

Energy Efficiency uses in Peri-Urban Regions Egyptian Case Study

K. A. ABED, A. A. EL-MALLAH, and M. A. BADR
Mechanical Engineering Department,
National Research Centre,
El-behouth St., Dokki, Giza,
EGYPT
Kaabed3@hotmail.com

Abstract:-In the context of a global energy crisis and growing trends in energy consumption, the dissemination of energy – efficient domestic appliances through labeling of energy performances and Minimum Energy Performance Standards (MEPS) is seen as a promising public policy tool to slow down the growth in residential electrical consumption. After the success of the US and European Energy Efficiency Standards and Labeling (EES& L) programs for domestic appliances, such programs are promoted and implemented in Southern and Eastern Mediterranean Countries (SEMC) with international donors support, [1, 2, & 3]. This research is carried out through MEDRES project which is funded by EC, [4]. The status of low-income families living in peri-urban areas represented a prospect for saving energy.

The present study is carried out on four steps; surveys, selection of the local initiatives, implementation of surveys and analysis of results. This study aims to analyze energy efficient appliances use in peri-urban and rural areas, technologies and practices effectiveness. This survey was developed in the frame of MEDRES WP3, which is dedicated to Energy Efficiency (EE) in peri-urban context. Results of this study are interesting as there is no available data for energy consumption of poor consumers and potential for energy and cost savings, [5], and [6]. Fridges were used as a measure of electricity consumption as fridges are considered a basic appliance even for urban poor population. This study is targeting the diffusion of "Energy Efficiency Concepts" in poor households, acquaintance of labeled fridges in poor households, and enabling poor consumers to benefit from Energy Efficiency Initiatives.

Key-Words: Energy efficiency – energy labeling of domestic appliances- peri-urban regions

1. Introduction

The high rate of low-income households and the threat of pauperization, in particular among large shares of the urban population create new challenges for the success of EES& L programs. In the absence of specific strategies, the expected national energy savings will hardly be reached, as low-income consumers have low opportunity to purchase more - efficient energy appliances, although they have more access to modern electrical appliances now. Furthermore, the integration of low-income consumers in EES&L strategies could allow them to reduce their energy expenditures and thus ease their general budget constraints. This is more relevant in the case of rising energy prices, a growing burden for low-income households. Through MEDRES project, a socio-economical field survey of this

specific consumer group is carried out aiming to identifying favorable conditions and barriers to access to energy-efficient appliances.

Sustainable development is a global objective that aims to respond to the needs of current generations without compromising the abilities of future generations to meet their needs. The implementation of a sustainable energy strategy is a challenge and an opportunity to make joint progress in the field of human and economic development, using environmentally safe technologies. The strategy focuses on the integration of both energy and environmental aspects into key economic development sectors. To follow up the implementation of the strategy, a set of indicators will be discussed and investigated.

2. Methodology and Survey

2.1. Adapted methodology to assess the EES & L program

Cooling appliances are becoming a basic good in the consumption basket of households and this is also true for low-income consumers. However, it can be assumed, and most of the expert interviews we carried out strengthened this belief, that these low-income consumers mainly possess old and inefficient cooling appliances, the income constraint remaining an important barrier to the diffusion of the energy-efficient appliances. Moreover, these low-income consumers are mostly affected by the increases in electricity prices and they would really benefit from energy-efficient appliances that would allow them to reduce their electricity bill and ease their budget constraint.

2.2. Objectives of the household survey:

This study aims to diffusion of labeled fridges and establishing energy efficiency concepts in low-standard of living households, as no data is available about the quality of life and knowledge concerning energy consumption for poor consumers. Acquisition of these data is necessary to assess the potentials for energy and cost savings, hence enabling poor consumers to benefit from energy saving, and energy efficiency initiatives.

The EE S&L programs are expected to have an impact on two levels; market level and consumer level. This study is focusing on the impacts of such S&L programs on poor urban consumers. The research will try to answer the following questions:

- Is there a potential of energy savings at a poor urban population level through an S&L program for refrigerators?
- Could such a program support related poverty reduction policies?
- What are the success factors of S&L programs in the region?
- How far the programs reach poor urban consumers?
- Would market structure allow an access of poor urban' consumers to labeled fridges?
- Is there a potential of replicating EE S&L programs in the region?

3. Implementation of the Survey

The household survey was implemented in El-Basateen region which is located in greater Cairo. The survey was carried out with the help of the "Environmental Protection and Solar Energy

Association", NGO working in this area. Threefold survey (households' survey) on the three levels; Programme, market and consumer levels was conducted to obtain necessary information. The

As fridge is considered a "basic appliance" in daily life of urban poor population, so, fridges were used as a measure of human life quality concerning electricity consumption.

2.3. Methodology: A three-fold assessment of the EE S&L programs

A three - fold assessment of the S & L programs were designed which aims at producing knowledge and data at the following three levels:

- 1) at program design and implementation level: identify success factors and barriers in the region;
- 2) at the market level: understand purchase and selling behavior in poor urban areas;
- 3) at the consumer level :assess cooling appliances stock and use in low- income households

To answer these research questions, three-fold approach were developed:

1. Program level: Identifying success factors and barriers in the region:

The aim of this part of the research is to identify success factors and barriers for the implementation of such programs in the region, and to formulate general recommendations at the policy level.

2. Market level: Assessing the purchase and selling behavior in shops in poor urban areas

The aim of this part is to assess the EE awareness and knowledge of the retailers and their selling strategies, as well as the consumers' EE understanding and purchase behavior.

3. Consumers' level: Assessing fridge stock and its use in low-income households

This assessment investigates how far low-income households and consumers are aware of the potential benefits of EE and understand this terminology as well as their access to EE appliances. To accomplish application of EE strategies and diffusion of energy-efficient appliances, commitment of all categories of end-users is a necessity, taking into consideration the growth of urban communities particularly, low-income family households, [7] and [8].

Association", NGO working in this area. Threefold survey (households' survey) on the three levels; Programme, market and consumer levels was conducted to obtain necessary information. The

survey was implemented in November 2008 by NRC team-work and the sample size was one hundred (100) households.

3.1. Tools: Socio-economic, semi-quantitative and qualitative surveys:

To assess the above mentioned dimensions, socio-economical field survey questionnaires focusing on crucial level of diffusion for households were designed. Household survey includes; assessment of the fridge status now and acquired, energy consumption behavior and access to EE appliances for low-income, peri-urban households. Questionnaire was developed by EIFER/EDF in

collaboration with the country partner (NRC). In the questionnaire the following dimensions were addressed:

- Socio-economical characterization of households
- Households' electrical equipment and consumption
- Fridge specification, specific uses and user satisfaction
- Household's awareness of EE
- Household's purchase behavior

4. Main Results and Findings

4.1. Cooling appliances in urban low-income households: high potential for national energy savings:

Urban low-income consumers represent a fast growing share of the population and a challenge for EE policies. The household survey sample, chosen within this category of urban dwellers, is aiming the representation of this specific socio-economic group. Some of the socio-economic characteristics of the sample are as follows:

Percentage of university certificate holders = 31%

Average living area (m²/person) = 14, Population density (people/50 m²) = 3.6

Electricity supply availability = 100%, Percentage of frequent electricity interruption = 92%

Water supply availability = 100%, Percentage of frequent interruption = 90%.

4.2. Current status of available refrigerators in poor urban households: old and inefficient appliances:

The first important observation is that most of these households own old and inefficient refrigerators. Despite this fact the interviewed householders show no intention of replacing their fridge in the near future, mainly due to tight income constraint. Additionally, we observed a tendency towards bigger fridges as most of the householders declared that they would change their fridge for a bigger one, which means an increase in energy consumption.

4.3. Urban low-income households and cooling appliances: potential for domestic cost savings

The majority of the interviewed householders expressed a need for saving their daily energy

consumption, as electricity bills represent a tangible share of their limited monthly income (5 to 8%). Some of the households already had problems to pay their bills in the past, and an important share of them assumes this can become a problem in the future given the evolution on electricity prices especially if energy subsidies are decreased as expected. Figures 1, 2, and 3 show a certain potential for energy savings for low-income households.

4.4. Urban low-income households and Energy Efficiency: lack of knowledge and awareness

Despite the previously observed situation showing a need for efficient energy habits in low-income households, we observed a striking lack of awareness and knowledge of EE. Low-income households show a minor knowledge of EE issues in general and of EE labels in particular.

4.5. Commercial channels and the diffusion of energy-efficient cooling appliances: obvious market failures

First, the structures of the market as well as some specific market barriers are impeding low-income consumers to access the most efficient appliances. Our survey highlighted some of these limitations.

1. Price barrier: Price is the first obvious barrier to the diffusion of energy-efficient refrigerators, given the specific income constraint of low-income consumers and the relatively high prices of energy-efficient appliances. The prices of the most efficient appliances that are observed in the shops, is sometimes by far exceeding low-income consumers declared capability to pay.

5.4. Fridge characteristic

- As “Ideal” is the first locally manufactured brand, 63% of all fridges are “Ideal” brand and 22% are “Kiriazi”.
- The capacity of 50% of fridges is in the range (200 to 300) liters and 44% of them range from 301 to 400 liters.
- Only 25% of the fridges are less than 5 years old, 39% are 5 to 10 years old and 21% are from 16 to 20 years.
- About 95% of all fridges are normal type, 53% of the sample are one door and 45% two doors.
- Only 4% of the sampled fridges have Energy Efficiency Label, while the 96% of the fridges does not have.

5.5. Fridge needs replacement

- About 70.6% of the interviewee plan to replace their fridges in the future for one of the following reasons: About 64% need a larger fridge, 26% have to repair their old one,

and 28% need to own new technology. About 48% need to reduce their energy consumption.

- Having the opportunity to buy new fridge they will seek the following characteristics: All the interviewee want fridges that consume less electricity, 91% need less noise, 96% seek better cooling performance and 96% need bigger size.
- Awareness on Energy Efficiency
 - Although 91 % of the sample sees a need for saving energy in their daily life, 90 % of them have never heard energy-efficiency term.
 - About 91 % of the interviewee had never seen fridges energy efficiency labels. 73% of those who have seen the label didn't know its meaning. This is mainly due to the low educational and cultural level of the surveyed sample.
- About 65% of the sample believes that fridge consumes most of their energy consumption, while 24.2% of them think that TV and washing machine consume the most.

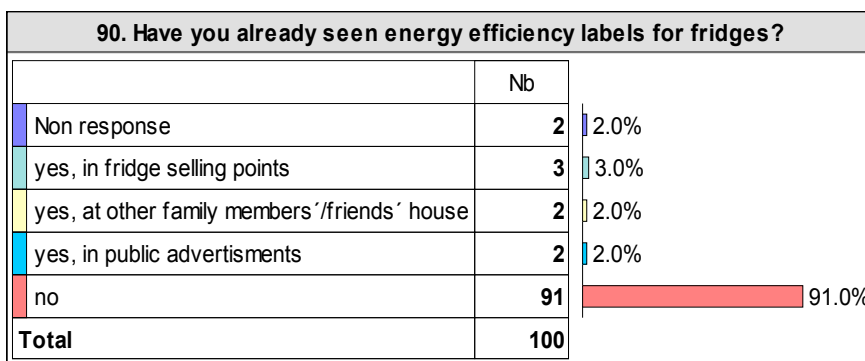
6. Conclusions

- Regarding the potential for energy savings, poor people should be considered as an important target group for EE policies, so it is very important to intensify raising the awareness about energy savings in electrical appliances.
- Low-income consumers are an important group but till now not well impacted by existing S&L programmes.
- In case of refrigerators, peri-urban low-income households show a remarkable potential for energy savings because of their inefficient uses of energy and old fridges.
- There should be strong incentives for these families to replace their old equipment. Households express the need to save energy in their daily life.
- There is an information gap; lack of penetration of EE and label information in shops, labels not always visible, lack of understanding and training of selling staff on these issues. So, the most effective media types for these communities are TV and radio should be used to raise their information about EE label.
- Globally, communications and common actions with all stakeholders should be intensified, as there is currently a lack of understanding and knowledge of EE labelling.
- Incomplete presence of the labels in shops, so new law is needed to force electric appliances factories to examine their products and put EE labels.

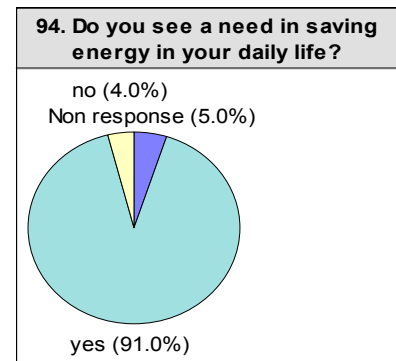
References:

- [1] California public utilities commission, Energy Efficiency, Evaluation, Measurement and Verification work plan, Energy Division, San Francisco, Version 1, Dec. 20, 2010.

- [2] Edwin Hornquist, peak demand, space cooling, energy efficiency and water, July 29, 2010.
- [3] SCE's 2010-2012 Energy Efficiency program Implementation Plan Amendments, Rosemead, California, July 2, 2009.
- [4] "Cost Effective Renewable Energy for rural areas in Mediterranean region", report published by MEDRES project Group, EU Contract No.INCO-CT-2006-032020, 2010.
- [5] John Eggink, "Managing Energy Costs", CRC Press, Taylor & Francis Group, 2006.
- [6] Dick Cheney, " National Energy Policy", report published by National Energy Policy Development Group, May 2001.
- [7] "Energy Labeling of household refrigerating appliances", report published by European Commission No. 1060/2010.
- [8] Lloyd Harrington and Melissa Damnic, "Energy labeling and Standards programs throughout the world", report published by the National Appliance and Equipments Energy Efficiency Committee, Australia, July 2004.



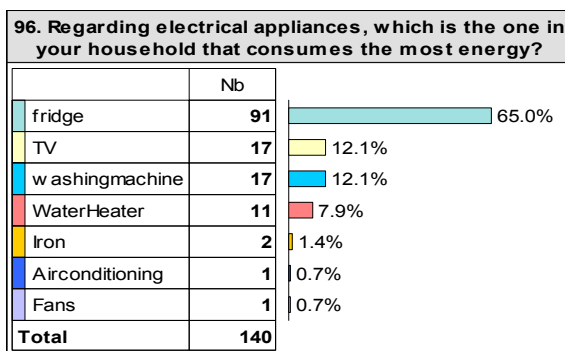
Households Egypt



Households Egypt

Fig. 1: Seeing energy efficiency labels for fridges.

Fig. 2: Need in saving energy



Households Egypt

Fig.3: Which appliances consume the most energy.