CONCERTO COMMUNITIES IN EU DEALING WITH OPTIMAL THERMAL AND ELECTRICAL EFFICIENCY OF BUILDINGS AND DISTRICTS, BASED ON MICROGRIDS

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Socio-economic effects of the PIME's project

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1 INTRODUCTION

This report summarizes the socio-economic effects of the retrofitting of two apartment blocks located in Szentendre, Hungary and Vitoria-Gasteiz, Spain, as well as the construction of a new energy efficient apartment blockhouse in Vitoria-Gasteiz, which were carried out through the PIME's-project.

Table 1. Overview of the projects carried out through PIME's.

Community	Scale of CONCERTO area	Name of CONCERTO areas	Project typology	Social housing invoved	Estimated population affected by CONCERTO
PIME's/ Szentendre	District/Neighbourhood	Hamvas Bela Utca	R		250
PIME's/Vitoria -Gasteiz	Neighbourhood	Zaramaga	R		60
	District/Neighbourhood	Salburua	NB	x	143

R = Refurbishment
NB = New Buildings

2 THE REFURBISHMENT PROJECT

2.1 SZENTENDRE

The building refurbished is an 80 dwellings apartment house, built in the late 60's. New external mineral wool insulation has been used for the parapet walls; meanwhile expanded polystyrene has been used on the South and Nord facade without windows. Increasing the fire safety between the apartments the old glazed „french door" were replaced by new large balconies, which has a shading function as well.

All the windows and portals have been replaced by high performance products. On the ground floor the glazing at the portals has been reduced as far as the function allowed, and greater solid areas has been achieved with relevant heat loss reduction. The ventilation system has been changed to a controlled system, which allows all households to adjust it depending on their needs and intentions

The flat roof of the house has been refurbished with 20 cm extra thermal insulation, and hybrid PV (30,97 kW) system has been implemented. The collector of the hybrid PV supply the greater part of the Domestic Hot Water need of the house in the summer period. There are integrated PV panels on the top of the new balcony as well, and there are visible PVs (14,52 kW) on the South wall of the building, which aim is also to raise the awareness of the inhabitants towards the use of renewables.

2.2 ZARAMAGA

The building refurbished is a 30 dwellings apartment house, built in the early 60's. The retrofitting in Zaramaga were conducted in similar way as in Szentendre with adding an insulating envelope around the building and replacing doors and windows with higher performance products. In addition, individual boilers and elevators were installed.

2.3 METHOD

The data from the primary stakeholders is collected through personal structured interviews. The questionnaire holds questions on the following subjects:

- Personal background information (age, gender, years lived in the apartment, occupation, education level and health condition)
- Attitude and behaviour towards domestic energy savings
- Indoor climate
- Perception of ethe apartment, building and neighbourhood
- Financial situation
- Specific questions on the measurements which were planned/imposed

Most of the question is on a household level, while personal background information is collected on an individual level.

The data collection was carried out over two periods, before and after the retrofitting took place. The population is every household in the retrofitted buildings as well as an equal number of households living in similar buildings with comparable standard before the retrofitting took place, functioning as the control group.

Table 2. Number of interviews carried out in Hungary and Spain at retrofitted buildings, and number of persons included in the survey.

	Hungary				Spain			
	Pre		Post		Pre		Post	
	Control group	PIME'S group	Control group	PIME'S group	Control group	PIME'S group	Control group	PIME'S group
Households	82	80	80	80	30	26	30	21
Persons	156	134	166	176	81	57	72	42
Persons per household	1,9	1,7	2,1	2,2	2,7	2,2	2,4	2,0

2.4 RESULTS

The participants of PIME's has become much more satisfied with the condition of the building as well as the apartment after the retrofitting, while this has not changed in the control group.

Both the control group and the PIME's group in Spain and Hungary rates the physical condition of the buildings in their neighbourhood, as well as cleanliness, level of security and condition of the green areas, higher than before the retrofitting took place. The effect is highest in the Hungarian PIME's group, and less notable in Spain. The reason for this difference could be that the retrofitted building in Hungary has a far more dominant place in its neighbourhood, located at a road junction and includes four times as many apartments than the retrofitted building in Spain.

The share of the respondents of the control groups which have become more positive towards retrofitting their own building after the retrofitting is notable in both countries. In Spain half of the control group became more or much more positive, in Hungary 29 %.

The indoor climate improved significantly as result of the retrofitting. The apartments keep a much more comfortable temperature both in summer and winter time, as well as insulating better from outside noise. However, problems with mould has increased in Hungary and has been unchanged in Spain after the retrofitting.

The majority of the respondents in both countries agrees on the statements that the indoor climate has improved and the temperature is more comfortable inside the apartment after the retrofitting. This effect is significantly stronger in the Hungarian case, indicating that the initial need for retrofitting was much higher there than in the Spanish case.

It is the oldest age groups that in largest degree agrees that the indoor climate and temperature has become more comfortable.

The share of households reporting that the cost of heating up the apartment is high or very high has decreased significantly in the Hungarian PIME's group from 95 % to 40 %, and more slightly in the Spanish PIME's group from 60 % to 45 %.

After the retrofitting 28 % in the Hungarian and 29 % in Spanish PIME's group agrees that the retrofitting has improved their general health condition. 10 % of the Spanish participants and 5 % of the Hungarian does not agree to this.

In Hungary respondents of households with children has the highest share which agrees on improvement in general health condition, with 40 %. After follows respondents of one person households (26 %) while respondents of households without children under 18 years has the lowest share which agrees to this, 16 %.

19 % of the Spanish and 43 % of the Hungarian participants agrees that their personal life has improved after the retrofitting

Respondents of one person households has the highest share which agrees on improvement in personal life, with 58 %. After follows respondents of households with children (47 %) while respondents of households without children under 18 years has the lowest share which agrees to this, 29 %.

67 % of the Spanish participants agrees that their standard of living has increased after the retrofitting while this is the case for 37 % of the Hungarian participants. The main reason for the Spanish participants agreeing in a much larger degree to this, is most likely the fact that elevators were installed as part of the retrofitting project.

In Spain particularly respondents above 30 years, either living alone or in households with children under 18 years which in the largest degree agrees on this. In Hungary the household type where the highest share agrees that the retrofitting has improved their standard of living is households without children (42 %).

Retrofitting reduces the energy use for heating or cooling the apartment. In Hungary 42 % agrees that this has caused an increased energy use for other activities such as hot water use while 5 % in Spain reports the same.

Reduced energy needed for heating or cooling the apartment could reduce the electricity bills if the tenants use electrical devises for controlling the room temperature, such as ovens, fans or air-conditions. 45 % of the Hungarian participants agrees that they spend less money on electricity after the retrofitting, while this is true for 15 % of the Spanish PIME's group.

In both the Spanish and the Hungarian case, around 40 % of the respondents agrees that PIME's participation had made them become more concerned about energy saving. A minority of 5 % in Spain and 11 % in Hungary does not agree to this statement.

There has been a large shift in the demographic groups of the test site area in Szentendre where older one-person households are replaced with younger households with two or more persons. In the retrofitted building, the share of apartments inhabited by households with children under 18 years have increased from 21 % in 2011 to 38 % in 2015, while at the control group building the share fell from 33 % to 31 % in the same period. This is clear evidences that the retrofitting has had an added effect on the demographic development. The apartments have become substantially more energy efficient, making them more attractive on the property market, while the accessibility is unchanged. This gives incentives for older households to cash in the value increase of the property and move to better apartments in terms of accessibility elsewhere, while the increase of standard makes the flat more attractive for interested buyers, mainly younger households. The new households acquired the apartment either by inheriting, buying or renting from family or buying the apartment from a real estate broker. The building not retrofitted had a larger increase in the share of households without children under 18 years than the retrofitted building.

In Spain there has been less changes in the distribution of household types between the two survey periods than in Hungary. This is natural giving the fact that the time period between

the surveys is three years less. However, it is a tendency of an opposite development of that observed in Hungary, where the share of one-person households is increasing on behalf of households with children. The building retrofitted in Zaramaga consists of 48 % one-person households which is slightly higher than the year before, while one-person households in the building of the control group increased from 13 % to 27 %. Since this effect also here is observed in both groups, the development seems to be general to the neighbourhood, indicating that the area has become less attractive for households with children. One important fact of the retrofitting project in Zaramaga is that elevators were installed in addition to the energy efficiency improvements. This improves the accessibility of the apartments considerably, particularly at the higher floors, making them highly attractive for older households. It should also be noted that the control group building already had elevators installed. One reason why the same effect as in Hungary with large decrease in one-person households is not observed in Spain could then be that the flats are made more attractive to that particular group.

One of the most interesting changes is that the education level among the persons in the retrofitted building in Hungary has increased significantly from 2011 to 2015. The share of person with education above high school level (trade school, college or university) has increased from 26 % to 45 %. In the control building the same share decreased from 32 % to 24 %. The reason for the increase is that individuals with higher education levels from the pre study were more likely to still live in the building than individuals with lower education. In addition, the group of individuals who lived shorter than 5 years in the apartment, and thus moved into the building between the pre and post study, has a higher education level than the group of individuals living in the building for 5 years or more. In Spain the share of person with education above high school level decreased slightly from 23 % to 21 % in the retrofitted building and increased from 15 % to 23 % in the control group.

3 THE NEW BUILDING PROJECT

3.1 SALBURUA

Construction of an entirely new building block in the city part of Salburua. The building is constructed according to a higher standard compared with previously built blockhouses owned by Alokabide, a public social housing provider in Basque country.

3.2 METHOD

The data from the primary stakeholders is collected through personal structured interviews. The questionnaire holds questions on the following subjects:

- Personal background information (age, gender, years lived in the apartment, occupation, education level and health condition)
- Attitude and behaviour towards domestic energy savings
- Indoor climate
- Perception of ethe apartment, building and neighbourhood
- Financial situation
- Specific questions on the measurements which were planned/imposed

Most of the question is on a household level, while personal background information is collected on an individual level. The data collection was carried out 6 months after the tenants moved in.

The population is every household in the new building as well as an equal number of households living in a building built according to previous standards nearby, functioning as the control group.

Table 3. Number of interviews carried out at Spain at the new building, and number of persons included in the survey.

	Spain	
	Control group	PIME'S group
Households	43	43
Persons	105	143
Persons per household	2,4	3,3

In addition, a focus group interview was carried out among eight of the tenants with main objective of identifying which effects the new systems of the building has on quality of life.

3.3 RESULTS

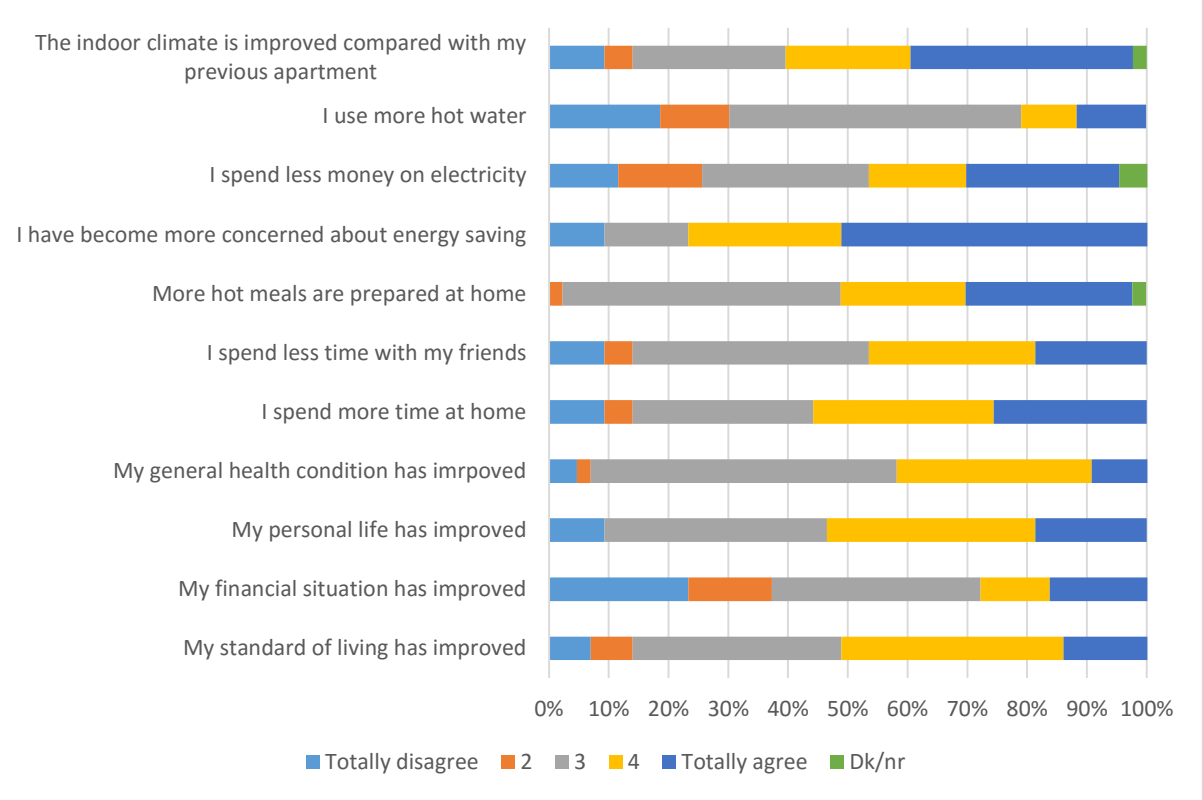

Figure 1 Changes compared with the situation before they moved in to the new apartment

The households who have moved in to the new building in Vitoria-Gasteiz are in general very satisfied with their new home. This is also confirmed by the focus group interviews were the participants says that it is a really well-built building and that it is the best home they have lived in.

Over 50 % agrees that the indoor climate, personal life and standard of living has improved compared with their previous apartment. 42 % also report that their general health condition has improved. Moving into an apartment with new technological solutions for energy saving has made the tenants more concerned about this topic and 77 % of the households agrees to this.

There is identified a controversy about the monitoring and self-management system of consumption which is controlled by a personal tablet. During the focus group two opposing ways of evaluate the system were detected: Promoters vs. Detractors. The promoters found the system easy to use and more convenient than what they were used to in their previous apartment. The detractors missed the control they had by an individual heating boiler and receiving invoices after energy use. This system requires a pre-payment of energy supply, where the power and heating supply is cut off if the balance goes below 10 €.

The new building in Vitoria-Gasteiz is located in a new part of the city, and the participants of the focus group interview thinks that the neighbourhood is lifeless. The schools are far away and it is a 30 minutes' walk to the nearest market. 56 % spend more time at home, 48 % prepare more hot meals at home and 47 % spend less time with friends compared with their previous apartment.

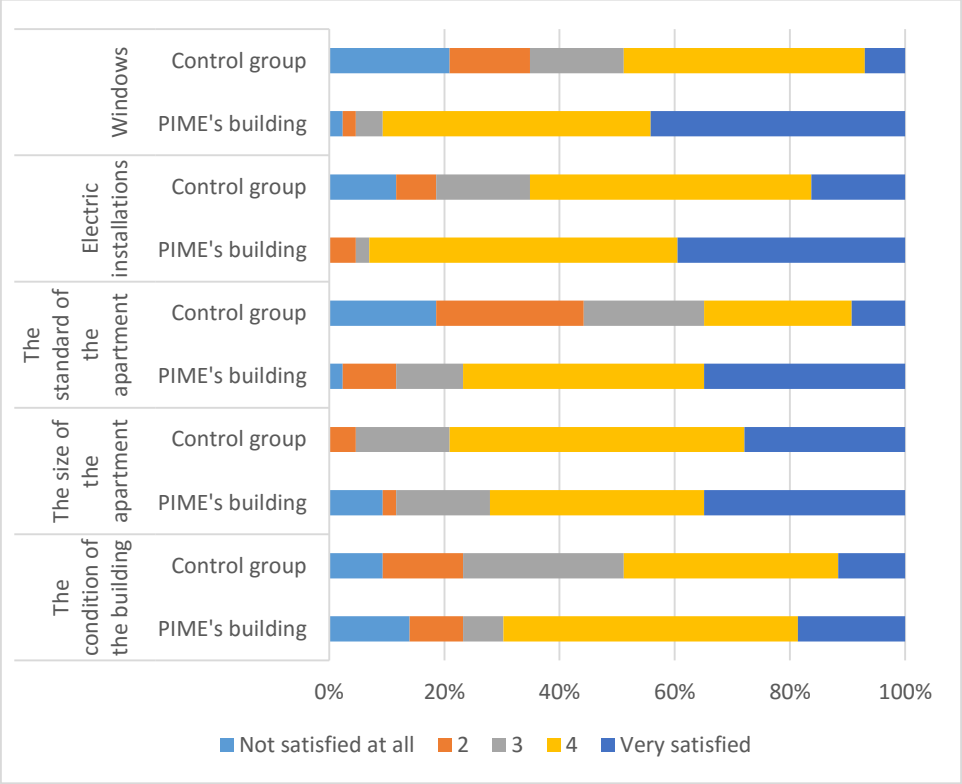

Figure 2 Satisfaction of various aspects of the apartment

Compared with the control group the households in the new building are much more satisfied with the standard of their apartments. 77 % of the respondents of the new building are satisfied or very satisfied with the standard of the apartment, while this is only the case for 35 % of the households in the control group. In general, the households of the new building are more satisfied with windows, electrical installation and the condition of the building, compared with the households living in the blockhouse built according to previous standards.

4 THE SECONDARY STAKEHOLDERS

4.1 METHOD

The data from the secondary stakeholders is collected through personal interviews with representatives of the stakeholders. The stakeholders were municipalities and owner/renter of the buildings.

4.2 RESULTS

The most important benefit listed from the view of the secondary stakeholders was the effect of making a fully functional demonstration site. By showing the advantages of the new technologies introduced in operation, they hope that others will be inspired to carry out similar projects. In addition, for the retrofitting projects the informants expect that a fully functional demonstration site will lower the willingness to pay for after insulation in general, because the public can see and get documentation of the benefits, like improved indoor climate and lower energy costs. The answers from the control group confirm that such an effect took place. In Spain half of the control group became more or much more positive, in Hungary 29 %. Some of the stakeholders also mentioned that the experience and knowledge gained by constructing or retrofitting the buildings will reduce the cost of carrying out similar projects elsewhere.

5 LESSONS FROM THE PIME'S PROJECT

In order to convince the majority of the tenants of a randomly selected building to accept to co finance a retrofitting program of their building using new technology, the level of subsidy has to be substantial. 83 % of the households in the retrofitted building in Szentendre would oppose to co-finance the cost of the refurbishment if the level of subsidy would be 50 %. Only an 80 % subsidy level made the majority of the households (75 %) support to participate in the retrofitting program. However here it is important to note that this was the agreement they had with the PIME's organisation. In future retrofitting projects it could be advantageous to make the selection of the buildings participating the other way around, that communities interested in participating has to apply to take part of the project. In this case it was the PIME's organisation which took contact with the tenants of the buildings they wanted to include in the project.

None of the households of the control group would initially support a proposal to refurbish their building in the same way as the PIME's building if they had to pay 50 % of the cost themselves. An important reason for this is that the retrofitting program of PIME's was more expensive but improved the energy ratings of the building at a higher degree compared with a standard refurbishing program. After they saw the final outcome, 29 % had become more positive on retrofitting their own building in Hungary. In Spain half of the control group became more or much more positive.

Retrofitting will affect the property value of the apartments. Heavily subsidized retrofitting programs will have the effect of increased turnover rate of households moving in and out of the building since selling the apartment is the only way to capitalise of the subsidy. In this process the income and education level of the inhabitants will increase, due to the increase of living standard and value of the apartments. This effect was especially noticeable in the Hungarian case, while the installation of elevators might have dampened this effect in the Spanish case.

Introducing new technology into homes can be challenging for the tenants. In the case of Salburua, the heat and electrical system installed is controlled by tablets. Tenants not familiar with the use of such devices report that they find the system difficult to use. They would rather prefer a more traditional system with energy meters and invoices, instead of pre paying their energy bills through an unfamiliar IT-system. Lack of knowledge of the tablet control system also causes user errors, and could lead to unnecessary high energy use. Some of the tenants also report that lack of user knowledge lead to involuntary payment defaults and disconnection from the energy system. The lesson that should be learned from this is that the introduction of new user interfaces might require a substantial training program of the users, if they are unfamiliar with the technology introduced.