



# Adaptation Options in Buildings

## Antigua & Barbuda

### Preparing for Climate Change

Climate change trends for Antigua and Barbuda suggest the following:

- The Caribbean could be 3°C warmer on average by 2070, which can cause heat stress to people, and increase mosquito breeding, contributing to virus outbreaks
- Antigua and Barbuda will likely receive less rainfall in the future – possibly up to 40% less
- At the same time, the country can expect greater downpours, leading to more frequent flooding
- There is a risk of more extreme hurricanes in the future

The Department of Environment in the Ministry of Health and the Environment has established a Revolving Fund to assist home and business owners prepare for climate change by adapting our infrastructure over time.

A number of adaptation options are provided here to help building owners be prepared. The best adaptation options are ones that give the owner value TODAY – not only in the future – by meeting your immediate needs.

### Information in this Packet

This information package presents standard adaptation options for: Energy, Buildings, Flooding, Vector Control, Water, and Temperature.

Each page covers one adaptation option, it includes a description, the benefits – including potential economic benefits, and requirements. An approximate budget is included and payback information, however all of this information is subject to change. More details specific to household circumstances can be determined with the staff of the Department of Environment.

### Questions? Contact Us at the Department of Environment

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ADAPTATION FUND



## Resilient Solar Renewable Energy System

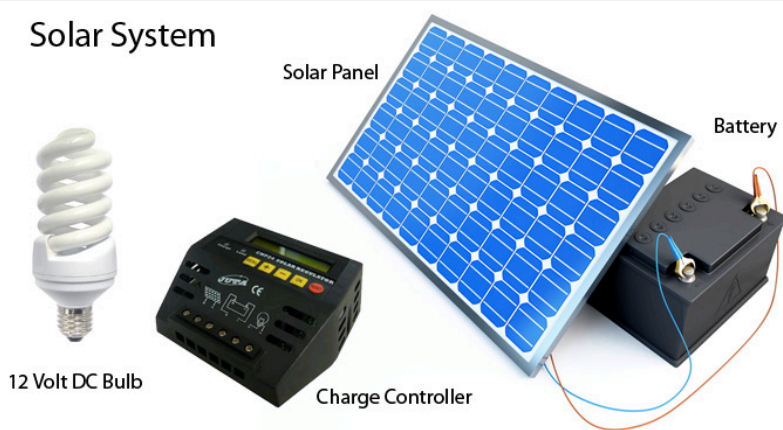
### Description

Solar panels are a **distributed renewable energy** system – electricity can be generated in small scales at different sites, such as on rooftops. **Energy resilience** means that the electricity supply is consistent and uninterrupted. Coupling solar panels with a battery system means that buildings can receive energy when the grid is down. The **environmental benefit** of solar is that it generates electricity without burning fossil fuels, thereby reducing carbon dioxide emissions, helping solve climate change, and supporting cleaner air in Antigua and Barbuda.

### Adaptation Benefits

Grid-interactive solar (which means that the solar is connected to the grid but also has a battery system) can help households and small businesses to have electricity immediately after a power outage, such as post-hurricane.

### Solar System



### Economic/Other Benefits

The cost of solar energy installation, spread out over the life of the technology, can be about one third of the cost of standard utility bills.

### Requirements

An energy audit is recommended. The roof should be sturdy, and have a gentle south-facing slope so that the panels face the sun. The owner should assess risks of theft and hurricane damage.

Est. Budget	Description	EC\$
Materials	3 kW solar system + 2 yr warranty	
Labour	Installation costs	
	<b>Total:</b>	<b>EC\$42,000</b>

❖ Assuming an interest rate of 3% and a payback period of 5 years

❖ Monthly payments = EC\$755  
 ❖ Sum of repayments = EC\$45,281



## Solar Water Heater

### Description

Solar water heating collectors capture and retain heat from the sun and transfer this heat to the water. Solar water heaters are energy efficient devices, “eliminating” the need for electricity or gas for water heating (except for water pumping costs) and using sunlight instead, saving up to 100% of water heating operating costs.

### Adaptation Benefits

Solar hot water heaters do not require any other inputs, and so they can continue to supply hot water post-disaster. “Load-shedding”, when energy intensive appliances are replaced with alternatives, helps make solar energy meet a building’s electricity needs.



### Economic/Other Benefits

Solar hot water heaters reduce electricity cost that would otherwise have been spent heating water.

### Requirements

Installation should be secure to withstand strong hurricane winds.

Est. Budget	Description	EC\$
Materials	26 Gallons	\$3,750
Labour	Installation	\$500
	<b>Total:</b>	<b>EC\$4,250</b>

❖ Assuming an interest rate of 3% and a payback period of 2 years

❖ Monthly payments = EC\$183  
❖ Sum of repayments = EC\$ 4,384



## Energy Efficient Appliances

### Description

Globally, buildings account for over a third of total energy use; typically 10 to 20% of energy is consumed during manufacturing and assembly of building materials, construction, maintenance, refurbishment and demolition. Some 80 to 90% of a building’s energy is used, over the life of the building, for heating, cooling, lighting and ventilation, and house appliances (laundry machines, televisions, refrigerators, etc). Energy efficient appliances that meet regional standards can be purchased through the Revolving Loan Facility.

### Adaptation Benefits

Replacing appliances with efficient ones helps, or “load-shedding”, helps make solar energy more viable to meet the building’s electricity needs.



### Economic/Other Benefits

Energy efficient appliances are a win-win or people and the environment, because they help to reduce energy bills, and reduce carbon emissions from the burning of fossil fuels.

### Requirements

For items to be disposed, there must be a solid waste management plan in place.

Est. Budget	Description	EC\$
LED lightbulbs	10 bulbs	\$130
Refrigerator	E.g. Energy Star	\$8,000
	<b>Total:</b>	<b>EC\$8,130</b>

❖ Assuming an interest rate of 3% and a payback period of 2 years

❖ Monthly payments = EC\$350  
❖ Sum of repayments = EC\$ 8,387





## Roof Reinforcements

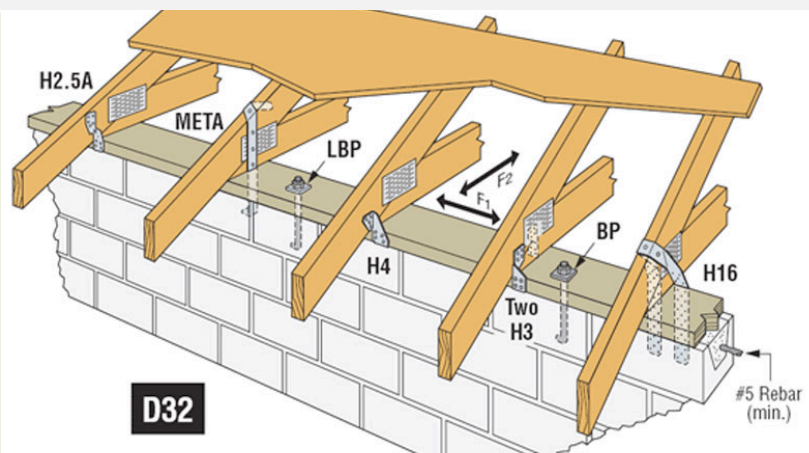
### Description

All buildings in Antigua and Barbuda should be able to withstand a Category 5 hurricane. Reinforcing roof structures by replacing galvanize, replacing beams and installing hurricane clips is an important investment for the next hurricane.

This adaptation activity can be coupled with air ventilation or air conditioning adaptations, or roof adjustments in order to install solar energy or solar water heaters.

### Adaptation Benefits

Buildings will be able to withstand extreme hurricanes. People will be safer at home during extreme events.



### Economic/Other Benefits

This adaptation should not impact day-to-day cost of living for borrowers.

### Requirements

This adaptation assumes that the walls and foundations are strong.

Est. Budget	Description (assuming 1,200 sq ft)	EC\$
Materials	Galvanize \$10 per sq ft	
Labour	Installation \$20 per sq ft	
	<b>Total:</b>	

- ❖ Assuming an interest rate of 3% and a payback period of 5 years
- ❖ Monthly payments = EC\$
- ❖ Sum of repayments = EC\$



## Strengthening Windows and Doors

### Description

All buildings in Antigua and Barbuda should be able to withstand a Category 5 hurricane. Reinforcing windows and doors is an important adaptation measure to bring buildings into compliance with the Building Code, and prepare our infrastructure for hurricanes and extreme weather.

### Adaptation Benefits

Buildings will be able to withstand extreme hurricanes. People will be safer at home during extreme events.

### Economic/Other Benefits

This adaptation should not impact day-to-day cost of living for borrowers.



### Requirements

Assumption that the walls and foundations are strong. This installation process can easily be coupled with installation of mosquito screens, and/or air ventilation and air conditioning.

Est. Budget	Description (concrete buildings)	EC\$
Materials	Per door (\$550), per window (\$550)	\$1,100
Materials	Per hurricane shutter (\$750)	\$750
Labour	Installation	\$1,750
	<b>Total:</b>	<b>\$3,600</b>

❖ Assuming an interest rate of 3% and a payback period of 2 years

❖ Monthly payments = EC\$155  
❖ Sum of repayments = EC\$ 3,713



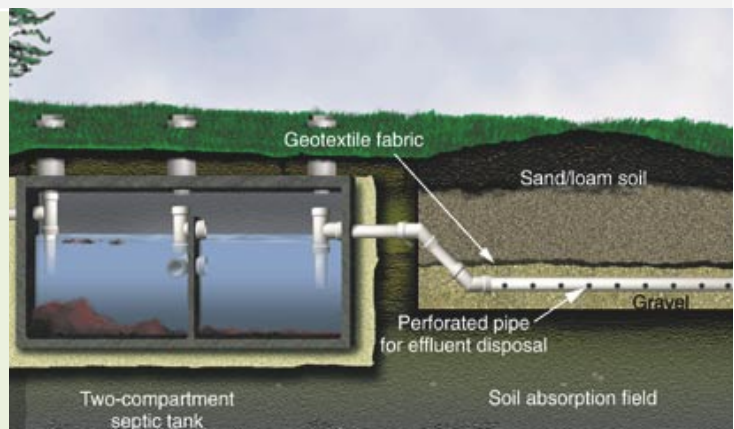
## Community Septic Systems for Building Density

### Description

Community Septic systems, also known as central septic systems, are septic systems that receive black waste or wastewater in volumes exceeding 2,500 gallons per day, or systems that receive black waste or wastewater from more than two homes or more than two buildings under separate ownership. Adaptation is also relevant for our style of development. Research has shown that single family detached houses take up a lot of land, convert beneficial greenery areas and waterways, and are contributing to environmental problems we are facing.

### Adaptation Benefits

Limiting single family type development is an adaptation, and doing this requires proper septic systems. Adaptation loans are available to support community septic systems, which will enable sustainable urban development by building up – not out.



### Economic/Other Benefits

Community septic systems can benefit developers and landowners by permitting compact development with smaller lotsizes and reduced infrastructure costs.

### Requirements

This requires that two or more households or businesses propose a joint venture to develop a community septic system. Adequate land and joint agreements are required.

Est. Budget	Description	EC\$
Materials		
Labour		
	<b>Total:</b>	<b>\$12,380</b>

❖ Assuming an interest rate of 3% and a payback period of 5 years

❖ Monthly payments = EC\$221  
 ❖ Sum of repayments = EC\$ 13,271



## Water Storage

### Description

Buildings in Antigua and Barbuda are required to have rain water harvesting in place, however enforcing this can be difficult. For buildings that do collect rainwater, the storage capacity is not always enough to serve the household or building occupancy.



### Adaptation Benefits

Rainwater harvesting is a win-win for people and the environment. It helps households to have water during drought, and collecting rainwater can reduce flooding because it diverts runoff.

### Economic/Other Benefits

Rainwater harvesting helps to reduce your water utility bill.

### Requirements

Guttering is required. The Revolving Loan Facility can provide loans for buildings to install guttering and other water infrastructure.

Est. Budget	Description	EC\$
Materials	1,000 gallon tank + base	\$2,950
Labour		\$950
	<b>Total:</b>	<b>\$3,900</b>

❖ Assuming an interest rate of 3% and a payback period of 2 years

❖ Monthly payments = EC\$168  
❖ Sum of repayments = EC\$ 4,023





## Water Use Efficiency

### Description

Do you have leaky taps or toilets that use way too much water to flush? Water use efficiency targets demand-side management – how much water people are using in homes and buildings. Residential water efficient appliances along with water reuse technologies (such as grey water recycling) can reduce water demand by 50%. Other measures especially for backyard gardens include drip irrigation. These measures are critical as Antigua and Barbuda is expected to experience more extreme droughts in the future.

### Adaptation Benefits

Fresh water resources are severely threatened by climate change, especially in Antigua and Barbuda which is already susceptible to slight changes in rainfall due to its lack of natural water sources. Water use efficiency is a cost-effective water conservation measure.



### Economic/Other Benefits

Water efficiency means less demand on energy infrastructure through less pumping, and the costs of combining water storage + efficiency are lower than just building storage.

### Requirements

Running water in the household. If pipes are leaky, then residents may also wish to repair pipes as part of the water efficiency measures.

Est. Budget	Description	EC\$
Materials		
Labour		
	<b>Total:</b>	

❖ Assuming an interest rate of 3% and a payback period of 5 years

❖ Monthly payments = EC\$  
❖ Sum of repayments = EC\$





## Green Infrastructure (Pervious Surfaces)

### Description

Pervious, or “penetrable”, surfaces means that water can be absorbed through the surface into the ground. When it rains, if there are only hard or impervious surfaces, the water runs off the land, carrying soil and waste with it, and often causes flooding on properties.

Green infrastructure and “pervious concrete” can help reduce flooding.

### Adaptation Benefits

Installing surfaces that have areas for water to soak into the ground helps to reduce runoff, recharge groundwater sources, and reduce flooding. Depending on your preference, it also looks nice!



### Economic/Other Benefits

This adaptation should not impact day-to-day cost of living for borrowers.

### Requirements

Est. Budget	Description	EC\$
Materials		
Labour		
	<b>Total:</b>	

❖ Assuming an interest rate of 3% and a payback period of 5 years

❖ Monthly payments = EC\$  
❖ Sum of repayments = EC\$



## Mosquito Screens

### Description

Mosquito mesh on windows and doors offers protection against mosquitos and other insects, protecting against the diseases they may carry, such as dengue fever, Chik-V and Zika. To be effective the mesh of a mosquito net must be fine enough to exclude such insects without reducing visibility or air flow to unacceptable levels.

### Adaptation Benefits

Mosquito breeding and therefore disease outbreaks are linked to climate variability – including rainfall and temperature. This adaptation helps to protect health and reduce outbreaks.



### Economic/Other Benefits

This adaptation should not impact day-to-day cost of living for borrowers.

### Requirements

Windows and doors should be structured to accommodate mosquito screens.

Est. Budget	Description	EC\$
Materials	Mosquito netting 4 sq ft	\$100
Labour	\$100 per 4 sq ft of window area	\$400
	<b>Total:</b>	<b>\$500</b>

❖ Assuming an interest rate of 3% and a payback period of 2 years

❖ Monthly payments = EC\$21  
 ❖ Sum of repayments = EC\$ 516



## Indoor Air Quality

### Description

Climate change may worsen existing indoor air quality, and it may introduce new problems as outdoor conditions become more severe. Our homes and buildings, where we spend most of our time, protect us. The design, construction, operation and maintenance of buildings can impact the air we breathe, our energy consumption, and our health. Natural ventilation and shading can help control indoor temperatures and the quality of air. This is a good adaptation option to couple with roof retrofits, windows or door replacements and designs.

### Adaptation Benefits

Increasing temperatures and changes in wind and other ambient factors can negatively impact indoor air quality. This is especially true in businesses where people are indoors for long periods of time.



### Economic/Other Benefits

This adaptation should not impact day-to-day cost of living for borrowers. If indoor areas are cooled, ventilation could increase air conditioning costs.

### Requirements

Monitoring air quality is a simple way to determine indoor air quality. Dealing with source pollutants is the most effective solution to improving indoor air quality.

Est. Budget	Description	EC\$
Materials		
Labour		
	<b>Total:</b>	

❖ Assuming an interest rate of 3% and a payback period of 5 years

❖ Monthly payments = EC\$  
❖ Sum of repayments = EC\$



## Air Conditioning

### Description

October 2015 set several new records for the top-ten hottest days in Antigua and Barbuda. Climate change is likely to cause more extreme heat waves, and also warmer nights. Air conditioning is one way to protect health from heat stress. Most residential air-conditioning systems do not bring outdoor air into the house mechanically; advanced designs are starting to add a mechanical feature that brings outdoor air into the building.

### Adaptation Benefits

Protect human health from heat stress, especially during hot nights for sleeping and daytime productivity.



### Economic/Other Benefits

This adaptation could result in an increased cost of living for borrowers. This measure should be coupled with energy efficiency and/or solar energy adaptations to reduce cost of living.

### Requirements

Air conditioning installation should be guided by the building code. Vents intake pipes should be located away from septic tanks.

Est. Budget	Description	EC\$
Materials		
Labour		
	<b>Total:</b>	

- ❖ Assuming an interest rate of 3% and a payback period of 5 years
- ❖ Monthly payments = EC\$
- ❖ Sum of repayments = EC\$