ADAPTATION FUND

PROGRAMME ON INNOVATION:
SMALL GRANTS PROJECTS THROUGH DIRECT ACCESS MODALITY

REQUEST FOR PROJECT FUNDING FROM THE ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project must be fully prepared when the request is submitted.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
1818 H Street NW
MSN P4-400
Washington, D.C., 20433
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Fax: +1 (202) 522-3240/5
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PROGRAMME ON INNOVATION: SMALL GRANT PROJECT PROPOSAL

Country:	Antigua and Barbuda
Title of Project:	Innovative technologies for improved water availability to increase food security in Antigua and Barbuda
National Implementing Entity:	Department of Environment, Ministry of Health, Wellness and the Environment
Executing Entity/ies:	Department of Environment
Amount of Financing Requested:	250,000 USD

Project Background and Context:

Climate Rationale Antigua and Barbuda (A&B) is a twin island state located in the Tropical Atlantic, with a Tropical Maritime climate of alternating dry and wet seasons. Such changes in the precipitation system have direct effects on livelihoods, the economy, and overall development of many small island nations. Experts have long predicted that the frequency and intensity of droughts would increase as a result of climate change, especially in tropical areas.[1]

Due to the island's low elevations, they are heavily prone to experiencing severe droughts. The only elevation of some importance is Boggy Peak, 402 meters (1,319 feet) high, in the southwest of Antigua Island. In Codrington, on the island of Barbuda, rainfall amounts to 1,165 mm (46 in) per year, while in Antigua, it amounts to 1,000 mm (40 in) in the north of the island, to 1.100 mm (43 in) in the southeastern part, and to 1,300 mm (51 in) in the southwest, near Boggy Peak giving a total average annual rainfall of 1,141.25 mm (45.08 in).

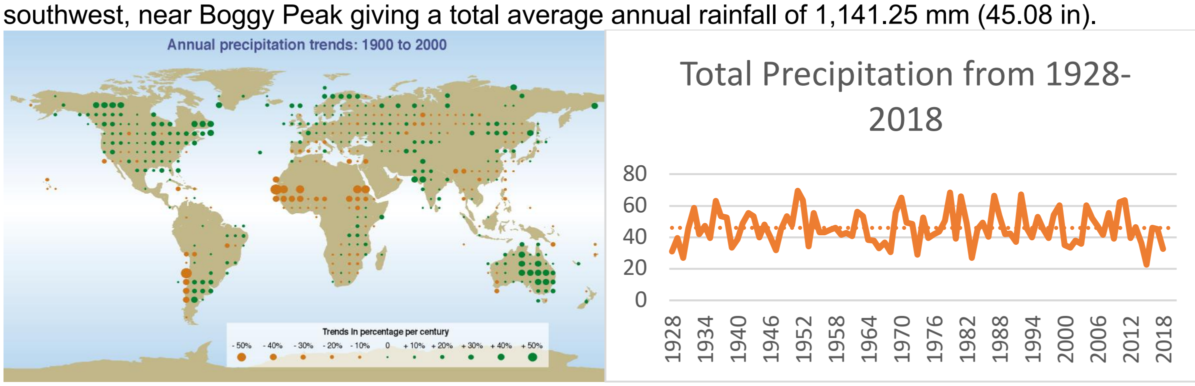

Fig. 1: (a) Global Annual Precipitation trends – 1900 to 2000 and (b) Precipitation totals for Antigua and Barbuda – 1928 to 2018

The dry months runs from January-June with the wet periods from September-November. What is clear is that there has been a decline in precipitation amounts within the last three decades. Moreover, data from the Antigua and Barbuda Meteorological Services indicates that during the September– November rainy seasons, droughts are becoming much more frequent. A total of thirty-two (32) serious- severe droughts occurred in Antigua and Barbuda between 1928 and 2019.[2] The probability of a serious to severe drought in Antigua and Barbuda at least once a year is 28.9%, with at least one in 5 years of 81.8%, and at least one in 10 years of 96.7% chance.

The IPCC technical report on climate change and water[3] concludes that, despite global increases in rainfall, many dry regions including the Caribbean will suffer badly from reduced rainfall and increased evaporation. As a result,

[1] T. Zhao et al. (2015) 'The Magnitude and Causes of Global Drought Changes in the Twenty-First Century under a Low–Moderate Emissions Scenario', Journal of Climate, 28
[2] ABMS, 2019. Droughts. http://www.antiguamet.com/Climate/STATS/anu_drought.html
[3] https://www.ipcc.ch/publication/climate-change-and-water-2/

the IPCC special report on climate change adaptation estimates that around one billion people in dry regions may face increasing water scarcity.

There is mounting evidence that climate change is likely to be contributing to higher temperatures in the region, and that increased temperatures are exacerbating the impacts of drought. Higher temperatures result in greater evaporation, meaning soil moisture is reduced, reinforcing drier conditions and intensifying the impacts of failed rains. This will either result in economic, environmental and social impacts or all, since crops and pasture will have less water, and the chance of failed harvests or lack of feed for livestock increases.

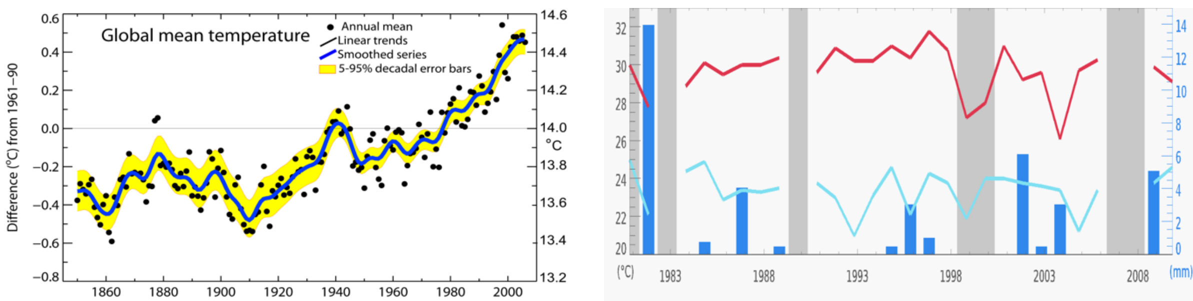

Fig. 2: (a) Global mean temperature rise from 1850 to 2000 and (b) Mean Temperature for Antigua and Barbuda – 1990 to 2010

There has also been a significant increasing trend in the overall number of tropical cyclones[4], or in the intensity of tropical cyclones, in the North Atlantic Ocean over the period 1989–2019. The islands have a return period for tropical cyclones of 1.45 years or a 71.4% probability chance of being affected by at least one (1) storm in an active season. These statistics are important because these systems have the potential to contaminate fresh water sources. In 2017, Hurricane Irma brought a storm surge to the island of Barbuda that resulted in 100% saltwater inundation of surface and groundwater.

Sea levels globally have been rising and is accelerating according to the Intergovernmental Panel on Climate Change (IPCC) in their special report on the Oceans and Cryosphere in a changing Climate (SROCC). Without proper adaptation, SLR will affect land and water resources in Antigua and Barbuda, mainly through land submergence, soil and fresh groundwater resources salinisation (contamination), and land loss due to permanent coastal erosion, with consequences on production, livelihood diversification and food security[5]. There is strong evidence that, under most climate change scenarios, water resources in small islands are likely to be seriously compromised[6].

Antigua and Barbuda is likely to experience increased water stress as a result of climate change. Reduced rainfall in summer is projected under all SRES scenarios, so that it is unlikely that demand would be met during low rainfall periods. With more demand for water for irrigation and loss of water through contamination due to salt intrusion, the most common solution is to increase water supply in Antigua and Barbuda by adaptation. A way of insuring against possible climate change impacts, is the engineered redistribution of freshwater over space and time: reservoirs to store it, pipelines to transfer it, and desalination to recover freshwater from the oceans.

[4] https://www.climatesignals.org/climate-signals/intense-atlantic-hurricane-frequency-increase
[5] https://www.ipcc.ch/srocc/chapter/chapter-4-sea-level-rise-and-implications-for-low-lying-islands-coasts-and-communities/
[6] https://www.ipcc.ch/report/ar5/wg2/

Economic, Social, and Environmental Context
Over the past few decades, Antigua and Barbuda has transitioned from a mainly agrarian economy to a tourism-based economy. According to the CIA World Fact Book, tourism accounts for nearly 60% of GDP, while agriculture accounts for roughly 3% of GDP.[7] The dual-island nation's agricultural production is focused on the domestic market and is constrained by a labour shortages, as well as a limited water supply caused by intense drought periods.

To cope with increased frequency and intensity of droughts, energy intensive RO desalination plants have been utilized to provide in excess of 60% of all potable water to the islands. This has made the potable water supply more expensive for Antigua and Barbuda, which already suffers from a high debt to GDP ratio. This added expense has further limited the government's ability to ensure consistent water supply for the population. The expense of water has consequences for the agricultural communities who depend heavily on rainfall for crop production and are not often prioritized due to the sector's limited contribution to GDP. This has severe implications for food security and nutrition within the country as limited water can result in limited agricultural production and a greater reliance on imported goods.

Furthermore, increased drought conditions and the passage of more intense hurricanes and tropical storms have increased the cost of doing business for farmers and local sellers, many of whom have limited access to financial resources outside of agriculture and are thus particularly vulnerable to climate change events. Over 90% of registered farmers, of whom 78% are male (Table 1) are reported to lease government land from the Ministry of Agriculture for farming activities.[8] Most farmers, can be characterized as non-traditional subsistence farmers where despite the goal of sustenance for one's household, farmers still plan and produce enough to also sell within the local market: the remainder of farmers operate solely for commercial purposes. Most have limited formal education and generally depend on traditional water conservation methods for the purpose of affordability.

The lack of land ownership is a significant barrier for farmers accessing loans from traditional financing institutions and thus investing in advance adaptation measures for drought conditions as well as hurricanes and tropical storms. Further, even as non-traditional subsistence farmers, the large majority generally farm year round as is common with subsistence farmers with no contingency plan for loss of harvest due to drought conditions or tropical storms and hurricanes during the year[9]; in addition, due to severe budget constraints within the Ministry of Agriculture, the government is unable to provide assistance for farmers and there are no registered NGO groups or unions representing the interest of the farming community.

Table 1: Farmers Registered with Central Market Cooperation By Sector

T3: FARMERS REGISTERED WITH CENTRAL MARKETING COOPERATION BY SEX

SEX	No.	Total %
Number of Males	62	77.5%
Number of Females	16	20%
Unknown	2	

Source: Country Gender Assessment Report (2015), Antigua and Barbuda

Within the agricultural community, the role of women is often overlooked as they account for around 20% of registered farmers (both crop and livestock farmers) (Table 1). However, women are reported to contribute considerably to the agricultural sector through managing its business operations, selling produce at the public market or within small shops in the villages through formal and informal employment. Some women, particularly elderly women, participate in "home gardening, which is unregistered at the Ministry of Agriculture and operates within the method of functioning which characterizes a traditional subsistence farmer. Low harvest yields

[7] Country Gender Assessment Report, 2015, Prepared by Tamara Huggins of Rawwida Baksh & Associates for the Caribbean Development Bank http://www.caribank.org/uploads/2014/12/CGA-AB-Vol-I-_JUNE-2014_FINAL.pd
[8] Bailey, G. and Aska, A. (2020). *A Gender Assessment of the Agricultural sector (farming) in Antigua and Barbuda*
[9] ibid

necessitate these small business owners or informal employers to rely on imported produce, which add a major expense to its operations that would not be as significant for larger businesses. Small businesses are then forced to sell produce at a more expensive rate, disadvantaging the most vulnerable populations who depend on affordable agricultural produce from the local market or village shops. This can be seen in St. John's City where the Public Market Complex operates and the St. Phillips parish, a generally rural area with large-scale agriculture: both of which have the highest rates of poverty in Antigua (Table 2).

Table 2. Head Count Index By District

District	Headcount (% of population poor)
St. John's City	22.29
St. John's Rural	18.41
St. Paul	15.63
St. Mary	13.57
St. George	12.28
St. Peter	15.03
St. Philip	25.85
Barbuda	10.53
All Antigua & Barbuda	18.36

Furthermore, whereas farmers may receive small assistance from international organizations such as the Food and Agriculture Organisation (FAO) as a result of significant loss from a natural disaster, as the primary role of women in agriculture is business related, the direct and indirect damages for such businesses is not assessed and women are unable to access assistance for the loss to business due to climate change impacts. This also applies for home gardening which is unregistered and informal.

The passage of hurricane Irma in Barbuda demonstrated the long-lasting effect of hurricanes and tropical storms on agriculture along with drought conditions. In addition to the destruction of crops, severe damage to the main RO facility and saltwater intrusion in the local wells have prevented large scale farming as well as home gardening on the twin-island state. The increase in hurricane frequency and intensity for Antigua indicates the vulnerability of the agricultural sector to the conditions which now exist in Barbuda due to Hurricane Irma.

Water in Antigua:

Historically potable water in Antigua and Barbuda has come from dug wells, water catchment, and the few natural small bodies of fresh water on the islands. Currently due to the growing populations, saltwater intrusion, increasing frequency and intensity of droughts, and growing consumption from natural storage, potable water on the islands must now be provided by desalination. There are four (4) reverse osmosis desalination plants on the island of Antigua. The main reverse osmosis (RO) plant on Antigua is collocated with the majority of the island's energy infrastructure on the low lying Crabbs peninsula on the North Eastern portion of island. It produces in excess of 4,000,000 gallons of potable water per day. The other 4 plants provide the other 2,500,000 gallons of capacity that is produced each day.

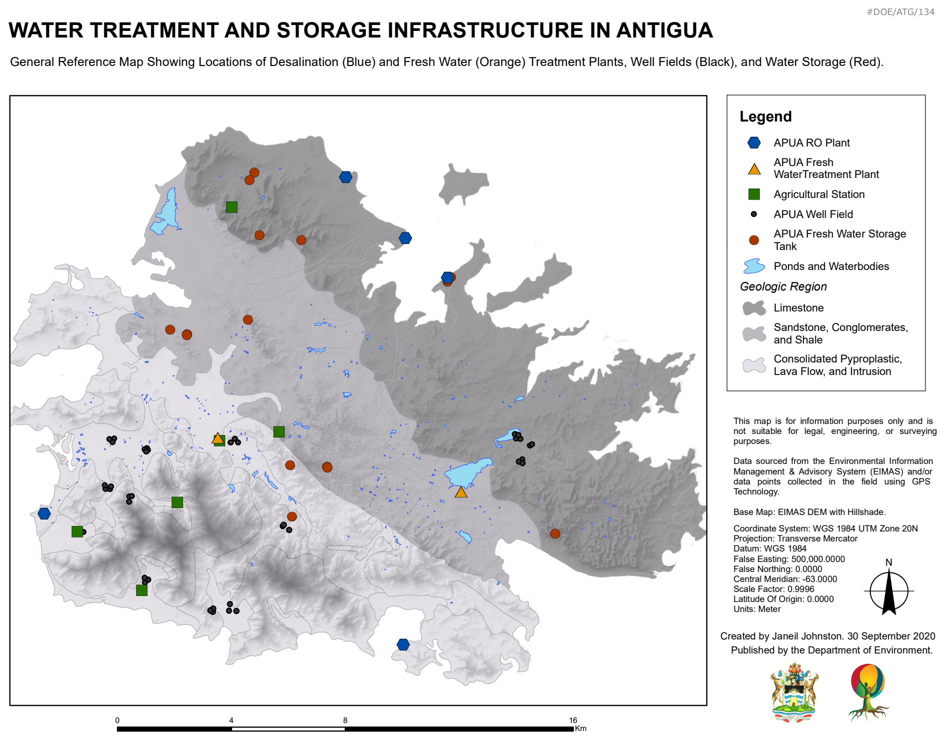

Figure 1: Water Treatment and Storage Infrastructure in Antigua

Due to cracks in distribution infrastructure and leaks in water storage tanks, over 2,600,000 gallons of water that is produced each day is lost[10]. Fractures in water distribution infrastructure also allow for intrusion of undetermined amounts of contaminants and pollutants into the water before it reaches it point of use. Resultantly, residents of Antigua are unable to safely consume the water that reaches their homes, businesses, and shelters. Residents rely on bottled water in the form of 5-gallon water jugs that are filled at locations and businesses around the country, or on small plastic water bottles which inevitably contribute to the countries growing solid waste management issues. Having to purchase drinking water, in addition to paying for the water from the national distribution system can place an additional financial strain on residents, especially the most vulnerable populations.

Currently all RO facilities are dependent on the national electrical grid to function. The national grid is also plagued by high frequency of failures, and high inefficiencies. Energy generation and transmission is also very vulnerable to the increasing frequency and intensity of extreme weather events.

Water use in agriculture in Antigua and Barbuda:

Small scale agriculture is mainly rainfed with heavy reliance on surface water sources and water provided by Antigua Pubic Utilities Authority (APUA). Drip irrigations is utilized by both medium and large-scale farming operations. It is the purview of APUA to supply the water resources to farmers. Antigua and Barbuda's Food and Nutrition security Policy has identified 6 major water supply challenges facing farmers in the country[11]:

1. Accelerated depletion of groundwater due to saline intrusion
2. High cost of water production from RO
3. High water transport cost to remote areas
4. Inadequate water catchment

[10] Joseph, C (November 29,2019) APUA to spend $30 million on water network. Retrieved from: https://www.antiguaobserver.com/apua-to-spend-30-million-on-water-network/

[11] Government of Antigua and Barbuda (2012) Food and nutrition security policy. Retrieved from: http://agriculture.gov.ag/wp-content/uploads/2016/09/FINAL_2012_Antigua_and_Barbuda_Food_and_Nutrition_Security_Policy_10_15_12.pdf

5. Chemical contamination of water resources due to chemical misuse
6. Proximity of farms to water resources

This project will address 4 of these 6 challenges, by desalinating ground water resources used for agriculture, lowering the cost of water production for farmers, lowering the cost of water transport, and providing water storage to lieu of increasing catchment areas. As these technologies are self-powered through renewable energy, they also serve as a continuous source of water for farmers when the utility company is unable to provide water due to the passage of a hurricane or tropical storm. The project will also provide financial analysis for additional adaptation technologies for agriculture in Antigua and Barbuda

Project Objectives:

This project aims to improve food security in Antigua and Barbuda by facilitating the availability and use of ground or surface water for agricultural purposes via innovative technologies. The proposed technologies for demonstration purposes run on self-generating renewable power, making them resilient to disruptions from grid instabilities or extreme climate events, and are aligned with the country's Nationally Determined Contribution (NDC) target of transitioning to 100% renewable energy by 2030. Currently, water for agriculture is provided by RO plants or through surface water catchments. The electrical grid that powers the RO plants run on heavy fuel oil, creating a large dependency for both the food and water sector on the importation and combustion of fossil fuels. This project would introduce technologies that have not been tested in the Agriculture Sector of Antigua and are new to the market.

There are two main objectives in this project, which correspond to the two components describes below. The objectives are to:

1) Demonstrate the application of two different innovative technologies for water provision in the agriculture sector. These demonstrations will i) provide water for agriculture to vulnerable populations facing water scarcity, and ii) provide information on the application of these technologies in Antigua and Barbuda to inform policy standards and potential scale-up projects.
2) Assess and develop policy standards to promote further uptake of innovative technologies to increase water availability for agriculture. This will be done through i) an assessment of technology gaps and needs in the agriculture sector with respect to water use through innovation proposals by schools and farmers, ii) an assessment of policy standards with recommendations, iii) development of a financing strategy to promote scaling up of these technologies in the country, iv) provision of a technical package for early up-takers to support them in accessing finance options, and v) knowledge sharing of key technologies identified with stakeholders.

Project Components and Financing:

Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
Component 1: Test the use of innovative technology to increase availability of water for agriculture.	**Output 1.1:** Demonstration of solar powered RO technology at main agriculture sites. **Output: 1.2:** Demonstration of solar-powered water pump at three farms.	**Outcome 1.1.** Test innovative technology to increase the availability of water for agriculture. **Outcome 1.2.** Standards and policy developed to ensure sustained availability of water for agriculture.	208,530
Component 2: Standards and policy developed to ensure	**Output 2.1:** Development of an Agriculture Technology Assessment	**Outcome 2.1.** Additional adaptation technologies are	24,255

sustained availability of water for agriculture.	in line with National Technology Needs Assessment (TNA) and the National Adaptation Plan (NAP). **Output 2.2:** Assessment of the potential for market mainstreaming of new technologies for the Agriculture Sector.	identified and selected for scale up. **Outcome 2.2.** New RE technologies for the Agriculture Sector mainstreamed	
6. Project Execution cost			2,715
7. Total Project Cost			232,785
8. Project Cycle Management Fee charged by the Implementing Entity (if applicable)			14,500
Amount of Financing Requested			250,000

Projected Calendar:

Milestones	Expected Dates
Start of Project Implementation	September 2020
Project Closing	August 2023
Terminal Evaluation	May 2024

PART II: PROJECT JUSTIFICATION [12]

A. Project Components

Component 1: Test the use of innovative technology to increase availability of water for agriculture.

A Technology Needs Assessment was conducted in 2020 by the Department of Environment to identify technologies for the water sector through examination of the current and future climate threats, natural landscape, socio-cultural and natural adaptive capacity. Of the potential technologies that could be tested in Antigua and Barbuda to meet the overarching objective of the project, two were selected for demonstration for this project: i) solar powered reverse osmosis units, and ii) solar powered water pumps. Both of the technologies and the justification for their selection are described below in their respective outputs.

Output 1.1:* *Demonstration of solar powered RO technology at main agriculture sites.

The first technology that has been identified to meet the objective of this project is the SolarRO 1500 solar photo voltaic (PV) powered desalination unit. The SolarRO 1500 is a brackish water (BW) or saltwater (SW), containerized reverse osmosis (RO) desalination unit that is designed to function solely on solar energy. The SolarRO 1500 operates with sixteen (16) 275 W solar panels and can also function on a small 3kW generator if needed. Feed water is drawn from a source (brackish or saltwater) utilizing a pump, upon reaching the Solar RO unit, the feed water is passed through a 3-stage water filtration process. This is necessary to remove debris and particulate matter that could damage or foul the RO membranes. Once feed water has been filtered, it is pressurized to 16 Bar for brackish water (approximately 232 PSI)[13] or 58 Bar for sea water (approximately 841 PSI)[14] and passed over the

[12] Parts II and III should jointly not exceed 10 pages.
[13] Solar Water Solutions (n.d.) SolarRO PRO 1500. Retrieved from: https://solarwatersolutions.fi/en/shop/solaro-pro-1500/
[14] Solar Water Solutions (n.d.) SolarRO PRO 1500 SW. Retrieved from: https://solarwatersolutions.fi/en/shop/solaro-pro-1500-sw/

partially permeable RO membranes. Dissolved Particlesare unable to pass through the RO membrane, allowing for only H_2O to pass. Finally, this fresh water is treated with a UV lamp to destroy any removing biological contaminants such as bacteria or viruses that may have been able to pass through the RO membrane.

This process is very similar to the current RO technology for potable water production in Antigua. However, there are key differences. The first of which being that the SolarRO unit operates on 100% self-generated renewable energy whereas the main RO plants function on energy generated from the combustion of heavy fuel oil (HFO). Utilizing renewable energy greatly reduces the cost of water production and enables the SolarRO unit to continue to function in the event of a grid outage. Secondly, the main RO plants do not have UV water treatment systems to eliminate biological contaminants. Coupled with cracks in existing water distribution infrastructure allowing for the ingress of biological contamination, fresh water from the country's main RO facilities is not recommended for drinking. As the SolarRO unit has UV treatment systems and is not connected to a distribution system, its water production is safe for consumption. Finally, the SolarRO unit is portable and can be relocated to where it is most needed. Coupled with the ability to treat brackish water as well as seawater, the SolarRO units enable the use of groundwater resources which are currently contaminated due to seawater intrusion.

The deployment of standalone SolarRO units will have a positive impact on the resilience of the agriculture sector in Antigua as well as create much needed water security in the event of extreme climate event or natural disasters.

The passage of Hurricane Irma in Barbuda and the saltwater intrusion in the ground water sources does demonstrate the need for such technologies to revitalize its agricultural sector. However, current challenges in Barbuda would prevent the successful demonstration of the technology and thus the potential for an upscale of the technology use in Barbuda. These challenges include:

- An agricultural site in the highlands for Barbuda was identified for the demonstration site. This comprised of near 35 acres of former agricultural lands located near the Barbuda highlands. It was proposed that the technologies would assist in the revitalization of agriculture on these sites by treating the man-made wells at the site which have been contaminated by saltwater intrusion. However, the Department has identified challenges to agriculture in Barbuda which may present a risk to the successful deployment of the new technology in Barbuda. This primary relates to limited staff and the site has gone into disrepair. The testing of the technologies requires active farms in order to determine its effectiveness. The project is currently unable to fulfil this requirement in Barbuda
- The local government in Barbuda was previously identified as the main body for monitoring the use of the technologies in Barbuda. However, an assessment of the local government has found deficiencies in capacity to continuously monitor the use of the technology. The capacity specifically relates to available expertise on the island as well as the commitment of staff to monitor the project. In addition, Barbuda does not have NGO's who are able to monitor the project if contracted. Without a strong monitoring regiment, the purpose of the grant to test the technical and financial usage of the technologies will be deflated. The Department seeks to demonstrate the use of the technology in Antigua and based on its impact on agriculture in Antigua, can be upscaled in Barbuda through full sized projects which can provide the funding for intense monitoring needed for Barbuda.

To this effect, the project will test both SolarRO 1500 solar photo voltaic (PV) powered desalination units at agricultural sites in Antigua. An evaluation of the use of the technology can then determine its suitability for Barbuda in a full-sized project as part of the scaling up of the technology. One of the sites chosen in Antigua should seek to ensure access for special/vulnerable farming groups. Therefore, the Department of Environment will partner with the Ministry of Agriculture, Fisheries and Barbuda Affairs to design selection criteria which includes the following minimal conditions[15]:

1. Community occupies multiple operating farms
2. The predominate ground water source for farms within the community is compromised due to salt-water intrusion
3. The community suffers from irregular water supply from the utility company
4. A significant amount of livestock can benefit from the location

[15] Subject to further conditions during further consultation with the Ministry of Agriculture

Activities:

1.1.1. Procurement and installation of solar panels and RO unit at two test sites.

The solar RO unit and all associated parts (including solar panels) will be procured, installed and commissioned at agriculture sites in Antigua.

To ensure the maximum benefit from the project and maximum water resource utilization from the SolarRO plant, drip irrigation or similarly efficient irrigation methods are recommended.

1.1.2. Workshop for the launch of the demonstration for key stakeholders.

The workshop will provide key stakeholders with a detailed description and workplan of the project, as well as provide the opportunity to become familiar with the technology and how it works. This will also provide feedback to inform development of the final protocol (Activity 1.1.6.) and the training needs for Activity 1.1.7. A workshop report will be developed as a deliverable and due no later than two weeks after the close of the workshop. There will be a workshop for each of the test sites, but only one report.

1.1.3. Develop protocol for monitoring of water quality, water usage, and well water levels.

This will involve setting water quality standards safe for agricultural use. Methodologies will be developed for water quality testing and well water level testing, and the testing frequency will also be established. Safety steps on what to be done in the event that any water quality parameter is exceeded will be developed. Steps should also be outlined for how much water will be allowed for use in times of water scarcity. One protocol developed for both sites.

1.1.4. Monitoring of water quality, water usage, and well water levels.

Well water levels are measured weekly. The amount of water used should be recorded on a daily basis, broken down per farmer if applicable. Quarterly water quality testing of water before and after treatment should be done. Monitoring is done at both sites.

1.1.5. Develop protocol for sustainable disposal of RO permeate.

This will involve researching ways to either dispose of or repurpose the brine water. One protocol developed for both sites.

1.1.6. Develop protocol for operation, maintenance, and repair.

This will involve setting operating and maintenance guidelines based on the operations/technical manual. Spare filters will be available for replacement after 3 years (have been budgeted for). A draft protocol must be prepared before the demonstration launch workshop, and final protocol complete after the workshop. One protocol developed for both sites.

1.1.7. Training workshop for operation, maintenance and repair.

This training workshop will be based on the operating and maintenance guidelines developed in Activity 1.1.6. A list of persons capable of maintaining and repairing the unit will be prepared. Workshop report completed two weeks following the workshop. There will be a workshop at each site, but only one report.

1.1.8. Quarterly reporting on operation and performance.

This should include total water treated, total permeate generated, total brine water generated, total electrical use, and quality of water pre and post treatment. Any unexpected problems and the actions taken thereafter should also be reported here to provide lessons learned. Water levels and water usage should be included in this report, which can be used to develop future projections on water use and water levels and to inform better water management practices and look for areas where water consumption can be reduced. One report for both sites.

1.1.9. *Final report on solar-powered RO demonstration.*

This should include total water treated, total permeate generated, total brine water generated, total electrical use, etc. Should also include a survey to collect farmer's feedback on the new technology. A summary of the water usage during the demonstration should be included in the final report, along with recommendations for improved water management practices based on the data presented. The lessons learned in the quarterly reports should also be compiled and summarized in the final report, with recommendations provided. One report for both sites.

***<u>Output: 1.2:</u>* Demonstration of solar-powered water pump at three farms.**

Water resources utilized for agriculture in Antigua and Barbuda are currently accessed in one of two ways. First, water can be transported to agriculture sites in water trucks and then pumped into holding tanks or used immediately. Water pumps on water trucks are either diesel or gasoline powered. Second, water pumps can be utilized to access water resources from catchment areas or wells. If in an inaccessible location, mobile diesel-powered water pumps are used. If the location is more accessible and nearby existing energy infrastructure, pumps can draw power from the national grid. The vulnerability of small island grids such as Antigua and Barbuda's was illustrated following hurricane Irma in 2017 where energy infrastructure on Barbuda was destroyed and has as of 2020, still has not been reconstructed.

The main difference between a diesel-powered water pump and SWP is the source of energy driving the system. Furthermore, SWPs are typically simpler, more reliable, and more cost-effective systems[16]. SWP systems have fewer moving parts, requiring less time be devoted to preventative maintenance and repairs. As the water pumping apparatus is the same as a diesel-powered system, the maintenance that is required should already be familiar to farmers. SWP are not vulnerable to the grid instability issues and frequent grid failures present in Antigua and Barbuda. This is particularly important in scenarios following natural disasters where grid infrastructure can be damaged for extended time frames. SWP also reduce the financial risk to farmers that exists due to limited fossil fuel resources present on Antigua and Barbuda. As a SIDS, Antigua and Barbuda is particularly vulnerable to external price shocks in the fossil fuel sector. Finally, the proliferation of SWP would also reduce the emissions profile of agriculture in Antigua and Barbuda.

In contrast to the technology described under Output 1.1, the technology to be demonstrated under Output 1.2 is more suited for one farm due to its smaller production capacity and its limitations in producing water that is only suitable for farming. As established under Output 1.1., the Department of Environment will partner with the Ministry of Agriculture, Fisheries and Barbuda Affairs to design a selection criteria for recipients including the following minimal requirements[17]:

1. In order to provide diverse experiences to the solar pump technology, the demonstration should include the following quota
    a. One (1) farmer generally in engaged in non-traditional subsistence farming as previously described
    b. One (1) farmer who's primary and sole purpose is commercial farming
    c. One (1) female farmer to showcase the experiences of female farmers with the technology
2. The farm is within a community with infrequent water supply from the power utility company
3. Potential recipients are:
    a. under a current land rental/lease agreement with the Government of Antigua and Barbuda
    b. confirmed by the Ministry of Agriculture to be in good standing with the set regulations of the Ministry of Agriculture and the Cabinet of Antigua and Barbuda

    has an existing, sustainable ground water source on farming land or is within proximity to sustainable ground water source which would allow for the reasonable transport of water from the point of production or storage to point of use

An expression of interest will be sent out inviting various farmers and a partnership will be established based on the requirements of the criteria. The selection process for potential recipients will be guided by the principles of equal opportunities for vulnerable communities regardless of the political affiliation, marital status, or sexual orientation.

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[16] Zhou, D., Shalmani, A. (2017) The acceptance of solar water pump technology among rural farmers in northern Pakistan: A structural equation model. *Cogent Food and Agriculture.* Vol.3.

[17] Subject to further conditions during further consultation with the Ministry of Agriculture

Activities:

1.2.1 *Install one solar-powered water pump at three farms.*

Three agriculture sites in Antigua with nearby wells or surface water catchments will be identified for participation in this demonstration. A letter with an expression of interest will be issued to the farmers, to which they will then have the opportunity to discuss the project with the PC and decide if they would like to participate. Preference in the selection of farms will be given to more vulnerable communities that would otherwise not afford a solar pump or other such adaptation measures.

Solar pumps and all associated parts (including solar panels) will be procured to channel water from wells or surface water catchments to nearby farms that will be utilized to irrigate their crops. The procurement process should give preference to local installers.

1.2.2 *Workshop for the launch of the demonstration for key stakeholders.*

Workshop will provide key stakeholders with a detailed description and workplan of the project. Stakeholders will be given the opportunity to address any issues or suggest better ways to ensure the success of the project. This will be one workshop and a workshop report will be due within two weeks of workshop close.

1.2.3 *Develop protocol for operation, maintenance and repair of unit.*

This will involve obtaining a list of persons capable of maintaining and repairing the unit. Setting operational guidelines based on the operating manual. Training based on the maintenance/ service manual. Ensuring that spare parts are always available. One protocol for all three sites.

1.2.4 *Develop protocol for monitoring water usage.*

Establish Rules and guidelines for the frequency at which to monitor well water levels and individual farmer water consumption. One protocol for all three sites.

1.2.5 *Monitoring of water usage.*

Well water levels are measured weekly. The amount of water used should be recorded on a daily basis.

1.2.6 *Quarterly reporting on operation and performance.*

This should include total water used/pumped daily, daily water catchment levels, daily electrical use, water consumption per farmer, etc. Any unexpected problems and the actions taken thereafter should also be reported here to provide lessons learned. Water usage data can be used to develop future projections on water use and water levels and to inform better water management practices and look for areas where water consumption can be reduced. One report for all three sites.

1.2.7 *Final report on solar-powered water pump technology demonstration.*

This should include total water used daily, daily water catchment levels, daily electrical use, water consumption per farmer, etc. Should also include a survey to collect farmer's feedback on the new technology. A summary of the water usage during the demonstration should be included in the final report, along with recommendations for improved water management practices based on the data presented. The lessons learned in the quarterly reports should also be compiled and summarized in the final report, with recommendations provided. One report for all three sites.

Component 2: Standards and policy developed to ensure sustained availability of water for agriculture.

To encourage and facilitate the uptake of innovative adaptation technologies for the Agriculture Sector in Antigua and Barbuda, particularly those demonstrated in Component 1, standards must be developed, and knowledge shared with the sector. Further to the demonstration of the two technologies selected for Component 1, the project will allow for the development of future scaled up initiatives utilising innovative technologies/approaches proposed by schools and farmers. To accelerate the uptake of the demonstrated technologies, a technical package with proposed business models will be developed and shared with stakeholders, as well as lessons learned from the demonstrations. Training materials informed from the demonstrations will also be developed and disseminated, and an exhibition workshop will be held at the demonstration sites to showcase the technologies in use to stakeholders.

These activities will support the wider adoption of the adaptation interventions proposed in Component 1, ensuring sustained availability of water for agriculture.

<u>Output 2.1:</u> Development of an Agriculture Technology Assessment in line with National Technology Needs Assessment (TNA) and the National Adaptation Plan (NAP).

<u>Activities:</u>

2.1.1 Conduct a scoping study of technologies currently used in the Agriculture Sector and assess the applicability of new adaptive technologies.

Identify the existing technologies being used within the Agriculture Sector and assess their viability taking into consideration the impacts of climate change on food security, particularly droughts and hurricanes. In addition to the technologies being tested, the project will issue a calls for proposals to students and farmers to submit innovative technologies and approaches which can help the sector become more resilient to climate change.

2.1.2 Stakeholder consultation

A stakeholder consultation workshop will be held with the support of the Ministry of Agriculture to identify the perceived risks that farmers may have regarding the new technology options and to provide the opportunity for their feedback. Workshop report will be conducted and due within two weeks of the close of the workshop.

2.1.3 Selection and prioritization of adaptive technologies for the agriculture sector.

A shortlist of adaptive technologies for the Agriculture Sector is developed based on climate change projections, stakeholder feedback in Activity 2.1.2., and the assessment conducted in Activity 2.1.1. This list can include but is not limited to the technologies demonstrated in Component 1 of this project; additional technology options should be considered. The final selection of adaptive technologies should be shared with relevant partners, such as the Ministry of Agriculture.

2.1.4 Development of a financing strategy for scale up in Antigua and Barbuda.

Based on the recommendations of Activity 2.1.3., a GCF concept note is developed. The concept note should involve a financing strategy to allow for scaling up the use of adaptive technologies in the Agriculture Sector of Antigua and Barbuda.

<u>Output 2.2:</u> Assessment of the potential for market mainstreaming of new technologies for the Agriculture Sector.

<u>Activities:</u>

2.2.1 Assessment of business models for the uptake of demonstrated technologies.

This will involve outlining various business models to support the update of the demonstrated technologies in Component 1 and selecting the most viable options. A technical package with all the relevant information on the technologies and selected business strategies will be prepared, including lessons learned from the demonstrations.

2.2.2*. Workshop with key stakeholders.*

A workshop will be conducted in collaboration with the Ministry of Agriculture to disseminate the technical package produced in Activity 2.2.1 to key stakeholders.

2.2.3. *Assessment of tax and other policies to support the uptake of the demonstrated technologies.*

This will involve assessing taxation and other policies applicable to promote and support the uptake of solar RO units or solar pumps. A policy recommendation will be developed based on this assessment.

2.2.4. Development of a training materials for local training groups to administer to potential technology up-takers.

This will involve developing training materials that outline the operations and maintenance requirements of the adaptive technologies demonstrated in country. These materials can then be used by local training groups to ensure that local technical capacity and knowledge of these technologies are developed.

2.2.5. Stakeholder workshop to exhibit the technology in use.

This workshop will exhibit the operations and maintenance of the technology to stakeholders interested in purchasing their own equipment. Stakeholders will be given the opportunity to see the technology in use, have their questions or concerns addressed, and will receive a briefing on the lessons learned during the demonstration projects.

B. Economic, social and environmental benefits

The proposed project aims to provide measures for food security in Antigua and Barbuda by investing in innovative technology which will ensure continuous water supply for the agricultural community in the face of climate change events. In addition to addressing the general matter of food security in the country, this project provides benefits and opportunities for identified farmers, particularly farming communities who are made even more vulnerable due to a compromised water source from salt-water or saline intrusion as well as inconsistent water supply within that community. The project also provides indirect benefits to other primary and vulnerable stakeholders including women who sell agricultural produce and impoverished urban and rural communities who depend on the affordability of agricultural produce sold in the public market or local shops in comparison to bigger businesses. Benefits can be divided as such:

Economic – Members of the agricultural community, particularly farmers are generally without financial capital and have limited opportunities for income outside of harvest yields. A loss in harvest yields due to limited water supply compromises access to livelihood for these farmers who do not have the capital to invest in alternative water sources, particularly due drought conditions or after a tropical storm or hurricane when the capacity of the utility company to provide services is compromised; it also has implications for vendors (majority of whom are women) who depend on the local produce to sell at the market or at small shops to provide for themselves. Increasing water security within the agricultural sector to adapt to climate change impacts such as drought and hurricanes will decrease the financial burden of finding alternative water sources while enabling larger harvest yields. In turn, this allows vendors to sell produce at a cheaper rate, benefiting vulnerable communities. The project also provides the opportunity to bring greater awareness to the work of women in agriculture. The Sustainable Island Resource Framework (SIRF) Fund, will provide the opportunity for farmers outside of the demonstration to apply for concessional loans to purchase tested technologies.

Social – Increased water security within agriculture is expected to ensure greater harvest yields, reducing dependence on imported agricultural produce as well as cost of local produce at the market and strengthening access to livelihood for men and women in agriculture. The proposal also involves the active participation of farmers as well as schools in developing future innovation for enhancing agriculture

Environment – Water scarcity has increased fertilizer use on crops, which can negatively impact health, as well as contaminate soil, water and non-target vegetation and organisms. Increased water security can result in decreased usage of fertilizers by farmers. In addition, the introduction of an RE technology within the water sector can contribute to the decreased use of water sources dependent on fossil fuel such as the RO desalination plants used by APUA and the electric pumps for ground water harvesting and begin the shift to clean energy within the water sector.

C. Encouraging and accelerating development of innovative adaptation technologies

An Innovative Approach to Water Challenges in Antigua and Barbuda's Agricultural Sector

Table 3 Evaluation of Water Technologies

Characteristics	ATG Current Desalination Plants	Best Available RO Desalination Technology	Proposed RO Technology	Atmospheric Water Generator
Age of Technology	1990s [18]	2017 [19]	2020	2019
Energy Demand	6 kW/h (Saltwater)	2.5 kW/h - 3.1 kW/h (Saltwater) 1.0 kW/h - 1.5 kW/h (Brackish Water)	1.75 kW/h (Saltwater) 0.5 kW/h (Brackish Water)	20 kW/h
Potential Location	Coastal	Coastal In-land	Coastal In-land	Outdoor near an electrical source
Power Source	Fossil Fuel	Renewable Energy	Renewable Energy	Fossil Fuel Renewable Energy
Approximate Daily Output (m^3)	19,400 [20]	7.5 [21] [22]		1 [23]
Approximate Cost of Procurement (USD)	n/a	50,000.00		40,000.00

Application of renewable energy to power reverse osmosis water desalination has had limited uptake in the Caribbean region as it requires significant capital investment. Additionally, there are legal barriers to importing and utilizing the technology. The costs associated with importing these technologies, in addition to the actual cost of the technologies can be prohibitive not just for the farmers, but for SIDS who lack economies of scale, regional distributors of new technologies, and access to finance.

Presently, the RO technology in Antigua and Barbuda is energy intensive with an energy demand of 6 kWh/m^3 of water produced from saltwater. In 2017, Voutchkov established that the best available reverse osmosis desalination technologies had an energy demand of 2.5 kWh/m^3 - 3.1 kWh/m^3 of water produced from saltwater and 1.0 - 1.5 kWh/m^3 of water produced from brackish water[24]. Presently, best available RO technology requires 1.75 kWh/m^3 and 0.5 kWh/m^3 to desalinate water from saltwater and brackish water respectively. This can be attributed to recent developments such as integrated energy recovery device within the system. The low energy requirement of the new RO technology makes this solution more suitable for SIDS than previous iterations of this technology, as less capital investment (upfront and otherwise i.e. fuel costs) is required for energy generation. This provides an opportunity for the proposed interventions to be upscaled in the OECS.

[18] Cooper, B. and Bowen, V., Integrating Management of Watersheds & Coastal Areas in Small Island Developing States of the Caribbean (2001), http://www.oas.org/reia/IWCAM/pdf/Antigua%20and%20Barbuda/abreport.pdf

[19] Voutchkov, N., Desalination (2017), http://dx.doi.org/10.1016/j.desal.2017.10.033

[20] FAO. 2015. AQUASTAT Country Profile – Antigua and Barbuda. Food and Agriculture Organization of the United Nations (FAO). Rome, Italy.

[21] https://solarwatersolutions.fi/en/products/

[22] Assuming this device is powered by solar power and there are 5 Peak Sun Hours for Antigua and Barbuda

[23] https://esharawater.com/products/ew-1000/

[24] Voutchkov, N., Desalination (2017), http://dx.doi.org/10.1016/j.desal.2017.10.033

Furthermore, while RO technology has existed in Antigua and Barbuda for over two decades,[25] the technology has not been explored:

- in-land;
- on a small-scale ; or
- off-grid.

Historically, all RO plants within the country have been large-scale[26], sited along the coastline and connected to the country's electric grid. For this project these units will be sited at in-land locations to utilize ground-water wells for agriculture that have been abandoned due to saltwater intrusion. The sites for the utility's RO plants as well as current well locations can be seen in figure 1.

Notably, the small-scale units proposed are plug and play technology[27] that are compact, easy to operate and allows for an ease of siting at well locations. Furthermore, the SolarRO 1500 can run as an off-grid system during daylight hours using the energy generated by the solar panels. It is not necessary for the device to run continuously as is the case with standard versions of RO; this means that battery storage is not required for this project and thus provides further savings on the upfront cost of the technology.

Of the technologies evaluated in table 3, in addition to the Technology Needs Assessment conducted in 2020 on the Water sector, it was determined that the solar water pumps and solar RO units would be best suited for the Antiguan and Barbudan context. These technologies will be implemented in novel approaches for the country as they are more efficient, small-scale and will be operated in-land, and off-grid.

Solar Water Pumps

The difference between a diesel-powered water pump and solar powered water pump is the source of energy driving the system. However, there are a number of benefits to using a solar powered system. Firstly, it eliminates the cost of fuel for farmers, as a SIDS, Antigua and Barbuda is particularly vulnerable to external price shocks in the fossil fuel sector. Secondly, a solar powered water pumping system is not vulnerable to the grid stability issues and frequent grid outages in the utility system. This is particularly important in scenarios following natural disasters where grid infrastructure can be damaged for extended periods. Finally, a solar powered water pumping system has fewer moving parts, requiring less time be devoted to preventative maintenance and repairs.

Scoping Study for other Adaptive Technologies

The project seeks to introduce technologies in the Antiguan and Barbudan market which focus on innovation and climate adaptation in agriculture. Once successful, lessons learnt from these demonstrations is expected to stimulate interest in other innovative technologies which would be suitable and beneficial for the agricultural sector. In addition to the actual demonstration of the mentioned technologies, the project will continue to stimulate ideas for new water technologies in Agriculture through a scoping study on potential adaptive technologies for the agricultural sector and the development of business models for the approved technologies. The study will benefit from local contribution by inviting secondary, tertiary level and training schools to provide options of innovative technologies and/or approaches for the agricultural sector. Local Farmers will also be invited to provide options on innovative practices and technologies which can address water scarcity in agriculture. Schools and local farmers will be required to present these options considering the following factors:

- the climate change impacts for agriculture in Antigua and Barbuda are considered when presenting the proposed technology/approach
- the identified challenges for water supply in agriculture as provided below
  - Accelerated depletion of groundwater due to saline intrusion
  - High cost of water production from RO

[25] http://www.apua.ag/business-units/water-business-unit/water-provision-in-antigua/

[26] RO units have had annual capacities ranging between 330,000 imperial gallons to 3.1 million imperial gallons.

[27] Plug and Play - devices that are intended to work perfectly when first used or connected, without reconfiguration or adjustment by the user.

    - High water transport cost to remote areas
    - Inadequate water catchment
    - Chemical contamination of water resources due to chemical misuse
    - Proximity of farms to water resources
- the social and financial profile for most farmers is taken into consideration
- Antigua and Barbuda environmental profile is considered in light of the proposed technologies/approaches
- Any legal barriers to the deployment of the technology is taken into consideration
- Ease of access and operation of proposed technologies/approaches

The Department will develop a financial strategy for proposed technologies/approaches for water scarcity in agriculture which are presented as the most reasonable and most revolutionary for agricultural in Antigua and Barbuda

This follows an approach used by the Department to stir local innovation in environmental matters in other projects. Under a project implemented by the Department titled "Grid-Interactive Solar Systems for Schools and Clinics" (GISS), the Department utilized an Integrated Schools Approach in which schools were invited to design and implement educational campaigns on climate change in Antigua and Barbuda. This project will also utilize this Integrated Approach by inviting schools as well as farmers to present innovative options for climate change adaptation in the agricultural sector

Innovation within the Antigua and Barbuda Economic context:
As previously noted, most farmers in Antigua and Barbuda lease lands from the government for agricultural use and have limited access to private financing; most receive financing from the Antigua and Barbuda Development Bank. The regularity of hurricanes and droughts in the region have led to unstable income levels in the agriculture industry; as such, there is a high rate of defaults in the repayment of loans. This has resulted in high non-performing loan rates at local banks, further decreasing the credibility of agricultural borrowers in the financial system.

Unavailability of credit also limits technological improvement, since funds will not be provided for purchase of untested technology. Without testing new technologies, banks cannot determine risk levels of investment or resale value in the event of default. The introduction of the proposed innovation affords the opportunity to test its feasibility for the agricultural sector and assess risks for the banking sector to allow for scaling up. The generation of demand for such systems in the local market will further the wider aims of climate change adaptation and reducing GHG emissions. At this time, maintenance costs are unknown; the exact long-term cost benefit of the new technology will be assessed after interventions.

There are many other innovative technologies that can facilitate adaptation to climate change. An Atmospheric Water Generator harvests water from the humidity in the air to produce clean water. This would be beneficial for an island such as Antigua and Barbuda where humidity levels are high. Farmers in particular are able to take advantage of this type of technology for livestock and water intensive crops. However, as demonstrated in Table 3, the technology is more expensive than the proposed RO technology due to its lower daily output and high energy demand for a similar cost.

Cost Justification for the use of technological interventions in agriculture:
As a SIDS, farmers in Antigua rely on traditional practices for agriculture. Even with the abundance of new agricultural technologies, these technologies are often too costly for farmers to afford Technology for climate change adaptation can be capital intensive and may be out of reach to a traditional small subsistence farmers. This leaves traditional farmers susceptible to issues arising from climate change.   The project can influence the technological learning curve of Antiguan and Barbudan farmers, introducing ways to increase their productivity and yield while reducing time and effort.

As a nation afflicted by drought, farmers are faced with the issue of water scarcity. It is a challenge to find potable water next to arable land, often leaving farmers with the issue of water transportation once a water source is found. This project will be able to treat water sources next to arable land that have been deemed unsuitable for agriculture ensuring easy access to farmers.

Below is a comparison table outlining the costs for a comparable Reverse Osmosis system utilising a diesel power source as opposed to the solar PV system. This innovation is an important contribution to the local agricultural sector as it is entirely independent and can be operated using wells around the country. The use of RE removes the need for fuel inputs and the associated market dependency.

Table 4: Cost Comparison for a diesel operated Reverse Osmosis and a Solar PV Reverse Osmosis Unit

Power Source	*Solar PV*		*Diesel*		*Utility*	
Description	**Capital (USD)**	**Operating Costs/yr (USD)**	**Capital (USD)**	**Operating Costs/yr (USD)**	**Capital (USD)**	**Operating Costs/yr (USD)**
RO System	$48,000.00	$ 1,440.00	$ 48,000.00	$1,440.00	$ 48,000.00	$ 1,440.00
						$ 20,235.00 -electricity costs
Solar PV System (4.4 kW)	$ 5,750.00	$ 200.00	n/a	n/a		
Additional Equipment	$4,540.00		$ 4,540.00		$ 4,540.00	
Diesel Generator 3kW			$ 3,600.00	$ 1700.00		
Total	$58,290.00	$ 1,640.00	$ 56,140.00	$ 3,140.00	$ 52,540.00	$ 21,675.00[28]

Table 3 displays capital investment and annual operating costs for the proposed RO system receiving power from 3 different sources: solar PV, diesel generator and the grid. It is divided into three columns, providing a comparison of the costs associated with these technologies based on current estimates. A list of assumptions that inform Table 3 can be found below.

[28] *Assumptions:*

- *RO unit consumes 3 filters per 6 months*
- *$200.00 annual ,=maintenance solar panels (based on consultation with local user)*
- *$220.00 annual maintenance diesel generator (based on consultation with local user)*
- *Diesel generator use 5hrs per day 365 days*
- *Diesel generator consumption 0.2 gallons/hr fuel at $12.50 p/gall*

The capital required for investment in this technology powered by the solar system ($58,290.00) exceeds the comparable investment for fossil fuel options ($ 56,140.00 & $ 52,540.00) . However, operating costs reflect longer term savings when using a renewable system, which is 48% and 92% less costly than a generator and the gird, respectively. This lower expenditure is complemented by the independence from volatile fossil fuel markets that stand to significantly impact the costs of fuel locally. Fluctuating fuel costs can substantially impact the expenditures of farmers, leading to increased food costs in the local market in response to external shocks.

Utilizing renewable energy for a reverse osmosis system will help to build resilience in the agricultural sector with respect to water availability. Frequent intense droughts have led to a decrease in the overall water supply level of Antigua & Barbuda. In the aftermath of severe storms, interruptions to supply chains can reduce the availability of fuel, leading to longer downtimes for a farming operation that utilizes the suggested RO technology. A solar PV system in this setting is exempted from such circumstances, allowing stability in the agricultural water supply.

The size of the intended reverse osmosis system will generate 330 Imperial Gallons of filtered water per hour. Assuming the pump is only operational for 5 peak sun hours a day, the system will generate 602,259f imperial gallons a year. According to the FAO, 395,944,646 million imperial gallons of water is used per year in Antigua's agricultural system[29].

D. Consistency with national strategies and technical standards

Firstly, the project is expected to contribute to at least four United Nations SDGs; *SDG 2: Zero Hunger, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation* and *SDG 7: Affordable and Clean Energy*. It is also aligned with Antigua and Barbuda's National Determined Contributions to:

- By 2025, increase seawater desalination capacity by 50% above 2015 levels.
- By 2030, 100% of electricity demand in the water sector and other essential services (including health, food storage and emergency services) will be met through off-grid renewable sources.

Secondly, the project seeks to fulfil the water quality requirements established under Schedule VII of the Environmental Protection Management Act.

Subject to section 23 (1), (2) and Schedule 3 of Physical Planning Act (PPA) 2003, the project does not require an Environmental Impact Assessment; in line with the Department of Environment's Environmental Social Safeguard and Gender policies, the project strives to ensure that environmental, socio-economic and gender benefits are equitably distributed among community members with special targets for vulnerable communities including women, men and farmers as well as additional activities which will benefit other vulnerable groups such as Barbudans

Finally, the project shall also comply with all laws of Antigua and Barbuda regarding permission requirements for implementation. These legislations include:

- *Public Utilities Act 1973*
- *Renewable Energy Act 2015*

Section 5 (1) of the Public Utilities Act 1973 outlines that the Antigua and Barbuda Public Utilities Authority ('Authority') possesses the exclusive right to supply, distribute, maintain and sell water and electricity. The Authority may delegate the Department of Environment ('DoE'), as the Executing Entity ('EE'), under section 8 (1) to implement the required water and renewable energy systems. Previously, the DoE executed a grid-interconnected project, as a delegate, via a Cabinet Decision for a *Create Interactive Solar PV Systems for Schools and Clinic Project*. However, this project differs to the previous delegation because it shall operate independently of the grid. Therefore, permission for off-grid renewable energy generation and use from the Authority would be required.

[29] Food and Agriculture Organization of the United Nations (FAO), Country Profile – Antigua and Barbuda (2015), http://www.fao.org/3/ca0429en/CA0429EN.pdf

Alternatively, the Minister of Public Utilities, Civil Aviation and Transport ('Minister') may give the Authority, when deemed necessary, policy directions to be followed in the interest of Antigua and Barbuda under section 37 (1). The Minister is also responsible for issuing renewable energy generation licences under section 11 of the Renewable Energy Act. As the project is powered by independent renewable energy sources, these are the applicable points of entry for the project to legally be applied to sustainable farming projects in Antigua and Barbuda.

In the long term, the Authority also possesses the power to make regulations regarding the supply of water to consumers under section 4 (1) (I) of the Public Utilities Act 1973. Potentially, the Authority can create regulations to oversee the long-term implementation, execution and maintenance of the innovative technologies being applied to this project. Thus, no longer requiring Cabinet decisions to expand the scope of the project itself.

E. Learning and knowledge management

While there is no dedicated component for learning and knowledge management, activities related to learning and knowledge management are a part of each component of this project.

The first component will collect several forms of data for reporting and knowledge sharing. The monthly reports on water usage will inform better water management practices and be used to determine if the water needs of the site or community are being adequately met, in addition to identifying how it can be improved. Quarterly reports conducted on the operation and performance of the demonstrated technology, as well as final demonstration reports, will inform further technology recommendations to help determine which options should be selected for scale-up projects.

Any issues and solutions will be reported as lessons learned, which will also help to inform the design and implementation of future scale up projects, as well as the technical package prepared in Activity 2.2.1. Further, this report will be shared with stakeholders interested in technology uptake and relevant partners. The training manual developed in activity 2.2.4 can then be used by local training groups to ensure that local technical capacity and knowledge of these technologies are developed.

Workshop reports will collect feedback from stakeholders on their understanding of the technologies and they will inform future technology workshops and determine if additional knowledge resources should be provided to the stakeholders.

The workshops, training materials as well as final report on the impact of the technological demonstration during the project will not only be shared with local partners for the purpose of upscaling the project but will also be shared with regional partners including the Organisation of Eastern Caribbean States (OECS). The OECS can provide the platform for sharing the best practices of the project and the technology used with other SIDS countries in the region with similar experiences concerning water availability. Through the Department of Environment Communication and Public Awareness team, the project can also visualise the lessons documented through the video demonstration which can be shared through global networks.

F. Environmental and social impacts and risks

As previously noted, most farmers in Antigua and Barbuda depend on government land for their farming activities. Discussions with the Ministry of Agriculture found that the majority depend on one-year rentals through the Ministry of Agriculture and are less likely to seek long term leases, mainly due to the convenience of the one-year rentals. More successful commercial farms are likely to secure long term leases (five years and more). In addition to the barrier this presents for farmers in accessing funding from traditional financing institutions, within the context of the project design, it presents the risk of rentals expiring before the completion of the project. On the other hand, if the project choses to focus on farmers with long term leases, it is extremely likely to alienize the most vulnerable farming communities from the project while solely providing benefits to more financial farmers.

Within the minimum conditions for selection criteria, is the requirement for farmers to be in good standing with the Ministry of Agriculture as it relates to their rental agreement. This provides a general base for rentals being renewed. Further, in addition to establishing a partnership with the Ministry of Agriculture to develop and implement the selection criteria for beneficiary farmers, the Department can also establish a Memorandum of Understanding (MOU) with the Ministry of Agriculture to ensure that beneficiary farmers are able to continue under their rental arrangement to allow for the implementation of the intervention as well as the monitoring and evaluation of those technologies.

Due to the establishment of the Sustainable Island Resource Framework (SIRF) Fund under the Environmental Protection Management Act (EPMA), farmers are able to access finance for adaptation which is particularly targeted for vulnerable communities and does not require the same stringent prerequisites within traditional financing institutions.

In addition, limited lighting within certain farming areas in Antigua may raise issues of theft as well as other security breaches for the solar panels. The project will also mitigate against security concerns at the demonstration sites by implementing appropriate security measures.

The role of men and women in Agriculture as well as the Energy Sector is divided along gender lines with men dominating as farmers and technicians and women involved in formal and informal business operations of farming and administrative roles within the Energy Sector and thus, the project will operate within this context and is unlikely to shift these roles within the timeframe of the project. Under this assumption, the participation of women in the implementation of the project as well as the direct beneficiaries of the technology and training opportunities will most likely be minimal. The project therefore risks contributing to gender stereotypical roles for men and women.

To mitigate against this risk, within the selection criteria established for recipients of the solar pumps, there is a requirement for a female farmer to receive the technology in order to demonstrate the experience of female farmers compared to male farmers when using the technology. Within the list of key stakeholders mentioned under Table 3, women NGOS/CSO are included as a means of reaching women within a technical background to participate in the training conducted under the project. As part of the requirement for government and private sector companies being exposed to training under the project, the Department can encourage such companies to send both male and female representatives to the training workshops. In addition to these activities, the training material is expected to be shared through the Department's global network and key partners, locally and regionally, and will thus be exposed to a wider audience including women.

As highlighted under knowledge sharing, the communication and public awareness team will be video capturing lessons learnt through the use of these technologies on the farms. This video presentation can be used to bring awareness to the primary contribution of women to agricultural, through formal and informal business operations by highlighting the role of women in the financial aspect of agricultural through imagery of women in the public market complex or the small shops in local villages.

The project also operates within the context of the energy portfolio of the Department which seeks to promote procurement practices which include women in technical fields, training geared at including women in STEM fields and gender sensitive campaigning aimed at breaking cultural stereotypes of male and female roles.

The engagement of stakeholders, particularly the most vulnerable is described in the following table:[30]

Table 3: Stakeholder Engagement Strategy

Position in Power / Interest Grid[31]	Stakeholder	Opinion, interests, feelings, discourse, information etc about the project change in question	How can they help in making the necessary change happen? (<u>Concretely</u>, what can they do?)	How should they be reached
MANAGE CLOSELY	Beneficiary farmers and surrounding communities	Baseline conditions of water in Antigua and Barbuda suggest that farmers are	Farmers will act as the "ambassadors" of a new and innovative	• Ministry of Agriculture,

[30] Subject to updates during implementation

[31] Manage Closely (high power, high interest); Keep Satisfied (high power, low interest); Keep Informed (low power, high interest); Monitor (low power, low interest)

		particularly interested in ways to ensure even better supply, particularly after a disaster. Consultation with the Ministry of Agriculture also suggest that farmers are open to new technology which could make their operation less expensive, more sustainable and less tedious	technology in the Antiguan and Barbudan market as their agricultural land will be the demonstration site. The active and positive participation of farmers is critical to the success of the project	Fisheries and Barbuda Affairs • Public and Community Consultation in identified communities
	Ministry of Agriculture, Fisheries and Barbuda Affairs	Due to the vulnerability of farmers in Antigua and Barbuda coupled with the climate change impacts on water and food security, the Ministry of Agriculture is highly interested in the proposed project and the benefits it will provide for farmers	The Ministry of Agriculture will act as a vital partner in communicating with the farmers, selecting the farms who will receive the new technology and monitoring and evaluating the use of the technology among the selected farmers	• Frequent correspondence between focal points through face to face meetings and other means
	Ministry of Health, Wellness and the Environment	Due to the benefits this project has for health and the environment through better sustainable water supply for the agricultural community and the display of new technology utilizing clean energy, the Ministry of Health has high interest in the project	Environmental Management Systems to support energy efficiency	Technical Advisory Committee (TAC) •
KEEP SATISFIED	APUA – Water Unit	Interest in water security for household in general but seemingly, no particular interest in greater water security for farmers	Providing information on available groundwater sources and vulnerability of communities to persistent water shortages from the company	• Correspondence with Mr. Ian Lews – Water Manager at APUA **ian@apua.ag**
	Antigua and Barbuda Media	Interest in the project has not been generated as yet	Has the power to raise awareness and well as turn public opinion and thus political support for a project intervention	• DOE Public Awareness and Community Outreach Unit
KEEP INFORMED	Men and Women NGO's/CSO's	Has a high interest in promoting the rights and protection of men and women as well as levelling gender representation in all sectors.	Can provide stakeholder input during project implementation from a gender perspective Can provide links to reaching women in technical fields	• Stakeholder consultations and community groups
	The Barbuda Council and people	The island has suffered from the contamination of its ground water sources and is one of the factors contributing to the inability of	Knowledge of the technology can revitalize interest in agriculture for Barbuda and allow for the	• Educational Campaign with farmers in

		the agricultural community to revitalize. However, additional developmental issues on island as well as capacity restraints would prevent the installation and successful monitoring of the technology in Barbuda. Due to the high interest in the project, lessons learnt from its application in Antigua can provide for the inclusion of Barbuda in a full-sized project	technology to be installed in a full-sized project	Barbudan on the technology •

G. Justification for funding requested

As Antigua and Barbuda continues to combat the impacts of increased drought and hurricane events, the risk to water and food security is expected to increase. As a SIDS with commitments to the domestic and commercial market to supply water, and an ever-increasing debt due to the aftermath of continuous hurricanes, Antigua and Barbuda is at risk of losing its ability to consistently provide potable water for its population. The Adaptation Fund will assist in mitigating against this increased risk by reducing water scarcity vulnerability among the agricultural community.

Funding utilized to test solar RO equipment will strengthen the agricultural sector in Antigua and provide lessons learnt for its future application in Barbuda. The Solar RO for Antigua will be used to support the agriculture sector as the farming communities in Antigua are socioeconomically vulnerable and heavily reliant on scarce rainfall and water supply from the utility company. Further, the ability to produce potable water is an additional benefit for farmers who struggle with water supply from the grid.

Funding utilized to deploy Solar Water Pumps to Antigua will enable farmers to efficiently transport water from wells and storage sites to farm sites. Paired with modern and efficient irrigation techniques, these technologies can increase the yield of local agricultural production. As both technologies will be deployed with project funding and functioning on self-generated renewable energy, these technologies will help increase the resilience of Antigua and Barbuda's agriculture sector to external fossil fuel-based price shocks.

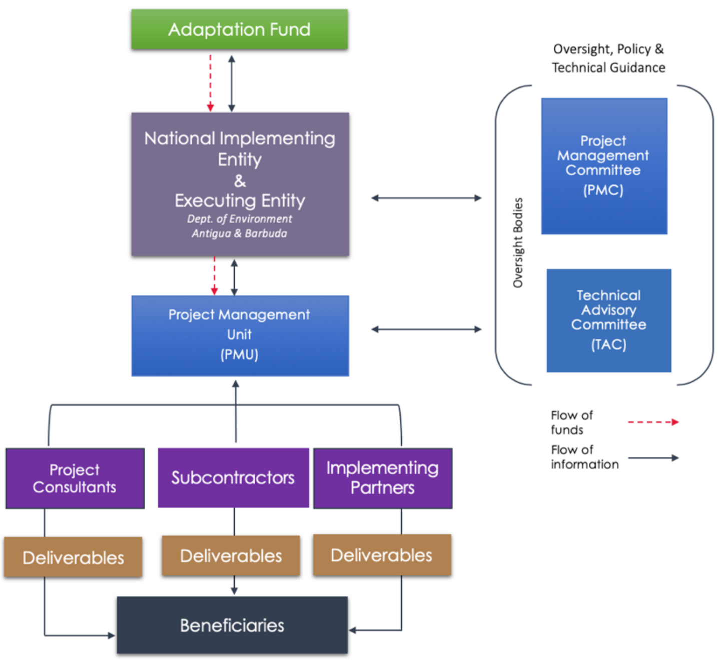
Lastly, funding for Component 2 will accelerate the uptake of adaptive and innovative technologies in the Agriculture Sector, securing the availability of water in a vulnerable sector. This will focus on innovative adaptive technology for the sector from the local environment by providing the avenue for schools and farmers to promote and develop innovative technologies and adaptive practices

PART III: IMPLEMENTATION ARRANGEMENTS

A. Implementation arrangements

The Department of Environment (DOE) is the National Implementing Entity (NIE) and will be the Executing Entity for this project. The Department was accredited as a NIE to the Adaptation Fund in 2015 and as a Direct Access Entity to the Green Climate Fund in 2017. The DOE has extensive project development and implementation experience, and expertise located within the other government agencies is available via the office of the Permanent Secretary, the Technical Advisory Committee, and through formal or informal consultations during project concept and development.

Figure 3. Diagram of the NIE's project management structure



The DOE is a regulatory entity that has established and maintained a strong inter-agency and cross-sectoral management framework. This framework consists of three main structures: 1) the Project Management Unit (PMU), 2) the Technical Advisory Committee (TAC), and 3) the Project Management Committee (PMC), summarized below.

The PMU is the management framework within the DOE, whose core structure consists of a Project Manager (PM), full-time Project Coordinators (PC) , and component coordinators with specialized expertise hired to work on specific components. In addition to this core structure, there may be: i) technical coordinators, project consultants, and interns. The PMU works together on a daily basis and meets monthly.

The PMU is designed to achieve efficiency and coordination in the management of funding from a variety of donors, the governments and even NGOs. The PMU also ensures that there is effective coordination and efficiency when there are project activities that are similar and inter-dependent on each other for execution. Antigua and Barbuda is a small island developing state where access to well-trained technical capacity is a key risk. The PMU is a mitigation measure to minimize this risk.

The TAC, mandated by a Cabinet Decision, is a mechanism that enhances coordination between key ministries and stakeholders. The TAC meets monthly and includes representatives from 17 key government agencies, 3 non-governmental organizations and one private sector coalition. The committee provides sustained technical guidance, policy recommendations and support for areas within their expertise to achieve policy coherence among country objectives and not just project-by-project. The TAC meets monthly.

The PMC is a high-level cross-sectorial committee comprising of lead policy makers and heads of departments. The function of the PMC is to focus mainly on procurement, institutional arrangements and financial management of the project. The selection of consultancies and companies is the responsibility of the PMC. The PMC meets quarterly and accounts signatories meet monthly.

B. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

The project's Monitoring Plan outlines the type of M&E activities that will be implemented to ensure that it is progressing as desired. Monitoring will be the responsibility of the Project Coordinator (PC) within the Project Management Unit (PMU) along with technical officers specializing in the areas of renewable energy and water quality testing. The project's results framework, which outlines the baseline condition, targets and indicators, will be used by the coordinator and the technical officers to monitor implementation. In the execution of these functions, these officers will also collaborate with the Ministry of Agriculture.

The Project Coordinator will prepare quarterly progress reports for submission to the Monitoring, Evaluation and Data Management Unit (DMU) and the Project Manager at the end of each quarter. The report should indicate outputs and milestones achieved, activities executed, the use of indicators to measure change, highlight challenges experienced during implementation, captured lessons learned as well as any knowledge disseminated to stakeholders on the interventions. Periodic reports on the performance of the technologies will be delivered to the

Project Manager (PM), PMU, the Technical Advisory Committee (TAC), and the Project Management Committee (PMC).

A Terminal Evaluation (TE) will take place at the close of the project. The DOE as the Accredited Entity will be responsible for managing the TE and will oversee the process of hiring an external consultant to carry out the evaluation. The evaluation will adhere to the standard evaluation criteria used to assess development interventions (strategic relevance, effectiveness, efficiency, likelihood of impact and sustainability) and will use a mixed method approach to evaluate results.

Additional M&E Activities and associated costs are indicated below in the Monitoring Plan:

M&E Activity	***Frequency***	***Responsibility***	***Cost (USD)***
Demonstration Workshops	Three two-day workshops one for each technology	PC	6,600
Workshop reports on the launch of the demonstration (3)	Two weeks after the close of each workshop	Project Manager/Project Coordinator and the PMU	1,500
Final report for each demonstration technology (2)	End of each demonstration	PC	1,000
Baseline data collection and measurement of project indicators (outcome, progress and performance indicators)	Before the start of the project and at start of project, mid-point and close of project	PMU (technical officers responsible for RE and water quality testing)	4,620
Training workshops and reports	Two weeks after the delivery of the training workshop	PC	500
Project Progress Report on operation, performance and water usage	Quarterly f	PMU, with review and approval of the TAC and the PMU	6,800
Annual Project Report	Annually	PMU, TAC, M&E Coordinator	None
Project Management Committee (PMC) meetings	Quarterly	PMC	None
Technical Advisory Committee (TAC) meetings	Quarterly	TAC (PMU serves as the Secretariat)	None
External Audits (3)	Annually	External Auditor	10,500
Terminal Independent Project Evaluation and Report	Two months after project completion or no later than nine months after project completion	M&E Coordinator, TAC, PMU	4,000
Total			35,520

C. Include a simple results framework for the project proposal, including milestones, targets and indicators.

Result	Indicator(s)	Baseline	Milestone	Means of Verification
Component 1: Test innovative technology to increase the availability of water for agriculture.				
Outcome 1.1. Test innovative technology to increase the availability of water for agriculture.	Ecosystem services and natural resource assets maintained or improved under climate change and variability-induced stress	0 Climate adaptive technology for water use in agriculture demonstrated.	Procurement, installation and commission of 2 RO units 20 stakeholders participate in demonstration launch workshop	-Procurement records -Workshop report on the launch of the demonstration technology- -Quarterly performance report -Water quality monitoring reports -Final report on solar-powered RO demonstration
Outcome 1.2. Standards and policy developed to ensure sustained availability of water for agriculture.	Number of standards and policies introduced	0	Procurement, installation and commission of 3 solar pumps at 3 agriculture sites	-Procurement records -Workshop report on the launch of the demonstration technology -Quarterly performance report -Final report on solar-powered water pump technology demonstration -Rules and guidelines for monitoring water usage
Component 2: Standards and policy developed to ensure sustained availability of water for agriculture.				
Outcome 2.1. Additional adaptation technologies are identified and selected for scale up.	Number of key findings on effective, efficient adaptation practices, products and technologies generated. Number proposals on innovation technologies received from schools and farmers Percentage of targeted population informed	0	Five (5) adaptative technologies identified for the agricultural sector	Sign-up sheets at Stakeholder Engagements -Stakeholder workshop reports -List of adaptative technologies -Concept note
Outcome 2.2. New RE technologies for the Agriculture Sector mainstreamed	Participation by stakeholders in sector and policy planning and uptake of	Vulnerable farming populations are unable to access funding for adaptive and innovative	Vulnerable farmers have improved access to concessional loans for adaptive and innovative	-Sign-up sheets at Stakeholder Engagements -Stakeholder workshop reports

	adaptative technologies	technologies for agriculture.	technologies for agriculture.	-Records of farmers receiving business model packages

D. Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

Project Objective(s)[32]	**Project Objective Indicato**	**Fund Outcome**	**Fund Outcome Indicator**	**Grant Amount (USD)**
To test renewable energy powered and distributed, water production and distribution technologies to increase the water security for citizens of Antigua and Barbuda.	Ecosystem services and natural resource assets maintained or improved under climate change and variability-induced stress	**Outcome 5.** Increased ecosystem resilience in response to climate change, droughts, and hurricane induced stress on water sources. **Outcome 6.** Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas. **Outcome 7.** Improved policies and regulations that promote and enforce resilience measures **Outcome 8.** Support the development and diffusion of innovative adaptation practices, tools and technologies.	**5.** Ecosystem services and natural resource assets maintained or improved under climate change and variability-induced stress. **6.1** Percentage of households and communities having more secure (increased) access to livelihood assets **7.** Climate change priorities are integrated into national development strategy **8.1.** Innovative adaptation practices are rolled out, scaled up, encouraged and/or accelerated at national and/or subnational level.	250,000
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**

[32] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

Outcome 1.1. Test innovative technology to increase the availability of water for agriculture.	Ecosystem services and natural resource assets maintained or improved under climate change and variability-induced stress. Percentage of households and communities having more secure access to livelihood assets.	**Output 5.1.** No. and type of natural resource assets created, maintained or improved to withstand conditions resulting from climate variability and change (by type of assets) **Output 6.2.** Type of income sources for households generated under climate change scenario.	**5.1.** No. of natural resource assets created, maintained or improved to withstand conditions resulting from climate variability and change (by type and scale) **6.1**. Percentage of households and communities having more secure access to livelihood assets	175,120
Outcome 1.2. Standards and policy developed to ensure sustained availability of water for agriculture.	Number of standards and policies in place to address the availability of water for agriculture.	**Output 7.** Improved integration of climate-resilience strategies into country development plans	**7.1.** No. of policies introduced or adjusted to address climate change risks (by sector)	33,410
Outcome 2.1. Additional adaptation technologies are identified and selected for scale up.	Number of adaptation technologies /models that have been adopted in other areas or 'scaled-up'.	**Output 8.** Viable innovations are rolled out, scaled up, encouraged and/or accelerated.	**8.2.** No. of key findings on effective, efficient adaptation practices, products and technologies generated.	6,675
Outcome 2.2. New RE technologies for the agriculture sector mainstreamed	Participation by stakeholders in sector and policy planning and implementation in energy development		**8.1.** No. of innovative adaptation practices, tools and technologies accelerated, scaled up and/or replicated.	17,580

E. Budget

Please see Annex 1. AF Innovation Grant Detailed Budget for a complete budget description.

	Output	Activities	Total
Component 1	Output 1.1	1.1.1. Install solar panels and RO unit at test site (s).	145,000
		1.1.2. Workshop for the launch of the demonstration for key stakeholders.	2,700
		1.1.3. Develop protocol for monitoring of water quality, water usage, and well water levels.	2,100
		1.1.4. Monitoring of water quality, water usage, and well water levels.	4,620
		1.1.5. Develop protocol for sustainable disposal of RO permeate.	2,100
		1.1.6. Develop protocol for operation, maintenance, and repair.	2,100

		1.1.7. Training workshop for operation, maintenance and repair.	9,200
		1.1.8. Quarterly reporting on operation and performance.	6,800
		1.1.9. Final report on solar-powered RO demonstration.	500
		Output Total	175,120
	Output 1.2	1.2.1 Install one solar-powered water pump at three farms.	14,300
		1.2.2 Workshop for the launch of the demonstration for key stakeholders.	2,700
		1.2.3 Develop protocol for operation, maintenance and repair of unit.	2,625
		1.2.4 Develop protocol for monitoring water usage.	2,625
		1.2.5 Monitoring of water usage.	2,160
		1.2.6 Quarterly reporting on operation and performance.	3,000
		1.2.7 Final report on solar-powered water pump technology demonstration.	500
		Output Total	33,410
Component 2	Output 2.1	2.1.1. Conduct a scoping study of technologies currently used in the Agriculture Sector and assess the applicability of new adaptive technologies. Issue calls for proposals to students and farmers to submit innovative technologies and approaches which can help the sector become more resilient to climate change.	900
		2.1.2 Stakeholder consultation	4,200
		2.1.3 Final selection and prioritization of adaptive technologies for the agriculture sector.	525
		2.1.4 Development of a financing strategy for scale up in Antigua and Barbuda.	1,050
		Output Total	6,675
	Output 2.2	2.2.1 Assessment of business models for the use of the selected technologies in 2.1.2.	1,440
		2.2.2 Workshop with key stakeholders	2,600
		2.2.3 Assessment of tax and other policies to support the update of the selected technologies in 2.1.2.	1,440
		2.2.4 Develop training materials for local training groups to administer potential technology up takers.	4,000
		2.2.5 Stakeholder workshop to exhibit the technology in use	8,100
		Output Total	17,580
		Total Components	**232,785**
		Travel to Barbuda quarterly	560
		Project Coordinator	2,155
		Audit (3)	10,500
		Terminal Evaluation	4,000
		TOTAL	**250,000**

F. Disbursement Schedule

Milestones	Date	Disbursement Percentage
Upon Signing Agreement	September 2020	130,000 USD
Submission of First Annual Report	August 2021	80,000 USD
Submission of Second Annual Report	August 2022	40,000 USD

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[1]

Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:

Ambassador Diann Black-Layne	Date*: January 20th 2020*

B. Implementing Entity certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (National Communications to the UNFCCC, INDC, Physical Planning Act) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
……………………………… *Ambassador Diann Black-Layne* Implementing Entity Coordinator	
Date: *January 20th 2020*	Tel. and email: +1(268) 464-6410 dcblack11@gmail.com
Project Contact Person: Rashauna Adams-Matthew	
Tel. And Email: +1 (268) 462-4625 rashauna.adams-matthew@ab.gov.ag	

[6] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.