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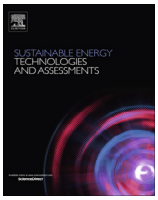

Original article

Innovative energy solutions for improving food preservation in humanitarian contexts: A case study from informal refugees settlements in Lebanon

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ABSTRACT

The paper describes some of the outcomes from the research and cooperation project SET4food (Sustainable Energy Technologies for food utilization), which main goal was to improve food security to refugees in camps and informal settlements, focusing on food utilization. Within the project, pilots have been developed and monitored in different countries, to test a number of energy technologies, mainly related to cooking and food preservation.

In particular, the paper focuses on one of the case studies, considering the methodological and technological innovations put in place in two different informal settlements in Lebanon to improve living conditions of refugees (mainly coming from Syria). The case study is presented from the design to the implementation phase, to the results of the monitoring that can highlight challenges, strengths, and weaknesses of each adopted solution.

The aim of the work is indeed to increase the scientific knowledge on such topic, based on qualitative and quantitative data collected in the field. The results and lessons learnt presented on the paper are likely to provide the basis for more effective technological implementations in humanitarian contexts.

Introduction

According to UNHCR, by the end of 2014 in the world there were about 20 million refugees, 38 million internally displaced persons (IDPs), and 1.8 million asylum-seekers [1]. Their number progressively increased during the last years. Such people show several needs, especially in terms of food security [2]. In the specific context of humanitarian emergencies, however, food security is strictly related to energy. In fact, energy plays a central role to guarantee safe and secure access to food, and its proper utilization. According to OCHA (Office for the Coordination of Humanitarian Affairs) [3]: "Energy insecurity may also drive food insecurity. Without access to a predictable energy supply, communities that are not food insecure may become so, and those who are already food-insecure may become even more vulnerable. There can be no food security for communities without reliable access to a fuel source for heating and cooking". Energy is also fundamental to provide safe and reliable access to water, as well as for water purification. Moreover, access to energy is also related to five more general key challenges in humanitarian contexts: "protection, relations between hosts and displaced people, environmental problems, household energy-related natural resource restrictions and livelihood-related challenges" [4]. Indeed, if people living in camps, and similarly in informal settlements, are provided with appropriate energy services, they may access to a wide range of opportunities to change their condition, and conduct a more productive and active life [5]. Despite the central role of energy in such a context, several gaps are still present in humanitarian response for providing displaced people with an adequate access, and very few studies exist on the matter, especially regarding technologies for food utilization other than improved stoves [6]. As a matter of facts, very few displaced people have access to modern forms of energy, which makes their practices unsustainable, with high average household costs per year and disproportionate CO2 emission compared to quantity and quality of final energy consumption [7]. Therefore, a gap in giving the right importance to energy access

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– in particular in linking relief, rehabilitation and development – is evidenced.

In such regard, in recent years several pilot projects focused on the utilization of energy-efficient equipment or renewable energy in refugee camps [8]. However, such projects often failed for several reasons: in many cases they did not properly consider local socio-cultural conditions, habits or market structures [7]. In other cases, successful pilot projects have not been scaled up because funds have run out. Others have stalled due to a lack in the engagement of the local community, which is often essential to ensure acceptability and the effective management and maintenance of new technologies. In addition, the quality of the evaluation work was usually weak. The focus has tended to be on how many pieces of a certain equipment were distributed rather than whether the equipment was successful in establishing sustainable energy systems.

More in detail, some representative examples of failures or poor outcomes can be reported. For example, in Kutupalong refugee camp in Bangladesh, compressed rice husks (CRH) were distributed as a cooking fuel, but after a reduction in the quantity provided due to a shortage, refugees returned to use firewood. In Nakivale camp in Uganda, UNHCR lead the distribution of several types of cooking stoves. Although the acceptance among local users was on average good, most of beneficiaries tended to sell these stoves to the host community rather than use them in their homes. Such results gave evidence to the need for continued and effective sensitization and training for refugees in order to get them used and comfortable with the technology [9]. In 2008, the organization International Lifeline Fund (ILF) began to distribute fuel-save-stove to refugees living in the Ifo and Hagadera camps in Dadaab. Unfortunately, lack of security in such camps affected negatively the activity of trainings and monitoring thus impacting on the outcomes of the whole project [10]. In 2012 the Moving Energy Initiative (MEI) survey in Goudoubo, Burkina Faso showed that only 1% of the surveyed beneficiaries really adopted a solar cooker, which however was typically used just as a secondary cooking stove [11]. In Haiti, during the humanitarian response to the 2012 earthquake, several international organizations decided to collaborate to produce a showcase for renewable energy supply in displaced contexts. In this framework, the consortium installed a biogas system and a mini-grid system to provide street lighting in Santo 17, a relocation camp in Haiti hosting 358 families. The systems consisted of five bio digesters and a mini-grid with photovoltaic panels and batteries, to provide energy for street lights. However, the project fell into disarray due to poor planning of accountability structures, inadequate assessment of the socio-cultural context and technical failures. The bio digesters never functioned properly, and the street lights stopped to work after a few months [5]. In Somalia, instead, the use of biogas for cooking was rejected by groups of refugees because they were not feeling comfortable using energy produced from human waste [7,11]. In Sag-Nioniogo, Burkina Faso, solar cookers and solar lanterns were distributed, and the construction of mud stoves was introduced. In this case, while the cookers were well accepted, the mud stoves were considered too cumbersome and not durable during the rainy season [7]. In 2013, a natural gas project was developed to cover 2500 households (10,000 refugees) in Abala in Niger. However, although this project is generally considered as a successful initiative which reduced the impact on the environment, 40% of targeted population has continued to use wood for cooking [7]. In the same year, in the framework of the project Atmosfair, improved cooking stoves were provided to 3930 refugees in Kigeme, Rwanda. Although the new stove was using 80% less wood to achieve the same performance compared to a traditional three-stone fire, survey results have shown that only 30% of users adopted such technology [12,13]. On the contrary, in 2014 UNHCR introduced improved energy-saving stoves in Emkulu (Eritrea) with a good level of acceptance by the refugees. However, there were difficulties to find further funding to continue the project since the initial donor chose to support non-energy projects rather than continue with the same pilot. In the same way, in 2015, improved shelters including solar panels to provide energy to power lights and charge phones were installed in Kawergosk (Iraq); however, a lack of funds prevented an extension of the pilot phase [7].

The previous examples give clear evidence on how a number of different issues can threat the introduction of energy-efficient technologies in humanitarian contexts. In this framework, specific actions are needed to overcome the described barriers and problems, with the main objective of improving food utilization in humanitarian contexts. To this end, the present research work aims at describing some of the main outcomes from the SET4Food (Sustainable Energy Technologies for food utilization) project [14], which aimed at enhancing the knowledge on different energy-related technologies for the preparation and conservation of food in humanitarian contexts. The project was carried out by a consortium that included COOPI-COOPERAZIONE INTERNAZIONALE, Politecnico di Milano and Fondazione Politecnico di Milano, and has been financed by the EU DG ECHO. Different case studies were developed in Lebanon, Haiti, Central Africa Republic and Somalia, to test innovative energy solutions in different refugee camps and informal settlements, to improve food security, and in particular food utilization. More specifically, the work focuses on the case of Lebanon, considering the methodological and technological innovations put in place in two different informal settlements of refugees mainly coming from Syria. The case study is presented from the design to the implementation phase, to the results of the monitoring that helped to highlight challenges, strengths, and weaknesses of tested solution. The aim of the work is indeed to increase the scientific knowledge on such topic, based on qualitative and quantitative data collected in the field. The results and lessons learnt presented on the paper are likely to provide the basis for more effective technological implementations in humanitarian contexts.

Methodology

Existing methodologies to support local access to energy services in developing countries usually aim at [15]: (a) supplying people with electricity through off- and on-grid solutions (*electrification*); (b) developing *Integrated Energy Centers*, which provide various energy carriers in bulk for further retail to small households; (c) providing *unplanned energy supply systems*, such as local firewood markets to meet households' cooking needs; (d) implementing *isolated energy carrier/technology programs* to enhance the spread of improved energy technologies, e.g. standalone electric systems, biogas programs, improved cooking stoves, LPG subsidy programs. The International Energy Agency (IEA) [16] introduced the Advanced Local Energy Planning (ALEP), which consists of six phases: (i) *preparation*, which is mainly the analysis of the stakeholders and the current energy situation of the target community; (ii) *orientation*, where the main issues related of existing energy systems are formulated, objectives of the planning process are set, and system boundaries and socio-economic framework are defined in parallel with the energy scenarios and strategies; (iii) *main study*, which consists of a comprehensive analysis of the future energy system, especially considering the design phase; (iv) *evaluation and decision making*, that is an assessment and a ranking of the solutions identified before, and the adoption of the eventual strategy; (iv) *implementation* and realization of the chosen solution; (v) *supervision and monitoring* of the implemented action planning. In the framework of sustainable energy

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