programme's logical framework: a year-on-year (2024 vs. 2023) 40% reduction in electricity consumption, GHG emissions, and energy bill expenditure. Additionally, the selection process sought to ensure that at least 50% of participating households were female-led. The programme exceeded this target, with 80% of the selected households being female-led, underscoring its commitment to gender equity.

Through targeted energy efficiency measures, the initiative sought to demonstrate the potential for these reductions while addressing the unique demands of low-income housing in Cayman. While the programme achieved notable progress, challenges in implementation highlighted areas for refinement in future projects. These included procedural delays, contractor performance, and the limited usability of certain energy efficiency features, such as the energy monitors. Nonetheless, the phased implementation of retrofits offered valuable insights into the individual contributions of each measure toward achieving the programme's overarching targets.

### *5.2.2 Scope Definition and Alignment*

The project scope involved:

- Conducting detailed energy audits to establish baseline energy consumption and identify appropriate measures.
- Implementing retrofits, including energy monitors, high-efficiency air conditioning systems, insulation upgrades, and solar PV installations.
- Ensuring that at least 50% of the selected homes were female-led households.

Certain measures initially proposed, such as LED lighting and solar water heating, were ultimately excluded. LED lights were deemed unnecessary as most households had independently installed them. Solar water heating was considered cost-ineffective and technically challenging for retrofits in Cayman's context. The focus shifted toward addressing cooling loads, the primary driver of household energy demand, by installing high-efficiency A/C units, insulation, and solar photovoltaic (PV) systems.

The audits provided critical insights into energy usage patterns and informed retrofit decisions. However, interviews with project stakeholders suggest that future projects could benefit from bypassing audits and adopting standardised retrofitting measures, leveraging the established knowledge base on suitable interventions for Cayman's housing stock.

### *5.2.3 Methodology and Execution*

**Energy Audits**

The ASHRAE Level 2 audits offered a comprehensive analysis of energy consumption in pilot homes, focusing on measures to mitigate cooling demands, which represent a significant proportion of household energy use.

**Retrofits**

- **Energy Monitors:**

  Monitors were installed in June/July to help households track energy consumption and encourage behaviour changes. However, post-retrofit survey findings (see appendix B for questions) indicated limited usability and impact.

  Specifically, in response to a question asking the ease of using monitors 8/10 respondents rated 1 indicating difficulty in using the monitors. Furthermore, when asked whether the monitors have impacted behaviours 8/10 respondents rated 1, indicating no change, 1 respondent stated 3 which aligns with somewhat of a change, and a further respondent rated 5 signalling the monitor had a significant impact on their behaviour. This suggests a need for clearer homeowner training and guidance to maximise their effectiveness.

- **Insulation**:

  Spray foam insulation with an R30 rating was applied to attic spaces in June/July, significantly reducing cooling loads. An interviewee noted that alternative insulation methods were estimated to cost three times more than spray foam, supporting the decision on cost grounds. However, the absence of formal cost-benefit documentation raises concerns about the transparency and robustness of the decision-making process. Additionally, a whole-life cycle analysis of insulation options could have provided greater insight into long-term suitability, particularly given concerns about spray foam's impact on insurance and mortgages in other jurisdictions.

- **Air Conditioning Units**:

  High-efficiency air conditioning systems replaced outdated models in August/September, delivering immediate reductions in energy consumption. Homeowners benefit from one-year warranties on the units and are offered a reduced cost maintenance contract from the installer. One homeowner raised a concern regarding the placement of a unit at a lower elevation than a replaced unit resulting in a potential flood risk due to the site's topography.

- **Solar PV Panels**:

  Solar panels are installed but remained unconnected during the reporting period, delaying their contribution to energy savings. The installer has provided a 2-year full system maintenance service, ensuring the system's optimal performance in the short and medium term. To support long-term sustainability, exploring avenues for accessible and affordable maintenance solutions post-service period may be beneficial, particularly for homeowners from low-income groups.

### *5.2.4 Logical Framework Performance Summary*

The implementation of ASHRAE Level 2 energy audits and retrofitting activities was critical for achieving Output 2, which aimed to demonstrate the benefits of targeted energy efficiency measures. However, delays in procurement, implementation, and external factors impacted the original project timelines, requiring adjustments to ensure delivery. Table 3 summarises the planned and actual implementation of key activities under Output 2, alongside their target statuses.

| Activity | Original Planned Date | Amended Planned Date | Implementation Date | Target Status |
|---|---|---|---|---|
| 10 Energy audits conducted | March 2023 | December 2023 | October 2023 | Target Met |
| 10 homes retrofitted | April 2023 | September 2024 | June/July 2024 (commenced with insulation) | In progress (delayed) |
| 50% female-headed homes | January 2023 | March 2023 | October 2023 | Target Met (delayed) |

**Table 3: Output 2 Activities - Planned vs. Implementation vs. Target Status**

The table illustrates the change in timeframe experienced under this output. The completion of energy audits and the significant progress made toward retrofitting pilot homes highlight the project team's resilience and adaptability in response to delays. Importantly, the gender equity objective was surpassed, with 80% of participating households being female-led, exceeding the 50% target.

While delays in retrofitting activities remain a challenge, the phased implementation approach provided an unintended opportunity to observe the incremental impacts of each intervention. This highlights the value of flexibility and adaptability in project delivery, particularly when external factors affect planned timelines. Moving forward, clear contingency planning and more robust project timelines will be critical to minimising disruptions and ensuring programme success.

### *5.2.5 Achievements and Progresses*

1. **50% female-led households**

   The objective of achieving at least 50% of participating properties to be female-led households was surpassed:

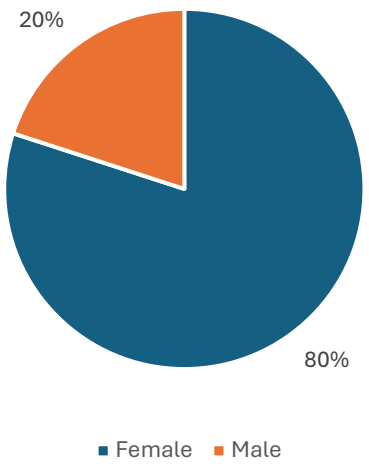


**Figure 6: Gender Proportion of Households**

A total of 80% of households participating in the retrofit programme are female-led, this achievement reflects a strong alignment with the programme's gender equity objectives.

2. **High-Efficiency Measures**

   Retrofitted A/C systems delivered immediate energy savings, directly addressing the largest energy demand in Cayman homes.

3. **Policy Alignment**

   The retrofits advanced the Cayman Islands' National Energy Policy goals and exceeded the programme's gender equity objective, with 80% of selected homes being female-led, this demonstrates the equity and feasibility of energy efficiency measures in low-income housing.

4. **Stakeholder Engagement**

   Project team efforts ensured meaningful homeowner engagement, fostering transparency and participation. This was evident in respondents post-retro fit survey whereby several participants highlighted the approachability, rapport building, and empathetic characteristics of the project team. This contributes towards CIG building a strong reputation within the community.

5. **Learning Opportunity**

   The phased implementation approach, though unplanned, offered valuable insights into the relative efficacy of individual energy efficiency measures.

### *5.2.6 Challenges in Implementation*

The following challenges impacted the successful delivery of Output 2 activities:

1. **Contractor Communication and Professionalism**

   Homeowners reported inconsistent communication from contractors regarding schedules and the installation process. In one instance, a contractor arrived without essential equipment, raising concerns about preparedness and professionalism Project team members similarly noted communication shortcomings, reinforcing the need for improved oversight and accountability for contractors.

2. **Internal CIG processes**

   Significant personnel changes occurred within CIG during the project's lifespan, including three different Ministers, four Chief Officers, and two Chief Financial Officers. While the support for the project team and the programme remained unwavering, these changes introduced additional procedural approval layers, which delayed contractor payments and the commencement of key work such as insulation and air conditioning installations.

3. **Delays in Retrofitting**

   Delays in procurement and building permit approvals significantly extended the timeline for completing retrofits. For instance, although solar PV panels were installed, they remained unconnected during the reporting period. This prevented the study from analysing their potential contribution toward achieving the three 40% reduction targets. These delays highlight the need to streamline regulatory processes and ensuring that interdependencies are accounted for in planning timelines.

   However, an unintended benefit of these delays was the opportunity to implement retrofits in phases, allowing for observations of the incremental impact of each measure. Though unplanned, this provided valuable insights that could inform future phased delivery of similar projects.

### *5.2.7 Lessons Learned*

1. **Evidence-Based Decision-Making**

   The selection of spray foam insulation was driven by cost considerations, compliance with the RfP specifications, and the constraints of a grant-funded budget. Expert consultations informed the exclusion of closed-cell spray foam due to its association with structural risks, and open-cell spray foam was selected as a balanced solution that adhered to financial limitations while providing a lifetime performance warranty.

   Alternative insulation options, such as fibreglass batts, cellulose insulation, or rigid foam boards, can achieve comparable R-values (e.g., R30). However, cost comparisons provided in the tender evaluation indicate that fibreglass batts were estimated to be three times the cost of spray foam, making them impractical within the project's budget.

   While the decision reflects a pragmatic approach to financial constraints, the absence of a documented cost-benefit analysis or whole-life cycle assessment limits the ability to fully evaluate whether alternative materials with higher upfront costs might have yielded greater long-term benefits, including fewer external complications related to insurance and mortgage considerations. Future programmes would benefit from such evaluations to ensure decisions are aligned with both immediate and long-term project objectives, supporting the principles of monitoring, evaluation, accountability, and learning.

2. **Strengthened Contractor Oversight**

   Clear communication protocols and accountability measures should be established for contractors to ensure professionalism and homeowner satisfaction.

3. **Simpler Sign-off Procedures**

   The project team are required to escalate payment requests through several layers within CIG to facilitate payments which delays commencement of contracts. Additionally, further financial reporting mechanisms are required directly with RESEMBID. Formulation of an efficient streamlined process which achieves public fiscal accountability requirements should be formulated to avoid unnecessary delays.

4. **Phased Implementation for Incremental Insights**

   The phased approach to retrofits, arising from delays in implementation, allowed for a clearer analysis of how each measure influenced energy efficiency. For future projects, adequate timeframes could incorporate a deliberate phased rollout, using this method to better evaluate the effectiveness of individual interventions. This would allow for a more data-driven refinement of measures, enhancing the overall impact of energy efficiency programmes and the streamlined journey towards the NEP vision of 100% renewable by 2045.

5. **Site-Specific Planning**

   Incorporating topographical assessments into retrofit planning is necessary to mitigate potential risks such as flooding and ensure installations are fit for purpose, particularly for the a/c units, basic desktop assessments would suffice.

6. **Revised Procurement Procedures**

   Typically, tenders are advertised through the online Bonfire platform, however, to increase participation the project team adapted their procurement procedure and determined for bids below EUR40,000 threshold would be advertised in local newspapers and distributed directly to potential vendors. This approach broadened reach, diversified the selection pool of suppliers, and ensured local companies bid.

7. **Streamlining Approvals**

   A dedicated liaison with regulatory bodies could reduce procedural delays and accelerate implementation timelines.

8. **Evidence-Based Decision-Making**

   Comprehensive cost-benefit analyses and whole life cycles for key measures should be documented to ensure their long-term viability for homeowners and potential challenges with financing and insurance.

9. **Energy Monitor Efficacy**

   Post-retrofit survey feedback revealed that energy monitors had limited impact on homeowner behaviour. Specifically, 80% of respondents reported difficulty in using the monitors, and only one respondent indicated a significant behavioural change. These findings suggest that homeowner training and clearer guidance are necessary to maximise the monitors' effectiveness.

### *5.2.8 Conclusion*

The retrofits demonstrated the potential for improving energy efficiency in NHDT pilot homes through targeted interventions. Despite delays and challenges with contractor communication and site-specific execution, the project achieved several key objectives, including the successful installation of high-efficiency air conditioning systems. Lessons learned from this output—particularly the limited need for energy audits, the considerations around spray foam insulation, and the usability of energy monitors—have the potential to inform the design and delivery of future energy efficiency programmes in the Cayman Islands and beyond.

Additionally, the unintended phased implementation provided a unique opportunity to observe the incremental impacts of individual measures. This valuable insight highlights the importance of flexibility in project delivery and reinforces the need for future programmes to incorporate whole-life cycle considerations, homeowner training, and robust site assessments to maximise long-term benefits.

## 5.3 Output 3: A training and apprenticeship programme for energy auditing and implementation of energy efficiency measures developed and implemented

### *5.3.1 Critical Analysis: Training and Apprenticeship Programme*

The Training and Apprenticeship Programme aimed to build local capacity in energy auditing and the implementation of energy efficiency measures. The programme's objectives included equipping participants with practical skills to conduct energy audits and fostering an understanding of energy efficiency measures tailored to the Cayman Islands' context.

The programme faced a fundamental shift in scope during its implementation. Initially envisioned as a hands-on apprenticeship designed to lead to formal certifications, it evolved into an awareness-focused training programme. This shift, while maintaining value in increasing energy efficiency awareness particularly for public sector property professionals, limited the programme's potential to achieve its original capacity-building goals of certifying new energy auditors.

### *5.3.2 Scope Definition and Alignment*

The original training programme was initially scoped to:

- Develop technical skills in energy auditing aligned with ASHRAE Level 2 standards.
- Establish an apprenticeship programme that could lead to job opportunities.
- Ensure inclusivity by offering accessibility to participants from diverse professional backgrounds.

The change in scope occurred due to several factors, including:

- Entry requirements for a certification course were higher than expected.
- Challenges in sourcing a training provider offering internationally recognised certifications within the project's timeframe.
- Limited awareness and time for recruitment among targeted groups, such as Public Works Department (PWD) apprentices and university students.

Consequently, the programme shifted to an awareness-focused approach, delivering introductory knowledge in energy audits and energy efficiency measures through online and in-person modules. This format enabled participants to apply basic concepts in their current roles but fell short of providing formal qualifications or creating new job-ready professionals in energy auditing.

This pivot aligned the programme more closely with local realities, ensuring greater participation and uptake, but it also diluted the hands-on apprenticeship component that had been intended to create a pipeline of local energy auditors.

### *5.3.3 Methodology and Execution*

The programme was designed to combine structured learning with practical application, ensuring participants gained a foundational understanding of energy audits and energy efficiency measures. A blended delivery model of online sessions, in-person training, and field visits was used to reinforce theoretical concepts with real-world examples.:

1. **Programme Development**

   Defined minimum entrance qualifications, emphasising experience in relevant sectors such as architecture, engineering, or facility management. Developed eight training modules covering topics such as energy audit planning, data collection, analysis, and reporting.

2. **Programme Delivery**

   Delivered six online sessions and two in-person sessions, with field visits to residential and public buildings. Conducted a final evaluation consisting of a multiple-choice exam and practical assessments.

**Figure 7: Energy Awareness Course**
*Source:* MEAL Progress Report #4 (2024)

**Figure 8: Energy Awareness Course**
*Source:* MEAL Progress Report #4 (2024)

3. **Participant Engagement:**

   Despite initial recruitment challenges, the programme attracted participants from various public sector entities, including government facility managers and utility company employees.

4. **Evaluation and Certification**

   Participants received either a Certificate of Completion or a Certificate of Attendance, depending on their level of engagement and exam participation.

### *5.3.4 Logical Framework Performance Summary*

The original vision for the training programme—a fully-fledged apprenticeship course leading to formal certifications—reflected an ambitious and forward-thinking approach by the project team. However, the practical realities of time constraints, stringent entry requirements, and a lack of immediate demand for private energy audits meant that a shift in scope was both necessary and appropriate. A certification-based programme, while valuable, would likely have excluded a significant portion of potential participants due to its limited accessibility.

The revised awareness-focused training broadened participation, delivering relevant professional development for public sector property managers, utility professionals, and others. By equipping participants with practical knowledge, the programme enables the CIG to step towards a greener future corporately and aligns with aligns with principles of Corporate Social Responsibility (CSR). Participants can now lead by example in their respective roles, demonstrating the benefits of energy efficiency within their organisations.

| Activity | Original Planned Date | Amended Planned Date | Implementation Date | Target Status |
|---|---|---|---|---|
| Status of training programme | January 2023 | October 2023 | October 2023 | Target Met |
| Number of individuals trained | N/A | N/A | N/A | 14 students |

**Table 4: Output 3 Activities - Planned vs. Implementation vs. Target Status**

The programme's delivery showcased a thoughtful approach to balancing ambition with practical realities. The shift from a certification-based apprenticeship to an awareness-focused model, driven by time and resource constraints, successfully met its adjusted targets while broadening accessibility. Participants from diverse backgrounds, particularly public sector professionals and utility stakeholders, gained tailored energy efficiency training, equipping them to lead by example and support the Cayman Islands Government's efforts to integrate energy efficiency into public sector operations.

### *5.3.5 Achievements and Progresses*

1. **Increased Awareness**

   The programme successfully delivered foundational knowledge in energy efficiency, with participants highlighting its value for professional development. Feedback from the training evaluation survey, in figures 9 and 10, indicated that participants found the content applicable to their roles, enabling them to lead by example in advancing energy efficiency within public sector operations.

   (i) Survey question – What was your motivation for participating in this training session?

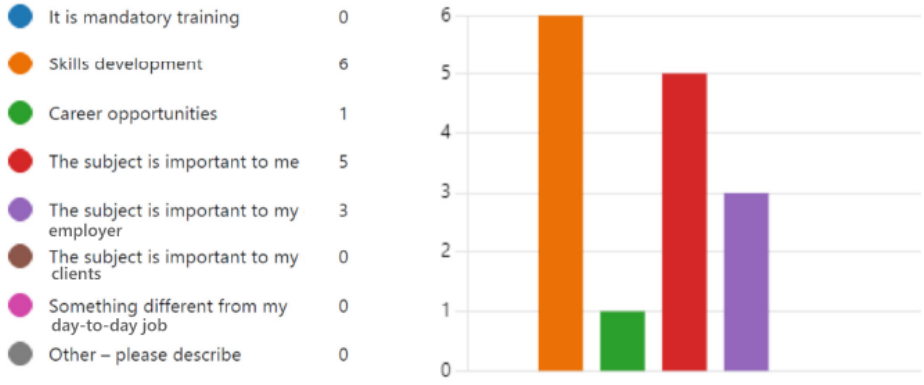


**Figure 9: Training Programme Survey Result**

*Source:* Econoler (2024)

Participants cited motivations such as improving technical knowledge, advancing career opportunities, and contributing to sustainability goals. These responses reflect the programme's success in aligning training content with participant expectations and local needs.

(ii) Survey question – Overall, how satisfied are you with the training programme?


**Figure 10: Training Programme Survey Result**
*Source:* Econoler (2024)

Feedback demonstrated high levels of satisfaction, with participants appreciating the combination of theoretical learning and practical site visits. These positive responses underscore the programme's ability to deliver relevant and engaging content, despite the shift in scope.

2. **Corporate Social Responsibility and Greener Operations**

   By training public sector property managers and CIG professionals, the programme aligns with Corporate Social Responsibility principles, enabling the Cayman Islands Government to act as a leader in sustainable practices.

3. **Tailored Content**

   The training modules were tailored to the Cayman Islands, incorporating local climate considerations and utility tariffs. Practical site visits reinforced the learning, providing participants with tangible examples of energy efficiency measures.

4. **Broadened Accessibility**

   The pivot away from a certification-based programme improved inclusivity, attracting participants from diverse backgrounds, including facility management and utility sectors. This ensured a wider dissemination of energy efficiency knowledge across key stakeholders.

### *5.3.6 Challenges in Implementation*

1. **Shift in Programme Scope**

   The difficulty in identifying a training provider offering internationally recognised certifications within the project's timeline necessitated a less ambitious programme focus. The pivot from a structured apprenticeship to workshop-based training diluted the hands-on component, which had been a cornerstone of the original design. While this change enabled broader participation, it limited the programme's ability to develop a cadre of certified energy auditors.

2. **Delays in Curriculum Development**

   Procedural delays in sourcing trainers and finalising the training curriculum pushed back the timeline significantly. Interviews revealed that initial procurement processes for trainers yielded few suitable candidates, necessitating a second round of recruitment.

3. **Participant Retention and Engagement**

   While initial participation rates were high, some participants dropped out due to scheduling conflicts and the limited duration of the workshops. The absence of certification or follow-up opportunities may have also reduced the perceived value of the programme.

### *5.3.7 Lessons Learned*

1. **Adequate Recruitment Timeframes**

   Future training programmes should allocate sufficient time for recruitment to ensure targeted groups can participate fully.

2. **Focus on Certifications**

   Establishing partnerships with institutions offering formal qualifications would enhance the programme's value and align with capacity-building goals.

3. **Sustainability Considerations**

   Incorporating a whole-life cycle perspective in training—addressing not only energy efficiency measures but also maintenance and operational sustainability—would strengthen the programme's long-term impact.

4. **Continuous Professional Development**

   Feedback from participants highlighted the value of practical demonstrations but also pointed to gaps in the continuity of training. Some participants expressed concerns about the lack of follow-up opportunities to deepen their expertise. This underscores the need for ongoing professional development to maximise the long-term impact of capacity-building initiatives.

### *5.3.8 Conclusion*

The training and apprenticeship programme played a crucial role in building local capacity for energy efficiency initiatives. By adapting to local realities, the programme successfully engaged a diverse participant base and laid the groundwork for future capacity-building efforts. While the shift in scope limited the depth of hands-on training, the insights gained from this pilot will inform the design of more robust and scalable programmes in the future.

## 5.4 Output 4: Incentives and financial programmes developed to increase the uptake of energy efficient measures throughout the wider residential sector

### *5.4.1 Critical Analysis: Incentives and Financial Programmes*

The development of incentives and financial programmes aimed to increase the uptake of energy-efficient EE measures across the wider residential sector. This output aligns with the overarching goals of the NEP, which seeks to reduce energy consumption, greenhouse gas GHG emissions, and energy costs for residential properties.

A comprehensive financial consultant's report provided an array of mechanisms, including subsidies, tax incentives, and financing options. However, it did not culminate in a fully developed programme, reflecting the complexity of coordinating multiple stakeholders, such as government ministries, financial institutions, energy regulators, and utility providers. While the scope was ambitious, the report is a commendable basis for further government action in advancing energy efficiency adoption.

### *5.4.2 Scope Definition and Alignment*

The financial consultant's report identified key opportunities to increase residential uptake of EE measures. This included:

- **Financial Mechanisms**: Recommendations such as low-interest green loans, direct subsidies, and property tax credits.
- **Utility-Based Incentives**: Rebates for EE upgrades and renewable energy integration.
- **Public-Private Partnerships**: Collaboration between government, private sector developers, and NHDT to improve funding accessibility.

Importantly, while the scope focused on addressing financial barriers, broader challenges—including affordability, grid limitations, and long-term policy planning—impacted the immediate feasibility of implementing a fully mapped-out programme.

### *5.4.3 Methodology and Execution*

The financial consultant's report was developed through stakeholder consultations and in-depth analysis of existing financial and energy-related systems. The recommendations were contextualised for the Cayman Islands, addressing specific challenges such as affordability and limited renewable energy grid capacity:

1. **Review of Global Best Practices**

   Evaluating successful EE incentive programmes and financial tools such as subsidies, low-interest loans, green bonds, and tax incentives.

2. **Consultations with Key Stakeholders**

   Including policymakers, financial institutions, and NHDT representatives.

3. **Assessment of Local Context**

   Evaluation of barriers specific to the Cayman Islands, including grid limitations, high upfront costs for renewable technologies, and diminishing FIT rates.

4. **Recommendations for Financial Mechanisms**

   A range of options were presented, including:

   - Subsidies and rebates to reduce upfront costs.
   - Low-interest financing through partnerships with financial institutions.
   - Revolving loan funds for sustainable, self-replenishing support.
   - Green bonds for large-scale EE investments.

The report explored viable solutions, however, the absence of immediate implementation mechanisms or government commitment to funding restricted its tangible outputs.

### *5.4.4 Logical Framework Performance Summary*

| Activity | Original Planned Date | Amended Planned Date | Implementation Date | Target Status |
|---|---|---|---|---|
| Financing Scheme | January 2023 | February 2024 | June 2024 | Target Met (Delayed) |

**Table 5: Output 4 Activities - Planned vs. Implementation vs. Target Status**

### *5.4.5 Achievements and Progresses*

1. **Solid Analytical Foundation**

   The financial consultant's report provides a comprehensive understanding of the financial mechanisms available and key barriers to EE adoption, laying the groundwork for a future strategy.

2. **Identification of Local Barriers**

   The analysis highlighted structural challenges—such as grid capacity limits, affordability issues, and FIT reductions—that must be addressed to unlock residential energy efficiency potential.

3. **Adaptable Recommendations**

   The proposed tools, including subsidies, low-interest loans, and revolving funds, offer adaptable solutions that can be implemented through a phased, government-led approach.

### *5.4.6 Challenges in Implementation*

1. **Delays in Project Initiation**

   While the intention to develop fully mapped-out financial programmes was well-founded, project initiation was delayed due to the requirement to obtain energy audit results before commencing financial consultancy. This prerequisite, combined with other delays such as release of funding and the awarding contracts, significantly compressed the timeline. Consequently, opportunities for deeper stakeholder engagement and detailed programme design were limited, making it challenging to move beyond broad recommendations to comprehensive implementation plans.

2. **Grid and Regulatory Constraints**

   The release of 1 MW of residential renewable energy capacity under CUC's current programme for RBEEP is encouraging, however, with a cap in place this restricts the scalability of solar PV adoption. Further capacity

allocations may be possible, however, there is no guarantee at this stage, the uncertainty surrounding grid availability presents a significant barrier to long-term planning and investment in renewable systems. Additionally, the declining FIT rates undermine financial returns, reducing the attractiveness of solar PV systems for residential households.

3. **Cost Barriers**

   The high upfront costs of solar PV systems, particularly when paired with battery storage for night-time consumption, remain a significant barrier for most households. Without substantial government subsidies, innovative financing mechanisms, or targeted affordability programmes, these systems remain out of reach for low-income residents. This challenge raises concerns about the feasibility of achieving the NEP vision for the Cayman Islands to run on 100% renewable energy by 2045. Exploring viable pathways to reduce costs and enhance accessibility will be critical to bridging this gap and ensuring equitable progress towards the NEP's long-term goals.

4. **Budget and RFP Response**

   The team experienced difficulties in recruiting a financial consultant, to address this proactive analysis of the issue highlighted a need for additional funds. The project team successfully applied for and were awarded an additional €32,943 in funding to attract a financial legal consultant.

### *5.4.7 Lessons Learned*

1. **Phased and Realistic Planning**

   Achieving systemic change requires a phased approach with clear timelines, stakeholder engagement, and policy alignment rather than expecting immediate results.

2. **Gaps and Overlooked Opportunities**

   The report did not explore the Cayman Islands Infrastructure Fund, which requires developers to pay KYDX/sqf of development towards infrastructure and affordable housing, which could be leveraged to subsidise EE measures, particularly in NHDT homes. Revising rates or reallocating portions of this fund for EE programmes presents a significant opportunity for local funding.

3. **Collaborative Stakeholder Engagement**

   Early and sustained engagement with regulators, utilities, financial institutions, and developers is critical to align incentives, policies, and market realities.

4. **Addressing Grid Limitations**

   A long-term strategy must include regulatory reforms to increase grid capacity and stabilise FIT rates, ensuring solar PV systems remain financially attractive.

5. **Targeted Affordability Solutions**

   Financial tools tailored for vulnerable households—such as blended finance, lease-to-own programmes, or government-backed subsidies—are critical to achieving equitable adoption of EE measures.

### *5.4.8 Conclusion*

While Output 4 did not achieve its intended goal of delivering fully developed financial programmes, the work undertaken provides a solid analytical foundation for the government to develop a comprehensive strategy. The

financial consultant's report identifies viable mechanisms, local barriers, and key opportunities for incentivising energy efficiency, offering a clear starting point for systemic reform.

Moving forward, leveraging local funding sources such as the Infrastructure Fund, engaging stakeholders, and addressing grid and affordability challenges will be essential to achieving widespread residential uptake of EE measures. The lessons learned from this output underscore the need for phased, realistic planning to deliver impactful, long-term solutions for the Cayman Islands.

## 5.5 Output 5: A residential energy efficiency policy, strategy and governance framework developed to enforce minimum energy efficient requirements for homes using the findings from the pilot project

### *5.5.1 Critical Analysis: Energy Efficiency Policy, Strategy, and Framework*

The development of residential EE guidelines represents a pivotal step toward embedding minimum EE requirements in Cayman's housing sector. These guidelines, issued as a draft in December 2024, aim to address energy consumption, promote sustainability, and improve affordability by providing practical recommendations to stakeholders, including policymakers, the construction industry, and suppliers.

While their issuance marks significant progress, the guidelines are currently voluntary. Without mandatory adoption or integration into regulatory frameworks such as the Building Code, their uptake may remain limited. Strategic alignment with the NEP ensures this initiative contributes to the country's long-term energy efficiency and emissions reduction goals.

### *5.5.2 Scope Definition and Alignment*

The output focused on achieving:

1. Development of energy efficiency policies to establish minimum EE requirements for residential homes.
2. A governance framework to enforce EE standards and guide implementation.
3. Incorporation of findings from the pilot retrofits to inform practical and achievable measures.
4. Production of an infographic to guide homeowners in energy efficiency changes.

Although originally planned for completion by mid-2023, delays in stakeholder coordination and procurement impacted delivery. The issuance of the draft guidelines in December 2024 reflects a significant milestone and provides a foundation for scaling energy-efficient measures in residential homes.

### *5.5.3 Methodology and Execution*

The project methodology incorporates:

1. **Stakeholder Workshops**

   Engagement sessions with built environment professionals were conducted to gather insights and recommendations for inclusion in residential EE policies. A workshop held in November facilitated productive discussions, underscoring the need for locally contextualised standards and practical guidelines.

2. **Review of Pilot Findings**

   Data from pilot retrofits has been used to identify effective EE measures for scaling and policy incorporation. This ensures a foundational evidence base for shaping the governance framework.

3. **Strategic Alignment**

   Efforts to align with the NEP and collaborate with the BCU are ongoing. These include discussions on integrating the guidelines into future revisions of the Building Code or adopting them as departmental policy to strengthen their enforceability.

### 5.5.4 *Logical Framework Performance Summary*

The table below summarises progress for the sole activity identified under this output:

| Activity | Original Planned Date | Amended Planned Date | Implementation Date | Target Status |
|---|---|---|---|---|
| EE policies included in NHDT framework | June 2023 | October 2024 | December 2024 | Target Met (Delayed) |

**Table 6: Output 5 Activities - Planning vs. Implementation vs. Target Status**

The issuance of the draft guidelines in December 2024 represents a major step forward. However, their integration into regulatory frameworks remains a critical next phase to ensure their full impact.

### 5.5.5 *Achievements and Progress*

1. **Stakeholder Engagement**

   Workshops with built environment professionals have provided valuable insights, ensuring the policy framework is practical, locally relevant, and well-informed.

2. **Strategic Alignment**

   Progress under this output supports the broader objectives of the NEP, contributing to Cayman's long-term energy efficiency and sustainability goals. Discussions with BCU realised updating the 2009 Building Code are pipelined, offering an opportunity to incorporate Output 5 into a regulatory framework.

3. **Foundational Work Completed**

   Despite delays, efforts to gather stakeholder input and review pilot project findings have created a foundation for the next phase of policy development.

### 5.5.6 *Challenges in Implementation*

1. **Voluntary Nature of Guidelines**

   The guidelines' voluntary status risks limiting their impact. Without a mandate, adoption by builders and homeowners depends largely on individual willingness, reducing their potential to drive widespread energy efficiency improvements.

2. **Procurement Timelines**

   Delays in procuring technical experts disrupted drafting and review schedules, underscoring the need for more efficient processes to keep policy development on track.

3. **Capacity and Expertise**

   The technical nature of energy efficiency policies required external expertise, highlighting a gap in local capacity. Building internal expertise will be critical for sustained implementation and adaptation.

### 5.5.7 *Lessons Learned*

1. **Mandatory Adoption**

   To achieve broader adoption, integrating the guidelines into the Building Code or formalising them as departmental policy would provide a stronger foundation for compliance and impact.

2. **Public Awareness Tools**

   Infographics or homeowner-friendly materials could clarify the guidelines' benefits, boosting understanding and encouraging uptake among key audiences.

3. **Strategic Alignment**

   Positioning the guidelines as part of the planning and building approval processes would enhance their relevance, ensuring they support the NEP's long-term goals and practical application.

4. **Holistic Built Environment Approach**

   Linking EE policy with other regulatory built environment processes would further underpin the requirement and importance of including such features at the early design stages of construction projects, specifically the planning application stage. For instance, design guidelines could provide clear direction on passive and cost-effective energy-efficient measures relating to:

   - Building orientation;
   - Native landscaping;
   - Roof overhangs and shading;
   - Strategic window placement; and
   - Reflective roofing materials.

   All of which can reduce cooling loads of mechanical equipment and consequently contribute towards less energy consumption.

### *5.5.8 Conclusion*

The issuance of the draft Residential Energy Efficiency Guidelines in December 2024 marks a significant milestone in advancing sustainability within the Cayman Islands' housing sector. The guidelines provide practical, climate-appropriate measures, such as building orientation and passive cooling features, which can reduce energy consumption and promote affordability.

However, their voluntary nature remains a key challenge. Without formal adoption into the Building Code or as departmental policy, uptake may be inconsistent. Aligning the guidelines with planning and building processes will be essential to ensure their widespread application and long-term impact.

By leveraging stakeholder engagement and developing accessible public awareness tools, such as infographics, the guidelines can reach a broader audience and gain traction among homeowners and industry professionals. With continued efforts to formalise and integrate these measures, the Cayman Islands is well-positioned to lead in residential energy efficiency and achieve its sustainability goals.

## 5.6 Output 6: Communications campaign implemented to drive improved public awareness of energy efficiency in the residential sector and increased nationwide action in undergoing energy efficiency measures

### *5.6.1 Critical Analysis: Communications Campaign*

The communications campaign aimed to increase public awareness of energy efficiency (EE) in the residential sector, while encouraging tangible actions to adopt energy-saving solutions. The campaign's objectives aligned with the broader RBEEP goals of fostering behavioural change, showcasing successful pilot projects, and building momentum for nationwide adoption of EE measures.

The project team adopted a multi-channel approach that combined public outreach events, media appearances, and social media updates. While these efforts demonstrated a strong commitment to engaging the public, significant challenges—such as delays in retrofitting pilot homes, incomplete financial incentives, and an underdeveloped communications strategy—hindered the campaign's ability to deliver consistent, evidence-based messaging.

The absence of a documented, cohesive communications strategy limited the consistency and overall impact of campaign activities. Social media efforts faced challenges: without an established follower base, organic posts had limited reach. Paid advertising or sponsored content would have been more effective in engaging broader audiences.

Homeowner surveys revealed limited awareness of energy efficiency beyond cost-saving measures, indicating opportunities for refining future communications to incorporate broader sustainability and environmental themes.

### *5.6.2 Scope Definition and Alignment*

The communications campaign aimed to achieve two core activities:

1. **Developing and Deploying communication tools**

   To educate the public on EE and related financing/incentive mechanisms.

2. **Raising public awareness**

   To encourage tangible action in adopting EE measures.

The scope recognised the importance of translating programme successes into actionable information for homeowners, tenants, and the wider public. While several tools were deployed including social media posts, radio interviews, and event participation, progress was hampered by delays in delivering evidence-based outputs, such as showcasing completed pilot retrofits and financial incentives.

### *5.6.3 Methodology and Execution*

The communications campaign used a mix of traditional and digital platforms, and direct public engagement events, to engage residents and stakeholders. Public awareness efforts were delivered through the following key activities with notable examples:

1. **Traditional Media**

   - **Press Release:** Issued on 18 July 2022 to announce RBEEP.
   - **Radio Interviews:** Two interviews aired on Radio Cayman on 9 May 2023, promoting awareness and sharing progrramme progress.
   - **Parliamentary Mention:** On 11 December 2023, the previous Minister for MSCRW highlighted RBEEP in Parliament, further amplifying programme visibility.

2. **Public Engagement**

    - **Builder's Expos:** In May 2023 and September 2024 an information booth provided an opportunity for in-person outreach, facilitating discussions about energy efficiency measures and the benefits of retrofitting.
    - **Training Course Promotion:** Highlighted as part of Output 3, this activity showcased the programme's effort to build local capacity for energy audits.

3. **Digital Media**

    - **Social Media Posts:** Updates on energy efficiency, training courses, and programme progress were shared via Facebook and Instagram such as:
        - 10 October 2022 (Project launch update).
        - 8 August 2023 (Project progress update).
        - October 2023 (Training course promotion).
    - **Programme Website**: A dedicated RESEMBID project page was added to the CIG energy website (www.energy.gov.ky) on 10 October 2022.

**Observations**

While traditional media and in-person events were effective in reaching target audiences, the campaign lacked a formulated strategy which impacted reach and visibility for example on social media. Posts were primarily organic and relied on existing followers, limiting engagement. Sponsored advertisements and targeted campaigns could have significantly amplified messaging to reach a broader audience.

### *5.6.4 Logical Framework Performance Summary*

| Activity | Target | Initialisation Date | Activity Status | Target Outcome | Activity Outcome |
|---|---|---|---|---|---|
| Number of public education and communication products and/or tools deployed | 2 | 18 July 2022 | Ongoing | Met | Delayed |
| Level of public awareness of EE and financing incentive | Greater level of awareness | 18 July 2022 | Ongoing | Low | Minimal |

**Table 7: Output 6 Activities - Planned vs. Implementation vs. Target Status**

**Observations**

1. **Public Education Tools and Events**

    The project team successfully delivered two public education products and surpassed expectations through media appearances, radio interviews, and public events, such as the Builder's Expo. However, the impact of these events on broader public awareness remains unclear due to the absence of visitor data to the booth.

2. **Social Media Engagement**

    Details of social media engagement is limited from the information shared, but insights can be obtained:

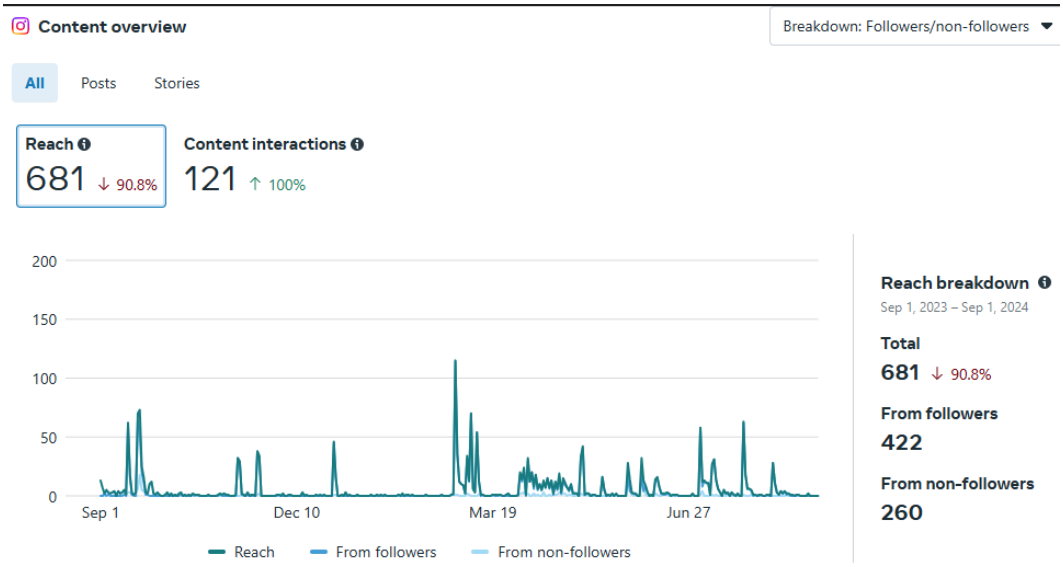


**Figure 11: Overvew of Social Media Reach**
*Source:* Instagram (2024)

Figure 11 provides detail regarding social media reach between 1st September 2023 and 1st September 2024. Instagram content received 681 views, of which 422 were from followers and 260 from non-followers. This indicates some level of outreach but highlights the limited reach of organic social media posts, underscoring the need for paid campaigns to extend visibility beyond existing audiences.

3. **Homeowner Awareness Survey Results**

Surveys administered to RBEEP participants provide limited but valuable insights into public awareness:

- **Conservation Motivation:** All respondents rated the need to conserve electricity as *5* (greatest), with saving money cited as the sole motivation. Environmental concerns, greenhouse gas emissions, or broader sustainability factors were not mentioned.
- **Energy Efficiency Measures:** Six respondents reported using gas stoves and tankless water heaters to reduce electricity costs. This indicates awareness of individual energy-saving measures driven primarily by financial considerations.
- **Awareness of Other EE Programmes:** None of the respondents were familiar with previous, ongoing, or new energy efficiency programmes, such as the PSBEEP and Cayman Home Energy Efficiency Retrofit (CHEER) Programme.

4. **Lack of Monitoring Mechanisms**

Output 5 aims to increase nationwide action in the uptake of EE measures, however, there is no evident method of monitoring or assessing this.

### *5.6.5 Achievements and Progresses*

1. **Strong Public Engagement Efforts**

The project team successfully engaged with the public through traditional media, events, and direct outreach, demonstrating their commitment to promoting energy efficiency. Events such as the *Builder's Expo* provided valuable opportunities for face-to-face interactions.

2. **Meeting and Surpassing Targets**

   The campaign achieved its goal of deploying two public education tools and exceeded expectations through additional outputs, including social media updates, press releases, radio interviews, and public mentions.

3. **Positive Social Media Engagement**

   While outreach was limited, social media platforms recorded meaningful engagement from followers, creating a foundation for strengthening future digital strategies.

4. **Enhanced Homeowner Awareness**

   Surveys demonstrated that homeowners strongly value energy conservation for financial reasons, providing a solid starting point for building awareness of broader sustainability benefits.

5. **Future Opportunities for Success**

   Planned activities, such as an infographic for homeowners to be produced under Output 5 and a public showcase upon programme completion, present valuable opportunities to amplify awareness and highlight tangible programme achievements.

### *5.6.6 Challenges in Implementation*

1. **Delays in Pilot Home Retrofits and Financial Incentives**

   The ongoing retrofitting process and delays in developing financial mechanisms reduced the campaign's ability to showcase tangible, evidence-based successes. These delays directly impacted public messaging opportunities.

2. **Limited Reach of Social Media**

   While the project team utilised social media platforms to share updates, the absence of a paid advertising strategy limited outreach beyond existing followers. Expanding visibility requires a more targeted approach, such as sponsored posts, to engage broader audiences effectively.

3. **Fragmented Communications Strategy**

   The communications consultant's role included developing a comprehensive, multi-pronged strategy. However, delays in programme activities and the absence of a documented plan hindered the campaign's overall coordination, consistency, and impact.

4. **Limited Awareness of Broader EE Themes**

   Homeowner survey responses revealed that awareness of energy efficiency measures remained narrowly focused on cost savings. Key themes, such as environmental benefits and greenhouse gas reduction, were not improved.

### *5.6.7 Lessons Learned*

1. **Develop a Comprehensive Communications Strategy**

   A documented, data-driven communications strategy should be developed early in the project timeline. This ensures consistent messaging across all channels and allows for adaptability in response to delays or changes in programme activities.

2. **Prioritise Paid Digital Advertising**

   Organic social media posting has limited impact without an established audience. Future campaigns should incorporate sponsored posts and targeted advertising to expand reach effectively.

3. **Tangible Evidence Drives Engagement**

   Public awareness campaigns benefit significantly from showcasing real-life successes. Aligning communications timelines with programme milestones, such as retrofitting completion and financial incentive rollouts, ensures messaging resonates with audiences.

4. **Expand Messaging Beyond Cost Savings**

   While financial considerations drive homeowner interest, future campaigns should incorporate broader themes—such as environmental benefits, carbon reduction, and long-term sustainability—and establish a consistent social media presence to engage diverse sectors of Cayman's community.

5. **Measure and Monitor Impact**

   Implementing mechanisms to measure campaign effectiveness—such as event attendance data, social media metrics, and pre- and post-awareness surveys—can provide valuable insights for refining future campaigns.

### *5.6.8 Conclusion*

The communications campaign demonstrated significant efforts to engage the public through traditional media, public events, and social media platforms successfully meeting t initial targets and delivered important educational outputs. However, delays in programme activities, an incomplete communications strategy, and limited outreach restricted its overall impact.

Despite these challenges, the campaign laid a strong foundation for increasing public awareness of energy efficiency measures. Future efforts should focus on aligning messaging with tangible programme milestones, adopting paid digital strategies to expand reach, and broadening communications to highlight environmental and sustainability benefits. Lessons learned from this output will inform the design and execution of more effective public awareness campaigns in future energy efficiency initiatives.

## 5.7 Specific Objective: Increased Energy Efficiency and Use of Renewable Energy within Pilot Homes in the Cayman Islands

**Overview**

This section focuses on assessing the impact of the retrofitting measures implemented under the RBEEP to determine whether the programme has met its three specific targets. These targets are essential to understanding the effectiveness of the interventions in improving energy efficiency and reducing environmental and financial burdens for pilot households in the Cayman Islands. The three targets are:

1. A **40% reduction** in electricity consumption year-on-year (2024 vs. 2023).
2. A **40% reduction** in greenhouse gas emissions (GHG) year-on-year (2024 vs. 2023).
3. A **40% reduction** in energy bill expenditure (2024 vs. 2023).

By analysing these targets, the section aims to provide a focused evaluation of the retrofits' direct impact, using quantitative data and qualitative feedback from participating households.

**How to Navigate this Section**

The structure of this section is designed to enable readers to approach the findings in an accessible and systematic way. Each target is explored in a dedicated analysis, supported by visuals such as year-on-year comparison tables and trend graphs derived from electricity consumption, emissions, and expenditure data. The data was sourced primarily from electricity bills provided by participants, ensuring the reliability of the findings.

Each target analysis concludes with a detailed evaluation, synthesising the findings to assess whether the 40% reduction goal was achieved. While some repetition in the text is inevitable due to overlapping themes and behaviours influencing multiple targets, this approach allows each analysis to function as a standalone assessment. This enables readers to focus on specific targets or consider all three collectively to identify overarching patterns and themes.

**Context of the Retrofits**

The analysis underscores the immediate and measurable impacts of retrofitting measures, including energy monitors, spray foam insulation, and high-efficiency air conditioning (A/C) units. The phased implementation of these interventions introduced a cycle lag in energy bill impacts, typically observed one month after each retrofit was completed. This stagged approach, though unplanned, offered valuable insights into the standalone effectiveness of each measure as well as their cumulative benefits when combined.

By focusing on the retrofits' impact, this section seeks to provide a detailed understanding of how energy efficiency improvements performed in the short term and their potential to meet longer-term goals. This analysis will inform decisions on how best to scale and optimise the programme for broader implementation across the Cayman Islands.

### *5.7.1 40% Reduction in Electricity Consumption Year-on-Year Between 2024 vs. 2023*

This section presents a detailed analysis of the programme's progress toward achieving a 40% reduction in electricity consumption across the ten pilot homes. Electricity consumption serves as a critical metric in evaluating the programme's success, as it directly links environmental goals, such as reduced greenhouse gas emissions, to tangible changes in household energy use. By addressing consumption patterns, this analysis not only reflects the environmental benefits but also provides a foundation for achieving economic savings through reduced energy expenditures.

The evaluation begins with an examination of the percentage change in energy consumption following the incremental implementation of each energy efficiency measure—energy monitors, spray foam insulation, and high-efficiency air conditioning units. The staggered rollout of these measures, though unintended, offers valuable insights into their standalone and cumulative impacts.

The analysis then progresses to a broader overview of trends across the year, highlighting the evolution of energy consumption patterns and the combined influence of all retrofits. This exploration captures seasonal variations, behavioural trends, and the synergies achieved by layering interventions. Finally, the section concludes with a year-on-year comparison, reflecting on the comprehensive impact of the programme. The findings are triangulated with the post-retrofit survey. Together, these layers of analysis provide a holistic understanding of the programme's achievements, challenges, and opportunities for optimisation.

**1. Overall Findings**

(i) Cumulative Impact of Measures:

A clear downward trend in electricity consumption emerged across most clients, particularly after the installation of high-efficiency A/C units in August 2024. Clients 1, 8, 9, and 10 achieved reductions exceeding 50%, with Client 9 leading at -66.2%. The staggered retrofits showcased the compounding effect of layering measures, amplifying energy savings over time.

Clients 2 and 4 experienced minimal or increased consumption during certain periods, with year-on-year reductions of only -2.8% and -9.9%, respectively. These results may be attributed to behavioural factors or household dynamics rather than the efficacy of the retrofits.

(ii) Client-Specific Variability:

While most households benefited, Clients 2 and 4 struggled to achieve significant reductions, recording -2.8% and -9.9% year-on-year. Behavioural challenges, such as improper A/C usage and limited engagement with energy monitors, were key contributors.

(iii) Behavioural Insights:

Survey responses highlighted that 30% of participants found energy monitors challenging to use, limiting their effectiveness. Financial savings remained the primary motivator for most households, with environmental concerns playing a secondary role. By the end of the programme, energy consumption levels across households became more consistent, narrowing disparities and showcasing the programme’s potential.

## 2. Detailed Analysis of Phased Retrofit Measures on Electricity Consumption

(i) Percentage Change of Electricity Consumption (kWh) Following Installation of Energy Efficient Features:

**Energy Monitor Installation**

*Installed June 2024*

| Client No. | Jul-23 | Jul-24 | % Change |
|---|---|---|---|
| 1 | 2694 | 2075 | -23.0%↓ |
| 2 | 988 | 1079 | 9.2%↑ |
| 3 | 1521 | 1494 | -1.8%↓ |
| 4 | 1154 | 1167 | 1.1%↑ |
| 5 | 1026 | 702 | -31.6%↓ |
| 6 | 723 | 561 | -22.4%↓ |
| 7 | 828 | 867 | 4.7%↑ |
| 8 | 1315 | 1332 | 1.3%↑ |
| 9 | 2545 | 1679 | -34.0%↓ |
| 10 | 2225 | 1614 | -27.5%↓ |

**Spray Foam Installation**

*Installed July 2024*

| Client No. | Aug-23 | Aug-24 | % Change |
|---|---|---|---|
| 1 | 2594 | 1633 | -37.0%↓ |
| 2 | 938 | 1096 | 16.8%↑ |
| 3 | 1326 | 1391 | 4.9%↑ |
| 4 | 1071 | 1119 | 4.5%↑ |
| 5 | 947 | 829 | -12.5%↓ |
| 6 | 708 | 667 | -5.8%↓ |
| 7 | 853 | 823 | -3.5%↓ |
| 8 | 1368 | 951 | -30.5%↓ |
| 9 | 2685 | 1665 | -38.0%↓ |
| 10 | 1848 | 1057 | -42.8%↓ |

**A/C Unit Installation**

*Installed August 2024*

| Client No. | Sep-23 | Sep-24 | % Change |
|---|---|---|---|
| 1 | 2522 | 1237 | -51.0%↓ |
| 2 | 752 | 905 | 20.3%↑ |
| 3 | 1319 | 973 | -26.2%↓ |
| 4 | 1006 | 887 | -11.8%↓ |
| 5 | 924 | 710 | -23.2%↓ |
| 6 | 650 | 536 | -17.5%↓ |
| 7 | 859 | 709 | -17.5%↓ |
| 8 | 1254 | 585 | -53.3%↓ |
| 9 | 2195 | 715 | -67.4%↓ |
| 10 | 2144 | 939 | -56.2%↓ |

**Table 8: Percentage Change of Energy Consumption (kWh) with Phasing of Retrofitted Energy Efficiency Measures**

(ii) Analysis of Retrofit Measures:

The phased implementation of energy efficiency measures demonstrated a clear pattern of cumulative impact on electricity consumption. High-energy-consuming households saw the most significant reductions, particularly after the installation of high-efficiency A/C units, which delivered the greatest savings. While some households achieved exceptional reductions, others experienced minimal changes or even increases, highlighting the influence of behavioural factors and engagement with the measures. Overall, the data underscores the effectiveness of combining interventions while pointing to the need for better support and education to maximise benefits for all participants.

(iii) Observations and Key Findings:

**Compounding Impact of Measures**

The sequential implementation of energy efficiency measures demonstrated a compounding effect, with reductions in energy consumption increasing as measures were layered. For instance, Client 1 achieved reductions of 23.0% (monitors), 37.0% (insulation), and 51.0% (A/C units), while Client 9 realised an impressive 67.4% reduction after the final intervention.

**Exceptional Successes**

Clients 1, 9, and 10 consistently achieved significant savings, exceeding 50% reductions by November 2024. Active engagement with energy monitors and effective use of high-efficiency A/C units were key contributors to these successes, as reflected in survey feedback highlighting improved cooling efficiency and reduced reliance on A/C systems.

**Mixed Outcomes**

Clients 2, 3, and 4 displayed inconsistent or modest reductions, with some even recording increases in energy consumption. For example, Client 2's energy use rose by 9.2% following monitor installation and further increased after insulation (+16.8%) and A/C upgrades (+20.3%).

**Behavioural and External Barriers**

- **Engagement with Energy Monitors:** 40% of participants found the monitors difficult to use, limiting behavioural changes. Those who actively engaged with the monitors reported noticeable reductions, emphasising the importance of simplified interfaces and effective user training.
- **Weather and Occupancy:** Warmer-than-average summer conditions and increased household occupancy, particularly for Clients 2 and 4, offset the benefits of the retrofits.
- **Improper A/C Usage:** Inefficient cooling behaviours, such as running A/C units unnecessarily, hindered potential savings for some households, with Client 2 notably failing to adjust usage patterns.

(iv) Insights and Recommendations:

**Integrated Interventions**

The compounding impact of retrofit measures highlights the importance of comprehensive retrofitting programs. Isolated interventions, such as energy monitors, may yield modest results, but their effectiveness increases when paired with structural improvements (e.g., insulation) and technology upgrades (e.g., high-efficiency A/C units).

**Targeted Support and Education**

To address behavioural barriers, future programmess should incorporate robust training initiatives focusing on:

1. Understanding and effectively using energy monitors.
2. Proper maintenance and usage of high-efficiency A/C systems.

Real-time feedback systems and user-friendly interfaces for energy monitors could further enhance engagement.

**Tailored Solutions**

Households with limited reductions, such as Clients 2 and 4, may benefit from tailored interventions that address specific challenges, such as:

1. Enhanced insulation for rooms with poor thermal performance.
2. Education on energy-saving habits, particularly during peak cooling periods.

## 3. Review of Year-Long Energy Consumption Trends

(i) Trend of Electricity Consumption Following Installation of Energy Efficient Features:

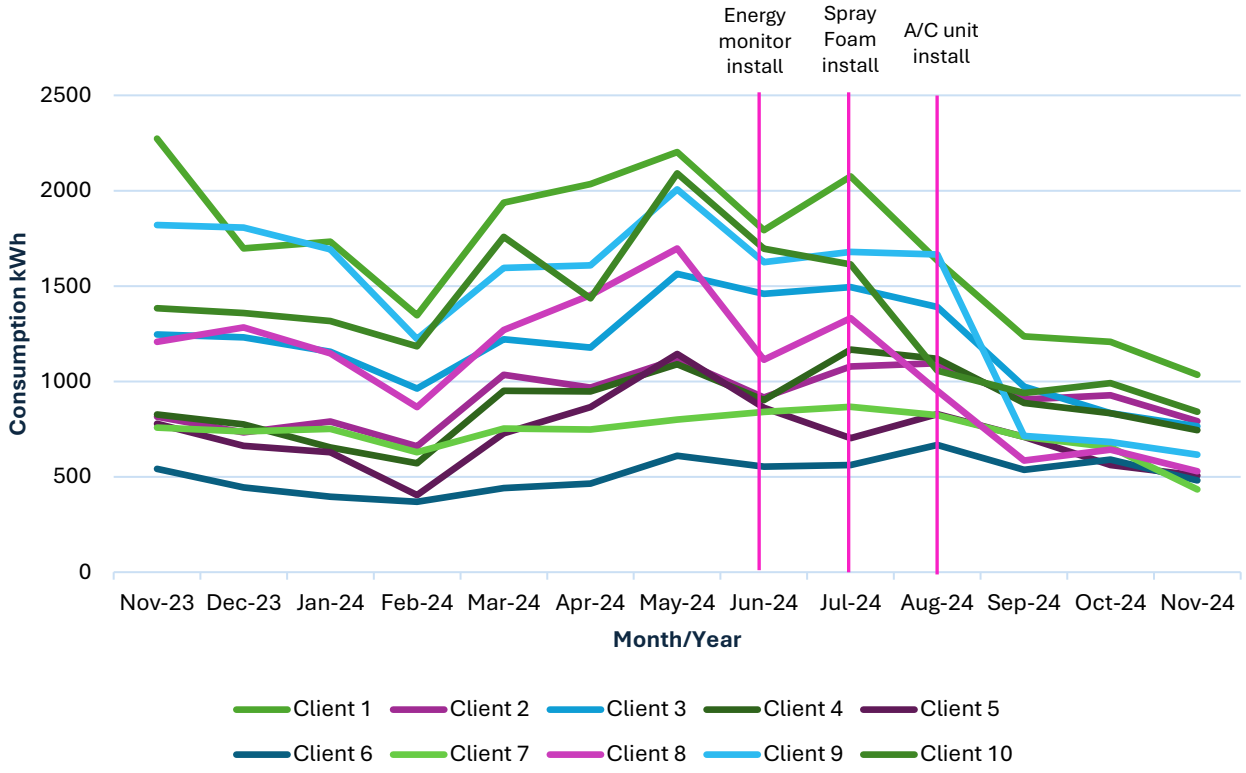


**Figure 12:Year-on-Year Trend of Energy Consumption (kWh)**

(ii) Analysis of Retrofit Measures:

The year-long trends graph in Figure 12 reveals a clear downward trajectory in energy consumption for most households following the phased implementation of retrofit measures. This reflects the cumulative effect of energy monitors, spray foam insulation, and high-efficiency A/C systems in achieving meaningful reductions in consumption.

Energy usage varied significantly throughout the study period, with November 2023 having the highest recorded consumption at 2273 kWh and the lowest at 542 kWh—a difference of 112.98%. Over time, a noticeable convergence in energy consumption emerges, with reductions becoming more consistent across households. By the end of the data period, consumption levels were more aligned, with the highest at 1035 kWh and the lowest at 434 kWh, narrowing the gap to 81.82%. This convergence suggests that retrofitted measures not only reduced overall consumption but also equalised energy usage patterns across the pilot homes, likely due to improved efficiency and behavioural adaptations.

The trends graph highlights this progression, with significant declines evident after the installation of high-efficiency A/C units in August 2024. This suggests that the retrofits worked synergistically, with each measure amplifying the benefits of the previous ones. Households that initially consumed more energy, such as Clients 1 and 9, appeared to benefit the most, likely due to the higher baseline efficiency gains achievable through retrofitting.

(iii) Observations and Key Findings:

**Compounding Impact of Retrofit Measures**

The sequential implementation of energy efficiency measures demonstrates a compounding effect, where reductions in energy consumption increased as more measures were introduced. For instance:

- Client 9 achieved reductions of 34.0% (monitors), 38.0% (insulation), and an exceptional 67.4% after the addition of high-efficiency A/C units.
- This pattern suggests that while each retrofit measure contributed independently, their combined impact amplified energy savings significantly.

**Exceptional Successes**

- Clients 1, 9, and 10 consistently demonstrated significant reductions across all phases of the retrofit program. By November 2024, these clients achieved cumulative savings exceeding 50% compared to the previous year.
- Survey feedback from these households highlighted active engagement with energy monitors and proper usage of high-efficiency A/C units. One respondent noted that insulation and upgraded A/C systems created a "much cooler home" while reducing the need for extended A/C operation.

**Client-Specific Variability**

While many households demonstrated consistent reductions, some experienced periods of stagnation or increases in energy consumption:

- Client 4's consumption plateaued following spray foam installation, with limited additional gains observed after the A/C upgrade. This indicates that structural retrofits alone may not address deeper inefficiencies or behavioural barriers.
- Client 2, conversely, showed erratic consumption trends, with increases during the summer months despite the implementation of all retrofits. Survey responses from this client cited confusion about energy monitor functionality and improper A/C usage patterns.

(iv) Insights and Recommendations:

**Seasonal Variability**

Energy consumption peaked during the warmer months (May–August 2024), driven by increased cooling demands. Some households, like Client 2, left A/C units running during absences, reducing potential savings. Warmer-than-average temperatures further offset the benefits of insulation and efficient A/C units for Clients 2 and 4. In contrast, Client 10 achieved steady reductions, emphasising the value of combining retrofits with proactive engagement.

**Maximising Retrofit Effectiveness**

The trends graph underscores the importance of a comprehensive retrofit strategy that combines:

- Behavioural training on energy monitor usage and efficient cooling practices.

- Structural upgrades, such as spray foam insulation, to reduce cooling loads during peak seasons.
- Advanced technologies, such as high-efficiency A/C units, to amplify savings.

**Tailored Support for Lagging Clients**

Households with limited gains, such as Clients 2 and 4, require targeted interventions:

1. Improved training on energy monitor functionality.
2. Enhancements to underperforming insulation.

   Real-time feedback systems to encourage efficient behaviours.

**Behavioural Engagement and External Barriers**

Homeowner behaviour strongly influenced retrofit effectiveness. Clients with significant reductions (e.g., 1, 8, 9, and 10) actively engaged with energy monitors and adopted efficient habits, while Clients 2 and 4 struggled due to usability challenges and inconsistent cooling practices. External factors, such as warmer weather and increased household occupancy, also shaped outcomes, further highlighting the need for adaptive and behavioural-focused solutions.

## 4. Year-on-Year Percentage Change in Electricity Consumption

(i) Percentage Change of electricity Consumption:

| Client No. | Nov-23 | Nov-24 | % Change |
|---|---|---|---|
| 1 | 2273 | 1035 | -54.5%↓ |
| 2 | 815 | 792 | -2.8%↓ |
| 3 | 1246 | 765 | -38.6%↓ |
| 4 | 826 | 744 | -9.9%↓ |
| 5 | 778 | 506 | -35.0%↓ |
| 6 | 542 | 482 | -11.1%↓ |
| 7 | 758 | 434 | -42.7%↓ |
| 8 | 1207 | 529 | -56.2%↓ |
| 9 | 1820 | 616 | -66.2%↓ |
| 10 | 1383 | 841 | -39.2%↓ |

**Table 9: Year-on-Year Percentage Change in Energy Consumption (kWh)**

(ii) Analysis of Retrofit Measures:

**Diverse Outcomes Across Households**

The year-on-year comparison highlights significant variability in energy consumption reductions. High-energy users, such as Clients 8, 9, and 1, achieved reductions of -56.2%, -66.2%, and -54.5%, respectively, showcasing the substantial impact of combining multiple interventions. In contrast, Clients 2 and 4 recorded reductions of only -2.8% and -9.9%, underscoring the role of behavioural and contextual factors in shaping outcomes.

**Cumulative Gains Through Layered Interventions**

Progressive layering of retrofit measures proved especially effective. For instance, Client 1's reductions deepened from -23.0% after energy monitor installation to -54.5% following A/C upgrades. This compounding effect demonstrates the enhanced efficiency achievable through sequential implementation.

(iii) Observations and Key Findings:

**Transformative Impact for High Energy Users**

Clients 8, 9, and 1 transitioned from being some of the highest energy consumers to among the most efficient, reflecting the potential of retrofit measures when paired with behavioural engagement. Survey feedback credited improved cooling efficiency and reduced reliance on outdated systems for these results.

**Stumbling Blocks for Participants**

For clients such as 2 and 4, behavioural challenges hindered success. Limited understanding of energy monitors and inconsistent usage of high-efficiency A/C units contributed to modest or negligible reductions.

**Influence of External Conditions**

Seasonal peaks in energy consumption (May–August 2024) due to higher temperatures and increased household occupancy presented ongoing challenges. For some, these factors offset the gains achieved through retrofits, particularly in poorly insulated homes.

(iv) Insights and Recommendations:

**Prioritising Engagement Through Practical Solutions**

To improve outcomes, future programmes should:

- Simplify energy monitor interfaces and provide accessible training to help participants understand and act on feedback.
- Introduce tailored behavioural nudges, such as real-time savings summaries, to encourage consistent energy-saving practices.

**Addressing Lagging Performance**

Clients with limited gains, such as 2 and 4, could benefit from:

- Targeted insulation upgrades to improve thermal efficiency.
- Customised guidance on optimising high-efficiency A/C unit usage during peak demand periods.

**Preparing for Environmental Challenges**

To counteract seasonal energy spikes, the programme should incorporate climate-adaptive measures, such as dynamic cooling systems and weather-responsive insulation strategies.

**Enhancing Synergies with Solar Panels**

The delayed connection of solar panels represents a missed opportunity to achieve greater reductions. Integrating these systems into future phases will further amplify the environmental and financial benefits for participants.

## 5. Conclusion: Assessment Against the Target of a 40% Reduction in Electricity Consumption (2024 vs. 2023)

The programme demonstrated significant progress toward the target of a 40% reduction in electricity consumption year-on-year across the ten pilot homes. Despite an unintended phased rollout due to programme delays, the data highlights the effectiveness of the retrofitting measures and the potential for further improvements as the programme evolves.

**Key Achievements**

Exceptional results were achieved by several households, with Clients 1, 8, 9, and 10 recording reductions exceeding 50%, with Client 9 achieving a standout reduction of 66.2%. These successes demonstrate the effectiveness of combining energy monitors, spray foam insulation, and high-efficiency A/C units.

The compounding impact of the interventions was evident despite the delays. As more measures were introduced, reductions deepened for many households, showcasing the synergies between structural improvements, technological upgrades, and behavioural adjustments.

A noticeable convergence in energy consumption levels across households by the end of the period indicates improved efficiency and consistency. The range of consumption narrowed from 112.98% in November 2023 to 81.82% in November 2024, reflecting the programme's capacity to address disparities in energy use.

**Challenges**

The delayed implementation of retrofits meant that households experienced staggered impacts of the interventions, limiting the ability to achieve cumulative benefits within the same timeframe.

Clients 2 and 4 achieved limited reductions of -2.8% and -9.9%, respectively. This was attributed to factors such as improper A/C usage, difficulty understanding energy monitors, and increased cooling demands during warmer months. Survey data highlighted a lack of engagement and limited behavioural adjustments in these households.

Warmer-than-average summer temperatures in 2024 increased cooling demands, reducing the effectiveness of spray foam insulation and high-efficiency A/C systems in some cases.

**Programme Insights**

While the phased approach was unintended, it inadvertently provided insight into the standalone and cumulative impacts of each intervention. This highlighted the importance of integrating retrofits to maximise energy savings.

Households that actively engaged with energy monitors and adapted their cooling practices achieved greater reductions. Conversely, participants who found the monitors challenging to use or who reported inconsistent cooling practices experienced more modest savings.

The data underscores the amplified impact of combining interventions, even when implemented sequentially. High-energy-consuming households, such as Clients 1 and 9, benefited most from this approach.

**Considerations for Scaling the Programme**

The absence of connected solar panels during the study period represents a missed opportunity for additional savings. Once operational, these systems are expected to significantly enhance the programme’s overall impact and bring households closer to or beyond the 40% target.

Tailored interventions for households with limited reductions, such as Clients 2 and 4, are critical. Enhanced training on energy monitor functionality and efficient cooling practices, coupled with real-time feedback mechanisms, would address behavioural barriers.

Future iterations of the programme should incorporate strategies to mitigate the effects of warmer weather on energy consumption, such as optimising insulation performance or introducing automated cooling solutions.

**Reflection on the Target**

While the programme did not achieve a universal 40% reduction, the overall results are commendable given the delays and external challenges. The exceptional performance of certain households demonstrates the effectiveness of the retrofitting measures and their potential when supported by behavioural engagement. Looking ahead, integrating solar panels, addressing behavioural and external challenges, and refining implementation strategies will be key to achieving the 40% target across all households in future phases.

### *5.7.2 40% reduction in greenhouse gas emissions (GHG) year-on-year between (2024 vs. 2023)*

This section evaluates the programme's progress toward achieving a 40% year-on-year reduction in GHG emissions across the ten pilot households. In the Cayman Islands, where 97% of electricity is generated from diesel, reducing electricity consumption is particularly vital for decreasing reliance on fossil fuels and advancing the country's sustainability objectives. These reductions hold environmental significance, while also supporting economic resilience through reduced energy bills.

The analysis begins with the percentage changes observed following the staged implementation of energy-efficient measures—energy monitors, spray foam insulation, and high-efficiency air conditioning (A/C) units. It then progresses to year-long trends and a year-on-year comparison, offering a comprehensive understanding of the programme's impact on household energy use. Post-retrofit survey insights are integrated to triangulate findings and reflect participant perspectives. This layered approach highlights the successes, challenges, and opportunities for improvement as the programme evolves.

**1. Overall Findings**

(i) Cumulative Impact

The programme demonstrated the transformative potential of layering retrofit measures, with several households achieving significant GHG reductions exceeding 50%. Clients 9, 8, and 1 emerged as standout performers, with reductions of -66.2%, -56.2%, and -54.5%, respectively.

(ii) Variability in Outcome

While most households benefited, Clients 2 (-2.8%) and 4 (-9.9%), experienced modest reductions or even increases in emissions during certain periods. These results were linked to behavioural barriers, usability challenges with energy monitors, and external factors such as increased occupancy.

(iii) Behavioural and Financial Motivations

Financial savings were the primary driver of participant engagement, with 80% of survey respondents prioritising cost reductions over environmental benefits. High-performing clients paired proactive engagement with the technology provided, while others struggled to adapt due to limited training or understanding.

(iv) Seasonal and External Changes

Warmer-than-average summer conditions in 2024 and increased cooling demands offset the effectiveness of some interventions, particularly for households with limited insulation performance or improper A/C usage patterns.

## 2. Detailed Analysis of Phased Retrofit Measures on Greenhouse Gas Emissions (GHG)

(i) Percentage Change of GHG ($tCO_2$/month) following Installation of Energy Efficient Features:

**Energy Monitor Installation**
*Installed June 2024*

| Client No. | Jul-23 | Jul-24 | % Change |
|---|---|---|---|
| 1 | 1.76 | 1.35 | -23.0%↓ |
| 2 | 0.65 | 0.70 | 9.2%↑ |
| 3 | 0.98 | 0.96 | -1.8%↓ |
| 4 | 0.75 | 0.76 | 1.1%↑ |
| 5 | 0.66 | 0.45 | -31.6%↓ |
| 6 | 0.46 | 0.36 | -22.4%↓ |
| 7 | 0.53 | 0.55 | 4.7%↑ |
| 8 | 0.85 | 0.86 | 1.3%↑ |
| 9 | 1.68 | 1.11 | -34.0%↓ |
| 10 | 1.43 | 1.04 | -27.5%↓ |

**Spray Foam Installation**
*Installed July 2024*

| Client No. | Aug-23 | Aug-24 | % Change |
|---|---|---|---|
| 1 | 1.69 | 1.06 | -37.0%↓ |
| 2 | 0.61 | 0.72 | 16.8%↑ |
| 3 | 0.86 | 0.90 | 4.9%↑ |
| 4 | 0.70 | 0.73 | 4.5%↑ |
| 5 | 0.61 | 0.53 | -12.5%↓ |
| 6 | 0.45 | 0.42 | -5.8%↓ |
| 7 | 0.55 | 0.53 | -3.5%↓ |
| 8 | 0.89 | 0.62 | -30.5%↓ |
| 9 | 1.77 | 1.10 | -38.0%↓ |
| 10 | 1.19 | 0.68 | -42.8%↓ |

**A/C Unit Installation**
*Installed August 2024*

| Client No. | Sep-23 | Sep-24 | % Change |
|---|---|---|---|
| 1 | 1.64 | 0.81 | -51.0%↓ |
| 2 | 0.49 | 0.59 | 20.3%↑ |
| 3 | 0.85 | 0.63 | -26.2%↓ |
| 4 | 0.66 | 0.58 | -11.8%↓ |
| 5 | 0.60 | 0.46 | -23.2%↓ |
| 6 | 0.41 | 0.34 | -17.5%↓ |
| 7 | 0.55 | 0.45 | -17.5%↓ |
| 8 | 0.81 | 0.38 | -53.3%↓ |
| 9 | 1.45 | 0.47 | -67.4%↓ |
| 10 | 1.38 | 0.60 | -56.2%↓ |

**Table 10: Percentage Change of GHG ($tCO_2$/month) with Phasing of Retrofitted Energy Efficiency Measures**

(ii) Analysis of Retrofit Measures

The phased implementation of energy efficiency measures—energy monitors, spray foam insulation, and high-efficiency air conditioning (A/C) units—highlighted the programme's potential for achieving meaningful reductions in greenhouse gas (GHG) emissions. High-energy-consuming households, such as Clients 9, 8, and 1, benefited significantly, with reductions exceeding 50% across the phased interventions. This underscores the effectiveness of combining structural and technological upgrades with behavioural engagement to drive transformative results.

However, variability in outcomes was evident across households, with some clients experiencing modest reductions or even increases in emissions. For example, Client 2 exhibited consistent increases across all interventions, culminating in a 20.3% rise after the A/C unit installation. These outcomes reflect challenges related to improper system usage, limited understanding of energy monitors, and external factors, such as warmer weather or increased occupancy.

Similarly, some clients, such as Client 4, achieved only modest reductions, indicating the potential for structural limitations or behavioural gaps that require tailored interventions.

The staggered rollout of measures revealed a compounding effect, where households that actively engaged with the technology and adopted energy-efficient behaviours saw progressive improvements. Clients 9 and 10 exemplify this, achieving reductions of -67.4% and -56.2%, respectively, after layering the interventions. Conversely, households with low baseline energy use or behavioural resistance, such as Client 6, faced challenges in realising substantial emissions reductions.

Overall, the programme demonstrated its ability to deliver significant GHG savings for engaged households but also highlighted the need for enhanced training, behavioural support, and alignment of programme goals with participants' financial motivations.

(iii) Observations and Key Findings

**Progressive Gains**

High-consuming households, including Clients 1, 9, and 10, demonstrated the value of layering interventions. Client 9, for instance, achieved a 67.4% reduction in emissions following the addition of high-efficiency A/C units, up from 34.0% after energy monitor installation. These results highlight the compounding benefits of combining structural and behavioural measures and underscore the potential impact of focusing on high-energy users.

**Behavioural Challenges**

Mixed outcomes for Clients 2 and 4 emphasise the role of user behaviour in retrofit success. Client 2 saw a 20.3% rise in emissions post-retrofit due to habits like running A/C units during absences, while Client 4 achieved only an 11.8% reduction. Limited engagement with energy monitors and insufficient awareness of optimal usage patterns were key barriers, underscoring the need for active participation to maximise outcomes.

**Influence of External Factors**

External factors, such as warmer-than-average summer temperatures and increased household occupancy, significantly influenced results. Higher cooling demands during peak months reduced the effectiveness of retrofits for households like Clients 2 and 4. Client 2 specifically noted increased energy use due to additional family members staying during the summer, highlighting the need for strategies that account for climate variability and occupancy changes.

(iv) Insights and Recommendations

**Targeting High-Impact Households**

To maximise the programme's impact:

- Focus on high-GHG-emitting households, providing tailored incentives to encourage participation and amplify reductions.
- Offer tiered subsidies or support packages based on baseline energy consumption levels.

**Enhancing Programme Design with Feedback**

Survey data revealed financial savings as the primary driver for engagement, with 80% of participants prioritising cost reduction over environmental concerns. To refine future iterations of the programme:

- Use participant surveys to address usability issues and align communication strategies with financial motivators.

Frame messaging around tangible benefits, subtly integrating environmental education without overshadowing financial priorities.

## 3. Review of Year-Long GHG Emission Trends

(i) Trend of GHG Emissions Following Installation of Energy Efficient Features:

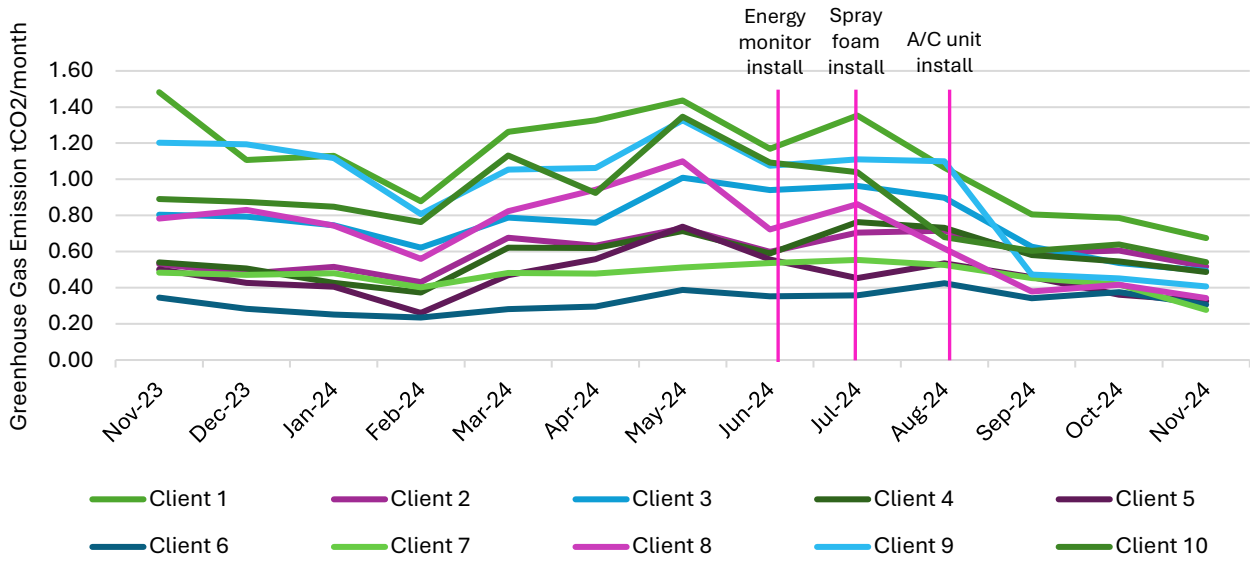


**Figure 13: Year-on-Year Trend of Greenhouse Gas Emissions $tCO_2$/month**

(ii) Analysis of Retrofit Measures:

The year-long trends in GHG emissions reveal a steady decline across most pilot households following the phased implementation of energy-efficient measures. The interventions, including energy monitors, spray foam insulation, and high-efficiency A/C systems, demonstrate cumulative benefits, with reductions becoming more pronounced after each retrofit phase. For example, Client 1 transitioned from 1.76 tCO2/month before retrofits to 1.35 tCO2/month following energy monitor installation, further decreasing to 1.06 tCO2/month after insulation, and culminating in 0.81 tCO2/month with the addition of high-efficiency A/C units. This pattern highlights the synergy between behavioural changes and technological upgrades, particularly for high-emission households.

The graph further illustrates the convergence of GHG emissions levels among households over time. Initially, significant disparities existed between clients, with the highest emitters producing over three times the GHG emissions of the lowest emitters. By November 2024, these differences had narrowed considerably, reflecting the programme's role in equalising energy efficiency outcomes across participants. However, some variability persisted, particularly for households with external or behavioural barriers, such as Clients 2 and 4, where challenges like increased occupancy and improper use of energy-efficient systems limited the effectiveness of the retrofits.

(iii) Observations and Key Findings:

**Progressive Declines in GHG Emissions**

The sequential implementation of retrofits consistently reduced GHG emissions across most households:

- Clients 9, 8, and 1 demonstrated the most significant declines, transitioning from some of the highest emitters to the lowest. For example, Client 9 reduced emissions from 1.68 tCO2/month before retrofits to 1.11 tCO2/month following energy monitor installation, and further down to 0.47 tCO2/month after the high-efficiency A/C upgrade.
- The convergence of emissions levels across households suggests a standardisation of energy efficiency benefits, driven by a combination of technological improvements and behavioural adjustments.

**Challenges for Behavioural Adoption**

Certain households exhibited limited reductions or increased GHG emissions:

- Client 2 experienced a rise in emissions, increasing from 0.49 tCO2/month to 0.59 tCO2/month after the A/C upgrade. Survey feedback attributed this to improper use, such as running the A/C during absences.
- Client 4 achieved only modest improvements, reducing emissions from 0.66 tCO2/month to 0.58 tCO2/month by the end of the programme. These outcomes highlight the critical role of consistent engagement with energy-saving practices in realising retrofit benefits.

**External Influences**

External factors, such as climatic conditions and household dynamics, shaped GHG outcomes:

- Warmer-than-average summer temperatures and increased cooling demands offset the benefits of retrofits for Clients 2 and 4.
- Survey responses noted that additional family members staying during peak cooling periods contributed to heightened emissions, particularly for Client 2.

(iv) Insights and Recommendations:

**Participant Feedback**

Post-retrofit surveys revealed that financial savings were the primary motivator for engagement, with 80% of participants prioritising cost reductions. However, 30% of respondents reported difficulties in understanding and using energy monitors. This misalignment between the programme's environmental goals and participants' priorities likely influenced the variability in outcomes

**Strengthening Behavioural Interventions**

- Simplify energy monitor interfaces and provide accessible training to ensure participants can effectively use the technology to identify energy-saving opportunities.
- Develop tailored behavioural nudges, such as real-time savings summaries, to promote consistent engagement with energy-efficient practices.

## 4. Year-on-Year Percentage Change in GHG Emissions ($tCO_2$/month)

(i) Percentage Change of GHG Emissions:

| Client No. | Nov-23 | Nov-24 | % Change |
|---|---|---|---|
| 1 | 1.48 | 0.67 | -54.5%↓ |
| 2 | 0.53 | 0.52 | -2.8%↓ |
| 3 | 0.80 | 0.49 | -38.6%↓ |
| 4 | 0.54 | 0.49 | -9.9%↓ |
| 5 | 0.50 | 0.33 | -35.0%↓ |
| 6 | 0.35 | 0.31 | -11.1%↓ |
| 7 | 0.48 | 0.28 | -42.7%↓ |
| 8 | 0.78 | 0.34 | -56.2%↓ |
| 9 | 1.20 | 0.41 | -66.2%↓ |
| 10 | 0.89 | 0.54 | -39.2%↓ |

**Table 11: Year-on-Year Percentage Change in GHG Emissions ($tCO_2$/month)**

(ii) Analysis of Retrofit Measures:

**Varied GHG Emission Reductions Across Households**

The year-on-year comparison of GHG emissions showcases a broad spectrum of outcomes. High-emitting households, such as Clients 8, 9, and 1, achieved notable reductions in emissions, dropping from 1.20 tCO2/month to 0.41 tCO2/month for Client 9, a reduction of 66.2%. Similarly, Client 8 reduced emissions from 0.78 tCO2/month to 0.34 tCO2/month, highlighting the effectiveness of comprehensive interventions. Conversely, Clients 2 and 4 recorded minimal reductions, at 2.8% and 9.9%, respectively, pointing to behavioural and situational barriers that limited the potential of retrofits.

**Amplified Results Through Multi-Phase Implementation**

Layering multiple retrofit measures produced compounding benefits. For instance, Client 1's emissions dropped steadily from 1.48 tCO2/month in November 2023 to 0.67 tCO2/month in November 2024, reflecting the combined impact of energy monitors, spray foam insulation, and high-efficiency A/C units. This pattern underscores the importance of integrating sequential interventions to maximise the cumulative impact of retrofits.

(iii) Observations and Key Findings:

**Significant Gains Among High-Emitters**

High-emitting clients demonstrated transformative results. Clients 1, 8, and 9 transitioned from among the highest emitters to some of the most efficient participants. Feedback from these households highlighted the dual role of technological upgrades and improved user engagement in achieving these outcomes. For example, Client 9 credited the upgrades with providing a more comfortable home while requiring far less energy.

**Barriers to Consistent Success**

Clients 2 and 4 exhibited minimal reductions, with negligible changes in emissions levels despite the retrofits. Survey responses revealed several barriers, including difficulties understanding energy monitor interfaces and improper use of high-efficiency A/C systems, such as running them during unoccupied periods. These challenges highlight the ongoing need for targeted behavioural support.

**External Influences on Performance**

External conditions significantly influenced the variability in outcomes. Warmer-than-average summer temperatures increased cooling demands, particularly for Clients 2 and 4, diluting the impact of retrofits. Additionally, households with increased occupancy during peak cooling periods reported higher-than-expected emissions, emphasising the importance of addressing external dynamics in retrofit programmes.

(iv) Insights and Recommendations:

**Adapting to Environmental Variability**

- Introduce weather-responsive cooling systems and insulation strategies to mitigate seasonal spikes in emissions.
- Develop occupancy-responsive interventions to address higher energy usage during periods of increased household activity.

**Expanding Retrofit Opportunities**

- Integrate delayed solar panel installations into future phases to further enhance emissions reductions. This measure would complement existing retrofits, enabling households to achieve even greater financial and environmental benefits.

## 5. Conclusion: Assessment Against the Target of a 40% Reduction in GHG Emissions (2024 vs. 2023)

The programme demonstrated measurable progress toward achieving the ambitious target of a 40% reduction in GHG emissions year-on-year across the ten pilot households. While not all participants reached the 40% threshold, the overall results underscore the effectiveness of the retrofitting measures and provide a strong foundation for future enhancements as the programme evolves.

**Key Achievements**

The programme delivered significant progress toward achieving a 40% year-on-year reduction in GHG emissions across the ten pilot households. Four households, including Clients 1, 8, 9, and 10, exceeded the 40% reduction target, with Client 9 achieving the most significant decrease, reducing emissions from 1.20 $tCO_2$/month to 0.41 $tCO_2$/month. These results highlight the transformative potential of layering interventions such as energy monitors, spray foam insulation, and high-efficiency A/C systems. Emissions disparities among households also narrowed considerably, reflecting the programme's capacity to drive consistent improvements across participants.

**Challenges**

While the overall outcomes were positive, variability in results underscores the programme's challenges. Clients 2 and 4 recorded limited reductions of -2.8% and -9.9%, respectively, due to behavioural barriers such as improper A/C usage and difficulty engaging with energy monitors. Warmer-than-average summer temperatures and increased

household occupancy during peak cooling months further offset the effectiveness of retrofits for some households, limiting their ability to achieve the target.

**Programme Insights**

The programme demonstrated the importance of integrating technological upgrades with behavioural engagement. Participants who actively adapted their energy use practices achieved the most significant reductions, while those struggling with usability challenges or lacking tailored support saw fewer substantial gains. Survey feedback revealed that financial savings were the primary motivator for engagement, indicating the need for future programmes to align environmental goals with participants' priorities. The delayed connection of solar panels emerged as a missed opportunity for additional reductions but remains a promising avenue for future phases.

**Considerations for Scaling the Programme**

Scaling the programme requires addressing variability in outcomes and refining implementation strategies. Enhanced training on energy monitor usage, tailored support for high-occupancy or low-performing households, and real-time feedback systems are vital to maximising future success. Weather-responsive strategies and occupancy-adaptive cooling technologies will further mitigate the impact of external factors. Finally, prioritising the integration of solar panels in subsequent phases offers a clear pathway to amplify environmental and financial benefits, ensuring wider adoption and consistent results across a more extensive participant base.

**Reflection on the Target**

Although not all households achieved the 40% target, the programme's successes illustrate its potential to deliver meaningful GHG reductions when supported by effective interventions and participant engagement. With several households exceeding the target and notable progress across the group, the findings highlight the value of a phased, cumulative approach to retrofits. Addressing challenges faced by lower-performing households through enhanced training, tailored behavioural support, and adaptive strategies will be critical for achieving consistent results across all participants. Integrating solar panels in subsequent phases offers further potential to meet or exceed the target across the board.

### *5.7.3 40% reduction in energy bill expenditure year-on-year between (2024 vs. 2023)*

This section evaluates the programme's progress toward achieving a 40% reduction in energy bill expenditure year-on-year across ten pilot households. In the Cayman Islands, where energy costs are among the highest globally, reducing household energy bills has significant economic and social implications. Lowering energy expenditure alleviates financial burdens, particularly for vulnerable households, and promotes greater equity by addressing the disproportionate impact of energy costs on low-income families.

The analysis focuses on monthly electricity costs for the pilot homes, examining percentage changes following the phased implementation of energy-efficient measures such as energy monitors, spray foam insulation, and high-efficiency air conditioning (A/C) units. The findings are integrated with participant survey insights to triangulate results and provide a comprehensive view of the programme's financial impact. This layered approach highlights successes, identifies challenges, and offers recommendations to optimise the programme's outcomes.

**1. Overall Findings**

(i) Cumulative Impact

The RBEEP programme demonstrated substantial reductions in energy expenditure across the ten pilot households, with five participants exceeding the ambitious 40% reduction target. Standout performers included Clients 9, 8, and 1, achieving remarkable savings of -65.2%, -54.9%, and -53.7%, respectively. These reductions underscore the programme's success in delivering meaningful financial benefits, particularly for high-energy-spending households.

(ii) Variability in Outcome

While most participants experienced significant savings, some households showed more modest improvements. For example:

- Client 4 achieved a reduction of -9.0%, reflecting limited behavioural adjustments or external influences such as increased occupancy.
- Client 2 recorded a minimal decrease of -2.0%, potentially influenced by factors such as increased energy demand during peak periods or warmer-than-average weather conditions.

These results highlight the programme's overall effectiveness while underscoring the importance of addressing individual household circumstances to maximise impact.

(iii) Behavioural and Financial Motivations

Financial savings were the primary driver of participant engagement, with 80% of survey respondents prioritising cost reductions over environmental benefits. High-performing clients paired proactive engagement with the technology provided, while others struggled to adapt due to limited training or understanding.

(iv) Seasonal and External Changes

Warmer-than-average summer conditions in 2024 and increased cooling demands offset the effectiveness of some interventions, particularly for households with limited insulation performance or improper A/C usage patterns.

## 2. Detailed Analysis of Phased Retrofit Measures on Energy Expenditure

(i) Percentage Change of Expenditure (KYD/month) following Installation of Energy Efficient Features:

| **Energy Monitor Installation** *Installed June 2024* | | | | **Spray Foam Installation** *Installed July 2024* | | | | **A/C Unit Installation** *Installed August 2024* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Client No. | Jul-23 | Jul-24 | % Change | Client No. | Aug-23 | Aug-24 | % Change | Client No. | Sep-23 | Sep-24 | % Change |
| 1 | KYD 1,102.52 | KYD 680.45 | -38.3%↓ | 1 | KYD 828.35 | KYD 548.38 | -33.8%↓ | 1 | KYD 788.58 | KYD 413.21 | -47.6%↓ |
| 2 | KYD 408.37 | KYD 356.89 | -12.6%↓ | 2 | KYD 303.60 | KYD 370.14 | 21.9%↑ | 2 | KYD 239.60 | KYD 304.01 | 26.9%↑ |
| 3 | KYD 625.24 | KYD 491.71 | -21.4%↓ | 3 | KYD 426.55 | KYD 468.05 | 9.7%↑ | 3 | KYD 415.46 | KYD 326.38 | -21.4%↓ |
| 4 | KYD 475.91 | KYD 385.48 | -19.0%↓ | 4 | KYD 345.74 | KYD 377.77 | 9.3%↑ | 4 | KYD 318.38 | KYD 298.09 | -6.4%↓ |
| 5 | KYD 423.83 | KYD 234.41 | -44.7%↓ | 5 | KYD 306.45 | KYD 281.52 | -8.1%↓ | 5 | KYD 292.95 | KYD 239.88 | -18.1%↓ |
| 6 | KYD 300.54 | KYD 188.61 | -37.2%↓ | 6 | KYD 230.71 | KYD 227.75 | -1.3%↓ | 6 | KYD 207.96 | KYD 182.65 | -12.2%↓ |
| 7 | KYD 343.26 | KYD 288.02 | -16.1%↓ | 7 | KYD 276.66 | KYD 279.53 | 1.0%↑ | 7 | KYD 272.79 | KYD 239.55 | -12.2%↓ |
| 8 | KYD 541.42 | KYD 439.08 | -18.9%↓ | 8 | KYD 439.85 | KYD 322.01 | -26.8%↓ | 8 | KYD 395.30 | KYD 198.76 | -49.7%↓ |
| 9 | KYD 1,041.89 | KYD 551.80 | -47.0%↓ | 9 | KYD 857.19 | KYD 559.00 | -34.8%↓ | 9 | KYD 687.16 | KYD 241.52 | -64.9%↓ |
| 10 | KYD 911.69 | KYD 530.69 | -41.8%↓ | 10 | KYD 591.96 | KYD 357.19 | -39.7%↓ | 10 | KYD 671.34 | KYD 315.19 | -53.0%↓ |

**Table 12: Percentage Change of Energy Expenditure (KYD) with Phasing of Retrofitted Energy Efficiency Measures**

(ii) Analysis of Retrofit Measures

The phased implementation of energy-efficient measures—energy monitors, spray foam insulation, and high-efficiency A/C units—had a notable impact on reducing energy expenditure across many households, particularly for high-energy users. Clients 1, 9, and 10 demonstrated substantial reductions in costs, with Client 9 achieving the most significant decrease, from KYD 1,041.89 to KYD 241.52 by the final intervention. These results highlight the compounding benefits of combining structural improvements with technological upgrades and energy-conscious behaviours.

However, variability in outcomes was evident. For example, Client 2 experienced increases in expenditure after specific retrofits, with costs rising by 21.9% following spray foam insulation and 26.9% after A/C upgrades. These increases may be attributed to external factors, such as higher household occupancy during peak cooling periods, which elevated energy demands. Additionally, potential increases in energy tariffs during the study period could have influenced costs, partially offsetting the financial benefits of efficiency gains.

Despite these challenges, the data underscores the programme's effectiveness in delivering significant financial savings for engaged households. However, the variability in outcomes points to the importance of accounting for external factors, such as energy tariff fluctuations and changes in household occupancy, alongside providing targeted support to maximise savings and ensure consistent benefits across all participants.

## 3. Overall Year-Long Energy Expenditure Trends

(i) Trend of Energy Expenditure Following Installation of Energy Efficient Features:

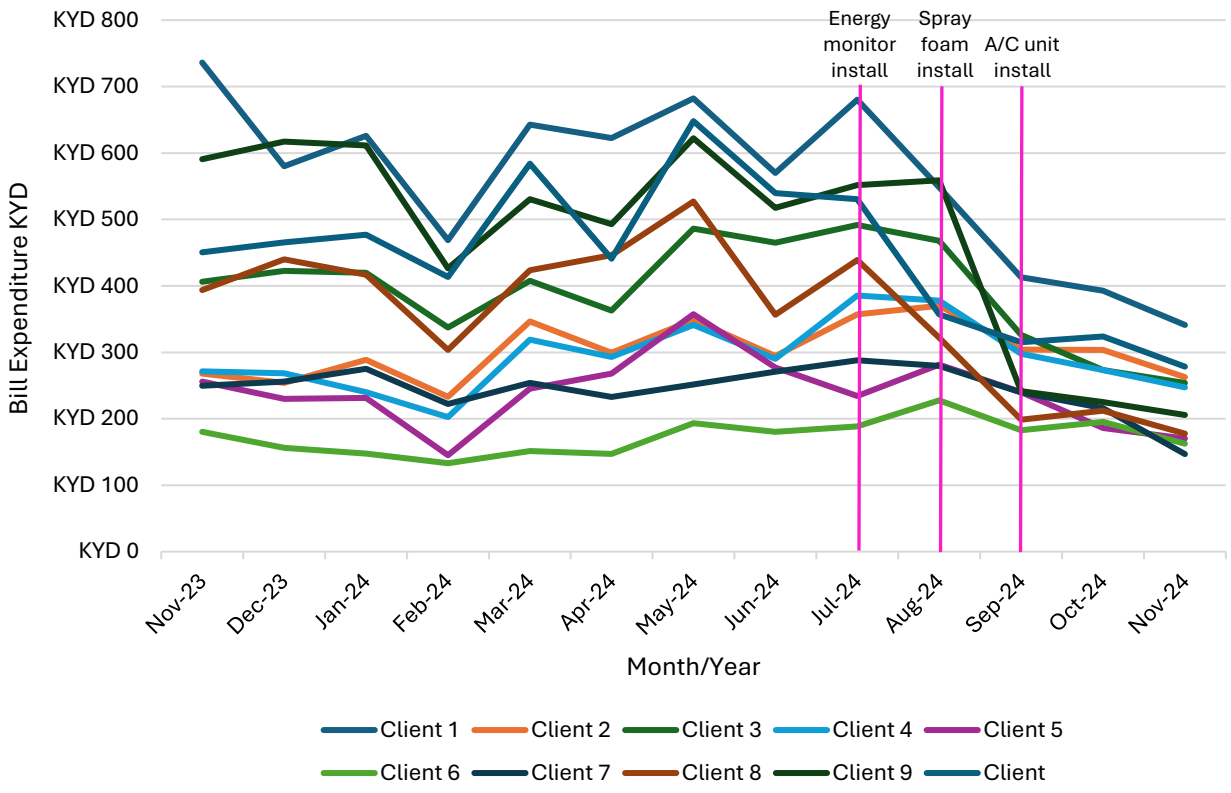


**Figure 14: Year-on-Year Trend of Energy Expenditure (KYD/Month)**

(ii) Analysis of Retrofit Measures:

The trend graph for November 2023 to November 2024 highlights a consistent downward trajectory in energy expenditure across most households following the phased implementation of energy-efficient measures. The sequential installation of energy monitors in June 2024, spray foam insulation in July 2024, and high-efficiency A/C units in August 2024 collectively contributed to this decline. Clients 1, 8, and 9 achieved the most substantial reductions in energy expenditure, with Client 9's costs decreasing from KYD 687.16 in September 2023 to KYD 241.52 in September 2024. These significant savings underscore the compounding benefits of layering interventions.

However, the data reveals variability in outcomes, with some households, such as Clients 2 and 4, showing increased energy expenditure during certain months. For example, Client 2's expenditure rose from KYD 239.60 in September 2023 to KYD 304.01 in September 2024. These anomalies may be attributed to increased household occupancy, warmer-than-average weather conditions, or rising energy tariffs, as indicated by post-retrofit survey responses.

Overall, the programme demonstrated its potential to deliver meaningful financial savings, particularly for high-energy-spending households that actively engaged with the interventions. Yet, the variability in results highlights the influence of behavioural, environmental, and external economic factors, necessitating a tailored approach to ensure consistent benefits across all participants.

(iii) Observations and Key Findings:

**Steady Declines in Energy Expenditure**

The trend graph indicates a steady decline in energy expenditure for most households following the phased implementation of energy-efficient measures.

- Clients 9, 1, and 8 achieved the most significant reductions, transitioning from some of the highest spenders to the lowest. For instance, Client 9's expenditure decreased from KYD 687.16 in September 2023 to KYD 241.52 in September 2024, reflecting the cumulative benefits of layered interventions.
- This convergence in expenditure across households suggests that the programme successfully reduced disparities, with energy savings becoming more uniform as retrofits were implemented.

**Variable Responses to Retrofits**

Some households showed limited reductions or increased expenditure, indicating variability in outcomes:

- Client 2 experienced an increase from KYD 239.60 in September 2023 to KYD 304.01 in September 2024. Survey data suggest this could be linked to increased occupancy, warmer-than-average weather, or rising energy tariffs rather than improper system usage.
- Similarly, Client 4 achieved only modest savings, with expenditure decreasing from KYD 318.38 in September 2023 to KYD 298.09 in September 2024, potentially reflecting limited engagement with retrofits or external challenges.

**Influence of External Factors**

External factors significantly impacted expenditure trends:

- Warmer-than-average temperatures during the summer months drove up cooling demands, which offset some benefits of retrofits for Clients 2 and 4.
- Increased occupancy during peak periods, as noted in survey responses, further contributed to heightened energy use for certain households.

(iv) Insights and Recommendations:

**Targeted Support for Low-Performing Households**

To improve outcomes for households with limited reductions:

- Provide tailored interventions, such as enhanced training on energy-efficient practices and clearer guidance on optimising A/C usage during peak periods.

- Develop adaptive solutions to address increased cooling demands caused by higher occupancy or extreme weather conditions.

**Develop Targeted Messaging Based on Household Profiles**

- Highlight high-performers by sharing success stories from households like Clients 1, 8, and 9 to encourage broader adoption of energy-efficient behaviours.
- Tailor support for low-performers by offering personalised consultations for households like Clients 2 and 4, identifying barriers and suggesting actionable improvements to enhance their outcomes.

**Strengthen Data-Driven Programme Adjustments**

- Regularly review participant data to identify trends and barriers. This could involve creating a dynamic feedback loop where adjustments to the programme are made in real-time, based on emerging patterns in energy expenditure and user engagement.

**Compounding Effects of Interventions on High-Spending Households**

High-spending households, such as Clients 1, 8, and 9, experienced the most pronounced reductions, underscoring the programme's ability to deliver transformative results for households with greater initial inefficiencies. These clients demonstrate the value of prioritising high-energy users for future interventions, as they offer the greatest return on investment for both environmental and financial objectives.

## 4. Year-on-Year Percentage Change in Energy Expenditure (KYD/month)

(i) Total Percentage Change Post-Retrofit

The aggregated results for November 2023 versus November 2024 highlight the cumulative savings across all retrofits:

| Client No. | Nov-23 | Nov-24 | % Change |
|---|---|---|---|
| 1 | KYD 736 | KYD 341 | -53.7%↓ |
| 2 | KYD 268 | KYD 263 | -2.0%↓ |
| 3 | KYD 406 | KYD 254 | -37.5%↓ |
| 4 | KYD 272 | KYD 247 | -9.0%↓ |
| 5 | KYD 256 | KYD 170 | -33.6%↓ |
| 6 | KYD 180 | KYD 162 | -10.0%↓ |
| 7 | KYD 250 | KYD 147 | -41.2%↓ |
| 8 | KYD 394 | KYD 178 | -54.9%↓ |
| 9 | KYD 591 | KYD 206 | -65.2%↓ |
| 10 | KYD 450 | KYD 278 | -38.2%↓ |

**Table 13: Year-on-Year Percentage Change in Energy Expenditure (KYD/Month)**

(ii) Analysis of Retrofit Measures

**Diverse Outcomes in Energy Expenditure Reductions**

The year-on-year comparison of energy expenditure across the pilot households reveals a wide range of outcomes. Households with high baseline energy costs, such as Clients 1, 9, and 7, achieved significant reductions of -53.7%, -65.2%, and -41.2%, respectively. These reductions highlight the transformative potential of the energy efficiency measures when paired with proactive engagement and consistent behavioural adjustments. In contrast, Clients 2 and 4 experienced minimal reductions of -2.0% and -9.0%, respectively, suggesting barriers related to external factors, increased occupancy, or incomplete adoption of energy-saving behaviours.

**Amplified Results Through Phased Implementation**

The phased introduction of energy monitors, spray foam insulation, and high-efficiency A/C units appears to have had a compounding effect on energy expenditure reductions. For example, Client 1 reduced expenditure from KYD 736 in November 2023 to KYD 341 in November 2024, demonstrating the cumulative benefits of integrating technological upgrades with behavioural adjustments. Similarly, Client 9's expenditure dropped dramatically, underscoring the value of targeting high-energy-consuming households for maximum programme impact.

(iii) Observations and Key Findings

**Transformative Impact on High-Expenditure Households**

High-expenditure households, including Clients 1, 7, and 9, demonstrated the most substantial savings, transitioning from some of the highest spenders to among the most efficient. Survey feedback from these participants credited the retrofits for providing consistent comfort while significantly reducing costs. For instance, Client 9 cited spray foam insulation as particularly effective in maintaining thermal comfort and reducing reliance on air conditioning.

**Variability in Outcomes**

Households such as Clients 2 and 4 showed limited reductions despite the interventions. Factors such as increased occupancy, external influences, and possible underutilisation of energy-saving technology likely contributed to these outcomes. Post-retrofit survey responses indicated a need for improved engagement strategies to encourage consistent adoption of energy-efficient practices.

**External and Behavioural Influences**

External factors, including rising energy tariffs and warmer-than-average temperatures, shaped year-on-year results. Households with increased occupancy during peak demand periods, such as Client 2, faced heightened expenditure despite retrofits. Behavioural insights from the survey further suggest that households with minimal reductions struggled with adapting to energy-efficient habits or maximising the functionality of the retrofits.

## 5. Conclusion: Assessment Against the Target of a 40% Reduction in Energy Expenditure (2024 vs. 2023)

The RBEEP programme demonstrated significant progress toward achieving the ambitious target of a 40% reduction in energy expenditure year-on-year across the ten pilot households. While not all participants achieved the 40% threshold, the overall results reflect the programme's success in reducing energy bills for many vulnerable households and highlight areas for improvement in addressing external and behavioural barriers.

**Key Achievements**

The programme successfully delivered measurable reductions in energy expenditure, with five households achieving reductions exceeding the 40% target. Clients 1, 8, and 9 achieved standout reductions of -53.7%, -54.9%, and -65.2%, respectively, underscoring the transformative impact of combining energy monitors, spray foam insulation, and high-efficiency A/C units. These reductions were particularly notable among high-expenditure households, where the layering of interventions amplified financial savings and improved equity.

A convergence in energy expenditure across households also emerged by November 2024, reflecting the programme's ability to reduce disparities and deliver consistent improvements in energy efficiency. This result demonstrates the success of integrating structural and behavioural interventions to drive equitable outcomes for vulnerable participants.

**Challenges**

Despite these successes, the programme faced challenges in achieving uniform results. Clients 2 and 4 recorded minimal reductions of -2.0% and -9.0%, respectively, highlighting the role of external influences and behavioural engagement in shaping outcomes. Post-retrofit survey responses revealed increased household occupancy and rising energy tariffs as key contributors to elevated energy demands, particularly during peak cooling periods.

Warmer-than-average temperatures during the summer months further offset the effectiveness of retrofits for some households, particularly those with limited engagement in energy-saving practices or inconsistent usage of upgraded systems. These external and behavioural factors underscore the complexity of achieving consistent results across diverse household circumstances.

**Programme Insights**

The programme reaffirmed the importance of aligning retrofits with household needs and behaviours to maximise energy expenditure reductions. High-performing households paired proactive engagement with technology, achieving substantial savings and reinforcing the value of integrating interventions.

Conversely, low-performing households struggled to realise the full benefits of the programme, highlighting the need for tailored support, adaptive strategies, and improved training to address barriers such as increased occupancy, external economic pressures, and limited engagement.

The delayed integration of renewable energy systems, such as solar panels, represented a missed opportunity for additional savings. Once operational, these systems are expected to amplify the programme's impact, further aligning financial and environmental goals.

**Considerations for Scaling the Programme**

To achieve greater consistency in outcomes and maximise the programme's impact, several enhancements are recommended:

- Targeted Support: Provide tailored interventions for low-performing households, including personalised training on optimising energy-efficient systems and adaptive strategies for increased occupancy or rising tariffs.
- Behavioural Engagement: Develop real-time feedback systems and household-specific energy-saving tips to encourage consistent adoption of energy-efficient practices.
- Weather-Responsive Measures: Incorporate adaptive cooling technologies and seasonal workshops to mitigate the impact of warmer temperatures on energy expenditure.
- Renewable Integration: Prioritise the connection of solar panels in future phases to amplify financial savings and meet or exceed the 40% reduction target across all participants.

**Reflection on the Target**

While not all households achieved the 40% target, the programme delivered commendable results, particularly among high-expenditure participants. These successes illustrate the potential for retrofitting measures to drive meaningful energy expenditure reductions when supported by effective interventions and participant engagement. Notably, the reductions have been achieved prior to the PV panels being connected.

The programme proved effective in addressing energy inequities, particularly for vulnerable households. Future phases should focus on overcoming external and behavioural barriers, integrating renewable systems, and refining implementation strategies to achieve universal success and ensure the programme's scalability and sustainability.

# 6 Conclusion

The RBEEP marks the Cayman Islands' first major effort to improve energy efficiency within the residential sector. Supported by the RESEMBID initiative, the programme represents a pioneering step towards achieving the goals of the updated NEP, including reducing energy consumption, cutting GHG emissions, and improving energy affordability. Through a multifaceted approach—encompassing targeted retrofits, capacity building, public awareness campaigns, and policy development—the programme sets a replicable foundation for energy efficiency transitions across small island contexts.

**Key Achievements**

1. **Energy Efficiency Gains**

   The programme demonstrated measurable progress toward achieving its three core targets despite the PV panels not being connected:

   - **Electricity Consumption:** Four households achieved reductions exceeding the 40% target, with the highest reduction reaching 66.2%. While variability in outcomes persisted, the overall reductions highlight the effectiveness of layering energy monitors, spray foam insulation, and high-efficiency A/C systems.
   - **Greenhouse Gas Emissions:** Clients achieving reductions of 40% or more demonstrated the environmental impact of the retrofits, with high-performing households significantly decreasing their reliance on diesel-generated electricity.
   - **Energy Expenditure:** Several households realised reductions in energy bills exceeding 40%, with the most significant savings driven by high baseline energy use and proactive engagement with retrofits.

2. **Targeted Socioeconomic Impact**

   By selecting ten pilot homes based on financial vulnerability, the programme addressed inequities in energy affordability. It also exceeded its gender equity target, with 80% of participating households being female-led, further underscoring its social impact.

3. **Capacity Building**

   Training initiatives equipped public sector professionals and stakeholders with foundational knowledge of energy efficiency, supporting Corporate Social Responsibility (CSR) principles and fostering a platform for sustainable practices.

4. **Public Engagement**

   Outreach through traditional and digital media raised awareness of energy efficiency benefits. While the impact was limited by resource constraints, the campaign established a foundation for future public education efforts.

**Challenges and Lessons Learned**

1. **Behavioural Shifts**

   Homeowner surveys revealed that financial savings are the primary motivator for energy efficiency, with limited awareness of broader environmental benefits. Enhanced training and education are needed to drive behavioural change.

2. **Incomplete Implementations**

   Delays in solar PV integration and financial incentive programmes restricted the programme's full potential for achieving measurable savings and emissions reductions.

3. **Communications Gaps**

   The absence of a comprehensive communications strategy limited the reach of public awareness efforts, particularly on digital platforms. Future campaigns require paid advertising and improved monitoring mechanisms.

4. **Technical and Procedural Hurdles**

   Procurement delays, contractor inconsistencies, and rising energy tariffs highlight the need for streamlined processes, robust oversight, and affordable financing solutions.

**Recommendations for Future Programmes**

1. **Integrate Financial Incentives**

   Develop targeted mechanisms, such as low-interest loans, subsidies, or revolving funds, to ensure energy efficiency measures remain accessible and affordable for vulnerable households.

2. **Promote Environmental Awareness**

   Broaden messaging beyond cost savings to include the environmental and climate resilience benefits of energy efficiency.

3. **Enhance Monitoring and Training**

   Simplify technologies (e.g., energy monitors) and provide hands-on homeowner guidance to ensure their usability and impact.

4. **Strengthen Communications Strategies**

   Develop cohesive, data-driven campaigns with paid digital advertising to maximise outreach and public engagement.

5. **Holistic Built Environment Approach**

   Mandate energy-efficient design requirements at the planning application stage, focusing on passive measures like building orientation, shading, and native landscaping, and the building control stage with regards to materials and construction methods.

**Final Reflection**

The RBEEP provides a valuable pilot model for advancing energy efficiency in residential sectors within small island jurisdictions. While the programme faced delays and limitations, its successes offer critical insights for future initiatives. By addressing technical, financial, and behavioural barriers, the Cayman Islands can build on this momentum to foster greater energy savings, reduce emissions, and enhance resilience, positioning itself as a regional leader in sustainable energy transitions.

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## Appendix A: Socioeconomic Segmentation Report – Homeowner Survey Questions

| | |
|---|---|
| 1 | Total Income |
| 2 | Number of income contributors |
| 3 | Number of occupants |
| 4 | House type |
| 5 | House Size |
| 6 | Gender |
| 7 | Age |
| 8 | Assistance from agencies? |
| 9 | Children under the age of 13 |
| 10 | Adults over the age of 75 |
| 11 | Persons with disabilities |
| 12 | Save Energy? |
| 13 | LED Lighting |
| 14 | EE AC |
| 15 | Insulation |
| 16 | Insulation type |
| 17 | Water heater |
| 18 | Solar Panels |
| 19 | Other EE equipment |
| 20 | EE type |
| 21 | Environment impact |
| 22 | CIG programmes |
| 23 | Auto appliances |
| 24 | AC when away |
| 25 | Closed doors |
| 26 | Energy saving habits |
| 27 | Notes |

## Appendix B: Case Study Homeowner Survey Questions

| | |
|---|---|
| 1 | Previously asked, do you believe we need to conserve electricity, to which you answered yes. Do you still agree with that answer? |
| 2 | Before beginning this journey, on a scale of 1-5, how important did you used to think it was to conserve energy? |
| 3 | What reasons did you previously believe we need to conserve electricity? |
| 4 | Now nearing the end of the programme, on a scale of 1-5 how important do you consider it is to conserve electricity? |
| 5 | What reasons do you now believe we need to conserve electricity? |
| 6 | Does your home have LED lighting? |
| 7 | If yes, when was it installed? |
| 8 | Does your home now have efficient air conditioning? |
| 9 | If yes, when was it installed? |
| 10 | Does your home now have roof insulation? |
| 11 | If yes, when was it installed? |
| 12 | Does your home now have PV panels installed? |
| 13 | If yes, when was it installed? |
| 14 | Apart from the a/c units, does your home have any other efficiency equipment? |
| 15 | Before beginning this journey, on a scale of 1-5, did you believe the environment was impacted by your electricity consumption? |
| 16 | Now, on a scale of 1-5 did you believe the environment was impacted by your electricity consumption? |
| 17 | Are you familiar with any other CIG energy efficiency programmes? |
| 18 | Have you automated the turning ON and OFF of any equipment? E.g. lights? |
| 19 | Do you run AC when you are away from home to keep it cool? |
| 20 | Are all your doors and windows closed when you run your AC? |
| 21 | Do you practice any other electricity saving activities? If so, which? |
| 22 | Is there anything which prevents you from undertaking further electricity saving activities? If so, what? |
| 23 | On a scale of 1-5 how have you found it using the monitors, 1 being difficult, 5 being easy? |
| 24 | On a scale of 1-5 have the monitors changed behaviours? |
| 25 | On a scale of 1-5 to what extent have you felt an improvement in the temperature of your home? |
| 26 | Have you seen a difference with your electricity bill? |