

# A collaborative platform to empower local actions against energy poverty

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## Abstract

Energy Poverty alleviation measures often require large public investments. However, successfully targeting the beneficiaries can be hard due to the territorial specificity of the issue. Decentralized collective impact ecosystems leveraging on social innovation schemes of public authorities, creating shared value for market actors and ensuring the widest outreach to the voluntary sector would enhance the effectiveness of coping programs.

A multi-disciplinary platform to tackle energy poverty composed of academic institutions, private stakeholders and charities is presented in this paper. Charities offer the confidence framework for a “door-to-door” engagement, academic institutions provide technical and socio-economic significance, bridging with the local administration. Profit companies contribute in the context of their CSR/CSV and explore new possible business models.

A first project involved 60 households from six cities in North-West Italy. An international-wide do-it-yourself company donated customized kits of energy saving devices, designed in accordance with building energy needs. Inputs are based on site surveys disseminated by charity volunteers, which investigated socio-economic aspects too. Volunteers attended a dedicated educational program on domestic energy appliances, household economy and energy billing beforehand. The first outcomes of the project are presented herewith.

## 1 The context

Energy Poverty (EP) is usually defined as the inability to afford the necessary energy consumption to guarantee minimal living and comfort conditions in a dwelling (Csiba, Bajomi, & Gosztanyi, 2016; Simcock, Thomson, Petrova, & Bouzarovski, 2017; Thomson & Snell, 2013). This issue affects up to 4.5 million households in Italy (17%) according to the 10% ratio between energy expenditure and income (Boardman, 1991), even though this amount can be reduced to less than 10% of the total households under the Low Income High Costs approach (Hills, 2012; Moore, 2012) or under a specific country-tailored indicator (details on the latter and on the cited figures for Italy in Faiella & Lavecchia, 2018; see also Fabbri, 2015).

The causes that influenced the manifestation of the problem in the last decade are identified in three main factors. First, the decrease of the resources available to the low-income households: against a generalized increase of the equalized median income between 2005 and 2015, the wealth distribution became more inhomogeneous, resulting in an augmented number of “at risk of poverty” households (below 60% of the equalized median income). In Italy, 21% of the population was “at risk

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of poverty” in 2016, roughly 2% more than in 2008 (Brandolini, 2018). Another reason resides in the energy efficiency of the building envelope and of the energy systems. Between 2000 and 2015, the increment of the residential energy efficiency in Italy was equal to 9.9%, among the lowest in the EU-28, where it attains 28.5% on average<sup>6</sup>. This value can partially be explained by the fragmentation of the housing ownership in Italy. As a third factor, the end user energy price should be considered. Italy stands out of the European energy costs ranking, both for electricity (0.2377 €/kWh vs an European average of 0.2053 €/kWh) and for natural gas (0.8301 €/kWh vs an European average of 0.6653 €/kWh): on such amounts, taxes and system charges have a high incidence, respectively equal to 13% and 18% for electricity, vs 39% and 3% for natural gas<sup>7</sup>. Still in 2017, 61% of Italian households adhered to the regulated market, which is planned to phase out by 2020, despite the liberalized offer is available since 2007<sup>8</sup>. This may be interpreted as a sign of low confidence facing the raising costs. A reasonable estimate for an annual household bill including space heating, domestic hot water production and gas cooking is expected to be around 1250 €/year<sup>9</sup>, which may not be affordable in many cases (see Table 1).

Table 1. Share of households declaring Energy Poverty symptoms, from EU-SILC statistics on income and living conditions, year 2015. Values in parentheses indicate the share for the low-incomes (< 60% equivalized median income).

HOUSEHOLDS WHO DECLARE:	ITALY*	EU-28 AVERAGE
<b>INABILITY TO KEEP HOME ADEQUATELY WARM</b>	17.0 % (35.9 %)	9.4 % (22.7 %)
<b>ARREARS ON UTILITY BILLS</b>	12.6 % (28.0%)	9.1 % (21.0%)
<b>LEAKING ROOF, DAMP WALLS, FLOORS OR FOUNDATIONS</b>	24.1 % (32.2 %)	15.2 % (24.0%)
<b>UNCOMFORTABLE HOME DURING SUMMER</b>	26.0 % (-)	19.1 % (-)

\*Equivalized median income for Italy in 2015: **812 €** for a single, **1706 €** for a couple with 2 children

The main existing Italian national policies associated with energy poverty problem fall within three categories: (i) the promotion of energy efficiency and renewable energy generation; (ii) the reduction of energy expenditure for some consumers groups; (iii) the consumers’ protection from supply disconnection under certain conditions. A wide support to the energy renovation of existing buildings in Italy has been offered by the first of the aforementioned measures (i), that is the fiscal deduction of (part of) the refurbishment costs and the capital grants, operational for more than 10 years. However, such measures are not well adapted in coping with energy poverty. Even if both housing owners and tenants can benefit from fiscal deductions, tenants are unlikely to apply without the owners’ consensus, which may be missing in many cases. In addition, an investment capital as well as a sufficient income to profit from a meaningful deduction are needed in the initial phase. The aforementioned “curative” strategies are necessarily complemented by “palliative” measures, aiming at the immediate reduction of the energy expenditure for certain consumers categories.

The reduction of energy expenditure for some consumers groups (ii) is one of them. The so-called “Energy bonus” has been set-up to discount electricity and gas bills on a yearly basis. Beneficiaries are the households under a certain income threshold, numerous families with more than three children, or people affected by chronic illness needing dedicated electromedical equipment (to whom are accorded further benefits). Official follow-ups witness that only one third of the eligible (grid-

<sup>6</sup> Database Odyssee-Mure: Energy Efficiency gains since 2000, [<http://www.indicators.odyssee-mure.eu/online-indicators.html>]

<sup>7</sup> ARERA elaboration on Eurostat data, July 2017

<sup>8</sup> ARERA Annual Report 2018, March 2018, fig. 2.13

<sup>9</sup> For a typical 2-3 people household occupying an 80 m<sup>2</sup> dwelling that consumes circa 15 000 kWh/year on average (68% for space heating, 17% for electricity, 5% for domestic hot water production and cooking)

connected) households have applied for this allowance in 2014, raising the equivalent of two monthly bills<sup>10</sup>: thus, the impact of the measure on energy poverty has been judged as substantially ineffective (Miniaci, Scarpa, & Valbonesi, 2014). According to a recent report (Faiella, Lavecchia, & Borgarello, 2017), the necessary funding to ensure minimal comfort to energy poor households during wintertime is equal to about 600 million €, roughly seven times the amount currently accorded in the framework of the gas bonus.

As for the third category of existing national policies associated with energy poverty problem (iii), that is the protection from energy services disconnections in specific circumstances, a dedicated vulnerable consumers list is established by law (Cfr. Art. 3 ARG elt 117/08). Currently, the list includes people affected by chronic illness needing dedicated electromedical equipment. A recent decision of the Italian Supreme Court of Cassazione<sup>11</sup> states that electricity is not to be considered an essential good, and poverty does not justify illegal, abusive yield from the grid on account of a claimed state of deprivation. One may conclude that the “universal right to energy access” promoted by the European Union and partially adopted in some countries, e.g. France (Dubois, 2012), is far from being compliant with the Italian case law.

From the previous description, the institutional awareness on the energy poverty issue seems to be at an early stage in Italy. In spite of this, the Italian National Energy Strategy 2017<sup>12</sup> evokes the institution of an Italian National Energy Poverty Observatory, gathering stakeholders and decision makers with the aim of identifying and protecting vulnerable energy consumers.

Beyond the public effort though, a flourishing ecosystem of social innovation is raising almost totally on private initiative: 90% of social incubators in Italy rely on private investments<sup>13</sup>. There is a growing corporate interest in creating new market opportunities from social impact, which is a distinctive and interesting element of Italy. The collaborative platform presented in this paper is ascribed to this framework, experiencing new cross-cutting interactions between academic institutions, charities and private companies.

## 2 Objectives and strategies

The common conviction that a local, participated action is essential to eradicate the problem of energy poverty is the starting point for the group constituted by the Energy Department of Politecnico di Torino (DENERG); the Department of Economical-Social and Mathematical-Statistical Studies (ESOMAS) of Università degli Studi di Torino; the do-it-yourself retailer Leroy-Merlin Italy and the S-NODI Committee “Gabriele Nigro”, operating on behalf of Caritas Piemonte charity.

A collaboration was initiated in 2016 to launch a pilot project targeting around a hundred households in Piemonte, a region in the North-West of Italy. The action entitled “Fighting against Energy Poverty” was designed to pursue three main synergistic goals:

1. Technical goal: analyze the structural causes of energy poverty and increase the energy efficiency of the households’ dwellings.

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<sup>10</sup> AEEGSI (2015), Segnalazione al Presidente del Consiglio dei Ministri, al Ministro dello Sviluppo Economico, al Ministro dell’Economia e delle Finanze, al Ministro del Lavoro e delle Politiche Sociali, in merito alla disciplina del bonus elettrico e gas, 287/2015/I/COM.

<sup>11</sup> Corte di Cassazione – summer term – sentence n. 39884 of 4<sup>th</sup> September 2017.

<sup>12</sup> Ministero dello Sviluppo Economico, Strategia Energetica Nazionale 2017 – 10<sup>th</sup> November 2017, p. 226

<sup>13</sup> Social Innovation Monitor (Politecnico di Torino), Impatto sociale degli incubatori/acceleratori italiani, Ricerca 2017, p. 13.

2. Educational goal: increase awareness on everyday life energy saving practices and household budget management strategies. Constitute a knowledge base for charities facing a growing demand to support the payment of energy bills.
3. Empowerment goal: involve households in a proactive action to improve their own condition with a do-it-yourself approach.

The first target was achieved through a simplified onsite energy assessment of the dwellings and the installation of a free set of simple and cheap energy saving devices, tailored on each household's needs. These actions were performed with the help of voluntary staff of the charities that provided the list of potential beneficiaries, selected among households in their care. The necessary technical and socio-economic background was offered to the operators of the charities through a dedicated educational program set-up by the academic institutions, as a support for the engagement, analysis, installation and follow-up phases. The devices were installed by households' members themselves, eventually assisted by the volunteers, to make them aware of their energy use and let them understand the systems and devices functioning. As such, they could take action in person to slightly improve the efficiency of their energy equipment and realize how to adjust their behavior in every day operation.

This strategic concept has been originally developed in Frankfurt by the municipal energy department together with the Caritas association in 2005, and then spread on the German territory, with the project name of "Energy Saving Check"<sup>14</sup>. "Stromsparcheck" in German, was active between 2009 and 2015. More than 600 000 cheap energy saving devices have been installed in dwellings belonging to 125 000 households (at 2014) from more than 90 cities on the German territory. A report in 2011<sup>15</sup>, estimated the average annual savings per household at 87 € for electricity and 24 € for heat, as for a global public investment of 28 million €.

Beyond the general methodology though, several adaptations to the North-West Italian context have been carried out, compared to the German case. As an experimental project without any funding support from the institutions, the budget was limited to 80 000 €, self-financed by the project partners. Instead of hiring a group of job seekers or long-term unemployed and educate them as "energy advisors", for this role the charities relied on their contract staff assisted by dedicated volunteers, motivated by finding an effective response to a growing and urgent exigence from their target public. This allowed a time contraction of the preparation phase and the containment of the costs. However, the most evident novelty introduced by the project "Fighting against Energy Poverty" is the involvement of a private company in the framework of its Corporate Social Responsibility.

The multinational do-it-yourself retailer Leroy-Merlin donated the energy saving devices needed for the pilot phase, creating a shared value in terms of both environmental and social impact for the whole community. A proactive attitude eventually arises from the conviction that cheap products, coupled with personal determination in adopting a correct behavior, are effective energy saving strategies: this attitude is positive for the do-it-yourself market promotion as well. This action offered, among others, the occasion to explore possible market segmentation and customer proximity strategies.

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<sup>14</sup> Caritasverband Frankfurt e.V. and Institut für Energie und Umweltforschung Heidelberg GmbH. Guidelines: Introducing advisory services on how to save energy for low-income households. Final report, on behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Frankfurt am Main, August 2010

<sup>15</sup> Dr. K. Tews, Evaluierung des Projektes „Stromspar-check für einkommensschwache Haushalte“ Ergebnisse zur erzielten Energieeinsparung / Klimawirkung in Phase 1 und 2, 24.10.2012, BMU, Berlin.

The ambition of the project is to stimulate local initiatives based on simple technical evidence and trigger community aggregation around energy saving opportunities. This synergy between energy efficiency and social aims, in line with the policy recommendations expressed at the European level (Atanasiu, Kontonasiou, & Mariottini, 2014; Ugarte et al., 2016), constitutes the main expectation in terms of practical outcome beyond the moderate energy saving goals.

### 3 Methodology and project realization

The project “Fighting against energy poverty” has been organized into several main phases, carried out along two years, starting in early 2017 (Figure 1). The preparation phase, including the recruitment of the staff, the accomplishment of the educational program and the selection of the eligible public. The engagement phase, featuring the visit of the dwellings and the administration of the surveys to the households. The installation and monitoring phase, in which customized energy saving product sets have been distributed to the beneficiaries and their impact assessed over time: the monitoring process is currently not concluded yet and expected to end by half 2019.

Preparation Phase	recruitment of the staff	50% contract staff and 50% volunteers
	educational program	energy billing and energy saving comfort households budget energy saving kits and video tutorials
	identification of the beneficiaries	definition of eligibility criteria households selection within Caritas lists
Engagement phase	survey filling	households conditions housing appliance dwelling technical features
	personal advice	
Installation phase	customized kit design	
	distribution to charities	
	delivery to households	
Monitoring phase	energy billing collection and analysis	

Figure 1. Project outline

### 3.1 Preparation phase

The project involved local charities of the Caritas network from six major cities in Piemonte and Valle d'Aosta (Alessandria, Aosta, Biella, Casale Monferrato, Novara, Torino). After the recruitment of the operative staff in charge of the charities, coordinated by the S-NODI Committee, participants could attend a dedicated educational program set-up by the academic institutions. The program included an introductory framework presenting statistics and socio-economic facts regarding energy poverty in Italy, before covering a practical guideline to tackle the issue. The standard format of energy bills was analyzed into detail and the meaning of all cost items explained, together with their usual incidence on the total cost. The typical household appliance power load and the energy labels were investigated, providing basic understanding of the building energy balance and energy supply networks. The differences between enhanced protection and liberalized market were also discussed, identifying public subsidies and the relative eligibility criteria. A definition of minimal comfort requirements was provided in relation with the different energy uses and “good energy saving practices” explored for each.

In total, 15 operators attended the specific educational program (8 from contract staff, 7 volunteers), representing a mixed technical and social assistance background. In parallel with the educational process, the charities began the selection of the beneficiaries from the public in their care, in accordance with some eligibility criteria agreed with the scientific partners. In particular, selected households were in a documented energy poverty condition, characterized by an energy expenditure above 10% of their income on an annual basis. They should guarantee a minimal housing stability of two years and committed to submit their energy bills from 12 months before to 12 months after the installation of the devices, in order to analyze the impact of the energy saving campaign. After the screening phase, 85 households from the six different cities could be selected (Table 2).

Table 2. Selected households in the screening of the preparation phase (total base = 85 households)

	1	2	3	4	>4	Number of respondents	
<b>NUMBER OF HOUSEHOLD'S COMPONENTS</b>	8	16	11	20	28	83	
	employed	unemployed	retired	Number of respondents			
<b>WORKING CONDITION</b>	28	23	10	61			
	primary s.	middle s.	high s. or higher	Number of respondents			
<b>SCHOLARIZATION</b>	9	23	3	35			
	no issues	chronical illness	Number of respondents				
<b>HEALTH CONDITIONS</b>	26	12	38				
	Alessandria	Aosta	Biella	Casale M.to	Novara	Torino	Number of respondents
<b>HOUSEHOLD'S CITY</b>	10	14	15	8	16	21	85

### 3.2 Engagement phase

During the engagement phase, carried out at end of 2017, the operators visited the households at their residence place. Households were asked to provide their electricity and natural gas bills, as well as to respond to a profile survey, prepared ad-hoc to collect information regarding the household's composition, the housing conditions, the technical and constructive features of the dwelling, the characteristics of electric appliances and other energy systems, as for space heating and domestic hot water supply. Information regarding the energy suppliers, the receipt of the energy bonus or other energy related allowances, the living standards and the household's behavior in relation to the energy use were also gathered, in an anonymized form: only charities are in personal contact with the target public.

Throughout the visit, the operators tried to identify appropriate energy saving practices to decrease the energy expenditure burden by keeping acceptable households' comfort conditions. A checklist of possible strategies together with an assessment methodology were provided to the operators by energy experts during the educational program. Specific advice was made available for lighting, electric and electronic appliance, cooking and food conservation, heating and cooling, water use.

After the contact with the families, a discussion between the operators and the scientific board was scheduled to gather feedbacks and feelings before starting the operational phase.

### 3.3 Installation and monitoring phase

All the devices potentially included in the energy saving kits were selected by a mixed team of energy engineers from the academic partner and retail staff from the commercial partner. The whole set was presented to the volunteers, highlighting installation instructions and expected benefits. To convey this information in the clearest way, a set of video tutorial was produced and published online<sup>16</sup>. Based on the outcome of the surveys distributed during the engagement phase, a customized set of devices was tailored by energy experts on each household's needs. As such, only the strictly necessary was delivered to the beneficiaries. The 2325 donated devices, with a total commercial value of 15 000 €, include switchable power strips, timed plugs, LED luminous sources (in replacement of incandescent ones), presence detectors, retro-reflective films for the back of radiators, caulk and sealant to improve airtightness of windows, thermostatic radiator valves, water saving shower heads and faucet aerators (Table 3). The delivery process was split in two steps: first, the devices were entrusted to the charity operators, and then they were allocated to the households. To avoid leaving the devices in a warehouse, contact persons from the charities could exchange the products and fine-tune the researchers' forecast. A web-based exchange platform dedicated to charity organizations<sup>17</sup> could be used in a scale-up perspective of the project.

The energy saving monitoring campaign has been launched in October 2018 and the anonymized data collection is still in progress, expected to end by half 2019. In the next months the researchers of the Energy Department will perform the analysis of the energy bills emitted one/two years before and one year after the intervention, to investigate the attained energy saving and the increased awareness of the households.

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<sup>16</sup> Video tutorials are available on the Leroy-Merlin CSR online portal:  
<https://csr.leroymerlin.it/sociale/insieme-contro-la-poverta-energetica/>

<sup>17</sup> [www.celocelo.it](http://www.celocelo.it)

Table 3. List of energy saving devices included in the kit.

	Light bulb LED 10 W (E27)
	Set of 3 light bulbs LED 7 W (E27)
	Light bulb LED 4 W (E27)
	Light bulb LED 5 W (E14)
	Light bulb LED 3 W (E14)
	Power strip with pedal switch
	Power strip with button switch
	Timed electric plug
	Light bulb LED 12 W with motion sensor
	Retro-reflective film for radiator back
	Kit Thermostatic radiator valve 3/8"
	Kit Thermostatic radiator valve 1/2"
	Thermostatic head
	Faucet aerator
	Water saving shower head
	Solar power bank for mobile phone
	Electric plug with embedded watt-meter
	Sealant for windows and doors
	Adhesive transparent sill

## 4 Preliminary outcomes

Between the engagement and the installation phase, 15 households changed their status and did not fulfil the eligibility criteria anymore. Mainly, the reason resides in the unstable housing conditions of the target public, who rarely spends more than few months in the same dwelling, sometimes incurring in rent payment arrears or simply looking for better working and living opportunities. In other cases, households were afraid of being monitored by the energy utility or were lacking confidence towards the charity operators. As such, only 60 of the 85 selected households (70%) in the screening of the preparation phase could be included in the operational phase of the program.

Currently, the average annual expenditure in energy bills per household amounts to 1267 €, which is close to the national average (see paragraph 1). The average electricity consumption per dwelling is equal to 33 kWh/m<sup>2</sup> year (42 for dwellings whose domestic hot water is supplied by electric boilers and 30 for the others) and the average gas consumption per dwelling is equal to 119 kWh/m<sup>2</sup> year. Both figures do not correspond to a particularly high consumption: on the other hand, the energy performance of the dwellings does not seem to be first-rate, which might reveal self-restrictions in energy consumption. Almost all the selected households live in a flat (95%), more than half of which (54%) is qualified as subsidized social housing: the average floor area is slightly lower than the national average, i.e. 71 m<sup>2</sup>. Unsurprisingly, 84% of the dwellings are situated in buildings realized before 1970, when no building insulation or energy saving standard was in force. One third of the sampled households declare their windows are in a poor maintenance status and another third states it is medium. Most of dwellings (75%) are equipped with gas boilers or district heating exchangers, but a non-negligible fraction (25%) is heated with oil boilers, stoves or electric heaters. As for the artificial light sources, before the distribution of the energy saving kits, 33% of all sources was constituted by

low-efficiency incandescent light bulbs, 46% by fluorescent lamps, 13% by halogen light bulbs and only 8% by high-efficiency LEDs.

Certainly, the energy expenditure is not easily affordable to the beneficiaries of the project: almost half of the households often experiences arrears in paying the energy bills (46%), summed with another third who encounters difficulties from time to time (34%); almost half (47%) declares being supported by a charity organization in paying the energy bills. Only one third of the households (32%) are supplied by the regulated market operator (i.e. enhanced protection), but 55% receives the energy bonus allowance.

At the current stage, it is still difficult to assess the effectiveness of the energy saving treatment operated in the framework of the project. In spite of this, some preliminary results from a small sub-sample of seven households in the city of Novara reveal some insights. In Table 4, electricity and gas consumption values are issued from the expected annual consumption specified on the energy bills, and then averaged across the available billing periods, before and after the installation of the energy saving kits. At a first glance, a variability of the trends can be observed across the different households, which may be explained by the uneven motivation of the participants, their behavior, the rebound effect due to the confidence in the energy saving devices, etc. It is soon to draw any conclusion, but beyond the variability and inconsistency of the data, the majority of the observations report a decrease in energy consumption, with an average 10% diminution, in line with the expectations.

Table 4. Electricity and gas consumption trends, issued from the annual consumption specified on the energy bills (before vs after the installation of the energy saving kits).

	ELECTRICITY (kWh/m <sup>2</sup> year)			GAS (kWh/m <sup>2</sup> year)		
	<i>pre</i>	<i>post</i>	<i>trend</i>	<i>pre</i>	<i>post</i>	<i>trend</i>
<b>NO01</b>	38	34	-11%	51	58	12%
<b>NO02</b>	39	20	-49%	47	42	-10%
<b>NO03</b>	20	18	-11%	12	10	-20%
<b>NO05</b>				87	98	12%
<b>NO08</b>	30	22	-28%	75	67	-10%
<b>NO09</b>	35	40	14%	464	215	-54%
<b>NO11</b>	18	21	17%	171	174	2%
<b>AVERAGE</b>			<b>-11%</b>			<b>-10%</b>

## Conclusions

In this paper, a framework of the energy poverty issue in Italy is outlined, to spread the awareness of the subject and support a multi-disciplinary understanding with the currently available data at the national level.

A mixed academic, commercial and charity platform is presented with the aim of steering local actions against energy poverty in North-West Italy. A pilot project issued from this collaboration and addressed to 60 energy poor households is described.

First feedbacks received from the visit of the volunteers, report a positive attitude of most of the beneficiaries (excluding elderly households), who are keen on collaborating (Figure 2) and sometimes over-optimistic in their energy saving expectations that are currently estimated up to roughly 100

€/year per household. Nevertheless, many difficulties were encountered in retrieving the energy bills; sometimes, beneficiaries simply keep the payment receipts without any energy consumption details, thus completely ignoring the impact of their dwelling conditions and daily behavior on energy bills. In many cases, the absence of cooperation is due to the lack of motivation from the beneficiaries who delay the submission of their bills without a careful follow-up by the charity that may be time and effort consuming.

Despite the general enthusiasm and the positive human relationships experienced during the engagement and survey-filling phase, some of the charity volunteers are sceptic about the effectiveness of the energy saving measures and they are convinced it is more fruitful to invest their effort in other assistive measures, or even just pay part of the households' bills without further investigations.

However, among the fulfilled purposes of this project, there is the creation of an action "toolkit" addressed to charities and institutions in charge of supporting energy poor households struggling with the payment of their energy bills. Moreover, the technical competences acquired by the volunteers during the educational program constitute an important asset that should optimize the process of facing energy poverty within their organization.

Hopefully, available data from the monitoring campaign will confirm the expected energy savings and support the reproduction of the scheme. In particular, possible evolutions of the residential energy advisors are under consideration as well as the promotion of the energy saving kits within a network of proximity level shops.



*Figure 2. A snapshot of the installation phase, captured by a volunteer.*

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