The green economy: a strategic approach to sustainable urban development in Caribbean Small Island Developing States (SIDS)

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Synopsis

Adopting a green economy approach in the Caribbean could provide a framework whereby decisions and strategies regarding cities and urban centres can promote resource efficiency, effective environmental management and a better standard of living for urban residents.

1. Introduction

Two major development issues currently facing Caribbean Small Island Developing States (SIDS) are the challenges associated with urban growth and the economic, environmental and social impacts of climate change related hazards. It is estimated that the Caribbean region is now 75% urbanised with variations in urban growth patterns across countries (Cohen 2004). Urban growth and development in Caribbean is often marred by growing informal settlements, urban sprawl, inefficient resource use and increasing demands on services such as water and sanitation. These urban issues are further exacerbated by climate change related threats such as sea level rise, increase intensity of storms and hurricanes. These associated hydrometeorological risks are detrimental to vulnerable coastal populations, since more than half the region's population live within 1.5km of the shoreline (Mimura et al. 2007). As a result it is critical that Caribbean policy makers address these development issues by identifying strategies that promote economically, socially and environmentally sustainable cities and urban centres.

The recently concluded Rio+20 United Nations Conference on Sustainable Development addressed the concept of the green economy as a mechanism for achieving the goals of sustainable development. The outcome document "The future we want' expressed the importance of utilising green economy initiatives as an important tool for achieving the overarching goal of sustainable development by means of informing policies that reconcile the economic, social and environmental dimensions of development. In this regard it was recognised that it is necessary to change unsustainable patterns of consumption and production and manage and protect natural resources while taking steps to alleviate poverty. It was also noted that countries can move towards a sustainable development path by addressing issues that are pertinent to their development needs. In the case of Caribbean SIDS, a green economy should adopt approaches that are in accordance with national development needs and priorities. Therefore this paper attempts to focus on the urban specificity of the green economy and to highlight the potential for achieving sustainable development goals through the greening of cities in the Caribbean.

The paper proposes strategies for greening the urban sector based on selected priorities from the Caribbean Urban Agenda in the area of natural hazard management and the cross cutting thematic areas of sustainability planning, climate change vulnerabilities. The paper discusses avenues for 'greening' the urban sector in the areas of water, waste and sanitation, transportation, urban form and the built environment and addresses the cross cutting issue of energy use and efficiency in the Caribbean. For the purpose of this discussion the 'urban sector' refers to the combination of essential service sectors that facilitate the efficient functioning of an urban area. This paper[i] is an abridged version of a discussion paper that was produced through an internship programme funded by the European Union (EU) under the EU MEAs project executed by the Caribbean Community (CARICOM) Secretariat. For the purpose of this paper the Caribbean refers to CARICOM member and associate member states.

The Caribbean Community (CARICOM) is an organisation of 15 Caribbean nations with member status and 5 Associate member states. Member states are Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago. Associate members are Anguilla, Bermuda, British Virgin Islands, Cayman Islands and Turks and Caicos Islands. The Caribbean Community and Common Market (CARICOM) was established by the Treaty of Chaguaramas, which was signed by Barbados, Jamaica, Guyana and Trinidad & Tobago and came into effect on August 1, 1973. In 2001 Heads of Governments signed the Revised Treaty of Chaguaramas which transformed the Common Market to a CARICOM Single Market and Economy. CARICOM's objectives include improving standards of living and work; enhancing co-ordination of Member States' foreign and foreign economic policies and coordinated and sustained economic development.

Through the Council for Trade and Economic Development (COTED), Ministers designated by member states are responsible for promotion of trade and economic development of the Community. In particular COTED is responsible for i. promoting measures for the development of energy and natural resources on a sustainable basis; ii. establishing and promoting measures for the accelerated development of science and technology; iii. promoting and developing policies for the protection of and preservation of the environment and for sustainable development. It is at this regional level that specific Caribbean priorities can be addressed and advanced.

2. Caribbean Context

Myers et al (cited in ECLAC 2010) views the Caribbean as a biodiversity hot spot, meriting global priority for conservation purposes. This is attributable to the fact that Caribbean islands have less than 30% of primary vegetation remaining (11.3%) and more than 0.5% of the World's known vascular plant species (2.3%). The region is also home to 2.9% of the World's endemic vertebrate species. The Caribbean region mainly consists of island states, with the exceptions of Belize in Central America, and Guyana and Suriname, situated on the South American continent (UNEP 2008). Territories are surrounded by the Caribbean Sea and the Gulf of Mexico totalling a combined area of approximately 5 326 000 km^2 (UNEP 2008).

Figure 1: The Caribbean Region and CARICOM Member countries

Caribbean economies are highly resource dependent and are usually reliant on a single economic resource resulting in a lack of economic resilience. The tourism and agricultural industries is the mainstay of several Caribbean economies and the in case of

Trinidad and Tobago oil and gas is the key foreign exchange earner. According to 2012 World Travel and Tourism Council (WTTC) statistics, the economic contribution of tourism in the Caribbean was greater than all other regions in the world. Several Caribbean countries recorded above world average contributions to GDP from Travel and Tourism. The total contribution of travel and tourism to GDP in Antigua and Barbuda totalled 77.4%, The Bahamas (48.4%), Barbados (39.4%) and St. Lucia (39%). One exception is Trinidad and Tobago where the energy sector is the largest contributor to GDP, figures from the Central Bank of Trinidad and Tobago Annual economic survey show that the energy sector accounted for 43.7% of GDP and 54.3% of government revenue in 2012.

Some of the countries in the region are also among the most indebted. St, Kitts and Nevis and Jamaica are the top two indebted countries in the region where 21.94% and 17.2% of exported goods and services is used to service debt. (ECLAC 2013) Added to this, poverty and unemployment are high in some Caribbean countries. In 2010 St. Lucia recorded an unemployment rate of 20.6%, whereas in Barbados and Jamaica unemployment statistics was estimated at 10.4 % and 12.3% respectively. (ECLAC 2013) Urban development in the Caribbean is often dominated by challenges of urban sprawl, informal settlements, peri-urbanism and increasing demands on services such as water and sanitation. It is worth noting that the Caribbean has a unique urban growth pattern characterised by a "… discontinuous, scattered, low density form of urbanisation" (UN-HABITAT 2012). Caribbean cities are usually capital cities dominated by high levels of primacy and intense urbanisation along coastal strips (Jaffe 2008). Owing to this many capital cities in the Caribbean continue to be the primary hub of administrative and economic activity, resulting in a skewed concentration of labour, political systems and administrative services. Urban and rural boundaries are often blurred due to extensive sprawl and as a result urban areas may include small administrative areas where human settlements and economic activity are concentrated.

3.1 Caribbean Vulnerabilities

As SIDS, Caribbean countries' economic and environmental vulnerabilities are exacerbated by challenges associated with urban growth and climate change related hazards. Most Caribbean cities, settlements, critical infrastructure, economic and social activities are located along the coast.

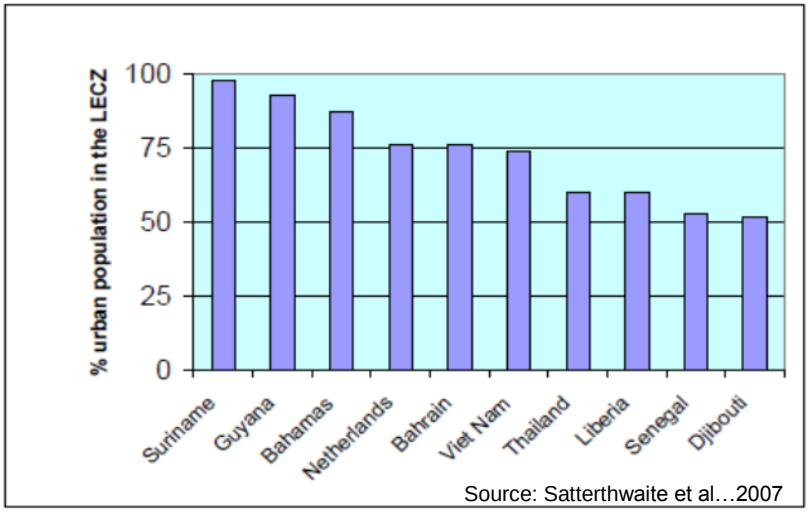

Figure 2: Nations with the highest urban populations in the Low Elevation Coastal Zone

Figure 2 show that three Caribbean territories possess the highest percentage of urban populations in the Low Elevation Coastal Zone. This increases vulnerabilities to climate change related threats such as sea level rise. Risks from extreme weather events that lead to storm surges can be detrimental to the Caribbean leading to inundation of

coastal cities and settlements, loss and damage to coastal infrastructure, flooding, loss of natural defences and aesthetic appeal due to beach erosion and loss of coral species. For instance in 1999 , eight Eastern Caribbean states (Anguilla, Antigua and Barbuda, British Virgin Islands, Dominica, Grenada, Saint Lucia, St Vincent and the Grenadines and St Kitts and Nevis) reported estimated damages of EC $712.5 million or US $268.8 million due to Hurricane Lenny. Most of the damages reported related to coastal infrastructure, coastal communities and businesses (E. Nurse 2013 pers. comm. June 6th). In some instances losses from a single hydrometeorological event such as a hurricane can devastate an already under resourced Caribbean economy.

According to the World Bank the financial cost of damages to Grenada from Hurricane Ivan in Sept 2004 was estimated at more than US$900 million, (more than double the country's GDP) (World Bank 2009). Similarly in 2010 St. Lucia recorded US$334 million in damages due to Hurricane Tomas. Within a single year, economic losses due to the 2004 hurricane season cost Caribbean countries over US$4 billion. The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC-FAR) estimated that climate change is likely to heavily impact coral reefs, fisheries and other marine-based resources in the Caribbean. This increases the potential impacts on critical livelihoods such as subsistence and commercial agriculture. (IPCC 2007). The IPCC-FAR further states that the Caribbean region experienced "on average a mean relative sea level rise (SLR) of 1mm/ yr during the 20th century".(IPCC 2007). The Caribbean Sea has warmed by 1.5ºC over the last century and data from the late 1950s to 2000 shows an increase in the number of very warm days and nights. Changes in rainfall patterns are also evident with an increase in the frequency of heavy rainfall events. (UNFCCC 2007)

Climate change impacts on key economic sectors in the region			
Issue or resource vulnerable to climate change	**Potential effects of climate change**	**Sectors at greatest risk**	**Economic relevance**
Freshwater availability	Reduced precipitation; increased evaporation Saline intrusion from SLR	Multi-sectoral	Insufficient supply to boast economic activity and for domestic purposes
Degradation of marine and coastal ecosystems	SLR and changes in sea temperature can affect important ecosystems such as mangroves, fishing grounds and coral reefs.	Tourism Agriculture Fisheries	. Most tourism activities are located in the coastal zone. Significant capital investment assets and infrastructure could be affected.
Coastal flooding	Sea level rise will result in flooding of low-lying Coastal areas.	Tourism, Agriculture, Forestry	*Same as degradation of marine and coastal ecosystems*
Climate	Climate change may increase extreme events such as precipitation intensity, tropical storms and hurricanes	Multi-sectoral	The cost of hurricanes and other natural disasters in the Caribbean region, estimated at several hundred million dollars during the last decade, may increase.
Adapted from UNEP ROLAC, 2008.			

Table 1: Climate change related impacts in the Caribbean

The climate related impacts outlined in Table 1 poses significant risk to livelihoods and already volatile economic sectors such as tourism and fisheries. Further to this, devastation from hurricane activity is also a recurring threat to many Caribbean islands, with some islands, suffering frequent damage e.g. The Bahamas, Cayman Islands and Cuba (Bueno et al. 2008). As a result environmental degradation and loss of livelihoods have

continued to hinder the region's progress towards achieving development goals. Since resources allocated for development initiatives are often diverted to finance recovery and reconstruction. (Trotz 2002, CDERA and CDB 2003, Howard 2009). In a business as usual scenario Bueno et al (2008) estimates that the cost of climate change in-action can reach 20.3%, 30.5% and 19% of current GDP by 2025 in Grenada, Haiti and Turks & Caicos respectively. This highlights the importance of implementing strategies to address these challenges.

3.2 The Regional Response to Climate Change

Caribbean Planning for Adaptation to Climate Change Project (CPACC) 1997-2001	**The Adaptation to Climate Change in the Caribbean Project (ACCC) 2001-2004**
Institution involved: Implemented by The World Bank, executed by the OAS and overseen by CARICOM.	**Institutions involved**: funded by the Canadian Climate Change Development Fund of CIDA, overseen by the World Bank, supported CARICOM
Goal: To build capacity in the Caribbean region for the adaptation to climate change impacts, particularly sea level rise.	**Goal**: To continue activities initiated under CPACC and to address issues of adaptation and capacity building not undertaken by CPACC.
Activities: vulnerability assessments, adaptation planning, and capacity building activities.	**Activities**: Public education and outreach Project design and implementation of a business plan for a regional climate change centre; technical capacity, strategies for food, agriculture and water sectors; integration of adaptation planning in development projects.
Main Achievements: Establishment of coral reef monitoring protocols**;** Establishment of a sea level and climate monitoring system; Improved access and availability of climate change related data**.**	**Main Achievements:** Development and distribution of risk management guidelines; A draft regional public education and outreach strategy; Implementation of pilot projects on adaptation studies in the water health and agricultural sectors.
Mainstreaming Adaptation to Climate Change Project (MACC) 2004- 2007	**Special Programme on Adaptation to Climate Change (SPACC) Project 2007 – 2011**
Institution involved: Implemented by The World Bank, funded by GEF, executed by CARICOM.	**Institution involved**: Implemented by the World Bank Funded by GEF, executed by the CCCCC
Goal: Mainstream climate change adaptation strategies into the sustainable development agendas of the Small Island and low-lying states of CARICOM.	**Goal:** To support, St. Lucia, Dominica & St. Vincent and the Grenadines to implement specific (integrated) pilot adaptation measures to address the impacts of climate change on natural resources, biodiversity & land degradation along coastal areas.
Activities: Furthering institutional capacity building, strengthening the knowledge base, and deepening awareness and participation.	**Activities:** Design of measures to reduce the adverse impact of climate change on the marine & terrestrial environment.
Main Achievements: Integrating climate change adaptation into national & sectoral polices; Strong public education & outreach	**Main Achievements:** To be evaluated
Source: UNEP 2008; Howard 2009; CARICOM Secretariat 2012;	

Table 2: Regional Climate Change related projects

Cruickshank et al. (2012) notes that despite numerous 'institutions, instruments and processes' addressing sustainable development practices, environmental problems continue to increase and have intensified globally. It is argued that since the region's contribution to global warming is insignificant and there is clear evidence of the consequences for Caribbean SIDS, focus should be placed on adaptation strategies that build resilience in these territories. Regionally, CARICOM have been advancing development initiatives in member states that are geared towards adaptation and capacity building. Several projects sought to further these objectives i.e. The Caribbean Planning for Adaptation to Climate Change project (CPACC) 1997-2001, The Adaptation to Climate Change in the Caribbean Project (ACCC) 2001 to 2004, the Mainstreaming Adaptation to Climate Change project (MACC) 2004- 2007. Table 3 highlights the projects' activities and achievements. These projects eventually led to the establishment of the Caribbean Community Climate Change Centre (CCCCC).

The Caribbean Community Climate Change Centre (CCCCC) was endorsed In July 2002 and became fully functional in July 2005. The Centre is registered under the UN System as a CARICOM Specialised Agency with a mission to "*coordinate the regional response to climate change and its efforts to manage and adapt to its projected impacts* The Centre is recognised by the UNFCCC, the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean (CCCCC 2011). The CCCCC further provides climate change related policy support and capacity building to manage climate risks related vulnerabilities in CARICOM member countries. In 2009, CARICOM Heads of Government highlighted the regions' commitment to strengthening the response to climate change adaptation by approving "The Regional framework for achieving development resilient to climate change".

The framework provides a plan of action for achieving the goals outlined over the period 2009-2015. An implementation plan was later adopted which places primary responsibility for coordinating the implementation of the key strategic elements of the framework with the CCCCC. The main strategic elements of the framework are as follows:

I. Mainstreaming climate change adaptation strategies into the sustainable development agendas of CARICOM states.
II. Promote the implementation of specific adaptation measures to address key vulnerabilities in the CARICOM region.
III. Promote actions to reduce greenhouse gas emissions through energy efficiency, conservation, and switching to renewable energy sources.
IV. Encouraging action to reduce the vulnerability of natural and human systems in CARICOM countries to the impacts of a changing climate.
V. Promoting action to derive social, economic, and environmental benefits through the prudent management of standing forests in CARICOM countries (CCCCC 2009).

3. Caribbean Urban Agenda

Current literature on urbanisation highlights the city as providing opportunities to collectively address developmental challenges. From a regional perspective well managed cities and urban areas can address challenges such as environmental degradation, resource depletion, vulnerability to the effects of climate change and increasing demands on urban infrastructure due to urban growth and sprawl. Well-designed urban areas with large population concentrations and dense urban settlements can present opportunities for efficient provision of adequate services such as water and electricity. In the Caribbean context, this can place the most vulnerable urban dwellers (people living along the coast and hazard prone areas) at the centre of shifts towards sustainable urban management.

It is argued that a region specific urban agenda should be advanced to address the unique challenges of the Caribbean and to deal with specific urban challenges. There are several global initiatives implemented in Caribbean cities that focused on urban issues albeit from an international standpoint. Some projects that addressed urban issues were the Urban Management Program (Port of Spain, Trinidad), Local Agenda 21 and Sustainable cities programme (Bayamo City, Cuba), the Safer City Program (Kingston, Jamaica) and

Participatory Slum Upgrading Program (Jamaica, Antigua and Barbuda, Trinidad and Tobago and Haiti). More recently the IDB Emerging and Sustainable Cities Initiative (Port of Spain, Trinidad and Tobago and Montego Bay, Jamaica) However; global urban agendas do not sufficiently address the inherent vulnerabilities of cities in the Caribbean.

4.1 CARICOM Policy Framework

Although CARICOM does not have a specific focus on urban issues, specific priority areas such as climate change, renewable energy, safety and crime, and economic vulnerability can be seen as cross cutting urban relevant priorities. Adopting an urban focus to development can promote and advance a Caribbean agenda that deals with sustainable energy, natural resource use and protection and preservation of the environment. In April 2011 the first annual policy meeting for the *Network for the Application of Science and Technology to the Urban Sector* (NSUS) project[ii] was convened in Guyana. The meeting was focused on "reassessing strategic priorities related to urban and land management in the Caribbean…"[iii] This represented the first Caribbean Urban Forum which recommended the development of a Caribbean Urban Agenda (CUA) to address urban issues that were of a more Caribbean nature. The meeting recommended that a "holistic and comprehensive framework" be developed that includes high and low thematic priority programmes, a research agenda, a knowledge management facility and capacity building.

Priorities for a Caribbean Urban Agenda (CUA) 2012			
Climate change *vulnerability to*: LECZ, Adaptation at local community level	**Sustainable planning** urban form (compact), holistic, Comprehensive Coastal zone settlements planning land management/use, rural/urban integrated planning	**Thematic Areas**	**Issues**
		Local economic development and poverty eradication	Unemployment Strengthening diversified local opportunities for economic development, provision of housing and basic services
		Enabling mechanisms for government and professional	Research, communication, training, education, financing etc.
		Governance	implementation, communication and legislation, municipal governance, awareness component, co-governance inclusive governance, partnerships, coordination
		Informal sector	tenure security, informal settlements, informal economy
		Natural hazards and disaster management	climate change, built environment resilience, response capacity
		Physical human security	Crime, safety, freedom from fear
		Physical Living Conditions	housing, basic services (water, sanitation, energy use, transportation etc.)
		Inequality	social, economic inequality based on gender, age
		Climate Change *contribution to*:	energy, emission, transportation, green economy

Table 3: Priorities for a Caribbean Urban Agenda

As a result of the NSUS project the urban sector is now being addressed at the regional level. Subsequently at the Thirty- Seventh Special Meeting of the Council for Trade and Economic Development (COTED) in September 2011, the papers "Development of a Caribbean urban agenda in the context of sustainable development"[iv] and "Urban Development and the Green Economy"[v] was presented by the Caribbean Network for Urban and Land Management (CNULM) and the CARICOM Secretariat. The papers made a case for the adoption of green initiatives in key priorities areas and suggested a revision of the proposed CUA to include the cross cutting issues of climate change vulnerability and

sustainability planning. Arising out of the meeting it was agreed that the Caribbean region should determine its own understanding of the green economy and show how these initiatives can be translated into a regional context. It was also recognised that the urban sector can be a key driver of green economy initiatives

The CUA was again discussed at the Caribbean Urban Forum held in March 2012 and at the Thirty-Ninth Special Meeting of the COTED in April 2012 in a paper entitled "*The role of cities in the green economy*"[vi]. The CUA currently comprises 11 thematic areas of region specific importance, that include the cross cutting issues of climate change and sustainable planning. See Table 3. The adoption of a CUA can now adequately inform policy at a regional level and provide urban specific inputs for policies currently in draft form (i.e. regional energy policy, climate change and implementation strategy policy and the tourism policy)

4. The Green Economy in the Caribbean

The most widely used and recognised definition of the green economy was posited by the UNEP, which states that a *"…green economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities…"* In this regard the concept of green economy and sustainable development is somewhat linked since both ideas embody the principles of integrating economic growth with environmental protection and social improvement. This reinforces the notion that "a green economy can be an enabling component of the overarching goals of sustainable development" (UNCTAD 2011). The recent Rio+20 conference suggests that a green economy should provide a roadmap to achieving development goals and objectives. In this regard the concept is viewed as a framework that enables decision making in key priority areas such as resource efficiency, sustainable cities, sustainable consumption and production patterns, and low-carbon development.

It is important to note that a green economy should not be considered as a wholesale set of rules to be adopted, but a framework whereby countries can address specific development needs and priorities. The Caribbean stands to benefit from adopting green economy initiatives with respect to achieving overarching sustainable development goals. Specific to the Caribbean region green economy initiatives should:

I. Provide effective environmental management- the Green economy can enable the transition to low carbon sustainable urban development in the Caribbean, which efficiently protects vulnerable ecological resources;
II. Build economic resilience to promote self-sufficiency through greening of key economic sectors such as fisheries, tourism and agriculture;
III. Mitigate and adapt to climate change induced hazards such as sea level rise, inundation of coastal cities and settlements, loss and damage to coastal infrastructure such as roads bridges airports; flooding, loss of natural defences and aesthetic appeal due to beach erosion and loss of coral species;
IV. Job creation and poverty reduction can be addressed through investments in key sectors that promote low carbon development such as transportation;
V. Provide avenues for promoting sustainable built form since well-designed urban areas and compact urban form can provide opportunities for more efficient urban infrastructure and service delivery.

In that regard, a green urban economy provides a framework to promote low carbon resource efficient cities, which provide a better quality of life for urban residents through growth and investment in key urban sectors such as transportation and infrastructure.

5. Strategies for greening the Urban Sector in the Caribbean

Energy use and efficiency-The global energy debate is inextricably linked to reducing greenhouse gas emissions (GHGs) and mitigating climate change. The UNFCCC recognises that while there is an inherent need for energy consumption to grow along with economic and social development, there is a possibility to be energy efficient and control

GHG emissions. Within urban areas the use of energy is a cross cutting issue, from managing fossil fuel dependent transportation sectors to efficiently managing urban spaces and resource consumption in buildings. The urban environment presents a great opportunity to utilise non- renewable energy resources more efficiently while promoting the use of alternative energy sources such as solar power. Although Caribbean territories are in an advantageous position to harness renewable energy, there is still a heavy reliance on fossil fuels to meet energy demands.

For instance Jamaica's petroleum product imports for the period January to August 2012 totalled US$1.6 billion; US$500 million more than the country's exports for the same period[vii]. According to the draft Jamaica National Renewable Energy Policy 2009-2030, the nation is characterized by an almost complete dependence on imported petroleum and high rates of energy consumption. It was estimated that 87% of Jamaica's foreign exchange revenue is used to buy imported oil. This is attributed mainly to the transport sector that accounted for 37% of petroleum consumption in 2008. Similarly, through the development of a Sustainable Energy framework[viii] Barbados is taking steps to promote renewable energy and energy efficiency in a bid to reduce the country's heavy dependence on imported fossil fuels and to improve the environmental sustainability of the country. The region's high dependence on imported fossil fuels, rising fuels prices and projected increase GHG emissions solidifies the need to work towards developing renewable and cleaner energy sources. The following sections highlights strategies to promote low carbon transportation, manage basic urban services and promote resource efficiency in the built environment

Water- Ecosystem management and restoration are an intrinsic component of transitioning to a green economy especially in the Caribbean. Efficient water management is critical to the very livelihoods of many Caribbean countries that are heavily dependent on the resource for key economies such as agriculture, industry and tourism. Inefficient management often results in losses and irregular supplies in some areas. For instance although Trinidad and Tobago is not considered a water scarce country; it is plagued by an irregular water supply in some areas. According to the Trinidad and Tobago, Ministry of Planning and the Economy (2012) water use statistics reflect a staggering 40% of demand is unaccounted for, highlighting the pressing need to manage water resources more efficiently.

In response to the Regional framework for achieving development resilient to climate change, the Global Water Partnership-Caribbean (GWP-C) was identified as a key partner in working for water security in the region. Through the Water, Climate and Development Programme and the promotion of an Integrated Water Resources Management (IWRM) approach the GWP-C is making strides in promoting water security and climate resilience. Countries such as Barbados, Dominica, Grenada, Jamaica, The Bahamas and Trinidad and Tobago; have developed or drafted IWRM roadmaps and action plans to ensure better resource management. Therefore greening the water sector within the Caribbean calls for the protection of groundwater and surface water resources through policy reform and regulatory frameworks, efficient watershed management, through effective land use planning (as in the case of Barbados strict zoning policy), urban growth boundaries, investments in adequate infrastructure, appropriate pricing mechanisms, public education.

Waste and sanitation- It is argued that solid waste such as garbage and chemicals from domestic use are often associated with growing affluence and are generated in tandem with population size and urbanisation. One of the primary dangers of ineffective waste management is human exposure to hazardous substances through contaminated drinking water (where contaminants are often leached into surface and groundwater). Waste in the form of pesticides can also contaminate food both inland and as effluent in coastal waters. According to UNEP (2011) solid waste services consume up to 2% of GDP in developing countries. Coupled with this, UN-HABITAT (2012) estimates that emissions from waste represent 3% of total global GHG emissions.

Waste management has become a critical component of thriving cities and thus human well-being hinges on solid waste management and pollution control. Waste generated

by human activity, agricultural and industrial processes can negatively impact ecosystems. Added to threats to human health, environmental degradation and loss of biodiversity can further result in economic losses which can affect important sectors such as fisheries and tourism. Another area of concern is methane emissions from landfills that contribute to overall GHGs. The key strategy for greening the waste sector is to reduce the amount of waste going into landfills. Satterthwaite (2002) argues that cities have the advantage of reducing resource use and waste due to the mere concentration of large groups in close proximity. In this regard, encouraging re-use and recycling presents an avenue for progression towards decoupling waste generation from increased economic growth in the region. However, Greening the waste sector requires a strong regulatory framework and incentives must be present in order to ensure buy-in by all stakeholders.

Transportation- The Latin America and the Caribbean (LAC) region possesses the highest level of motorisation in the developing world. The region has twice as many cars as the Middle East and North Africa and five times more cars than Sub-Saharan Africa and Asia. UN-HABITAT (2012). Continued car oriented development and infrastructure planning and low cost/subsidised fuel may be attributable to the growth of the private car market. In Trinidad and Tobago, the Ministry of Planning and the Economy (2012) estimated that there were 630,000 vehicles in the country, with a projected increase of 30,000 annually. Likewise the Barbados Licensing Authority showed that in 2009 the total vehicle stock on the island was 131,680, suggesting one vehicle for every two persons on the island (UNEP, UWI and The Government of Barbados 2012).Along with private vehicle ownership comes an increase in GHG emissions namely CO_2. The IPCC (2007) estimates that the global transport sector accounted for 13% of total GHG emissions. The IEA 2012 Statistics show that Jamaica and Trinidad and Tobago are the highest emitters of CO_2 among CARICOM members. IEA estimates that from fuel combustion Jamaica emits 8.0 million tonnes of CO_2 (2.8 million tonnes from the transport sector) while Trinidad produces 42.8 million tonnes CO_2 (3.1 million tonnes from the transport sector). Therefore, any greening strategy for the transportation sector in the Caribbean should be geared towards adopting sustainable transport solutions which combine a mix of multi-modal mobility options; complementary land use practices and a strict regulatory framework.

Central to the concept of sustainable low carbon transportation sector is the Avoid-Shift-Improve strategy. The Avoid-Shift-Improve strategy not only attempts to provide environmentally conscious low carbon mobility options but the concept also addresses social and economic sustainability (Dalkmann and Brannigan 2007). The strategy hinges on

i. **Avoiding** or reducing the need to travel, through more integrated land use planning i.e. creating high density, mixed use developments and integrating transport options along key nodes of activity;

ii. **Shifting** to more environmentally conscious modes of transportation; refers to the option of alternative low carbon transportation modes, for instance shifting from using private cars towards non-motorised options such as walking and cycling or mass transit;

iii. **Improving** the energy efficiency of private motor vehicles and in some cases public transport which in turn has a direct effect on the amount of CO_2 emissions. Strategies can include introduction of electric and hybrid vehicles into the Caribbean market. Substituting fossil fuel for cleaner Compressed Natural Gas as in the case of Trinidad.

Urban form and the built environment- Density and compact urban form is a critical component of managing energy consumption (UN-HABITAT 2011). Tackling CO_2 emissions must be collectively addressed by combining effective transport management strategies with utilising energy alternatives and applying the principles of compact urban

form. According to UNEP (2011), dense cities that employ mixed uses are more resource efficient than other settlement patterns. Compact urban form presents an avenue to achieve resource efficiency in the utilisation and management of urban land. This in turn results in less reliance on motorised modes of transport, lower energy consumption and better access to services in cities. Unlike the characteristic low density outward expansion of several Caribbean cities, compact urban form can be realised through adopting smart growth principles that mitigate sprawl and encourage walking, cycling and transit oriented development by

i. Urban growth boundaries- An officially mapped boundary that is used to separate open space and sensitive watersheds;
ii. Land use regulation- Zoning can ensure that focus is placed on developing brownfield sites versus greenfield;
iii. Increasing density- Setting clear density standards for new development projects especially in areas close to transit;
iv. Infill development- Focusing on developing and regenerating underutilised or derelict sites;
v. Mixed used developments- Provide a mix of residential, commercial and recreational options where people can live, work and play in one place
vi. Design standards- establishing strict building codes and standards can translate into increased energy efficiency of buildings and multiple use of urban space (parks, green roofs etc.)
vii. Street layout and design- urban design standards that promote the use of non-motorised transport such as tree lined streets, walking and jogging paths, building setbacks can encourage alternative modes of transport.

So far this paper has highlighted the benefits of implementing a green economy in the Caribbean. While there is a strong case for this transition, certain factors can hinder the uptake of green economy initiatives. Some of these include:

i. uncoordinated governance that does not provide an integrated framework for the effective management of green initiatives;
ii. negative consumer attitudes towards alternative green strategies, such as high density living and alternative modes of transport;
iii. vested business interest in current unsustainable consumption and production patterns;
iv. lack of investment by the public and private sectors and
v. lack of cost effectiveness/ affordability of green products.

6. Recommendations

Policy, regulatory and Institutional framework- the transition toward a green urban economy should be facilitated by a strong regulatory and institutional framework. The proposed Caribbean Urban Agenda can be a good starting point to inform policy on areas that are of critical importance to the Caribbean i.e. energy and climate change. This offers policy makers a framework for streamlining development action to address the common vulnerabilities in the region.

Development strategies- Planning regulations and standards make up a critical component of sustainable urban development planning. Without strict enforcement of planning standards and regulations, efforts to green the environment and change behaviour would be short lived. Key policy instruments can focus on land use regulations that promote infill development and limit the amount of new or greenfield development within urban areas. Promoting high densities, compact urban form and mixed use development is an efficient policy strategy that affords some of the benefits discussed in this paper. Additional building standards and codes can also allow government to ensure best practices in the construction sector by promoting energy efficient certification.

Capacity building and Training- Capacity building and training (including Science Technology and Innovation STI) is critical for the effective deployment of green economy initiatives. Many ideas and best practices can be shared across countries and regions. However, new technologies and best practices used elsewhere require capacity building and re-tooling of locals to ensure a green transition in certain sectors. This would in turn ensure 'green jobs' are created and a market that is supported by innovative green enterprise is facilitated.

Stimulate green investment in technology- There is a central role of technology in the transition to a green economy. Hence government policies should encourage investment in green technologies. For instance technology in landfill gas capture is not highly developed in the Caribbean therefore training and capacity building is needed in this priority area. This can encourage buy-in by the private sector since investment in 'greening' certain sector (which holds high upfront cost) can be justified in the long term.

Fiscal incentives, disincentives and market mechanism- The importance of public and private investment as an enabling condition for the green economy is also critical. For a green economy to work it is imperative that fiscal incentives are tied in with other policy directives. The creation of markets for green products can also stimulate demand and further investment in green technologies.

7. Conclusion

It is now imperative that Caribbean SIDS adopt a framework for development that is driven by social equity, environmental sustainability and inclusive economic growth. It is important to highlight that cities and urban areas in the Caribbean are now facing an urban future marked by increased demands on essential services such as transportation, water, waste and sanitation. Coupled with these urban challenges is the issue of the upward trajectory of climate change related hazards, due in large part to anthropogenic factors.

A business as usual scenario presents a worrying picture for Caribbean SIDS if strides are not made to mainstream sustainability strategies into development planning. Though the region's contribution to climate change may be considerably less than developed countries, there is still a responsibility to lessen the deleterious activities that contribute to overall GHG emissions. A main point of contention is the region's heavy reliance on imported fossil fuels and the ever expanding private car market. Additionally, inefficient resource consumption and lack of energy efficient built form is also adding to the region's contribution to global climate change. To deal with these issues Caribbean governments would have to adopt approaches that effectively use urban planning and resource management approaches as means to achieving sustainable cities and building resilient economies.

A green economy approach provides a framework whereby decisions and strategies regarding cities and urban centres can promote resource efficiency, effective environmental management and a better standard of living for urban residents. Ultimately building economically resilient, well managed socially inclusive Caribbean societies. Although these opportunities can be realised, uncoordinated governance, vested business interest in unsustainable practices and negative consumer attitudes can hinder the shift to a green economy. Added to this, capacity building, effective regulatory instruments and financing options are needed to advance the transition in the Caribbean. While Caribbean regions have demonstrated their willingness to implement sustainability strategies, progress have been uneven. Therefore employing green economy strategies can provide a pathway to sustainable urban development in Caribbean cities.

Endnotes

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[iii] http://bluespacecaribbean.com/wp-content/uploads/2012/07/Technical-paper-A-Caribbean-Urban-Agenda-2011-FINAL.pdf

[iv] http://bluespacecaribbean.com/wp-content/uploads/2012/07/COTED-2011-Development-of-a-Caribbean-Urban-Agenda-in-the-Context-of-Sustainable-Development.pdf

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