

KGA Hill Climate Energy Nexus Call to Action Lecture 2 in Series 24  
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## **The Geopolitics of Climate Change and Energy Balances**

### *Introduction*

Professor Michael Taylor and Professor Emeritus Abraham A. Chen have given me the opportunity to speak on a topic that is most relevant for an island country effectively wholly dependent on the outside world for its modernization ambitions.

I set my ideas in the context of a Jamaica in a time of transition, in political and economic international relationships and in the changing climate of the Earth system. Jamaica will have to do more than just coping. We, individually and collectively must manage our affairs to take us to a higher level of national well-being.

Why is “The Geopolitics of Climate Change and Energy Balances” of interest, especially in a science setting of the Physics Department and the Lecture Series titled “Climate Change and the Energy Nexus”?

We will have to make some significant changes. My reflections suggest that we are better able to make these changes, if we have a much clearer understanding of the cultural aspects of our history.

Culture’s structural and superficial expressions shape the way we see and relate to wider world – the country’s international relations. They influence the ways we relate to each other in our daily lives. Think the shortcomings in the institutions providing our public services, whether security, health, education or at the work place.

With a clearer understanding of some of the still structural aspects of the society we may better build that sense of solidarity so poorly developed and so badly eroded over the past few decades.

*Colonial Plantation Jamaica – Labour and “renewables” as the energy base*

With the utmost brevity, these are the structural features. Consider from whence modern Jamaica sprung:

\* imported energy in the form of manual labour, slave and bonded to engage in both agricultural cultivation and industrial processing;

\* the allied use of indigenous renewable primary energy resources of its country's iconic name, land of wood and water. The water to turn the wheels and the wood and the biomass of sugarcane, bagasse, to be burned for charcoal for cooking and generating steam in that era of early and pioneering industrialisation.

Thus was enormous capital accumulated for the owners of energy and the wealth appropriated by the Imperial project of the then greatest geopolitical power of the time, the maritime nation called Great Britain. Note the maritime. It is the infrastructure of international power, then merely considered an inert infrastructure for transport. Note "Great". It was the first mover of fossil fueled industrialization and by extension a pioneer in the global emissions of greenhouse gases (GHG).

Come then to the 20<sup>th</sup> century and the "externalities" associated with the callous and careless use of energy, manual, wood and water and here is the environment that is modern Jamaica, a product of geopolitics, favoured by its geography of location and climate. A land still among the fairest of them all.

### ***Early 20<sup>th</sup> Century Geopolitics***

All hell has surfaced in the inferno of Europe in its unceasing civil wars at the turn of that 20<sup>th</sup> century, the era signaling 'people power' and the dawning of broader and deepening democracies. A titanic Geopolitical struggle took Jamaican labour, now to be expended on the battlefields of Europe.

Our northern neighbour, itself flourishing on that "free labour", a rising power with indigenous supplies of coal and oil was now a key actor in the great games of geopolitical competition. The Americas had been cordoned off from its like-minded Atlantic allies. In this New World only one power would 'run things', the United States.

At the outset, the outcome in Europe seemed uncertain. And so the imperial power turned to its trans-Atlantic partner and began to organize a succession for its Caribbean dependencies. They would, in the event of any unfortunate outcome in Europe, fall to the USA to take charge and administer. Thus the Caribbean Commission and various lend-lease base arrangements. The fuller story will soon be told.

Some time later in this year the secret files on Jamaica's rise to Independence will be open for inspection, for the first time ever. The 'unfortunate' did not happen in Europe and so the dependencies, prodded hard by a paradoxical foreign policy of the United States were set on the path to self-government and constitutional Independence.

WW II ended. Britain and its allies were victorious. A new chapter in geopolitical competition opened. The US was now the pre-eminent maritime power. Still the rule was North Atlantic and now the "West" was truly anchored. Geopolitics after WWII became truly inter-continental and geo-strategic in its dispensation. Ever more so, with the Eurasian empire of the Russian led-soviets (USSR) and a rapidly emerging China unshackling its century of European (including Russia) and Japanese colonial depreations.

### *A modernizing Jamaica*

That was the international setting in which Jamaica's domestic policies, social, political and economic were being contemplated and framed. In looking out, Jamaica's first Prime Minister, Sir Alexander Bustamante summed up the reality of 500 years of European hegemony over the country. "We are with the West". In its different dimensions it encapsulated Jamaica's political, economic, technological and cultural hierarchies of preferences. Thus was the external policy framework sunk deep.

In essence, Political – representative democracy and monarchical system within the Commonwealth; Economic – "reciprocal and privileged trade and investment" arrangements within a mixed market matrix; Technological – reliance on scientific disciplines and technical applications and Cultural – the education and linguistic adoption of the *lingua franca* of geopolitical status, English. The roots of the majority and their rural backgrounds made sure that African retentions shaped the Jamaican culture, at the work place, in music, movement, metaphor and speech of language. But a "worldview" still forming, anti-"Colonial" but not anti-"West".

The domestic policy framework too had been sunk deep. The colonial system monopolized and entrenched political-governmental control over most of the national economy. Those economic structures determined how the fruits of national production were disposed. Recall “preferential” primary commodity exports to British/Commonwealth metropolitan markets and “preferential” manufactured imports from their workshops.

Private property of agricultural production, commercial import houses and public regulation would drive the economic modernization; democratic participation would speed social mobility and together in search of a Jamaica of sustainable development, with its own identity. That too was well articulated by Jamaica’s first Premier, Norman Manley, at the early stage of a self-governing Jamaica. He had worked with foreign and private investors to establish a “social welfare commission”, sent his Minister of Finance to New York to raise capital on the New York bond market and opened another groove for Jamaica’s economic modernization by luring foreign capital with tax ‘breaks’ or ‘incentives’ by another name to invest in first stage manufacturing.

Jamaica still exhibits too much of this first stage, though much of the production has migrated from the “goods” to the “services” sectors. We import more than we export, we still “subsidise/incentivise” the private foreign investor in factory space in “free zones” and tax breaks at customs and on income.

Our imports rightly favour “capital goods”. Information and communication technology (ICT) goods have high status and thus high demand. While they have increased productivity, far too much of it is used for “consumption” (social networking) with the returns flowing offshore.

To change Jamaica’s economic prospects, similar “subsidies and incentives” will be required to mitigate and adapt to climate change, to improve energy efficiencies at the consumption and production levels and to transition the workforce and the economy in which renewable energy plays a far greater role.

All sectors of the society will have to invest in renewable energy technologies. Government with its still extensive control over the economy

has to take the lead. Without public sector leadership and close working relationships, the transition will not happen.

## **Recap of Professor Chen's presentation on the nexus between global warming impacts and mitigation of fossil fuels induced greenhouse gases (GHG)**

Professor Chen's Lecture "**The Nexus between Climate & Energy: Global warming impacts and Mitigation of Greenhouse Gases**", the first in the series is posted on the website managed by Mr. Kevin Mills<sup>1</sup>

The key points bear repetition:

- \* the high degree of confidence that an unprecedented and projected warming of the earth system is confirmed by the overwhelming majority of the world's scientific community, using controlled observations, empirical data, computer modeling and the historical findings of paleo-climatology;
- \* the impacts are already manifested, but that there is further work to be done as Prof. Chen points to what is perhaps some data to be inserted in the models, given the most recent events of ice melt of polar caps and glaciers, which could speed one or more impacts, notably sea level rise and adverse effects on weather and hence health and agriculture;
- \* we should neither be indifferent to nor complacent in the face of what could well be an existential threat to humanity as the probabilities increase and the earth system reaches a "tipping point" and then precipitously to the "point of no return"; more specifically to the Jamaican society, in the event of a possible 5 metre rise over the rest of the 21<sup>st</sup> century;
- \* it is rapid build up and retention in the atmosphere of the greenhouse gases, largely from fossil fuel burning, deforestation, ice melt of frozen permafrost that establishes the direct relationship in the feedback loop of global warming, in which the lifestyles of the advanced countries is the major contributor, along with the yearnings and replications of developing countries, most notably rising China.

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<sup>1</sup> <http://myspot.uwimona.edu/physics/climate-energy-nexus-call-to-order-lecture-series>

The **nexus** of climate change and Energy is established. The urgent challenge is how to stop, and reverse the release of man-induced GHGs and so avoid the tipping point limit of less than the 350/450 ppm of CO<sub>2</sub> equivalents being reached. Professor Chen includes a timeline and emission levels up to and including 2050 with differentiated targets.

Professor Chen concluded his presentation with a call to action by Jamaica and the Caribbean, pointing to the role of renewable energy and a larger than 20% share in the mix of primary and secondary energy for fuel and electricity in a shorter time span.

### ***The Route Map in explaining and operationalising the “Nexus”***

I use the term “route” to distinguish it from the “road” mapping exercise, which is simpler, delineated more clearly and often well traversed. Traditionally a road map is one-dimensional, identifies the starting and destination points and highlights alternative pathways.

The route map, on the other hand is more problematic. As used here it utilizes many transport modes, different infrastructures and traverses continents. One faces an uncertain destination and the journey will be attended by unanticipated and unintended events. Many different measures and compasses will be called to service and the uncertain geopolitical interventions will influence the domestic situation. One thing seems fairly certain. The journey will be difficult, take time and span a generation of leadership and other changes. There is not much room for errors of judgment and misuse of resources.

### ***Profile of Jamaica’s geo-physical features and its location in relation to climate and primary energy resources***

It is a volcanic, mountainous island with a tropical marine climate, 18° North latitude and 77° West longitude and an average temperature of 27° Celsius (81° Fahrenheit), fertile, with more than ample supplies of water (rain-fed, rivers and underground stored, unevenly distributed, inefficiently managed and high levels of aquifer pollution in urban settings), coral-reefed coastline, with bays and one of the world’s finest deep-water harbours (and highly polluted), good location for primary energy of solar and wind, with potential for others.

The country lies along a major shipping lane. The Caribbean Sea provides

three major routes for the carriage of oil by these oil ferrying supertankers. Jamaica's extensive Exclusive Economic Zone (EEZ) is at risk from pollution and other hazardous substances. The country sits astride a major geological fault line, and in the path of annual hurricanes developing over the Atlantic.

Trade, the movement of goods and people, is an influential driver.

*A route map with its basic physical, spatial features, including its inner limits of sea, its ports and EEZ.*

The basic topographic map would be enriched by overlays of details on water, wind, solar irradiation, and other potential primary energy resources (there is offshore exploration for oil and I understand for natural gas). To this would be added the transportation networks, the buildings in towns and cities, the zoning for economic exploitation, minerals, agriculture, energy plants, industry, tourism and entertainment related locations and government (central and local) offices and local government jurisdictions.

The topographic profile would then be completed by the latest (2010/2011) Census data for population distribution. An interactive map would be prepared as the basis by all in all socio-economic analyses. All projections would then be made on a common set of references and geophysical and socio-econometric data for projections over timeframes appropriate to objectives.

The relationship between the physical and socio-economic might more easily be observed as incremental and observable changes occur, due to sudden storm surges, flooding or drought and sea level rise, and economic investments for public and infrastructures, especially in the energy, transportation, tourism, in urban settings would be factored into decisions. Policies would be made with as much comprehensive and real time data as possible.

The data and the tools for such basic mapping already are available and at different levels of aggregation. Jamaica is not as deficient in expertise and data as it appears. Wherever gaps exist it is sometimes due to too little integration within networks and across systems. Instead, the preferred route is 'coordination', with the misuse of too many meetings without clearly defined objectives and outcomes.



Here are some illustrations of the data that is available for broad consultation with the public as for policy and decision making from the Land Information Council and Jamaica's National Land Policy (1996), which states that "Empirical studies have found that approximately 80 percent of government's administrative decisions are related to, or impact on, the geographic domain".

***Jamaica's Second National Communication (SNC) to UNFCCC on the state of the country's environment with particular attention to climate change***

Jamaica's Second National Communication (SNC) includes GHG inventories for 2000-05 (the reference year is 2000). It also assesses climate change impacts for the key sectors of health, human settlements, and tourism, in addition to revisiting agriculture, water, and coastal zones, with projections for the years 2015, 2030, and 2050. Professors Chen and Taylor contributed to this data-rich report from the perspectives of vulnerability and adaptation.

**BOX 1** Jamaica's Second National Communication 2011

***Key findings from Jamaica's 2011 Second National Communication to the United Nations Framework Convention on Climate Change***

\* "Overall, annual emissions for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O all showed an increasing trend from 2000-05, as shown in Figure 2.9, with only a minor drop in 2004.

\* "CO<sub>2</sub> emissions increased consistently from 9,531 Gg in 2000 to 13,956 Gg in 2005. The large (46%) increase in CO<sub>2</sub> emissions in the **energy sector** was due to increases in fuel consumption in the manufacturing (bauxite and alumina industry) and transportation categories (Figure 2.10). There was little change in the magnitudes of the sources and sinks for CO<sub>2</sub> in the **Agriculture, Forestry and Other Land Use sectors** between 2000 and 2005.

\* "In the **Industrial Processes and Products Use Sector**, the CO<sub>2</sub> emissions from the cement industry increased over 2000-05 but those due to lime manufacture declined (Figure 2.11). Importation of lime was required to meet the alumina industry demands.

\* "CO<sub>2</sub> emissions in the **waste sector** increased over 2000-05. The contribution from managed disposal sites decreased while that from unmanaged sites increased (see Figure 2.12). There was a similar pattern for CH<sub>4</sub> emissions in the waste sector. Overall, CH<sub>4</sub> emissions rose from 31.1 Gg in 2000 to 41.9 Gg in 2005". Jamaica's SNC 2011

## **BOX 2** Jamaica's Second National Communication 2011

### ***Programmes Containing Measures to Facilitate Adaptation to Climate Change***

***Vulnerability and adaptation assessments were undertaken for five sectors: water resources, agriculture, human health, coastal zones and human settlements, and tourism.***

#### *Existing and Future Climate in the Caribbean and Jamaica*

*The annual average rainfall in Jamaica is 1,871 mm based on data from the National Meteorological Service for 1981-07. While there are no discernable long-term trends, the maximum level of consecutive dry days is increasing and the number of heavy rain days is increasing. While there are variations in tropical and extra-tropical cyclone activities, such as hurricanes and typhoons, daily temperatures are at an average of 26.2° Celsius to 30.0° Celsius over coastal areas. According to the 2007 IPCC 4<sup>th</sup> Assessment Report, warming ranged from 0.0° Celsius to 0.5° Celsius per decade, globally.*

#### *This gives rise to the following four emission ranking scenarios:*

- 1. A1 – More integrated sub-groups, economic growth and liberal globalisation*
- 2. A2 – More divided world, economic growth with greater regional focus*
- 3. B1 – Integrated, environmentally sensitive with strong global relationships*
- 4. B2 – More divided but environmentally sensitive with high regional focus*

*Various models were used to assess future climate projections, including the AOGCM (HAD, EHC, MRI models) and RCM (PRECIS). There is an indication of consistent temperature warming across all seasons and scenarios. The projected 1.5°-2.0° Celsius increase in temperature results in increased evaporation losses, decreased precipitation, and a continuation of rainfall decline. Jamaica's SNC 2011*

Jamaica's SNC should be in the data bases of every public, private, NGO and academic body, to be consulted on a daily basis in their decisions, regularly assessing the “four emission ranking scenarios”.

With the basic data of the country now in view, the focus is then on the demographic profile. The Census of 2010/2011 and the several surveys will provide information on the age composition, economic activities, employment, social amenities and generally the social conditions of the population by regional distribution.

The major concern is the trade off between GHG mitigation and economic growth and development. Some key measures of CO<sub>2</sub> and GDP will indicate the degree to which energy/electricity balances reflect increased efficiency and productivity.

A major and disturbing concern must be the fact that after such a long period, Jamaica's labour force remains so unskilled. Jamaica's economy has not shown the necessary transformation into higher levels of sophistication required. Consider the emphasis on policies of "export-led growth" predicated on international competitiveness, on Information and Communication Technologies (ICT) and Intellectual Property Rights (IPRs). These were to usher in a "knowledge economy".

The poor results should caution us all in giving in too easily the current buzzwords and work programmes of international organizations, without the necessary preparation at the national level.

An obvious lesson is the fact that policy at the public sector level did not give the priority attention to the secondary energy of electric power generation, transmission and distribution, when in fact to get full benefit from ICT and IPRs affordable and efficient supplies of electricity were indispensable. Nor did the private sector.

### ***The electricity industry of secondary energy***

At last electricity has been disambiguated from the generic term of energy. We will have the chance to discuss the electricity policy in this Lecture series, hopefully before the good options are foreclosed

The register of government policies in official documents is quite extensive. It does not include an electricity policy, though one is promised. The electricity sector was considered from that of the buzzword of "privatization".

Retail pricing issues from fossil fueled power generation plants and how this may be achieved in the short term is being discussed. Among the issues are: i) competition and regulation, ii) expansion of generation capacity, iii) primary energy supplies with natural gas as the base in the transition to "cleaner fuel", iv) primary energy balances with a significant increase in "renewables".

### ***Policy coherence and implementation***

The opportunity exists to begin to correct the mistakes of the past. It will require a properly staffed administrative structure to craft energy/electricity

policies and have them implemented. The regulatory regime and the public financing must be in place from the outset. The policies must be clear and credible to attract the necessary pools of expertise.

Jamaica’s Office of Utility Regulation (OUR) has selected the dominant electricity supplier to install new capacity of the order of 360 MW to be fueled by natural gas. Given that the range of “economic and technical factors create roles for a spectrum of power generation technologies—to provide base load, cycling, and peaking capacity and to maintain grid stability, (N)o single technology or fuel provides the lowest cost of electric production to meet all requirements of the power supply process”. (*IHS CERA Special Report, Fueling North America’s Energy Future The Unconventional Natural Gas Revolution and the Carbon Agenda, 2010*)

A major consideration is the reduction of GHGs and pollution of waterways.

### **BOX 3** Costing the “externalities” of different fuels on the environment

*In this regard, note that the U.S. National Research Council (NRC) a private, nonprofit institution under the auspices of the National Academy of Sciences, Institute of Medicine, and National Academy of Engineering recently evaluated “health, environmental, security, and infrastructural external costs and benefits associated” with energy. Among its findings:*

*\* [O]n average, non-climate change damages associated with electricity generation from natural gas are an order of magnitude lower than damages from coal-fired electricity generation. (pp. 243-4)*

*\* Natural gas plants on average emitted approximately half as much CO<sub>2</sub> at the generation stage as did coal-fired power plants in 2005—about half a ton of CO<sub>2</sub> per MWh. (p. 248)*

*\* If the social cost of carbon were \$30 per ton of CO<sub>2</sub>-eq, climate change related damages would be approximately 3 cents per kWh at coal fired power plants and 1.5 cents per kWh at natural gas plants... (p. 26)]*

Private capital investments from within the national economy must be in sufficient volume as to retain the returns for further roll out over the longer term. In this connection, the news report below gives a glimpse into a most important development:

*“JAMAICA Gas Trust (JCT), the new company that will handle the purchase and sale of liquefied natural gas (LNG) in Jamaica, is expected to go to the capital market to raise US\$100 million (\$8.6 billion) in private equity by next April, says the chairman of the LNG steering committee, Chris Zacca.*

*The regulatory framework and commercial structure of JGT should be presented to Cabinet for consideration by early next year, Zacca told the Business Observer yesterday.” (Jamaica Observer 23 November 2011)*

Consider the magnitude of this expenditure and its implications. Clearly this deserves a Ministry Paper for wide public discussion. The mechanism undermines the coherence and integrity of public sector management and accountability. The decisions will shape Jamaica’s energy future and hence its society and economy far into the future

### **Energy balances, energy technologies and renewable energy**

It is assumed that the wide assortment of data available from national, regional and international organizations for the exercise. Among the data are the **energy balances** and energy technologies within PCJ and the Ministry of Energy as well as from the International Energy Agency of the OECD group of countries, and importantly from the Latin America and Caribbean Energy Organisation (OLADE). Nuclear, with its safety, technical, capital, regulatory and security implications requires special consideration.

#### **BOX 4 Selected sources for information on Energy Balances**

\* OLADE’s Energy OBSERVATORY provides a valuable interactive site for the public to consult. This will complement the data that is available in the several energy policy documents issued by the Ministry.

<http://www.renenergyobservatory.org/statmaps/production/StatPlanet.html>

\* IEA for Statistics on energy - <http://www.iea.org/stats/index.asp>

\* ESDS for economic and social data and guides to usage -

<http://www.esds.ac.uk/international/support/support.asp>

\* The Major Economies Forum on Energy and Climate <http://www.majoreconomiesforum.org/>

\* Gas Exporters Forum (GECF) – Trinidad & Tobago is a member and its address is given -

[http://www.energy.gov.tt/energy\\_industry.php?mid=108](http://www.energy.gov.tt/energy_industry.php?mid=108)

\* American Clean Skies Foundation – regarding the exploitation of shale gas, an “unconventional natural gas” that will have a global impact in the electricity, transportation and heating markets - [www.cleanskies.org](http://www.cleanskies.org)

Three points to note – Venezuela as the fifth largest energy supplier is in the ‘geopolitical’ mix and so too T&T as one of the largest LNG exporters worldwide and the largest supplier to the US market. Shale gas has come on stream. Note that “(T)his is the **unconventional** natural gas revolution—specifically, the emergence of shale gas. A veritable “shale gale” is

transforming the supply and price outlooks for natural gas and the competition among energy options. Shale gas accounted for only 1 percent of US natural gas supply in 2000; today it is 20 percent. By 2035 it could be 50 percent.” (*IHS CERA Special Report, Fueling North America’s Energy Future The Unconventional Natural Gas Revolution and the Carbon Agenda, 2010*)

Research and fulltime institutional capacity will have to be installed *post haste*. Energy diplomacy will have to be prioritized and placed even ahead of some other activities.

### ***Energy – Water Nexus - Two Basics for Survival***

In Jamaica, we are far less aware that there is occurring around the world, a water crisis. In much the same way there is a climate – energy nexus, there is a water–energy nexus. The mining – water nexus is as important in Jamaica, especially due to the red mud lakes of pollution. Also when water is pumped for irrigation.

The balances in energy will need to be matched by close attention to water balances and between water and energy. This must be emphasized and pushed up the country’s list of priorities.

My search for studies on Jamaica has not revealed such a link. I will therefore limit myself to basing the findings on the US experience and highlight four main findings from the research findings to date: i) large quantities of water for cooling and consumption (steam generation) per unit of energy are required with more required for certain fuel technologies; ii) waste water is polluting and has negative environmental effects; iii) certain “clean” fossil fuel technologies (natural gas from shale) requires increased volumes of water; and iv) All new energy technologies except wind and solar PV will require increased freshwater withdrawals.

It is reported that after the release of the initial report of the “National Energy-Water Roadmap” as part of the Energy Security Act of 2005, requested by the US Congress in 2005, the second and final report remains under wraps.

### ***Sequential steps in climate change and energy fuels and electricity***

Climate Change and Energy should be more closely managed so as to keep abreast of the rapid developments in renewable technologies. The chain of energy-electricity-water requires no less than some fundamental restructuring of public sector policy-making and management. The structures as presently prevailing are no longer optimum. The ‘divide’ between functional and vertically organized bureaucratic units as Ministries or Agencies is no longer effective. The Public Sector Transformation Unit should therefore turn their research in this direction.

The regulatory and standard setting bodies should be part of this exercise. The OUR and the National Water Commission (NWC) must be reviewed as to their roles. There is some evidence that even as the utilities of Water and Electricity require large capital infusions and state regulation they are failing to meet the primary objective of serving the national interest.

Foreign and domestic policies should be more integrally aligned and both climate change and energy should be prioritized. They are considerable employment, growth and development factors at play.

- Geopolitical issues and Trade policy affect the world’s flow of energy and require diplomatic, trade, financial, science and engineering skills. The military, as a matter of course will be prepared for emergencies due to climate change, such as “climate refugees”
- Job creation with its attendant skill training and the register of GOJ policies should be synthesized for overlap and coherence ensured.
- Project implementation should be prioritized over policymaking and given the resources to bring policies to life, including through research, development and deployment and pilot plants. Illustrations are most relevant in the water (incl. irrigation), transportation and building sectors
- The Universities and their colleges and faculties should be brought more directly into all aspects of public sector programming as important technical resources.
- Jamaica runs the risk of being overwhelmed by its “waste” of all kinds, and must therefore fast track its recyclable use to energy fuel and electricity.

The sharp focus must be “on-the-Job-training”. Any job opening should be designed with two in-built elements – i) add lasting-value and ii) impart and

upgrade the worker's skills. Skill & Technology upgrading in the traditional sectors of the economy should be complemented with those in the environment and renewable energy sectors. The objective of ushering the so-called "Green Economy" would lead to a fundamentally different Jamaica.

Such an inclusive Employment & Skills Programme, led by the public sector would be a major boost to Investment in human capital, infrastructure, and new technologies for goods and services. It would touch every facet of Jamaican life, especially as the government retains so large a share in the capital formation of the country'

The formal private sector associations, large and small should in turn play a far greater role in assisting their individual members. There are several studies that would be of value, notably the report of the Caribbean Association of Industry and Commerce on "Renewable Energy in the Caribbean, Where we are; Where we should be" and the Draft Baseline Study for Jamaica 2011 with its several recommendations, prepared for the Private Sector Organisation of Jamaica (PSOJ).

This lecture series is designed with a view to contributing to bringing the country's combined resources to bear on mitigating climate change impacts, especially through a remodeled energy sector with synergies throughout the society.

The Department of Physics could take the lead through its Climate Studies Group and the newly created Climate & Energy Technologies Group by preparing a **Reference book** on the initiatives, studies and projects in these two areas. This would assist the preparation of the **Route Map, completing Jamaica's Electricity Policy and initiating a framework for understanding Jamaica's Climate-Water-Energy/Electricity Nexus.**

K. G. A. Hill  
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