Chapter 5
Towards the Comprehensive Bonus for Social Housing Services

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Abstract The main objective of the work under study is to find means and tools to achieve the reduction of energy poverty in Spain: creation of a social bonus of services that allows politicians to make decisions for it. This energy bond or "social service bonus" includes energy costs: electricity and gas, telecommunications (Internet), as well as other supplies (water and discharge). The first thing that arises is the reduction of supply costs by optimizing the installation and contracting systems. We start from the data provided from the previous study on energy demand and the corresponding energy improvement and sustainability measures, in a public building of social housing in C / La María, in Seville. This study shows that it is possible to achieve energy self-sufficiency and improved comfort in an efficient and cost-effective way in the short term. Next, the reduction of costs by modifying the contracting systems and the study of the social bonuses offered by the different companies in the different supplies are studied. With the data obtained, it is proposed to create a "social bonus of services" where the total cost of them could be reduced from 80 to 90% of the current payment. Finally, it is proposed that the social bonus of services can have the same treatment as the rent, with a system of subsidy or bonus of the same depending on the family and income parameters of the tenants.

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Introduction

The 2020 Indicators Update report explains and analyzes the evolution in 2019 of energy poverty in Spain compared to previous years through the four indicators proposed by the European Observatory on Energy Poverty (EPOV) and adopted in the ENPE as main indicators to monitor its monitoring in our country [1, 2] (Table 5.1).

Royal Decree-Law 15/2018, of 5 October, on urgent measures for the energy transition and consumer protection establishes the obligation of the Government to approve a National Strategy against Energy Poverty within 6 months of its entry into force, which prepares and approves this Strategy, whose execution period covers, from 2019 to 2024 [3].

For each of the EPOV indicators: reduce, at least 25% in 2025 seeking to go further and reach 50% its current values. The following table shows the following percentages of the population suffering from the circumstances of energy poverty included in each of the four indicators, and the results of reduction are observed with a decrease of 25% of them (minimum objective) and with a decrease of 50%, indicated in the objective sought.

Primary Indicators

I. Percentage of population with disproportionate expenditures (2 M): indicator that measures the percentage of the population for which the actual expenditures on domestic energy are twice the average.
II. Hidden energy poverty (PEE or HEP): an indicator that measures the percentage of the population for which total domestic energy expenditure is below half the national average.
III. Percentage of the population that declares itself unable to maintain housing at an adequate temperature (indicator of the Survey of Living Conditions—ECV).
IV. Percentage of the population that declares delays in the payment of housing bills (ECV indicator).

Seville has hosted the launch of the European project POWERTY (renewable energies for vulnerable groups), which aims to facilitate the use of renewable energies for vulnerable groups affected by energy poverty, through the promotion of innovative low-cost solutions. Led by the Andalusian Energy Agency, this European project,

Table 5.1 Evolution of the four indicators of energy poverty from 2016 to 2019 in Spain

Primary indicator	2016	2017	2018	2019
Disproportionate expenditure 2 M (% households)	16,7	17,3	16,9	16,7
Hidden energy poverty HEP (% households)	11,3	10,7	11,0	10,6
Inadequate temperature in housing in winter (% population)	10,1	8,0	9,1	7,6
Late payment of bills for housing supplies (% population)	7,8	7,4	7,2	6,6

framed within the Interreg Europe program, has a budget of 1.1 million euros, of which 83.6% are co-financed by the European Commission.

The partners specified the different thematic axes on which the project will be structured, highlighting the new innovative renewable energy technologies aimed at vulnerable groups, which include from collective and urban energy systems to new renewable energy financing formulas suitable for vulnerable groups or improvements in the regulatory framework, without obviate encouraging citizen participation of these social groups.

To highlight, the intervention of the University of Manchester, which, after a brief presentation of the work of the European Observatory on Energy Poverty, guided on the methodology followed to determine this energy poverty, describing various successful practices that have been developed in other countries of the European Union and that are related to renewable energies and energy poverty.

Likewise, the Andalusian Energy Agency detailed the different organizational, management, financing, and communication aspects of the project, in accordance with the rules of the Interreg Europe program.

Causes and Measures in Energy Poverty

Energy poverty can be defined as that situation suffered by households that cannot afford sufficient energy services to meet their domestic needs and/or are forced to allocate an excessive part of their income to meet the energy expenditure of their homes. From here, the term vulnerable consumer is also extracted, such as that consumer of electrical energy or thermal uses who is in a situation of energy poverty, being able to be a beneficiary of the support measures established by the administrations.

Energy is a basic good and energy poverty is a measure of the energy vulnerability of the population, whose causes as well as the measures for its reduction (correction, prevention, and transformation) are in Table 5.2.

Some studies refer to other additional elements that have a more or less direct impact on energy poverty, such as

- Weather conditions (if they are extreme the energy consumption is higher).
- Habitat (rural areas have higher rates of energy poverty due to the characteristics of homes—large, old, and with greater consumption needs—and difficulties in accessing natural gas, which make them have to use other fuels, which are generally more expensive).
- The lack of information (not only on measures to improve the energy efficiency of households—subsidies for the purchase of more efficient appliances, aid for the rehabilitation of housing, change of habits …—but the impact that these have on bills) (SIIS Center for Documentation and Studies, 2013) [4, 5].

The first factor causing energy poverty is a low level of household income. Whatever definition of energy poverty we use as a starting point, they all refer to the

Table 5.2 Causes and measures to reduce energy poverty

Main causes	Measures to reduce energy poverty
• Low household income • Poor state of general socio-economic "health"	Urgent-corrective: • Social rates • Direct financial aid
• Lack of criteria for managing energy consumption • Bad habits	Preventive: Energy saving (bill reduction): • Information to improve our behavior when consuming energy: defend the right to know our consumption data, to be able to buy energy judiciously, and to improve our consumption habits
• Limited energy efficiency of homes, facilities, and equipment • Building culture and equipment without energy criteria	Preventive: • Energy efficiency (doing the same with less energy) and power generation for self-consumption from renewable sources • Information, improvements in the building, facilities, appliances, equipment, vehicles…
• High energy prices • Current unsustainable energy model	Transformative: Collective initiatives that favor the transition to another more sustainable energy model. For example: • Energy cooperatives (consumption, energy generation) • Development of active local and regional energy policies • Distributed generation for self-sufficiency of communities

inability to meet adequate energy expenses on the part of the household, a reality to which those households with low incomes are mainly exposed. Works such as the ACA report in 2012 and 2014 emphasize this reality, highlighting the close relationship between energy poverty and social exclusion or unemployment. However, there may be times when the relationship between energy poverty and general poverty was not biunivocal. There could be false positives in both directions, namely, households that, although they have an insufficient income, were not energy poor, and households that, despite enjoying an income situation that allowed them a comfortable life, were in a situation of energy poverty. The first case would correspond to households whose energy expenditure is very small in relation to the rest of the expenses. To put it another way, they would be households in which the energy component is not relevant for the purposes of placing them in a situation of poverty. The second case would affect households capable of meeting all basic expenses except energy. In general, this case corresponds not so much to causes associated with the level of income as to the following two causes described.

In the period 2007–2012, according to data from the INE, the average annual income of households in Spain barely grew by 1%, and, what is more worrying, the Gini coefficient, which measures inequality in the distribution of income, suffered an

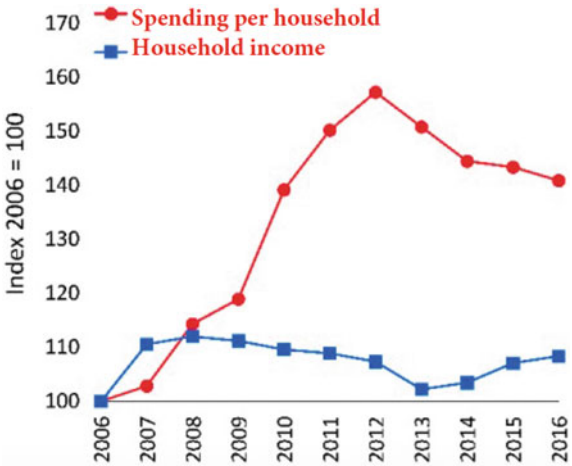

Fig. 5.1 Evolution income/expenses 2006–2016

increase of 13%. That is, the data confirm that the economic crisis has contributed to exacerbating the differences between the highest and lowest incomes in our country. Given that energy poverty greatly affects the latter, this is a clear indicator that the problem has increased in recent years [6] (Fig. 5.1).

Everything changed from March 2020, with the pandemic and, although experts agree that energy poverty has escalated due to the effect of COVID-19, it is too early to know to what degree. Even so, we find some indirect indicators: since April 2020, applications for the electricity social bond have grown at a rate of more than 200 requests per day. This has caused that in August of last year exceeded 1.3 million beneficiaries, according to the National Commission of Markets and Competition (CNMC).

"The confinement first, and the situations of unemployment or ERTE, teleworking or the cessations of activity that have been associated with the crisis later, have forced thousands of people to stay many more hours in their homes and, as a consequence, to consume more energy," argues José Luis López, Director of the Association of Environmental Sciences (ACA), pioneer entity in the study of this problem.

Also a report prepared by the General Council of Technical Architecture of Spain and Mutual Owners during the confinement states that 8% of Spanish homes would be cold this past winter in their homes and 35% would not reach a comfort temperature [7, 8].

Energy efficiency

Once again, if we review the proposals for the definition of energy poverty presented to date, in all of them we find the reference to the inability of households to pay for adequate energy services, the most important element being the ability to maintain a sufficiently warm temperature in the home in winter. A thermally inefficient home needs a greater amount of energy to reach that temperature, which has a direct influence on its energy bill or, more specifically, on the difficulty of facing it.

Hence, any action to improve the energy efficiency of a home, to the extent that it reduces its demand and energy consumption, contributes to alleviate the problem of energy poverty of the same if it has it, or in any case reduces its vulnerability to suffer it. The objective of energy efficiency is one of the pillars in the European energy strategy to 2020 and 2030. Within it, the issue of housing rehabilitation plays a key role that has its legal expression in Directive 2012/27/EU transposed by Spanish legislation in Law 8/2013 on urban rehabilitation, regeneration, and renewal.

Impact of the cost of energy on the family budget

That the cost of energy has an influence on the problem of energy poverty is obvious, but it is necessary to be very cautious when analyzing this relationship.

First of all, it should be noted that the cost of energy in the main house accounted for an average of 6.67% of the family budget in Spain in 2013. This can be compared with the expenditure groups present in the Family Budget Survey (EPF).

Secondly, it is also important to point out that the only way to walk towards a path of greater efficiency in which the right signals are sent to agents is for the price of energy to collect all its costs, internal and external, and exclude those that do not correspond to it. Therefore, we should not speak of high or low prices, but of prices that correctly collect the total costs associated with the production and consumption of energy or not. That said, it is clear that, for various reasons (the description of which is beyond the scope of this report), the energy cost for Spanish households has increased significantly in recent years (especially since 2007). According to Eurostat data, the price of the electricity bill of an average household in Spain increased by 76% in the period 2007–2014, partly due to the incorporation of costs associated with social and environmental policies. In the same way, the natural gas bill in an average Spanish household also increased by 35% in the same period. These increases obviously contribute to a greater impact of these costs on family budgets, and therefore on their contribution to situations of energy poverty [9].

Measures to reduce energy costs at home

A household that has difficulty coping with adequate energy costs has three options.

(a) The first option is to reduce your energy bill. If this reduction does not imply keeping the home outside the range of temperatures recommended by the WHO, then that household itself would not be in a situation of energy poverty. Now, if this reduction in consumption exceeds the minimum comfort threshold, we can speak of a home in a situation of energy poverty, and therefore exposed to its consequences.
(b) The second option for the home is to stop paying their energy bills, which in most cases leads to a power outage, the most serious case being when this cut is in winter.
(c) The third option, which only applies to those households that can afford it, is to increase the percentage of income that goes to energy, which entails other types of indirect consequences that are more difficult to quantify, but no less real.

Consequences of Energy Poverty

Some of the consequences of energy poverty must be treated in an approximate and qualitative way, since there are no reliable empirical studies that allow them to be reasonably quantified. It is difficult to separate the consequences of energy poverty from those arising from general poverty.

Health impact

The most serious consequences are associated with exposure to cold temperatures and their consequences can be severe, especially in children and the elderly. Following the 1987 WHO report, the effects that exposures to certain excessively low temperature ranges in the home can cause are

- Below 16 °C: respiratory problems.
- Below 12 °C: circulatory problems.
- Below 5 °C–6 °C: risk of hypothermia.
- Mortality in winter. Some of the health impacts described above can be aggravated to cause premature death of people. In Spain, this fact has been highlighted in the ACA reports of 2012 and 2014. That the number of deaths from disease increases in winter is an empirical finding, and the indicator that collects this phenomenon is the Winter Additional Mortality Rate (TMAI). The problem is to relate this TMAI with the degree of incidence of energy poverty, something for which there are no reliable studies. The ACA, in its 2014 report, assigned a range of between 10 and 40% of the TMAI to energy poverty, which yielded average figures for the period 1996–2012 of between 2,400 and 9,600 deaths per year. Finally, they set the percentage of the TMAI directly attributable to energy poverty at 30%, as suggested by the WHO report for the European region in 2011, which meant attributing to energy poverty a figure of additional deaths in winter in Spain of 7,200 people each year. In any case, it must be remembered that this attribution of 30% is nothing more than an approximation without basis in the empirical evidence for Spain.

Social impact

A more diffuse effect of energy poverty than that related to health is social impact. This is a two-faceted problem.

For adults, energy poverty often adds to an existing problem of social exclusion. The social agents note cases of households in which their inability to meet the energy bill leads them to keep the temperature of the house below the minimum of comfort. This means that some of them, especially those inhabited by families that exceed the poverty line for the first time, restrict their relationships and social activities for fear that their precariousness will be exposed.

For young people and adolescents, it also means barriers to proper development, especially in the field of education. Poor energy conditions in the home have a negative impact on the performance of the students who inhabit it.

Economic impact

All the consequences described above are limited to the personal sphere, either directly in health issues for those affected, or indirectly in other social considerations related to the well-being or integration of people. However, this impact on household members also has a social translation that can be reflected in monetary terms.

- Health system, which has to face the treatment of all the ailments linked to energy poverty exposed in the previous points.
- Reduction in productivity, mainly due to the sick leave that diseases linked to energy poverty entail. The chapter on premature deaths due to energy poverty deserves special mention, since they also entail economic costs.

There are several methods proposed for the calculation of economic costs that do not have to date a concretion for the case of Spain. Although this report does not address it, as also highlighted in the 2012 ACA report, an estimate of the aggregate costs incurred by society due to energy poverty, or seen from the opposite perspective, an analysis of the aggregate social benefits that adequate energy poverty alleviation policies would generate, it would be very useful to correctly assess the importance of the problem and guide its possible solutions. This analysis should also include an attribution of the above costs or benefits to the various components of general poverty, which makes it even more complex.

Energy poverty, as poverty, is not only a social or economic dysfunction, but it is also primarily an ethical problem that threatens the dignity of every human being who suffers from it, the same dignity that the Universal Declaration of Human Rights seeks to protect. If we use Sen's capabilities approach, energy poverty, generally as one more element of general poverty, curtails the ability of household members to develop personally and collectively in the society in which they live. We are therefore faced with a question of justice, and not merely with a socio-political or socio-economic problem.

The measures proposed in this Strategy for People in Energy Poverty will seek to prevent the worsening of health as a result of the lack of correct access to energy sources.

This is evidenced by the Bulletin on Social Vulnerability nº17 of the Spanish Red Cross, in a study carried out on its population served.

The Environment of Social Housing

Housing has been a fundamental right universally recognized for more than a quarter of a century. It is a permanent and safe place that every person deserves, where they can gather with their family, recover physically and emotionally from daily work, and leave daily rehabilitated to earn the support of their own and themselves. It is a family refuge where you get understanding, energy, encouragement, optimism to

live, and give yourself positively to the society to which you belong. It is a small portion of territory where exclusivity of use is recognized [9].

Society must make a commitment to ensure that every citizen has access to at least one site with climate protection and hygiene. It has been the object of a growing social and institutional concern in our country, manifested with a profuse legislation and a very varied housing experience.

Now, the concept of social housing that includes all the values indicated above refers to the most dispossessed sectors of the population and with the most precarious socio-economic situation. This last quality affects and compromises the deepest levels of feeling and consciousness, encouraging society to give a comprehensive and definitive response and solution, trying to overcome all obstacles arising from services and human errors.

Environmental conditioning of the space

It is not customary, for reasons of scarcity of resources, for the social housing program to pronounce itself in a precise and quantified way on the environmental quality of the spaces. Moreover, there is a generalized characteristic in which any housing design dispenses with studies of quantifiable conditioning of its different environments. We would say that the normal thing is that the solution is solved conceptually and intuitively. In this sense, the housing design has not been technified and there are no standards on the amount of light, ventilation, temperature, acoustics, humidity, etc. that must be met in each of the different activities that are carried out inside the social housing.

The quality of life in social housing

Social housing is not an object, but a system and process that must meet certain minimum requirements to ensure adequate comfort to the activities that users must perform inside.

But in addition to this, this user must really satisfy his own desires and aspirations, as well as feel the right to exercise his property; he must participate in the stages of the process that define the character of his home and not be restricted only to the financing and construction of it.

The user must understand their home and shape it as their family group transforms and evolves; he must be the main protagonist of this process and the first to feel, appreciate, and qualify this quality of life that housing provides. That is why in the gestation of social housing we must have the presence of the inhabitant; we must know him and also commit him to the origin and destiny of it, because only he will know authentically the right or right about the quality of life that is conformed to him by defining him and providing him with social housing.

On the other hand, when the State opts for a progressive housing line of action, it is understood that it is committed to monitoring the process, providing professional advice and material help to the inhabitant, until he finishes his housing, constituting not only an authority that provides subsidy, but also promotes, stimulates, and also controls the process as a non-permanent phenomenon, in order to optimize the

harmony and quality of residential areas of the most precarious social levels of the community until their total complementation.

The scarcity of resources does not justify dispensing with standards that define quantifiably the optimal levels, or the maximum and minimum limits, of the different environmental conditions required by the spaces consulted in housing in general and especially in that of social interest.

Unfortunately, this finding allows us to assume that, if quantifiable environmental conditions are not defined and standardized, less can be expected from more subjective ones, such as privacy, intimacy, promiscuity, etc., and it is painful to recognize this emptiness because we are responsible for generating the physical environment that determines the way in which the members of each family should organize, relate, behave, and perhaps due to planning and design defects [10, 11].

Description of the Building Under Study

The building on which the study is based is constituted by 16 VPOs in General Regime, Garages, and Storage Rooms, developed on four floors above ground and a basement, located on La María Street in Seville, promoted by EMVISESA (Municipal Company of Housing, Land and Equipment of Seville, S.A). It has a rectangular shape with a bottom of 17 m and a façade of 28.08 m. It borders on the northwest with the rest of the parent farm, to the southwest with the farm number 1 of La María Street, in the background with the block patio that is accessed by the Ronda de Capuchinos, 17 and 19.

As for the interior distribution, it has four houses per floor, symmetrical two by two with respect to the axis of the plot and all of them facing the façade. The house adapted for wheelchair users is located on the ground floor. In total, there are 93 bedroom and 72 bedroom homes, projected as illustrated below.

From the PFG on Energy Measures in this building, written by Eduardo Fernández Gaspar, it is extracted: "that energy self-sufficiency is achieved with the consequent economic savings of its users, pursuing the elimination of dangerous heat producers (stoves, portable kitchen, …) and improving home comfort. Investments in these improvements, in social housing, are 95% subsidized (Figs. 5.2 and 5.3)."

Energy Cost or Energy Efficiency

Energy efficiency translates as the efficient use of energy. An appliance, process, or installation is energy efficient when it consumes less than the average amount of energy to perform an activity. An efficient person, service, or product committed to the environment, in addition to needing less energy to perform the same work, also seeks to supply, if not completely, with as much renewable energy as possible (also called alternative energies).

Fig. 5.2 Location. Building 16 VPO street La María

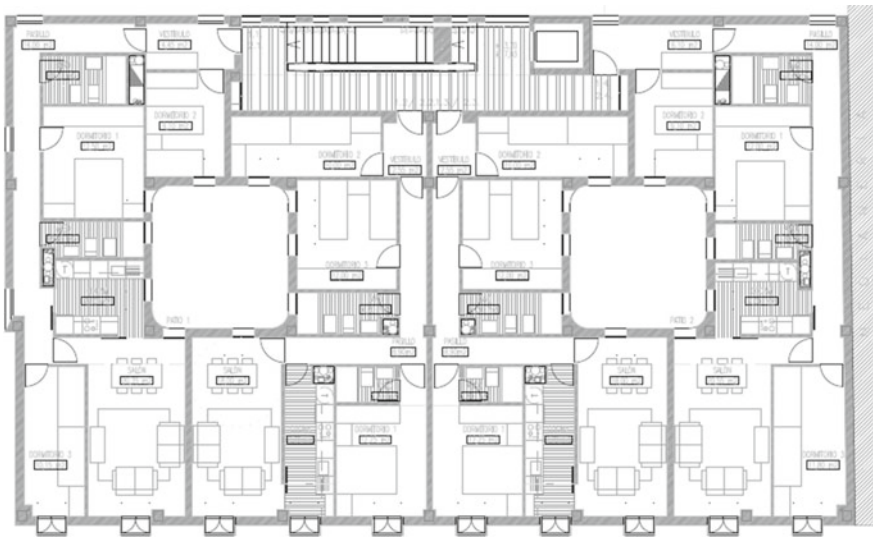

Fig. 5.3 First and second floor. Building 16 VPO street La María

Energy efficiency seeks to protect the environment by reducing energy intensity and accustoming the user to consume what is necessary and no more. The emissions of CO_2 sent into the atmosphere are increasing and, for that reason, energy efficiency has become a way of taking care of the planet since it is not only in using appliances that consume less, but in that we are the ones who consume less and in a more "green" way.

The problem with energy efficiency is that it's still a choice. Currently, not all products are efficient; they can be seen on the energy efficiency labels of many appliances. This is because the efficient alternative is always somewhat more expensive, as happens, for example, with traditional bulbs and LED lights.

Therefore, energy efficiency is, for the moment, a matter of environmental awareness. However, we must bear in mind that, not only do they pay for themselves quickly, but an efficient product directly favors your pocket, since energy efficiency is linked to saving electricity [12].

The factors that determine energy efficiency are as follows:

I. Design of the house.
   (a) *Location*: Depending on the climatic zone, the envelope of the house will have to comply with some limitations or others.
   (b) *Orientation*: The most optimal is that the façade, where the living room and bedrooms are located, is facing south, since in winter as the sun's rays are lower it heats the interior while in summer, as the sun's rays are higher, if there are protections in the gaps the interior temperature does not rise too much so that cool nights cool the house.
   (c) *Shape*: It is advisable that, if the house is rectangular, the longest side is where the largest number of holes are located and in south orientation (Fig. 5.4).

II. Construction quality: Use of materials with low embodied energy.

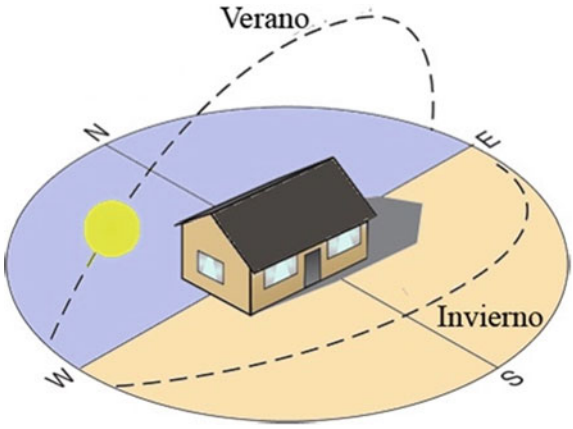

Fig. 5.4 Influencing factors on energy efficiency

(a) Improvement of the envelope, thermal installations, and lighting in rehabilitations.
(b) Install renewable energy in buildings.
(c) User behavior with respect to consumption: awareness of controlling energy consumption.

Social Bonds

Electric social bonus

In Spain, there is an electricity social bonus regulated by *Royal Decree RD 897/2017, of October 6*, which regulates the figure of the vulnerable consumer, the social bonus, and other protection measures for domestic consumers of electricity.

The Social Bonus is a significant discount on the electricity bill, regulated by the Government and which aims to protect households considered vulnerable due to their socio-economic conditions. To benefit from it is essential to have contracted the PVPC electricity tariff (with or without hourly discrimination) and a power equal to or less than 10 kW in your habitual residence.

The following figures of vulnerable consumer are differentiated, to a lesser or greater degree, whose benefits will vary depending on the latter.

(a) Vulnerable customers: *They* will have a discount on their bill of 25%.

Vulnerable customers are people who are holders of a regulated tariff contract (PVPC) and meet at least one of the following three conditions:

Annual income less than or equal to the limits established according to the IPREM (the index of habitual use for the granting of aid and subsidies):

- 1.5 times the IPREM*: if you are not part of a family unit or there are no dependent children.
- 2 times the IPREM*: if there is 1 child in the family unit.
- 2.5 times the IPREM*: if there are 2 minors in the family unit.

*Annual IPREM 14 payments valid for 2021: 7,908.60 euros.

These thresholds shall be increased by 0,5 times the IPREM if any of the circumstances are met:

- That a member of the family unit has a recognized disability
- equal to or greater than 33%, is a victim of gender violence or a victim of terrorism.
- That a member of the family unit is in a situation of recognized dependency of grade 2 or 3.
- That it is proven that the family unit is composed of a single parent and, at least, one minor (single-parent families).

– Pensioners with the minimum pension: that the applicant (or in case there is a family unit, all members of the same who have income) perceive the

minimum pension (for retirement or permanent disability). In addition, if you have another source of income apart from the pension, your annual amount cannot exceed € 500.
– Large families: all without exception.

(b) *Severe vulnerable customers*: They will have a discount on their bill of 40%.

Persons who are holders of a regulated tariff contract (PVPC) and meet at least one of the following three conditions are considered to be severe vulnerable customers:

- Lower annual income: those with income levels below 50% of the limits valid for vulnerable clients.
- Pensioners with minimum pension and lower income: that all members of the family unit are Social Security pensioners, they perceive the minimum pension (for retirement or permanent disability) and have an annual income less than or equal to 1 time the IPREM.
- Large families with lower income: those with an annual income of less than 2 times the IPREM.

(c) *Severe vulnerable customers at risk of social exclusion:* in this special category enter those who meet these two conditions:

- Have been considered severe vulnerable clients.
- Be being served by the social services of an autonomous or local administration that finances at least 50% of the amount of your electricity bill.

New social bonus for COVID-19.

Royal Decree-Law 8/2020, of 17 March, on extraordinary urgent measures to address the economic and social impact of COVID-19 prohibits the cutting of electricity, natural gas, and water supply to vulnerable, severely vulnerable consumers or at risk of social exclusion.

Due to COVID-19, there is a legislative extension of the social bonus that favors some groups affected by the coronavirus. In this way, they can also request the social bonus:

- People in unemployment.
- People affected by a Temporary Employment Regulation File (ERTE).
- Employers, who have had their working hours reduced due to care or other similar circumstances that involve a substantial loss of income.

The income requirements for this new Social Bonus are based on the fact that the month prior to the time of submitting the application, the income of the members of the family unit must be within the thresholds as shown in Table 5.3.

These COVID-19 measures are applicable from September 30, 2020 to June 30, 2021. Therefore, people who meet the requirements detailed above and apply for the

Table 5.3 Requirements social electric bonus

Type of family unit	Family unit income in the month prior to the request for a social bonus	Monthly income	Special circumstances	Monthly income
No dependent children Not part of family unit	1.5 × IPREM (14 payments) per month	€988	2 × IPREM (14 payments) monthly	€1,318
1 minor in charge	2 × IPREM (14 payments) monthly	€1,318	2.5 × IPREM (14 payments) per month	€1,647
2 minors in charge	2.5 × IPREM (14 payments) per month	€1,647	3 × IPREM (14 payments) monthly	€1,977

*IPREM 14 payments (Year 2021): €7,908.60

Social Bonus during this period will be considered vulnerable and will obtain a 25% discount on their electricity bill [13].

Discounts of 25 and 40% of the total bill are subject to a limit on electricity consumption. Once this limit has been exceeded, the energy will be billed according to the prices of the regulated tariff (PVPC), without discount:

- Pensioners: 1,932 kWh of electricity consumed per year.
- Large families: 4,140 kWh/year.
- Consumers without minors in charge: 1,380 kWh/year.
- Consumers with a minor in charge: 1,932 kWh/year.
- Consumers with two minors in charge: 2,346 kWh/year.

EMASESA social rate

EMASESA's tariff rebates want to guarantee a minimum water consumption to live. They are discounts on the water bill for the people who need it most.

The new social rate offers a discount for a consumption of up to 110 L of water per person per day in a house. People who have the social tariff must pay for the water they consume if it exceeds that amount.

There are two types of vulnerability situations according to income:

1. *Severe vulnerability or people at risk of social exclusion*: when the gross income of all people living in the same house is lower than the Minimum Insertion Income. (The Minimum Insertion Income for the year 2021 is € 419.52 per month). People are also in a situation of severe vulnerability when the social services of the City Council say so.
2. *Vulnerability*: when the gross income of all people living in the same house is less than the IPREM.

There are two types of bonuses according to the money that people over 16 years of age who live in the same house earn.

50% BONUS

For houses where all people over 16 years of age earn less than € 790.86 or 1.2 of the IPREM.

100% BONUS

For houses where the cohabitants earn less than the Minimum Income for Social Insertion or are at risk of social exclusion according to the social services of the City Council.

These discounts also apply to fixed fees for supply and sanitation services and contracting and reconnection fees.

The rate discount does not cover other services included in the invoice.

For example, provincial and regional royalties or taxes or the improvement of infrastructures.

Social gas bonus

In Spain, the Social Gas Bond is still under development, as aid for vulnerable consumers.

Social telecommunications bond

Currently, there is only the Social Telephony Subscription, which is an economic benefit included within the Universal Telecommunications Service and who aims to help retirees and pensioners, citizens with low incomes or at risk of social exclusion—provided they meet some requirements—when hiring a fixed telephone line.

But there is a commitment from the president of the Spanish government to create the Social Internet Access Bonus, a program to ensure Internet access for groups at risk of social exclusion, rural areas and assimilated, pensioners, and people with low incomes. With this, it seeks to guarantee medium high-speed Internet connections, more than 30 Mbps, to combat the digital divide. So far the details of this bond are not known, it is foreseeable that it will be part of the Universal Telecommunications Service.

The financing of the Internet bond is about to be defined, three options are proposed:

– Public financing through the General State Budget.
– Finance the bond through telecommunications operators.
– Do it through a mixed public–private system.

Methodology

First of all, we want to emphasize that this study will not be limited to the so-called "energy poverty," which would supposedly include only electricity, gas, and /or other

alternative energy supplies, but we include water and discharge supplies, as well as broadband data. In that sense, we will refer to the Services including:

- Energy services: electricity, gas, and others.
- Hydraulic services: water supply and discharge.
- Telecommunications services: broadband communication.

Regarding the study methodology, the following steps will be followed:

- Reduction of energy cost. Energy efficiency.
- Optimization of contracts. Rates.
- Change of contracting systems. Collective bargaining.
- Creation of the social bonus of supplies. Management.

Reduction of Energy Cost

The proposal of the energy study of the PFG of Mr. Eduardo Fernández Gaspar consists of the adoption of the following MAE Energy Saving Measure:

- Use of air conditioning by heat pump type "Super digital Inverter 3-Phase."
- Use of enthalpy recuperators for the ventilation of homes.
- Use of solar thermal panels for the production of DHW and heating aid.

This achieves a global indicator of 17.38 kWh/m^2 year, which means an economic saving of 83.70% of electricity consumption.

With this proposal the total annual consumption of the building is of 8.687,59 kWh/year that can be generated and self-consumed with PV boards.

Optimization of Contracts

In this section, the optimization of contracting is studied, studying the different rates available to the different companies in the market. This system can basically be applied to electricity, gas, and telecommunications services. In Spain, it does not apply to water supply and discharge services since it is a regulated market directly managed by the municipalities or given in concession to a single company.

Proposal for Improvement in Electrical Energy

This improvement proposal consists of using different hourly rates of different electricity companies, which, in this case, are Endesa and ODF Energy, and applying them to the consumption data and different proposed improvements provided in the PFG of Eduardo Fernández Gaspar.

The considerations to be taken into account in the calculation of the annexed tables, for any improvement in electrical energy, are summarized as follows:

- 16 homes + 1 by common areas would be a total of 17 to be counted.
- Annual consumption KWh/year: 139,256.91 kWh. This data is taken from the Final Degree Project of Eduardo Fernández Gaspar.
- For the calculation of the invoice, a fixed amount is contemplated that depends on the contracted power and a variable amount for energy consumed, to which are added other taxes such as: electricity tax, meter rental, and VAT 21%.
- Rate with hourly discrimination in two periods, night and day, before June 1 were the following:
  - Price rush hour: 0.1490 €/kWh.
  - Price of the valley hour: 0.0703 €/kWh.
  - Power: 0.1152 €/kW day.
  - Permanence: No permanence.
  - Rate type: 2 prices.
  - Access fee: 2.0DHA.
- As of June 1, RD 244/2019, of April 5, is applied with an increase in the price of the contracted power and the energy consumed, establishing a single hourly discrimination rate. This is called One Luz 3 periods, in which there are two ways to contract the power and three time slots a day, except holidays and weekends (Tables 5.4 and 5.5).
- Splar Tempo Rate Self-consumption

It is a tariff designed for the self-consumption of energy from a photovoltaic solar installation. This rate benefits from a cheaper price in the Tempo Hours when the installation is not generating its own energy and needs to resort to the electricity grid.

Summer timetable:

- Tempo Hours: from 18.00 to 9.00 h. (15 h).

Table 5.4 Schedule prices per contracted power. Endesa

Power (up to 15 KW)	€/KW month
Peak hour	2.815472
Valley time	0.378113

Table 5.5 Schedule prices electricity consumption. Endesa

Energy term	€/KWh	Timetable
Peak hour	0.252870	10:00–14:00 and 18:00–22:00 h
Flat time	0,12,657	8:00–10:00 and 22:00–00:00 h
Valley time	0,074,384	00:00–8:00 h

Table 5.6 Prices contracted power and electricity consumption self-consumption

Access fee	T. power €/kW month	T. energy €/kW Cte. imported (energy purchased)	T. energy €/kWh Other taxes	T. energy €/kWh Cte. Exported (energy sold)
2.0 DHA	3,984,651	0,05	0,070,185	0,05
2.1 DHA	4,18,225	0,05	0,067,755	0,05

Table 5.7 Change rates 1/June/2021. ODF energy

	CURRENT POWER TERMS €/kW YEAR		
	P1	P2	P3
2.0 A	38,043		
2.0 DHA	38,043		

	CURRENT ENERGY TERMS €/kW YEAR		
	P1	P2	P3
2.0 A	0,136		
2.0 DHA	0,157		0,086

	CURRENT POWER TERMS JUNE 1est €/kW YEAR		
	P1	P2	P3
2.0 TD	30,672	1,424	

	CURRENT ENERGY TERMS JUNE 1est €/kW YEAR		
	P1	P2	P3
2.0 TD	0,227	0,085	0,068

- Rest of hours: from 9.01 to 17.59 h. (9 h).

Winter timetable:

- Tempo hours: from 17.00 to 10.00 h. (17 h).
- Rest of hours: from 10.01 to 16.59 h. (7 h).

In the hours of optimal solar incidence, there will be self-consumption and the energy of the plate itself will be consumed. On the other hand, in the hours of the day in which there is no sunlight, the so-called tempo hours will be taken from the network, whose prices stipulated in this rate are the following, as of June 1, 2021 (Tables 5.6 and 5.7).

- Another alternative is the change to the ODF supplier, whose rate is summarized below.

Comparative Study with Individual Hiring for Housing

Endesa Company

(a) In the first place, the building is considered with a contracted power per house, of 4.4 KW, which, in the conditions of construction of the building, as reflected

in the tables, each household would pay an average of € 104.40/month, and currently with the change of rate amounts to € 137.31, a very high cost in the case of social housing.

(b) Then, taking into account the same considerations above, but applying the energy improvements in the building as studied in Eduardo Fernández Gaspar's PFG, each one independent according to what is reflected in tables, would have a lower electricity cost than in the previous section, which depending on the effectiveness of the improvement itself ranges between € 53.48 and €102.07 per month, although now it would go from €64.77 to €134.03 €.

(c) If all the improvements in the building are executed together, in tables it appears that the energy consumption costs fall considerably to the amount of € 32.70/month, but with the change of rates according to RD 244/2019 they amount to € 35.16.

(d) Taking the option of using renewable energy with photovoltaic panels, it represents a total of 13 plates of 0.410 KW, which add up to a total of 5.2Kwp for self-production of 8,687.59 kWh/year, and considering 1/3 as surplus energy that is sold to the company Endesa at € 0.05/KWh and the necessary during the hours that there is no sun, it is also purchased at €0.05/KWh plus the rest of the taxes of 7.0185%. In this case, the energy compensation has been made with the company and as reflected in tables, the amount of monthly electricity only reaches € 20.50/housing, although currently it would reach the amount of € 21.72/monthly housing.

(e) As a last study, the approach is made that, in the case of not executing the improvements in the building, the number of plates necessary to supply the energy demand would be 205 plates (Table 5.8).

The following table shows the comparison between the application of different measures (Table 5.9, 5.10, 5.11 and 5.12).

Table 5.8 Cost installation of photovoltaic panels

Description	€/unit	Unit	Amount (€)
Photovoltaic panels	166	205.00	34.030,00
Plate installation	600	205,00	123.000,00
			157.030,00

Table 5.9 Comparative cost installation photovoltaic panels with or without joint improvements

Description	Amount (€)
Joint measures + photovoltaic panels	112.461,96
Only photovoltaic panels	157.030,00

Table 5.10 Comparative cost of electricity consumption before June 1, 2021. Endesa

Endesa: Night and day rate (before June 1st)											
	Fixed annual amount					Amount per energy consumption					
Consumption current building status	N. houses	Contracted power (KW)/ housing	Price €/KW day	Day/Year	Fixed annual amount (€)	Annual consumption KWh/Year	Price €/KW rush hour	Price €/KW valley hour	Annual amount peak hours	Annual amount hours valley	Annual amount per energy consumed
	17	4,4	0,1152	365	3.145,19	139.256,91	0,149	0,0703	8.645,53	5.710,69	14.356,23
Consumption with facility improvements	N°. houses	Contracted power (KW)	Price €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consumption KWH/ Year	Price €/ KW rush hour	Price€/ KW valley hour	Annual amount peak hours	Annual amount hours valley	Annual amount per energy consumed
Solar control sheets	17	4,4	0,1152	365	3.145,19	108.869,55	0,149	0,0703	6.758,98	4.464,56	11.223,54
Air conditioning installation						82.438,94			5.118,08	3.380,68	8.498,77
Inst. entálpico retriever						100.890,74			6.263,63	4.137,36	10.400,99
Inst. air conditioning + recuperator						70.359,74			4.368,17	2.885,34	7.253,50
Susti. PVC aluminium windows						135.574,39			8.416,91	5.559,68	13.976,59
Solar panels 100% ACS						105.448,20			6.546,58	4.324,25	10.870,83
Solar panels for heating						56.504,56			3.507,99	2.317,16	5.825,15
Joint						22.695,85			1.409,03	930,72	2.339,75
Consumption with non-renewable energy + improvementS	Nº. housing	Contracted power (KW)/ housing	Price €/ KW day	Days/ Year	Fixed annual amount (€)	Annual consumption KWh/ Year	Energy sold/ bought	Price €/ KWh	Price €/ KW valley hour	Annual amount to be compensated	Annual amount per energy

(continued)

Table 5.10 (continued)

Endesa: Night and day rate (before June 1st)											
	Fixed annual amount					Amount per energy consumption					
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	17	4,4	0,1152	365	3.145,19	8.687,59	2.895,86	0,05212		150,93	284,24
Buy energy from Endesa(1/3)									0,150275	435,18	
Consumption with non-renewable energy without improvements	Nº. housing	Contracted power (KW)/ housing	Price €/ KW day	Days/ Year	Fixed annual amount (€)	Annual consumption KWh/ Year	Energy sold/ bought	Price €/ KWh	Price €/ KW valley hour	Annual amount to be compensated	Annual amount per energy
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	17	4,4	0,1152	365	3.145,19	139.256,91	46.418,97	0,05212		2.419,36	4.556,25
Buy energy from Endesa(1/3)									0,150275	6.975,61	
Endesa: Night and day rate (before June 1st)											
	Invoice break down										
Consumption current building status	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus 25%	Social bonus 75%
	17.501,42	89,48	0,0265630	9,70	17.600,59	3.696,12	21.296,72	1.252,75	104,40	78,30	62,64
Consumption with facility improvements	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%
Solar control sheets	14.368,73	73,46	0,0265630	9,70	14.451,89	3.034,90	17.486,79	1.028,63	85,72	64,29	51,43
Air conditioning installation	11.643,96	59,53			11.703,49	2.457,73	14.161,22	833,01	69,42	52,06	41,65
Inst. entálpico retriever	13.546,18	69,26			13.615,44	2.859,24	16.474,69	969,10	80,76	60,57	48,45

(continued)

Table 5.10 (continued)

Endesa: Night and day rate (before June 1st)											
	Invoice break down										
Inst. airconditioning + recuperator	10.398,69	53,17			10.451,86	2.194,89	12.646,75	743,93	61,99	46,50	37,20
Susti. PVC aluminium windows	17.121,78	87,54			17.209,32	3.613,96	20.823,28	1.224,90	102,07	76,56	61,24
Solar panels 100% ACS	14.016,02	71,66			14.087,68	2.958,41	17.046,09	1.002,71	83,56	62,67	50,14
Solar panels for heating	8.970,34	45,86			9.016,20	1.893,40	10.909,60	641,74	53,48	40,11	32,09
Joint	5.484,94	28,04			5.512,99	1.157,73	6.670,71	392,39	32,70	24,52	19,62
Consumption with non- renewable energy + improvements	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	3.429,43	17,53	0,0265630	9,70	3.456,66	725,90	4.182,56	246,03	20,50	15,38	12,30
Buy energy from Endesa (1/3)											
Consumption with non- renewable energy without improvements	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	7.701,44	39,38	0,0265630	9,70	7.750,52	1.627,61	9.378,12	551,65	45,97	34,48	20,69
Buy energy from Endesa(1/3)											

Table 5.11 Comparative cost of electricity consumption as of June 1, 2021. Endesa

Endesa: One electricity rate (from June 1st)													
	Fixed annual amount						Amount per energy consumption						
Consumption current building status	N. houses	Contracted power (KW)/ housing	Price H. tip €/ KW day	Price H. valle €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consumption KWh/ Year	Price €/ KW rush hour	Price €/ KW flat hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley
	17	4,4	0,093849	0,0126	365	2.562,27	139.256,91	0,25287	0,12657	0,074384	11.737,96	4.406,44	4.316,04
Consumption with facility improvements	N°. houses	Contracted power (KW)	Price H. tip €/ KW day	Price H. valle €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consumption KWh/ Year	Price €/ KW rush hour	Price €/ KW flat hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley
Solar control sheets	17	4,4	0,093849	0,0126	365	2.562,27	108.869,55	0,25287	0,127	0,074384	9.176,61	3.444,90	3.374,23
Air conditioning installation							82.438,94				6.948,78	2.608,57	2.555,06
Inst. entálpico retriever							100.890,74				8.504,08	3.192,44	3.126,94
Inst. airconditioning + recuperator							70.359,74				5.930,62	2.226,36	2.180,68
Susti. PVC aluminium windows							135.574,39				11.427,57	4.289,91	4.201,90
Solar panels 100% ACS							105.448,20				8.888,23	3.336,64	3.268,19
Solar panels for heating							56.504,56				4.762,77	1.787,95	1.751,26
Joint							22.695,85				1.913,03	718,15	703,42

(continued)

Table 5.11 (continued)

Endesa: One electricity rate (from June 1st)													
	Fixed annual amount						Amount per energy consumption						
Endesa: Tempo self-consumption rate													
Consumption with non-renewable energy + improvements	Nº. housing	COntracted power(KW)/ housing	Price €/ KW day	Price H. valle €/ KW day	Days/ Year	Fixed annual amount (€)	Annual consumption KWh/Year	Energy sold/ bought	Price €/ KW tempo hour	Price €/ KW valley hour			Annual amount to be compensated
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	17	4,4	0,1328217		365	3.626,30	8.687,59	2.895,86		0,05			144,79
Buy energy from Endesa (1/3)								2.895,86	0,05				−144,79
Consumptionwithnon-renewable energy without improvementS	Nº housing	Contracted power (KW)/ housing	Price €/ KW day		Days/ Year	Fixed annual amount (€)	Annual consumption KWh/Year	Energy sold/ bought	Price €/ KW tempo hour	Price €/ KW valley hour			Annual amount to be compensated
Inst. photovoltaic panels 84KWp(energy produced and sold to Endesa)	17	4,4	0,1328217		365	3.626,30	139.256,91	46.418,97		0,05			2.320,95
Buy energy from Endesa (1/3)									0,05				−2.320,95

(continued)

Table 5.11 (continued)

Endesa: One electricity rate (from June 1st)													
	Invoice break down												
Consumption current building status	Annual amount per energy consumed	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%	–
	20.460,44	23.022,70	117,71	0,0265630	9,70	23.150,11	4.861,52	28.011,63	1.647,74	137,31	102,98	82,39	–
Consumption with facility improvements	Annual amount per energy consumed	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%	–
Solar control sheets	15.995,75	18.558,01	94,88	0,0265630	9,70	18.662,59	3.919,14	22.581,74	1.328,34	110,69	83,02	66,42	–
Air conditioning installation	12.112,41	14.674,68	75,03			14.749,70	3.097,44	17.847,14	1.049,83	87,49	65,61	52,49	–
Inst. entálpico retriever	14.823,46	17.385,72	88,89			17.474,61	3.669,67	21.144,28	1.243,78	103,65	77,74	62,19	–
Inst. air conditioning+ recuperator	10.337,66	12.899,93	65,95			12.965,88	2.722,84	15.688,72	922,87	76,91	57,68	46,14	–
Susti. PVC aluminium windows	19.919,38	22.481,65	114,94			22.596,59	4.745,28	27.341,87	1.608,35	134,03	100,52	80,42	–
Solar panels 100% ACS	15.493,06	18.055,33	92,31			18.147,64	3.811,00	21.958,65	1.291,69	107,64	80,73	64,58	–

(continued)

Table 5.11 (continued)

Endesa: One electricity rate (from June 1st)													
	Invoice break down												
Solar panels for heating	8.301,98	10.864,24	55,55			10.919,79	2.293,16	13.212,95	777,23	64,77	48,58	38,86	–
Joint	3.334,61	5.896,87	30,15			5.927,02	1.244,67	7.171,70	421,86	35,16	26,37	21,09	–
Endesa: Tempo self-consumption rate													
Consumption with non-renewable energy + improvements	Annual amount per energy	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%	
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	–	3.626,30	25,45	0,0265630	9,70	3.661,44	768,90	4.430,35	260,61	21,72	16,29	13,03	
Buy energy from Endesa (1/3)													
Consumption with non-renewable energy without improvements	Annual amount per energy	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%	
Inst. photo voltaic panels 84 KWp (energy produced and sold to Endesa)	–	3.626,30	25,45	0,0265630	9,70	3.661,44	768,90	4.430,35	260,61	21,72	16,29		13,03
Buy energy from Endesa (1/3)													

Table 5.12 Comparative cost of electricity consumption as of June 1, 2021. ODF Energy

Rate 2.0 TD ODF supplier (from June 1st)														
	Fixed annual amount						Amount per energy consumption							
Consumption current building status	N. houses	Contracted power (KW)/ housing	Price H. tip €/ KW day	Price H. valle €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consump-tion KWh/Year	Price €/ KW rush hour	Price €/ KW flat hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley	Annual amount per energy consumed
		4,3	0,0852	0,0039	365	2.273,26	139.256,91	0,22700	0,08500	0,068	10.537,11	3.945,61	3.156,49	17.639,21
Consumption with facility improvements	N°. houses	Contracted power (KW)	Price H. tip €/ KW day	Price H. valle €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consump-tion KWh/Year	Price €/ KW rush hour	Price €/ KW flat hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley	Annual amount per energy consumed
Solar control sheets	17	4,4	0,093849	0,0126	365	2.562,27	108.869,55	0,22700	0,085	0,068	8.237,80	3.084,64	2.467,71	13.790,14
Air conditioning installation							82.438,94				6.237,88	2.335,77	1.868,62	10.442,27
Inst. entálpico retriever							100.890,74				7.634,07	2.858,57	2.286,86	12.779,49
Inst. aircondi-tioning + recuperator							70.359,74				5.323,89	1.993,53	1.594,82	8.912,23
Susti. PVC aluminium windows							135.574,39				10.258,46	3.841,27	3.073,02	17.172,76
Solar panels 100% ACS							105.448,20				7.978,91	2.987,70	2.390,16	13.356,77
Solar panels for heating							56.504,56				4.275,51	1.600,96	1.280,77	7.157,24

(continued)

Table 5.12 (continued)

Rate 2.0 TD ODF supplier (from June 1st)														
	Fixed annual amount						Amount per energy consumption							
Joint							22.695,85				1.717,32	643,05	514,44	2.874,81
Consumption with non-renewable energy + improvements	Nº housing	Contracted power (KW)/ housing	Price €/ KW day	Price H. valley €/ KW day	Days/ Year	Fixed annual amount(€)	Annual consump-tion kwh/ Year	Energy sold/ bought		Price €/ KW valley hour			Annual amount to be compen-sated	Annual amount per energy
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	17	4,4	0,093849	0,0126	365	2.562,27	8.687,59	2.895,86		0,05			144,79	−52,13
Buy energy from Endesa (1/3)								2.895,86		0,068			−196,92	
Consumptionwithnon-renewable energy without improvements	Nº housing	Contracted power (KW)/ housing	Price €/ KW day		Days/ Year	Fixed annual amount (€)	Annual consump-tion kwh/ Year	Energy sold/ bought		Price €/ KWh			Annual amount to be compen-sated	Annual amount per energy
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	17	4,4	0,1328217		365	3.626,30	139.256,91	46.418,97		0,05			2.320,95	835,54
Buy energy from Endesa (1/3)										0,068			3.156,49	

(continued)

Table 5.12 (continued)

Rate 2.0 TD ODF supplier(from June 1st)														
	Invoice break down													
Consumption current building status	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%	-	-	-
	19.912,47	101,81	0,0265630	9,70	20.023, 97	4.205, 03	24.229,01	1.425,24	118,77	89,08	71,26			
Consumption with facility improvements	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%			
Solar control sheets	16.352,41	83,60	0,0265630	9,70	16.445, 71	3.453,60	19.899,31	1.170,55	97,55	73,16	58,53			
Air conditioning installation	13.004,53	66,49			13.071,02	2.744,91	15.815,93	930,35	77,53	58,15	46,52			
Inst. entálpico retriever	15.341,76	78,44			15.420,20	3.238,24	18.658,44	1.097,56	91,46	68,60	54,88			
Inst. aircondi-tioning + recuperator	11.474,50	58,67			11.533,16	2.421,96	13.955,13	820,89	68,41	51,31	41,04			
Susti. PVC aluminium windows	19.735,02	100,90			19.835,92	4.165,54	24.001,46	1.411,85	117,65	88,24	70,59			

(continued)

Table 5.12 (continued)

Rate 2.0 TD ODF supplier(from June 1st)														
	Invoice break down													
Solar panels 100% ACS	15.919,04	81,39			16.000,43	3.360,09	19.360,52	1.138,85	94,90	71,18	56,94			
Solar panels for heating	9.719,51	49,69			9.769,20	2.051,53	11.820,74	695,34	57,94	43,46	34,77			
Joint	5.437,07	27,80			5.464,87	1.147,62	6.612,49	388,97	32,41	24,31	19,45			
Consumption with non-renewable energy + improvements	Subt-otal annual invoice	Annual electricity tax (7.0185%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%			
Inst. photovoltaic panels 5.2 KWp(energy produced and sold to Endesa)	2.510,14	17,62	0,0265630	9,70	2.537,45	532,87	3.070,32	180,61	15,05	11,29	9,03			
Buy energy from Endesa (1/3)														
Consumptionwithnon-renewable energy without improvements	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%			
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	4.461,84	31,32	0,0265630	9,70	4.502,85	945,60	5.448,45	320,50	26,71	20,03	16,02			
Buy energy from Endesa (1/3)														

Comparative Study with Collective Bargaining

The collective contract consists of the installation of a single meter in the building, considering that each house would be contracted with an average power of 2.2, since the peak consumption does not occur simultaneously, with which the total maximum power contracted would be 37.4 KW. This contract would be easily adjustable in reality by checking a posteriori the measurement of the maximeters.

The same alternatives are proposed as in the previous point:

Endesa Company

(a) In the first place, the building is considered in the current conditions without any improvement of installation, as reflected in the tables, each household would pay an average of € 95.02/month, and currently with the change of rate amounts to € 129.67, very high cost for the case of social housing.

(b) Then, taking into account the same considerations above, but applying the energy improvements in the building as studied in PFG by Eduardo Fernández Gaspar, each one independent according to what is reflected in tables, would have a lower cost of electrical energy than in the previous section, which, depending on the effectiveness of the best, as reflected in attached tables, it ranges between € 44.10 and € 92.70/month, although with the current rate it would go from € 57.13 to € 103.06.

(c) If all the improvements in the building are executed together, in tables it appears that the energy consumption costs fall considerably to the amount of € 23.32/month, but with the change of rates according to RD 244/2019 they amount to € 27.52.

(d) Taking the option of using renewable energy with photovoltaic panels, it represents a total of 13 plates of 0.410 KW, which add up to a total of 5.2 Kwp for self-production of 8,687.59 kWh/year, and considering 1/3 as surplus energy that is sold to the company Endesa at € 0.05/KWh and the necessary during the hours that there is no sun, it is also purchased at €0.05/KWh plus the rest of the taxes of 7.0185%. In this case, the energy compensation has been made with the company and as reflected in tables, the amount of monthly electricity only reaches € 0.89/housing, although currently it would reach the amount of € 11.13/monthly housing.

(e) As a last study, the approach in the case of not executing the improvements in the building, the number of plates necessary to supply the energy demand would also be 205 plates (Tables 5.13, 5.14 and 5.15).

Best Proposal for Energy Improvement

Once the comparative study has been carried out in terms of the contracted power and the consumption of electrical energy, both at the level of individual and collective contracting, with the company Endesa, and obtained the aforementioned results, a better proposal is investigated with the marketing company ODF ENERGÍA.

Table 5.13 Comparison of electricity consumption costs before June 1st, 2021. Endesa

Night and day rate (before June 1st)											
	Fixed annual amount					Amount per energy consumption					
Consumption current building status	N° houses	Contracted power(KW)/ housing	Price €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consumption KWH/Year	Price €/ KW rush hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount hours valley	Annual amount per energy consumed
	17	37,4	0,1152	365	1.572,60	139.256,91	0,149	0,0703	8.645,53	5.710,69	14.356,23
	N° houses	Contracted power (KW)/ housing	Price €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consumption KWH/ Year	Price €/ KW rush hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount hours valley	Annual amount per energy consumed
Solar control sheets	17	37,4	0,1152	365	1.572,60	108.869,55	0,149	0,0703	6.758,98	4.464,56	11.223,54
Air conditioning installation						82.438,94			5.118,08	3.380,68	8.498,77
Inst. entálpico retriever						100.890,74			6.263,63	4.137,36	10.400,99
Inst. airconditioning + recuperator						70.359,74			4.368,17	2.885,34	7.253,50
Susti. PVC aluminium windows						135.574,39			8.416,91	5.559,68	13.976,59
Solar panels 100% ACS						105.448,20			6.546,58	4.324,25	10.870,83
Solar panels for heating						56.504,56			3.507,99	2.317,16	5.825,15

(continued)

Table 5.13 (continued)

Night and day rate (before June 1st)											
	Fixed annual amount					Amount per energy consumption					
Joint						22.695,85			1.409,03	930,72	2.339,75
	Nº housing	Contracted power (KW)/ housing	Price €/ KW day	Days/ Year	Fixed annual amount (€)	Annual consumption KWH/ Year	Energy sold/ bought	Price €/ KWh	Price €/ KW valley hour	Annual amount to be compensated	Annual amount per energy
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	17	37,4	0,1152	365	1.572,60	8.687,59	2.895,86	0,05212		150,93	284,24
Buy energy from Endesa (1/3)									0,150275	435,18	
	Nº housing	Contracted power (KW)/housing	Price €/ KW day	Days/ Year	Fixed annual amount (€)	Annual consumption KWH/Year	Energy sold/ bought	Price €/ KWh	Price €/ KW valley hour	Annual amount to be compensated	Annual amount per energy
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	17	37,4	0,1152	365	1.572,60	139.256,91	46.418,97	0,05212		2.419,36	4.556,25
Buy energy from Endesa (1/3)									0,150275	6.975,61	

(continued)

Table 5.13 (continued)

Night and day rate (before June 1st)											
	Invoice break down										
Consumption current building status	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 40%	Bono social DCTO. 40%
	15.928,82	81,44	0,0265630	9,70	16.019,96	3.364,19	19.384,15	1.140,24	95,02	57,01	57,01
	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 40%	Bono social DCTO. 40%
Solar control sheets	12.796,14	65,42	0,0265630	9,70	12.871,26	2.702,96	15.574,22	916,13	76,34	45,81	45,80
Air conditioning installation	10.071,36	51,49			10.122,85	2.125,80	12.248,65	720,51	60,04	36,03	36,02
Inst. entálpico retriever	11.973,59	61,22			12.034,81	2.527,31	14.562,12	856,60	71,38	42,83	42,83
Inst. airconditioning + recuperator	8.826,10	45,13			8.871,22	1.862,96	10.734,18	631,42	52,62	31,57	31,57
Susti. PVC aluminium windows	15.549,19	79,50			15.628,68	3.282,02	18.910,71	1.112,39	92,70	55,62	55,62
Solar panels 100% ACS	12.443,43	63,62			12.507,05	2.626,48	15.133,52	890,21	74,18	44,51	44,51
Solar panels for heating	7.397,74	37,82			7.435,57	1.561,47	8.997,04	529,24	44,10	26,46	26,46

(continued)

Table 5.13 (continued)

Night and day rate (before June 1st)											
	Invoice break down										
Joint	3.912,35	20,00			3.932,35	825,79	4.758,14	279,89	23,32	13,99	13,99
	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 40%	Bono social DCTO. 40%
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	1.856,84	9,49	0,0265630	9,70	1.876,03	393,97	2.269,99	133,53	11,13	6,68	6,68
Buy energy from Endesa (1/3)											
	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 40%	Bono social DCTO. 40%
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	6.128,85	31,33	0,0265630	9,70	6.169,88	1.295,67	7.465,55	439,15	36,60	21,96	21,96
Buy energy from Endesa (1/3)											

Table 5.14 Comparison of electricity consumption costs as of June 1st, 2021. Endesa

Endesa: One LUZ rate (from June 1st)														
	Fixed annual amount						Amount per energy consumption							
Consumption current building status	Nº. houses	Contracted power (KW)	Price H. tip €/ KW day	Price H. valle €/ KW day	Day/ Year	Fixed annual amount(€)	Annual consump-tion kwh/ Year	Price €/ KW rush hour	Price €/ KW flat hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley	Annual amount per energy consumed
	17	37,4	0,093849	0,0126	365	1.281,13	139.256,91	0,25287	0,12657	0,074384	11.737,96	4.406,44	4.316,04	20.460,44
Consumption with facility improvements	Nº. houses	Contracted power (KW)	Price H. tip €/ KW day	Price H. valle €/ KW day	Day/ Year	Fixed annual amount(€)	Annual consump-tion kwh/ Year	Price €/ KW rush hour	Price €/ KW flat hour	Price €/ KW valley hour	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley	Annual amount per energy consumed
Solar control sheets	17	37,4	0,093849	0,0126	365	1.281,13	108.869,55	0,25287	0,127	0,074384	9.176,61	3.444,90	3.374,23	15.995,75
Air conditioning installation							82.438,94				6.948,78	2.608,57	2.555,06	12.112,41
Inst. entálpico retriever							100.890,74				8.504,08	3.192,44	3.126,94	14.823,46
Inst. air conditioning + recuperator							70.359,74				5.930,62	2.226,36	2.180,68	10.337,66
Susti. PVC aluminium windows							135.574,39				11.427,57	4.289,91	4.201,90	19.919,38
Solar panels 100% ACS							105.448,20				8.888,23	3.336,64	3.268,19	15.493,06

(continued)

Table 5.14 (continued)

Endesa: One LUZ rate (from June 1st)														
	Fixed annual amount						Amount per energy consumption							
Solar panels for heating							56.504,56				4.762,77	1.787,95	1.751,26	8.301,98
Joint							22.695,85				1.913,03	718,15	703,42	3.334,61
Consumption with non-renewable energy + improvements	N°. housing	Contracted power (KW)	Price €/ KW day	Price H. valley €/ KW day	Days/ Year	Fixed annual amount (€)	Annual consump-tion kwh/ Year	Energy sold/ bought	Price €/ KW tempo hour	Price €/ KW valley hour			Annual amount to be compen-sated	Annual amount per energy
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	17	37,4	0,1328217		365	1.813,15	8.687,59	2.895,86		0,05			144,79	–
Buy energy from Endesa (1/3)								2.895,86		0,05			−144,79	
Consumption with non-renewable energy without improvements	N° housing	Contracted power (KW)	Price €/ KW day		Days/ Year	Fixed annual amount (€)	Annual consump-tion kwh/ Year	Energy sold/ bought		Price €/ KWh			Annual amount to be compen-sated	Annual amount per energy
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	17	37,4	0,1328217		365	1.813,15	139.256,91	46.418,97		0,05			2.320,95	–

(continued)

Table 5.14 (continued)

Endesa: One LUZ rate (from June 1st)														
	Fixed annual amount						Amount per energy consumption							
Buy energy from Endesa (1/3)										0,05			2.320,95	
Endesa: One LUZ rate (from June 1st)														
	Invoice break down													
Consumption current building status	Sub-total annual invoice	Annual electricity tax (5.11%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%	–	–	–
	21.741,57	111,16	0,0265630	9,70	21.862,42	4.591,11	26.453,53	1.556,09	129,67	97,26	77,80			
Consumption with facility improvements	Sub-total annual invoice	Annual electricity tax (5.11%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%			
Solar control sheets	17.276,88	88,33	0,0265630	9,70	17.374,91	3.648,73	21.023,64	1.236,68	103,06	77,29	61,83			
Air conditioning installation	13.393,54	68,48			13.462,02	2.827,02	16.289,04	958,18	79,85	59,89	47,91			
Inst. entálpico retriever	16.104,59	82,34			16.186,93	3.399,25	19.586,18	1.152,13	96,01	72,01	57,61			
Inst. air conditioning + recuperator	11.618,80	59,40			11.678,20	2.452,42	14.130,62	831,21	69,27	51,95	41,56			
Susti. PVC aluminium windows	21.200,51	108,39			21.308,90	4.474,87	25.783,77	1.516,69	126,39	94,79	75,83			

(continued)

Table 5.14 (continued)

Endesa: One LUZ rate (from June 1st)														
	Invoice break down													
Solar panels 100% ACS	16.774,20	85,76			16.859,96	3.540,59	20.400,55	1.200,03	100,00	75,00	60,00			
Solar panels for heating	9.583,11	49,00			9.632,11	2.022,74	11.654,85	685,58	57,13	42,85	34,28			
Joint	4.615,74	23,60			4.639,34	974,26	5.613,60	330,21	27,52	20,64	16,51			
Consumption with non-renewable energy + improvements	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%			
Inst.photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	1.813,15	12,73	0,0265630	9,70	1.835,57	385,47	2.221,04	130,65	10,89	8,17	6,53			
Buy energy from Endesa (1/3)														
Consumption with non-renewable energy without improvements	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%			
Inst.photovoltaic panels 84 KWp (energy produced and sold to Endesa)	1.813,15	12,73	0,0265630	9,70	1.835,57	385,47	2.221,04	130,65	10,89	8,17	6,53			
Buy energy from Endesa (1/3)														

Table 5.15 Comparison of electricity consumption costs as of June 1, 2021. ODF energy

Rate 3.0 TD middle high season														
	Fixed annual amount						Amount per energy consumption							
Consumption current building status	N° houses	Contracted power (KW)/ housing	Price H. tip €/ KW DAY	Price H. valle €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consump-tion KWh/ year	Price €/ KW P2	Price €/ KW hour P3	Price €/ KW P6	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley	Annual amount per energy consumed
	17	4,3	0,0852	0,0039	365	2.273,26	139.256,91	0,12800	0,10100	0,067	6.684,33	4.102,28	3.110,07	13.896,68
Consumption with facility improvements	N° houses	Contracted power (KW)/ housing	Price H. tip €/ KW DAY	Price H. valle €/ KW day	Day/ Year	Fixed annual amount (€)	Annual consump-tion KWh/year	Price €/ KW P2	Price €/ KW hour P3	Price €/ KW P6	Annual amount peak hours	Annual amount flat hours	Annual amount hours valley	Annual amount per energy consumed
Solar control sheets	17	4,4	0,0852	0,0039	365	2.326,13	108.869,55	0,12800	0,101	0,067	4.645,10	3.665,27	2.431,42	10.741,80
Air conditioning installation							82.438,94				3.517,39	2.775,44	1.841,14	8.133,98
Inst. entálpico retriever							100.890,74				4.304,67	3.396,65	2.253,23	9.954,55
Inst. air conditioning + recuperator							70.359,74				3.002,02	2.368,78	1.571,37	6.942,16
Susti. PVC aluminium windows							135.574,39				5.784,51	4.564,34	3.027,83	13.376,67
Solar panels 100% ACS							105.448,20				4.499,12	3.550,09	2.355,01	10.404,22
Solar panels for heating							56.504,56				2.410,86	1.902,32	1.261,94	5.575,12
Joint							22.695,85				968,36	764,09	506,87	2.239,32

(continued)

Table 5.15 (continued)

Rate 3.0 TD middle high season														
	Fixed annual amount						Amount per energy consumption							
Consumption with non-renewable energy + improvements	N° housing	Contracted power (KW)/ housing	Price €/ KW day	Price H. valle €/ KW day	Days/ year	Fixed annual amount(€)	Annual consump-tion kwh/ year	Energy sold/ bought	Price €/ KW hour	Price €/ KW valley hour			Annual amount to be compen-sated	Annual amount per energy
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	17	4,4	0,0852	0,0039	365	2.326,13	8.687,59	2.895,86		0,05			144,79	−49,23
Buy energy from Endesa (1/3)								2.895,86		0,067			−194,02	
Consumption with non-renewable energy without improvements	N° housing	Contracted power (KW)/ housing	Price €/ KW day		Days/ Year	Fixed annual amount (€)	Annual consump-tion KWh/ year	Energy sold/ bought		Price €/ KWh			Annual amount to be compen-sated	Annual amount per energy
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	17	4,4	0,0852	0,0039	365	######	######	######		0,05			######	######
Buy energy from Endesa (1/3)										0,067			######	

Rate 3.0 TD middle high season													
	Invoice break down												
Consumption current building status	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%		

(continued)

Table 5.15 (continued)

Rate 3.0 TD middle high season													
	Invoice break down												
	16.169,94	82,67	0,0265630	9,70	16.262,31	3.415,09	19.677,40	1.157,49	96,46	72,34	57,87		
Consumption with facility improvements	Sub-total annual invoice	Annual electricity tax	Price rental counter/ day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%		
Solar control sheets	13.067,93	66,81	0,0265630	9,70	13.144,43	2.760,33	15.904,76	935,57	77,96	58,47	46,78		
Air conditioning installation	10.460,11	53,48			10.513,59	2.207,85	12.721,44	748,32	62,36	46,77	37,42		
Inst. entálpico retriever	12.280,68	62,79			12.343,47	2.592,13	14.935,60	878,56	73,21	54,91	43,93		
Inst. air conditioning+ recuperator	9.268,29	47,39			9.315,68	1.956,29	11.271,97	663,06	55,25	41,44	33,15		
Susti. PVC aluminium windows	15.702,80	80,28			15.783,09	3.314,45	19.097,54	1.123,38	93,62	70,21	56,17		
Solar panels 100% ACS	12.730,35	65,09			12.795,44	2.687,04	15.482,48	910,73	75,89	56,92	45,54		
Solar panels for heating	7.901,25	40,40			7.941,64	1.667,75	9.609,39	565,26	47,10	35,33	28,26		
Joint	4.565,45	23,34			4.588,80	963,65	5.552,44	326,61	27,22	20,41	16,33		
Consumption with non-renewable energy + improvements	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%		
Inst. photovoltaic panels 5.2 KWp (energy produced and sold to Endesa)	2.276,90	15,98	0,0265630	9,70	2.302,58	483,54	2.786,12	163,89	13,66	10,24	8,19		

(continued)

Table 5.15 (continued)

Rate 3.0 TD middle high season													
	Invoice break down												
Buy energy from Endesa (1/3)													
Consumption with non-renewable energy without improvements	Sub-total annual invoice	Annual electricity tax (7.0185%)	Price rental counter/day	Annual rental contador	Annual total	VAT 21%	Total annual invoice amount	Total annual amount/ housing	Total monthly amount/ housing	Social bonus DCTO. 25%	Social bonus DCTO. 40%		
Inst. photovoltaic panels 84 KWp (energy produced and sold to Endesa)	######	10,79	######	9,70	######	######	######	110,86	9,24	6,93	5,54		
Buy energy from Endesa (1/3)													

Once the corresponding calculations have been made, it is verified in the following tables that with the new electricity marketer even more energy savings can be achieved (Tables 5.16 and 5.17).

For the execution of the electrical energy installation collectively, it is necessary:

- Power control maximeter contracted in the building.
- ICP of electricity consumption limiter in housing: it is a home energy meter with single-phase Wi-Fi 100-240VAC, with timer switch. Remote control by application, voltage current sensing synchronization. The cost/unit is 20 € (Fig. 5.5).

The meter has the following characteristics:

- On/off by remote control App.
- Calculates the total daily and monthly consumption in KWh, displayed in mobile application.
- Timer schedule.
- Dimensions: 66.8*90*18 mm.
- Limit current 16A, if exceeded by the product automatically disconnects the charging circuit.
- 2.4G wireless network.

With this meter, it is proposed that energy consumption can be controlled by the inhabitants of the house, so that, if the contracted power is exceeded, it is billed at the prices stipulated by the company. Therefore, it will be paid according to the consumer's responsibility with respect to the demand.

In addition, the investment involved in switching to this type of installation is minimal.

Proposal for Improvement in Supply and Sanitation

Comparative Study with Individual Hiring for Housing

In the individual installation of supply and sanitation, 1 meter is required per dwelling, and its billing is constituted:

- The taxable base will be constituted by two tax elements: one represented by the availability of the sanitation service and another determinable by the use, depending on the pollution discharged and the amount of water measured in cubic meters used in the farm regardless of the flow discharged.
- The tax quotas will be determined by applying to the tax base a binomial structure fee consisting of a fixed fee and a variable quota, as indicated below.
- As a fixed fee for the availability of the sanitation service (discharge and purification) and as a fixed amount payable periodically, any water supply and/or sanitation in force will be issued the rates corresponding to the year 2021.

Table 5.16 Comparison of electricity costs by companies in individual contracting

	Individual contract								
	Endesa						ODF energy		
	One electricity rate (before 1/06/2021)			One electricity rate (from 1/06/2021) + Tempo self-consumption rate			Fare 2. TD (from 01/06/2021)		
Performances in the building	Amount (€) without bonus	Amount (€) with bonus 25%	Amount (€) with 40% bonus	Amount (€) without bonus	Amount (€) with bonus 25%	Amount (€) with 40% bonus	Amount (€) without bonus	Amount (€) with bonus 25%	Amount (€) with 40% bonus
Current status (no improvements)	104,40	78,30	62,64	137,31	102,98	82,39	118,77	89,08	71,26
Solar control sheets	85,72	64,29	51,43	110,69	83,02	66,41	97,55	73,16	58,53
Air conditioning installation	69,42	52,07	41,65	87,49	65,62	52,49	77,53	58,15	46,52
Inst. entálpico retriever	80,76	60,57	48,46	103,65	77,74	62,19	91,46	68,60	54,88
Inst. air conditioning + recuperator	61,99	46,49	37,19	76,91	57,68	46,15	68,41	51,31	41,05
Susti. PVC aluminium windows	102,07	76,55	61,24	134,03	100,52	80,42	117,65	88,24	70,59
Solar panels 100% ACS	83,56	62,67	50,14	107,64	80,73	64,58	94,90	71,18	56,94
Solar panels for heating	53,48	40,11	32,09	64,77	48,58	38,86	57,94	43,46	34,76
Joint ant improvements	32,70	24,53	19,62	35,16	26,37	21,10	32,41	24,31	19,45
Photovoltaic energy + building improvements	20,50	15,38	12,30	21,72	16,29	13,03	15,05	11,29	9,03
Photovoltaic energy without building improvements	45,97	34,48	27,58	21,72	16,29	13,03	26,71	20,03	16,03

Table 5.17 Best proposal for improvement in collective contracting

	Endesa						ODF energy		
	One electricity rate (before 1/06/2021)			One electricity rate (from 1/06/2021) + Tempo self-consumption rate			Rate 2. TD (from 01/06/2021) MID Season—high		
Performances in the building	Amount (€) without bonus	Amount (€) with bonus 25%	Amount (€) with 40% bonus	Amount (€) without bonus	Amount (€) with bonus 25%	Amount (€) with 40% bonus	Amount (€) without bonus	Amount (€) with bonus 25%	Amount (€) with 40% bonus
Current status (no improvements)	95,02	71,27	57,01	129,67	97,25	77,80	96,46	72,35	57,88
Solar control sheets	76,34	57,26	45,80	103,06	77,30	61,84	77,96	58,47	46,78
Air conditioning installation	60,04	45,03	36,02	79,85	59,89	47,91	62,36	46,77	37,42
Inst. entálpico retriever	71,38	53,54	42,83	96,01	72,01	57,61	73,21	54,91	43,93
Inst. air conditioning + recuperator	52,62	39,47	31,57	69,27	51,95	41,56	55,25	41,44	33,15
Susti. PVC aluminium windows	92,70	69,53	55,62	126,39	94,79	75,83	93,62	70,22	56,17
Solar panels 100% ACS	74,18	55,64	44,51	100,00	75,00	60,00	75,89	56,92	45,53
Solar panels for heating	44,10	33,08	26,46	57,13	42,85	34,28	47,10	35,33	28,26
Joint ant improvements	23,32	17,49	13,99	27,52	20,64	16,51	27,22	20,42	16,33
Photovoltaic energy + building improvements	11,13	8,35	6,68	10,89	8,17	6,53	13,66	10,25	8,20
Photovoltaic energy without building improvements	36,60	27,45	21,96	10,89	8,17	6,53	9,24	6,93	5,54

Fig. 5.5 ICP limiting power consumption. Sinotimer1

For the calculation of the variable quota, the corresponding variable concepts are applicable, which in our case are the following:

Home use—Block 1:

- Supply: 0,542 €/m^3.
- Discharge: 0,334 €/m^3.
- Purification: 0,348 €/m^3.
- Provincial Consortium Canon: €0.1865/m^3.
- Autonomous Canon: 0.20 €/m^3.

Taking the data corresponding to the building under study, the following results are obtained (Table 5.18).

Each household will have to pay an average of € 38.52/month of supply and sewerage, with an individual-type contract. Being a social housing building, the logical thing is that it is assigned to economically vulnerable people, with which they will have the application of some bonus, leaving the quotas as shown in Table 5.19 (Table 5.20).

In the two previous cases, the amount of water consumed is reduced to 13.20 m^3 because for the application of the voucher they require a maximum consumption, and from there it is charged at the corresponding price.

Table 5.18 Monthly amount EMASESA. Individual contracting

Concepts	Nº housing	Price €/Day	Days/Year	Fixed annual amount (€)	Monthly consumption m^3/housing	Total annual consumption m^3/year	Price €/M^3	Annual amount per consumption	Fixed amount+annual variable	Total import/MES	Total amount/month/housing
Supply	17	0,1398	365	867,46	16,00	3.264,00	0,542	1.769,09			
Bonus for compliance. Payment		−0,004166		−25,85				–			
Direct debit bonus		−0,004166		−25,85							
Poured		0,0408		253,16			0,334	1.090,18			
Purification		0,0408		253,16			0,348	1.135,87			
Canon Provincial							0,1865	608,74			
Autonomous Canon		0,0333		206,63			0,20	652,80			
Total integral cycle				1.528,71				5.256,67	**6.785,39**	**565,45**	**33,26**
VAT 10%								–	678,54	56,54	3,33
Sub-total invoice									**7.463,92**	**621,99**	**36,59**
RSU-fixed fee	17	23,20		394,40				–	394,40		
RSU-variable quota											
Total RSU											
Total import								–	**7.858,32**	**654,86**	**38,52**

Table 5.19 Monthly amount EMASESA with 50% bonus. Individual contracting

50% bonus														
Concepts	Nº housing	Price €/day	Days/Year	Fixed annual amount 50% (€)	Monthly consumption m^3/housing (50%)	Total annual consumption m^3/year (50%)	Monthly consumption m^3/housing (100%)	Total annual consumption m^3/year (100%)	Price €/M^3	Annual amount per consumption 50%	Annual amount per consumption 100%	Fixed amount + annual variable	Total import/MES	Total amount/ month/housing
Supply	17	0,1398	365	433,73	13,20	2.692,80	2,80	571,20	0,542	729,75	309,59	1.421,37		
Bonus for compliance. Payment		−0,004166		−25,85						–	–			
Direct debit bonus		−0,004166		−25,85										
Poured		0,0408		126,58					0,334	449,70	190,78	767,06		
Purification		0,0408		126,58					0,348	468,55	198,78	793,91		
Canon provincial									0,1865	502,21	106,53	608,74		
Autonomous Canon		0,0333		206,63					0,2000	538,56	114,24	320,87		
Total integral cycle				841,82						2.688,76	919,92	**3.608,68**	**300,72**	**17,69**
VAT 10%										–	–	360,87	30,07	1,77
Sub-total invoice												**3.969,55**	**330,80**	**19,46**
RSU-fixed fee	17	23,20		394,40						–	394,40	394,40		
RSU-variable quota														
Total RSU														
Total import										–	–	4.363,95	363,66	21,39

Table 5.20 Monthly amount EMASESA with 100% bonus. Individual contracting

100% bonus														
Concepts	Nº housing	Price €/day	Days/Year	FIxed annual amount 0% (€)	Monthly consumption m^3/housing (0%)	Total annual consumption m^3/year (0%)	Monthly consumption m^3/housing (100%)	Total annual consumption m^3/year (100%)	Price €/M^3	Annual amount per consumption 0%	Annual amount per consumption 100%	Fixed amount + annual variable	Total import/MES	Total amount/month/housing
Supply	17	0,1278	365	0,00	13,20	2.692,80	2,80	571,20	0,542	–	309,59	309,59		
Bonus for compliance.Payment		−0,004166								–	–			
Direct debit bonus		−0,004166												
Poured		0,0408		0,00					0,334	–	190,78	190,78		
Purification		0,0408		0,00					0,348	–	198,78	198,78		
Canon provincial									0,1865		106,53	106,53		
Autonomous Canon		0,0333		206,63					0,2000		114,24	320,87		
Total integral cycle				206,63					0,600	342,72	919,92	**1.262,64**	**105,22**	**6,19**
VAT 10%										–	–	126,26	10,52	0,62
Sub-total invoice												**1.388,90**	**115,74**	**6,81**
RSU-fixed fee	17	23,20		394,40						–	–	394,40	32,87	1,93
RSU-variable quota														
Total RSU												394,40	32,87	1,93
Total import										–	–	1.783,30	148,61	8,74

Comparative Study with Collective Bargaining of the Building

If you opt for the installation collectively, the data resulting from the calculation of supply and sewerage is practically the same as individually, both with and without bonus (Table 5.21).

Best Proposal for Improvement in Supply

Analyzing the results obtained in the two main options, it is considered necessary to request a water and discharge rate bonus, at least in the same proportion as the rental price, so that the application of the contract collectively throughout the building is profitable.

Proposal for Improvement in Gas

The gas installation would be eliminated, since when using photovoltaic panels it would be changed to the use of electric water heaters.

Proposal for Improvement in Telecommunications

The telecommunications service can be offered with an offer of € 29.95/month per contract, with Jazztel, which regardless of whether the contract is individual or collective, the cost will be higher or lower.

Comparative Study with Individual Contracting

Nowadays, it happens that many homes do not have an Internet network and after the COVID-19 pandemic, it has been shown that it is a necessary work tool both at school level and at the professional level. Therefore, a basic need facility in homes should be considered.

The conventional system consists of the installation of a router per house connected by wiring to the Wi-Fi network. The company Jazztel offers an offer of € 29.95/month, using the fiber optic of 600 Mbps of upload and download per house, a very high speed to obtain excellent browsing results. The installation is free for homes where there is already a Fiber Jazztel telephone network.

Table 5.21 Monthly amount EMASESA with or without bonus. Collective bargaining

Concepts	Nº housing	Price €/day	Days/Year	Fixed annual amount (€)	Monthly consumption m^3/housing	Total annual consumption m^3/year	Price €/M^3	Annual amount per consumption	Fixed amount + annual variable	Total import/MES	Total amount/month/housing	–	–	–
Supply	17	0,128766	365	798,99	16,00	3.264,00	0,542	1.769,09						
Bonus for compliance.Payment		−0,00417		−25,85				–						
Direct debit bonus		−0,00417		−25,85										
Poured		0,0408		253,16			0,334	1.090,18						
Purification		0,0408		253,16			0,348	1.135,87						
Canon Provincial							0,187	608,74						
Autonomous Canon		0,0333		206,63			0,2000	652,80						
Total integral cycle				1.460,25				5.256,67	**6.716,92**	**559,74**	**32,93**			
VAT 10%								-	671,69	55,97	3,29			
Subtotal invoice									**7.388,61**	**615,72**	**36,22**			
RSU-fixed fee	17	23,20		394,40				–	394,40					
RSU-variable quota														

(continued)

Table 5.21 (continued)

Concepts	Nº housing	Price €/day	Days/Year	Fixed annual amount (€)	Monthly consumption m^3/housing	Total annual consumption m^3/year	Price €/M^3	Annual amount per consumption	Fixed amount + annual variable	Total import/MES	Total amount/month/housing	–	–	–
Total RSU														
Total import								–	**7.783,01**	**648,58**	**38,15**			
50% bonus														
Concepts	Nº housing	Price €/Day	Days/Year	Fixed annual amount 50% (€)	Monthly consumption m^3/housing (50%)	Total annual consumption m^3/year (50%)	Monthly consumption m^3/housing (100%)	Total annual consumption m^3/year(100%)	Price €/M^3	Annual amount per consumption 50%	Annual amount per consumption 100%	Fixed amount + annual variable	Total import/MES	Total amount/month/housing
Supply	17	0,1287	365	399,29	13,20	2.692,80	2,80	571,20	0,542	729,75	309,59	1.386,93		
Bonus for compliance. Payment		−0,00417		−25,85						–	–			
Direct debit bonus		−0,00417		−25,85										
Poured		0,0408		126,58					0,334	449,70	190,78	767,06		
Purification		0,0408		126,58					0,348	468,55	198,78	793,91		
Canon provincial									0,1865	502,21	106,53	608,74		
Autonomous canon		0,0333		206,63					0,2000	538,56	114,24	320,87		
Total integral cycle				807,38						2.688,76	919,92	**3.608,68**	**300,72**	**17,69**
VAT 10%										–	–	360,87	30,07	1,77
Sub-total invoice												**3.969,55**	**330,80**	**19,46**

(continued)

Table 5.21 (continued)

Concepts	Nº housing	Price €/day	Days/Year	Fixed annual amount (€)	Monthly consump-tion m^3/ housing	Total annual consumption m^3/year	Price €/ M^3	Annual amount per consumption	Fixed amount + annual variable	Total import/ MES	Total amount/ month/ housing	–	–	–
RSU-fixed fee	17	23,20		394,40						–	394,40	394,40		
RSU-variable quota														
Total RSU														
Total import										–	–	4.363,95	363,66	21,39
100% bonus														
Concepts	Nº housing	Price €/Day	Days/Year	Fixed annual amount 0% (€)	Monthly consumption m^3/ housing (0%)	Total annual consumption m^3/year (0%)	Monthly consumption m^3/ housing (100%)	Total annual consumption m^3/ year (100%)	Price €/ M^3	Annual amount per consump-tion 0%	Annual amount per consump-tion 100%	Fixed amount + annual variable	Total import/ MES	Total amount/ month/ housing
Supply	17	0,1278	365	0,00	13,20	2.692,80	2,80	571,20	0,542	–	309,59	309,59		
Bonus for compli-ance.Payment		−0,00417								–	–			
Direct debit bonus		−0,00417												
Poured		0,0408		0,00					0,334	–	190,78	190,78		
Purification		0,0408		0,00					0,348	–	198,78	198,78		
Canon Provincial									0,1865		106,53	106,53		
Autonomous Canon		0,0333		206,63					0,2000		114,24	320,87		
Total integral cycle				206,63					0,600	342,72	919,92	**1.262,64**	**105,22**	**6,19**

(continued)

Table 5.21 (continued)

Concepts	Nº housing	Price €/day	Days/Year	Fixed annual amount (€)	Monthly consumption m^3/housing	Total annual consumption m^3/year	Price €/M^3	Annual amount per consumption	Fixed amount + annual variable	Total import/MES	Total amount/month/housing	–	–	–
VAT 10%										–	–	126,26	10,52	0,62
Sub-total invoice												**1.388,90**	**115,74**	**6,81**
RSU-fixed fee	17	23,20		394,40						–	–	394,40	32,87	1,93
RSU-variable quota														
Total RSU												394,40	32,87	1,93
Total import										–	–	1.783,30	148,61	8,74

Table 5.22 Cost of installation Wi-Fi/housing in conventional system. Individual contracting

Element and quantity	Item (€/ud)	Amount (€)
1 Router Xiaomi AX1800	45,00	45,00
Labor	30,00	30,00
Amount/housing		75,00

The Xiaomi AX1800 Router is updated improving in terms of its installation without wiring and without the need for an outdoor antenna. In addition, it will be compatible with Mesh networks, allowing a simultaneous connection of up to 128 wireless devices. Its price reaches around 45 €/unit, with which the investment would be as shown in Table 5.22.

Comparative Study with Collective Bargaining by Floor of the Building

Mesh or Mesh networks:

Today, it continues to happen that in many homes the Wi-Fi coverage is not very good with the conventional system, you have 100 Mgts or 1 Gb. As a solution to this, mesh or mesh networks appear, significantly improving wireless access. It is a way of not having the house full of cables, to give adequate access to computers, smartphones, tablets, and other devices.

The mesh-type network consists of a group of devices that act as a single Wi-Fi network, that is, there will be several Wi-Fi sources (Wi-Fi points) in the home, instead of a single router.

Its operation is automatic and intelligent, the network itself establishes which the best element is the better which the optimal coverage is achieved, adapting to the different spaces of the house. Therefore, this solution is excellent in homes with more than one floor.

It would be necessary to contract the Internet access of 5 × 600Mbps or 5 × 1 Gb with the provider Jazztel, which provides access routers compatible with mesh networks, with a cost of € 30 per repeater placed per floor, located in common areas of the building. The maintenance cost would be around € 7.5/housing (Table 5.23).

Table 5.23 Cost installation Wi-Fi/housing in mesh system. Collective bargaining

Element and quantity	Item (€/unit)	Amount (€)
1 Router Xiaomi AX1800	45,00	45,00
5 repeaters (Basement + housing floors)	30,00	180,00
Labor	200,00	200,00
Total amount		521,00
Amount/housing		32,56

From the above table, it is concluded that the router installation is more expensive than the mesh-type installation, as well as the monthly contracting fee of the line.

This system offers excellent coverage and a transfer speed of a minimum of 200 Mbps to ensure that the use of multimedia content and online games is executed with adequate quality. As for the connection capacity, it supplies a minimum of 20 devices per repeater.

Discussion of Results

Table 5.24 gives a summary of the energy amount and total savings that would mean to each home of the building under study, the services proposed with photovoltaic installation, with or without bonus, of the best proposals studied.

The table shows the following conclusions:

- Electricity: Changing the company ODF Energy and collective bargaining, with the energy improvements of the previous project, a saving of 91% would be achieved, with respect to current consumption.
- Supply: The alternative that is proposed to Amases so that there are savings is to propose discounts on the variable costs of the invoice, so that in this way up to 100% savings can be achieved in the cost of said service.
- Telecommunications: With the new mesh-type networks, 75% would be saved in the monthly fee.

According to the comparison made, the savings that would mean the cost of energy maintenance of a social housing are as follows:

- Consumer without bonus: 70%.
- Vulnerable consumer: 74%.
- Severe vulnerable consumer: 80%.

Given all these proposals, the rest of the percentage to be paid in the bills can be covered with a social bonus of services that the administration supports, and in this way achieve that at least in social housing energy poverty is eliminated.

Conclusions

As the main objective of the Project, a social bonus of services applied to social housing can be created for an amount of about € 25/50/month, depending on whether they present the normal or severe bonus, to eliminate energy poverty in publicly owned housing, so that these consumers would go from paying a monthly average of about € 200 to € 55 without bonus and from about € 110 to € 23 with the maximum bonus. In this way, the objectives proposed in the project, both main and secondary, are achieved:

Table 5.24 Economic energy savings in social housing

		ODF energy			EMASESA			Jazztel	Amount (€)/housing/month		
		S/Bono	25% Bonif	40% Bonif	S/Bono	50% Bonif	100% Bonif		S/Bono	Vulnerable consumer	Severe C.vulnerable
Hous. S/improvements	C.individual	118,77	89,08	71,26	38,52	21,39	8,74	29,95	187,24	140,42	109,95
	C.collective	96,46	72,34	57,87	38,15	21,39	8,74	7,50	142,11	101,23	74,11
Hous. C/improvements	C.individual	15,05	11,29	9,03	38,52	21,39	8,74	29,95	83,52	62,63	47,72
	C.collective	10,89	8,17	6,53	38,15	21,39	8,74	7,50	56,54	37,06	22,77
% Consumption savings		90,83%	90,83%	90,84%	0%			74,96%	69,80%	73,61%	79,29%

1. Energy rehabilitation and energy efficiency of the building: increase in thermal stability in the house, achieving savings of up to 84.00%.
2. Use of photovoltaic renewable energy, favoring respect for the environment and avoiding climate change, which applied after energy rehabilitation allows the energy autonomy of the building.
3. Reduction of the cost of energy supplies, mainly electricity and telecommunications, reaching savings of up to 91.00% in electricity and 75.00% in Wi-Fi network.
4. Application of collective contracting systems in social housing, because it is owned by the public entity and has a single owner of the building, reaching savings of up to 80.00%.
5. The collective bargaining system allows the creation of "social service bonuses" for all tenants, which means a fixed monthly cost of about € 25/50/month, instead of a current average monthly cost of about € 110/200.
6. In turn, the existence of a fixed fee of services through this social bonus of services.

   – Universality of supply sources.
   – Automation.
   – Coordinated management with other AAPP.

Likewise, this approach is made to social housing of public property, because the subsidies of the Andalusian Agency of the Energy to the Administration can reach up to 95% of the expense of the energy rehabilitation.

As a future line of work, research on privately owned housing is proposed for those households that do not suffer from monetary poverty, but from energy poverty, since when paying the energy costs consumed by housing they have to eliminate them from other basic needs: food, clothing, and education.

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