# Workforce Development Strategy to Address Energy Priority Sectors in Antigua and Barbuda's Nationally Determined Contribution

**Summary of Climate Technology Centre and Network Technical Assistance**

**Response to Antigua and Barbuda**

**Request No. 2015-029/ATG-01**

August 2016

# Contents

# Introduction

Following the United Nations Framework Convention on Climate Change (UNFCCC) 21st Paris Conference of the Parties (COP 21), many nations have realized the need for assistance in achieving goals established in Paris and outlined in their Nationally Determined Contributions (NDC). Antigua and Barbuda requested such support from the UNFCCC Climate Technology Centre and Network (CTCN) for developing a workforce strategy to mobilize local labor to implement projects in fulfillment of the country's NDC. The CTCN selected the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) to partner with the Antigua and Barbuda Department of Environment on this endeavor, the key outcomes of which were a stakeholder workshop and this workforce strategy.

The Department of Environment in the Ministry of Health and the Environment is Antigua and Barbuda's national focal point on climate change. This workforce strategy was developed in consultation with Department staff, and NREL conducted an in-country consultation in March 2016 targeting private sector stakeholders in particular. The Technical Advisory Committee (TAC) validated the strategy. The TAC is a multi-stakeholder committee that includes seventeen government departments with responsibilities for environment, waste, energy, water, land management, development, and standards, among others; three non-governmental organizations; and one private sector coalition representative.

Building on the information collected during the stakeholder workshop, the workforce strategy identifies short-, medium-, and long-term actions for Antigua and Barbuda to enhance local capacity to implement priority energy sector projects that can help the country to meet its NDC. The workforce strategy includes the purpose and objectives, a budget for programme development and implementation, and key stakeholders and their roles in implementation. The document also describes the expected workforce breakdown, the baseline skills profile of the islands of Antigua and Barbuda, and anticipated areas of skills shortages. The strategy defines the objectives of the workforce and training activities, as well as actions needed to achieve these objectives. The document then goes on to note potential partner organizations, including regional and international finance and development institutions.

# 1. About the Workforce Development Plan

To demonstrate support for the adoption of the Paris Agreement and as part of its responsibilities under the Agreement, Antigua and Barbuda developed a Nationally Determined Contribution (NDC)[1] outlining its climate change mitigation and adaptation targets. Targets are:

- Unconditional targets
    - Enhancing the enabling legal, policy, and institutional environment, for a low carbon emission development pathway to achieve poverty reduction and sustainable development, *and*
    - By 2020, updating the building code to meet projected impacts of climate change.
- Conditional mitigation targets
    - By 2020, establishing efficiency standards for the importation of all vehicles and appliances,
    - By 2020, finalizing the technical studies with the intention to construct and operationalize a waste-to-energy (WTE) plant by 2025,
    - By 2030, achieving an energy matrix with 50 megawatts (MW) of electricity from renewable sources, both on and off grid and in the public and private sectors, *and*
    - By 2030, protecting all remaining wetlands and watershed areas with carbon sequestration potential as carbon sinks.
- Conditional adaptation targets
    - By 2025, increasing seawater desalination capacity by 50% above 2015 levels,
    - By 2030, improving and preparing all buildings for extreme climate events, including drought, flooding, and hurricanes,
    - By 2030, meeting 100% of electricity demand in the water sector and other essential services (including health, food storage, and emergency services) through off-grid renewable sources,
    - By 2030, protecting all waterways to reduce the risks of flooding and health impacts
    - By 2030, making available an affordable insurance scheme for farmers, fishers, *and* home and business owners to cope with losses resulting from climate variability.

Antigua and Barbuda is actively working to reach its climate targets through a number of national and sub-regional initiatives and policies. For example, the 2010 National Energy Policy contains goals to reduce energy costs, diversify energy sources, and develop new technologies and sectors. The 2013 Sustainable Energy Action plan builds off of the 2010 policy by providing a comprehensive roadmap for renewable energy and energy efficiency policy development, with recommendations for the creation of certain government institutions, policies, and proposed budgets. The Action Plan also includes an internal government goal to reduce public energy consumption and expenditures by 30% by 2020, and, energy goals to achieve 10% electricity generation from renewables by 2020, 15% by 2030, and a 25% reduction in GHG emissions below 1990 by 2020 [1]. Antigua and Barbuda is also actively working to reach its climate development goals through a number of national initiatives and international partnerships. See Appendix A for further information on relevant policies and programs.

For Antigua and Barbuda to achieve its NDC commitments, a sufficient and appropriately trained workforce must be in place. This workforce will include a variety of personnel who will be needed to

[1] Prior to the 21st COP, these commitments were referred to as Intended Nationally Determined Contributions (INDCs) and post COP, as NDCs. "NDC" is used throughout the workforce development plan for simplicity.

contribute different skills to support the high-quality development, construction, and operation of best-fit technologies at reasonable labor rates. Antigua and Barbuda has a strong commitment towards training and developing an appropriate workforce. Training and development is also key to empowering employees with the knowledge and skills required to meet the health, safety and environment standards specified in employment and permitting regulations and encountered when developing clean energy projects. This strategy is designed with the local context in mind, focusing on Antigua and Barbuda's climate and development priorities, while utilizing existing on-island as well as regional institutions. This strategy has been prepared to address particular social opportunities and issues, including:

- Encouraging economic development with increased private sector participation and entrepreneurship in developing new energy projects
- Increasing labor-force participation and local skills capacity, including maximizing employment opportunities for local residents and under-represented groups
- Establishing apprenticeships, scholarships, vocational training, and other programs
- Supporting readiness work programs and pre-trade training concepts
- Identifying necessary enabling activities to promote successful initiatives

## 1.1 Scope of the Workforce Strategy

Antigua and Barbuda's NDC priority sectors are:

1. Energy, including islanded renewable energy, storage, energy efficiency and audits, and WTE;
2. Buildings and Construction, including climate resilient buildings and infrastructure;
3. Transportation, including setting and enforcing new standards for vehicles; and
4. Finance and Fund Management, including the national Sustainable Island Resource Framework Fund (SIRF Fund)

Per guidance from the Department of Environment and given the emphasis of this strategy on private sector and NGO engagement, the workforce strategy focuses on the energy and buildings sectors with actions in the transportation and finance sectors pertaining more specifically to internal government capacity. Within the energy sector, this strategy centers around opportunities to develop and operate solar photovoltaics (PV), WTE, and wind energy generation projects, as well as improve the resiliency and energy efficiency of buildings via retrofits and new construction.

The workforce strategy involves all workforce and training activities, including those of primary contractors. The actions and activities outlined extend across the construction, operation, and decommissioning phases of clean energy projects. This can also include conducting price assessments, developing viable projects, and maintaining systems. Initial recommendations from Antigua and Barbuda indicate capacity development would target small and medium enterprises (SMEs) and would focus on in-person, learning-by-doing trainings leading to internationally recognized certifications. The trainings would be designed for working professionals with a minimum of a primary education. Given the extensive capacity building requirements, the workforce strategy includes specific activities to facilitate the successful recruitment and retention of an appropriate workforce by optimizing direct and indirect employment opportunities, while managing challenges around the availability of, and competition for, local labor.

Most of the categories of labor could be provided by small and medium enterprises. Labor for engineering, design, construction, inspection, operation and maintenance, distribution and retail

services can all be provided by SMEs. Some of the services not likely to be provided by SMEs include financing, insurance, and manufacturing. In our analysis of job creation we consider statistics from Hawaii as a model rather than the mainland United States. Hawaii has much more work performed by SMEs than the mainland, and the jobs are more in these service sectors whereas the mainland workforce also includes manufacturing and other aspects not provided by SMEs.

## 1.2 Stakeholder Engagement and Potential Roles for Workforce Development Related Activities

Engagement with key local, regional and national stakeholders has been essential to the development of this strategy. Initial stakeholder engagement was conducted during a March 2016 workshop. The CTCN collaborated with the Department of Environment to host an in-country workshop on key clean energy issues relating to the implementation of the country's NDC. NREL and the Department of Environment conducted the workshop at the Department of Environment's offices in St. John's, Antigua from March 21-24, 2016. The workshop included over 20 participants from the public and private sector, with several participating organizations delivering presentations on workforce development, renewable energy, energy efficiency, resiliency and disaster recovery, and private sector engagement (a full list of the organizations consulted can be found in Appendix B). The objective of the workshop was two-fold:

1) Facilitate in-country stakeholder meetings to discuss barriers to clean energy technology deployment and opportunities for unlocking investments; and,
2) Gather information on domestic market conditions and policies to inform the design of a national and regional workforce training program

Consultations with these and other stakeholders aim to provide a broad and holistic perspective on training and recruitment challenges and opportunities in Antigua and Barbuda. As this workforce training strategy is further refined and adopted, stakeholder engagement should continue in an effort to ensure training programs are appropriate; that local, existing institutions are utilized as much as possible; and that training programs are aligned with national policies and cultural requirements. Various stakeholders may also choose to adopt and implement aspects of this strategy.

There are several government agencies and related organizations that can play leading roles in implementing a workforce training strategy; see Table 1.

**Table 1. Potential Lead Implementing Organizations and Responsibilities**

| Organization | Responsibility |
|---|---|
| **Department of the Environment** | Develops national resources management policy including for energy resources;<br>Leads implementation of projects to address national climate development priorities;<br>Sets emissions standards and issues pollution permits |
| **Ministry of Tourism, Economic Development, Investment & Energy** | Regulates the APUA, the monopoly utility;<br>Establishes stable interconnection policies which are a prerequisite for industrial activity;<br>Engages with hotels and tourism industry for synergy |
| **Labour Department** | Identifies requirements from labor force survey; Issues job announcements |
| **Ministry of Public Utilities, Civil Aviation and Transportation, APUA Electricity Unit** | Operates the island energy system and therefore maintains overarching accountability for managing employment and training |
| **National Training Agency** | Works with training institutions to set standards and get required training done |
| **APUA** | As the upstream originator of many of the projects, ensures workforce recruitment and training conditions and commitments are met for their projects |
| **National Solid Waste Management Authority** | Identifies staffing and training requirements for landfill energy projects |
| **Bureau of Standards, Development Control Authority** | Identifies required standards for energy efficient and resilient building codes;<br>Establishes codes and zoning policies;<br>Provides training and qualification systems to meet required codes. Examples of existing programs can serve as a guide for A&B as a starting point |
| **Contractors** | Identifies the skills required to support projects– Primary contractors are required to develop Workforce Development Plans which:<br>• Provide evidence of arranging timely training and qualifications programs to meet the skills development needs of the project<br>• Provide training and qualification systems to meet the requirements of the project<br>• Maximize the inclusion of qualified local people to support all phases of the project |
| **Directorate of Gender Affairs; Community Development Division; Professional Organization for Women in Antigua and Barbuda** | Engage local women leaders in designing training opportunities;<br>Conducts outreach;<br>Potentially implements mentorships |
| **Donor and partner organizations** | Help identify what specific workforce development activities would best enable Antigua and Barbuda to participate in their programs |

## 1.3 Inclusion of Gender, Local Labor and Under-Represented Groups and Safety and Health Considerations

The workforce requirements to implement Antigua and Barbuda's NDC are significant, and offer an important economic and development opportunity for residents in Antigua and Barbuda. This is particularly relevant for the component of the local labor force that is currently unemployed or under-utilized. Of approximately 90,000 total populations, the workforce comprises approximately 30,000, and the unemployment rate is around 11% in 2014 (so roughly 3,300 persons). The unemployment rate among younger workers exceeds 20%. Around 80% are employed in the service economy, which is highly dependent upon the global (US, Canada and Europe mainly) due to tourism [9]. The strategy is to develop a renewable energy and efficiency workforce of approximately 400, which is a significant reduction in the unemployment rate.

The use of local labor facilitates a more stable workforce, and enhances the ability of employees to contribute to other aspects of local community development. Local labor can also help avoid the issues around housing and service demand that are often associated with a non-local workforce. Opportunities for local people are defined in Section 2.2 and will optimize the inclusion of local workers during all phases of the project and in all labor categories from professional to unskilled labor.

In line with equal employment principles, this strategy actively encourages the participation women and under-represented groups in all sectors of the workforce. In general, women are often underrepresented in the energy sector. Additional, aft-under-represented groups include people with disabilities, mature-age workers, and young entry-level workers. Antigua and Barbuda, as it implements its NDC, can build capacity in these groups to facilitate access to the range of opportunities available.

The Men Against Negative Attitudes (MANA) is a prisoner rehabilitation programme that was established in 2014 and aims to build skills and experience of prisoners in order to reduce recidivism rates. The role of the MANA programme in this strategy is to be determined in consultation with the administration of that program, but could be substantial since many of the jobs installing utility-scale measures such as large PV, wind, and WTE do not put workers in unsupervised contact with at-risk persons (e.g., children and the elderly).

This workforce development strategy must comply with all applicable regulations and laws in Antigua and Barbuda. Apart from specific legal requirements there is also the common law requirement of 'duty of care,' which is basic an underlying legal principal of ensuring that personnel are equipped with the necessary resources, including knowledge through training and personal protective equipment or safety precautions, to undertake their work in a productive manner that ensures their safety and safety of others with due consideration to environmental aspects. The workforce development strategy is aligned with these requirements.

The DOE provides employment opportunity for persons with physical, mental and social needs. The building of the Department is designed to facilitate the participation of the persons in wheel chair, there is a staff member with Autism, and DOE provides a trainee program for young offended leaving prison. The training program will continue to include these persons. There are further opportunities to design a workforce training program to include persons with special needs and these will be vigorously pursued and encouraged in other departments of the Government.

# 2. Antigua and Barbuda's Clean Energy Workforce Profile

This plan for workforce development plan responds to expected skills that will be required in the energy sector to achieve the climate commitments Antigua and Barbuda established in its NDC, taking into account cost effectiveness and capacity constraints. Antigua and Barbuda has a population of 90,000 and a workforce of 30,000, and its GDP is ECD 3.2 billion (USD 1.2 billion) [9]. This strategy takes a practical approach to workforce development by identifying roles and responsibilities that would be more cost effective to build on a regional level, for example jobs that are only needed intermittently given projected demand.

The profile section outlines the baseline and anticipated growth areas to achieve those goals.

## 2.1 Analysis of Gaps in the Existing Clean Energy Workforce

Currently, renewable energy businesses are small and still developing in Antigua and Barbuda. In 2015, the renewable energy industry employed approximately 20-40 people. Reportedly, pushback from the utility, APUA, slowed growth.[2] And, uncertainty in policy and regulations needs to be reduced before the renewable energy industry can expand on the islands.

It is anticipated that most of the jobs related to renewable energy development and efficiency will be small and medium sized private firms, although some countries have also had success with state-owned firms or government agencies directly involved in developing and operating power generation assets. In this study we assume private-sector workforce, but some jobs are intrinsic government functions such as permitting, code development and enforcement, and probably inspections.

An analysis of existing gaps in capacity was conducted based primarily during the March 2016 in-country workshop and field visits. The identified needs for workforce development fall into general categories:

### *Continuation of clear policy signals that will catalyze market development in solar PV, wind, waste-to-energy, and energy efficient, resilient buildings*

There needs to be a steady flow of projects to create a workstream and to avoid boom/bust cycles that could hinder development of the sector [5]. Given the relative nascence of the Antigua and Barbuda clean energy workforce, the government will need to establish clear and transparent market signals that provide investors with sufficient assurance to create new, on-island businesses. This market pull will also drive employment opportunities.

### *Address key skills*

Typical job types that are difficult to fill in emerging economies and small islands with a limited work force include project developers; service technicians; data analysts; electrical, computer, mechanical and construction engineers; solar PV and solar thermal system and wind installers and maintainers; architects, code officials and building inspectors [5]. Additional needs identified in Antigua and Barbuda include energy audit activities for which a job task analysis could be broken down into sales, corporate and project management, field data collection, energy modeler/analyst, financial analyst, cost estimator, writer/communications services, and supervisors. Examples of data analytics include geospatial analysis, electric distribution grid analysis, and data analytics involved in monitoring and maintenance of generation assets for stable and reliable grid operations. Actually implementing the results of energy audits requires all of the equipment suppliers and installers involved in the building

[2] Based on discussions at the March 2016 workshop.

trades including refrigeration/air-conditioning, building metering and controls, lighting, building wiring/electrical, and water heating among all others. Additional needs include the financiers, bonding and insurance agents and adjustors, system integrators, and project managers to support equipment installers with project development services.

### *Improve capacity at APUA and develop transferable skills*

APUA is concerned about its own need for skills development to integrate larger quantities of renewable energy and the potential for renewable energy projects to put APUA employees out of work. There is a need as well as a lack of funding for workforce training and investment in grid stability to support high penetration levels of renewable energy. For example, the grid will eventually have to transition from passive "droop mode" in response to load changes and eventually transition to a fully capable System Control and Data Acquisition (SCADA) system to maintain constant frequency. APUA staff could be trained in installation and operation of a SCADA system. However, APUA must pay generators for spinning reserve and the expertise is not there, so there is a need for skill development and capacity-building in the costs for these spinning reserves at the power plant within independent power purchaser (IPP) contracts. In other words, plants have to develop the physical (automated) controls and human capacity to modulate power output cost-effectively and contracts have to be structured so that they are compensated for providing spinning reserve and resulting reliability even if they are not selling power (because power is coming from renewable plants elsewhere). Positions that are relevant to skills building in APUA for a clean energy transition include: distribution system engineers, generator plant operators, and controls technicians. Operation of a grid with diversified generation resource would ordinarily require a high level of automation, replacing manual generator operators with expertise in controls and information technology.

Regarding negative impacts on the jobs currently held by APUA staff, we do not expect the number of APUA employees (almost 800 persons) to be reduced. The same number of generator operators, linesmen, and customer service representatives will be required. Rather, we do expect a conversion in the way utility revenues and utility expenses are balanced, with an increase of approximately 20, rather than a decrease in APUA staff. Renewable energy measures and many energy efficiency measures do not generally reduce the amount of electrical generation capacity required, since there are always times when the sun is not shining and wind not blowing. Rather, measures reduce the fuel consumption of those generators. The effect is to transition from exporting money from the island to import energy (oil) to keeping that money on the island to install, operate, maintain, and replace renewable energy and energy efficiency systems.

The cost of most solar and wind measures is roughly 50% equipment and materials and 50% labor, with the later providing new jobs. In addition to new jobs related to a new utility SCADA system and more advanced utility operations, consideration should also be given to how APUA employees could receive additional training to participate in the development and operations of clean energy projects. In many areas in the United States, the utility itself is the largest implementer of renewable energy systems and this could be the case in Antigua and Barbuda, with much of the renewable energy in utility-scale plants owned by APUA or an IPP.

### *Establish certifications and other related requirements, and trainings to meet these needs*

Developing a pool of certified staff that can carry out specific work has been identified as a need. The Labour Department identifies requirements from a labor force survey and job openings are a source of information regarding required training. A more detailed analysis of the gaps in openings and current certifications required in postings could provide more insight into areas for developing capacity.

Once policies and codes are established, a workforce needs to be created to support the implementation and enforcement of those policies and codes. This will require training and certification of professionals in the following areas: architects and designers, the construction industry, operations and maintenance staff, and auditors and enforcement officials. There is also a need for certification of wind installers and operations and maintenance staff, along with a desire for manufacturers to commit to hiring local personnel for these roles. The wind manufacturer Vergnet has done projects in Martinique and Guadalupe and may be able to offer local training, pending development of projects on Antigua and Barbuda.

The training process must include procurement, as developing a competitive bid for requests for proposals (RFPs) is essential for SMEs to access clean energy opportunities.

#### *Build skills of government building managers and auditors to access near-term energy savings*

There is an identified need for training of maintenance staff in each government building to diligently pursue practices that reduce energy use as well as deploy and maintain new systems. Trained energy efficiency auditors are also needed to ensure buildings are being constructed or renovated to achieve the nation's energy efficiency and resiliency goals.

#### *Landfill energy: Train on evaluating proposals, and operations and maintenance of current systems*

Regarding the current landfill workforce, there is a requirement for more staff to support operations and maintenance (O&M), including preventative and repair measures as well as monitoring. The expectation is that the National Solid Waste Management Authority (NSWMA) would issue a "request for proposals" for a third party to finance, design and construct the plant and recruit local labor to operate it. Jobs would be created at the authority to oversee the contract and manage the on-going financial and logistical relationship between the landfill and the WTE provider. There would be a need for people to write the specific terms and conditions and regulations under which a WTE provider would design and operate the plant. There is also a need to for training to properly evaluate proposals in terms of the technologies, costs, construction plans, operations and maintenance requirements, among other considerations.

#### *Soliciting sponsors and competing for project and program funds from international and regional development and finance institutions*

Perhaps one of the most refined skills required is to effectively compete for funding offered by international or bi-lateral relationships. Donor agencies are identified as stakeholders in this plan with the expectation that they can help identify what specific workforce development activities would best enable Antigua and Barbuda to participate in their programs. Skills include the ability to research what the current and emerging funding sources are, identify and prioritize project opportunities on the island, plan projects and estimate costs, and write grants. In addition, a project management specialist can help to package the content into a coherent and effective proposal.

## 2.2 Expected Workforce Breakdown for Clean Energy Sectors

Based on resource assessments, feasibility studies, and the March 2016 workshop, the following technologies have been prioritized as leading opportunities for Antigua and Barbuda to develop the local workforce, in line with its NDC.

- Renewable Energy Electricity Generation
    - Solar PV

    - Wind
    - Waste-to-Energy
- Energy Efficiency and Resiliency
    - Energy efficiency and resilient retrofits
    - Energy efficiency and resilient new builds
    - Solar hot water

A variety of roles are needed to support the clean energy value chain, including equipment manufacture and distribution, project development, construction and installation, and operations and maintenance [5]. However, given the size of Antigua and Barbuda's economy and available manufacturing inputs, we have not included manufacture and distribution estimates. Much of the employment with clean energy is associated with project development and construction and installation with much smaller numbers needed to support operations and maintenance, although operations and maintenance jobs are likely to last longer for energy generation technologies, i.e., 20 to 30 years or roughly the lifetime of the system [5]. Also, many of the skills needed to support clean energy projects are already utilized for other types of projects; however, workers may require some supplemental skills development specific to clean energy projects [5].

Workforce requirements could be identified in the areas of renewable energy (including solar energy, wind energy, waste-to-energy), building energy efficiency and resiliency, and fuels and transportation system efficiency. Of these, renewable energy has a quantitative NDC goal that can be translated into a quantitative number of jobs. Energy efficiency and transportation will also have training and workforce requirements and these are handled in a quantitative way similar to renewable energy, but without the statistical data from Hawaii that informs the estimated number of jobs for renewable energy. Energy efficiency, distributed PV, and solar water heating require the most labor per unit of benefit delivered, whereas wind energy and transportation energy efficiency relies more on off-island manufacturing and less on labor. Jobs are not calculated for energy efficient new construction since the same amount of labor would be involved, presumably, in not-energy-efficient new construction. The estimates are based on jobs commencing in 2017 and continuing through 2030 when the NDC goals are to be met. Assuming it will take until 2020 to get industry employers established, most of the progress towards the goals and resulting employment will occur over the 10-year period from 2020 to 2030. Thus, we average the labor requirement over 10 years. So if it takes 30 workers to install a 1-MW plant in one year, we tally that here as 3 jobs lasting 10 years. Table 2 outlines the occupational categories of the workforce, as well as the scope of activities required for the project planning, construction and operation.

**Table 2. Number of Workers in the Island Industry (averaged over 10 year deployment period) Associated with NDC Goals (NREL Estimates, Proximal)**

| Position Type | Central PV | Distributed PV | Solar Water Heating | Waste-to-Energy | Energy Efficiency | Transportation | Wind Energy |
|---|---|---|---|---|---|---|---|
| **PRIVATE SECTOR JOBS** | | | | | | | |
| Architect | | | | | 1 | | |
| Asset management | | | | | | | |
| Battery/Storage Consultant | 1 | 1 | | | | | |
| Building inspectors | | 3 | 1 | | 6 | | |
| Code officials | 1 | 3 | 1 | | 3 | 3 | 1 |
| Codes inspector | 1 | 3 | 3 | | 3 | | 1 |
| Commissioning agent | 1 | | | 1 | 4 | | 1 |
| Communications | 1 | 3 | 3 | 1 | 3 | 9 | 1 |
| Construction worker | 6 | 9 | 9 | 10 | 5 | | 5 |
| Cultural heritage consultant | 2 | 1 | 1 | | | | 2 |
| Data analyst | | | | | | | |
| Debt financier representatives | 1 | | | | 1 | | 1 |
| Electrical System Designer | 3 | 9 | | | | | |
| Electrician - journeyman | 9 | | 1 | 4 | 18 | | 3 |
| Electrician - master | 3 | 9 | | 1 | 9 | | 1 |
| Energy auditor | | | | | 18 | | |
| Environmental consultant/advisors | 1 | | | 2 | | | 2 |
| Environmental engineer | 1 | | | 3 | | | 1 |
| Field construction supervisors | 3 | 1 | 1 | 3 | 9 | | 3 |
| Field construction technicians | 9 | 18 | 3 | 5 | 18 | | 5 |
| Financial consultant/broker | 1 | | | 1 | | | 1 |
| Independent engineer | 1 | | | 1 | | | 1 |
| Information technology (IT) specialist | 1 | 1 | | 1 | 3 | 1 | 1 |
| Inspectors/Certifiers | 2 | 9 | 3 | 1 | 5 | 9 | 1 |
| Instrument/Control engineers | 1 | | | 1 | 4 | | 1 |
| Instrument/Control technicians | 2 | 3 | 3 | 3 | 5 | | 3 |

| Position Type | Central PV | Distributed PV | Solar Water Heating | Waste-to-Energy | Energy Efficiency | Transportation | Wind Energy |
|---|---|---|---|---|---|---|---|
| **Insurance Agent/Adjuster/Underwriter** | 2 | 1 | | 1 | | | 1 |
| **Laborer** | 7 | 9 | 9 | 3 | 3 | | 3 |
| **Land use negotiator** | 1 | 1 | | | 1 | | 1 |
| **Lawyers** | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Logistics supervisors** | 1 | 1 | 1 | 1 | 1 | | 1 |

| Position Type | Central PV | Distributed PV | Solar Water Heating | Waste-to-Energy | Energy Efficiency | Transportation | Wind Energy |
|---|---|---|---|---|---|---|---|
| Logistics technicians | 2 | 5 | 3 | 3 | 5 | | 3 |
| Maintenance supervisor | 2 | | | | | | |
| Maintenance technician | 6 | 9 | 9 | 9 | 9 | | 18 |
| Mechanical engineer | 2 | | 4 | 3 | 9 | | 4 |
| Medium/High voltage grid connection lineman | 4 | 1 | | 3 | 1 | | 3 |
| Occupational health & safety advisors | 1 | | | 2 | | | 1 |
| Primary contracting staff/contracting officer | 2 | | | 2 | | | 2 |
| Recycling and repurposing material/ equipment (life cycle) | | | | | | | |
| Roofers specializing in solar | | 9 | | | | | |
| Sales/retailers | | 9 | 9 | | 9 | | |
| Small PV – electrician specializing in solar | | 9 | | | | | |
| Small PV system designer | | 9 | | | | | |
| Solar engineers | 2 | 2 | 2 | | | | |
| Solar thermal – plumbers specializing in solar | | | 18 | | | | |
| Standards-making facilitator | | | | | | 1 | |
| Structural engineer | 2 | | | 1 | | | 1 |
| Superintendents & supervisors | 2 | 5 | 2 | 6 | 5 | | 3 |
| Utility engineers | 1 | 1 | | 1 | | | 1 |
| Waste-to-energy | 2 | | | 3 | | | |

| Position Type | Central PV | Distributed PV | Solar Water Heating | Waste-to-Energy | Energy Efficiency | Transportation | Wind Energy |
|---|---|---|---|---|---|---|---|
| **engineer** | | | | | | | |
| **Waste collection and processing** | | | | 19 | | | |
| **Wind engineers** | | | | | | | **3** |
| **GOVERNMENT** | | | | | | | |
| **Code Officials** | **1** | **1** | | **1** | **3** | | **1** |
| **Electrical Inspectors** | | **3** | | | **1** | | |
| **Environmental Compliance Officers** | | **1** | | **2** | | | **2** |
| **Cultural Resource Officers** | **1** | **1** | | **1** | | | **1** |
| **Permit Officials (building and electrical)** | **1** | **1** | **1** | **2** | **2** | | **1** |
| **APUA** | | | | | | | |
| **Accountant** | **1** | | | **1** | | | **1** |
| **Generator Plant Operator** | **1** | **1** | | **1** | | | |
| **Distribution Engineer/Planner** | **1** | **3** | | **1** | | **1** | **1** |
| **Front Office (interconnect agreement process)** | | **3** | | | | | |
| **Information Technology** | **1** | **1** | | **1** | | | **1** |
| ***TOTAL JOBS EACH YEAR AVERAGED OVER 10 YEAR DEPOLYMENT*** | ***105*** | ***160*** | ***88*** | ***105*** | ***165*** | ***25*** | ***88*** |

### *Renewable Energy*

Based on United States' statistics, there are around 25 job-years per MW of installed capacity for solar PV [2]. This is at least loosely consistent with [8] that estimates 32 job-years per MW for installation of PV and 0.4 job years per MW for ongoing maintenance. Reference [8] also addresses other renewable energy technologies such as solar thermal, wind, biomass and efficiency. It is anticipated that much of the 50-MW renewable energy goal for Antigua and Barbuda will be met with solar PV, based on cost, barriers to implementation, and reliability of renewable energy technologies, however significant wind investments are also planned.

Since U.S. nation-wide statistics include manufacturing and centralized services, references in this document are made to employment statistics for Hawaii due to its similarity to Antigua and Barbuda in terms of the types of jobs and the island conditions [2]. In Hawaii, there are higher percentages of companies involved in installations (73%), sales (12%), and project development (7%), than in other categories such as manufacturing [2].

In Antigua and Barbuda, maximizing local sourcing of materials and manufacturing will assist with creation of jobs and improvement of island resilience. Manufacturing of PV or wind equipment on a small scale would be possible in Antigua and Barbuda, however due to cost competitiveness and scale of production from countries like China a large operation would not be economically feasible. Some local assembly and fabrication of some components could be explored. A range of professional, trades, skilled, semi-skilled, and unskilled jobs will be created during construction and operation of the projects. Distributed PV would result in more jobs than centralized/medium to large-scale PV, both for initial marketing and installation as well as for ongoing operations and maintenance. Wind energy would rely largely on imported equipment but also involve large-scale, on-island construction for tower foundations, access roads, and other infrastructure as well as installation of the equipment. WTE plants also involve a lot of imported equipment and also employ a lot of jobs due to the scale and complexity of the plant and the material handling required to collect and process the fuel. For example a Refuse Derived Fuel (RDF) Processing Facility sized at 200 tons per day of MSW (much larger than what is being considered for Antigua and Barbuda) employed 75 jobs for construction and 30 permanent operation jobs. A Power Generating Station of 10-MW net output (again, larger than the waste stream in Antigua and Barbuda would support) employs 300 construction jobs and 60 permanent operation jobs.

### *Building Energy Efficiency and Resiliency*

Energy efficiency improvements in new and existing buildings require skills to identify, evaluate, design and ultimately to implement energy efficiency measures in buildings. Different types of buildings require different skills, with residential buildings being quite simple and uniform and commercial and industrial buildings being more complicated and varied.

There are more retrofit opportunities than new buildings because the building stock "turns over" very slowly; with perhaps 10 times as many retrofit opportunities as new builds. New building construction generates a lot of jobs, but we assume here that it takes as many jobs to construct an inefficient building as it does an efficient one, since in new construction it is more a matter of making the best decisions and not a matter of implementing additional measures. "Energy Auditor" may be identified as a separate job title, but it is closely related to electrical and mechanical engineering. It does not, however, require the professional licensure of an engineer. Energy audit services are often provided by unlicensed individuals, but under the supervision of an engineer or specialist. However, it does take a high level of experience or insight to walk into a mechanical room or to examine a computer control system and see what improvements may be made. Training can help prepare energy auditors, but there is no substitute for

experience and the best auditors have a long background in system installation or operation and maintenance. An auditor identifies, measures and evaluates them in terms of technical feasibility and cost-effectiveness.

Once an auditor identifies measures, a designer is engaged to specify the size and type of replacement components and detail how the measure will be implemented in construction drawings and specifications. The design is often let for bid and the project implemented by building trades such as electrical, mechanical, lighting, refrigeration/air conditioning/ and control system contractors. A commissioning agent may be engaged to ensure that the retrofit system is operating according to the intent of the design. Due to the fact that opportunities are distributed within buildings, and varied and detailed in nature, it requires a lot of labor to deliver benefits compared to central renewable energy plants, but the benefits are robust and permanent. The best kWh is a kWh not used, and efficiency is recognized as a prerequisite to sizing renewable energy systems. Renewable energy and the appropriate controls and system designs are also needed to meet the goals.

# 3. Key Opportunities for Expanding the Domestic Workforce

To develop and foster skills required for achieving goals established in the NDC, key focus areas have been identified to guide the implementation of the workforce development strategy nationally. The strategy has been laid out by identifying standards and credentials needed, which training institutions can build knowledge within the workforce, and how these employment opportunities can be communicated more broadly.

## 3.1 Develop Clean Energy Standards

Developing standards is the first step to outlining the goals established in Antigua and Barbuda's NDC. These standards will help the nation achieve those goals and assist the training organizations to identify areas where the workforce needs to continue to develop. Examples of the standards to be developed are broken out by the NDC goals related to energy efficient and resilient building codes, renewable energy, and diversifying fuel to reduce the dependency on imported fossil fuels. The energy specific goals in the NDC are:

- Updating the building code to meet projected impacts of climate change by 2020;
- A low carbon emission development pathway to achieve poverty reduction and sustainable development;
- By 2020, establishing efficiency standards for the importation of all vehicles and appliances;
- By 2020, finalizing the technical studies with the intention to construct and operationalize a WTE plant by 2025; *and*
- By 2030, achieving an energy matrix with 50 MW of electricity from renewable energy sources, both on and off grid and in the public and private sectors

These standards and policies will assist Antigua and Barbuda with achieving goals of gaining energy independence away from imported fuels, diversifying the energy mix away from fossil fuels, and lowering energy costs by increasing competition among energy providers and utilizing lower cost resources, including renewable energy. Once standards are established, the workforce will need to be trained on the techniques and principles in the standards in order to implement change.

### *Building Codes*

Energy efficient and resilient building technologies are deployed as a result of public policy. This is even

the case when the cost of energy efficiency measures may not be significantly more expensive than traditional methods or when investments in energy efficient technologies result in energy savings [6].

A study conducted by the U.S. National Institute of Building Science in 2005 determined that the return on the incremental investment in resilience pays off over the life of the building. The study concludes that for every $1 spent on hazard mitigation, an average of $4 is saved during the disaster recovery phase. This metric has been applied to multiple situations and is broadly used by U.S. agencies addressing resilience. Not only is updating building codes in Antigua and Barbuda's NDC, but it will likely lead to fewer costs associated with disaster recovery with anticipated severe weather (e.g., increased hurricanes and severity of storm surges, etc.). "Under circumstances where many countries, faced with elevated levels of unemployment, wish to stimulate activity that creates more decent employment, many have found that encouraging the retrofitting of existing building to reduce carbon emissions makes an effective and significant contrition to this goal" [6].

It is recommended that climate change considerations be incorporated into building codes along with energy efficiency requirements, which will also help with sustainable development and lower poverty levels associated with energy bills and recovering from severe climate-related events.

Antigua and Barbuda plans to use building code guidelines from the Organization of Eastern Caribbean States (OECS) as a basis for revising the building code, and will adapt the code to local circumstances. For example, setback zone guidelines are established in the coastal setbacks policy to protect buildings from sea level rise and increasing storm surges, elevated structures may be needed in certain areas to protect from the same threats, and requiring installation of attached features, such as roofing materials or solar PV panels to a Hurricane 5 level may be needed. Antigua and Barbuda will need to identify the risks, identify the technical measures to reduce the impacts associated with those risks, and also integrate energy requirements at the same time. The Environmental Protection and Management Act of 2015 includes in Part VI "Environmental Management and Monitoring", in Section 39, which provides for Environmental Management Systems (EMS). The Department of Environment submitted a request in February 2016 to the Bureau of Standards for adopting ISO 14001 Environmental Management Systems.

Energy efficient and resilient building codes will address the following considerations:

- For new buildings, siting to reduce impact from climate related threats (e.g., setback from shore, no more than two stories tall, etc.)
- Passive survivability techniques to reduce energy consumption and allow the building to be occupied without power (e.g., natural daylighting, natural ventilation, rainwater collection, etc.)
- Energy and water storage on site to allow for continued operation without utility services (e.g., solar PV with islanding controls and battery storage, cistern collectors with graywater systems, etc.)

Rolling out codes in a way to target critical infrastructure, such as schools, hospitals/medical clinics, evacuation centers, fire stations, and police stations first will help communities be more resilient during natural disasters. Focusing on residential and commercial buildings after critical infrastructure will help to lower energy costs within those sectors, as well as make them more resilient. Codes should address new construction and renovations. Examples of codes can be found for the region and specific sectors, as well as studies on the topic of passive design codes for specific climates.

With respect to compliance with the EMS, Part XI – Financial Provisions of the Environment Act establishes through the SIRF Fund an incentive-based approach, where government offices, the private

sector, and non-governmental organizations can access funds from the SIRF Fund in order to meet their EMS and environmental plans, demonstrated efforts to comply with the EMS will be a prerequisite to accessing SIRF Funds over time.

### *Renewable Energy Standards*

Antigua and Barbuda will adopt standards promulgated by standards-making organizations such as the International Electrotechnical Commission (IEC) rather than develop standards specific to Antigua and Barbuda. Harmonizing standards with existing international standards will smooth implementation and result in a lower cost to meet the NDC goals. A detailed description of standards is beyond the scope of this report, but they may be grouped into categories related to equipment performance, safety, implementation practices, and maintenance. Standards provide uniform definitions of terms and ways of performing calculations and procedures that smooth transactions between parties (financiers; engineering, procurement, construction firms; owners, etc.).

### *Vehicle Efficiency and Emissions Standards*

Antigua and Barbuda will adopt international (European or United States) standards related to vehicle efficiency and emissions. The vehicle market is global and it would not be feasible for manufacturers to deviate from these standards for small markets. Still, within the definitions and procedures established by such standards, Antigua and Barbuda could specify the highest level of efficiency, resulting in significant reduction in fuel imports and emissions. While mainly an issue of off-island manufacturing, some jobs would be created to research, select, and advocate for adopted standards; to educate suppliers and the consumer public on standards; and to enforce standards through customs or inspection stations. It is not clear whether electrification of vehicles would result in more jobs or different jobs for vehicle maintenance. Electric drivetrains require less maintenance than gasoline or diesel because electric vehicles do not have air filters, fuel filters, oil filters, oil to change, etc. and have much fewer moving parts. Batteries do require replacement, however. The training required for electric vehicles would be similar to, and delivered, in the same way that training is provided through certified dealer networks for conventional vehicles.

## 3.2 Implement Certification and Credentialing Programs

Creating systems for trained workforce to obtain certifications and credentials will be essential to establishing a quality clean-energy workforce. For example, there is a certification for PV installers in Antigua and Barbuda by APUA, but there is also a need for certification for wind installers; licensed architects with energy efficiency and resiliency design skills; and for O&M service providers for PV, wind energy systems, and energy efficient systems in buildings. Certification offers assurance that those who have been certified have met standards and qualifications. Because developing certification programs can be a complex and time-consuming process, requires administration, enforcement and review to maintain quality and validity, Antigua and Barbuda may choose to require certifications from existing programs rather than create its own credentialing department. Examples of certification programmes that currently exist elsewhere, which could serve as models or be used as robust certification programs within Antigua and Barbuda, are summarized below:

**Renewable Energy**

The *North American Board of Certified Energy Practitioners (NABCEP)* offers professional certification and accreditation programs to renewable energy professionals. Raising industry standards and promoting consumer confidence has put NABCEP at the forefront for PV and solar thermal certifications.

- NABCEP PV Technical Sales: http://www.nabcep.org/certification/pv-technical-sales-certification
- NABCEP PV Installation Professional: http://www.nabcep.org/certification/pv-installer-certification
- NABCEP Solar Heating Installer Certification: http://www.nabcep.org/certification/solar-thermal-installer-certification
- NABCEP Small Wind Installer Certification: http://www.nabcep.org/certification/small-wind

*Performance Excellence in Energy Renewal (PEER)* is a comprehensive, data-driven system for evaluating power system performance. PEER is a dynamic, adaptive rating process designed to measure and improve sustainable power system performance, giving power grids an opportunity to gain competitive advantage by differentiating performance and documenting the value produced. PEER is designed to change the way power systems are regulated, designed and operated, including reliability and resiliency. The resilience category focuses on ensuring reliable delivery of electricity and reducing interruptions and power quality issues, addressing supply availability, risk mitigation, redundancy and microgrid capabilities. Another category addresses energy efficiency and environmental considerations, including adoption of clean and efficient energy, efficiency of power delivery, resource use, renewable energy credits, etc. http://peer.gbci.org/

**Buildings**

The *U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED)* programme is a certification program for assessors and buildings from homes to offices and neighborhoods. LEED certification requires buildings to earn points across various sustainability areas including energy, waste, water and transportation. Buildings are scored to achieve four separate rating levels: Certified, Silver, Gold and Platinum. According to the USGBC, "LEED-certified buildings are resource efficient" and "use less water and energy and reduce greenhouse gas emissions". Because LEED has various rating systems a good place to start is the Selection Guidance page on the USGBC website: http://www.usgbc.org/articles/rating-system-selection-guidance

*Sustainable Sites Initiative (SITES®)* is a program based on the understanding that land is a crucial component of the built environment and can be planned, designed, developed, and maintained to protect and enhance the benefits we derive from healthy functioning landscapes. SITES provides tools for land development and management practices, can address concerns such as climate change, loss of biodiversity, and resource depletion. The SITES Rating System can apply to development projects located on sites with or without buildings, including: open spaces, streetscapes and plazas, commercial, residential, educational/institutional, infrastructure, government, military and industrial locations. https://sitesonline.usgbc.org/

*EDGE* is a green building certification system for new residential and commercial buildings that enables design teams and project owners to assess the most cost effective ways to incorporate energy and water saving options into their buildings. EDGE certification is available in nearly 120 countries, and as a project from the International Finance Corporation (IFC), EDGE is intended to be an easy-to-use mass market transformation tool. It empowers developers and builders to quickly evaluate and compare estimated costs for design strategies targeting reductions in energy use, water use, and embodied energy in materials. Cost effective strategies integrated into the project design are verified by an EDGE Auditor. The drivers are financial, but the results are focused on environmental considerations to mitigate climate change through resource-efficient development. https://edge.gbci.org/

This list serves as a starting point for consideration of certification programs. An opportunity for individuals to demonstrate competency in a specialty area, not typically covering a full job description, can be obtained through 'micro-credentialing.' Candidates may or may not be in the core profession, but some portion of their job might call for a specific set of knowledge and skills associated with that core profession to be performed competently and safely. For example, allied industry workers whose job tasks intersect with energy audits, solar PV, or other clean energy systems on certain projects could benefit from credentialing opportunities based on an analysis of specific subsets of clean energy-related skills and knowledge. Examples of allied industries include code officials and inspectors, real estate appraisers, first responders, electrical engineers, project managers, and architects. Micro-credentials can also apply to practitioners who wish to add defined specialties to existing certifications, or to reach a higher credentialed status through stackable credentials.

Specialized clean energy micro-credentials could, for example, cover select topics from areas such as energy storage, energy management, operations and maintenance, and data acquisition. It will be essential for Antigua and Barbuda to identify who will be responsible for credentialing or confirming off-island credentials. This could be a responsibility of the National Training Agency or a separate organization.

## 3.3 Utilize National and Regional Institutions to Support Implementation

Antigua and Barbuda has a strong national institutional capacity to implement clean energy workforce development training and educational activities as well as access to a regional university system, the University of the West Indies. Making extended training and higher educational opportunities for clean energy skills available is key, as clean energy jobs generally require higher-level qualifications of workers than the average qualification level of the overall workforce [5]. The upside is that higher qualifications should also result in higher wages. And while there are some hazardous tasks required, especially those pertaining to project and building construction, many clean energy jobs can provide for safe and healthy occupations. At the same time, there are also a number of low-skilled and semi-skilled clean energy jobs. But these jobs may provide for more opportunities to move up the occupational ladder, as compared with other low-skills jobs [5].

Many skills can be delivered through specialized as well as cross-disciplinary trainings that are offered through educational and training institutions as well as by companies. Trainings can be provided not only to upcoming or current students, but also to new graduates of less specialized courses as well as those who are already in the workforce [5]. This can include trainings to provide professionals with "add-on" skills, such as "eco-smart" electricians who can install solar panels, efficient lighting, efficient pumps, and other technologies or "eco-plumbers" who have capacity to implement greywater systems, solar hot water systems, rainwater capture, and heating efficiency [6].

Building the capacity of local labor can not only result in additional employment opportunities but also help ensure that Antigua and Barbuda meets its NDC targets through the implementation of high quality projects that achieve the intended energy savings, emissions reductions, and other goals. This may be especially pertinent to economies like Antigua and Barbuda's where there is a large, informal construction industry and a need to improve general construction skills [6].

### 3.3.1 Antigua and Barbuda National Training Agency

The Antigua and Barbuda National Training Agency is central to workforce development. The agency establishes, promotes and maintains national occupational standards, establishes an awarding body for National Vocational Qualifications (ABNVQ), and facilitates the implementation of modern apprenticeship through ABNVQs. The functions of the Agency are to:

a) Promote and coordinate technical and vocational training;
b) Develop and maintain a national training policy;
c) Advise on matters related to technical vocational education and training;
d) Manage a national technical and vocational training system to ensure an adequate supply of trained employees for national development;
e) Maintain, operate and regulate a system of apprenticeship and traineeship;
f) Establish and maintain standards in technical vocational education and training;
g) Ensure that appropriate training courses and places, syllabi, schedules and programs are available in technical or vocational training centers, in industrial, commercial and public sectors, in state enterprises, private establishments and in other places of employment, education or training to meet the needs of the country and of the population;
h) Develop and maintain a register of national training facilities and resources, national dictionary of occupations, including self-employment, skill profiles for existing and projected occupational opportunities, learning and training materials such as training manuals, information booklets, learning packages, self-learning packages and audio-visual packages, information on the supply and availability of various skills and on the skills requirements of various trades, industries and technologies;
i) Define the qualifications system to ensure that no confusion exists regarding qualifications;
j) Set up a new system of certification (ABNVQs) in a national qualifications framework and cooperate with counterparts at the CARICOM level to set up a regional system of certification (CVQs);
k) Develop occupational standards based on industry requirements;
l) Promote a culture of lifelong learning;
m) Engage in the other activities that the Board determines in consultation the relevant government agencies and bodies.

Antigua and Barbuda also has an Engineering Board that has been reconstituted with the intention of registering architects and involving contractor associations. Certifications range from levels 1 to 5 with level 5 being the highest (professional), 4 being power professionals, and so on. The National Training Agency can cover level 1; the State College can cover level 3; however, a gap has been identified at level 2. Antigua Institute of Continuing Education and State College may be source of level 2 training. CARICOM and the Caribbean Association of National Training Agencies (CANTA) must review and approve certifications programs, and accredit training institutions.[3] Only those with a Certificate of Vocational Qualification (CVQ) are recognized as qualified between islands in the region. “Lead bodies” consisting of private contractors and associations of industry develop standards. Specific industries, such as hotels, can train staff, but the curriculum must be approved by the Ministry of Labour to be considered as accepted. The Ministry of Labour also has members on the board of the National Training Agency to coordinate various processes. There is an Occupational Standards Officer and a Quality Assurance Officer who supports this coordination.

[3] http://cantaonline.org/

### 3.3.2 Educational Institutions

The ability Antigua and Barbuda to meet its workforce needs for this effort relies on the implementation of a comprehensive training and development strategy, including coordination with public schools, colleges, and universities. The delivery of relevant coursework in these institutions is essential to supporting the recruitment of an appropriate workforce for the energy project, given the specialized nature and large scale of activities to be undertaken. Although the Antigua and Barbuda Institute of Technology and Antigua Barbuda Training Institute have focused on computer skills, they offer a good model regarding workforce development that could be applied to building out energy efficiency and renewable energy capacity.

From a broader perspective, training and development programs would support community development and build on-island social capital. This aligns with a key objective of this plan to "improve the skills base of people in Antigua and Barbuda through education and training strategies."

Specific programs and initiatives are outlined below that could be implemented to promote training and up-skilling of the workforce over time.

#### *Secondary Education*

Schools are the first opportunity to pique students' interest in careers related to efficiency and renewable energy, as well as educate tomorrow's consumers. In schools, there is a challenge to get synchronized with the curriculum and make sure relevant topics are covered when they appear in the curriculum. There are 40 schools in Antigua and Barbuda, which include high schools with vocational training programs. Secondary education is also a good opportunity to encourage girls' participation in science, technology, engineering, and math courses, which could help prepare them for higher-skill clean energy jobs.

*Course example: Introduction to clean energy technologies in science course; Clean energy themes includes in science fairs; Upper secondary vocational education as a renewable energy technician specializing in solar systems [5]*

#### *Vocational Training*

A good example of what the National Training Institute can accomplish was a recent air conditioning and refrigeration training that came through National Training Institute. New refrigerants are very flammable and hazardous and training was needed regarding occupational safety and health. The refrigeration association was part of coalition sitting on the committee that developed, organized, and delivered the required training. The National Training Institute is also considering standards for energy management (technical capabilities), but this would require the support of executive leadership to move forward.

*Course example: Installation and maintenance of wind farms; Installation and maintenance of solar PV; Building analysis for auditors or residential buildings including training on building science fundamental, analysis of diagnostic equipment, and assessment of building tightness; Building envelope specialist training including building analysis course, health and safety, indoor air quality, and advanced blower door applications and other topics [5,6]*

#### *2-Year Community College*

The State College of Antigua and Barbuda has an Engineering Department. Usually students first do two years of study at the State college and then go to University of West Indies in Jamaica, Trinidad and Tobago, or Barbados. There is an opportunity to provide scholarships to students to go on to the

University of the West Indies to get degrees that are pertinent to clean energy with some requirement or encouragement to return to Antigua and Barbuda to contribute to the local job force. The Antigua State College could also offer energy auditor training, similar to the Industrial Assessment Centers in the United States that send students to collect information and prepare energy audit reports under the supervision of qualified faculty.

*Course examples: Two-year energy auditor training; Green building certification; Renewable energy systems sales; Small project design and development*

#### *4-Year Undergraduate and Graduate Studies*

The University of the West Indies has campuses in Barbados, Trinidad, and Jamaica, and it maintains extramural departments on several other islands, including Antigua and Barbuda. After completing two years at the Antigua and Barbuda State College, students can complete a two-year degree program at this university. Or they can initiate a 4-year degree at a West Indies campus. Those seeking higher education and professional studies also travel to schools in Cuba, the United Kingdom, the United States, Europe and Canada. These courses can build off of existing curricula, such as engineering, geosciences, law, business, information technology, social sciences, architecture, etc. [5]

*Course examples: Mechanical, energy, and environmental engineering, with a major in energy conservation, renewable energy, or green building [5]; Green building engineers; Energy management; Environment design courses required or offered as part of architectural design studies; Electives on sustainable construction and thermal performance of buildings [6]*

### 3.3.3 Industry-Led Skills Development

APUA conducts training in-house, in-plant. Renewable energy industries may also provide or facilitate skills development, including via internships and apprenticeships. The Antigua and Barbuda government could also consider sponsoring students to study abroad to develop technical know-how via internships, apprenticeships, and other training programs [5]. All of these opportunities are a chance to not only engage women as trainees, but also as trainers and mentors.

#### *Internships*

Paid and unpaid internships can be helpful at many stages of a career, especially for sectors that are young in Antigua and Barbuda where foreign consultants have a competitive advantage. Most internships are geared towards students in a formal education program, but many internships also accept focused people with relevant background and interests. Internships provide: experience working in different environments before graduating, the opportunity to get to know how to work in a company or agency before accepting a job there, and the chance to make contacts that may be helpful throughout a career.

Securing an internship is not as difficult or expensive as a university degree or finding a permanent job, as many companies are eager to engage interested and motivated people in their field. Internships can be arranged by lists or on-line searches, but the best approach is to network by “word of mouth.” Applicants can search individual company websites for internship opportunities, as most are listed on company job search pages and contain a category for internships. Large companies offer more opportunities than small companies, and are more likely to have formal internship programs. The small businesses more typical of Antigua and Barbuda would rely more on networks of contacts. Such contacts include teachers and training instructors who can point to specific companies with intern programs.

Government agencies such as the Antigua and Barbuda National Training Agency (ABNTA)[4] can also help match internships to interested parties. Even if there are not specific programs tailored for renewable energy, a sponsoring agency can include clean energy topics. Non-profit agencies are more likely to offer technical internship programs. A national coordinator such as ABNTA could work with businesses, educational institutions, and training programs in Antigua and Barbuda to create internship opportunities in the clean energy sector.

With robust industry support, students will get applied learning experiences to enrich their formal classroom learning. People will migrate if they do not find training opportunities, so one idea is to seek internship opportunities abroad. This will not only provide a good technical experience but provide an exposure to newer technologies and approaches.

### *Apprenticeships*

The Antigua and Barbuda government has a role in regulating apprenticeship programs to ensure they adequately prepare apprentices to practice. An apprenticeship is an occupational training that is required to progress through a licensure regime, for example, from apprentice to journeyman to master electrician. Apprenticeships combine supervised on-the-job training experience with classroom instruction. Apprentices usually begin at half the salary of journey workers (those who have completed their training and have industry certification). Apprentices receive pay increases as they learn to perform more complex tasks. When they become licensed, they increase their chances of finding a well-paying job in industry. Apprenticeship committees, made up of employee and employer representatives from the specific industries, operate apprenticeship programs. Typically, apprenticeships last two to five years, depending on these requirements imposed by industry and government regulators. Apprentices must attend related classroom training along with gaining on-the-job-training experience. Most programs require approximately 12 hours of classroom training per month. The industry/government committee determines the related training requirements according to industry standards. Apprentices might earn credit towards a degree (e.g., an associate degrees at the Antigua State College) for classroom hours or for the completion of a properly regulated apprenticeship program.

*Examples: Green building construction and maintenance [6]*

### *Professional Development, Continuing Education, and Other In-Company Training*

Companies may find it necessary and a benefit to their employees to provide professional development trainings to ensure that staff remain current in their understanding of clean energy technologies and related standards and policies. Even outside of the company environment, experienced clean energy personnel may find it necessary or an opportunity to participate in additional training, either to maintain current levels of certifications or to potentially be able to access other types of employment given the acquisition of additional skillsets. Professional development and continuing education courses vary in content and length but are often short [6]. Some trainings may be provided by outside organizations, whereas large companies (e.g., multinational resorts) may offer in-house capacity building. [6] This includes technologies providers, such as those that supply green building products, wind turbines, etc., which may provide training as part of their business model, enabling access to local skilled labor.

*Example: Short courses for architects on energy efficient, resilient buildings [6]*

[4] http://www.caribbeanjobs.com/National-Training-Agency-Jobs-193.aspx

### 3.3.4 Additional Outreach and Training Opportunities

Antigua and Barbuda may also want to consider additional opportunities for supporting workforce development and broader outreach, such as community initiatives, creating a regional center or excellence, as well as frequent and wide-reaching job vacancy announcements.

#### *Community Outreach*

Community-based programs might be the first exposure to energy efficiency and renewable energy for people that pursue careers in those fields, as well as the primary way in which consumers of these services and technologies become aware. These programs are important, as a "lack of sufficient knowledge about energy efficiency and retrofitting by many household and building owners is a significant factor limiting investment in retrofitting projects…and is a factor in decisions about incorporating energy efficiency, water efficiency, and other sustainability features in the design of new buildings…" [6]. One idea that was raised during the March 2016 workshop was to utilize advertisement space in bus shelters to promote clean energy messages. This could be one of several valuable and lower-cost opportunities to spread the word on clean energy interventions, with others including use of radio and television spots. Another opportunity identified during the 2016 workshop was to do a train-the-trainer program for community organizers who could then conduct information sessions on "low-hanging fruit" ways to reduce energy costs and improve sustainability in the home and in the community.

*Example: Information campaigns, conferences, publications, and web sites" [6]*

#### *Regional Center of Excellence*

There is an opportunity for an institution to be a regional leader in energy efficiency, resiliency and renewable energy training. Such a "center of expertise" could attract students from other islands and abroad; work with the Antigua State College; merge tourism and education and research; and be similar to schools of medicine and archeology on Antigua and Barbuda. The Antigua and Barbuda Institute of Technology was trying to do something similar with computer technology. Medical schools succeed because the high value of the medical education justifies the travel costs, and they are private for-profit enterprises and have more autonomy. Antigua and Barbuda, if it develops a strong skills-based clean energy sector, could export this expertise to other OECS islands.

#### *Announcing Job Opportunities and Fair Procurement Procedures*

To successfully realize the objectives of this strategy, it is important to provide full and fair access to information on job and training opportunities. Mechanisms to communicate opportunities, and explain the processes involved in expressing an interest in these opportunities include:

- Word of mouth/referral
- Job fairs
- Print advertising/newspaper help wanted ads
- Workforce investment board referrals
- Social media tools such as LinkedIn, Twitter, or Facebook
- College/school recruitment
- Online job postings such as Monster.com, HelpWanted.com, KnowYourPros.com, CallForProposals.com
- Industry employment websites/advertisements
- Local job expos

Of these, “Word of mouth/referral” is by far the most effective. Solar firms do not rely heavily on traditional methods of recruitment. Instead, solar firms strongly prefer word of mouth and referrals to fill vacant positions. Other leading means of recruitment are online job postings and seeking out talent through educational institutions.

The Labour Department is a key resource. It is implementing registry of unemployed and job opportunities to match job seekers to vacancies. The registry was revamped in 2014, the Department is building relationships with employers, and the Department has a Facebook page and an interactive website to advertise vacancies.

# 4. Strategy Implementation

This section identifies specific focus areas, action plan, risks, and possible evaluation and reporting requirements.

## 4.1 Focus Areas

Table 3. shows where strategic partnerships with government, industry and community stakeholders could be formed to leverage workforce development initiatives. The focus areas for this strategy have been designed to incorporate short-, medium- and long-term activities that focus on various sectors of the community and training providers. Short term is typically activities that can be accomplished within one year, while medium term ranges between two and three years and long-term is anything over three years. This approach aims to support a diverse workforce, which is sustainable over the long term.

**Table 3. Action Plan for Workforce Strategy Implementation**

| Timeframe | Action Item | Responsible Party and Deadline |
|---|---|---|
| **Short term** | **Identify labor market needs**<br>The Antigua and Barbuda National Training Agency (ABNTA) will conduct a gap analysis through a survey and interviews to identify a) relevant workforce training providers and b) highlight the gap between the skills that trainees already possess and those needed to be marketable to clean energy employers. This analysis is similar to what has been done for other topic areas, such as the hospitality sector and the results of the study will inform workforce strategies moving forward. | **Antigua and Barbuda National Training Agency**<br>**By January 2017** |
| | **Issue high-quality standards and manage credentialing**<br>Elect an agency or committee to conduct a number of activities, such as a) develop a list of required credentials involving objective and transparent assessments according to well-developed sets of criteria, requirements, and standards, to ensure not only safety and quality in the workforce, but also, the industry's long-term success. (Examples of existing credentialing bodies provided in Section 3.2); b) manage the certification process confirming on- and off-island credentials; c) Identify 'micro-credentialing' opportunities; d) incorporate accreditation standards into workforce development efforts so training program providers can be assured that their students will gain the skills and training that they require to succeed, and employees know what they are getting when they hire a credentialed worker. | **Accreditation Board and the Technical Advisory Committee (TAC)**<br>**By January 2017** |
| | **Implement stable utility interconnection policies**<br>Use examples of stable utility interconnection policies as examples and revise for Antigua and Barbuda. The clean energy industry benefits from policies and incentives that | **APUA has the legal authority but the Energy Unit should be involved. Cabinet mat also have to ratify as a means of dispute settlement**<br>**By January 2017** |

| | | |
|---|---|---|
| | accelerate growth and help bring the industry to scale. Employers cite unstable or hostile interconnect policies as the main impediment and customs incentives as the main driver of industry and employment growth.<br><br>**Develop high-skills training programs**<br>Training providers will create curriculum to train the workforce, or identify trainings that are required off-island to be certified. Options for integration into A&B's education system are through comprehensive entry-level programs through technical high schools, community-based organizations, and community colleges that prepare lower-skilled workers to move into more highly skilled occupations. Training should be compiled for a) installation, b) the procurement process (e.g., how to create a competitive bid in response to requests for proposals), c) operations and maintenance of systems. Through this program a "match-making" approach should be implemented for apprenticeships/internships and interested parties. | **APUA has already trained PV installers. However, perhaps we should seek to have them transfer the course modalities to the State College**<br>**By September 2017** |
| **Medium term** | **Provide clear, transparent, and adjustable policies**<br>Policymakers and decision makers will collaborate to make a multi-year, staged policy strategy that provides near-term incentive for market development without risking environmental considerations. Policies should address clean energy, energy efficiency, sustainable development and resilient buildings. | **Ministry of Energy (energy)**<br>**Department of Environment (sustainable development)**<br>**Development Control Authority (building code)**<br>**By January 2018** |
| **Long term** | **Integrate renewable energy, energy efficiency, and resilient building curricula into traditional mainstream coursework**<br>Curriculum writers will work with training providers and educators to include clean energy skills along with other training programs and help ensure that program graduates are diverse enough to be successful in numerous clean energy fields, educating a generation of clean energy consumers utilizing the public education system.<br><br>**Industry directly supports high-quality training**<br>The A&B government will engage industry through "advisory boards" at institutions; through donating time and equipment for practical educational experiences; and by providing field trips and sharing information.<br><br>**Financial support for trainees**<br>A&B has two revolving loan programmes, the National Student Loan Fund under the Ministry of Finance and the SIRF | **Ministry of Education**<br>**By January 2017**<br><br>**APUA & Antigua State College (ASC)**<br>**By December 2017**<br><br>**Ministry of Finance/Department of Environment**<br>**By January 2018** |

| | |
|---|---|
| | Fund under the DoE, that could be capitalized through industry contributions, creating a mechanism for supporting clean energy projects and workforce development into the future. Financial support (e.g., scholarships and loans) could solve the potential problem of workers not being able to afford training until they get a job, but needing qualifications to get a job. |

## 4.2 Risk Analysis of Key Challenges to Successful Implementation

In consideration of the skills context of Antigua and Barbuda, a risk assessment determines the key challenges and focus areas for the workforce development strategy. Table 4 includes risks/challenges that have been identified, and that serve as drivers for the development of appropriate and responsive programs and strategies.

**Table 4. Risk Types and Descriptions**

| Risk | Description |
|---|---|
| **Labor supply** | Shortfalls in labor supply can occur when there is a sharp increase in demand or a lack of interest such jobs [5]. Because clean energy jobs are based around projects, market booms and busts can significantly impact employment levels. |
| **Workforce competency** | There is a risk that the workforce is not competent to meet industry requirements without structured learning. Most employers experience some difficulty in recruiting qualified employees, which impacts workforce competency. Main reasons cited for worker application deficiency include [2]:<br>• Not enough applicants with required technical experience<br>• Competition from other companies<br>• Applicants demonstrated poor work ethic<br>• Lack of networking or other opportunities to meet prospective applicants<br>• Not enough applicants with required education<br>• Applicants had deficiencies with communications, problem solving, or analytical abilities.<br><br>A lack in appropriate competency could result in these skills being procured outside of Antigua and Barbuda or in poor quality projects being installed. Regarding poor quality, example implications include problems with:<br>• Insulation, which may lead to higher cooling costs than planned, higher carbon emissions and lower comfort<br>• Renewable energy systems that can result in a lower energy yield of useful energy than planned, this makes the technology less economically viable, reduces its impact on carbon emissions, and may shift the lifecycle impact on carbon emissions against the technology<br>• The design of heating and cooling systems and with building environmental controls that can cause them to consumer more energy than necessary, resulting in higher carbon emission than necessary, while at the same time compromising comfort." [6] |
| **Training capacity** | The capacity and capability of training providers may be insufficient to respond to rapid accelerated growth in workforce demand. It can be difficult for training providers to quickly respond to rapid changes in requirements for workforce skills [5]. This is because it takes some time for course providers to develop new |

| Risk | Description |
|---|---|
| | curriculum [5]. "The absolute minimum delay between recognizing a need and providing new graduates is the duration of the course, which for many relevant types of skill will be two, three, four or more years for an initial education or training course. Even for a course design to provide specialist skills to people with a relevant existing qualification, the course duration may be anything from a few weeks to perhaps two years." Also, developing a new course is an investment that a training institution expects to recoup over time as the training is delivered on multiple occasions [5]. |
| **Generic programs** | Generic competency based training packages may be misaligned with specific project needs. Trainings must be adapted to match standards. |
| **Replacement demand** | Loss of skills, experience, knowledge over time. This can be addressed with continuing education and professional development programs. |
| **Community impacts** | Recruitment of a new workforce might draw skilled labor from traditional occupations in the local community and local businesses may experience difficulties in replacing a large number of employees. One barrier to renewable energy deployment is concern regarding the impact on APUA workforce; penetration of renewable energy should not put APUA personnel out of work. Training should engage APUA in training for people involved in grid stability and grid upgrades needed to accommodate high-penetration of renewable energy, as well as engage the APUA workforce in renewable energy deployments. |
| **Regulatory and policy framework** | The opportunity for workforce growth in Antigua and Barbuda is a direct reflection of the strength, transparency, and bankability of national clean energy policies.<br><br>There is also risk in having APUA as the single off-taker of power sales. Legislation that would allow wheeling to other customers and payment to APUA for transmission or distribution costs would help address this risk. |
| **Grant funding for training** | Antigua and Barbuda is a highly indebted nation and has very limited public finance available. Grant funding to implement the training programme is necessary to catalyze private finance in clean energy in the island. |
| **Clean energy investments** | Investing in clean energy workforce development will only be worthwhile if the country transitions to a clean energy economy, and this will require considerable investments in to these technologies in Antigua and Barbuda |

## 4.3 Reporting and Evaluation

The evaluation of progress against workforce and training objectives will occur through Monitoring, Reporting, and Review (MRR). In general, MRR is designed to:

- Respond to conditions on monitoring social impacts
- Outline internal processes for monitoring performance indicators of implementation
- Outline an external reporting framework through which key stakeholders can receive information on implementation and progress
- Identify known performance indicators (KPIs) specific to workforce and training targets will likely include:
  - Proportion of people employed nationally, regionally, and internationally
  - Proportion of the workforce comprised of under-represented groups (e.g. women)
  - Participation in training opportunities, including enrollment and completion rates
  - Participation in apprenticeships

- Satisfaction of industry and partner agencies with engagement and delivery process determined through surveys and consultations

Educational institutions will report on courses delivered and the number of people trained. Industry will also report on employment, training, and development figures, including details of the number of workers and types of skills hired. Evaluation and reporting will be undertaken in consultation with key stakeholders including Antigua and Barbuda National Training Agency; the Ministry of Energy; the Ministry of Legal Affairs, Public Safety, Immigration and Labour; the Antigua and Barbuda Coalition of Service Industries; and the Community Development Division.

## 5. Budget

The following is a budget estimate for key elements of the workforce development strategy.

| Organization | Sum of Budget EC |
|---|---|
| **Bureau of Standards, Development Control Authority** | **$2,180,000** |
| Establish codes and zoning policies | $1,200,000 |
| Train on codes | $300,000 |
| Identify standards for adoption into EE building codes | $180,000 |
| Identify standards for adoption into resiliency codes | $280,000 |
| Establish qualification system for codes | $220,000 |
| **Contractors** | **$380,000** |
| Design of Trainings | |
| Outreach to disabled/disadvantaged | $300,000 |
| Identify Skills to support projects | $80,000 |
| **Department of the Environment** | **$2,440,000** |
| Develop national resources management policy for energy resources | $280,000 |
| Issue pollution permits | $800,000 |
| Lead implementation of projects | $400,000 |
| Set emissions standards | $400,000 |
| Convene stakeholders (workshops) | $320,000 |
| Plan and Report | $240,000 |
| **Directorate of Gender Affairs; Community Development Division; Professional Organization for Women in** | **$1,350,000** |
| Sponsor mentorships | $450,000 |
| Outreach to women | $900,000 |
| **Labour Department** | **$320,000** |
| Issue job announcements | $200,000 |
| Survey labor force | $120,000 |
| **Liaison to Donor Agencies** | **$120,000** |
| Identify specific workforce development activities | $120,000 |
| | |
| **Ministry of Public Utilities, Civil Aviation and Transportation, APUA Electricity Unit** | **$1,800,000** |
| Employ and train | $800,000 |
| Originate projects | $600,000 |
| Recruit workforce | $400,000 |
| **Ministry of Tourism, Economic Development, Investment & Energ** | **$1,600,000** |
| Engage hospitality industry | $400,000 |
| Establish interconnection policy | $400,000 |
| Establish utility regulations for EE and RE | $800,000 |
| **National Solid Waste Management Authority** | **$140,000** |
| Identify staffing and training requirements for landfill energy projects | $140,000 |

| | |
|---|---|
| **National Training Agency** | **$1,700,000** |
| Provide required training | $1,400,000 |
| Set training standards | $300,000 |
| **Grand Total** | **EC$12,030,000** |

## 6. Potential Partner Initiatives

Antigua and Barbuda could consider partnering with any of the following initiatives to help implement aspects of this strategy (e.g., developing a vocational training program or offering an entrepreneurial mentorship). Or, in some cases, these organizations may have done preparatory work off of which Antigua and Barbuda could build (e.g., the CARCIOM Technical and Vocational Education and Training Strategy).

**Table 5. Potential Partners, Initiatives and Descriptions**

| Organization | Program Description |
|---|---|
| **Organization of Eastern Caribbean States (OECS)** | The OECS can provide sub-regional training for member states, which would be relevant since OECS is working towards a more common framework for climate-related standards. |
| **Green Climate Fund (GCF)** | Although the GCF focuses on concrete adaptation and mitigation projects, the GCF provides Readiness support to countries to build capacity, and Antigua and Barbuda's Readiness allocation could be programmed to provide training and capacity building |
| **New Joint Initiative of the Inter-American Development Bank, Caribbean Development Bank, United States Department of Energy, and the Caribbean Community** | This Memorandum of Understanding provides that these organizations will collaborate to support strategic projects, activities, and programs developed in cooperation with regional governments in the Caribbean, including non-reimbursable technical assistance and programs to promote knowledge exchanges, capacity building activities, and to help mobilize technical assistance.<br><br>*More information: http://www.iadb.org/en/news/news-releases/2016-05-05/idb-cdb-caricom-usdoe-offer-caribbean-energy-aid,11461.html* |
| **CARICOM Regional Technical and Vocational Education and Training Strategy** | The strategy, developed in 2014, is a 5-year program that provides "stakeholders, policymakers, practitioners and clients with a framework that will develop and certify, to international standards, the competence and productive capacities of the region's workforce."<br><br>*More information: http://www.collegesinstitutes.ca/wp-content/uploads/2014/09/CARICOM_Carribean_Report_September12.pdf* |
| **Organization of American States - Energy and Climate Partnership of the Americas** | Various regional initiatives including capacity building and educational programs.<br><br>*More information: http://www.ecpamericas.org/Initiatives/default.aspx?id=88 and http://www.oas.org/en/sedi/dsd/Energy/SECBI/SECBI_default.asp* |
| **Organization of American States - Caribbean Energy Education and Awareness Programme** | The European Union funded the Caribbean Sustainable Energy Program (CSEP), which comprised the pilot initiative "Caribbean Energy Education and Awareness Program" (CEEAP) and the communication campaign "Learn and Save". The program yielded educational materials for teachers and students in primary and secondary schools, developed by the OAS/DSD in partnership with science teachers and staff from ministries of education.<br>http://www.oas.org/en/sedi/dsd/Energy/CEEAP1.asp |
| **CARICOM Building Codes and Minimum Performance** | 'The CARICOM Energy Programme with support from the Renewable Energy and Energy Efficiency (REETA) Project has been collaborating with the CARICOM |

| Organization | Program Description |
|---|---|
| **Standards** | Regional Organisation for Standards and Quality (CROSSQ) towards the development of a Draft Energy Codes for Building as well the Minimum Energy Performance Standards (MEPS) for public buildings within the Region by the end of 2015.'<br><br>*More information: http://caricom.org/projects/detail/minimum-energy-performance-standards-meps* |
| **Clinton Foundation** | The Clinton Foundation focuses its efforts in Latin America and the Caribbean on "strengthening economic development by training individuals in underserved communities with marketable job skills, providing small business and micro-enterprises with greater market access, and working with city governments to implement green technologies." This includes a distinct Islands Energy Program.<br><br>*More information: https://www.clintonfoundation.org/our-work/by-region/latin-america-caribbean and* https://www.clintonfoundation.org/our-work/clinton-climate-initiative/programs/islands-energy-program |
| **Branson Centre for Entrepreneurship, Caribbean** | "The centre specifically recruits entrepreneurs who are passionate about people, planet, and profit and who can act as socially-minded change makers in their communities. The centre takes a personalized and family-like approach, so that recruits can form meaningful relationships and links to help each other's businesses grow. The centre's entrepreneurs are enrolled onto a training programme where they have access to online learning. Some are also given mentoring and expert advice too."<br><br>*More information: https://www.virgin.com/unite/branson-centre-entrepreneurship-caribbean* |
| **Caribbean Centre for Renewable Energy and Energy Efficiency** | The CCREEE offers regional capacity building efforts, including development of training competency standards and certification and accreditation schemes; coordination of national training centres and related accreditation programs; implementation of train-the-trainer workshops; baseline industry assessments; trainings for utilities on renewable energy grid integration and stability; and, provision of targeted business development training for clean-tech SMEs and entrepreneurs (e.g., energy auditors, equipment installers, renewable energy service providers).<br><br>*More information: http://www.ccreee.org/content/capacity-development* |

## Appendix A: Policies and Legislation

This appendix provides an overview of policies and legislation:

- **Utility Act of 1993:** APUA exclusive right to distribute electricity but allows for IPP with written permission from APUA; $3k fine or 6 months in jail for selling power without permission. But in one area utility power was not available so they were allowed to develop with solar and batteries (off grid, Turtle Bay).
- **National Energy Policy of 2011** (to be reviewed soon); reduce energy cost; reduce energy intensity by 10% from 2010 to 2020; diversify sources into 15% RE by 2030 (already there); increase reliability; protect customer; protect quality of electricity; stimulate environmental protection. 15% "penetration" is exceeded per capacity, but only 5% of Energy (10MW=16.5 GWh).
- **APUA Interconnection Policy:** goal of 15% on grid RE; changed net metering to net billing; dual registry meter; any excess power bought at 45% of retail. 0-5kW net billing; >5kW buy all sell all.
- **RE Act of 2015:** gives Ministry of Energy authority for RE policy. Sets goal of 20% RE by 2020; 20% reduction in energy use; 20% carbon reduction; promotes solar, wind, WTE and geothermal. New tariff structure for on grid solar; creates RE fund to do 10 MW (3 MW airport; 1 MW Barbuda; 4 MW in Bethesda; 2 MW on government facilities in Antigua). Exempts RE from import duties; waiver of customs; no corporate tax; no A+B tax.

The following, additional policies and studies are relevant in the development of a workforce development strategy:

- IRENA Readiness Assessment
- IRENA Grid Stability Study
- World Bank Impacts of Increased RE Penetration in Antigua (by HOMER Energy)
- 2013 Sustainable Energy Scope of Work: http://www.oas.org/en/sedi/dsd/Energy/Doc/EAP_AntiguaBarbuda_web.pdf
- APUA's interconnection standards
- APUA's net billing program
- The RET shall consider the data, analysis and recommendations including within these recent analyses conducted by third parties:
  Wind Data Evaluation of Crabbs Peninsula in Antigua and Barbuda
- 2013 CARICOM Caribbean Sustainable Energy Roadmap: http://www.worldwatch.org/system/files/nPhase%201%20CSERMS%20Summary%20for%20Policymakers%20(1).pdf

The following are highly relevant ongoing projects Antigua and Barbuda is conducting with other international and regional institutions:

- The **National Renewable Energy Laboratory** worked with Antigua and Barbuda on modeling and analysis to inform the country's Intended National Contribution (INDC) submission to the UNFCCC.
- The **World Bank** is exploring providing assistance to Antigua and Barbuda on analysis and recommendations regarding a potential new net-metering/net-billing/feed-in-tariff policy.
- The **Sustainable Island Resource Framework Fund (SIRF)** was established by the Environmental Protection and Management Act of 2015 to raise investment funds for renewable energy technology initiatives, including up to 25 MW of solar, wind, and possibly ocean thermal energy conversion. The

electricity generated will be sold to the national utility, the Antigua Public Utilities Authority (APUA), which has agreed to these purchases. Proceeds from these power purchase agreements will be funneled back to the SIRF in a revolving fund to further other investments. Expenditures or the SIRF are guided by legislation.

  - Antigua and Barbuda have submitted a policy-based Nationally Appropriate Mitigation Actions (NAMA) to the **UNFCCC** requesting financial and technical assistance support. The request is for implementation of sustainable financing for environmental stewardship through capital investments in renewable energy. Revenues generated will be used to fund climate change adaptation and biodiversity conservation.

- **International Renewable Energy Agency (IRENA)** worked with Antigua and Barbuda to provide a renewables readiness assessment (RRA), which is a holistic assessment of conditions for renewable energy deployment in a country, and the actions necessary to further improve conditions.
- Antigua and Barbuda have been working with the United Nation's Environment Programme to create **Sustainable Pathways – Protected Areas and Renewable Energy**, which will formalize an agreement for the SIRF Environment Fund to receive profits from renewable energy systems (see component 2) and increase revenue for protected areas by $2 million annually. The program would initiate the following projects:
  - A pilot installation of 1 to 4MW wind and/or solar energy (which would generate an eventual estimated minimum of $700,000/year for PA management) with feasibility scale up of up to 50% of A&B's energy needs at 25MW,
  - Improve management effectiveness of a financially sustainable pilot protected area -- Mount Obama National Park, *and*
  - Restore surrounding watershed forests key to improved water management and eventual pumped hydro energy storage (to scale up component 2), as well as reduce the threat of fire to forested areas.
- Antigua and Barbuda secured a concessional loan from the **Abu Dhabi Fund for Development (ADFB)** for USD 15 million in 2016 to invest in climate resilient solar and wind capacity

## Appendix B. Stakeholder meeting in Antigua

The three-day stakeholder meetings had over 20 participants, including representatives from the following A&B organizations with seven women and 14 men:

- Ministry of Health & Environment
- National Solid Waste Authority
- Ministry of Tourism, Economic Development, Investment & Energy
- Ministry of Energy
- Ministry of Legal Affairs, Public Safety, Immigration and Labour
- Ministry of Minister of Works and Housing
- AB Coalition of Service Industries
- Royal Police Force
- Community Development Division
- Citizenship by Investment Unit (CIP)
- Themba Biofuels
- Rotary Club of Antigua Sundown (RCAS)
- OSIW Energy Solutions
- FP Electrical Engineering
- Antigua and Barbuda Investment Authority
- Antigua and Barbuda Refrigeration and Air Conditioning (ABRACA) Association
- Fire Department

## Appendix C. References


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