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AILEG Analysis and Investment for Low-Emission Growth

VOLUME I: JAMAICA ECONOMIC PLANNING AND MODELING ASSESSMENT REPORT

THE AILEG PROJECT

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ACRONYMS

AILEG	Analysis and Investment for Low-Emission Growth
BAU	Business-as-usual
BOJ	Bank of Jamaica
CBA	Cost-benefit analysis
CO_2	Carbon dioxide
ENPEP	Energy and Power Evaluation Program
ESSJ	Economic and Social Survey of Jamaica
FINPLAN	Financial Analysis of Electric Sector Expansion Plan
GDP	Gross Domestic Product
GHG	Greenhouse gas
GoJ	Government of Jamaica
HDM	Highway Development and Management Model
IAEA	International Atomic Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent power producers
JBI	Jamaica Bauxite Institute
JPS	Jamaica Public Service Company
LEAP	Long-range Energy Alternatives Planning
LEDS	Low-emission development strategy
MAED	Model for Analysis of Energy Demand
MDA	Ministries, departments, and agencies
MDG	Millennium Development Goal
MEM	Ministry of Energy and Mining
MESSAGE	Model for Energy Supply Strategy Alternatives and their General Environmental Impact
MLGCD	Ministry of Local Government and Community Development

MOAF	Ministry of Agriculture and Fisheries
MOFP	Ministry of Finance and Planning
MSTEM	Ministry of Science, Technology, Energy and Mining
Mt	Metric tons
MTE	Ministry of Tourism and Entertainment
MTF	Medium-Term Socio-Economic Policy Framework
MTWH	Ministry of Transport, Works and Housing
MWLECC	Ministry of Water, Land, Environment and Climate Change
NEIC	National Energy Information Clearing
NEPA	National Environment and Planning Agency
NIP	National Industrial Policy
NPTCC	National Policy for the Trading of Carbon Credits
NRV	Natural resource valuation
NWA	National Works Agency
OUR	Office of Utilities Regulation
PIOJ	Planning Institute of Jamaica
PCJ	Petroleum Corporation of Jamaica
RBM	Results-based management
SIRI	Jamaica Sugar Industry Research Institute
SLC	Survey of Living Conditions
SNC	Second National Communication
STATIN	Statistical Institute of Jamaica
T21	Threshold 21
TEF	Tourism Enhancement Fund
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USG	United States Government
UTech	University of Technology

UWI University of the West Indies

WASP Wien Automatic System Planning

EXECUTIVE SUMMARY

The Analysis and Investment for Low-Emission Growth (AILEG) Project in Jamaica is designed to offer technical assistance to the Government of Jamaica (GoJ) on Low Emissions Development Strategies (LEDS), climate economics and green investment. Funded by the United States Agency for International Development (USAID) and implemented by Abt Associates, Inc., the goal of the project is to build capacity of the GoJ and other stakeholders to analyze low emissions scenarios and integrate them into economic development strategic planning and implementation, as well as conducting economic analysis to promote investment in low emissions technologies and projects.

AILEG Jamaica implemented three major activities: climate finance analysis, low emissions development economic modeling, and LEDS integration into national planning. This report describes the results of the assessment of LEDS economic modeling capacity and data issues. This activity is focused on assessing planning processes, modeling tools, data and capacity within GoJ to use the tools. It contains a description of the state of LEDS planning in Jamaica and more specifically the planning process used in developing Vision 2030 Jamaica - National Development Plan. It provides an assessment of the level of LEDS economic modeling incorporated in the sector plans, particularly the Energy Sector Plan and the Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change Combined Sector Plan. The report also includes an assessment of LEDS economic modeling capacity and needs of the GoJ and recommendations for future capacity development on economic modeling in Jamaica.

The AILEG team conducted interviews with public and private sector stakeholders and academia. The information gathered from these interviews was analyzed by comparing processes and models used in Jamaica with best practices in economic modeling as garnered from a review of literature and an analysis of other countries' experiences implementing low-emission development strategies. The team also identified economic modeling needs and made recommendations on the capacity development, training, and technical assistance support needed to improve LEDS economic modeling in Jamaica.

Overall, the GoJ has a well-developed framework for whole-of-economy planning, as well as for climate change adaptation, energy, agriculture, tourism, and (to some extent) transport planning. However, the degree to which economic modeling is applied at the sectoral level varies among GoJ ministries, departments and agencies (MDAs). The planning process for climate change mitigation is not yet well developed. Across economic sectors, LEDS has not been a primary focus. As a result, LEDS modeling is very limited in the public sector and non-existent in the private sector. The Planning Institute of Jamaica (PIOJ), with its mandate for overall economic planning, has used the Threshold 21 (T21) model for integrated development planning. Other MDAs, such as the Ministry of Science, Technology, Energy and Mining (MSTEM) and the Office of Utilities Regulation (OUR), have used sector-specific models.

The GoJ's national development plan (Vision 2030 Jamaica) recognizes the importance of climate change mitigation and includes a target of reducing greenhouse gas (GHG) emissions from the baseline of 5 metric tons (Mt) per annum in 2007 to 3.5 Mt per annum by 2030. However, there is no documentation of any analysis to inform this target. The only evidence of LEDS modeling done in Jamaica is in the Second National Communication of Jamaica to the United Nations Framework Convention on Climate Change (UNFCCC). That report (GoJ 2011) used the Long-range Energy Alternatives Planning (LEAP) model to analyze a reference (baseline) scenario and two alternative scenarios. The scenarios incorporated different rates of growth for the gross domestic product (GDP) and population, as well as different mitigation options.

Seven economic models were being used by different government MDAs. The PIOJ used T21. MSTEM used the Energy and Power Evaluation Program (ENPEP), Model for Analysis of Energy Demand (MAED), Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE), and the Financial Analysis of Electric Sector Expansion Plan (FINPLAN). OUR used the Wien Automatic System Planning (WASP). , The National Works Agency (NWA) under the Ministry of Transport, Works and Housing (MTWH) used the Highway Development and Management Model (HDM). Some of these models are not well-suited for LEDS modeling. Data limitations (for T21) or nonalignment of mandates (for WASP) hampered use of these models for LEDS. MSTEM recognized the need for LEDS modeling , but its implementation has been hampered by the limited availability of modeling expertise internally and the competing demands for that expertise (e.g., providing modeling inputs to address energy security and high energy costs). Although the WASP model could be used for LEDS modeling, the OUR emphasized that its mandate does not cover emissions control.

Ample opportunities exist for LEDS economic modeling in various MDAs, including the Ministry of Water, Land, Environment and Climate Change (MWLECC), MTWH, the Ministry of Tourism and Entertainment (MTE), the National Environment and Planning Agency (NEPA), and the Ministry of Local Government and Community Development (MLGCD). Although some of these MDAs currently undertake limited economic modeling, this modeling does not extend beyond cost-benefit analysis (CBA) at MTWH and natural resource valuation (NRV) at NEPA.

The relatively high cost of energy in Jamaica was identified as a major concern for the private sector and the impetus for adopting renewable energy and energy efficiency and conservation. This concern was reiterated by representatives of the Jamaica Manufacturers Association and the Private Sector Organization of Jamaica during AILEG's stakeholder interviews. The Jamaica Public Service (JPS) Company indicated that, given the high-tariff regime under which it must operate, its interest and investment in renewable energy is driven solely by cost considerations and that GHG emissions reduction potential was not factored into the decision-making process.

The AILEG team identified several economists with economic modeling expertise at the Kingston, Jamaica Mona Campus of the University of the West Indies (UWI), a public university, but found that only a few have applied their skills in environmental economics or energy economics. The team also identified expertise in climate studies at UWI and in renewable energy, energy efficiency, and energy conservation at UWI and the Kingston-based University of Technology (UTech). There are opportunities for cross-disciplinary collaboration in developing LEDS economic models across the two institutions (UWI and UTech) that would benefit various government MDAs.

The AILEG team identified environmental data limitations and energy data accessibility as constraints to LEDS economic modeling in Jamaica. These limitations are related to data availability. Both NEPA and MSTEM have recently implemented initiatives to establishing databases to increase data availability and improve accessibility to available data for economic modeling.

Because climate change cuts across all sectors, an integrated modeling approach to LEDS is needed. In addition, the GoJ has adopted a "no-regrets" approach[1] to climate change mitigation. All sectors with the potential to implement renewable energy, energy efficiency, and energy conservation actions should be incorporated into LEDS planning for transport, housing, tourism, and agriculture. The other aspect of a "no-regrets" approach, which has not received any real attention in Jamaica, is the use of afforestation and reforestation to enhance carbon sinks. In all these sectors, economic

[1] "No-regrets" actions are actions by households, communities, and local/national/international institutions that can be justified from economic, and social, and environmental perspectives whether natural hazard events or climate change (or other hazards) take place or not. "No-regrets" actions increase resilience, which is the ability of a "system" to deal with different types of hazards in a timely, efficient, and equitable manner (see Heltberg, Siegel, Jorgensen, 2009).

modeling could play a major role in guiding the selection of strategies and in determining the optimal path to achieve targets for each sector at the least cost. Economic modeling must become an integral part of the activities of MWLECC, MTWH, MTE, the Ministry of Agriculture and Fisheries (MOAF), and the Forestry Department. Staff at these MDAs must be equipped with the skills to run economic models for LEDS planning.

Heavy reliance on individuals rather than n a system for economic modeling activities in many MDAs limits the sustainability of modeling activities in many arms of the GoJ. To increase the pool of economic modelers that could serve the GoJ, and to develop a sustainable system of modeling activities and approaches, the AILEG team recommends establishing an Economic Modeling Center at UWI, where routine and periodic simulations and analyses to support LEDS would be performed in collaboration with the PIOJ, MSTEM, and MWLECC. This could provide exposure for student research assistants to analytical tools and modeling, and provide an opportunity for them to gain familiarity with and working knowledge of these tools and techniques, which they would then take to their future employers, potentially the GoJ, academia, or the private sector.

1 INTRODUCTION

1.1 BACKGROUND

Small island developing countries like Jamaica are very susceptible to the effects of climate change due to their geomorphology and small size of their economies. Jamaica is vulnerable to rising sea levels, temperature and precipitation increases, and extreme weather events. Between 2002 and 2007, damages from storms were estimated at $70.72 billion, 3.2 percent of GDP (PIOJ 2009). Recognizing the threats that climate change poses to the economy and its citizens, the GoJ has been planning and implementing adaptation and mitigation measures. The GoJ's primary focus has been on adaptation measures given the country's small role in GHG emissions, though notable mitigation efforts include the Wigton Wind Farm I and II projects. These efforts are highlighted in the Vision 2030 Jamaica - National Development Plan and the GoJ's Medium-Term Socio-Economic Policy Frameworks (MTFs) for 2009–2012 and 2012-2015. The Second National Communication of Jamaica to the UNFCCC (GoJ 2011) outlines the country's progress in climate change adaptation and mitigation.[2] Recently, the GoJ has taken steps to mainstream climate change into its sustainable development planning process:

- Establishing a climate change portfolio in MWLECC in 2012
- Establishing a Climate Change Advisory Committee in 2012
- Drafting a Climate Change Policy that will articulate the country's goals for climate change mitigation and adaptation and describe its strategies for achieving these goals
- Making plans to establish a Climate Change Division in MWLECC to act as the coordinating unit for all GoJ climate change activities

These initiatives show the government's commitment to a sustainable economic development path.

1.2 SCOPE OF THE LEDS ECONOMIC MODELING ASSESSMENT

This assessment of the state of LEDS planning in Jamaica focuses on the capacity to conduct LEDS economic modeling, to identify potential gaps for future technical assistance or training. Specific tasks included:

- **Assess planning processes for LEDS.** Assess the planning processes for LEDS in Jamaica, including overall economic development planning, energy planning, and climate change mitigation and adaptation planning. Review processes managed by the PIOJ, MSTEM, MWLECC, and other relevant agencies.
- **Assess economic modeling capabilities and needs for LEDS.** Assess LEDS modeling expertise in Jamaica, including the GoJ, universities, research institutes, and the private sector. Determine which models are currently in use, where the expertise resides, what preliminary work (e.g.,) has been undertaken in baselines and scenario development, and needs.
- **Recommend future capacity development on economic modeling.** Based on findings from the assessment of planning processes and economic modeling capabilities, make recommendations on the LEDS economic modeling training that should be undertaken in Jamaica, including the types of models and the critical sectors to be targeted.

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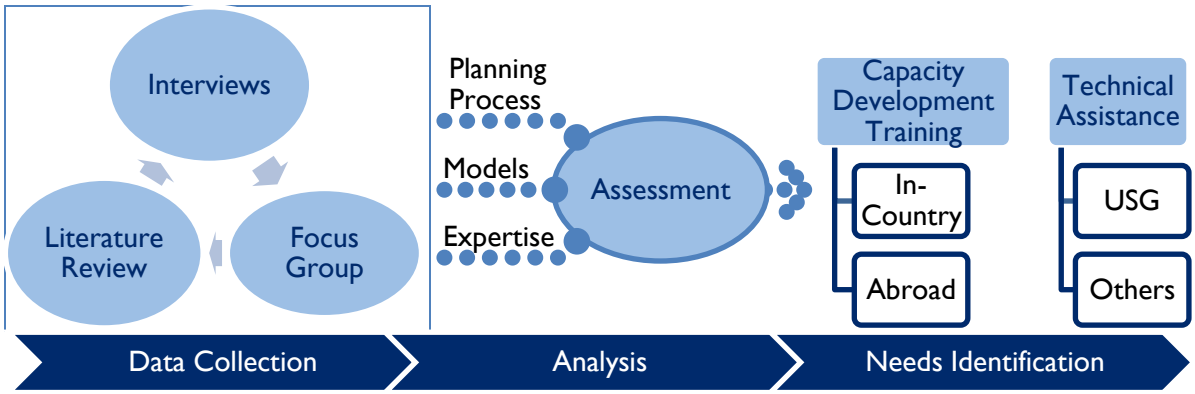
[2] See Jamaica's Second National Communications to the UNFCCC for details.

2 METHODOLOGY

The goal of this assessment was to identify gaps that may exist in technical capacity to perform economic planning and modeling for LEDS in Jamaica and determine the types of future technical assistance or training that may be required to close those gaps. To achieve this goal, the AILEG team developed an analytical framework for collecting and analyzing information and identifying gaps to inform recommendations for future technical assistance and training. Figure 2.1 presents this three-stage framework: 1) data collection, 2) analysis of information collected to inform the assessments of the LEDS planning processes and economic modeling capabilities, and 3) identification of needs for LEDS training and technical assistance.

Figure 2.1: Analytical Framework for LEDS Planning and Economic Modeling Capabilities Assessments



2.1 DATA COLLECTION

The assessment process was built around the need for consultation with three main groups of stakeholders -- the government, the private sector, and academia. Before these consultations, the AILEG team reviewed the academic literature and technical reports on low-carbon development strategies (World Bank 2012, ClimateWorks 2009) and the following GoJ documents:

- Vision 2030 Jamaica – National Development Plan
- MTF 2009–2012
- The National Energy Policy 2009–2030
- National Renewable Energy Policy 2010–2030
- National Energy Conservation and Efficiency Policy 2010–2030
- National Policy for the Trading of Carbon Credits 2010–2030
- National Energy from Waste Policy 2010–2030,
- National Biofuels Policy 2010–2030
- Second National Communication of Jamaica to the UNFCCC
- Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change Combined Sector Plan 2009–2030
- Energy Sector Plan 2009–2030

- The Transport Sector Plan 2009–2030
- Agriculture Sector Plan 2009–2030
- Tourism Sector Plan 2009–2030
- Housing Sector Plan 2009–2030

After the document review, the AILEG team held consultations with stakeholders to gain an understanding of the current GoJ planning processes for LEDS, as conducted by the MDAs. The consultations also provided information on the economic modeling expertise available at the MDAs for LEDS-related economic modeling, and the models used. These consultations were carried out through individual and group discussions.

To provide structure for the interviews, the AILEG team developed an interview protocol (See sample in Annex 1).

Based on their responses to the broad questions in the protocol, stakeholders were asked follow-up questions specific to their organization.

Interviews were held with technical and senior management staff of MDAs involved in climate change, energy, transportation, housing, agriculture, forestry, and tourism. Annex 2 lists the MDAs covered. Interviews with government officials addressed the economic models used for planning, technical expertise to run these models, and use of the models in LEDS planning.

The AILEG team interviewed nongovernmental stakeholders from the Private Sector Organization of Jamaica, the Jamaica Manufacturers Association, and the JPS Company. The private sector consultations focused on the interactions between business planning and government policies and the roles of the private sector in increasing energy efficiency and renewable energy use.

Interviews were also held with faculty and researchers at UWI and UTech with interests in economic modeling, renewable energy, energy efficiency, sustainable development, climate change, and the environment. These discussions assessed the familiarity of the academicians with the models currently being used by the MDAs and possible areas of collaboration with the public and private sectors to build the capacity for LEDS economic modeling.

AILEG convened a focus group of key participants from the stakeholder interviews to discuss the preliminary findings of the assessment, validate the conclusions drawn from the analyses, and provide practitioner perspectives on the recommendations.

2.2 ANALYSIS OF INFORMATION

The AILEG team analyzed the information gathered from the document reviews o and stakeholder consultations and considered best practices in economic modeling from the literature and other countries' experiences in developing and implementing LEDS and plans. The team reviewed the planning processes and modeling used in Jamaica for overall economic development planning and for planning in energy, climate change mitigation and adaptation, transportation, housing development, agriculture, forestry and tourism:

- Economic tools
- Specific purposes of the tools
- In-house expertise to use the tools
- Expertise that could be leveraged from the academic community
- Data available for analysis using these tools

This information was compared to best practices in LEDS economic modeling. The selection of best practices was based on several factors: 1) data requirements and recommended uses of the models, 2) limitations of the tools as determined by the developers and users, and 3) examples of application in other countries. Following this process, the AILEG team answered the following questions for each tool:

- What was the tool designed to do?
- What are the minimum and optimal data requirements for using the tool?
- What platforms and interfaces were used in developing the tools?
- What expertise is required to use the tool?
- What are the limitations of the tool?

2.3 NEEDS IDENTIFICATION

The information analysis carried out as part of this assessment enabled the AILEG team to compare the existing situation of LEDS planning and economic modeling in Jamaica to the ideal condition desired to identify gaps in the LEDS planning process, economic model use, and economic modeling expertise in the country. The AILEG team then made recommendations for training and technical assistance and filling existing data gaps in each sector so that appropriate tools could be adopted for sector analysis or LEDS planning.

2.4 LIMITATIONS

This assessment of capacity to implement LEDS in Jamaica primarily relied on information provided by stakeholders. This resulted in the omission of some sectors from the current assessment, as relevant stakeholders were not available during the time available for the interviews.

A large majority of the interviewed stakeholders came from the public sector. Obtaining interviews with private sector representatives was challenging and only three participated. Consequently, the findings on LEDS planning and economic modeling at the three participating organizations may not necessarily represent the general situation in the private sector. The private sector perceived LEDS planning and economic modeling as a GoJ responsibility and has not invested in it.

UWI and UTech, two of the three main research institutions in Jamaica, were the only academic institutions participating in interviews. A focus group was planned at the Northern Caribbean University, but did not occur and interviews could not be completed at other regional universities and research institutions due to time constraints. For this reason, the AILEG team could not ascertain modeling expertise available at these other institutions.

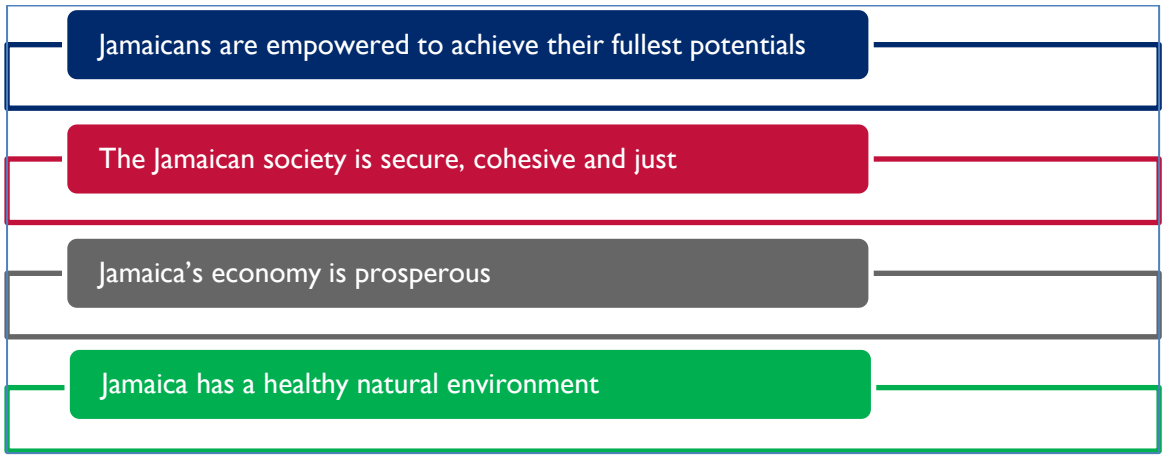
3 ASSESSMENT FINDINGS OF LEDS PLANNING PROCESS

AILEG's assessment of the planning process for LEDS in Jamaica focused attention on both economy-wide and sector-specific processes. The results of this assessment are presented for the national economy as well as the energy, agriculture, tourism, transport, and housing sectors[3] as well as for climate change mitigation and adaptation generally. Based on the findings, the AILEG team was able to determine the state of LEDS planning at the national and sectoral levels and the gaps that need to be addressed.

3.1 JAMAICA'S NATIONAL DEVELOPMENT PLANNING

Jamaica is currently implementing the Vision 2030 plan. This comprehensive national plan sets the vision for Jamaica to be ***the place of choice to live, work, raise families, and do business***. This vision is embodied in four main national goals for the country's development (Figure 3.1).

Figure 3.1: Jamaica's National Goals



Source: PIOJ (2009). Vision 2030 Jamaica - National Development Plan.

Each of these goals consists of a number of national outcomes that represent the desired changes in the country's development conditions within or across sectors. The plan specifies national strategies for each sector to support attainment of the fifteen desired national outcomes (PIOJ 2009). Table 3.1 lists the three national outcomes that are directly relevant to LEDS, along with the strategies proposed to attain them.

[3] These sectors represent sectors within the national economy where LEDS is expected to have the greatest impacts and from which GoJ representatives participated in stakeholder interviews.

Table 3.1: National Goals, Outcomes, and Strategies with Implications for LEDS in Jamaica

National Goal	National Outcome	National Strategies
3. Jamaica's economy is prosperous	10. Energy security and efficiency	• Diversify the energy supply • Promote energy efficiency and conservation
3. Jamaica's economy is prosperous	12. Internationally competitive industry structure	• Promote eco-efficiency and green economy
4. Jamaica has a healthy natural environment	14. Hazard risk reduction and adaptation to climate change	• Contribute to the effort to reduce the global rate of climate change

Source: PIOJ (2009). Vision 2030 Jamaica - National Development Plan.

National Outcome 10 on *Energy security and efficiency* and National Outcome 12 on *Internationally competitive industry structure* are part of the third national goal of making Jamaica's economy prosperous. National Outcome 14 on *Hazard risk reduction and adaptation to climate change* is part of the fourth National Goal of ensuring that Jamaica has a healthy natural environment. The specific strategies proposed for attaining these outcomes have direct implications for LEDS by introducing renewable energy sources; promoting energy efficiency, energy conservation, and a green economy; and facilitating Jamaica's contribution to global efforts to reduce the rate of climate change.

The planning process for the overall economic development plan followed a results-based management (RBM) approach.[4] This approach was utilized to arrive at the vision, goals, and outcomes for Vision 2030 Jamaica and to select strategies for achieving these goals and outcomes. RBM focuses on results and uses a consensus-based approach that involves various stakeholders and the general public. The strategies and action plans emanating from the process were selected through meetings with various MDAs and through public consultations. Selection was guided by the following criteria:

- External opportunities and threats
- Quick wins
- Binding constraints
- Long-run transformative potential
- Existing programs and plans
- Government priorities (PIOJ 2009, p. 262)

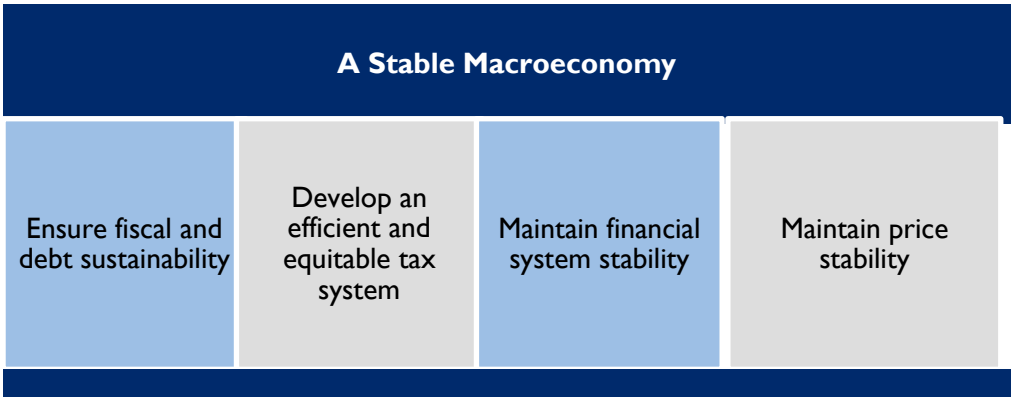
The T21 economic model was used to inform the Vision 2030 Jamaica planning, particularly the long-run transformative potential of selected strategies. This provided policymakers with future scenarios associated with implementation of different strategies.

Vision 2030 Jamaica is supported by three-year rolling plans for transforming the Vision 2030 Jamaica goals and outcomes into actions through Medium Term Socio-Economic Policy Frameworks (MTFs). In addition, action plans were developed for each sector during the term of an MTF. These sector action plans are integral elements of the broader sector plans in which the vision for the sectors, the strategies for achieving them and the implementation, monitoring and evaluation framework.

[4] An RBM is a life-cycle approach that follows a logical framework to set goals and identify strategies for achieving results. It includes a monitoring framework that permits the evaluation of progress made towards achieving set goals.

The 2009–2012 MTF focuses on six priority national outcomes and five supporting national outcomes from the fifteen in Vision 2030 Jamaica. One of these priority areas is the seventh National Outcome on *Building a stable macroeconomy.* Since the macroeconomy affects all sectors, strategies for achieving this outcome are likely to provide an enabling environment for the other outcomes by addressing fiscal and debt sustainability, tax reform, financial system stability, and price stability (Figure 3.2).

Figure 3.2: National Strategies for Achieving a Stable Macroeconomy



Source: PIOJ (2009). Vision 2030 Jamaica - National Development Plan.

These four National Strategies are complemented by several sector-specific strategies and targets set for economic indicators. The GoJ extrapolated existing national targets for 2012 to 2030. The targets for nominal GDP per capita are USD 6,629 in 2015 and USD 23,567 in 2030, compared to the baseline of USD 4,817 in 2007. From a baseline value of 1.4 percent in 2007, annual real GDP growth targets are 5 percent from 2015 through 2030. From a baseline value of 111.4 percent in 2007, the debt-to-GDP ratio targets are 90 percent by 2015 and 75 percent by 2030. The economy was expected to grow out of a 4.7 percent deficit in 2007 to achieve a balanced budget target in 2012 and beyond. The target for annual inflation is 10 percent or less from 2012 on from a baseline of 16.8 percent in 2007. Real GDP growth targets for 2015–2030 were informed by the performance of other countries in Latin America and the Caribbean (PIOJ 2009). For each strategic focus, the issues and challenges were clearly stated in the plan and the MDAs responsible for implementing each National Strategy were identified.

3.2 NATIONAL ENERGY PLANNING

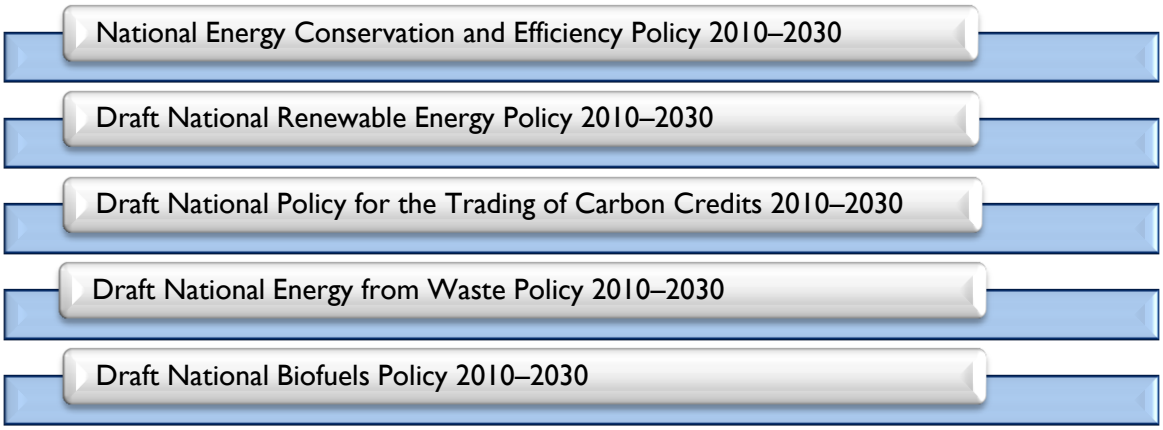
The vision for in the National Energy Policy 2009–2030 (MEM 2009),[5] is for Jamaica to become

> A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behavior on energy issues and an appropriate policy, regulatory and institutional framework.

Figure 3.3 below outlines other supporting policies for Jamaica's energy sector.

[5] Prior to 2011, MSTEM was known as the Ministry of Energy and Mining (MEM).

Figure 3.3: National Energy Policy Addendum



Source: http://www.mstem.gov.jm/?q=node/6.

The National Energy Policy addenda include detailed action plans and strategies to support the specified goals.

Seven goals were specified in the National Energy Policy to support the National Outcome of Energy Security and Efficiency. The National Energy Policy also touches on climate change, but strategies for climate change adaptation and mitigation are addressed in detail in the Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change Combined Sector Plan 2009–2030.

GoJ documents and interviews with government officials indicate that the energy planning process is detailed, but driven by national aspirations to increase energy security and reduce energy costs, rather than GHG emissions. This may be due to the relatively high cost of electricity in Jamaica compared to its trading partners in the region and the large share of foreign exchange for imported crude oil. Nevertheless, the "no-regrets strategy" of increasing the share of renewable energy and energy conservation and efficiency will also contribute to reducing greenhouse gas emissions.[6]

The energy sector is the main contributor to GHG emissions in Jamaica. Other regulations or incentives to reduce GHG emissions have not been considered in the economic models MSTEM and OUR have used for energy planning. This is a missed opportunity for jump-starting LEDS modeling and providing baseline data for future LEDS modeling.

The National Energy Policy includes energy demand projections for 2008 to 2030 based on three growth scenarios: 1) business-as-usual (BAU), 2) energy efficiency improvement and energy conservation, and 3) energy efficiency improvement with fuel diversification. The second and third scenarios offer cost savings over the BAU scenario and the third scenario has the largest potential for lower energy imports. GHG emission reductions were not calculated for the scenarios.

The draft National Policy for the Trading of Carbon Credits (NPTCC) 2010–2030 was developed to enable Jamaica to attain "a competitive, diversified, efficient and investment-conducive carbon credits trading sector that fosters socio-economic development and induces a less carbon-intensive economy" (MEM 2010c, p. v). This policy is an important part of "Jamaica's climate change strategy

[6] As a non-Annex I country, Jamaica does not have an emissions-reduction target under the Kyoto Protocol that ended in 2012. Non-Annex I Parties is a grouping of countries under the UNFCCC. It consists mainly of developing countries that are especially vulnerable to the adverse impacts of climate change. For a list of non-Annex I countries see: https://unfccc.int/parties_and_observers/parties/non_annex_i/items/2833.php.

that facilitates reductions in the country's greenhouse gas emissions and carbon footprint, thereby reducing the country's contribution to this global problem" (MEM 2010c, p. v). The strategies for emission reductions rely carbon credit trading, alternative energy, energy efficiency, and afforestation and reforestation. The limitation is that mitigation was not seen as a contributor to economic development, potentially reducing the importance of LEDS modeling to inform policy decisions. Within the NPTCC, the main incentive for renewable energy and energy efficiency and conservation projects is the opportunity to earn carbon credits. With the collapse of the Clean Development Mechanism and limited opportunities in the voluntary carbon market, the incentive to invest in renewable energy and energy efficiency and conservation projects under NPTCC has been eroded.

Consequently, the best practice is to make these investments LEDS-driven, with any opportunity to earn carbon credits an additional benefit.

3.3 CLIMATE CHANGE MITIGATION AND ADAPTATION PLANNING

Climate change mitigation and adaptation are addressed in the Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change Combined Sector Plan 2009-2030. The plan highlights the challenges posed by climate change and identifies natural hazard mitigation and climate change as one of the four priority areas under the combined sector plan. This aligns well with the National Outcome of Hazard risk reduction and adaptation to climate change.

Although the National Energy Policy and Action Plan set indicators and targets for some strategies (MEM 2009, pp. 44-47), no targets were included in the combined sector plan. The combined sector plan goal also contains no specific strategy for GHG mitigation or emissions reduction, apart from indicating that the National Energy Policy will be implemented. The Energy Sector Action Plan had a target of reducing annual GHG emissions from 5.0 Mt in 2007 to 3.5 Mt by 2030. The objectives of energy security and reduced energy costs may not necessarily be achieved through a low-carbon energy mix.

With the establishment of a new climate change division in MWLECC and e drafting of a climate change policy, climate change mitigation and LEDS are expected to receive greater attention and priority in the nation's sustainable development planning agenda. This will create opportunities for mainstreaming LEDS modeling and analysis in Jamaica's energy, environment tourism, agriculture, transport, and health sectors.

3.4 AGRICULTURE PLANNING

Agriculture is a major employer in Jamaica and contributor to foreign exchange earnings, but it has had productivity and competitiveness problems and is vulnerable to natural hazards and market shocks. Nonetheless, agriculture has experienced growth and efforts address its problems. Table 3.2 summarizes efforts of the Ministry of Agriculture and Fisheries under the Agriculture Sector Plan (Agriculture Task Force 2009).

The goals in the Agriculture Sector Plan 2009–2030 address productivity, competitiveness, and environmental sustainability through improved agricultural practices, organic farming, and risk and hazard mitigation. The Agriculture Sector Action Plan lists specific actions and the responsible MDAs, along with timeframes for implementation. However, targets were only provided for productivity and competitiveness indicators and not any LEDS actions. The AILEG team discussed this lack with MOAF officials during stakeholder interviews. Ministry staff pointed out that its primary role is to serve the needs of farmers, rather than broader activities for climate change mitigation and adaptation.

Table 3.2: New Initiatives and Projects Implemented by the Ministry of Agriculture and Fisheries

Initiative/Project	Purpose
Production and Productivity Programme	• Aimed at boosting production and productivity and enhancing food security • Targeted at 12 priority crops
Centre of Excellence for Advanced Technology in Agriculture	• Established to strengthen the nexus between research and development and technology dissemination
Agro-Investment Corporation	• Established to stimulate investment in agriculture and promote the viability of agriculture as a business opportunity
Dairy Revitalization Programme	• Aimed at stimulating expansion and increased productivity in the dairy sub-sector • Aimed at enabling sustained international competitiveness of the dairy sub-sector • Designed to enhance the contribution of the dairy sub-sector to national food security, livelihood protection, and rural development
Gustav Rehabilitation Project	• Targeted at tropical storm Gustav's sector recovery efforts
Improving Jamaica's Agricultural Productivity Project	• Targeted at increasing vegetable production capacity through the use of greenhouses • Aimed at improving environmental management in small-scale fisheries
Tractor Programme	• Focused on mechanizing the small and medium farming sector
European Commission Food Facility	• Focused on boosting food production to improve food security
Fruit Tree Crop Development Project	• Aimed at revitalizing the fruit tree crop industry

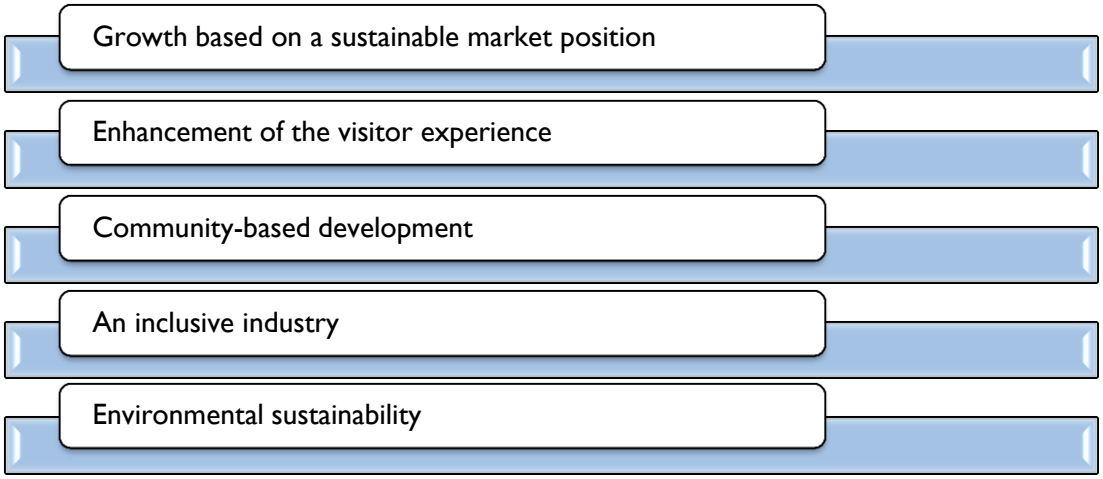
Source: Agriculture Task Force. 2009. "Vision 2030 Jamaica: Agriculture Sector Plan 2009–2030.

3.5 TOURISM PLANNING

Tourism is particularly important in Jamaica and is a priority sector in the National Industrial Policy (NIP) of 1996. TA Master Plan for Sustainable Tourism Development was prepared in 2003. In 2005, the GoJ established a Tourism Enhancement Fund (TEF) to implement the Master Plan and finance the development of tourist attractions.

Figure 3.4 lists the five objectives of the Tourism Master Plan.

Figure 3.4: Objectives of the Tourism Master Plan



Source: Tourism Task Force. 2009.

The Tourism Sector Plan under Vision 2030 Jamaica followed the Tourism Master Plan and is built on its achievements and addressed its shortcomings.

The tourism and travel industry may be affected by climate change. The Tourism Sector Plan included a general goal of "a safe, secure, sustainably managed natural, social and built environment" and provided strategies for achieving this goal. These strategies included promoting sustainable development planning of resort areas; developing and applying multi-hazard mitigation measures for the tourism sector; addressing waste, emissions, water, and energy issues; and ensuring that environmental management systems are implemented by tourism entities. The plan specifies actions, responsible MDAs, and the timeframe for implementation.

Although environmental sustainability features prominently in the Tourism Sector Plan, the only specific outcome indicator included that measures environmental sustainability is "percent change in number of establishments with environmental management systems." No baseline data were provided for this indicator. No targets were set for outcomes such as waste reduction, emissions, energy efficiency, and hazard mitigation, even though strategies were proposed to address these factors. However, staff of the Ministry of Tourism and Entertainment has acknowledged that sectoral planning for tourism has not incorporated LEDS.

3.6 TRANSPORT PLANNING

Land, air, and maritime transport play a critical role of facilitating economic activities within the country and internationally. Vision 2030 noted the importance of high-quality transportation infrastructure. Figure 3.5 lists the five national strategies identified for the transport sector.

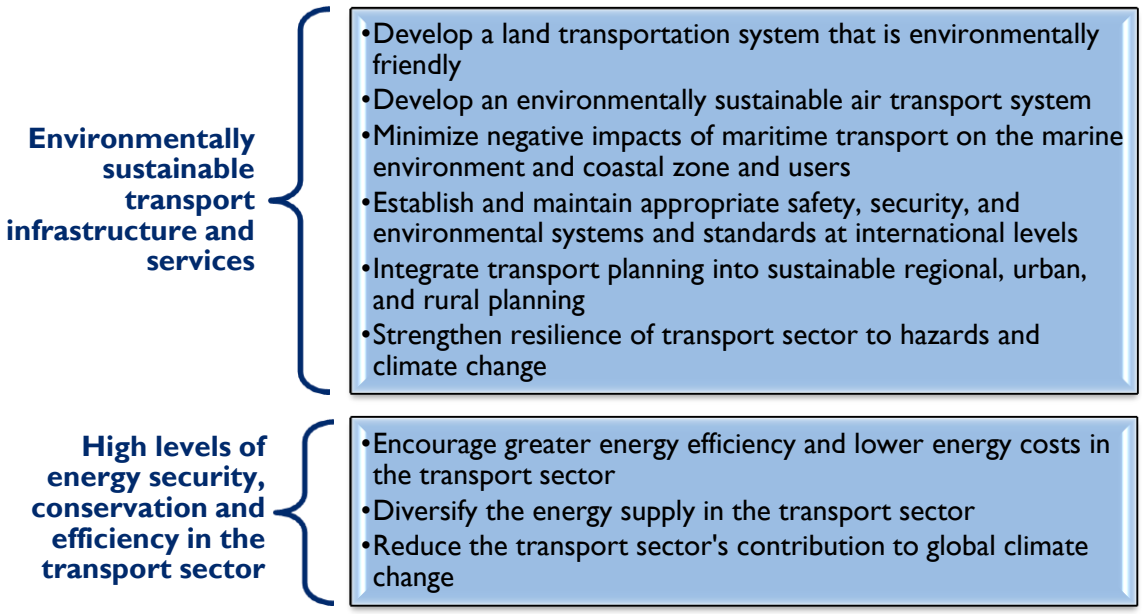
Figure 3.5: National Strategies Emanating from the Transport Sector

Strong Economic Infrastructure				
Expand and rationalize land transport infrastructure and services	Develop a modern public transport system	Expand domestic and international air transport infrastructure and services	Expand and diversify maritime infrastructure and services	Develop Jamaica as a regional logistic hub with multimodal transport linkages

Source: Transport Task Force. 2009.

The Transport Sector Action Plan listed seven specific goals, associated outcomes, and implementation strategies and actions for the sector (Transport Task Force, 2009). One of these goals is environmentally sustainability. Figure 3.6 presents the two associated outcomes and nine strategies for making transportation more environmentally sustainable.

Figure 3.6: Action Plans for Making the Transport Sector Environmentally Sustainable



Source: Transport Task Force, 2009.

Jamaica is gearing up to modernize its transport sector and set the stage for the country to be a regional logistics hub. This will have implications for the environment, particularly for GHG emissions. The GoJ has proposed actions to help ensure that the sector is environmentally sustainable and that energy conservation and efficiency are promoted in the transport sector. Although specific actions for various MDAs were identified, measurable targets to gauge the achievement of goals and outcomes are generally absent (Transport Task Force 2009). The results of the T21 simulation exercise showed an increase in per-capita GDP in 2030 of 20.6 percent (with a 10 percent proportional transfer of the GoJ's discretionary budget for investment in infrastructure) to 24.7 percent (if investment is financed through transfer from general services instead) (PIOJ 2009). However, no modeling was done, of the potential to reduce GHG emissions in transportation.

Stakeholder interviews confirmed the absence of any rigorous economic modeling in the transport sector beyond road project appraisals, although opportunities for economic modeling to inform LEDS in the transport sector are abundant. These opportunities include emissions abatement from alternate fuels for land, aviation, and ship transport, reductions in traffic congestion and the associated cost and emissions reductions from the implementation of carpooling and flexi-hours in the labor market, and motor vehicle emission standards.

3.7 HOUSING PLANNING

The Housing Sector Plan 2009–2030 set the vision for Jamaica's housing sector "All Jamaican households have access to affordable, appropriate and legal housing options in livable, vibrant, inclusive and aesthetically pleasing communities" (Housing Task Force 2009, p. 7).

This vision is reflected in the National Outcome of "Sustainable urban and rural development" in Vision 2030 Jamaica. The Housing Sector Plan provides specific goals and outcomes. Although these primarily directed at affordable housing, the plan also addresses the vulnerability of housing settlements to natural hazards and promotes a sustainable livelihoods approach to housing development. Specific actions identified under this sustainable livelihoods approach include the use of the highest feasible green building and site design measures and residential energy efficiency programs. However, the Housing Sector Plan has no measurable targets for actions relevant to LEDS.

According to staff of the Housing Division of MWTH, there has been limited use of economic modeling to inform planning in the housing sector has been limited. Furthermore, LEDS planning is not developed in this sector.

3.8 LEDS PLANNING PROCESS IN JAMAICA

There appears to be a well-developed framework for overall economic planning, energy planning, and climate change adaptation planning in various MDAs. In addition, agriculture and tourism planning are at an advanced stage in Jamaica. Transport planning is an emerging exercise, while housing planning is at a basic level. The planning process for climate change mitigation is not yet well-organized. LEDS has not been a primary focus across economic sectors, LEDS modeling and analysis is very limited in the public sector and non-existent in the private sector. Although the Vision 2030 Jamaica recognizes the importance of climate change mitigation and set a target for reducing GHG emissions 30 percent below the 2007 level in 2030, there is no evidence of any rigorous analysis to inform this target. Similarly, a target has been set for a minimum of 15 percent of energy supply from renewable sources by 2020, but evidence of any rigorous analysis to inform this target is absent. Within Jamaica's National Energy Policy 2009-2030, demand and supply projections out to 2030 indicate that energy efficiency improvements and conservation programs plus fuel diversification could lead to 20 percent of the country's energy mix coming from renewables by 2030.

The only evidence of LEDS modeling and analysis completed in Jamaica is in the Second National Communication (SNC) of Jamaica to the UNFCCC (GoJ 2011) conducted by the Meteorological Service of Jamaica. That report used the LEAP model to generate a baseline scenario and two alternative scenarios of GDP and population growth and mitigation options.

3.9 CONCLUSIONS

The Vision 2030 Jamaica development process was thorough and followed best practices in national economic development planning. Sector plans addressing climate change mitigation and adaptation, energy, agriculture, tourism, transport, and housing were incorporated into the national development plan. Vision 2030 Jamaica aims for the country to attain developed nation status by 2030. Similar processes were used in the sector plans and Vision 2030 Jamaica, but with varying detail and use of economic modeling to inform outcome targets. The sector planning processes appeared to be strong, except in the housing sector. However, only the energy sector planning incorporated LEDS and even for this sector, only limited scenarios were considered. There are ample opportunities to further integrate LEDS into the energy planning process and introduce it in the planning for agriculture, tourism, transport, housing, and climate change mitigation and adaptation.

4 FINDINGS ON ECONOMIC MODELING CAPABILITIES AND NEEDS FOR LEDS CAPACITY DEVELOPMENT

This chapter assesses economic modeling capabilities and the need for analytical capacity development for LEDS in Jamaica. It discusses the tools used for LEDS planning and the expertise available for their use. Annex 2 lists the MDAs, companies, and organizations interviewed for this assessment.

The AILEG team identified seven economic models currently in use by different Jamaican government MDAs (Table 4.1)

Table 4.1: Economic Models Used by Ministries, Departments, and Agencies of the Government of Jamaica

MDA	Model
PIOJ	Threshold 21 (T21)
MSTEM	Energy and Power Evaluation Program (ENPEP)
	Model for Analysis of Energy Demand (MAED)
	Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE)
	Financial Analysis of Electric Sector Expansion Plan (FINPLAN)
OUR	Wien Automatic System Planning (WASP)
NWA	Highway Development and Management Model (HDM)

Source: Stakeholder Interviews (April-June 2013).

Only some of these tools have been used for LEDS modeling. Two factors have impeded the use of the WASP model for LEDS: data limitations for T21, and OUR's mandate does not cover emissions control. While MSTEM has recognized the need for LEDS modeling and analysis, i it has been hampered by limited internal expertise on modeling.

There are good opportunities for LEDS economic modeling in the MWLECC, MWTH, MTE, NEPA, and MLGCD. Although The MTWH has done cost-benefit analysis (CBA) and NEPA has used natural resource valuation (NRV) techniques.

Representatives of the private sector in Jamaica have identified the high cost of energy as a major concern and the motivation for adopting renewable energy and energy efficiency and conservation measures. This concern was reiterated by the JMA and the PSOJ. The JPS Company has used the Wien Automatic System Planning (WASP) in the past. However, since OUR took on responsibility for energy planning, the JPS Company has mainly focused on meeting the nation's energy requirements under the guidelines set by the OUR. As a result, it discontinued its economic modeling work, although it still does engage in optimization modeling for internal electricity dispatch. Since JPS operates under high electricity tariffs, the company's interest and investments in renewable energy are driven by cost considerations, rather than GHGs reduction potential. The AILEG team did not identify any initiatives for LEDS modeling in the private sector, although two large manufacturers were embarking on renewable energy projects to reduce electricity consumption.

4.1 ECONOMIC MODELING TOOLS USED BY THE GOVERNMENT OF JAMAICA

This section discusses the models currently used by the MDAs included in this study for overall economic planning and specific sectors.

4.1.1 Threshold 21

Threshold 21 (T21) is a dynamic simulation model used for national macroeconomic planning that was designed by the Millennium Institute.[7] This model allows for comparative analysis of policy options. The PIOJ used T21 as the main tool to develop scenarios and analyze policy options for Vision 2030 Jamaica.

Figure 4.1 summarizes he properties and applications of T21.

The PIOJ also routinely uses T21 for budget and policy analyses.

The Modeling Unit of the PIOJ handles T21. Although a static version of T21 can be obtained by anyone, the dynamic model is only available at the PIOJ. T21 can be used across all sectors of the economy. The PIOJ will conduct T21analyses for other MDAs.

[7] . http://www.millennium-institute.org/integrated_planning/tools/T21/

Figure 4.1: Properties and Applications of T21

Model	• Threshold 21
Sector	• Macroeconomy
MDA	• PIOJ
Current Usage	• Economy-wide planning, policy analysis, and economic forecasting. Used to assess the transformational potential of different development plan options for Vision 2030. Also used for routine budget analysis.
Data Requirements	• Data requirements are extensive and include social, macroeconomic, and environmental data. *Social data requirements* include total population, total fertility, life expectancy, adult literacy, poverty, gang violence, prison population, age cohorts (1990 and 2005), age-dependency ratio, labor supply (15-60), total employment, labor supply/demand balance, agricultural employment, industry employment, service employment, HIV positive population, annual AIDS deaths, AIDS baby deaths, and life expectancy including AIDS. *Macroeconomic data requirements* include agriculture, industry, and services production; real GDP; tourism income; sugar cane production; tax revenue; domestic and external borrowing; government domestic and foreign debt; interest payments; grain yield; industry and service productivity; private savings rate; private investment/GDP ratio; sector imports and exports; and import and export/GDP ratio. *Environmental data requirements* include electricity demand; oil and coal demand; per-person oil and electricity use; GDP energy intensity; GHG emissions; plantation yields; forest land; domestic, industry, and agricultural water demand; renewable water; industry BOD pollutants; adequate sanitation; and access to safe water.
Data Sources	• Statstical Institute of Jamaica (Survey of Living Conditions), PIOJ (Economic and Social Survey Jamaica), Bank of Jamaica, NEPA
Countries of Application	• The Balkans, Bangladesh, China, Denmark, Ecuador, Ghana, Guyana, Malawi, Mali, Mozambique, St. Lucia
International Applications	• Analysis of climate change mitigation processes • Evaluation of impacts of investing in renewable energy • Assessment of impacts of MDG-related interventions. Assessment of environmental sustainability considerations. Analysis of costs/benefits of structural reform of bauxite and sugar industries • Evaluation of public transport • Analysis of impact of waste reuse for energy production

Sources: http://www.millennium-institute.org/integrated_planning/tools/T21/ and stakeholder interviews (April-June 2013).

4.1.2 Energy and Power Evaluation Program

The Energy and Power Evaluation Program (ENPEP) was developed by the Argonne National Laboratory for the United States Department of Energy. It addresses energy demand and supply and the environmental implications.[8] In Jamaica, MSTEM runs ENPEP.

[8] http://www.dis.anl.gov/projects/Enpepwin.html

ENPEP is a versatile tool that can be used for GHG mitigation and energy policy analyses. It is used extensively worldwide and has been applied in over 80 countries. The latest version is called ENPEP-BALANCE. It uses a non-linear equilibrium model that matches the demand for energy with available resources and technologies. Its market-based simulation approach allows ENPEP-BALANCE to estimate the effects of changes in energy prices and demand levels. The model relies on a decentralized decision-making process in the energy sector and can be calibrated to the different preferences of energy users and suppliers. Basic input parameters include information on the energy system structure; base-year energy production, consumption, and prices; projected energy demand growth; and technical and policy constraints.

MSTEM has used ENPEP-BALANCE to inform the drafting of the National Energy Policy 2009–2030 and analyze energy policy decisions and their impact on other sectors, such as transportation. In other countries (e.g., Greece and the United States), ENPEP-BALANCE has been used to analyze the environmental impacts of the power generation sector, including projections of carbon emissions under a baseline scenario and development of a number of GHG mitigation scenarios. However, MSTEM has not used ENPEP to assess the environmental implications of different energy strategies does not use it for this purpose. Figure 4.2 summarizes the properties of ENPEP and its applications.

ENPEP-BALANCE is data-intensive, requiring input from the major energy users and suppliers. MSTEM has data on energy supply and demand, but not environmental data. The necessary energy data are available from MSTEM, OUR, JPS, the Petroleum Corporation of Jamaica (PCJ), the Jamaica Bauxite Institute (JBI), Wigton, and the Jamaica Sugar Industry Research Institute (SIRI). MSTEM has access to data on the production capacity and price of various energy--biomass, solar, wind, hydropower, biogas, wood, and sugar cane. It also has data on electricity production (at the unit level for thermal units and the plant level for hydropower units); loads for on- and off-grid systems; and plant capacities for bauxite and sugar production.

Figure 4.2: Properties and Applications of ENPEP

Model	• ENPEP
Sector	• Energy
MDA	• MSTEM
Current Usage in Jamaica	• Used in energy planning process. Used to inform National Energy Policy 2009–2030 as it relates to future energy demand. • Has not been used for GHG mitigation analysis.
Data Requirements	• Data on renewable and non-renewable resources, conversion processes, refineries, thermal and hydropower stations, cogeneration units, boilers and furnaces, marketplace competition, taxes and subsidies, and energy demand
Data Sources	• The JPS Company, OUR, SIRI, MSTEM, Wigton, PCJ
Countries of Application	• Belarus, Brazil, China, Colombia, Egypt, Greece, India, Jordan, Republic of Korea, Turkey, USA, and Venezuela
International Applications	• Identification and analysis of impact of implementing several energy policies and measures on transport sector, energy demand, and atmospheric emissions • Analysis of environmental impacts of power generation sector • Evaluation of future electricity and energy needs and estimation of associated environmental burden • Detailed energy supply and demand analysis • Projection of carbon emissions under a baseline scenario • Development of GHG mitigation scenarios

Sources: http://www.dis.anl.gov/projects/Enpepwin.html and stakeholder interviews (April-June 2013).

4.1.3 Model for Analysis of Energy Demand

The Model for Analysis of Energy Demand (MAED) was developed by the International Atomic Energy Agency (IAEA). MAED is a flexible tool for r diverse energy consumption patterns. MSTEM used MAED for energy demand analysis and planning for the National Energy Policy 2009–2030.

MAED projects future energy demand based on medium- or long-term socio-economic, technological, and demographic scenarios. This model disaggregates the energy requirements for producing various goods and services by end-use categories. Inputs include population growth, number of inhabitants per dwelling, number of electrical appliances per household, mobility and preferences for transportation modes, and national priorities for industries or economic sectors.

MAED calculates energy consumption by service performed ("useful" energy), rather than the final energy supplied. This distinction can provide a better understanding of the ability to substitute different forms of energy. It also reflects t technological improvements in the end-use technologies and addresses system losses in electricity generation and distribution (a major issue in LEDS in Jamaica). Figure 4.3 summarizes the properties and applications of MAED.

Due to its well-developed national statistical system that includes an annual Survey of Living Conditions (SLC), Jamaica is well-situated to use MAED. Data for the model comes from the SLC administered by the Statistical Institute of Jamaica (STATIN) and the PIOJ's Economic and Social Survey Jamaica (ESSJ).

Figure 4.3: Properties and Applications of MAED

Model	•MAED
Sector	•Energy
MDA	•MSTEM
Current Usage	•Analyzing and forecasting energy demand and assessing future energy needs of the country
Data Requirements	•Energy demand, disaggregated into a large number of end-use categories corresponding to different goods and services. Scenario assumptions such as socioeconomic and technological. Substitutable energy uses, process efficiencies, and hourly load characteristics
Data Sources	•STATIN (SLC), PIOJ (ESSJ)
Countries of Application	•Algeria, Argentina, Colombia, Indonesia, Jordan, Pakistan, Poland, Sudan, and Turkey
International Applications	•Forecasts of electricity and energy demand •Evaluation of country's energy requirements •Assessment of potential energy supply options

Sources: http://www-pub.iaea.org/books/IAEABooks/7430/Model-for-Analysis-of-Energy-Demand-MAED-2 and Stakeholder Interviews (April-June 2013).

4.1.4 Model for Energy Supply Strategy Alternatives and their General Environmental Impact

The Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE) is a system engineering optimization tool for medium- to long-term energy system planning, energy policy analysis, and scenario development. This model developed by the IAEA differs slightly from the other energy models developed by the agency in that it accounts for both the supply and demand side of energy flows through "energy chains". MESSAGE represents the energy system with its interdependencies from resource extraction, imports and exports, conversion, transport, and distribution to end-use services. It was designed to formulate and evaluate alternative energy supply strategies consistent with user-defined constraints on new investment, adoption rates for new technologies, fuel availability and trade, and environmental emissions. MESSAGE i uses the projections of useful or final energy demand from MAED to analyze energy and electricity markets and climate change issues.

MSTEM uses MESSAGE to map energy flows from resource extraction to energy services. For MESSAGE, MSTEM uses data from the JPS Company and OUR. Because of MESSAGE's relatively simple framework, data requirements are relatively small and include power plant capacity (new and existing units), domestic and imported fuels, and electricity demand. Figure 4.4 summarizes the properties of MESSAGE and its applications.

Figure 4.4: Properties and Applications of MESSAGE

Model	•MESSAGE
Sector	•Energy
MDA	•MSTEM
Current Usage	•Analyzing and forecasting energy supply
Data Requirements	•Demand for energy services. Energy system structure (including vintage of plant and equipment), base year energy flows and prices, energy demand projections, technology and resource options and their techno-economic performance profiles, technical and policy constraints.
Data Sources	•The JPS Company, MSTEM, OUR
Countries of Application	•Argentina, Belize, Cuba, and India
International Applications	•Forecasting energy supply

Sources: http://www.iaea.org/NuclearPower/Downloads/INPRO/Files/INPROPESS-brochure.pdf and stakeholder interviews (April-June 2013).

4.1.5 Financial Analysis of Electric Sector Expansion Plans

In most developing countries, financial constraints are the most important hurdle to implementing electricity expansion plans. The Financial Analysis of Electric Sector Expansion Plans (FINPLAN) model, developed by the IAEA, assesses the long-term financial viability of expansion plans and fora power generation projects. The method includes preparing cash flows, income statements, balance sheets, and financial ratios. FINPLAN takes into account financing from revenues, taxes, export credits, commercial loans, bonds, equity, and modern instruments like swaps and calculates projected cash flows, balance sheets, and financial indicators.

FINPLAN is particularly useful in the energy sector since it helps analyze financial consequences alternative expansion plans. The model calculates all expenditures in foreign and domestic currency since exchange rate changes can have a significant impact on plans. FINPLAN is used in the energy sector in over 20 countries.

In Jamaica, MSTEM uses FINPLAN to analyze the viability of proposed energy projects. For FINPLAN, MSTEM relies on data on new projects from JPS, OUR, and independent power producers (IPPs). FINPLAN is not an economic modeling tool *per se*. It is a project analysis tool that can provide useful input for other economic models used in LEDS planning. Figure 4.5 summarizes its properties and applications.

Figure 4.5: Properties and Applications of FINPLAN

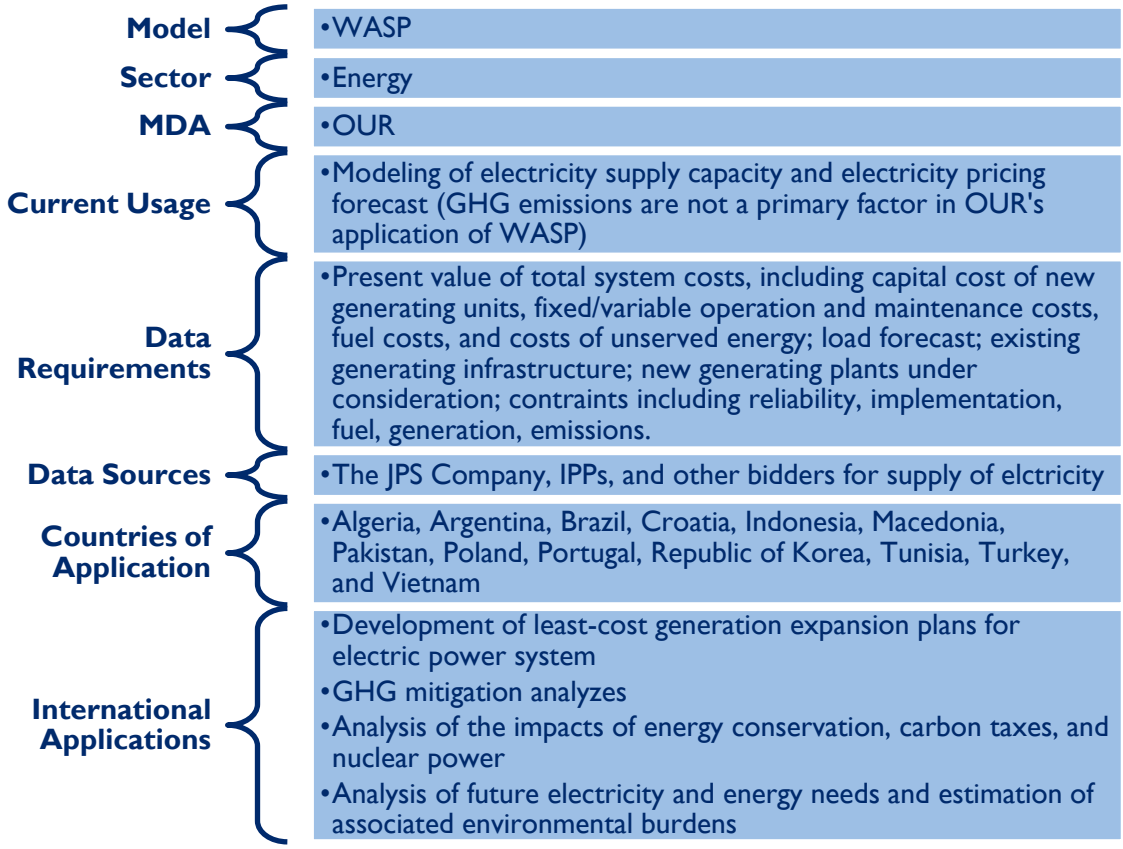
Model	•FINPLAN
Sector	•Energy
MDA	•MSTEM
Current Usage	•Financial analysis of new energy projects
Data Requirements	•Data on investment costs for capacity additions and operating expenses. Economic and fiscal parameters (inflation, escalation, exchange rates, taxes). Financial parameters (credits and bonds).
Data Sources	•JPS, MSTEM, OUR, IPPs
Countries of Application	•Belarus, Columbia, Mali, Nigeria, Republic of Korea, Uganda
International Applications	•Financial appraisal of projects

Sources: http://www.iaea.org/NuclearPower/Downloads/INPRO/Files/INPROPESS-brochure.pdf and Stakeholder Interviews (April-June 2013).

4.1.6 Wien Automatic System Planning

The Office of Utilities Regulations (OUR) is the utilities regulatory body in Jamaica. OUR utilizes the Wien Automatic System Planning (WASP) package to inform energy supply expansion planning. WASP is an optimization tool for electricity capacity planning and regulation. WASP was developed in 1972 by the Tennessee Valley Authority and the Oak Ridge National Laboratory in the United States. It was designed to meet the IAEA's need to compare the economic competitiveness of nuclear power to other alternatives for electricity supplies for a country or region (IAEA 2001). OUR uses WASP to model the country's electricity supply capacity and assess alternatives for meeting the projected demand. It is also used in electricity price forecasting when new power generation plants are being added to the grid. Figure 4.6 summarizes the properties and applications of WASP.

Figure 4.6: Properties and Applications of WASP



Sources: IAEA 2001. "Wien Automatic System Planning (WASP) Package A Computer Code for Power Generating System Expansion Planning, User's Manual" and Stakeholder Interviews (April-June 2013).

WASP can also be used to estimate GHG emissions, but OUR does not use this since they are not a primary factor in its choice of energy sources. OUR staff noted that their mandate is to ensure an efficient and reliable supply of electricity through a least-cost expansion path that will adequately meet the demand. Consequently, OUR has not generated baseline data on the emissions abatement potential of different electricity capacity expansion options or scenarios for GHG mitigation. WASP only addresses electricity generation, rather than all types of energy. Highway Development and Management Model

The Highway Development and Management Model (HDM), developed by the World Bank, is used for engineering and economic assessment of road investments and maintenance and transport pricing and regulation. It has been applied in strategic planning to prepare medium- to long-term planning estimates of funding requirements for road network development and maintenance within a country. The HDM estimates the economic or engineering viability of road investment projects through life-cycle analysis of pavement performance, maintenance, and/or improvement effects, and road-user costs. The model accepts but does not perform network traffic assignment and has a limited capacity to estimate environmental impacts. It is only partially applicable to urban traffic conditions. In Jamaica, the NWA uses HDM for road project appraisals. Figure 4.7 summarizes the properties and applications of HDM.

Figure 4.7: Properties and Applications of HDM

Model	•HDM
Sector	•Transport
MDA	•NWA
Current Usage	•Road project appraisals
Data Requirements	•Vehicle fleets, road networks, road standards
Data Sources	•MTWH, road project design proposal
Countries of Application	•Australia, India
International Applications	•Road pavement decision support tool •Estimation of road maintainence and rehabilitation needs

Sources: http://www.hdmglobal.com/hdm4v2information.asp and Stakeholder Interviews (April-June 2013).

4.2 LEDS MODELING CAPABILITIES OF THE GOVERNMENT OF JAMAICA

The modeling capabilities of the MDAs covered in this study varied widely. Only the PIOJ, MSTEM, and OUR are currently active in economic modeling. Several MDAs have no capacity to conduct economic modeling or have no active economic modeling in place. Figure 4.8 below summarizes the economic modeling expertise available at these MDAs.

Figure 4.8: LEDS Modeling Capabilities of the Government of Jamaica

PIOJ

- One economist with expert knowledge of T21 and two others with advanced knowledge

MSTEM

- One economist with expert knowledge of FINPLAN, MAED, and MESSAGE, supported by three economists/engineers with advanced to working knowledge

OUR

- One engineer with expert knowledge of WASP and at least two economists/egineers with advanced knowledge

Source: Stakeholder Interviews (April-June 2013).

The PIOJ has a Modeling Unit that uses the T21 model to conduct analysis for other MDAs. The unit has three staff with advanced knowledge of this model. As the planning agency of the GoJ, the PIOJ also houses some economists trained in T21 in other units. These persons could be assisting the Modeling Unit.

MSTEM has a senior economist in its Energy Economics and Planning Unit is responsible for economic modeling with ENPEP-BALANCE, MAED, and MESSAGE. It also has two managers and an

engineer with advanced or working knowledge of these models. MSTEM has not fully deployed ENPEP-BALANCE to evaluate emissions due to lack of data. When MSTEM has analyzed emissions, it has relied on non- country specific emission factors from the Intergovernmental Panel on Climate Change (IPCC) for product types, technologies, and pollution control equipment.. MSTEM also uses FINPLAN and has adequate expertise in using the tool.

OUR is also the only agency in Jamaica that uses the WASP model. OUR has three staff who know how to use the WASP Model. Other staff with backgrounds in economics or engineering could also use WASP after some training.

MSTEM is the only MDA in Jamaica ithat has used ENPEP. Other current staff in some MDAs has received training on ENPEP trainings, but has not used it in their work.

LEAP is an energy and GHG mitigation model developed by the Stockholm Environment Institute.[9]It can address demand and supply and has considerable flexibility for various levels of complexity. Unlike other energy planning tools, LEAP is not restricted to a specific energy system,; it can be used by the public and private sectors for various applications at different levels of analytical complexity . It has been widely applied in more than 190 countries, including China, Lebanon, Mexico, the Philippines, and the United States. It was used in the preparation of Jamaica's Second National Communication to the UNFCCC.

LEAP can also be applied to assess the potential for emissions reductions in agriculture, transport, tourism and other sectors. Some of the Vision 2030 Jamaica sector plans did not specify targets for outcome indicators and LEAP could be used to fill these gaps. Although LEAP has many potential applications in Jamaica, the AILEG team found no local expertise in its use in any of the MDAs use of LEAP the Second National Communication to the UNFCCC was conducted by a foreign consultant to the Meteorological Service of Jamaica. Since LEAP is relatively easy to use, it would not be difficult to develop this expertise in country.

4.3 LEDS MODELING EXPERTISE IN ACADEMIA

Although UWI has lecturers with economic modeling skills, few have had formal training related expertise in environmental economics. Some UWI lecturers have worked with T21, but none has experience using the other models discussed in this section. The inexperience in running these models is due largely to the fact that they have not participated in studies that required use of these tools. UWI researchers said the university could quickly develop expertise in these tools if MDAs engaged them to work in this area.

UWI has active research in climate modeling for the region. UWI and UTech are currently working on renewable energy and energy efficiency issues, although mainly on engineering and science aspects, rather than economics. Some UTech staff has received prior training in WASP, but has not used it in any of their research projects.

4.4 DATA CHALLENGES

Jamaican MDAs often cited data limitations as a constraint in economic modeling for energy and GHG mitigation. The PIOJ identified limited data as a major constraint in running the environment module of T21. To a lesser extent, MSTEM also cited environmental data limitations as an obstacle to full deployment of its economic analysis tools. To address this gap, NEPA is preparing a database on GHG emissions and other environmental issues.

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[9] http://www.sei-us.org/Publications_PDF/SEI-LEAP-brochure-Jan2012.pdf.

The challenge with energy data is accessibility, not availability, but. Multiple MDAs and private sector entities generate energy data. To address this challenge, MSTEM has rolled out the National Energy Information Clearing House (NEIC) as a one-stop shop for energy data in Jamaica. The Scientific Research Council also houses the Caribbean Energy Information System, Caribbean Information Platform on Petroleum, and Caribbean Information Platform on Renewable Energy. These databases complement the NEIC and could be linked.

4.5 CONCLUSIONS

MSTEM uses multiple economic models but lacks adequate expertise in modeling. As a result, there is under-use LEDS modeling at MSTEM. The PIOJ uses T21 for integrated development planning and has sufficient capacity in this model. OUR has sufficient capacity to use the WASP model for energy supply planning, but has not used it to analyze GHG emission reduction potential. The T21 model is adequate for overall macroeconomic planning, but its use in Jamaica for LEDS has been hampered by insufficient environmental data. MSTEM has not fully deployed its suite of economic models for LEDS due to competing demands on the time of its experts.

There is limited expertise in LEDS economic modeling at UWI. However, some UWI and UTech staff has good potential to expand this expertise rapidly because they already have knowledge of economic modeling, climate modeling, and renewable energy and energy efficiency technologies.

Jamaica needs to institutionalize economic modeling activities in many MDAs where modeling is not currently being done, such as the MWLECC, MTWH, MTE, MOAF, Forestry Department, and the National Water Commission. Senior management of these MDAs may have to be sensitized about the importance of economic modeling in setting targets for GHG emission reductions and projecting emissions under alternative development scenarios.

5 KEY FINDINGS

The GoJ has a well-developed framework for economic planning and energy, agriculture, tourism, and (to a lesser extent) transport planning. The ability to use economic modeling differs across sectors. The PIOJ has a mandate for economic planning and has used the T21model effectively for integrated development planning. OUR has used the WASP model. Economic modeling has been under used at MSTEM.

Opportunities exist for LEDS economic modeling in the environmental, agricultural, tourism, transport, housing, and forestry sectors.

Data availability is a major constraint that has hindered LEDS economic modeling at the PIOJ and MSTEM. Data accessibility has also limited energy sector analysis. These data bottlenecks are currently being addressed by MSTEM for the energy sector and NEPA for environmental quality.

The economic modeling activities at the MDAs covered in this assessment have mainly been conducted by one person or a few individuals. The lack of depth in public sector modeling capacity constitutes a serious challenge to the sustainability of LEDS economic modeling. Although external support enabled use of the LEAP model for the Second National Communication to UNFCCC, no GoJ staff with a working knowledge of this model could be identified two years after the consultancy report was completed. Administrative arrangements have also restricted use of the full version of T21 to the PIOJ.

Since climate change cuts across multiple sectors, an integrated modeling approach to LEDS is important. The GoJ has adopted a "no-regrets" approach to climate change mitigation. To identify "no-regrets" mitigation options, all sectors with potential for implementing renewable energy, energy efficiency, and energy conservation have to be incorporated in any LEDS planning. This extends to transport, housing, tourism, and agriculture. One aspect of the "no-regrets" approach that has not received sufficient attention is afforestation and reforestation. In the other these sectors, economic modeling could play a huge role in guiding the selection of strategies and determining the optimal path for achieving each sector's targets at the least cost.

Economic modeling needs to be incorporated into the activities of MWLECC, MTWH, MTE, MOAF, and the Forestry Department. Some staff of the MDAs will have to gain new skills to use economic modeling tools for LEDS planning. The identification of specific tools to train staff in may be premature at this stage, since measurable targets for LEDS options have not been identified for these sectors.

Because the economic modeling activities in many MDAs have relied on individuals rather than a system, the sustainability is questionable. The lack of local expertise in economic modeling is partly due to the lack of exposure to this technical skill during the university training of staff. There could be important benefits if the U.S. Government provided technical assistance to set up an economic modeling center at a local university collaborating with the PIOJ, MSTEM, and MWLECC. This would help faculty and students become proficient in economic modeling for LEDS planning and implementation.

6 RECOMMENDATIONS FOR ECONOMIC MODELING

The AILEG team identified gaps in the current LEDS planning processes in Jamaica and the capacity to perform LEDS economic modeling. Figure 6.1 contains recommendations to address these gaps.

Figure 6.1: Recommendations for addressing Gaps in Current LEDS Planning Process and Economic Modeling Capabilities and Need

Improve LEDS Understanding	•Sensitize senior management of MDAs to the relevance and importance of economic modeling in LEDS planning through training and workshops
Expand MSTEM's Modeling Capacity	•Expand economic modeling expertise at MSTEM through new hires and re-train staff of other MDAs in the use of ENPEP
Rotate Economists	•Institute rotational assignments in modeling work for GoJ economists to deepen economic modeling skills in the public sector
Enhance Databases	•Enhance available databases for energy and environmental data through cross-sectoral data sharing and centralized coordination of data archiving
Improve Access to T21	•Grant university researchers full access to the T21 model to support and extend modeling work done at the PIOJ
MDA Adoption of LEAP	•Adopt LEAP in MDAs with identified needs for LEDS economic modeling and conduct training for staff in its use
Emphasize Reforestation	•Commission an economic modeling study on reforestation as a "no-regrets" approach
Economic Modeling Center	•Establish an economic modeling center at UWI to develop interests and capacities in economic modeling among undergraduate and graduate students, the pool of candidates for future GoJ employment and contracting
UWI/UTech Collaboration	•Fund a multidisciplinary collaboration between UWI and UTech to develop economic modeling expertise

Source: AILEG Team.

6.1 RECOMMENDATIONS FOR CAPACITY DEVELOPMENT

6.1.1 Improve LEDS Understanding

It is essential that senior management of the MDAs understand the critical role of economic modeling in LEDS planning and sustainable development initiatives. The PIOJ, OUR, Ministry of Finance and Planning (MOFP), and the Bank of Jamaica (BOJ) have economists in key roles; however, most other MDAs do not. Training workshops can inform MDA managers about economic modeling and help create a culture of evidence-based planning in the public sector. This training should be a priority action for implementation within the next six months. Experts in the public sector and academia can develop and deliver the workshops. On-location at the MDAs along with an annual, joint workshop to share experiences and best practices

6.1.2 Expand MSTEM's Modeling Capacity

MMSTEM has made concerted efforts to make economic modeling an established activity, but is challenged by the limited economic modeling expertise compared to the potential workload. Since MSTEM has an Energy Economics and Planning unit with responsibility for economic modeling, there is already senior management understanding of the importance of economic modeling in the ministry. This unit needs to increased staffing or contracted support from academia. The high turnover of public sector economists has also been a constraint that will make it necessary for MSTEM to expand its pool of modeling experts

Some staff from other MDAs has received training in EFNEP, but has not used the model in their work because their managers do not understand the importance of economic modeling. These individuals may need retraining. Prior familiarity with ENPEP will make it easier for these staff to regain the ability to use this model and learn other economic models.

The recommendation to expand ENPEP modeling expertise in MSTEM and academia should be implemented in within a year.

6.1.3 Rotate Economists

Other MDAs could benefit from the expertise of an economist even if they do not have existing staff or approved positions in this area. A system of rotating assignments for GoJ economists with modeling expertise could expand use of these tools. The PIOJ may be best suited to establish and coordinate these rotating assignments. This could be initiated within a year. AILEG recommends implementing this system for three years, with an evaluation at the end of that period to assess the value of continuing the program.

6.1.4 Enhance Databases

Challenges in energy sector data availability and accessibility are already being addressed by MSTEM and NEPA. MSTEM has established a National Energy Information Clearing House and NEPA created a web portal for environmental data. Coordination of these two efforts could help ensure that meet cross-sectoral requirements for model development and validation as well as research and planning. This effort could begin immediately and be carried out within six months.

6.1.5 Improve Access to T21

The PIOJ's customized T21 model for Jamaica is available to other users in a run-only version with pre-assigned parameters that cannot be altered. This is very limiting for researchers, who may want to run different scenarios that have not previously been considered. PIOJ's modeling work could actually be enhanced by providing academic researchers with full access to the customized T21 model. This recommendation could be implemented in the short term. The PIOJ and Department of Economics at UWI should establish an institutional agreement on sharing the Jamaican T21 model. The inclusion of other departments, institutes and centers at UWI and UTech in this model-sharing arrangement could further strengthen LEDS modeling.

6.2 RECOMMENDATIONS FOR TECHNICAL ASSISTANCE

6.2.1 MDA Adoption of the LEAP Model

Evidence gathered by AILEG team showed that many tools were in use for different aspects of energy planning and LEDS across the MDAs. While some specialized tools may be required for specific modeling tasks, LEAP offers a versatile tool that can be applied across multiple sectors and in a variety of ways spanning energy planning, GHG mitigation assessment and LEDS modeling. The use of LEAP avoids the multiplicity of tools across MDAs and allows efforts to be concentrated on building expertise on a few essential tools as opposed to gaining limited familiarity with multiple tools. LEAP has been successfully applied in more than 190 countries covering both developed and developing countries. Jamaica will benefit from the adoption of LEAP as its versatility will enable it to be applied across many MDAs thus facilitating the sharing of expertise across these MDAs. LEAP can also easily integrate other tools to expand analytical rigor.

One deficiency identified in the various Sector and Action Plans for Vision 2030 Jamaica – National Development Plan is the lack of information on the emission-reduction potential of strategies proposed for implementation. Here is one area where LEAP could be effectively used to inform LEDS planning across sectors.

For adoption of LEAP to be successful, local expertise should be developed first. The AILEG team found no expertise in using LEAP in the public sector and limited familiarity with the tool among the academic community. The USG will be ideally positioned to provide LEAP training to key economists in the public sector and academia with economic modeling skills. These persons would then serve as local trainers for MDA staff.

The LEAP train-the-trainer as well as the training of MDA staff would best be coordinated by the PIOJ which would be responsible for identifying local experts to be trained as trainers and making recommendations on the training venue. Implementation in the short to medium term, within the next 1-2 years, would enable improved rigor of LEDS economic modeling in the energy sector and expanded LEDS economic modeling in other sectors.

6.2.2 Emphasize Reforestation

Reforestation has not received sufficient attention in Jamaica, in part due to lack of information on GHG abatement by forests in the country. The Forestry Department expressed a strong interest in the mitigation potential from reforestation and economic analysis of existing and new forests. Reforestation might constitute a "no-regrets" approach for Jamaica's LEDS planning.

Expertise is available in Jamaica to conduct this study. UWI could provide a multidisciplinary team if funding were available from the GoJ or donors and development assistance agencies. The Forestry Department should work with the PIOJ to secure funding for this study which could be completed within the next three years.

6.2.3 Economic Modeling Center

The limited use of economic modeling in the public sector in Jamaica can be traced to the type of training received by students at the universities. Most economics students have little practical exposure to economic modeling. An economic modeling center could develop interests and capacity of undergraduate and graduate economics students in modeling. These students will form the pool of future GoJ staff. The economic modeling center will also serve to further the development of ties between MDAs and the academic community by providing a platform for academics to contribute to public sector decision making through simulation exercises of policy considerations.

Technical and financial assistance from donors would be needed to establish an economic modeling center. The Fulbright program of the USG could be one source of expertise.

Establishment of the economic modeling center is a medium- to long-term project. A funding proposal should be developed in the short term. The center might be best housed within the UWI Department of Economics.

6.2.4 UWI/UTech Collaboration

The GoJ could benefit from funding a UWI and UTech collaboration to develop economic modeling expertise. Collaborations could begin with one year.

6.3 CONCLUSIONS

The nine recommendations above for addressing the gaps in the current LEDS planning and climate change economic modeling in Jamaica are initial steps. However, any one recommendation or even the whole set of recommendations are necessary, but not sufficient to for comprehensive LEDS planning.

REFERENCES

Agriculture Task Force. (2009). *Vision 2030 Jamaica: Agriculture Sector Plan 2009–2030*. Kingston: Agriculture Task Force.

ClimateWorks. (2009). *Low Carbon Growth Plans: Advancing Good Practice (Working Draft)*. San Francisco: ClimateWorks Foundation.

Commonwealth Secretariat. (2003). *Master Plan for Sustainable Tourism Development*. London: Government of Jamaica.

GoJ (Government of Jamaica). (1996). *National Industrial Policy*. Kingston: GoJ.

GoJ. (2011). *The Second National Communication of Jamaica to the United Nations Framework Convention on Climate Change*. Kingston: Meteorological Service.

Heltberg, R., Siegel, P.B., & Jorgensen S. L. (2009). Addressing Human Vulnerability to Climate Change: Toward a 'No Regrets' Approach. *Global Environmental Change*, *19*(1): 89-99.

Housing Task Force. (2009). *Vision 2030 Jamaica: Housing Sector Plan 2009–2030*. Kingston: Housing Task Force.

IAEA (International Atomic Energy Agency). (2001). *Wien Automatic System Planning (WASP) Package A Computer Code for Power Generating System Expansion Planning, User's Manual.* Vienna: IAEA.

Natural Resources and Environmental Management & the Hazard Risk Reduction and Climate Change Task Forces. (2009). *Vision 2030 Jamaica: Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change Combined Sector Plan 2009–2030*. Kingston: PIOJ.

MSTEM (Ministry of Science, Technology, Energy and Mining). (2009). *National Energy Policy 2009–2030*. Kingston: Ministry of Science, Technology, Energy and Mining.

MSTEM. (2010a). *National Energy Conservation and Efficiency Policy 2010–2030*. Kingston: Ministry of Science, Technology, Energy and Mining.

MSTEM. (2010b). *National Renewable Energy Policy 2010–2030 (Draft)*. Kingston: Ministry of Science, Technology, Energy and Mining.

MSTEM. (2010c). *National Policy for the Trading of Carbon Credits 2010–2030 (Draft)*. Kingston: Ministry of Science, Technology, Energy and Mining.

MSTEM. (2010d). *National Energy from Waste Policy 2010–2030 (Draft)*. Kingston: Ministry of Science, Technology, Energy and Mining.

MSTEM. (2010e). *National Biofuels Policy 2010–2030 (Draft)*. Kingston: Ministry of Science, Technology, Energy and Mining.

PIOJ (Planning Institute of Jamaica). (2009a). *Vision 2030 Jamaica: National Development Plan*. Kingston: Planning Institute of Jamaica.

PIOJ. (2009b). *Vision 2030 Jamaica: National Development Plan*. Kingston: PIOJ.

PIOJ. (2009c). *Medium Term Socio-Economic Policy Framework 2009-2012*. Kingston: PIOJ.

Tourism Task Force. (2009). *Vision 2030 Jamaica: Tourism Sector Plan 2009–2030*. Kingston: PIOJ.

Transport Task Force. (2009). *Vision 2030 Jamaica: Transport Sector Plan 2009–2030*. Kingston: PIOJ.

World Bank. (2012). *Planning for a Low Carbon Future: Lessons Learned from Seven Country Studies*. Washington, D.C.: Energy Sector Management Assistance Program, Knowledge Series 011/12, World Bank.

ANNEX 1: SAMPLE PROTOCOL FOR STAKEHOLDER INTERVIEWS

ANALYSIS AND INVESTMENT FOR LOW-EMISSION GROWTH (AILEG) PROJECT

ECONOMIC PLANNING AND MODELING COMPONENT

Interview Protocol for LEDS Planning and Modeling

Ministry:

Agency:

Responding Official(s): _____Position/Title: _____

_____Position/Title: _____

_____Position/Title: _____

_____Position/Title: _____

Interview Date: _____

1. What is the process of economic planning/energy planning/climate change mitigation and adaptation planning in your Ministry/Agency?

2. What was the process used for arriving at the sectorial strategies and action plans for Vision 2030?

3. Was any modeling exercise done to inform targets set for your sector under Vision 2030?

    a. If yes, what type of modeling was performed and what tools were used?

    b. If yes, who were involved in these modeling/simulation exercise and what were their roles?

    c. If no, why was it not done?

4. Does your ministry typically perform economic modeling in relation to economic planning/energy planning/climate change mitigation and adaptation planning internally?

    a. If modeling is done internally, how frequently is it done and who are the key participants?

b. If modeling is done by other ministries/agencies/consultants for your ministry/agency, who is responsible for conducting this exercise?

5. In your opinion, is economic modeling adequately incorporated in the planning process for your ministry/agency?

    a. If so, please elaborate with examples.

    b. If not, how would you like economic modeling to be more integrated in your planning process?

    c. What do you think are the obstacles/constraints for why that is not currently being done?

6. Does your ministry/agency have a working relationship/MOU with any of the higher institutions of learning for research/planning support?

    a. If yes, what sort of working relation exists

    b. If not, will such an arrangement be beneficial to your ministry/agency in terms of planning?

    c. In what areas would you suggest such an arrangement be established?

7. What suggestions do you have for technical assistance and capacity development in economic modeling in your ministry/agency?

Sector/Agency-Specific Questions—PIOJ Sustainable Development Division

1. What was the process for developing scenarios for energy demand and GHG emissions for the Second National Communication (SNC) to UNFCCC?

2. The LEAP model was used for simulating results for the different scenarios presented in the SNC. Who was responsible for generating these results?

    a. Are these technical experts based at the PIOJ?
    b. Are they based in other ministries or agencies of the GoJ?

3. Is the LEAP model routinely used at the PIOJ for planning and making projections?
    a. If Yes, how frequently?
    b. If Not, why is it not being used?

4. How do you judge the usefulness of LEAP for sustainable development planning?

5. Is there adequate technical expertise in the running of LEAP at the PIOJ?

6. What technical support and/or capacity-enhancement training for economic modeling in sustainable development planning will you recommend for PIOJ staff?

Thank you.

ANNEX 2: LIST OF INSTITUTIONAL STAKEHOLDER INTERVIEWED

MDA/Organization/Institution	Stakeholders Represented
Ministry of Water, Land, Environment and Climate Change	Public Sector
Ministry of Science, Technology, Energy and Mining	Public Sector
Planning Institute of Jamaica	Public Sector
Ministry of Finance and Planning	Public Sector
Ministry of Transport, Works and Housing	Public Sector
Ministry of Local Government and Community Development	Public Sector
Cabinet Office	Public Sector
Ministry of Agriculture and Fisheries	Public Sector
Rural Agriculture Development Authority	Public Sector
Ministry of Tourism and Entertainment	Public Sector
Office of Disaster Preparedness and Emergency Management	Public Sector
National Environment and Planning Agency	Public Sector
Office of Utilities Regulation	Public Sector
Forestry Department	Public Sector
Petroleum Corporation of Jamaica	Public Sector
Scientific Research Council	Public Sector
National Water Commission	Public Sector
Development Bank of Jamaica	Public Sector
Jamaica Manufacturers' Association	Private Sector
Private Sector Organization of Jamaica	Private Sector
Jamaica Public Service Company	Private Sector
The University of the West Indies	Academia
University of Technology	Academia

Note: List in no particular order.