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CARIBBEAN EXPORT DEVELOPMENT AGENCY

THE DEVELOPMENT OF SECTOR PROFILES FOR THE RENEWABLE ENERGY, NICHE TOURISM AND BUSINESS PROCESS OUTSOURCING SECTORS FOR CAIPA

FINAL REPORT 2
RENEWABLE ENERGY

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1. INTRODUCTION

This report analyses the potential of the Caribbean to promote the development of their renewable energy sectors to international investors.[1] Hence, it is not a comprehensive analysis of the technical feasibility to develop specific renewable energies by country – an exercise that has been partially conducted elsewhere. To establish a basis for later discussion *Section 2* will however present latest global trends in renewable energies. The overall focus of the report is placed on identifying potential competitive advantages, as well as other factors affecting the regions' **attractiveness to foreign investment** in renewable energies.

Generally speaking, the region of the Caribbean has already started to develop its renewable energy sources. While some countries have existing capacity in solar, wind, hydro and biomass, there is a **large cross-country difference**. *Section 3* will cover the existing capacity by country. Following a recent working paper published by the IDB and the Worldwatch Institute, the main drivers for these trends are decreasing costs linked to maturing technologies and a large, unexplored potential in the region[2]. Hereby the continued efforts in developing renewables represent an **opportunity as well as a necessity**. Since the development of renewable energies can help in addressing big economic, social, and environmental challenges the IDB highlights universal access to electricity, rising future demand of energy, out-dated grid infrastructure, and adapting to adverse effects of climate change. However, there is a need to stress that renewable energies are by no means the panacea to wider government and market failures. They should rather be considered as **part of a larger integrated policy framework** encompassing the public and private sector as well as domestic and international investors.

Regarding the natural potential many islands are looking to leverage their year-round sunshine to develop renewable energy, in addition to its attractiveness for tourists. Along with solar, the Caribbean nations also have potential for wind, hydro and biomass, and this is why many of them have set ambitious targets to increase the use of renewables in the energy matrix, as well as to lower energy costs, and offer a reliable output.

The Caribbean Development Bank (CDB) announced last year that US$30 billion would be required to cut reliance on fossil fuel and expand renewable energy.[3] A large portion of the US$30 billion required will have to be contributed by private investors. *Section 4* of this report will take a closer look at the investment climate and incentives in place for renewable energy investments. While the region does not lack the natural potential and the political commitment, the number of reference projects is limited. Thus, in order to understand and assess the competitive advantages and opportunities by sector and country, *Section 5* will compare the region against a set of benchmark countries (Costa Rica, Fiji Islands, Germany, Iceland, Uruguay). Section 6 concludes the study with a SWOT analysis.

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[1] The term "Caribbean" will refer to the nine beneficiary countries of CAIPA: The Bahamas, Barbados, Belize, Dominican
[2] "*Study on the Development of the Renewable Energy Market in Latin America and the Caribbean*", IDB Nov. 2014
[3] www.caribank.org

2. Global Industry Trends

Global trends in renewables are reviewed in a number of recent, high-profile reports that discuss renewable energy as a feasible source for the generation of electricity. These include cross-organisational initiative such as REN21's *Renewables 2014 Global Status Report* or the *Sustainable Energy For All* led by the UN. Dedicated organisations such as IRENA and the IEA also publish regular reports on trends, forecasts, and country-analysis of the sector. In addition there are numerous think tanks, online blogs and academics commenting on the topic. This report is no attempt to summarise all aspects that play a role in the global industry of renewables. Table 1 provides a broad overview of the main technologies analysed here, including typical investment and electricity retail costs. In addition the main global trends are highlighted below. Hereby the focus is placed on the most relevant for developing renewables in the Caribbean where foreign investment (FDI) attraction plays a role.

World transition to renewables

The energy sector is going through a transition process around the world. More countries have adopted policies to support a transition to renewable energy. According to REN21's 2015 Global Status Report, 145 countries now have renewable energy support policies. This number is nine times higher than the 15 countries identified with such policies in 2005. As a result, 130 GW of renewable capacity were installed in the power sector in 2014, establishing a new record-high. Furthermore, the IEA forecasts this trend to continue with an average investment of US$ 230 billion per year in new renewable capacity to 2020.[4]

Increasing cost-competitiveness drives expansion:

Renewables have expanded both in terms of capacity installed and energy produced. Global renewable energy power capacity has grown 85% over the last ten years.[5] This trend has been driven in part by the decline in renewable energy costs. In many countries renewables are now broadly competitive with conventional energy source.

Solar and wind power are the leading technologies

Solar and wind power have been the leading subsectors in terms of investment in renewables over the last two years. In 2014, US$ 149.6 billion has been invested in solar power, accounting for more than 55% of total new investment in renewable power and fuels.[6] Wind power followed with US$ 99.5 billion, or 37% of the total. The remaining 8% was divided between biomass and waste-to-energy (US$ 8.4 billion), biofuels (US$ 5.1 billion), small-scale hydropower (US$ 4.5 billion), geothermal power (US$ 2.7 billion) and ocean power (US$ 0.4 billion). Although both developed and developing countries have increased their investments in renewables, developing economies are responsible for the majority of investments in wind power, small-scale

[4] International Energy Agency. *Renewable Energy Medium-Term Market Report: Market Analysis and Forecasts to 2020*. 2015.
[5] IRENA. *IRENA 2014-2015: At a Glance*, 2016.
[6] This figure does not include hydro power above 50 MW.

hydro and geothermal power. Conversely, developed economies have the largest share in all other technologies.

COST OF RENEWABLES WILL CONTINUE TO DECLINE

IEA's Renewable Energy Medium-Term Market Report forecasts that onshore wind costs will decline by 10% and solar PV costs by 25% by 2020. Although these technologies will become more cost-competitive, their economic attractiveness will still depend strongly on the regulatory framework and market design. Similarly, technologies such as offshore wind, solar thermal electricity and some bioenergy continue to need policy support.

INCREASE OF MARKET LIBERALIZATION AND OPENNESS TO PRIVATE SECTOR PARTICIPATION IN EMERGING MARKETS

Developing countries surveyed by Global Climatescope[7] have shown continued progress in their renewable energy policy frameworks over the last two years. In total, 76 new renewable energy-friendly policies went into effect in 2014.

EMERGING MARKETS WILL CONTINUE TO BE THE PREFERRED DESTINATION FOR NEW INVESTMENTS IN RENEWABLES

According to Global Climatescope, emerging markets registered US$ 126 billion in new investments in renewable power generation during 2014. For the first time emerging markets received more than half of all new global investments in renewables and a 39% increase compared to the previous year.

UNCERTAINTY OVER THE POSSIBLE IMPACT OF LOWER OIL PRICES

Lower oil prices generate debate over its possible impact on new investments in power generation and energy efficiency. The IEA forecasts that the transition speed to renewables will be negatively affected by current oil prices, discouraging energy efficiency investments over the next years. As a result, experts are recommending stronger policy efforts to support the energy sector transformation. On the other hand, IRENA notes that decreasing oil prices have not affected investments in renewables.[8]

SLOWER ADVANCES OF RENEWABLES IN TRANSPORT, HEATING AND INDUSTRY

Although there have been major advances in renewables in the power sector, advances in transport, heating and industry have been slower. Liquid biofuel development has been affected by lower oil prices and the industry has traditionally been excluded from support policies. For the future it is expected that the electrification of heating and transport will increase power demand. Forecasts by IRENA highlight that by 2030 half of all renewable energy use will come from direct uses, such as biofuel-based heating, cooking, cooling and transport.

[7] www.global-climatescope.org
[8] IRENA. *Roadmap for a Renewable Energy Future*, 2016

Table 1: Status of Renewable Energy Technologies: Characteristics and Costs[9]

Techno-logy	Market Niches	Capital Cost (USD/kW)	Levelised Cost of Electricity (USD kWh)	Tech/Operational Conditions
Wind	Utility-scale onshore Utility-scale offshore Off-grid	925-1,950 4,500-5,500 1,900-6,040	0.04-0.16 0.15-0.23 0.15-0.20	Onshore wind cost is competitive with fossil fuels. Higher capital costs of offshore wind are somewhat offset by higher generating capacities achieved. Off-grid wind turbines can be coupled with diesel generators, batteries, or other distributed sources for higher reliability.
Solar PV	Distributed (Rooftop) Utility-Scale Off-grid	2,150-7,000 1,200-1,950 large factorial variance	0.16-0.55 0.09-0.40 0.20-0.45	A mature, proven technology that has achieved grid parity in many markets. Capacity factors vary with resource available. Distributed systems have higher costs but are competitive with residential electricity tariffs in some markets. PV with store is a cheaper option than diesel for off-grid electricity.
Biomass	Utility-scale Industrial co-generation or self-generation Off-grid	800-4,500 800-6,500 500-6,500	0.04-0.20 0.04-0.24 0.06-0.24	Many technologies are well established, although gasification and pyrolysis are less mature. Biomass is low cost where long-term, sustainable supply of low low-cost feedstock is available.

[9] Adapted from Table 1.2 in IDB Working Paper "*Study on the Development of the Renewable Energy Market in Latin America and the Caribbean*", November 2014

3. The Industry in the Caribbean

3.1. The Caribbean key figures and trends

The Caribbean, in this report, consists of 9 diverse markets in terms of market potential as well as development level of electricity markets. The largest markets in terms of population are Haiti, the Dominican Republic, and Jamaica (see Table 2). Measured by total GDP the largest markets are the Dominican Republic, Trinidad & Tobago and Jamaica. Finally, looking at GDP per capita the picture looks different again as the richest markets are Trinidad & Tobago, The Bahamas, and Barbados at the same level as Suriname. To assess the level of development in energy markets in the Caribbean it is crucial to look at the existing capacity in the region. Broadly speaking as economies grow they consume more energy in total and also on a per capita basis. This is reflected well when comparing total GDP and total installed power capacity, as the largest Caribbean economies also have the largest total installed capacity.

Table 2: Key figures on Caribbean energy markets[10]

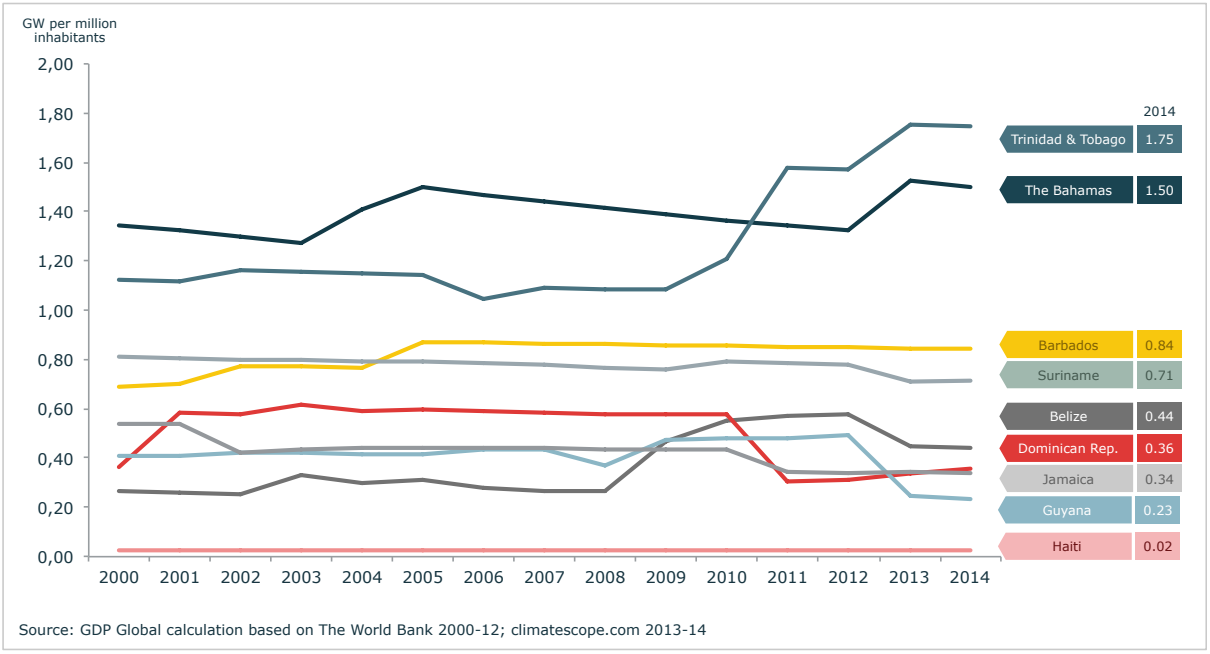
Country	GDP in BN$ (2015)	Population in Million (2015)	5 Year Economic Growth Rate (%)	Clean Energy Investments in BN$ (09-14)	Average Retail Electricity Rate Cents per kWh	Installed Power Capacity in MW (2014)	Renewable Share in % (2014)	Electrification Rate in % (2014)
Bahamas	9.2	0.4	0.9	0.0	39	576	0	100
Barbados	4.6	0.3	0.3	0.0	22	239	0	100
Belize	3.0	0.4	2.5	0.0	22	155	56	90
Dominican Republic	149.7	10.0	4.9	0.33	25	3,742	19	96
Guyana	5.8	0.8	4.5	0.0	29	177	17	82
Haiti	18.7	10.7	3.3	0.0	36	255	25	15
Jamaica	24.6	2.8	0.5	0.10	28	925	8	98
Suriname	9.1	0.6	2.6	0.01	7	445	44	85
Trinidad & Tobago	44.3	1.4	0.1	0.0	7	2,368	0	94

[10] Sources: GDP measured in PPP, GDP growth measured as CAGR 2010-15, Data from IMF World Economic Outlook database; Energy investments and retail rate from global-climatescope.org; Electrification rate from climatescope.com; Rest from World Bank Renewable Energy For All database.

RENEWABLE ENERGIES

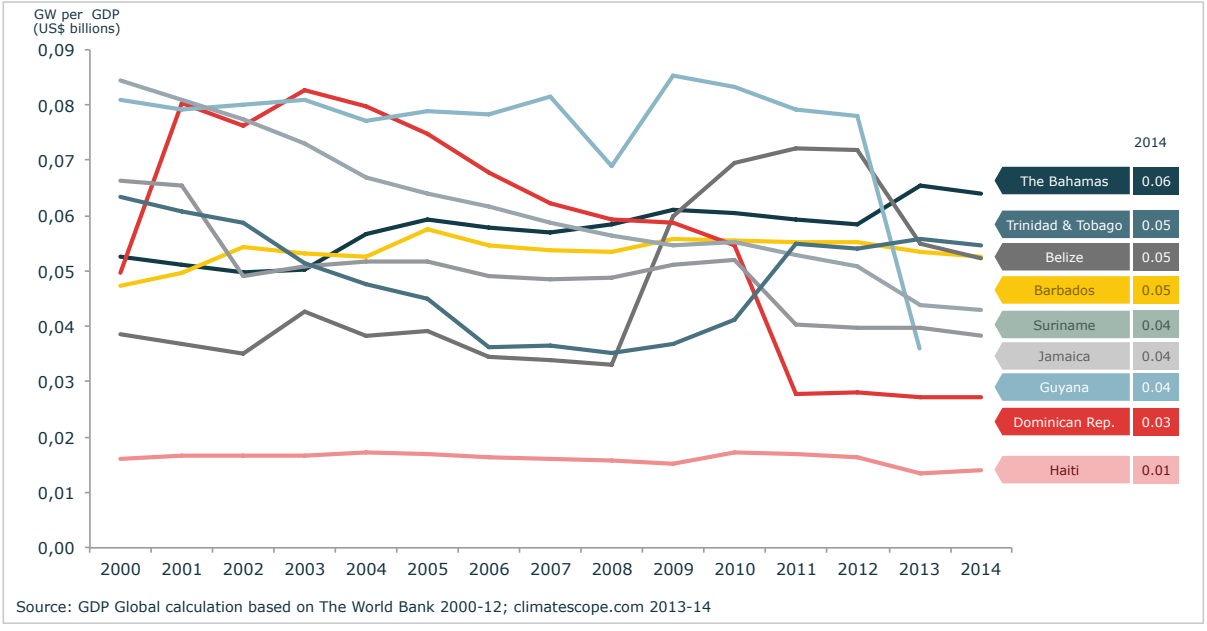
Figure 1 shows the total installed capacity (not renewables) per 1 million inhabitants, while Figure 2 shows the same per billion USD of GDP. It becomes apparent that only comparing total capacity at one point in time is not sufficient, as the trends by country look very different. While The Bahamas and Trinidad & Tobago exhibit the highest installed capacity per capita, some countries rely on less than 0.5 GW per million inhabitants (Belize, Dominican Republic, Jamaica, Guyana and Haiti). As a comparison, Germany has a total installed capacity of 177.1 GW and the US 1,063 GW. This equates to 2.2 GW per million inhabitants in Germany and 3.4 GW in the US.

Figure 1: Total installed capacity per million inhabitants (GW, 2000-14)



Source: GDP Global calculation based on The World Bank 2000-12; climatescope.com 2013-14

Figure 2: Total installed capacity per GDP in billion USD (GW, 2000-14)



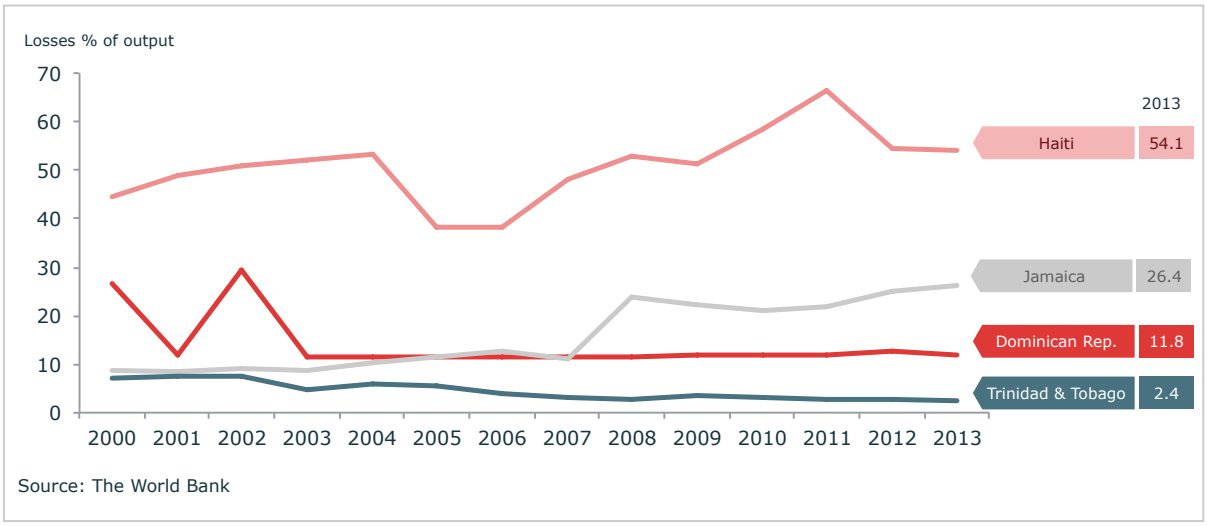
Source: GDP Global calculation based on The World Bank 2000-12; climatescope.com 2013-14

Caribbean countries are on similar levels to Germany and the US when it comes to installed capacity per billion USD of GDP (Graph 2), with an average of 0.05 and 0.07, respectively. However, this also shows that this might not be an ideal indicator as industrialised countries often offshore energy-intensive stages of their value chain. They also have access to more energy-efficient machinery and equipment.

The main insights from Figures 1 and 2 are that there is a considerable amount of variation between Caribbean countries with regards to relative installed capacity. When comparing countries of equal size (Haiti and Dominican Republic, Trinidad & Tobago and Jamaica, Bahamas and Belize) it is clear that some countries exhibit considerable potential for further investments in energy capacity in general. Since most countries in the region are highly dependent on fossil fuels, policymakers are committed to ensuring that renewables will cover some or all of the future demand.

Figure 3 shows the electricity transmission and distribution losses for selected countries. With more than 50% losses are significant in Haiti, in Jamaica it reaches almost 30%, while the Dominican Republic has 12% and Trinidad & Tobago 2.4% through more efficient grids. Similar cross-country differences are apparent when looking at the electrification rate (Table 2). Especially Haiti but also Guyana, Suriname and Belize have significant parts of their population not connected to the electricity grid. Hence, it is apparent that some of the Caribbean countries need to invest heavily in grid modernisation as well as expansion.

Figure 3: Electric power transmission and distribution losses by country (in %, 2000-13)



The significance of fossil fuels as a driver of high retail prices for electricity is partially a reason of the lack of grid efficiency, but also caused by large fossil fuel imports (see Table 2). While virtually all countries in the Caribbean import petroleum, the Dominican Republic also imports natural gas and oil. Other oil importers are Jamaica and Trinidad & Tobago. Due to its grid integration with Mexico, Belize is a direct importer of electricity.

Table 3: Energy imports by country

Countries	Electricity imports (million kWh) 2014	Crude Oil imports (bbl / day) 2014	Natural gas imports (cubic meter) 2013	Refined Petroleum imports (bbl/day) 2012
The Bahamas	0	0	0	64.430
Barbados	0	0	0	9.276
Belize	171	0	0	3.486
Dominican Republic	0	265,00	1,450,000,000	54.920
Guyana	0	0	0	10.810
Haiti	0	0	0	14.720
Jamaica	0	24,160 (2012)	0	32.140
Suriname	0	0	0	10.070
Trinidad & Tobago	0	76,700	0	8.823

Source: CIA World Factbook, OPEC

Key findings of The Caribbean Renewable Energy market are highlighted here below:

- The region is characterized by large disparities in terms of market size, level of development and access to electricity.
- Comparing installed capacity by size of population or GDP shows that smaller countries tend to perform better.
- Import of fossil fuels (mostly petroleum and oil) is significant in most countries. The Dominican Republic also imports natural gas, while Belize imports electricity due to its grid integration with Mexico.
- Average retail price for electricity per kWh range from 39 cents in The Bahamas to 22 cents in Barbados and Belize. Suriname and Trinidad & Tobago have significantly lower rates at 7 cents. While the picture is potentially distorted by energy subsidies, prices are around 3 to 4 times to those paid in most developed countries.[11]

[11] Christopher Barton et al, IDB, Improves Lives, Caribbean DEVTrends, 2016

3.2. PROSPECTS AND OPPORTUNITIES FOR RENEWABLES

A review of the global trends in Section 2 revealed a significant increase in the commitment and installation to renewables over recent years. The factors ranged from political long-term commitment to maturing technologies suitable for small-scale deployment. It is clear that developing renewable energy is key to solving the regions' energy problems. Key factors for international investors assessing the viability of developing renewables in the region are:

- The Caribbean's electricity demand is forecasted to double by 2027 as population and market size increases.[12] This requires large **investments in the physical infrastructure** of the electricity grid to guarantee stable electricity supply.
- In addition the transmission and distribution networks need to be **upgraded and modernized** to increase reliability and reduce the loss during electricity transmission. This is particularly important when increasing the share of renewable sources, which can have higher fluctuations in the supply.
- CARICOM estimates that 40% of future carbon abatement will come from **enhancing energy efficiency**, such as switching to more efficient electronic appliances and machinery – both residential and industrial.[13]
- Since the share of renewables in the energy mix is projected to increase this requires **additional electricity storing capacities** – especially on small islands relying on solar and wind.

Tables 4 - 6 highlight the development of the share of renewable generation capacity in the region since 2000. It is apparent that there is a large heterogeneity in terms of the existing capacity by country. However, looking at shares means that changing either variable (total capacity or the capacity of renewables) can change the picture. Hence, the graphs should be explored in conjunction with the development of total installed capacity of renewables (Figure 5).

It could be concluded that the increasing renewables share in the Dominican Republic and to some degree in Belize and Jamaica is the result of new renewable capacity installed in those countries. However, when looking at the total electricity generation capacity including fossil fuels (Figure 6) it becomes apparent that the total capacity in the Dominican Republic dropped sharply in 2011, thus the jump in the share of renewables energy sources as seen in Figure 4 heavily overstates the apparent rise in the share of renewables (from 10% to 20%) of total installed operating generating capacity.

[12] Alexander Ochs et al., *Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS): Baseline Report and Assessment* (Washington, DC: Worldwatch Institute, 2015)
[13] ibid

Figure 4: Renewable generation capacity share of total generation capacity (2000-14)

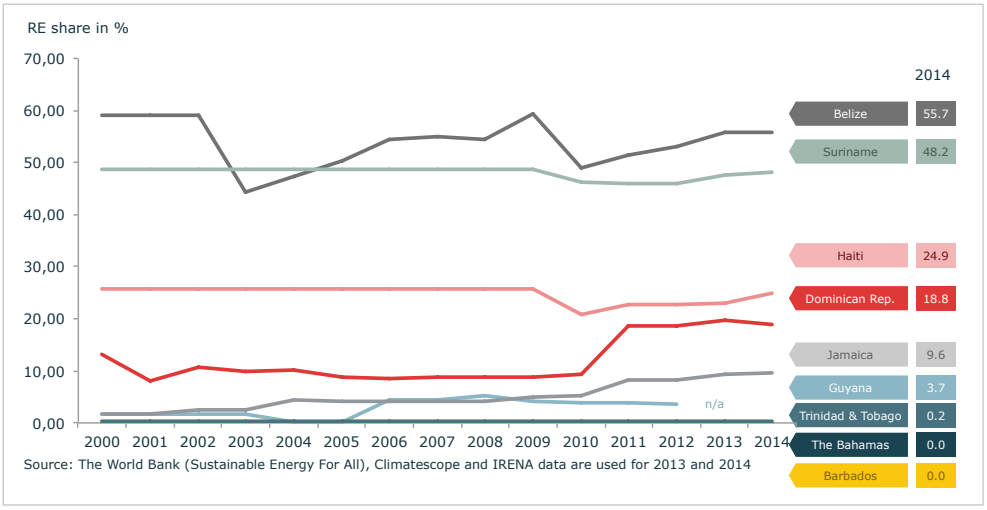


Figure 5: Total installed renewable energy generation capacity by country (GW, 2000-14)

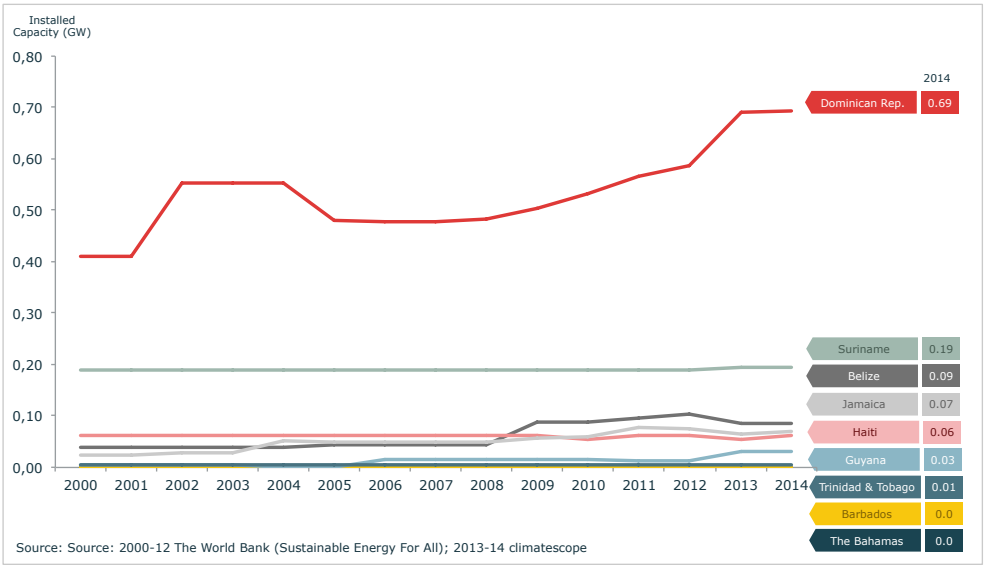


Figure 6: Total installed generation capacity by country (GW, 2000-14)

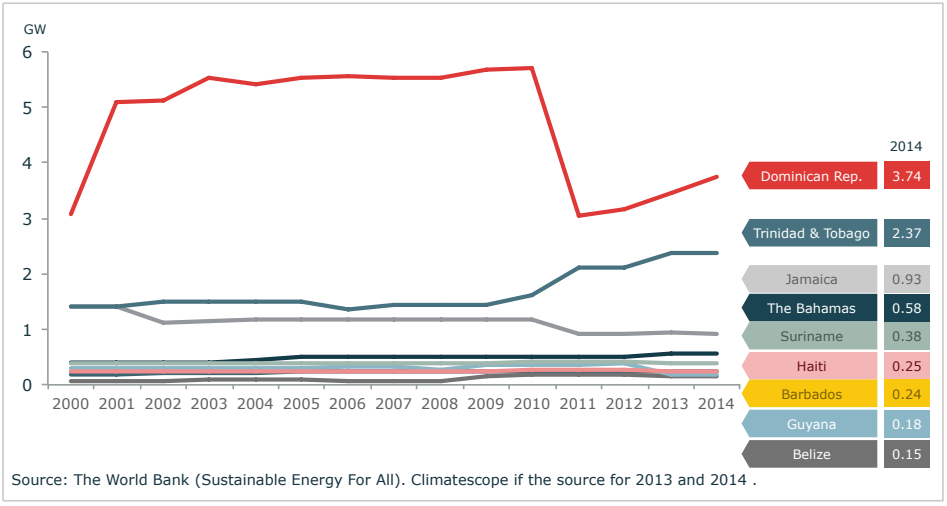


Table 4 shows the existing capacity in renewables in the Caribbean compared to the estimated potential where data was available. It has to be noted that the figures should not be taken at face value but have been aggregated from numerous sources in the Caribbean Sustainable Energy Roadmap and Strategy report (C-SERMS) conducted by the IDB and Worldwatch in 2015. Overall it seems clear though that every country punches below its potential in virtually every source of renewable energy presented. In addition there seems to be a large variation between countries as to which energy source has more potential. This is a first important insight for investment promotion to foreign investors.

Table 4: Existing & Potential capacity in renewables by country, and potential

Country	Fossil fuels (2014) MW	Hydro (2014) MW		Wind (2014) MW		Solar (2014) MW		Biomass & waste (2014) MW	
	MW	MW	Potential	MW	Potential	MW	Potential	MW	Potential
The Bahamas	576	0	**0**	0	**229**	0	**60**	0	**1**
Barbados	239	0	n/a	0	**40**	0	**40**	0	**24**
Belize	69	54	**70**	0	n/a	0	**42**	32	n/a
Dominican Republic	3,050	606	n/a	85	n/a	2	n/a	0	n/a
Guyana	147	0	**7,000**	0	n/a	0	**576**	30	**60.2 GWh**
Haiti	191	63	**897**	0	**27,300**	0	**2**	0	**8**
Jamaica	854	29	**56**	42	**1,313**	0	**1.876**	0	**192**
Suriname	190	189	**1,700**	0	n/a	5	n/a	0	n/a
Trinidad & Tobago	2,368	0	n/a	0	**50**	0	**308**	0	n/a
Total	7,684	941	**9,723**	127	**28,932**	7	**2,904**	62	**244**

Sources: global-climatescope.com & C-SERMS report 2015; Note "0" indicates there is no installed capacity at present, n/a indicates that data were not available at the time of the publication

3.3. Existing capacity and potential by country

The section will look at each country in more detail to work out the different specificities.

3.3.1. The Bahamas

The Bahamas currently rely to 100% on fossil fuels for electricity generation. In conjunction with the large petroleum imports this leads to the highest retail price for electricity in the region at 39 cents per kWh (Table 2). Total capacity has only increased slightly over the last 10 years to 576 MW. This equates to a relatively high capacity per capita at 1.5 MW per 1,000 people. The population of the Bahamas also has one of the highest incomes in the region, while growth has been moderate in recent years. Following the C-SERMS Report the highest potential of renewables lies in the development of wind and solar. The waste from the islands large cruise ship traffic and

big hotels could potentially be turned from waste to green energy, in particular in Gran Bahama/Freeport.

3.3.2. BARBADOS

The energy mix in Barbados is entirely dependent on burning fossil fuels of which some have to be imported. Though imports are considerably lower than in The Bahamas, the population is also smaller and less affluent. Electricity prices at 22 cent per kWh are more moderate, however the installed capacity per capita is lower at 0.8 MW per 1,000 people. This is still a relatively high value for the Caribbean overall though, with an average of 0.7 MW. The estimated potential for Barbados is modest but feasible in Wind, Solar and Biomass. However the overall renewables investment climate has scope for improvement.

3.3.3. BELIZE

Belize has the highest existing share of renewables in its energy mix in the region. At 22 cents per kWh and an average income below the regional mean this also demonstrates the potential that renewables can have in the region. The share of 56% renewables is mainly generated using hydro and biomass. However, the estimated potential is even higher for hydro and also shows scope to develop the solar industry, which does not exist so far. Through its grid integration with Mexico it is potentially also feasible to become a net exporter of electricity. Due to its existing capacity in Biomass the other renewable sectors show a higher potential for investment. Overall, Belize has a low level of installed capacity compared to its population (0.4 MW per 1,000 people).

3.3.4. DOMINICAN REPUBLIC

The Dominican Republic (DR) renewable energy generation reached 18.8% of the total installed capacity of 3,740 MW. Hydro accounts for 16% and Wind for around 2%. The retail price of electricity at 25 cents per kWh is equal to the average in the region, as is the average income at around 15,000 USD.[14] Considering the population of 10 million people, the installed capacity per capita is relatively low at 0.4 MW per 1,000 people. The country is also the largest absolute importer of petroleum and natural gas in the Caribbean. Taken together this suggests significant opportunities for further energy diversification away from fossil fuels. Regarding the potential of renewables the DR already has a few projects established in wind energy. Currently around 85 MW are installed, while 80 MW are under construction. In solar the country has around 300 MW in planning and development, while hydro already contributes with around 0.6 GW of electricity to the mix. The US Department of Energy attests a large potential for further wind and solar projects.[15] Also the track record of existing projects and the high electrification rate signals a functional renewable energy investment climate.

3.3.5. GUYANA

Guyana generates 24% of its electricity from renewable sources. An overall installed capacity of 177 MW for a country of almost 800,000 people translates into a very low capacity per capita (around 0.2 MW per 1,000 people). The country imports around

[14] Measured in Purchasing Power Parity for the year 2015, see also Table 2.
[15] NREL. Energy Snapshot: Dominican Republic, Energy Transition Initiative, US Department of Energy, September 2015

10,000 barrels of petroleum per day and electricity costs are relatively high at 29 cents per kWh. Exiting capacities in renewables are concentrated around biomass. Following the C-SERMS report this is also the sector with the highest potential for future development in renewables with around 60 GW. This is followed with a potential of around 7 GW in Hydro and 0.5 GW in Solar. All in all the country has considerable potential to invest in renewables, especially Biomass and Hydro. Considering that it is located on the South American continent also opens up the possibility of exporting biomass products, being the most storable renewable energy source.

3.3.6. HAITI

With a population exceeding 10 million, Haiti is the largest country in the region, however with the lowest installed capacity per capita (0.02 MW per 1,000 people). In Haiti 85% of electricity is produced using fossil fuel. Since it has to be imported the country is exposed to fluctuations of global petroleum prices. Though 15% of its electricity comes from one large hydroelectric plant, retail price is high at 36 cents per kWh. Significant projects in other renewable sources are lacking so far. The country's electricity market faces serious challenges such as huge transmission losses almost of 55%, and the electrification rate is as low as 15%. Nevertheless the estimated potential for hydro (0.9 GW) and wind (27 GW) is important, and provides investment opportunities despite all challenges.

3.3.7. JAMAICA

The island of Jamaica has a total installed capacity of almost 1 GW, its share of renewables is around 8%. It is the third largest country in the region with 2.8 million inhabitants, though the average income of around US$ 9,000 is below regional average. Also the installed capacity per capita is low with 0.3 MW per 1,000 people. Jamaica furthermore relies heavily on petroleum and oil imports, which puts pressure on the electricity price. At around 28 cents the average industrial electricity tariff is above the regional average and the residential and commercial price is closer to 40 cents.[16] The estimated potential for Hydro (56 MW), Wind (1.3 GW), Solar (1.8 GW) and Biomass (192 MW) is high according to the C-SERMS report and the US Department of Energy. Successful projects are established in Wind and Hydro, while a 20 MW solar facility project has been awarded and is under development. Planned projects also include 2 wind farms with a combined capacity of 58 MW.

3.3.8. SURINAME

Suriname has a total capacity of 384 MW, which equates to 0.7 MW per 1,000 people. Of those 51% is produced using hydropower. Petroleum imports are low and the country is an oil producer. The result is very low electricity price at around 7 cents per kWh. The potential for hydro is large, estimated to around 1.7 GW. Given that the country has existing capacity in Hydro this demonstrates the potential to develop it further. However, the low electricity price could be a risk for competing renewables beyond Hydro where a certain scale has been achieved already.

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[16] NREL. *Energy Snapshot: Jamaica*, Energy Transition Initiative, US Department of Energy, April 2015.

3.3.9. TRINIDAD & TOBAGO

In Trinidad & Tobago the total installed capacity for power generation adds up to 2.3 GW. Electricity is mostly generated using domestically extracted natural gas but there are currently no renewable energy sources. At 7 cents per kWh electricity prices are low. The country has some potential in Wind (50 MW) and Solar (308 MW) but only very small projects are currently being developed. Incomes are among the highest in the region and the installed capacity per capita is high with 1.7 MW per 1,000 people. The development of clean energies is gaining momentum in society, politics and the economy[17] and the investment climate is advanced, as the next section will highlight.

3.4. OUTLOOK OF SUBSECTORS OF OPPORTUNITY FOR INVESTORS

Table 5 combines various data indicators to estimate the investment potential in the Caribbean. A fuller circle represents a higher potential. The columns by sector (hydro, wind, solar and biomass) combine the data on existing and potential capacity as outlined in Table 4. The last column termed "Renewables Investment Climate Index" is a simple composite index considering past investments in renewables, electrification rate, electricity consumption per capita, and the retail price of electricity.

Table 5: Renewables Investment Potential and investment climate[18]

COUNTRY	HYDRO	WIND	SOLAR	BIOMASS	RENEWABLES INVESTMENT CLIMATE INDEX
The Bahamas	○	◔	◑	◔	◑
Barbados	○	◑	◑	◑	◔
Belize	◔	◔	◔	◔	◑
Dominican Republic	◑	◑	◑	◑	◑
Guyana	◔	◔	◑	◔	◔
Haiti	◔	◔	◑	◑	◔
Jamaica	◑	◔	◔	◔	◔
Suriname	●	◔	◔	◔	◔
Trinidad & Tobago	○	◑	◔	◔	○

○ Low Potential ◑ Medium ● High

[17] NREL. *Energy Snapshot: Trinidad & Tobago*, Energy Transition Initiative, US Department of Energy, May 2015.
[18] Sources: Own calculation based on World Bank Development Indicators, www.global-climatescope.org, www.climatemps.com, www.myweather2.com, C-SERMS Report. For columns 2-5 data from Table 4 has been used while potential capacity has a weight of 2:1 compared to existing capacity. For column 6 the factors considered were past investments in renewables, electrification rate (lowest weight), consumption per capita and electricity price (highest weight).

Table 6: Various Energy market indicators by country

Country	Total clean energy investment 2009-2014 (Bn US$)	Electrification rate (%)	Forest Area (sq. km)	Share of Forest Area (% of land area)	Hours of sunshine per year	Average Wind Speed (km/h)
The Bahamas	0.0	100	5,150	51	2,880	14
Barbados	0.0	100	60	14	3,028	19
Belize	0.0	90	13,660	60	2,857	12
Dominican Republic	0.33	96	19,830	41	2,316	13
Guyana	0.0	82	165,260	84	2,444	8
Haiti	0.0	15	970	4	3,115	9
Jamaica	0.10	98	3,350	31	3,002	16
Suriname	0.01	85	153,320	98	2,542	7
Trinidad & Tobago	0.0	94	2,340	46	2,608	10

Sources: World Bank Development Indicators, www.global-climatescope.org, www.climatemps.com, www.myweather2.com

4. Investment Climate

4.1 Regulation and Incentives

This section will review the regulatory framework in the region, with a specific focus on the energy market. In order to inform investment promotion those are subsequently confronted with incentives and other policies that countries have created to attract foreign investors. Table 7 provides an overview of the renewable targets by country, as outlined in national policies. It also provides the estimates from the C-SERMS Report on the suggested targets for countries in the region.

Table 7: Renewable Targets by country

Country	C-SERMS targets by 2027		National Renewables Target
	% in capacity	% in generation	
The Bahamas	55	63	15% by 2020, 30% by 2030
Barbados	67	55	20% by 2026
Belize	76	85	89% by 2033
Dominican Republic	-	-	25% by 2025
Guyana	84	90	90% (mostly hydro)
Haiti	46	52	20% by 2017, 28% by 2022, 46% by 2027
Jamaica	40	40	20% by 2030
Suriname	52	60	n/a
Trinidad and Tobago	52	29	5% of peak demand (or 60 MW) by 2020

RENEWABLE ENERGIES

Table 8 summarises the main national energy plans, which provide detailed and additional information on the national energy frameworks.

Table 8: National Energy Plans

COUNTRY	NATIONAL ENERGY PLAN
The Bahamas	The Bahamas National Energy Policy 2013-2033 (Approved Sep 2014)
Barbados	The National Energy Policy of Barbados (Submitted Dec 2006) / Draft National Sustainable Energy Policy (Proposed Sep 2011)
Belize	Draft National Energy Policy Framework (In Draft Nov 2011) / MESTPU Strategic Plan 2012-2017 (Submitted Sep 2012)
Dominican Republic	National Energy Plan, National Development Strategy 2030 (Law 1-12) and Climate Compatible Development Plan
Guyana	National Low Carbon Development Strategy (Updated Mar 2013)
Haiti	National Energy Sector Development Plan (In Draft Feb 2011)
Jamaica	Jamaica's National Energy Policy 2009-2030 (Approved Oct 2009)
Suriname	Renewable Energy Policy of Suriname (Submitted Nov 2010)
Trinidad & Tobago	Framework for Development of a Renewable Energy Policy for Trinidad and Tobago (In Draft Jan 2011) (Approved Nov 2011)

In Table 9 a comprehensive summary of the different regulations and incentives that exist in the renewable energy sector by country. It distinguishes between regulations under development with those already in place.

Table 9: Regulations and incentives in place / in development, by country

Type of Incentive	Bahamas	Barbados	Belize	Dominican Republic	Guyana	Haiti	Jamaica	Suriname	Trinidad & Tobago
Feed-in Tariffs	◐	◐		●				●	◐
Public Loans/Grants		●		●		◐			
Tax Credits		●		●					●
Tax Reduction/ Exemption		●	●	●			●		●
Net Metering/ Billing	◐	●		●	●		●		◐
Inter-Connection Standards		●	◐	●	◐		●	◐	◐

◐ In development ● In place

From section 4.1.1 each country with its regulatory framework and conditions for investments in renewables is reviewed individually.

4.1.1. THE BAHAMAS

The Bahamas Electricity Corporation (BEC) controls the electricity market in The Bahamas. The BEC owns 76% of the total installed capacity, while the private company Grand Bahama Power Corporation (GBPC) provides the remaining share.[19] The regulator is the Utilities Regulation Competition Authority under the Ministry of the Environment.

The Bahamas National Energy Policy 2013-2033 was approved in September 2014 and sets forward a target of 15% renewable electricity by 2020 and 30% by 2030. Feed-in tariffs and net metering/billing are currently under development. The country has no specific investment incentives in place or under development (Table 9).

4.1.2. BARBADOS

The Barbados Light and Power Company (BL&P) is the sole supplier of electricity in Barbados. It operates the generation, transmission and distribution systems on the island. There are no other market participants although independent power producers are permitted under current legislation. The regulator is the Utility Regulation Department under the Fair Trading Commission.[20]

The Draft National Sustainable Energy Policy was proposed in September 2011 and establishes a renewables target of 20% by 2026. Public loans/grants, tax credits, tax reduction/exemption, net metering/billing and inter-connection standards are currently in place. In addition, feed-in tariffs are under development.

4.1.3. BELIZE

Belize Electricity Limited (BEL), a legal monopoly created in the year 2000 with a 15-year license for the generation, transmission and distribution of electricity and an automatic 10-year recurring license, controls the electricity market in Belize. Private participants are allowed to generate up to 75 kilowatts of power. The regulator is Belize's Public Utilities Commission.

Belize's renewable energy policy includes the Draft National Energy Policy Framework and the Ministry of Energy Science & Technology and Public Utilities' Strategic Plan 2012-2017, submitted in September 2012. It puts forward a target of 89% renewable electricity by 2033. Belize provides a tax reduction / exemption incentive and is currently developing inter-connection standards.

4.1.4. DOMINICAN REPUBLIC

Since 1997, the Dominican Republic's electricity market allows private companies to participate in the generation and distribution of electricity. As a result, there has been a significant entry of private companies, mainly in the generation sector. The largest generator is AES Andre (private company) with almost 16% of total generation. Empresa

[19] NREL *Energy Transition Initiative Islands*, US Department of Energy, Feb. 2015
[20] NREL *Energy Transition Initiative Islands: Barbados*, US Department of Energy, June 2015

de Generación Hidroeléctrica (state-owned) is in second place with 14%, and Empresa Generadora de Electricidad (state-owned) is third with 12%. All state-owned companies are part of a holding named Corporación Dinámica de Empresas Eléctricas Estatales. The regulator is the Superintendency of Electricity.[21]

The Dominican Republic's renewable energy policy includes the National Energy Plan, National Development Strategy 2030 (Law 1-12) and the Climate Compatible Development Plan. This framework puts forward a target of 25% renewable electricity by 2025. The Dominican Republic has a broad set of regulations and incentives in place, which include feed-in tariffs, public loans/grants, tax credits, tax reduction/exemption, net metering/billing and inter-connection standards.

4.1.5. GUYANA

State-owned Guyana Power and Light (GPL) is the only company responsible for transmission and distribution of electricity in the country. Although GPL has its own power generation fleet, it also purchases electricity from independent power producers.[22] The regulator is the Public Utilities Commission.[23]

Guyana's renewable energy policy is based on the National Low Carbon Development Strategy, updated in March 2013. This policy puts forward a target of 90% renewable electricity (mostly hydro). Net metering/billing is already in place and inter-connection standards are currently under development.

4.1.6. HAITI

Electricité d'Haiti (EDH) is a government-owned and sole supplier of electricity in Haiti. Although it holds monopoly rights, it purchases electricity from some independent power producers. In Port-au-Prince there are 3 operators: Petro-Caribe a joint venture Haiti-Venezuela with 100MW, Groupe Jean Vorby (GJV) with a 100% government contract to provide mix of heavy oil and mix gas oil, produces at 29 cent KWH, sold back to the state at 16.98 cent KWH according to the company president Mr Vorby, who also states a future renewable energy market needs a reliable grid but Haiti's is unstable and until then it is not possible to operate. E-Power produces 40 MW. EDH also operates the country's transmission and distribution system, which is formed by 10 isolated regional grids. The country has no dedicated energy regulator.[24]
Haiti's renewable energy policy is based on the National Energy Sector Development Plan. It puts forward a series of targets for renewable electricity: 20% by 2027, 28% by 2022 and 46% by 2027. Public loans / grants are currently under development.

4.1.7. JAMAICA

The Jamaican electricity market is controlled by Jamaica Public Service Company Limited (JPS), the company is the sole distributor of electricity in the country. About 57% of the electricity distributed by JPS comes from its own generation fleet, while the remaining

[21] NREL *Energy Transition Initiative Islands: Dominican Republic*, US Department of Energy, September 2015
[22] Climatescope *The Clean Energy Country Competitiveness Index: Guyana,* Multilateral Investment Fund, 2015
[23] Caricom Energy Programme: www.caricomenergy.org/guyana/
[24] NREL *Energy Transition Initiative Islands: Haiti*, US Department of Energy, June 2015

43% is purchased from independent power producers. The regulator is the Office of Utilities Regulation (OUR).

Jamaica's National Energy Policy 2009-2033 was approved in October 2009 and puts forward a target of 20% renewable electricity by 2030. Tax reduction / exemption, net metering/billing and inter-connection standards are already in place.

4.1.8. SURINAME

One state-owned company, Energie Bedrijven Suriname (EBS), controls the transmission and distribution of electricity in Suriname. EBS also accounts for around 30% of total power generation, while the remaining 70% is provided by two companies: Staatsolie (state-owned oil company) and Suralco (private mining company).[25] There is no dedicated energy regulator in the country.[26]

The Renewable Energy Policy of Suriname was submitted on November 2010, although there is no specific target for renewable electricity. Feed-in tariffs are already in place and inter-connection standards are currently under development.

4.1.9. TRINIDAD & TOBAGO

The transmission and distribution of electricity in Trinidad and Tobago is provided by one company, The Trinidad and Tobago Electricity Commission (T&TEC). Since 1994 it purchases electricity from independent power producers to serve its customers in the island of Trinidad. Meanwhile the T&TEC is still the only operator of generation in the island of Tobago. Both islands are separated by 30 km and are not electrically interconnected. The regulator is the Regulated Industries Commission.[27]

Trinidad and Tobago's Framework for Development of a Renewable Energy Policy was approved in November 2011 and puts forward a target for renewable energy of 5% of peak demand (or 60 MW) by 2020. The country provides incentives such as tax credits and tax reduction / exemption. Feed-in tariffs, net metering/billing and inter-connection standards are currently in development.

[25] Climatescope *The Clean Energy Country Competitiveness Index: Suriname,* Multilateral Investment Fund, 2015
[26] Caricom Energy Programme: www.caricomenergy.org/suriname/
[27] NREL *Energy Transition Initiative Islands: Trinidad and Tobago*, US Department of Energy, May 2015

5. Competitive Benchmarking

To obtain a framework for successful renewable energy development it is useful to benchmark countries. The benchmarking can provide insights on successful policies from similar countries, as well as those with differing underlying economic conditions. They can inform policy by learning about adopted best practices in the renewable energy arena. Benchmarked locations include Costa Rica, Germany, the Fiji Islands, and Uruguay. The analysis will look at their enabling environment and market conditions, as well as infrastructure and government support for the development of renewable energies. Each section will provide a tabular overview of the main points and address country-specific factors in more detail below. Table 10 provides an extension of Table 2 adding the benchmarked countries, while Table 11 compares the installed capacity of renewables.

Table 10: Comparison of key economic indicators with benchmarked countries

Country	GDP CAGR 10-15 (%)	Population, 2015 (Million)	GDP capita (PPP)	Price of electricity (US$ cents per kWh)	Net Electricity Consumption (Million kWh)	Installed capacity (MW)	Installed capacity per '000 ppl	Consumption per '000 ppl
The Bahamas	0.9	0.4	25,181	39	1,716	576	1.6	4.7
Barbados	0.3	0.3	16,557	22	938	239	0.9	3.4
Belize	2.5	0.4	8,376	22	605	155	0.4	1.7
Dominican Republic	4.9	10.0	14,984	25	11,899	3,742	0.4	1.2
Guyana	4.5	0.8	7,508	29	558	177	0.2	0.7
Haiti	3.3	10.7	1,750	36	452	244	0.0	0.04
Jamaica	0.5	2.8	8,759	28	3,008	925	0.3	1.1
Suriname	2.6	0.6	16,290	7	1,572	384	0.7	2.8
Trinidad & Tobago	0.1	1.4	32,626	7	8,365	2,368	1.7	6.2
Benchmarked Countries								
Costa Rica	3.6	4.8	15,482	26	8,987	2,847	0.6	1.9
Fiji Islands	3.7	0.9	9,043	24	778	259	0.3	0.9
Germany	1.5	81.9	46,893	29	559,220	187,470	2.3	6.8
Iceland	2.7	0.3	46,061	9	16,940	2,760	8.4	51.5
Uruguay	3.7	3.4	21,507	19	10,565	4,059	1.2	3.0

Sources: GDP measured in PPP, GDP growth measured as CAGR 2010-15, Data from IMF World Economic Outlook database; Energy investments and retail rate from global-climatescope.org; Electrification rate from REN21 Global Status Report 2014; Rest from World Bank Renewable Energy For All database.

Table 11: Comparison of renewables capacity with benchmarked countries

Country	Fossil fuels	Hydro	Biomass & waste	Solar	Wind	Renewables share	Renewables targets
The Bahamas	100	0	0	0	0	0	15% by 2020, 30% by 2030
Barbados	100	0	0	0	0	0	20% by 2026
Belize	44	35	20	0	0	56	89% by 2033
Dominican Republic	81	16	0	0	2	19	25% by 2025
Guyana	83	0	17	0	0	17	90% (mostly hydro)
Haiti	85	15	0	0	0	15	28% by 2022, 46% by 2027
Jamaica	92	3	0	0	5	8	20% by 2030
Suriname	49	49	0	1	0	51	None
Trinidad & Tobago	100	0	0	0	0	0	5% of peak demand (or 60 MW) by 2020
Benchmarked Countries							
Costa Rica	21	63	1	0	7	79	97% by 2018
Fiji Islands	46	48	2	0	4	54	81% by 2020, 99% by 2030
Germany	42	3	5	21	24	53	80% by 2050
Iceland	4	72	0	0	0	96	72% by 2020
Uruguay	29	38	10	2	21	71	Optimal use of renewable sources by 2020

Sources: www.global-climatescope.org, US Energy Information Agency, US Department of Energy; Ministry of Industry, Energy and Mining of Uruguay; Energy-charts.de and National Energy Authority of Iceland.

5.1. ENABLING ENVIRONMENT FOR RENEWABLES

Figure 7: Enabling environment & market factors in benchmarked countries

COUNTRIES	ENABLING ENVIRONMENT: MACRO STABILITY & MARKET FACTORS
Costa Rica	• Political stability & educated workforce • Market demand of 9 billion kWh at installed capacity of 2.8 GW • Solid economic growth in last 5 years (3.6%) • 79% is the share of renewables (mostly hydro)
Fiji Islands	• Market demand of 0.8 billion kWh at installed capacity of 260 MW • Strong economic performance at an average growth of 3.7% in the last years • Share of renewables: 54% (mostly hydro)

COUNTRIES	ENABLING ENVIRONMENT: MACRO STABILITY & MARKET FACTORS
Germany	• Total demand is 540 billion kWh at an installed capacity of 177 GW. • Moderate growth at 1.5% in last 5 years • Current share of renewables: 48% (solar and wind)
Iceland	• Electricity demand of 17 billion kWh per year with installed capacity of 2 GW. • 8.1 MW per 1,000 people. • Strengthening growth following the financial crisis • Already 96% of renewables, relying on abundant Hydro and Geothermal sources.
Uruguay	• Market demand of 10.5 billion kWh at and installed capacity of 4 GW. • Solid economic growth in the last five years (3.7% average growth) • Share of renewables capacity: 71% (mostly hydro and wind)

5.1.1. COSTA RICA

The country is a stable democracy with an educated workforce[28] and an average per capita income that is slightly higher than the average in the Caribbean. For its power generation it relies to 79% on renewables. The largest contribution is hydro (63%), while the rest is generated using wind, biomass and geothermal sources. Total energy market demand reached almost 9 billion kWh at an average price of 26 cents per kWh. The total installed capacity per 1,000 people reaches 0.6 MW and is thus comparable to the Caribbean average.

The market is largely controlled by the state-owned *Costarricense de Electricidad*, however the power sector is in the process of being opened to the private sector.[29] In 2015 the authority announced that for 285 days the country managed to power its grid on 100% renewable sources. The estimated potential for Hydropower is 1,700 MW, though 780 MW are located in national parks where the law prohibits any kind of exploitation. Geothermal energy sources are also mostly located in volcanic areas in national parks and thus not available for exploitation. Regarding wind energy Costa Rica has been a Latin American pioneer and around 5 percent of the country's energy needs are met by wind. The annual cycle of wind generation complements hydropower, since the strongest winds occur in the dry season.[30]

5.1.2. FIJI ISLANDS

At 900,000 inhabitants the Fiji Islands are comparable in population to many Caribbean islands. Its economy relies mostly on tourism and sugar industries[31], while economic growth has picked up in recent years. Continued ethnic tensions and political instability is a liability for the islands long-term economic development. In 2009 the country was

[28] costarica.net, "Doing Business in Costa Rica", August 2015
[29] www.climatescope.org/en/country/costar-rica
[30] ibid
[31] Fiji Renewables Readiness Assessment - The International Renewable Energy Agency, (IRENA), June 13, 2015.

expelled from the Commonwealth of Nations due to lacking democratic institutions, which has been reversed following successful elections in 2014.[32]

The Fiji Islands demand for electricity increased at 4% per year since 2004, reaching 0.7 billion kWh in 2014.[33] Total Installed power capacity is 259 MW of which the Fiji Electric Authority (FEA) operates 94%. Currently around 54% of those are generated using renewable sources, mostly Hydropower together with some Wind and Biomass. To reduce the environmental impact the FEA wants to replace retired diesel with renewable energy and is looking for independent power producers to provide additional renewable capacity.[34]

5.1.3. GERMANY

Germany is the largest market in the EU with a population of 81.1 million. Following strong negative impacts of the global financial crisis the country has recovered and grown at 1.5% in the last 5 years. This trend is expected to continue in the following years.[35]

German demand in energy grew at 6.3% since 2005[36] and now totals 559 billion kWh annually. Installed capacity per 1,000 people reached 2.3 MW. Solar and wind renewables are set to generate around 193 billion kWh of energy in 2015, compared to 161 billion in 2014. Despite a moderate installation rate[37], solar plants produced 35 billion kWh the first 10 months of 2015 – the same amount produced in 2014. Wind, meanwhile, had already generated 63 billion kWh by October 31, 2015 compared to 47% for the same period in 2014.[38] Approximately 42% of the total gross electricity production is based on coal. This marks a decrease compared to 1990 when it accounted for 57% of total power generated.[39] Figures from research institute, ZSW for solar energy and hydrogen, and the German Association of Energy and Water Industries (BDEW), indicate renewable energy will meet roughly 33% of Germany's gross energy demand in 2015, up from 27% last year.[40]

5.1.4. ICELAND

Iceland is recovering from the global banking crisis of 2008 and GDP is approaching the same level as it was before the crisis. The country grew at 2.7% in the last 5 years. Iceland's demand for electricity has increased approximately 9% per year since 2004. The country consumed 16.23 billion kWh in 2014, while the corresponding figure for 2004 is 7.34 billion kWh.[41] In 2014, roughly 85% of primary energy use in Iceland came from indigenous renewable resources, 66% was from geothermal.[42]

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[32] BBC News, Asia, August 20, 2015
[33] CIA World Factbook, June, 2015.
[34] IRENA. *Fiji Renewables Readiness Assessment*, June 2015.
[35] export.gov, *Doing Business in Germany*, July 2015.
[36] CIA World Fact Book – Germany, June 2015
[37] http://www.pv-magazine.com/news/details/beitrag/germany--just-1275-mw-of-pv-registered-in-september_100021807/
[38] Federal Statistical Office, Wiesbaden, In Focus, January 28, 2016
[39] Ari Phillips, "Climate Progress, Germany Just Got 78 Percent Of Its Electricity From Renewable Source, July 29, 2015
[40] Germany: Renewables likely to cover 33% of 2015 gross power consumption, PV Magazine, by Becky Beetz, Nov. 4, 2015.
[41] Index Mundi – Iceland, Source: CIA World Factbook - June 30, 2015
[42] ORKUSTOFNUN, National Energy Authority, 2015.

The National Power Company is the largest producer of electricity and covers around 75% of the total. The rapid expansion of Iceland's energy-intensive industries, is the main cause of the increasing demand for electricity. In 2014, the aluminium industry used approximately 90% of all electricity produced in Iceland.[43] This is also why the installed capacity per capita is so high. Nevertheless the country maintained very low electricity prices at around 9 cents per kWh.

5.1.5. URUGUAY

Uruguay is a relatively small country with a population of 3.5 million, strong economic growth and a GDP per capita of US $21,507, which is above the average of the Caribbean countries. Energy consumption in Uruguay grew 5% annually over the last 10 years (2005-2015) and now totals 10.6 billion kWh, at an average price of 19 cents per kWh. Hydro is the country's most important energy source. It accounts for almost 59% of total electricity generation.

The country has significantly increased its installed capacity of renewable energy in recent years with an additional 804 GW of wind energy, 181 GW of biomass and 64 GW of solar energy.[44] As of 2015, 92.8% of the electricity generated by the country came from a mix of renewable energy sources.

The Ministry of Industry, Energy and Mines oversees the country's electricity market, which is controlled by UTE (Administración Nacional de Usinas y Trasmisiones Eléctricas), a state-owned and vertically integrated utility. Independent power producers are allowed to participate through 20-year power purchase agreements.[45]

5.2. INFRASTRUCTURE & GOVERNMENT SUPPORT

Figure 8: Infrastructure & Government support in benchmarked countries

COUNTRIES	INFRASTRUCTURE: NATURAL RESOURCES, POWER INFRASTRUCTURE, AND LOCAL SUPPLY CHAINS
Costa Rica	• Geological features favour hydropower, which is complemented by wind, biomass and geothermal energy • National plan to coordinate construction and development plans - aims to be carbon neutral by 2021 • Independent producers can sell to the national energy provider • Part of regional electricity market • Some tax breaks in selected renewable energy materials and equipment • Strict regulations of no-exploitation of national parks

[43] ORKUSTOFNUN, National Energy Authority, Electricity, Hydro, Power Intensive Industries, March 2016.
[44] Ministerio de Industria, Energía y Minería. *Balance Energético Preliminar*, 2015.
[45] www.climatescope.org/en/country/costar-rica

Countries	Infrastructure: Natural resources, Power infrastructure, and Local supply chains
Fiji Islands	• State-owned electricity provider • 50% of energy from biomass (coconut, sugar cane residues), independent producers can sell to national energy provider • 80% of renewable sources in electricity generation by 2020 • Government vision highlights affordability and sustainability • Emphasis of engaging the private sector
Germany	• Coal still largest source of energy, also due to 'exit' from nuclear power • Production of renewable energy increasing rapidly with corresponding issues for the grid • Expansion of transmission networks is a pressing issue and a national plan is under discussion • 45% of energy from renewables by 2030 • From 2000 any individual or business can sell renewable energy to the grid under certain circumstances • Policy regarded successful and starting to phase-out from 2015
Iceland	• Volcanic island benefits geothermal energy production • District-based heating system based on geothermal energy • Owners of small electricity plants can connect and sell to the national grid • Energy subsidies make it difficult for private entrepreneurs • Grant system mostly for researchers but not sufficient
Uruguay	• Renewable energy target established by the country's National Energy Policy 2005-2030: Setting a short term target of 50% share of renewable sources in the **primary energy** matrix by 2015, resulting in over 70% share of total installed capacity and over 90% share of power generation. This target was achieved in 2010, in 2014 it reached 58%. The long-term objective is to become a global leader in the renewable energy generation. • Favorable conditions to further develop wind energy with good wind speed throughout the year. • Strong clean energy policies: investors are attracted by the stability provided by a long term energy plan and 20-year purchase power agreements with a fixed price that can be adjusted by a pre-defined methodology, incentive package including corporate tax reduction and import duty exemptions

5.2.1. Costa Rica

The 'Plan de Expansion de Generacion is Costa Rica's framework under which the country is expanding various renewable energy sources. The electricity market allows for cooperatives and independent power producers to sell capacity to national utilities provider.[46] Costa Rica want to become the world's first carbon-neutral economy by 2021

[46] Expansion Plan Generation (PEG) Taxes and Incentives for RE, KMPG Global Energy & Natural Resources, October 27, 2015

and have 100% of the energy mix provided by renewables by 2030.[47] The country is integrated in the Central American Regional Electricity Market, which connects the grids of Mexico, Belize, Honduras, Guatemala, El Salvador, Nicaragua, Panama and Colombia.

The country does not offer feed-in tariffs but is planning to develop them for Solar power. The head of the national energy regulator described the proposals as "a bold step to promote the integration of renewable energy into the national electricity system, diversifying the energy matrix, promoting innovation and investment in this technology".[48] However, Costa Rica does offer import, value-added and income tax breaks for some renewable energy materials and equipment.

5.2.2. FIJI ISLANDS

The Fijian Government is committed to providing access to modern energy. Following the Sustainable Energy for All (SE4All) initiative the country is pursuing a green growth development path. Stated goals are 80% share of renewable electricity by 2020 and 25% share of renewable energy in overall energy mix by 2030. The government's vision for its energy future was clarified in the National Energy Plan (NEP) draft of 2014. Policy objectives highlight affordability for all Fijians and sustainable energy supply with less expenditure on imported fuels.[49] Furthermore emphasis is placed in private-led development.[50]

The Fiji Electric Authority (FEA) is the state owned electricity provider, providing power to 80% of the population. The FEA operates two large thermal and several decentralised thermal stations, as well as four hydro power stations and a Wind Farm. Power purchase agreements with independent power providers exist which are most relevant during the sugar-crushing season.[51] Feed-in tariffs are a key pillar of the energy policy.

5.2.3. GERMANY

The German Federal Government intends to reduce greenhouse gas emissions by 40% until 2020. According to experts, this can only be done by shutting down old coal-fired power plants one by one. In response to the Fukushima nuclear meltdown in Japan in 2011, Germany decided to close its nuclear power operations, causing the country to rely more on coal as it transitions to renewables.[52] Nevertheless, Germany plans to obtain 45% of its energy from renewable sources by 2030. Germany's Ministry for the Environment, Nature Conservation and Nuclear Safety released a draft progress report[53] on the country's Renewable Energy Sources Act in July 2015[54].

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[47] www.climatescope.org/en/country/costa-rica
[48] PV, Magazine, Financial & Legal Affairs, Global PV Markets, Industry & Supplies, Markets & Trends, Investor News, By E. Meza
[49] Fiji Renewables Readiness Assessment - The International Renewable Energy Agency, (IRENA), June 13, 2015.
[50] Fiji Renewable Energy Power Project (FREPP), Waste to Energy Resource Assessment in Fiji, Report on Options and Recommendations for Effective Implementation of Waste-to-Energy Power Generation in Fiji, November 2014
[51] Energy and Infrastructure, The Fiji Electric Authority , by Jamie Morgan, March 2016.
[52] Climate Progress, Germany Just Got 78 Percent Of Its Electricity From Renewable Source, Ari Phillips, July 29, 2015
[53] http://www.bmu.de/files/pdfs/allgemein/application/pdf/erfahrungsbericht_eeg_en.pdf
[54] http://www.germany.info/relaunch/info/archives/background/renewable.html

The Act, adopted in 2000, establishes an advanced "feed-in tariff" in Germany, enabling any company or individual who meets the technical and legal requirements to sell renewable electricity into the power grid for a guaranteed, long-term price for each kilowatt-hour sold. "The Renewable Energy Sources Act is the most important and successful instrument to promote the expansion of renewable energies in the electricity sector," the report notes.[55]

Under the revised Renewable Energy Sources Act (2014), incentive rates for renewable electricity will no longer be set by the government but by a market mechanism. The aim of the process is to cut the costs of expanding renewable energy while at the same time keeping the present diversity of market players and meeting the government's expansion targets, the Network Agency explains. The pilot is being tested for solar farms before it is introduced for all other renewable energy forms in 2017.[56]
As a result Germany has Europe's second highest consumer electricity prices, yet public support for its 'Energiewende' ("energy transition initiative") remains high. Support is rooted in an eco-friendly culture, a collective desire to abandon nuclear energy, and laws that allow citizens to profit from selling their energy to the grid. The goal is to reach a minimum of 80 percent by 2050.[57]

Wind power now accounts for more than 9% of the German power supply. The expansion of offshore wind energy is playing a growing role. New wind turbines were installed in Germany's North Sea at the end of 2014 and connected to the grid in 2015. Biomass in solid, liquid and gaseous form is being used for electricity and heat generation and for the production of biofuels. Just under two-thirds of the total final energy from renewable sources was generated by the different types of biomass used to this end in 2014.[58]

However, following the increase in the share of renewables the country faces issues in handling the occasional excess capacity. Additional investments in the grid infrastructure have been delayed, which includes the expansion of transmission and distribution networks.[59] Grid companies in Germany are set to invest close to $24 billion for upgrading their network and modify its existing high voltage power lines.[60]

5.2.4. ICELAND

The National Energy Authority (NEA) is the authority granting licenses to install power lines and also for distribution concessions. The State Planning Agency provides an advisory opinion and environmental impact assessment for all new licenses, and on the basis of this opinion, the local municipality to host the distribution concession grants the final license.[61] The NEA supervises and regulates the transmission and distribution

[55] Janet L. Sawin, Worldwatch Institute,"Germany aims to obtain 45 percent of its energy from renewable sources by 2030, July 2015
[56] Germany launches new solar farm incentive. PV Magazine, by Edgar Meza, February 25, 2015.

[57] Germany Could Be a Model for How We'll Get Power in the Future, By Robert Kunzig, October 15, 2015.
[58] Federal Ministry for Economic Affairs and Energy, Renewable Energy at a Glance, Working Group on Energy Balances, December 2015
[59] Germany: Renewables likely to cover 33% of 2015 gross power consumption, PV Magazine, by Becky Beetz, November 4, 2015.
[60] Germany Struggles With Too Much Renewable Energy, Real Clear Energy, by Gaurav Agnihotri, August 18, 2015
[61] www.reegle.info/counrty/iceland

enterprises, which includes the regulation of revenue caps, tariffs and the quality of electricity and security of supply. The generation and sale of electricity are under the surveillance of the Icelandic Competition Authority, although the NEA issues and monitors operating licenses to the competing firms. For investors it is often difficult to compete with subsidized energy.[62]

5.2.5. URUGUAY

Uruguay developed a comprehensive National Energy Policy 2005-2030 with the objective of diversifying its energy matrix, reduce dependency from fossil fuels, improve energy efficiency, and increase the use of endogenous resources like biomass and wind energy.[63] The policy established a 50% share of renewable sources in the **primary energy** matrix by 2015 and becoming a global leader in renewable energy generation by 2030.[64]

"Auctions have been the main instrument for the promotion of renewable electricity in Uruguay, whereby the government-owned national electric company (UTE) awards power purchase agreements (PPAs) to successful bidders. All auctions are subject to a bidding guarantee of 1% of the expected 10 year income"[65]. Similarly Ramón Méndez, Uruguay's former national director of energy, the country has been successful promoting renewable energy due to three main factors: clear decision-making, a supportive regulatory environment, and strong partnerships between the public and private sector. From the investor's point of view, the main attraction is a fixed price for 20 years that is guaranteed by the state utility. [66] Other natural conditions that have been helpful are good wind speed throughout the year and abundant biomass from agriculture.

Other incentives provided by Uruguay are tax incentives. Uruguay's Law 16.906, Decree 354/009 provides benefits for non-traditional renewable energy sources (wind, solar thermal, solar PV, geothermal, tidal, wave energy and from biomass) that consist of corporate income tax exemptions equivalent to:

- 90% of net fiscal income for all fiscal years up to 31 December 2017
- 60% of net fiscal income for all fiscal years from 1 January 2018 to 31 December 2020
- 40% of net fiscal income for all fiscal years from 1 January 2021 to 31 December 2023

The national production of machines and equipment necessary for the production of these renewable energies also benefit from this incentive. As a condition, at least 35% of the cost of these products must correspond to Uruguayan inputs. Also consumers with their own renewable energy micro generation systems can connect to the grid, deliver surplus energy and obtain a billing credit.[67]

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[62] Ibid
[63] IRENA. *Uruguay Renewable Energy Policy Brief*. June, 2015.
[64] Ministerio de Industria, Energía y Minería. Política Energética 2005-2030.
[65] IRENA. *Uruguay Renewable Energy Policy Brief*. June, 2015.
[66] The Guardian. Uruguay makes dramatic shift to nearly 95% electricity from clean energy. December, 2015. https://www.theguardian.com/environment/2015/dec/03/uruguay-makes-dramatic-shift-to-nearly-95-clean-energy
[67] www.climatescope.org/en/country/uruguay

6. SWOT Analysis

Despite the rise in renewable energy investment in the Caribbean region, some countries lag behind others. The region as a whole falls short from using its full renewable energy potential to supply affordable, reliable, and sustainable energy for all. The concept of Strengths-Weaknesses-Opportunities-Threats (SWOT) is used to evaluate the current state of the sector and identify points of action for policy. The diversity of each country presents its unique features, while the analysis below represents a comprehensive approach to commonalities in the region.

Figure 9: SWOT analysis

STRENGHTS	WEAKNESSES
• Emerging markets will continue to be the preferred destination for new investments in renewables • Abundant natural resources • Existing power distribution systems • Possibility of Co-generation opportunities • Critical mass and continued growth trends • Growing public and private attention to the need of renewable energy sources • Topography • Ideal location for renewable energy research and development • Regional political stability • Increase political awareness for renewable energy sources • Maturation of regional renewable energy dialogue • Growing energy needs • Increased regional and global awareness of renewable energy	• High dependence on imported petroleum/fossil fuel • High rate of electricity cost • Aging electricity generation plants • High technical and non-technical electricity system losses • Slow development of renewable energy resources • Low level of public actions • Weak enforcement power of regulatory agencies • No fossil fuel resources • High and growing energy import bill • Lack of well organized data-gathering infrastructure of energy supply and consumption data • Lack of well-defined institutional structure for planning and implementing renewable energy projects • Grid integration cost for utility scale application • Limited government funding for key technologies • Paradigm shift in changed public and private behavior • Initial cost of implementation of renewable energy projects are high • Comprehensive regional renewable energy policies • Regulatory framework

RENEWABLE ENERGIES

OPPORTUNITIES	THREATS
• Increased interest in renewable energy investments • Emergence of new affordable renewable energy technologies • Existence of proven technologies to exploit renewable energy resources • Jobs • Conservation • Emergence of new related industries • Economic gains • Feed-in tariffs • Net-metering potential • Increased economical standing • Potential for profitable investments	• Potential impact on local economy of high energy prices • Pressure of financing for renewable energy projects • Potential impact of international competitiveness caused by varied energy costs • Securing the necessary investments • Potential impact of natural hazards • Geo-political influences on international energy supply and demand • High reliance on imported fuel • Declining fuel cost • Climate change • Fragile ecosystems • Institutional disincentives and opposition to change • Complacency

ANNEX

7. INVESTMENT CLIMATE CHALLENGES

The deployment of renewable energy in the region can face a multitude of barriers and restrictions. This section will use the PEST-analysis to map out the main Political, Economic, Social and Technical factors that can act as such. It explains the importance of specific barriers and where possible highlights opportunities to overcome them.

7.1.1. POLITICAL FACTORS

The development of renewable energy continues to be strongly influenced by a country's policy support mechanism. A lack of regulation and incentives are two of the main barriers to the development of renewable energy markets. Successful renewable energy policies generally have five key elements: they include concrete targets, focus on resource potential, address technological challenges, are implemented rigorously and are consistent over time. Furthermore it is crucial that they are part of a country's development agenda and fit their overall regulatory environment. The implementation of these policies should be fair, transparent, accountable and reasonable, while the impact should be closely monitored and evaluated.

The Caribbean countries still need to make significant improvement in their policy support mechanisms. Following the Clean Energy Country Competitiveness Index developed by Climatescope,[68] four of the nine Caribbean countries are ranked among the lowest ten countries. The index measures policies and regulations of 55 emerging markets under its Enabling Framework parameter. The Dominican Republic ranks the highest at place 24.

Some examples of successful policies implemented by countries to attract investment in renewable energy include Mexico's target of 35% renewable energy in overall power production by 2024, Chile's energy market liberalization, Nicaragua's tax exemptions for renewable energy equipment, Uruguay's tendering system and Peru's utility regulation prioritizing dispatch of renewable energy sources.[69]

7.1.2. ECONOMIC FACTORS

Although technical solutions have been developed to manage the intermittency of renewable energy sources, addressing this challenge effectively requires significant investments in modernizing the grid. Extending transmission and distribution networks to meet existing and future demand growth is necessary in all countries of the region. Following the IDB specific factors to consider when for achieving open, fair and competitive electricity markets are[70]:

[68] Climatescope. *The Clean Energy Country Competitiveness Index*, 2015
[69] IDB. *Study on the Development of the Renewable Energy Market in Latin America and the Caribbean*, Nov 2014
[70] ibid

- **Access to grid and power market:** A common characteristic of the energy markets in many Caribbean countries is the existence of vertically integrated monopolies that control the generation, transmission and distribution of electricity. However in a few countries the private sector is able to participate in power generation.

- **Economies of scale:** The size of the power market and the size of individual projects are key factors to gain economies of scale and full exploitation of certain technologies. Caribbean countries face barriers to economies of scale due to low-demand markets, rising transaction costs and lower investor confidence or attractiveness. The interconnection of Caribbean islands would help build larger regional power markets.

- **Transaction costs:** Complex procedures and long timeframes to obtain licenses and permits increases transaction costs. This is normally the consequence of a lack of central authority for renewable energy and ineffective policy formulation. According to the latest World Bank's Doing Business, it takes an average of 200 days to obtain construction permits in the selected Caribbean countries; while the average for OECD countries is 150[71]. Additionally, renewable energy projects require environmental permits and other special requirements that increase the timeframe and costs further.

- **Counter-party risk:** Contractual uncertainty between IPPs and utilities for power off-take and their enforcement represents a barrier to the development of renewable energy. Mexico had self-supply difficulties during a period of time, since the utility only offered short-term contracts for purchasing excess supply[72]. Power purchase agreements, together with clear regulation for both utility and IPPs, and standardized power purchase contracts can help reduce counter-party risk barriers.

- **Inadequacy of financial products:** Renewable energy projects face financial barriers as they have longer payback periods than available debt financing. At the same time equity financing is not a common alternative due to high equity requirements (on average 40%). Investors are affected by non-competitive interest rates, as few public and financial products correctly assess the inherent risk. Governments in the region can work together with private banks and international financial institutions, to overcome these barriers.

7.1.3. SOCIAL FACTORS

Potential societal barriers to renewable energy advancement include a lack of awareness of the opportunities, vested interests in the status quo, and not-in-my-backyard (NIMBY) resistance at the project level. In general these barriers should not be understated in their importance.

[71] World Bank. *Doing Business 2016*
[72] IDB. *Study on the Development of the Renewable Energy Market in Latin America and the Caribbean*, Nov 2014

- **Lack of public acceptance**: There is a risk of remaining societal resistance to change due to a lack of understanding of the costs and opportunities of renewables when compared to fossil fuels. Especially with regards to costs the perception is still that they cannot reach grid parity. Thus it becomes crucial to involve local stakeholders such as the community and local governments in all stages and present data and evidence. This can raise awareness and ultimately guarantee acceptance and support.

- **Vested interest in business as usual**: Since fossil fuels still comprise the majority of power generation strong vested interests exist to maintain the status quo. Net exporters often see few reasons to abandon fossil fuels. However the example of Trinidad & Tobago may serve as a success story if the country manages to go ahead in its plans to develop renewable energy sources.

- **Not-in-my-backyard (NIMBY) mentality**: The key issue here are the ownership of land. One example provided by the IDB is the case of a wind farm in the Dominican Republic, which was moved to a location with less potential due to the resistance of the tourism industry. Workshops and meetings with stakeholders are necessary on a continuous basis to ensure that everyone can voice concerns and feels involved in the decision-making process.

7.1.4. TECHNOLOGICAL FACTORS

Uncertainties regarding renewable energy resource potentials and the technical feasibility of their deployment can hinder the deployment of renewable energy. Specific challenges include electricity transmission in on-or off-grid settings. The perception of many technical risks is sometimes out-dated, and integrated energy planning can help to address many remaining technological challenges where they still occur.

- **Lack of available data and information**: Though some countries conducted initial analyses of its potential in renewables, a coherent mapping of across the region is lacking. Hereby a specific focus should be placed on the feasibility of different technologies. A positive example is the GE Energy Consulting study of Solar and Wind potential in Barbados.[73]

- **Transmission and distribution challenges**: Limited and outdated electricity infrastructure is an issue for conventional and renewable energy projects, as they raise the risks and costs of development. The lack of energy transmission efficiency as analysed above can serve as an indicator of these issues.

- **Integration into the grid**: Renewables pose additional challenges to electricity grids in terms of voltage fluctuations, storage and load management. Looking for complementarities in the energy mix can minimise the challenges, however, further investments in modern technical solutions are a necessary pre-condition.

[73] GE Energy Consulting. *Barbados Wind and Solar Integration Study*. February 2015.