



Alleviating Energy Poverty in Developing Countries Through Utilization of Diaspora Finances in Renewable Energy Projects

A Research Paper presented by: Amirhossein Chitsazzadeh
(Iran)

in partial fulfilment of the requirements for obtaining the degree of
MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

GDP

SPECIALIZATION: PUBLIC POLICY AND MANAGEMENT (PPM)

Members of the Examining Committee:

Professor Peter Knorinnga

Professor Arjun Sing Bedi

Disclaimer:

This document represents part of the author's study programme while at the International Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

Inquiries:

International Institute of Social Studies
P.O. Box 29776
2502 LT The Hague
The Netherlands

t: +31 70 426 0460
e: info@iss.nl
w: www.iss.nl
fb: <http://www.facebook.com/iss.nl>
twitter: @issnl

Location:

Kortenaerkade 12
2518 AX The Hague
The Netherlands

Contents

Chapter 1: Presentation of subject	1
Chapter 2: Literature review	8
Chapter 3: Methodology and strategy of data gathering	25
Chapter 4: Discussing case studies	36
Chapter 5: Analysis and recommendations	66

List of Tables

Table 2-1: Remittances vs Diaspora Investments characteristics	9
Table 2-2: Mechanisms of diaspora philanthropy	11
Table 2-3: Off-grid systems matrix for rural electrification	19
Table 2-4: Common risks in off-grid electrification projects, stakeholders driving these risks, and their governance level	23
Table 3-1: Summary of known instances of remittance-based financing of sustainable energy and climate change resilience	27
Table 3-2: List of interviews	34
Table 4-1: Possible business models for directing remittances to renewable energy products	37-39
Table 4-2: The solar energy products in the third phase: first row for remittance platform, second row for sale in Haiti	45
Table 4-3: ARC's capacity-building strategies	46
Table 4-4: Possible business models in the Bolivia market assessment phase	54-56

List of Figures

Figure 1-1: Percentage of the total population with access to electricity (2000–2019)	2
Figure 1-2: Percentage of the total population with access to clean fuels for cooking	3
Figure 1-3: Share of renewable energy in total final energy consumption and by end-use, 2010 and 2019	4
Figure 1-4: Annual international public financial flows towards renewables in developing countries, by technology, 2000-19	5
Figure 1-5: Trends in major financial inflows to low and middle-income countries 1990-2023	6
Figure 2-1: Types of diaspora finance mechanism	9
Figure 2-2: Sectors invested in through diaspora finance	10
Figure 2-3: Schematic channels between remittances and energy poverty alleviation	13
Figure 2-4: Remittances and Carbon Emissions Relationship	14
Figure 2-5: Remittances-energy security link: A conceptual framework	15
Figure 2-6: Remittance investment spectrum	17
Figure 2-7: Off-grid generation technology classification	20
Figure 2-8: Indicative positioning of some off-grid delivery and financing models	22
Figure 4-1: The business model of the second phase	40
Figure 4-2: Business model promoting agent sales for clean energy products	41

Figure 4-3: The solar energy products in the second phase	42
Figure 4-4: Business model linking remittances with sustainable energy products	43
Figure 4-5: Expansion of diaspora model through agent pilot	44
Figure 4-6: Graphical project overview and commercial platform with key implementation partners and their responsibilities	57
Figure 5-1: The schematic synthesis of research findings	70

Abstract

Unlike the rapid advancement in accessing electricity in the past two decades, there are huge numbers of people all over the world who suffer from energy poverty. Most of these people live in remote areas and sparse populations. The consensual solution for this problem is off-grid electrification based on the potential of renewable energies but there is a financial scarcity to support this initiative. It seems that diaspora finances and especially remittances will be an opportunity for developing countries to overcome this impasse since remittances is the most stable and ever-increasing financial flow from developed to developing countries. In this research, I try to test the viability of this idea by investigating some cases of previous or ongoing projects that make the connection between diaspora finances and renewable energy in Haiti, Bolivia, and the African continent by solar companies. I find that diaspora finances can play an important role in different levels of finance generating electricity from clean energy resources but it is not possible to be the main financial resource of these projects and is more effective in the blended finance method. The other important matters for making a success story are related to building trust with diaspora communities on the push side of these initiatives and having a robust distribution network in the target community on the pull side. These requirements make partnerships with local stakeholders an inevitable element of these projects in an interactive business model.

Relevance to Development Studies

This initiative has some direct social impacts and indirect environmental and economic impacts on target groups. Alleviating energy poverty through this idea enables children to do their assignments in their homes and have more time to study at night, shopkeepers can work more hours after sunset in the evenings and women and girls feel more safety and will have more time with decreasing load of housework. Additionally, it helps to decrease carbon emissions by eradicating traditional fuel usage and declines the households' expenditure for energy products in the long-term.

Keywords

Diaspora finances, Off-grid electrification, Energy poverty, Green remittances, Renewable energies

Chapter 1: Presentation of subject

Introduction

Honestly, I have a controversial background from engineering to social sciences. In my tortuous route, I started my studies in mechanical engineering 18 years ago. At that time, I thought about renewable energies as a way to cut carbon emissions and air pollution. However, my social concerns finally changed my way to a master of political science but energy matters hadn't left me so I did my thesis about "A Comparative Study of Natural Gas Export Policy & Energy Security in Russia, Qatar & Iran" 6 years ago. Due to this research, I read some references in energy security literature and got familiar with the concept of energy poverty.

Unfortunately, after graduating from my first master I couldn't find any job in the energy sector and by chance hired by an NGO as a migration policy researcher. This was an invaluable experience for me to learn more about the pros and cons of this global phenomenon. Since I am an optimistic person, the positive sides attract my attention more. So in the migration field, I was interested to know more about remittances and the role of diaspora communities in the developing process of origin countries.

Finally, in ISS, I thought that I should merge all of my former knowledge and interests to test a new method for financing renewable energy projects in developing countries by diaspora finances. This idea was called recently by one of the famous climate change researchers, Evan Mills, as "Green Remittances" and in line with Sustainable Development Goal 7 that insisted on accessing affordable, reliable, sustainable, and modern energy for all in the 2030 horizon.

Nature of the research problem

Sustainable Development Goal 7 emphasizes ensuring access to affordable, reliable, sustainable, and modern energy for all in the 2030 horizon. This dream can terminate 2.5 million premature deaths annually because of household

air pollution, decrease deforestation because of fuelwood harvesting (IEA,2022), improve the quality of education in schools, and open up time and space for women and girls in daily life (Mandelson,2011,p3)

Based on the International Energy Agency report, 775 million people didn't have access to electricity in 2022 (Cozzi *et al.*,2022). Most of them live in Sub-Saharan Africa with 77 percent of all people who live without electricity in the world. Unfortunately, this poor condition was exacerbated by the COVID-19 pandemic and the Ukraine war that have increased economic problems for poor people so 90 million of them in Africa and Asia have lost their affordability to pay the electricity bills (UNSTATS,2022). IEA predicted that the purpose of SDG7 will not be achieved in 2030 and 672 million people will live without electricity at that time. African people will consist of 85 percent of them (IEA,2022). Additionally, more than 2.5 billion people rely on traditional fuels like biomass, kerosene, coal, and fuelwood for cooking that 60 percent of them with 1.5 billion population living in Asia. Also, 940 million African people are in the same situation. IEA prediction shows that 2.1 billion people won't have clean cooking facilities in 2030 (IEA,2022). This condition is defined by the term "Energy Poverty" which reflects "a lack of access to the modern sources of energy (electricity and non-solid fuels) needed to provide basic energy services like lighting, cooking, and heating" (A.T. Kearney Energy Transition Institute, 2018,p2). In the following maps from the Djeunankan *et al.* (2023) article, it is possible to take a holistic view of this global problem.

Figure 1-1: Percentage of the total population with access to electricity (2000–2019) (Djeunankan *et al.*,2023,p2)

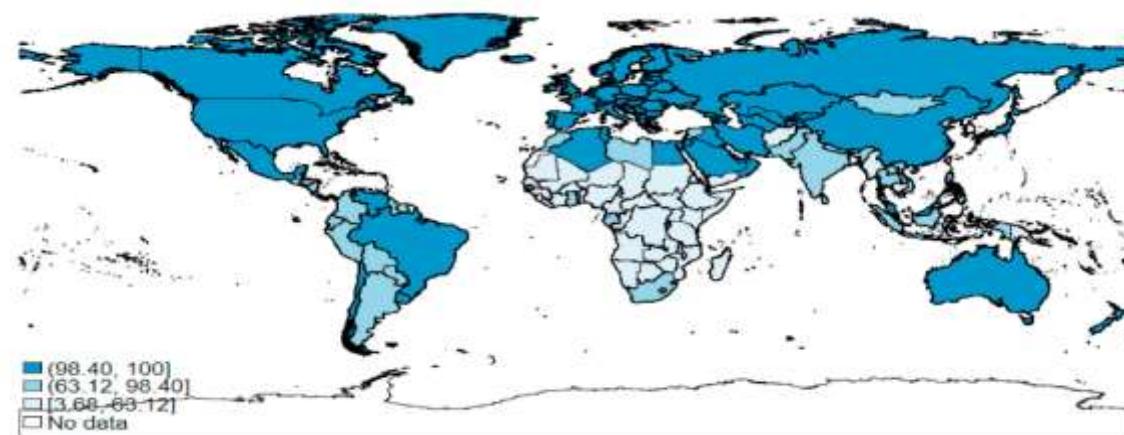
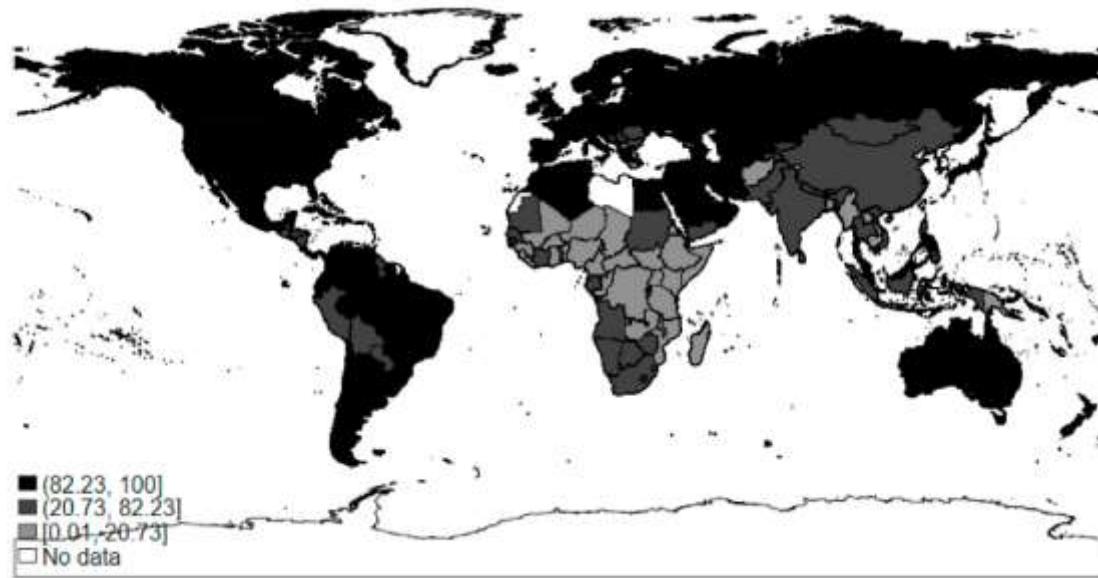


Figure 1-2: Percentage of the total population with access to clean fuels for cooking (2000–2019) (Djeunangkan *et al.*, 2023, p3)

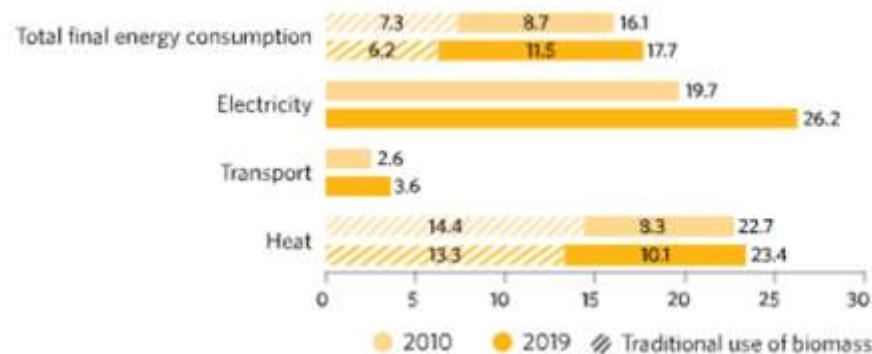


Tracking the outcome of SDG.7 shows that the world experienced considerable growth in electrification, one billion got access in one decade, but this accessibility was distributed unequally across regions since there is a concentration on allocating international public financial flows for boosting renewable energies in a few countries and the others which need more deprived of these finances (World Bank, 2021). The other asymmetry in power distribution is related to the gap between urban and rural areas. Despite an impressive growth in the global electrification rate from 73% in 1998 to 90% in 2020 (UNDP, no date), A.T. Kearney Energy Transition Institute (2018) declared that 87% of people in the world without access to electricity were living in rural areas. They claimed there was the same trend for accessing clean fuel. This huge gap shows there is a serious problem in rural areas to access national grids since the extension of them to scattered communities in remote locations is so costly and not affordable for governments in developing countries. Based on this reality, the International Energy Agency's (IEA) assessment in 2011 supported the idea that off-grid electrification with mini-grids or stand-alone systems will be the best option for 70% of people

without electricity access (Muchunku *et al.*, 2017). All in all, it seems that without universal electrification, the goal of net-zero emission in 2050 will not be attained (Cozzi *et al.*, 2022).

Although, increasing global access to electricity happened via coal and hydropower plants in the past two decades but it seems to end energy poverty in remote areas of developing countries must rely more on the exploiting potential of local renewable resources like solar and wind energy (Muchunku *et al.*, 2017). In 2019, renewables consisted of 11.5 percent of global energy consumption, and is expected it will increase up to 18 percent by 2030. Also, these will produce 42 percent of electricity generation by 2030. Among different varieties, the largest source is hydropower but the fastest-growing types are solar and wind (IEA, 2022). In this regard, access to electricity via decentralized mini-grids has become popular in the last decade, and in 2019 more than two times of 2010 (11 million people) connected to these renewable-based grids. (World Bank, 2021). As we can see in the following graph, modern renewable energies are most used for generating electricity.

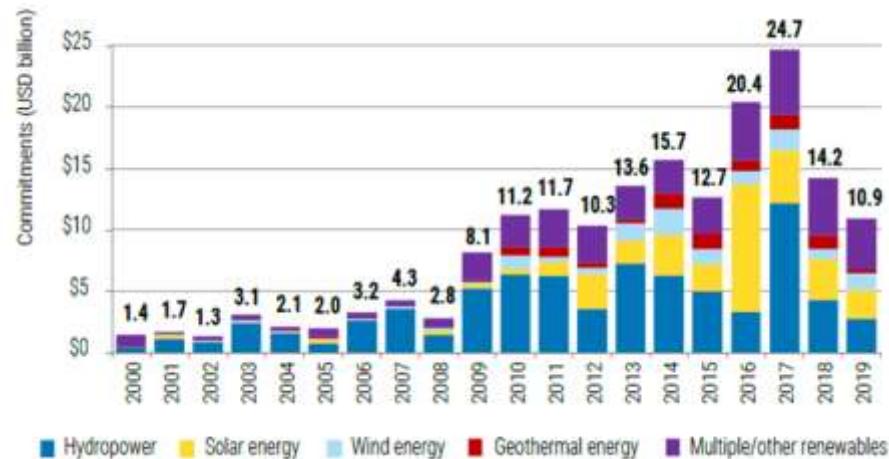
Figure 1-3: Share of renewable energy in total final energy consumption and by end-use, 2010 and 2019 (UNSTATS, 2022)



There is a great impediment to expanding renewable energy capacity in developing countries since financial resources are not enough for sustainable energy solutions like off-grid electrification projects for inaccessible and isolated communities. UNDP claims that estimations demonstrate the demand for 35 to 40 billion USD per year to achieve universal electricity access. Unfortunately, public institutions cannot provide this amount of money annually

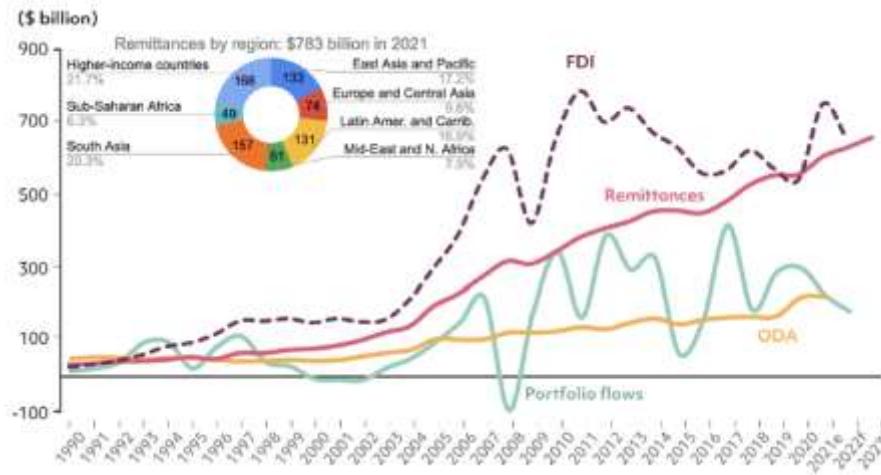
and most private companies don't prefer to take the risk of investment in developing countries (UNDP). The next graph illustrates the volume of financial public resources that were allocated to renewable energy projects in developing countries from 2000 to 2019. The upward trend experienced its peak point in 2017 then turned down and may continue this new trend along Covid-19 and Ukraine war.

Figure 1-4: Annual international public financial flows towards renewables in developing countries, by technology, 2000-19 (World Bank,2022,p141)



Unlike this disappointing trend, there is another financial resource for developing countries that is stable and not affected by political and economic crises. Indeed, remittances are a room for manoeuvre for these countries to reach sustainable development.

Figure 1-5: Trends in major financial inflows to low and middle-income countries 1990-2023 (Mills,2023,p.3)



This graph demonstrates that remittances are three times larger than development assistance and approximately equal to foreign direct investment in these years. Statistics show that 200 million immigrants send remittances to their homes and 800 million of their families receive them. This is a decentralized, integral, and informal finance system that is impactful for poverty alleviation (Mills,2023,p.2). It is noteworthy that this graph contains only officially recorded remittances. There are informal flows and in-kind remittances that increase the developmental effect of immigrants on their local communities.

It is evident Mills talked about a mostly untapped potential for financing renewable-based electrification which can raise some doubts and questions about the possibility of it:

- What is the effect of remittances on the energy consumption pattern of recipients?
- How many percentage of remittances are spent on energy necessities by recipients?
- Are there any interests in diaspora and local communities to invest remittances on renewable energy projects or buy renewable energy products in a collective action?

- Have any projects been implemented based on this idea yet? What lessons can we get about the feasibility of this combination from those samples?

According to these uncertainties, I try to frame my research questions.

Main question:

To what extent is the “Green Remittances” a viable method to finance renewable energy projects in developing countries?

Sub questions:

- What are the attributes of different actors’ interaction (the business models) in “Green Remittances” projects?
- What are the bottlenecks for these projects to be successful?
- What are the actors’ evaluations of strengths, weaknesses, opportunities, and threats of these projects?

To test the viability of this method, I will try to investigate how this idea worked out in reality based on evidence from the projects that were planned in this way. For this purpose, I will review diaspora finances and off-grid electrification literature to find the main categorizations in each of them and the debate around business models and the success or failure of off-grid projects as an applicable broader knowledge for evaluation of green remittances projects in Chapter 2. Then in Chapter 3, I will discuss methodological points such as the logic of selecting multiple case study method to analyze findings and my strategy and efforts to identify detectable case studies. Subsequently, Chapter 4 will provide more details and knowledge about the case studies based on primary and secondary sources and ultimately in Chapter 5, I will analyze the findings with analytical tools in Chapter 2 and wrap up the answers to research questions in the conclusion section.

Chapter 2: Literature review

In Chapter 1, I talked about the definition of energy poverty and now it is better to start the literature review by discussing “diaspora finances”, “green remittances” and “off-grid electrification” concepts as three keywords in this research.

Diaspora finances:

In this part, I focus on characteristics of different varieties of diaspora finances that will be helpful to analyze case studies in the following chapters. Asare (2022) looked at diaspora finances as a complementary resource in a blended finance mechanism that can:

- (1) “Providing additional private resources to finance development
- (2) expanding and enabling access to patient long-term credit
- (3) encouraging greater non-diaspora investor confidence
- (4) providing a reliable flow of resources in growing global uncertainty”

Asquith and Opoku-Owusu (2021) stated that there are four main forms of diaspora investment: diaspora philanthropy, diaspora remittances, diaspora direct investment (DDI), and diaspora portfolio investment (DPI). In another categorization, Gelb *et al.* (2021) in their technical report for the European Commission defined diaspora finance as “An umbrella term which includes remittances on one hand and diaspora investment on the other. Whereas the former are interpersonal, international financial transfers between migrants and their families and civil society organizations in countries of origin, the latter are asset-transferring mechanisms which channel financial resources from diasporas to private and public sector organizations and agencies”. So this definition is formed in a duality of remittances and diaspora investment and tried to describe their differences based on five indicators: monetary value flows, sender, recipient, sender/recipient link, and sender/recipient legal identities.

Figure 2-1: Types of diaspora finance mechanism (Gelb *et al.*,2021,p15)

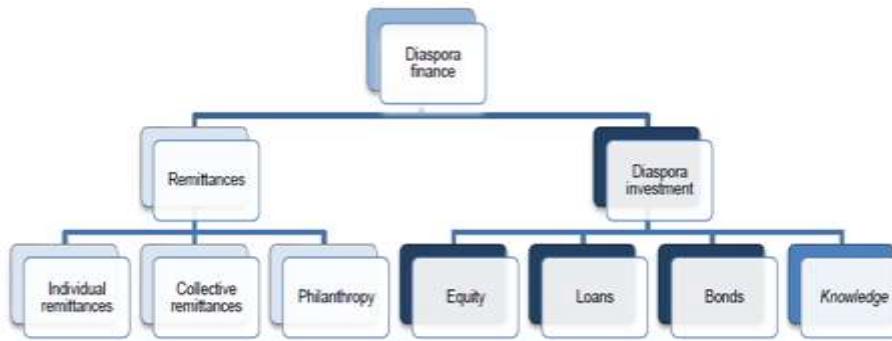


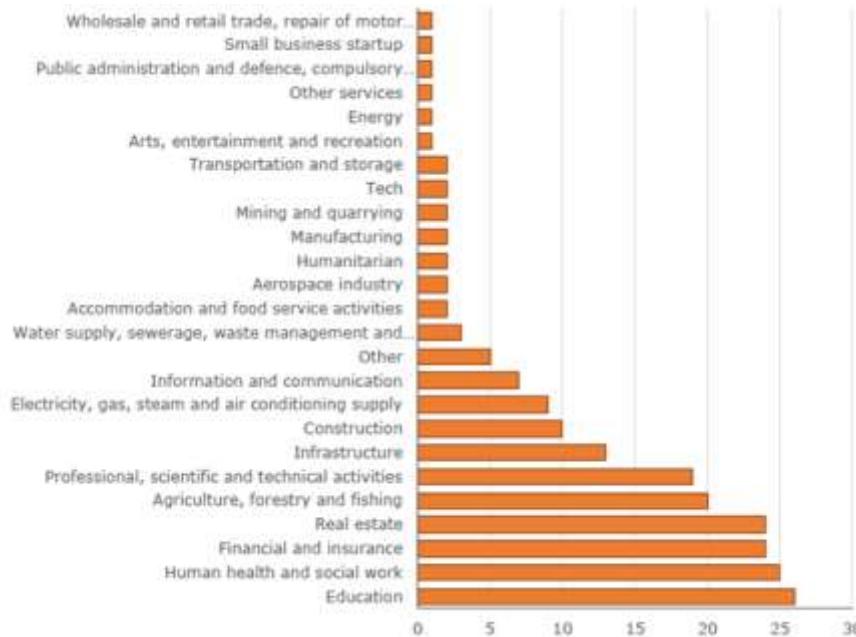
Table 2-1: Remittances vs Diaspora Investments characteristics (Gelb *et al.*,2021,p13)

Feature of transaction	Remittances	Diaspora investments
Monetary value flows	One-way	Two-way
Sender	Migrants	Diaspora = migrants + later generations
Recipient	Households	Non-households = firms, government, NGOs
Sender/recipient links	Must be direct and interpersonal = one-to-one	Usually (but not always) indirect and impersonal = many-to-one, many-to-many, one-to-many
Sender/recipient legal identities (property ownership title)	Often overlap with no clear distinction	Distinct

Moreover, in this report, authors investigated more than 300 individual projects that their financial resources were raised from the diaspora. These initiatives happened between 54 sending countries and 93 receiving countries in

different economic sections (Gelb *et al.*,2021,p4). The following diagram shows that the energy sector is not popular for the diaspora in comparison to education, health, or real estate.

Figure 2-2: Sectors invested in through diaspora finance (Gelb *et al.*,2021,p28)



Flanigan (2017) in her article elaborated “diaspora philanthropy” concept with these words: “money, goods, volunteer labor, knowledge and skills, and other assets donated for the social benefit of a community broader than ones’ family members, in a country or region where there is a population with whom the donor(s) have ancestral ties”. Then she used one table from Newland *et al.* (2010) to show different kinds of diaspora philanthropy based on two criteria: donation size and donor aggregation.

Table 2-2: Mechanisms of diaspora philanthropy (Flanigan,2017,p495)

		Donor Aggregation	
		Individual donor	Multiple donors
Donation Size	Small	Some remittances, individual donations	Hometown associations, neighborhood and regional groups, ethnic and clan associations, foreign-based ethnic NGOs, online platforms, small foundations
	Large	Direct donations from highly successful businesspersons, celebrities, sports stars, and large foundations started by such individuals	Professional associations, family foundations, venture philanthropy funds

Elo and Riddle (2016) explained diaspora portfolio investment as “Investments made in the country of origin by a diasporan or groups of diasporans, including:

- (1) the purchase of sovereign bonds issued by the country of origin government,
- (2) the purchase of equity in companies in the country of origin,
- (3) investments made in fixed-income or other securities that lend money to firms exclusively in the country of origin,
- (4) stock purchases in the country of origin,
- (5) investments made in mutual funds comprised of firms in the country of origin.”

Remittances and energy:

In this section, I will start by discussing the effect of migration as a general phenomenon on the energy sector then will detail on role of remittances, and ultimately will review the intersection between diaspora finances and renewable energies.

Scott *et al.*(2018) in their briefing note for the Swiss Agency for Development and Cooperation SDC said that immigration can affect the energy sector on three channels: energy consumption of inhabitants, transfer of financial resources like remittances and technology, or knowledge transferring of energy-efficient appliances or methods. They claimed that remittances expedite the delivery of clean energy technologies to places where poor people live without electricity all over the world via investment in energy access or efficiency. Mandelson (2013) believed that the intersection between microcredits and energy projects had not happened for decades because of poor energy technologies but introducing small, portable solar products makes it possible. This technological advancement happens at a time when the global value chain and simple transaction systems like mobile banking can support it. He claimed that with the financial support of remittances, we can bring renewable micro-energy to off-grid regions.

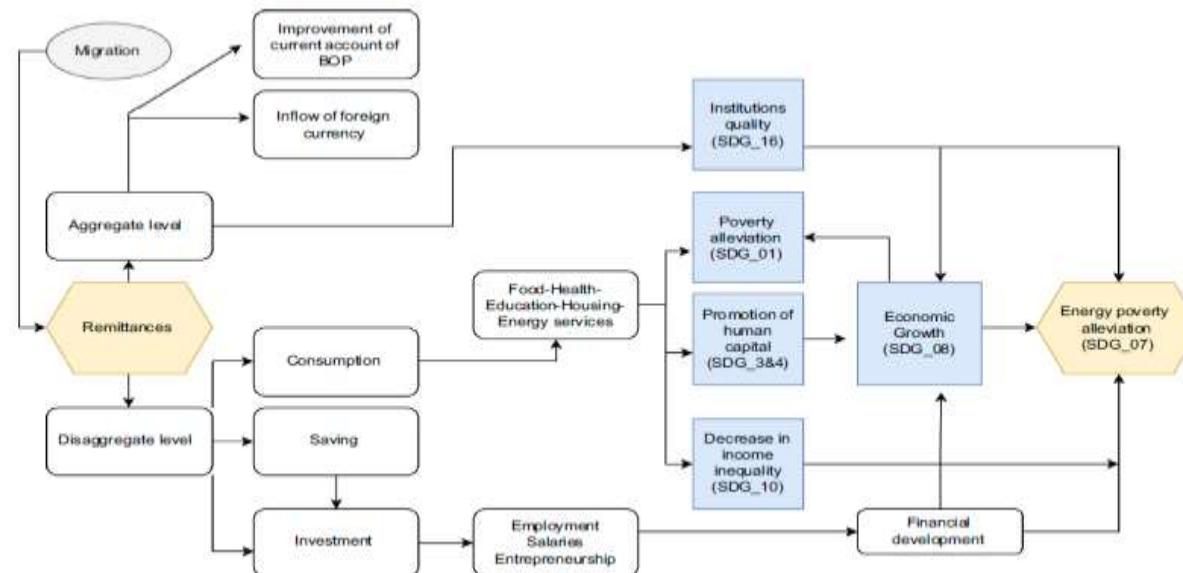
But what do we know about the current effects of remittances on different phenomena that are related to energy security like environmental degradation, CO2 emission, ecological footprint, energy consumption, and energy poverty? Many researchers tried to apply different econometric models to estimate the correlation between these variables. I found 40 articles in Google Scholar 5 of them focused on the effect of remittances on electricity or renewable energy consumption, 5 of them discovered the correlation of this concept to energy poverty and 30 articles put their effort into evaluating the environmental impacts of remittances.

Researchers investigated the effect of remittances on energy poverty and energy security with two micro and macro outlooks. In the former, researchers paid more attention to household level of analysis. Djeunangkan *et al.* (2023) claimed that “income inequality, economic growth, and education as some transmission channels through which remittances may reduce energy poverty”, Hosan *et al.* (2023) found that households who receive remittances, don’t experience comprehensive energy poverty. Subramaniam *et al.* (2022) declared if there are appropriate impetuses, remittances will increase renewable energy consumption in an affordable manner. Sahoo & Setti (2020) demonstrated that electricity consumption in India had been stimulated by remittance inflows in three channels consumer effect, business effect, and wealth effect. Murshed (2023) showed that however remittances cannot only improve electricity accessibility without any institutional effort but the relationship between clean energy's adoption and electricity accessibility is unconditional, Das *et al.* (2021) declared there is a “unidirectional causality from remittances per capita to renewable energy consumption” that can enlarge with offering incentives to remittance-

recipient households. In a different research, Shrestha and Kakinaka (2022) tested the hypothetical correlation between remittances and household energy transition from low-efficiency fuels like coal and wood to high-efficiency fuels such as gas and electricity in 27 developing countries from 1995 to 2018. They demonstrated that a 1% increase in the ratio of remittances to GDP in the long term will relate to a 0.24% rise in the share of high-efficiency fuels in the household's energy consumption.

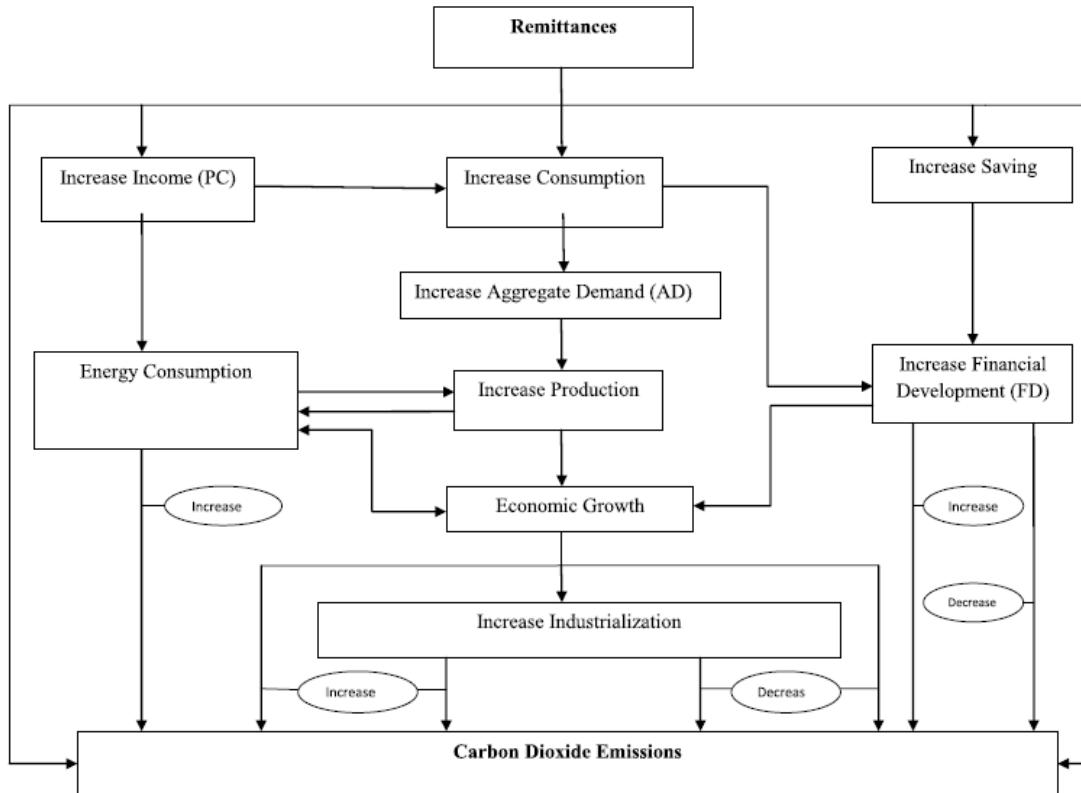
On the other hand, some of the researchers concentrated on determining the effect of remittances on the general outputs of the energy sector like energy security indicators or carbon dioxide emission. Barkat *et al.* (2023) discussed that remittances mitigate energy poverty through income poverty, human development, institutional quality, and income inequality. The process of this nexus is exhibited in the following diagram:

Figure 2-3: Schematic channels between remittances and energy poverty alleviation (Barkat *et al.*,2023,p3)



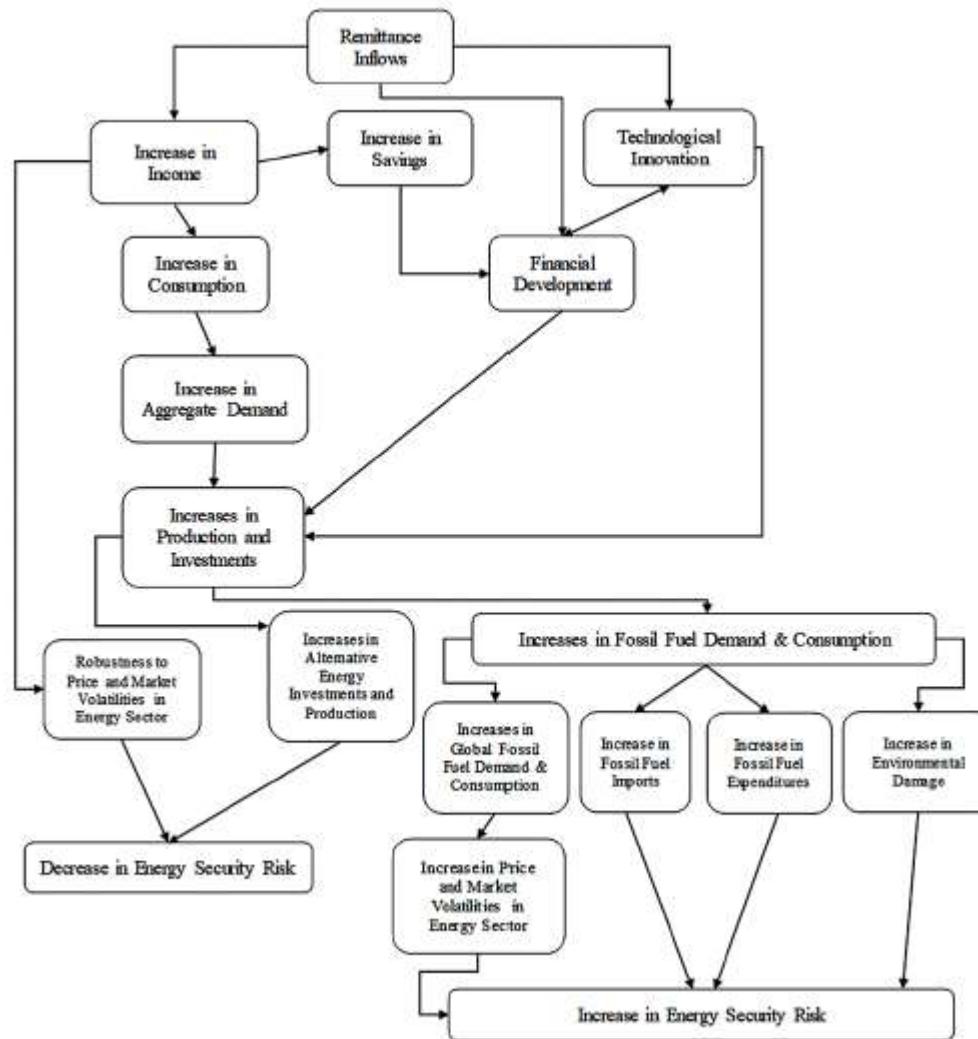
On the contrary, Rahman *et al.* (2019) visualized the causal chain from remittances to carbon dioxide emissions in different flowchart.

Figure 2-4: Remittances and Carbon Emissions Relationship (Rahman *et al.*,2019,p4)



To synthesize these two diagrams, Karasoy (2022) tried to develop a conceptual framework based on the International Energy Security Risk Index that was introduced by the Global Energy Institute in 2021. All in all, he believed that remittance inflows would exacerbate energy insecurity in the long term.

Figure 2-5: Remittances-energy security link: A conceptual framework (Karasoy,2022,p150)

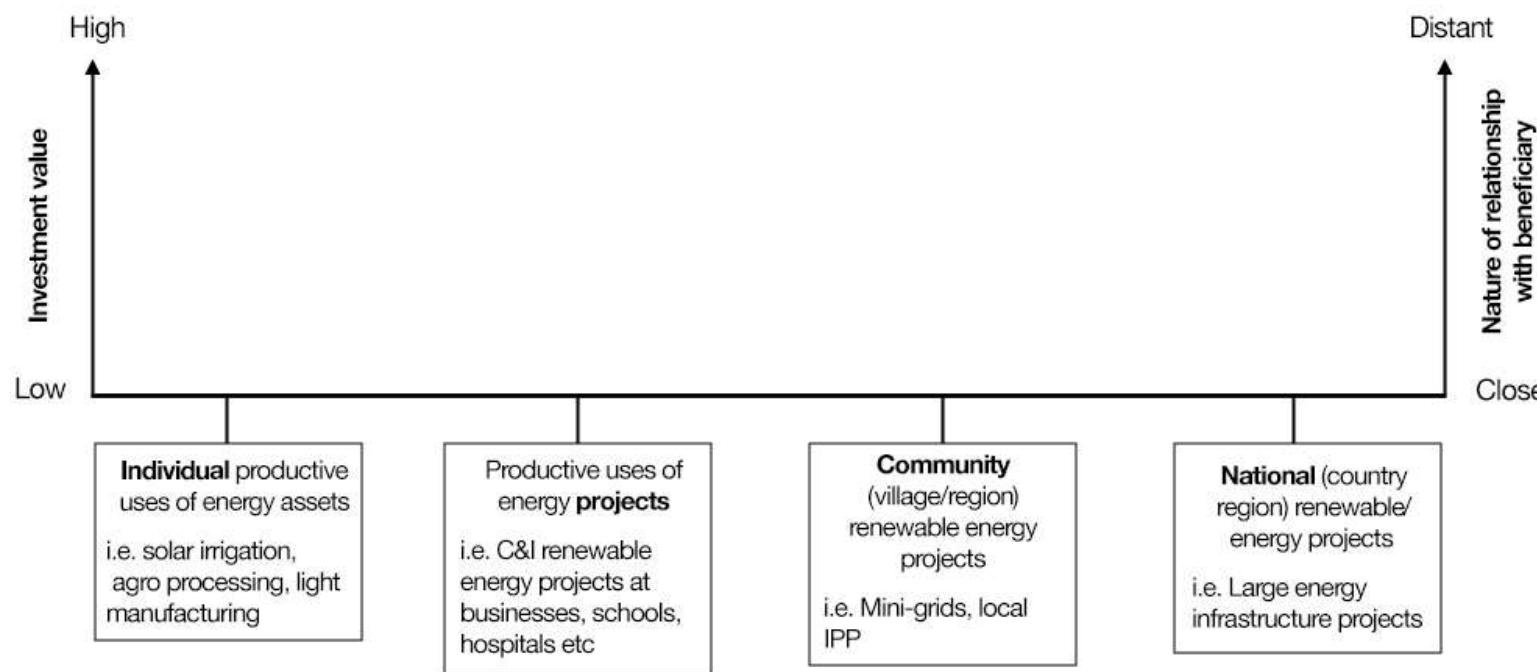


Testing these models with quantitative data from different countries also generated controversial results. Karasoy (2022) indicated that Egypt's (one of the main remittance-receipt countries) ecological footprint has been increased by remittance inflows in the short run and long run. The other researchers supported this hypothesis between different categories of countries (Mensh & Abdul-Mumuni,2022), (Ahmad *et al.*,2021), (Jamil *et al.*,2021), (Arogundade *et al.*,2021), (Karasoy,2020), (Uche,2022), (Nwani *et al.*,2022), (Rani *et al.*,2022), (Yang *et al.*,2021), (Kibria,2021), (Zhang *et al.*,2021), (Yang *et al.*, 2020) but Sharma *et al.* (2019) declared that more remittances decrease CO2 emissions in Nepal, (Raihan & Voumik, 2022) and (Saliba *et al.*,2022) came to this conclusion for China, (Wang *et al.*,2021) for India, the Philippines, Egypt, Pakistan, and Bangladesh and (Zafar, M. W. *et al.*, 2021) for top ten remittances receiving countries also. Yakubu *et al.* (2022), Mazhar *et al.* (2022), Rahman *et al.* (2019), Wang *et al.* (2021), Khan *et al.* (2020), Ahmad *et al.* (2021) and Usman & Jahanger (2021) reported both effects in their articles by applying different models. All in all, we can say there isn't a consensus about the impact of remittance inflows on environmental degradation, and using various models and contexts may produce different results.

To leverage diaspora finances in renewable energy projects, there is poor literature that has stopped only in developing this idea. For example, the International Fund for Agricultural Development (IFAD) in its handout to commemorate International Day of Family Remittance tried to describe the linkages between the concept of “remittance” and sustainable development goals. This organization in the SDG 7 section that insists on different pillars of energy security (accessibility, affordability, reliability, sustainability, and equity) declared that remittances can play a considerable role in improving the quality of accommodations, providing efficient stoves and electricity for local communities by clean energy technologies. This agency believed that international organizations and national public and private sectors must promote remittances as a stable financial resource to implement solar energy projects in developing countries (IFAD,2017). Makanza (2021) believed that the high upfront cost of renewable energy projects is not affordable for target groups in low and middle-income countries. He mentioned that this financial gap can be filled by their diasporan relatives who have more income and access to financial services in developed countries. He evaluated accessibility to cheap credit for diasporans as an excellent chance to invest in

renewable energy projects in developing countries. He also saw a growing pattern of digitalization since the outbreak of the Covid-19 pandemic as a catalyst for this idea that will enable people in diaspora to monitor the devices remotely and pay their costs digitally on behalf of their families or friends. He visualized his outlook for this type of financing in the following figure:

Figure 2-6: Remittance investment spectrum (Makanza,2021)



In the scientific literature, Evan Mills (2023) in his article tried to develop a new concept “Green Remittances”. He mentions that the main obstacle to achieving sustainable development is insufficient financial resources that are not

distributed inclusively. He thought that remittances can be a game-changer however these have not been led to sustainable projects yet. He insisted on three advantages of remittances in this regard: “Remittance flows are more stable, more widely and evenly distributed among and within countries, and are counter-cyclical and resilient even during economic downturns or other crises in countries where remittance-sending migrants live” (Mills,2023, p2) so remittances will be helpful if are directed to sustainable projects and programs, especially for decentralized energy projects or microgrids and for improving the energy efficiency of home appliances with new technologies, intentionally with the use of in-kind remittances category. According to this explanation, he defined green remittances as “The sustainability-focused remittances that spend or invest in the renewable energy sector and for climate change resilience and adaptation. They can take the form of cash, goods, or services and be targeted to households, transportation, agriculture, entrepreneurial purposes, or community-level infrastructure projects.” (Mills,2023, p1)

In terms of challenges and solutions in performing this idea, Mills enumerated “market and technology information, product quality, awareness of sustainability and climate resilience technology options and their application, technical challenges in implementing remittance-based finance mechanisms, and transaction costs” as the main challenges to boosting sustainable projects based on remittances (Mills,2023, p8). Mandelson (2013) suggests that developing renewable micro-energy initiatives depends on improving distribution and logistics, raising awareness of consumers about the health consequences of traditional fuels, facilitating end-user finance, and importantly focusing on after-sales service. In another research, Musah-Surugu *et al.* (2017) recommended allocating remittances to sustainable development projects effectively will happen by creating specific financial measures to facilitate the sending of remittances, a considerable decrease in transfer fees, and promoting environmental literacy in local communities.

Off-grid electrification:

In Chapter 1, I mentioned there is a consensus on off-grid electrification as an ideal solution to alleviate energy poverty in remote areas with sparse and small populations. In this part, I try to review some aspects of this method in terms of main categories, financing methods, and common business models to find a way to connect this literature with diaspora finances for analyzing green remittance projects that have been implemented yet.

Mandeli *et al.* (2015) explained there are some independent units with no conversion and distribution connection between them in decentralized systems. In general, there are two categories in decentralized initiatives to provide electricity: 1- Mini-grids and 2- standalone systems such as solar home systems (SHS). This categorization is based on consumer number indicator since stand-alone systems provide energy for single close customers but mini-grids supply power to several consumers. The following table shows the classification of rural electrification based on rural energy uses, consumer numbers, and energy sources:

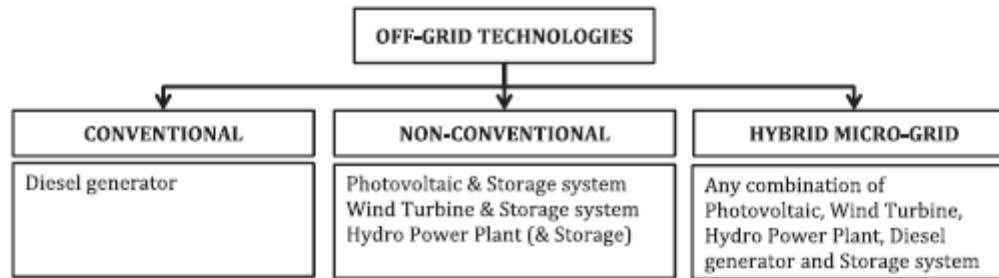
Table 2-3: Off-grid systems matrix for rural electrification (Mandelli *et al.*,2015,p1625)

OFF-GRID SYSTEMS MATRIX	DECENTRALIZED		DISTRIBUTED
	Stand-alone Systems	Micro-Grid Systems	Hybrid Micro-Grid Systems
Rural Energy Uses	Home-based Systems	Systems including a distribution grid	Systems including a distribution grid
Community services	Community-based Systems		
Productive uses	Productive-based Systems		
Consumer Number	Single	Multiple	Single OR Multiple
Energy Sources	Single		Multiple

In terms of technologies that are used in this type of electrification, we must know that diesel generator has been a dominant energy producer for some decades, and technologies based on renewable energies are newcomers in this

field. It is noteworthy to say that in a hybrid micro-grid, using a diesel generator as a source of energy is restricted to the time that renewable sources of energy like wind or sun are not accessible.

Figure 2-7: Off-grid generation technology classification (Mandelli, *et al.*, 2015, p1626)



Based on research questions, the business models of these initiatives will be important for the final analysis. Knuckles (2015) started his article about this matter in the base of pyramid markets with the definition of the business model as “a system that solves the problem of identifying who is (or are) the customer(s), engaging with their needs, delivering satisfaction, and monetizing the value.” Then he elaborated that poor people are the main customers so the success of these projects is related to creating value for them. In this regard, firms that provide products and services at the bottom of pyramid markets must know that not only pay attention to the affordability of products through installments or the Pay-As-You-GO system but also must think about their diversity since there are customers with different incomes and willingness to pay in these markets. To get a real overview, he advises firms to collaborate with local non-traditional partners like NGOs in the implementation phase.

According to the last point, Heynen *et al.* (2019) categorized business models that operate in BoP (Bottom of Pyramid) into two main groups:

- **Isolated business model:** The firm doesn't have any meaningful connection to the local community and any concern about creating more social value. It only thinks about the affordability of products or services for the local community. (Top-Down approach)

- **Interactive business model:** The embeddedness of commercial affairs in the social context of the project is important for the company and there is a serious effort to make partnerships with the local community. (Bottom-Up approach)

Another practical classification of the off-grid electrification business model was presented by Krithika and Palit (2012) and Safdar (2017). The former authors sorted out business models in four groups based on former efforts of UNDP and World Bank:

- **Commercially led models:** The implementer in these models is the private sector and governments don't have a serious role. The method of payment is commonly cash sale.
- **Multi-stakeholder programmatic model:** These projects are managed by the rural consumers' partnership and cooperation and the service or product cost is paid by consumer credit which is often supported by an intermediary finance organization like a bank, a micro-credit institution, or a village cooperative.
- **Utility model:** A utility or rural energy service company is the operator of this model and has a long-term relationship with consumers via a fee-for-service monthly payment method. In this model, ownership is not transferred to consumers and maintenance must be done by utility company.
- **Grant-based models:** In this model, products or systems are purchased in bulk by the national government and then are installed locally. It is more common in public institutions like schools or medical clinics. (Krithika & Palit, 2012)

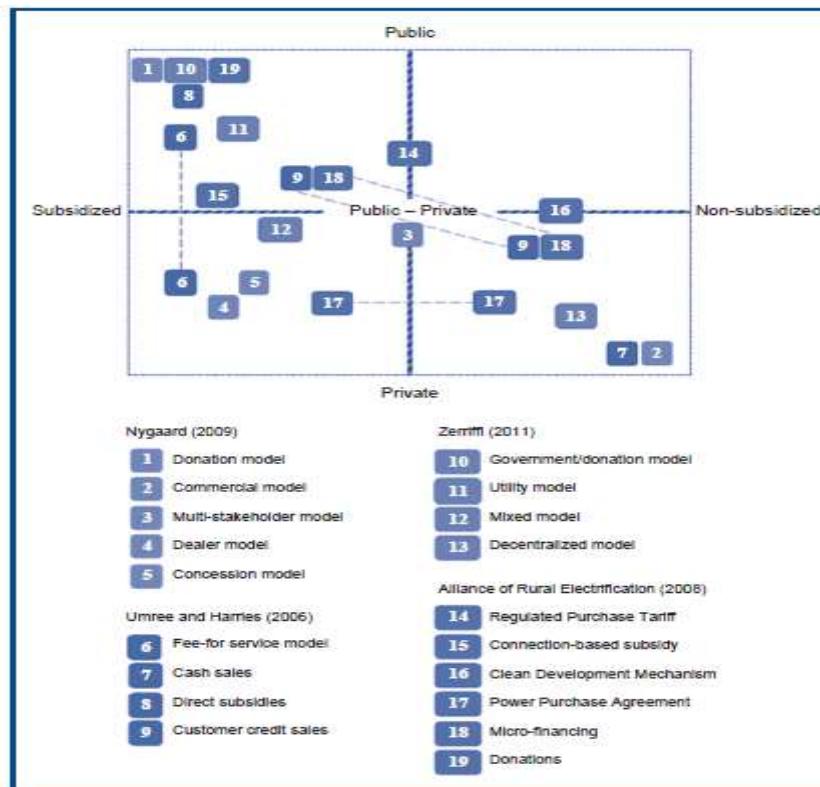
Safdar (2017) in his report for “Smart Villages Initiative” discussed four types of operational models: 1) Utility operated 2) Private sector operated 3) Community operated 4) Hybrid models combining aspects of the other three models. The first three groups are the same as the former article but he mentioned that the hybrid model works based on sharing responsibilities in the generation and distribution of electricity between government companies, private firms, and local communities and happens in different types of contracts: 1) Public-private partnerships 2) Renewable energy service companies (RESCOs) 3) Concessions 4) Power purchase agreements.

Falchetta *et al.* (2022) divided the financing methods of these projects into upstream for running the project and downstream to increase the purchasing power of customers. Upstream finance methods include: 1) equity or

(concessional) debt financing by public agencies 2) asset-based lending 3) non-recourse financing 4) supplier credits. On the other hand, downstream finance methods consist of: 1) small-scale lending 2) micro credits by specialized institutions 3) leasing arrangements 4) revolving funds that are generally provided by philanthropic organizations or donors.

As you can see various business models may call in different names with different researchers. To wrap up this part, I use a schematic classification based on two indicators 1) the share of public subsidization and 2) the nature of the implementer that was developed by Kolk and van den Buuse (2012) with reviewing four articles in this field.

Figure 2-8: Indicative positioning of some off-grid delivery and financing models (Kolk and van den Buuse, 2012,p565)



The last important matter in the field of off-grid electrification is related to the reasons for project failure since different evidence show that a high number of these projects were abandoned, failed, or didn't become a viable and self-sustaining long-term business. There are some reasons for this phenomenon like hazardous project management, incapability of collecting the required financing, corruption, lack of or poor quality of feasibility studies, and lack of expertise to operate and maintain the infrastructure (Falchetta *et al*,2022,p8). In this regard, Schmidt (2015) developed a framework to analyze the risk of these projects.

Table 2-4: Common risks in off-grid electrification projects, stakeholders driving these risks, and their governance level (Schmidet,2015,p83)

Risk	Stakeholder	Governance level
Regulatory risk <i>permits, market access, power market regulation</i>	Public sector	National/(local)
Grid extension risk <i>arrival of main grid</i>	Electricity utility/grid operator/grid regulator	National/sub-national
Technology risk <i>quality of equipment and project planning</i>	Technology supplier/ engineering contractor	International/ national/(local)
Operations risk <i>operating and maintaining equipment</i>	Project developer	Local
Financing risk	Financial sector	National/international
Customer payment risk	Villagers	Local
Public acceptance risk	General public	National/local

To conclude, there isn't any deep literature about green remittances as a method of off-grid electrification since this concept is novel, developed recently, and located in the overlap of classical concepts. In this literature review, I tried to select the parts of diaspora finance and off-grid electrification that will help me to analyze case studies in

Chapter 5. I hope after this analysis, can take the first step to establish a new analytical framework by synthesizing developed categorizations of classical concepts with each other based on findings from initial efforts in this way.

Mills (2023) in his article presented a table from previous projects that was supported by green remittances but he mentioned that most cases of green remittances haven't been evaluated precisely and his team couldn't find elaborated documents about them. He believes preparing detailed impact evaluations of past effort is the present gap for this concept in this stage and filling it facilitate scale-up of it through the learning process. According to this statement, in the next step of this research, I will try to reach out to the cases to find detailed information about their design, implementation, and results.

Chapter 3: Methodology and strategy of data gathering

As I discussed in the last part of Chapter 2, “Green Remittances” is a newly developed concept that its viability as a finance method to establish a self-sustaining business model in renewable energy projects is not clear so the nature of the research topic and research question conducted me to apply multiple case study method for this research since it will help me to look at a multi-dimensional concept with a comparative lens and test an idea to make a general evaluation about success or failure of it in the real world. I will elaborate on the useful characteristics of this method in the following lines:

- **Investigating multi-dimensional subjects:** There are some different complexities around these subjects in terms of interactions between stakeholders and some hidden variables. Multiple case study allows researchers to consider various aspects of some experiences that increases the validity of the research.
- **Comprehensiveness of gathered information:** The multiple case study method enables researchers to explore more about a unique phenomenon in different contexts and collect extensive and disparate data so the diversity of cases has an important role in forming an encyclopedic view.
- **Generalization through comparative analysis:** In this research method, researchers can make comparisons between cases to find similarities and differences between them and show established patterns. Through this process, researchers can go beyond the restrictions of one case and generalize their findings about a controversial topic to build an applicable theory.
- **Practical recommendation:** Thanks to involvement with reality, researchers can discuss the success and failure of an idea and suggest applicable solutions and policy recommendations according to the lessons which they get from them (Yin,2009).

In the next section of this chapter, I will describe how to reach out to this topic, how to select the cases, what technique I used for gathering data and ultimately will talk about the limitations of this research.

How did I manage gathering data process?

In the beginning, my idea for a research topic seemed outlandish for the professors whom I took their advice. They believed that diaspora finances and especially remittances are spent by recipients only for subsistence matters like buying groceries or medical costs and maybe educational purposes for children and the extra money may be invested in the construction sector so its trickle down to renewable energy projects is not conceivable. Because of this, they advised me to find cases for testing the possibility of this idea. Frankly, I overestimated the size of the possible projects so I started to search with the word “Diaspora Direct Investment (DDI)” but couldn’t find anything related to renewable energy projects. When I became disappointed gradually, one day I met a French man from ISS alumni in the butterfly bar who suggested me to search for renewable or sustainable energy in combination with remittances. After this search, I found BASE Foundation and its projects with the title of “RemitEnergy”(BASE Foundation, 2021). This finding was promising to continue this research topic.

In the next stage for preparing the draft of the RP design, I discussed the nature of the energy poverty problem as a lack of access to electricity or clean fuels for cooking based on the International Energy Agency statistics and then elaborated on the potential of remittances to tackle this problem with evidence from the newly published article of Evan Mills with this title: “Green Remittances: A novel form of sustainability finance”. Moreover, I looked at the Joint Research Center technical report about diaspora finance for development that was drafted by Stephen Gelb and his colleagues for the European Commission. They investigated more than 300 individual projects that were supported financially by the diaspora from 54 sending countries in 93 receiving countries. Their data from these projects showed that a few number of these projects were related to the energy or electricity sectors. Since researchers of the second document were not accessible to clarify possible cases of connection between diaspora finances and renewable energy projects, I confined the search for case studies to the following table from Mills' article in first step:

Table 3-1: Summary of known instances of remittance-based financing of sustainable energy and climate change resilience
(Mills,2023,p.7)

	Diaspora Energy	Diaspora Initiative	Diaspora Power	Dolma Impact Fund	Easy Solar	EcoBazar	IFAD	Sogexpress	Umlilo	
Prime implementing entity	Électricité de France [electricity provider]	Arnergy [product manufacturer]	Community Energy and Social Enterprise, LTD [entity type unknown]	Dolma Impact Fund [investor]	Easy Solar [distributor]	Gaia Consulting [consultancy]	International Fund for Agricultural Development [public agency]	Arc Finance [non-profit]	Umlilo Energy [installer]	
Partners/sponsors	Unspecified	Flutter-wave	Unspecified	UK Department of International Development; development finance institutions-FMO, Finnfund, Austrian Development Bank- OeEB, International Development Finance Corporation, Swedfund, IFC	Africell/ Afrimoney (telecom); Aurora Foundation	Nordic Climate Facility, Harder Trust, Basel Agency for Sustainable Energy, Foundation, Banco FIE, Energética, Arc Finance, Fundación AMIBE CODEM/ ACOBE - Asociación de Cooperación Bolivia España	Unspecified	Inter-American Development Bank, Clinton Bush Haiti Fund, FOMIN, Basel Agency for Sustainable Energy, Sogexpress (money-transfer agent), Food Express (Miami remittance center), Micama Soley (appliance importer)	Unspecified	
Receiving country	Ivory Coast	Nigeria	Nigeria	Nepal	Sierra Leone	Bolivia	Ecuador	Haiti	Zimbabwe	
Diaspora country	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Spain	Spain	United States (Miami)	UK	
Start-up year	2021	2021	2019	2014	2020	2014	2009	2012	2019	
Sector/Strategy	Household	Solar home kits: PV panel, battery, radio, LED lights, phone charging port, optional television and fan	Solar systems	Solar home kits	none	Solar home systems, solar lanterns, solar fans, solar televisions, solar phone charging	Solar water heaters	"Clean energy" perhaps lighting	Solar Lanterns with phone-charging	Solar home systems
Transportation	none	none	none	none	none	none	none	none	none	
Agriculture	none	none	none	none	none	none	none	none	none	
Business	none	Solar systems	none	none	none	none	none	none	none	
Community- scale	none	none	Small mini-grids	Central solar targeted at households	none	none	none	none	none	
Climate adaptation	none	none	none	none	none	none	none	none	none	
Digital payment			Mobile money			Mobile money; Pay-as-you-go				
Sources	Takouleu (2021)	Whitlock (2021)	Takouleu (2019)	Clark (2014); Nepal Energy Forum (2014);	Sierra Leone Telegraph (2020); Dumbuya (2022)	NCP (2015); BASE, 2022b	IFAD (2009)	Arc Finance (2014)	Kahudzari (2022)	

Then I started to review the available documents and make a direct connection to organizations that led these projects. You can read about my findings in the following lines:

- **Diaspora Energie by EDF:** This platform was created by Électricité de France (EDF) to make a connection between the Ivorian diaspora and ZECI company as a subsidiary of EDF in the Ivory Coast to provide solar kits for rural people who don't access to national electric grid with the financial support of their relatives in

foreign countries in November 2016. The services of this platform expanded to Cameroon and Togo quickly in 2018 (Diaspora Energie, no date). The local partner of this platform for selling solar kits to households and solar pumps to local farmers in Togo is Bbox EDF company (Diaspora Energie, no date). Unfortunately, I couldn't find any report or contact person from this initiative.

- **Arnergy in Nigeria:** This company installed solar systems for homes, shops, hospitals, etc in Nigeria. It launched the “Diaspora initiative” to sell solar systems to the Nigerian diaspora on behalf of their relatives in 2021 (Arnergy, no date). They haven’t published any report about its performance and only two videos are accessible for the diaspora initiative. My efforts to make a connection were unsuccessful since they didn’t respond to my emails and some of my Nigerian classmates who reached them out on behalf of me.
- **Community Energy and Social Enterprise (CESEL), LTD in Nigeria** in 2019 claimed that have a plan to raise one billion dollars from the Nigerian diaspora annually to implement solar off-grid projects and replace one million diesel generators after one decade in the Diaspora-Power (DPower) initiative. (Takouleu,2019). I could only find one presentation about this program in the official website of the company with many photos from their local visits and not useful data. My efforts to make a connection with this company were unsuccessful since they didn’t respond to my emails.
- **Dolma Impact Fund** is a subsidiary of Dolma Foundation in Nepal and started investing in TMT, healthcare, and renewable energy sectors to achieve sustainable Development Goals in Nepal (Dolma Impactfund, no date). Although in the table, this organization was mentioned as one of the green remittances cases, I couldn’t find any documents to verify this claim. Additionally, the email address of the organization was not active to make a direct connection.
- **Easy Solar in Sierra Leone & Liberia:** This company was founded by three students of the School of International and Public Affairs, Columbia University ('Nthabiseng Mosia',2023) and tries to offer a range of products including solar lanterns, home lighting systems, appliances and cook stoves on affordable financing plans. It has an online sale platform to attract remittances from Sierra Leonean and Liberian immigrants with the slogan “Sending Power Home Just Become Easy”. I couldn’t find any report on its website but generally, it indicates that 720,000 people have access to energy in six years by this company (Easy Solar, no time). I had an interview with the representative of this company.

- **Remitting Solar Water Heaters in Bolivia:** This project is one of the “RemitEnergy” projects of the Base Foundation. BASE Foundation and Arc Finance did market assessment phase with financial support of Nordic Climate Facility as a subsidiary of Nordic Climate Fund (Nordic Climate Facility, no date) and then project implemented by a local online platform that was called EcoBazar with the advisory of Gaia Consulting from 2012 to 2015 to help Bolivian migrants in Spain buying solar water heaters for their families in home (Nordic Climate Fund,2015). I received market assessment documents of this project from the BASE Foundation and found the final report of the project that was published in 2015 on the Nordic Development Fund website. Additionally, I had 4 interviews about this project and will explain my findings from this project in detail later.
- **International Fund for Agricultural Development (IFAD):** One paragraph of an IFAD document in 2009 mentioned a two-year project funded by this organization to establish a mechanism for Ecuadorian immigrants in Spain to invest in clean energy technology for rural areas of origin country (IFAD,2009). There isn’t any record from this project anywhere else and it is not clear whether this project was finally implemented or not. My effort to make a connection with the remittance department and the Ecuador department of IFAD to receive more information was not successful.
- **RemitEnergy project in Haiti:** This was the first project of the “RemitEnergy” initiative that had three phases. Market assessment was conducted in Haiti & Dominican Republic by Arc Finance & BASE Foundation in 2009 (Phase 1) and then implemented by Sogexpress and consultancy of Arc Finance only in Haiti with the financial support of Multilateral Investment Fund/ InterAmerican Development Bank (MIF/IDB) and the Clinton Bush Haiti Fund from 2012 to 2014 (Phase 2) and continued from 2015 to 2017 with support from FOMIN/IDB and USAID (Phase 3). The latter phase was part of a bigger project “USAID’s Renewable Energy Microfinance and Microenterprise Program (REMMP)” which helped MFIs, MTOs, and distribution networks to facilitate rural renewable electrification projects with financial and technical advice. The remittance-based parts of this program were implemented in Haiti & Kenya (REMMP). There isn’t any record from the Kenya part anywhere else and it is not clear whether this part was ultimately implemented or not. For the Haiti project,

I reviewed market assessment report in addition to presentations and documents from Arc Finance. Moreover, I had 4 interviews about this project and will discuss about my findings in detail later.

- **Umlilo Energy in Zimbabwe & South Africa:** This is a UK-based start-up that introduces itself with this statement: “Umlilo is an end-to-end service designed to enable Africans in the diaspora to seamlessly purchase, finance, and install solar systems in their home country from anywhere in the world!” (Umlilo Energy, no date). Although, I couldn’t find any report on its website but had an interview with its representative.

During my searches about these cases, I found other cases that explain them in the following lines:

- **Remittances for Energy in Central Asia (Kyrgyzstan and Tajikistan):** This was the third project of BASE Foundation in the “RemitEnergy” initiative. The market assessment phase of this project was conducted by BASE Foundation with financial support from the Swiss State Secretariat for Economic Affairs (SECO) in 2014 (BASE Foundation,2014) but it stopped at this phase because of political tensions between European countries and Russia in the first round of Ukraine war. I received a market assessment report of this project from the BASE Foundation.
- **GEF-UNDP Small Grants Programme & Alternative NGO in Tajikistan:** In the aforementioned market assessment, I found that in 2013, one Tajik NGO implemented a project in some villages of Khatlon Province with financial support from GEF-UNDP Small Grants Programme. In this project, Alternative NGO encouraged 40 labor migrants’ families and vulnerable families to invest part of remittances received from their relatives to buy solar PV panels and solar water heaters. The target group must pay at least 50 percent of these products' price and the remaining parts paid from the project's budget. Moreover, some of the local people were trained in the installation and maintenance of solar devices. That project wasn’t scaled up since there weren’t more financial resources under the Small Grant Programme (BASE Foundation,2014). I couldn’t find any detailed report about this project and my effort to find an informant was not successful.
- **Power Africa Off-grid Project (PAOP):** This is a four-year project that was funded by USAID and started in November 2018 to facilitate rural off-grid electrification in Sub-Saharan Africa by improving the capacity of the private sector in this field. One of the sub-projects in this initiative was the Ethiopia Solar Energy

Remittance Program which tried to support remittance platforms and off-grid companies in Ethiopia to form a consortium to solve the energy poverty problem in Ethiopia (USAID,2018). PAOP also conducted some preliminary studies for similar programs in Kenya, Rwanda, Senegal, Sierra Leone, and Niger but based on unofficial chat these studies were not transformed into real projects because of budget restrictions in the implementation phase and lower priority of remittance base initiative than other parts.

It seems that HelloSolar is the local partner of the PAOP program in Ethiopia. In 2018, this company announced that make a partnership with the HelloCash mobile banking platform to use a Pay-as-You-Go (PAYGO) installment credit plan from International Remittance Payment to allow Ethiopian Diaspora to pay for their off-grid relatives from abroad. To find the output of this project, I sent an email to HelloSolar about this project and they said this project was abandoned because of breaking the partnership with HelloCash mobile banking platform. Another informant gave me another narrative from this abandonment off the record. She said this project was stopped that year similar to other projects of USAID in Ethiopia due to political tension between the USA and Ethiopia governments.

- **Diaspora bond in Ethiopia:** In a different form, the Ethiopian government issued some diaspora bonds to raise money from Ethiopian Immigrants all over the world to construct the Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile in 2011 since they couldn't access foreign financial resources because of Egypt objection with this project (Beyene,2014). This project can help electrify some parts of countries by generating hydropower. Through this channel, the government could attract 50 million USD in more than ten years (Fanbac,2023) which was only one percent of the required budget of this project. It seems this initiative was not as successful as expected due to poor marketing from the government's side and negative campaign by the Ethiopian opposition in the diaspora (Beyene,2014).

After these investigations, my supervisor suggested me search more about possible cases in the Netherlands context to facilitate the availability of fieldwork. So, I sent 27 emails to 14 solar companies and received two responses that both of them rejected any collaboration with possible green remittance projects, sent 32 emails to 21 diaspora

community organizations and received only one response from the Netherlands India Association (NIA) and 26 emails to 21 professional renewable energy organizations or programs all over the world and received 4 responses that only the response of the Netherlands Enterprise Agency was practical. Through this investigation, I found SolarPipo & Pollinate Group as other cases of green remittances and conducted two interviews with them.

- **SolarPipo in Uganda:** SolarPipo is an intermediary start-up in Uganda's dairy sector that tries to provide solar systems for dairy producers for cooling, water pumping and other productive applications (<https://www.f6s.com/company/solarpipo-peopleandenergy#about>, no date). I had an interview with the representative of the company and he talked about different experiences from other cases. Some of the Ugandan people who live in the Denmark and Netherlands support this start-up at the early stage of establishment with their financial help. This help was an investment to make an impact in the origin country. Another model of diaspora contribution in his business is related to purchasing company services for their families or communities (Interview1).
- **Pollinate Group in Australia:** “Pollinate Group is a social enterprise that works at the intersection of multiple SDGs to address poverty, and gender equality and improve access to clean energy for marginalized communities living in informal slum settlements in India and Nepal. We are dedicated to ensuring that communities living in poverty can access solar products that improve their health, the health of the environment and save them money” (interview3). I found this company from one of the Indian diaspora organizations in the Netherlands and had an interview with its philanthropy manager. This company has tried to reach out to Indian diaspora communities in Australia and the USA to attract some philanthropic funds for their project in India but they are at the beginning of this initiative and only one percent of their financial turnover comes from diaspora.

What is the selection logic of cases?

To reach the final selection of research cases, I applied two criteria that will discuss in the following lines:

- **Homogeneity:** Most of the cases were implemented by international organizations, non-governmental actors, or private companies in the form of off-grid electrification through renewable energies, especially solar products. Only the project of dam construction in Ethiopia was a completely government-led fundraising project from the diaspora that can help to distribute more electricity via the national grid from a renewable resource. So I exclude this case from more investigation to keep the homogeneity of cases.
- **Accessibility to data:** As you can see in the brief report of some cases, there are not any detailed reports as secondary data about the performance of the purported project or company. Honestly, it is not possible to prove or reject a claim only based on a selling web page or a paragraph in an article or a report. In this regard, only the documents of three projects in the “RemitEnergy” initiative of BASE Foundation were accessible. Since one of these projects in Central Asia was not implemented based on accessibility to secondary data criteria, the Haiti & Bolivia projects can be case studies.
The next step to reach out to those cases that don't have any reliable secondary data was trying to find informants or relevant persons to that project or company. To do this, I activated local networks of ISS students and alumni besides efforts to make direct connections via emails. This process resulted in three interviews with the representatives of three African solar companies in different parts of the continent: Umlilo Energy, Easy Solar & Solar Pipo. I categorized these companies as a unique case study.

To wrap up, there are three case studies in this research that I will try to analyze their activities comparatively: 1- Haiti project 2- Bolivia project 3- African solar companies.

Data gathering instrument:

As I described in the last part, I tried to find credible reports from projects or companies to verify their websites' statements. In most cases, accessibility to the annual or performance reports of companies was not possible so in this obscure condition I had only one option to find more information which was interviewing informants.

At the beginning of the data-gathering stage, I decided to go to Switzerland to visit the experts of BASE Foundation and extract more information via face-to-face talk but they said it is not possible because of time constraints. This was an unpromising event for this research since the cases in Africa not only was more unclear but also there wasn't enough financial resource to travel there

In this stage, I designed two semi-structured interview questionnaires for implementers and donors of these projects based on preliminary information from market assessment reports in Haiti, Dominican Republic, Tajikistan, and Kyrgyzstan. After getting approval from my supervisor, I started an exploratory remote journey since interviews helped me to access new documents, correct my assumptions, and find underlying interaction stories between stakeholders to supply a narrative thread for each initiative. In this path, qualitative interviewing enabled me to talk with ten interviewees about their expectation, their ups and downs along the projects, their decision to pave the way for an untested idea, and ultimately their success or failure factors in these experiences. The list of interviewee without their name is available in the following table:

Table 3-2: List of interviews

Row	Name	Company	Channel of Remittance	Position	Date	Type of Interview
1	-	Solar Pipo	Denmark/Netherlands-Uganda	-	08/08/2023	Online & Text
2	-	Umlilo Energy	United Kingdom-Zimbabwe/South Africa	-	08/08/2023	Online
3	-	Pollinate Group	United States/ Australia- India	-	08/15/2023 08/22/2023	Text
4	-	Arc Finance	United States - Haiti	-	08/17/2023	Online
5	-	Easy Solar	United States/United Kingdom- Liberia/Sierra Leone	-	08/24/2023	Online
6	-	Gaia Consulting	Spain-Bolivia	-	08/28/2023	Online
7	-	Nordic Climate Facility	Spain -Bolivia	-	08/28/2023	Online
8		Arc Finance	United States – Haiti Spain -Bolivia	-	09/14/2023	Online
9	-	BASE Foundation	United States – Haiti Spain -Bolivia	-	09/15/2023	Online & Text
10	-	Sogexpress	United States - Haiti	-	09/29/2023	Online

Limitations of research:

- There is some evidence about projects that stopped in the market assessment phase. Clarifying this matter in the process of selecting case studies was time-consuming.
- It seems that some of the companies' homepages are only for propaganda or exaggeration. This made a bias for researchers about the prevalence of this idea and took time to accept or reject each of these claims.
- The case studies in Haiti and Bolivia were implemented from 2009-2017 and 2012-2015 respectively. Some years after the termination of projects, reaching out to informants was difficult since some of them left their former job positions in recent years. In addition, some of them mentioned in their interviews that they forgot some of the details.
- Conducting online interviews without accessibility to main target groups (senders & recipients of remittances) can decrease the validity of research
- Poor literature on green remittances topic made finding a concrete analytical framework impossible so the researcher could only pick some relevant parts of other literature to analyze the findings. This process is another factor for decreasing the validity of research.

Chapter 4: Discussing case studies

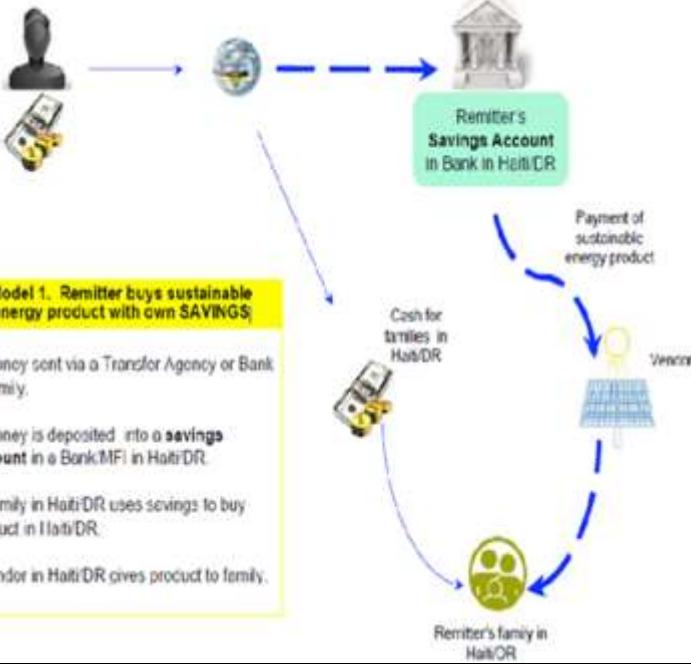
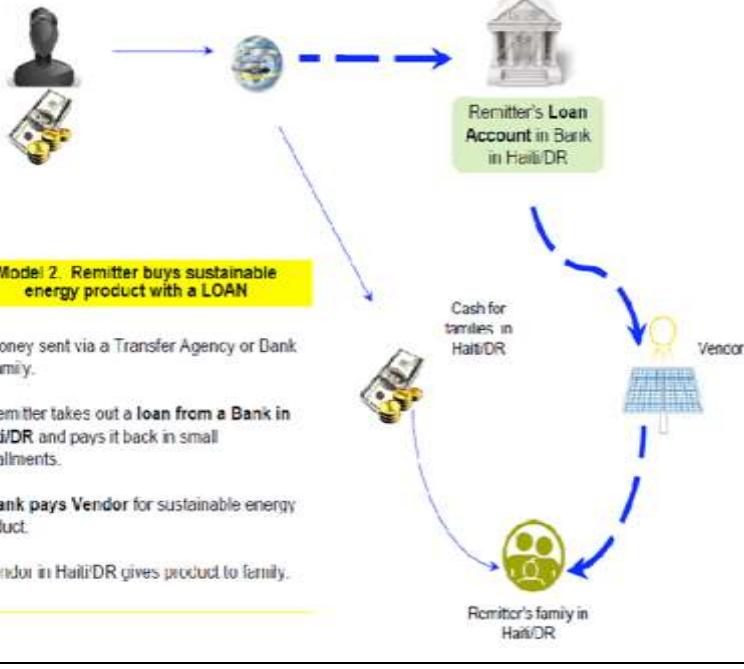
In this chapter, I will try to discuss my findings from secondary data (market assessment reports, final reports, flyers, ...) and primary data (interviews with informants and stakeholders) of three cases: 1- Haiti project 2- Bolivia project 3- African solar companies

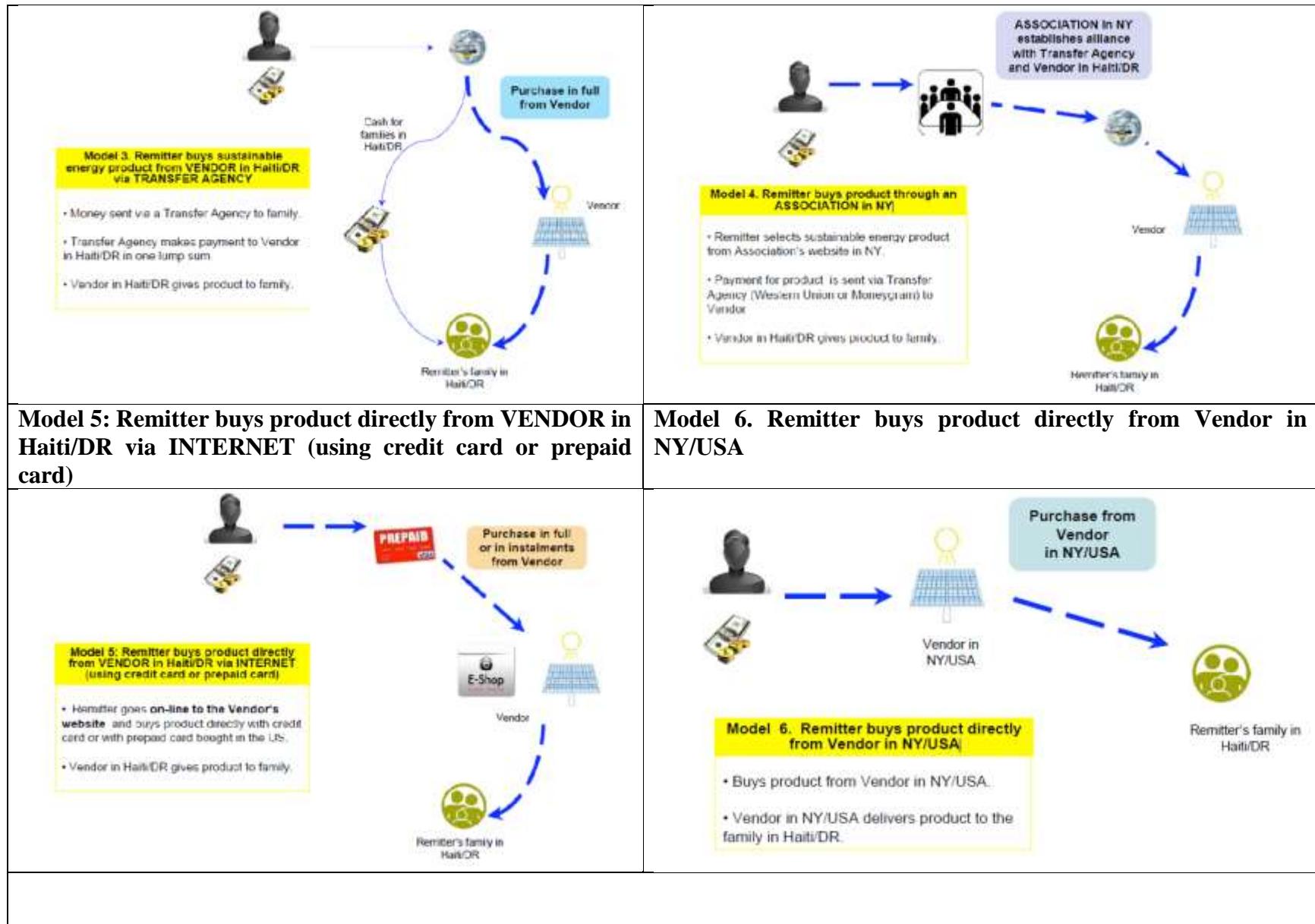
- Haiti project

As I mentioned in Chapter 3, the Haiti project was implemented in three phases from 2009 to 2017. At that time, Haiti had 8.9 million inhabitants and only 1.1 million of them (12.5%) had access to electricity which was the lowest coverage rate in the Western Hemisphere. Another issue is related to the fragility of grids in the Caribbean islands since these places experience many hurricanes each year so this was an opportunity to boost renewable energy projects to generate electricity. On the other hand, there were approximately one million Haitians who lived in the United States and sent 1.8 billion USD to their home in remittances in 2008. This amount of money consisted of 20 percent of Haiti's GDP at that time (Armacost et al,2009).

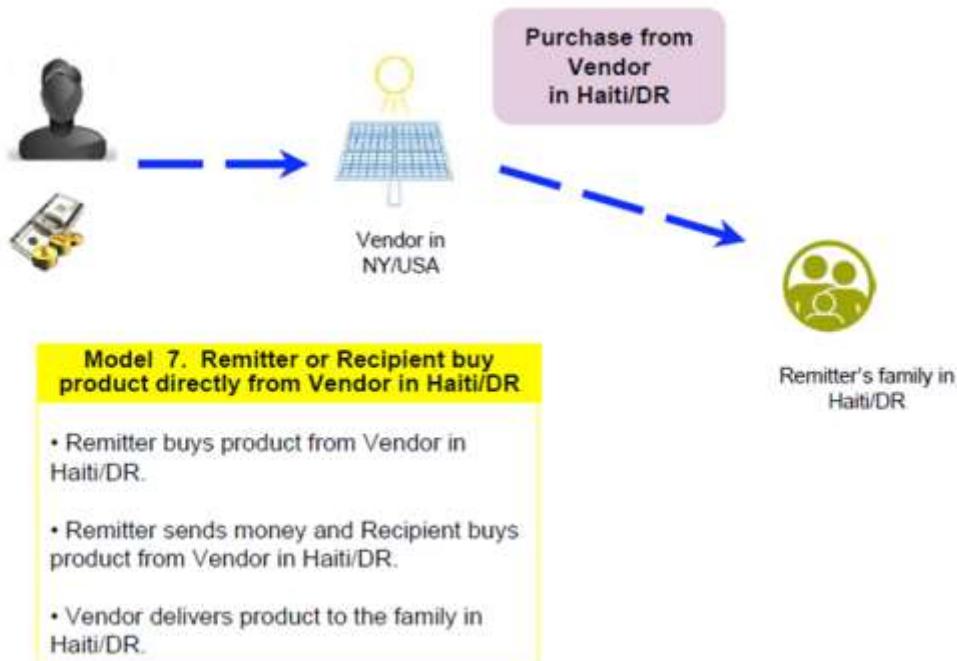
In the first phase, BASE Foundation & Arc Finance experts developed seven business models in their first effort (market assessment in Haiti and the Dominican Republic) for testing the idea of using remittance flows from developed countries as financial support to purchase renewable energy products in the developing world:

Table 4-1: Possible business models for directing remittances to renewable energy products (Armacost *et al.*,2009,p5)

Model 1. Remitter buys sustainable energy product with own SAVINGS	Model 2: Remitter buys sustainable energy product with a LOAN
 <p>Model 1. Remitter buys sustainable energy product with own SAVINGS;</p> <ul style="list-style-type: none"> • Money sent via a Transfer Agency or Bank to family. • Money is deposited into a savings account in a Bank/MFI in Haiti/DR. • Family in Haiti/DR uses savings to buy product in Haiti/DR. • Vendor in Haiti/DR gives product to family. 	 <p>Model 2. Remitter buys sustainable energy product with a LOAN</p> <ul style="list-style-type: none"> • Money sent via a Transfer Agency or Bank to family. • Remitter takes out a loan from a Bank in Haiti/DR and pays it back in small installments. • Bank pays Vendor for sustainable energy product. • Vendor in Haiti/DR gives product to family.
Model 3. Remitter buys sustainable energy product from VENDOR in Haiti/DR via TRANSFER AGENCY	Model 4. Remitter buys product through an ASSOCIATION in NY



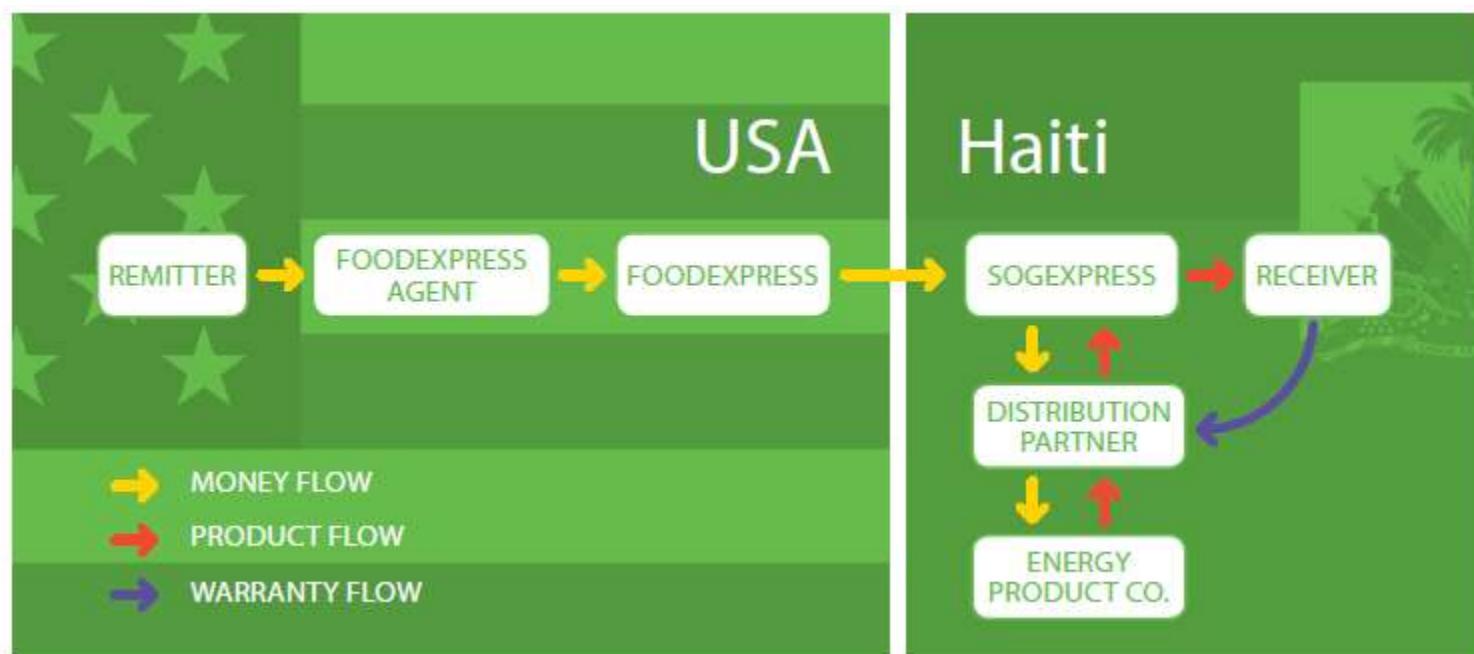
Model 7. Remitter or Recipient buy product directly from Vendor in Haiti/DR



According to the market assessment report, the preferences of remitters and recipients in the focus groups were firstly model number 7 and secondly, model number 6 since they didn't prefer any intermediary like banks or transfer agencies and preferred to deal with vendors directly (Armacost *et al.*,2009,p12). This selection was changed by the project team a bit and model 3 was replaced with model 6. Ultimately between model 7 and model 3, the project team selected the latter since based on their interviews with stakeholders they found that local vendors as representatives of international manufacturers/importers were small and didn't have a robust distribution network to serve a national market. Therefore, they decided to change the business model for using the capacity of a widespread network of an MTI to solve the problem of product distribution (Armacost *et al.*,2009,p16).

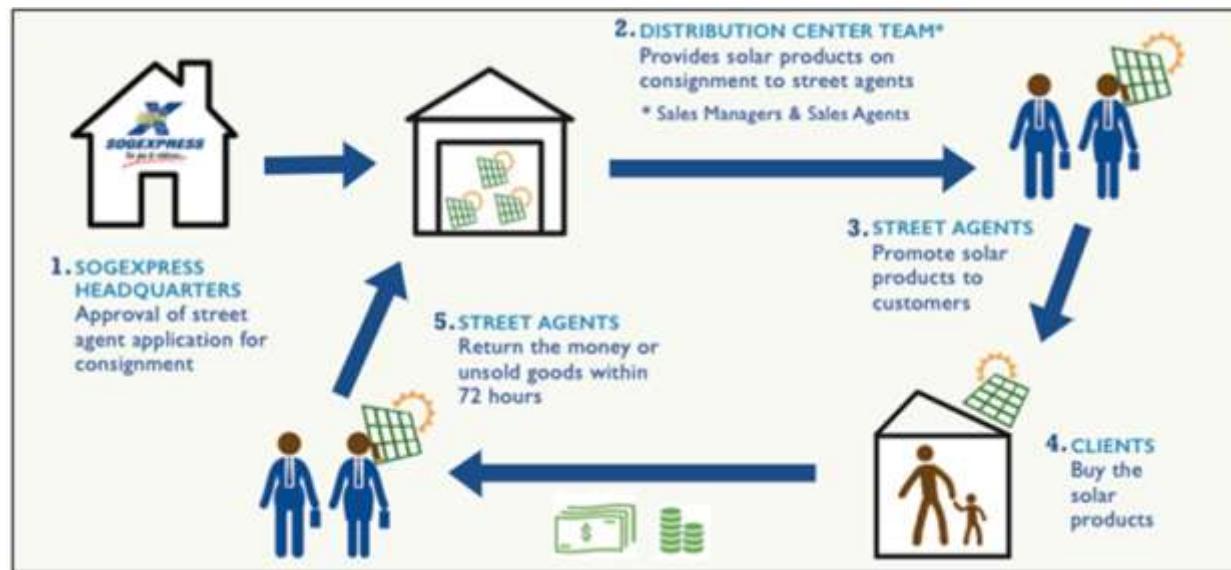
The implementers of this project in the second phase was a consortium of local partners, with the consultancy of Arc Finance. On the sender side, Food Express, a Haitian-owned goods-remittance company based in Miami, was the agent who tried to sell clean energy products to the Haitian diaspora that delivered to their families with the established network of Sogexpress, a money transfer agency in Haiti that have some flagship shops to provide services for receivers across the country. Another important actor was Micama Soley, a Haitian home appliance distribution company, that provided clean energy products for the Sogexpress network by importing and warranty and after-sales service for recipients (Akkari and Armacost,2013,p7). The following diagram shows the implemented business model of the second phase:

Figure 4-1: The business model of the second phase (Akkari and Armacost,2013,p8)



One year after launching the project, Sogexpress hired 500 independent agents who sold solar lamps in the streets based on the consignment model that you can see in the following diagram.

Figure 4-2: Business model promoting agent sales for clean energy products (Armacost *et al.*,2017,p6)



Based on the findings of the market assessment study, five solar products were offered in this program. Initially, three more expensive products with more capabilities were only available for the remitter side and two cheaper ones with fewer services were only accessible in the Sogexpress shops for the people who would like to pay directly by cash. This differentiation between customers disappeared soon since there was a serious demand in the local community to buy all of five solar products in cash form (Akkari and Armacost,2013,p8). You can see the characteristics of the products in the next figure.

Figure 4-3: The solar energy products in the second phase (Akkari and Armacost,2013,p8)



There was a widespread awareness-building campaign via TV and radio, street marketing, SMS, and social media on both sides of this business line that resulted in selling 6136 solar lamps and providing electricity for approximately 30700 people in the first year of the project (March 2012- April 2013) who 55 percent of them lived in the capital city and others lived in other provinces. In addition to the direct impact of the project on alleviating energy poverty that enabled children to do their assignments in their homes and shopkeepers to work more hours after sunset in the evenings or increase the security of women, there were some indirect environmental and economic impacts in this project, for instance, it is estimated that in the first year of project, it decreased 495 tons carbon emission and helped to decline energy cost of all consumers by 223460 USD annually (Akkari and Armacost,2013,pp 9-10).

After terminating phase 2 of the Haiti project, the Arc Finance team discussed the lessons learned. Firstly, they categorized lessons broadly into three groups of implementation, marketing, and sustainability. In the implementation section, they paid attention to the mechanism of selecting partners and identifying prices and

incentives, the importance of soft project piloting, capacity building for all players along the implementation phase, and gaining customer satisfaction through providing warranty and after-sale service. For successful marketing, they highlighted determining products based on the optimal share of remittances, adopting contextual promotion methods, and letting customers test sample products before purchasing. In terms of project sustainability, they thought continuous monitoring, product neutrality of the platform and decreasing local partner risk by donor revolving fund was crucial in this way (Akkari and Armacost,2013,pp 14-15).

In the third phase, a change happened in the diaspora-related business model. The implementing team tried to allow Haitians in the diaspora to provide solar products to their families in Haiti via klereayiti.com. They could register their orders on this website and then pay the cost of it to Western Union, the largest money transfer company in the world, then Sogexpress followed up the path in Haiti as a branch of Western Union (Armacost *et al.*,2017,p7). You can see the schematic diagram of this business model in the following:

Figure 4-4: Business model linking remittances with sustainable energy products (Armacost *et al.*,2017,p7)



They also tried to apply an agent business model on the sender side to expand the diaspora market so through this grassroots marketing, they could reach out to more than 8000 remittance senders (Armacost *et al.*,2017,p8).

Figure 4-5: Expansion of diaspora model through agent pilot (Armacost *et al.*,2017,p8)



In this phase, eight products were offered to clients. Four of them were accessible through a website for the Haitian diaspora and the others were cheaper for sale in Haiti.

Table 4-2: The solar energy products in the third phase: first row for remittance platform, second row for sale in Haiti (Armacost *et al.*,2017,pp 10-11)

BRAND	Sundaya	Sundaya	EKOTEK	EKOTEK
MODEL	T-Light T3	T-light T2	Student Inverter	ONIX
				
PRICE	\$180.00	\$140.00	\$85.00	\$55.00

BRAND	EKOTEK	EKOTEK	EKOTEK	EKOTEK
MODEL	PRO	SOLO	EKO	DUO
				
PRICE	\$17.00	\$33.00	\$25.00	\$28.00

One of the vital elements of the REMMP project (phase 3) is related to ARC's capacity-building strategies that you can review them below:

Table 4-3: ARC's capacity-building strategies (ARC Finance and USAID,2017,p3)

CLIENT ENGAGEMENT STRATEGIES	PROJECT	OBJECTIVE
ENERGY LITERACY PROGRAM	Training for MFI clients under REMMP	To ensure women clients have the skills and knowledge to make informed and effective decision
FRONT-LINE STAFF TRAININGS	Training for MFI field staff under REMMP	To support MFI staff in understanding clients' pain points and train them in sales and marketing
MARKET RESEARCH (FGDS, ENERGY DIARY, PHONE SURVEYS)	Soliciting clients' information and feedback	To gather client-level insights and collect feedback on services and products

Based on these activities, they sold Lantern with Mobile Charging (77%), Simple Lantern (13%), and Mini Solar Home System (10%) to 96600 clients and 483000 people benefited from them (). The positive environmental impact of this phase was estimated at 13773 tons of decrease in carbon emission. Furthermore, it made 47 percent energy cost savings per household each month.

At this moment, Sogexpress is working with another brand “Lakay Express” an online store that helps the Haitian diaspora purchase goods and services for their families and friends in Haiti (Lakay Express, no date). In the marketplace tab of this website, more than 250 products are accessible 8 of them are solar products consisting of 4 types of solar kits from 484 USD to 1062 USD and 4 types of solar refrigerators or freezers from 575 USD to 750 USD. The type and price of solar products are now completely different from project time and it seems only to be a small share of Lakay Express business turnover.

For this project, I conducted four interviews you can read the main points of them next page to get deep insight from the project background.

- Criteria for location selection in BASE projects:
 - The dependence of the country on the remittances
 - Patterns in terms of location of the remittance sender and the remittance recipient
 - Condition of households' energy access
 - How easy to do business
 - The stability of the country
 - The donor priority (Interview 9)
- It seems two people joined each other in 2008 and started the "RemitEnergy". -, Co-founder and Managing Director of Arc Finance, declared that she had worked for a microfinance network called "Women's World Banking" and got a deep knowledge and network in the fields of microfinance and remittances then she established her company for financing clean energy projects. Since she is an immigrant in the United States feels the importance of remittances in the developing process of origin countries directly so in her new business thought about the possibility of this linkage between remittances and renewable energy projects. Then through her network, she reached out to InterAmerican Development Bank (IDB) to fundraise for her idea. On the other side, a Mexican immigrant in Switzerland who is the Managing Director of BASE Foundation traveled to Chicago for a conference during the same period. On that trip, he found one shop where Mexican immigrants in the United States could buy construction materials and their families could receive them in Mexico with a code¹. He guessed that this business model can work in the renewable energy sector so he also started to negotiate with IDB to collect some money for testing this business model. Then they prepared a proposal to undertake a market assessment in Haiti & Dominican Republic for the first phase. (Interviews 8 & 9)
- It is possible to differentiate the two phases of the project conceptually. One is the architecture phase to develop the whole structure of the model based on the preferences of stakeholders, identifying possible partners, and establishing their roles and connections in the pilot phase. The other is the operational phase for testing the

¹ - Costrumex, a social enterprise developed by the CEMEX, a Mexican construction material company, in 2001 to enable the Mexican diaspora in the USA to invest their remittances in building homes for themselves or their relatives in Mexico. (Runde,2015)

business model on the ground, adapting it to contextual requirements, and using capacity-building methods to increase the productivity of the business model. (Interview 9)

- In the market assessment phase, they evaluate the expectations, aspirations, and emotional aspects of people who receive or send remittances. For example, one of the things that they did, was testing different products on the recipient side to see which of them was more attractive for them. (Interview 9)
- In the initial research, they found Foodexpress as a subset of Sogexpress (the biggest remittance company and the largest partner of Western Union in Haiti) that was a food remittance model and felt that the Haitian diaspora preferred this company to banks or global financial institutions to transfer their remittances so it is possible to add renewable energy products to the basket of this money transfer institution. (Interview 8)
- After the market assessment phase, Sogexpress implemented the final business model in the second phase with the consultation of Arc Finance and financial help of IDB and Clinton Bush Haiti Fund for marketing and revolving fund. BASE Foundation didn't have an active role after market assessment since its mission is only related to boosting innovative business models for financing renewable energy projects and aligning local and international stakeholders to guarantee the output of projects. (Interview 9)
- The interviewees mentioned that 20 to 25 percent of remittances that people received in Haiti were spent on buying kerosene, candle, or firewood so they tried to target this part of remittances (approximately 125 USD) and increased energy productivity and sustainability by introducing solar products that were cheaper than this amount of money since recipients didn't prefer to invest more on energy and decrease their income from remittances. Also, recipients didn't prefer any saving or loan arrangement for buying solar energy products. (Interview 4&9)
- On the other hand, remitters saw in-kind remittances as a gift that helped them to have more control over the spending targets of remittances by their families than cash transferring. It made them more confident this help would improve the quality of their family life. Also, most of the remitters were construction workers or taxi drivers in the United States and couldn't work with online payments at that time so the payment mechanism for them must be simple enough. (Interview 8)

- If you ask that question on the recipient side, what is the priority investment of remittances, in some cases the recipient wants to have a new TV, a new car, new clothes, new mobile phone, but when you ask the sender, they have a different view. They wanted to improve the house, improve the roof, or invest in another source of income for instance a business. They didn't like to make the family dependent on just one income resource which was the remittance. So you can see that different interests were depending on who answer these questions. (Interview 9)
- They realized during the market assessment that already was a lot of disruption in the market because people were buying products that were perceived as bad quality and that they failed. So they wanted to put in place a very robust maintenance or guarantee system. And in all the cases the deal was that if during the period of the guarantee, there was a claim or failure of the equipment. The equipment will be completely replaced by a new one. So there was no middle point it was the full guarantee for a failure in the equipment if it was within the guarantee period. (Interview 9)
- Initially, marketing for the project was started from the push side and there were some campaigns in Miami for Haitian diasporas but since they were dispersed in different cities and countries and didn't have the same communication channels to receive advertisements so selling products with push strategies was not successful as the project team expected. At that moment (second phase) they were flexible and tested another way to sell the products. They started marketing in the pull side (Haiti) and added another counter in flagship shops of Sogexpress all over the country. This was similar to another initiative of Sogexpress for selling cell phones via remittances. In this way, recipients could receive their remittances on one counter and then buy solar products on another counter with cash remittances. This type of selling opened the market for the people who their relatives didn't send solar lamps to them. This model increases the selling sharply. So changing the marketing strategy from abroad to inside of the country where there was a monopoly by Sogexpress promoted the project successfully. (Interview 8)
- There are some reasons that the first business model via platform couldn't work well. First remitters didn't like to go to a website select the product and then pay the price online. This method couldn't motivate them

more than sending money simply to their families. Another thing was their inability to see and check the products at the time of purchasing.

- In the middle of phase two, another idea was launched to create a revolving fund with the help of donors where the profits from the sale of the product would be put into the purchase of new products so that they could try to diversify the business model with hiring agents to sell solar products in the streets. For the people who bought products from agent sales, you don't know for sure that they received the money through remittances, but they were encouraged by the Sogexpress marketing campaign as a remittance company. It is clear that getting to the agent model was moving further and further away from a pure remittance model. (Interview 8)
- In the process of even the same sender side, they face some difficulties to convince them and they change the strategy at different times in the project to see which one was more effective to build trust. Because in the end, I told you it's a matter of trust. To connect with the different stakeholders, they implemented a strategy with the recipient side with the distribution center as well. So it's a process where you are refining and changing according to the context and according to the circumstances in each of the countries. (Interview 9)
- The other thing that happened in phase three is that they shifted from international suppliers, which were more expensive to cheaper local suppliers. “One of the things that we always try to do is to partner with entities that are well recognized in Haiti so we don't have to build reputation from scratch, and trust” “It's a different way to do things when you don't know the things. It creates. Risk aversion, a lack of trust. And for that, it's very important to build trust. How do we build trust? Well, first, partnering with people that they are familiar with second we normally do raising awareness campaigns. We have been testing different things and different approaches. You know, it sounds silly, but in the case of Haiti, one of the campaigns worked very well because we hired a marketing campaign marketing company in Haiti that had offices in Miami. So they have this kind of both visions of what understanding that both sides and the guy told us listen, if you hire these comedians, from Haiti, he has a TV show, a TV show and a radio show in Miami. This guy, if he promotes products, your products are gonna be sold. Because people trust this guy, even if it's in the way of jokes and a way of a comedian. That happened to be very effective for us.” (Interview 9)

- In the third phase, there was a communication problem between the Haitian diaspora who speak more French or their local language with the Western Union's staff who can speak more English or Spanish. (Interview 10)
- Agent business model was inspired by a G-cell company that sold top-up for cell phones by their agents in the streets and at the beginning Sogexpress started to use this network to increase the number of selling solar products. (Interview 10)
- USAID & IDB's role was providing funds for covering the cost of consultants, revolving fund in phase 3, and marketing. (Interview 8)
- The national government in Haiti didn't have any role and engagement but their tax policy for solar products was not helpful for importers since the government put a high tax rate on this type of products. Also, they didn't need any permission for their work since everything happened under the permit of Sogexpress. (Interview 10)
- There was a delivery challenge for the shops in provinces and remote areas. The Sogexpress couldn't monitor and trace products effectively so in some cases stock never reached the location or some lasts happened in the path. (Interview 10)
- Sogexpress representative believed that this company as a money transfer company doesn't have enough expertise to work as a retailer in local communities and only can play as a middleman between seller and clients by receiving orders and payments from the diaspora and delivering products and cannot perform a retail marketing in the local community. (Interview 10)
- A range of reasons were suggested by interviewees as to why Sogexpress did not continue the solar program despite its success. It was difficult for Sogexpress to manage the business model without the support of the consultant, the potential of the agent model was restricted because of advancing online money transferring, and despite having developed a sizable reserve pool of funds from the sale of solar products, Sogexpress needed to use those funds for other purposes after the project was completed due to political and economic unrest in the country. (Interviews 8,9,10)

- **Bolivia project**

This project is the second project of the “RemitEnergy” initiative which started in 2012. The market assessment phase was conducted by Arc Finance researchers during August and September 2012 in Bolivia and Spain (ARC Finance,2012,p4). They investigated in characteristics of remittances (Frequency & amount, length of time, the cities of receiving or sending, ways of receiving or sending, uses, and who control it), the interest of target groups to banks or other money transferring organization, their favorite payment methods and how they prefer the advertisements, their opinions about preferred products and potential business models.

The Bolivia project was implemented in a different context than the Haiti project since the participants of focus group sessions on the sender side said 98 percent of their families had access to the national grid (ARC Finance,2012,p19). On the other side, the recipients declared all of them had grid connections (ARC Finance,2012,p14). Moreover, 20 percent of senders' families had gas connections in their homes (ARC Finance,2012,p16). This rate was 32 percent for the recipients' homes (ARC Finance,2012,p14). Both groups mentioned that the government had a program to make free gas connections to more citizens at that time. Thus in the Bolivia context, we couldn't talk about energy poverty, and the only problem was related to affordability due to many of the participants in focus groups in both sides that “Electricity is expensive or so expensive in Bolivia” (ARC Finance,2012,p16).

In terms of remittances, reports of the project show that in 2010, 684600 Bolivian immigrants sent more than 1 billion USD to their relatives in origin country (ARC Finance,2012,p4). 430 million of this amount of money was remitted from Spain. It seems that Bolivia's economy relied more than South American countries on remittances at that time. The share of remittances in Bolivia's GNP was 8.5 and 8.7 percent in 2005 and 2006 respectively.

In this context, the project team decided to test the idea of financing through remittance on some small-scale renewable energy (RE) and energy efficient (EE) products or technologies to reduce GHG emissions and cost of energy for low-income households in urban and rural areas with raising awareness about cleaner and less intensive energy resources (ARC Finance,2012,p4). To reach this aim, they evaluated the preferences and positive or negative ideas of remitters and recipients about nine products:

- Natural Gas Connection
- Solar Home System
- Solar Water Heater
- Efficient Boiler
- Biomass Cookstove
- Efficient Refrigerator
- Natural Gas Converter for Car
- New Car
- Prefabricated House

For sender participants in Madrid and Barcelona, the most preferred products to invest in were firstly solar panels (27 votes), then gas connection and refrigerator with the same interests (18 votes), and lastly solar water heater (16 votes) (ARC Finance,2012,p26). On the other side, recipients in La Paz, Santa Cruz, and Cochabamba preferred to have prefabricated houses (21 votes), efficient refrigerators (17 votes), and biomass cookstoves (16 votes) respectively. Since the only mutual choice between the two groups was an efficient refrigerator so it is expected logically that the project started with this product to realize one of the project objectives to decrease households' energy costs but peculiarly they selected a solar water heater that was preferred by only 5 people. It is noteworthy to say that solar panels as the most popular product for senders could get 9 votes on the recipient side (ARC Finance,2012,p24).

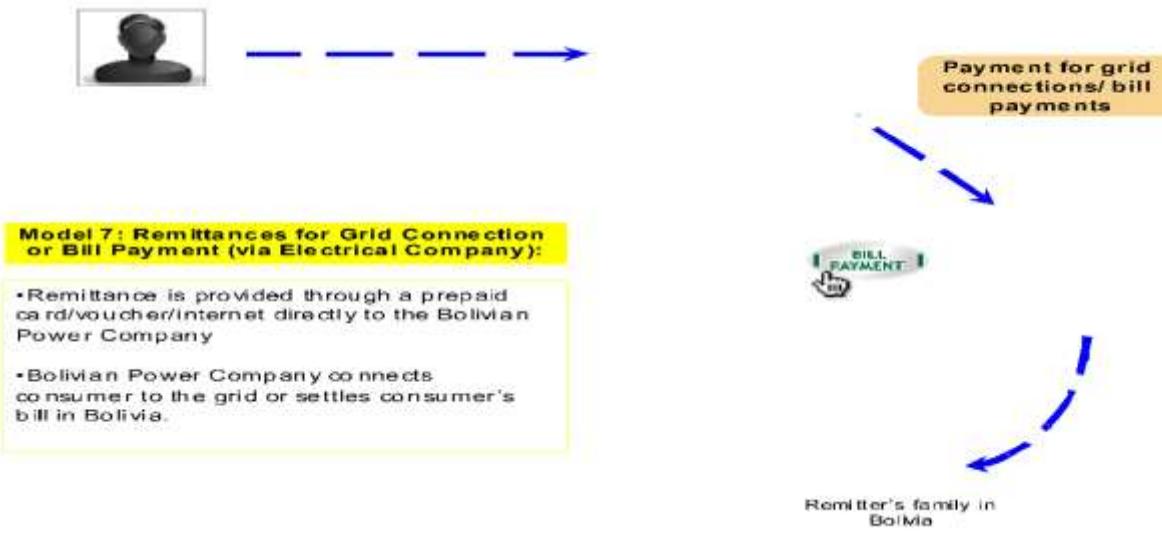
The other important element of the market assessment phase was testing the seven business models to explore the priorities of senders and recipients to engage in this new business line. There are some differences between the business models that were tested in this market assessment than the Haiti project so you can review them in the following table.

Table 4-4: Possible business models in the Bolivia market assessment phase (ARC Finance,2012,pp 28-34)

Model 1: Purchase Via Savings Account	Model 2: Purchase Via Loan Account
<p>Model 1. Remittances to Savings Account Model (via bank or MTO):</p> <ul style="list-style-type: none"> • Money sent via traditional remittance provider from Spain (for example a bank or a Money Transfer Organization (MTO)) to a bank/microfinance organization (MFI) in the recipient country. • Money is put into a savings account in a Bank/MFI in Bolivia. • Family in Bolivia uses savings to purchase sustainable energy products in Bolivia. • Vendor in Bolivia delivers product to family or makes available for pick up. 	<p>Model 2. Remittances to Loan Account Model (via bank or MTO):</p> <ul style="list-style-type: none"> • The remittance is sent by a traditional remittance provider from Spain – for example a bank or a Money Transfer Organization (MTO) - to a bank/MFI in the recipient country. • The money is put into a loan account that can be used to purchase sustainable energy products. The family can pay for the product in small installments.
Model 3: Purchase Via Money Transfer Organization	Model 4: Direct Purchase from Vendor in Spain

<p>Model 3. Remittances for Energy Product via MTO or GTO:</p> <ul style="list-style-type: none"> The remittances are sent through a Money Transfer Organization (MTO) or a Goods Transfer Organization (GTO) based in Spain. The MTO/GTO selects the sustainable energy products and purchases the product from an energy vendor. The remitter can choose to have the sustainable energy product home delivered or picked up at a specific location in the recipient country. 	<p>Model 4. Remittances for Energy Product (directly from Vendor in the sending country):</p> <ul style="list-style-type: none"> The remittance is provided through a prepaid card/voucher/internet to an energy company or a consumer durable company based in Spain. The company delivers the product directly to the family or makes it available for pick up in a warehouse in the receiving country.
<p>Model 5: Direct Purchase from Vendor in Bolivia</p> <p>Model 5. Remittances for Energy Product (directly from Vendor in the receiving country):</p> <ul style="list-style-type: none"> The remittance is provided through a prepaid card/voucher/internet directly to an energy vendor or consumer durable company that operates in Bolivia. The company delivers the product directly to the family or makes it available for pick up in a warehouse in the Bolivia. 	<p>Model 6: Purchase Via Mobile Phone Company in Bolivia</p> <p>Model 6. Remittances for Energy Product (via Mobile Phone):</p> <ul style="list-style-type: none"> The remittance is sent via mobile phone in the form of vouchers or credits to a Mobile Phone Company that operates in Bolivia. Mobile Phone Company identifies products and services available to send to family in Bolivia. The company delivers the product directly to the family or makes it available for pick up in a sales office in Bolivia.

Model 7: Direct Purchase from Electric Company in Bolivia



After proposing business models to focus groups, they voted for them based on their preferences and group discussions. Bolivian immigrants in Spain preferred model 5 with (23 votes) then model 7 with (18 votes) and finally model 1 with (17 votes). On the other hand, the inhabitants in Bolivia thought model 5 was the best option with (26 votes) then model 2 with (21 votes) and finally model 1 with (15 votes). So both of the target groups had the same idea about the most effective business model but based on the final report of the project, what was implemented on the ground was more similar to model 2 since the price of the solar water heater was 750 USD (2 people) or 2059 USD (5 people) that was too expensive for clients and some them said they need loan or credit from vendor to buy this product.

The final business model consisted of local financial partners, local provider for installation, maintenance, and after-sale service, and sales and information networks in both countries. In this business model, the Bolivian diaspora could buy solar water heaters for their relatives –in full, in installments, or with credit from a financial institution.

The commercial operation of these deals was handled by an internet-based platform EcoBazar and a Facebook portal (Nordic Climate Facility, 2015, p3). The marketing strategy of this project consisted of traditional media, social networks for example YouTube and Facebook as well as some campaigns (Nordic Climate Facility, 2015, p6).

Figure 4-6: Graphical project overview and commercial platform with key implementation partners and their responsibilities (Nordic Climate Facility, 2015, p7)



In terms of evaluating this project, it doesn't seem successful since it targeted 50000 Bolivian immigrants in Spain and 250000 recipients of remittances in Bolivia (Nordic Climate Facility, 2015, p10). One month before terminating the project in November 2015, they only sold and installed 150 solar water heaters one year after starting the sale in October 2014. The project's planned target for the first year was 5000 units so their performance was not defensible. The final report enumerates some reasons for this performance:

- “Delay in project implementation and hence in entering the commercialization phase
- The decision to focus early commercialization on one technology option (SWH) only
- The significant and unforeseen delay in materializing the pledged financial support from the International Fund for Agricultural Development (IFAD)
- The complicated administrative process to establish the originally designed business entity that was supposed to operationalize the commercial functions of the platform for sustainable financing
- The delay by banking partners in implementing the developed consumer credit solution
- The government of Bolivia’s policy on extending and possibly subsidizing the national gas grid and related products, has slowed down sales of SWH and their market penetration.
- There have also been international aid projects aiming to subsidize, among other SWH, which the project has had to accommodate.
- The continued weak economic growth in Europe has decelerated remittance flows from Spain to Bolivia.”

(Nordic Climate Facility, 2015)

To verify my findings from the market assessment and final reports, I conducted four interviews you can see some points from interviewees about the reasons for poor performance in the following lines:

- Energy poverty wasn’t a critical issue in Bolivia (Interview 9)
- The proposal was not strong enough (Interview 7)
- The project team couldn’t make an agreement with the main money transfer organizations in Bolivia to be a partner in the project (similar to what happened in Haiti) since they preferred to focus on their own business (Interview 9)
- Two banks were the channel of transferring remittances that didn’t have more experience since a smaller amount of remittances goes through banks in Bolivia and they weren’t agile and capable partners. (Interview 6)

- There was a rigid remittance mechanism in the project and the implementer team didn't have enough flexibility to test different business models similar to what happened in the Haiti project. (Interview 8)
- The price of a solar water heater wasn't affordable for remitters to buy it as a gift in a straight transaction. It needed to make a loan that wasn't interesting for the recipients since it required complicated financial relationships with people in the diaspora. (Interview 8)
- Wrong selection of implementing partner from Finland that consultancy firm didn't have enough knowledge and experience about remittance and Bolivia context. (Interview 7)
- Finish consultancy who managed the project didn't have enough commitment. It only needed to make money from short projects so it didn't hire enough personnel for the implementing phase only one person was hired. They also were not honest and tried to prepare fake reports or fake Facebook page or website for the project. (Interview 7)
- The donor of the project from the Finnish government screwed it up. They had a mission trip to Bolivia and offered some water heaters to the Bolivian government for free. So when the Bolivian government made a public announcement, the target group guessed that can get this product for free in the future so this was a big disincentive for the project that unfortunately was happened by the same donor somehow related to the project. (Interview 9)
- At the same time, the Bolivian government started a program to extend the connection of citizens to natural gas for free so this was another disincentive for the target group since they thought can get heat water cheaper by natural gas than investing in a solar water heater. (Interview 9)
- The project team for advertising the solar water heater on the diaspora side relied very much on the Bolivian immigrant association in Madrid which didn't have enough commitment to the project since that association was a non-beneficiary organization was supported by Madrid municipality to help immigrants in their daily paperwork so promoting this project was not their main business and project team wasn't successful to make financial incentives for them. (Interview 7)

- At that time there were some financial difficulties in Bolivia since some of the people who had immigrated were kicked out of the country because they didn't have legal permission to travel. (Interview 7)
- There was not a real market for solar water heaters in Bolivia. (Interview 7)
- Lack of enough knowledge about the Bolivian diaspora community in Spain. (Interview 7)

One of the interviewees (Interview 9) also explained the reasons why they selected the solar water heater as a final product of the project:

- There were huge campaigns in Spain about solar water heaters at that time so it seemed that the Bolivian diaspora community has enough knowledge about this product and the project team doesn't need to launch a raising awareness campaign
- From the market assessment phase, they got there was a huge concern about electric showers in Bolivia at that time. This was common technology for heating water that was old and in some cases very dangerous. So it seemed this is an urgent matter for people to have solar water heaters not only for climate concerns or economic saving but for their safety and security

- **African solar companies**

As I mentioned earlier there were some similar programs in different African countries but unfortunately, their performances are not transparent since none of them published any reports about business models and outputs of their activities around the “Green Remittances” concept. Some of them have only a website for introducing their idea or receiving purchasing orders from the diaspora community but it is not evident how they provide services. As a researcher, I tried to make a connection with all of these companies but in some cases, they haven't responded to my messages from different channels so I guess that maybe these webpages are only a way to show off or optimistically related to abandoned projects in their infancy phase.

Fortunately, I had three interviews with SolarPipo, Easy Solar, and Umlilo Energy companies and talked about their experience in making a connection between diaspora finances and renewable energy projects. You can read the main points of these interviews in the following lines:

- The first prominent thing is related to the share of diaspora finances in the financial turnover of independent companies that launched this kind of initiative. Easy Solar and SolarPipo representatives declared that only 5 percent of their financial resources come from diaspora communities. The only pure diaspora-led company is Umlilo Energy, a UK-based start-up, which has sold and erected 22 solar home systems since 2020 in Zimbabwe and South Africa. Its representative talked about their decision to extend this business to some other African countries soon not only based on diaspora finances but also through a financial mechanism with the support of UK banks.
- Although all of these companies are leveraging remittance for financing demand side in different forms, but in the case of SolarPipo, there was a considerable emphasis on the role of diaspora as angel investors or connectors of Western investors to African people in establishing phase of renewable energy companies that happened based on the diaspora incentive for making a long-term impact on their local community. In this regard, SolarPipo representative believed that convincing the diaspora to invest in this field is not difficult with triggering these incentives and feelings since they are frustrated to help the local community effectively and say they tried but their money was mishandled or misused (there was a same statement in Pollinate Group interview that works on philanthropic remittances from Australia and USA to India). (Interview 1)
- The main product of Easy Solar and Umlilo Energy is a solar home system but the product of SolarPipo is a hybrid or pure micro-grid system for dairy producers especially dairy cooperatives or farmers' associations who can pay the price collectively by cash, mobile money, or credits which they received from processing companies.
- Umlilo Energy is trying to leverage the diaspora possibility to get credit from UK banks to finance purchasing and installation of solar home systems in Zimbabwe. This is a different business model that has a limitation of "a higher risk threshold for customers or operations that are not in the UK" (Interview 2)
- Easy Solar representative mentioned that developing the diaspora side of this business is difficult since most people still prefer to purchase by cash not online. The other thing is related to the lack of their physical presence in the UK and USA (diaspora side) so this is difficult for them to build up trust in the diaspora community

toward their brand (Interview 5). In the same manner, the Umlilo Energy representative mentioned that their presence in the UK helps them to build trust with the diaspora community since they can observe them as a UK registry company or call them with a UK line. It seems that the price of the product plays a vital role in this trust mechanism because he mentioned that when a person in diaspora would like to invest between 2000 to 6000 USD for their relatives in the origin country needs to know and visit the people that deals with them on the ground. For Umlilo Energy, maintaining the high quality of products and providing an active customer service plan are other strategies for building trust. (Interview 2)

- There is a different promotion concentration in these projects or companies. For example, in the case of Easy Solar, they only put their efforts into increasing awareness of the local community while Umlilo Energy only tries to attract the attention of the Zimbabwean community in the UK via their social groups. Although they employed various advertising strategies, all of them insisted that gaining customers' trust was the most difficult part of their businesses. For example, Easy Solar compare its business with Western Union or Money Gram, the companies that transfer remittances, for immigrants, and say to them we don't receive transaction cost from you and in this way can persuade them to change their money to a service for their family. (Interview 5)
- Solar Pipo representative mentioned "Negative feedback might have centered around affordability concerns, potential technical issues, or limited access to financial resources for repayments. Addressing these concerns transparently and providing strong customer support helped us mitigate such issues. We provided flexible payment options such as installment plans, which make the products more accessible." (Interview 1)
- On the side of the local community, they use education and word of mouth as the main strategies for convincing people to use solar products.
- All of the implementers are importers of solar products and provide installation, guarantee, and after-sale services from 2 to 25 years based on the type of products and their providers.
- National governments can help these companies with tax waiving on solar products, cutting the importing tariffs, or making an exemption from value-added tax. This is similar to an indirect subsidy to renewable

energy companies and local governments can offer supports through permits, infrastructure development, or community engagement, facilitating smoother project implementation.

To wrap up this chapter, I prefer to discuss the strengths, weaknesses, opportunities, and threats of this idea in reality based on projects' documents and the comments of interviewees.

At the end of phase 3 in 2017, they mentioned economic instability due to currency devaluation, political violence because of Hurricane Matthew, product selection, and gaining customers' trust in the closing workshop. Then they argued the strengths, weaknesses, opportunities, and threats of the project:

- **Strengths:**
 - Reliable market research
 - Broad product selection as well as several pricing options for diaspora clients
 - Staff ongoing training
 - Designing an IT system to generate data from agents' performance
 - Neutrality of platform toward products' brand
- **Weaknesses:**
 - Developing and rolling out a new IT system is time-consuming
 - The order and payment in the remittances platform hadn't simplified and streamlined the process
- **Opportunities:**
 - The direct impact of street marketing and special promotions on increasing cash sales
 - Energy literacy materials for educating clients on solar energy can rise the sales rate
 - Providers must offer high-quality products, adequate stock, and a diversity of product choices to meet consumer demand
- **Threats:**
 - External shocks decreased the profit of business significantly (Armacost *et al.*, 2017).

It is possible to get the similar model from the final report of the Bolivia project:

- **Strengths:**
 - Partnership with local stakeholders to increase the robustness and credibility of the business model
- **Weaknesses:**
 - The implementation phase of the project had some delays
- **Opportunities:**
 - The project was highly matched with the country climate commitments
 - The project could decrease the cost of electricity in the families' budget and improve personal safety
 - Banks had a positive approach to give credits based on remittances
 - Diaspora demand was firmly established (Nordic Climate Facility, 2015)

To complete my knowledge, I asked similar questions from interviewees and report their opinions here:

- **Strengths:**
 - It actually brought a local Haitian company into the solar business. The marketing campaign raised huge amounts of money for Sogexpress
 - A deep market assessment research was conducted for the project
 - Strong partnerships and collaborations with local stakeholders were built
 - The implementer team was flexible about the business model in the Haiti project
- **Weaknesses:**
 - The local implementer of the Haiti project left the governance structure that can take decisions and share responsibilities once the consultancy team retired from the project and they were not able to further support the project
- **Opportunities:**
 - Remittances as a river that is flowing. So if it can be channeled into productive uses, whether it is energy or whether it is other things, I think that's a great thing
 - The partnership of the Inter-American Development Bank, and the USAID to fund the marketing and creation revolving fund, released Sogexpress to invest a lot of money in an unclear business plan

- o The distribution of products was very difficult, but we were lucky to work with a local remittance company, Sogexpress, they already had more than 60 points of sales across Haiti, which made the distribution of products
- Threats:
 - o At the beginning of the project, local companies were not confident about the viability of this initiative
 - o Understanding the most effective angle for marketing was time-consuming
 - o The whole education aspect, all that's why it's kind of difficult. It's a difficult initiative and project because it doesn't only require people to just change the way they spend their money, but it's like the whole training education aspect of it
 - o The difficult element here of the project is building that trust, trust in the product, which is a big challenge for solar companies and creation in general is being able to trust that the product works. And we'll be working for you know, enough time that they could at least trust the brand and trust the project
 - o Haiti constantly had unrest and a very challenging environment that made doing business difficult because of many constraints about trade, tax or government corruption

Chapter 5: Analysis and recommendations

I commenced this research with an evidence-based explanation of the severity of energy poverty all over the world. Then, I discuss the utility of off-grid electrification as a consensual solution for this problem since most of the people who suffer from energy poverty live in remote areas. After that, I showed the financial gap to support sustainable energy solutions globally. On the demand side, UNDP claims that 35 to 40 billion USD is needed annually to achieve SDG 7 goals but on the other side upward trend of investment in renewable that reached its peak in 2017 (25 billion USD) stopped and after that decreased dramatically. To tackle this scarcity of financial resources, I mentioned the enormous potential of remittances to support renewable energy projects in developing countries.

To investigate the viability of this untapped finance method, I tried to consider business models, bottlenecks, and each positive or negative points in a few cases of this initiative which were implemented before. Thanks to the novelty of the topic, there isn't any extensive scientific literature but in Chapter 2, I tried to discuss literature around diaspora finances, off-grid electrification, and renewable energies in detail and extract some parts of them that will help me to analyze my findings.

In Chapter 3, I argued my preference for research methodology as a multiple case study method because it enables me to research a multi-dimensional subject in various contexts that can give a general or comprehensive overview to put forward practical recommendations. Subsequently, I described the process and criteria of case selection that led to three cases: 1- Haiti project 2- Bolivia project 3- African solar companies (Easy Solar, Umlilo Energy, and SolarPipo). As you saw in Chapter 4, I discussed my findings from accessible documents and the interviews with informants. Now in the following paragraphs, I will try to analyze my findings based on classical concepts categorizations in Chapter 2, respond to research questions, suggest an initial outline of an analytical framework in this field, and finally offer my recommendation for future researches about green remittances.

Firstly, I pay attention to the kind of diaspora finances in case studies. I can say that in Haiti and Bolivia projects, Umlilo Energy and Easy Solar observed a pure form of remittances that an intermediary such as a money transfer

organization like Sogexpress or solar companies try independently to transform cash to in-kind remittances. But there is an exception, SolarPipo's experience demonstrates the potential of diaspora direct investment and especially diaspora portfolio investment for promoting green solutions in local communities.

In terms of the initiative scale, I can discuss two criteria 1- number of consumers and 2- geographical area of initiative. For the first one, I am referring to Figure 2-6 (Remittance investment spectrum) and think Haiti and Bolivia projects, Umlilo Energy and Easy Solar are in the category of “Individual productive uses of energy assets” but SolarPipo is classified in “Productive uses of energy projects”. For the second criterion, I asked from interviews about the location of their projects and their target groups. Most of the cases declared they work for people who don't have access to electricity or energy but they didn't confine their efforts to rural areas. Specifically, in the Haiti and Bolivia projects, the main parts of the target group lived in urban areas. Only SolarPipo representative said, “All the projects are in rural areas because we target commercial farmers who need energy for productive use”.

To classify these initiatives around their business model (sub-question number 1), it seems that most of them are based on stand-alone systems but SolarPipo is based on hybrid or pure micro-grid systems. In the duality of Isolated or interactive models, I can say the Haiti and Bolivia projects had interactive models since their main implementers were a consortium of local companies that had foreign consultants, Solar Pipo has an interactive model since tries to collaborate with local dairy cooperatives to implement projects. On the other side, it seems that Easy Solar and Umlilo Energy's business models are isolated since there isn't any evidence that they make any partnerships with local communities to implement their projects.

When we look at the financing models of these initiatives, the Haiti project, Easy Solar, and Umlilo Energy are purely commercial-led initiatives that private sector companies implement projects and the payment method is cash-based with support of direct remittances but on the other hand in Bolivia project and Solar Pipo have multi-stakeholder programmatic model since the payment of product or services is with consumer credits that supported by a bank (Bolivia project) or a village cooperative (Solar Pipo).

If I would like to talk about the viability aspect of the “Green Remittances” finance method, I can say that the case of African solar companies shows us remittances cannot be the main financial resource of their projects because it only consists of 5 percent of financial turnover of Easy Solar and Solar Pipo and in case of Umlilo Energy, its representative insisted that for the development phase of his business cannot rely only on remittances. This matter is also evident in the Haiti project since the project team hired agents to boost sales in street marketing. This decision was a deviation from the remittance-based business model. In this regard, this result can be interpreted as a confirmation of Joevas Asare's, Managing Director of ARK Group International, opinion who looked at diaspora finances as a complementary resource in a blended finance mechanism

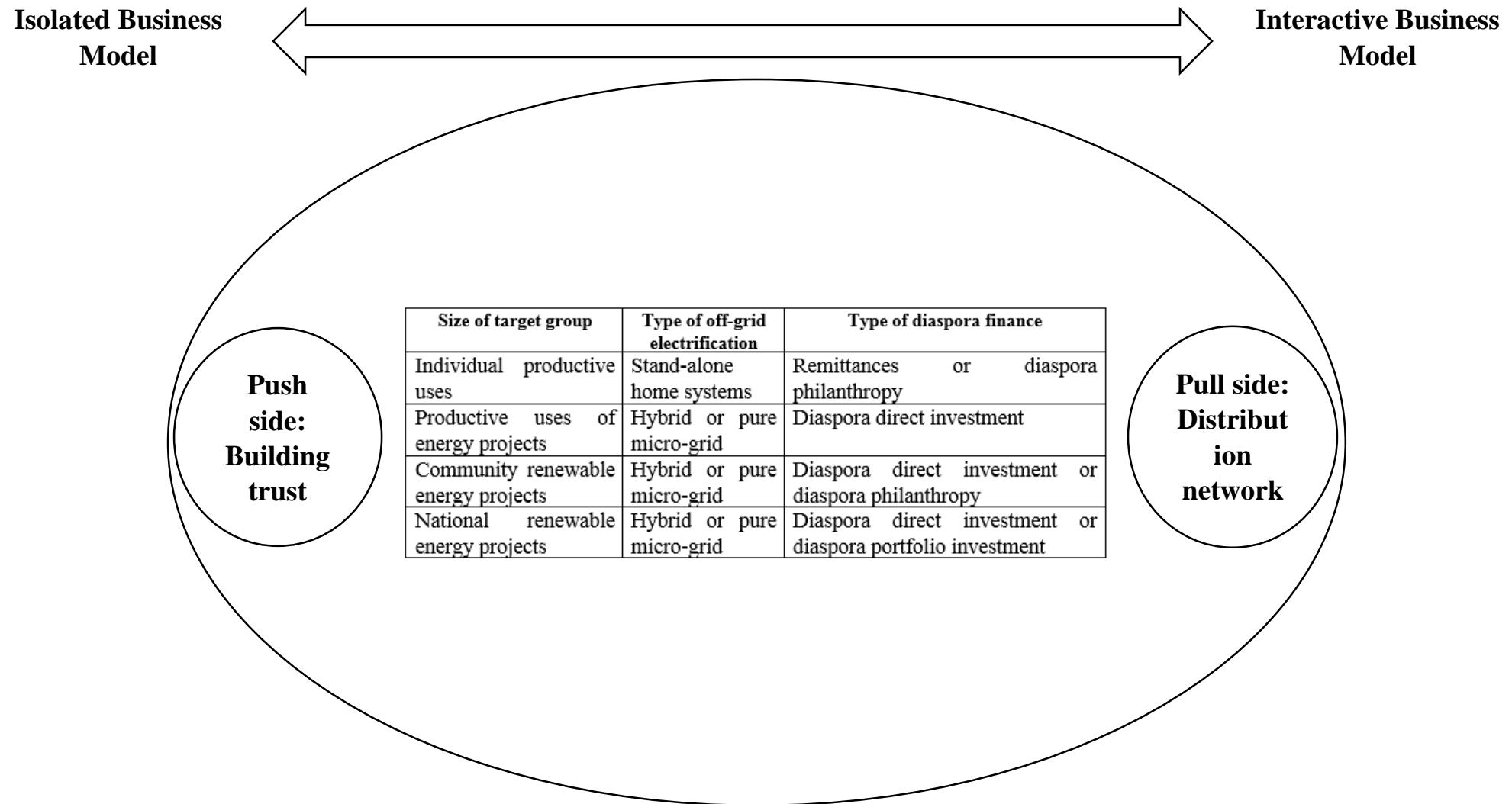
About two other cases that are not ongoing and were finished some years ago, the Bolivia project completely failed because of mainly inattention of implementers to the findings of the market assessment. They changed the product in the platform only to cut the budget for raising awareness campaigns in Spain and didn't think about the impact of government policy to extend natural gas household connections on this project. These are only the most important signs of hazardous project management that were completed with some unexpected happenings like the donation of some solar water heaters to the Bolivia government with a Finnish donor. After reviewing the documents of this project and listening to stakeholders' judgment I cannot say that the failure of this project was related to its finance method.

In Haiti, the project was successful and demonstrated that “Green Remittance” is a viable finance method for renewable energy projects in developing countries, but it was not a self-sustaining business since the solar products finally became a small subset of large products and services of Lakay Express. It seems that a money-transferring organization doesn't have enough incentives to guarantee the self-sustaining of this business model in the long term. It is noteworthy to say, that African solar companies practice this idea later than two other cases and they rely on online banking as a payment method by diaspora so I can conclude that the importance of partnership with money transferring organizations or banks has decreased over the time especially when there isn't any need to give credit to local customers for purchasing products.

Referring to the main bottlenecks for the success of this idea (sub-question 2), I think that building trust in the diaspora side is the most important issue for practitioners in these projects since people in the diaspora need face-to-face interactions with representatives of implementers and physical touch of solar products before purchasing. Another thing is related to their internet literacy, if they are simple workers in the destination countries, the online shopping system will not be user-friendly for them and will be a barrier to their engagement with these initiatives. Ultimately diaspora community of one country don't live only in one neighborhood or city of the destination country so making connection with all of them and convincing them to participate in these initiative needs a lot of money for marketing. Maybe one of the recommendations of this research for solving this problem in the future is establishing a professional marketing company that can make some contracts with local solar companies in developing countries and will launch marketing campaigns on behalf of them in the diaspora side.

Another main bottleneck is related to the distribution network in the origin country, we must pay enough attention that most of the people who live without energy are in remote rural areas, and distributing solar products between them needs a widespread network of shops in four corners of a country. So in designing off-grid electrification projects based on green remittance findings local partners that can support this idea with their local logistic network will be very important. The following figure is an initial outline to synthesize the main findings around the interaction of diaspora finances and off-grid electrification based on renewable energies.

Figure 5-1: The schematic synthesis of research findings



Finally, we must categorize diaspora people based on their purchase power. If their purchase power only can support stand-alone systems, it seems that the business models tested in these case studies can work effectively and more digitalization after the Covid-19 pandemic will help them to be smoother but if we think about running mini-grid projects for generating power for a community, it will need to other forms of diaspora finances like diaspora direct investment or diaspora philanthropy. This can be an important subject for researchers to find a way to activate the potential of these new fields in diaspora studies for boosting renewable energy projects in developing countries via collective actions like crowdfunding or establishing local cooperatives.

References

1. Adebayo, T.S., Ghosh, S., Nathaniel, S. and Wada, I., 2023. Technological innovations, renewable energy, globalization, financial development, and carbon emissions: role of inward remittances for top ten remittances receiving countries. *Environmental Science and Pollution Research*, pp.1-19.
2. Ahmad, M., Ul Haq, Z., Khan, Z., Khattak, S.I., Ur Rahman, Z. and Khan, S., 2019. Does the inflow of remittances cause environmental degradation? Empirical evidence from China. *Economic research-Ekonomska istraživanja*, 32(1), pp.2099-2121.
3. Ahmad, W., Ozturk, I. and Majeed, M.T., 2021. How do remittances affect environmental sustainability in Pakistan? Evidence from NARDL approach. *Energy*, 243, 122726.
4. Akkari, Y., Armacost, N. (2013). *USING REMITTANCES TO FINANCE CLEAN ENERGY: INSPIRING THE HAITIAN DIASPORA TO COMBAT CLIMATE CHANGE*. Available at: https://arcfinance.org/pdfs/pubs/Arc%20Finance_Case%20Study_Sogexpress_2013.pdf (Accessed: 5 September 2023)
5. ARC Finance & USAID. (2017) 'LESSONS LEARNED FROM REMMP' [PowerPoint presentation]. (Accessed: 5 September 2023)
6. ARC Finance. (2012) FINANCING SUSTAINABLE ENERGY THROUGH REMITTANCE FLOWS IN BOLIVIA: FINAL REPORT: RECIPIENT FOCUS GROUPS. (Accessed: 5 September 2012).
7. ARC Finance. (2012) FINANCING SUSTAINABLE ENERGY THROUGH REMITTANCE FLOWS IN BOLIVIA: FINAL REPORT: SENDER FOCUS GROUPS. (Accessed: 5 September 2012).
8. Armacost, N., Magallon, D., López de Llergo, G., Sánchez, M.D. and Felix, K., 2009. Financing Sustainable Energy through Remittance Flows in Haiti and the Dominican Republic.
9. Armacost, N., Akkari, Y., Policard, D. (2017) 'SCALING THE DELIVERY OF CLEAN ENERGY THROUGH DIASPORA ENGAGEMENT AND AGENT SALES' [PowerPoint presentation]. (Accessed: 5 September 2023)
10. Arnergy (no date) *About Us*. Available at: <https://arnergy.com/about/> (Accessed: 5 September 2023).
11. Arogundade, S., Hassan, A.S. and Bila, S., 2022. Diaspora income, financial development and ecological footprint in Africa. *International Journal of Sustainable Development & World Ecology*, 29(5), pp.440-454.
12. Asare, J. (2022) *How diaspora investment can finance energy access in fragile settings*. Available at: <https://www.theigc.org/blogs/escaping-fragility-trap/how-diaspora-investment-can-finance-energy-access-fragile-settings> (Accessed: 10 October 2023).
13. Asquith, P. and Opoku-Owusu, S., 2021. Diaspora Investment to Help Achieve the SDGs in Africa: Prospects and Trends. *Foreign Direct Investment Perspective Through Foreign Direct Investment*, pp.61-74.

14. A.T. Kearney Energy Transition Institute (2018) *Introduction to Energy Poverty*. Available at: energy-transition-institute.com/documents/17779499/17781903/Energy+Poverty_FactBook.pdf/9364dcbb-a297-39b2-53c85981b0d962f8?t=1561052366359 (Accessed: 10 October 2023).
15. Barkat, K., Alsamara, M. and Mimouni, K., 2023. Can remittances alleviate energy poverty in developing countries? New evidence from panel data. *Energy Economics*, 119, p.106527.
16. BASE Foundation (2021) *REMITENERGY: POWERING COMMUNITIES THROUGH REMITTANCES*. Available at: <https://energy-base.org/news/remitenergy-powering-communities-through-remittances/> (Accessed: 5 September 2023).
17. Beyene, B.M., 2014. The grand Ethiopian renaissance dam and the Ethiopian diaspora.
18. Cozzi, L., Wetzel, D., Tonolo, G. and Hyppolite, J., (2021) *For the first time in decades, the number of people without access to electricity is set to increase in 2022*. Available at: <https://www.iea.org/commentaries/for-the-first-time-in-decades-the-number-of-people-without-access-to-electricity-is-set-to-increase-in-2022> (Accessed: 15 May 2023).
19. Das, A., McFarlane, A. and Carels, L., 2021. Empirical exploration of remittances and renewable energy consumption in Bangladesh. *Asia-Pacific Journal of Regional Science*, 5, pp.65-89.
20. Diaspora Energie (no date) Available at: <https://diasporaenergie.com/elements/pages/contact/> (Accessed: 10 October 2023).
21. Diaspora Energie (no date) *With Diaspora Énergie by EDF: enlighten the daily lives of your loved ones in Africa*. Available at: <https://diasporaenergie.com/apropos/> (Accessed: 10 October 2023).
22. Djeunankan, R., Njangang, H., Tadadjeu, S. and Kamguia, B., 2023. Remittances and energy poverty: Fresh evidence from developing countries. *Utilities Policy*, 81, p.101516.
23. Dolma Impactfund (no date) *The Dolma story*. Available at: <https://www.dolmaimpact.com/dolma-story.php> (Accessed: 10 October 2023).
24. Easy Solar (no date) *ABOUT US*. Available at: <https://easysolar.org/about-us> (Accessed: 5 September 2023).
25. Elo, M. and Riddle, L., 2016. Understanding diaspora investment. In *Diaspora business* (pp. 13-28). Brill.
26. Falchetta, G., Michoud, B., Hafner, M. and Rother, M., 2022. Harnessing finance for a new era of decentralised electricity access: A review of private investment patterns and emerging business models. *Energy Research & Social Science*, 90, p.102587.
27. Fanbac (2023) *Diaspora Contributes Over \$50mln To GERD Construction*. Available at: fanabc.com/english/diaspora-contributes-over-50mln-to-gerd-construction/ (Accessed: 10 October 2023).
28. Flanigan, S.T., 2017. Crowdfunding and diaspora philanthropy: An integration of the literature and major concepts. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, 28, pp.492-509.

29. Gelb, S., Kalantaryan, S., McMahon, S. and Perez-Fernandez, M., 2021. *Diaspora finance for development: From remittances to investment*. Luxembourg: Publications Office of the European Union.

30. Heynen, A.P., Lant, P.A., Sridharan, S., Smart, S. and Greig, C., 2019. The role of private sector off-grid actors in addressing India's energy poverty: An analysis of selected exemplar firms delivering household energy. *Energy and Buildings*, 191, pp.95-103.

31. Hosan, S., Rahman, M.M., Karmaker, S.C., Chapman, A.J. and Saha, B.B., 2023. Remittances and multidimensional energy poverty: Evidence from a household survey in Bangladesh. *Energy*, 262, p.125326.

32. IEA (2022) *Access to clean cooking*. Available at: <https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking> (Accessed: 15 May 2023).

33. IEA (2022) *Access to electricity*. Available at: <https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity> (Accessed: 15 May 2023).

34. IFAD (2017) *Remittances, investments and the Sustainable Development Goals*. Available at: https://www.ifad.org/en/web/knowledge/-/publication/remittances-investments-and-the-sustainable-developmentgoals?p_1_back_url=%2Fen%2Fweb%2Fknowledge%2Fpublications%3Fmode%3Dsearch%26catSubject%3D39130737 (Accessed: 10 May 2023).

35. Jamil, K., Liu, D., Gul, R.F., Hussain, Z., Mohsin, M., Qin, G. and Khan, F.U., 2022. Do remittance and renewable energy affect CO2 emissions? An empirical evidence from selected G-20 countries. *Energy & Environment*, 33(5), pp.916-932.

36. Karasoy, A., 2022. How Do Consuming Alternative Energy Sources and Remittance Inflows Impact Egypt's Ecological Footprint?. *Beykent Üniversitesi Sosyal Bilimler Dergisi*, 15(1), pp.8-28.

37. Karasoy, A., 2022. Do Remittance Inflows Increase Energy Security Risk in the Long Run?: Evidence From Selected MENA Countries. In *Eco-Friendly and Agile Energy Strategies and Policy Development* (pp. 143-171). IGI Global.

38. Karasoy, A., 2021, May. How do remittances to the Philippines affect its environmental sustainability? Evidence based on the augmented ARDL approach. In *Natural Resources Forum* (Vol. 45, No. 2, pp. 120-137). Oxford, UK: Blackwell Publishing Ltd.

39. Khan, Z.U., Ahmad, M. and Khan, A., 2020. On the remittances-environment led hypothesis: empirical evidence from BRICS economies. *Environmental Science and Pollution Research*, 27, pp.16460-16471.

40. Kibria, M.G., 2022. Environmental downfall in Bangladesh: revealing the asymmetric effectiveness of remittance inflow in the presence of foreign aid. *Environmental Science and Pollution Research*, 29(1), pp.731-741.

41. Knuckles, J., 2016. Business models for mini-grid electricity in base of the pyramid markets. *Energy for Sustainable Development*, 31, pp.67-82.

42. Kolk, A. and van den Buuse, D., 2012. In search of viable business models for development: sustainable energy in developing countries. *Corporate Governance: The international journal of business in society*, 12(4), pp.551-567.
43. Krithika, P.R. and Palit, D., 2012. Participatory business models for off-grid electrification. In *Rural electrification through decentralised off-grid systems in developing countries* (pp. 187-225). London: Springer London.
44. Lakay Express (no date) *Lakay Express is a subsidiary of Sogexpress, member of Sogebank's Group Haiti*. Available at: <https://lakayexpress.com/about-us> (Accessed: 10 October 2023).
45. Li, K., Wang, X., Musah, M., Ning, Y., Murshed, M., Alfred, M., Gong, Z., Xu, H., Yu, X., Yang, X. and Shao, K., 2022. Have international remittance inflows degraded environmental quality? A carbon emission mitigation analysis for Ghana. *Environmental Science and Pollution Research*, 29(40), pp.60354-60370.
46. Makanza, K. (2021) *How remittances could accelerate renewable energy investment in Africa*. Available at: <https://renewafrica.biz/mega-read/how-remittances-could-accelerate-renewable-energy-investment-in-africa/> (Accessed: 10 October 2023).
47. Mandelli, S., Barbieri, J., Mereu, R. and Colombo, E., 2016. Off-grid systems for rural electrification in developing countries: Definitions, classification and a comprehensive literature review. *Renewable and Sustainable Energy Reviews*, 58, pp.1621-1646.
48. Mazhar, M., Majeed, M.T. and Hussain, Z., 2022. Remittance inflows, technological innovations, financial development and ecological footprint: A global analysis using PSQR approach. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, 16(3), pp.424-451.
49. Mendelson, S., 2013. Sustainable energy access for the poor. *Americas Quarterly Online* (www.americasquarterly.org/content/sustainable-energy-access-poor).
50. Mensah, B.D. and Abdul-Mumuni, A., 2022. Asymmetric effect of remittances and financial development on carbon emissions in sub-Saharan Africa: an application of panel NARDL approach. *International Journal of Energy Sector Management*, (ahead-of-print).
51. Mills, E., 2023. Green Remittances: A novel form of sustainability finance. *Energy Policy*, 176, p.113501.
52. Muchinku, C., Ulsrud, K., Palit, D. and Jonker-Klunne, W., 2018. Diffusion of solar PV in East Africa: What can be learned from private sector delivery models?. *Wiley interdisciplinary reviews: Energy and environment*, 7(3), p.e282.
53. Murshed, M., 2023. A regional appraisal of electricity accessibility determinants: the relevance of international remittances, clean energy, income inequality, and institutional quality. *Environmental Science and Pollution Research*, pp.1-17.

54. Musah-Surugu, I.J., Ahenkan, A., Bawole, J.N. and Darkwah, S.A., 2017. Migrants' remittances: A complementary source of financing adaptation to climate change at the local level in Ghana. *International Journal of Climate Change Strategies and Management*, 10(1), pp.178-196.

55. Nordic Climate Facility (no date) *About Us*. Available at: <https://www.nordicclimatefacility.com/about-us> (Accessed: 10 October 2023).

56. Nordic Climate Facility. (2015) *Final Report: Financing sustainable energy through remittances flows to Bolivia, Bolivia*. Available at: <https://www.nordicclimatefacility.com/info/8029> (Accessed: 5 September 2023).

57. 'Nthabiseng Mosia' (2023) Wikipedia. Available at: https://en.wikipedia.org/wiki/Nthabiseng_Mosia (Accessed: 5 September 2023).

58. Nwani, C., Alola, A.A., Omoke, C.P., Adeleye, B.N. and Bekun, F.V., 2022. Responding to the environmental effects of remittances and trade liberalization in net-importing economies: the role of renewable energy in Sub-Saharan Africa. *Economic Change and Restructuring*, 55(4), pp.2631-2661.

59. Rahman, Z.U., Cai, H. and Ahmad, M., 2019. A new look at the remittances-FDI-energy-environment nexus in the case of selected Asian nations. *The Singapore Economic Review*, pp.1-19.

60. Raihan, A. and Voumik, L.C., 2022. Carbon emission reduction potential of renewable energy, remittance, and technological innovation: empirical evidence from China. *Journal of Technology Innovations and Energy*, 1(4), pp.25-36.

61. Rani, T., Wang, F., Rauf, F., Ain, Q.U. and Ali, H., 2022. Linking personal remittance and fossil fuels energy consumption to environmental degradation: evidence from all SAARC countries. *Environment, Development and Sustainability*, pp.1-22.

62. Runde, D.F. (2015) *Harnessing the Potential of Diaspora Finance*. Available at: <https://www.csis.org/analysis/harnessing-potential-diaspora-finance> (Accessed: 10 October 2023).

63. Safdar, T., 2017. Business models for mini-grids. *Smart Villages: New Thinking for Off-Grid Communities Worldwide; Smart Villages Initiative: Cambridge, UK*.

64. Sahoo, M. and Sethi, N., 2020. Does remittance inflow stimulate electricity consumption in India? An empirical insight. *South Asian Journal of Business Studies*, 11(1), pp.45-66.

65. Sajjad, A. and Siddique, H.M.A., 2022. Remittances, Financial Development, and Environment Quality: Evidence from South Asia. *Journal of Policy Research*, 8(3), pp.113-121.

66. Saliba, C.B., Hassanein, F.R., Athari, S.A., Dördüncü, H., Agyekum, E.B. and Adadi, P., 2022. The Dynamic Impact of Renewable Energy and Economic Growth on CO2 Emissions in China: Do Remittances and Technological Innovations Matter?. *Sustainability*, 14(21), p.14629.

67. Schmidt, T.S., 2015. Will private-sector finance support off-grid energy?. *CMEDT–Smart Villages Initiative*, available online at <http://e4sv.org/>, Cambridge, UK.

68. Scott, A. et al. (2018) *Energy, migration and the 2030 Agenda for Sustainable Development*. Available at: <https://cdn.odi.org/media/documents/12301.pdf> (Accessed: 10 May 2023).

69. Sharma, K., Bhattarai, B. and Ahmed, S., 2019. Aid, growth, remittances and carbon emissions in Nepal. *The Energy Journal*, 40(1).

70. Shrestha, A. and Kakinaka, M., 2022. Remittance Inflows and Energy Transition of the Residential Sector in Developing Countries. *Sustainability*, 14(17), p.10547.

71. *SolarPipo - People and Energy* (no date) Available at: <https://www.f6s.com/company/solarpipo-peopleandenergy#about> (Accessed: 10 October 2023).

72. Subramaniam, Y., Masron, T.A. and Loganathan, N., 2022. Remittances and renewable energy: an empirical analysis. *International Journal of Energy Sector Management*, (ahead-of-print).

73. Takouleu, J.M. (2019) *NIGERIA: CESEL plans to invest \$1 billion in solar off-grid with the diaspora*. Available at: <https://www.afrik21.africa/en/nigeria-cesel-plans-to-invest-1-billion-in-solar-off-grid-with-the-diaspora/> (Accessed: 5 September 2023).

74. Uche, E., 2022. Strategic pathways to combating remittance-induced carbon emissions; the imperatives of renewable energy, structural transformations, urbanization and human development. *Energy Sources, Part B: Economics, Planning, and Policy*, 17(1), p.2141375.

75. Umlilo Energy (no date) *WELCOME TO Umlilo*. Available at: <https://www.umliloenergy.co.uk/> (Accessed: 5 September 2023).

76. United Nations Development Programme (no date) *Energy Access: ACCESS TO ELECTRICITY*. Available at: <https://www.undp.org/energy/our-work-areas/energy-access/access-electricity> (Accessed: 5 September 2023).

77. UNSTATS (2022) *Ensure access to affordable, reliable, sustainable and modern energy for all*. Available at: <https://unstats.un.org/sdgs/report/2022/goal-07/> (Accessed: 15 May 2023).

78. Usman, M. and Jahanger, A., 2021. Heterogeneous effects of remittances and institutional quality in reducing environmental deficit in the presence of EKC hypothesis: a global study with the application of panel quantile regression. *Environmental Science and Pollution Research*, 28(28), pp.37292-37310.

79. Wang, Z., Zaman, S., Zaman, Q.U. and Rasool, S.F., 2021. Impact of remittances on carbon emission: fresh evidence from a panel of five remittance-receiving countries. *Environmental Science and Pollution Research*, 28(37), pp.52418-52430.

80. World Bank (2021) *Report: Universal Access to Sustainable Energy Will Remain Elusive Without Addressing Inequalities*. Available at: <https://www.worldbank.org/en/news/press-release/2021/06/07/report-universal-access-to-sustainable-energy-will-remain-elusive-without-addressing-inequalities> (Accessed: 15 May 2023).
81. World Bank (2022) *Tracking SDG7: The energy progress report 2022*. Available at: <https://trackingsdg7.esmap.org/> (Accessed: 15 May 2023).
82. Yakubu, I.N., Kapusuzoglu, A. and Ceylan, N.B., 2022. Investigating the Role of Export Diversification, Remittances, and Environmental Sustainability in Accordance with Clean Energy and Zero Emission. In *Circular Economy and the Energy Market: Achieving Sustainable Economic Development Through Energy Policy* (pp. 51-65). Cham: Springer International Publishing.
83. Yang, B., Jahanger, A. and Ali, M., 2021. Remittance inflows affect the ecological footprint in BICS countries: do technological innovation and financial development matter?. *Environmental Science and Pollution Research*, 28, pp.23482-23500.
84. Yang, B., Jahanger, A. and Khan, M.A., 2020. Does the inflow of remittances and energy consumption increase CO 2 emissions in the era of globalization? A global perspective. *Air Quality, Atmosphere & Health*, 13, pp.1313-1328.
85. Yin, R.K., 2009. *Case study research: Design and methods* (Vol. 5). sage.
86. Zafar, M.W., Saleem, M.M., Destek, M.A. and Caglar, A.E., 2022. The dynamic linkage between remittances, export diversification, education, renewable energy consumption, economic growth, and CO2 emissions in top remittance-receiving countries. *Sustainable Development*, 30(1), pp.165-175.
87. Zhang, L., Yang, B. and Jahanger, A., 2022. The role of remittance inflow and renewable and non-renewable energy consumption in the environment: Accounting ecological footprint indicator for top remittance-receiving countries. *Environmental Science and Pollution Research*, 29(11), pp.15915-15930.