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Financing renewable energy projects in the Dominican Republic: An empirical study

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Abstract

Purpose
Currently, Renewable Energy (RE) sources represent a crucial pillar in obtaining sustainable development, one of the global goals for all countries. However, this presents a unique challenge for emerging and developing countries. Since, the technical and financial issues remain a significant barrier in implementing RE projects several mechanisms are available to aid the financial aspect of investing and implementing clean energy projects. This paper discusses new and traditional trends in the financial area of renewable investment, focusing on the Dominican Republic (DR), identifying the gaps in the financial area regarding RE.

Design/methodology/approach
An empirical study was conducted in the Dominican Republic. This country is located at the heart of the Caribbean. Given the complexity of RE and developing countries issues and the scarcity of comparable research in the area, an interpretivist research paradigm along with the qualitative methodology was adopted. Primary data was collected through semi-structured interviews. The study sample includes: Directors, Chief Executive Officers (CEOs) and Managers responsible for the implementation of RE strategies in their respective departments/organisations. NVivo software was used for data management and the collected data was analysed using content analysis.

Findings
The research highlighted several severe financial handicaps regarding RE in the DR: The lack of RE assets recognition; Lack of RE investment loans; Perceived RE risk; and Lack of financial guarantor. After extensive interviews with critical actors in the RE sector in the DR, the possible solutions and recommendations for avoiding locking the energy and economic sector in fossil fuel debt, are: (a) diversification of RE technology assets recognition (b) implementation of government RE fund (c) RE education on all actors (d) introduction and adoption of new financial trends such as: green bonds, bank pooling, cooperatives and more.

Originality/value
This paper provides information and knowledge related to financial tools and policies that are available for the RE projects in the DR. The results have a socio-economic impact. This research provides a better understanding of the key financial tools to be explored by RE project developers in the developing countries. This study shows the gaps that exist between the

knowledge that the stakeholders should possess and the actual knowledge that exists in the country regarding the financial aspect of an RE project.

Keywords: Renewable Energy; Financing; Loans; Policies; Dominican Republic

1. Introduction

The current global financial goal is to possess a sustainable economy; this is especially true of developing nations. Due to the impacts of fossil fuel dependency and depletion it has on the business in these nations (Donastorg, et al., 2017). Renewable Energy (RE) sources represent a key pillar to obtaining a sustainable economy, diversifying the energy matrix, enhancing the financial sector of any nation and achieving one of the global developing goals. However, the implementation of RE in developing countries represents an evolving challenge, as they lack the financial development and stability, RE strategy and correlation of the legal framework to successfully transform or diversify the fossil fuel energy sector. The Latin America and the Caribbean (LAC) region is a perfect example and more specifically the Dominican Republic (DR). Given the region's vulnerability, mitigating climate change is of vital importance (Bull, 2009). Due to this, the region has heavily invested into hydroelectric power, Costa Rica, for example, has been able to achieve high (90% or more) renewable production based on hydroelectric. Highlighting the three main fuel sources of the LAC area, hydroelectric, gas and fossil fuel (Vazquez et al. 2018). However, the development and investment into RE in the LAC region remain scarce. In accordance with IRENA (International Renewable Energy Agency, 2016) of the 40 nations worldwide responsible for 80% of the energy demand and CO2 emission, the DR is the only one in the Caribbean region. This small island nation that has not only included in its strategic development plan for 2010-2030 (Merenson, 2001) goals for energy security and efficiency; but has signed and agreed in several international world leader meetings (Rio, Kyoto, Paris) to reduce its carbon footprint (The second highest of the LAC region and the highest in the Caribbean) and to enhance its energy matrix with RE to reach 25% by 2025 (Bull, 2009). In order to introduce new RE into the region an overview of the financial instrument of the region is needed. The LAC region possesses strong political incentives to promote RE as a means to reduce the fossil fuel dependency of the area. For that reason most of the countries have three key instruments: (1) Tax reductions, (2) Loans, (3) Auctions (Vazquez et al. 2018). However, as many developing countries, the DR does not possess the financial solvency or stability to implement RE projects to reach the agreed goals successfully. Henceforth, the aim of this paper is to evaluate and recommend possible successful strategy for the DR to transform into a more sustainable and RE driven economy and energy sector. The research is focused on both financial policies for enhancement and financial tools for implementing RE projects specifically in the DR.

2. Outlook of the renewable energy sector in the Dominican Republic

Dominican Republic is primed to become a significant proving ground for the viability of RE in the LCA region (ESMAP, 2005). Although it still has major issues to address, some of the critical challenges in the DR are the high cost of electricity, generation peaked facilities, and a distribution system but there is 42% energy loss and power flow instabilities. This is due to inadequate infrastructure and interruptions from natural disasters. Also, the DR's electricity sector is dominated by fossil fuels, with oil (46%), natural gas (25%), and coal (14%) accounting for 85% of the country's power generation in 2015 (Anon, 2015). In response to this, the DR government has made international compromises to start the transition from a

fossil fuel dependent economy to a low carbon economy by 2025 with a goal of 25% renewable sources installed for the generation of electricity (Gardner, 2015; International Renewable Energy Agency, 2016). Because of the local wind potential of 100-10000 MW and solar potential of 5 to 7 kilowatt-hours per square meter per day, the DR represents heaven for RE strategies implementation and development, and could potentially represent the change that the region needs to move to a low carbon economy (International Renewable Energy Agency, 2016). This provides businesses an excellent opportunity for investing in solar and wind development in the DR. This change to renewable would need the analysis, development and possible creation of supporting mechanisms to advance the exploitation of RE sources.

Table 1: Energy Matrix of DR from 2010, 2012-2015

Resources	2010	2012	2013	2014	2015
Natural gas	9%	24.8%	24.9%	24%	25.92%
Fuel oil no.6	70%	49.1%	33.6%	50%	38.68%
coal	6.2%	12.9%	14.2%	12%	14.03%
hydro	12.4%	10.5%	13.2%	9%	6.26%
Fuel oil no.2	2.2%	2.5%	2.7%	2%	7.59%
wind	0.1%	0.2%	1.7%	1.5%	1.9%
other	12.5%	---	9.7%	1.1%	5.63%

Table 1 shows the energy matrix of the DR. However, to keep with its RE goals, the DR has inefficiently balanced the matrix by reducing the hydroelectric to provide space in the matrix for solar and wind. The DR needs an extra 1,451 MW by 2016 that were not met and by 2018 needs additional 1,380MW which seems not to be met (Anon, 2015).

The capacity of hydroelectricity has reduced due to the scarcity of water in the DR. This is due to the changing weather patterns. To balance the energy demand, the DR has preferred to depend increasingly on energy derived by coal. Therefore, the government has approved several projects for coal power plants. This implementation has locked the energy industry of the DR in a fossil and carbon dependent sector. Thus limiting the penetration of the RE sector in the DR due to lack of government policies and financial tools (International Renewable Energy Agency, 2016).

Abolhosseini and Heshmati (2014) noted that the most used financial tools for the implementation of RE are Feed-In-Tarif (FIT), tax incentives, RE portfolio and cross-national incentive policies. However, these techniques are policy measures that are used by various governments to accelerate the implementation of RE projects and not to fund the actual RE projects. Although sources and limited policies exist in the DR that has helped in lowering the price of the wind and solar energy generation, a market for RE has barely been created, and it seems not to be correctly developed; subjecting the market to fluctuations for the RE prices and discouraging investors and project owners from investing in RE. Developing of this market sector poses several pressing challenges, especially in the economic respect such as the investment risks and capital costs. Along with, subsidies for the FIT; utilities currently lack the capital to pay for the tariff and have limitations in passing the price on to consumers because of high transmission and distribution losses. As well as the lack of awareness of the benefits of the RE market and business models, along with periodical governmental changes, inconsistent law implementation, and lack of accountability in guaranteeing that the funds are utilised as mandated pose barriers to implementation of any RE business plan in the DR.

The two critical laws regarding energy in the DR are the 57-07 law (Comisión Nacional de Energía, 2012) that governs RE and the law 112-00 on hydrocarbons. The 57-07 details, not just the implementation of a ten year FIT, starting from the year 2008 but provides the incentives and the regulations required to increase the RE. However, as of 2014, the FIT had yet to be implemented. Also, as of 2012, the 57-07 law had a Senate reform that slashed the incentives by more than half, reducing even more, the interest and possibilities of investment in RE. As can be seen in Table 2 the funds for implementing the 57-07 law was to come from 5% of the taxes of the 112-00 law. However, this fund was supposed to be created in 2005, and as of 2017, it was yet to be created. Also, many exemptions are reaching or have reached the ten-year mark, and the law is to be reformed again in the year 2018-2019, leaving a period without clear incentives or leadership to handle the direction for the development, investment and implementation of RE in DR.

Table 2: The Dominican Republic Laws regarding energy

DR Law regarding energy	**Benefits**	**Reform of the law**
57-07	• 100% exemption for renewable energy technologies from import taxes and taxes on the transfer of industrialised goods and services • Ten-year tax exemption on income generated from the sale of renewable energy power and equipment. • 75% tax credit for self-producers • Low-interest loans for community projects • A 10 year FIT for grid-connected renewable energy installations	• Reduction from 75% to 35% of the tax credit for tax exemption on income. • Reduction of a 5% of the taxes for foreigner financing.
112-00	• Created a fund for RE based on taxes on fossil fuel based electricity generation, 5% of the taxes to be allocated for RE investment and enhancement.	N/A

As shown in Table 2, the law 57-07 covert the FIT, the incentives going so far as to describe the prices of the RE energy kilowatt/hour and the institutions in charge of the implementation and development of the RE projects and incentives.

3. Research Methodology

Research is used to develop further knowledge on any topic, in this case the financial aspect of RE in the DR. Given the complexity of RE and developing countries issues and the scarcity of comparable research in the area, a interpretivist research paradigm along with the qualitative methodology was adopted. This approach as Strand (2015) explains: "*there are many different ways of interpreting the world and undertaking research, that no single point of view can ever give the entire picture and that there may be multiple realities"*. The data utilised in this study was based on current scientific literature review, project documentation and interviews with principal actors of RE in the DR; for achieving the aims and objectives of this research. Purposive sampling was used, where the subjective judgements of the researcher are used in selecting the sample (Remenyi *et al.*, 1998). The study sample included: Directors, Chief Executive Officers (CEOs) and managers responsible for implementating RE strategies in their

respective departments/organisations. The primary data was collected through semi-structured interviews. A total of 25 professionals were interviewed from the RE sector organisations: (1) seven CEO's, (2) eleven director's and (3) seven managers. The interviewees where chosen based on the seniority in the field, expertise in diverse RE areas (technological, generation, legal, financial, public and private sector), knowledge of the RE subject and minimum five years of experience in this field (See Table 3).

Table 3: Breakdown of professionals who were interviewed for the study

Sl. No	Code	Responsibility of interviewee in the organisation	Experience in the RE sector
1.	EI1	CEO	30
2.	EI2	Director	15
3.	EI3	Director	12
4.	EI4	Director	05
5.	EI5	Director	07
6.	EI6	CEO	14
7.	EI7	Director	20
8.	EI8	Director	08
9.	EI9	Director	05
10.	EI10	Director	35
11.	EI11	CEO	28
12.	EI12	Director	07
13.	EI13	CEO	10
14.	EI14	Director	06
15.	EI15	Director	21
16.	EI16	Director	15
17.	EI17	Director	12
18.	EI18	Director	15
19.	EI19	Director	20
20.	EI20	Director	07
21.	EI21	CEO	25
22.	EI22	Director	10
23.	EI23	Director	17
24.	EI24	Director	12
25.	EI25	Director	20

The interviews were face-to-face and lasted between 30 and 90 minutes. It was recorded and transcribed. These semi-structured interviews, aided in answering the research question: What financial policies and tools does the DR possess or could implement for a succesful deployment of RE that the country has commited to globally? What challenges does the country faces? To answer these questions the participants were asked: (a) what are the key RE related financial policies that are available in the DR; (b) what are the financial tools that are available for the RE projetcs in the DR; (c) what are the barriers for financing RE projects in the DR; (d) what are the key drivers for financing RE projects in the DR; and (e) what are the critical success factors for financing RE projects in the DR.The above questions allowed interviewees to express their views and knowledge on the subject (Strang, 2015). The small sample is the result of the emerging market and the lack of projects, knowledge and understanding in the area of RE in the DR. However, even with this sample, data saturation was obtained allowing for a comprehensive understanding. The saturation was confirmed with existing documents of the inner workings of the DR sector structure. It is important to note that the literature for the DR regarding RE is quite limited. The research pertaining to the RE in the DR is scarce, only 12

documents produced by different international entities and the government were available (Table 4).

Table 4: Existing renewable energy literature for the Dominican Republic

No.	Title	Author	year	Type of publication
1	Wind Energy Resource Atlas of The Dominican Republic	NREL	2001	Report
2	Plan Energético Nacional – National Energy Plan	CNE	2010	Report
3	Dossier Energético República Dominicana (Energy dossier of the Dominican Republic)	BID	2013	Report
4	Aspectos Regulatorios y Tarifarios - Caso Republica Dominicana	OLADE	2013	Report
5	Harnessing the Dominican Republic's Sustainable Energy Resources	WORLDWATCH INSTITUTE	2015	Report
6	Climate Change Legislation In Dominican Republic An Excerpt From The 2015 Global Climate Legislation Study A Review of Climate Change Legislation In 99 Countries	Michal Nachmany, Sam Fankhauser, Jana Davidová, Nick Kingsmill, Tucker Landesman, Hitomi Roppongi, Philip Schleifer, Joana Setzer, Amelia Sharman, C. Stolle Singleton, Jayaraj Sundaresan and Terry Townshend	2015	Report
7	El Futuro Del Sector Eléctrico en la República Dominicana (The Future of the electric sector in the Dominican Republic)	FUNGLODE	2015	Report
8	Energy Snapshot Dominican Republic	NREL	2015	Report
9	Renewable Energy Prospects: Dominican Republic	IRENA	November 2016	Report
10	Decision-Making for Risk Management In Sustainable Renewable Energy Facilities: A Case Study in the Dominican Republic	Guido C. Guerrero-Liquet, Juan Miguel Sánchez-Lozano, María Socorro García-Cascales María Teresa Lamata and José Luis Verdegay	2016	Paper
11	Boletin (Internal reports)	CNE	2017	Report
12	Renewables 2018 Global Status Report	REN21	2018	Report

In this research NVivo software was used for data management. NVivo is a invaluable in helping the researcher index segments of text to particular themes, to link research notes to coding, to carry out complex search and develop parent and child nodes. The collected data was analysed using content analysis as it is a research tool used to observe the presence of specific words indirectly, images or concepts within the data collected and allowed to quantify and evaluate the presence, meaning and connection of the financial support and tools available, drivers, challenges and benefits of RE in the DR, or lack of them as it were (Strang, 2015). For such analysis, the data collection has been broken down and coded to maintain anonymity of the participants. Later breaking down the information collected into several categories into RE related financial policies, financial tools, barriers, drivers, and critical success factors.

4. Findings

4.1 Renewable energy related financial policies that are available in the Dominican Republic

The current study reveals that the DR possess three financial policies with the law 57-07 (Comisión Nacional de Energía, 2012) containing financial incentives in its core, along with FIT agreements and RE portfolio being part of the mission and vision of the country's national development strategy. However, the same does not apply to the financial tools, as interviewees tended to lean on loans more than any financial tool. Regardless, the critical challenge in the DR is that no financial tool has been fully implemented. Only partial implementation has been achieved and in some cases minimal to zero practical implementation. The study revealed that interviewees had minimal knowledge of financial policies where as interviewees had some knowledge on financial tools. Although, all the interviewees highlighted that the only way to get a capital grant or loan from a financial institution in the DR is to be in possession of a power purchase agreements (PPA) and to have a proven RE reputation or business reputation. For instance, interviewee 12 (EI2) expressed that:

> *"Reputation plays a major role to get financial help and loans from banks. This provides capital access and attracts investors".*

With current advancements in RE technologies, many countries have stabilised the investment for RE and are in par with fossil fuel. However, for developing nations this is not the reality as in many countries RE investment still demands large initial capital costs. Therefore, many governments have implemented incentives and tax exemption regulations to encourage investors and energy generators to implement RE (Ng and Tao, 2016; Krishnaswamy and Stuggins, 2007). In the DR, the 57-07 law regulates all the incentives, 20% of the stakeholders interviewed view the law as a financial tool and not the financial policy that it represents (Comisión Nacional de Energía, 2012). Of this 20% of stakeholders, 78% considered the law unstable due to the rapid reforms that the regulation has had, along with the reduction and cuts of the incentives. As EI7 explains:

> *"The main challenge is the incentive or investment".*

EI13 agrees by stating that the 2012 incentives had reduced and slowed the uptake of RE. However, 22% of the 20% of the interviewees do not agree that the reform and reduction of the incentives have impacted negatively on RE projects in the DR. The perception and reality of the impacts in the reduction and reform of the law that regulates RE in the DR reflects an inner conflict of the management and leadership of the sector that derails possible investors, diminishes the market value and delays RE in the country.

As per Ng TH (2016), Dolezal *et al.* (2013) and Tampier and Beaulieu (2006) a renewable portfolio standard (RPS) or renewable energy portfolio (REP) is a regulation to aid the diversification of the energy matrix in a country and enhance the RE development by increasing the generation of energy from renewable sources. This regulation creates an obligation mechanism on the electricity supply to generate a specified fraction of their energy from renewable sources. Tampier and Beaulieu (2006) explain this regulation has worked in many countries, such as USA, UK, Belgium and many more. In the DR, RE portfolio is one of the political measures taken to aid in the implementation of alternative sources as it is mentioned

in the national strategic plan of the country for 2030. Only 4% of the stakeholders had awareness as EI8 explains:

> *"It is a financial issue because there are investors for project investment portfolio creation but do not have financial capacity to do it. Therefore, superintendent de Bancos and we are working to revaluate assets which will enable better finance options"*

Moreover, the government has created the measure but not any of the financial or political tools that this measure needs to be implemented and to promote the take-up of RE market or projects, as other Caribbean nations have done, the Island of Aruba, for example has set the goal of 100% of renewable energy by 2020, the strategy for such an achievement has been based on net metering, interconnected standards, tax reductions and green public procurement. The Aruban government has clearly defined and is highlight involved in the implementation of renewables in the country by providing public demonstrations and procurements (NREL, 2020). On the contrary, the island of Antigua and Barbuda have achieved their target of 15% renewable in 2011 based on interconnected standards, energy access (electrification rates), and tax reductions. Indicating that the area of the Caribbean has a vast implementation of financial mechanism, but the successful execution of them depends heavily on the government.

4.2 Financial tools available for the renewable energy projects in the Dominican Republic

The current study reveals that the financial tools available for the RE in the DR are: loans, power purchase agreements (PPA), international aid and loans, mutual funds, asset-backed securities, capital grants, and private investment (See Table 5). Each of these financial tools is discussed below. Countries tend to lean to a specific category and tool more than others. However, before decision makers can choose and implement any of these measures the risk and challenges of each must be identified. These issues and constraints are inevitably country specific. These financial tools are not the norm in the region, as the NREL (2020) highlights, that the latin american region relies heavily in a convention of tax exemption and government funds.

Table 5: Financial tools available for the renewable energy projects in the Dominican Republic

Financial tools	Percentage of interviewees cited (N=25)
Loans	60%
Power Purchase Agreements (PPA)	44%
International aid and loans	24%
Mutual Funds	12%
Asset-Backed Securities	8%
Capital grants	4%
Private investment	4%

- **Loans**

Liu and Zeng (2017) and Ming *et al.* (2014) explains that loans are commonly written agreements of a temporary transfer of a goods or product (money usually) between two parties

at least, with specific conditions in accordance to set terms (interest rates, return time, collateral, and more). In the case of the DR, the financial institutions classify loans into consumer or personal, commercial and industrial loans (ESMAP, 2015). However, regardless of the end consumer, all loans in DR regarding RE are based on an instalment loan, as equal monthly payments need to be made. 60% of the interviewees in this study cited that the available financial tool are loans for implementing RE projects. IE22 describes:

> *"The loans are the normal personal and commerical loans there is no specific loan for RE. These loans depends on the guarantees and reputation. Also based on the relationship the bank as with the companies".*

The need to have an established reputation is an unspoken need that the financial institutions in the DR consider. This is due as the IDB (2014) explains to the lack or limited experience not just in the DR but in the Caribbean of local financial institutions with renewable energy projects. Of this 60 % of interviewees, 78% agreed that the financial institutions are ill-prepared to fund but 22% stated there were green energy laons which the banks are providing. However, 89% agreed that the loans in existence even the green ones are based on a normal, either personal or commercial loan and therefore have the same return time and policies as a normal loan. On the contrary, the Develomenpt Bank of Jamaica (DBJ) manages several lines of credit with the sole focus of aiding the increase of local financial institutions in the implementation of renewable energy loans, as to stimulate the development of such projects (IDB, 2014).

The DR government and financial entities recently approved the use of RE technology, specifically solar panels, as asset-backed security or collateral for the loan. However, this clause is one for auto-production and not for grand scale projects. This reflects the lack of RE market in the DR, lack of leadership and lack of law coherence, as financial tools are an instrument utilised by banks to have a share in the market. The lack of availability of loans is the key challenge that the interviewees highlighted; this may be because financial tools and options are not transparent and very little knowledge of them is available to the population.

In the RE loan, only one bank in the DR offer this service, however, the loan offer is usually for solar panels for personal use, and the loan terms are the same of a personal loan. EI23 highlighted*:*

> *"More financial support is needed from banks and financial institutions, given that few developers are able to finance all the investment with their own funds".*

This is a paradox for the DR as for the implementation of a new financial mechanism especially for RE investments by the stakeholder. Specifically, the government, need to possess a high level of understanding in some key subjects, such as: the viability of the RE project or investment; the life cycle and practical implementation of any tax incentives; and fundamental financial analysis (Donastorg, *et al.*, 2017). EI14, EI21and EI24 highlight another loan or sub-loan type the bank pool loan is known to support RE projects:

As Gintschel and Hacketha (2004) explains Bank Pool Loan (BPL) is a new form of a loan that allows companies to usually borrow up to $10 million from the USA, however, this will depend on the solvency of the company and banks, the type of project and return time. This loan is done by a group of banks that join for a sole purpose. This loan is to minimise the risk that one bank would incur on and the loan is usually secured with a stock of the company or project. Currently, only one RE project in DR has been awarded and has successfully executed the loan and completed the RE project as EI21 explains:

> *"The interest rates are based on American Dollars by a pool of local banks for RE projects and it worked well as the project is completed and currently working".*

As no local financial entity wishes to invest alone in RE in the DR as the risks that the country represent are too high for one entity to support. This last case is fascinating as it was done by an established Dominican corporation that not only has an outstanding reputation in the country but has the solvency to cover the loan and hire the needed international experts in RE for the project. This places all other projects in an uncomfortable situation as the precedent is that loans will only go to establish, local and financially solvent companies. Restricting the international investment and new investors in the area. The bank pool along with green loans seem like a possible solution to the financial difficulties that local investor face. However, many changes to the financial legislation and implementation in the DR need to be done, before these tools can be widely implemented and available for all.

- **Power Purchase Agreements (PPA)**

PPA is usually a contract between the contractor (private) and the government to fulfil the energy demand and electricity sale. This agreement covers from the beginning of the commercial operation, the schedule, penalty and payments of the delivery of electricity between the parties. However, the principal function of the PPA is to define the credit and revenue qualities that the project will generate (Jenkins and Miguel Guevara, 2014; Comisión Nacional de Energía, 2012; Krishnaswamy and Stuggins, 2007). As per Bruck, et al., (2018) a PPA is a conmonly use financial agreement in Europe, the U.S.A and Latin America. However, the U.S.A and Europe usually award PPA to renewable energy projects, while in Latin America it is use for any energy generator. However, in the DR this financial policy is used more as a financial tool than a financial agreement. PPA as an essential financial tool was noted by 40% of the interviewees for the implementation of RE projects in DR. EI8 noted:

> *"The normative forces requires you to have a PPA, and you do not always have a PPA. Financial institutions force you to have a PPA even to consider financing (example of how by the time it comes to finance the project the PPA has to expire due to the long process to secure documentation and finance). You can always go to the spot market to sell, however with the oil prices going down the marginal price that can sell the energy at is very low. You need a PPA, and usually, this is awarded for five years, yet the financing is for 6-7 years, with this discrepancy between the two most banks refuses to finance the RE projects."*

As the interviewee explains without a PPA all financial resources through the local or national bank are limited and in most of the cases will have the financial aid refused. However, EI12 putforth a view regarding the non-critical need of a PPA because over 90% of the RE projects that have been successfully implemented in the country have been with private or international funds and later received a PPA and only 10% of the projects have been completed with the support of the local banks and a PPA before financing. In this study, there is a contradict claim as 7% of the interviewees noted that RE project need PPA as no local financial entity wishes to acquire the risk of financing RE projects due to the lack of support from the government and the countries financial risk category worldwide. As a consequence of this risk, the PPA which should be a financial agreement has become a requirement for the financial aid need to implement RE in the DR. However successfully, 100% of the interviewees highlighted that obtaining a PPA is a challenge in itself.

- **International aid or loans**

With the current climate change situation, many countries have come together to tackle the issues, while at the same time financially stable countries have been offering aid to the rest. From the Kyoto agreement to the Paris accord more than 300 billion US dollars have been set aside for international help and loans in the RE area for developing nations to aid in reaching the sustainable development goals (SDGs) in renewable energy. The EU alone has promised over €51 million to the Caribbean and €9.3 million for DR alone (Kavanagh, 2016). However, knowledge of this aid and loans is insufficient, and the requirements are very restricting as the DR has been categorised by the UN as an upper middle-income country based on the gross national income (GNI) of 2012 (Dji, 2011). Consequently, of this categorisation, many of the aids requested by private investors and the government have been denied and instead the country qualifies for many loans that promote a debt economy in the country. However, 24% of the stakeholders are in possession of international aids and loan information, as several interviewees such as EI11, EI20, EI21 and EI22 noted that most RE projects in DR are done by the help of international banks. The interviewees had limited information and knowledge with respect to UN loans, EU loans and carbon credits.

- **Mutual funds**

Mutual funds is an investment programme managed professionally which is funded by shareholders that trade in diversified holdings (Bobinaite and Tarvydas, 2014). 12% of the interviewees had some knowledge of mutual funds as this is a new financial tool in the DR. EI2 explains:

> *"Mutual funds are new and it is just starting in the DR. What is right now in the Dominican Republic is 'fix rent fix' income bonds commercial paper all other financial trends are difficult to implement in the Dominican Republic due to the economic limitations that the population has and the access and offers that the banks have for such endeavours".*

Furthermore, EI20 highlighted:

> *"Mutual fund or pool of banks can do it but at high rates and the company needs to give not only collateral but enough guarantees, not just the concession they have to give the project as collateral".*

The comments of the interviewees indicates that they had some knowledge regarding mutual funds however it clear that the wider population are not informed and as the stakeholder have highlighted that they are difficult to implement due to the economic limitations and lack of marketing options from the banks to the public. The challenges of implemented mutual funds is viewed in the U.S.A and Europe as Marti-Ballester (2019) explains, that the U.S and Europe were partially successful in the implementation of mutual funds due to the identification and use of a specific global index as market benchmark. A process that the DR does not seem to have performed.

- **Asset-Backed Securities (ABS)**

Asset-backed security (ABS) is a type of bond(s) or notes backed by financial assets. For example: home-equity loans, auto loans and credit card receivable. ABS consist of receivables other than mortgage loans. The ABS differ from other bonds in that their solvency is derived from other sources than the ability of payment of the originator (Ng and Tao, 2016). This

financial tool has been implemented by the U.S.A since 2013 specifically in the solar market (commercial and residential) securing over $100 million in securitization of fonds (NREL, 2013). In the DR, ABS has not been fully implemented. In 2011, the government approved and disseminated the 189-11 law for the development of the mortgage market and trust. In this new law, ABS was defined and contemplated, yet it has not been implemented in the country, as unlike the U.S.A no clear market was created or utilized, and no funds have been secured for implementation. In this study, 8% of the interviewees had some knowledge of ABS and when asked the details, it showed that 100% of this 8% were relating ABS with collateral backing for loans. As EI14 highlights:

> *"Last year for auto- production a regulation was approved to re-classify the assets for solar panel, making 80% of the solar panel now able to be financed with lower interest and the down payment is only 20% before it was inverse".*

Alternatively, as EI11stated:

> *"Several years ago, the issue was the price of technology. However, the prices for RE have gone down. Now the problem is the cash flow to get the technology".*

This confusion in simple financial terms demonstrates the lack of understanding of the financial tools, the need for transparency of local financial entities and a comprehensive RE education of the stakeholders, this includes more than just the awareness of RE technologies. On the other hand, the DR does possess and implement collateral banking for loans as Cheung and Sundaresan (2007) explain a property or other asset that a borrower offers as a way for a lender to secure the loan. If the borrower stops making the promised loan payments, the lender can seize the collateral to recoup its losses. Since collateral offers some security to the lender, loans that are secured by collateral typically have lower interest rates than other loans. However, for RE in the DR, the interest rates have not decreased, the loans are still considered hard regarding interest rates and returns. Also, this loan is only available for auto-production (personal use), and only one to two banks in the DR have this credit line available. However, the interest rates range from 13.65% to 18.95% depending on the type of RE technology, initial down payment, credit history, amount of the loan and return time (which is from 5-10 years) in comparison to the RE loan in the UK, China and India that are between 3.5% to 11.5% from Natural Energy Sources (NES). A possible solution for these hard loans would be the implementation of soft loans for RE. A soft loan is a loan with a below-market rate of interest (Guerrero-Liquet *et al.,* 2016). This is also known as soft financing. Soft loans are usually provided by governments for projects they think are worthwhile which provided long repayment periods or interest holidays.

- **Capital grants**

The first financial tool that many countries use for financing RE is capital grants. In the DR, several funds have been created due to different government measures; for example, with the PETROCARIBE contract with Venezuela, an RE public fund was created with 5% of the supposed savings that the agreement was created for the DR, yet it has never been implemented (World Bank Group, 2016). Law 102 of the DR facilitated in the creation and implementation of the energy law. Furthermore, additional 5% was to be allocated for the stimulating alternative energies in the country. Both funds are obscure to the population, as the research showed none of the interviewed participants had any knowledge of this fund, their availability or how to apply for them. This lack of transparency contradicts the national goal to reach 25% of RE by 2025 as it diminishes the investment and narrows financial options for current and future investments. At the same time, it sends a message to the financial entities of a lack of commitment and support for RE.

- **Private investment**

Regarding venture capital, as Krishnaswamy and Stuggins (2007) demonstrates, is a financial tool that defines the capital that investors facilitate to new (startup) and small but stablished companies that are believed to have long-term growth potential, making then a business opportunity. Venture capital comes from wealthy investors, investment banks and any other financial institutions. However, it does not always take just a monetary form; it can be provided in the form of technical or managerial expertise. In the DR, this tool is present in all RE projects as 90% of the projects have been financed almost in its entirety by the private sectors own capital. As 88% of the interviewers noted the financial process for an RE project is practically non-existent. The DR is not the only nation reliant of private investment for the development of RE. From 1990-2014 Guyana, Haiti, and Jamaica registered over 30 energy projects funded solely from private investment (GDP Global, 2016).

Although several RE loans are now in play, these loans are the same as a personal loan and are only available for auto-production (individuals who wish to have solar panels in their house). However, this is not available for big projects. Other factors that interviewees marked were: (a) reputation: financial institutions will not even consider your project if you do not have a business reputation in the country and for RE you need expertise in the specific area (b) Power Purchase Agreement: the need for a Power Purchase Agreement (PPA) from the government to guarantee the project. Lack of a fair market and reputation of the country and precisely the lack of leadership of the government makes this a compulsory part yet one that discourages financial entities.

4.3 Financial barriers, drivers and critical success factors

After understanding the financial policies and tools that exist in the DR, the next critical step is to identify, categorise and analyse the financial barriers ,drivers and critical success factors (CSFs) of RE projects in the DR. As can be seen in Figure 2, the financial challenges that the DR faces are based on the energy stakeholder interviews With this foundation six barriers were highlighted: (1) lack of RE loans is the main barrier with 50% of the interviewees highlight this is the key issue for the under development in the RE sector in the country. (2) lack of knowledge is the second critical barrier, 33% of the interviewees had minimum to no knowledge regarding the financial policies or tools for RE projects, demonstrating the lack of information and resources that have been assigned by the government for the promotion and development of the RE market. (3) the third key barrier is the lack of financial guarantee, as 33% of the interviewees explain that a PPA is essential in the RE project. Even though the PPA is an agreement in the DR it is used as a financial tool. Without it the chances of having a successful project are minimal. (4) the fourth is the reduction of the tax incentives, with the reform of the 57-07 law in 2012. Incentives were cut from 75% to 40%, this government decision impacted the RE investment and projects that had been submitted and approved as of the 800 MW of RE that have been approved only 25% of them have been implemented. As the interviewees pointed out:

> *"The change in the incentives in 2012 that reduced the incentive and slowed down the RE investment also the lack of knowledge in RE and the lack of education in this type of energy".*

This opinion is shared by 22% of the stakeholders as the research shows. (5) the fifth barrier is lack of RE technology assets recognition. This was only considered by 11% of the interviewees and (6) the sixth barrier is the interest rates and return time. This was only highlighted by 5% of the stakeholders, demonstrating the lack of knowledge in the area along with the lack of development that this area has in the DR.

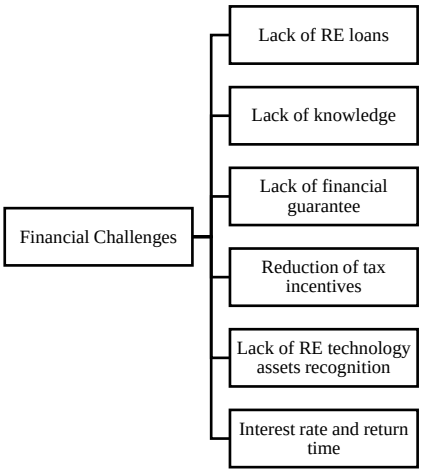

Figure 1. Financial barriers in the DR based on interviews

Even with the barriers presented in Figure 1 DR has a growing investment into RE, around 900 MW of RE projects have been approved along with several expansions of the projects already in services (World Bank Group, 2015). In accordance with the interviews, the key drivers can be seen in Figure 2 in order of importance. These drivers are the key for promoting and developing an RE market in the DR. As these drivers represent the attractive features of the RE projects that must be increased and maintained.

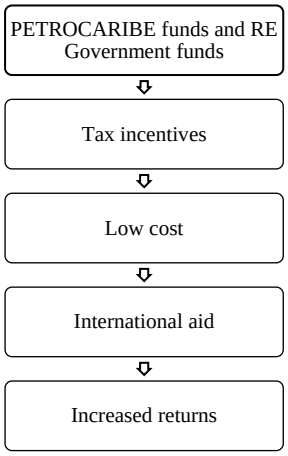

Figure 2. Financial drivers for the DR based on the interviews

In this area of drivers, the interviewees were more knowledgeable as 72% agreed that the most important driver is the financial gain from this business opportunity. These financial drivers are based on the financial tools, agreements and policies available in the country, regardless of the knowledge of the population. For these drivers to work, several critical success factors must be monitored, and key performance indicators must be created to assure the successful implementation of financial aspects of an RE project, as can be seen in Figure 3.

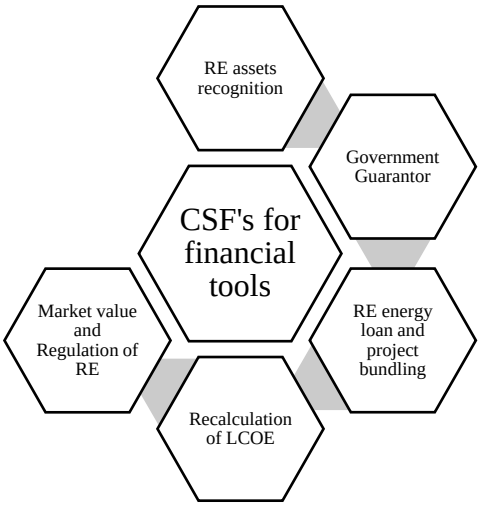

Figure 3. CSFs for financial tools in the DR based on the interviews

Table 6 summarises the financial status in the DR regarding RE projects based on the interviews.

Table 6: Summary of the financial status in the DR regarding RE based on the interviews

Financial tools in the DR for RE	**Financial barriers in the DR for RE**	**Financial drivers in the DR for RE**	**CSFs in the financial sector of DR for RE**
Loans	Lack of RE loans	PETROCARIBE funds and RE government funds	RE energy loan and project bundling
PPA	Lack of financial guarantee	Low cost	Government Guarantor
Incentives and cost of RE	Reduction of Tax incentives	Tax incentives	Market value and Regulation of RE
International aid and loans	Lack of knowledge	International aid	
Asset-backed security	Lack of technology asset-bracket	Increase returns	RE asset recognition
Capital Grants	Interest Rates and return times		Recalculation of LCOE
Private investment			
RE portfolio			
Mutual funds			

5 Conclusions and recommendations

The current study reveals that the DR possess three financial policies including: FIT, incentives and RE portfolio. Seven finanicial tools were currently found in the DR for RE projects including: loans, power purchase agreements, international aid and loans, mutual funds, asset-backed securities, capital grants, and private investment. This does not mean that the tools found are implemented to full capacity, some are partially implemented, and others are implemented in the fossil fuel energy sector. The country has made several commitments to the climate change agreements, yet the RE energy market is under-developed and under-promoted. This might be a direct consequence of the implementation of numerous financial mechanism, many Caribbean nations have been successful in achieving the proposed RE

targets, with fewer financial mechanisms, such as Aruba that relied on net metering, interconnect standards, tax redcution and green public procurement.

This research shows the gaps that exist between the knowledge that the stakeholders should possess and the actual knowledge that exists in the country regarding the financial aspect of an RE project. This has been noted before as a key for continuous development of the DR. However, due to a lack of leadership, knowledge and market development of RE in the DR is poor and the commitment to its development is not reflected in a direct manner in the countries financial policies and more specifically the financial tools available for enhancing RE as the country has committed to in previous agreements.

This research shows that the greatest financial tool that is known to the stakeholders is loans. These loans in the DR are normally commercial or personal loans, as no RE-loan exist in the country. New regulations are taking into consideration solar panels as asset-backed for loans. However, this is a measure only for personal or auto-consume projects. Taken into account the need to have a reputation in the country as 22% of the interviewees agreed that this particular barrier makes international investment hard to be acquired and limits the financial tools that the project have access to.

Several areas of findings are highlighted in this paper: (1) need to align the legal and financial framework (2) financial education regarding the available tools and difference between financial policies and tools (3) the adoption and implementation of innovative financial tools in the market (4) need to define the roles of the various RE players in a financial context. These are indicators of a low level of maturity and preparedness that the DR RE market possess. Also, this demonstrates the lack of engagement of the government in RE matters and the lack of a unified and sustainable vision for the future.

In the DR, the ABS is usually created by the government and is called “Bonos Soberanos” or sovereign bonds. This is awarded to different initiatives, usually for fossil fuel or other commercial utilities. However, this has not been used for RE. In this regard, again the reputation and lack of leadership of the government interferes with the financial institutions as many of the entities do not recognise the bonds. These results have a socio-economic impact. Therefore, the following recommendations for DR are to start pro-actively taking measures, such as:

- A 10-15 years continuous plan to deface or dismantle fossil fuels in the country.
- To ensure not just the creation of an RE financial law but the correct implementation and continuity of the law.
- The assurance of assets creation for RE.
- The government participation to ensure that all financial institutions adhere to the financial and political RE laws.
- The implementation of renewable portfolio standard (RPS) to enhance the production of energy from renewable resources by all the electricity supplier companies.
- A nationwide educational program in RE and not just in energy efficiency.

In addition, actual and perceived risks continue to slow down investment growth in RE, especially in new markets like DR. Therefore, policymakers and international financial institutions must deploy the right policy and fiscal tools to address these risks and mobilise private sector investment. These measures along with the conclusions are time sensitives as the

decisions of the DR government to invest in coal energy production could potentially lock the energy market in a fossil fuel-based economy for the next 10-20 years.

Finally, a review of funding mechanism for each country is needed as each case differs to others. Also, financial tools alone cannot transform a country to the use of RE, it is a joint effort, of not only the actors (e.g. government, industry and citizens) but of the different sectors, business plan, technology, education and resources. Given that the research reported in this paper is largely exploratory by nature, the results presented here provide a useful insight for the purposes of generalisability and repeatability. Therefore, it is advocated that additional research should explore the complex issues of financing RE projects, particularly the business case for RE within organisational settings and the contextual constraints that shape decisions.

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