CARILEC

An Association Of Electric Energy Solution Providers

Position Paper on Policies for Energy Transition

JUNE 2021

ABOUT US

The Caribbean Electric Utility Services Corporation (CARILEC) is an association of electric energy solutions providers and other stakeholders operating in the electricity industry in the Caribbean region, Central and South Americas and Globally. The CARILEC Secretariat endeavors to improve communication among its members, providing technical information, training, capacity building, conference, and other services. The Secretariat plays a leading role in electric utility advocacy, growth, and sustainability in the Region.

Mission

CARILEC will enhance the effectiveness of its members by providing industry related services, creating regular networking, training and knowledge sharing opportunities; supporting mutual assistance programs and accelerating the Caribbean Region's energy sector transition, through innovation and advocacy.

Vision

To be the Premier Association of Energy Service Providers and their partners, facilitating the development of world class sustainable electric energy solutions for all peoples of the Caribbean Region States.

Values

Collaboration: We foster and celebrate team work across the Caribbean region and beyond; bridging gaps between private and public sector, local, regional and international organizations, technical and policy expertise.

Innovation & Agility: We are catalysts for change in our region: we create multiples opportunities for our stakeholders to experience and adopt the latest technologies and opportunities in the fields of energy solutions.

High Ethical & Professional Standards: We cultivate trust from all our stakeholders by maintaining the highest quality of service and integrity standards.

Social & Environmental Responsibility: We ultimately work for the benefits of the people of our region and the welfare of our planet: we orient our decisions to increase the prosperity and sustainability of the Caribbean way-of-life.

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LIST OF ACRONYMS

CARICOM	Caribbean Community
CCREEE	Caribbean Centre for Renewable Energy and Energy Efficiency
CNG	Compressed Natural Gas
EMS	Energy Management System
GDP	Gross Domestic Product
HFO	Heavy Fuel Oil
IPP	Independent Power Producer
IRRP	Integrated Resource and Resilience Plans
ktoe	Kiloton of Oil Equivalent
LCGEP	Least Cost Generation Expansion Plan
LCOE	Levelized Cost of Electricity
LFO	Light Fuel Oil
LNG	Liquified Natural Gas
MW	Megawatt
MWh	Megawatt hour
PCB	Polychlorinated Biphenyl
PPA	Power Purchase Agreement
VRE	Variable Renewable Energy

0 EXECUTIVE SUMMARY

The electric utility's major goal is to serve the community by providing electric services at the least cost and the highest reliability as possible with a fair return to shareholders, aiming to keep the environmental impact low and accounting for fair market rules and regulations.

Member utilities of the Caribbean Association of Electric Utilities (CARILEC) are of the opinion that initiatives for establishing Policies for Energy Transition require the input and the expertise from the electric utilities. This will assure an overall and appropriate coverage of all relevant fields of the prevailing energy realities. Furthermore, observations of energy policies developed so far tend to be rather general, sometimes vague or not based on realistic assumptions and reliable data.

In order to increase the involvement of electric utilities in the Caribbean energy policy process, CARILEC has prepared this Position Paper on Policy for Energy Transition. Through this paper, CARILEC utilities express their views on the important issue of Energy Transition and related policy aspects for their countries and/or the Caribbean region.

CARILEC believes in the importance of effectively designing policies and legal frameworks for sustainable energy transition which lead to productive outcomes for all stakeholders involved. A key priority for CARILEC within energy transition is strengthening the resilience of the Caribbean power systems. Although ambitious targets for decarbonization can contribute to a cleaner energy supply, they simultaneously demand a more resilient energy infrastructure accompanied by more complex regulation mechanisms. This requires a comprehensive and inclusive planning process, resulting in effective policy measures, support programs and regulations, customized to the specific characteristics and realities of the Caribbean region and each country. In this Position Paper, the CARILEC utilities are expressing their collective need for involvement in the development of Energy Policies in the Caribbean, with a strong emphasis on the utilities' willingness to contribute to governmental initiatives towards a sound policy for energy transition. In chapter 3, CARILEC states its opinions on relevant issues of energy transition and the adherent planning of policies, while chapter 4 summarizes key priorities and principles for a consistent policy and implementing frameworks for energy transition in the Caribbean.

Additionally, and in order to elaborate on the regulatory aspects of energy transition, CARILEC has prepared a complementary Position Paper on Regulation for Energy Transition.

In other words: with the electric utility at the table to provide input and active support for policy making, the policy makers will be assured that technical and economic impacts of energy options are properly weighted. Feasibility and non-feasibility of options can be assessed technically and economically, which will lead to an energy policy document that can serve as a realistic roadmap for sustainable energy transition in the region.

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CARILEC
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1 INTRODUCTION

1.1 Background

Most of the Caribbean countries disproportionately depend on imported fossil fuels for electricity generation. Currently, petrol products still account for over 80% of the Caribbean's primary energy consumption.[1] A large share of its power generation stems from fossil fuel imports exposing the region particularly to fluctuations in global oil prices. Several Caribbean countries spend up to 10% of their GDP on imported fossil fuels.[2]

Electricity rates in the Caribbean are among the highest in the world and directly impact the competitiveness of tourism, commerce, industry as well as national budgets. The natural limitation of comparatively small energy markets has up to now limited the options for energy utilities to invest in capital-intensive technologies, that in the long-term may lead to reduced generation costs and more sustainable and resilient energy systems. This accounts for generation facilities as well as complex equipment for grid infrastructure and energy efficiency measures.

The vulnerability of the region to natural disasters like hurricanes, floods, droughts, earthquakes, volcanic eruptions and the adverse effects of climate change are additional key challenges that hamper economic growth. Climate- and disaster-resilient designs of energy plants and infrastructure are ranking high on key energy stakeholders and power utilities lists, however addressing that topic is just the start.

Despite the significant and largely untapped potential of renewable energy resources such as wind, hydro, solar, geothermal and bioenergy – in addition to the potential for energy conservation - implementation of renewable energy (RE) projects and energy efficiency (EE) measures in the region is largely unrealized.

Key barriers hampering the shift from cost-intensive, fossil fuel dominated to sustainable energy landscapes are the lack of i) scale-effects in the relatively small and isolated power markets and ii) consistent supporting and regulatory frameworks.

1 ECLAC, 2016: Sustainable Energy for All in the Caribbean
2 CARICOM Secretariat, 2018: 2017 Energy Report Card - CARICOM

Over the past decade many Caribbean States have adopted or started to draft National Energy Policies. The main thematical objectives of those policies for sustainable transition towards universal access to affordable, clean and secure energy are:

- **Energy affordability**, related to affordable energy cost and prices, reduction of final energy consumption and enhancing conditions for economic development;

- **System resilience**, related to security of energy supply, fuel diversification, the response to climate change, natural disasters and hazards and to the modernization of energy infrastructure;

- **Decarbonization** of energy systems through increasing the share of renewable energy and reducing the primary energy consumption.

While these policies are already adopted and approved in more than 50% of CARICOM countries, they lack the definition of clear legislative and regulatory proposals. Furthermore, target setting in many cases of these policies still needs to be adjusted to be based on reliable data and realistic capacities of the existing power systems.

On the other hand, electric utilities and independent power producers (IPPs) are key energy players within the Caribbean as they provide a significant portion of the region's overall energy needs. Electric utilities are also experts in the fields of power supply, energy services, grid management, renewables, energy efficiency, etc. Their contribution in establishing a coherent Energy Policy and implementing frameworks is therefore of eminent importance.

There still remain occasions in which electric utilities are not always able to provide their expertise to the national and regional platforms where energy issues are discussed and policy measures and implementing frameworks are developed or updated. Especially when setting up policy targets and measures for tariff regulations, renewable energy, energy efficiency and grid extension, the contributions of electric utilities and IPPs in terms of input and expertise are a crucial factor for the success of such policies.

1.2 Paper Objectives

The electric utility's major goal is to serve the community and the country's economy by providing electric power and energy services at

i) affordable cost and the highest possible reliability with a fair return to shareholders,
ii) aiming to keep the environmental impact low and considering fair market rules and regulations.

As part of the pursued energy transition, the Caribbean power sector is witnessing important changes in the policy and regulatory framework, evidenced by the introduction of regulatory entities, competition, ambitious targets and an increasingly important role for renewable technologies and energy efficiency measures. The Caribbean Association of Electric Utilities (CARILEC) and its Members[3] recognize the needs for and the benefits of sustainable Energy Transition and welcome them.

3 CARILEC members comprise stakeholders from public and private electric utilities, independent power producers (IPP), energy service providers and institutional stakeholders from the public sector.

At the same time, CARILEC believes in the importance of effectively designing policies and legal frameworks for sustainable energy transition which can lead to productive outcomes for all stakeholders involved. A key priority for CARILEC within energy transition is strengthening the resilience of the Caribbean power systems. Although ambitious targets for decarbonization may contribute to a cleaner energy supply, they simultaneously demand a more resilient energy infrastructure accompanied by more complex regulation mechanisms. This requires a comprehensive and inclusive planning process, resulting in effective policy measures, support programs and regulations customized to the specific characteristics and realities of the Caribbean region and each country.

Member Utilities of CARILEC are of the opinion that electric utilities can and should provide valuable input in helping to shape energy policies in the region. Indeed, international experience shows that the expertise and knowledge of utilities is an important factor in assuring the development of an effective policy framework.

In order to increase the involvement of electric utilities in the Caribbean energy policy process, CARILEC has set up this Position Paper on Energy Policy and Energy Transition. Through this paper, CARILEC utilities collectively express their views on the important issues of an Energy Policy and on Energy Transition for their countries and/or the Caribbean region.

Additionally, and to reflect more details regarding the regulatory aspects of energy transition, CARILEC has produced a Position Paper on Regulation and Energy Transition.

1.3 Caribbean Island Systems: Similarities and Diversity

There is a wide diversity in the characteristics of the various countries in the Caribbean. These differences relate to the size of each individual island as measured in the area size, peak load, energy consumption, etc., as well as in the economic characteristics such as GDP per capita and economic growth. Furthermore, there are geographical differences which result in variations in power system configuration (e.g. voltage level choice) as well as the potential for renewable generation. Finally, there are institutional differences such as type of utility ownership and presence of regulatory bodies.

At the same time, Caribbean energy systems have several energy issues in common. They are mostly isolated systems with no or very limited possibilities for interconnection. This requires high reserve capacity margins in order to dispose of sufficient generation availability for maintaining sufficient reliability of supply. This in turn implies that running an island system is more capital intensive. Due to the small size of island systems, there are no economies of scale to be exploited, while requirements for up-front capital and dependency on fuel supply are high. Being small also leads to higher prices for inputs as bulk purchase is limited. Transportation efforts and custom contributions for the import of technology and services to the islands further increase specific investment costs. Such factors tend to lead to higher costs in general and consequently, higher electricity prices.

These issues can be identified as general similarities of island systems, even when including the systems of larger Caribbean mainland countries. The notable exception is Trinidad & Tobago with their abundant reserves of Natural Gas and their subsequently low energy prices.

In summary, there are both differences and similarities among the different Caribbean countries and their power systems. This will have impact on the development of a suitable Policy for Energy Transition. The general energy issues will be similar whilst at the same time, there will be a need to consider differences and consequential variations in preferred policy.

2 ENERGY CHALLENGES FOR THE CARIBBEAN

Electricity plays a vital role in economic development. Availability of predictably priced electricity allows economic processes to take place on a continuous and reliable basis and accommodates the introduction of modern and more efficient production techniques. Also, access to electricity results in a higher standard of living as consumers can utilize more sophisticated electrical equipment and further improve their quality of life.

Moreover, the ongoing and continuing digitization of economies and households, as an important pillar of economic progress of societies, requires a permanent, predictable and affordable electricity supply.

Worldwide, the electricity sector is the largest contributor to climate change, accounting for almost a third of global greenhouse gas emissions.[4] Although contributing only a fraction to those emissions, the Caribbean energy industry is directly impacted by climate change and global warming. Many of those impacts manifest themselves through increases in intensity and frequency of extreme weather events and rising sea levels.

These seriously affect local energy infrastructure, leading to damages and disruption of supply. All segments of the energy industry will be affected by the changing global climate and the policy responses to it.

Considering the region's vulnerability towards climate change, its significant untapped potential for renewable energy, and energy efficiency and its exposed position as a hot spot for tourism and an important international meeting point, it is an obligation for the Caribbean to become a world' leader for energy transition.

Under these scenarios, the Caribbean power sector faces the following socio-economic and environmental challenges and barriers:

Key Challenges

- Lack of scale-effects for the installation of cost-efficient and clean power supply and distribution infrastructure due to small and isolated power markets;
- Current dependence on imports of petrol fuels and their volatile and high prices for power generation;
- Lack of technical and financial capacities of Caribbean consumers to implement energy efficiency measures that help to reduce their electricity bill;
- Lack of detailed implementing and regulatory frameworks for supporting renewable energy generation, energy efficiency measures and increasing the resilience of the Caribbean power systems to meet more ambitious targets for renewable energy and energy efficiency as set in regional policies for energy transition.

Fossil fuel-based electricity generation with its low up-front capital requirements has been the most economic option for Caribbean electricity utilities for decades. Petrol-based power generation facilities have relatively low requirements for upfront-capital and do not involve complex planning and development procedures as compared to RE based generation.

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4 See European Environment Agency, 2016: Sectoral greenhouse gas emissions by IPCC sector - https://www.eea.europa.eu/data-and-maps/daviz/change-of-co2-eq-emissions-2#tab-dashboard-01 (excluding LULUCF)

The natural limitation of comparatively small energy markets has up to now limited the options for energy utilities to invest into capital-intensive technologies, that on the long-term may lead to reduced generation costs and more sustainable and resilient energy systems.

This accounts for generation facilities as well as complex equipment for efficient grid infrastructure and energy efficient measures.

Consumers on the other hand do not possess the knowledge and the financial budget to invest and implement energy efficient measures, that would help to reduce their electricity consumption, thus reducing their financial burden.

These key challenges result in the following problems and barriers for sustainable energy transition towards a resilient and climate-friendly electricity sector in the Caribbean:

Resulting Problems and Barriers from Key Challenges

- High financial burden for the Caribbean society through high costs of electricity (price and physical consumption), hampering economic growth and development
- In-efficient energy consumption and high energy-intensity
- High carbon footprint of electricity sector per generated kWh[5]
- Increased vulnerability of power supply and distribution infrastructure to natural disasters, climate change and global crises, binding capital and resources for disaster response
- Limited access to capital for financing of capital-intensive technologies (renewable energy, storage and grid infrastructure, energy efficiency) for long-term reduction of electricity generation costs
- Limited technical capacity of grid infrastructure to increase share of fluctuating renewable energies, such as solar and wind power

➡ Little or slow implementation of sustainable Energy Transition in the Caribbean region

Natural disasters and global pandemic crises additionally raised the need for measures to ensure energy affordability and security of supply. During the global pandemic crisis around COVID-19, decreased energy demand on the commercial side and increased energy demand of the residential sector due to social distancing measures such as working from home, were already observed. On the other side, the lockdown of the tourism industry has led not only to a significant decrease in energy demand of commercial customers, but also to reduced income and liquidity of citizens and residential customers.

One of the biggest problems especially for smaller energy-suppliers is liquidity, particularly in times of crises. During the appearance of economic or pandemic crises customer liquidity and opportunities for new sales go down, access to capital is reduced which makes it difficult to maintain the energy infrastructures. This has resulted in exposing vulnerable utilities (already operating on small profit margins), to an extended financial burden and additional technical challenges.

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5 See IGES Climate Database - List of Grid Emission Factors 2021

Against this background it is ***essential to establish consistent policies for transition towards a more resilient energy system and market with realistic targets*** indicating clear proposals and mandates for further development and adoption of policy and regulatory measures, that:

- ✓ Incentivize and stimulate the generation of renewable energy and innovative technologies for energy storage, flexible supply and demand, grid stabilization and expansion,

- ✓ Ensure fuel diversification, the availability of reliable and flexible back-up generation through a coherent and efficient dispatch approach,

- ✓ Enable and promote the implementation of business models for energy efficiency and decentralized renewable energy generation and

- ✓ Regulate the integration and balancing of decentralized and fluctuating renewable energy generation. In the Caribbean Energy Policy documents issued so far, many initiatives and measures are listed to address the challenges and to reach the goals as set by the policy makers. Many of those initiatives will require roadmaps towards realization. Some – like promoting high-efficiency generators – are already part of electric utilities' focus for a long time.

What is missing in many cases is a real focus on the development and implementation of supporting and regulatory frameworks that would need action plans with timelines, responsibilities and concrete proposals for addressing these key issues.

The following sections provide a set of recommendations and suggestions on behalf of CARILEC and its member utilities on the definition of realistic targets, issues to be addressed and respective priorities for Energy Policies.

In its Position Paper on Regulation and Energy Transition, CARILEC has additionally outlined more concrete provisions regarding the establishment of regulatory frameworks and regulation of energy transition in the Caribbean.

3 THE CARILEC POLICY ON ENERGY TRANSITION

3.1 Planning process for Energy Transition

As stated earlier, it is important to guarantee both the technical and economic feasibility of the formulated energy policy. The best possible and most realistic frontiers must be explored between most desirable but too utopian objectives, and what can still be achieved within acceptable, technical and economical preconditions with innovative and advanced solutions.

At the same time, objectives and targets should be accompanied by respective policy measures, identified within the energy policy and set in place by respective supporting and regulatory frameworks. These frameworks should define clear roles, mandates and processes as well as required support schemes and financing mechanisms.

CARILEC views holistic energy sector planning and resilience-building of the energy systems as key for a successful energy transition in the region. The process of developing policies on and targets for energy transition therefore requires an inclusive involvement of relevant stakeholders and the availability of comprehensive and reliable data for evidence-based decision-making.

Effective planning of energy transition entails comprehensive, technical data on electrical demand and demand-side matters, the existing grid infrastructure, electrical supply assets and their performance. In addition to the technical energy system dataset, information on policy, social and economic statistics and hazard and vulnerability data should also be made available. One inherent challenge to the data collection process is that such wide-ranging data is held across many different entities. Different scenarios for planning and modelling of fuel diversification, resilient energy infrastructure, expansion of renewable energy and energy efficiency should however be built on the same baseline set of data. This requires effective engagement and coordination and a structured planning approach.

For example, to plan targets for the share of renewable energies within a specific period, the expected final energy consumption should be given. This in turn requires that the future energy consumption is already simulated with the consideration of economic growth, demographic changes, market development and the implementation of planned energy efficiency measures. Hence, target setting for energy efficiency should ideally be done prior to target setting for renewable energy.

CARILEC therefore suggests the establishment of sector steering committees in the countries, led by the responsible governmental bodies and involving representatives from regulatory authorities and electric utilities. Additionally, permanent and non-permanent working groups (WGs) could be set-up under the umbrella of such steering committees involving additional sector stakeholders.[6]

Within the WG, efficient and effective thematic expert discussions could be realized based on assessed data incorporating a broad range of stakeholders with the relevant expertise to prepare solutions and contribute with experience, different perspectives, and suggestions. Relevant strategies and recommendations could be prepared within these WGs and brought to the sector steering committees for evaluation and integrative incorporation in the final policy planning.

An electric utility will be optimally prepared for implementing energy policy objectives into its strategy, if it has been involved in the policy making process from the beginning and if the policy objectives have clearly been identified as feasible objectives.

6 i.e. representatives of energy solutions providers, Universities, NGOs, international organizations

CARILEC and its member utilities welcome the initiative and efforts started by CCREEE and CARICOM member states to introduce holistic Integrated Resource and Resilience Plans (IRRP) to effectively plan and design energy transition tailored to national frameworks and conditions.

An IRRP is a plan for how a country can supply its need for electricity for the foreseeable future. IRRPs are integrated because they consider many different resources to satisfy the need for electric power.[7] The IRRPs significantly contribute to a country`s climate policy focussing on climate resiliency and decarbonization of the electricity sector. By defining respective targets for decarbonization through energy efficiency and renewable energy, the IRRP defines the sector contribution to the country`s carbon footprint and related targets in the future.[8]

In the following sections, the perspective and recommendations of CARILEC member utilities for the development of such plans are outlined with a special focus on the electricity sector.

3.1.1 Targets for Energy Efficiency

The planification of energy efficiency measures and the definition of respective targets is key for achieving both decarbonization of the energy sector while ensuring affordability of energy supply. EE can be considered as the quickest and most effective way to reduce costs in the energy sector.

Conversely, energy efficiency is difficult to assess and monitor. Changes in final energy consumption and energy intensity of a country do not only depend on the level and success of implemented EE measures. They are in some cases even more, impacted by demographic changes, economic progress or recess and by other drivers of global economy. Various metrics exist to measure how efficiently energy is being used within a specific region, country, or sector. EE related targets exist for reduced energy intensity, decreased primary or final energy consumption.

Reduced energy-intensity as a metric for energy efficiency targets could be counterproductive to economic progress and development, given the situation in the Caribbean. CARILEC and its members therefore suggest defining EE targets based on reduced final energy consumption. The reduction potential should be set against a previously simulated baseline scenario for the targeted period that already considers i) the need for universal access to energy and new power capacities, ii) economic growth and iii) demographic development of the country.

The defined targets should be based on technical as well as the financial feasibility of EE measures in the different key sectors for electricity consumption (residential, commercial, tourism, industry, public buildings). Respective proposals for policy measures and financing programs (see following sections) that realistically reflect the required up-front capital under the set target should therefore be included in the policy document on energy transition.

3.1.2 Targets for Renewable Energy

The expansion of RE is not only required to improve and increase fuel diversification, security supply and decarbonization. It can furthermore significantly contribute to energy affordability if designed accordingly and accompanied by supporting policies and regulatory changes. A target of 100% RE could be envisaged for some islands on a long-term horizon, however, security of supply and energy affordability must be considered.

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7 Please see for further information: https://www.ccreee.org/irrp/

8 In line with United Nation's Sustainable Development Goal (SDG) 13 calls to take urgent action to combat climate change and its impacts as well as with related commitments to the Paris Agreement through Nationally Determined Contributions (NDCs).

Ideally, RE target setting can be built on the modelled future final energy consumption under the defined EE targets. Based on the estimated future consumption scenario a Least Cost Generation Expansion Plan (LCGEP) can be developed that considers the following factors of feasible RE expansion and integration:

- Available technical and economic potential per type of RE source and technology
- Typical generation capacities and plant sizes per RE source and technology
- Levelized cost of electricity (LCOE) per RE source and technology
- Annual, seasonal, daily, and hourly availability per RE source and technology and plant size
- Environmental and social constraints per RE source and technology (i.e. with regards to wind parks in protected areas)
- System capacity to integrate intermittent RE and to balance supply and demand, maintaining the required quality parameters for a stable and secure electricity supply
- Additional costs for required grid infrastructure, flexible generation and balancing mechanisms for the integration of intermittent RE

These factors should be based on local conditions and circumstances and should account for human and financial capacities of the involved institutions, especially of key stakeholders such as the incumbent electric utility. This includes the respective regulatory measures and mechanisms that are required to enable a secure and stable operation of the electricity grids under high penetration of especially intermittent RE.

Every power market, grid and sub-grid is unique and detailed analysis and planning is essential to determine the critical point for RE penetration and the optimal generation mix. However, in all cases the key to success is to start with a policy framework that plans for a 100% renewable energy system and planning using modern power system tools. It is then a matter of working backwards to define the path, appropriate platform, and thus the critical target point for RE penetration and the required implementation schedule to achieve this target.

In case environmental objectives prevail over operating at lowest costs, requires an assessment on how costs factors can be recovered. That includes the provision of subsidies, incentive schemes, and additional funding or favourable financing by – for example – development banks or by exploring the possibilities of the carbon credits market, etc. Subsequently, a portfolio planning on renewables could be prepared by each individual island utility, taking the local renewable sources, security of supply, economic and environmental aspects into account.

Financial requirements of the utility should be considered both in the short-term as in the long-term. This implies that all costs can be recouped including all capital costs, fuel and O&M costs, as well as the rate of return for the utilities' shareholders.

Considering that transitioning economies in the Caribbean must utilize flexible and dispatchable systems of energy generation involving both renewable and non-renewable energy sources, it is important to evaluate the contributive potential of renewable resources using a time-sensitive metric (MWh or ktoe) rather than a simple capacity-oriented metric (MW) to determine and monitor the target share of renewable energy-based electricity generation.

3.2 Policy Positions for Energy Transition

CARILEC's member utilities and IPPs would endorse major Policy Positions as set forth hereafter based on their corporate goals and objectives for providing energy services to the community at the lowest possible costs and simultaneously at the highest possible reliability. This will pave the pathway for sustainable energy transition towards a resilient and climate-friendly electricity sector in the Caribbean.

The complexity of the different issues involved, when reviewing the business objectives of an electric utility, IPPs and the governmental objectives, need close cooperation between those stakeholders. This will ensure the arrival at an optimal match of a sound utility business and a visionary policy on energy transition.

Aiming to establish universal access to affordable, clean and secure energy, the main policy issues are related to one or more of the following key pillars for energy transition:

- **Energy affordability**, related to affordable energy cost and prices, reduction of final energy consumption and enhancing conditions for economic development;

- **System resilience**, related to security of energy supply, fuel diversification, the response to climate change, global crises and economic changes, natural disasters and hazards and to the modernization of energy infrastructure;

- **Decarbonization** of energy systems through increasing the share of renewable energy and reducing primary energy consumption.

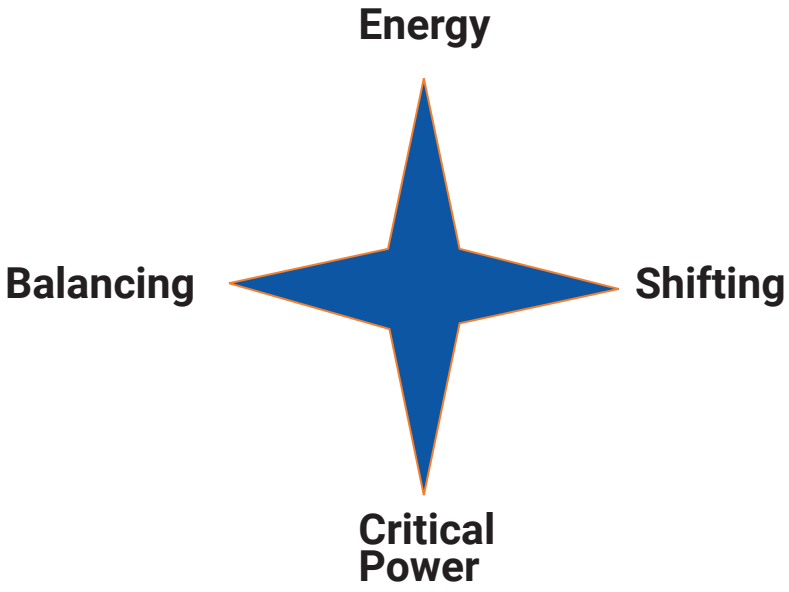
The following sub-chapters are explaining the most relevant policy issues under these key pillars.

3.2.1 Security of supply

The security, stability and reliability of energy supply is viewed as the most important characteristic of all Caribbean Electric Utilities because they are mostly island systems that are not interconnected. Therefore failure, due to shortage in fuel supply, generation or transmission capacity will result in the inability to meet the power demand of the island and cause blackouts which could lead to dire consequences.

There must be adequate spare dependable capacity to meet the country's peak load even in worst-case scenarios which invariably result in higher levels of reserve margins than interconnected systems. Most island utilities still use the n-2 criterion as a minimum requirement for the installed capacity. It stipulates that the total installed capacity including storage facilities should be at least at such a level that the peak demand can be met without load shedding, with the two largest units being out of service.

In setting this level of capacity it must be recognized that by increasing the share of fluctuating renewable energies such as solar and wind power, the availability of average installed generation capacities can be significantly reduced.



An electricity grid with a high share of RE penetration requires five key elements to ensure security of supply as illustrated in the figure above.[9]

These five elements form the basis (the "Platform for Security of Supply") for RE integration to be successful above the mentioned critical target point under section 3.1.2. and are explained below.

ENERGY. The electrical energy necessary to serve load is generated by RE (hydro, wind, solar, geothermal, biomass, etc.) with the objective that RE is the de facto base load – regardless of it being dispatchable or not. Without a flexible thermal base, it may be necessary to install wind and solar in quantities that are several multiples of the peak load demand of the system – and still not have a resilient grid.

Modern tools allow for a high degree of accuracy in predicting both wind and solar performance (subject to time horizon constraints), however, both forms of generation are highly susceptible to physical damage due to natural events (windstorm and seismic activity etc.) and the uncertainty of climate change. Forecasting errors must be factored in. Flexible generation may also provide for the emergency backup and to future proof the grid. Flexible generation is the essential "enabler" of RE when combined with energy storage.

SHIFTING. Solar is typically the least cost form of RE and, in most cases, the installation of solar should be maximized. At current costs, battery storage is ideal for frequency control, "cloud cover" and spinning reserve reduction. Shifting solar energy generated beyond that needed to satisfy the daytime demand may make economic sense - as determined by the system model. This "excess" solar energy should be stored and "shifted" to the evening rather than curtailed or "spilled". Battery shifting is currently economically viable for modest shifting and as the technology improves and prices continue to drop, it will become ever more viable.

BALANCING. A means of balancing the intermittency and variability in solar and wind generation is an essential

9 The figure and the explanation of the five elements is based on the Article "New Regulatory Frameworks for Grid Flexibility", published in the CARILEC CE Journal #16, July 2020, written by Paul Smith, V.P. Wärtsilä Development & Financial Services, Inc.

element of the RE grid. Balancing is necessary in real-time and is needed on a milli-second time basis to maintain frequency and on minute, hourly, and longer periods to ensure that the load demand is reliably met. The need for balancing depends on the characteristics of the environment, grid, and generation mix. Flexible thermal generation and energy storage systems are the only viable solution in many systems, such as islands, where hydro generation is not an option. An optimally balanced RE system does not need thermal capacity for "spinning" or "frequency" reserve - which add costs to the grid.

CRITICAL POWER. It is essential that resilience and reliability be factored into all RE system planning. The CARILEC Community is especially susceptible to seismic and hurricane damage and it is prudent to install reliable, dispatchable capacity close to the total RE installed capacity as backup ("Critical Power"). Thermal generation by its very nature is resilient, reliable and dispatchable – if the fuel supply chain is robust. However, with the transition towards a cleaner electricity supply and further market development, storage technologies, hydro, geothermal and bioenergy-based power generation as well as power-to-x[10] , biofuels and synthetic fuels[11] may be considered for the provision of critical power as well.

ENERGY MANAGEMENT SYSTEM (EMS). Manual dispatch of the grid becomes less and less efficient and near impossible as the percentage of RE increases. Each element described above must be automatically managed through an intelligent "Energy Management System" ("EMS") using Artificial Intelligence to optimize the overall performance of the system and minimize total generation cost. The customary human dispatch interface is an obstacle to RE growth and cost optimization. The EMS must be capable of reliably and efficiently running the entire generation for the grid. Beyond the critical target point, the EMS forms an integral part of the Platform. The EMS will simultaneously receive and analyse data for load demand, current generation state, weather forecasts, load variations, fuel costs, the optimal amount of system reserves, energy storage status, and use thermal units heat rate curves to optimise to manage generation. Choice of the appropriate EMS is critical to success.

This may require[12] the introduction of new measures such as, amongst others:

- ✓ the installation or modification of flexible renewable or fossil-fuel based generation capacities[13],
- ✓ reliable generation forecast mechanisms,
- ✓ installation of storage capacities,
- ✓ improved grid infrastructure.
- ✓ incentivization of demand flexibility on the customer side through
- ✓ increased requirements on and new procedures and methodologies for grid management, shifting and balancing.

These are primarily technical measures, that should be accompanied by appropriate support schemes and regulating frameworks. Increased costs for the implementation and operation of such measures are to be considered when setting respective tariffs for electricity consumption from and injection into the power network.

The objective to interconnect various islands is a long-term objective which should always be explored and implemented if economically feasible. Interconnection can increase the capacity to balance high penetration of intermittent RE and can contribute to higher shares of RE in the local grids.

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10 Power-to-X refers to a number of electricity conversion, energy storage, and reconversion pathways that use surplus electric power, typically during periods where fluctuating RE generation exceeds load. The X in the terminology can refer to one of the following: power-to-ammonia, power-to-chemicals, power-to-fuel, power-to-gas, power-to-hydrogen, power-to-liquid, power-to-methane, power to food,[3] power-to-power, and power-to-syngas.

11 These fuels may be synthesized within the grid system using excess RE (e.g. from excess wind and solar).

12 Depending on the local/national conditions, existing RE potentials, grid condition and capacities, share of flexible generation, etc.

13 "Flexible Generation" is generation that provides energy, balancing and critical power to a resilient electricity network.

The dynamic impact on the distribution grids of such generation units needs to be addressed for the sake of supply stability. Isolated island grids possess a weaker predisposition than interconnected mainland grids and already need special care to maintain the standards for reliability and power quality. The installation of RE based "microgrids", connected to the main grid, but also able to disconnect to "island mode" as physical or economic conditions dictate, can further contribute to grid resiliency and supply stability for specific purposes. In terms of fuel supply, the supply source must be secure and reliable, and adequate levels of inventory must be stored on island. This ensures that no less than a two-month level of inventory is on island during the hurricane season and no less than a one-month reserve is in place outside the hurricane season.

Another area which is key to security and stability is the adequacy of transmission and distribution capacity. This must be reviewed on an ongoing basis and plans must be developed and implemented to ensure that there is adequate capacity to transfer power from the generating plants to the load centres.

CARILEC member utilities will furthermore re-address the requirements for security and stability of supply by reviewing the standards for SAIDI, SAIFI and CAIDI, and the power quality standards that need to be maintained in the entire grid. Benchmark information will be reviewed, and weak points considered for improvement plans. This way, electric utilities will also be prepared for studying the impact on these standards when introducing new technologies. CARILEC is currently developing an Automated Benchmark System that envisages to monitor Key Performance Indicators. Once established, the system can serve as a reference for performance monitoring and decision-making to introduce more resilience into the national energy system.

3.2.2 Energy affordability

Energy affordability represents a crucial, key factor for economic development and progress of a society. Availability of predictable and moderately priced electricity allows continuous and reliable economic processes and accommodates the introduction of modern and more efficient production techniques.

Within energy transition, customers and general society will experience significant changes in existing tariff systems and visual changes in the landscape of generation facilities and grid infrastructure. Maintaining or improving energy affordability in the long-term is imperative to obtaining society's acceptance for new energy policies.

Energy affordability is however not only related to costs and prices of electricity supply. It is also reflected within the productivity and energy intensity of electricity customers and the supply system itself. The following issues and policies of energy transition directly target a more affordable energy supply:

i. Energy conservation and energy efficiency
ii. Fuel diversification
iii. Renewable Energy

However, if not thoroughly planned and implemented based on local conditions and capacities, these issues may influence a counter-effect and decrease energy affordability. The following sub-sections address and explain the conditions and requirements to avoid such counter-effects and instead to contribute to increased energy affordability.

Moreover, it is CARILEC's point of view that governments should subsidize affordable energy to the poor - in case political decisions have been made to alleviate poverty this way.

By all means, the electricity rates should be defined according to the Cost-of-Service principles. Poverty alleviation restricted to the absolute needs can be considered by the utilities, while the basic needs can be determined together with the governments and relevant governmental agencies. All other forms of poverty alleviation must be subsidized by the governments.

3.2.3 Energy conservation

Given the high costs for electricity throughout the Caribbean, energy conservation is a key success factor to improve energy affordability in the region. Despite the well-recognized potential for, and ongoing activities to promote energy efficiency – such as tax and other incentives for energy efficient equipment, energy standards and labelling – progress in deployment has been slow thus far. Customers are typically aware of financial benefits from energy conservation. However, they do not possess the financial capacity and required knowledge to select, invest and implement comprehensive energy efficiency measures and energy efficient equipment on the demand side. This leads to high financial burdens from energy consumption on customers, resulting in high shares of unpaid bills that can inadvertently affect the financial stability of electric utilities.

Furthermore, natural disasters and global pandemic crises amplify such impacts. During the global pandemic crisis around COVID-19, decreased energy demand on the commercial side and increased energy demand of the residential sector due to social distancing measures such as working from home, were already observed. Additionally, the lockdown of the tourism industry has led not only to a significant decrease in energy demand of commercial customers, but also to reduced income and liquidity of businesses, citizens and residential customers.

This has resulted in exposing vulnerable utilities, already operating on small profit margins, to an extended financial burden and additional technical challenges. Against this background it is essential to

I. improve the awareness and knowledge of customers on the financial and environmental benefits and the technical requirements for the implementation of energy efficiency measures, accompanied by financial programs to provide the respective capital, and

II. to pave the regulatory pathway for electric utilities to provide innovative energy services that reduce energy costs for customers and offer new business activities for the utilities.

Such innovative energy services would diversify the utility's business model by providing new revenue from service charges for the implementation of energy efficiency measures on the demand side, while at the same time delivering savings to customers. Policies on energy transition should therefore define the required measures and programs that help to pave the supporting and regulatory pathway to unlock the potential for energy efficiency. Such measures include educational and awareness-raising campaigns, knowledge transfer, financing models and loan programs as well as necessary regulations, labelling and standards.

In parallel, improvement of the utilities' efficiency through the continuation of activities like reduction of losses and improvement of generation efficiency, using benchmarking studies and efficiency improvement programs, is a continued priority of CARILEC's member utilities.

3.2.4 Fuel diversification

With all Caribbean countries still dependent on oil there is a dire need for every effort to be made by the respective countries to diversify their fuel mix. Journeying towards sustainable energy transition, the expansion of renewable energies, above all, solar and wind power will play the most significant role for diversification (for more details on renewable energy see following section 3.2.5).

The diversification of the current fuel supply based on diesel and petrol fuel oils should however not be solely focused on RE expansion. As stated under section 3.2.1, a high and secure penetration of renewable energy into the electricity grid requires respective capacities for flexible generation and critical power.

In countries like Belize or Guyana with a high installed capacity of hydro power or the respective potential, RE sources can be considered for flexible generation as well. Some Eastern Caribbean Islands may also consider the use of geothermal power for flexible generation and the provision of critical power in the future.

However, in most of the other Caribbean countries and on the short and mid-term perspective, such capacities will be based on fossil fuels. The ability of a generation unit to run on alternative fuels (for example gas and diesel or gas and biofuel) may be desirable or essential in certain grid systems where the fuel supply may be interruptible. The Caribbean islands are especially exposed to localized fuel shortages resulting from natural events or where dependent on a single source of fuel. Take or pay fuel supply contracts restrict RE penetration and may impose increased costs on the grid by forcing generation to run on higher costs.

Three factors determine the need for reduction of oil dependence and diversification of fuel (see respective sections for Policy Issues):

i. Security of Supply
ii. Energy Affordability
iii. Decarbonization (Renewable Energy)

These factors have to be considered when planning the strategy and policies for fuel diversification. Where they may counteract each other, intended targets and resulting impacts of these factors must be thoroughly weighed against each other.

A long-term view will point at Trinidad & Tobago with its natural gas reserves as well as to Guyana with its recently discovered oil resources. In specific occasions, it may be feasible to supply islands without own resources of fossil fuels via pipelines from countries with abundant resources. With rising oil prices and the increasing need for flexible power generation, CNG, LNG and power-to-x will also become more feasible alternatives in some islands.

Other options for fuel diversification and/or less dependence on oil are looming on the horizon, like submarine cables interconnecting the islands while supplying the island utilities with hydropower from the main land or geothermal power from several Eastern Caribbean islands.

The islands with geothermal potential may enter deeper into the possibilities of developing geothermal energy in an economically feasible way, since there is principally a huge “reservoir” of geothermal energy available.

Exploration of feasible possibilities for fuel diversification should be pursued in the case of plant expansions and replacement of retired generators. The feasibility of shifting to CNG or LNG should be a topic to be studied by the individual islands.

Utilizing economies of scale should also be pursued by negotiating as a "block" for all island utilities, and by developing joint supply concept for other fuels like CNG or LNG. When initiating co-operation of fuel purchase, an assessment of mark-ups and taxes that utilities currently need to pay should be undertaken in order to identify areas where cost reductions could be achieved.

3.2.5 Renewable Energy

The primary objective for expansion of renewable energies within energy transition is the decarbonization of the sector. Nonetheless, renewable technologies also offer the possibility to decrease costs of energy supply in the long term, reduce dependence on fossil fuel imports, increase energy security and local added value of the energy supply chain. To achieve this potential, the regulatory framework will need to accommodate the introduction and integration of renewable technologies. Furthermore, Governments may have to adopt additional incentive schemes to promote the use of RE.

Driven by competition and scaling-effects, most of the renewable technologies already generate electricity at competitive cost levels. The cost of electricity from onshore wind and solar PV is increasingly cheaper than from new and some existing fossil fuel plants. In most countries, renewables are the cheapest way of meeting growing demand.[14]

However, some variable RE technologies (VRE) such as wind and solar PV are intermittent and require back-up supply from other (renewable) sources, flexible generation capacities and storage systems. Generally, the critical target point sets the limit on the degree of penetration based on the grid capacity and compensatory measures in place as well as on the limits given by the targets for energy affordability.

While several islands and regions around the world with favourable local conditions have already managed to cover their complete electricity demand based on 100% of RE[15], some larger countries have reached hourly maximums of 100% RE based electricity generation.[16] In this light, renewable technologies have reached a competitive market status. They could, together with respective improvement measures for energy infrastructure and demand-supply balancing (see also section 3.2.1), significantly contribute to increased fuel independence, energy affordability and security of supply, while decarbonizing the energy sector.

Given the sizes and limited economies of scale of Caribbean power markets, RE expansion will not necessarily result in a reduction of electricity costs. Even though the variable costs of renewable sources are minimal, there are still significant capital costs involved which may be larger than those of for example, diesel generators. This especially applies, if being combined with required investments in energy infrastructure, such as storage systems or technologies for grid upgrading. These capital costs will need to be properly reflected in the electricity tariffs for which an effective regulatory framework is crucial.

Although in international markets, generation costs, especially for solar and wind power, have been decreasing significantly over recent years, cost reductions may not be as significant for the Caribbean region due to (i) the lack of scale-effects, (ii) lack of interconnection and (iii) more complex requirements regarding the construction design[17] and environmental impacts.

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15 See database of countries, regions and islands targeting or having achieved 100% RE supply: https://www.100-percent.org/country-island/

16 In Germany for example, VRE shares in electricity demand have reached hourly maximums of 100%, while contributing on average between 20 to 50% of the electricity supply throughout the year. - Please check https://www.iea.org/reports/covid-19-impact-on-electricity for further details.

17 i.e. to prevent damages from extreme weather events (hurricanes, floods, etc.)

To promote the further expansion of renewable technologies, Governments should, where suitable, undertake specific initiatives such as for example:

- ✓ financial incentive schemes (including feed-in-tariffs or premiums where feasible and effective),
- ✓ underwriting debt with sovereign guarantees or subsidies,
- ✓ grants to reduce upfront capital costs, soft loans,
- ✓ loan guarantees,
- ✓ tax credits, and/or
- ✓ other financial assistance.

Such incentives should however be financed by taxes or levies and should not affect the utility financially. In the event that incentives are financed by additional levies on electricity prices, the resulting energy affordability and thus, the society`s acceptance and willingness to support energy transition, should be assessed and taken into consideration as well.

Citizen involvement is a prerequisite for the society`s willingness to support energy transition and for the further "democratization" of an energy market. This can be achieved in the Caribbean by allowing citizens and communities to engage in small-scale RE self-generation and consumption or even in forming "citizen (renewable) energy community projects" with other stakeholders for large-scale RE generation as an IPP. Such projects and initiatives organise collective and citizen-driven energy actions that will help pave the way for a clean energy transition, while moving citizens to the fore. They contribute to increase public acceptance of renewable energy projects and make it easier to attract private investments in the clean energy transition. At the same time, they have the potential to provide direct benefits to citizens by advancing RE, EE and lowering their electricity bills. Policy frameworks should therefore enable the participation of such initiatives in competitive bidding procedures for new RE capacities. Furthermore, households, citizens and small enterprises should be able to generate part of their electricity needs from their own small scale RE based power plant while using the distribution grid to inject excess production and to withdraw electricity when self-production is not sufficient to meet their own needs.

3.2.6 Environmental protection

With the ongoing energy transition towards a clean and efficient energy sector, the construction of new energy infrastructure, such as RE power plants, fossil fuel based spinning reserves, transmission networks and distribution lines, storage systems, etc. is required.

Each of these infrastructural components can have environmental impacts at multiple stages of their development and use, including in their construction, during the generation of electricity, and in their decommissioning and disposal. In keeping with the sustainability goals of energy transition, the construction and operation of energy infrastructure must be carried out with the lowest environmental impact possible. Planning of RE and grid expansion should therefore follow international, regional and national environmental standards that ensure climate-friendly energy supply of low environmental impact, and resilience to the occurrence of extreme weather events.

Therefore, regulatory frameworks, financial mechanisms and programs should be in place, that allow electric utilities to consider such standards and to enable investment into resilient energy infrastructure without reducing the affordability of energy supply.

As a special topic CARILEC wants to additionally emphasize the concern of the member utilities when it comes to environmental protection. When purchasing new fossil fuel fired generation units, the applicable international standards for emission levels are considered Member utilities consider environmental protection as an important issue in all processes and procedures. This includes preventing oil spills, responsible handling of materials and supplements, collection of hazardous waste, removal of contaminated equipment and responsible disposal of solid waste according to the prevailing international standards.

3.2.7 Regulation & Pricing

CARILEC is of the opinion that pro-active cooperation of the electric utilities with establishing an independent and competent energy regulator is a prerequisite for achieving an appropriate regulatory framework and regulatory practices. The Regulation model should be a model tailored to the situation of the Caribbean island states, since isolated power systems have their specific characteristics that need to be taken into account. Tailoring the regulation model to the situation of small island states should also include tailoring of the cost of Regulation.

Particularly in times of continuing increases in fuel and other input prices, the presence of independent regulatory institutions is of utmost importance. An effective pricing policy should ideally be disconnected from the political process, at least in the short run. This can only be achieved through the establishment of independent energy regulators. Regulators have already been set up in most of the Caribbean States. True regulatory independence – albeit in parallel with accountability - remains an important precondition for an effective electricity pricing policy.

The presence of a stable regulatory framework is important to assure a proper balance between consumer demand for low prices and investors' need for a reasonable return. Rate setting should rather be implemented by incentive-based regulation using the so-called price cap methodology than by applying the methodology of rate of return regulation which may lead to weak efficiency incentives and over-capitalization (the "Averch-Johnson" effect). Additionally, price-regulation must be balanced against the need to provide lower risk to utility investors and the need to attract capital to a region that is historically high risk. Depending on the applied mechanism, price caps can hurt utilities during low growth and low inflation periods. When the financial benefit is fully passed on to customers, there is also no incentive for utilities to invest in fuel efficiency or renewables.

Electricity needs to be appropriately priced in order to allow the electric utility a fair rate of return on its investment. Balancing the interests of consumers' demands for low prices and investors/shareholders needs for a reasonable return is a challenging task for Caribbean electric utilities. Increases in oil prices lead to a significant increase in the fuel costs of utilities. This has been and needs to be reflected in upward adjustment (via fuel surcharges) of prices which, for obvious reasons, is not welcomed by both the general public and the political establishment. It must be kept in mind that a financially weak utility cannot attract capital needed for investments and thus maintain a reliable power supply.

Price stability and social policy objectives should also be pursued, but without jeopardizing the utility's financial sustainability. At the same time, it is also recognized that further improvement in operational efficiency can help to dampen the increase in electricity prices. Such initiatives are currently being undertaken and can for example be witnessed by means of the on-going benchmarking project within CARILEC.

Considering future changes towards the integration of distributed small-scale and fluctuating large-scale renewable energy sources, it is recommended that the existing customer tariff systems be adjusted so that costs related to the network connection and operation, metering and administration are separated from costs related to electricity generation and distribution. This could be realized by the introduction of grid and

measurement charges, that will be taken from the current base charges and listed separately on the bill without increasing the total electricity tariff.

Moreover, the introduction of separate charges for grid operation and management in all tariffs would allow a cause-based and transparent designation of additional costs for the investment into more resilient grid infrastructure (i.e., for grid infrastructure, spinning reserves, forecast and dispatch software). This is especially important with regards to the expansion and integration of (intermittent) RE. While generation related price components may decrease with the expansion of RE in the grid, cost for grid infrastructure and operation of spinning reserves for all generators will increase. A more detailed aggregation of the base charges could help to visualize actual costs of RE expansion and in that way contribute to the further planning process as well as to increase acceptance for energy transition among customers.

Where applicable and required, Governments may provide cost-efficient incentives for renewable energy and energy efficiency measures, financed by levies charged to final electricity customers but without affecting the utility financially. If incentives are to be financed by additional levies on electricity prices, energy affordability and thus the society's acceptance and willingness to support energy transition should be considered when planning the expansion of RE technology and EE measures.

3.2.8 Sector Restructuring & Competition

In a number of countries that have restructured the power sector, the prescription for addressing this presumed lack of competitiveness has been to split up the utility into its component parts. Given the small size of Caribbean utilities which are all vertically integrated utilities, this approach is not considered feasible and should not be taken into consideration. With the small scale of power generation and distribution, the overall costs will be burdened with more overhead costs and interactions, and interrelated activities will take more time and efforts if not combined within one company.

Competition should only be introduced in the field of generation in cases where the need for generation expansion occurs (i.e. for RE expansion). If IPP's are invited to bid and to present a Power Purchase Agreement (PPA), the local electric utility should either i) be actively involved in developing the tender specifications on behalf of the procuring authority or ii) be provided the opportunity to bid for new capacity as well in case it has not been involved in the prior bid preparation. In the evaluation of a PPA with an IPP, the effect of the financial burden for the electric utility for keeping up the reserves margin (which is not the IPP's concern), should be accounted for.

As said, the Single Buyer Model can be considered as the most suitable option to enable energy transition in comparatively small power markets as given in the Caribbean countries. The electric utility will remain responsible for load forecasting and planning. However, policy measures should consider outsourcing generation forecast responsibilities to IPP`s if deemed feasible. A respective remuneration scheme that considers positive and negative deviation from such forecasts should also be considered.

Cross border trade is a related issue and some CARILEC member utilities already identified the feasibility of cross border trade. Cross border trade is currently being initiated for the islands - St. Maarten, St. Barth and Anguilla. Cross border trade does not look feasible yet for most islands. However, the possibilities should be monitored as fuel prices continue increasing in the long term.

If future developments such as submarine interconnections are realized, studies could be initiated on further interconnection between islands to reduce reserve margins per island and increase the secure and stable supply of electricity. CARILEC is considering this as a long-term option.

3.2.9 Human Resource Development

In the opinion of CARILEC, Human Resource Development must also be considered as a key issue of Energy Transition in the Caribbean, since there are increasing concerns about the availability of educated and skilled engineers and technicians in the region.

A successful energy transition requires stakeholder alignment and a collaborative platform that adopts a systemic approach to confronting challenges and seizing opportunities. The traditional business model is becoming less effective and consequently, utilities must explore all potentially new and additional services that utilities can offer. Technical planning, design, and operation of new and resilient energy infrastructure as well the related procurement of new generation capacities, services and equipment will become more and more complex, requiring new skills and capacities, more holistic approaches, and inclusive perspectives. Key success factors that will meaningfully contribute to utilities and energy-affiliated organizations reshaping energy landscapes include the strengthening of strategic alliances and cooperation among sector and non-sector stakeholders, acceleration of the digitization of processes and active participation of citizens and customers in energy transition.

Therefore, utilities as well as regional and international organizations and institutions active in this field must ensure that these skillsets and capacities are being developed technically, operationally, commercially, and financially, with a focus on effective communication and cooperation. Each department in the utility must be trained to become a catalyst for change in the energy market.

CARILEC is a key facilitator of such training measures and programs for capacity-building in the region. Through its CAREC platform[18] and tailored utility trainings, webinars and conferences, CARILEC will continue to set a strong focus on learning and exchange of best practices on energy transition in the Caribbean.

3.2.10 Research & Development

In recent years, engineers, entrepreneurs, and politicians worldwide have developed a multitude of innovative technologies, smart business concepts and effective policy measures for energy transition which permit the reduction of energy costs on a long-term basis while at the same time bringing long-lasting environmental and socioeconomic benefits to societies. The remaining challenge on the ground consists now of finding and designing tailored solutions for practical implementation of theoretical examples and recommended approaches to combine the three key pillars of sustainable energy transition in the Caribbean:

- ✓ System Resilience,
- ✓ Energy Affordability and
- ✓ Decarbonization.

Extensive Research and Development (R&D) is required to implement existing and to identify new solutions (i.e. maritime RE generation, interconnection of islands) for the sustainable transition of Caribbean electricity sectors. Governments, regional and international institutions are encouraged to support and promote respective R&D programs and initiatives. CARILEC and its member utilities will continue to cooperate with and provide own contributions to respective regional R&D activities and goals.

18 See: https://community.carilec.org/

4 PRIORITY PRINCIPLES FOR A POLICY ON ENERGY TRANSITION

Based on the described issues of energy transition, CARILEC has identified the following priority principles that should be considered as the basis for developing policies for sustainable transition of the Caribbean Electricity Industry:

1. Define realistic and feasible targets for energy transition with respect to the i) reduction of final energy consumption and ii) the share of renewable energy within the targeted final energy consumption of the country for the envisaged period. Targets should be defined based on reliable information and modelling systems and developed in a consultative process with key stakeholders such as local electric utilities and energy service providers. Target setting should be in-line with defined policy and regulatory measures that will support the target achievement.

2. Involvement of electric utilities in the planning process of the power system, supporting governmental institutions and regulating authorities in the definition and set-up of respective policies and expansion strategies. Support could encompass the provision of feedback, information and data on existing network capacities, power plants as well as the identification and tendering of new capacities, including those based on renewable technologies. Open communication and discussions between policy decision-makers and affected stakeholders, such as electric utilities should ensure the consideration of relevant expert opinions in the planning procedures for energy transition.

3. Ensuring a resilient, universal and reliable power supply at highest quality to all sectors of the society at lowest costs and lowest environmental and climate impact as possible.

4. Maximizing the efficiency of energy use in production, distribution and end-use

5. Introduction of enabling and regulatory frameworks to facilitate and promote the market for energy services, offered by utilities to reduce energy consumption, implement energy efficiency measures and to install decentralized renewable energy and storage technologies.

6. Application of price controls which are based on realistic assumptions regarding efficiency and improvement whilst allowing for adequate levels of investment and returns to shareholders.

7. Ensuring access to affordable energy by the poor and vulnerable customers in line with government policy, but always, accompanied by corresponding direct or indirect subsidies to maintain financial health of the utility.

8. Reduction of dependence on oil by fuel diversification and placing special emphasis on renewable energy sources that can contribute to a lower environmental burden in an economically feasible manner, increasing the value added from power generation remaining in the region.

9. Supporting the expansion of renewable technologies with respective technical measures, accompanied by appropriate support schemes and regulating frameworks. Such measures include the installation of flexible generation capacities, reliable generation forecast mechanisms, improved grid infrastructure, installation of storage capacities and increased requirements on grid management and balancing. These measures should be supported through respective regulations. Increased costs for the implementation and operation of such measures are to be considered when setting respective tariffs for electricity consumption from and injection into the power network.

10. Actively promoting the use of renewable technologies by Governments with the help of the utility. Where applicable and required, Governments may need to provide cost-efficient incentives, but these should be financed by taxes or levies and should not affect the utility financially. However, in the case of additional levies and taxes, energy affordability and thus the society`s acceptance and willingness to support energy transition should be considered.

11. Introduction of policy and regulatory frameworks that enable citizen participation in energy markets. Households, citizens and enterprises should be able to generate part of their electricity needs from their own small scale RE based power plant while using the distribution grid to inject excess production and to withdraw electricity when self-production is not sufficient to meet their own needs. Furthermore, rules and procedures should provide respective criteria and conditions to allow local energy community initiatives to participate in competitive bidding procedures for new RE capacities.

12. Establishment of consistent and independent regulatory frameworks, appropriate for the size of the country; CARILEC and its member utilities will continue to play a constructive role as subject matter experts in the further progressing of the regulatory landscape in the Caribbean to advance towards an effective regulatory framework for the Caribbean power sector.

13. Enhancement of regional and local human and institutional capacities in the face of increasing regional and international scarcity of technical resources in the electric utility sector, considering the growing complexity and diversity of work exigencies and utility processes through energy transition and digitization.

14. Performance of Impact Studies of technologies that may become adequate and affordable in the future (i.e., maritime renewable energy, island interconnection, storage alternatives).

15. Continue the support of Regional Initiatives for:

- **a.** centralized studies on fuel diversification, renewable energy technologies, energy efficiency, system loss reduction, generation efficiency, energy conservation programs, customer education programs;
- **b.** public relations campaigns on Energy Policy issues and initiatives like energy efficiency and energy conservation programs;
- **c.** joint purchase and/or storage of fuel.

CARILEC

An Association Of Electric Energy Solution Providers

Contact Info Tel: (758) 731-7111 Fax: (758) 452-0142 Email: esa@carilec.org Website: www.carilec.org

P.O. Box 5907, Desir Avenue, Sans Souci, Castries, St. Lucia, West Indies