A Work Project, presented as part of the requirements for the Master's degree in Impact Entrepreneurship and Innovation at the NOVA School of Business and Economics.

From Awareness to Action:

Empowering Portuguese Households in Tackling Energy Efficiency Challenges with EcoSeal

Solution Design and Product Development

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Abstract

This report documents EcoSeal's entrepreneurial journey in developing a Do-It-Yourself-inspired energy assessment kit to address home energy inefficiencies, impacting approximately 80% of Portuguese homes. By leveraging the Lean Startup methodology, a solution was developed, refined, and validated to empower families to increase their home's energy efficiency through accessible tools and practical guidance. EcoSeal discovered that a Do-It-Yourself inspired approach resonates with Portugal's culture of self-reliance and has the potential to lead households from awareness to action. EcoSeal connected with organizations and affected populations to inform kit development, usability, and impact. The results are presented in this work project report.

Keywords: Energy Poverty, Energy Efficiency, Affordable Energy Solutions, Business Model Validation, Impact Entrepreneurship

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1. Introduction

1.1 Background & Context

In the historic district of Alfama, Lisbon, Rui and his family live in a chilly apartment, struggling to keep warm despite the sunny December days. Relying on a single electric heater in the living room, they bundle up in layers, avoiding extra heating costs they cannot afford. For daily comfort, they rely on wearing extra socks and simmering soup. Though Rui may not know the term "Energy Poverty," his family feels its effects firsthand, sharing the same challenges as approximately two million other households in Portugal, struggling to balance comfort and energy expenses (*Directive (EU) 2023/1791 on Energy Efficiency* 2024).

The Portuguese Long-Term Strategy for Combating Energy Poverty underscores the national severity of the issue (*Resolução Do Conselho de Ministros n.º 11/2024, de 8 de Janeiro* 2024). While the challenge is not unique to Portugal, the country faces a unique set of circumstances that position it as having one of the highest levels of energy poverty in the EU, ranking in fourth place (*Directive (EU) 2023/1791 on Energy Efficiency* 2024). Energy poverty, as defined in the EU Energy Efficiency Directive, refers to a household's lack of access to essential energy services that ensure basic levels and decent standards of living and health. These services include adequate heating, hot water, cooling, lighting, and energy to power appliances. In Portugal, it affects approximately 20-30% (1.3-3 million) of the population, with varying levels of severity (*Resolução Do Conselho de Ministros n.º 11/2024, de 8 de Janeiro* 2024).

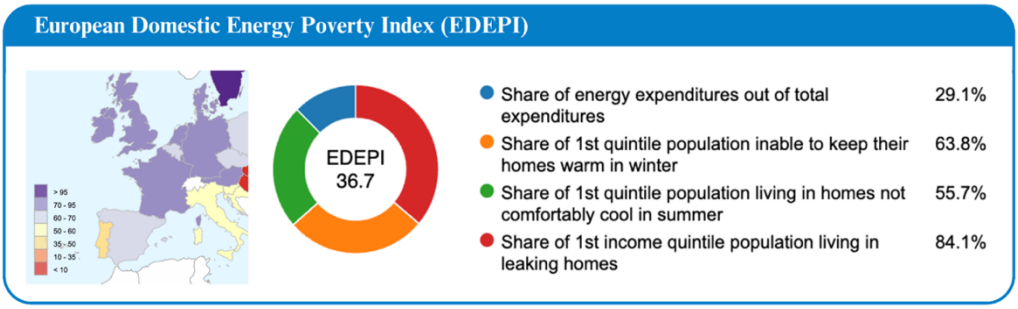


Figure 1: European Domestic Energy Poverty Index by OpenExp (2022)

Energy poverty arises from a combination of factors, including non-affordability, insufficient disposable income, high energy expenditure, and poor energy efficiency of homes (*Directive (EU) 2023/1791 on Energy Efficiency* 2024). It is further intensified by reliance on outdated energy systems, persistent cultural perceptions, and behavioral practices (Horta and Schmidt 2024). Particularly, the poor energy performance of the residential housing sector is slowing down national efforts. In fact, two out of three homes in Portugal are classified as C or lower in energy efficiency, lacking proper insulation and requiring expensive renovations that households can rarely afford (Figure 2; ADENE 2023). High energy prices strain households' budgets even more, promoting inefficient practices like reliance on portable heaters and outdated appliances. In addition to a nationwide normalization of discomfort and perception of heating as a luxury, a self-reinforcing cycle emerges. Energy-inefficient infrastructure and systems drive consumption and costs, which reduce disposable incomes needed to invest in meaningful energy-efficient upgrades (*DIRECTIVE (EU) 2018/844 on the Energy Performance of Buildings* 2018). The consequences include adverse effects on economic stability, physical and mental health, social well-being, and equality, impacting not only individuals but entire communities across the country (Feitosa and Mesquita 2023).

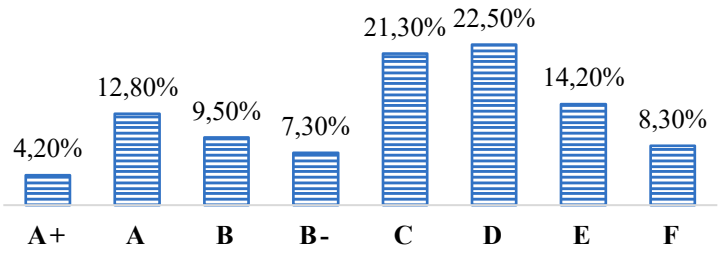


Figure 2: Energy Performance for The Residential Sector - Classes of Energy Certificates Issued up to 2022 (ADENE)

There are several opportunities for intervention: (1) *implementing consumer protection measures*, (2) *supporting household incomes*, and (3) *reducing energy needs through increased efficiency and lower consumption*. The latter focuses on structural changes and behavioral adaptations, which aligns with this project's mission.

Despite recent energy efficiency investments through public programs like More Sustainable Buildings and Energy Efficiency Voucher initiatives derived from the Recovery and Resilience Program, families like Rui's still shiver in cold apartments. Studies have shown that existing aid programs and energy service providers are particularly challenged in engaging vulnerable groups, including renters, low-income households, families, and the elderly (Gouveia et al. 2024). Even though these are groups disproportionally affected by energy-related challenges, they tend to adopt energy-efficient upgrades at significantly lower levels (Das, Richman, and Brown 2018; Klöckner and Nayum 2016).

Systemic challenges slow down the rollout of energy efficiency upgrades due to bureaucratic hurdles, lengthy processes, and the overwhelmingly large building stock requiring intervention. At the same time, these groups' specific needs and circumstances are not adequately addressed. Renters and inhabitants of historic buildings are often limited in their ability to make structural improvements in their homes, and many households generally cannot afford the high upfront costs associated with these interventions. Additionally, many households lack sufficient awareness of energy-saving practices and available solutions and face psychological barriers such as resistance to change or normalization of poor living conditions. For many of these households, the complex bureaucratic processes, financing mechanisms, and overwhelming volume of information are difficult to navigate and add a thick layer of resistance.

In summary, energy poverty disproportionately affects low-income households, renters, families, and the elderly due to a mix of low incomes, inefficient housing, high prices, and psychographic attitudes. Despite some governmental and private efforts, vulnerable groups remain hard to reach and are not adopting energy-efficient practices (Sequeira, Gouveia, and Melo 2024).

1.2 Project Overview & Goals

EcoSeal recognizes a pressing gap between existing energy efficiency initiatives and their ability to engage underserved households in a way that appeals to them, leading to low adoption rates. EcoSeal was created to bridge this gap and to encourage these groups to adopt energy-efficient practices and solutions. The primary objectives are to identify and validate a viable business model that contributes to alleviating energy poverty in Portugal and improving the energy efficiency of Portuguese homes while setting up EcoSeal for real-world success beyond this project's scope.

EcoSeal's journey began in October 2023 as part of the Impact Entrepreneurship and Innovation Master's program at Nova SBE. Initially, EcoSeal proposed the idea of **non-invasive, lower-cost** retrofits for households, targeting renters who are either unable or unwilling to make structural changes or commit to significant financial investments. With initial validations showing the potential value of non-invasive measures to improve energy efficiency, the approach was pivoted and refined during this work project, ultimately leading to the development of the DIY Energy Assessment Kit.

1.3 About this Report

This report documents EcoSeal's journey, outlining the process from validating the problem to developing a final product and business model aimed at addressing energy efficiency challenges in Portuguese homes. The following sections outline EcoSeal's iterative development process across three validation cycles. The methodology chapter provides an overview of the approach used. Finally, the report contains four individual contribution chapters that cover various aspects, including problem validation, customer discovery, solution design, operational strategies, financial analysis, and impact assessment. Each section presents key findings and activities that collectively shaped EcoSeal's entrepreneurial journey.

2. Methodology

EcoSeal's approach, guided by the Lean Startup methodology, combines entrepreneurship with academic rigor to empirically validate key business model assumptions (Eisenmann, Ries, and Sarah Dillard 2011). EcoSeal focused on validating and refining the overarching concept of non-invasive energy efficiency interventions, grounding them in customer insights to develop solution approaches tailored to specific user segments. A combination of data collection methods was employed, guided by entrepreneurial frameworks to iteratively refine the solution.

2.1 Entrepreneurial Methods

EcoSeal adapted the iterative Build-Measure-Learn approach from the Lean Startup Method (Ries 2011). Each development cycle included the following stages: Plan, Build, Measure, and Learn (Figure 3). As a basis, EcoSeal used the Customer Discovery and Validation principles to develop a customer-centric solution design at each stage (Cespedes, Eisenmann, and Blank 2012). The process was documented on a validation board with Miro, where hypotheses, experiment cards and insights were organized across iterations. The team conducted design thinking workshops between cycles inspired by IDEO's human-centered design thinking approach and Alex Osterwalder's "Testing Business Ideas" to identify and reframe unmet problems and prioritize potential solutions or refinements ("Design Kit: The Human-Centered Design Toolkit," n.d.; Bland and Osterwalder 2019).

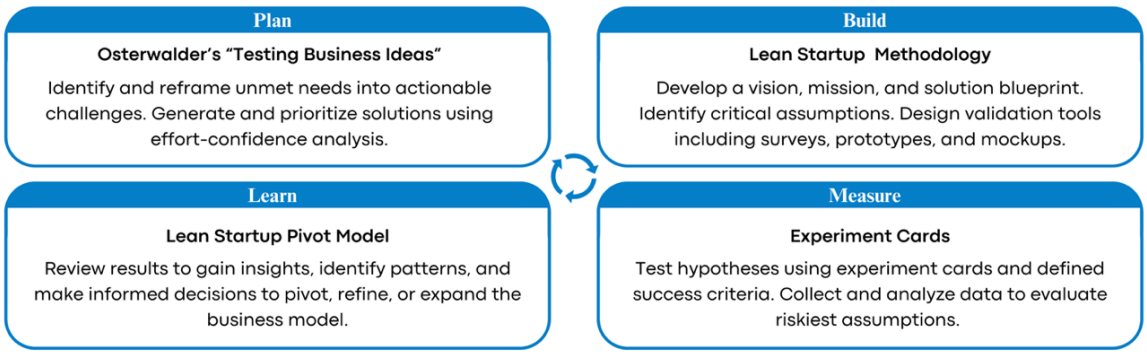


Figure 3: Plan-Build-Measure-Learn Cycle

2.2 Data Collection

EcoSeal employed various primary research methods to inform its solution development, broadly outlined in Table 1. Overall, the team engaged with various stakeholders to gather different perspectives and feedback. That included several Portuguese energy efficiency experts, with visits to Nova FCT to collaborate on the technical aspects of the solution. EcoSeal also connected with various industry players worldwide, such as the Energy Agency Codema in Dublin, which shared valuable experiences and best practices. Beyond this, the team took a hands-on approach by engaging directly with households on the street, attending workshops at the Haddad Entrepreneurship Institute, and meeting impact investors at Web Summit.

Additionally, the team held bi-weekly meetings with advisors and Galp representatives, who continuously provided insights into the proposed solutions' practical and technical aspects. Overall, the process has been marked by continuous stakeholder engagement and feedback collection. Secondary research complemented these efforts throughout the whole process. The respective research methods and collaborative inputs will be discussed in more detail in Chapter 3 and the individual sections where they were applied.

Table 1: Primary Data Collection Methods

Data Collection Method	Sample Size	Objectives
Household Surveys	2 Surveys, n = 50	Household energy challenges, preferences, and barriers to adoption
Household Interviews	n = 10	In-depth understanding of user behavior, needs, attitudes, and interest
Institutional Interviews	n = 4	Assess potential for partnerships and gauge institutional interest in supporting solutions
Expert Interviews	n = 6+	Validate solution feasibility and gain technical insights from industry professionals
Pilot Tests	1/2 carried out	Test product usability, effectiveness and gather actionable feedback
Facebook Ad Campaign	415	Evaluate market interest and engagement through digital outreach

3. EcoSeal's Entrepreneurial Journey

EcoSeal's entrepreneurial journey is characterized by three development cycles drawing closer to a solution that addresses home's low energy performance while creating alignment with household needs and preferences. This chapter will demonstrate EcoSeal's iterative development process through the three cycles. It will highlight how the team refined its approach and showcase the methodologies, insights, and learnings that guided this evolution.

Cycle 1 began with the idea of non-invasive retrofitting services, removing the need for costly, disruptive renovations. In Cycle 2, EcoSeal pivoted to a DIY Energy Saving Kit to provide households with a ready-to-assemble set of products to implement independently. Cycle 3 introduced the DIY Energy Assessment Kit to empower households to assess their energy consumption, understand savings potential, and receive actionable guidance.

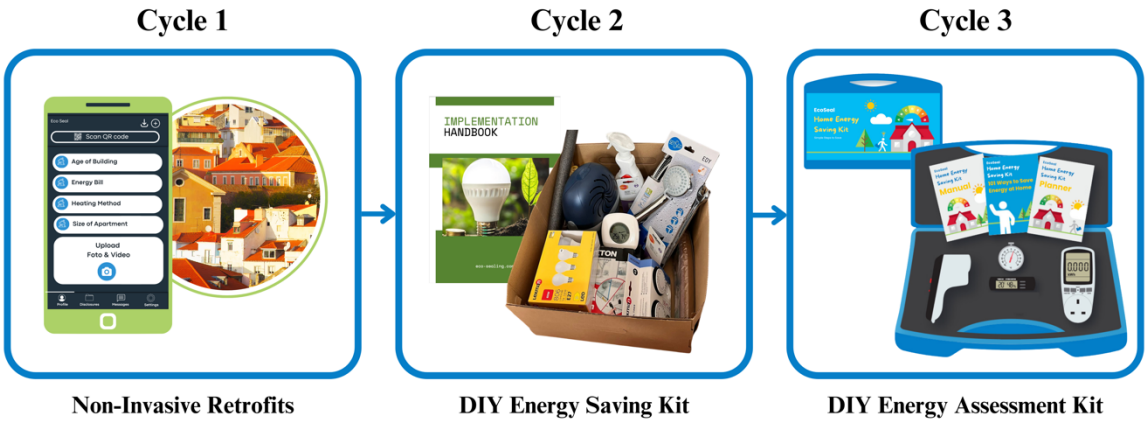


Figure 4: EcoSeal's Development Cycles

3.1 Validation Cycle 1: Non-Invasive Retrofits

3.1.1 Build

Cycle 1 began with the idea of providing non-invasive energy retrofits based on previous research on energy poverty, industry landscape, and existing energy-efficiency interventions. The solution focused on maximizing energy efficiency through non-invasive interventions, such as sealing air leaks or installing smart upgrades like thermal wallpapers and power strips. At the start of the work project, the team had already designed a preliminary solution and partnered with Galp. At the start of the work project, the team revisited critical assumptions of this model to externally validate them.

EcoSeal proposed establishing an energy service company focused on providing cost-effective, non-invasive energy-saving measures targeted for renters who cannot make structural changes to their homes and lower-income households who were assumed to prefer lower-cost options to reduce their energy use. The approach combined remote energy assessments, a customizable "intervention menu," and the provision of alternative financing options to deliver increased thermal comfort and energy savings at a lower cost and without costly, disruptive interventions. An intervention "menu" was created to provide customization at scale, tailored to urban historical apartments due to their low energy efficiency, restrictions on structural modifications, and similar energy-related problem areas.

Figure 5: Remote Energy Assessment and Non-Invasive Retrofit Packages

3.1.2 Measure

The most critical assumptions regarding this business model concerned the solution's effectiveness in lowering energy bills and increasing thermal comfort, household interest, and operational feasibility (Table 2).

Table 2: Critical Hypotheses for Cycle 1

Problem & Customer Hypotheses	
H1: At least 60% of surveyed households cite high upfront cost as the primary barrier	✓
H2: At least 50% of surveyed renters cite structural limitations as a barrier	✓
H3: At least 30% of approached households are willing to engage with the solution	x
Solution Hypotheses	
H4: At least 60% of experts agree that proposed measures will reduce energy costs	✓
H5: A pilot test reduces energy consumption by at least 10% with an investment of €1000	-
H6: Viable interventions can be offered at a price between €1000-€2000	x

EcoSeal validated that a combination of non-invasive measures has the potential to reduce energy consumption, particularly in older buildings. A panel of six energy intervention experts from Galp and Dr. João Pedro Gouveia (Work Project supervisor) confirmed the potential impact of the proposed measures, given the right conditions. The customizable intervention "menus" showed great potential with high commonalities found across similar building types in Portugal, particularly for urban historical buildings (Gouveia et al. 2021; Gregório and Seixas 2017) and multi-unit buildings.

Through a survey, EcoSeal also confirmed financial and structural constraints as relevant adoption barriers for many households, particularly renters and low-income groups (survey results discussed in Chapter 5). However, there were severe difficulties in engaging the intended audience. Despite distributing 200 flyers (Appendix H) outlining the proposed solution in low-income neighborhoods to promote the service for free to a selected pilot participant, the initiative resulted in zero sign-ups or engagement. The impact report of Ponto de Transição shared similar experiences, where vulnerable households hesitated to adopt solutions even

when offered for free (Gouveia et al. 2024), indicating other barriers at play. Later expert consultations revealed high skepticism and low prioritization as potential causes.

Lastly, a unit economic analysis investigated the potential profitability and possible pricing structure (Appendix A). The analysis revealed high startup and operational expenses attributed to the high cost of skilled labor and development or outsourcing of the remote energy assessment. While the energy interventions were found to be effective at an affordable cost, the organizational expenses would escalate without enough scale. This would limit EcoSeal's value proposition of affordable energy efficiency solutions.

3.1.3 Learn

While the potential and appeal of non-invasive interventions were confirmed, several factors challenged the feasibility of the business model. EcoSeal needed to address high transaction costs and operational expenses to reduce the price, given the highly cost-sensitive audience. Also, further psychographic barriers to adoption had to be investigated and addressed to increase engagement. EcoSeal specifically assumed high skepticism towards private service providers, hindering interest.

In an internal workshop, EcoSeal collected the main problems (e.g., high energy bills, low willingness to pay, low trust, structural limitations), reframed them into challenges, and brainstormed possible solutions. Using a matrix to rank the solution ideas, EcoSeal identified the next best solution with the highest confidence to change desired consumer behavior and the lowest effort to launch an experiment around the idea (Appendix L). The DIY Energy Saving Kit emerged, designed to offer households a user-friendly solution to improve energy efficiency through simple, self-installable measures. The kit was chosen because it focuses on simple, non-invasive measures, lowers costs by removing labor, and lets households implement changes on their own terms to increase trust.

3.2 Validation Cycle 2: DIY Energy Saving Kit

3.2.1 Build

With the decision to shift towards a DIY-inspired approach, EcoSeal built a solution to empower households to take control of their energy consumption by implementing small yet impactful changes to improve living conditions and potentially lower utility costs without professional help. Some studies emphasized that simpler energy efficiency measures are more likely to be adopted, especially when they can be implemented without professional help (Azizi, Nair, and Olofsson 2020). EcoSeal explored this approach in Cycle 2.

Figure 6: DIY Energy Saving Kit

DIY Energy Saving Kit (Prototype in Figure 6) was designed to provide households with an all-in-one solution to address common energy efficiency concerns. A second survey assessed common building challenges, which provided the foundation for the products included in the kit. The final kit included LED light bulbs, insulating window film, draft stoppers, water-saving showerhead and faucets, pipe insulation, window sealant, a moisture absorber, mechanical timers, and an anti-mold kit. Additionally, it included a Kill-A-Watt meter and tools needed for installation. Furthermore, a user-friendly instruction handbook was created to guide households in the implementation process. The development of the kit is discussed in detail in Chapter 6.

The kit was designed to deliver quick and achievable wins while motivating households to take charge of their energy consumption and home comfort. By reducing barriers such as cost, the need for extensive research, and multiple store trips, the kit is intended to make energy-saving accessible, simple, convenient, and self-driven.

3.2.2 Measure

The second validation cycle focused on understanding secondary adoption barriers, confirming resonance with self-installations, and validating the kit's effectiveness in lowering energy consumption and improving indoor comfort. The refined hypotheses focused on household resonance, kit usability, and effectiveness (Table 3).

Table 3: Critical Hypotheses for Cycle 2

Problem & Customer Hypotheses	
H1: 60% of respondents feel capable of making self-installations	✓
H2: At least 40% of respondents value self-driven improvements	✓
Solution Hypotheses	
H3: The DIY kit effectively reduces perceived energy consumption by the test user	X
H4: The DIY Kit improves perceived household comfort by the test user	✓
H4: Users can successfully install and use the kit without professional assistance.	✓
H5: At least 70% of the measures included in the kit will be implemented by the test user	X

To test these assumptions, the second survey (discussed in Chapter 5) focused on understanding user preferences and resonance with self-installations. A competitor analysis was also conducted to compare different DIY Kits to validate the solution's effectiveness (Chapter 6). After validating the kit contents, EcoSeal created a prototype and conducted its first pilot with a test user.

The DIY kit resonated strongly in both the survey and household interviews, with key drivers such as affordability, ease of use, tangible results, and suitability for renters frequently mentioned. Portuguese respondents emphasized the importance of affordability and the ability to make changes without professional assistance. These findings underscored an important insight: households are willing to make improvements independently and value self-driven solutions when given proper guidance. During the pilot participant search, interest also increased significantly. A detailed analysis of the survey insights can be found in Chapter 5.

During the pilot test, the focus was on assessing the ease of use and adaptability of the DIY energy-saving kit across different housing types. A prototype was developed and tested by a Portuguese couple of young professionals (full report in Chapter 6). After hearing about the pilot test, they expressed interest after noticing their energy bill was higher than usual. Although time constraints prevented measuring actual reductions in energy use, initial observations and perceived improvements could be documented. The test user reported a positive experience with the self-installation but highlighted a need for more customization to their specific home. Prof. João Joanaz de Melo, an environmental engineer specializing in energy efficiency (NOVA FCT), and Prof. João Pedro Gouveia, the work project supervisor and an expert on the topic of energy poverty and buildings energy efficiency, raised similar concerns. Furthermore, they raised potential issues with specific measures, such as window film and draft insulation, which could negatively affect indoor air quality.

3.2.3 Learn

The journey up to this moment has shown that EcoSeal was moving in the right direction. Initial household feedback resonated well with the DIY approach, and autonomy and self-determination emerged as significant value creators. However, respondents and interviewees continued to underline trust as a major driver in their purchase decisions. Representatives from Codema and Okotoks (Appendix E: Interview 3, 4) suggested local institutions as distribution channels in response. Furthermore, the conducted household and expert interviews (Appendix E: Interview 1, 2) uncovered another major hurdle to adoption: low problem recognition in terms of home energy challenges and savings potential of energy-efficient solutions.

Although the kit's appeal was validated, the preliminary findings suggest the need for further refinement to enhance its impact on energy bills and comfort across various housing settings and socio-economic conditions. Given that users expressed a willingness to pay for immediate

improvements in comfort or cost savings, refining the solution would be essential to uphold and strengthen its value proposition. The interview with Afonso Mendes (NOVA FCT), a student who conducted his own home energy assessment and improvement as part of Prof. Melo's class, offered valuable insights that would motivate EcoSeal's next pivot. Based on a self-performed energy audit, Afonso reduced his home energy bills by 30%, mainly by replacing old appliances and installing some similar measures as proposed by the kit.

At the end of Cycle 2, EcoSeal conducted another ideation workshop (Appendix M). EcoSeal investigated challenges related to scaling the kit across diverse housing types, intriguing households to try it, effectively communicating savings potential to raise motivation, building trust, and achieving more significant energy bill reductions. This workshop has inspired the development of the DIY Energy Assessment Kit through a lending-based system. The refined kit would help users identify inefficiencies and savings potential in their homes and guide them in making simple and immediate improvements.

This approach could address several outlined challenges: it builds trust by leveraging community institutions, lowers costs by having institutions buy and lend out kits for free, and provides meaningful, self-directed guidance on lowering energy consumption regardless of housing type.

In parallel, the Portuguese government announced the launch of the e-lar program in 2025, aligning well with EcoSeal's proposed DIY Energy Assessment Kit. The program plans to subsidize appliance upgrades to improve household energy efficiency. By combining the kit with the e-lar subsidies, households could identify and replace inefficient appliances, thereby achieving meaningful energy savings.

3.3 Validation Cycle 3: DIY Energy Assessment Kit

3.3.1 Build

EcoSeal's DIY Energy Assessment Kit provides households with a user-friendly set of tools and instructions to analyze their energy use, identify inefficiencies, discover savings potential, and take actionable steps to reduce consumption on their own terms. The development of the kit is outlined in Chapter 6.

Figure 7: EcoSeal's DIY Energy Assessment Kit

It includes devices like energy meters to measure appliance usage, guidance to interpret findings, and recommendations for targeted improvements based on the measurements. The kit is designed for distribution through local institutions, such as community centers or libraries, where it can be rented for free. Figure 8 depicts this journey from institutions to households.

Figure 8 DIY Energy Assessment Kit - Lifecycle Journey

3.3.2 Measure

To measure interest and engagement with the DIY Energy Assessment Kit, the team conducted validation interviews with entities offering a similar solution in other geographies[1] (Appendix E: Interviews 3, 4) and created a Facebook Ad Campaign (Appendix D). The campaign tested different messaging, click-through rates and led users to the landing page (www.eco-sealing.com), where they could sign up for a waiting list. To gauge institutional interest, several institutions were contacted and presented with the kit solution (Appendix B).

On the technical side, EcoSeal must validate whether households can easily operate the kit to identify energy inefficiencies and whether it provides actionable solutions that lower energy consumption. Part of that value proposition includes whether the kit drives meaningful behavioral changes by empowering users to act after use. The main hypotheses are in Table 4.

Table 4: Critical Hypotheses for Cycle 3

Problem & Customer Hypotheses
H1: Users feel capable of conducting an energy assessment when tools and guidance provided H2: Households are willing to learn and engage with a tool that provides insights H3: Institutions are interested to buy the kit to help their communities
Solution Hypotheses
H4: Users can easily understand and operate the kit without professional assistance H5: The kit can identify energy inefficiencies & give recommendations that result in energy savings H6: The kit is adaptable to different housing types and can deliver consistent results H7: Users will take meaningful action based on the insights provided by the kit

Initial validations have indicated interest in the kit, especially from an older demographic, who responded positively to messaging emphasizing cost savings, comfort, and availability in local community centers (complete analysis in Chapter 5). The presentations to institutions also yielded positive interest, with recommendations to improve kit branding and impact

[1] The team did not find any similar solution in Portugal. Interviews for validation and feedback with entities from Dublin, Ireland (Codema) and Okotoks, Canada (Okotoks Municipality) were conducted (Appendix E)

demonstration. EcoSeal will conduct a second pilot test to validate its real impact at a suitable partner institution and measure real-world demand, kit usability, and effectiveness.

3.3.3 Learn

The **validation process** for the DIY Energy Assessment Kit is still **ongoing**. However, some important insights that will inform further product refinements, marketing strategies, and operational processes have already been uncovered.

In the Facebook Ad campaign, older populations emerged as a likely customer segment, responding positively to the ads. The target demographic remains highly cost-sensitive, favoring affordable, self-directed, simple solutions. In future refinements, the kit design must prioritize simplicity, including an analog format with clear step-by-step instructions and visual aids. Marketing materials will emphasize the free rental model and highlight cost savings and comfort with a special focus on the wintertime when problem recognition is high. Furthermore, based on institutional feedback, the kit will be rebranded with a Portuguese name and redesigned to highlight its simplicity.

To better engage institutions, EcoSeal will conduct a pilot test to measure and quantify the kit's impact on energy savings, comfort levels, and behavioral changes. Furthermore, the operational processes for kit rental and distribution will be streamlined to minimize the effort for institutions. Once a prototype is ready, EcoSeal plans to conduct the pilot test with a local municipality to create a proof of concept and collect more feedback for further refinements.

EcoSeal plans to explore follow-up interventions to promote energy-saving measures with immediate results. This may include recommending products via affiliate links, offering booster boxes with supplementary tools, or a pick-up service at partner institutions where users can choose items like weather stripping or smart plugs based on their needs after returning the kit.

3.4 Business Model

Building on the entrepreneurial journey and development of the DIY Energy Assessment Kit, this chapter outlines EcoSeal's strategic business model under consideration. A non-exhaustive analysis of two distinct business models was developed, considering the following options: **Option A**, a one-time purchase model, and **Option B**, a subscription-based service. The decision between these models hinges on balancing customer affordability, market adoption rates, and EcoSeal's ability to sustain operational growth.

Option A presents a more simplistic solution, with a single fee and no additional costs or administrative complexities. This allows EcoSeal to generate revenue faster to cover the operational costs, making it suitable for early-stage scaling. However, it relies heavily on strong initial sales, which may be more challenging due to the higher up-front investment. It also reduces customer engagement and lacks a continuous revenue stream.

Alternatively, **Option B** introduces a subscription-based model, with a recurring monthly or yearly fee to get access to the kit and ongoing services, such as follow-up with users and informative content. This model provides continuous revenue and could be used to ensure long-term operational sustainability. It also requires lower up-front costs from the institutional partners, which could increase sales.

A social business model canvas (Appendix C) was developed, outlining the social value proposition, the key activities, resources, stakeholders, main channels, partnerships, revenue streams, and the cost structure of EcoSeal. This canvas reflects the strategic framework of EcoSeal and underlines its social purpose and vision.

A stakeholder map was created to identify the **key partners**, and an outreach strategy was conducted. Interviews with several of these provided an outline of the central partnerships for

EcoSeal. Among these are local governments, which are critical partners, ensuring the kits are distributed in the communities. The city councilman of Cascais Municipality, Dr. Nuno Lopes, was contacted, but unfortunately, the team could not get in touch with him. As another partnership to reach the end users, NGOs with the social purpose of promoting energy efficiency were also contacted. An interview with Islena Facanha from ZERO NGO was conducted (Appendix E: Interview 8). Partnerships with energy companies were also considered crucial, and EcoSeal's contact with Galp has led to close collaboration. Finally, visits to retail suppliers of the kit components and consultations with a manager at Leroy Merlin retail store were another step towards aligning all key partners for EcoSeal's business model.

The **main activities** for EcoSeal's business model are sourcing and assembling the kit components, including tools, promotional content, and a guidebook; developing and maintaining a digital platform; establishing and managing partnerships; conducting follow-up consultations with kit users; and measuring its impact. Additionally, marketing or fundraising campaigns are also relevant.

The **key resources** to conduct the previously outlined activities are an inventory of tools for the kits, a team of human resources to manage operations, storage infrastructure, and promotional and support materials, such as flyers, guidebooks, videos, and photography.

The **customer segments** being considered are institutions with community involvement, such as libraries, universities and schools, health centers, NGOs, and companies. Additionally, customers to be addressed at a later stage (see more in Chapter 8.5 "Exploring Additional Impact Avenues") are landlords, property managers, and small and medium enterprises looking to reduce their energy costs and comply with regulations. The initial approach is, however, to sell the kits to institutions with a social purpose and community proximity, which would

provide them for free to citizens and users. The kit would also be available for purchase through EcoSeal's website[2].

This is why it is considered crucial to develop strong **customer relationships** by delivering a kit that addresses a pressing issue and gives these institutions the opportunity to become leaders in social impact among their communities.

Nowadays, a digital platform is fundamental for distribution and communication **channels**, but EcoSeal's community-centered approach means that a lot of outreach has to be done through external and partnered entities that are already trusted by the target audience. Nonetheless, alternative channels have also been considered, such as ads on media outlets.

The **cost structure** of EcoSeal has been drawn out, and the main capital expenditures in startup costs are the development and optimization of the kits and the setup of a strong brand and communication strategy to attract users and customers. Once partnerships are established and the product has demonstrated positive results, the main expenses will primarily be related to human resources. These costs include managing sales and operations, conducting follow-up analysis, and exploring additional revenue streams or scaling opportunities, like consultations.

Finally, the **revenue streams** are sales of the kits to local partnered institutions and companies through their CSR initiatives and sales to a widespread audience through digital platforms. Moreover, governmental grants, subsidies, and donations, described in detail in Chapter 8, will make up the rest of the revenue for EcoSeal's initial stage.

[2] www.eco-sealing.com

3.5 The Creation of the EcoSeal Brand

EcoSeal was designed to be more than just a product. It was developed to be a reliable partner in helping households achieve energy efficiency. The brand identity emphasizes simplicity, accessibility, and empowerment, ensuring it resonates with households from all backgrounds. Every element of the EcoSeal brand was chosen to lower barriers, encourage engagement, and make energy-saving a positive experience.

EcoSeal's visual identity plays an essential role in communicating its mission. The color palette of green and blue was selected for its symbolism: **green** represents sustainability and environmental consciousness, while **blue** represents trust, reliability, and calmness. Together, these colors create a playful but professional tone that makes energy-saving approachable. Even the kit's design was inspired by a toy toolbox, emphasizing simplicity and fun and ensuring users feel encouraged rather than intimidated.

Figure 9: EcoSeal Color Palette & Logo

Messaging and communication were equally important. EcoSeal speaks with a friendly, supportive, and clear tone. The goal is to provide users with straightforward guidance that empowers them to take actionable steps without feeling overwhelmed. Every interaction — whether through the instruction handbook, website, or community partnerships — reinforces the message that energy efficiency can be simple, effective, and enjoyable. To increase engagement, EcoSeal used the concept of gamification (Xi and Hamari 2020). By making the kit and its tools feel like a challenge rather than a chore, users are more likely to engage in and

complete energy-saving activities. This approach also aligns with the brand's focus on accessibility and ensures that even less tech-savvy users feel empowered to act.

The EcoSeal brand is more than just a visual identity - it is a commitment to helping individuals and communities use energy sustainably. Through its thoughtful design, easy-to-understand messaging, and practical tools, EcoSeal aims to build trust and inspire action to make the journey to energy efficiency as simple and rewarding as possible.

3.6 Reflection & Milestones

EcoSeal's journey has been marked by important milestones and collaborations that paved its way. Partnering with Galp provided unique opportunities to engage with energy experts and receive consistent feedback. Despite an initially planned internship falling through, the EcoSeal team made valuable experiences strengthening their resilience and adaptability. Securing João Pedro Gouveia, a renowned energy efficiency expert, as our thesis supervisor was a major win for EcoSeal, providing critical insights into the Portuguese energy landscape. The timeline in Figure 10 illustrates some of EcoSeal's most notable milestones. Despite only arriving at a viable solution in late November, the team demonstrated the value of the Lean Startup Method by reducing time and resources wasted while ensuring the creation of an effective and achievable solution.

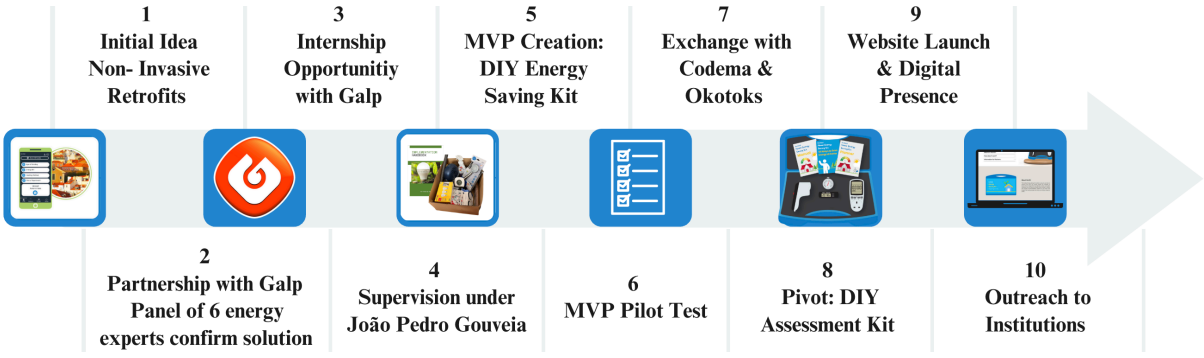


Figure 10: A chronological overview of EcoSeal's milestones

4. Solution Design & Product Development

[Paula Reimold, 58805]

4.1. Introduction & Relevance

Building on the insights from the Problem Validation and Customer Discovery activities, this chapter outlines the development and refinement of EcoSeal's solution and final product. Two main objectives and priorities marked this process. Initially, it aimed to address the validated customer pain points, preferences, and adoption barriers to create a user-centric solution. Secondly, the process ensured the solution’s technical effectiveness in improving energy efficiency and indoor thermal comfort. Furthermore, Eco Seal aimed to increase scalability by improving effectiveness across different user contexts and needs.

Following the iterative approach laid out by the Lean Startup Method, the solution evolved through multiple stages of prototyping and testing. This ensured a continuous improvement in problem-solution fit and solution efficiency. Through iterative refinements, a product was developed that balances simplicity and functionality.

4.2 Methodology

The methodology behind the kit developments combined primary and secondary research methods. The solution design started with Design Thinking ideation workshops, outlining an initial solution proposition. Given the technical nature of energy efficiency interventions, the planning process required developing a more detailed solution from a technical perspective, which was heavily informed by existing research and expert consultations. In the second step, the solution concepts were validated to ensure their effectiveness in reducing energy bills and alignment with the outlined customer needs. Secondary research included a review of existing literature, case studies, and best practices in energy efficiency solutions on the market.

4.3 Market Analysis

Following the pivot in Cycle 2, EcoSeal shifted towards a DIY Kit approach. Various organizations that are already distributing DIY kits were reviewed and analyzed to assess their merit and inform the development of EcoSeal's kit.

Existing DIY kits were found in several shapes and forms, both from public and private providers. This idea has gained some traction, especially in the United States and Canada. Several kits and models were compared, considering their strengths and weaknesses (see Appendix F). Some notable initiatives were the Tri-County Regional Energy Network, California in the United States, the Codema Home Energy Audit Kit in Ireland, the Okotoks DIY Energy Kit Program in Canada, and HomeBoost in the United Kingdom.

The kit from the Tri-County Energy Network is being distributed through libraries and includes tools like light bulbs and weatherstripping. While the kit was highly accessible to vulnerable groups, problems with replenishments and refilling were highlighted (3C-REN, n.d.). Codema's kit, on the other hand, did not include quick fixes but included tools for conducting energy assessments with supporting training videos and workbooks (Codema, n.d.). Therefore, the kit is operationally less complex and is being distributed through a lending system in public libraries all over Ireland. With a price point of €570, the kit is sold as a one-time purchase to institutions but requires additional steps from households to reduce their energy savings. The Okotoks DIY Energy Kit Program in Canada takes a hybrid approach combining measurement tools with post-assessment quick fixes, available for pickup at local institutions. It includes an energy meter, an infrared camera, and further measurement tools. The kit and products are provided for free, but only for residents of Okotoks ("Do-It-Yourself Home Energy Audit Kit Program | The Town of Okotoks," n.d.). Lastly, HomeBoost provides a home improvement kit for £99 (€119), including advanced tools and app-guided assessments. Users receive a detailed report with tailored recommendations after the assessment ("HomeBoost | DIY Home Energy

Assessment," n.d.-b). Despite the innovative digital guidance and comprehensive reports, it has a relatively high cost compared to community-based programs, making the offering less accessible.

Overall, there are several unique approaches to DIY energy kits. Some kits emphasize initial assessments to educate users, while others provide immediate relief. Furthermore, the pricing varies among the different kits depending on quality, desired impact, and operational model. Especially many community-based models were discovered, where intermediary institutions or governments address households directly. In many cases, institutions such as libraries, are the customers who buy the kit, acting in the community's interest. These community-based lending models not only increase accessibility but also promote a sense of shared responsibility.

Based on the market analysis, there are several opportunities for differentiation, leveraging the strengths of different initiatives. While many existing DIY kits focus on either assessments or quick fixes, a lack of user support during implementation can lead to frustration and incomplete adoption of energy-saving measures. By integrating a digital feedback system, EcoSeal can provide tailored guidance, ensuring users successfully implement improvements and achieve measurable results. The team saw an opportunity for a DIY kit that is specifically tailored to Portuguese homes, which often face similar challenges in poor insulation, humidity, drafts, and use of inefficient appliances. Many existing DIY kits only contain a small number of products that are unlikely to make a significant impact. This could call for a more practical, targeted, and comprehensive kit. On the other hand, the assessment-focused kits have other benefits, like lower logistical complexities and higher accessibility, but require stronger follow-ups to track and prompt the adoption of energy-efficient improvements. Additionally, customization has shown that customized kits have a higher potential for an immediate impact on energy consumption and user comfort, as well as increased logistical efforts and the cost of the kit. Kits

like HomeBoost show that considering specific information like budget or residential characteristics could pave the way for self-driven customizable guidance.

4.4 Solution Design - Cycle 2

4.4.1 Building the DIY Energy Saving Kit

Following the pivot in Cycle 2, EcoSeal's new concept outlined a DIY Energy Saving Kit, including non-invasive measures for immediate and independent relief. The planning process for the Cycle 2 kit required an independent installation by the user and provided immediate relief. The kit required a detailed handbook explaining each measure's implementation steps and potential impact for easy installation. Based on secondary research, expert consultations, and prototype development, a kit was built to address household needs for simple, low-cost, and non-invasive interventions while impacting energy savings and indoor comfort.

Following the Lean Startup principle, the first Minimum Viable Product was built, including the minimum set of features to quickly validate its merit, gather user feedback, and further optimize the product. For the initial MVP testing round, the Piecemeal MVP approach was chosen. This approach follows the combination of existing tools to create a product without designing or manufacturing anything yet (Göcke and Weninger 2021). Therefore, the strategy was to minimize sourcing efforts and costs and conduct a pilot project in a Portuguese home. Testing the kit in a real-life scenario had the objective of assessing usability, time requirements, and impact on energy bills and indoor comfort.

The technical product specifications were driven by secondary research on residential energy challenges conducted in the previous cycle, new insights collected by Survey 2, and consultations with experts. The inclusion of a mold kit, for instance, was motivated by the overwhelming reports on humidity issues reported by the survey respondents. Ultimately, a set

of measures was chosen to provide immediate relief for commonly cited residential issues, which were categorized into the following categories: humidity and temperature, electricity use, and water consumption (Table 12). Based on preliminary insights from household interviews and both surveys, the design focused on simplicity, ease of use, and clear instructions. A printed instruction handbook (Figure 14) was created to guide each step, explain the contents of the kit, and highlight the benefits of each implementation. The kit was specifically designed to reduce complexity and information overload by simplifying the implementation process and reducing the time invested.

Table 5: Energy Efficiency Kit Contents

Category	Feature
Water Consumption	low-flow water faucets; efficient showerhead
Electricity Consumption	LED light bulbs; energy meter; mechanical timer; pipe insulation
Humidity and Temperature	Moisture absorbers or dehumidifiers; window insulation film; silicone sealant; weather stripping; anti-mold kit

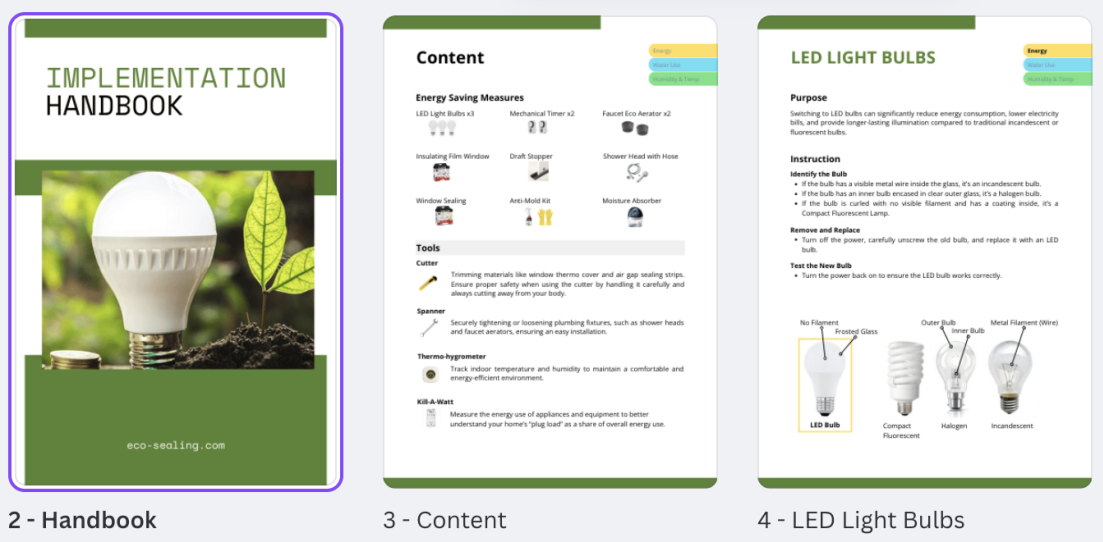


Figure 11: Implementation Handbook for DIY Energy Saving Kit

4.4.2 Testing the DIY Energy Saving Kit

The MVP Pilot test was a key step to validate usability and technical assumptions of the DIY Energy Saving kit. Through the conducted household interviews, a voluntary participant for the pilot test was selected. This step was crucial to understand user satisfaction, usability, and impact of the kit. A set of hypotheses was developed and tested during the pilot test (Table 13).

Table 6: Hypotheses Cycle 2

Hypothesis	Validation Status
H1: The implemented DIY Kit results in measurable energy savings of at least 10%	-
H2: The implemented DIY Kit results in perceived improvements in energy consumption & comfort	✓
H3: The user was able to independently implement the Kit contents only using the handbook	✓
H4: The user implemented over 70% of the Kit's products	✓

The usability testing approach proposed by Joseph F. Dumas was employed to conduct a representative pilot test (Dumas and Redish 1993). Usability testing is a method used to evaluate a product by observing how real users interact with it under realistic conditions. It aims to identify areas where users encounter difficulties and assess how effectively the product meets their needs (Dumas and Redish 1993). In line with this approach, the user was provided with the necessary materials: the product and the implementation handbook. Furthermore, the participant received the pilot test instructions (Appendix N), entailing the users' tasks and a survey to track progress. No additional explanation regarding the objectives or measurements was given. By limiting external information, the test encouraged genuine feedback on the clarity and sufficiency of the handbook and the overall user experience, aligning with Dumas' principle of observing users in naturalistic settings to uncover usability issues. After the pilot test was complete, a short interview was conducted with the participant to receive feedback (Appendix E: Interview 9).

4.4.3 Pilot Test Results

The feedback from the pilot participant provided valuable insights into the practicality of various measures included in the kit, as seen in Figure 15.

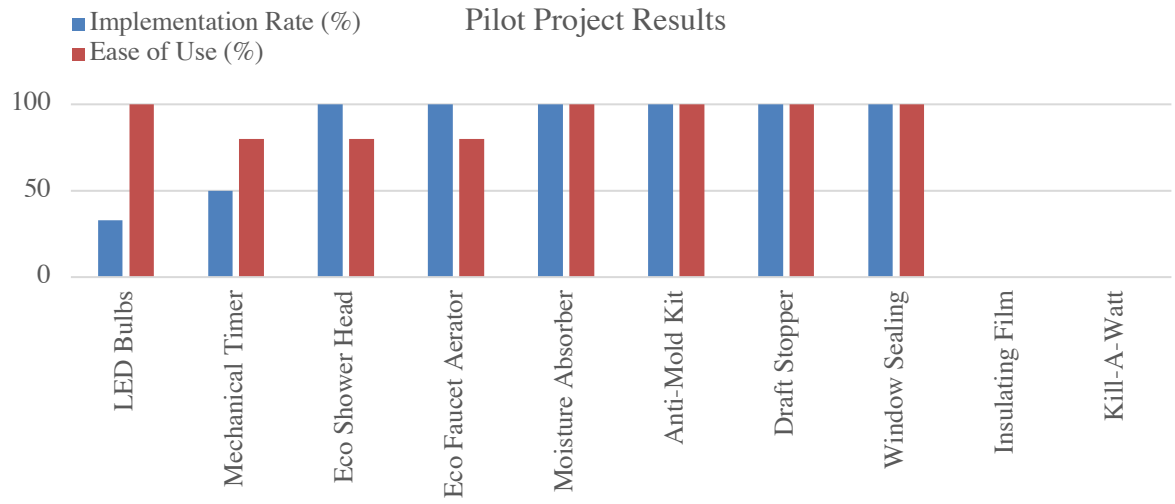


Figure 12: Implementation rates and ease-of-use perceptions for DIY Energy Kit from the pilot project

The pilot project also provided critical insights into the adoption and practicality of various measures included in the kit. For instance, products such as the moisture absorber, the anti-mold kit, and the draft stopper were successfully implemented, requiring less than five minutes each for installation. Ultimately, the previously outlined hypotheses were revisited.

(H1 Validation Pending) The hypothesis that the DIY Energy Saving kit would deliver measurable reductions in energy consumption could not yet be validated due to time constraints. The team suspects a moderate reduction in energy use, with room for improvement.

(H2 Validated) The hypothesis that DIY kit would deliver noticeable benefits was validated through user feedback. The pilot project participant reported noticeable improvements, particularly in comfort, after implementing quick fixes such as the draft stopper and the window sealing.

(H3 Validated) The hypothesis that the user will be able to independently implement the provided products was validated. The pilot test user could implement 70% of the provided measures without external assistance. Quick fixes like draft stoppers and moisture absorbers were implemented successfully due to their simplicity and minimal learning curve. However, tools like the Energy Meter and Insulating Films were not implemented due to challenges such as unsuitable home conditions or lack of instructions in the user handbook. More complex tools, like the Energy Meter, require improved instructions to provide additional clarity.

(H4 Partially Validated) The tools were successfully implemented in over 80% of cases, demonstrating their practicality and impact. However, later concerns about some measures were raised by the consulted experts, calling for further revision.

Overall, the results confirmed that DIY solutions have merit. The test user reported high satisfaction with the product and documented initial improvements in home comfort. He also mentioned ideas for improvement, such as more visual instructions or demonstration videos for better guidance. Additionally, the test user also mentioned the issue of standardization. While some measures could not be implemented and remained unused, other materials were not sufficient to cover all problem areas (Appendix E: Interview 9).

4.4.4 External Feedback Collection

Expert interviews further confirmed the assumption that behavioral changes play a critical role in achieving energy savings. Prof. Joanaz de Melo emphasized the importance of problem recognition and thorough energy assessments in encouraging user engagement (Appendix E: Interview 2). This insight reinforced the need for comprehensive educational materials alongside quick fixes and the opportunity to build connections with existing energy efficiency platforms like the European Energy Efficiency Platform “E3P.” Additionally, the logistics of managing and distributing the kits could bring operational challenges, especially when

considering how to scale the solution. Implementing all measures could be very time-consuming, which could discourage engagement.

Customer discovery highlighted the demand for immediate relief measures, validating their inclusion in the kit. However, it also revealed gaps in user awareness regarding the impact of outdated appliances and inefficient heating systems. These findings informed the decision to enhance the educational aspects of the kit and to focus on actionable insights for long-term energy efficiency.

4.4.5 Final Considerations

Overall, the DIY Energy Saving Kit received positive feedback from the test user and interview respondents. Households generally felt capable of implementing tools and found value in the approach. However, some additional considerations need to be addressed. One key observation was the dilution between creating comfort and cost savings. While comfort drives urgency, most survey participants prioritized lowering costs, highlighting the need to address cost-saving measures more. The kit's exact impact on cost savings is yet to be assessed, but preliminary results highlight improvement potential in this area. Furthermore, experts raised concerns about the applicability of certain measures, highlighting the need for a more individual assessment before providing appropriate tools. A key challenge remains to balance customization and scalability. Another consideration is the institutional fit. EcoSeal initially considered partnering with institutions to distribute the kit. However, the relatively high cost per kit raised questions about whether institutions would be willing to invest, given the limited customization and impact on energy efficiency. Going forward, EcoSeal could aim to close this gap by starting with a returnable energy measurement kit and providing tools and products based on individual needs.

4.5 Refined Solution Design - Cycle 3

The refined solution design in Cycle 3 builds on the insights from earlier iterations, shifting from immediate energy-saving measures to an advanced energy assessment approach. This cycle introduces a DIY Energy Assessment Kit, offering households valuable insights into their energy consumption and customized recommendations to improve efficiency. The design focuses on precision, usability, and sustainability to ensure long-term impact and ease of adoption. The solution included additional measurement tools to better understand the households' current state of energy consumption. The implementation manual, provided in physical and digital form, focuses on guiding users step-by-step through a detailed energy assessment process and collecting consumption data for further analysis.

Initially, the workspace was developed as a digital platform to simplify data entry and provide users with automatic recommendations. Hosted as a separate page on the EcoSeal website using Squarespace as the content management system, the workspace allowed users to enter their measured data and compare it to reliable energy benchmarks. These benchmarks, researched via sources such as the IEA ("Appliances & Equipment," n.d.), guaranteed accurate and actionable results and are further analyzed in Chapter 7. The platform is equipped with a user-friendly interface, simplifying understanding of energy consumption, and creating customized recommendations. The workspace also includes an overview of quick fixes and partner links so users can take immediate action based on their assessment. However, as the project evolved and further insights into the target audience were gathered, the older population was identified as an important customer segment. This led to the need for an analog alternative to the digital workspace. While the digital workspace remains a valuable option for tech-savvy users, an analog workbook was introduced as a simplified solution for older users or those without reliable access to digital tools. This workbook provides a physical, step-by-step guide that mirrors the functionality of the digital platform. Users can record measured values and manually

compare them to printed benchmark values, allowing them to identify areas for improvement without relying on online tools.

The inclusion of both options - digital workspace and analog workbook - ensures accessibility and usability for a wider audience while maintaining the main goal of empowering users to improve their energy efficiency.

4.5.1. Strategy and Design Approach

The main objective of Cycle 3 was to create a solution that supports a comprehensive energy assessment while maintaining simplicity and affordability for users.

While moving beyond the quick fixes, the refined kit prioritizes accurate energy measurements and actionable insights. The inclusion of reusable tools ensures sustainability and cost-effectiveness. Guided by user-centered design principles (D. A. Norman 2002), the focus was on simplicity, clarity, and accessibility. This resulted in a printed manual and a digital workspace that provides users with step-by-step guidance. The digital workspace, integrated into the EcoSeal website, allows users to enter measurement data, create automatic calculations, and receive customized recommendations. To ensure accuracy, reliable energy consumption benchmarks have been included (“Appliances & Equipment,” n.d.).

4.5.2 Design Specifics & Features

The DIY Energy Assessment Kit includes tools for measuring energy and water consumption, detecting air leaks, and monitoring room temperature and humidity. Each function has been carefully selected based on secondary research, expert consultation, and practical usability.

Table 7: Overview of the DIY Energy Assessment Kit

Feature	Purpose
Infrared digital thermometer	Identify air leaks and measure temperature
Kill-A-Watt	Measure energy consumption of different household appliances
Flow and temperature measuring connector	Assess water consumption in the shower
Thermometer & Hygrometer	Check humidity, temperature and CO_2 levels

The **printed handbook** simplifies the user experience with a clear, step-by-step guide to the assessment process. It explains each tool's function, provides implementation steps, and highlights the benefits of energy-saving actions.

The **digital workspace**, integrated into EcoSeal's website, complements the physical kit by allowing users to input their measured data, receive automated insights, and access tailored recommendations. It also provides quick fixes and affiliate links for users seeking further actions. Having reliable energy consumption benchmarks enabled EcoSeal to create a system with automated calculations to ensure accurate comparisons of user data with standard metrics. The team prioritized a user-friendly and visually clear interface in the design process, which helps users input data and understand results easily. The third part of the workspace provides an overview of quick fixes and affiliate links, enabling the user to take immediate action.

After recognizing the needs of an older target group, the **analog workbook** was developed as an alternative. This physical guide enables users to manually record their measured values and

compare them to printed benchmark values, allowing them to identify areas for improvement without requiring digital access.

4.5.3 Rental Process

The rental process for the kit has been designed to streamline operations and accommodate both digital and analog users. Users can sign up via a Google Form, where they need to provide their contact information and NIF- Número de Identificação Fiscal and agree to terms and conditions. This form can be embedded on partner websites or displayed as a QR code in community centers. Once registered, users select a pickup time based on availability, and the facility prepares the kit for collection. Users can also book a kit directly at the partner institution. Each kit includes all necessary tools, a printed handbook, and an optional analog workbook for manual data recording.

During the two-week rental period, users can either input measured data into the EcoSeal online workspace or record their findings in the workbook to compare values with printed benchmarks. EcoSeal offers user support via the platform throughout this period to ensure a smooth assessment process. After use, the kit is returned to the institution, where staff inspect the contents, address missing items, and prepare it for the next rental. User feedback is collected through the EcoSeal platform or, for analog users, via a short-written form included in the workbook. Partner institutions receive onboarding support and a manual to ensure the process runs efficiently. This approach ensures accessibility, supports scalability, and reduces friction for both partners and end users.

4.5.4 Testing & Final Validation

The refined solution design was validated through a structured, evidence-based approach based on principles from entrepreneurial literature, such as the lean startup method (Ries 2011) and

user-centered design principles (S. Norman 1986). These frameworks emphasize iterative feedback loops and user involvement as critical product development and validation components. Due to time constraints, a second pilot project was not conducted. Instead, EcoSeal validated its new approach across multiple channels. Feedback from pilot users from Cycle 2 highlighted the need for actionable, customized recommendations and tools to identify inefficiencies. Users emphasized the need for additional measurement tools to guide the following steps to improve energy efficiency (Appendix E: Interview 9). Institutional feedback from potential partners, such as community centers and libraries, showed strong alignment with their goals of promoting community well-being and reducing energy poverty. In addition, benchmarking with similar initiatives, such as Codema and Okotoks, confirmed the feasibility of DIY energy kits in comparable settings, further validating EcoSeal's design for the Portuguese market. While these results indicate great potential for the refined solution, further validation through a larger scale pilot is required to accurately assess the ease of use and long-term impact of the assessment kit.

4.6 Discussion & Next Steps

By bringing together insights from institutional partners, pilot projects, and validated external sources, EcoSeal presents its final solution as a robust, evidence-based design ready for real-world application. The alignment of user feedback, institutional interest, and best practices from similar initiatives ensures practicality, scalability, and the potential for significant impact in addressing the issue of Energy Inefficiency in Portugal. While the development and refinement of the DIY Energy Assessment Kit has created a solid foundation, further validation of the solution is required. EcoSeal's next steps include conducting a larger pilot project to rigorously test the usability and solution hypotheses listed in Table 15. This extended testing will provide valuable insights into how users interact with the kit, how accurate the recommendations are, and their impact on user understanding and energy-saving behavior. By exploring these

hypotheses, EcoSeal can further refine the kit and ensure that it effectively meets users' needs and can be scaled to reach a wider audience.

Table 8: Hypotheses to Be Tested

Usability Hypotheses	
H1: Users can independently assess their energy needs by conducting an energy assessment with the tools provided in the DIY Kit. **H2**: The recommendations and actionable insights provided by the DIY Kit accurately reflect users' energy consumption patterns and needs. **H3**: The DIY Kit enhances users' understanding of their energy consumption patterns.	- - -
Solution Hypotheses	
H4: The kit provides real-time or periodic insights into energy usage patterns, allowing users to pinpoint inefficient appliances or practices **H5**: The kit provides clear and actionable feedback that helps users identify and implement energy-saving measure	- -

5. Conclusion

5.1 Limitations

EcoSeal achieved significant milestones during the development process but encountered several limitations that must be addressed in future iterations.

The pilot test was limited to one participant, which restricted the ability to validate applicability across different household types. Due to the short duration of the project, it was not possible to validate the long-term impact. Future pilot tests on a larger scale would provide more insights into product performance over time. User feedback also revealed that some households lack awareness or motivation to implement energy-saving measures, which is an issue that EcoSeal must further address and requires more extensive engagement strategies. EcoSeal is currently sourcing the kit components from one single supplier, which creates the risk of sourcing delays and scalability. Therefore, the team needs to consider diversifying suppliers to improve resilience. Additionally, the manual assembly process of kits relies on manual labor, which is feasible for the initial phase. If demand increases suddenly, EcoSeal could face a bottleneck, so outsourcing options should be considered.

5.2 Reflection on the Entrepreneurial Journey

EcoSeal's journey was characterized by an iterative and adaptive process that was heavily influenced by methods such as Lean Startup and Design Thinking.

Throughout the development process, EcoSeal continued to evolve. The team moved from an initial idea of apartment retrofits in Cycle 1 to the DIY energy saving kit of Cycle 2 and finally to the DIY assessment kit of Cycle 3. Each iteration brought improvements based on user and expert feedback, which enabled EcoSeal to refine the value proposition. Stakeholder involvement also played an important role during EcoSeal’s journey so far – the feedback

provided by all entities, experts and users was fundamental in the decisions taken throughout this Work Project.

Several challenges were also part of the process – from opportunities of collaboration that did not develop further, outreach to several additional stakeholders that did not get a reply, and the challenge of pivoting to a different approach and solution along the development of this journey. All these setbacks became valuable lessons in resilience and flexibility. Despite limitations, significant progress was made. Not all hypotheses could be fully validated, but the project provided key insights into user needs and operational feasibility.

5.3 Conclusion & Future Outlook

After completing the validations, EcoSeal will proceed with establishing its legal entity as a formally recognized NGO, through the steps described above (Chapter 8.3). Once a legal entity is formed, raising funds to build the first kits will be the main priority. With the legal entity in place, an inventory of kits and capital to cover the initial costs, EcoSeal will commence its operations by launching the first batch of DIY Energy Assessment Kits to institutional partners. Success at this stage will be measured by the number of kits distributed, and the number of users who follow-up after using the kit and book a consultation with the EcoSeal Team.

In the long-term, scaling the operations and expanding geographically to underserved regions within Portugal will be a priority. This expansion will be complemented by delivering training programs to prepare local consultants, towards educating households on energy efficiency across Portugal, and developing partnerships with municipalities to integrate the kits into broader energy programs. Regular publication of impact reports will ensure transparency and accountability, while bolstering the reputation among stakeholders.

While EcoSeal may not be the next million-dollar unicorn, it is a practical and impactful project with real potential. With interest from partners already in place and the ability to launch immediately, EcoSeal is ready to make its mark.

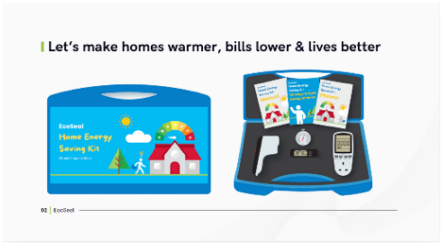
Looking ahead, EcoSeal aspires to establish itself as mission driven organization, that serves the purpose of improving the levels of energy efficiency in Portugal, by collaborating with a network of partnered entities to increase problem recognition and empower Portuguese citizens to make changes towards a more sustainable and fair energy transition.

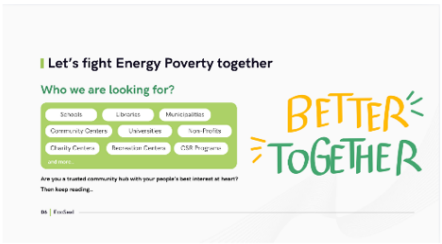
6. Appendix

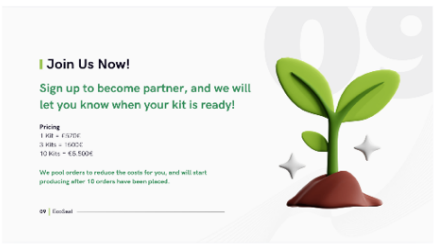
Appendix A: Excerpt Unit Economics Analysis for Cycle 1

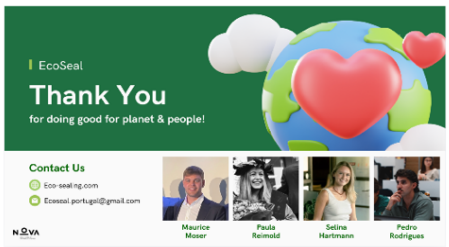
EXPENSES	PACKAGE 1	PACKAGE 2	PACKAGE 3
DIRECT EXPENSES	View in "Service Packages"		
TOTAL DIRECT EXPENSES	$ 1.000,00	$ 2.000,00	$ 3.000,00
INDIRECT EXPENSES			
Processing & Administrative Expenses	$ 50,00	$ 50,00	$ 50,00
Customer Acquisition Cost	$ 50,00	$ 50,00	$ 50,00
Insurance	$ 10,00	$ 10,00	$ 10,00
Technician Salary	$ 300,00	$ 300,00	$ 300,00
TOTAL INDIRECT EXPENSES	$ 410,00	$ 410,00	$ 410,00
MONTHLY OVERHEAD TOTAL	$ 14.725,90	$ 14.725,90	$ 14.725,90
OVERHEAD PER UNIT	$ 736,30	$ 736,30	$ 736,30
CONTIGENCY BUFFER (10%)	$ 214,63	$ 314,63	$ 414,63
TOTAL EXPENSE PER UNIT	$ 2.360,92	$ 3.460,92	$ 4.560,92
TOTAL PRICE PER UNIT	$ 2.715,06	$ 3.980,06	$ 5.245,06
CONTRIBUTION MARGIN (in %)	15%	15%	15%
CONTRIBUTION MARGIN (in €)	354,14 €	519,14 €	684,14 €

Appendix B: Presentation for Institutions

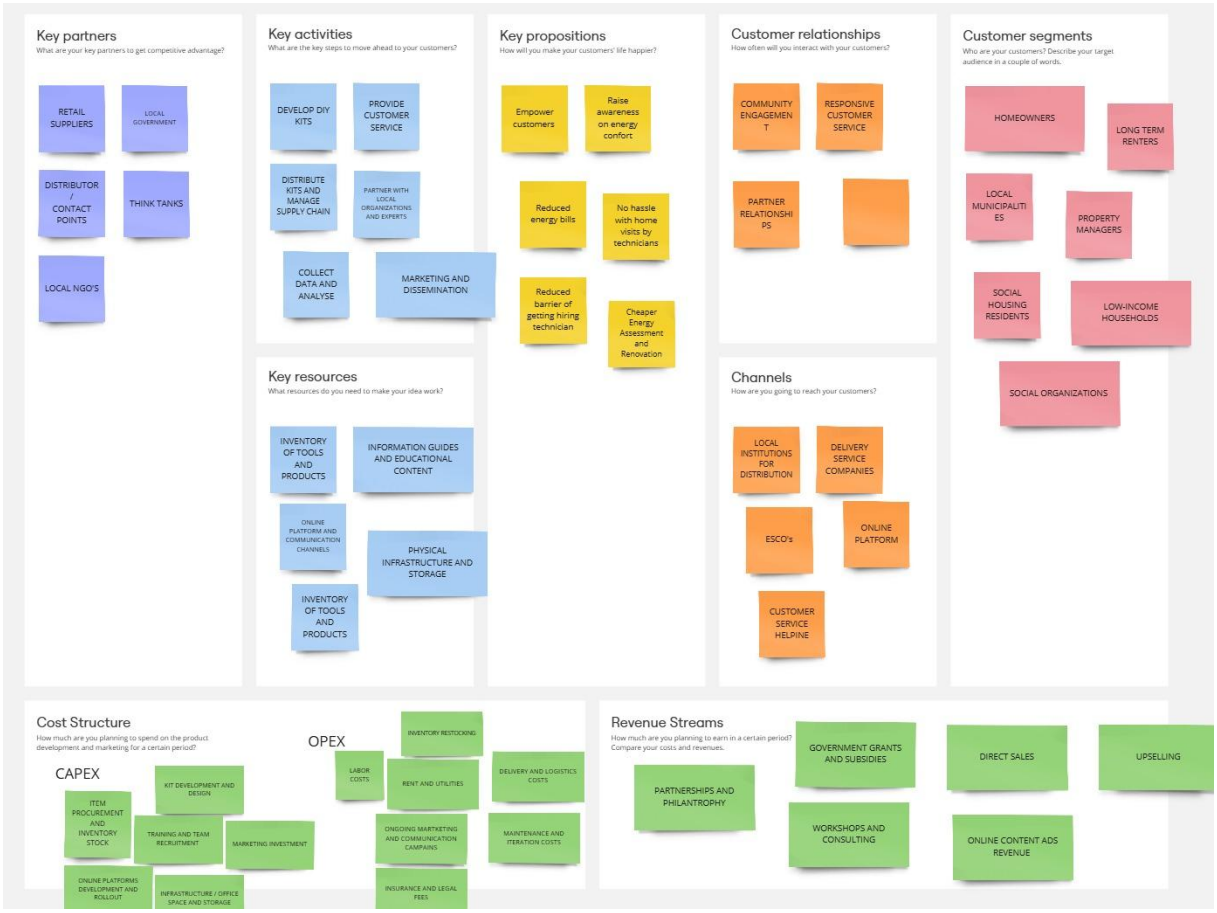








Appendix C: Social Business Model Canvas



Appendix D: Facebook Ad Campaign

Campaign Overview

- **Name**: EcoSeal Smoke Test
- **Objective**: Drive traffic to the website to gauge interest in the DIY Energy Saving Kit.
- **Total Budget**: €35.00
- **Duration**: December 4, 2024, 00:13 CET – December 10, 2024, 17:18 CET.

Target Audience

- **Location**: Lisbon, Portugal (+40 km radius).
- **Age Range**: 18+
- **Interests**: Home renovation, household appliances, and DIY projects.

Report Dez.-1-2024 until Dez.-14-2024 Report Period: Dec 1, 2024 - Dec 14, 2024

Name	Age	Headline	Reach	Clicks (all)	CTR (all)	Budget Spent	Timstamp
EcoSeal Ad Test	All	All	25565	420,00	0,65	30,47	2024-12-01
	65+	All	12870	243,00	0,74	18,84	2024-12-01
		Poupe nas Contas, Viva com Conforto!	4579	105,00	1,54	7,28	2024-12-01
		Poupe Energia Agora—Veja os Resultados Hoje!	2787	45,00	1,33	3,43	2024-12-01
		Kits de Poupança de Energia Gratuitos Perto de Si!	674	7,00	0,88	0,78	2024-12-01
		Kit de Poupança de Energia DIY: Economize de forma fácil!	417	3,00	0,69	0,51	2024-12-01
		Assuma o Controle dos Seus Custos de Energia!	293	2,00	0,64	0,33	2024-12-01
	55-64	All	6207	103,00	0,61	6,46	2024-12-01
		Poupe nas Contas, Viva com Conforto!	1600	41,00	1,90	2,21	2024-12-01
		Poupe Energia Agora—Veja os Resultados Hoje!	936	15,00	1,37	0,91	2024-12-01
		Kits de Poupança de Energia Gratuitos Perto de Si!	267	3,00	0,99	0,30	2024-12-01
		Kit de Poupança de Energia DIY: Economize de forma fácil!	130	3,00	2,16	0,17	2024-12-01
		Assuma o Controle dos Seus Custos de Energia!	100	0,00	0,00	0,02	2024-12-01
	45-54	All	2944	36,00	0,45	2,58	2024-12-01
		Poupe nas Contas, Viva com Conforto!	522	13,00	1,91	0,72	2024-12-01
		Poupe Energia Agora—Veja os Resultados Hoje!	302	5,00	1,50	0,22	2024-12-01
		Kit de Poupança de Energia DIY: Economize de forma fácil!	41	1,00	2,22	0,02	2024-12-01
		Kits de Poupança de Energia Gratuitos Perto de Si!	75	1,00	1,32	0,09	2024-12-01
		Assuma o Controle dos Seus Custos de Energia!	25	0,00	0,00	0,01	2024-12-01
	35-44	All	1760	23,00	0,65	1,28	2024-12-01
		Poupe nas Contas, Viva com Conforto!	324	6,00	1,54	0,44	2024-12-01
		Poupe Energia Agora—Veja os Resultados Hoje!	143	2,00	1,26	0,11	2024-12-01
		Kits de Poupança de Energia Gratuitos Perto de Si!	38	1,00	2,33	0,07	2024-12-01
		Kit de Poupança de Energia DIY: Economize de forma fácil!	32	1,00	2,94	0,06	2024-12-01
		Assuma o Controle dos Seus Custos de Energia!	14	0,00	0,00	0,01	2024-12-01
	25-34	All	1328	11,00	0,42	0,90	2024-12-01
		Poupe Energia Agora—Veja os Resultados Hoje!	66	2,00	2,78	0,08	2024-12-01
		Assuma o Controle dos Seus Custos de Energia!	11	1,00	9,09	0,01	2024-12-01
		Kits de Poupança de Energia Gratuitos Perto de Si!	15	0,00	0,00	0,03	2024-12-01
		Kit de Poupança de Energia DIY: Economize de forma fácil!	13	0,00	0,00	0,01	2024-12-01
		Poupe nas Contas, Viva com Conforto!	140	0,00	0,00	0,23	2024-12-01
	18-24	All	456	4,00	0,34	0,41	2024-12-01
		Poupe Energia Agora—Veja os Resultados Hoje!	36	1,00	2,56	0,07	2024-12-01
		Kit de Poupança de Energia DIY: Economize de forma fácil!	8	1,00	12,50	0,03	2024-12-01
		Kits de Poupança de Energia Gratuitos Perto de Si!	8	0,00	0,00	0,01	2024-12-01
		Poupe nas Contas, Viva com Conforto!	46	0,00	0,00	0,03	2024-12-01
		Assuma o Controle dos Seus Custos de Energia!	5	0,00	0,00	0,00	2024-12-01

Appendix E: Interviews

Interview 1: João Pedro Gouveia

Interview Details	
Interviewee: João Pedro Gouveia	
Position: Principal Researcher for Environmental and Sustainability Research at Nova FCT; Leader of Firefly Energy Lab; Coordination Team member of the EU energy Poverty Advisory Hub	**Organization:** Nova FCT
Date of Interview: 25.10.2024	**Mode of Interview:** Zoom
Key Discussion Points: Cultural and behavioral barriers, outreach strategies; strategies for stakeholder engagement; key recommendations; product design; funding and partnerships	
Insights Created	
Cultural & Behavioral Barriers	● Lack of recognition of energy poverty as a problem, influenced by cultural adaptation to discomfort in homes. ● Low energy literacy: People struggle to understand technical and financial impacts of energy efficiency decisions (e.g., energy classes, savings potential). ● Stigma associated with energy poverty prevents people from seeking help or participating in initiatives.
Outreach Strategies	● Importance of proactive, trust-building approaches through partnerships with local organizations and municipalities. ● Multi-channel awareness efforts (leaflets, community workshops, events) to reach diverse demographics. ● Bottom-up approaches, engaging people through entities they already trust (e.g., NGOs, social support schemes).
Recommendations for Engagement	● Simplify messaging to avoid the perception of a sales pitch; emphasize help and trustworthiness. ● Offer tangible incentives (e.g., LED bulbs, smart plugs) to attract participants to initiatives. ● Conduct groundwork with municipalities and social entities to pre-engage communities before project rollouts.
Product Design	● Address basic needs with low-cost, impactful tools, focusing on common problems (e.g., drafty windows, poor insulation). ● Distinguish between comfort-focused and cost-saving solutions, adapting kits to both. ● Develop measurement tools as part of the kit to empower users to recognize and address energy inefficiencies independently.
Partnerships and Funding	● Collaborate with local governments and foundations for sustainable funding and broader reach. ● Avoid partnerships with corporations that might erode public trust in the initiative. ● Explore multi-layered support mechanisms, including European funding for long-term stability.

Interview 2: João Joanaz de Melo

Interview Details	
Interviewee: João Joanaz de Melo	
Position: Associate Professor at the Department* of Environmental Sciences and Engineering at Nova FCT; Lecturer in Home Energy Auditing	**Organization:** Nova FCT
Date of Interview: 30.10.2024	**Mode of Interview:** In-Person
Key Discussion Points: Cultural and behavioral barriers, energy literacy, engagement strategies, energy auditing methods and tools	
Insights Created	
Behavior & Awareness:	● Most people do not read handbooks; visual aids, videos, and hands-on guidance are far more effective. ● Very low energy literacy among many households; even basic energy-saving actions are not understood or implemented. ● A significant cultural focus on comfort over structural solutions (e.g., using blankets instead of fixing inefficiencies). ● Accurate measurement is crucial; poorly conducted audits can lead to incorrect recommendations ("garbage in, garbage out").
Target Groups and Engagement	● Clear entry strategy is needed to define the target audience: ○ Renters with limited ability to make structural changes. ○ Elderly individuals who often live alone and need volunteer assistance. ○ Families in extreme poverty who can only be reached through existing social support schemes. ○ Homeowners who have more flexibility to make changes. ● Outreach through community hubs like libraries and community centers is a promising approach.
Energy-Saving Actions	● Small behavioral changes can yield up to 50% savings in energy usage, such as: ○ Using washing machines at the lowest possible temperature. ○ Installing shower timers to reduce water usage. ○ Managing sunlight exposure in apartments effectively.
Energy Auditing	● Suggested tools for audits include: ○ Infrared thermometer. ○ Energy meter. ○ Temperature and humidity monitoring devices (house meteorological set). ○ Thermal imaging camera (optional). ○ Measuring tape for wall thickness. ● Energy audits should focus on teaching users what and how to measure effectively.
Volunteer and Community Support	● Volunteer networks are essential for assisting vulnerable groups, especially the elderly and energy-poor households. ● Public-private partnerships and decentralized, independent organizations are needed for scalability and sustainability.

Interview 3: Gobnait Ní Néill (Codema)

Interview Details	
Interviewee: Gobnait Ní Néill	
Position: Energy Planner at Codema, Dublin' Energy Agency; Project Manager for the Energy Saving Kit initiative	**Organization:** Codema Dublin Energy Agency
Date of Interview: 22.10.2024	**Mode of Interview:** Zoom
Key Discussion Points: Challenges & best practices for Assessment kit distribution, user insights, impact measurement, operational considerations	

Insights Created	
Market Insights and Target Audience	● Main motivators for interventions: cost, health, comfort (climate is secondary). ● Owners or long-term renters are more likely to invest in energy efficiency than short-term renters ● People often lack awareness or knowledge about simple interventions that can improve energy efficiency and comfort ● Basic home energy-saving behaviors (e.g., sealing leaks, managing indoor moisture) are not widely practiced ● Digital integration (e.g., smartphone apps) could appeal to some users but not all, as not everyone is comfortable with advanced technology ● Lack of trust in information sources or institutions, especially among vulnerable groups ● Difficulty in sharing personal data (e.g., utility costs, home conditions) due to privacy concerns and discomfort discussing such matters ● People often default to behaviors they are comfortable with (e.g., layering clothes instead of addressing insulation or heat loss)
Engagement and Outreach Strategies	● Work with trusted middle actors already engaged with target audiences ● Partner with trusted middle actors ● Trust is key, particularly for vulnerable groups who may distrust municipalities or institutions
Solution Design	● Users value tools that are easy to understand and use ● Essential tools: Thermal leak detector, electricity monitor, radiator key, fridge freezer thermometer, temperature, and humidity meter ● Hard copy resources (e.g., printed guides) remain essential for some audiences ● Tools with small displays or poor usability (e.g., non-backlit displays) are problematic, particularly for older users or those with vision issues ● Incremental improvements, such as backlit displays and larger numbers, improve user satisfaction
Challenges	● Lack of technical skills among users to implement changes ● Tool durability and consistent quality control issues ● Surveys are the main channel, but collecting long-term impact data is difficult due to privacy and self-reporting biases ● Libraries serve as intermediaries for kit distribution but face challenges replenishing consumables
Strategic Advise	● Start small with clear focus areas ● Test interventions in manageable environments before scaling ● Target students or university communities as a starting audience for feedback and piloting

Interview 4: Cassidy Stillie (Okotoks)

Interview Details	
Interviewee: Cassidy Stillie	
Position: Project Specialist for the Clean Energy Improvement Program in Okotoks, Canada; Coordinator for the DIY Home Energy Audit Kit Program	**Organization:** Town of Okotoks
Date of Interview: 08.11.2024	**Mode of Interview:** Zoom
Key Discussion Points: DIY Kit program design, user engagement, challenges, best practices, impact measurement	
Insights Created	
Program Design	● Kit customization is important; users can select only what they need, avoiding unnecessary items. ● User-friendly designs and walkthroughs (booklets, websites) reduce confusion but don't fully prevent it. ● Including tools like thermal imaging cameras, energy meters, and radon monitors is impactful but requires guidance for proper use ● Seasonal factors influence the effectiveness of certain tools (e.g., thermal imaging cameras are less effective in warmer months). ● Clear and simple instructions are critical to ensuring the kits are effectively utilized by diverse users ● Users often require support to fully utilize more technical tools, such as thermal cameras, pointing to the need for accessible resources like video tutorials.
User Engagement	● The primary motivators for users to engage with the kit include cost savings, curiosity, and environmental consciousness ● Seniors are the largest demographic engaging with the kit. ● Word of mouth and community-focused advertising (e.g., local newspapers, social media) are highly effective. ● Building a strong community network ensures higher participation and trust in the program
Challenges	● Ensuring usability of advanced tools like thermal cameras and radon monitors. ● Seasonal limitations: Thermal imaging is less effective in warmer months. ● Reliance on grants makes long-term financial sustainability challenging
Scalability	● DIY kits offer a simplified, hands-off model with high potential for scaling. ● In-person audits are resource-intensive and less scalable compared to DIY approaches.
Partnerships	● Partnerships with local sponsors (e.g., radon monitor suppliers) can offset program costs. ● Municipal support ensures operational sustainability.
Program Impact and Metrics	● Measuring the impact of the program through energy savings and behavioral changes is critical for refining its design. ● Feedback loops from users can help improve the kit's usability and ensure it addresses the most common challenges. ● Success metrics include cost savings, increased energy literacy, and expanded adoption of energy-saving practices.

Interview 5: João Costa Ribeiro

Interview Details	
Interviewee: João Costa Ribeiro	
Position: Lead Open Innovation Manager at Galp; Professor in innovation and technology at the University of Bergen and Porto Business School	**Organization:** Galp
Date of Interview: 30.09.2024	**Mode of Interview:** Zoom
Key Discussion Points:	

Insights Created	
Project Development and Strategy	● Exploring DIY energy-saving kits to empower individuals to implement energy-saving measures themselves ● Discussion of Galps role in EcoSeal ● Collaborative models with companies like Galp can diversify distribution channels and funding
Market Research and Feasibility	● Visits to local stores (e.g., Leroy Merlin) are planned to gather information on existing DIY energy-saving kits and assess market offerings ● The goal is to benchmark existing solutions to improve the DIY kit design
Insights on Energy Poverty and Audience	● Low to mid-income households often lack the financial resources or knowledge to invest in energy-saving measures ● Empowering users with simple, low-cost solutions, like DIY kits, can overcome accessibility challenges ● Households may struggle with recognizing the importance of energy efficiency or lack confidence in implementing solutions themselves ● There's a significant knowledge gap about low-cost, impactful energy-saving measures
Pilot Testing Advice	● Digital testing (e.g., mockups, quick interviews) can help assess initial desirability before investing in physical prototypes ● Real-world physical testing highlights practical feasibility issues (e.g., tool usability, accessibility) ● Testing should focus on practical interventions with measurable outcomes
Product & Solution Discussion	● DIY energy-saving kits on the market may lack customization for specific household needs ● In-person store visits and competitor analysis are critical for identifying gaps in existing products ● The scalability of DIY solutions depends on ease of distribution, cost-efficiency, and user education ● The process must balance affordability with impact to ensure adoption
Collaboration and Partnerships	● Collaboration with external partners, including Galp and the Galp Foundation, is critical ● Potential roles for the foundation include: supporting pilot project, act as customer channel for distribution ● Next steps include rekindling the conversation with Galp Foundation and exploring potential collaboration models ● Working with organizations already active in the energy poverty space accelerates validation and access to data ● Co-development opportunities (e.g., involving libraries or municipalities in kit design) can enhance the relevance of the solution

Interview 6: Sara Pais

Interview Details	
Interviewee: Sara Pais	
Position: Sustainability Project Manager	**Organization:** Calouste Gulbenkian Foundation
Date of Interview: 04.12.2024	**Mode of Interview:** Teams
Key Discussion Points:	
Insights Created	
Alignment with the Institutions Mission	● Gulbenkian has developed a variety of projects focusing on the topic of energy efficiency, as sustainability and a fair energy transition is a top priority of the foundation. ● One of the latest projects has been "Transition Point", a one-stop-shop that aims to promote energy efficiency in a community-centered approach, through a re-used container working as a information center that goes around neighbourhoods in Portugal.
Communication Strategy	● Sara highlighted the importance of adjusting the way the product is communicated to the target audience, referring to the importance of having it in portuguese, and the branding be reflective of the solution being presented. ● Sara felt that "EcoSeal" didn't provide an immediate signal of the solution offered.
Insights on Energy Poverty and Audience	● Sara was very familiar with the data used to highlight the problem, and gave some insights on other sources that could be considered. ● From the experience of Transition Point, engaging with the target audience is the most difficult challenge. ● The solution of the kit could have the potential of eliminating various in reaching this audience, by eliminating the need to get into peoples homes, which may be a barrier for many.
Product & Solution Discussion	● Sara understood the utility of the kit and it's design, highlighting the importance of the guide. ● She shared concerns on if the target audience would have the time and mindspace to engage in using the kit and reporting back their findings.
Collaboration and Partnerships	● For potential collaboration, Sara highlighted the potential to work with ADENE, who already delivers various training programs and workshops on the topic. ● Although Gulbenkian is no longer directly involved in the Transition Point project, she refered to the potential of the kit being used by the Transitiom Agents, those working at the one-stop-shop and providing guidance to the citizens that visited.

Interview 7: Margarida Queiroz

Interview Details	
Interviewee: Margarida Queiroz	
Position: Social Impact Manager	**Organization:** Galp Foundation
Date of Interview: 05.12.2024	**Mode of Interview:** Microsoft Teams

Insights Created	
Alignment with the Institutions Mission	● The concept of the kit was given positive feedback by Margarida, although she highlighted that the main value is in the follow-up, through providing actionable measures to the users. ● The initial goal of this interview, which was to test if the kit would be interesting for Galp to have it available for their employees wasn't validated, because Margarida refereed that the Foundation works independently from the company, and that should be validated with someone from the People & Spaces Department.
Avenues to Develop the Solution	● Galp Foundationn is lauching a new edition of Colmeia, a open innovation program, that supports projects/startups/ideas to promote a fair energy transition in the municipality of Matosinhos. Margarida said that there was a great alignment between Ecoseal and what they are looking for with this program, and that she is expecting an application to be part of it when it opens (January 2025)
Collaboration and Partnerships	● Galp Foundation has collaborated with many institutions on the topic of energy poverty and efficiency, delivering workshops in schools and community centers. Margarida referred to ADENE as a potential key partner, and showcased the work that has been done in collaborateion with the agency. ● Margarida explains the way Galp Foundation always works in partnerships with organizations closer to the target audience they are trying to reach, by supporting them in delivering real impact - she insisted that the only way to tackle a social problem is to build trust with the communities and there is no better way than through organizations that have already developed that type of trust in their day-to-day work.

Interview 8: Islene Facanha

Interview Details	
Interviewee: Islene Facanha	
Position: Project & Policy Officer	**Organization:** Zero NGO
Date of Interview: 04.12.2024	**Mode of Interview:** Google Meet

Insights Created	
Alignment with the Institutions Mission	● ZERO NGO is a non-profit organization addressing the problem of energy efficiency and poverty. Islene highlighted the great fit of EcoSeal with the organizations mission and goals. ● Some alignment with the Project Live Effect, by the Social Climate Fund, which aims to help people in the most vulnerable status of energy poverty.
Communication Strategy	● Islene provided important feedback on how to communicate the problem of energy poverty in an inclusive manner, refering to the importance of not using the term "poverty" when communicating to the people living in that condition. As an alternative, she mentioned how it's being widely referred to as "energy dignity".
Insights on Energy Poverty and Audience	● With extensive experience in engaging with the target audiences of those more enthusiast about energy efficiency (through their associates), Islene referred that those would be a great audience to test out the kit with, and the ones more likely to use it properly.
Collaboration and Partnerships	● The main insight from the interview with Islene regarding potential partnerships, was to consider also Health Centers as institutions where the kit could be interesting to have available, due to their close contact with the local communities.

Interview 9: Pilot Test User

Interview Details	
Interviewee: Pilot Test User **Position**: Young Professional **Date of Interview:** 05.12.2024 **Mode of Interview:** In-Person **Key Discussion Points:** DIY Energy Saving Kit Feedback	
Insights Created	
Usability and Simplicity	● **Ease of Use**: - Easiest: LED lights, moisture absorber, humidity thermometer - Moderate: Timer (used on TV and computer), window sealing (applied on two windows), draft stopper (very nice) - Most Difficult: Eco aerator ● **Instructions**: Clear and straightforward. No confusing or overly complicated parts. ● **Setup Process**: Met and surpassed expectations in terms of simplicity and clarity. ● **Improvements**: Suggestions for tips on behavioral changes (e.g., solutions for flushing water effectively).
Perceived Improvements	● **Understanding**: Improved understanding of home energy consumption. ● **Energy-Saving Opportunities**: Identified inefficiencies. ● **Immediate Benefits**: - Draft stopper and dehumidifier improved comfort. - Mold kit is effective. - Sealing improved sound insulation, reduced drafts, though no significant temperature change noted.
Value and Willingness to Pay	● **Price Willingness**: €80-€150, depending on the customization. ● **Value Improvement**: - Customization based on specific needs (e.g., separate humidity or electricity kits). ● **Overall Value**: Kit perceived as offering good value for its purpose.
Net Promoter Score	● **Score**: 8/10 ● **Motivation**: Motivated to make further improvements
Feedback and Suggestions	● **Liked Most**: - Draft stopper, window sealing, and humidity kit were most impactful. - All-in-one design appreciated. ● **Challenges**: Difficulty with the Eco Faucet Aerator. ● **Suggestions**: Include more visuals and a QR code for video instructions.

Appendix F: DIY Kit Comparison

Competitor	Business Model	Product/ Service	Strengths	Weaknesses	Price Range
Tri-County Regional Energy Network (California)	Government-funded, free kits through libraries	DIY Kit: Includes LED bulbs, weather-stripping, aerators, and measuring tools	Accessible; Includes quick fixes and behavior advice	High logistical effort; Limited to local residents	Free
Codema (Ireland)	Non-profit, institution-driven lending model	Measurement-focused kit: Professional tools, training guides, and user workbook	Professional tools; Reusable; Strong digital support	High cost for institutions; No immediate user relief	€570 (for institutions, free for users)
Okotoks (Canada)	Community-based lending program	DIY Kit: Measurement tools + quick fixes; free materials post-assessment	Includes free tools post-assessment; Extended user support	Limited to residents; High demand limits access	Free for local residents
HomeBoost (UK)	For-profit, direct-to-consumer	Digital-first kit with app integration for detailed assessment	Comprehensive reports; App-based guidance	Expensive; No quick fixes included	£99

Appendix G: User Persona 1

USER PERSONA 1

NAME Joao Costa
LOCATION Lisbon
AGE 69 years
JOB Retired

About: António Costa is a 69-year-old retired teacher living in a small apartment on the outskirts of Lisbon. He has lived there for 35 years and takes pride in his home, though it's starting to feel less comfortable due to its age. He manages on a modest pension, carefully budgeting each month to make ends meet.

Frustrations: António feels frustrated by the rising energy costs that take a large chunk of his pension. During winters, his apartment is cold and damp, but he can't afford expensive renovations. He finds technical solutions confusing and is reluctant to try unfamiliar products.

Motivation: António wants to reduce his energy bills to ease his financial strain and make his home more comfortable, especially in the colder months. He values solutions that are straightforward, low-cost, and allow him to remain self-sufficient.

Behaviors & Attitudes: António is practical and down-to-earth, preferring tried-and-true solutions. While he's skeptical of new products, he trusts recommendations from local community centers or neighbors. Living on a fixed pension, he is highly frugal, prioritizing cost-effective solutions with clear long-term savings. While he tries to adapt to digital tools, such as using his smartphone for basic tasks, he prefers simple, practical solutions with clear, visual instructions. He values his independence, appreciates tools that empower him to make improvements on his own.

Appendix H: Household Surveys

Survey 1 - published 21. September 2024

Questions	**Answer Options**
Which nationality best describes you?	Portuguese / EU National / Non-EU National
Are you a homeowner or long-term renter in the Greater Lisbon area?	Homeowner / Long-term renter / Neither
What type of home do you live in?	House / Apartment
How old is your home?	< 10 years / 10-30 years / > 30 years / Not sure
How comfortable is your home's temperature year-round?	Comfortable year-round / Uncomfortable in summer or winter / Uncomfortable year-round
Do you consider your energy bills too high for your income?	Yes, definitely / Yes, somewhat / No / Unsure
What is your income range?	< €20,000 / €20,000-€40,000 / €40,000-€60,000 / > €60,000
Have you made any energy efficiency improvements?	Yes / No, but planning / No, not interested
What has prevented you from making energy efficiency improvements?	Too expensive / Don't know what to do / Lack of time / Other
Additional comments (optional).	Free text
Contact information for follow-up interviews?	Name, Email, Phone

Flyer for Survey 1

Survey 2 - published on October 5. 2024

Questions	**Answer Options**
Which nationality best describes you?	Portuguese / EU National / Non-EU National
Where do you live?	Lisbon Area / Other Region in Portugal / Outside of Portugal
What is your income range?	Not sure / Under €20,000/year / €20,000-€40,000/year / €40,000-€60,000/year / More than €60,000/year
What type of home do you live in?	House / Apartment / Other
How old is your home?	Less than 10 years / 10-30 years / More than 30 years / Not sure
How comfortable is your home's temperature during the year?	Comfortable year-round / Comfortable in summer, uncomfortable in winter / Comfortable in winter, uncomfortable in summer / Uncomfortable year-round
How would you describe the thermal condition of your house?	Scale: Very Poor (1) to Very Good (8)
What are the biggest energy efficiency issues in your home?	I don't know what the main issues are in my home/ Air drafts through windows or doors/ Windows that don't retain heat or cold/ Poor insulation in walls or ceilings/ High humidity, mold or dampness/ Inefficient lighting/ Outdated or inefficient heating systems/ Heat loss from radiators or heaters/ Gaps around pipes or vents/ Old or inefficient appliances/ Water waste/ Poor ventilation in some areas/ My home does not need improvements/ Other (specify)
Have you made any energy efficiency improvements in your home?	Yes, I've made some improvements / No, but I'm interested or planning to make improvements / No, and I'm not interested
What has prevented you from making energy efficiency improvements so far?	Lack of awareness about available programs or solutions / Solutions are too expensive or have high upfront costs / Difficulty accessing existing programs (e.g., eligibility requirements, paperwork) / Long waiting times or delays in getting improvements done / Concerns about the effectiveness of available solutions / Lack of trust in contractors, government programs, or energy companies / I rent my home and cannot make structural changes / The process seems too complex or confusing / I don't want to make large financial commitments / I am unsure of how to make energy-efficient changes myself (lack of technical knowledge) / Energy efficiency is not a high priority for me right now / I'm used to the problem and cope differently (e.g., wearing warm clothing inside) / Fear that making changes will disrupt my daily life / Lack of time / I don't think energy efficiency improvements are necessary in my home / I don't know where to start or who to ask for help / Other (specify)
If given clear, step-by-step instructions, would you feel comfortable installing DIY improvements?	Yes, I would be comfortable / Maybe, I would try if the instructions were very clear / No, I would need professional help
What would motivate you to use a DIY energy efficiency kit?	It's affordable and requires a low upfront cost / It's easy to install and use without professional help / I can see immediate results in energy savings or comfort / It allows me to make improvements on my own schedule / It's flexible and I can start small with gradual improvements / I get a personalized kit based on my apartment's needs / It's suitable for renters and doesn't require structural changes / It's simple / I can save money on my energy bills over time / It comes with clear instructions and guidance, even for those without technical knowledge / I can purchase it online / I can rent it out in local institutions / I feel empowered to make changes without needing external help / It's a fast and convenient solution for improving home comfort / There is an option to have someone install the kit for me (e.g., by a volunteer or paid additional service) / I would not be interested / Other (specify)
Additional comments (optional).	Free text
Contact information for follow-up interviews.	Name, Email, Phone

Appendix I: Unit Economics DIY Energy Assessment Kit

Expense Category	Item	Unit Cost (€)	Units Per Kit (#)	Total Cost (€)	Sourcing
Kit Equipment					
	Thermometer	13,99	1	13,99	Equation
	Hygrometer	6,59	1	6,59	Equation
	Energy Meter	13,99	2	27,98	Lexman
	Flow Gauge	15,99	1	15,99	Ekogest
	Infrared Thermometer	41,99	1	41,99	Cindar
	Transport Case	25,00	1	25,00	Leroy Merlin
Handbook & Promotional Materials					
	Printing Pages	0,50	17	8,50	In-House
	Promotional Material	18,30	1	18,30	Copimat
Additional Costs					
	Transportation and Distribution	18,99	1	18,99	CTT
	Kit Assembly	20,45	1	23,75	Klog
	Buffer (15%)	23,30	1	26,60	
TOTAL COST PER UNIT				**227,68**	

Appendix J: Cost Structure

BUSINESS EXPENSE	START-UP COST	MONTHLY COST
LEGAL & ADMIN		
Business Registration	500,00 €	0,00 €
Trade Name Registration	150,00 €	0,00 €
Legal Consultations	1.000,00 €	50,00 €
Accounting & Financial Services	1.000,00 €	80,00 €
TOTAL LEGAL & ADMIN	2.650,00 €	130,00 €
MARKETING/BRANDING		
Brand & Logo	10,00 €	80,00 €
Partnerships Development	300,00 €	4,00 €
Marketing Materials	1.000,00 €	80,00 €
Social Media Campaigns	800,00 €	50,00 €
TOTAL MARKETING/PROMO	2.110,00 €	214,00 €
TECH & INFRASTRUCTURE		
Digital Platform Development	4.250,00 €	
Software Subscriptions	400,00 €	
Platform Maintenance		300,00 €
TOTAL TECH & INFRASTRUCTURE	4.650,00 €	300,00 €
PRODUCT		
Initial Inventory (15 Kits)	3.417,57€	
New Kits per Month (15 kits p/ month)		3.417,57€
TOTAL INVENTORY	3.417,57€	3.417,57€
OTHER		
Contigency Buffer (15%)	1.760,84 €	401,60 €
Misc.	2.000,00 €	
TOTAL EXPENSES – OPERATIONAL	**17.500 €**	**4.433,60 €**

Appendix K: Breakeven Analysis

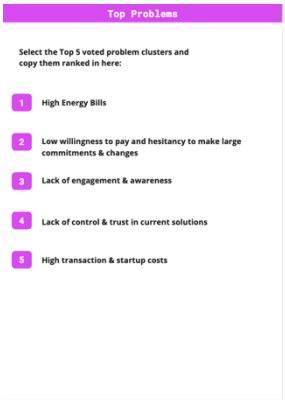
(Option A)

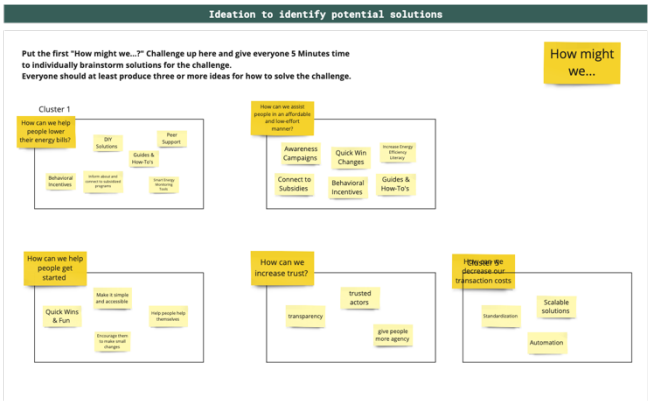
Breakeven Analysis	Scenario 1	Scenario 2	Scenario 3
CONTRIBUTION MARGIN (in %)	20%	40%	60%
CONTRIBUTION MARGIN (in €)	45,54	91,07	136,61
Final Price (in €	275,00	320,00	365,00
Total Margin (in €)	47,32	92,32	137,32
Average Montlhy Revenue	4125,00	4800,00	5475,12
Breakeven (in months)	**4,19**	**3,60**	**3,15**

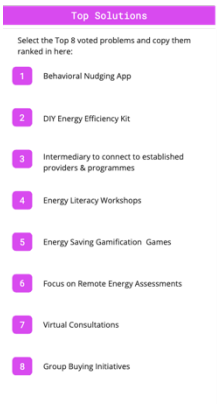
(Option B)

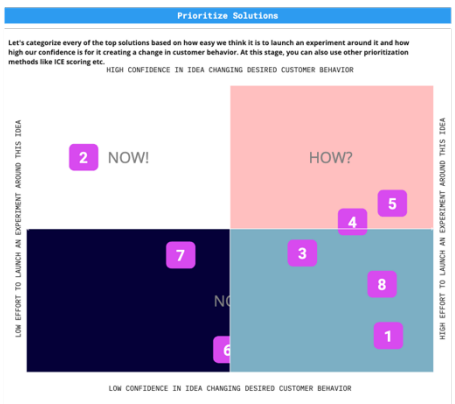
Breakeven Analysis	
Subscription Fee	35€
Kits Sold	30
Average Monthly Revenue (1 year)	6825€
Annual Revenue	81.900€
Breakeven (in months)	**6,74**

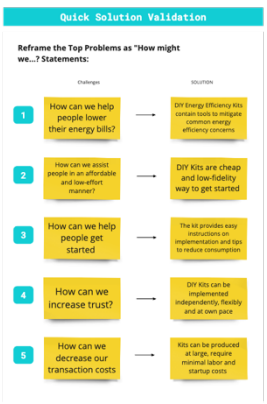
Appendix L: Solution Ideation Workshop After Cycle 1



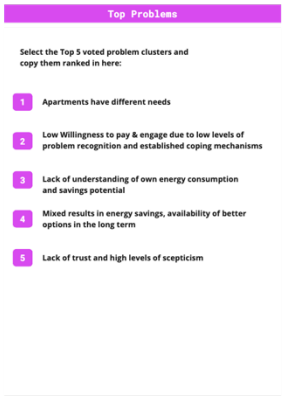


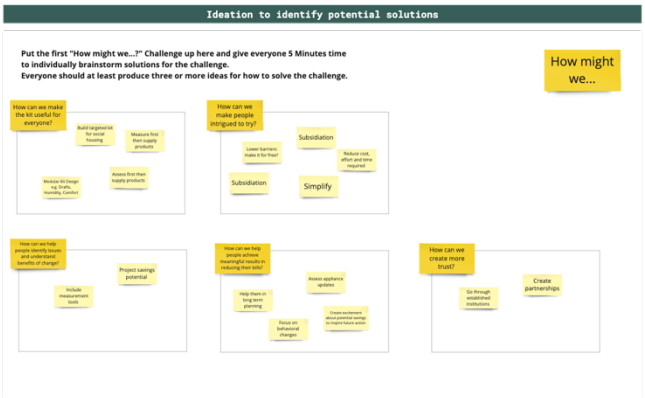


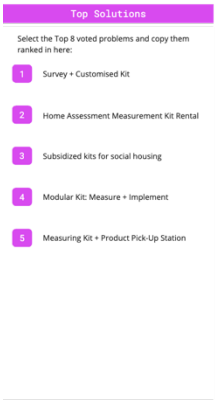


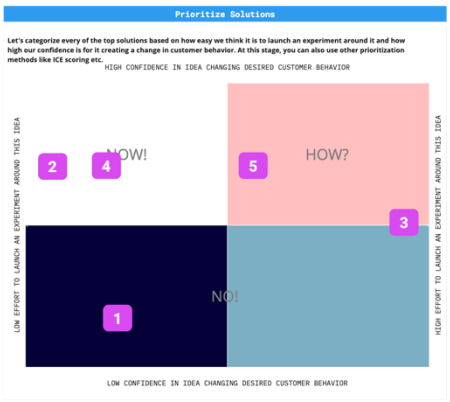


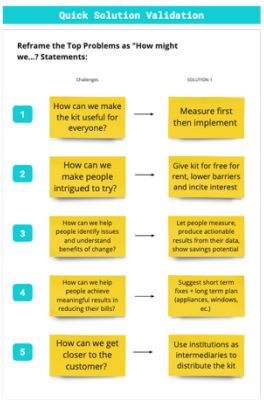
Appendix M: Solution Ideation Workshop After Cycle 2











Appendix N: **Pilot Test Instructions**

Pilot Test Instructions (Read First)

Hello! Thank you for agreeing to test our prototype energy efficiency kit! Your feedback is incredibly valuable to us, and we're excited to hear your thoughts. The goal of this test is to evaluate how well the kit works in your apartment and to gather feedback on its usability and effectiveness. Below you can find the instructions. Please go through the tasks and let us know if you encounter any issues. Feel free to share your thoughts throughout the process, and remember, there's no right or wrong way to use the product – we want your honest experience!

Once you're done, please get in touch with us for a brief follow-up about your experience. We appreciate your time and input!

Instructions:

In the kit you will find various tools and materials that will allow you to implement energy-saving measures in your home. Your task involves installing these measures, following the provided handbook.

Your Tasks:

- Unpack the kit and review its contents
- Install each item using the handbook, following the step-by-step instructions to ensure proper setup of each component.
- Attempt to complete the installation independently, without external assistance, to help us assess the clarity and usability of the handbook.
- Note any challenges and thoughts during installation, documenting any unclear steps or difficult-to-execute instructions to help improve the user experience.
- You can use the checklist below to document your experience

To monitor the usability we kindly ask you to implement the measures following the steps in the following check-list. The process covers three main areas:

1. Energy Consumption
2. Water Use
3. Humidity & Temperature

After completing each category we ask you to document your work & give honest feedback regarding time consumption & complexity of the implementation process.

1

1. Energy Consumption

In this section you will implement the following measures:

1. LED Light Bulbs
2. Energy Meter
3. Mechanical Timer
4. Pipe Insulation

1.1 LED Light Bulbs

How many LED Light Bulbs did you implement?

☐ 3 ☐ 2 ☐ 1 ☐ None

How easy was the implementation?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

1.2. Energy Meter

Did you use the Energy Meter?

☐ Yes ☐ No

How easy was the application?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Is there anything you would like to share about the process?

1.3 Mechanical Timer

Did you implement both mechanical timers?

☐ Yes ☐ Only One ☐ None

How easy was the implementation?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

2

1.4 Pipe Insulation

Did you implement the Pipe Insulation?

☐ Yes ☐ No

How easy was the installation?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

2. Water Use

In this section you will implement the following measures:

1. Low-Flow Shower Head
2. Faucet Eco Aerator

2.1 Low-Flow Shower Head

Did you implement the Low-Flow Shower Head?

☐ Yes ☐ No

How easy was the implementation?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

2.2 Faucet Eco Aerator

Did you implement the Faucet Eco Aerator?

☐ Yes ☐ No

How easy was the installation?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

3

3. Humidity & Temperature

Almost done! In this section you will implement the following measures:

1. Moisture Absorber
2. Anti-mold kit
3. Draft stopper for doors
4. Window Sealing
5. Insulating film for windows

3.1 Moisture Absorber

Did you implement the Moisture Absorber?

☐ Yes ☐ No

How easy was the implementation?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

3.2 Anti-mold kit

Did you use the anti-mold kit?

☐ Yes ☐ No

How easy was the application?

☐ Very Easy ☐ Easy ☐ Complex ☐ Very Complex

Time required: _____

Is there anything you would like to share about the process?

4

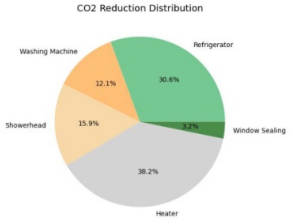
Appendix O: EcoSeal Energy Efficiency Report

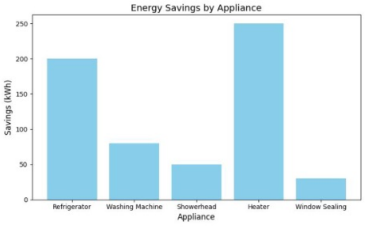
EcoSeal Energy Efficiency Report

Actionable Insights for Sustainable Living

ECOSEAL

The EcoSeal Energy Efficiency Report provides a comprehensive analysis of your household's energy consumption patterns and offers tailored recommendations to reduce energy use, save costs, and minimize environmental impact. By utilizing the data collected through the EcoSeal Measurement Kit, this report highlights potential areas for improvement and suggests actionable steps to achieve greater sustainability.



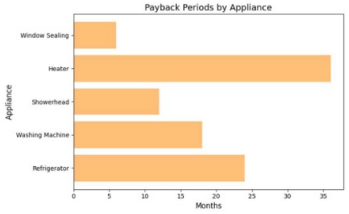


Recommendations

Based on the data collected, we recommend the following measures:

- Appliance Upgrades: Replace older appliances, such as your refrigerator or washing machine, with energy-efficient models. This can save up to €56 annually and has an average payback period of 18-24 months.
- Water Efficiency: Install a water-saving showerhead to reduce water consumption by up to 30%, saving approximately €20 annually while conserving resources.
- Behavioral Changes: Adopt simple practices like targeted ventilation and reducing standby energy use by unplugging devices when not in use.

Appliance	Savings (kWh)	CO2 Reduction (kg)	Cost Savings (€)	Payback Period (Months)
Refrigerator	200	96	40	24
Washing Machine	80	38	16	18
Showerhead	50	50	20	12
Heater	250	120	50	36
Window Sealing	30	10	15	6



Water Usage Savings Analysis

The water usage savings chart highlights the reductions achieved by upgrading appliances such as showerheads, dishwashers, and washing machines. By replacing inefficient appliances, you can save up to 30% of your annual water consumption. For instance, switching to a water-saving showerhead can reduce usage from 12,000 liters/year to 8,400 liters/year, conserving resources and lowering costs.

Payback Period Overview

The chart on Page 3 outlines the payback periods for recommended upgrades, helping you prioritize changes based on affordability and impact. For instance, sealing windows can pay for itself within 6 months, while replacing an old heater offers substantial savings over time despite a longer payback period.

Next Steps

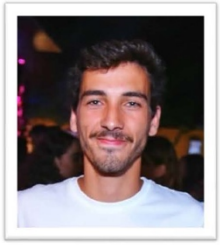
Implementing these recommendations will not only reduce your energy costs but also contribute to a more sustainable lifestyle. We encourage you to explore additional energy-saving products through EcoSeal's website for further guidance and support. A sample action plan with product suggestions and savings estimates is included in the Appendix for reference.

Appendix P: Case Study Home Energy Plan

NOVA SCHOOL OF SCIENCE & TECHNOLOGY

Energy and Climate Change

Professor Júlia Seixas
Professor Joanaz de Melo



Effort: 60 hours

Home Energy Plan

by João Afonso Mendes, Integrated Master in Micro and Nanotechnology Engineering
(student ID: 50770)

UNIVERSIDADE NOVA DE LISBOA

2021

Energy By Use

Category	Equipment	Source	Cons. (kWh/year)	Cons. (GJ/year)	Cons. (%)	Method for Computation
Lighting	Lamps	Electricity	417,16	1,502	7,50	Assumption
Cooking	Oven	Electricity	322,70	1,162	5,80	Energy Monitor
	Stove	Electricity	438,40	1,578	7,88	Tech. Note
	Microwave	Electricity	10,95	0,039	0,20	Tech. Note
	Coffee Machine	Electricity	10,40	0,037	0,19	Energy Monitor
	Toaster	Electricity	1,56	0,006	0,03	Tech. Note
	Sandwich Maker	Electricity	4,90	0,018	0,09	Tech. Note
	Blender	Electricity	7,80	0,028	0,03	Tech. Note
Cold Storage	Refrigerator #1	Electricity	321,60	1,158	5,78	Energy Monitor
	Refrigerator #2	Electricity	771,20	2,776	13,86	Energy Monitor
Hot Water	Water Boiler	Natural Gas	4018,33	14,466	100,00	Gas Invoice

2021

Category	Equipment	Source	Cons. (kWh/year)	Cons. (GJ/year)	Cons. (%)	Method for Computation
Climatization	Fireplace	Firewood	123,00	0,443	100,00	Assumption
	Oil Heater #1 (x2)	Electricity	486,00	1,750	8,74	Tech. Note
	Oil Heater #2	Electricity	243,00	0,875	4,39	Tech. Note
House Keeping	Washing Machine	Electricity	625,90	2,253	11,25	Energy Monitor
	Dishwasher	Electricity	425,10	1,530	7,64	Energy Monitor
	Vacuum Cleaner	Electricity	23,40	0,084	0,42	Tech. Note
	Iron	Electricity	200,85	0,723	3,61	Tech. Note
	Hair Drier	Electricity	17,52	0,063	0,31	Energy Monitor
Audiovisual	Main TV + Extras	Electricity	418,50	1,507	7,52	Energy Monitor
	PC #1	Electricity	161,10	0,580	2,90	Energy Monitor
	PC #2	Electricity	621,23	2,24	11,17	Energy Monitor
Total		**Electricity**	**5562,47**	**20,025**	**100**	
		Natural Gas	**4018,33**	**14,466**	**100**	
		Firewood	**123,00**	**0,443**	**100**	

Energy Balance and Indicators

Source	Acquisition					Identified Uses	Unidentified Uses	
	Quantity (orig. units)	Quantity (GJ/year)	Cost (€/year)	Per Capita (GJ/year/person)	Per Useful Area (MJ/year/m²)	Quantity (GJ/year)	Quantity (GJ/year)	%
Electricity	6231 kWh/yr	22,43	1107,77	4,49	208,26	20,03	2,4	10,70
Natural Gas	353 m³/yr	14,47	254,62	2,89	134,35	14,47	0	0
Firewood	30 kg/yr	0,44	15	0,09	4,09	0,44	0	0
Total	**-**	**37,34**	**1377,39**	**7,47**	**346,7**	**34,94**	**2,4**	**6,43**

House Classification (REH)

Indicators expressed as (fossil) primary energy				Total
kWh PE/m²/year	Winter Warming	Summer Cooling	Hot Water	
My Home	Nic	Nvc	Nac	**Ntc**
	25,93	5,88	26,28	**104,33**
Reference	Ni	Nv	Na	**Nt**
	33,74	11,89	26,28	**131,63**

Certificação Energética e Ar Interior EDIFÍCIOS

$$R_{NT} = \frac{Ntc}{Nt} = \frac{104,33}{131,64} \cong 0,79$$

Energy Class "B –"

Corresponds to the energy classification of new buildings that fulfill the **minimum energy regulation requirements**.

The house is well oriented and has good window-wall ratio, except for the Eastern facade wall. It is relatively well insolated for summer cooling and less so for winter warming.

2021

Savings Potential

As seen on "Energy By Use"

Equipment	Source	Cons. (kWh/year)	Cons. (GJ/year)	Cons. (%)
Refrigerator #2	Electricity	771,20	2,776	13,86
Washing Machine	Electricity	625,90	2,253	11,25
PC #2	Electricity	621,23	2,240	11,17
Dishwasher	Electricity	425,10	1,530	7,64
Total	**Electricity**	**2443,33**	**8,799**	**43,92**

More Efficient Equipments:

Kitchen Renovations (expected to happen in 1 to 2 years):

- **Refrigerator #2** (underground storage room) has double the consumption of the fridge in the kitchen → *BECKEN BDD5394 WH 246L (222 kWh/year, A++ energy efficiency)*
- **Washing Machine** is over 20 years old → *CANDY CSS 1610TWMCE/1-S (143 kWh/year, A+++ energy efficiency)*
- **Dishwasher** is also over 20 years old → *CDPN 4D620PW/E (140 kWh/year, C energy efficiency)*

PC #2 is a custom built "tower" which has not been upgraded in 10 years → *can become more efficient (consumption of 350 kWh/year or less) or be substituted.*

2021

Savings Potential Table

Type of Measure	Measure	Savings Potential			Investment (€)	Payback Time (years)	Comfort Change	Practical Difficulty
		Energy (GJ/year)	GHG ($kgCO_2eq$/year)	Cost (€/year)				
More Efficient Equipments	Replacing Fridge #2	1,98	107,64	97,76	350	3 years, 7 months		
	Replacing Washing Machine	1,74	94,65	85,97	450	5 years, 3 months		
	Overhauling PC #2	0,98	53,16	48,28	1200	25 years		
	Replacing Dishwasher	1,03	55,88	50,75	400	8 years		
Subtotal	-	**5,73**	**311,33**	**282,76**	**2400**	**8 years, 6 months**	-	-

Savings Potential Table

Type of Measure	Measure	Savings Potential			Investment (€)	Payback Time (years)	Comfort Change	Practical Difficulty
		Energy (GJ/year)	GHG ($kgCO_2eq$/year)	Cost (€/year)				
Alternative Sources	Installation of Solar Panels	22,43	1223,43	200	2400	12 years		
Better Practices	Implementing Current-cutters	0,44	21,87	54,67	20	5 months		
	Defrosting refrigerator #2	0,28	15,11	13,73	0	0		
	Sealing Air Leaks	0,13	7,14	6,49	5	10 months		
	Taking Cooler Showers	0,72	25,92	12,73	0	0		
Total	-	**29,73**	**1604,80**	**570,38**	**4825**	**8 years, 6 months**	-	-

Measures for Implementation

Type of Measure	Measure	Savings Potential			Investment (€)	Payback Time (years)	Comfort Change	Practical Difficulty
		Energy (GJ/year)	GHG ($kgCO_2eq$/year)	Cost (€/year)				
Alternative Sources	Installation of Solar Panels	22,43	1223,43	200	2400	12 years		
Better Practices	Implementing Current-cutters	0,44	21,87	54,67	20	5 months		
	Defrosting refrigerator #2	0,28	15,11	13,73	0	0		
	Sealing Air Leaks	0,13	7,14	6,49	5	10 months		
	Taking Cooler Showers	0,72	25,92	12,73	0	0		
Total	-	**24,00**	**1293,47**	**287,62**	**2425**	**8 years, 5 months**	-	-

Savings Potential - Synthesis

	Savings Potential						Investment	Payback Time
	Energy		GHG		Cost			
	GJ/year	% BL	$kgCO_2eq$/year	% BL	€/year	% BL	€	years
Total Identified Potential	29,73	79,62	1604,80	88,28	570,38	43,10	4850	8 years, 6 months
Selected Measures	**24,00**	**64,27**	**1293,47**	**71,15**	**287,62**	**21,73**	**2425**	**8 years 5 months**

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