1. BACKGROUND

The AMS Programme

The Sugar industry is a vital component of Jamaica's economy, providing a stream of economic benefits to the island including an average USD75 million annual foreign exchange earnings; employment of up to 38,000 persons, and other social and environmental benefits. Overall it is estimated that the sugar cane industry still accounts for 1% of the GDP or 4% of employment.

The reform of the EU Sugar Regime and the consequent 36% reduction in price as of year 2009 is forcing the sugar protocol countries to undergo profound transformations aimed at fostering the competitiveness of the industry and shielding the social impact of the reforms. The European Commission therefore announced in 2006 an eight year aid scheme (the accompanying measures for sugar protocol countries - AMS) to assist sugar protocol countries in the transformation process.

Under this scheme, Jamaica has been the beneficiary of € 86,634,000 for the period 2006-2010 (Multi-annual Indicative Programme MIP 2007-2010). A second phase of the programme for 2011-2013 is under preparation, for an additional € 62 mln. Main objective of the AMS Programme is to support the implementation of the Jamaica Country Strategy (JCS) for the Adaptation of the Sugar Cane Industry 2006-2020 whose twin thrust is to privatise the state-owned sector as a measure to introduce new investment and improve competitiveness, and to counteract the negative consequences of reduced employment in the Sugar Dependent Areas (SDA). At the same time, another important element of the strategy is to diversify within the sugar cane industry from merely the production of brown sugar to other added value downstream products such as refined sugar, ethanol, rum and electricity from bagasse fuelled cogeneration.

To achieve this, the strategy seeks to realize three key objectives:
1. to develop and maintain a sustainable private sector led Sugar Cane industry;
2. to strengthen the economic diversification, social resilience and environmental sustainability of sugar dependent areas; and
3. to support progress towards macroeconomic goals

During the first phase 2007-2010 the GoJ has made significant progress in advancing the reform agenda. All 5 public estates have been privatized, a programme for cushioning the social fall-out of the privatization has been rolled-out and a local market for 70 M litres of ethanol was established through the compulsory introduction of E10 blend in gasoline.

Current state of affairs in the renewable energy sector

The steep increase/volatility in oil prices in recent times has created the impetus for Jamaica to urgently seek to diversify its energy base. Jamaica’s dependency on imported oil for more than 90 percent of its energy sources during the period from 1998 – 2008 has resulted in a dramatic increase in the cost of imported energy from US$300 million to over US$2 billion.
Jamaica’s National Energy Policy 2009-2030, was developed by the Ministry of Energy and Mining (MEM), approved by Cabinet and tabled in Parliament in December 2010. The Energy Policy makes explicit reference to the Long Term National Development Plan “Vision 2030” that was adopted in April 2009. Under two of its “fundamental elements”, it promotes “... an energy sector that is environmentally sustainable, with significantly increased use of economically viable renewable energy sources, while fully protecting the environment, as well as (viii) the responsible and efficient use of this vital commodity”.

Jamaica’s National Energy Policy (JNEP) 2009 – 2030 calls for Jamaica to realize its energy resource potential through the development of renewable energy sources and enhance its international competitiveness, energy security whilst reducing its carbon footprint. This is further emphasized in Goal 3 of that policy. The National Policy also sets targets for the percentages of renewable energy in the energy supply mix to 2030. By 2030, the policy articulates that 20% of the country’s energy mix would be from renewable sources. One of the main purposes of setting these national targets for renewable energy is to provide certainty for investors and to encourage continuous research in technologies which have the potential to generate energy from all types of renewable sources.

The JNEP is complemented by 6 sub-policies of which one is the National Renewable Energy Policy 2009-2030 and the National Bio-Fuels Policy 2009-2030. Both sub-policies are meant to contribute to the achievements of Goals 3 and 4 of the National Energy Policy, namely the development of renewable energy sources and promoting energy security.

The National Biofuels Policy currently being drafted seeks “to develop a sustainable biofuels industry that is capable of meeting local demand for biofuels whilst contributing to rural economic development; generating employment opportunities; reducing environment degradation; providing safeguards for food production, and harnessing indigenous energy sources.

The European Commission, through the AMS programme, intends therefore to support the GoJ’s efforts of creating an enabling environment for the development of the bio-fuels sector, as a way to improve the profitability of the sugar industry as well as to achieve important benefits in terms of employment generation, environmental sustainability and energy security.

Rationale for the Study

The Sugarcane industry and associated diversified products namely, ethanol and bagasse-based electricity cogeneration increasingly offers Jamaica the opportunity to satisfy part of its renewable energy targets in an environmentally responsible and cost-effective manner, whilst reducing dependence on fossil fuels and providing a stimulus for rural recovery.

With 43,000 hectares of suitable land available for sugar cane, Jamaica has the capability to produce all the sugar and molasses the nation needs for its domestic consumption and rum production plus enough ethanol for 10 percent blending in gasoline (E10) throughout the island1.

However, when investing in co-generation the main challenge faced by sugar industries in entering power sales agreements with the utility company is to guarantee firm power in those months when sugar mills are not processing cane. To make the cogeneration investment rentable, there is a need to provide electricity at a competitive price all-year round, to attract a “capacity” premium in the price paid by the electric utility. This gap in bagasse availability may be bridged by stocking the bagasse directly or in pelletised form (not always currently possible because of the level available),

1 Winrock Final report "Assistance for BioFuels Development and Policy Support in Jamaica"; The Mukerjhi report ……..etc should be used to gain familiarity with the Sugar industry and its Ethanol and Cogeneration potential.
using fossil-fuels as supplemental fuel (not recommended) or exploring the possibility of burning other biomass feedstock such as agro-forestry by-products and/or dedicated energy crops during the off season of the sugarcane industry.

The other biomass option will have the additional benefit of providing employment opportunities to cane cutters and other individuals outside the normal harvesting season, which in Jamaica last for about 7 months from December to July.

The most common energy crops used around the world are usually high biomass yielding species such as e-grass (Miscanthus giganteus), giant reed (Arundo donax), switchgrass (Panicum virgatum), elephant grass, also known as king grass (Pennisetum purpureum), the fast growing shrub (short rotation coppice) like woody legume, Leucaena, Black-Locust (Robinia pseudo-Acacia), or Eucaliptus (Eucaliptus Cinerea). Fibre Sorghum and cane varieties selected for energy value are other possibilities.

When selecting the species of energy crops to be investigated, priority should be given to indigenous species as to limit the risk of imported ones becoming noxious weeds in the local environment leading to unforeseeable consequences. Some of those species are in fact considered "invasive" in some areas of the world and the importation to different geographical locations should be done with extreme caution.

Some field trials on short rotation forestry had been carried out in the past by the Petroleum Corporation of Jamaica in the framework of the fuel wood demonstration project at Font Hill Farm. PCJ has also tested Leucaena in firing boilers at Frome sugar factory. There is therefore an existing area of this crop in cultivation and a body of data on its productivity. Material for a comparative study is therefore readily available from the PCJ if necessary. The Center of Excellence for Renewable Energy (CERE) of PCJ is also working on a charcoal feedstock study, the consultants are encouraged to look what relevant date from that study can be leveraged.

The West Indies Central Sugar Cane Breeding Station (WICSCBS) in Barbados is conducting studies for the development of new "multi-purpose" sugar cane varieties with higher than normal fibre levels. The Sugar Industry Research Institute (SIRI) of Jamaica is collaborating with WICSCBS and has tested some varieties with fibre levels exceeding 20% in experimental plots.

There is also a programme to eventually switch to green cane harvesting (GCH) throughout the industry in Jamaica, providing an increased volume of fibre for combustion. This transfer is experiencing some delays for technical and financial reasons, but in the meantime there remains the opportunity to utilise un-burnt tops and trash, normally left in the field to provide additional biomass, provided the additional costs of collection and the impact of soil fertility are manageable.

The scope of this assignment is therefore to assess the potential for biomass feedstock for cogeneration, looking at suitable energy crop species, the potential from improved cultivation and harvesting techniques, and the implications for processing technologies, to refine cost estimates. To be viable, the average cost of running the Cogeneration plant on supplemental fuel must remain below the average price realised through sale of the electricity to the grid, providing a return on the investment for the Cogeneration plant, while at the same time providing additional energy and environmental benefits to Jamaica. When ranking the different alternatives it is recommended to make two assessments:

1. The most economical and environmental alternative as Cogeneration fuel
2. The same analysis, but then look whether the feedstock could generate additional value as Ethonal feedstock for the Sugar Mills.
Besides crops, an assessment should also be made of the availability of other commercially exploitable biomass by-products or wastes from different existing agro-industries (coconut, citrus, coffee, cacao, etc), forestry activities (pruning, wood-mills, etc) or urban green waste disposal (gardening waste, yard-clippings, etc. currently brought to landfills) could be evaluated.

Cogeneration of electricity from biomass would qualify Jamaica for carbon credits under the CDM for the fossil fuel use thus avoided. The attendant reduction in greenhouse gas emissions would have direct environmental benefits, supplemented by the increased sequestration of atmospheric carbon dioxide associated with the expansion of acreage under crop. There would be employment benefits in the local production of renewable energy stemming from the growing and harvesting of the supplementary fuel crops, and economic benefits in terms of foreign exchange savings from reduced purchases of imported fossil fuels.

2. THE ASSIGNMENT

Overall objective

The present study should contribute to the long term energy and rural development objectives of the Country by providing a framework for the development of biomass energy in Jamaica. The exploitation of bagasse fuelled cogeneration and other renewable feedstock as supplemental fuel, will largely contribute to the improvement of the competitiveness of the sugar industry, creating new employment opportunity in sugar dependent areas, as well as in achieving long term environmental sustainability and energy security of the Country.

Specific objective(s) of the present initiative:

- To assess the potential for supplemental biomass feedstock to cogeneration on sugar cane bagasse in Jamaica, to allow for all-year operations;
- Design a programme for the development of biomass energy in Jamaica.
- Recommend a strategy to show how year round cogeneration could be implemented economically fairly quickly in the short term to cover the next two to five years while long term optimal feedstock trial are being developed.

Requested Services:

1. Review of policies and relevant existing literature in the field of biofuels and biomass development in Jamaica.
2. Make a preliminary assessment of available biomass resources, in terms of waste and by-products that could be used as supplemental fuels in sugar mills/cogeneration plants.
3. Identify potential energy crops that could be suitable for off-season sugar mill operations/cogeneration plants.
4. Look at the various technological options including harvesting, handling, storage transport and cogeneration of the various energy crops/feedstock.
5. Make a preliminary economic analysis including market, delivered cost for the feedstock in a usable form for the Cogeneration plan (include the cost for storage), financial considerations as well as environmental and employment benefits.
6. Collect Key data and other information in order to evaluate the technical and economical feasibility of possible biomass projects. These data will have to include also the potential of these biomass feedstock from an energy point of view such as energy content, moisture levels, seasonality and the costs for possible processing/storage of the biomass before it can be utilised for energy.
7. Identify and assess the capacity of potential institutions involved in the R&D of biomass energy.
8. Identify interim solutions while long term best alternatives are being implemented.
9. Engage the private sector (newly privatized sugar Estates), Research Institutions (SIRI), Government Institutions (MoA, MEM, NEPA etc) in a common platform for the Development of Biomass Energy, and Trade and Farmers Unions.

10. Design a preliminary pilot R&D programme for testing and developing suitable energy crops in Jamaica

11. Organize a workshop to present the findings of the study and get feedbacks from the major stakeholders.

Expected Results
1. Assessment of the biomass potential in Jamaica, specifically with reference to sugar cane, biomass waste and dedicated energy crops;
2. Assessment of the policies and institutional capacity in the field of energy from biomass;
3. Recommend an interim solution for supplementary fuel that allows the cogeneration plants to be built
4. Draft a programme design for the development of dedicated energy crops to be co-financed by the EU AMS programme
5. Assessment of the environmental consequences of the introduction of this “crop” to Jamaica
6. A suggestion how to best leverage the Energy and Environmental Fund to accelerate implementation of the recommendations of this study.

The consultant will drive this process in close consultation and interaction with the Ministry of Agriculture, Ministry of Energy and Mining, the SIRI, PCJ (CERE), the EU Delegation and the private sector.

3. EXPERTS’ PROFILE

3.1 Number of requested experts per category and number of man-days per expert or per category
Two senior experts
1) Energy from Biomass Expert (75 man days)
2) Energy Crops R&D Expert (40 man days)

3.2 Profile per expert or expertise required:

Expert 1: Energy from Biomass Expert /Team leader (75 man days) Senior expert

Education
The Technical Assistant will have at least a Master Degree (or equivalent) in engineering, agriculture, economics or related field.

Experience
- At least 10 years experience working in the renewable energy sector, of which at least 5 in the field of biomass energy.
- Thorough knowledge of best practices and technologies related to electricity production from biomass and waste
- Documented experience in conducting feasibility studies in the above mentioned sectors
- Working experience in managing private led projects in the field of electricity generation from biomass, preferably within the sugar cane industry, would be considered a strong asset.
- Experience in logistic, handling and storage of biomass would be an asset
- Experience in Development Countries would be an asset

Language skills
Proficiency in oral and written communications in English, and operational knowledge of computer database and analytical systems

Proven experience in managing research and field work in the development of energy crops

**Expert 2: Energy Crops R&D Expert (40 man days) Senior expert**

**Education**
The Technical Assistant will have at least a Master Degree (or equivalent) in agriculture, natural sciences, engineering or related field.

**Experience**
- At least 10 years experience working in the field of agricultural research of which 3 in energy crops,
- Thorough knowledge of best practices and technologies related to production, mechanization, handling, and storage of dedicated energy crops
- Documented experience in conducting field trials and research programmes for the development of energy crops
- Working experience in developing countries would be a distinguished asset

**Language skills**
Proficiency in oral and written communications in English, and operational knowledge of computer database and analytical systems

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### 4. LOCATION AND DURATION

**Starting date**
Indicative starting date: 15 August 2011

**Duration**
The consultants will provide a total of 115 man days of Technical Assistance within a period not exceeding 5 months (the performance period) through one or maximum 2 in-country missions:

<table>
<thead>
<tr>
<th>Mission calendar</th>
<th>Expert 1 Senior (Working days)</th>
<th>Expert 2 Senior (Working days)</th>
<th>Total</th>
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<tbody>
<tr>
<td></td>
<td>JM Home</td>
<td>JM Home</td>
<td></td>
</tr>
<tr>
<td>Working days</td>
<td>70 5</td>
<td>36 4</td>
<td>115</td>
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The indicative timetable is presented here below:

<table>
<thead>
<tr>
<th>Content</th>
<th>Exp 1</th>
<th>Exp 2</th>
<th>Indicative dates</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Travel</td>
<td>4</td>
<td>2</td>
<td>Mid Aug</td>
<td></td>
</tr>
<tr>
<td>In Country 1st Mission</td>
<td>40</td>
<td>34</td>
<td>August-Sept-Oct</td>
<td>Inception report</td>
</tr>
<tr>
<td>In Country 2nd Mission</td>
<td>26</td>
<td>0</td>
<td>November-December</td>
<td>Workshop, Draft Final Report</td>
</tr>
<tr>
<td>Report writing</td>
<td>5</td>
<td>4</td>
<td>December</td>
<td>Final report</td>
</tr>
<tr>
<td>Man-days</td>
<td>75</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
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</table>
The longest duration of the assignment should not exceed 75 working days.

Location(s) of assignment
The Expert(s) will be based in Kingston at the offices of the Ministry of Energy (MEM), and work in close cooperation with Ministry of Agriculture, SIRI and PCJ’s CERE. The Coordinator for the MEM will be Dr Betsy Bandy, who will facilitate the interviews with the relevant people and organizations in the early phase of the project. The assignment will require travelling around the island.

5. REPORTING
All reports must be written in English and submitted electronically and in 5 hard copies.

The Ministry of Agriculture and Fisheries, Ministry of Energy and the Delegation of European Union are responsible for approving the final report. They will have two weeks following its submission date to respond on the draft final report. After receiving comments, the Consultant will have a maximum of two weeks to finalize the report.

<table>
<thead>
<tr>
<th>Type</th>
<th>Timing</th>
<th>Content (to include but not limited to)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inception report</td>
<td>No later than 2 week after</td>
<td>Technical approach and methodology to the assignment, a work breakdown structure, main milestones as per expected results listed in section 2 above,</td>
</tr>
<tr>
<td></td>
<td>assignment commences</td>
<td></td>
</tr>
<tr>
<td>Draft Final Report</td>
<td>4 weeks before end of assignment</td>
<td>Duties planned, duties undertaken, results achieved, variances, and recommendations for Jamaica Including the deliverables listed in point 2 above</td>
</tr>
<tr>
<td>Final Report</td>
<td>At the end of assignment, no</td>
<td>Duties planned, duties undertaken, results achieved, variances, and recommendations for Jamaica Including the deliverables listed in point 2 above</td>
</tr>
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<td></td>
<td>later than 30 October 2011</td>
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ADMINISTRATIVE INFORMATION

Interviews if necessary indicating for which experts/position
During the evaluation process, the EU Delegation may conduct an interview of the expert proposed for the assignment.

Language of the specific contract
English

Other authorized items to foresee under ‘Reimbursable’
- International air travel to Jamaica (4 return tickets economy class)
- Transport within Jamaica (i.e. out of Kingston)
- Per diem. Note: per diems include taxi costs for transport within urban agglomerations (i.e. Kingston)
- Report shipment costs by express courier
- Organisation of a workshop (half day for 35 people) in Kingston with coffee and light food

Provision of other miscellaneous expenses for example for maps, data analysis, etc. will require prior approval by the EC Delegation in Kingston.