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Energy Provision in Refugee Settings -
Linking Relief, Rehabilitation And Development

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Abstract

This research investigates how energy provision has been implemented in refugee settings. It develops a framework of analysis using concepts of linking relief rehabilitation and development and energy access (basic energy services, social infrastructures, productive uses and market based approach) to identify challenges, benefits and possibilities to improve energy provision with a long-term approach. It applies the framework to review programmes applied in mid to long-term refugee camps and recovers opinions of energy experts and official from humanitarian and development agencies. It concludes that programmes that take into account the interception between energy for social infrastructure and productive uses present opportunities for market development, long-term outcomes and possibilities for resilience among refugees and host communities.

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Acronyms & Abbreviations

BMZ – Bundesministerium für Wirtschaftliche Zusammenarbeit

DFID - UK Department for International Development

EC – European Commission

ESI - Energy services for Social Infrastructures

EUEI – PDF European Union Energy Initiative - Partnership Dialogue Facility

EnDev – Energizing Development /GIZ

GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit

GTZ - Deutsche Gesellschaft für Technische Zusammenarbeit

GVEP - Global Village Energy Partnership

HERA - Basic Energy Services Programme /GIZ

IASC - Inter-Agency Standing Committee

ICT – Information and Communication Technologies

ICS - Improved Cooked Stoves

IEA – International Energy Agency

LDC - The Least Developed Countries

LRRD – Linking Relief, Rehabilitation and Development

MEI – Moving Energy Initiative

NGO – Non-Governmental Organization

OECD - Organization for Economic Co-operation and Development

POBES - Poverty oriented basic energy services

PPEO - Poor's People Energy Outlook

PUE - Productive Use of Energy

RS – Refugee Settings

RVO.NL - Rijksdienst voor Ondernemend Nederland

SAFE - Safe Access to Fuel and Energy

SDG – Sustainable Development Goals

UNDP – United Nations Development Programme

UNHCR - United Nations High Commissioner For Refugees

WFP - World Food Programme

WB - World Bank

WRC – Women’s Refugee Council

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1. Introduction

The world is now facing a worldwide crisis. Currently, there are more people in need and for longer periods of time. According to UNHCR (2016), there were 65,3 million forcibly displaced people worldwide in 2015; and the average waiting period for a refugee is about 17 years. The increment of displaced population around the world have also incremented the energy demand and pressure on resources in the hosting countries, as well as the efficient use of budget by the international community. Most of the refugees living in refugee settlements (RS) managed by humanitarian organizations do not have access to energy or are not connected to gas and power supplies (Lahn & Grafham 2015). This population relies on traditional biomass and kerosene for cooking and lighting, which have bad impacts on the environment and their health (Gunning 2014).

1.1. The challenge of linking aid interventions with sustainable development

Issues such as the duration's uncertainty of refugee camps for planning to achieve a successful transition towards self-reliance of the populations are dilemmas for the humanitarian and development work. Different approaches exist between the immediate responses to emergencies provided by humanitarian agencies and middle to long-term actions implemented by development actors to support reconstruction efforts. At the first stages of a crisis, the most immediate needs have to be covered in the fastest and efficient way for direct impacts. Later on, development actors, with a mandate of transitional assistance, approach crisis aiming for outcomes in the mid to long-term working through governments and other stakeholders such as the private sector. Due to this, there are now new trends for conceptualizing and delivering humanitarian aid. Helen Clark UNDP director used the term "Emergency development" (2016) to refer to a new way of thinking humanitarian aid in crises,

"(...) Even though humanitarian relief spending has tripled in the last decade, it's still not enough. So the emphasis is, how do you shrink the need for it by supporting people's innate resilience and capacities to stand on their own feet?" (CGDEV 2016).

This new concept implies taking into account not only relief aid but also aspects of development such as governance and the support of national policies, institutional strengthening, risk management and market creation and reconstruction. Furthermore, giving the permanent nature of some (RS), it also entails policies on labor permits and the empowerment of the affected population to sustain their own livelihoods (UNDP 2016))

1.2. Energy Access in Refugee Settings (RS)

Access to energy is a basic human need. It is recognized by the Sustainable Development Goals (SDG), which aim to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030 (Goal 7). (Gunning 2014) Basic energy needs must be met to ensure the nutrition and protection of refugees, as well as to manage the camps

efficiently. Energy services such as light, power, heat, cooling and mobility are required to use for water treatment, sanitation, cooking, upholding livable temperatures, running schools and medical centers, public lighting, electricity for lighting households, communication and productive/economic activities (Lahn & Grafham 2015).

The lack of information on energy consumption-provision in RS is a demand of the international community and host countries to respond adequately to the challenge set by the crisis. The most comprehensive research study on energy provision in RS is the recently made by Chatham House within the Moving Energy Initiative¹ (MEI) (See: Lahn & Grafham 2015). In this study, it is explained how some relevant questions regarding energy provision appear in the context of short-term delivery of energy services and long-term development solutions.

According to Lahn and Grafham (2015), there is a nexus between energy provision and other areas of humanitarian services, such as water, sanitation, food, health and education. Furthermore, effective energy management requires the expertise, practices, materials and governance involved in delivering larger services from development. The latter requires commitments to a long-term planning and the participation of various stakeholders, including the local authorities and communities. Unfortunately, the energy topic in the humanitarian sector is generally overlooked in the planning phases.

The challenges for providing energy during the first stages of a crisis and a sustainable energy access in the long-term are numerous. The acute nature of humanitarian assistance in the relief phase is one of the factors that impede long-term-planning. Energy projects tend to be larger in scale for the development sector and sometimes some key stakeholders are at the national level when the needs of the displaced population should be tackled at the local level. The approach of energy provision in RS has been commonly implemented as short-term deliverables and other structural factors, such as market reconstruction have not been taken into account. As Lahn & Grafham (2015) describe, energy provision can have problematic overlaps; many displaced people face challenges of poverty and energy access similar to those encountered by host populations. Furthermore, political will plays a major role in setting the response for energy because the governments don't think that the refugee camps could be semi-permanent (Lahn and Grafham 2015).

The literature about energy provision in RS presents some documentation about lessons learned on particular projects. However, it shows that pilot projects using more energy-efficient equipment or renewable energy have often failed because they did not consider local social conditions for using products, preferences or market structures (Lahn

¹ MEI is a project, financed by UK DFID and others, "which seeks to meet the energy needs of refugees and internally displaced persons (IDPs) in a sustainable way". More info: <https://www.chathamhouse.org/about/structure/eeer-department/moving-energy-initiative-Project>

and Grafham 2015). There is a gap in the literature identifying conceptual intersections to implement projects using energy-efficient or renewable supply that takes into account not only the basic energy service but also local development gaps. Important initiatives such as the one led by UNHCR and WFP, Safe Access to Fuel and Energy SAFE², MEI and pilot projects such as GIZ's Energy Access for Refugees and Host Communities (HERA)³ in Kenya attempt to coordinate efforts on this matter. However, as Lahn and Grafham argue, the past focus has tended to be on how many items of equipment were distributed rather than whether the equipment is successful in establishing sustainable energy systems. Thus, it is important to address crucial questions about the reconciliation of humanitarian aid strategies requiring fast effective direct solutions and the transition of development actions for the long-term in the energy sector.

² The SAFE humanitarian working group is a coordination platform of key partners working to meet the energy needs of crisis-affected populations around the world. This platform provides coordination and shares information, as well as technical support, tools and guidance for implementation of energy projects in humanitarian settings. The most relevant partners are the UNHCR and WFP. More info: <http://www.safefuelandenergy.org>

³ More info: https://energypedia.info/wiki/File:Factsheet_GIZ_Basic_Energy_Services_for_Refugees_EN.pdf

2. Research Question, Methodology and Limitations

The aim of this research is to investigate whether and how energy provision in RS can be improved with an LRRD approach. It explores the complexity of energy provision in RS by identifying the challenges, benefits and possibilities of connecting energy provision at a basic level with development approaches such as energy for social infrastructures, productive uses and a market energy system for LRRD.

Methodology and limitations

The method chosen for the research is qualitative due to constraints in time, resources and data availability. A literature review was undertaken on the concepts of LRRD and energy access to create a framework of analysis that illustrates the intersections between short-term aid interventions and mid-long-term development actions on a conceptual level. Furthermore, a literature review of energy provision interventions on particular types of RS (Mid-long term planned camps)⁴ was undertaken to identify evidence on the benefits of mid- to long-term actions and extract lessons learned. An important limitation was the lack of data available from energy provision interventions using a market-based approach in RS. Therefore, to complement the validity of the findings a series of semi-structured interviews was implemented with a set of relevant stakeholders directly involved in coordinating long-term measures for energy access in humanitarian settings. This included a convenient sample (Marshall 1996) of 5 senior officials from the SAFE initiative (UNHCR, WFP, The Global Alliance for Clean Cook stoves, United Nations Foundation, Women Refugee Council), 2 practitioners from MEI (DFID and Practical Action based in Pakistan and Kenya), 7 practitioners of the development sector (A representative of RVO.NL and 6 different programmes within GIZ)⁵ and a renewable energy consultant. Semi-structured interviews are adequate because questions can be prepared in advance to tailor them with the previously developed conceptual framework⁶ (Wengraf 2001)

Because the sample was limited, broad generalizations cannot be concluded, however, key aspects for further research were identified.

Outline

The paper is organized as follows. Chapter three presents a general background on the situation of the worldwide refugee crisis. Chapter four firstly reviews the concept of LRRD and describes tools on the energy sector. Secondly, it looks into concepts of energy access. It identifies conceptual inter-relations present in energy access at the household

⁴ The time horizon is described as starting point, middle or long-term settlement. Type of settlements: collective center, reception/transit camp, and self-settled camp or planned/managed camp. (Lahn & Grafham 2015)

⁵ View Appendix 1 for a complete list of the respondents

⁶ View Appendix 3 and 4 for the concepts and the standard questionnaire that was used

level, ESI and PUE for livelihoods' opportunities and EMS. Chapter 5 describes a framework of analysis created from this perspective. Chapter 6, using this framework, organizes a revision of documented cases of energy provision in RS, classifying the types of measures into 4 categories: energy supplies at the household level, ESI, PUE an EMS. Furthermore, it identifies the most important challenges, results and lessons learned of these interventions. Chapter 7 analyses and classifies a selection of challenges, benefits and lessons learned selected from the presented cases and the reflections from the experts interviewed. Chapter 8 concludes presenting some possibilities for improving energy provision having into account ESI and PUE in RS and exposes recommendations for further research.

3. Background

3.1. Refugee Situation

According to the UNHCR 'Global Trends Report' (2016) by the end of 2015 65.3 million people were forcibly displaced globally of which 21.3 million were refugees, a number not seen since the World War II. The root causes are generally related to persecution, conflict or human rights violations. The so-called refugee crisis is global but the developing regions hosted 86% of the world's refugees under UNHCR's mandate. The Least Developed Countries (LDC) gave asylum to 4.2 million refugees 26% of the global total (UNHCR, 2016).

3.2. Types of refugee settings

According to the UNHCR a refugee camp is defined as a settlement that facilitates "(...) the rapid provision of protection and life-saving assistance in the event of a large-scale refugee influx. The establishment of camps can also facilitate the identification of people with specific needs and the delivery of services to them." (UNHCR, 2014:4). Lahn and Grafham (2015) make a distinction between individual accommodation, undefined/unknown (no camp) and different camp accommodations: collective center, reception/transit camp, self-settled camp and planned/managed camp. On this regard Schmidt (ND) elaborates 5 differences between a self-settled camp and a planned camp: freedom of movement, mode of assistance, governance, temporality and population size. Generally planned camps are more restricted, controlled, with temporarily shelter structures, no formal work allowed and high fluidity of population (See Appendix 2). These differences are relevant to identify some of the challenges for energy provision present in RS in comparison to others such as poor rural households.

3.3. Protracted crisis

According to UNHCR (2016), out of the total refugee population a small proportion 201,400 was able to return home voluntarily in 2015, the majority to Afghanistan, Sudan, and Somalia. Resettlement arrivals increased marginally from 105,200 in 2014 to 107,100 in 2015. Nearly 6.7 million refugees were considered to be in a protracted displacement situation at the end of 2015. A protracted crisis is defined as a "situation in which 25,000 or more refugees of the same nationality have been in exile for five years or longer in a given asylum country. (...) These refugees were living in 27 host countries, constituting 32 protracted situations". (UNHCR, 2016:8). The countries with the majority of refugee influx are Turkey, Pakistan, Lebanon, Islamic Republic of Iran, Ethiopia and Jordan. Of which 5 are considered underdeveloped. All of these figures suggest the idea of a worldwide-protracted

crisis and also indicate the urgency to act and think in a differentiated manner beyond mere assistance, taking into account the constraints in LDC for managing protracted crisis.

3.4. Essential needs in a protracted refugee situation

In an acute situation relief and a minimum standard to ensure human survival is the priority. At the start of an emergency, affected persons should have access to minimum protection and assistance, offered provided by an international organization, host government or other entities. For the UNHCR refugee protection requires the access to clean water, food and shelter as minimum standards (Jamal 2000) . However, in protracted crisis the UNHCR has adopted the concept of *essential needs*, defined as “ (...) those elements required to lead a safe and dignified life, this includes having access to education, training, employment, social development, etc.” (Jamal 2000:11). All of these actions encounter the necessity for long term planning. In that sense, sustainable energy access becomes a priority to facilitate the access to complex services beyond survival.

3.5. Energy Access in Refugee Settings

The basic energy needs in RS are cooking, heating and lighting. Different sets of needs are extended, particularly in protracted crisis. The amount of energy –principally firewood– required to fulfil these needs is greater than the provided for the aid agencies (Lyytinen 2009). According to the report of Lahn & Grafham (2015), the majority of household energy use is the responsibility of displaced people themselves. This implies higher prices paid by them for heating and lighting and physical risks collecting and using fuel. For example, in Kenya within the Dadaab refugee camps, household energy calculations are about 24% of refugee’s income on energy (firewood and torch batteries mostly) (Lahn & Grafham 2015).

The MEI has made a global estimate of energy consumption in refugee settings. They used statistical annexes of the UNHCR Global Trends 2014 report, to identify the data on the location and size of displaced populations. The baseline for energy use within the camp population was divided among cooking and lighting as follows, cooking: firewood-dependent household, firewood/charcoal mix, liquid fuel-dependent, LPG and alternative biomass. Lighting: Torch-dependent, kerosene, electricity and solar-dependent. By multiplying the numbers of displaced households in each camp by the average annual household fuel spend for its respective baseline type global estimates were made. According to this model approximately 89% of people in refugee camps have less than 4 hours of access to lighting (Tier 0) and 80% still have low or no access cooking facilities. Also, the daily consumption levels do not exceed 12 watt-hours (Lahn & Grafham 2015). The total spending of displaced households will be of about \$2.1 billion most of it in the form of firewood and charcoal. Many refugee families cannot afford lighting. The costs are paid by

the refugees' population themselves and in some cases, international agencies provide a minimum of firewood to the most vulnerable⁷.

Regarding camp operations, the MEI initiative reports that humanitarian agencies, national governments and NGOs spend significant amounts of money on operations that require energy to deliver essential services such as infrastructure equipment like water pumps, street lights, and facilities such as schools, training centers, hospitals and camp offices. Fuel is also required to transport camp staff. Many of the expenses are charged to the UNHCR main's operation budget. Generally, electricity for camp management comes from diesel generators, which has high costs. An example of this from Dadaab refugee camps in Kenya presents an annual spending of around \$2.3 million in operations and \$9.2 million on fulfilling household needs. (Lahn & Grafham 2015) The lack of reliable energy access also makes the picture worse.

⁷ For details see: (Lahn & Grafham 2015)

4. Conceptual Framework

This section looks into the LRRD approach. Secondly, it explores how the concepts of pro-poor basic energy services and energy for development are inter-related in order to develop a framework of analysis to identify how energy provision measures in RS can be sustainable linking aid actions and development outcomes.

4.1. Linking Relief Rehabilitation and Development (LRRD)

Back in the 80's the concept of LRRD emerged in humanitarian aid while addressing the food security crisis in Africa. It was understood as a linear one-way transition from a phase of relief to a phase of development – the '*continuum*' model. (Mosel & Levine 2014) This model describes how after the end of the emergency relief phase, where humanitarian agencies provide the minimum provision for survival, it follows a phase of reconstruction and then the use of classical development cooperation, carried by different actors. This process passes by handing on tasks from one organization to another. Later on, in the 90's the idea of a linear model was replaced by an approach where all of the elements should be applied simultaneously. This is known as 'Contigum' meaning that various measures of relief aid, rehabilitation and development should be implemented in a more holistic and coordinated approach at the same time (Buchanan-Smith and Maxwell, 1994). This concept was particularly important in the European Commission in the year 2001 for planning on aid budgets. The main objective was trying to fill the gaps between a short-term (1-year budget) humanitarian aid based on immediate deliverables and a long-term budget for development activities in a protracted crisis. More recently, the commitment to LRRD was reaffirmed within The European Consensus on Humanitarian Aid of 2007, trying to carry on with transitions between different forms of assistance (EC, 2007). As Mosel & Levine (2014) describe it, while there have been some changes in the way that relief is delivered and conceptualized, with the use of schemes such as cash transfers and taking into account exit strategies and sustainability, there have been few changes in the way development assistance is provided in protracted crises, specially within the bureaucratic structures. Specialist Duncan Green (2016) narrates how "Oxfam went to a humanitarian donor for drought response funding for Guatemala and Honduras and was told it was 'too resiliency'. (...) It was refused". This shows how the humanitarian funding is still not assessing the long-term approach to respond to crisis.

4.2. Tools for Linking Relief, Rehabilitation and Development regarding energy provision in humanitarian settings

Very few specific tools or guidelines have been developed accordingly with the statements emitted by the European Commission on LRRD (Otto. and Weingärtner, 2013). There is a

gap between the concept and its practical implementation in protracted crisis. Nevertheless, some guides have been developed in the context of food security crisis and disasters. Some approaches take into account vulnerability and capacity assessments (E.g. Hammock and Lautze, 1996:24) while others are more prone into coordination mechanisms; E.g. the 'Joint Humanitarian Development Framework (JHDF)' for 'transition situations' (2011) (Levine and Mosel, 2014) (View Appendix 5). Other example is the OECD DAC guideline for donors in relation to engagement in fragile states and financing transition (OECD DAC, 2007). Even though these frameworks are relevant for operationalizing the LRRD concept; the value of these has to be established with more concrete and sector-wide results (Otto. and Weingärtner, 2013).

Nevertheless, as Bailey R. and Keting M. (2015) describe: "Dedicated agencies, organizational arrangements and funding lines exist for basic needs such as food, water, shelter and health, but not for energy. This means that in the rush to save lives and respond to crises, energy provision is an afterthought - uncoordinated and short-term". Energy is not officially integrated in the cluster system, adopted in 2005 by the Inter-Agency Standing Committee (IASC) as a means of making emergency responses more holistic (Grafham, O. Et. Al. 2016).

4.2.1. Decision Tree Diagrams of Fuel Strategy in Humanitarian Settings

The most important initiative for coordination on energy from the IASC is SAFE. The objective was to provide practical guidance on developing effective coordination and response mechanisms for the collection, supply and use of household energy in humanitarian settings. Within this it was created a decision tree diagram on factors affecting choice of fuel strategy in humanitarian settings. This model proposes 2 paths of action depending on the availability of the resources: Patrols through local authorities or direct provision. Aspects to take into account are: secure physical infrastructure, sustainability of fuel source, safe storage options, familiarity of users and strong market for resale (IASC 2009). Later on SAFE became a multi-stakeholder humanitarian working group but it is not institutionalized as a cluster.

4.3. Energy Access Concepts

Besides the recently created SAFE initiative, sustained efforts of energy provision in refugee settings are inexistent. Moreover, energy provision in refugee settings is rarely achieving a sustainable delivery (Lahn & Grafham 2015). Taking into account that energy provision is a determinant of success that enables not only the minimum standards for survival (heating, cooking) but also to cover essential needs in a protracted crisis, (education, training, health facilities and PUE). It is adequate to review the different

theoretical concepts that have emerged to provide energy access for millions of people in poverty as well as its inter-relations to promote sustainable development.

4.3.1. Poverty oriented basic energy services (POBES)

A first approach that is related with the hard conditions of refugee populations is the so-called pro-poor basic energy supply. The GIZ integrates this approach using the WB's multidimensional concept of poverty "insufficient satisfaction of material and immaterial basic needs" (WB, 2004:10). The basic material needs include food, water, clothing, shelter and health. Intangible basic needs are education, independence, legal certainty, and self-determination (GTZ 2010:5). Consequently, the BMZ identifies a relation between basic needs satisfaction, energy services and development: "Access to energy services is a prerequisite for the satisfaction of [human] basic needs as well as for the development of a modern productive economy." (BMZ, 2007:3). The IEA defines *access to modern energy services* as "a household having reliable and affordable access to clean cooking facilities, a first connection to electricity and then an increasing level of electricity consumption over time" (OECD/IEA, 2011:12). Accordingly Poor's People Energy Outlook (PPEO) 2012, determined the concept of 'Total Energy Access' outlining 6 energy services required by the households as follows:

1. Lighting
2. Cooking and water heating
3. Space heating
4. Cooling
5. Information and communications
6. Earning a living

PPEO helps to identify the basic energy services needed to have a dignified life at the household level with possibilities for human development. Thus, the first challenge in the relief stages of a crisis involves energy basic energy access. However, there can be traced other energy services that require further developmental approach and long-term planning, such as access to mechanical power, including static and mobile shaft power, e.g. mechanized pumps, mills and vehicles. (Bellanca et. Al, 2013).

4.3.2. Energy and Development

Energy is crucial for sustainable development. As Bellanca et al (2013) mention energy access is increasingly recognized in the literature as a prerequisite for human and economic development (Munasinghe, 1987; Perlack et al., 1990; DFID, 2002; GNESD, 2007). The end use of the energy also determines the approach taken for delivering energy (Bellanca & Garside 2013). Naturally, a functioning energy supply is crucial to generating economic growth but is not the only condition. This concept understands energy provision as an

engine for economic development. And the former at the macro level should in the long run lead to developmental effects; for example, the increase of financial income at the micro level. Nevertheless, sustainable energy interventions can contribute directly to alleviate basic human needs, which in a refugee context diminish the acute pressures put into hosting countries. Thus, the following concepts take high relevance to implement long-term measures for energy provision in RS

4.3.3. Energy services for Social Infrastructures (ESI)

ESI is understood as the provision of energy for community services contributing to well-being, e.g. hospitals and schools, communal street lighting or communal water pumps (GTZ 2010). An improvement in the power supply can make a contribution to save lives and improved health care at the same time (GTZ 2010). Social infrastructures such as health facilities need energy, for example for vaccines cooling or the illumination of operating rooms (Lahn and Grafham, 2015).

Tackling energy poverty becomes more urgent when it comes to the refugee population. Especially, when the majority of the hosting countries are those least able to meet the development needs of their own citizens (UNHCR, 2016)

4.3.4. Productive Use of Energy (PUE)

PUE are those which increase income or productivity; "(...) agricultural, commercial and industrial activities involving electricity services as a direct input to the production of goods or provision of services" (Brüderle et al. 2011:13). PUE could be associated with agro-processing, basic industries such as carpentry, tailoring, welding and looming, refrigeration or mobiles charging. (Brüderle et al. 2011) According to Bellanca et al (2013), the need to plan beyond lighting and cooking towards productive usage of energy has been overlooked by practitioners. The expert argues that access to energy should be seen as the beginning of a process to stimulate several impacts for productive uses as well as for welfare-improving services. She recalls on the importance of developing appropriate productive uses of energy through seed capital, capacity building and technology transfer. Improved provision of basic energy services contributes to independence and self-determination of the population's living conditions. It also allows women and men to pursue entrepreneurial income-generating activities or improve productivity of already existent ones (GTZ 2010). Furthermore, small and medium enterprises creation that benefits from social infrastructures such as carpentry or mechanic workshops, training facilities and/or renewable energy products distribution can be seen as examples that interconnect energy for social infrastructures and productive uses. (Bellanca & Garside 2013) Thus, all of these factors are relevant for the long term planning of actions that contribute to enhance self-reliance of refugees' populations and host communities.

4.3.5. Energy Market Systems (EMS)

Franz et al. (2015:12) defines an EMS as a space to “deliver the full range of energy services required by households, community services and businesses, from electricity for lighting and productive uses to space and food heating”. In the EMS different stakeholders are involved in supporting the development of energy markets. The importance of this definition lays in the role it plays to identify the main challenges and actions that different stakeholders (especially humanitarian and development agencies) can make for sustainable energy provision in RS.

In order to achieve sustainable solutions, it is important to collect information to understand what kind of models can be developing to provide energy. It is important to understand the nature of local service management, local supply chain development for equipment and maintenance, and ideally local income-generation activities relating to energy equipment. The particular situation in refugee settings implies different approaches to those used by market development in just a poor setting. The nature of generating protection environments in acute crises makes important to balance the interest of private sector competition and humanitarian principles (Lahn & Grafham 2015)

5. Framework of analysis: Inter-relation between aid basic energy services and energy for development

In order to understand, how energy provision in RS could be improved with a holistic approach. This paper proposes an analytical framework that relates energy services with LRRD on three dimensions: Relief → Poverty-Oriented Basic Energy Services at the household level, Rehabilitation → As Energy for Social Infrastructures and Development → As the integration of ESI, Productive Uses of Energy and Energy Market Systems.

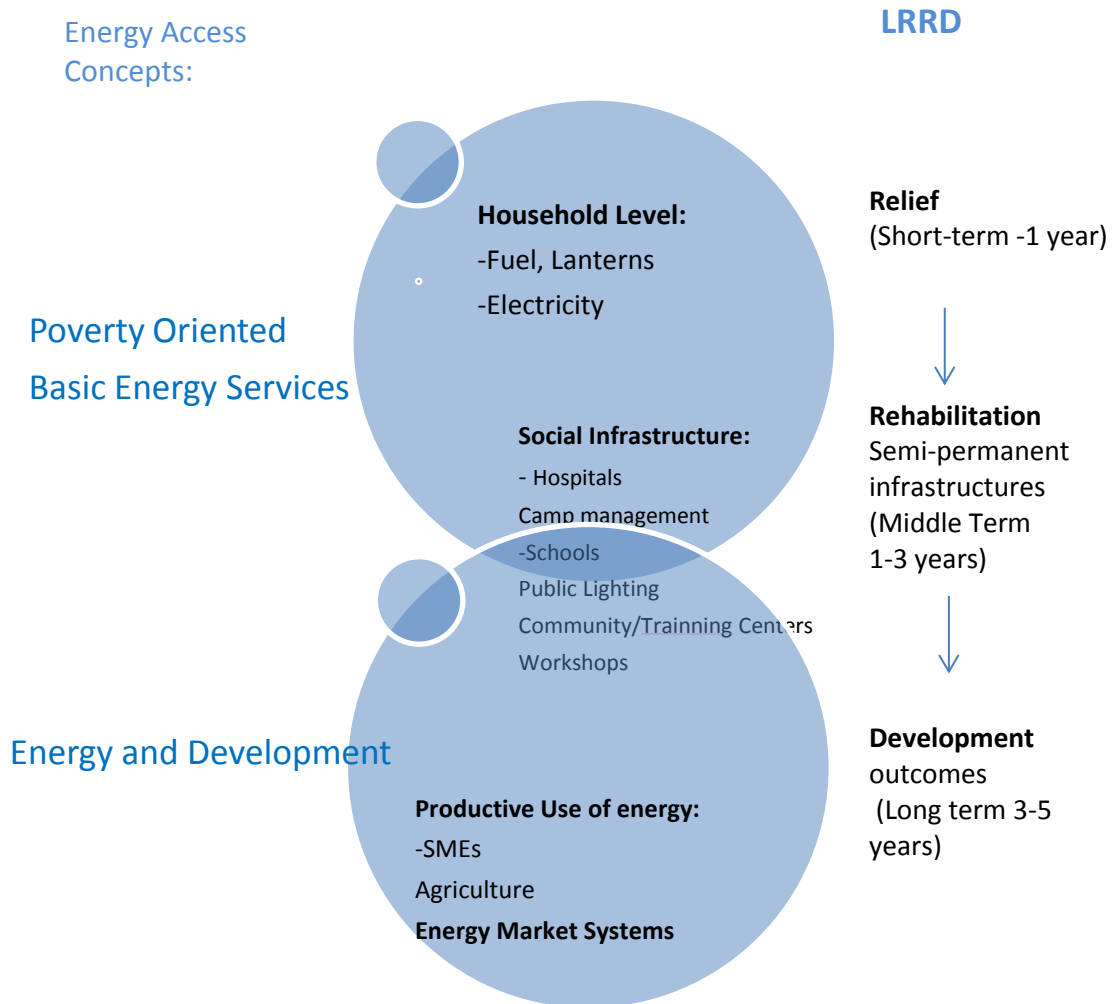
Diagram 1 illustrates how services of the POBES concept can be associated with those implemented in the early stages of relief aid in RS (Fuel and lanterns provision for cooking and lighting), commonly situated at the household and short-term level.

The concepts of ESI and the support of PUE can be found at the stages of rehabilitation and development in RS. Some measures of energy provision for social infrastructure (Energy for semi-permanent infrastructures such as health, education and training centers) and productive uses lead to co-benefits for the host countries in terms of social and economic development.

The concept of EMS is the combination of the former ones taking into account the livelihoods opportunities that emerge from the energy services for productive uses.

The aim of this framework is to classify some examples of energy provision in RS within the categories and to identify the challenges of implementing measures of energy provision that cover the basic survival needs (Relief) but also contribute to the rehabilitation of social infrastructures and support income-generating activities for the refugees and the host community.

Diagram 1: Inter-relation between basic energy services and energy for development in refugee settings



In order to understand how the energy services could be improved in RS in the following section a general overview of relevant examples of energy provision will be categorized accordingly to the analytical framework. Some measures could only be located at the household level, but others play a double/triple role in ESI as well as possible PUE. The column of lessons learned tries to explain how longer-term measures could contribute to the deployment of EMS.

6. Cases overview

6.1. Selection rationale

The case overview is based on the category of formal camps with 2 years of constitution to long-term settlements. Especial emphasis was given to cases where sustainable energy provision was present and sufficient data was available.

6.2. Basic Energy Access at the Household Level

The majority of the energy services in RS are design to cover the acute needs of the refugee population, firewood consumption for cooking, basic heating and lighting. Most of the knowledge and data available regarding energy provision in refugee settings is on cooking energy (cook stoves provision).

Table 1, illustrates 2 examples of Improved Cooked Stoves (ICS) and 2 lighting programmes.

Table 1. Relief Energy Services

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
<p>1. Rational Energy Supply Conservation, Utilization and Education (RESCUE)/GTZ (Kimani, 1995)</p> <p>Dadaab Refugee complex Kenya.</p> <p>1992- 1997 (Camp duration: 25 years)</p>	<p>In 1991 over 400,000 Somali refugees fled into Kenya due to internal conflicts. The camps were located in a fragile ecosystem.</p> <p>Firewood was the main fuel use for cooking and lighting. Women walked up to 8 km and spent 8 hours average collecting firewood that last 4 days.</p> <p>Danger of gender violence was high.</p> <p>Three stones stove the most common. Not saving fuel practices in place. Deforestation. Conflict for resources.</p>	<p>To improve households and environmental problems, the project try to address household's energy supply and utilization trough ICS distribution:</p> <p>Stove for trees and stove for work.</p> <p>Distribution through milk sellers, community cooking and vendors. (Kimani, 1995)</p> <p>ICS self-production and exchange for work.</p> <p>Public education of ICS utilization.</p> <p>Environmental protection included: Tree planting, establishments of green belts, which included labor paid.</p> <p>The aim was that refugees</p>	<p>Free stoves for the most vulnerable can have mixed results because there are not incentives for the refugees to buy ICS.</p> <p>Some vendors refuse to sell ICS because of the lower prices of the black market, which products came from the ICS subsidized programmes.</p> <p>Women do not practice communal cooking.</p> <p>Most of the households had more than one stove, free stoves are not appreciated. (Habermehl, 1997)</p> <p>Environmental awareness programmes can have longer periods of implementation and low impact.</p> <p>The travels made by women</p>	<p>Fuel wood savings:</p> <p>Average of 30% in total Fuel wood savings in institutional kitchens (Schools and hospitals) was of 60% (Habermehl, 1997)</p> <p>Reduce exposure to violence, reduce physical stress</p> <p>Improve nutrition hygiene</p> <p>Lower incidence of burns (Habermehl, 1997)</p> <p>Environmental awareness, slowdown of ecosystem degradation</p> <p>Income generation</p> <p>Refugees acquire new skills and knowledge (Tree planting, ICS production, HH energy saving methods) (Habermehl, 1997)</p>	<p>Aid approaches can be reconcile with development measures such as education and environmental programmes.</p> <p>Sustainability: It is better to facilitate systems under which refugees contribute to the procurement of their fuel e.g. building ICS or exchange for labor.</p> <p>"Energy and refugee programmes should be initiated at the beginning of the refugee situation" (Kimani, 1995:57)</p> <p>"Environmental and energy programmes should be based on a minimum 4 year intervention". (Ibid)</p> <p>Coordination among programmes is crucial to</p>

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
		and host community utilized saving devices, energy saving methods and environmental protection measures. Communal cooking. (Kimani, 1995)	to collect firewood were reduced but the violence persisted because the firewood is the most accessible form of energy. (Kimani, 1995)	"Small producers went into the region in order to sell to the aid agencies or to develop a market in the region. It was an opportunity for the host community and the displaced people to sell locally produce stoves and there was a traditional knowledge already built". Marlin Kees	prevent wrong incentives (market disruptions) "Rehabilitation programmes should be started while the refugees are still in the country, to utilize their abundant labor". (Ibid) Traditional knowledge is important to implement projects regarding daily practices
2. Project Gaia. Alcohol-fuelled Clean Cook Stove project UNHCR's Shimelba Camp Tigray Ethiopia (G/Egziabher et. Al. 2006) Camp duration 12 years	Camp isolated. Lack of energy resources and ban on the cutting of live wood. 10,644 refugees living on the camp. Over population Chronicle lack of firewood Conflicts for resources with host community	Distribution of ethanol-improved cook stoves ethanol supply Environmental interventions with the local authorities, Solid biomass distribution, planting trees, awareness rising. Solar cooking promotion	Ethanol cooker: The ethanol is provided by the agencies and is a costly item more than the stove. Lack of income in the households present a challenge to sustain ethanol supply Solar Cooker performance is not efficient. Traditional cooking practices are different. Refugees do not adopted solar technology. (G/Egziabher et. Al. 2006)	Decrease in the time spent collecting wood and a decrease in the amount of wood Collected. Save time for labor Air quality improvement → Better health	UNHCR concluded that the promotion of solar cookers at Shimelba did not work. It is important to acknowledge local cooking preferences "A more thorough investigation into a cost-sharing mechanism in the camp should be completed". (G/Egziabher et. Al. 2006:23)

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
3. Lights emergency distribution Dollo Ado camps Ethiopia ⁸ 2012	Camp situated in an arid zone. Dollo Ado district is relatively marginalized, deficient in terms of hospitals and schools. Transportation poorly developed. Somali refugees (260,000 approx. at mid year 2013) Limited energy access. Energy limitations affect camp conditions	World Vision targeted 20,000 households Objective: to provide refugee families in Ethiopia with access to lighting solutions. The lantern provided was d.light S2 solar lantern (\$40.00)	Capacity building and ownership awareness for durable solutions and equip maintenance. Funding Insufficient income EMS	Distributed 20,000 solar lanterns to refugee households in Dolo Ado. Improvement in lighting for home study at night Increase sense of security among women and children	Through better partnership with suppliers and NGOs after sales service and follow-up could be improved. Solar handheld devices only provide a basic level of energy access (Thomas 2016)
4. Waka Waka Solar lamps. (Kenya 2013) Kambioos, Dadaab, Kenya. November 2012- January 2013 Camp duration: 2011-present 5 years	Recently experienced draught in the Horn of Africa. Kenya received 1,500 Somali refugees per day in 2011. Kambioos was opened in 2011 to decongest the existing camps 20,000 refugees with 4,212 households. (Kenya 2013) Presence of wild animals (snakes and scorpions) 89% use torches for lighting	Waka Waka Foundation put 144 units of solar lamps at the disposal of UNHCR for testing in Dadaab It was given to the vulnerable (widows, disabled and child headed households)	Majority of the refugees, 50% of the beneficiaries depend on food ration – low to none income. "Beneficiaries found it difficult to pay a suggested value of US \$ 10. 54% (Kenya 2013) People that didn't received lamps felt discriminated	144 households received lamps Increased working and reading hours to six hours. 68% Tends lighting. 100% Increase security perception. They could prevent attacks from snakes and scorpions 95% would like more solar lamps distributed. (Kenya 2013)	The beneficiaries found the lamps useful but they say that were not able to pay for the lamp. With the lacking of funds to buy the lamps other programmes of income generation could be complimentary to the initiative

⁸ <http://www.safefuelandenergy.org/where-we-work/project.cfm?p=128>

6.3. Energy for Social Infrastructures

In the RS context according to Sphere Standards, basic health services require electricity for cooling vaccines and blood storage, power and light to carry out routine operations and power for diagnostic equipment (Sphere Project, 2011). Table 2, illustrates some programmes regarding energy for social infrastructures in RS and its lessons learned for improvement and LRDD.

Table 2. Energy for Social Infrastructures

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
5. Access to public lighting in refugee camps. Jordan. Zaatari. 2012 – present 4 years (WAME, 2015)	Zaatari camp hosts Syrians fleeing the civil war. 2012 45000 people lived in the camp (now approx. 150000). Darkness in the night represents lack of security for women and children who needed to use cooking and toilet facilities.	Actors involved: UNHCR ESF (Electriciens Sans Frontières) Sunna Design, a French company manufacturing. (WAME, 2015) decided install streetlights above facilities and alongside the pathways. Breakthrough technology for solar streetlights that offers unequalled resistance to extreme heat. 10 years durability	Because extreme weather conditions the appropriate technology needed a heat resistant product able to guarantee lighting throughout the night and the years.	100 Sunna ISSL+ streetlights have been installed throughout the Zaatari camp, more specifically around the toilet and cooking facilities. "Reduction of the risk of sexual and gender-based violence Reduction of the incidence of crime. Improvement of the lives of refugees, enabling more community gatherings and social activities" (Merieau &	Products with durable technology need less maintenance cost. Portable devices are better at RS Multistakeholder partnerships are important to deploy new business models and bring innovative solutions tailored to the context

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
				Gebre Egyziabher 2012)	
6. Solar Farm in Jordan Azraq. 2015-1026 (Lahn et al. 2016) April 2014-present + 2 years (Lahn et al. 2016)	Population 54,605. Opened by UNHCR and Jordanian government Limited connection to the national grid Electricity is provided to the base camp Diesel generation for power facilities and NGO's Controlled environment with little economic activity and low income (Lahn et al. 2016)	Mustaqbal – private Jordanian company constructor partnership with UNHCR and the IKEA Foundation. IKEA provides capital UNHCR expect the first 2 MW of capacity to be completed in October 2016. Intended market based approach to raise use. The energy generated by the solar farm will feed the national grid, diminishing energy demands overflows. Refugees are been trained and hired to build the solar farm	Sustainability of financing Transience of residence Lack of payment ability "Jordanian authorities may reject smart metering systems on the basis that they make the population appear more permanent".(Lahn et al. 2016:20) Collecting money needs a special permit and has to be managed by the local electrical companies. Prepaid metering also needs institutional arrangement and a legitimate partner willing to participate.	Provide electricity for refugees, provide a lasting legacy for local populations, and reduce pressure on the electricity grid. "The cost of the amount of electricity generated by the farm and fed back into the grid will be deducted from Azraq camp's electricity bill" (Lahn et al. 2016) 3 highly qualified Jordanians employed and 20 Syrians (Lahn et al. 2016) Government committed to 12 hours of electricity supply to the camps (Hammed Ziadé)	Negotiate with the hosting governments, aligning with their priorities in order to ensure that humanitarian interventions can benefit hosting countries' development goals. EMS (Metering installations) has a highly political factor that has to be negotiated involving the local authorities into the most adequate solution between a semi permanent structure and a reliable energy provision Assessments of private contractors' capacities is necessary Lack of clarity in renewable energy regulation is a constraint for implementation on

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
					refugee settings
7. Solar powered drinking water pumps Kenya. Dadaab IFO-II Refugee Camp 2012 Installation. Camp duration 25 years (Lorentz 2013)	Project installed by Epicenter Trading Co. Ltd. Located in Dadaab the “largest refugee camp in the world” Dadaab is totally dependent on the infrastructure provided by UNHCR and other agencies. Power is only available from several large Diesel Generators, which run 24 hours per day. The only source of water is from boreholes 130m deep (Lorentz 2013)	Findings on an UNHCR energy assessment to explore the use of renewable energy indicated that solar energy was a sustainable solution for pumping water. (Lorentz 2013) Project has replaced diesel generator powered pumps with a solar powered pump. The region has a good solar irradiation. (10 hours of sunshine daily) (Lorentz 2013)	Maintenance experts and training courses. Adaptation to new technologies	Savings of operation cost, diminished risk and complexity in water supply. System is expected to provide an annual saving of about \$10,000 compared to a generator powered-system of a similar capacity. Annual operation cost reduced 70% and by 60% including the capital cost of the system	High operational cost savings validate the higher investment in solar technologies quickly

6.4. Energy for Productive Uses

The literature on energy for productive uses in RS is not extensive. Most of the findings are related to the savings in time produced by reducing the travels to collect wood. Findings mentioned on the previous sections show how solar lamps could increase working and reading hours (Average 6 h)(Kenya, 2013). However, PUE can merge with social infrastructure projects and promote small enterprises. Following is presented a case selection that shows successful enterprises requiring power.

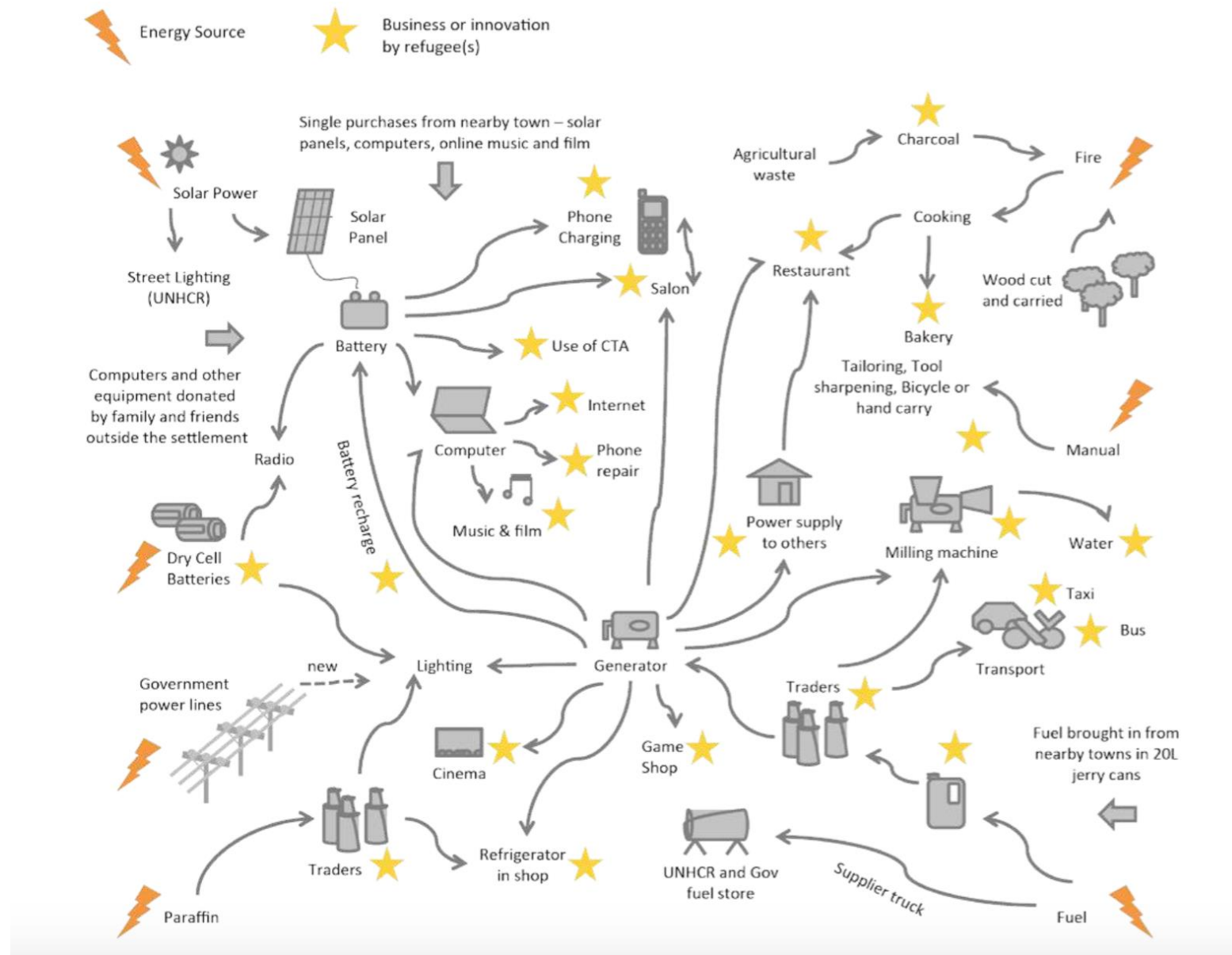
Table 3. Energy for Productive Uses

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
<p>8. Dynamo powered electric generators</p> <p>Kenya, Kakuma III Refugee camp</p> <p>1992- present 24 years (Betts et al. 2015)</p>	<p>Kakuma camp received relocated refugees from Dadaab.</p> <p>Kakuma is not connected to the national power grid. Homes and businesses are dependent on generators as the only energy sources.</p> <p>A GVEP survey in 2015 showed that 83,277 households in Kenya's Dadaab camps spent around \$6.2 million in total per year on firewood. They spent \$1.6 million per year on dry-cell batteries and \$1.3 million per year on diesel for power. (Okello 2016)</p>	<p>An Ethiopian refugee is installing dynamo-powered generators for businesses. Energy is generated through large motors attached to wooden frames and coupled to purchased dynamos, one of which could generate enough energy to power 5 large refrigerators and 40-60 (75 Watt) bulbs for nearby households.</p>	<p>Refugees in Kenya do not have the right to work and have to remain within camps to maintain their refugee status or receive humanitarian assistance (Betts et al. 2015) This puts constraints to livelihoods opportunities and enterprise development.</p> <p>Political will in Kenya is a major constraint, the announcement of the closure of Dadaab refugee camp and there are concerns regarding forced resettlements or discrimination</p>	<p>One dynamo-powered generator in Kakuma III provided electricity for four large refrigerators and a cinema space in a restaurant</p>	<p>Highly skilled individuals are able to serve as a catalyst that allows other businesses and entrepreneurs to flourish.</p> <p>The technical aspects of energy can be enhanced by providing more training on basic renewable energy projects</p> <p>Different enterprises schemes were refugees can improved their skills at the same time that develop livelihood opportunities should be encourage.</p>

# Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
			Resource constraints impedes further innovative ideas to deploy		
<p>9. Connectivity in Kakuma I Kenya, Kakuma Refugee camp 1992- present 24 years (Betts et al. 2015)</p>	<p>Access to mobile and internet services are scarce. Deployment of a tower to provide signal from one of Kenya's largest 3G mobile internet providers. A Somali refugee entrepreneur set up the tower. (Betts et al. 2015)</p>	<p>The signal travels down to a router board in the small cyber cafe at the base of the tower It provides local Wi-Fi to users via four high-power internet routers. Provides the service to camp customers for a monthly fee of 5 USD, more reliable internet service and profits.</p>	<p>Another refugee set up the infrastructure later on he was resettled and the enterprise was lost.</p>	<p>As Abdi describes: "This Wi-Fi service has changed life in the camp in many ways. If you need to know something, you just download it. If you need to check your casework with the UNHCR, you can just check it from the comfort of your home. In the past, you had to go to the highway near the Lutheran World Federation office to receive good 3G signal."(Betts et al. 2015) More affordable internet services provision Income generation</p>	<p>Technical abilities are useful to improve enterprises. Reselling and redistribution from big providers can tailored approaches for PUE with EMS</p>

#	Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
10.	Instant Network Schools (UNHCR, 2015) and Dadaab Community Technology Access Centre (CTA) (Badsah, 2013) Kenya, Dadaab Refugee camp 1992- present 24 years	<p>Leveraging mobile technology to improve the quality of education provided for refugees.</p> <p>Many existing school services for displaced children suffer from under-investment. Educating refugees and internally displaced people is crucial considering the average duration of their displacement exceeds 17 years. UNHCR and Vodafone foundation established 13 Instant Network Classrooms located within three secondary schools, six primary schools and four vocational training centers.</p> <p>Each class room was powered with solar +batteries and back up generator, satellite or mobile network, suit of content and other online resources.</p>	<p>Human-centered approach and community consultation to members about their ideal learning environment.</p> <p>Instant Network School model was developed tailoring it with particular context.</p> <p>Training of coaches and IT support members. Train the trainer scheme</p> <p>Focusing less on the technology and more on developing a cohesive system with a strong emphasis on content and capacity building</p> <p>Vodafone Foundation's staff, including volunteers who have travelled to the camps to assist with the setup and trainings.</p> <p>All Instant Network Schools are built on existing ICT projects to create synergies among the local community.</p> <p>Schools are offering additional training programmes after hours, charging a small fee, to create ownership, a flair for business.</p>	Deconstructing traditional models of teaching, and culturally embedded models of lecturing alone.	<p>20,000 students impacted</p> <p>"The project has helped with children's retention in school and led to an increase in primary school enrolment". (UNHCR, 2015)</p> <p>Computer studies have become a highly valued and demanded course in the community.</p> <p>214 computers distributed to 39 schools and four vocational centers, effectively increasing formal access by 100% in schools and doubling the number of available computers to vocational learners. 145 secondary school students enroll in a week to IT skills classes. Over 800 vocational students registered for the 2013 curriculum. (Badsah, 2013)</p>	<p>Partnerships with private actors foundations while build in a transparent way are beneficial in a long-term approach. The leverage form the private actors is significant to deploy new approaches</p> <p>The approach of built on existing ICT projects presents potential to sustainable solutions and livelihoods possibilities for providing remote basic ICT services (Bellanca 2014)</p> <p>Capacity building for individuals as training of trainers' networks increases the possibilities for sustainability.</p>

Diagram 2. Energy for productive uses. Innovation enterprises in Nakivale camp Uganda. Source: (Betts et al. 2015)



Energy sources are identified in orange and PUE in yellow.

Many micro and small enterprises are interconnected with PUE in the camp. These vary from traditional agricultural, technical workshops (tailoring, phone repair), to ICT business for entertainment (cinemas, game shop). (Betts et al. 2015)

6.5. Market Energy Systems

It is important to recall that there are not many examples of energy provision with a market-based approach in RS. Some interesting lessons could be taken from programmes of rural electrification in poor settings, however, bigger challenges regarding the tensions with the legality of the refugee population and their rights to protection are present in RS.

The MEI initiative is already undertaken research disseminations and trying to elevate the profile of sustainable energy provision in refugee settings. According to the experts interviewed, some key actions to create energy market systems in RS include the improvement of funds to invest in energy initiatives in humanitarian settings, considering opportunities to create benefits for host communities in enterprises that require energy, connecting it with initiatives within a wider energy strategy. Most importantly, to engage local energy contractors and stakeholders accordingly to options identified in the local context. The initiatives should consider “novel payment systems” e.g. franchises for competitively select “Pay as you Go” solar companies, as well as solar kiosk or centers for productive uses. The following are two examples identified to illustrate possible encounters between entrepreneurial initiatives of the refugees to provide energy, one was a pilot coming from the private sector.

Table 4. Market Energy Services

Project Name/ Location/ Time	Description	Approach	Challenges	Results	Lessons learned
11. Electrical power provision refugee enterprise. Uganda – Nakivale camp 1960 - present	60,992 (as of March 31st 2014) National population surrounding settlement 35,000 benefit from water, education, health and nutrition programmes (UNHCR 2015) A private refugee Congolese entrepreneur started a power provision business with a generator purchased from own savings (Betts et al. 2015)	Approach in the words of the refugee entrepreneur: "I have a central generator which gives four major wires with each contracted house. I differentiate the price depending on the number of electronic items in their house. For heavy users, I charge 50,000 UGX [approximately 16 USD] per month but I only charge 10,000 UGX for less users." (Betts et al. 2015)	Initial capital is a constraint to start a business in a shorter period of time. Several different sources of energy can create a dysfunctional market Refugee entrepreneurs and innovators are the ones that are pioneering the use of energy for productive uses. Lack the capital to escalate on their projects	The refugee entrepreneur has positioned her business as basic energy infrastructure provider in her immediate village. Provides electricity for 77 costumers, including Ugandans. The energy provision helps to run other entrepreneurs that require energy access, such as bar (refrigeration) and internet cafés. (Betts et al. 2015)	Uganda has an approach that enables legal work for refugees, which facilitates the entrepreneurial activities and the integration with the locals Seed capital or technology provision to entrepreneur can boost the initial market created on energy for productive uses. (View Diagram 2)
12. Street light mobile phone charging stations - Digicel. Haiti. (Bellanca 2014)	Developed solar-panel-powered street light units that were equipped with sockets to charge mobile phones and car batteries "The station would at the same time render a service to the community by lighting the street and generating income for the operator." (Bellanca 2014:49)	The equipment was provided free as long as it was taken care of. Profit for the entrepreneur was \$100–150 per month Stations installed near the kiosks selling Top Up mobile phone cards and other goods.	There was a culture of paying for the mobile chargers because they prefer that someone took a look after, rather than charging at no cost within the unsupervised station. (Bellanca 2014) Batteries can be stolen and this leads to under utilization of solar installations	400 stations around Haiti Increase in the use of telephones SIM cards were distributed to camp residents and mobiles to leaders. This permitted that the aid agencies could communicate with them	A private actor can work with the humanitarian agencies in a good coordination scheme.

7. ANALYSIS

7.1. Possibilities for improving energy provision using LRRD

The revision of cases presents evidence for an analysis of the possibilities that emerged from interventions that take into account LRRD involving ESI, PUE and EMS. Table 1 shows how most of the programmes in the relief stage were built on free deliverables. However, the cases show how it can be integrated a long-term planning rationale, visualizing an integrated response and inter-sectorial actions. The clearest example of this was the environmental programmes developed around ICS provision, where some agencies implemented environmental education and try to integrate capacity building measures tied to livelihoods possibilities⁹. Options such as planting trees in exchange for ICS or locally produced ICS encouraged the resilience capacities of the refugees and put the seeds to develop basic EMS on the camps. However, at the time (1991) it was still not clear the degree of awareness needed to coordinate free deliverable interventions and the disruptions it creates in EMS.

The concept of ESI helps to understand how there can be co-benefits from sustainable energy provision for the RS and the host communities. The cases described in table 2 show how sustainable provision of electricity is important to have access to ICTs as learning tools in schools and training centers, which later on can represent livelihood (ICT services) for refugees and host communities. This ratifies that focusing on energy access can give the humanitarian and development sectors an opportunity to improve outcomes for refugees while simultaneously supporting host governments' developmental goals (Lahn & Grafham 2015). The deployment of ESI has mixed perceptions, while in the view of the UNHCR, health and education is part of protection beyond survival (Jamal 2000), there are some tensions regarding the permanent character of adequate installations for social infrastructures. Local politicians do not want to accept that the refugees could stay for longer period of times (Lahn & Grafham 2015) or failed at identifying development outcomes for their countries. Case # 7 and 11 illustrates how social infrastructures can provide basic services while building semi-permanent infrastructures.

Cases 8 and 9 in table 3 show the importance to take into account projects that are already been undertaken by different actors to provide energy in RS and to make connections to PUE (See Diagram 2). Putting the lens of an approach such as LRRD contribute to facilitating the transition of humanitarian relief dependence to the ownership and self-reliance of the population. These cases also give evidence of the importance of investing in

⁹ For an integrated revision of Cooking stoves see: (GIZ HERA, 2015)

the skills development of refugees, possibly to rebuild their infrastructures back home, but also to develop local infrastructure. The cases of Jordan are valuable to learn how to identify possible plans of maintenance and/or building of social infrastructure, in the communities/areas close to the camps in order to facilitate energy needs of the hosting country. This represents development spillovers in the longer term. If the local policies prioritize sustainable energy provision in the national plans, an opportunity can be reached to facilitate the willingness of implementing reliable and sustainable energy systems in the areas of the RS, preferable prioritizing sustainable energy alternatives.

Table 3 and 4 illustrate how independence and self-determination enabled by PUE resonates with sustainable approaches that connect EMS. However, particular challenges and risks exist within the RS, which are not present in regular rural settings. Therefore, the identification of inter-related aspects from a conceptual level (availability of local resources, socio-political conditions, market linkages and appropriate socio-cultural process) is required (Bellanca et al., 2013) Some interesting possibilities (Cases 7, 8 and 12) emerge for instance with community owned hydro plants (in some cases private owned for management). Also if there is still the need for humanitarian aid UNHCR could manage this type of plants, having into account that the energy needed inside the majority of the camps is currently provided by diesel generator sets, with overly high cost for the humanitarian agencies an investment in hybrid solar plants will be recovered in shorter time (Lahn & Grafham, 2015).

From a commercial perspective, an important challenge in RS had to do with the demand levels of electricity, which typically tend to be lower due to the low energy consumption per household; as well as the lower payment capacity. However, tables 3 and 4 show how multistakeholder partnerships of humanitarian, development, private and governmental actors could make initial investments in settings where levels of EMS already exist with an emphasis on the intersection between PUE and ESI. According to a senior official of the RVO, the key is to de-risk the private sector investment. Thus, the limitations of energy profitability could be overcome by increasing the demand of PUE (Brüderle et al. 2011). However, the feasibility potential to implement an EMS in RS is even lower than in poor rural settings because of the extreme crisis conditions and other external factors. The lack of income is a challenge identified by advisors of EnDev, which is also present in poor rural settings, therefore some lessons from the energy access for development programmes can be reviewed and adapted to contextual requirements in the different RS. Further research is needed to determine the political economy present at the camps.

7.2. Challenges for implementing sustainable energy provision in a RS

The challenges of energy provision in RS with a longer-term perspective are various. The political context, security and instability are the most recognized by the practitioners

interviewed because of the uncertainty conditions and inability of planning it presents. A crucial matter has to do with livelihoods to guarantee well being of this population. The aim of the international community is not only to provide survival but also to enable that the people make a life with dignity and autonomy. Therefore, it becomes important to find measures of energy provision that improve the quality of life within the camps, and to provide refugees with autonomy. Table 5 presents a summary of the challenges described by the respondents and those identified in the cases. Table 6 shows the benefits of implementing longer-term approaches. Table 7 exposes lessons learned

Table 5 Challenges

Challenge	Description
Coordination	Lack of coordination makes it harder to support EMS and develop ownership. Data on energy consumption is collected by various agencies, which disaggregate the information. There is not a clear lead agency for energy provision in refugee settings due to the lack of an energy cluster in the humanitarian United Nations system.
Ownership	Sometimes people sell the stoves in the market because they prefer cash, then they cut trees and set a traditional fire. It is important to create awareness and ownership with projects such as street lights, so it last longer and is taking care from the population themselves.
Regular income	It is unknown how much money will people spend on electricity, this exacerbates when there is no regular income
Information availability	Lack of data on consumer preferences and energy demand on the camps is an impediment to deploy EMS
Geographical location	Refugee camps tend to be disconnected, poor infrastructure to access grid or markets. Poor access to land.
Capacities of the population	Different capacities among refugees and host communities depending on the context can be a challenge to implement high technology projects
Time framework planning	Uncertainty is a barrier for further planning. Humanitarian agencies have 1 year budget planning and renewable energy takes longer periods of time to deploy. EMS would not work if the refugees are going to be resettled
Legal framework	Lack of regulations to provide coordination with production and distribution utilities, meters and to implement sustainable energy projects. Legal status of the population to work and perform economic activities is burdensome.
Security	Gender based violence and robbery (See SAFE initiative)
Energy experts	Lack of personnel expert on energy provision in the humanitarian sector

7.3. Benefits of a long-term approach

Table 6 Benefits

Benefit	Description
Livelihoods	Training in renewable energy contributes to dignify the lives of the people. Energy access facilitates time availability.
Ownership	"Psychological momentum. A product is valued higher when you choose it and buy it than getting it for free" EnDev expert Ideas coming directly from the population's description of their needs brings better results
Coordination	Helps to facilitate the transition from aid to development by determining the complimentary roles from the beginning of the project
Development co-benefits	Countries that lack sufficient energy access could benefit from energy infrastructures building or enhancement (E.g. Jordan Solar Farm)
Savings	Sustainable energy provision impacts on refugee's budget per household It also ends continuous funding from the international community
Quality	Improvement in the services
Eco-friendly	Sustainable Energy diminishes environmental degradation

7.4. Lessons learned

Table 7 Lessons Learned

Lessons Learned	Description
Ownership	When cultural knowledge is taken into account, sustainability and rate of success is bigger. Training and knowledge transfer is important for success and scalability of the products delivered
Participation	Helps developing better project structures. Is important to involve the refugee leaders.
Involve local authorities	Clarify the regulations is needed to develop a long-term approach. Work with what the government has already built. Establish governance mechanisms for the energy market from the beginning. Design alternatives models of work and legal permits for entrepreneurial activities. As an UNHCR official said, "In locations were there is right to work. The energy planning takes other dimension".
Energy planning	"Thinking about the energy factor from the beginning of the establishments of the refugee setting is important" Energy Consultant
Reduce cost	Renewable energy could be a cost-effective investment for ESI and camps management offices vs. diesel generators
Coordination	Multistakeholder partnerships represent opportunities to LRRD in energy provision. Clear roles and task need to be defined wit the coordination of UNHCR and local government.
Research	Is important to understand the political economy and governance of the RS Information of consumers' energy preferences
De-risk private sector investment	In order to build energy supply with an EMS perspective Pay as You Go for household solar system is a possibility
Energy for Social Infrastructures and Productive Uses	ESI projects are easier to implement and represent developmental outcomes for the hosting community. Also helps to develop PUE and on the long run to build EMS

8. Conclusions

This research has identified the complexity of energy provision in RS. Even though concepts such as LRRD have been put in the scope of the mechanisms to finance and respond humanitarian crises, its implementation is difficult because of the challenges to coordinate, plan and design mechanisms of transition for empowering the populations.

The Energy sector particularly presents challenges to implement actions with LRRD because of the uncertainty for planning, the political instability and the different natures of the humanitarian and development actors involved. However, the literature shows that the concepts of energy access (POBES, ESI, and PUE) and LRRD can be related in a time framework if there is taken into account the basic provision of energy in the short term while addressing more complex responses in the mid and long term such as energy for social infrastructures and productive uses.

The case revision and the respondents' reflections illustrate the importance to respond different to protracted crisis because they had different type of needs. Lessons learned show that clarifying the local government position on refugees is important to identify the type of actions to be implemented and guarantee a long-term approach. The case revision also evidence that projects that include ESI and PUE are easier to implement and have developmental outcomes that can encourage livelihoods opportunities for the refugees and host communities and therefore incentivizes the private sector to invest in EMS. However, further research is needed regarding the political economy and governance of the RS to design holistic solutions that address the immediate needs of the displaced populations, while simultaneously guaranteeing possible EMS linking relief aid and development.

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Appendix 1. List of respondents

Name	Organization
Kathleen Callaghy	Humanitarian Program Fellow United Nations Foundation - Global Alliance for Clean Cookstoves
Corinne Hart	Global Alliance for Clean Cookstoves
Sandra Kraus	Women Refugee Commission Director, Reproductive Health Program
Hamed Ziade	– Ex UNHCR intern Renewable energy consultor
Inga Buchholz	EnDev GIZ
Marlis Kees	HERA GIZ
Marcel Raats	Senior Advisor at RVO.NL
Laura Patel	Programme manager –MEI at GVEP International Kenya
Michael Köberlein	ENDEV/GIZ
Razi Latiff	Resilience & Climate Change Adviser DFID Pakistan
Martin Kerres	Water and sanitation in Subsaharan Africa/ GIZ
Gehrad Rappold	Water and energy nexus in MENA / GIZ
Daphné Carliez	WFP SAFE Global Coordinator Climate and Disaster Risk Reduction Programme Unit
Brigitte Reichelt	Programme manager Somali Reintegration Programme (SRP) /GIZ
Paul Mccallion	Renewable Energy Officer at UNHCR

Appendix 2. Refugee camps vs. self-settled. Data based on (Schmidt, ND)

Aspect	Planned Camp	Self-settled
(i) Freedom of movement	More restricted	Movement to earn livelihood outside the settlement
(ii) Mode of assistance	Based on relief handouts and food distribution with little possibility for refugees to engage in subsistence generally. Only limited income-generating programmes are permitted.	Self-settled refugees tend to be more integrated into the local economy, with or without governmental permission.
(iii) Issues of governance	Generally controlled with participation of local governments and international agencies	Spontaneous decision making mechanisms with autonomous voices and organizations
(iv) Temporality	Temporary shelter structures (tends)	Tends to have more "permanent" shelter structures
(v) Population size	Population Fluidity. Major influx and also people going out due to asylum cases.	Tends to be lower on population

Appendix 3 LRRD concepts applicable to energy measures projects

Adapted from (Levine and Mosel, 2014: and IASC, 2009) the table illustrates key aspects to take into account while designing and assessing LRRD in energy provision

Aspects	Description
1. Politics	Detailed evaluation and planning for scenarios of specific political context
2. Needs and capabilities assessment	Need assessment and capability assessment for developing technical solutions
3. Coordination among stakeholders (International, national and local)	Coordinated context' evaluation and planning coordination among agencies, local governments and others
4. Participation of the beneficiaries in the design	Sense of ownership for the beneficiaries and integration with hosting communities to design innovative solutions
5. Technical aspects	Technological assessment for adapting technology, priority to local availability
6. Flexibility – Adaptation (Including budgets)	Longer-term planning especially for humanitarian agencies
7. Market perspectives	Market possibilities tied to livelihoods possibilities
8. Ownership.	Measures Interconnected with National, regional, local institutions and policies

Appendix 4. Research Questions Sustainable Energy Access for Refugees

Context

1. Description of the context/situation problematic regarding energy provision in the refugee setting
2. Description of the aims/objectives of the energy supply programme
3. Which approach was used? Measures – Long term perspective?
4. What were the most valuable results, impacts, good practices, if already exist?

Long-term approach (Cost and benefits)

- What is the biggest challenge/cost/ risk of applying such approach (long-term or market based)?
- What are the benefits of applying a long-term approach? (Emphasis on the beneficiaries)

Ownership

- Did the measures of energy provision in the camps involved local authorities?
- Did the measures of energy provision in the camps were aligned somehow with the national/regional/local policies? (e.g. RE energy policy, refugees policy, environmental policy)
- How important do you think it is to get involved the refugee population in the design of a project?

Coordination among stakeholders

- How important do you think is coordination with other stakeholders (especially local actors)?
- Can you mention a good practice for coordination in the energy context?

Energy for productive uses/market based approach

- What are the biggest challenges to implement a project of energy provision with a market based approach?
- What possibilities do you recognize for implementing projects of energy as an enabler of entrepreneurship/productive uses?

Social Infrastructures:

- What examples of energy provision for social infrastructure has your organization worked on?
- Is the energy provision of energy for social infrastructures a way to address issues in long – term planning?

Before starting the design of a project, in gathering the information what of the following aspects do you think has to be prioritized. Qualify from 1 to 5 being 1 High priority and 5 low priority.

1. Politics / Security.
2. Needs and capabilities assessment
3. Coordination among stakeholders (International, national and local)
4. Participation of the beneficiaries in the design
5. Technical aspects
6. Flexibility – Adaptation (Including budgets)
7. Market perspectives
8. Institutions (Interconnect with National, regional, local policy/plans)

Appendix 5. Tool. Joint Humanitarian-Development Framework (Henökl & Webersik 2011)

This framework is one of the few that has been developed to implement the concept of LRRD. The European Commission made it for a food security thematic programme. This should be prepared in each beneficiary country, if possible, in collaboration with other donors and partners. It is a decentralized action. It is propose to prepare it in 5 steps: (i) Visions and ideas of each member to understand the crisis (ii) Identification of the population (iii) Joint analysis of all the causes of the problem (iv) Identification of the responses (v) Assessment of the coherence of EU interventions, and strategic priorities to develop a detailed plan