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Solar for All (Making Solar Available to Everyone), Striking a Balance for Sustainable Growth

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Abstract

A lot of effort is being placed on bridging the gap and allowing the financially challenged sector of the population to reap the benefits of solar. However, the biggest hurdle for local and state governments is the impact that these programs may have on their treasuries. So what can regulators and decision makers do, to fund these programs efficiently.

The merging of Community Based Solar initiatives in combination with enhanced revolving funds accompanied by a change in the utility business model, can generate sustainable growth and allow everyone to enjoy cleaner forms of electricity generation.

The key is to strike a balance among all these strategies so that the subscribers will be able to access the service.

Keywords: Cash flow, Pigovian Tax, Paradigm Shift, and Community Solar.

1. Introduction

The energy requirements of the world are in a state of constant growth, this demands greater improvements in generation, transmission and distribution of electricity. The increasing demand is coupled with the need for considerable reductions in the fossil fuel bill making economic growth extremely difficult.

When faced with a reduction in their fossil fuel bill, countries also encounter challenges in areas, such as: high ratio of debt to Gross Domestic Product; low Income per Capita and absence of a legal framework for alternative generation and / or in a setting of subsidized Levelized Cost of Electricity.

Governments in developing countries seek solutions that can create jobs and job opportunities while reducing the dependency on fossil fuels, reduce its annual budget deficit that constrains its expenditure on developmental initiatives, and last offer diversification away from our predominant source of income, to overcome the boom and bust cycles to which single product economies are always exposed too.

As the countries in Latin America and the Caribbean grapple with a difficult path to economic growth with the on-going economic downturn, what can we do to bring change, what savings will it represent, how do we face these challenges, without creating additional burden to the treasury.

Opportunities and market conditions can differ from Region to Region; however, in Latin America and The Caribbean, there are several patterns that are common to most, these trends and conditions are:

— **Subsidies**. For most of Latin America and the Caribbean power generation, transmission and distribution is provided by the state at a price that gives access to the bulk of the population. This hides the true cost of the service from the subscriber promoting inefficiencies.

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- **Poverty**. For many years it was believed that Globalization was the key answer to economic growth, reduction of poverty, etc. Although this might be true, the Caribbean and Latin America has not benefit entirely from this growing trend. Poverty and growth are issues carry a high priority in governments on this side of the world.
- **Competition**. Market forces demand that companies competing in the global arena become more efficient. As they seek lower production costs, the demand more energy efficient systems.
- **Limits in Power Generation and Supply**. Generally speaking the demand for electricity expands faster than its supply. It is a fact that many developing nations experience a shortage in their supply that often threaten economic growth.
- **Environmental concerns**.

Given the current state of affairs, it is safe to say that emerging markets pose a unique opportunity to alternative energy solutions. It is in this context that it is important that governments have the vision to implement such solutions, and in so doing, improving the quality of life of their citizens.

In seizing the opportunity emerging market governments must realize that the implementation of such solutions will have to compete for financial and other resources that may be otherwise used for development projects. However, in executing their vision for the improvement of the life of the citizens, governments must make hard choices in order to guarantee the sustainability of their countries' economies.

There is a need to institute a balance between the people, time, resources and deliverables – an important aspect that it is not usually considered in economic models - a subject which has been the debate among many economists.

It is often difficult to balance economic growth models while satisfying the needs of the less fortunate. As expressed by Finn Kidland and Norman C. Prescott in their classic 1977 article "Rules vs. Discretion" which points to the fact that a:

> *"**Time-inconsistent policy may make the public happy in the short run but will ultimately fail to produce the long-run policy goal. A time-consistent policy, in contrast, nails the long-run policy goal but does not make people happy in the short run."***

Hence the reason why pondering the long term policy goals vs. the immediate goals is so important. Trinidad and Tobago is in no way different to any of its neighbors in the Caribbean and Latin America. Everyday our governments are faced with time inconsistent decisions and time consistent policy.

The renewable energy market is no different, solar power; wind generation, solar thermal and its counterparts face these crossroads. In a highly subsidized electricity generation industry responsible for dumping some fourteen million tons of carbon dioxide into the atmosphere, how is it possible to bring on stream electricity generation by means of renewable energy which have significant startup cost to the end user, way in excess to what they are currently paying.

To policy makers the answer is easy, maintain status quo – a time-inconsistent policy. Add the fact that main sources of revenue are under pressure, treaties that you are in breach of, a stagnant economy and rising unemployment, a formula for a very fragile, increasingly skeptical and hostile environment. The question must be put forward, time-consistent or time-inconsistent. Clearly, the population will favor a time-inconsistent policy. The question remains – what consequences will this policy have in the near future?

In contrast, choosing a time-consistent solution can be a cause for concern among the population making the policy an unpopular one. It then becomes a question of good governance, making a hard choice now which will benefit future generations.

This is the dilemma facing the renewable energy industry today, curb carbon dioxide emissions or hinder immediate economic growth.

2. Programs

Over the years research has shown that the development of a strong Solar Electric Generation Industry is tied three basic elements:

- Gross Domestic Product per Capita,
- Having a Legislation to Support the Industry,
- Levelized Cost of Electricity that will allow the penetration of Photovoltaic.

Figure 2.1 Elements that Support a Solar Electric Generation Industry

For Latin America and the Caribbean, we notice that one or two of the three elements are always missing, the chart below shows countries that have had a successful migration from fossil fuels to cleaner forms of electricity generation and those that are currently trying to move towards that path (Table 2.1).

Country	GPD per Capita in Real Values Expressed in US$	Energy from Renewables		
		Wind Power in Gwh	Biomas	Solar
Germany	$ 41,514.00	45,300.00	40,900.00	28,000.00
Spain	$ 29,195.00	42,400.00	9,120.00	7,280.00
Italy	$ 33,049.00	13,333	9821	18,637
Japan	$ 46,720.00	4,350.00	2,310.00	3,800.00
United States	$ 49,965.00	70,800.00	54,300.00	808.00
Trinidad and Tobago	$ 17,934.00	0.00	0.00	0.00
Venezuela	$ 12,767.00	0.00	0.00	0.00
Mexico	$ 9,742.00	86.75	823.00	9.00

Table 2.1

2.1 Paradigm Shift

A lot of ideas have been put forward to bridge the gap for solar electricity generation, notwithstanding, one model that comes to mind is the Grid Tied Utility Assisted Model, due to its nature, this paradigm shift in the way utility conducts their activities, offers a smooth transition from fossil fuel power generation systems to cleaner forms of energy, mainly solar and wind power systems in an environment of subsidized rates and in the absence of a legal framework.

This is achieved utilizing the Utility Company as the vehicle for change. Instead of being another player, the Utility acts as the supplier of the solar modules and /or other forms of alternative energy, by means of a lease agreement. The subscriber provides the space for the unit or units; the Utility provides the installation and sale of electricity power by leasing the power generating system where the homeowner pays the Utility the rate currently applied.

Because the equipment is leased to the property holder, the excess power goes back to the grid at no benefit to the homeowner. This cogeneration arrangement permits the gradual adjustment of rates, while reducing inflationary fears.

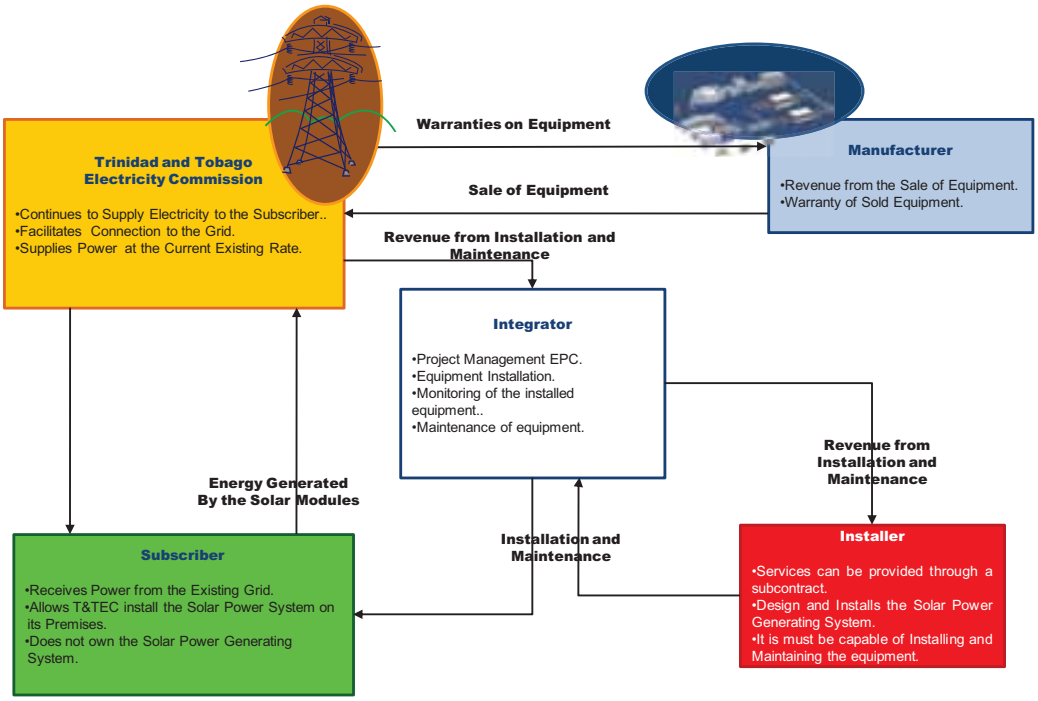

Figure 2.1.1, Inner workings of the Grid Tied Utility Assisted Model

2.2 Enhanced Revolving Fund

Unlike financial instruments such as Climate Bonds, Zero Coupon Indexed Bonds and other mechanisms used in investing in renewable energy projects, an Enhanced Revolving Fund is a mandatory contribution imposed on the industries that account for at least seventy percent (70%) of the GHG emissions released, in the form of tax. The program would mirror a trust fund that will use these contributions to finance small distributed generation projects.

An initiative such as this, is essentially a localized, downsized version of the United Nations Convention on Climate Change Clean Development Mechanism, with one fundamental difference, funding is made available to anyone who complies with the requirements.

Such schemes can operate under the supervision of Multilateral Organizations. Its primary function is the award of grants to allow organizations interested in migrating from fossil fuel electricity generation to renewable forms of electricity generation (PV and / or Wind).

The collection monies come from mandatory contributions made from the major players responsible for Carbon Dioxide Emissions and the Certificates of Emission Reductions generated in the process. This Pigouvian Tax Regime System imposed by Governments of the Region can look at: 0.5% of the total revenue of the organization and / or a ten percent 10% of the country's total carbon dioxide emissions (Table 2.2.1) at a rate of US$ 3.50 per CO_2 per ton. Similar to CDMs, guidelines for the approvals of projects must be in place. Once approved, the recipient will be in a position to give back to fund in the form of Certificates of Emission Reductions. These CERs can then be used to offset CO_2 emissions from those companies who have made payments to the fund.

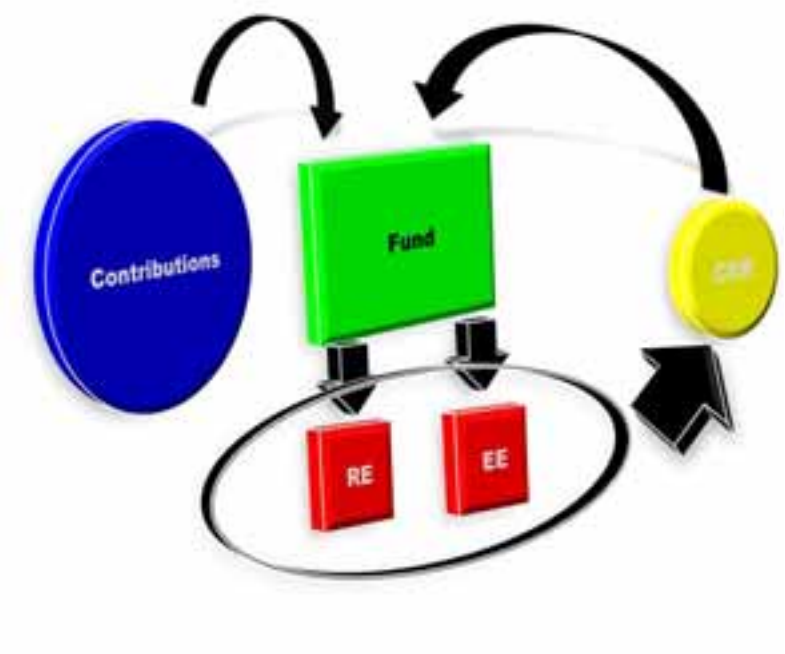

Figure 2.2.1, Enhanced Revolving Fund

The thought of using a neutral body to act the regulator and to pool the resources of the region, will move the Caribbean and Latin America closer to significantly reducing their CO_2 while democratizing renewable energy.

Country	Millions of CO2 Tons per Year
Argentina	191
Brazil	475
Venezuela	183
Trinidad and Tobago	52
Chile	80
Colombia	71
Peru	38
Puerto Rico	29
Dominican Republic	21
Ecuador	29
Total	**1,169**

Table 2.2.1

The Collection of ten percent (10%) of a total of 1,688,909,000 Tons that the Region generates at the above mentioned Carbon Dioxide per ton rate will yield US$ 590,000,000 a year, which will translate to 234 Mega Watts of Distributed Generation installed per year. At such levels the Enhanced Revolving Fund will in a position to remove from the less fortunate nations of the region their dependency of fossil fuels in a short space of time (Table 2.2.1).

2.3 Community Solar

Another model that has gained a lot of acceptance in recent years has been the creation of co-operative by communities with the purpose of using their pooled resources to provide electricity to their community members (Figure 2.3.1).

Figure 2.3.1 Graphic Representation of a Community Solar Initiative

Based on motives, the format of a community solar may vary. But undoubtedly, the most commonly used formats of this type of agreement are as follows:

- Utility Sponsored Model,
- Special Purpose Entity,
- Non – Profit "Buy a Brick" Model.

Notwithstanding, and depending on the financial benefits that the community solar format is pursuing, these alternatives can be divided as follows:

- Allocation of Cost and Benefits,
- Financial and Tax Considerations,
- Other Legal Issues.

Ultimately, when a group of people or community chooses an arrangement such as the one we have just described, they understand the complexity of the project that they are going to undertake and different elements that a venture of this nature entails.

3. Striking a Balance

Many solutions come to mind, however, the most popular and effective ones are those that we are currently considering. We begin with The Grid Tied Utility Assisted Model with roots originating from the Property Asses Clean Energy Program and the Solar Power Purchase Agreement. Then there are Community Based Solar Initiatives and last the consolidation of a Pigovian Tax System.

Bear in mind that all the proposals above mentioned qualify for Certificates of Emission Reductions, which at the end add that element that improves the returns on any of the projects that can be undertaken.

The question of striking a balance is not one that can be answered in simple terms, however, in maximizing the use of the resources, Gross Domestic Product per Capita, CO2 emission generation and society stratification play important roles.

Notwithstanding, by establishing the energy needs of the different sectors of the population, we can determine what program or combination of program works best, and therefore minimizing the levels of investment which otherwise would have been disbursed if just one solution had been considered (Figure 3.1).

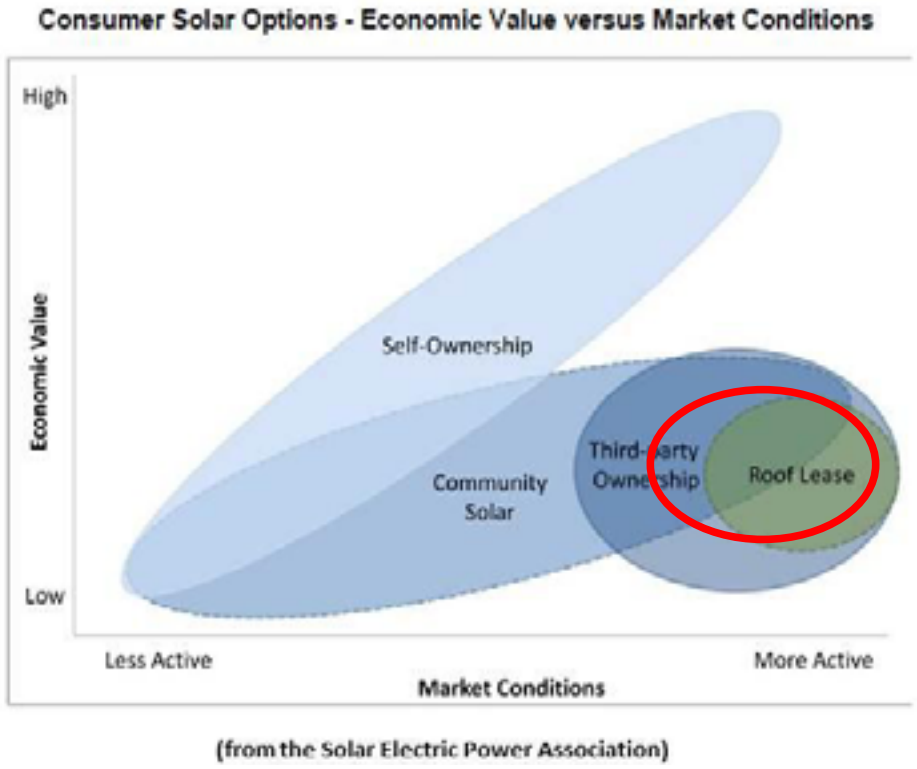

Figure 3.1

This is achieved by developing a linear model where the objective is to maximize photovoltaic penetration subject a group of constraints. Where the objective function represents what we intend to maximize or minimize and the constraints symbolize the limitation to which the model is subject to.

Our model can be expressed as follows:

Max Total PV Penetration: Max: $\sum c_i x_{i=} c_1x_1 + c_2x_2 + \ldots\ldots\ldots\ldots\ldots + c_nx_n$

Subject to:

$c_1x_1 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + c_nx_{n<} m_1$

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$c_mx_m + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + c_nx_{n<} m_n$

Once the model is constructed, we determine the value of our variables by applying the simplex method. After several iterations, for a population with a low GDP per capita, where the population is skewed more to low middle and low income.

The solution is weighted to a combination of an enhanced revolving with a Grid Tied Utility Assisted model.

Figure 3.2 Graphical Representation of the Results of the Model

CONCLUSIONS

The benefits of undertaking such a venture are many, however, we will limit ourselves to listing those that we consider to be the most important ones, they are as follows:

- **Reduction In Carbon Dioxide Emission**
- **Elimination of the Gas Subsidy**
- **Job Creation**
- **Export Opportunities**
- **Boost to the local assembly industry**
- **Downstream Development**

Benefits to the Nations

- **Creates permanent jobs –** nationwide and across a range of skills**.**
- **Promotes energy security** – without federal regulation or taxes that drive up energy costs.
- **Avoids costly power plants** – increasingly difficult to site.
- **No budgetary impact** - voluntary participants pay all fees and expenses.
- **Improves air quality** - reduced exhaust emissions make communities healthier.

Benefits to Property Owners

- **No upfront cost** - financing spreads costs over the life of UTILITY return on their investment.
- **Owners save money** – The absence of financing reduces the homeowner bill for the equipment that at the end of the period can be bought for residual value amount thereby allowing for the widest possible participation by the national community.
- **Assessment transfers upon sale** - new owner benefits from improvements that stay with the property.
- **Safety** - assured by best practices and guidelines established to protect all program participants.

— **Broad applicability** – residential, industrial and commercial properties. Cross border, government or privately owned Electricity Companies.
— **Voluntary** Homeowners benefit from the improvements.
— **Comfort** – efficient buildings are healthier and more comfortable.

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