ENERGY BASED SOLUTION FOR MUNICIPAL SOLID WASTE (WASTE-TO-ENERGY)

TECHNOLOGY DESCRIPTION

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Jamaica produces over 1 million tonnes of solid waste per annum and growing, at a time when land resources are becoming more constrained and solid waste and environmental management becomes more challenging. Current efforts and proposals to address solid wastes are not economically sustainable, land and labour intensive, costly for the state and carry health and safety risks.

One (1) 10 MW waste to energy (WTE) power plant is proposed for a solid waste facility to achieve the following objectives:

(a) addition of power generation on the national grid;
(b) disposal/destruction of solid waste and reduction in ground water pollution;
(c) reduction of recurring fire events at site; and
(d) mitigation of greenhouse gas (GHG) emissions in the electricity sector.

This relatively small scale WTE power plant is preferred to larger ones in order to maximise the available solid waste, without a need to depend on co-firing (using fossil fuels which add to greenhouse gas (GHG) emissions). The plant will utilise proven high temperature combustion and heat exchange/heat and power technologies (gasification/pyrolysis) for low emissions and increased efficiency. These processes render toxic and hazardous materials innocuous, and create a net negative GHG emission profile based on avoidance of methane release, low carbon dioxide (CO_2) emissions (pre-sorting included) and pollution controls.

From 2018 – 2037 over 1,600 MW of new or replacement generation will be required on the national grid under an Integrated Resource Plan (IRP) to 2037 (Integrated Resource Plan - A 20 Year Roadmap to Sustain and Enable Jamaica's Electricity Future Draft, 8 January 2020, revised 20 January 2020). Solid waste to energy provides an excellent nexus technology for the above objectives. For that reason, the Integrated Resource Plan (IRP) 2018 (revised 2020) allocates 74 MW for new generation from WTE, hydro or biomass resources. This project will be developed to meet the IRP renewable energy target, the National Energy Policy goal of 50% electricity on the national grid, the Vision 2030 Jamaica National Development Plan goals, and the Nationally Determined Contribution (NDC) emission mitigation ambitions for the energy sector. The establishment and successful operation of this first project in the south-east of Jamaica (Riverton Waste Facility > 400,000 tonnes per annum of solid waste), will enable a second WTE plant for either central or western areas of Jamaica which also have solid waste management issues and increasing electricity demand. Various studies have confirmed the Riverton site as suitable for WTE.

The WTE project will be implemented as a commercial Build Own Operate (BOO) from a possible combination of private sector investments and foreign direct investment, or a Public Private Partnership (PPP), thus alleviating the Government of Jamaica from significant financial and operational obligations. Commerciality and sustainability of the project will not require continuing international financial support as it will be implemented as a commercial venture.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The Technology Readiness Level (TRL) outlines the current state of the technology in the country. This technology is well established, and proven WTE power plants are located worldwide, from global power generation leaders such as Electricite de France (EDF), Babcock & Wilcox and Wartsila for over a half-century. The technology has never been implemented in Jamaica; however, all the systems are in-place for such a technology to be incorporated into the energy mix.

Although there is no use of this technology in Jamaica, The Technology Readiness Level is rated at '*TRL 9 – actual system proven in operational environment.'*

CLIMATE RATIONALE OF THE TECHNOLOGY

Natural anaerobic bio-digestion of organic materials (60 – 70% in Jamaican Municipal Solid Waste [MSW]) produces landfill gas which is composed of roughly 50% methane, 50% carbon dioxide (CO_2) and a small amount of non-methane organic compounds such as ammonia and sulphides. Methane is a very potent greenhouse gas, roughly 82 times the Global Warming Potential of CO_2 on a 20-year basis[1]. One million tons of landfill waste may emit over 400,000 cubic feet of landfill gas (LFG) per day dependent on temperature, oxygen, moisture and other environmental conditions.

In 2012 waste sector in general contributed 625 Gg CO_2e of greenhouse gas emissions or 5% of total net GHG contributions in 2012. Solid waste sub-sector in particular contributed 3% of CO_2 equivalent emissions primarily in the form of methane primarily from waste disposal sites and this is increasing over time (Assessment of Jamaica's Climate Change Mitigation – Potential and implications for its Undated NDC [Sectoral Review] 2019).

A 10 MW WTE plant will initially reduce methane emissions for over 400,000 tonnes of waste per annum at the Riverton site and additional projects from other sites in the future. This is in keeping with the draft Energy from Waste sub-policy, Climate Change Framework Policy (2015), and NDC.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The project will initially reduce methane emissions from 40% of Jamaica's total solid waste generated annum and add 10 MW of renewable energy capacity to the national grid.

The project concept development should take place by mid- 2022 in preparation for a call for proposals for new generation sources by the end of 2022. The project should be ready for implementation in 2023 based on the determined timeline under the IRP schedule.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies).

There have been previous proposals from various international investors for WTE plants, (the Riverton site being one option) but of a larger scale. One WTE project was approved but later aborted by the developers. An additional note is that, the Government of Jamaica has contemplated this technology over many years, and formed inter-governmental working groups to determine how best to incentivize and implement this technology, so this suggested opportunity will not require significant preparation for readiness.

[1] Intergovernmental Panel on Climate Change (IPCC) assessment report (AR6).

EXPECTED IMPACTS OF THE TECHNOLOGY

Waste to Energy power generation will have the following positive impacts: -

- Overall reduction of GHG emissions primarily by reducing direct methane emission and uncontrolled combustion of organic materials made from fossil fuels.
- Reduced GHG emission from avoidance of more fossil fuel importation for power generation and the concomitant emissions.
- Reduced volume of solid wastes at waste facilities.
- Reduced number of annual spontaneous fires at waste facilities.
- Social and health benefits by reducing vermin and disease vectors, reducing air pollution from occasional fires and reducing exposure to health and safety risks in a controlled and regulated environment.
- Reduction of pollution to waterways and the marine environment due to leachates and surface runoff.
- Improved socio-economic context as employment will be available for persons who are low-skilled, and also at the managerial and technical levels for the power generation and manual waste sorting process. An opportunity would be created for elevating the living standards for persons accessing the waste facilities, by providing an opportunity to gain transferable skills. Special opportunities could be created to introduce and increase technical capacity for youth to break generational poverty.
- Continuity in livelihood activities related to recyclable materials which cannot be combusted (e.g., scrap metals).
- Energy security from the use of more local energy sources.
- Additional income for municipalities from rents and fees etc.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES AND FRAMEWORK IN RELATION TO THE TECHNOLOGY

- National Energy Policy 2019 – 2030
- Energy from Waste sub-policy 2019 – 2030
- Vision 2030 - Jamaica National Development Plan.
- Climate Change Policy Framework (2015).
- Nationally Determined Contribution (NDC) (updated 2020).
- Integrated Resource Plan - A 20 Year Roadmap to Sustain and Enable Jamaica's Electricity Future (Draft - revised 20 January 2020).

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

No new policies have been proposed; however, the National Energy Policy will undergo a review and update in 2021.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

- Government of Jamaica public procurement exercise = US$ 35,000.
- GoJ securing green financing to enhance project financing in the event of a PPP venture = US$ 15,000.
- Public education sensitization programme to stimulate investment interest from the financial sector and private sector organizations, and citizenry = US$ 55,000 (up to 1 year).

Cost for implementing the technology would be approximately US$ 2,000 – US$ 2,300 per kW to install.

USEFUL INFORMATION

CONTACT DETAILS

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LINKS TO TNA REPORTS

All reports can be found at: https://tech-action.unepdtu.org/country/jamaica/