

# ***Analysis of Stakeholder for Effective Use of Arundo donax as Biomass Fuel in Belize***

Final Report

*This report is the identification of key stakeholders and stakeholder perspectives regarding the production and processing of the Arundo donax Biomass as biomass fuel in Belize. It is an output of the Project Preparation Activity funded by the Green Climate Fund, and is being executed by the Caribbean Community Climate Change Centre, in collaboration with and on behalf of the Government of Belize.*

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## EXECUTIVE SUMMARY

This report is an analysis of stakeholders' perspectives and influence on proposed initiatives to assess the viability of using a plant identified as *Arundo donax* and commonly known as wild cane, as biomass energy in Belize. It is one of the outputs of a project preparation initiative being financed by the Green Climate Fund, and consisting of two components- funding proposal preparation and fuel compatibility testing. In addition to this stakeholder analysis and stakeholder management and engagement plan prepared under the funding proposal, that component includes a gender analysis, an environmental and social analysis and a feasibility study.

In addition to the GCF funded project preparation initiative, the assessment of wild cane as biomass fuel also involves a separate but closely related initiative to test the conditions under which the plant identified as *A. donax* and known to be endemic at least in the North Stann Creek and Belize Districts, on 400 acres of land in the Orange Walk District. This initiative, designed initially as an integral part of the assessment, is being financed by the Belize Electricity Limited. This related initiative was included in the discussions with stakeholders and assessment of their perspectives and positions.

The approach to determining the stakeholders of the project included an initial research and desktop review, stakeholder identification, consultative meetings with stakeholders, and analysis of the issues, concerns and recommendations arising from the various discussions. The stakeholders were consulted through a series of one-on-one and group interviews, and focus group discussions. Focus group and meetings were coordinated and co-facilitated with the gender specialist.

The desktop analysis identified consistency of the project objectives with Belize's national plans and related international commitments. These include the medium and long term development plans (Horizon 2030 and Growth and Sustainable Development Strategy), the national climate change policy and strategy, the national energy policy framework, the national Food and Agriculture Policy and the National Forest Policy. Commitments and provisions of these plans and strategies center on increasing Belize's level of renewable energy generation and thereby reducing carbon emissions, and promotion of use of suitable crop for energy. The wild cane biomass project is explicitly provided for in the Growth and Sustainable Development Strategy. In addition to reduced emissions of carbon indicated, at least one document—the Growth and Sustainable Development Strategy, describes anticipated benefits to include increased levels of employment from a new biomass industry.

The objectives incorporated in the national plans to which the *A. donax* biomass project responds are further embedded in Belize's international commitment, especially those of the United Nations Framework Convention on Climate Change. These include countries' commitment to reduce levels of global average temperatures to less than 2 degrees Celsius, and aligning financing flows to facilitate lower greenhouse emissions.

In addition to the policy context, desktop analysis pointed to key macro-socioeconomic developments that set the national and local context for stakeholders' stance to the wild cane biomass initiative. This includes contraction in output experienced in 2016—partly as a result of external shock from Hurricane Earl and continued contraction in Belize's already modest petroleum sector. In addition to the overall economic performance, levels of unemployment and types of household tenure were examined as proxy indicators of stakeholders' well-being. Examined at the level of the districts for the years—Orange Walk, Corozal and Stann Creek—for the years 2015 and 2016, labor force participation and

unemployment rates shows highest levels of participation and unemployment among the three to be estimated for the Stann Creek District. Additionally, estimated levels in this district are higher than the national average estimated, while those in the Orange Walk and Corozal Districts are lower. The household ownership for the same districts showed higher levels of ownership in the Northern districts, while rent-free status is higher in Stann Creek. Notably, the number of homes owned or held by hire purchase in the Orange Walk District is significantly lower in 2016 than in 2015.

During consultations and discussions, stakeholders' demonstrated support for the initiative and enthusiasm at the prospect of a new industry should the assessments indicate viability in the use of wild cane as biomass fuel. There is also confidence in the Caribbean Community Climate Change Centre's leadership of the process, confirmed commitment of project proponents—particularly the Belize Co-generation Energy Limited and the Belize Electricity Limited—and generally high levels of interest in collaboration and participation. Interest in collaborating on the technical aspects was specifically indicated by the Sugar Industry Research Institute in the Corozal District, the Ministry of Agriculture Research Station in the Orange Walk District and the University of Belize. Interest in participation or in future uptake as an economic activity is high among cane farmers and community residents consulted.

Based on issues expressed or revealed in consultations, and on respondents' experiences and recommendations shared, a number of issues were flagged for immediate action in order to ensure effective continued implementation of the assessment activities. These actions included measures to fully engage stakeholders with technical expertise, to ensure regular and clear communication with and among stakeholders in order to maintain support and reduce risk of negative impacts from existing tensions based on traditional relationships. The risks and measures identified were factored into the design of the management and engagement plan, prepared under separate cover.

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## ABBREVIATIONS

A. donax	Arundo donax
ASR	American Sugar Refinery
BEL	Belize Electricity Limited
BELCOGEN	Belize Co-generation Energy Limited
BSI	Belize Sugar Industries
CCCCC/5Cs	Caribbean Community Climate Change Centre
CFE	Comisión Federal de Electricidad (Federal Electricity Commission, Mexico)
CSF	Critical Success Factor
ERMP	Environmental Risk Management Plan
EU	European Union
GCF	Green Climate Fund
GOB	Government of Belize
GSDS	Growth and Sustainable Development Strategy
MFFSD	Ministry of Forestry, Fisheries and Sustainable Development
NC	Necessary Condition
NDC	Nationally Determined Contribution
UNDP	United Nations Development Programme
UNFCC	United Nations Framework Convention on Climate Change

# 1. INTRODUCTION

The efforts through which the viability of this *A. donax* is to be determined were first formulated as a single project consisting of three components. The project was subsequently reconstituted into two separate and related initiatives with different funding sources. The first initiative is a set of project preparation activities intended to inform decisions on upscaling and is financed by the Green Climate Fund (GCF). The second is a pilot activity to test the feasibility of cultivating the plant identified as *A. donax* and is being financed by the Belize Electricity Limited (BEL).

This document is one of the outputs of the GCF funded project preparation process and presents the results of the activities and assessments required by the terms of reference (TOR) for stakeholder analysis and preparation of a stakeholder management and engagement plan. The TOR states explicitly that the primary objective of the consultancy is the formulation and presentation of reports to-

“provide insight and recommendations from a stakeholder engagement and management perspective on the project entitled **Arundo Donax Renewable Bio-mass Fuel for Belize**, and specifically how to meaningfully and effectively integrate stakeholders into the design and scope of the referenced project to align with best policy and practice locally, regionally, and internationally.”

The TOR also indicates that the results of the stakeholder analysis and management and engagement plan will “form a part of the preparation of the full funding proposal for the **Arundo Donax Renewable Bio-mass Fuel Investment Initiative for Belize.**” It requires analysis and presentation to take account of the relevant international, legal and local legislation, policies, norms, standards, guidelines, and current best practices.

This report presents the stakeholders' perspectives identified in accordance with the TOR guidelines and informs the management and engagement plan, prepared under separate cover. An overview of the *A. donax* projects is presented in the background described in the next subsection, and relevance to Belize national plans and policies and its related international commitments is set out in the institutional context described in subsection 1.2. The likely impact of climate change on the project beneficiaries is articulated in subsection 1.3. Section 2 is a description of the methodology used to formulate the analysis and management and engagement plan. Section 3 contains the country and community context around the development of the initiatives. The stakeholder matrix that should have been set out at Section 4 is placed instead at Annex 1 to better accommodate its length. Details of stakeholders' perspectives shared and analysis of critical issues related to their experience and context are outlined in Section 5. Conclusions and recommendations are set out in Section 6. Based on issues raised and observations made during the consultations, this section highlights key issues requiring urgent or early action and recommendations for steps toward resolution.

## 1.1. Background

### A. *Arundo donax* as Potential Biomass

The Approved Project Preparation Application for Green Climate Fund financing of the biomass project describes *Arundo donax* as “an indigenous fast growing C3 perennial rhizomatous grass...currently available and to be cultivated widely on marginal lands in Belize (GCF, 2018, p. 3).” The approach to

identifying *A. donax* as the best option for potential biomass production is described in detail in Section 1.2 of the Environment and Risk Management Plan (ERMP) for Piloting *Arundo donax*, a document that supported the initial project design (CCCCC, 2016b). The range of crops that were considered for potential biomass and described in this section includes Caribbean Pine, Cohune Palm and *Acacia mangium*, a broadleaf legume. *A. donax* was identified as the best option partly because “It has the resilience and rapid growth characteristics making it the most suitable...(p. 6).”

Other characteristics of *A. donax* drawn from several observations and analyses described in the ERMP are listed below (p. 7). Activities through which these observations were made included an initial, small-scale compatibility test at the Belize Co-generation Energy Limited (BELCOGEN) plant at Tower Hill of 10 tons of a perennial grass identified as *A. donax* and extracted from the Northern Stann Creek area.

- 1) Lower ash content and higher calorific value<sup>1</sup> than Bagasse.
- 2) Resistivity to fires during cultivation because of high moisture content.
- 3) Ability to grow on marginal land not adequate for agriculture provides an opportunity to use marginal lands.

The resistivity and fast growing characteristics of *A. donax* led to it being considered as an invasive species, particularly in the United States.<sup>2</sup> The ERMP points out, however, that the plant was not included in Belize’s list of invasive species in its 2010 Fourth National Report to the United Nations Convention on Biological Diversity (p. 21), and that, in those areas where it has been identified as growing, no significant expansion beyond its riparian habitats have been detected.<sup>3</sup> The ERMP relates that *Arundo* was identified in Belize as early as 1883 by D. Morris, then Director of Public Gardens and Plantations in Jamaica, in a publication entitled *The Colony of British Honduras, its Resources and Prospects, with Particular Reference to its Indigenous Plants and Economic Production*.

The two related initiatives to explore the feasibility of using *A. donax* as biomass in Belize are being spearheaded by the Caribbean Community Climate Change Centre (the 5Cs). This is in accordance with a Memorandum of Understanding with the Government of Belize under which the Centre is committed to supporting the development of the country’s energy sector. The initial intent was to test the plant’s performance in different soil types using a total of 1,800 acres of land in different locations across the country. Given the endemic scarcity of available land in Belize, this approach was not viable in the short run. Not only was the project therefore reconstituted into two separate initiatives, but due to the availability of land and lessons learned regarding the cost of transportation in the delivery and burning

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<sup>1</sup> Described by Collins Dictionary as the quantity of heat produced by the complete combustion of a given mass of fuel, usually expressed in joules per kilogram. <https://www.collinsdictionary.com/us/dictionary/english/calorific-value>

<sup>2</sup> California State has a strategy and program aimed at eradicating *A. donax* whereas North Carolina is pursuing studies of its use as biofuel.

<sup>3</sup> As described in more detail in this report, this may reflect the fact that the *Arundo* that was identified and is being tested is, in fact, native to Belize and the Central and South America region, and is a variant of the species. Further testing is being undertaken under the related cultivation initiative to verify the specific variant, concurrent with the continued extraction and compatibility testing of the identified grass.

of the initial amount, the scale of the cultivation activities was adjusted and sited in Orange Walk, in the first instance.

The related initiatives are set out in more detail below.

## **B. The Project Preparation Initiative**

The project preparation initiative accepted for GCF funding consists mainly of two sets of activities as described below.

### ***Component 1: Funding Proposal Preparation***

The outputs under this component are a series of analytical reports that will inform decision-making on the feasibility of *A. donax* for production of biofuel. The analyses for the preparation of these reports are being undertaken through separate consultancies, and are described below.

1. A feasibility study focused on the technical, financial and economic aspects of using *A. donax* as biomass and funding modalities to enable long-term sustainability.
2. A stakeholder analysis and management and engagement plan that will identify stakeholders and set out actions for their engagement, with a view to enabling the successful implementation of the project preparation activities. In addition to government, non-profit, civil society and private sector stakeholders, the plan should make recommendations for addressing issues related to the participation of or project impacts on women, children, youth and the differently abled.
3. A Gender Study and Gender Action Plan to incorporate gender considerations into the funding proposal and facilitate its' mainstreaming in the project. A particular focus of the gender focus is ensuring that women and children will benefit from the project in both the short and long terms. An Environmental and Social Impact Assessment (ESIA) and Social Management Plan (ESMP) that would include, but not be limited to the following.
  - a) Identification of all of the project's potential environmental and social impacts and measures for their prevention or mitigation, or for compensation in the event of adverse impacts.
  - b) Assessment of the legislative and regulatory environment;
  - c) Identification of appropriate institutional arrangements for the sustainable development and stewardship of the *A. donax* renewable energy initiative;
  - d) Survey of commercial interest from the sugar industry and other pertinent third parties
  - e) Investigate and present findings for Public-Private Partnership investment options
  - f) Describe the number of beneficiaries potentially affected by the proposed project
  - g) Identify opportunities, risk and concerns or issues related to the proposed project.

### ***Component 2: Fuel Compatibility Test***

The main output of the second component of the Project Preparation Initiative is an assessment of the compatibility of *Arundo* fuel with the BELCOGEN equipment, and suitability for electricity co-generation. This consists mainly of burning of 150 tons of *Arundo* at the BELCOGEN cogeneration plant at Tower Hill, Orange Walk, under various conditions in order to test its viability. The tonnage is to be extracted from

stands already growing in natural, mainly riparian habitats across Belize. The intention is to facilitate sufficient burning to determine the calorific value or efficiency of the *Arundo* grass. The trials will involve testing different proportions of *Arundo* with bagasse in order to observe their relative performance.

### **C. Related Pilot Cultivation Initiative**

The project preparation activities to be complemented by a separate initiative centered on testing the cultivation of the plant identified as *A. donax* on approximately 400 acres of leased lands near the San Lazaro and Yo Creek villages. The second initiative is aimed at assessing the best conditions under which *A. donax* would be cultivated, and the most effective risk management measures required for expanded planting activities. The description of this initiative set out in the ERMP outlines two phases. The first is a test phase and second is a managed production and cultivation phase. The test phase will consist of cultivating 50 individual plants within a one-acre parcel of the 400 acres of leased land, and identifying best approaches to management and effective techniques for eradication.

The second phase of the pilot will consist of utilizing the wider 400 acres for cultivation. This phase will include measures to mitigate unintended propagation outside the cultivation area. While the grass identified for compatibility testing and cultivation is described in relevant research and proposal documents as endemic to Belize, *A. donax* is known and recognized as being hardy and aggressive in nature. It grows easily under extremely difficult conditions and is therefore able to displace other vegetation. The mitigating measures described in the ERMP include

- 1) construction of a 20 feet wide buffer completely around the acreage to be cultivated, and
- 2) use of groundwater from wells to be constructed inside the buffer to avoid run-off of any pieces of *A. donax* rhizomes<sup>4</sup> into nearby streams and waterways.

The *A. donax* seeds are sterile and the plant is known to propagate by rhizomes. As with sugar cane, germination can be done using sections of the stalk that include a joint.

### **D. Problem or Objective**

The approved project preparation document sets out the objective of the project preparation assessments as “to demonstrate, using an innovative and impactful approach, the long-term feasibility of a viable...renewable energy programme based on the utilization of the widely available, indigenous *Arundo donax* (GCF, 2018, p.4).” This innovative and impactful approach is to be informed by and responsive to the perspectives and expectations of stakeholders. This analysis is intended to facilitate that end.

### **E. Identified Stakeholder Groups**

There is a wide cross-section of socioeconomic groups that are stakeholders of the *A. donax* biomass initiative, and expert judgment was applied in identifying those with the most immediate connection to the initiative for inclusion in this analysis and plan. This was done in part by taking account of the agencies directly engaged in project activities, the economic sectors that would be directly impacted by its potential success and the location where most of the project preparation or feasibility activities would be executed. The result was an identification of the following as the key stakeholder groups.

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<sup>4</sup> Rhizomes are described by Encyclopedia Britannica as “horizontal underground plant stem capable of producing the shoot and root systems of a new plant”, and also referred to as ‘creeping rootstalk’. See <https://www.britannica.com/science/rhizome>

- **Policymakers and Regulators:** This group includes the ministries responsible for economic development, climate change, energy, agriculture, environment and forestry. This group accommodates the project, ensuring that it aligns with national priorities, and provides the needed permits and certifications as required under any relevant laws. This refers particularly to research permits and environmental clearance.
- **Project proponents:** This group includes the Caribbean Community Climate Change Centre, The Government offices responsible for oversight Energy and Climate Change activities, the American Sugar Refinery/Belize Sugar Industries Group and its subsidiary, the Belize Co-generation Company, and the Belize Electricity Limited. These agencies are all involved in any or a combination of the oversight, execution or funding of project activities.
- **Research and Technical Units:** These are research agencies such as the Sugar Industry Research and Development Institute, the Orange Walk Agricultural Station, Ministry of Agriculture, the University of Belize which are all involved in research and data collection in areas related to agriculture, energy and climate change.
- **Cane Farmers:** This group includes the Belize Sugar Cane Farmers Association, the Progressive Sugar Cane Farmers Association and the Corozal Sugar Cane Producers Association, representative of the main economic activity in the Northern districts, where the compatibility testing is to be undertaken and the related cultivation initiative will be executed.
- **Community members or households:** While not limited to the Orange Walk and Corozal Districts, this category includes residents of the Yo Creek and San Lazaro Communities, inclusive of youth, women, farmers and community leaders such as teachers and heads of churches or other faith-based organizations. The geographic focus reflects the intended location of the related pilot cultivation activity and the testing to be done at the BELCOGEN facility. Residents within that area of North Stann Creek where there are existing stands of Arundo which is to be extracted and tested are also included here.

## 1.2. Institutional Context

The *A. donax* initiatives are consistent with the objectives of a number of national policies and plans and related international commitments. In addition to the macro and sector strategies and plans, these include the United Nations Framework Convention on Climate Change (UNFCCC), and the related Green Climate Fund (GCF) which finances initiatives aimed at achieving commitments under the Convention. The objectives and targets relevant to the initiatives under the local policies, strategies and plans and the various convention commitments are described in this section.

### A. National Policy Objectives

#### *Horizon 2030*

Efforts to realize Belize's biomass potential align with commitments incorporated in the framework for Belize's long-term development entitled Horizon 2030. This framework is built in part on seven thematic areas referred to as either pillars, binding constraints or the bricks and mortar for long-term development. The seven thematic areas numbered I through vii are organized within the Horizon 2030 report as outlined below, (GOB, n.d.a, p. xi), with bracketed phrases added for context.

1. [Under] Two Pillars for future Development
  - a. Governance for effective public administration and sustainable development
    - i. Democratic Governance as a foundation for development
    - ii. Crime, Citizen Security and Access to Justice
  - b. [In pursuit of] Education for development
    - iii. Education for Development-Education for life
2. [Addressing] One Binding Constraint – generating resources for future development
  - iv. Build a resilient economy
  - v. Focus on Key Productive Sector
3. [Building with] The bricks and the mortar-the core of long-term development
  - vi. Healthy Citizens throughout the Life Cycle
  - vii. Care for the Natural Environment

Most relevant to the *A. donax* Biomass initiative is the Horizon 2030 indication that increasing the use of appropriate green technologies and renewable energy as a critical aspect of the higher level goal of protecting Belize’s natural heritage and economic value of its natural resources (p. 85). Specific provisions of this long-term development guide include the following intended action under the strategy Promote Green Energy: “Create an energy office that will be responsible for promoting investment in and development of renewable energy in the areas of wind, solar, biomass, geothermal and hydroelectricity ( p.121 ).”

It is important to note that an initiative to supplement the current cogeneration arrangement and allow for an increase in the level of biomass-powered electricity to be provided to the national energy grid would respond to Horizon 2030 thematic areas iv and v, and ease the binding constraint on long-term development. This could happen in two ways. The first is that a higher mix of biomass energy using locally grown fuel in a cost-effective way could reduce demand on foreign exchange. Secondly, the increase in renewables would reduce the level of dependency on CFE, and the mix of hydro, biomass and lower levels of fossil fuel-generated energy would allow for greater flexibility and therefore resilience. Seen from these perspectives, the *A. donax* Biofuel initiative is a critical component of determining options for Belize's attaining its long-term development goals related to energy.

### *Growth and Sustainable Development Strategy*

The *A. donax* initiative also responds to the Growth and Sustainable Development Strategy 2010 to 2030 (GSDS), which contains even more specific plans and provisions for biomass fuel and co-generation. The GSDS is structured around goals [referred to as critical success factors (CSF)] and objectives termed necessary conditions (NC). There are four CSFs as listed below, and each is to be achieved through the realization of a cluster of NCs.

1. Optimal National Income and Investment
2. Enhanced social cohesion and resilience (enhanced equity)
3. Sustained or improved health of natural, environmental, historical, and cultural assets
4. Enhanced governance and citizen security

The *A. donax* biofuel project is expressly recognized within the GSDS as an important ongoing initiative, evident by its inclusion in several NCs (objectives) in planned activities under two of the four CSFs (goals). The activities cited fall mainly under CSF 1, which posits the successful piloting of the *A. donax* biomass as critical for (GOB, 2016, p.).

- Contributing to expanding opportunities for income and employment and in the process reducing levels of poverty and vulnerability;
- Allowing for greater diversity in terms of energy sources to include renewables beyond hydro-electricity and
- Helping reduce dependence on fossil fuel and imported energy.

These anticipated contributions to improving economic conditions is further underscored by reference to the project as one of the initiatives that can have a positive influence on citizen security under CSF 4. The several necessary conditions and related actions through which the initiatives are incorporated into the GSDS are set out immediately below.

Necessary Condition No.	Necessary Condition Text	Action No.	Action Text
1.2	Attracting Foreign Investments	3	Mount specific effort to attract investments
1.3.2	Optimal Economic Transition: Supporting New and Emerging Activity with Good Prospects	5	Use pilots, demonstrations and research as foundation tools
1.3.4	Promoting Inclusive Growth (Growth with Equity)	11	Identify and develop activities that can provide significant employment and earning opportunities to the poor and the vulnerable population.
1.5	Adequate Infrastructure (Roads, Ports, Energy, Water, Telecommunications, and Transport)	9	Promote and facilitate other potential opportunities for the generation of electricity from renewable sources
4.2	Amelioration of Social Issues that Fuel Crime	3	Identify sustainable gainful employment opportunities for at-risk youth

### ***National Climate Change Policy, Strategy and Action Plan***

Development of a successful *A. donax* biomass industry would lower the level of fossil fuel generated electricity in Belize and therefore reduce our carbon emissions, a key strategy in combating climate change. The Belize National Climate Change Policy, Strategy and Action Plan sets out the following Climate Policy Goal: “to guide the short, medium and long-term processes of adaptation and mitigation of Climate Change in accordance with national prospects for sustainable development in addition to regional and international commitments (CCCCC and MFFSD, 2014, p. 85).”

Of the eight (8) objectives under this goal, the *A. donax* biomass initiative aligns with objectives 2 and 4, reproduced below.-

Objective 2: “Build Climate Change resilience in order to prevent, reduce or adapt to the negative impacts of Climate Change on key sectors, economic activity, society and the environment through policies and strategic processes (p. 85).”

Objective 4: “Capitalize on opportunities currently available through Climate Change negotiation processes that can also enhance development prospects of the nation (p. 86).

### ***National Energy Policy Framework***

The Belize National Energy Policy Framework also provides context and rationale for renewable energy and an impetus for the *A. donax* initiative (GOB, 2012). Some highlights of the Policy Framework include the definition of primary and secondary energy, an indication of the types being used in Belize, and of the level of utilization and potential additional capacity of each energy source in Belize. The document outlines the costs and benefits of each option. It describes primary energy as consisting of fossil fuels and renewable energy, and secondary energy as including refined petroleum products, biofuels, and electricity (p. 8).

In exploring the rationale for an energy policy, the document describes energy resiliency- “the capacity of individual parts of the national energy sector or of the sector as a whole to bounce back quickly from or absorb shocks arising from energy price flaring (p. 14).” It further describes the manner in which Belize can benefit from having energy resilience.

“shifting our dependence from foreign fossil fuel to renewable energy sources result in greater environmental and social sustainability, but also reduce our vulnerability – and hence boost our resilience - to external price shocks (p. 15).

The Energy Policy Framework points to fuel resource diversity and process flexibility as two main components of resilience. Fuel resource diversity further incorporates having a variety of fuel types as well as different and dispersed locations for energy generation (pp. 15-17). Examples of fuel types indicated include wind, natural gas, diesel, hydro and biomass (p. 15). The document points to the fact that energy independence is not necessarily energy resilience, and demonstrates the benefits of optimizing energy imports with energy generation and exports (pp. 18-19).

In outlining energy options for Belize, the Policy Framework covers renewable and non-renewable energy sources. The renewable energy options for Belize that are explored include plant biomass, which is indicated as having positive net benefits. This is because the greenhouse gases emitted during the burning of plant biomass are part of a closed carbon loop balanced off by either (p. 50)-

- a. The natural uptake of carbon dioxide during plant growth or
- b. Being considered a part of the natural cycle of carbon dioxide sequestration and release.

The energy policy framework does point to environmental risks associated with biomass combustion and gasification—the production of high-pressure steam to drive turbines. These risks are mainly the potential use of large amounts of water or contribution to air pollution which can damage habitats or ecosystems (p. 50). The document recommends mitigating these risks through careful selection of the technology and conversion process to be employed in cases where biomass is to be used to produce secondary energy.

### ***National Food and Agriculture Policy 2002-2020***

The National Food and Agriculture Policy document includes commitments to supporting the identification and promotion of crops for use as fiber and energy (GOB, 2003, p.41). Additional policy context for the project preparation activities and the related but separate pilot *A. donax* cultivation was sought through the stakeholder consultation activities related to the analysis and preparation of this report and will be presented in the section on stakeholders' perspectives.

### *Forest and Biodiversity Policy*

While Belize's National Forest Policy 2015 makes reference to national energy policy and indicated the widespread use of wood for fuel, there is no specific provision for potential use of forest resource for biomass. On the other hand, the policy makes sound provision for research which by extension accommodates the use of existing stands of *A. donax* to facilitate the compatibility test.

## **B. Relevant International Commitments**

### *The United Nations Framework Convention on Climate Change*

Belize has been a signatory of the UNFCCC since June 13<sup>th</sup>, 1992 and has ratified the convention as of October 31<sup>st</sup>, 1994. Article 2 of the Convention describes its ultimate objective as “to achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” The article further states that this level is to be achieved in a timely enough manner to allow ecosystems to adapt naturally to climate change and ensure the security of food production and the ability for sustainable economic development.

At the Convention’s Conference of the Parties (COP) in 2015, countries negotiated the Paris Agreement, intended in part to “accelerate and intensify the actions and investments needed for a sustainable low carbon future (<https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement>).” The Paris Agreement encapsulates a set of commitments taken by the UNFCCC conference of the parties to enhance the implementation of the Convention and enable a stronger global response to the threat of climate change. Of relevance to the *A. donax* Biomass initiative is Article 2 of the Agreement, through which parties commit to strengthening the global response to climate change in part by-:

- 1) Maintaining the global average temperatures to less than 2 degrees Celsius above pre-industrial levels and pushing to reduce the temperature increase to 1.5 degrees Celsius above pre-industrial levels.
- 2) Increasing the ability to adapt to the negative impacts of climate change and to promote climate resilience and development that generates low levels of greenhouse gas emissions while not threatening food production.
- 3) Aligning financing flows in a manner that leads to low greenhouse gas emissions and promotes climate-resilient development.

Article 3 of the Paris Agreement calls for countries to make nationally determined contributions to the global response to climate change by, inter-alia, “undertake[ing] and communicat[ing] ambitious efforts as defined by Articles 4, 7, 9, 10, 11 and 12” of the same Convention. The referenced Article 4 sets agreements and guidelines for nationally determine contributions, Article 7 provides for global goals and responses, and Article 9 sets out a framework for financing flows. Articles 10 and 11 address technology transfer and capacity building, respectively. Article 12 calls for appropriate measures to be taken to enhance public education, awareness, participation and access to information.

Responding to the Paris Agreement Article 4 commitment by countries to articulate their nationally determined contributions to the effort to combat climate change, Belize tabled the document entitled *Belize. Nationally Determined Contribution Under the United Nations Framework Convention on Climate Change* (GOB, n.d.a.). The document indicates that the country’s Nationally Determined Contribution

(NDC) “is guided by its commitment to strategically transition to low carbon development while strengthening its resilience to the effects of climate change (Government of Belize, n.d.b, p.1). It points to provisions of national policies and strategies to identify the mitigation and adaptation components of Belize’s NDC. The most relevant policies and strategies indicated in this report will be described under the national context set out in this section.

### *The Green Climate Fund*

A key result of the Paris Agreement was the establishment of supporting financing mechanism. The Green Climate Fund is described at its portal as a global fund created “to support the efforts of developing countries to respond to the challenge of climate change (<https://www.greenclimate.fund/who-we-are/about-the-fund>).” The portal further indicates that the GCF supports countries efforts to reduce greenhouse gas (GHG) emissions and adapt to climate changes, in part by promoting a paradigm shift to low-emission, climate resilient development. It was initiated by 194 countries and seeks to take account of the needs of those nations that are most vulnerable to climate change. The GCF supports the Paris Agreement especially concerning capping the increase in the average global climate level at well below 2 degrees Celsius.

### **1.3. Climate Vulnerability and Change**

Richardson (2009) asserts that most of the evidence related to the effects of climate change on energy arise in terms of the likely changes in users’ consumption and demand (p.35). In addition to requirements for more cooling of residential and commercial buildings and amenities, climate change is expected to affect the supply side as the increase in demand would lead to higher use of fossil fuel for energy consumption for Caribbean many countries, Belize included. Belize is a net importer of petroleum and vulnerable to increases in world oil prices as these translate directly to the local economy. Petroleum makes up a significant portion of the national energy source; diesel and importation from CFE accounted respectively for 11.1% and 15.6% of Belize’s energy inputs in 2010 (GOB, 2012).

Belize is also extremely vulnerable as it lies in the hurricane path, faces the Caribbean sea, and is endowed with 240 miles of low-lying coastline marked by portions of dense urban populations. It is important to point out here that while this vulnerability also includes the risk to biomass indicated in Richardson (2009), the resistivity of the crop identified for project preparation and its endemic characteristics suggest that it is less impacted by extreme weather events and recovers more quickly than most other plants.

Of the stakeholders identified for this biomass initiative, climate change impacts indicated above would affect each group in specific ways. Some specific risks include-

- Increasing energy costs to all households and businesses due to higher demand over time as temperatures rise;
- Loss of energy generation capacity by BEL in the event of compromise of facilities such as hydroelectric dams;
- Farmers loss of livelihoods due to lower crop yields; in the case of sugarcane this might also compromise the biomass cogeneration capacity of BELCOGEN and therefore of BEL.
- Constraints on the country’s ability to realize development goals due to negative impacts on input prices and need for frequent short-term responses to shocks to populations’ well-being.

## 2. STAKEHOLDER ANALYSIS METHODOLOGY

In order to meet the requirements of the terms of reference a number of steps were taken to clarify the context for the analysis, identify and engage stakeholders to gain their perspectives and represent their position and recommendation, and design a plan for their continued engagement through the completion of the preparation initiatives and the development of scaled-up activities that may follow. The specific steps undertaken are described in more details immediately below.

1. Initial research and desktop review was undertaken to collect available data and information, and to identify regional and national policies, strategies and legislation in development areas relevant to the proposed initiative.
2. Stakeholders were identified at the institutional and community levels. Institutional stakeholders include the agencies in the energy and agriculture sectors, as well as those engaged in climate change mitigation and national development planning. Community-level stakeholders identified are mainly from the areas where much of the project preparation activities and the separate but related piloting of *A. donax* cultivation will be undertaken.
3. Stakeholders identified were consulted for insight into their perspectives on and level of interest in the *A. donax* biomass initiatives. This was facilitated with the instrument at Annex 2, designed to enable information gathering that would help to clarify
  - a. the respondents level of awareness about the project the relevant climate change, energy and agriculture issues,
  - b. the extent of their receptiveness to the initiative and objectives,
  - c. any experience and concerns that are to be addressed in the execution of the project preparation or up-scaled activities and in the related cultivation initiative, and
  - d. information that would help to shape a plan for their consistent engagement through the life of the related and follow-on initiatives.
4. Analysis of stakeholder perspectives to identify key issues, and assess their influence on and anticipated impact by the project, and to formulate stakeholder report card. The specific steps for this activity included-
  - a. Developing an initial compendium of issues raised by and perspectives of communities and groups toward project objective and activities, based on first round of discussions and desk-top research.
  - b. Community-level consultation through focus group discussions.
  - c. Assessing stakeholder positions, perspectives and rationale and proposing strategies to address issues and incorporate stakeholder recommendations.
5. Preparation of reports with analysis of stakeholder perspectives and assessed influence on and impact by proposed bio-mass initiative and recommended plan for their continued engagement through the completion of the preparation activities and any follow-up developments related to the use of *A. donax* as Bio-fuel.

There were two rounds of stakeholder consultations, with the first focused on institutional respondents and the second incorporating community groups and tailored to highlight social components. In addition to a high focus on gender, this round sought to identify the role of youth and the differently abled. Much of the lead in this regard was undertaken by the **Gender consultant**, and there was joint participation and facilitation of a number of community-level meetings in the Yo Creek and San Lazaro communities. Images of the sign in sheets for these meetings are at Annex 3.

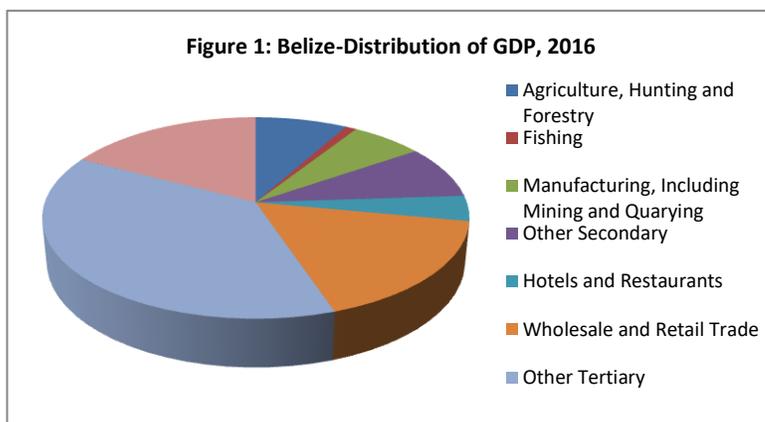
The community level consultations were structured in group discussions and were facilitated by a cluster of approximately thirty (30) questions aimed at understanding gender roles of communities in the immediate vicinity of BELCOGEN facility and the site for the related but separate test cultivation initiative. *The list of stakeholders consulted, along with indicators of respective organization, meeting dates and contact information can be found at Annex 4, and an indication of their grouping and levels of influence, impact and awareness can be found at Annex 5.* The issues, concerns, and recommendations drawn from the individual and focus group meetings are detailed in the Section 5 of this document.

### 3. COUNTRY AND COMMUNITY CONTEXT

#### 3.1. Description

Belize is classified as an upper middle income country and was ranked 103 among 188 countries in terms of its composite Human Development Index in 2016. The country has some crude oil exports but no refineries, and services makes up 60% or more of total exports (See Figure 1). As can be seen from Table 1 of Appendix 6, Belize is recovering from an economic downturn in 2016, and economic growth has been variable over the five year period starting in 2013.

Central Bank of Belize analysis (CBB, 2017, 2018) indicates that the 2016 decline in output and modest recovery in 2017 in part reflected continued contraction of petroleum output and reductions then recovery in agriculture production. International factors contributing to volatility in output during the last three years include depressed world prices for and phase-out of preferential arrangements for sugar, and continued downward trend



in world oil prices from the highest levels in 2008 which have impacted production decisions. Production in 2016 was also negatively impacted by Hurricane Earl, which directly affected Belize that year.

#### A. Select Socioeconomic Indicators by Geography, Sex, and Age

The planned extraction of the plant identified as *A. Donax* from the North Stann Creek District and the test burning and operation of the pilot cultivation sites in the Orange Walk district makes these the immediate impact areas in terms of geography. Furthermore, the dominance of sugar cane as the primary crop in the both the Corozal and Orange Walk districts, and the identification of known stands of a grass identified by cane-farmers as wild cane, as discussed in more detail below, lends to a consideration of the Corozal District as a primary geographic area of immediate impact also. Mid-year population estimates for each of these three districts and for the country of Belize can be seen in Table 1 of Annex 6. Notably, *the rural areas of these three districts account for just under half of the total rural population of Belize*, whereas their urban areas account for approximately one-fifth of the residents of all towns and cities.

In order to gauge the well-being of the communities to be directly impacted by the *A. donax* initiatives, and in the absence of recent poverty estimates, the Abstract of Statistics data labour force, employment, and housing tenure data for 2015 and 2016 were analyzed for indication of well-being (SIB, n.d.). As can be seen at Annex 6, this was done particularly for the Orange Walk, Corozal and Stann Creek Districts. The analyses of these select socioeconomic indicators for insight into levels of well-being of the Districts to be impacted are set out immediately below.

#### *Labour and employment by District and Sex*

Compared to the national labor force participation rates of 63.4% and 64.0% for 2015 and 2016 respectively, participation rates in the Orange Walk and Corozal Districts were lower for those years,

while that for the Stann Creek district was higher. Sex-disaggregated estimates show the highest differential to be between the female participation rates in the Stann Creek district, estimated at between 55.8% and 54.3%, significantly higher than the 48.9% and 50.0% female participation rate estimated at the national level for the years 2015 and 2016, respectively. It is notable that whilst the Orange Walk and Corozal District population of working age females were higher than those of the Stann Creek District, a greater proportion of the latter was actively seeking employment.

The differences in unemployment levels among these districts and compared to national levels is even more notable. Orange Walk and Corozal District unemployment levels were estimated at between 7.3% and 7.9% compared to national rates estimated at between 10.1% and 9.5%. On the other hand, the estimated unemployment rates for the Stann Creek District for these two years are in the much higher range of 14.0% to 15.0%. **The estimated rates of unemployment for the Northern districts were lower than the national average, whilst the Stann Creek District estimated rates were higher.** The differences are even more significant for females, with unemployment rates for that sex in the Stann Creek District estimated at 25.6% and 24.1% for 2015 and 2016 respectively compared to estimates of between 10.1% to 15.1% for the Orange Walk and Corozal Districts for those two years. This follows from the higher female participation rate in the Stann Creek District.

### Unemployment by Sex and Age

As seen in Table 1 below, overall estimates of unemployment by age shows the highest levels among females between the ages of 14 and 24 years, and overall average unemployment being highest among all youth. Unemployment is also high in the 25 to 34 age group, perhaps reflecting higher participation rates.

**Table 1: Unemployment rate for select age groups**

Age Brackets	2015			2016		
	Male	Female	Total	Male	Female	Total
<b>All Age Brackets</b>	<b>6.8</b>	<b>15.4</b>	<b>10.2</b>	<b>5.6</b>	<b>15.6</b>	<b>9.6</b>
14-24	14.0	33.3	<b>21.2</b>	14.0	33.2	<b>21.2</b>
25-34	5.9	14.4	<b>9.4</b>	4.1	14.5	<b>8.5</b>
35-44	3.4	9.0	<b>5.7</b>	2.5	10.5	<b>5.8</b>
45-54	4.0	4.7	<b>4.3</b>	1.9	6.3	<b>3.6</b>
55+	4.5	6.5	<b>5.1</b>	2.0	2.5	<b>2.1</b>

### B. Household by Tenure Type

Estimates of households by tenure type show more than 70.0% of homes in the Corozal and Orange Walk Districts and more than 50.0% of those in the Stann Creek District are held through outright ownership or a hire-purchase arrangement (Annex 6, Table 3). The percentage of homes owned or held by hire purchase within the Corozal and Stann Creek Districts increased from 2015 to 2016, whereas the percentage of this same type of ownership declined significantly in the Orange Walk District. It is important to note that with a Free Zone operating on the Corozal-Chetumal (Belize-Mexico) Border, the economy of that district is more diverse than that of the Orange Walk District. This means that

sugarcane cultivation is more dominant in Orange Walk, and it is possible that the effect of the decline in sugar prices is being reflected in the changes in tenure status as mortgage default rates increase.

### **3.2. Project impact**

The *A. donax* biomass project is likely to result in a new industry that offers a diversification in entrepreneurship and livelihoods options and in sources of energy. The proposal document for the GCF funded project preparation initiative indicates the following specific potential benefits to Belize in the event the *A. donax* project is successful (GCF, 2018, p.7).

1. The development of a new industry both at the community and company levels;
2. increased energy security;
3. Increased adaptive capacity to climate change;
4. Increasing the country's contribution to the reduction of GHG emissions;
5. Increased competitiveness through reduction in the cost of energy;
6. Improvement in the living standard of the country, as a whole, by providing new jobs.

## **4. STAKEHOLDER MATRIX**

The Stakeholder Matrix can be found at Annex 1, and identify actions to be taken with assignment of timelines and person or agency leading are found in the separate Stakeholder Management and Engagement Plan developed along with this report.

## **5. FINDINGS AND DISCUSSIONS**

### **5.2. Issues, Concerns, and Recommendations**

#### **A. Recent Development Relevant to the Northern Districts**

Stakeholders' responses generally indicated an understanding that the *A. donax* initiatives were conceptualized in response to policy priorities and socioeconomic context. The related projects—the GCF funded compatibility and assessment studies, and the BEL funded pilot cultivation—are thought of by most respondents as relating directly to the challenges faced by the sugar industry. In this regard, the following points were made respectively by at least two separate respondents.

- 1) The accompanying measures for sugar initiative had an objective of supporting farmers improve their practices to enable greater yields from the same lands under cultivation.
- 2) *A. donax* discussion first emerged among Caribbean countries as a response to the then-impending expiration of the EU preferential arrangements for sugar, and as an alternative for diversification of economic activity. Belize took the position that most Caribbean countries could not, and opted continue commercial production of sugar.

#### ***Sugar Prices and the Drive for Diversification***

Notwithstanding the decision to continue sugar production, stakeholders have been open to the idea of exploring the feasibility of using *A. donax* biomass. Based on views shared in almost all of the consultations, receptiveness within the communities consulted is influenced by the performance of sugar and the impact on payments for cane deliveries and bagasse. Some of the factors placing

downward pressure on sugar prices on the world market are that there are no quotas imposed on beet sugar supplies and that the long-standing system of preferential arrangements for cane sugar imports from African, Caribbean and Pacific countries into the European markets has now completely expired. Discussions with SIRDI highlighted the following response strategies being taken by the factory and by or on behalf of the farmers.

- 1) ASR/BSI is pursuing a strategy of increasing the level of production and export of direct consumption (DC) sugar. This is advantageous because the price for DC sugar is roughly twice that of raw sugar. The following are the current and projected levels of income based on these plans.

Type of Sugar	2018 Distribution (\$mn)	Income Projected Production Levels (tons)	Projected 2019 Income (\$mn)	2019 Levels
Raw Sugar	50	65,000	35	
Direct Consumption Sugar	15	50,000	50	
Totals	65		85	

- 2) An increase in the level of DC sugar would be beneficial to farmers as the ratio of the split between the processors and the farmers is 35:65.
- 3) Options are being sought for crop that is not linked to sugar cane and that will help cane farmers cash flow. SIRDI is helping in the drive to identify opportunities for diversification. In this regard, parties are receptive to the possibility of *A. donax* as a cash crop, and the pilot project is seen as critical.
- 4) SIRDI is planning a demonstration project cultivating several crops in different sections of a one-acre plot, to demonstrate the possibilities of using an inter-cropping system. Considerations for successful small-scale driven diversification are
  - i) the market needs to exist
  - ii) A critical mass can be achieved by spreading the sourcing across a wide number of farmers, for instance for 100 acres of cultivations, sources 100 farmers each with a 1-acre cultivation.
  - iii) The output should be brought to a central location for sale to the buyer (the market)
- 5) The distributed cultivation and centralized buying are being spearheaded by a company located in Southern Belize which has interest in sourcing crops such as coconuts and limes.
- 6) The company has been doing outreach to initiate this effort and have been giving out plants to farmers who are interested and ready to start. SIRDI has observed that most of those who have been stepping up to start already are women.

### The Fair Trade Program

The fair trade program was mentioned by participants in most of the discussions at the community level. The Fair Trade initiative is reported as being a program conditioned on the implementation of measures in the following four areas.

- 1) Institutional Strengthening
- 2) Investment in Improving Productivity

- 3) Social measures
- 4) Environmental measures.

Once beneficiaries are Fair Trade certified, they receive access to a quota for an amount of their sugar to be sold to the European market at a premium. The premium paid to each ton of the assigned quota delivered by the beneficiary is US\$60.00.

## **B. Stakeholder Perspectives**

The information set out in this subsection mainly represents the views of the stakeholders, with appropriate application of expert judgement aimed at clarifying the rationale for certain positions or expectations. These views were gained through the focus group discussions covered in the next segment, as well as the group and individual interviews, which are the basis for the remainder of the subsection.

### *Community Identified Issues and Recommendations*

Although the *A. donax* initiative was not conceptualized solely for implementation in the Northern Districts, the GCF funded compatibility testing as well as the related BEL funded pilot cultivation are both centered in the Orange Walks District. Given this design feature, the community level stakeholders consulted were members of the three cane farmers associations and residents of the Yo Creek and San Lazaro villages, which are the closest to the cultivation site. Residents were consulted in separate focus or discussion groups. Efforts were made to construct groups representing a particular demographic, such as cane farmers, women or community elders. Despite the effort to achieve homogeneity, there were marked differences in perspectives, experience and expectations even within groups or across the same types of groups. Some of the key experiences, expectations and recommendations are related in the following subsection.

### **Respondents' Related Experience and Expectations**

Community level consultations highlighted important experiences and expectations which have to be taken into account to ensure effective implementation of the initiatives and any follow-on activities, whether up-scaling or exiting. It is important to note that the perspectives and expectations shared are grounded in the following:

- 1) the long standing position of sugarcane as Belize's single most important commodity export;
- 2) the legislated exclusivity of access to the cane delivery quotas enjoyed by the cane farmers; and
- 3) the payment arrangements for both sugar and bagasse arrived at over several rounds of sometimes contentious negotiations between factory and farmers.

Some of the most salient points expressed or questions raised in the various group discussions are set out below, along with some added observations or analysis based on expert judgment.

- 1) Questions posed by the community members relayed an understanding of a potential *A. donax* industry in the framework of the current sugar industry structure, and an assumption that the players would be the same. This was evident the following set of questions posed in the several meetings-
  - a. What price will be paid by ASR/BSI for delivery of *A. donax*, and what would be the unit of measurement? It is notable that this question presumes the same delivery mechanism as is used for sugar cane.

- b. On what basis will quotas will be assigned?
  - c. What will be the structure be for the organization of the industry and the assignment of quotas?
  - d. *Will the farmers in the Northern districts be given preference for their engagement in an A. donax initiative?* This question was further explained as logical as the respondents' viewed such an approach as necessary to allow cane farmers to recover or regain their footing in light of the impact of the world market decline in sugar on their operations. The respondents expanded on the point by asserting that farmers should to be allowed to "recoup returns of resources that would be extracted".
  - e. Cane farmers expressed the view that building an *A. donax* industry in the North will be difficult because of trust issues between the farmers and the factory owners.
  - f. Related to the perception that trust between farmers and the factory is low, and expanding on the question of pricing, a repeated concern was whether payment for *A. donax* would be set at the same level as that for bagasse, which is US\$0.50 per ton of cane delivered. At each instance of this being expressed, respondents were reminded that *A. donax* is a separate plant, and not a by-product of sugarcane, as bagasse is.
- 2) Focus group participants and members of the cane farmers association indicate experience with a plant they know to as wild cane. They relay that in their preparation of land for cultivation of sugar cane farms, every effort is made to ensure the removal of the wild cane grass. At least one female and several male cane farms related the most effective method applied, which is to trace and remove the roots of the wild cane. At least one farmer indicated that the process is a multi-year one, with the wild cane roots being removed and burned each year.<sup>5</sup>
  - 3) Notwithstanding their experience with the grass they know as wild cane to be threatening to the survival of sugar cane, farmers are open to the idea of the cultivation and use of *A. donax* for biomass. This is driven by the desire to find additional sources of income and rests on the assumption that effective methods for its control will be applied. Participants in focus group discussions shared that the return from cane farming is now insufficient or barely enough to cover costs.
  - 4) Perhaps reflecting the openness to new opportunities, some focus group participants inquired whether and when *A. donax* "seeds" would be distributed for the start of cultivation. In addition to repeating the purpose of the focus group consultations and the fact that the plant does not propagate by seeds, the facilitators reminded the participants of the description of effort required to manage *A. donax*, and the fact that the initial activity is only a pilot phase intended to provide information on whether and how to move forward.<sup>6</sup>

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<sup>5</sup> Further literature review in this regard suggests some similarities between the grass described by the community members and cane farmers and *Arundo Saccharoides* or *Gynerium Sagittatum*, a plant that is native to Central America. It is indicated by Hicks, Goodwin, Bridgewater, Harris and Furley as being one of the dominant herbs in the Savannah Swamps in the San Pastor Savanna within Belize's Chiquibul Forest Reserve (2011).

<sup>6</sup> The question about the distribution of seeds was put forward in a community level focus group meeting where the information was very new to the participants. Although the word "seeds" is used, it could be replaced easily with seedlings or young trees. Communities are accustomed to receiving a "jump-start" in initiatives such as these, so the expectation coming to the meeting may have been that supplies would have been provided for community members to initiate activities, notwithstanding the intent imparted when the invitation was issued.

In addition to their experience and familiarity with the sugar cane cultivation and delivery and payment arrangements with the factory, this last question may have been influenced by recent developments in agriculture. The second round of discussions with SIRDI leadership revealed that meetings had been conducted a few weeks prior by representatives of the company at Maya Center to inform and mobilize farmers to cultivate several fruit and vegetable crops and to a central market on a regular basis. This is intended to provide a steady supply of the crops, which includes coconut, to the organization for processing and export. *A key activity of these sessions was the distribution of young trees free of cost, a measure intended to help start the crop. It was noted that women made up a significant part of the audiences, and were more likely to decide to become involved by the end of the sessions and to immediately accept young trees offered.* This information experience may be a factor in the expectations of focus group participants.

### **Farming Practices and Traditions**

One of the stated anticipated advantages of the proposed *A. donax* biomass project is the possibility for year-round generation of biomass electricity. Respondents consider this as an implication that cultivation and delivery activities would be possible for more than the traditional six (6) month period that is practiced with sugar cane. In this regard, respondents raise two issues.

- 1) The six-month cycle exists in part because of the weather patterns in the Northern region; the six month period of factory closure includes the rainy season.
- 2) The structure of crop maturing and being harvested and delivered six months of the year, and farmers able to step away from farming for the other 6 months of the year may prove a challenge in adopting year-round cultivation.

### **Financial and Economic Feasibility**

The question of pricing that resonated through all of the meetings points to the issue of financing and returns on investment. In addition to commercial banks, cane farmers rely on credit unions as one of their principal sources of financing their operations. Some key points related to the prospect of diversification into *A. donax* and the key finance related considerations from the standpoint of the St. Francis Xavier Credit Union leadership are outlined below.

- 1) *A. donax* as biomass represents an opportunity for cane farmers and the credit union would welcome farmers' involvement in any diversification initiative, subject to the results of feasibility studies and piloting.
- 2) Lands not being used currently for cane production (idle lands) can be converted for *A. donax* use.
- 3) A key factor in future financing would be arrangements between the *A. donax* buyer(s) and farmers. Currently, BELCOGEN provides collateral by allowing the cane farmers to assign their payments to the Credit Union.

Perspectives on financial and economic issues related that influence farming activities in the Northern districts were also gleaned from discussions with SIRDI. Regarding the availability of resources for investment, SIRDI indicates that the organization previously had access to BZ\$17 million to establish a revolving credit fund for cane farmers. This was thanks to an EU project started in 2012. Since then only approximately BZ\$10 million has been contracted out. Challenges to full up-take include the existence of competing funds.

### *Energy and Climate Policy and Climate Finance*

Stakeholders also consider the *A. donax* biomass projects as aligned with Belize's energy and climate policy objectives. Articulated observations of the link these objectives and the implications for future efforts at mobilizing climate finance are as set out below.

- 1) One respondent believes that since Belize's renewable energy production already amounts to approximately 40% of domestic energy use, using *A. donax* as biomass for cogeneration may not qualify as a climate mitigation measure to be covered from grant resources. In that circumstance funding for up-scaled operations may be available through loan facilities only.
- 2) If the activity is justified initially as a mitigation measure, then it would be carefully scrutinized to ensure there is no mal-adaptation. This is important since the scale of output required for financial feasibility in converting using *A. donax* biomass for electricity co-generation may require conversion of lands being used for crop production. This would be considered mal-adaptation from a climate policy perspective.
- 3) Given the classification of *A. donax* as invasive species in jurisdictions outside of Belize, options for funding of large-scale cultivation to facilitate production of biomass energy will be narrow.
- 4) Whilst the level of output of renewable energy may increase, it is important to note that the mix may change at a different rate since the level of domestic energy demand is also increasing.

### *Agriculture and Food Security*

Respondent from within the Ministry of Agriculture and practitioners of agricultural production view the *A. donax* initiative with support, moderated by some caution with respect to food security. From the perspective of the Ministry the main concerns relate to the following

- 4) The potential for the conversion of land currently under cultivation for food crop to be used for the production of *A. donax*. In this regard the Ministry has indicated that it could not be supportive of an industry that would see large-scale land conversion as it would undermine food security.
- 5) The perceived need to understand and guard against potential negative impacts of having *A. donax* cultivation in close proximity with sugar cane crop, with specific questions and assertions being-
  - a. Whether there is a possibility that pests that are harmful to sugarcane and being effectively controlled will find safe haven among the *A. donax* plants, thereby undermining control measures.
  - b. Whether there is a possibility of cross-pollination. On this specific point, the Ministry leadership asserted that would not want to support an initiative that would bring harm to the industry, and committed to having the matter of potential risk further researched by the Belize Agricultural Health Authority plant risk specialist.

### *Resource and Risk Management*

Resource management considerations and recommendations came out of the various group meetings and focus group discussions, as well as meetings with Ministry of Agriculture staff. The most critical resource use issues that arose relate to land and to potential ecological impact of *A. donax*, as described below.

## Land Use

The question of land use and conversion is one of the central considerations raised by stakeholders when discussing the *A. donax* initiatives. Some of the most important points raised by respondents are described in the numbered bullets below.

- 1) There is a strong level of support for the *A. donax* initiative at the community level, even as there are expressions of caution based on first-hand experience working with the crop. Feedback from focus group discussions with community members consulted within the Orange Walk and Corozal district underscore a frustration with the current state of the sugar market that is driving a need to consider alternative livelihoods. This, in turn, lends to openness toward considering options for economic activity would use some of the same resources held. *In this regard, there is a readiness on the part of many of the members, voiced explicitly in the focus group discussions, to convert lands from cane farming to A. donax cultivation.* It is to be noted that the preference the Ministry of Agriculture and intent of proponents to utilize only marginal lands for *A. Donx* cultivation was communicated at all meetings and in response whenever such views were expressed. The consultants further indicated that in the event the pilot activity leads to upscaling, the intent to use only marginal lands would likely be built into policy and guidelines to protect food crop.
- 2) Interest in the location and tenure status of the plot to be used for the related pilot cultivation project was raised across several focus group meetings. This was not surprising given the high demand for and scarcity of large tracts of available land across Belize. The perspective shared in at least one interaction with a community leader is that the residents took a decision to forego the lands surveyed and demarcated for this activity. The member expressed the fear that should the activity not be undertaken, the land would be transferred to someone who would have more means than most of the Yo Creek and San Lazaro community members, and who would use it for speculative purposes. ***This exchange signals the need for urgency in securing freehold title to this leased land, and to initiate on-site activities to establish clear ownership.***
- 3) The project proposal documents make reference to limiting *A. donax* cultivation to marginal lands only. SIRD1 and cane farmers participating in the several discussions shared their criteria for marginal lands, which collectively are-
  - a. Too acidic
  - b. Too alkaline
  - c. Pine ridge lands not adequate for
  - d. Low, waterlogged land

It is important to note the following two additional points raised by respondents with respect to the use of marginal lands.

- 1) Cane farmers assert that the terrain for such lands is often very difficult, so that manual harvesting would translate to high labor cost, and a mechanized method may be the only option for reaping *A. donax*.
- 2) Ministry of agriculture respondents point out that much of the cane farming in the North is already being done on marginal lands, and that this has translated to low yields. This point has implications for expected *A. donax* yields and for the question of land conversion.

## Environmental and Ecosystem Health

Stakeholders managing project activities are acutely aware of the need for careful management of the *A. donax* crop to avoid unintentional propagation. This is reflected in risk management measures such as use of sealed containers and examination and cleaning of at before leaving site where plants are to be harvested for preparation and conveyance to the BELCOGEN plant for test burning. Other specific issues and recommendations related to risk management are set out below.

- 1) Respondents from the Ministry of Agriculture, the Forest Department, SIRDI, cane farmers association and the community focus group meetings have all flagged a need for a clear exit strategy, should the *A. donax* cultivation not prove viable. Based on the various questions and recommendations in these discussions, the strategy should clearly outline the measure to be taken to remove any *A. donax* completely.
- 2) The question of the impact *A. donax* could have on watersheds was raised in several of the stakeholder meetings. Respondents generally shared the view that although the plant is hardy, the fact that it tends to propagate in riparian and low-lying areas may be an indicator that its water consumption may be high.
- 3) The question of the potential impact of *A. donax* cultivation on water resources is highlighted by Ministry of Agriculture stakeholders indicating that an initiative is currently underway to map information to accommodate the design of a surface irrigation (gravity) system (proponents and implementation status to be verified). Perhaps related to this, separate reference was also made to a master drainage plan being designed for the Corozal and Orange Walk Districts.
- 4) Community-level stakeholders also demonstrated an understanding of climate-related issues and anticipation that the involvement of the 5Cs in the implementation of the *A. donax* projects meant that appropriate measures would be taken to protect environment and ecosystem health. This perspective was strongest amongst the cane farmers associations and evident points or assertions of the following-
  - a. The 5Cs would not favor or use a harvesting technique that would involve burning as this would result in emissions, and therefore be contrary to the mission of the organization.
  - b. More experienced cane farmers with first-hand knowledge of *A. donax* raised the question of measures to be taken to ensure the protection of sugarcane crop, as they have experienced that the root system threatens the survival of the sugar-cane. In this regard, stakeholders were very receptive to the plan for the construction of a buffer zone that would completely enclose the *A. donax* cultivation site.

## Gender and Resource Control

Assigned gender roles within the communities of the North are transitioning, yet control of resources continue to reflect the traditional arrangements. Older members of the community relate a higher tendency to have women as home-makers, and the primary caregivers to couple's children while men work outside the home. For the younger families, this demarcation in roles is not as marked, and there is a higher proportion of families with females working outside the homes. Some respondents suggest that the changing role of women is a contributor to an observed increase in the number of unsupervised children and that these, in turn, are now more prone to misbehavior and delinquency.

Drawing from the stakeholder responses, the following are key aspects of the gender roles and relationships that have bearing on the economic life of the communities.

- 1) There are virtually no women on the board of the cane farmers associations. Some respondents shared the view that board members often needing to be at the factory to oversee deliveries in the interest of farmers until midnight or beyond during the grinding season may be a key deterrent to women wanting to serve. Another point made was that the result of the election of officers is often influenced by prior activities where members organize and lead smaller initiatives. This is observed as something that is rarely done by women, putting them at a disadvantage by election time.
- 2) The data on registered cane farmers drawn from the Sugar Industry Management Information System (SIMIS) show female cane farmers make up 40% of the total number registered. While there is a significant level, discussions with focus groups and the associations suggest that a considerable proportion of that group rely on male relatives—husbands, brothers, and fathers—to cultivate, reap and deliver their share of crop and to conduct transactions such as receiving fertilizers in their name. A smaller proportion of women cane farmers actively manage their farms and hire males to perform the on-farm physical labor. The focus group discussions further suggest that the percentage of women actively engaged in the full range of activities related to their farms is small.
- 3) Where women are actively engaged in managing or working their own farms, they are recognized as being highly effective, mainly because they are disciplined about following good agricultural practices and are seen as good financial managers.
- 4) Women are heavily involved in managing the finances of the cane farming businesses and are observed as being the main ones who do banking for the families' farming business. Many respondents indicate women typically make up the majority of those queuing at the banks' automatic teller machines.

### *Youth and Aging*

There are no persons under 25 years of age on any the boards of any of the three cane farmers' associations, nor on the village councils in the Yo Creek and San Lazaro communities. SIMIS data shows less than 5% of cane farmers under the age of 25, and those between 25 and 30 years of age account for less than an additional 3% of the total. Cane farmers aged 50 years and more make up 62.5% of the total number of registered farmers, indicating an aging industry and no clear succession.

Perspectives on the role of youth and contributors to their low involvement in cane farming and community level leadership are set out below.

- 1) Cane farmers ensure they can educate their children and encourage them to move away from the industry because they view it to be too arduous.
- 2) Another contributing factor was a rule/policy of the sugar board that prevented registration of new members cane farmer as long as there was enough production to be distributed among already registered farmers. The Association successfully challenged this ruling, so that now anyone can be registered as a long as he or she can produce and deliver cane.
- 3) Young people prefer to be office workers rather than farmers
- 4) There is not enough technology used in the farming industry to attract young people.

- 5) Young people are not willing to take on the level of responsibilities needed to effectively serve as community leaders, and therefore rarely run for village council positions. Of the two village councils, only in the San Lazaro community is their recollection of a village council chairman younger than 25 years of age.
- 6) Some respondents cited the Fair Trade related program as a contributor to the changes in the level of youth engagement in the industry. Whereas it had been traditional to have children accompany parents to the cane fields, particularly on the weekends, measures to eliminate child labour practices incorporated in the fair trade program militates against this.

### ***Project Design and Implementation***

#### **Implementation process**

- 1) At least three (3) respondents in the Agriculture and Energy fields have questioned why *A. donax* is the proposed biomass crop, and whether the cultivation should not be done in the areas where it has been documented as growing currently. This signals an assumption that the plant is “endemic” to those areas and not the North. Based on the information offered by older cane farmers regarding their experience with a plant known in that region as wild cane, however, there can be some confusion on whether *A. donax* exists only in the Southern Belize and North Stann Creek districts, and what plant was in fact displaced by sugar cane in the Northern districts.
- 2) With respect to the delivery of dried and shredded *A. donax* to the BELCOGEN plant for compatibility testing, the following may affect the rate of program implementation.
  - a. The requirement to bundle the extraction, drying, and transportation to the plant in one single package is making it difficult to find single providers that can deliver on all of those segments.
  - b. The warehousing capacity needed for the much larger quantity required now for testing compatibility (150 tons compared to the 10 tons delivered previously) is not readily available, and efforts to procure the space are also tied to procurement rules that slow the process since there are a limited number of suppliers available.

#### **Opportunities for Research and Development Collaboration**

- 1) Stakeholders signaled a high level of confidence in the 5Cs capacity to manage the pilot processes coupled with an awareness of the scale of activities required vis-à-vis the Centre’s core capacity. In this regard, the following questions were raised and suggestions tabled in various meetings.
  - a) Some cane farmers asked what approach the Centre would take for the planting and harvesting of the *A. donax* in the cultivation site. In this regard underlined the challenge of a small labour pool and related their challenges in finding workers during the peak of the cane harvesting season.
  - b) SIRDI indicated interest in testing cultivation in different soil types. The respondents inquired into whether cultivation tests would be done in southern Belize, and suggested that different climates, particularly rainfall, would produce different yield results.
  - c) Based on existing maps of cultivation areas and previous survey of soil types, SIRDI staff suggests that it may be possible to identify approximately thirty-thousand acres of surplus and marginal land.

- d) Both SIRDI and the Ministry of Agriculture are interested in supporting the monitoring of the crop management and agronomy on the testing site.
- e) SIRDI staff further emphasized that, aside from preparation of the site, management at the field level would be required. The organization would be able to identify potential candidates for planting, management, and data collection.
- f) SIRDI would be interested in reviewing project documents to identify areas for possible cooperation.

## C. Consultant Identified Issues and Recommendations

### *Potential Conflict Points and Recommended Actions for Diffusion*

#### **Land Tenure and Land Use**

##### *Issue 1: Status of A. donax cultivation site*

The clear indication of concerns around the status of the land to be used for cultivation suggests the risk of conflict over its tenure if that is not secured timely. It is important to note here too that even where the land may be settled with the acquisition of freehold title, there can be issues such as encroachment.

##### *Recommended Strategy: Issue 1*

Take immediate steps to complete the securing of tenure on the surveyed property and to initiate preparation for cultivations, and for constant vigilance through regular site visits. Future measures may include signage and established boundaries, in addition to the buffer road.

##### *Issue 2: Land Use Conversion*

There is also a potential for conflict in terms of the land use practices that can evolve with the project. Whilst project proponents and the Ministry of Agriculture are projecting land use measures that would mitigate against conversion of land under production or suitable for food crop, community residents and landowners are eager to convert what they view as idle lands in an effort to gain early financial returns. This may lead to efforts by community members to convert non-marginal lands to *A. donax* use.

##### *Recommended Strategy: Issue 2*

Share indicated guidelines based on North Carolina and Caribbean Community Climate Change Centre Environment and Risk Management Plan to signal the required scale of activities and diffuse land speculation and mal-adaptation; Collaborate with a technical team led by the Ministry of Agriculture and involving key stakeholders such as the Forest and Lands Departments and energy producers, to develop protocols for Belize in the event that activities are to be up-scaled.

#### **Industry Structure**

##### *Issue 3: Potential Players and Roles*

The location of the compatibility test component of the GCF funded initiative and of the pilot cultivation project funded by BEL makes the Orange Walk District communities the most immediate stakeholders at that level. The discussions in those communities highlighted a potential conflict over the role of ASR/BSI and BELCOGEN in a potential *A. donax* biomass industry, and the influence the traditional relationship between factory and farmers in the sugar industry can have on farmers' receptiveness to new players in the industry. **In particular, community residents view themselves as being in a somewhat adversarial relationship and being at a disadvantage vis-à-vis processors.**

### *Recommended Resolution Strategy-Issue 3*

An effective response strategy here would be to conduct regular meetings with community residents and provide honest and open feedback, and a clear explanation of plans and activities as implementation progresses.

### *Issue 4: Industry Focal Point*

The focus of the project activities in the Orange Walk District and the early consultation with stakeholders there, coupled with the history and structure of the cane sugar industry appeared to contribute to some respondents assuming that participation in a potential *A. donax* biomass industry would or should be open to cane farmers only.

### *Recommended Strategy: Issue 4*

Early and repeated efforts should be made to communicate that a potential *A. donax* biomass industry is intended to be a countrywide opportunity. The Ministries of Energy and Agriculture should be actively engaged in monitoring any effort to establish monopolies through policy or legislation. Furthermore, representatives of non-cane farmers' associations should be included in a project monitoring group as soon as possible.

## **Information Asymmetry**

### *Issue 5: Energy Production and Sale*

Most stakeholders were unclear about how Belize could and would go about exporting energy, as indicated in national and energy sector plans. On the other hand, BEL has negotiated an updated buy-sell agreement with CFE which makes provisions for Belize to sell excess energy to Mexico. Awareness of this development did not appear to be widespread among respondents.

### *Recommended Strategy: Issue 5*

A communication activity needs to be built into the *A. donax* process that would entail accessing regular updates from stakeholders on elements of their operations that have bearing on the *A. donax* projects and collating these into content to be shared with all parties.

### *Issue 6: A. donax Habitat and Cultivation Siting*

With the research showing most of the existing stands of *A. donax* in the Southern districts, there is an assumption that this is its "natural" habitat in Belize and several respondents indicated that it may have been best to undertake the cultivation activities there instead of in the Orange Walk District. An additional consideration is that respondents within the Orange Walk and Corozal communities pointed to their experience with what is known to them as wild cane, and shared their knowledge of areas where there are existing stands of this grass.

### *Recommended Strategy: Issue 6*

Since the literature suggests that *Arundo saccharoides* or *Gynerium sagittatum* may be the endemic species and suited to soil types in the Orange Walk and Corozal Districts, it would be useful to conduct ground-truthing in these districts to confirm the species that is prevalent there, and to map stands of *A. donax* and similar grass that may be found. This can help to clear uncertainty regarding the type of

## 6. CONCLUSIONS AND RECOMMENDATIONS

The stakeholder consultations and document review show a general acceptance of the *A. donax* initiatives by all stakeholders, muted by concerns about potential ecological impacts. This muted concern is outweighed by the range of potential benefits that stakeholders identify. Foremost of these is the potential improvement in income from diversification into what is viewed as a cash crop, and the hope for reduced prices for and reliable supply of energy.

Viewed in terms of gender and age, the data shows high levels of unemployment among youth, with the highest levels among females between the ages of 14 and 24 years. This suggests that implementation of an upscale activity and any industry that may develop should include measures to actively engage youth. Findings such as the lack of youth engagement in sugarcane farming reinforce this need, as well as highlight the need to incorporate incentives that would lead to retention of that segment of the population, once they are initially engaged. The disaggregated socioeconomic indicators also points to the need for a strategy to facilitate the early inclusion of the Stann Creek District in a new industry if feasibility assessment and piloting proves successful. This strategy should take account of the fact that transport costs from the Stann Creek District to Orange Walk District makes transferring Arundo to the Tower Hill factory between these two points financially unfeasible.

Notwithstanding the overall level of support, implementation of the initiative can be impacted by conflict or issues that can arise from the omission of key stakeholders or misconceptions regarding the roles or arising from historical relationships. These potential conflicts and misconceptions include a tendency to conflate the type of biomass as it is known locally—Wild Cane—and the location of the project activities to mean that the project is intended for the Northern Districts only. Furthermore, the experience and history of the sugarcane industry lends to assumptions about the structure of the potential biomass industry and the role of collaborators. The inclusion of stakeholders engaged in farming beyond sugarcane and the implementation of regular communication that extends to the community level will be critical in ensuring the appropriate perspective, participation, and support.

Finally, the level of engagement of key stakeholders should be improved. This includes expanding the representation or participation of the Ministry of Agriculture, at least by including the Yo Creek agriculture station in the activities, and by ensuring the government agencies responsible for climate and energy are regularly updated and included in oversight activities.

## BIBLIOGRAPHY

- Caribbean Community Climate Change Centre. (2016a). *Potential Study on producible Biogas and Renewable Energy Biomass and Organic Waste in Belize*.
- Caribbean Community Climate Change Centre. (2016b). *Environment and Risk Management Plan for Piloting the Cultivation of Arundo donax in Northern Belize*.
- Caribbean Community Climate Change Centre and the Ministry of Energy, Public Service, Science & Technology and Public Utilities (MESTPU). (2017). *Project Proposal. Project for the Production of Arundo donax as a Renewable Biomass Fuel for Belize*.
- Caribbean Community Climate Change Centre and the Ministry of Forestry, Fisheries, and Sustainable Development. (2014). *A National Climate Change Policy Strategy and Action Plan to Address Climate Change in Belize*.
- Central Bank of Belize. (2018). *2017 Annual Report & Statement of Accounts*.
- Central Bank of Belize. (2017). *2016 Annual Report & Statement of Accounts*.
- Central Bank of Belize. (2016). *2015 Annual Report & Statement of Accounts*.
- Central Bank of Belize. (2015). *2014 Annual Report & Statement of Accounts*.
- Daniels, E.A. (2016). *The Suitability of wild cane (Arundo donax) as a potential supplement to bagasse for electricity generation in Belize*. Center for Resource Management and Environmental Studies (CERMES), Barbados.
- Gischler, C., Rodrigues, E., Rojas Sanchez, L., Gonzalez Torres, C., Servetti, G., Olson, L. (2014). *The Energy Sector in Belize*. Inter-American Development Bank
- Government of Belize. (2016). *Belize 2016 – 2019. Growth and Sustainable Development Strategy*. Ministry of Economic Development.
- Government of Belize. (2012). *National Energy Policy Framework. Energy by the People, for the People. Towards Energy Efficiency, Sustainability and Resilience for Belize in the 21st Century*. Tillett, A., Locke, J., Mencias, J.
- Government of Belize. (2013). *National Climate Resilient Investment Plan*.
- Government of Belize. (2003). *The National Food & Agriculture Policy 2002-2020*.
- Government of Belize. (n.d.a). *Horizon 2030. National Development Framework for Belize. 2010 – 2030*.
- Government of Belize. (n.d.b). *Belize. Nationally Determined Contribution Under the United Nations Framework Convention on Climate Change*. Belize National Climate Change Office.
- Green Climate Fund. (2018). *Approved Project Preparation Funding Application. Arundo donax Renewable Bio-mass Fuel for Belize-Feasibility Study and Funding Proposal Preparation*.
- Hicks, J., Goodwin, Z.A., Bridgewater, S.G.M., Harris, D.J., Furley, P.A. (2011). *A Floristic Description of the San Pastor Savanna, Belize, Central America*. Edinburgh Journal of Botany, 68, 273-296.
- Richardson, R. B., PhD., (2009). *Belize and Climate Change. The Cost of Inaction*. Ed. UNDP. Michigan State University.

Statistical Institute of Belize. (n.d.) *Abstract of Statistics 2016*.

*The United Nations Framework Convention on Climate Change*. Downloaded from  
<https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

United Nations. (2015). *Paris Agreement*.

## ANNEX 1: STAKEHOLDER MATRIX

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
Belize Electricity Limited	Produces and purchases electricity and distributes to users through the national grid; funders of related pilot cultivation activity.	Receiving data and information on co-generation testing; Assessing the feasibility and acceptability of Arundo <i>donax</i> mix of biomass generated energy within the national grid; financing the related pilot cultivation initiative.	Ceasing collaboration on project preparation activities; Withdrawing financial support for related pilot cultivation initiative	L	H	Interested in exploring all options.	Include in Quarterly Project Oversight Meeting
Energy Unit, Ministry of Public Service	Energy Policy, Government Focal Point for MOU with 5Cs	Maintaining oversight of the Arundo <i>donax</i> project with a view to ensuring consistency with national energy policy	Withdraw support at the policy level	S	M	Level of engagement affected by the distribution of the portfolios of the former ministry of Energy among three (3) separate ministries	Include in Quarterly project oversight Meeting/Update
Climate Change Unit	Climate Change Policy;	Maintaining oversight of the Arundo <i>donax</i> project with a view to ensuring consistency with national climate change policy	Can withdraw support at the policy level	S	M	Interested in project's alignment with Belize's objective of implementing adaptation and mitigation measures.	Include in Quarterly Project Oversight Meeting/Update

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
BELCOGEN	Provides electricity to national grid under co-generation agreement with BEL	Test burning of Arundo <i>donax</i> in existing facility and at varying conditions; recording and reporting of results, including measures of calorific values and levels and types of emissions.	Can cease collaborating on compatibility testing	L	H	Committed to compatibility testing; determined that in the event AD is feasible for biomass, will not utilize more than a 10% mix with bagasse for co-generation.	Include in Monthly Meeting for Status Update and exchange of Information
ASR/BSI	Owners of BELCOGEN, Primary producers of sugar bi-product bagasse, used in current co-generation operation	Facilitation and oversight of the co-generation testing activities at BELCOGEN	Can direct BELCOGEN to cease collaborating on compatibility testing	L	H	Interested in exploring AD as supplementary biomass to enable year round generation	Include in Monthly Status Meeting for exchange of Information
Sugar Industry Research and Development Institute	Scientists that can support the feasibility study by helping to identify risks and ecological impacts and determine best	Supporting research and outreach; monitoring ecological impacts; collaborating on implementation of on-site activities of related pilot cultivation; collecting and recording data on yields.	Providing adverse information on ecological impacts	S	H	Interested in participating in the research activities to determine the ecological impacts of cultivation of Arundo <i>donax</i> , and in refining best practices for its management.	Include in Technical Committee, meet on regular basis or at least bi-monthly

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
	practices if cultivation is feasible.						
Ministry of Economic Development	Responsible for ensuring that any new activity aligns with national development plans	Maintaining oversight of the <i>Arundo donax</i> project with a view to ensuring consistency with national development policy; supporting or facilitating relevant negotiations with international governments or multilateral institutions, if and as needed.	Withdrawing support for project preparation activities and for related cultivation	S	M	Interested in ensuring consistency with national development plans	Include in Quarterly Project Oversight Meeting
Ministry of Agriculture, CEO	Responsible for ensuring that any new activity aligns with national agriculture policies.	Maintaining oversight of the <i>Arundo donax</i> project with a view to ensuring consistency with national agriculture policy and sound agricultural practices.	Mounting opposition to project activities; opposing related pilot cultivation; lobbying against the initiative at the policy level.	N	H	Concerned with potential risks to existing stock of sugarcane farms, potential water demand from crop, and potential conversion of land currently being used for agricultural production	Include Agriculture Department in quarterly updates.

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
Ministry of Agriculture, CAO	Responsible for working with general public to facilitate agricultural activities ensuring that any new activity aligns with national agriculture policies.	Oversight of local level outreach and research around the related pilot cultivation of <i>Arundo donax</i> and monitoring of ecological impacts.	Non-support for research and outreach; identifying or reporting adverse ecological impacts.	N	H	Concerned with the ecological impact of <i>Arundo donax</i> cultivation and the potential economic benefit to farmers	Include in quarterly updates.
Yo Creek Agricultural Station	Government agencies responsible for outreach and extension services to farmers at local level.	Supporting local level outreach and research around the related pilot cultivation of <i>Arundo donax</i> ; Lending oversight of on-site cultivation of <i>Arundo donax</i> once initiated. Monitoring of ecological impacts.	Non-support for research and outreach; identifying or reporting adverse ecological impacts.	S	M	Concerned with the ecological impact of <i>Arundo donax</i> cultivation and the potential economic benefit to farmers	Include in Local Technical Committee, meet on regular basis or at least bi-monthly in Orange Walk or Corozal; Include in monthly email updates.
Department of the Environment	Government agencies responsible for ensuring	Issuing environmental clearances as required by law	Not issuing environmental clearance; issuing stop	N	H	Concerned with ensuring minimal environmental damage	Report as required per Environmental Clearance

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
	environmental regulations are adhered to in project execution and that socioeconomic activities align are consistent with sound environmental practices.		order				conditions
Forest Department	Responsible for ensuring forest and biodiversity activities are consistent with national forest and biodiversity policies	Issuing permits as required by law	Not issuing research permits	S	H	Concerned with understanding the ecological impacts of <i>Arundo donax</i> cultivation and concurrent preservation of Belize biodiversity	Include in Quarterly Project Oversight Meeting
Non Cane Farming Community	New opportunities for income generation	No established link	Lobbying at the political level	U	M	Can help to establish broad based support	Include key representative in a monitoring team; include

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
							representative group(s) in information dissemination via email updates; Include in broad based consultations as needed
Landowners	Potential providers of land for cultivation	Collaborating with Policymakers and Co-generation operators to provide	Opting to not utilize land in alignment with policy and regulatory guidelines; withholding marginal lands or insisting on conversion of lands being used for food crop.	U	H	At risk of converting non-marginal or agricultural land to AD production	Develop Appropriate Outreach Material at critical points and set intervals; ensure outreach is done at the local level, using Village Councils and community leaders.

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
Families	Indirect beneficiaries that would be positively impacted by a viable and vibrant biomass industry	Using and purchasing energy provided through national grid.	Opposing biomass	U	L	May be interested in participating as producers in new and viable economic activities	Communicate through local leaders, such as village chairmen or community leaders
Sugar Cane Farmers Associations (Belize, Progressive, Corozal)	Primary stakeholders in sugarcane cultivation and beneficiaries of sugar production activities.	Being open to cultivating <i>Arundo donax</i> along the guidelines to be determined, in the event that the project preparation and related pilot cultivation activities demonstrate feasibility and that there are institutional investors interested in purchasing <i>Arundo donax</i> for conversion to biomass.	Mounting sustained opposition to project preparation activities and to related pilot cultivation at the political level; Premature lobbying for exclusive access or first rights to anticipated biomass and co-generation	S	H	Interested in participating as producers in new and viable economic activities	Include in quarterly email updates.

Stakeholder Name or Group	What is important to the stakeholder?	Stakeholder's actual or potential link to the project?	How could the stakeholder block the project?	Stakeholder is unaware, resistant, neutral, supportive or leading.*	Level of influence (Low, Medium, High)	Issues, Opportunities and Risks	Strategy for engaging the stakeholder
			industry; Premature attempts to negotiate terms, such as pricing and delivery mechanism.				

## ANNEX 2: STAKEHOLDER CONSULTATION GUIDE

### A. Respondent Profile

Name of Individual or Group: \_\_\_\_\_

Community of Residence: \_\_\_\_\_

Group: \_\_\_\_\_ Age Group: 14 – 26: \_\_\_\_\_

Individual: \_\_\_\_\_ Over 70: \_\_\_\_\_

M / F: \_\_\_\_\_ Other \_\_\_\_\_

Current Occupation: \_\_\_\_\_

Respondent Stakeholder Group:

Government Farmer Land Co-Gen Elderly Youth Child Differently Female Community  
Official Owner Purchaser Ableled Leader

### B. Respondent Perspective

1. What do you know about electricity co-generation activities in Belize?
2. What types of co-generation methods/sources are you aware of?
3. What are your views about electricity co-generation?
  - a. Do you see benefits to co-generation?
  - b. Are there downsides to co-generation?
4. What is your opinion of the use of bagasse for co-generation at the BSI factory?
5. Are you familiar with wild cane?
6. Do you know of wild cane growing already in Belize?
7. What do you think of using wild cane as a source of bio-fuel?
8. Do you think wild cane can be cultivated?
9. Would you have specific concerns regarding the cultivation of wild cane, and its use for biofuel?
10. Do you see particular benefits
  - a. To the cultivation of wild cane?
  - b. To its use as bio-fuel?

### C. Respondent Role and Main Issues

11. What is Respondent(s) Direct Connection to proposed Arundo Donax L.

12. For policy-makers and government officials, what are key planning mechanisms your ministry or agency is involved in that involve stakeholders in the geographic or industrial areas of focus (such as Orange Walk and Corozal Farming Communities, Energy and Agriculture Sectors.

13. What would be your recommendation for maximizing on the benefits of

a. Cultivating wild cane for biofuel use?

b. Using wild cane as a supplement to bagasse for the generation of electricity?

14. Issues indicated

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# ANNEX 3: FOCUS GROUP PARTICIPANTS' SIGN IN SHEETS

FOCUS GROUP SESSION ON

PROPOSED ARUNDO DONAX RENEWABLE BIO-MASS FUEL INVESTMENT INITIATIVE FOR BELIZE

COMMUNITY: Yo Creek

DATE: 27/8/18

TARGET GROUP: Village Leaders

NAME	SEX	AGE GROUP (PLEASE PUT A ✓)			OCCUPATION	PHONE NUMBER OR EMAIL
		14-24	25-55	55+		
Damian Cal	M		✓		Teacher Yo Creek <sup>primary</sup> <del>secondary</del>	665-7707
Virgilia Gonzora	F			✓	House wife / waterboard	661-6603
Abel Sosa	M		✓		Chairman	662-8085
Alejandra Cocóm	F		✓		House wife (helper councilor)	627-8957
Adalila Pech	F		✓		<del>House</del> Village Councilor	665-8324
Isidoro Castillo	M			✓		

**FOCUS GROUP SESSION ON**

**PROPOSED ARUNDO DONAX RENEWABLE BIO-MASS FUEL INVESTMENT INITIATIVE FOR BELIZE**

COMMUNITY: 10 Creek

DATE: August 29, 2018

TARGET GROUP: Cane Farmers

NAME	SEX	AGE GROUP (PLEASE PUT A ✓)			OCCUPATION	PHONE NUMBER OR EMAIL
		14-24	25-55	55+		
<u>Elvin Mason</u>	<u>M.</u>		<u>47</u>		<u>Cane Farmer.</u>	
<u>FRANCISCA J. PEREZ</u>	<u>M</u>		<u>69</u>	<u>69</u>	<u>Cane FARMER</u>	<u>660 4837</u>
<u>Evangelista Bobadilla</u>	<u>M</u>		<u>79</u>		<u>Cane Farmer</u>	<u>668-4971</u>
<u>Rogelio Castillo</u>	<u>M</u>			<u>✓</u>	<u>Cane farmer</u>	
<u>Gilberto Camillo</u>	<u>M</u>		<u>40</u>		<u>Cane Farmer</u>	<u>625-5896</u>
<u>RASARIO Pech</u>	<u>F</u>		<u>✓</u>		<u>Cane FARMER.</u>	

FOCUS GROUP SESSION ON

PROPOSED ARUNDO DONAX RENEWABLE BIO-MASS FUEL INVESTMENT INITIATIVE FOR BELIZE

COMMUNITY: San Lazaro

DATE: 29/8/18

TARGET GROUP: Village Council

NAME	SEX	AGE GROUP (PLEASE PUT A ✓)			OCCUPATION	PHONE NUMBER OR EMAIL
		14-24	25-55	55+		
Miguel A. Cabanig	M.		✓		Sales Man chairman	6677982 668-5156
Rosalva Cocom	F.		✓		housewife	652-6500
Elisa Domingus	F		✓		housewife	663-7467
Juan Miguel	M		✓		Farmer	652-8430
Lorenzo meguel	M.		✓		farmer	
Juana Aguirre	F		✓		Domestic	6630610
Yohana Gonzales	F		✓		domestic	6520273

FOCUS GROUP SESSION ON

PROPOSED ARUNDO DONAX RENEWABLE BIO-MASS FUEL INVESTMENT INITIATIVE FOR BELIZE

COMMUNITY: San Lázaro

DATE: 29/8/18

TARGET GROUP: Women's Group

NAME	SEX	AGE GROUP (PLEASE PUT A ✓)			OCCUPATION	PHONE NUMBER OR EMAIL
		14-24	25-55	55+		
Margarita Ujaira Canche	F		✓		House wife	630-8112
Vanessa Novelo	F		✓		House wife	652-6364
Sonia Blasquez	F		✓		House wife	
Ana Cruz	F		✓		Ho Housewife	630-8112
Isidora Flata	F		✓		House wife	633-3557
Mariel Men	F	✓			House wife	621-3825
Reina Corado	F		✓		House wife	633-4143
Isabel Corado	F			✓	stay home	

FOCUS GROUP SESSION ON

PROPOSED ARUNDO DONAX RENEWABLE BIO-MASS FUEL INVESTMENT INITIATIVE FOR BELIZE

COMMUNITY: San Lazaro

DATE: 29/8/18

TARGET GROUP: Church Leaders

NAME	SEX	AGE GROUP (PLEASE PUT A ✓)			OCCUPATION	PHONE NUMBER OR EMAIL
		14-24	25-55	55+		
Ruth Elizabeth pag	F		✓		House wife - pentecostal	661-5718
Eriselda maguel	F		✓		House wife - Church of Christ	663 8952
Maribel Carrillo	F		✓		Housewife - Methodist	661-6753
Jose Carlos	M		✓		Cane farmer - Church Leader	660-9343
Jessie M. Castella	F		✓		Housewife - Methodist	

## ANNEX 4: STAKEHOLDER MEETINGS AND FOCUS GROUP DISCUSSIONS HELD

Agency	Contact Person	Position	Phone Contact	Meeting Date
<b>Individual or Small Group Meetings</b>				
Caribbean Community Climate Change Centre	Mr. Earl Green	Project Officer	(501) 824-1104	5-Jul-18
	Dr. Al Binger	Adviser	+1 (301)-873-4522	12-Jul-18
	Dr. Kenrick Leslie	Executive Director	(501) 824-1104	26-Jul-18
National Climate Change Office	Dr. Lennox Gladden	NCCO	(501) 828-5964	11-Jul-18
United Nations Development Programme	Ms. Diane Wade	Environment Program Manager	(501) 822-2688	18-Jul-18
Ministry of Economic Development	Mrs. Y. Sharman Hyde	CEO, MED	(501) 822-2527	19-Jul-18
Forest Department	Mr. Wilber Sabido	Chief Forest Officer	(501) 822-2079	20-Jul-18
Ministry of Agriculture	Min. Godwin Hulse	Minister	(501) 822-2241	20-Jul-18
	Mr. Andrew Harrison	Chief Agricultural Officer	(501) 822-2241	20-Jul-18
	Mr. Andrew Mejia		(501) 822-2241	20-Jul-18
	Dr. Victorino Pascual	Director, Water and Climate Change	(501) 622-9327	25-Jul-18
Ministry of the Public Service, Energy Unit	Mr. Ryan Cobb	Director	(501) 822-2204	25-Jul-18
	Environment Department	Mr. Leonides Sosa	Environment Officer	(501) 802-2542
Sugar Industry Research and Development Institute	Mr. Marcos Osorio	Executive Director	(501)-677-4794	30-Jul-18
	Dr. Luciano Chi	Scientist	(501)-677-4794	30-Jul-18
Yo Creek Agricultural Station	Mr. (Barry) Fulton Palacio	Agricultural Officer	(501) 615-3410	30-Jul-18
American Sugar Refinery/Belize Sugar Industry	Mr. Donnie Tun	Power Plant Superintendent	(501) 322-2150	31-Jul-18
	Mr. Luis Ramirez	Industrial Operations Manager	(501) 322-2150	31-Jul-18
	Ms. Susana Castillo	Project Assistant, Government Affairs and Communications Officer	(501) 322-2150	31-Jul-18

<b>Agency</b>	<b>Contact Person</b>	<b>Position</b>	<b>Phone Contact</b>	<b>Meeting Date</b>
Public Utilities Commission	Mr. Ambrose Tillett	Consultant	(501) 223-4398	2-Aug-18
Belize Electricity Limited	Mr. Jeffrey Locke	Chief Executive Officer	(501) 227-0954	6-Sep-18
	Mr. Ernesto Gomez	Generation Planning Officer	(501) 227-0954	6-Sep-18
Saint Francis Xavier Credit Union	Mr. Elvis Canul	Head Office Manager	(501) 422-2892	31-Aug-18
<b>Focus or Group Discussions</b>				
Belize Sugar Cane Farmers' Association	Mr. Oscar Alonso,		(501) 322-3670	27-Aug-18
Belize Sugar Cane Farmers' Association	Mr. A. Wicab and Board		(501) 322-3670	27-Aug-18
Progressive Sugarcane Producers Association	Mr. Octavio Bol		(501) 302-1568	28-Aug-18
Corozal Sugarcane Producers Association	Mr. Vladimir Puck		(501) 667-1150	31-Aug-18
	Mr. Leonardo Fulgarait		(501) 667-1150	31-Aug-18
Yo Creek Village Council	Mr. Abel Sosa	Chairman	(501)-631-4324	27-Aug-18
Yo Creek Residents	Mr. Abel Sosa	Residents	(501)-631-4324	27-Aug-18
San Lazaro Village Council	Mr. Miguel Cabanas	Chairman	(501) 631-5156	29-Aug-18
San Lazaro Village Residents	Mr. Miguel Cabanas	Residents	(501) 663-5156	29-Aug-18

## ANNEX 5: STAKEHOLDERS BY GROUP AND INFLUENCE

Role	Group Name	Agency/Individual	Description & Key attributes	Influence on Project (Low, Medium, High)	Impacted by Project (Low, Medium, High)	Current State (Unaware, Resistant, Neutral, Supportive, Leading)
Policy and Governance	Project Proponents	Energy Unit, Ministry of Public Service	Co-owners with project oversight role	H	H	L
Policy and Governance	Project Proponents	Climate Change Unit	Positioned for project oversight	M	H	S
Proponents	Project Proponents	Caribbean Community Climate Change Centre	Project Design and Project Management	H	H	L
Proponents	Energy Operators	BELCOGEN	Provides electricity to national grid under co-generation agreement with BEL	H	H	L
Proponents	Energy Operators	ASR/BSI	Owners of BELCOGEN, Primary producers of sugar bi-product bagasse, used in current co-generation operation	H	H	L
Proponents	Energy Operators	Belize Electricity Limited	Produces and purchases electricity and distributes to users through the national grid; funders of <i>A. Donax</i> pilot cultivation initiative	H	H	L

Role	Group Name	Agency/Individual	Description & Key attributes	Influence on Project (Low, Medium, High)	Impacted by Project (Low, Medium, High)	Current State (Unaware, Resistant, Neutral, Supportive, Leading)
Research Institute	Agriculture Researchers	Sugar Industry Research and Development Institute	Scientists that can support the feasibility study by helping to identify risks and ecological impacts and to determine best practices if cultivation is feasible.	H	H	S
Community Members	Households	Landowners	Potential providers of land for cultivation	H	M	U
Policy and Governance	Policymakers and Regulators	Ministry of Economic Development	Government agencies responsible for ensuring that any new activity aligns with national policies and plans	M	L	S
Policy and Governance	Policymakers and Regulators	Ministry of Agriculture, CEO	Government agencies responsible for ensuring that any new activity aligns with national agriculture policies.	H	H	N
Policy and Governance	Policymakers and Regulators	Ministry of Agriculture, CAO	Government agencies responsible for ensuring that any new activity aligns with national agriculture policies.	H	H	N
Research Institute	Policymakers and Regulators	Yo Creek Agricultural Station	Government agencies responsible for ensuring that any new activity aligns with national agriculture	H	M	N

Role	Group Name	Agency/Individual	Description & Key attributes	Influence on Project (Low, Medium, High)	Impacted by Project (Low, Medium, High)	Current State (Unaware, Resistant, Neutral, Supportive, Leading)
			policies.			
Policy and Governance	Policymakers and Regulators	Department of the Environment	Government agencies responsible for ensuring environmental regulations are adhered to in project execution and that socioeconomic activities align are consistent with sound environmental practices.	H	H	N
Policy and Governance	Policymakers and Regulators	Forest Department	Responsible for ensuring forest and biodiversity activities are consistent with national forest and biodiversity policies	H	H	S
Community Members	Households	Households	Indirect beneficiaries that would be positively impacted by a viable and vibrant biomass industry	L	H	U
Community Members	Cane Farmers	Belize Sugar Cane Farmers Association	Primary stakeholders in sugarcane cultivation and beneficiaries of sugar production activities.	H	H	U
Community Members	Cane Farmers	Progressive Sugarcane Producers	Primary stakeholders in sugarcane cultivation and beneficiaries of	H	H	U

Role	Group Name	Agency/Individual	Description & Key attributes	Influence on Project (Low, Medium, High)	Impacted by Project (Low, Medium, High)	Current State (Unaware, Resistant, Neutral, Supportive, Leading)
		Association	sugar production activities.			
Community Members	Cane Farmers	Corozal Sugarcane Producers Association	Primary stakeholders in sugarcane cultivation and beneficiaries of sugar production activities.	H	H	U
Community Members	Non-cane Farmers		Potential operators of Arundo Donax cultivations	H	H	U
Policy and Governance	Policymakers and Regulators	Public Utilities Commission	Responsible for regulating the electricity industry	M	M	U

## ANNEX 6: SELECT SOCIOECONOMIC INDICATORS

*Table 1: Select Macroeconomic Indicators*

Indicator	2013	2014	2015	2016	2017
Population (Thousands)	347.8	356.9	366.3	375.9	385.8
Employed Labor Force (Thousands)	131.4	134.6	138.1	146.9	150.1
Unemployment Rates (%)	11.7	11.1	10.1	8.0	9.0
Per Capita GDP (US\$, Current Market Price)	4,636.2	4,773.7	4,855.5	4,842.0	4,831.6
<b>Sectoral Distribution of Constant GDP</b>					
Primary Activities	14.6	14.3	12.3	9.7	10.2
Secondary Activities	15.6	15.0	14.6	15.0	14.8
Services	60.0	59.9	62.0	66.2	67.0
Change in Real GDP (%)	0.7	4.0	3.8	-0.5	1.2
<i>Source: Central Bank of Belize Annual Reports 2016, 2017 and 2018.</i>					

*Table 2: Exports of Select Goods and Services*

Value	2013	2014	2015	2016	2017
<b>Value (BZ\$ '000)</b>					
Market Price GDP	3,227	3,413	3,557	3,640	3,728
Petroleum Exports	140.2	102.3	36.4	22.5	22.7
Crops and Agro-products	429.4	431.0	402.4	293.5	363.0
Tourism	702.0	747.7	742.5	780.9	853.4
<b>Share of Market Price GDP</b>					
Petroleum Exports	4.3	3.0	1.0	0.6	0.6
Crops and Agro-products	13.3	12.6	11.3	8.1	9.7
Tourism	21.8	21.9	20.9	21.5	22.9
<i>Data sourced and extrapolated from Central Bank of Belize Annual Reports 2016, 2017 and 2018.</i>					

*Table 3: Labour Force Estimates*

	2,015			2,016		
	Male	Female	Total	Male	Female	Total
<b>Working Age Population</b>						
<b>Corozal</b>	15,389	15,566	<b>30,955</b>	15,667	15,889	<b>31,555</b>
<b>Orange Walk</b>	16,510	16,538	<b>33,048</b>	16,811	16,856	<b>33,667</b>
<b>Belize</b>	37,978	39,658	<b>77,636</b>	39,182	41,018	<b>80,200</b>
<b>Cayo</b>	27,887	28,511	<b>56,397</b>	28,818	29,496	<b>58,314</b>
<b>Stann Creek</b>	13,502	12,283	<b>25,785</b>	13,890	12,634	<b>26,524</b>
<b>Toledo</b>	10,297	10,270	<b>20,567</b>	10,561	10,531	<b>21,092</b>
<b>Total</b>	121,561	122,825	<b>244,386</b>	124,927	126,423	<b>251,350</b>
<b>Labor Force</b>						
<b>Corozal</b>	11,984	6,014	<b>17,998</b>	12,582	6,724	<b>19,306</b>
<b>Orange Walk</b>	13,598	6,996	<b>20,594</b>	13,652	7,219	<b>20,871</b>
<b>Belize</b>	28,889	23,801	<b>52,689</b>	29,786	24,570	<b>54,356</b>
<b>Cayo</b>	21,735	13,533	<b>35,268</b>	22,252	13,898	<b>36,149</b>
<b>Stann Creek</b>	10,924	6,857	<b>17,781</b>	10,745	6,866	<b>17,610</b>
<b>Toledo</b>	7,859	2,848	<b>10,707</b>	8,421	4,239	<b>12,660</b>
<b>Total</b>	94,988	60,048	<b>155,036</b>	97,436	63,515	<b>160,951</b>
<b>Labor Force Participation Rates</b>						
<b>Corozal</b>	77.9%	38.6%	<b>58.1%</b>	80.3%	42.3%	<b>61.2%</b>
<b>Orange Walk</b>	82.4%	42.3%	<b>62.3%</b>	81.2%	42.8%	<b>62.0%</b>
<b>Belize</b>	76.1%	60.0%	<b>67.9%</b>	76.0%	59.9%	<b>67.8%</b>
<b>Cayo</b>	77.9%	47.5%	<b>62.5%</b>	77.2%	47.1%	<b>62.0%</b>
<b>Stann Creek</b>	80.9%	55.8%	<b>69.0%</b>	77.4%	54.3%	<b>66.4%</b>
<b>Toledo</b>	76.3%	27.7%	<b>52.1%</b>	79.7%	40.3%	<b>60.0%</b>
<b>Total</b>	78.1%	48.9%	<b>63.4%</b>	78.0%	50.2%	<b>64.0%</b>

*Table 4: Unemployment Estimates for Project Activity Districts*

Estimated Population	2015			2016		
	Male	Female	Total	Male	Female	Total
Corozal	22,721	22,809	<b>45,530</b>	23,185	23,287	
Orange Walk	24,858	24,608	<b>49,466</b>	25,205	25,003	
Stann Creek						
<b>All Districts</b>	184,157	184,153		188,986	188,982	
<b>Working Age Population</b>						
Corozal	15,389	15,566	<b>30,955</b>	15,667	15,889	<b>31,555</b>
Orange Walk	16,510	16,538	<b>33,048</b>	16,811	16,856	<b>33,667</b>
Stann Creek	13,502	12,283	<b>25,785</b>	13,890	12,634	<b>26,524</b>
<b>All Districts</b>	121,561	122,780	<b>244,340</b>	124,927	126,422	<b>251,349</b>
<b>Labour Force</b>						
Corozal	11,984	6,014	<b>17,998</b>	12,582	6,724	<b>19,306</b>
Orange Walk	13,598	6,996	<b>20,594</b>	13,652	7,219	<b>20,871</b>
Stann Creek	10,924	6,857	<b>17,781</b>	10,745	6,866	<b>17,610</b>
<b>All Districts</b>	94,988	60,048	<b>155,036</b>	97,437	63,516	<b>160,952</b>
<b>Employed Labour Force</b>						
Corozal	11,312	5,372	<b>16,684</b>	11,820	6,047	<b>17,867</b>
Orange Walk	12,986	5,987	<b>18,973</b>	13,119	6,126	<b>19,245</b>
Stann Creek	9,961	5,171	<b>15,132</b>	9,905	5,210	<b>15,114</b>
<b>All Districts</b>	88,505	50,805	<b>139,310</b>	92,006	53,604	<b>145,610</b>
<b>Percent Labour Force Unemployed</b>						
Corozal	5.6	10.9	<b>7.3</b>	6.1	10.1	<b>7.5</b>
Orange Walk	4.5	14.4	<b>7.9</b>	3.9	15.1	<b>7.8</b>
Stann Creek	8.8	24.6	<b>14.9</b>	7.8	24.1	<b>14.2</b>
<b>All Districts</b>	6.8	15.4	<b>10.1</b>	5.6	15.6	<b>9.5</b>

*Table 5: Households by Tenure Type*

<b>Corozal</b>	<b>2015</b>			<b>2016</b>		
	<b>Urban</b>	<b>Rural</b>	<b>Total</b>	<b>Urban</b>	<b>Rural</b>	<b>Total</b>
Own/Hire Purchase	1,822	6,545	<b>8,367</b>	1,976	6,117	<b>8,093</b>
Lease		-	-	59	66	<b>125</b>
Rent	1,127	449	<b>1,576</b>	593	374	<b>967</b>
Rent Free	182	607	<b>789</b>	316	749	<b>1,065</b>
Squat and Other			-			-
<b>Total Households</b>	<b>3,131</b>	<b>7,601</b>	<b>10,732</b>	<b>2,944</b>	<b>7,306</b>	<b>10,250</b>
<b>Orange Walk</b>	<b>Urban</b>	<b>Rural</b>	<b>Total</b>	<b>Urban</b>	<b>Rural</b>	<b>Total</b>
Own/Hire Purchase	2,440	6,502	<b>8,942</b>	1,945	5,548	<b>7,493</b>
Lease	22	18	<b>40</b>	26	51	<b>77</b>
Rent	651	596	<b>1,247</b>	810	436	<b>1,246</b>
Rent Free	470	598	<b>1,068</b>	398	1,010	<b>1,408</b>
Squat and Other		46	<b>46</b>	-	-	-
<b>Total Households</b>	<b>3,583</b>	<b>7,760</b>	<b>11,343</b>	<b>3,179</b>	<b>7,045</b>	<b>10,224</b>
<b>Stann Creek</b>	<b>Urban</b>	<b>Rural</b>	<b>Total</b>	<b>Urban</b>	<b>Rural</b>	<b>Total</b>
Own/Hire Purchase	1,457	4,468	<b>5,925</b>	1,804	4,631	<b>6,435</b>
Lease	-	59	<b>59</b>	29	184	<b>213</b>
Rent	760	1,301	<b>2,061</b>	683	1,222	<b>1,905</b>
Rent Free	544	2,000	<b>2,544</b>	209	2,073	<b>2,282</b>
Squat and Other	-	72	<b>72</b>	-	-	-
<b>Total Households</b>	<b>2,761</b>	<b>7,900</b>	<b>10,661</b>	<b>2,725</b>	<b>8,110</b>	<b>10,835</b>

*Table 4: Households by Tenure Type*

	2015			2016		
	Urban	Rural	Total	Urban	Rural	Total
<b>Corozal</b>						
Own/Hire Purchase	17.0	61.0	<b>78.0</b>	19.3	59.7	<b>79.0</b>
Lease	-	-	-	0.6	0.6	<b>1.2</b>
Rent	10.5	4.2	<b>14.7</b>	5.8	3.6	<b>9.4</b>
Rent Free	1.7	5.7	<b>7.4</b>	3.1	7.3	<b>10.4</b>
Squat and Other	-	-	-	-	-	-
<b>Total Households</b>	<b>29.2</b>	<b>70.8</b>	<b>100.0</b>	<b>28.7</b>	<b>71.3</b>	<b>100.0</b>
<b>Orange Walk</b>						
Own/Hire Purchase	21.5	57.3	<b>78.8</b>	19.0	54.3	<b>73.3</b>
Lease	0.2	0.2	<b>0.4</b>	0.3	0.5	<b>0.8</b>
Rent	5.7	5.3	<b>11.0</b>	7.9	4.3	<b>12.2</b>
Rent Free	4.1	5.3	<b>9.4</b>	3.9	9.9	<b>13.8</b>
Squat and Other	-	0.4	<b>0.4</b>	-	-	-
<b>Total Households</b>	<b>31.6</b>	<b>68.4</b>	<b>100.0</b>	<b>31.1</b>	<b>68.9</b>	<b>100.0</b>
<b>Stann Creek</b>						
Own/Hire Purchase	13.7	41.9	<b>55.6</b>	16.6	42.7	<b>59.4</b>
Lease	-	0.6	<b>0.6</b>	0.3	1.7	<b>2.0</b>
Rent	7.1	12.2	<b>19.3</b>	6.3	11.3	<b>17.6</b>
Rent Free	5.1	18.8	<b>23.9</b>	1.9	19.1	<b>21.1</b>
Squat and Other	-	0.7	<b>0.7</b>	-	-	-
<b>Total Households</b>	<b>25.9</b>	<b>74.1</b>	<b>100.0</b>	<b>25.1</b>	<b>74.9</b>	<b>100.0</b>