Inclusion Policy Lab: Evaluation Results

Catalonia: Training and Housing Improvement Project to Address Energy Poverty

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Financiado por la Unión Europea NextGenerationEU
MINISTERIO DE INCLUSIÓN, SEGURIDAD SOCIAL Y MIGRACIONES
Plan de Recuperación, Transformación y Resiliencia
Generalitat de Catalunya Departament de Drets Socials
J-PAL

The General Secretariat for Inclusion of the Ministry of Inclusion, Social Security, and Migration has prepared this report within the framework of the Inclusion Policy Lab, as part of the Recovery, Transformation and Resilience Plan (RTRP), with funding from the Next Generation EU funds. The Department of Social Rights of the Government of Catalonia has collaborated in the preparation of this report as the entity responsible for implementing the project. This collaborating entity is one of those implementing the pilot projects and has collaborated with the General Secretariat of Inclusion in the design of the RCT methodology, actively participating in the provision of the necessary information for the design, monitoring, and evaluation of the social inclusion itinerary. Furthermore, their collaboration has been essential to gathering informed consents, ensuring that the participants in the itinerary have been adequately informed and that their participation has been voluntary.

The partnership with J-PAL Europe has been a vital component in the efforts of the General Secretariat of Inclusion to improve social inclusion in Spain. Their team has provided technical support and shared international experience, assisting the General Secretariat in the comprehensive evaluation of pilot programs. Throughout this partnership, J-PAL Europe has consistently demonstrated a commitment to promoting the adoption of evidence-based policy, facilitating the integration of empirical data into strategies that seek to promote inclusion and progress within our society.

This evaluation report has been produced using the data available at the time of its writing and it is based on the knowledge acquired about the project up to that date. General Secretariat of Inclusion reserves the right to clarify, modify, or delve into the results presented in this report in future publications. These potential variations could be based on the availability of additional data, advances in evaluation methodologies, or the emergence of new information related to the project that may influence the interpretation of the results.

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Executive Summary

- The **Minimum Income Scheme,** established in May 2020, is a minimum income policy that aims to guarantee a minimum income to vulnerable groups and provide ways to promote their social and labor integration.
- Within the framework of this policy, the Ministry of Inclusion, Social Security and Migration (MISSM) fosters a strategy to promote inclusion through pilot projects of social innovation, which are conducted in the **Inclusion Policy Lab**. These projects are evaluated according to the standards of scientific rigor and using the methodology of Randomized Controlled Trials.
- This document presents the evaluation results and main findings of the project «Training and Housing Improvement Project to Address Energy Poverty», which has been conducted in **cooperation between the MISSM and the Government of Catalonia**.
- This study evaluates the impact of **3 treatments** on the reduction of energy poverty: physical investments to improve the **energy efficiency of homes,** advice focused on **efficient consumption habits,** and a third treatment that **combines the two previous interventions**. Thus, to contrast the impact of the different treatments, **a control group** was established that did not receive any intervention.
- The project took place in the **Autonomous Region of Catalonia**, with the intervention targeting the publicly **owned social housing stock** with investment needs and inhabited by families with a low level of income. A total of 1,992 households or family units participated: 500 in each group of the three treatment groups and 492 in the control group.
    - On average, participating family units have 3.1 members, and the monthly household income stands at 1,086 euros. 50% of the participants are recipients of a social bonus for spending on energy supplies. Regarding the conditions of the housing, the energy certification of the homes is, on average, around categories F and E and the state of the same is considered, for more than 80%, poor or fair, which evidences the initial hypothesis that the homes for social rent are ageing.
- The degree of attrition of the experimental groups was 34% of the initial sample for the treatment involving physical investment in the home, 41% for the group treated with counseling, 37% for the treatment group combining investment in housing and counseling, and 42% for the control group. It is evident that the follow-up is higher in treatments that involve an investment for the improvement of the home. In addition, it is relevant to note that 235 families who received the intervention have not provided data at the end of the project. This, along with the wear and tear that has occurred, can affect the results of the analysis.
- The main results of the evaluation are as follows:
    - **Improvement in consumption habits**: the indicator of **better distribution of energy consumption** throughout the day increases by 32%, and the indicator of **more efficient use of energy-consuming elements** increases by 2%, in those homes that are advised.

- **Improvement of the energy efficiency of** the home: the index for the energy certification of the dwellings shows a significant improvement of 12% in the groups treated with investment in the dwelling, compared to the treatment group that does not receive investment and the control group. However, despite the investment made, the technical difficulty in maintaining an adequate temperature in the home does not diminish.
- **Improvement in the quality of life**: an improvement in the quality **of life due to housing conditions** is observed in the groups that receive investment, compared to those that do not, and there is no significant difference between applying only investment or investment together with advice. The family's self-perceived quality of life and health do not improve significantly with any treatment.
- The results indicate that the proposed treatments do not generate a decrease in **monthly energy consumption**. There is a saving on the energy bill in the treatment groups where energy advice is offered, as the monthly expenditure on gas and electricity is reduced.

1 Introduction

General Regulatory Framework

The Minimum Income Scheme (MIS), regulated by Law 19/2021[1], is an economic benefit whose main objective is to prevent the risk of poverty and social exclusion of people in situations of economic vulnerability. Thus, it is part of the protective action of the Social Security system in its non-contributory modality and responds to the recommendations of various international organizations to address the problem of inequality and poverty in Spain.

The provision of the MIS has a double objective: to provide economic support to those who need it most and to promote social inclusion and employability in the labor market. This is one of the social inclusion measures designed by the General State Administration, together with the support of the autonomous regions, the Third Sector of Social Action, and local corporations[2]. It is a central policy of the Welfare State that aims to provide minimum economic resources to all individuals in Spain, regardless of where they live.

Within the framework of the National Recovery, Transformation and Resilience Plan (PRTR)[3] the General Secretariat for Inclusion (SGI) of the Ministry of Inclusion, Social Security and Migration (MISSM) participates significantly in Component 23 "New public policies for a dynamic, resilient and inclusive labor market", framed in policy area VIII "New care economy and employment policies".

Investment 7: "Promotion of Inclusive Growth by linking socio-labor inclusion policies to the Minimum Income Scheme" is among the reforms and investments proposed in this Component 23. Investment 7 promotes the implementation of a new model of inclusion based on the MIS, which reduces income inequality and poverty rates. Therefore, the MIS goes beyond being a mere economic benefit and supports the development of a series of complementary programs that promote socio-labor inclusion. However, the range of possible inclusion programs is very wide, and the government decides to pilot different programs and interventions to evaluate them and generate knowledge that allows prioritizing certain actions. With the support of investment 7 under component 23, the MISSM establishes a new framework for pilot projects of inclusion projects constituted in two phases, through two royal decrees covering a set of pilot projects based on experimentation and evaluation:

[1] Law 19/2021, of 20 December, establishing the Minimum Income Scheme (BOE-A-2021-21007).

[2] Article 31.1 of Law 19/2021, of December 20, 2021, establishing the Minimum Income Scheme.

[3] The Recovery, Transformation and Resilience Plan refers to the Recovery Plan for Europe, which was designed by the European Union in response to the economic and social crisis triggered by the COVID-19 pandemic. This plan, also known as Next Generation EU, sets out a framework for the allocation of recovery funds and for boosting the transformation and resilience of member countries' economies.

- **Phase I: Royal Decree 938/2021**[4], through which the subsidies for the execution of 16 pilot projects of inclusion itineraries corresponding to autonomous regions, local organizations, and the Third Sector of Social Action organizations. This royal decree contributed to the fulfilment of milestone number 350[5] and monitoring indicator 351.1[6] of the RTRP.
- **Phase II: Royal Decree 378/2022**[7], which grants subsidies for a total of 18 pilot projects of inclusion itineraries executed by autonomous regions, local entities, and entities of the Third Sector of Social Action organizations. This royal decree contributed, together with the previous one, to compliance with monitoring indicator number 351.1 of the RTRP.

To support the implementation of evidence-based public and social policies, the Government of Spain decided to evaluate the social inclusion pilot projects using the Randomized Control Trial (RCT) methodology. This methodology, which has gained relevance in recent years, represents one of the most rigorous tools to measure the causal impact of a public policy intervention or a social program on indicators of interest, such as social and labor insertion or the well-being of beneficiaries.

Specifically, RCT is an experimental method of impact evaluation in which a representative sample of the population potentially benefiting from a public program or policy is randomly assigned either to a group receiving the intervention or to a comparison group that does not receive the intervention for the duration of the evaluation. Thanks to the randomization in the allocation of the program, this methodology can statistically identify the causal impact of an intervention on a series of variables of interest. This methodology enables us to analyze the effect of this measure, which helps to determine if the policy is adequate to achieve the planned public policy objectives. Experimental evaluations enable us to obtain rigorous results of the intervention effect, i.e., what changes the participants have experienced in their lives due to the intervention. In addition, these evaluations provide an exhaustive analysis of the program and its effects, facilitating insights into why the program was effective, who has benefited most from the interventions, whether it has indirect or unexpected effects, and which components of the intervention work and which do not.

[4] Royal Decree 938/2021, of October 26, 2021, which regulates the direct granting of subsidies from the Ministry of Inclusion, Social Security and Migration in the field of social inclusion, for an amount of 109,787,404 euros, within the framework of the Recovery, Transformation and Resilience Plan (BOE-A-2021-17464).

[5] Milestone 350 of the RTRP: "Improve the rate of access to the Minimum Income Scheme and increase the effectiveness of the MIS through inclusion policies, which, according to its description, will translate into supporting the socio-economic inclusion of the beneficiaries of the MIS through itineraries: eight collaboration agreements signed with subnational public administrations, social partners and social action entities of the third sector to carry out the itineraries. The objectives of these partnership agreements are: (i) to improve the MIS access rate; ii) increase the effectiveness of the MIS through inclusion policies."

[6] Monitoring indicator 351.1 of the RTRP: "at least 10 additional collaboration agreements signed with subnational public administrations, social partners and social action entities of the third sector to carry out pilot projects to support the socio-economic inclusion of MIS beneficiaries through itineraries".

[7] Royal Decree 378/2022, of May 17, 2022, regulating the direct granting of subsidies from the Ministry of Inclusion, Social Security and Migration in the field of social inclusion, for an amount of 102,036,066 euros, within the framework of the Recovery, Transformation and Resilience Plan (BOE-A-2022-8124).

These evaluations have focused on the promotion of social and labor inclusion of the beneficiaries of the MIS, recipients of regional minimum incomes and other vulnerable groups. In this way, the MISSM establishes a design and impact evaluation of results-oriented inclusion policies, which offer evidence for decision-making and its potential application in the rest of the territories. The promotion and coordination of 32 pilot projects by the Government of Spain has led to the establishment of a laboratory for innovation in public policies of global reference named the Inclusion Policy Lab.

For the implementation and development of the Inclusion Policy Lab, the General Secretariat for Inclusion has established a governance framework that has made it possible to establish a clear and potentially scalable methodology for the design of future evaluations and the promotion of decision-making based on empirical evidence. The General State Administration has had a triple role as promoter, evaluator, and executive of the different programs. Different regional and local administrations and organizations of the Third Sector of Social Action have implemented the programs, collaborating closely in all their facets, including evaluation and monitoring. In addition, the Ministry has had the academic and scientific support of the Abdul Latif Jameel Poverty Action Lab (J-PAL) Europe and the Centre for Monetary and Financial Studies (CEMFI), as strategic partners to ensure scientific rigor in the assessments. Likewise, the Inclusion Policy Lab has an Ethics Committee[8], which has ensured the strictest compliance with the protection of the rights of the people participating in the social inclusion itineraries.

This report refers to the "Training and Housing Improvement Project to Address Energy Poverty", executed within the framework of Royal Decree 378/2022 by the Autonomous Region of Catalonia. In this sense, the Department of Social Rights of the Government of Catalonia has been responsible for the execution of the project, as an entity of the regional government with functions in terms of services, benefits, and social protection. This report contributes to the fulfillment of milestone 351 of the PRTR "Following the completion of at least 18 pilot projects, the publication of an evaluation on the coverage, effectiveness and success of the MIS, including recommendations to increase the level of application and improve the effectiveness of social inclusion policies".

Context of the project

Energy poverty refers to the situation in which a household cannot meet its basic needs for energy supplies because of an insufficient level of income, and which can be aggravated by having an energy-inefficient home. Likewise, suffering from energy poverty has various implications both in the personal sphere – well-being, health, and economy – and in the social sphere.

Due to the complex interplay of factors that determines energy poverty, and considering its important implications, it is crucial to observe different indicators that allow us to observe the incidence and severity of this phenomenon from different angles. To measure the situation of energy poverty, the

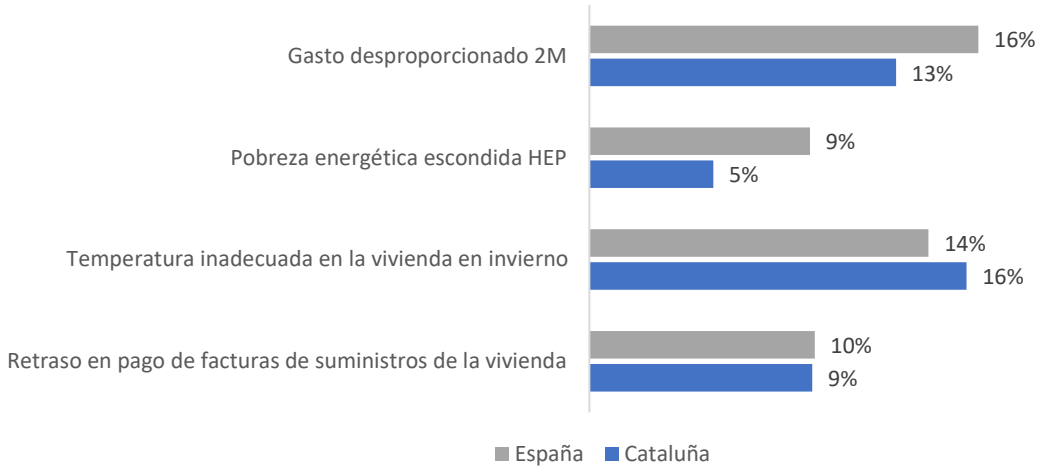
[8] Regulated by Order ISM/208/2022, of March 10, 2022, which creates the Ethics Committee linked to social inclusion itineraries, on 22/07/2022 it issued a favorable report for the realization of the project that is the subject of the report.

European Observatory against Energy Poverty proposes the monitoring of the following four indicators:

- **Disproportionate expenditure (2M):** percentage of households whose energy expenditure relative to their income is more than double the national median.
- **Hidden energy poverty (HEP):** percentage of households whose absolute energy expenditure is less than half of the national median.
- **Inability to keep the home at an adequate temperature**: percentage of the population unable to maintain their home at an adequate temperature.
- **Late payment of bills**: percentage of the population that is late in paying bills for household supplies.

In Spain, during 2021, the highest indicator was disproportionate spending, which affected 16.4% of households. In the Autonomous Region of Catalonia, the territorial area of the project that is the subject of this report, the predominant indicator was the inability to maintain an adequate temperature in the home, affecting 15.9% of households in the region[9].

Figure 1: Energy poverty indicators in households in Spain and Catalonia (% households, 2021)



Source: Ministry for Ecological Transition and Demographic Challenge.

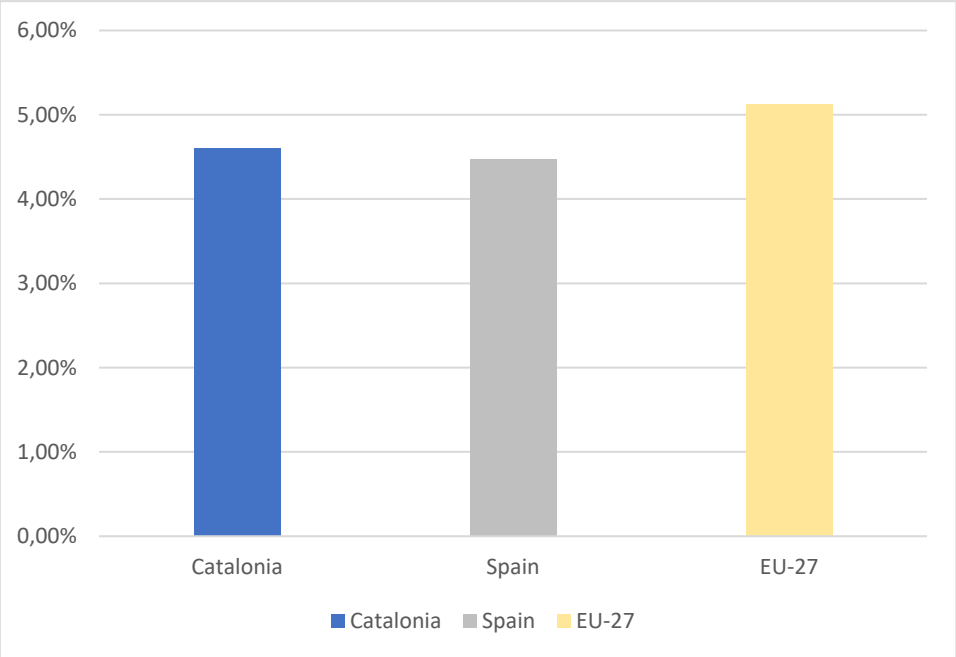
In the current context, the problem of energy poverty has become even more relevant due to the increase in the prices of household supplies. Specifically, electricity prices have increased 3.9 times and gas prices 8.9 times in 2022 compared to 2020 prices, according to data from regulatory bodies OMIE and MIBGAS. Due to this situation, institutions have implemented measures to protect

[9] In December 2022, the Ministry for the Ecological Transition and the Demographic Challenge published the update of the indicators of the national strategy against energy poverty. This document explains and analyses the evolution of energy poverty in 2021, in Spain and in the different Autonomous Regions, through the four indicators proposed by the EPOV and adopted in the ENPE as main indicators to monitor in Spain.
https://www.miteco.gob.es/content/dam/miteco/es/ministerio/planes-estrategias/estrategia-pobreza-energetica/actualizaciondelosindicadoresdelaestrategianacionalcontralapobrezaenergetica-2022_tcm30-549718.pdf

consumers, trying to prevent the negative impact of price increases on these families. These measures include the reduction in VAT and excise duties on household supplies, as well as the establishment of a ceiling on the revision of tariffs of last resort. Other measures implemented have been aimed at the most vulnerable households, such as the Social Electricity Bonus, the Thermal Social Bonus, or the law that prevents disconnecting the supply to vulnerable households in the event of non-payment.[10]

According to the INE's Household Budget Survey, in 2022 average expenditure on electricity, gas and other household fuels represented around 4.5% and 4.6% in Spain and Catalonia, respectively. This relative expenditure is slightly lower than the average for the European Union, where in 2022 it accounted for 5.1% of household budgets.

Figure 2: Weight of basic supplies in the total household budget



Notes: Data for 2022 and the ECOICOP/EPF 04.4 T expenditure subgroup.

Source: INE and OECD.

In a context in which many households are unable to meet their basic energy supply needs, it is of great social relevance to conduct an impact assessment of different actions that can contribute to minimize the degree of energy poverty of families at risk of social exclusion.

Regulatory framework associated with the project and governance structure

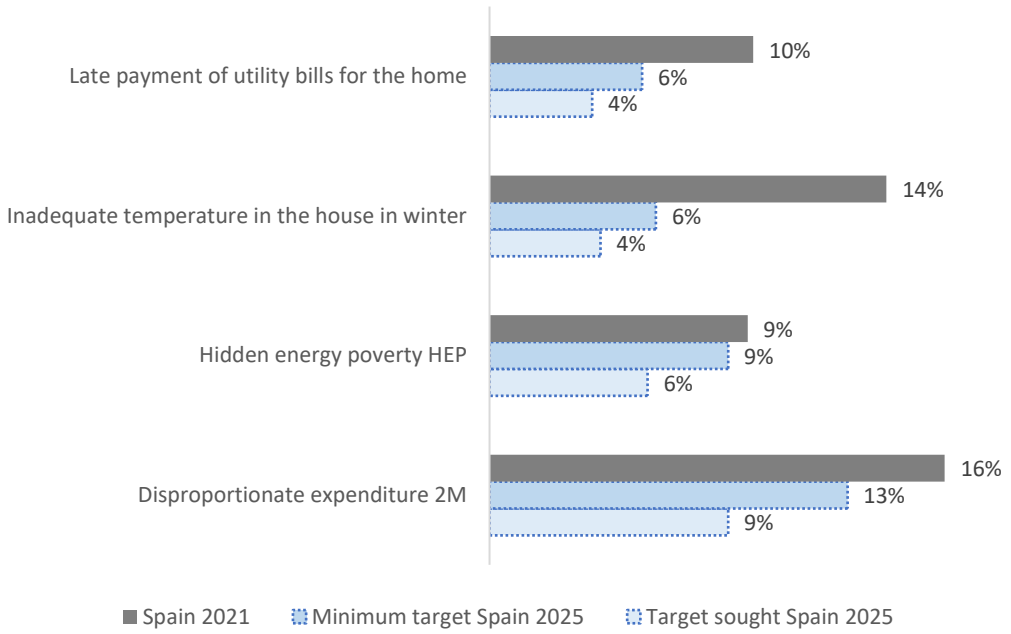
[10] In addition to the above-mentioned measures, measures were adopted by the European institutions such as Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market in electricity or Directive 2009/73/EC of 13 July 2009 on the internal market in natural gas.

The relevance of the phenomenon of energy poverty goes beyond national borders, and for this reason the European Union has implemented measures such as the Social Climate Fund, recently adopted by Regulation (EU) 2023/955 of 10 May 2023. This fund proposes to allocate part of the economic resources to combat the high levels of energy poverty through "specific structural measures, in particular the renovations of buildings and the active promotion of renewable energy sources aimed at households through information and awareness-raising measures ".

It is noteworthy to mention previous European directives aimed at combating energy poverty, such as Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings, Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market in electricity or Directive 2009/73/EC, of 13 July 2009 for the internal market in natural gas.

In the case of Spain, Royal Decree-Law 15/2018 on urgent measures for the energy transition and consumer protection was published on 5 October, amending current laws to contemplate the figure of the vulnerable consumer, the social bonus and other protection measures for domestic energy consumers. This decree also promoted the definition and approval of the **National Strategy against Energy Poverty 2019-2024**, a strategic plan that establishes the lines of action and objectives in the fight against this problem, with a time focus until 2025.

Figure 3: Objectives of the National Strategy against Energy Poverty (% households)



Source: National Strategy against Energy Poverty 2019-2024.

For their part, the Autonomous Regions also implement specific measures and policies to address this problem within their territorial scope. In this regard, the Government of Catalonia enacted **Law 24/2015 of 29 July 2015 on urgent measures to address the emergency in the field of housing and energy poverty**. This law aims to protect individuals and families in situations of economic

vulnerability or risk of residential exclusion, especially against electricity, gas and drinking water supply cuts that may be agreed by the supplier companies due to non-payment.

The European, national, and regional regulations are in line with the framework established in the 2030 Agenda and the Sustainable Development Goals (SDGs). Similarly, the pilot project investigated in this report is aligned with European, national, and regional strategies in the field of energy poverty, as well as with the 2030 Agenda for Sustainable Development, specifically contributing to SDGs 1, 10 and 11.

Considering the context of energy poverty, the Department of Social Rights of the Government of Catalonia has conducted this project that seeks to study the effect of different policies or public actions about energy poverty of groups at risk of social exclusion.

The scientific objective of the project is to evaluate the effectiveness of actions aimed at improving the energy efficiency of homes and advising households on energy consumption. All of this is aimed at reducing energy poverty and promoting the social inclusion of the most vulnerable households. In addition, it is intended to promote the transfer of knowledge to the process of public policy development and to be accountable for the results of the project.

The governance framework configured for the correct execution and evaluation of the project includes the following actors:

- The **Department of Social Rights of the Government of Catalonia** is responsible for promoting policies on social services, benefits and protection, social inclusion policies and community action[11].
- The **Agència de l'Habitatge de Catalunya (AHC),** the public body responsible for implementing the region's housing policy, as it is the administrator and manager of the housing stock of the Government of Catalonia on which the actions of the pilot project are conducted.
- The **Ministry of Inclusion, Social Security and Migration** (MISSM), as the founder of the project and responsible for the RCT evaluation. For this reason, the General Secretariat for Inclusion assumes a series of commitments with the Department of Social Rights of the Government of Catalonia:
    - Assist the beneficiary entity in the design of the actions to be conducted, for the execution and monitoring of the object of the subsidy, as well as for the profiling of the potential participants of the pilot project.

[11] Decree 184/2022, of October 10, 2022, naming and determining the scope of competence of the departments into which the Government and Administration of the Generalitat of Catalonia are organized

- Design the randomized controlled trial (RCT) methodology of the pilot project in coordination with the beneficiary entity and scientific collaborators. Also, conduct the evaluation of the project.
- Ensure strict compliance with ethical considerations by obtaining the approval of the Ethics Committee.

- **CEMFI and J-PAL Europe,** as scientific and academic institutions that support MISSM in the design and RCT evaluation of the project.

In view of the above, this report follows the following structure. **Section 2** provides a project description, detailing the issues to be addressed, the target audience for the intervention, and the specific interventions associated with improving levels of social inclusion. Next, **Section 3** contains information related to the evaluation design, defining the theory of change linked to the project, hypotheses, sources of information, and indicators used. **Section 4** describes the implementation of the intervention, analyzing the sample, the results of random allocation, and the level of participation and attrition in the intervention. This section is followed by **Section 5**, which presents the evaluation results, with a detailed analysis of the econometric analysis carried out and the results for each of the indicators used. Finally, the general conclusions of the project evaluation are described in **Section 6**. Finally, in the **Economic Management and Regulatory** appendix, additional information is provided on management tools and project governance.

Ethics Committee linked to Social Inclusion Itineraries

In the course of research involving human subjects, whether in the field of biology or the social sciences, researchers and workers associated with the program often face ethical or moral dilemmas in the development of the project or its implementation. For this reason, in many countries it is common practice to create ethics committees that verify the ethical viability of a project, as well as its compliance with current legislation on research involving human beings. The Belmont Report (1979) and its three fundamental ethical principles – respect for persons, profit, and justice – constitute the most common frame of reference in which ethics committees operate, in addition to the corresponding legislation in each country.

With the aim of protecting the rights of participants in the development of social inclusion itineraries and ensuring that their dignity and respect for their autonomy and privacy are guaranteed, Order ISM/208/2022 dated March 10 creates the Ethics Committee linked to Social Inclusion Itineraries. The Ethics Committee, attached to the General Secretariat for Inclusion and Social Welfare Objectives and Policies, is made up of a president – with an outstanding professional career in defense of ethical values, a social scientific profile of recognized prestige and experience in evaluation processes – and two experts appointed as members.

The Ethics Committee has conducted the analysis and advice of the ethical issues that have arisen in the execution, development and evaluation of the itineraries, formulated proposals in those cases that present conflicts of values and approved the evaluation plans of all the itineraries. The Ethics Committee issued its approval for the development of this evaluation on April 27, 2023.

2 Description of the program and its context

This section describes the program that the Government of Catalonia implemented within the framework of the evaluation project. The target population and territorial framework are described, and the intervention is described in detail.

2.1 Introduction

This project aims to compare the impact of different interventions or treatments in reducing energy poverty in groups at risk of social exclusion. Specifically, it seeks to assess whether training and counseling processes on domestic energy consumption habits and investments to improve energy efficiency in homes are effective and to what extent they can reduce energy poverty. In addition, the project aims that, once the effectiveness of the interventions has been evaluated, it will be replicable,

transferable, and scalable to other social and territorial realities to generate a greater impact in the fight against energy poverty.

The central area of intervention of the program is energy poverty; due to its implications, it extends to other areas such as physical health, mental health, emotional well-being, and the economic situation of households. Additionally, the project seeks to empower families to optimize their energy consumption so that they can adapt their energy consumption habits and their basic utility rates to their needs and economic possibilities.

In addition, two satellite actions are conducted with the following objectives:

1. Improving the situation of the participants in relation to their minimum income, accompanying them towards obtaining income through the Minimum Income Scheme (MIS).
2. To break with the situations of social isolation that the participants in the program may suffer which represents an obstacle to their social progress.

The theme of this project aligns with numerous scientific studies, particularly the meta-analysis conducted by Nisa et al. (2019) of empirical articles that use RCTs to measure the effect of different actions on, among others, the household energy consumption. Specifically, the results show limited effects of interventions such as installing more efficient appliances, and of measures based on information like labels and statistics. Furthermore, it is indicated that strategies based on social norms, particularly those related to social comparison or the herd effect, have the greatest positive impact in promoting energy savings.

Two studies where interventions similar to those of the project that is the subject of the report have been applied. On one hand, the study by Osman et al. (2010) stands out for studying the impact of investments in energy efficiency improvements in the homes of patients with respiratory diseases. Using RCT methodology, they conclude that the implementation of efficient heating systems and structural improvements in thermal insulation have significant positive results not only in reducing energy consumption and expenditure, but also in the health of the people who reside in these homes. On the other hand, the study by Asensio, O. I., & Delmas, M. A. (2015) examines the effect of non-monetary incentives on household energy savings, also using the RCT methodology. The results show that providing information on the importance and implications of efficient consumption of household supplies on the domestic economy, health, and the environment, promotes an average energy saving of 8%, increasing to 19% in households with minors.

At the national level, and in relation to the specific phenomenon of energy poverty, similar studies have not been conducted using the RCT methodology. However, for the design and implementation of this program, various studies about the incidence, consequences, effects, and characteristics of energy poverty in Spain have been considered, such as ACA (2013), Bruel et al. (2017) and Guevara Sánchez (2021). Research that analyzes the impact of home renovation in terms of improving energy efficiency has also been considered, such as the study by López Mesa et al. (2014).

2.2 Target population and territorial scope

The target group of the actions comprises family units residing in publicly owned and socially rented housing, administered by the Agència de l'Habitatge de Catalunya. Filters have been applied to this initial sample of households to narrow down the candidates for them to meet the following characteristics:

- Reside in **homes with energy efficiency investment needs**; and
- Belong to the classification of **households with incomes** that **do not exceed 2.5 times** the **Sufficiency Income Indicator of Catalonia** (IRSC).

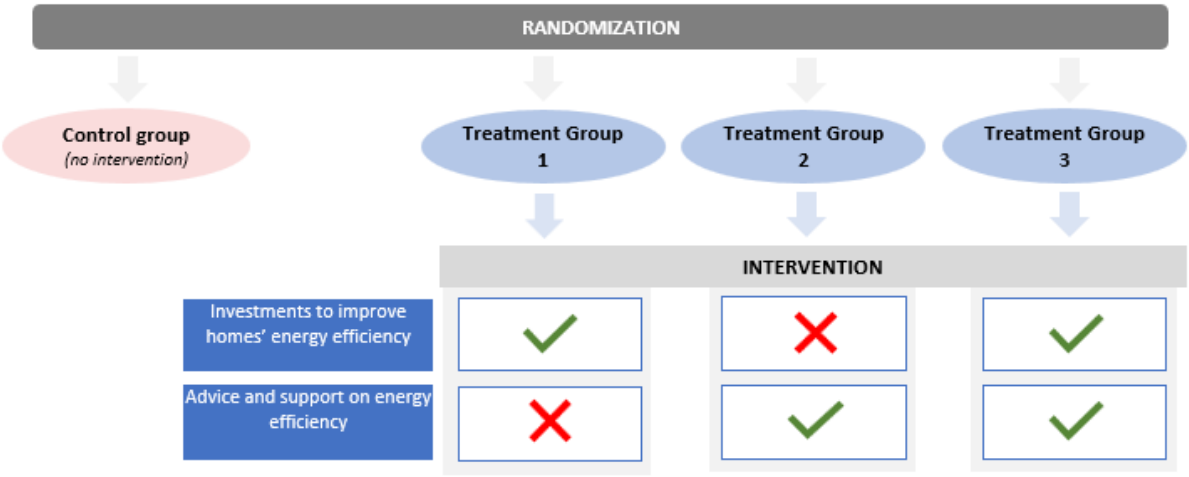
The territories covered by the program include the four provinces of Catalonia: Barcelona, Tarragona, Lleida, and Girona. In this sense, a distribution of the households studied covers the entire territory, both at the provincial and local level.

2.3 Description of interventions

The project consists of two main actions, one aimed at advising on improving energy efficiency, and the other focused on the installation of different systems to improve the energy efficiency of homes. The main innovation of the project lies in its ability to measure the effect of each of these actions both individually and jointly.

The intervention was designed following the RCT methodology, with a control group and three treatment groups. The control group is a pure group that does not receive any type of intervention. Treatment group 1 receives investments to improve energy efficiency in their home, treatment group 2 receives advice and support on energy efficiency and treatment group 3 receives both actions (advice and investments to improve energy efficiency). The **Figure 4** summarizes the interventions for each experimental group.

Figure 4: Outline of the intervention



The content of the two implemented actions is described below:

Investments to improve the energy efficiency of homes

Consists of executing actions to improve and/or rehabilitate energy efficiency. To conduct this action, the following methodological process is followed:

1. Scheduling of home visits and conducting diagnostic visits in homes.
2. Determination of possible improvement and/or rehabilitation actions.
3. Scheduling of the date and time of intervention.
4. Execution of the actions.
5. Validation and certification of actions.
6. Completion of the Energy Performance Certificate (EEC) for each home.
7. Scheduling and conducting audit and control visits on 35% of the homes intervened.

Although the type of works depends on the condition and needs of each home, in general terms actions are contemplated in terms of improving insulation, heating and boiler systems, and efficiency in appliances connected to the supply networks. The amount invested in each household is determined based on the needs and specific situation of the home.

Advice and support on energy efficiency

Consists of making available to households all the useful and necessary information to optimize the use of household supplies, according to the home's needs and economic capacity. The service is provided to residents in the home. Advice is provided for the improvement of consumption habits, and advice on the interpretation of invoices and for the management and rights of the consumer.

To this end, the following methodological process is followed:

1. Elaboration of the service implementation strategy
2. Scheduling of home visits.
3. Diagnosis to determine the main characteristics and condition of the property.
4. Performing counseling tasks and delivering support material and recommendations to family units.
5. Definition of the Individual Action Plan (IAP).
6. Conducting complementary advice.
7. Preparation of the Individual Execution Report.
8. Evaluation of family satisfaction.

The main milestones of the implementation of the action are the following:

- Design, implement and evaluate an information and advice service for the participants in the program with the aim of increasing energy efficiency and reducing energy expenditure by the participating families, depending on the starting point.
- Design, implement and evaluate training and training actions for participants in terms of consumption habits and energy efficiency, adapted to the starting point and the needs of the family unit.
- Disseminate valid resources for the improvement of energy consumption.

On the other hand, in addition to the two actions subject to evaluation, two satellite actions are conducted for those participants who require them[12]:

- Community support to improve the situation of social isolation.
- Individualized accompaniment for the application and processing of the Minimum Income Scheme (MIS).

The first action consists of making spaces, resources, or tools for community participation available to families that they have around them, urging them to become familiar and identifying those that best suit their needs. To this end, the following methodological process is followed:

1. Territorial distribution of families.
2. Scheduling of home visits.
3. Diagnosis of family members.
4. Identification of available resources.
5. Preparation and signing of the Individual Action Plan (IAP).
6. Monitoring and evaluation of people's connection with resources.
7. Evaluation of family satisfaction.

[12] It is considered an optimal opportunity to take advantage of the opportunity to treat vulnerable families who have been identified and contacted for the overall project in these two areas.

The second action consists of providing families with information on the Minimum Income Scheme (MIS) and accompanying them from the completion of the procedure to the final resolution is obtained. The following methodological process is followed:

1. Analysis of the characteristics of the families and the susceptibility of the families to receive the benefit.
2. Accompaniment and creation of individual itineraries.
3. Preparation of the Individual Execution Report.
4. Evaluation of family satisfaction.

3 Evaluation design

This section describes the design of the impact evaluation of the programs described in the previous section. The theory of change is described, which identifies the mechanisms and aspects to be measured, the hypotheses to be tested in the evaluation, the sources of information to construct the indicators, the indicators, and the design of the experiment.

3.1 Theory of Change

This report, with the aim to design an evaluation that enables us to understand the causal relationship between the intervention and its final objective, develops a Theory of Change. The Theory of Change schematizes the relationship between the needs identified in the target population, the benefits, or services that the intervention provides, and the immediate and medium-long term results sought by the intervention. It explains the relationships between these elements, the assumptions underlying them, and outlines measures or outcome indicators.

Theory of Change

A Theory of Change begins with the correct identification of the needs or problems to be addressed and their underlying causes. This situational analysis should guide the design of the intervention, i.e., the activities or products provided to alleviate or resolve the needs, as well as the necessary processes for the treatment to be properly implemented. Next, this theory identifies what effect(s) are expected to happen, depending on the initial hypothesis, i.e., what changes – in behavior, expectations, or knowledge – are expected to be obtained in the short term with the actions conducted. Finally, the process concludes with the definition of the medium- to long-term results that the intervention aims to achieve. Sometimes, the effects directly obtained with the actions are identified as intermediate results and one identifies the indirect effects in the final results.

The development of a Theory of Change is a fundamental element for impact evaluation. At the design stage, the Theory of Change helps to formulate hypotheses and identify the indicators needed for the measurement of results. Once the results have been obtained, the Theory of Change makes it easier, if results are not as expected, to detect which part of the hypothetical causal chain failed, as well as to identify, in case of positive results, the mechanisms through which the program works. Likewise, the identification of the mechanisms that made the expected change possible allows a greater understanding of the possible generalization or not of the results to different contexts.

The Theory of Change for this project is based on identifying two problems related to energy poverty. On the one hand, the fact that families with a low level of income face this situation. On the other hand, social rental housing is ageing. The implications of this led to a situation of energy poverty in families, affecting physical health, mental health, or emotional well-being. Therefore, it is necessary to reduce the energy bill of families in vulnerable situations and improve their quality of life.

Within the project framework, a series of services (inputs or activities) are offered, constituting the resources and actions required to generate the program's outputs: advice for improving energy efficiency and support in appropriate consumption habits, and investments to improve home energy efficiency.

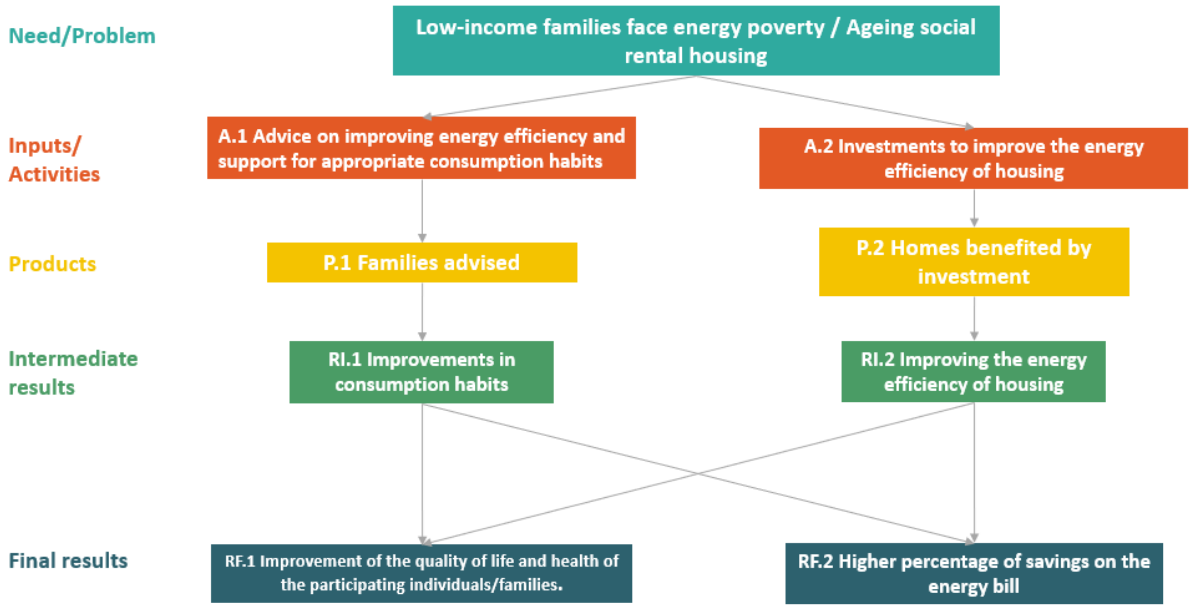
As a result of the actions described above, a series of products are expected. In other words, families are advised for more efficient energy use and homes benefit from the investment.

The entire development of the project leads to a series of intermediate results (mechanisms or changes that act as precursors) enabling final results. Advice is expected to result in improved energy consumption habits as an intermediate result. In the case of the housing investment intervention, improved energy efficiency is expected.

Thus, based on both intermediate results, final results are expected to include improved quality of life for the participating individuals/families and a higher saving percentage in the energy bill.

The following figure illustrates this causal sequence of actions, initiated by the activities and resources needed to achieve the expected changes in the participants. Each phase encompasses a series of components that make these changes possible and that are determined by the actions executed in the previous phase.

Figure 5. Theory of Change of the model of action against energy poverty



As indicated above, three treatment groups are organized where one of them will access the first action (A1), another group will access the second (A2) and a third group that will have both treatments (A1 and A2). Finally, there will be a control group that receives neither performance.

In this way, the impact analysis of the actions is more complete and allows:

- To check whether the advice improves the indicators related to consumption habits, quality of life and health and savings in the energy bill (of those who receive it compared to those who do not).
- To contrast whether the investment improves the indicators related to energy efficiency, quality of life and health and savings in the energy bill (of those who receive it versus those who do not).
- Contrast whether there is a difference in the impact of the final results between receiving advice alone, versus investment alone, or both together.

With the results obtained, it will be possible to know which intervention is effective, which is more effective and in what dimension and whether the combination of both actions substantially improves the results.

3.2 Hypothesis

The main objective of the project is to reduce energy poverty levels in households at risk of social exclusion. As mentioned earlier, energy poverty is a multifaceted phenomenon with various implications. Therefore, as detailed in the Theory of Change, this project does not focus solely on

reducing household energy expenditure or bills, but also on improving people's quality of life and health. Consequently, when evaluating the model, several hypotheses compare the results of the different treatments in each of the two impact areas mentioned. This multidimensional approach allows for a comprehensive evaluation of each intervention's impact on the beneficiary households and enables a more complete understanding of their effectiveness in different dimensions.

Below are the hypotheses to be tested in each of the four main areas addressed in this pilot project. Each area has two hypotheses directly linked to the areas to be evaluated (main hypotheses). In a unique case, for the block of energy bill savings, a secondary hypothesis complements the two main hypotheses mentioned.

1. Improvement in consumption habits

The hypotheses suggest that advice for improving energy efficiency and supporting appropriate consumption habits favors, firstly, that consumption is distributed more efficiently throughout the day (first hypothesis) and secondly, that energy-consuming household elements should be used more efficiently (second hypothesis).

2. Improving the energy efficiency of the home

The first hypothesis regarding home energy efficiency postulates that investment to improve energy efficiency of the home results in obtaining a better energy certification. The second hypothesis suggests that such investment in housing also reduces the technical difficulty of maintaining an adequate temperature in the home.

3. Improvement in the quality of life and health of the participating individuals/families

The two hypotheses in this block focus on improving the quality of life and health of household's members who receive some of the treatments compared to those that do not receive any action (control group). Specifically, quality of life is expected to be improved as a result of improved housing status and conditions (first main hypothesis) and improved self-perception of household members' quality of life and health (second hypothesis).

4. Greater savings on energy bills

Two main hypotheses and one secondary hypothesis are considered. The main hypotheses postulate that homes with any of the proposed interventions manage to reduce energy consumption (first hypothesis) and reduce energy expenditure (second hypothesis). On the secondary assumption, the treatment is considered to reduce delays in the payment of utility bills.

3.3 Sources of information

To collect the necessary information to construct the outcome indicators and analyze the pilot project results, questionnaires are used. These questionnaires are administered to all program participants, regardless of whether they are in the control or treatment group. Specifically, information is collected

through two questionnaires, one prior to the intervention (baseline) and the other at the end of the intervention (final line).

The **baseline questionnaire** has two main objectives: to obtain sociodemographic information from households, and to assess the baseline situation of the participating households with respect to the outcome indicators. It focuses on collecting data on the characteristics and equipment of the home, as well as on the family unit's composition. Information is also collected on energy consumption habits and the resulting expenditure charged to utility bills. Regarding quality of life and health, this initial questionnaire collects data on thermal comfort, state of the home, equipment, and self-perceived physical health.

The **endline questionnaire** aims to collect data evidencing any changes from the initial situation. It repeats many of the points asked in the baseline questionnaire, to assess changes in responses. Additionally, it poses additional questions to capture other possible changes in the home and expand information on the efficient use of additional energy-consuming items.

The surveys are conducted via telephone calls by an external company on behalf of the Government of Catalonia and MISSM.

Besides the questionnaires, and without being directly linked to the generation of indicators, other sources are used to collect information to complete previous processes such as defining the target population, recruitment of participants and segmenting of the sample. This data is obtained through the administrative database of the Generalitat and includes variables such as the home's location and energy certificate. Additionally, to conduct an optimal stratification of the homes before the random assignment, information is collected from the potentially beneficiary families during the information and acceptance call to participate in the project, amount and consumption of the supply bills and contracted electrical power.

3.4 Indicators

This section describes the indicators used for the evaluation of the impact of the pathway, divided by themes related to the hypotheses described above.

1. Consumption habits

To evaluate the improvement in consumption habits, two indicators are constructed from information obtained through the surveys. These indicators are generated for all experimental groups and are constructed using the information prior to the intervention, and with the information from the final survey. The following indicators are used:

Distribution of consumption throughout the day: indicator constructed as the interaction between two variables: knowledge of the reduced-price bands (dichotomous, with values 0=No, 1=Yes) and use of the reduced-price band (qualitative polytomy, takes values between 0=Never uses the reduced-price band and 3=Always uses the reduced-price band). The indicator is obtained by multiplying the two variables, and the result is normalized so that it takes values between 0 (does not know or use

the reduced-price band) and 1 (always knows and uses the reduced-price band). Additionally, to complete and give robustness to the analysis, an Anderson index (2008) has been composed from the same two variables. This method aggregates information from a set of variables that attempt to measure a common latent variable. Intuitively, the method calculates a weighted average of all the variables, where the weight assigned to each of them depends on how correlated it is with the others (the lower the correlation, the greater the weight). Subsequently, it is standardized, so it has a mean equal to zero and standard deviation equal to one.

Efficient use of energy-consuming elements: This is constructed from the interaction of five variables that provide information on the home's energy consumption habits. These variables include questions about whether they use energy-saving light bulbs, turn off the lights in rooms when they are not in use, close the blinds at dusk in winter, fill the washing machine, and use low-temperature programs[13]. All these variables have values between 0 and 3 (0=Never, 1=Rarely, 2=Most of the time, 3=Always). The indicator is constructed from the normalized sum of these variables and takes values between 0 (less efficient use of energy-consuming elements) and 1 (more efficient use of energy-consuming elements). Additionally, to complete and give robustness to the analysis, an Anderson index (2008) has been composed from the same five variables.

2. Energy efficiency of the home

Two indicators are used to measure the energy efficiency of the home. The first of these is based on information collected through the baseline and endline questionnaires for all participants. The energy certification of the home is provided by the Agència de l'Habitatge de Catalunya. The indicators are detailed below:

Technical difficulty in maintaining an adequate temperature in the home: This is measured from a variable where participants are asked if they agree that they face difficulties in maintaining an adequate temperature in the home. Responses range from 1 to 5 (1=Strongly agree, 2=Somewhat agree, 3=Neutral, 4=Somewhat disagree, 5=Strongly disagree). For the construction of the indicator, the results are normalized to values between 0 (greater technical difficulty in maintaining an adequate temperature) and 1 (less technical difficulty in maintaining an adequate temperature).

Home energy certification: This indicator is calculated from a variable that takes values between 1 and 7, depending on the letter associated with the home's energy performance certificate (1=G, 2=F, 3=E, 4=D, 5=C, 6=B, 7=A). Higher values of this indicator show a higher energy certification.

3. Quality of life and health of participating individuals/families

The hypothesis of improvement in quality of life and health is evaluated using two indicators constructed from information collected in the questionnaires before and after the intervention:

[13] Only the first two items were included in the baseline questionnaire, so the calculated indicator is slightly different in both periods.

Quality of life by housing conditions: Measured as the interaction of three variables included in the questionnaires. These correspond to the questions of: whether you can afford to keep the house at an adequate temperature (dichotomous, 0=No, 1=Yes), if you cannot afford to wash clothes using the washing machine or cook using the oven (1=Strongly agree, 2=Somewhat agree, 3=Neutral, 4=Somewhat disagree, 5=Strongly disagree), and your assessment of the state of the house (1=Very bad, 2=Bad, 3=Fair, 4=Good, 5=Very good). To obtain the indicator, a normalized sum of the results of the three variables is calculated, and its values range from 0 (worse quality of life due to housing conditions) to 1 (better quality of life due to housing conditions). Additionally, and to complete and give robustness to the analysis, an Anderson index (2008) has been composed from the same three variables.

Quality of life and health self-perceived by the family: results from the interaction of the variable of satisfaction with life and the general health status of the family. Both variables take values between 1 and 5 (a higher value indicates greater satisfaction with life and better health). The indicator is derived by averaging these variables and normalizing them to range between 0 (indicating lower satisfaction with quality of life and self-perceived health) and 1 (indicating higher satisfaction with quality of life and self-perceived health). Additionally, and to complete and give robustness to the analysis, an Anderson index (2008) has been composed from the same two variables.

4. Savings on energy bills

To measure the effect on savings on energy bills, three indicators are considered: two for the main hypothesis and one for the secondary hypothesis. In each case, the initial and post-intervention situation is measured using the responses collected in the questionnaires. In the case of consumption and expenditure, to make a more correct interpretation of the results, given the different circumstances of temperature and weather at the different times of collection and given the different characteristics of the dwellings and/or family units, both indicators are normalized according to the number of members in the dwelling and the location of the dwelling[14]. The following indicators are defined:

Overall monthly energy consumption of the home (electricity plus gas): measured from the variables of average electricity and gas consumption in monthly calculation, measured in KWh. For constructing the indicator, the results are normalized so that it takes values between 0 (lower consumption) and 1 (higher consumption).

[14] After an exhaustive analysis of correlations between expenditure and consumption based on: the average, minimum and maximum temperature of the municipality, year of construction, height of the house, number of members in the house, surface area of the house and location, the normalization is finally defined according to the number of members in the house and the location (coast/interior-mountain). First, the total consumption is calculated as the sum of electricity and gas consumption and the total expenditure as the sum of electricity and gas expenditure. Subsequently, consumption and expenditure per member are obtained. It is then normalized according to the mean values in both locations and, finally, to facilitate the interpretation of the results, it is normalized between 0 and 1. In cases where the family has a bi-monthly bill, the monthly average of the expense/consumption is taken.

Overall monthly energy expenditure of the home (electricity plus gas): similar to the previous one, it is calculated from the variables of average expenditure on electricity and gas in monthly calculation, measured in euros. For constructing the indicator, the results are normalized so that it takes values between 0 (lower expenditure) and 1 (higher expenditure).

Delay in payment of utility bills: To evaluate the secondary hypothesis that treatment decreases the delay in payment of utility bills, the answer to the question of whether there have been delays in the payment of expenses related to the main residence (dichotomous, 1=No, 0=Yes) in the last twelve months or recent period is used.

3.5 Design of the experiment

To evaluate the effect of the different interventions on the indicators of consumption habits, energy efficiency, quality of life and health, and savings in energy bills, an experimental evaluation (RCT) is used in which participants are randomly assigned between the control group and the different treatment groups.

Recruitment of the beneficiaries of the intervention

The target population of the intervention consists of family units residing in social housing managed by the Agència de l'Habitatge de Catalunya, requiring investment to improve energy efficiency Additionally, potential beneficiaries of the program must be family units with a Sufficiency Income Indicator of Catalonia of less than 2.5. The Department of Social Rights coordinates the identification of this population, assisted by the Agència de l'Habitatge de Catalunya as the public entity managing the public housing stock.

The target population identification concludes with 3,406 households meeting the requirements. These households are potential candidates for the project, followed by a random selection of 2,000 homes forming part of the recruitment objective. The selection is made at the provincial level, ensuring proportions match those in the original list. Non-selected homes are assigned to a list of reserve homes, randomly ordered for use in case of contact failure or refusal to participate by selected homes.

The recruitment method consists of contacting the owners of the homes through coordinated communication through different channels. The first contact is made by post, informing those selected about the project and attaching the informed consent. Subsequently, as a follow-up, messages are sent to the phone to notify about the postal shipment and anticipate a phone call. Finally, individual phone calls are made to confirm receipt of the letter, explain the project, and request the signature of the informed consent. These calls are recorded to record the acceptance to participate in the project.

Due to the heterogeneity of the candidates and the size of the sample, the recruitment model through individualized communications was based on telephone contact and postal mailing, and the provision of a telephone contact line to resolve any doubts or needs of the candidates.

Once the candidates have been contacted and the project explained in detail, the family units that provide their informed consent to participate in the pilot project go on to define the study sample.

Informed Consent

One of the fundamental ethical principles of research involving human beings (respect for persons) requires study participants to be informed about the research and consent to be included in the study. Informed consent is usually part of the initial interview and has two essential parts: the explanation of the experiment to the person, and the request and registration of their consent to participate. Consent should begin with a comprehensible presentation of key information that will help the person make an informed decision, i.e., understand the research, what is expected of it, and the potential risks and benefits. Documentation is required as a record that the process has taken place and as proof of informed consent if so.

Informed consent is required in most of research and may be oral or written depending on different factors such as the literacy of the population or the risks posed by consent. Only under very specific circumstances, such as when the potential risks to the participants are minimal and the informed consent is very complex to achieve or harms the validity of the experiment, informed consent can be avoided, or one can give partial information to participants with the approval of the ethics committee.

Random assignment of participants

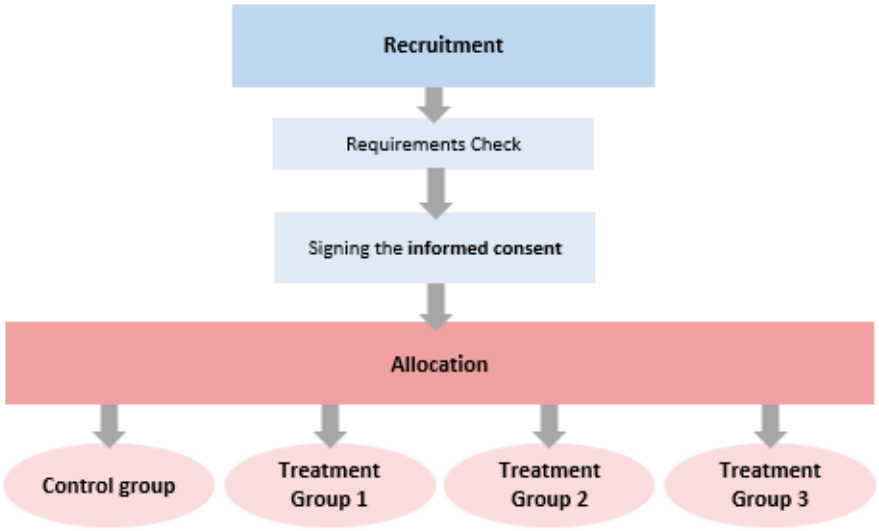
After signing consent and defining the final study sample, participants are randomly assigned to either the control group or the different treatment groups. Randomization is the cornerstone of RCTs, allowing the identification of a causal relationship between treatment and outcomes. Properly conducted, this process ensures that the treatment and control groups are statistically comparable, encompassing both observable and unobservable variables. This homogeneity provides the structure required to make an accurate measurement of the possible effects derived from the intervention.

The experiment design envisions having 2,000 participants equally divided between the control group and the treatment groups. Additionally, randomization is performed in a stratified manner to ensure that groups are balanced on certain characteristics relevant to the outcome indicators and to prevent potential imbalances from leading to biased measurement of the effect of interventions. In this way, from a design perspective, a balance is sought in the distribution of the dwellings according to the **location of the dwelling** (coast or interior-mountain),[15] **condition of the dwelling** (bad, fair, or good) and **energy consumption of the dwelling** (low or high). To this end, the sample is classified into strata of participants who share the characteristics and random assignment is made within each stratum.

[15] Given the small number of houses located in the mountains, they have been added together with those in the interior.

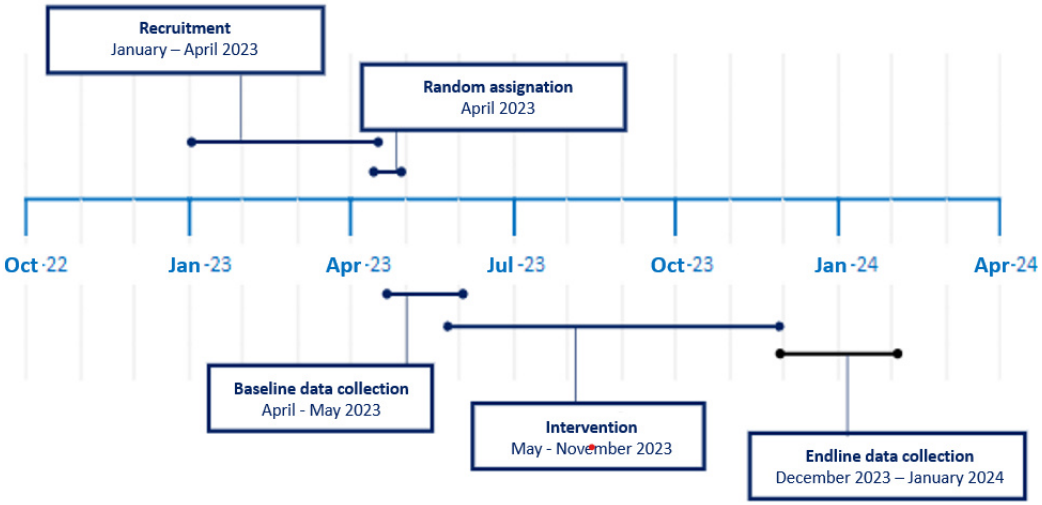
Once the random allocation of the available housing has been conducted between treatment and control groups, it is decided that, if any additional housing arrives that provides informed consent later after this assignment, it will be assigned to the control group directly.

Figure 6: Sample Design



The **Figure 7** It shows the time frame in which the implementation and evaluation of the itinerary takes place.

Figure 7: Timeframe of the evaluation



4 Description of the implementation of the intervention

This section describes the practical aspects of how the intervention was implemented as part of the evaluation design. It describes the results of the participant recruitment process and other relevant logistical aspects to contextualize the results of the evaluation.

4.1 Sample Description

As explained in the section dedicated to the target population of the program, and as shown by **Table 1**, the first approach to the sample coincides with the dwellings that are part of the public housing stock of the Agència de l'Habitatge de Catalunya. In the process of limiting the sample to filters on the housing situation (housing stock managed directly by the Agència de l'Habitatge de Catalunya) and the participation requirements (household income and housing investment needs and long-term delinquency situation)[¡Error! Marcador no definido.], the universe of potential candidates to participate in the program was limited to 3,406 homes.

As explained in the Design section, a random selection of 2,000 homes was conducted, along with the preparation of a list of possible substitutes. Finally, all of them had to be contacted, initially with the 2,000 selected and later with the substitutes.

The size of the initial sample created numerous difficulties in contacting and informing candidates of their participation in the project. Thus, with 214 homes it was not possible to establish contact due to the wrong telephone number, 379 homes did not answer the call, and another 406 homes were contacted, but their recruitment process could not be completed satisfactorily for different reasons[16]. As a result, the sample of households was reduced to 2,407 with which full contact was established.

Into **Table 1**, data from the recruitment process reveal that, of the total of 2,407 households with which satisfactory and complete contact was established, 18 per cent (434 households) chose not to participate in the program. As a result, the number of households participating in the final sample was 1,973 homes, slightly below the initial target of 2,000. As agreed in the design phase, the planned procedure was activated, where, after the late receipt of informed consent for 19 additional dwellings, they were included in the control group of the pilot project, with the final sample amounting to 1,992 dwellings.

[16] The reasons that explain the drop in the number of candidates with whom contact is established are: (i) in the first contact they responded to the call, but in the second they have not answered the phone call (400 households), (ii) they request to call later (4 households) and (iii) they are thinking about whether to participate (2 households).

Table 1. Recruitment process register

Concept	Number of Housing Units
Public housing managed by the Generalitat	**21,716**
∟ **Public housing owned** by the Generalitat	**17,326**
∟ Housing units **requiring investment** and inhabited by families with an **Income Sufficiency of Catalonia less than 2.5**[17] **and in prolonged arrears (with 7 or more unpaid bills)**	**3,406**
∟ **Satisfactory and complete contact** established with the head of the household	**2,407**
∟ **Signed informed consent** within the stipulated period and prior to random assignment	**1,973**
∟ **Signed informed consent**	**1,992**

Characteristics of the final evaluation sample

Based on the sample of 1,992 households that agreed to participate, 441 did not complete the initial questionnaire prior to the intervention. In addition, among those who responded, some did not answer all the points asked. Given the above, the information collected prior to the intervention is limited in many cases to a sample of 1,551 observations, or less for the variables that some family units were unable to answer.

Table 2 presents the descriptive statistics for the sociodemographic variables and the outcome indicators. The table is structured into six columns: variable name, sample analyzed, mean, standard deviation, and minimum and maximum value.

The results in the table come from both the telephone call prior to the random assignment (covering the state of the house and the classification between low and medium energy consumption), hence the 1,992 observations, and from the survey conducted before the intervention. Likewise, the energy certification is provided by the Agència de l'Habitatge along with the variables constructed from administrative databases, making it available for all participants.

[17] Additionally, to the indicated participation requirements, filters are applied to eliminate unoccupied or illegally occupied housing units that have not been allocated under the Public Promotion, special VPO, or by pre-emption via the Emergency Committee, and that are not current on rent payments (fewer than 7 unpaid rent bills).

The sociodemographic analysis reveals a wide diversity in the characteristics of the family units participating in the pilot project, evidenced by household sizes ranging from 1 to 9 people, with an average of 3.1 members, and household incomes ranging from 1 to 5,000 euros per month, with an average of just over 1,000 euros. Regarding household conditions, it can be observed that almost half of the households (47%) have what is considered complete equipment, including hot water, electricity, a kitchen, a washing machine, a telephone, a television, a computer and/or Internet access, and individual or central heating. However, 25% of households have only basic equipment, including a computer or Internet, as indicated above, but without heating.

62% of families have energy-saving light bulbs but no other energy-saving equipment. Regarding the use of electricity and gas by different family units, there is considerable heterogeneity in the number of elements they use. Additionally, the sample shows an equal presence (50%) of participants with and without a social bonus for spending on energy supplies (considering both the thermal social bonus and the energy social bonus). The table also includes information related to participation in the satellite actions provided by the project, showing that 17% receive assistance to apply for the MIS, 10% receive community assistance, and 6% receive both.

The table also shows that, regarding energy consumption habits, families generally make efficient use of energy-consuming elements, averaging 0.7 points. However, they somewhat agree that the house has technical difficulties in maintaining an adequate temperature (0.32 points).

The energy certification of homes is, on average, around categories F and E, supporting the initial hypothesis that social rental housing is aging.

Additionally, the indicator summarizing the perception of housing conditions shows a value below the average of the range, which also confirms the previous hypothesis. Regarding self-perceived quality of life, the average value is 0.58 points on a scale from 0 to 1.

Standardized indicators of energy consumption and expenditure reflect reduced averages. Finally, 38% of households indicate they have fallen behind on their energy bills over the last year.

Table 2: Descriptive statistics of the sample

Variable	N	Mean	Standard deviation	Minimum	Maximum
Sociodemographic variables (pre-intervention)					
Coast	1,992	0.36	0.48	0	1
Interior/Mountain	1,992	0.64	0.48	0	1
Poor housing condition	1,992	0.38	0.48	0	1
Fair housing condition	1,992	0.43	0.50	0	1
Good housing condition	1,992	0.19	0.39	0	1
Low energy consumption	1,992	0.67	0.47	0	1
Medium energy consumption	1,992	0.33	0.47	0	1
Number of household members	1,551	3.10	1.59	1	9

Variable	N	Mean	Standard deviation	Minimum	Maximum
Household monthly income	1,551	1,086.17	552.89	1	5,000
Incomplete basic household equipment	1,537	0.10	0.30	0	1
Basic equipment	1,537	0.03	0.18	0	1
Basic equipment with computer or Internet	1,537	0.25	0.43	0	1
Basic equipment with heating	1,537	0.05	0.23	0	1
Complete equipment without air conditioning	1,537	0.47	0.50	0	1
Complete equipment with air conditioning	1,537	0.10	0.31	0	1
No energy-saving equipment	1,534	0.16	0.36	0	1
Only light bulbs	1,534	0.62	0.49	0	1
With energy-saving equipment	1,534	0.22	0.42	0	1
Does not use gas for any element	1,537	0.33	0.47	0	1
Uses gas for one element	1,537	0.17	0.37	0	1
Uses gas for two elements	1,537	0.36	0.48	0	1
Uses gas for three elements	1,537	0.14	0.35	0	1
Does not use electricity for any element	1,542	0.29	0.45	0	1
Uses electricity for one element	1,542	0.30	0.46	0	1
Uses electricity for two elements	1,542	0.28	0.45	0	1
Uses electricity for three elements	1,542	0.13	0.33	0	1
No social bonus	1,519	0.50	0.50	0	1
Has some social bonus	1,519	0.50	0.50	0	1
Does not receive support	1,992	0.67	0.47	0	1
Receives support only from MIS	1,992	0.17	0.37	0	1
Receives only community support	1,992	0.10	0.30	0	1
Receives support from MIS and community	1,992	0.06	0.24	0	1
Outcome indicators (pre-intervention)					
Distribution of consumption throughout the day	1,524	0.31	0.40	0	1
Distribution of consumption throughout the day (I, Anderson_std)	1,514	0	1	-1.07	1.44

Variable	N	Mean	Standard deviation	Minimum	Maximum
Efficient use of energy-consuming elements	1,511	0.70	0.26	0	1
Efficient use of energy-consuming elements (I, Anderson_std)	1,511	0	1	-2.70	1.16
Technical difficulty in maintaining adequate home temperature	1,522	0.32	0.33	0	1
Home energy certification	1,992	2.40	0.80	1	7
Quality of life due to housing conditions	1,475	0.45	0.24	0	1
Quality of life due to housing conditions (I, Anderson_std)	1,475	0	1	-2.22	2.18
Self-perceived quality of life and health by the family	1,486	0.58	0.22	0	1
Self-perceived quality of life and health by the family (I, Anderson_std)	1,486	0	1	-2.73	1.97
Overall monthly energy consumption of the home (electricity and gas)	1,551	0.12	0.10	0	1
Overall monthly energy expenditure of the home (electricity and gas)	1,551	0.16	0.14	0	1
Late payment of utility bills	1,511	0.62	0.48	0	1

4.2 Random Assignment Results

To verify the random assignment explained in Section 3.5, a balance test is executed to show that, on average, the observable characteristics of the participants in the different groups are statistically equal. The balance between the experimental groups is key to inferring the causal effect of the program by comparing its results.

In **Table 3a**, the result of randomization is shown, with approximately 25% of participants assigned to each group (24.7% in the control group and 25.1% in each treatment group). The stratification variables used, as mentioned above, include location, housing condition, and energy consumption. The original allocation was made with the 1,973 homes for which the signed consent was obtained in time. However, as predicted, 19 homes arrived late and were assigned to the control group, as the treatment groups already had the maximum number of homes assigned to them at 500. This late assignment to the control group cannot be considered strictly random but given the priority to

urgently allocate the treatment groups to start the interventions, it was deemed the most appropriate in terms of management and efficiency. The table shows the final result of the assignment.

Table 3a: Result of random assignment

Location	Housing Condition	Energy Consumption	Control Group	Treatment Group 1	Treatment Group 2	Treatment Group 3	TOTAL
Coast	Poor	Low	46	46	46	47	**185**
		Medium	21	18	19	19	**77**
	Fair	Low	52	54	54	53	**213**
		Medium	24	26	25	26	**101**
	Good	Low	27	24	25	24	**100**
		Medium	12	12	12	12	**48**
Interior	Poor	Low	75	79	79	79	**312**
		Medium	41	46	45	45	**177**
	Fair	Low	93	92	92	92	**369**
		Medium	43	45	45	45	**178**
	Good	Low	40	39	39	39	**157**
		Medium	18	19	19	19	**75**
TOTAL			**492**	**500**	**500**	**500**	**1,992**

By provinces, the allocation made by groups was shown as follows: **Table 3b**.

Table 3b: Result of random assignment

	Control Group	Treatment Group 1	Treatment Group 2	Treatment Group 3	TOTAL
Barcelona	380	382	363	375	1,500
Girona	55	57	58	48	218
Lleida	33	28	39	30	130
Tarragona	25	33	39	47	144
TOTAL	493	500	499	500	1,992

Then, in **Figure 8**, the results of the balance tests (or difference between means) between the control group and the treatment groups are shown. All the data in this figure refers to the collection of information conducted before the intervention through the baseline survey and the information provided by the Generalitat.

In this analysis and in all subsequent analyses, it was determined to eliminate the data from the 19 households that were assigned late to the control group.

For each observable variable, the difference between the mean of that variable in the different groups compared is represented by a point and focused on it, the 95% confidence interval of this difference

is shown. A confidence interval containing zero, i.e., the vertical axis, will indicate that the mean difference between groups is not statistically significant or, in other words, is not statistically different from zero. Therefore, it will be concluded, that the intervention groups are balanced in this characteristic. In cases where the confidence interval of the mean difference does not contain zero, it can be concluded that the difference is statistically significant and, therefore, the groups are unbalanced in this characteristic.

The appendix of the document[18] provides a detailed report of the mean value of each variable for the control group and the three treatment groups, as well as the statistical result of the mean differences between groups using the F-stat[19] and the p-value associated with it.

Overall, the control and treatment groups are balanced on most variables, suggesting that randomization was successful in creating comparable groups. However, there are some exceptions where the differences are statistically significant.

There is a significant difference in the variable of household equipment in homes that have incomplete home equipment and complete equipment without air. The main reason is that, as can be seen in the table, treatment groups 1 and 3 have more incomplete equipment compared to the control group and treatment 2. Similarly, in terms of complete equipment without air conditioning, treatment group 3 stands out for having a lower representativeness than the rest of the groups.

There are also significant differences in the use of electricity and gas between the experimental groups. Regarding the use of gas, it was found that some groups show significant differences at 5% in their means. On the other hand, in terms of electricity use, numerous significant differences were found at 5% between individual crosses (resulting in a significant F-statistic at more than 5%), particularly in the variables: uses electricity in two elements of the home, uses electricity in one element and does not use electricity in any element. This indicates that the differences between groups are more evident in the use of electricity by households compared to those found in the use of gas.

Regarding the accompaniment received by households, there are significant differences at 5% in the reception of accompaniment in terms of MIS. The greatest differences in means are between the control group and treatment groups 1 and 3.

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[18] See Table 11, **Table 12** and

Table 13 in the Appendix Sample Balance for the detail of means, F-statistical, observations, and the results of individual crossovers between groups.

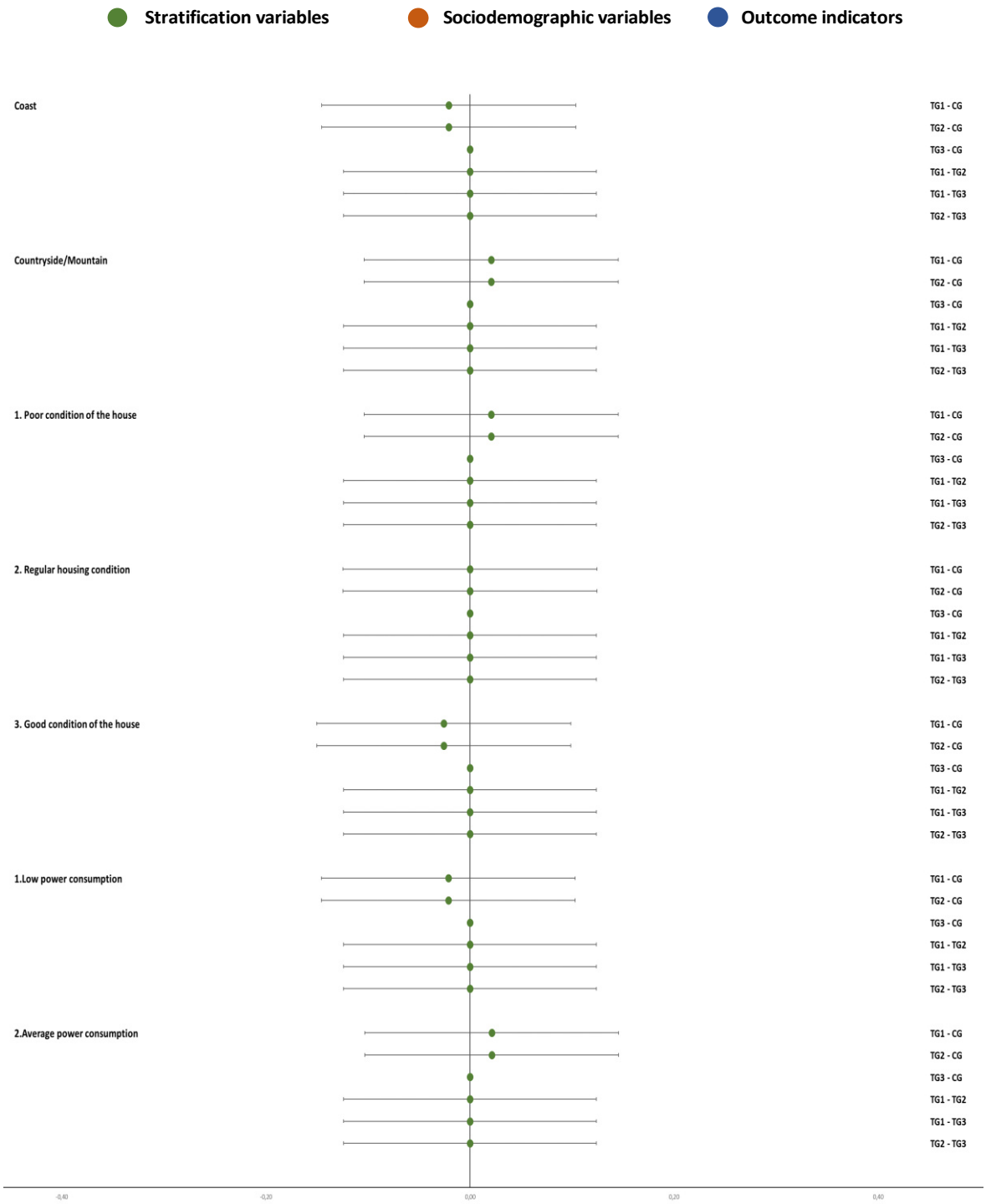
[19] The F-statistic is taken as an indicator that shows whether there is a significant difference between the means of the 4 groups together. This statistic summarizes the differences found in the means of the 6 possible crosses ([1]-[2], [1]-[3], [1]-[4], [2]-[3], [2]-[4] and [3]-[4]).

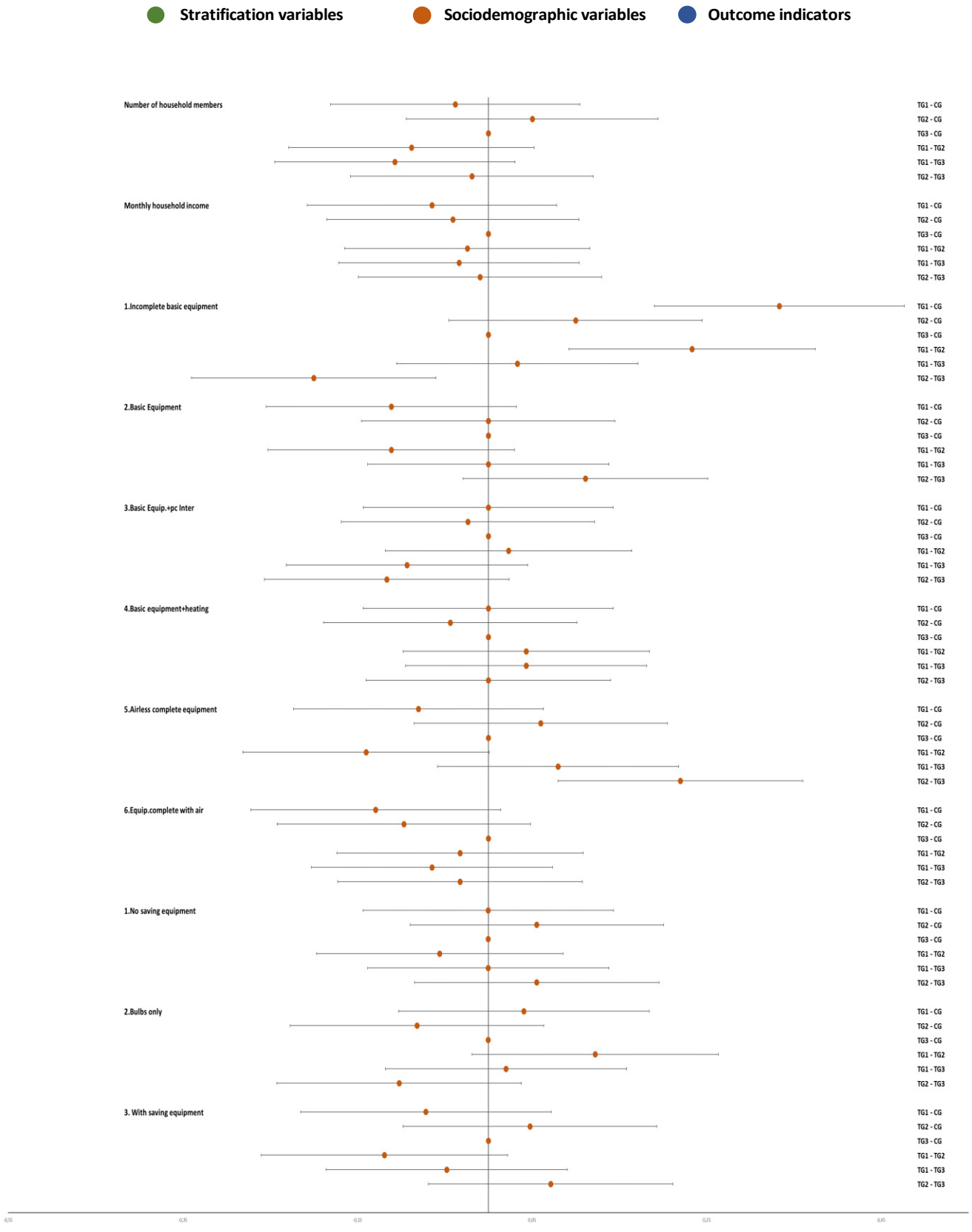
Moving on to the outcome indicators, the technical difficulty in maintaining an adequate temperature in the home shows a significant difference between groups, mainly due to the fact that the control group and treatment group 2 claim to have greater ability to maintain an adequate temperature in the home compared to treatment groups 1 and 3.

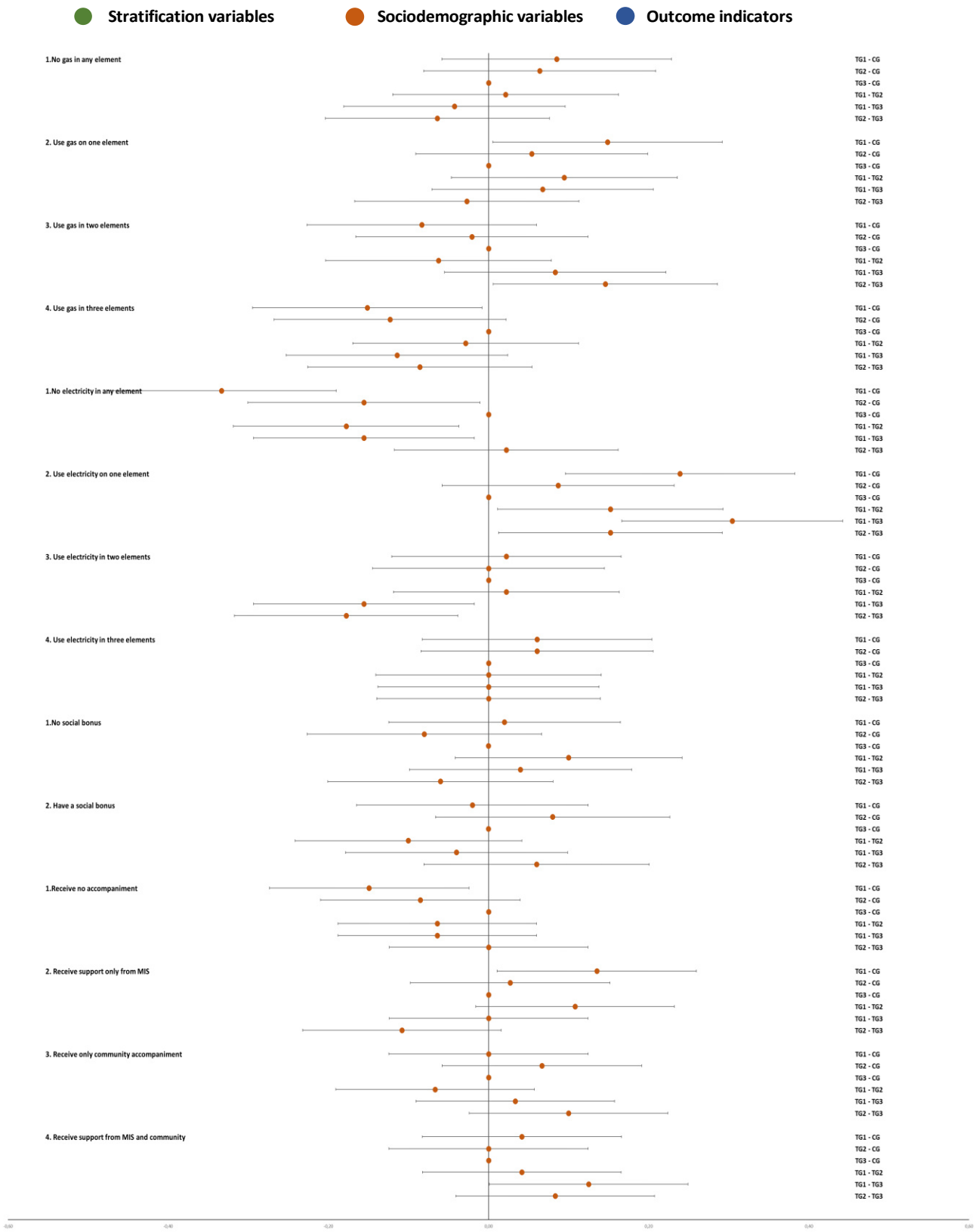
The two indicators related to the quality of life and health of the participants also show notable differences in the means between groups. Both the indicator of quality of life due to housing conditions and the indicator of self-perceived quality of life and health have obtained a significant p-value, which indicates that the average results between the groups are statistically different. In both cases, the mean results of the indicator are lower in treatment groups 1 and 3, compared to the control and treatment group 2.

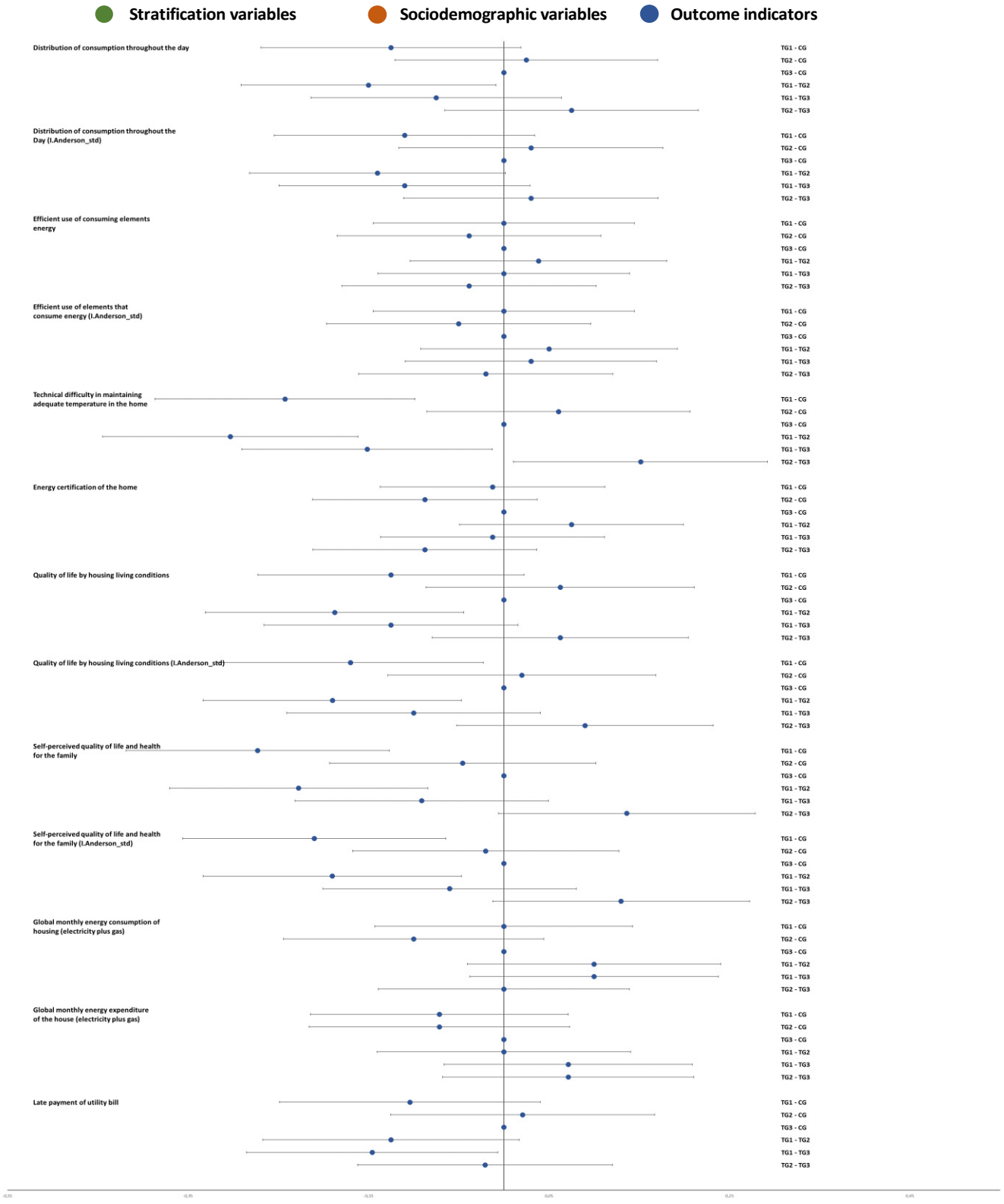
Although the balance table shows that in general the control and treatment groups are broadly comparable, the differences found suggest that there are relevant imbalances between the experimental groups that make them not perfectly comparable. To address this aspect, the regressions conducted to obtain the results of this pilot program incorporate controls for the variables and indicators that show a significant lack of balance between groups. This includes the variables of equipment, electricity use, gas use and participation in accompanying policies, the indicators of technical difficulty in maintaining an adequate temperature in the home, and the two quality of life indicators.

Figure 8: Standardized mean difference between treatment group and control group (95% confidence interval)




Stratification variables
Sociodemographic variables
Outcome indicators
Number of household members
Monthly household income
1.Incomplete basic equipment
2.Basic Equipment
3.Basic Equip.+pc Inter
4.Basic equipment+heating
5.Airless complete equipment
6.Equip.complete with air
1.No saving equipment
2.Bulbs only
3. With saving equipment
TG1 - CG
TG2 - CG
TG3 - CG
TG1 - TG2
TG1 - TG3
TG2 - TG3
-0,55
-0,35
-0,15
0,05
0,25
0,45


Stratification variables
Sociodemographic variables
Outcome indicators
1.No gas in any element
2. Use gas on one element
3. Use gas in two elements
4. Use gas in three elements
1.No electricity in any element
2. Use electricity on one element
3. Use electricity in two elements
4. Use electricity in three elements
1.No social bonus
2. Have a social bonus
1.Receive no accompaniment
2. Receive support only from MIS
3. Receive only community accompaniment
4. Receive support from MIS and community
TG1 - CG
TG2 - CG
TG3 - CG
TG1 - TG2
TG1 - TG3
TG2 - TG3


Stratification variables
Sociodemographic variables
Outcome indicators
Distribution of consumption throughout the day
Distribution of consumption throughout the Day (I.Anderson_std)
Efficient use of consuming elements energy
Efficient use of elements that consume energy (I.Anderson_std)
Technical difficulty in maintaining adequate temperature in the home
Energy certification of the home
Quality of life by housing living conditions
Quality of life by housing living conditions (I.Anderson_std)
Self-perceived quality of life and health for the family
Self-perceived quality of life and health for the family (I.Anderson_std)
Global monthly energy consumption of housing (electricity plus gas)
Global monthly energy expenditure of the house (electricity plus gas)
Late payment of utility bill
TG1 - CG
TG2 - CG
TG3 - CG
TG1 - TG2
TG1 - TG3
TG2 - TG3

4.3 Degree of participation and attrition by groups

The informed consent group was the experimental sample that was randomly assigned to the control and treatment groups [20]. However, both participation in the program and response to the initial and final surveys are voluntary. On the one hand, it is convenient to analyze the degree of participation in the program, since the estimation of results will refer to the effects on average of offering it given the degree of participation. For example, if participation in treatment activities is low, the treatment and control groups will be very similar, and it will be more difficult to find an effect. On the other hand, this section tests whether the noncompletion of the final survey by some of the participants reduces the comparability of the treatment and control groups after the intervention, if the response rate is different between groups or according to the demographic characteristics of the participants in each group.

Degree of participation

As mentioned above, the process of assigning the participants or dwellings to the different experimental groups reached a final sample of 1,992 participants.

There has been a total of 446 withdrawals from the intervention assigned to some treatment group: 307 at the beginning of the intervention and 139 along the itinerary. Some families in treatment group 3 have dropped out of only one of the two treatments. Thirty families in this group have dropped out of both.

The main reason for dropout for the first 307 casualties was that they were untraceable. For the withdrawals that occur when the intervention has already begun, the main reason for dropout was lack of interest. Finally, 1,546 families completed the intervention, which represents 78% of the planned total.

Of the families that begin the intervention, 345 from T1 receive the investment treatment, 325 from T2 receive the advisory treatment, and from T3, 312 families receive both, 53 receive only advisory, and 19 receive only investment. In total, 676 households receive one of the following types of intervention:

Type of intervention
Single-handle faucets (663 households) LED lighting (547 households) Partial flush system for toilet cistern (391 households)
Appliances with energy category A (671 households) Induction cooktops (257 households) Thermostatic valves (60 households) Windows (9 households)

[20] Except for a small number of households that were later added to the control group when they received informed consent outside the initial period.

Boiler (55 households) Geyser (172 households)

The average time spent making investments in housing was 34 hours in group T1 and 33 hours in group T3. On the other hand, the average investment is 5.080 and 4.930 euros in each group respectively.

On the other hand, 690 participants have received energy advice, with 80% around 2 hours and around 16% receiving 3 and a half hours.

Regarding satellite policies, 318 families have received community accompaniment, out of a total of 400 to which it was initially offered. Additionally, 450 out of a total of 1,000 participants received accompaniment to apply for the MIS. Approximately in the 4 intervention groups, there is the same percentage of participants in both policies.

Table 4 provides an overview of the degree of participation in the intervention and sample attrition by experimental group. The table describes the number of participants assigned to each group that completed the baseline questionnaire, received the treatment, and completed the final questionnaire, respectively. Additionally, a column is included that shows the attrition in participation, calculated as the difference between the participants who answered the final questionnaire and those initially assigned to the experimental group.

Starting with the control group, of the 473 households assigned to this group, 127 households did not respond to the baseline survey, while 346 did). Since this is a pure non-intervention control group, all 473 households are considered to have started and completed treatment. However, only 274 households completed the final survey, resulting in a 42% decrease over the initial homes allocated to this group.

In treatment group 1, 80% of the 500 assigned participants completed the initial questionnaire, while the number of participants who received treatment dropped to 69% (i.e., 345 households received energy efficiency investment). Of this first treatment group, 331 households responded to the final questionnaire, reflecting a 34% attrition with respect to the total number of participants.

In treatment group 2, baseline survey data were collected for 76% of the 500 participants, while the number of households that ultimately received treatment decreased to 65%. The survey aimed at collecting post-treatment data was answered by 59% of participants in the second treatment group, reflecting an attrition of 41%.

In treatment group 3, the baseline survey was answered by 414 households, of which 384 subsequently received treatment. Because this treatment group is characterized by receiving both housing investment treatments and consumption habit counseling, it is important to note that 53 of the 384 households treated only received counseling (but not investment in energy efficiency), and 19 received only investment in household energy efficiency (but not counseling in consumption habits). Finally, the number of those who responded to the final questionnaire was reduced to 316

homes, reflecting a 37% attrition compared to the 500 homes initially assigned to this treatment group.

In general, a high degree of attrition was observed in all experimental groups. Comparing attrition between experimental groups, a greater loss was seen in the groups that did not receive investment (control group and treatment 2) compared to those that did receive investment in housing (treatment groups 1 and 3).

Finally, there are 114 families who did not provide data at the beginning of the intervention but did at the end. On the other hand, there are 435 families who provided data at the beginning but not at the end.

It is important to note that this fact may affect the results of the analysis, as 235 families that received the intervention have not provided data at the end of the project. Consequently, the effect may be minimized, as a high percentage of families with intervention have not responded. On the other hand, there are 125 families who provided data at the end of the intervention but who have not undergone any treatment, despite belonging to a treatment group.

Table 4: Dropout rate of the experimental group

Group	Initial Sample (Assigned families)	Completed baseline survey	Completed treatment	Completed endline survey	Attrition
Control Group	473 100%	346 73%	473 100%	274 58%	199 42%
Treatment Group 1	500 100%	398 80%	345 69%	331 66%	169 34%
Treatment Group 2	500 100%	381 76%	325 65%	297 59%	203 41%
Treatment Group 3	500 100%	414 83%	384 77%	316 63%	184 37%
N	1,973	1,539	1,527	1,218	

Attrition by groups

To delve deeper into the nature of attrition, defined as the lack of response to the final survey, a formal test is presented in **Table 5**. Specifically, the table presents the results of a regression analysis to compare attrition between different treatment groups, using the control group as a reference point.

Based on the results in the table, the attrition rate in treatment group 1 is seen to be 8 percentage points lower than in the control group. With a confidence level of 99%, this result suggests that the attrition rate in this group is significantly lower than that in the control group. On the other hand, the attrition rate of treatment group 2 is very similar to that of the control group, with a difference of -

0.01 that is not statistically significant. Finally, treatment group 3 shows an attrition rate that is 0.05 percentage points lower than the control group, but this difference is not statistically significant either.

These figures confirm what was previously observed: the treatment groups that received intervention show lower attrition.

These results can potentially affect the analysis of the effectiveness of the intervention in the different groups and should therefore be considered when interpreting the outcomes.

Table 5: Attrition rates by experimental groups

	Final survey
Treatment Group 1	-0.08***
	(0.03)
Treatment Group 2	-0.01
	(0.03)
Treatment Group 3	-0.05*
	(0.03)
N	1,973

Score: ***=.01, **=.05, *=.1. Robust standard errors have been used

Digging deeper into group attrition, **Table 6** shows attrition as a function of the sociodemographic variables and outcome indicators considered. This regression analysis makes it possible to assess whether attrition is selective, i.e., associated with the characteristics of the participants in different ways between groups. The table shows the coefficients of the interactions between each variable and the experimental groups. The results of the different regressions are presented in the same column, and only the coefficients associated with the interactions between treatment and each control variable are shown.

The results suggest that dropout is not significantly associated with most variables differentially between the experimental groups. H However, there are some exceptions. For example, there is a positive correlation between the attrition rate of treatment group 2 and the type of equipment in the home. Similarly, there is a significant relationship between electricity use in fewer than 3 elements and attrition in treatment group 1.

Table 6: Attrition selectivity between treatment groups[21]

Control variable	Treatment Group 1	Treatment Group 2	Treatment Group 3
Sociodemographic variables			

[21] In order to simplify the table, only the coefficients associated with the interactions between treatment and each control variable are presented in the same column for all regressions identified by a separation line.

Control variable	Treatment Group 1	Treatment Group 2	Treatment Group 3
Coast	-0.11*	-0.06	0.03
	(0.06)	(0.07)	(0.07)
Poor housing condition	0.02	0.04	0.04
	(0.09)	(0.09)	(0.09)
Fair housing condition	0.03	-0.01	-0.01
	(0.09)	(0.09)	(0.09)
Low energy consumption	0.11*	0.04	0.03
	(0.07)	(0.07)	(0.07)
Incomplete basic household equipment	0.13	0.40**	0.12
	(0.17)	(0.18)	(0.17)
Basic equipment	0.09	0.25	0.04
	(0.23)	(0.20)	(0.23)
Basic equipment with computer or Internet	0.12	0.28**	0.08
	(0.12)	(0.11)	(0.12)
Basic equipment with heating	-0.01	0.14	-0.06
	(0.17)	(0.18)	(0.18)
Complete equipment without air conditioning	0.15	0.27**	0.01
	(0.11)	(0.10)	(0.11)
No energy-saving equipment	0.09	0.14	0.05
	(0.11)	(0.11)	(0.11)
Only light bulbs	0.04	-0.02	0.01
	(0.08)	(0.08)	(0.08)
Does not use gas for any element	0.02	-0.13	0.02
	(0.10)	(0.11)	(0.10)
Uses gas for one element	-0.02	-0.11	-0.04
	(0.11)	(0.12)	(0.11)
Uses gas for two elements	0.01	-0.12	-0.08
	(0.09)	(0.10)	(0.09)
Does not use electricity for any element	0.17	0.16	0.02
	(0.11)	(0.12)	(0.12)
Uses electricity for one element	0.30***	0.16	0.14
	(0.11)	(0.12)	(0.12)
Uses electricity for two elements	0.31***	0.18	0.10
	(0.12)	(0.13)	(0.12)
No social bonus	-0.02	-0.02	-0.04
	(0.07)	(0.07)	(0.07)
Does not receive support	-0.06	-0.15	-0.12
	(0.10)	(0.12)	(0.12)
Receives support only from MIS	0.00	-0.16	-0.09
	(0.12)	(0.13)	(0.14)
Receives only community support	0.03	-0.17	-0.15
	(0.13)	(0.14)	(0.15)

Control variable	Treatment Group 1	Treatment Group 2	Treatment Group 3
Outcome indicators			
Distribution of consumption throughout the day (I.Anderson_std)	0.02 (0.03)	0.00 (0.03)	0.01 (0.03)
Efficient use of energy-consuming elements (I.Anderson_std)	-0.02 (0.03)	-0.01 (0.04)	0.02 (0.03)
Technical difficulty in maintaining adequate home temperature	0.02 (0.11)	0.07 (0.11)	0.07 (0.11)
Home energy certification	-0.04 (0.04)	0.00 (0.04)	-0.04 (0.04)
Quality of life due to housing conditions (I.Anderson_std)	0.04 (0.03)	-0.00 (0.04)	0.00 (0.03)
Self-perceived quality of life and health by the family (I.Anderson_std)	0.04 (0.03)	0.01 (0.04)	0.03 (0.03)
Overall monthly energy consumption of the home (electricity and gas)	-0.43 (0.33)	-0.22 (0.35)	-0.52* (0.31)
Overall monthly energy expenditure of the home (electricity and gas)	-0.32 (0.23)	-0.00 (0.25)	-0.35 (0.24)
Late payment of utility bills	-0.03 (0.07)	-0.05 (0.07)	-0.09 (0.07)

=.01, **=.05, *=.1. Robust standard errors have been used.

5 Results of the evaluation

Random assignment of the experimental sample to the control and treatment groups ensures that, with a sufficiently large sample, the groups are statistically comparable and therefore any differences observed after the intervention can be causally associated with the treatment. Econometric analysis provides, in essence, this comparison. However, it has the advantages of allowing other variables to be included to gain accuracy in the estimates and of providing confidence intervals for the estimates. In this section, the econometric analysis and the estimated regressions are presented, as well as the analysis of the results obtained.

5.1 Description of the econometric analysis: estimated regressions

The regression model specified to estimate the causal effect in a randomized experiment is usually the difference in the variable of interest between the treatment group(s) and the control group, as these groups are statistically comparable through randomization. However, given the imbalances described above between groups, this analysis presents regressions where variables control for statistically significant imbalances between the different groups. Thus, specifications include the following control variables: equipment, use of electricity, use of gas, participation in accompanying policies, and indicators of technical difficulty in maintaining an adequate temperature in the home, as

well as two indicators of quality of life. This ensures that differences between the pre-intervention treatment and control groups are accounted for in the analysis and increases the accuracy of the estimates. Additionally, to improve the accuracy and robustness of the analysis, specifications include the value of the dependent variable before the intervention, in addition to the controls.

Specifically, the specification of the regressions presented below is as follows:

$$Y_{i,t=1} = \alpha + \beta_1 T1_i + \beta_2 T2_i + \beta_3 T3_i + \delta_i X_{i,t=0} + \gamma Y_{i,t=0} + \varepsilon_i$$

where Yi,t=1 is the dependent variable of interest observed after the intervention for family i. $T1i$, $T2i$, and $T3i$ are dummy variables that have a value of one when the family is assigned to receive the treatment of investment in energy efficiency, advice on consumption habits, or both treatments together, respectively, and 0 otherwise. $X_{i,t=0}$ is a vector of controls measured at baseline (which includes equipment, electricity use, gas use, participation in accompanying policies, technical difficulty in maintaining the appropriate temperature, quality of life due to housing conditions, and self-perceived quality of life and health). $Y_{i,t=0}$ is the value of the dependent variable before the intervention, and ε_i is the error term. The coefficients measure the effect of each of the treatments versus the control group for each $Y_{i,t=0}\varepsilon_i\beta Y$.

The sequence of regressions specified to measure the impact of the interventions is as follows: first, a regression is performed without controls; second, controls are incorporated into the regression to address the random assignment imbalances mentioned above; and finally, the regression is performed controlling for both the random assignment imbalances and the baseline value of the dependent variable.

Additionally, since the purpose of including three treatment groups is to allow comparisons between them, the following specifications shown in the Appendix are also obtained:

$$Y_{i,t=1} = \alpha + \beta(T1_i + T2_i + T3_i) + \delta_i X_{i,t=0} + \gamma Y_{i,t=0} + \varepsilon_i$$

which makes it possible to analyze the impact of receiving any treatment, either of the two, compared to the control group.

$$Y_{i,t=1} = \alpha + \beta(T2_i + T3_i) + \delta_i X_{i,t=0} + \gamma Y_{i,t=0} + \varepsilon_i$$

which makes it possible to analyze the impact of energy advice of the two groups that receive it, compared to not receiving it.

$$Y_{i,t=1} = \alpha + \beta(T1_i + T3_i) + \delta_i X_{i,t=0} + \gamma Y_{i,t=0} + \varepsilon_i$$

This enables the analysis of the impact of investment by comparing two groups: those that receive the investment versus those that do not.

5.2 Analysis of the results

5.2.1 Primary and secondary outcomes

This section presents the evaluation results for the main and secondary indicators, following the structure of the evaluation scheme. All outcome variables are standardized to be between 0 and 1, except for Energy Performance Certification, allowing homogeneous interpretation of all regression coefficients. For indicators that are unbalanced between groups and therefore included in the specifications with controls and their baseline value, only the basic specification and the specification that includes controls and the baseline indicator value are displayed.

The regression results calculated for the outcome indicators obtained by the Anderson method are shown in the Appendix.

In all the tables in this section, the data from the 19 households assigned late to the control group have been eliminated.

1. Consumption habits

Table 7 shows the results of the intervention on the improvement in consumption habits of the participants. The three specifications mentioned above are presented: one without controls, one with controls to address random assignment imbalances (Controls), and one with controls and the values of the dependent variables at baseline (Var. Dep. Pre.).

The first three columns estimate the impact on the distribution of consumption throughout the day. These show a significant improvement in groups 2 and 3, which received advice on improving consumption habits. This positive effect is maintained across the three model specifications and is significant at the 1% level. Additionally, there is no significant difference between the isolated counseling treatment (treatment 2) and the one that combines it with investment (treatment 3), as the p-value for the contrast between the coefficient associated with T2 and that associated with T3 is greater than 0.10 (0.9This result is consistent with the result for treatment 1, investment in housing, which does not show any effect on this indicator. The indicator increases by about 32% in the groups that receive counseling compared to the control group. This is also evident in the specifications that discuss the effect of advice, as shown in the Appendix. Additionally, the indicator calculated using the Anderson method shows the same significance.

Columns 4 and 6 show the results for Efficient Use of Energy-Consuming Elements. Similar to the previous point, treatments involving counseling on energy consumption habits, treatments 2 and 3, show a significant effect on this variable. The increase in this indicator is around 2% on average for both experimental groups (2 and 3) compared to the control group. Again, this is evident in the specifications that analyze the effect of advice and in the indicator calculated using the Anderson method, which reinforces the conclusions obtained. There was no significant difference between the isolated counseling treatment and the one that combined it with investment (the p-value for the contrast between the coefficient associated with T2 and that associated with T3 is greater than 0.10).

Table 7: Effects on consumption habits

	Distribution of consumption throughout the day			Efficient use of energy-consuming elements		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment 1	0.01	0.00	0.03	0.00	0.00	0.00
	(0.03)	(0.04)	(0.03)	(0.01)	(0.01)	(0.01)
Treatment 2	0.11***	0.13***	0.12***	0.02**	0.02**	0.02**
	(0.04)	(0.04)	(0.04)	(0.01)	(0.01)	(0.01)
Treatment 3	0.11***	0.12***	0.12***	0.02**	0.02*	0.02*
	(0.03)	(0.04)	(0.04)	(0.01)	(0.01)	(0.01)
N	1,200	1,023	1,020	1,189	1,020	1,011
Controls	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.34	0.33	0.33	0.88	0.88	0.88
p. value_diff. 1-3	0.00	0.00	0.00	0.05	0.12	0.06
p. value_diff. 2-3	0.90	0.84	0.96	0.93	0.73	0.82

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used. Dep. Var. Mean. is the mean of the final in-line indicator for the control group.

In summary, the analysis finds that counseling alone has a statistically significant positive effect on improving consumption habits. However, the results indicate that combining counseling with investment in energy-efficient home elements does not produce an additional or reinforcing effect on consumption habits.

2. Energy efficiency of the home

The results for improving the energy efficiency of the home are shown in **Table 8**. The table follows the same structure as the previous one. In this case, the first three columns refer to the technical difficulty in maintaining an adequate temperature in the home, with no significant improvement identified. Treatments 1 and 3, which involve an investment in the home's energy efficiency, are the ones that should a priori show improvements in this indicator. In this context, the coefficients are not only insignificant, but they are also negative. Conversely, treatment 2 shows a positive coefficient, but with a significant level of 10%.

The effect on the energy certification of the home, shown in the last three columns of the table, is positive and significant in treatment groups 1 and 3, i.e., when it involves an investment. This improvement is statistically significant at the 1% level in all analyzed specifications and results in an average improvement of 12% in homes receiving investment in energy efficiency.

Table 8: Effects on household energy efficiency (comparison of T1 with GC, T2 with GC, and T3 with GC)

	Technical difficulty in maintaining adequate home temperature		Home energy certification		
	(1)	(2)	(3)	(4)	(5)
Treatment 1	-0.03	-0.01	0.19***	0.32***	0.27***
	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)
Treatment 2	0.05*	0.06*	-0.06	0.01	0.00
	(0.03)	(0.03)	(0.05)	(0.05)	(0.02)
Treatment 3	-0.03	-0.01	0.21***	0.34***	0.29***
	(0.03)	(0.03)	(0.05)	(0.06)	(0.04)
N	1,207	1,025	1,973	1,424	1,424
Controls	No	Yes	No	Yes	Yes
Dep. Var. Pre	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.31	0.29	2.41	2.34	2.34
p. value_diff. 1-3	0.97	0.81	0.74	0.64	0.70
p. value_diff. 2-3	0.01	0.02	0.00	0.00	0.00

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used. Dep. Var. Mean. is the mean of the final in-line indicator for the control group.

Analyzing the results, they suggest that investment in energy efficiency elements in homes has the expected direct effect on obtaining a better energy certificate. However, there is no significant effect on the difficulty reported by the beneficiaries in maintaining an adequate temperature in the home.

3. Quality of life and health of participating individuals/families

Table 9 reports the results of the intervention related to the quality of life and health of the participants.

Regarding quality of life by housing conditions, a significant effect was observed in the columns where controls are included (column 2) in treatments 1 and 3. This analysis concludes that investment in housing yields a significant positive impact at the 5% significance level, resulting in an average increase of 6.5%. This effect remains statistically consistent, regardless of whether the investment includes advice on energy consumption habits.

The family's **self-perceived quality of life and health** does not improve significantly with any treatment in any of the proposed specifications.

Table 9: Effects on quality of life and health (comparison of T1 with CG, T2 with CG and T3 with CG)

	Quality of life due to housing conditions		Self-perceived quality of life and health by the family	
	(1)	(2)	(3)	(4)
Treatment 1	0.01	0.04**	-0.02	0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Treatment 2	0.01	0.02	-0.02	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)
Treatment 3	0.02	0.04**	-0.02	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	0.46	0.45	0.67	0.66
p. value_diff. 1-3	0.94	0.96	0.94	0.53
p. value_diff. 2-3	0.91	0.31	0.80	0.89

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used. Dep. Var. Mean. is the mean of the final in-line indicator for the control group.

In summary, the quality of life of the participants is positively impacted only if the homes receive investment, according to the indicator that approximates this quality of life in relation to housing conditions. According to the indicator obtained from self-perceived quality of life and health, no significant effect was observed in any experimental group.

4. Savings on energy bills

Table 10 shows the results linked to savings on the energy bill.

Starting with the main indicators, the overall monthly energy consumption of the home does not show significant improvements for any treatment in any of the model configurations. However, improvements were observed in the overall monthly energy expenditure of the home for treatment 2, with a significance level of 5% in all specifications, being around 20% lower than in the control group. On the other hand, in treatment 3, where advisory and investment treatments are applied together, negative coefficients are observed, although they are only statistically significant in the specifications without controls and with controls (columns 4 and 5), with a reduction compared to control of around 13%. Additionally, although not significant, the monthly expenses are also reduced when treatment 1 is applied.

Regarding the effect on energy bill savings, a secondary indicator addressing the **delay in utility bill payment** is also considered. The results for this variable are reported in columns 7, 8, and 9, and do not show any robust improvement from any treatment. In fact, the coefficients are negative, indicating that the situation worsens for all treatments compared to the control group.

Table 10: Effects on savings on energy bills

	Overall monthly energy consumption of the home			Overall monthly energy expenditure of the home			Late payment of utility bills		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Treatment 1	0.00	0.00	-0.00	-0.02	-0.01	-0.01	-0.06*	-0.04	-0.04
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.04)
Treatment 2	-0.01	-0.00	-0.00	-0.03**	-0.02**	-0.02**	-0.06	-0.07*	-0.09**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.04)
Treatment 3	0.01	0.01	0.01	-0.02*	-0.02*	-0.01	-0.02	-0.02	-0.04
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.04)
N	1,105	1,033	1,033	1,105	1,033	1,033	1,135	974	962
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.14	0.14	0.14	0.15	0.15	0.15	0.76	0.77	0.77
p. value_diff. 1-3	0.33	0.54	0.39	0.77	0.34	0.96	0.27	0.63	0.88
p. value_diff. 2-3	0.08	0.33	0.27	0.32	0.50	0.31	0.38	0.19	0.20

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used. Dep. Var. Mean. is the mean of the final in-line indicator for the control group.

In summary, although the intervention did not significantly affect household energy consumption nor reduce bill payment delays, it significantly reduced expenditure associated with household supplies for households that received advice on improving consumption habits and those that received both treatments together. This suggests that the strategy involves using the same amount of energy in a more cost-effective way, while the motivation to reduce utility costs may decrease when households receive investment in the home.

6 Conclusions of the evaluation

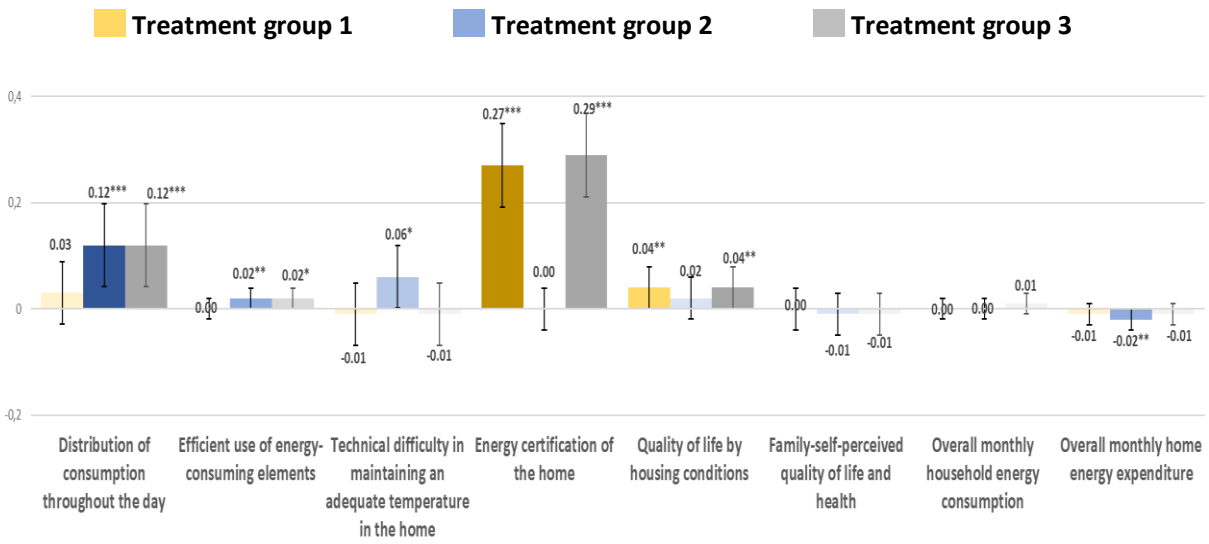
This pilot project has made it possible to evaluate the effects of two different strategies to address the problem of energy poverty. On one hand, the effect of making investments in homes to achieve greater energy efficiency has been tested, and on the other hand, the effect of providing advice and support on efficient consumption habits. Additionally, the effect of applying both interventions simultaneously has been studied to test for synergies that achieve positive results rather than proportional ones. The evaluation is experimental, using stratified randomization (by location, housing condition, and energy consumption) to randomly assign participants to one of three treatment groups or the control group. The initial sample includes 1,992 homes throughout Catalonia, distributed at both the provincial and local levels.

The different interventions conducted results on most of the observed energy poverty indicators. The advice optimizes energy use, favoring better distribution of consumption throughout the day and the efficient use of energy-consuming elements. Conversely, investment in housing improves the energy

efficiency of the home, reduces energy expenditure, and slightly improves the quality of life of households due to housing conditions.

No significant benefits have been found in performing a simultaneous investment and advisory intervention versus isolated interventions.

Figure 9: Effect of the intervention on key indicators



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Note: The colors of the figures vary from dark to light depending on the level of significance of the variable's coefficient. The effects included in the graphs refer to regressions with controls

P-value **< 0.01** **0.01-0.05** **0.05-0.10** **> 0.10**

This study has some limitations from the point of view of RCT analysis and in relation to the availability of data. On the one hand, a high rate of attrition is observed, which has been shown to be differential between groups and selective in certain characteristics, potentially biasing the estimated results. This issue is especially relevant in the treatment groups, where 235 households that received the intervention have not responded. On the other hand, 125 households that did not receive the program have been included in the estimates as information is available at the end of the intervention. This implies that the results obtained for the treatment groups have been influenced by some households without intervention and the absence of some households that received it, which could bias the results downwards and, therefore, underestimate the impacts.

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Appendix

Economic and regulatory management

1. Introduction

Within the framework of the National Recovery, Transformation, and Resilience Plan, the General Secretariat of Inclusion (SGI) of the Ministry of Inclusion, Social Security, and Migrations plays a relevant role in Component 23 "New public policies for a dynamic, resilient, and inclusive labor market," framed within Policy Area VIII "New care economy and employment policies."

Investment 7 "Promotion of Inclusive Growth through the linkage of socio-labor inclusion policies to the Minimum Income Scheme" " is one of the reforms and investments proposed in this Component 23. Investment 7 promotes the implementation of a new inclusion model based on the Minimum Income Scheme (MIS), aimed at reducing income inequality and poverty rates. To achieve this goal, the development of pilot projects for the implementation of social inclusion itineraries with communities and autonomous communities, local entities, and Third Sector organizations of Social Action, as well as with various social actors, has been proposed.

Royal Decree 938/2021, of October 26, which regulates the direct granting of subsidies from the Ministry of Inclusion, Social Security, and Migrations in the field of social inclusion, for an amount of 109,787,404 euros, within the framework of the Recovery, Transformation, and Resilience Plan [22], contributed to achieving critical milestone (as stated in the Council's Implementation Decision) number 350 for the first quarter of 2022 "Improving the access rate of the Minimum Income Scheme, and increasing the effectiveness of the MIS through inclusion policies," which, according to its description, will translate into supporting the socio-economic inclusion of MIS beneficiaries through itineraries: eight collaboration agreements signed with subnational public administrations, social partners, and Third Sector organizations of Social Action to execute the itineraries. These partnership agreements aim to: i) improve the access rate of the MIS; ii) increase the effectiveness of the MIS through inclusion policies. Additionally, jointly with Royal Decree 378/2022, of May 17 [23] , it contributed to meeting tracking indicator number 351.1 in the first quarter of 2023 "at least 10 additional collaboration agreements signed with subnational public administrations, social partners, and Third Sector organizations of Social Action to execute pilot projects supporting the socio-economic

[22]Royal Decree 938/2021, of October 26, regulating the direct granting of subsidies from the Ministry of Inclusion, Social Security, and Migrations in the field of social inclusion, for an amount of 109,787,404 euros, within the framework of the Recovery, Transformation, and Resilience Plan (BOE-A-2021-17464). It can be consulted at the following link: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-17464.

[23] Royal Decree 378/2022, of May 17, regulating the direct granting of subsidies from the Ministry of Inclusion, Social Security, and Migrations in the field of social inclusion, for an amount of 102,036,066 euros, within the framework of the Recovery, Transformation, and Resilience Plan (BOE-A-2022-8124). It can be consulted at the following link: [link](https://www.boe.es/diario_boe/txt.php?id=BOE-A-2022-8124).: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-17464.

inclusion of MIS beneficiaries through itineraries," linked to the Operational Arrangements [24] document.

Furthermore, following the execution and evaluation of each of the subsidized pilot projects, an assessment will be conducted to evaluate the coverage, effectiveness, and success of the minimum income schemes. The publication of this assessment, which will include specific recommendations to improve the access rate to the benefit and enhance the effectiveness of social inclusion policies, contributes to the achievement of milestone 351 of the Recovery, Transformation, and Resilience Plan scheduled for the first quarter of 2024.

In accordance with Article 3 of Royal Decree 938/2021, of October 26, the granting of subsidies will be conducted by means of a resolution accompanied by an agreement from the person holding the position of Minister of Inclusion, Social Security, and Migrations as the competent body for granting them, without prejudice to existing delegations of powers in the matter, upon prior request by the beneficiary entities.

On **September 15, 2022**, the Government of Catalonia was notified of the Resolution of the General Secretariat for Inclusion and Social Welfare Objectives and Policies granting a subsidy of 11,000,000 euros to the Government of Catalonia. On **December 23, 2022**, an Agreement was signed between the General State Administration, through the General Secretariat for Inclusion and Social Welfare Objectives and Policies, and the Government of Catalonia for the implementation of a project for social inclusion within the framework of the Recovery, Transformation and Resilience Plan. This Agreement was published in the "Boletín Oficial del Estado" on **January 3, 2023** (BOE no.2).[25]

2. Time frame of the intervention

Article 17(1) of Royal Decree 378/2022 of May 17, 2022, established that the deadline for the implementation of pilot projects for social inclusion itineraries covered by the subsidies provided for in this text must not exceed November 30, 2023, while the evaluation of the same will not extend beyond March 31, 2024, to meet the milestones, set by the Recovery, Transformation and Resilience Plan in terms of inclusion policy.

Within this generic time frame, the beginning of the implementation can be placed on **May 26, 2023**, when the first phase corresponding to the scheduling of visits for the interventions began, continuing

[24] Decision of the European Commission approving the Operational Arrangements document of the Recovery, Transformation, and Resilience Plan, which can be consulted at the following link:

https://www.lamoncloa.gob.es/serviciosdeprensa/notasprensa/hacienda/Documents/2021/101121-CountersignedESFirstCopy.pdf

[25] Resolution of December 27, 2022, of the General Secretariat for Inclusion and Social Welfare Objectives and Policies, which publishes the Agreement with the Government of Catalonia, for the implementation of a project for social inclusion within the framework of the Recovery, Transformation and Resilience Plan. It can be consulted at: the following link: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2023-110

until **November 30, 2023**, and subsequently developing dissemination and evaluation tasks of the project until **March 31, 2024**.

3. Relevant Agents

Among the relevant agents for the implementation of the project are:

- **Government of Catalonia,** the beneficiary entity and coordinator of the project, especially the following units:

  a) The **Department of Social Rights** (responsible and implementer).
  b) The **Housing Agency of Catalonia** (implementer).

- **Technical secretariat for the coordination and supervision of investments in improvements for energy efficiency in homes.** and **SM Sistemas Ambientals, S.L.**, subcontracted by the Government of Catalonia for the execution of the project:

Company name	Sector of activity
Copisa Constructora Pirenaica, SA	Optimization of energy efficiency.
SM Sistemas Ambientales, S.L	Training and advice on energy consumption habits, as well as data collection and processing.
Daleph	Technical secretariat of the project.
APROTECNIC GROUP	Technical secretariat for the coordination and supervision of investments in energy efficiency improvements in homes.

- The **Ministry of Inclusion, Social Security and Migration (MISSM)** as the funder of the project, and as the main responsible for the RCT evaluation process. To this end, the General Secretariat (SGI) assumes the following commitments:
  a) Assist the beneficiary entity in the design of the actions to be conducted for the execution and monitoring of the grant's objective, as well as for the profiling of the potential participants of the pilot project.
  b) Design the randomized controlled trial (RCT) methodology of the pilot project in coordination with the beneficiary entity.
  c) Evaluate the pilot project in coordination with the beneficiary entity.
- **CEMFI and J-PAL Europe,** as scientific and academic institutions that support MISSM in the design and evaluation of RCT of the project.

Sample Balance

Table 11 shows the mean value of the different variables for each experimental group and the F-statistic, which indicates whether there are statistically significant differences together. **Table 11** reports the number of observations omitted in **Table 11** for visual reasons. Similarly, in

Table 13 The numerical result of the equilibrium contrast, or difference in means, shown graphically in the **Figure 8** in the body of the document. In the latter, the result of the balance test between the control and treatment groups is reported individually using the statistic *t the Student* and including the resulting p-value.

Table 11: Balance test between experimental groups

Variable	Mean CG (var.)	Mean TG1 (var.)	Mean TG2 (var.)	Mean TG3 (var.)	Difference F-stat (p-value)
Sociodemographic variables (pre-intervention)					
Coast	0.37	0.36	0.36	0.36	0.01
	(0.23)	(0.23)	(0.23)	(0.23)	(1.00)
Interior/Mountain	0.63	0.64	0.64	0.64	0.01
	(0.23)	(0.23)	(0.23)	(0.23)	(1.00)
Poor housing condition	0.37	0.38	0.38	0.38	0.01
	(0.23)	(0.24)	(0.24)	(0.24)	(1.00)
Fair housing condition	0.44	0.43	0.43	0.43	0.01
	(0.25)	(0.25)	(0.25)	(0.25)	(1.00)
Good housing condition	0.19	0.19	0.19	0.19	0.01
	(0.15)	(0.15)	(0.15)	(0.15)	(1.00)
Low energy consumption	0.67	0.67	0.67	0.67	0.01
	(0.22)	(0.22)	(0.22)	(0.22)	(1.00)
Medium energy consumption	0.33	0.33	0.33	0.33	0.01
	(0.22)	(0.22)	(0.22)	(0.22)	(1.00)
Number of household members	3.08	3.01	3.15	3.18	0.88
	(2.54)	(2.57)	(2.65)	(2.40)	(0.45)
Household monthly income	1,113.14	1,069.71	1,082.99	1,088.27	0.39
	(310,632.95)	(284,596.70)	(314,633.87)	(322,233.97)	(0.76)
Incomplete basic household equipment	0.04	0.14	0.07	0.13	10.10***
	(0.04)	(0.12)	(0.06)	(0.11)	(0.00)
Basic equipment	0.04	0.02	0.04	0.02	1.37
	(0.04)	(0.02)	(0.04)	(0.02)	(0.25)
Basic equipment with computer or	0.24	0.24	0.23	0.28	0.96

Variable	Mean CG (var.)	Mean TG1 (var.)	Mean TG2 (var.)	Mean TG3 (var.)	Difference F-stat (p-value)
Internet	(0.18)	(0.18)	(0.18)	(0.20)	(0.41)
Basic equipment with heating	0.06	0.06	0.05	0.05	0.06
	(0.05)	(0.05)	(0.05)	(0.05)	(0.98)
Complete equipment without air conditioning	0.50	0.45	0.52	0.41	3.76**
	(0.25)	(0.25)	(0.25)	(0.24)	(0.01)
Complete equipment with air conditioning	0.12	0.09	0.10	0.11	1.09
	(0.11)	(0.08)	(0.09)	(0.10)	(0.35)
No energy-saving equipment	0.15	0.15	0.17	0.15	0.19
	(0.13)	(0.13)	(0.14)	(0.13)	(0.91)
Only light bulbs	0.62	0.64	0.58	0.63	1.29
	(0.24)	(0.23)	(0.24)	(0.23)	(0.28)
With energy-saving equipment	0.23	0.20	0.25	0.22	0.99
	(0.18)	(0.16)	(0.19)	(0.17)	(0.40)
Does not use gas for any element	0.29	0.34	0.33	0.36	1.32
	(0.21)	(0.22)	(0.22)	(0.23)	(0.27)
Uses gas for one element	0.14	0.19	0.16	0.17	1.34
	(0.12)	(0.16)	(0.13)	(0.14)	(0.26)
Uses gas for two elements	0.39	0.35	0.38	0.31	2.09*
	(0.24)	(0.23)	(0.24)	(0.21)	(0.10)
Uses gas for three elements	0.18	0.12	0.13	0.16	2.47*
	(0.15)	(0.10)	(0.11)	(0.13)	(0.06)
Does not use electricity for any element	0.37	0.22	0.30	0.29	6.17***
	(0.23)	(0.17)	(0.21)	(0.21)	(0.00)
Uses electricity for one element	0.27	0.38	0.31	0.24	6.52***
	(0.20)	(0.24)	(0.21)	(0.18)	(0.00)
Uses electricity for two elements	0.26	0.27	0.26	0.34	2.77**
	(0.19)	(0.20)	(0.19)	(0.22)	(0.04)
Uses electricity for three elements	0.11	0.13	0.13	0.13	0.46
	(0.10)	(0.11)	(0.12)	(0.12)	(0.71)
No social bonus	0.52	0.52	0.47	0.50	0.92
	(0.25)	(0.25)	(0.25)	(0.25)	(0.43)
Has some social bonus	0.48	0.48	0.53	0.50	0.92
	(0.25)	(0.25)	(0.25)	(0.25)	(0.43)
Does not receive support	0.71	0.64	0.67	0.67	1.53
	(0.21)	(0.23)	(0.22)	(0.22)	(0.20)
Receives support only from MIS	0.14	0.19	0.15	0.19	2.71**
	(0.12)	(0.15)	(0.13)	(0.16)	(0.04)
Receives only community support	0.09	0.10	0.12	0.09	0.66
	(0.09)	(0.09)	(0.10)	(0.09)	(0.58)
Receives support from MIS and	0.06	0.07	0.06	0.04	1.44

Variable	Mean CG (var.)	Mean TG1 (var.)	Mean TG2 (var.)	Mean TG3 (var.)	Difference F-stat (p-value)
community	(0.06)	(0.07)	(0.06)	(0.04)	(0.23)
Outcome indicators (pre-intervention)					
Distribution of consumption throughout the day	0.33	0.27	0.33	0.30	1.74
	(0.17)	(0.15)	(0.17)	(0.15)	(0.16)
Distribution of consumption throughout the day (I, Anderson_std)	0.02	-0.09	0.05	0.02	1.43
	(1.06)	(0.96)	(1.04)	(0.95)	(0.23)
Efficient use of energy-consuming elements	0.71	0.70	0.69	0.70	0.32
	(0.07)	(0.07)	(0.06)	(0.07)	(0.81)
Efficient use of energy-consuming elements (I, Anderson_std)	0.02	0.02	-0.03	-0.01	0.27
	(1.01)	(1.02)	(0.91)	(1.06)	(0.85)
Technical difficulty in maintaining adequate home temperature	0.35	0.27	0.37	0.32	7.83***
	(0.10)	(0.11)	(0.11)	(0.11)	(0.00)
Home energy certification	2.41	2.41	2.35	2.42	0.75
	(0.66)	(0.66)	(0.55)	(0.68)	(0.52)
Quality of life due to housing conditions	0.46	0.42	0.47	0.46	2.33*
	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)
Quality of life due to housing conditions (I, Anderson_std)	0.06	-0.11	0.08	-0.01	2.63**
	(0.93)	(0.99)	(1.00)	(1.06)	(0.05)
Self-perceived quality of life and health by the family	0.61	0.55	0.60	0.57	4.61***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.00)
Self-perceived quality of life and health by the family (I, Anderson_std)	0.11	-0.11	0.08	-0.05	4.00**
	(0.95)	(1.08)	(0.95)	(0.99)	(0.01)
Overall monthly energy consumption of the home (electricity and gas)	0.12	0.12	0.11	0.11	0.31
	(0.01)	(0.01)	(0.01)	(0.01)	(0.82)
Overall monthly energy expenditure of the home (electricity and gas)	0.17	0.16	0.16	0.15	1.78
	(0.02)	(0.02)	(0.02)	(0.02)	(0.15)
Late payment of utility bills	0.64	0.58	0.64	0.65	1.82
	(0.23)	(0.24)	(0.23)	(0.23)	(0.14)

Notes: The p-value indicates the level of significance as follows: * <10%, ** <5% and *** <1%

Table 12: Report of the observations of the table of balance tests between the experimental groups

Variable	CG Obs.	TG1 Obs.	TG2 Obs.	TG3 Obs.	F-stat Obs.
Sociodemographic variables (pre-intervention)					
Coast	473	500	500	500	1,973
Interior/Mountain	473	500	500	500	1,973
Poor housing condition	473	500	500	500	1,973
Fair housing condition	473	500	500	500	1,973
Good housing condition	473	500	500	500	1,973
Low energy consumption	473	500	500	500	1,973
Medium energy consumption	473	500	500	500	1,973
Number of household members	343	398	381	414	1,536
Household monthly income	343	398	381	414	1,536
Incomplete basic household equipment	340	397	376	409	1,522
Basic equipment	340	397	376	409	1,522
Basic equipment with computer or Internet	340	397	376	409	1,522
Basic equipment with heating	340	397	376	409	1,522
Complete equipment without air conditioning	340	397	376	409	1,522
Complete equipment with air conditioning	340	397	376	409	1,522
No energy-saving equipment	338	396	376	409	1,519
Only light bulbs	338	396	376	409	1,519
With energy-saving equipment	338	396	376	409	1,519
Does not use gas for any element	340	396	378	408	1,522
Uses gas for one element	340	396	378	408	1,522
Uses gas for two elements	340	396	378	408	1,522
Uses gas for three elements	340	396	378	408	1,522
Does not use electricity for any element	340	397	379	411	1,527
Uses electricity for one element	340	397	379	411	1,527
Uses electricity for two elements	340	397	379	411	1,527
Uses electricity for three elements	340	397	379	411	1,527
No social bonus	331	393	374	406	1,504
Has some social bonus	331	393	374	406	1,504
Does not receive support	473	500	500	500	1,973

Receives support only from MIS	473	500	500	500	1,973
Receives only community support	473	500	500	500	1,973
Receives support from MIS and community	473	500	500	500	1,973
Outcome indicators (pre-intervention)					
Distribution of consumption throughout the day	335	394	376	404	1,509
Distribution of consumption throughout the day (I, Anderson_std)	333	393	372	401	1,499
Efficient use of energy-consuming elements	333	387	372	404	1,496
Efficient use of energy-consuming elements (I, Anderson_std)	333	387	372	404	1,496
Technical difficulty in maintaining adequate home temperature	336	394	373	404	1,507
Home energy certification	473	500	500	500	1,973
Quality of life due to housing conditions	330	382	368	395	1,475
Quality of life due to housing conditions (I, Anderson_std)	330	382	368	395	1,475
Self-perceived quality of life and health by the family	326	384	366	395	1,471
Self-perceived quality of life and health by the family (I, Anderson_std)	326	384	366	395	1,471
Overall monthly energy consumption of the home (electricity and gas)	343	398	381	414	1,535
Overall monthly energy expenditure of the home (electricity and gas)	343	398	381	414	1,536
Late payment of utility bills	333	391	370	402	1,496

Table 13: Report of the results for the individual crosses of the balance test between the experimental groups

Variable	CG-TG1 (N)	CG-TG2 (N)	CG-TG3 (N)	TG1-TG2 (N)	TG1-TG3 (N)	TG2-TG3 (N)
Sociodemographic variables (pre-intervention)						
Coast	0.85 (973)	0.90 (973)	0.90 (973)	0.95 (1000)	0.95 (1000)	1.00 (1000)
Interior/Mountain	0.85 (973)	0.90 (973)	0.90 (973)	0.95 (1000)	0.95 (1000)	1.00 (1000)
Poor housing condition	0.90 (973)	0.90 (973)	0.85 (973)	1.00 (1000)	0.95 (1000)	0.95 (1000)
Fair housing condition	0.96 (973)	0.91 (973)	0.91 (973)	0.95 (1000)	0.95 (1000)	1.00 (1000)
Good housing condition	0.93 (973)	0.99 (973)	0.93 (973)	0.94 (1000)	1.00 (1000)	0.94 (1000)
Low energy consumption	0.89 (973)	0.94 (973)	0.89 (973)	0.95 (1000)	1.00 (1000)	0.95 (1000)
Medium energy consumption	0.89 (973)	0.94 (973)	0.89 (973)	0.95 (1000)	1.00 (1000)	0.95 (1000)
Number of households members	0.51 (741)	0.60 (724)	0.42 (757)	0.23 (779)	0.13 (812)	0.79 (795)
Household monthly income	0.28 (741)	0.47 (724)	0.55 (757)	0.73 (779)	0.63 (812)	0.90 (795)
Incomplete basic household equipment	0.00*** (737)	0.14 (716)	0.00*** (749)	0.00*** (773)	0.63 (806)	0.00*** (785)
Basic equipment	0.15 (737)	0.93 (716)	0.20 (749)	0.12 (773)	0.87 (806)	0.16 (785)
Basic equipment with computer or Internet	0.98 (737)	0.63 (716)	0.28 (749)	0.61 (773)	0.26 (806)	0.11 (785)
Basic equipment with heating	0.98 (737)	0.75 (716)	0.78 (749)	0.76 (773)	0.80 (806)	0.96 (785)
Complete equipment without air conditioning	0.24 (737)	0.57 (716)	0.02** (749)	0.07* (773)	0.20 (806)	0.00*** (785)
Complete equipment with air conditioning	0.09* (737)	0.23 (716)	0.57 (749)	0.63 (773)	0.24 (806)	0.51 (785)

No energy-saving equipment	0.99	0.55	0.99	0.54	1.00	0.54
	(734)	(714)	(747)	(772)	(805)	(785)
Only light bulbs	0.42	0.30	0.77	0.06*	0.60	0.16
	(734)	(714)	(747)	(772)	(805)	(785)
With energy-saving equipment	0.35	0.50	0.73	0.09*	0.53	0.28
	(734)	(714)	(747)	(772)	(805)	(785)
Does not use gas for any element	0.23	0.26	0.05**	0.94	0.42	0.39
	(736)	(718)	(748)	(774)	(804)	(786)
Uses gas for one element	0.06*	0.51	0.26	0.19	0.40	0.63
	(736)	(718)	(748)	(774)	(804)	(786)
Uses gas for two elements	0.37	0.91	0.03**	0.43	0.18	0.03**
	(736)	(718)	(748)	(774)	(804)	(786)
Uses gas for three elements	0.02**	0.05*	0.41	0.65	0.09*	0.23
	(736)	(718)	(748)	(774)	(804)	(786)
Does not use electricity for any element	0.00***	0.04**	0.02**	0.02**	0.04**	0.80
	(737)	(719)	(751)	(776)	(808)	(790)
Uses electricity for one element	0.00***	0.26	0.40	0.04**	0.00***	0.04**
	(737)	(719)	(751)	(776)	(808)	(790)
Uses electricity for two elements	0.62	0.81	0.01**	0.80	0.04**	0.02**
	(737)	(719)	(751)	(776)	(808)	(790)
Uses electricity for three elements	0.41	0.29	0.30	0.80	0.82	0.98
	(737)	(719)	(751)	(776)	(808)	(790)
No social bonus	0.96	0.17	0.64	0.14	0.59	0.34
	(724)	(705)	(737)	(767)	(799)	(780)
Has some social bonus	0.96	0.17	0.64	0.14	0.59	0.34
	(724)	(705)	(737)	(767)	(799)	(780)
Does not receive support	0.03**	0.22	0.22	0.35	0.35	1.00
	(973)	(973)	(973)	(1000)	(1000)	(1000)
Receives support only from MIS	0.03**	0.64	0.02**	0.09*	0.87	0.06*
	(973)	(973)	(973)	(1000)	(1000)	(1000)
Receives only community support	0.87	0.24	0.96	0.30	0.91	0.26
	(973)	(973)	(973)	(1000)	(1000)	(1000)
Receives support from MIS and community	0.50	0.86	0.17	0.62	0.04**	0.12
	(973)	(973)	(973)	(1000)	(1000)	(1000)
Outcome indicators (pre-intervention)						
Distribution of consumption throughout the day	0.07*	0.87	0.41	0.04**	0.28	0.30
	(729)	(711)	(739)	(770)	(798)	(780)
Distribution of consumption throughout the day (I, Anderson_std)	0.14	0.73	0.94	0.06*	0.13	0.65
	(726)	(705)	(734)	(765)	(794)	(773)
Efficient use of energy-consuming elements	0.99	0.40	0.68	0.39	0.68	0.66
	(720)	(705)	(737)	(759)	(791)	(776)

Efficient use of energy-consuming elements (I, Anderson_std)	0.95 (720)	0.42 (705)	0.69 (737)	0.44 (759)	0.73 (791)	0.68 (776)
Technical difficulty in maintaining adequate home temperature	0.00*** (730)	0.32 (709)	0.15 (740)	0.00*** (767)	0.03** (798)	0.02** (777)
Home energy certification	0.97 (973)	0.23 (973)	0.91 (973)	0.24 (1000)	0.88 (1000)	0.18 (1000)
Quality of life due to housing conditions	0.06* (712)	0.59 (698)	0.89 (725)	0.01** (750)	0.07* (777)	0.49 (763)
Quality of life due to housing conditions (I, Anderson_std)	0.02** (712)	0.77 (698)	0.37 (725)	0.01** (750)	0.17 (777)	0.23 763
Self-perceived quality of life and health by the family	0.00*** (710)	0.58 (692)	0.02** (721)	0.01*** (750)	0.39 (779)	0.06* (761)
Self-perceived quality of life and health by the family (I, Anderson_std)	0.00*** (710)	0.63 (692)	0.03** (721)	0.01** (750)	0.37 (779)	0.08* (761)
Overall monthly energy consumption of the home (electricity and gas)	0.81 (741)	0.51 (724)	0.40 (757)	0.66 (779)	0.52 (812)	0.84 (795)
Overall monthly energy expenditure of the home (electricity and gas)	0.36 (741)	0.17 (724)	0.02** (757)	0.64 (779)	0.17 (812)	0.37 (795)
Late payment of utility bills	0.09* (724)	0.97 (703)	0.72 (735)	0.09* (761)	0.03** (793)	0.68 (772)

Supplementary Assessment Results

Table 14: Effects on consumption habits measured with Anderson indices

	Distribution of consumption throughout the day (I, Anderson_std)			Efficient use of energy-consuming elements (I.Anderson_std)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment 1	0.06	0.03	0.08	-0.01	-0.02	-0.03
	(0.08)	(0.09)	(0.08)	(0.07)	(0.09)	(0.09)
Treatment 2	0.28***	0.31***	0.29***	0.04	0.06	0.06
	(0.08)	(0.09)	(0.09)	(0.08)	(0.09)	(0.09)
Treatment 3	0.26***	0.29***	0.29***	0.04	0.02	0.02
	(0.08)	(0.09)	(0.08)	(0.08)	(0.09)	(0.09)
N	1,196	1,023	1,018	1,189	1,020	1,011
Controls	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	-0.15	-0.18	-0.17	-0.02	-0.02	-0.02
p. value_diff. 1-3	0.01	0.00	0.00	0.57	0.73	0.61
p. value_diff. 2-3	0.78	0.81	0.97	0.98	0.64	0.68

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 15: Effects on consumption habits (comparison between receiving treatment with counselling (T2 or T3) versus not having it). Effect of counseling

	Distribution of consumption throughout the day			Efficient use of energy-consuming elements		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment with	0.10***	0.12***	0.11***	0.02***	0.02**	0.02***
counseling (2-3)	(0.02)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)
N	1,200	1,023	1,020	1,189	1,020	1,011
Controls	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.35	0.34	0.34	0.88	0.88	0.88

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 16: Effects on consumption habits (comparison between receiving treatment with counselling (T2 or T3) versus not having it) measured with Anderson indices. Effect of counseling

	Distribution of consumption throughout the day (I, Anderson_std)			Efficient use of energy-consuming elements (I.Anderson_std)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment with counseling (2-3)	0.24***	0.28***	0.25***	0.05	0.05	0.06
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
N	1,196	1,023	1,018	1,189	1,020	1,011
Controls	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	-0.12	-0.16	-0.16	-0.02	-0.03	-0.03

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 17: Effects on consumption habits (comparison between receiving an inversion treatment (T1 or T3) versus not having it). Effect of investment

	Technical difficulty in maintaining adequate home temperature		Home energy certification		
	(1)	(3)	(4)	(5)	(6)
Treatment with investment (1-3)	-0.06***	-0.04*	0.23***	0.33***	0.28***
	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)
N	1,207	1,025	1,973	1,424	1,424
Controls	No	Yes	No	Yes	Yes
Dep. Var. Pre	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.33	0.33	2.38	2.34	2.34

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 18: Effects on quality of life measured with Anderson indices

	Quality of life due to housing conditions (I.Anderson_std)		Self-perceived quality of life and health by the family (I.Anderson_std)	
	(1)	(2)	(3)	(4)
Treatment 1	-0.00	0.11	-0.11	0.01
	(0.08)	(0.08)	(0.08)	(0.09)
Treatment 2	0.02	0.07	-0.09	-0.05
	(0.08)	(0.09)	(0.08)	(0.08)
Treatment 3	0.01	0.14	-0.12	-0.05
	(0.09)	(0.09)	(0.08)	(0.09)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	0.00	-0.06	0.08	0.04
p. value_diff. 1-3	0.83	0.69	0.98	0.46
p. value_diff. 2-3	0.86	0.39	0.71	1.00

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 19: Effects on quality of life (comparison between receiving any treatment (T1, T2 or T3) versus not having it)

	Quality of life due to housing conditions		Self-perceived quality of life and health by the family	
	(1)	(2)	(3)	(4)
Treatment (1-2-3)	0.01	0.11	-0.02	-0.03
	(0.02)	(0.07)	(0.02)	(0.07)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	0.46	-0.06	0.67	0.04

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 20: Effects on quality of life measured with Anderson indices (comparison between receiving any treatment (T1, T2 or T3) versus not having it)

	Quality of life due to housing conditions (I.Anderson_std)		Self-perceived quality of life and health by the family (I.Anderson_std)	
	(1)	**(2)**	**(3)**	**(4)**
Treatment (1-2-3)	0.01	0.04**	-0.11	-0.01
	(0.07)	(0.02)	(0.07)	(0.02)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	-0.01	0.45	0.08	0.66

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 21: Effects on quality of life (comparison between receiving treatment with counselling (T2 or T3) versus not having it). Effect of counseling

	Quality of life due to housing conditions		Self-perceived quality of life and health by the family	
	(1)	**(2)**	**(3)**	**(4)**
Treatment with counselling (2-3)	0.01	0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	0.47	0.47	0.65	0.65

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 22: Effects on quality of life measured with Anderson indices (comparison between receiving treatment with counselling (T2 or T3) versus not having it). Effect of counseling

	Quality of life due to housing conditions (I.Anderson_std)		Self-perceived quality of life and health by the family (I.Anderson_std)	
	(1)	**(2)**	**(3)**	**(4)**
Treatment with counselling (2-3)	0.02	0.05	-0.04	-0.06
	(0.06)	(0.06)	(0.06)	(0.06)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	-0.01	-0.04	0.02	-0.01

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 23: Effects on quality of life (comparison between receiving a treatment with inversion (T1 or T3) versus not having it). Effect of investment

	Quality of life due to housing conditions		Self-perceived quality of life and health by the family	
	(1)	**(2)**	**(3)**	**(4)**
Treatment with investment (1-3)	0.01	0.03**	-0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	0.47	0.46	0.66	0.65

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 24: Effects on quality of life measured with Anderson indices (comparison between receiving a treatment with inversion (T1 or T3) versus not having it). Effect of investment

	Quality of life due to housing conditions (I.Anderson_std)		Self-perceived quality of life and health by the family (I.Anderson_std)	
	(1)	**(2)**	**(3)**	**(4)**
Treatment with investment (1-3)	-0.01	0.09	-0.07	0.01
	(0.06)	(0.06)	(0.06)	(0.06)
N	1,198	1,022	1,203	1,022
Controls	No	Yes	No	Yes
Dep. Var. Pre	No	Yes	No	Yes
Dep. Var. Mean Pre	0.01	-0.02	0.04	0.01

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 25: Effects on energy bill savings (comparison between receiving any treatment (T1, T2 or T3) versus not having one)

	Overall monthly energy consumption of the home			Overall monthly energy expenditure of the home			Late payment of utility bills		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Treatment (1-2-3)	0.00	0.00	0.00	-0.02**	-0.02*	-0.01*	-0.05	-0.04	-0.06*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
N	1,105	1,033	1,033	1,105	1,033	1,033	1,135	974	962
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.14	0.14	0.14	0.15	0.15	0.15	0.76	0.77	0.77

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 26: Effects on savings on energy bills (comparison between receiving treatment with counselling (T2 or T3) versus not having it). Effect of counseling

	Overall monthly energy consumption of the home			Overall monthly energy expenditure of the home			Late payment of utility bills		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Treatment with counselling (2-3)	0.00	0.00	0.00	-0.01**	-0.02**	-0.01	-0.00	-0.02	-0.04*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
N	1,105	1,033	1,033	1,105	1,033	1,033	1,135	974	962
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.14	0.14	0.14	0.14	0.14	0.14	0.73	0.73	0.73

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used

Table 27: Effects on savings on energy bills (comparison between receiving a treatment with investment (T1 or T3) versus not having one). Effect of investment

	Overall monthly energy consumption of the home			Overall monthly energy expenditure of the home			Late payment of utility bills		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Treatment with investment (1-3)	0.01	0.01	0.01	-0.00	-0.00	-0.00	-0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
N	1,105	1,033	1,033	1,105	1,033	1,033	1,135	974	962
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Dep. Var. Pre	No	No	Yes	No	No	Yes	No	No	Yes
Dep. Var. Mean Pre	0.13	0.13	0.13	0.14	0.14	0.14	0.74	0.73	0.73

Levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard bugs have been used