

MODULE 3
CLIMATE CHANGE: WHAT CAN WE DO?
MITIGATION AND ADAPTATION
MEASURES



FOREWORD

The Project Management Coordination Unit (PMCU) of the Ministry of Environment and Drainage is coordinating the Consultancy to Develop Adaptation Measures to Counter the Effects of Climate Change with a focus on Water Resource Management & Flood Resilience, or the AMCECC programme. The programme, which is funded by the United States Agency for International Development (USAID), aims to lessen the possible effects of climate change and increase the resilience of Barbados, through public education as well as the design and implementation of various structures and actions.

Two critical components of this project are the development of climate change education materials and the training of civil society organisations (CSO) and non-governmental organisations (NGO). The objective is to build general awareness, expand scientific knowledge and transfer skills to ensure effective partnerships in building the resilience of communities to disasters and their adaptation to climate change.

To this end a set of training materials were developed by CERMES and Baird & Associates, including – educational modules, power point presentations and videos. These were designed to provide representatives of CSOs, NGOs and primary and secondary school teachers with simplified information about climate change, its causes and effects. Most importantly, the materials provide details on the actions that can be taken by citizens to mitigate against and adapt to the effects of climate change.

Training of trainer sessions in November 2016 introduced this material to representatives of local CSOs, NGOs and the teaching community to assist them in using the information to develop their own training or teaching programmes.

Barbados is a small island developing state, particularly vulnerable to the impacts of climate change. The island receives significant rainfall, seasonally, yet it remains one of the most water-scarce countries in the world. It is predicted that with ongoing climate change, periods of both drought and flooding may become more prolonged in Barbados in the future. We therefore hope that you will use these modules, videos and power point presentations to enhance your knowledge of climate change. We are even more hopeful that you will share them with your relatives, school mates, work colleagues, people in your churches and clubs.

1 ADDRESSING THE EFFECTS OF CLIMATE CHANGE

In Module 1 we explained climate change and its causes; and in Module 2 we took a closer look at the impact of climate change on water resources. Once we accept that climate change is a reality, the logical question to ask is: “What do we do about it?” In this respect it is important to understand that carbon dioxide, the heat-trapping greenhouse gas that has driven recent climate change, lingers in the atmosphere for hundreds of years, and the planet (especially the oceans) takes a while to respond to warming. So even if we stopped emitting all greenhouse gases today, climate change will continue to affect future generations.

In the United Nations Framework Convention on Climate Change (UNFCCC) of 1992, almost all nations of the world have committed themselves to preventing a "dangerous interference" with the climate system. To avoid the most dangerous consequences of climate change, the Copenhagen Accord of 2009 calls for keeping global warming below 2°C above pre-industrial temperatures, possibly even less¹. To reach this goal, the greenhouse gas concentration in the atmosphere needs to be stabilised well below 450 ppm CO₂- equivalent. To achieve this, the global CO₂ emissions need to be reduced by 50- 80% by 2050, compared to the level of 1990².

So our options are twofold – mitigation and adaptation. The International Panel on Climate Change (IPCC) defines these terms as follows:

- **Mitigation** is “an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.”
- **Adaptation** is “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”³

In layman’s language **mitigation** deals with reducing or stopping activities that produce greenhouse gases (GHG), and **adaptation** means that we adjust the way we live so that we are less vulnerable to the climatic changes. The great thing about adaptation is that it also ties in to many disaster risk reduction activities that are already taking place.

Climate mitigation and adaptation are not alternatives to each other; rather they are complementary approaches for reducing risks of climate change impacts over different timescales. Mitigation measures, if implemented in the near-term and through the century, can substantially reduce climate change impacts in the latter decades of the 21st century and beyond. Benefits from adaptation can be gained immediately by addressing existing risks, but can also be realized in the future by addressing emerging risks. Substantial cuts in GHG emissions over the

¹ Asariotis, R., & Benamara, H. (2012). *Maritime transport and the climate change challenge*. Routledge.

² Rahmstorf S. Climate change—state of the science. Potsdam Institute for Climate Impact Research, 2008

³ IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 976pp

next few decades can substantially reduce risks of climate change by limiting warming in the second half of the 21st century and beyond.

In December 2015, a deal to attempt to limit the rise in global temperatures to less than 2°C was agreed upon at the international climate change summit in Paris, France (COP21). Known as the Paris Accord, this agreement is the first to commit all countries to cut carbon emissions and is partly legally binding and partly voluntary.

Mitigation and adaptation will require changes at all levels in society – new legislation, new rules for the private sector and changes in individual lifestyles. We will now examine mitigation and adaptation more closely.

Activity

Watch the video Adaptation and Mitigation.

- List the examples of adaptation that were mentioned in the video.
- List the examples of mitigation that were mentioned in the video.

2 MITIGATION

Mitigation refers to efforts to prevent or reduce the emission of heat-trapping greenhouse gases into the atmosphere. There are two ways to stop increasing the amount of greenhouse gases in the atmosphere:

Reducing sources – stopping the emission of so many greenhouse gases into the atmosphere, or inventing ways to remove greenhouse gases from the atmosphere; e.g. using new technologies and renewable energies, making older equipment more energy efficient, changing management practices or consumer behaviour.⁴

Protecting and enhancing carbon sinks – A carbon sink is anything that absorbs more carbon than it releases as carbon dioxide. So we must protect our forests and oceans, and engage in forestry and agricultural practices that increase forest cover.⁵

2.1 Mitigation Strategies: What You Can Do

Individually, making a few small behavioural changes, whether at home, at school or work, can reduce greenhouse gases. Possible mitigation strategies include the following:

Use water efficiently

Saving water reduces greenhouse gas emissions as it takes a considerable amount of energy to treat, heat and pump water. Turning off the tap when brushing teeth, fixing all leaks immediately, and using harvested rain water to irrigate the garden, are all simple steps that can be taken.



Figure 1: Needless running water whilst brushing teeth

List the ways that you can think of to conserve water at your home, office or school.

⁴ UNEP. (2014). Climate Change Mitigation. United Nations Environment Programme: <http://www.unep.org/climatechange/mitigation/>

⁵ IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Conserve Energy

We can implement simple and inexpensive actions such as replacing lightbulbs with energy-efficient ones that use less energy and also last longer; as well as using energy efficient appliances and equipment such as those with an **Energy Star** label. This has the twofold effect of saving you money on your electricity bill and also reducing greenhouse gas emissions. Go to the Barbados Light and Power co. Ltd. Webpage for some useful tips on how you can conserve energy:



<http://www.blpc.com.bb/tips-gen/tips-ener.html>





Reduce, reuse, recycle, recover

Waste reduction, reuse, recycling and energy recovery not only help to conserve energy, but also reduce greenhouse gas emissions from disposal. Composting food and yard waste will greatly reduce the amount of garbage sent to the landfills, thereby reducing greenhouse gas emissions.



Come up with a list of ways that you can reduce, reuse or recycle in your (i) household; (ii) school; (iii) office; (iv) community

Here is a list of recycling facilities that operate in Barbados:

-  Sustainable Barbados Recycling Centre - <http://www.sbrinc.com/>
-  B's Recycling - <http://bsrecyclingbarbados.com/>
-  Ace Recycling - 423-0510
-  Scrap Man - <http://www.scrapmanrecycling.com/contact-us>

Give your car a break

Driving your vehicle releases greenhouse gases into the atmosphere and contributes to climate change. Using alternate forms of transportation such as bicycles, walking, public transportation, carpooling or electric or hybrid vehicles are simple steps to cut your carbon emissions. Being safe on the road is good for the environment as well as human safety - fast acceleration and braking is much less efficient than anticipating stops and starts and taking your time, it makes a tank of gas go further! Keep your tyre pressures up and get regular tuning. Avoid idling – 10 seconds of idling uses as much gas as starting the car.







Figure 2: Alternate forms of transportation

2.2 Mitigation Strategies: National level actions

Beyond the individual steps mentioned above, countries can implement various mitigation strategies across various sectors such as the water, agriculture, waste and energy sectors, throughout the Caribbean.

2.2.1 Water

Researchers at the University of the West Indies Cave Hill Campus, having recognised the challenges that will be placed on the existing water resources because of climate change, have made some recommendations that could build capacity in water resources management in the Caribbean. These include:

-  Increasing the available storage of water supplies.
-  Paying greater attention to the maintenance of the existing water service infrastructure and implementing programmes to fix existing pipes to reduce leakages.
-  Promoting and adopting appropriate water harvesting and reuse measures and technologies.
-  Giving financial incentives to improve water use efficiency.⁶

⁶ Cashman Adrian, Leonard Nurse and John Charlery. (2010) Climate Change in the Caribbean: The Water Management Implications. *The Journal of Environment & Development* 19(1) 42–67

2.2.2 Agriculture

In agriculture, options include improved cropland management and grazing land management; the restoration of organic soils and degraded lands; and improved fertilizer application techniques.

Carbon storage and sequestration

Carbon dioxide is taken in by plants during photosynthesis (sequestration) and some carbon is lost through respiration while the rest is stored in the leaves, branches and roots of the plants. Dead leaves, branches and roots containing carbon are buried in the soil and this oxygen-poor environment causes the slow breakdown of plant materials, resulting in significant carbon storage.

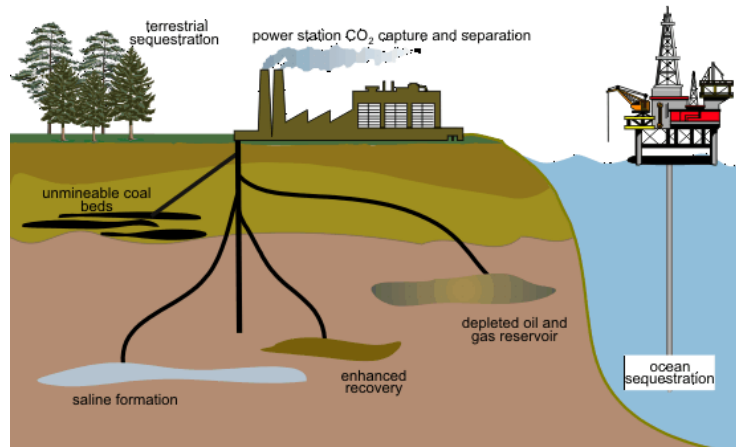


Figure 3: Source: <https://www.quora.com/How-is-carbon-sequestration-useful-to-the-environment>

Reforestation, restoration and conservation

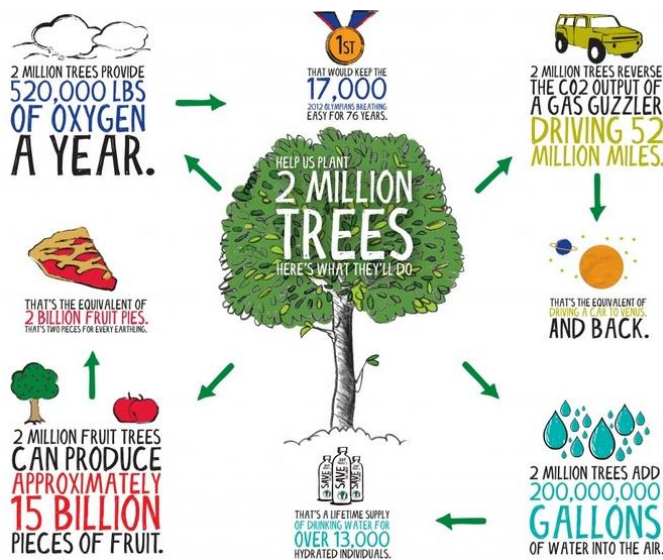


Figure 4: Source: https://shutterstock.files.wordpress.com/2013/05/2_million_trees_infographic.jpg

The most cost-effective mitigation options in forestry are afforestation (i.e., planting trees), sustainable forest management and reducing deforestation. By expanding (replanting trees) and protecting existing forests, it is possible to boost the removal of carbon dioxide from the atmosphere. At the same time this will also contribute to climate change adaptation by ensuring that the forests and mangroves can provide ecosystem services like protecting water supplies and food sources, among other things.

2.2.3 Waste

Mitigation strategies in waste management include landfill methane recovery; waste to energy; recycling and composting of organic wastes.

2.2.4 Renewable energy

Five hundred windmills in Barbados powered the sugar cane industry that made parts of the UK extremely wealthy. There are a number of viable renewable energy options for the Caribbean – wind, solar, ocean thermal energy conversion (OTEC), geothermal energy, biomass and biofuels⁷.

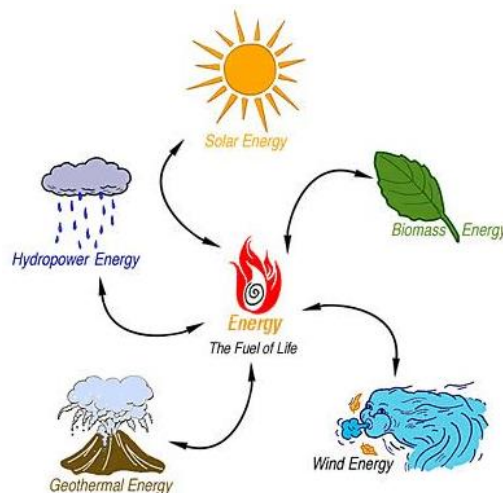


Figure 5: Source: <http://greenplanetethics.com/wordpress/renewable-and-non-renewable-energy-sources-explained/renewable-non-renewable-energy-sources-image/>

For more information on the United Nations Environment Programme (UNEP)'s work on mitigation with links to: agriculture; forests; energy; manufacturing; transport; tourism, building and waste, visit <http://www.unep.org/climatechange/mitigation/>.

Additionally, for a Caribbean perspective on climate change, check out “5 Things You Should Know About Climate Change in the Caribbean” produced by the Caribbean Community Climate Change Centre in October 2014 with support from the UK-based Climate and Development Knowledge Network (4.15 min) at <https://www.youtube.com/watch?v=NkJQM8Ihad4> as well as the CCDMC Climate Change: Adaptation is everyone's business Video (2.34 min) at <http://www.youtube.com/watch?v=j2KNLk9P8AE>.

⁷ Biofuels should be pursued cautiously. The recent rapid shift to biofuels has created more conflict and more poverty in some regions of the world as forests were cleared to create palm oil and other similar plantations. The production of biofuels also competes for space and resources with food production and has been blamed in part for some of the high food prices globally.

3 ADAPTATION

Adaptation involves adjusting to the actual or expected future climate, with the goal of reducing our vulnerability to the harmful effects of climate change. It requires that we make the most of any potential beneficial opportunities associated with climate change and may involve changing lifestyles and establishing and implementing new rules.

3.1 Adaptation strategies

Climate change adaptation strategies available to Small Island Developing States (SIDS) come in three main categories: retreat, accommodation, and protection and enhancement.

- 🌿 **Retreat** refers to the abandonment of the vulnerable areas and the relocation of activities to sites away from those areas e.g. moving away from coastal areas to higher ground.
- 🌿 **Accommodation** is where alteration is made to the use of the area, but people continue their activities in the same place.
- 🌿 **Protection and enhancement** can be in terms of hard structure, such as seawalls, dikes, groins, and detached breakwaters or soft structures, such as the maintenance of healthy and vibrant ecosystems such as coral reefs, sea grass beds, mangrove forests, and wetlands.⁸

3.2 Examples of Adaptation

Many governments and organizations across the world are already adapting to climate change because we are already experiencing the effects of climate change in the form of sea level rise, changing precipitation patterns, and more intense extreme weather events. Adapting to the changes that are already underway, and preparing for future climate change, can help reduce the risks societies will face from climate change. Some examples of adaptation measures include:

3.2.1 Protecting and conserving water resources



Improving water use efficiency by building additional water storage capacity; using rainwater harvesting, sewage treatment and recycling; low-water use appliances; and protecting ecosystems that support the water cycle – forests, mangroves etc.

Figure 6: Rain Water Harvesting

⁸ Veitayaki, J. (2010). Climate change adaptation issues in small island developing states. *Climate Change Adaptation and Disaster Risk Reduction: Issues and Challenges*, 4, 369.

3.2.2 Planning for sea level rise



Figure 7: Richard Haynes Boardwalk;

Source: <http://archinect.com/blog/article/36670110/day-4-barbados-or-how-i-fell-in-love>

Barbadians and visitors to the island enjoy the recreational benefits of the Richard Haynes Boardwalk in Christ Church. But in addition to the human health benefits that are derived from the boardwalk, it serves the primary objective of protecting the coastal businesses and homes from the impacts of storms and hurricanes.

3.2.3 Enforcing the building codes

Building next to the coastline means that we must also obey the setback rules that have been put in place by the Coastal Zone Management Unit and the Town and Country Planning Development Planning Office which are intended to ensure that our coastal homes and businesses do not contribute to flooding and erosion and are also protected in the event of storms and hurricanes. We must follow the building codes and construct buildings that can withstand hurricanes. We can use the concept of “sacrificial floors”. For example, the next time you visit the Barbados Hilton you will see that like many coastal hotels, the guest rooms are situated from the second floor and other facilities such as restaurants and the spa are located on the ground level. That way they can re-open for business much faster in the event of a storm which could cause damage to the ground level. We must also install efficient drainage systems to cope with intense rainfall events; and we should avoid building in flood plains. We can also take climate change into consideration when we conduct Environmental Impact Assessments (EIA) prior to making decisions to build, especially in coastal locations. EIAs can make recommendations for increasing resilience in our building designs.

3.2.4 Changing agricultural practices

There are many practices that can be used in agriculture to increase adaptation to the effects of climate change – you will recognise that some of these have been used historically with much success:

- Use terracing on sloping lands to reduce the risk of landslide and soil erosion.
- Reduce chemical use to avoid pollution of rivers and coastal waters.
- Plant ‘hedgerows’ to reduce erosion.
- Plant crops that are more drought and pest resistant.

- 1. Devise measures to protect livestock from heat stress, lack of water and flooding.
- 2. Increase self-sufficiency by growing vegetables and fruit trees.
- 3. Composting can be practised to reduce chemical use as well as the energy utilised in transporting waste to the landfill.
- 4. Working together as a region to increase regional food security.

3.2.5 Securing human safety and health

Create Your Own ZERO ZIKA ZONE

ZIKA TASK FORCE
Informing the Caribbean's Response
www.will.cdbi.zika

Information compiled by the experts of the WHO Regional Zika Task Force. Includes: Guidelines for the re-introduction of Aedes aegypti in Trinidad with evidence for the re-introduction of Aedes albopictus in Guyana (2015) and Guyana (2015); The Zika & Dengue (ZIKD) 2015; <http://www.will.cdbi.zika/mosquitoes/36.html> (2015)

Your attack plan in 4 simple steps

1. Start at your home and map a 100m radius zone
2. Make a personal commitment to conduct weekly checks for possible mosquito breeding sites and eliminate them
3. Involve your community by encouraging your neighbours to do the same
4. Enjoy a Zero Zika Zone as wide as your community, your country and eventually your region

Use these 5 tips to create your Zero Zika Zone

TIP 1
Protect yourself from being bitten

- Apply repellents with DEET
- Wear light colored protective clothing
- Use mosquito nets especially for children and the elderly during the early morning and afternoon

TIP 2
The Aedes mosquito prefers to bite indoors and during daytime

Remember to open all windows during fogging. Also use insecticide sprays in bedrooms since they can host large numbers of adult mosquitoes at certain stages of their lifecycle.

TIP 3
The Aedes mosquito can also breed indoors

Check water collection units in refrigerators and Air conditioning units as possible breeding sites

TIP 4
The Aedes mosquito can breed above or below ground and in natural sites

Check the common spots where water settles but also look for mosquito breeding sites in the unusual spaces:

Above Ground

- Chipped roof gutters
- Bottle pieces on top of walls or open brick holes
- Open flower pots which can collect water

Below Ground

- Septic tanks with cracked walls or lids
- Chipped drains
- Wells
- Storm drains

Natural Breeding Sites

- The leaves of plants which can hold water e.g., Bromeliads, Peace lilies and Elephant's Ear plants
- Tree trunks with deep cavities and holes
- Empty giant African snail shells

TIP 5
Eliminate the Aedes mosquito at its source

- Cover all barrels and water containers to prevent breeding
- Use BTI (Bacillus thuringiensis israelensis) larvicide "Buzink" and fill in water containers
- Use a Liquid Chlorine (e.g. Clorox) wash to acids containers and kill mosquito eggs
- Unclog drains or use cooking oil on the surface of stagnant water to suffocate mosquito larvae
- Fill tree holes with sand or soil
- Clean discarded food or drink containers
- Properly cover up open fecal pots
- Remove or crush empty giant snail shells

We should establish early warning systems and emergency response plans so that we can be ready for more extreme weather events. Having effective insurance coverage to facilitate recovery after storms and hurricanes is also very important.

More effort must also be placed on controlling disease carriers such as mosquitoes or rodents.

4 EDUCATION AND PUBLIC AWARENESS

So we have come to the end of our series of modules. We hope that you now understand what climate change is; what causes it; how it impacts our water resources; and the many actions that can be taken to adapt or mitigate.

Clearly action is needed – big actions at the global level; actions at the regional and national levels; and most importantly, actions that you can take right now. Some of you are probably taking adaptation measures already.

Our aim is to ensure that more people learn about climate change and take the necessary actions. That means that people at all levels (age, gender, social class etc.) need to be informed and educated about climate change so that they can become aware of the options available and be able to implement them. Education can therefore be considered an adaptation and mitigation activity because it influences the implementation of all other actions.

We therefore hope that you will use these modules, videos and power point presentations to enhance your knowledge of climate change. We are even more hopeful that you will share them with your relatives, school mates, work colleagues, people in your churches and clubs. Agencies that you can contact for additional or updated information about climate change include:

- The Centre for Resource Management and Environmental Studies (CERMES) Website: <http://www.cavehill.uwi.edu/cermes/home.aspx>; Telephone: (246)417-4316; Fax: (246) 424-4204; E-mail: cermes@cavehill.uwi.edu
- The Ministry of Environment and Drainage Website <https://www.gov.bb/government-main/directory/ministry-of-environment/>; Telephone: (246) 467-5700; Fax: (246) 437-8859; Email: envirobdos@gov.bb
- The Drainage Division: Telephone: (246) 426-9695 or (246) 4271609
- The Coastal Zone Management Unit (CZMU) Website <http://www.coastal.gov.bb/>; Telephone: (246) 622-1610; Fax: (246) 228-5956; Email: info@coastal.gov.bb
- The Barbados Water Authority (BWA) Website: <http://barbadoswaterauthority.com/>; Telephone: (246) 434-4200; Fax: (246) 435-3736; Email: bwa@caribsurf.com
- The Environment Protection Department (EPD) Telephone: (246) 535-4600; Fax: (246) 228-7103; Email: enveng@caribsurf.com
- The Natural Heritage Department (NHD) Website: <http://www.heritage.gov.bb/>; Telephone: (246) 438-7761; Fax:(246) 438-7767; Email: heritage@barbados.gov.bb

- The Ministry of Agriculture, Food, Fisheries and Water Resource Management Website: <http://www.agriculture.gov.bb/agri/>; Telephone: (246) 535-5100; (246) 535-5257/8
- The Caribbean Community Climate Change Centre (CCCCC) Website; <http://www.caribbeanclimate.bz/>; Telephone: +(501) 822-1094(501) 822-1094 or +(501) 822-1104(501) 822-1104; Fax: +(501) 822-1365; E-mail: info@caribbeanclimate.bz
- The United Nations Environment Programme Caribbean Environment Programme (UNEP CEP) Website: <http://www.cep.unep.org/>;
- The Caribbean Institute for Meteorology and Hydrology (CIMH) Website: <http://www.cimh.edu.bb/>; Telephone: (246)-425-1362/3/5; Fax: (246)-424-4733

Climate Change Mitigation and Adaptation

H Y B R I D V E H I C L E Y R
S T N H E I P E F U T C Z G E
G E E O D D L L H Y O I E R F
M S Q M I C U O I N M G N E O
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C S K N I S N O B R A C W R K

ADAPTATION

CARBONSINKS

CARPOOL

CLIMATE CHANGE

CONSERVATION

HYBRID VEHICLE

MITIGATION

RECYCLE

REDUCE

REFORESTATION

RENEWABLE ENERGY

REUSE

SEQUESTRATION