

The Government of Aruba



Request For Information (RFI)

RFI 1: Solid Waste Thermal Treatment for Energy Recovery

RFI 18-1106

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1 Disclaimer - Conditions

The Government of Aruba has prepared this Request for Information (RFI) document to obtain information on globally available technologies for the processing of solid waste and to identify entities capable of delivering and implementing such technologies. It is not the Government's objective to make any supplier selection on the basis of this RFI process. Moreover, this RFI document is expressly not intended as a public tender / Request for Proposal, or any part or phase thereof. Instead, this RFI process is intended by the Government of Aruba as an information gathering tool towards an envisaged tendering process / Request for Proposal for a Solid Waste Treatment Facility.

While the Government of Aruba has taken due care in the preparation and presentation of the information contained herein, neither the Government of Aruba, its representatives, officers, employees, advisors, subsidiary companies or any other stakeholder providing assistance to the Government of Aruba warrants or makes any representation, express or implied, as to the accuracy or completeness, for any purpose, of the information contained in this document and/or any information which may be provided in connection herewith by or on behalf of the Government, its representatives, officers, employees, advisors, subsidiary companies or any other stakeholder providing assistance to the Government of Aruba.

The information contained herein is not intended to be exhaustive. Interested local and/or international parties shall undertake their own research and enquiries, and should not rely solely on the information provided in this RFI document in participating in this RFI process and/or in preparing and submitting their responses. The Government of Aruba, its representatives, officers, employees, advisors, subsidiary companies or any other stakeholder providing assistance to the Government of Aruba are however not obliged to provide any additional information or access to information, other than the information



contained herein, to interested local and/or international parties during the undertaking of their own research and enquiries.

All information contained herein is provided on the condition that it is non-binding to the Government of Aruba, its representatives, officers, employees, advisors, subsidiary companies or any other stakeholder providing assistance to Government. Oral explanations or oral instructions from the Government, its representatives, officers, employees, advisors, subsidiary companies or any other stakeholder providing assistance to the Government shall not be considered binding and no rights can be derived from oral explanations or instructions.

The Government of Aruba reserves the right to, at its sole discretion, without incurring any liability and without the obligation to provide any reason:

- modify or withdraw this RFI document or any part of it at any time;
- modify or cancel the RFI process at any time;
- reject any and all responses to this RFI and to seek new responses;
- seek clarification or additional information from respondents, whether individually or collectively, as it deems necessary for the evaluation of the responses;
- evaluate the respondents' written and/or oral representations as to their veracity, substance and relevance to the subject of this RFI document, including seeking and evaluating independent information on any respondent;
- refrain from discussing the RFI process, any and all responses, the Solid Waste Treatment Facility initiative and or any tendering process aimed at the Solid Waste Treatment Facility, with any respondent;
- refrain from proceeding with a tendering process for a Solid Waste Treatment Facility and/or from pursuing the Solid Waste Treatment Facility itself.

Any and all costs or damages incurred by any respondent in relation to this RFI process and/or its response to the RFI, are the sole responsibility and are for the sole account of



such respondent. The Government of Aruba, its representatives, officers, employees, advisors, subsidiary companies and any other stakeholder providing assistance to the Government shall not, directly or indirectly, have, assume or incur any responsibility or liability for these costs or for any damage or claim related to any and all aspects of the RFI process.

The respondents shall not offer any gratuities, favors, or anything of monetary value to any representative, officer, employee, advisor, subsidiary company of the Government of Aruba or any other stakeholder providing assistance to the Government for purposes of influencing evaluation of a response.

All documents, conversations, correspondence, multimedia, etc. between the Government of Aruba, its representatives, officers, advisors, subsidiary companies and any other stakeholder providing assistance to the Government and respondents are public information subject to local law and regulations, unless specifically identified otherwise.

The laws of Aruba shall be exclusively applicable to all acts under or related to as well as the interpretation of this RFI. Any and all disputes arising out of or in connection with this RFI shall be submitted exclusively to the court in first instance of Aruba and its appellate court. By participating in this RFI process, all parties irrevocably accept the aforementioned disclaimer and conditions.



2 General

2.1 Information about Aruba

Aruba is an island and a constituent country of the Kingdom of the Netherlands in the southern Caribbean Sea, located about 1,600 kilometers (990 mi) west of the main part of the Lesser Antilles and 29 kilometers (18 mi) north of the coast of Venezuela. It measures 32 kilometers (20 mi) long from its northwestern to its southeastern end and 10 kilometers (6 mi) across at its widest point. Aruba has approximately 110 thousand inhabitants and approximately 40,000 households. Aruba accommodates nearly 2 million visitors per year. Aruba's basic characteristics and selected economic indicators are given in tables 1 and 2.

Table 1 Characteristics of Aruba

Official name	Aruba
Form of Government	Unitary parliamentary representative democracy under constitutional monarchy
Total area	Land: 179 km ² (69.1 sq. mi); Water %: negligible
Climate	Hot semi-arid. Mean monthly temperature from 26.7 °C (80.1 °F) to 29.2 °C (84.6 °F), with constant trade winds from the Atlantic Ocean, coming from the north-east.
Total population	110300 (2016 estimate)
Population density	612 inh./km ² (1,585 inh./sq. mi)
Population growth rate	0.5% (2010-2015 annual average)
Highest Peak	(188 m) (620 ft.) above Sea level (Jamanota)
Capital City	Oranjestad

Table 2 Economy of Aruba

Currency	Aruban florin (AWG). Pegged to the US dollar at 1.79 florins to 1 USD
Nominal GDP	2,668 (millions of U.S. dollars, 2016)
GDP per capita	24.1 (thousands of U.S. dollars, 2016)
Unemployment rate	7.3% (2015)
Human Development Index	0.908 very high (2013)
Main trading partners	Colombia, the United States, Venezuela, and the Netherlands
Main industries	Over 85 percent of the economy depends on tourism



2.2 Current waste management situation

The amount of solid waste generated on Aruba is estimated at 130 to 150 kilotons per year. Appendix B presents a fact sheet of the waste streams and corresponding volumes in Aruba. Currently, the majority of the waste is deposited without pre-treatment at landfill Parkietenbos, located on the South side of the island. The landfill does not have facilities for the reduction of undesirable environmental impact. In addition, and aside from the social and environmental aspects, the landfill will reach its maximum capacity within 2 years at the current growth rate.

In view of the protection of public health and conservation of the environment and in order to keep pace with evolving international standards and best practices, the Government of Aruba has established the objective to transition from its current solid waste management system to sustainable and sanitary waste management that entails a complete process from the waste sources to the recovery of valuable products and environmentally friendly treatment of the remaining waste. In connection herewith, the Government of Aruba is actively seeking for possible solutions to achieve a combination of sanitary landfilling together with other waste management methods, which are more in line with a circular economy and international standards.

2.3 Desired situation and envisioned process

Solid waste management solutions cannot be addressed effectively without considering the value chain, ranging from waste collection in the first stages to product export or landfilling in the final stages. As an example, Figure 1 presents the basic model of such solid waste value chain. In this process, the collection of waste from households, businesses, hotels and industry needs to be improved through national awareness campaigns and the introduction of effective regulation and implementation of waste separation at source.

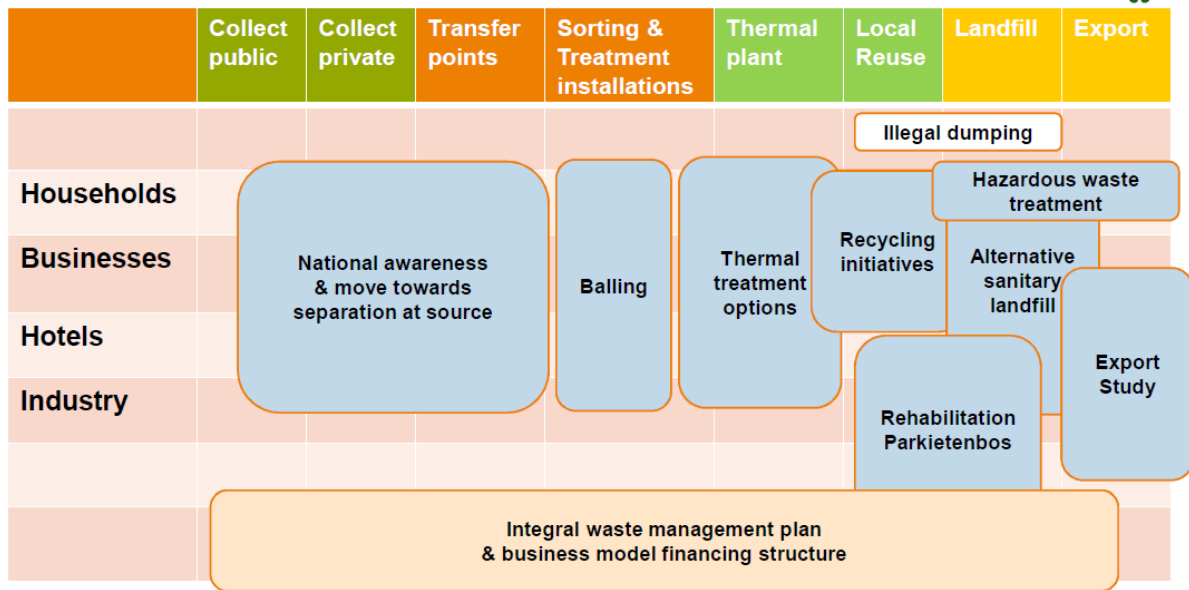


Figure 1 Example of a Solid waste value chain model

The collected waste is then transferred to materials recovery and energy recovery facilities, where further sorting and treatment are performed. Recovered recyclable materials can be locally re-used in a variety of ways (e.g. in local construction projects). Alternatively, these materials can also be exported. In addition to the recovery of recyclable materials, other materials with high calorific value can be separated and treated in a thermal facility in order to generate useful energy streams. Residual waste such as hazardous/toxic waste or waste with insignificant economic value will need to be treated and stored using environmentally responsible methods.

The entire process is to be governed by an effective integral waste management plan, thereby realizing an end-to-end value chain and business model that are beneficial from the economic, social and environmental perspectives.

Direction for a sustainable waste management solution for Aruba

The Government of Aruba is working to identify pathways towards a long-term sustainable solution for Aruba's waste management. In order to do this, the government has identified a three-track approach:

1. A new solid waste thermal treatment facility for energy recovery;
2. Closure and remediation of the existent landfill at Parkietenbos; and



3. Creation of a sanitary landfill for residual waste and in case of debris from disasters

The Government of Aruba has prepared a market participation process seeking input from interested industry partners for either solutions on the individual tracks or integrated solutions. To this extent, the Government of Aruba intends to publish two RFI's:

- RFI 1 solid waste thermal treatment for energy recovery solution (Track 1)
- RFI 2 remediation landfill & a sanitary landfill (Track 2 & 3)

This document represents RFI 1 on the solid waste thermal treatment for energy recovery solution. The intention is to request and obtain detailed information for a Solid Waste Treatment Facility (SWTF) that includes materials recovery, energy recovery, and residual waste handling according to the Best Available Technologies (BAT) for the Aruban situation.



3 RFI Scope

At present, the vast majority of solid waste generated on Aruba is deposited at a landfill located at Parkietenbos. The Government of Aruba aims to introduce a sustainable waste management system to address the current environmental and social challenges, aligned with the circular economy philosophy. The Government of Aruba is committed to explore and evaluate options for a waste management system that separates solid waste and converts recovered materials into energy and other useful products. It is thereby envisaged that such energy may allow the local utility company, to increase/replace its existing installed capacity within the scope of sustainable waste management and circular economy.

This RFI is a non-committal information gathering tool towards an envisaged tendering process / Request for Proposal for a Solid Waste Treatment Facility (SWTF) that includes a Materials Recovery Facility (MRF), a Waste To Energy Facility (WTEF) and a solution to handle the facility's residual waste.

Figure 2 shows the basic scope of the RFI and desired end products. The objective is to process all the offered solid waste, to separate recyclable products (e.g. glass, ferrous, and non-ferrous) and produce energy (e.g. electricity, steam or syngas) with a minimum of residual waste. Additionally, other products/streams may be proposed if these are beneficial from an economic and/or environmental point-of-view.

In the current situation, the solid waste generated in Aruba consists of all types of waste; including Municipal Solid Waste (MSW), Commercial Waste (CW), and Construction and Demolition Waste (C&D) of different characteristics (e.g. combustible/non-combustible, toxic/non-toxic). Source separation of food and yard wastes prior to collection, are currently not being applied.



In the envisaged situation, materials recovery by means of a separation process is intended for the production of recyclable materials. Refuse Derived Fuel (RDF) resulting from the waste separation process is to be used in a thermo-chemical waste-to-energy conversion process that entails a direct combustion process or a gasification process to produce combustible gas. An effective and efficient combination of these technologies may also be presented. An environmentally sound solution is needed for waste that is neither recyclable nor combustible. Bio-chemical conversion techniques such as fuel and/or compost recovery by anaerobic digestion or aerobic bioconversion composting are not part of the scope.

The intention of this RFI is to gather information and to explore concepts, technologies, budgetary cost, technical, contractual and financial approaches that can be used to complete a feasibility study and streamline a possible tendering / Request for Proposal process. Respondents are requested to provide detailed information to clarify proposed approaches and solutions.

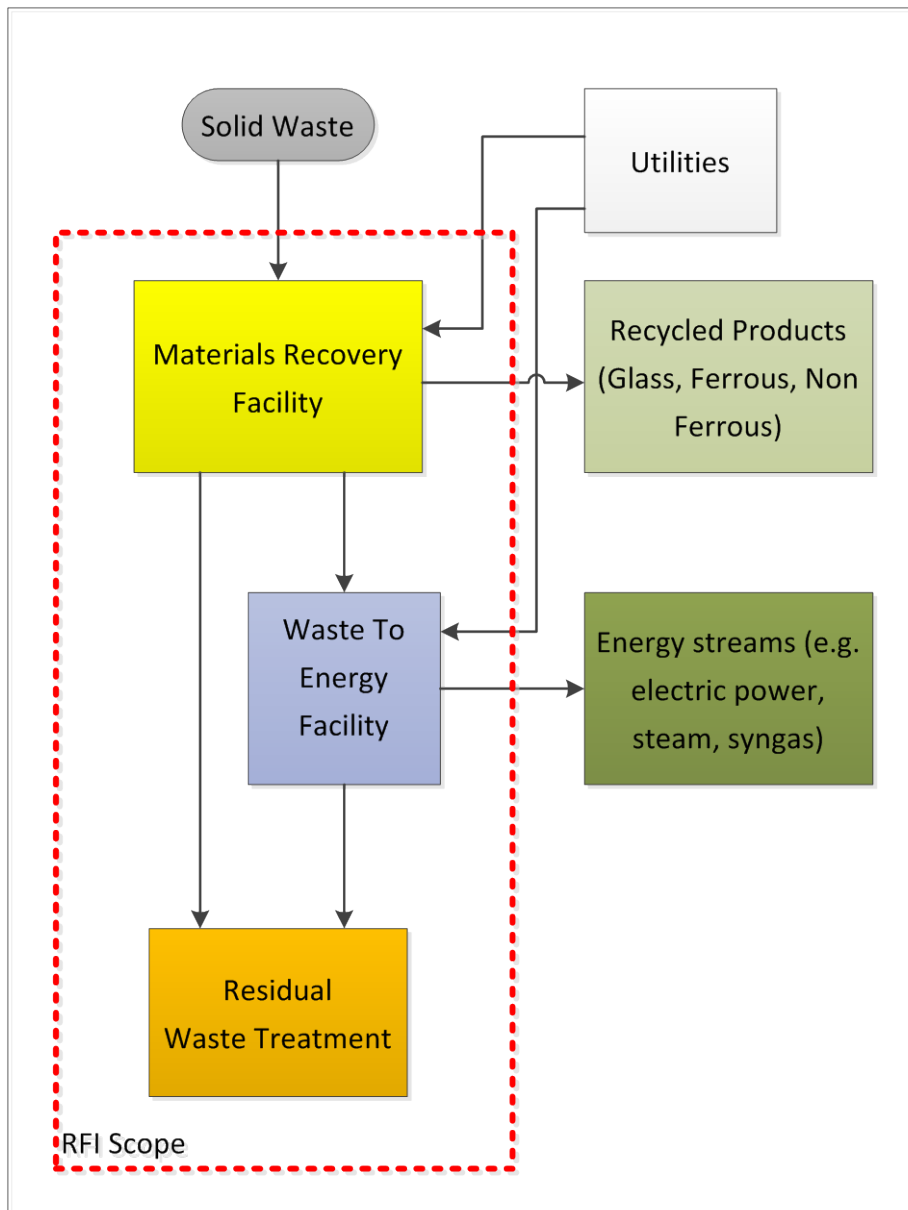


Figure 2 Overall solid waste treatment process.

Design Philosophy, Requirements and Conditions

- The Respondent shall supply a SWTF and all other related systems.
- The design of the SWTF and equipment shall be of proven technology. The SWTF shall be designed with emphasis on reliability, availability, scalability, operation flexibility and ease of operation and maintenance.
- In the design, the Respondent shall incorporate the influences of the tropical, marine, saline, corrosive and high UV environment to comply with the requirements



in the design and construction and operations. Corrosivity category C5-I (very high, industrial) as per guideline ISO 12944-2, or higher shall be considered.

- d. The system must be designed and constructed to take into account earthquake loads based on IBC 2012 Seismic Codes and Category 3 hurricane wind load.
- e. Building heating systems are not desirable in Aruba due to the continuously hot climate. Heat recovery for power generation is therefore to be considered in the process design.
- f. Control System: The Respondent shall supply a PLC/SCADA system for the control of the SWTF.
- g. Environmental Requirements
 - 1) Vibration: The facilities shall comply with the requirements for effective vibration acceleration as per guideline ISO 8528 and ISO 10816-6, zone A.
 - 2) Air emission conditions: The facilities shall comply with international standards (e.g. EU and/or USA EPA standards) equivalent or better -
 - 3) The quality of residuals produced by the facilities shall comply with international standards (e.g. EU and/or USA EPA standards) equivalent or better.
 - 4) Ambient conditions are as per Table 3:

Table 3 - Ambient conditions

Ambient Conditions	Data
Design ambient conditions	
Altitude above sea level	25 m
Ambient air temperature	31.7 °C
Relative humidity	77.6%
Wet bulb temperature	28.3 °C
Maximum ambient conditions	
Maximum ambient air temperature	35.6 °C



Ambient Conditions	Data
Relative humidity at maximum ambient temperature	97%
Wet bulb temperature at maximum ambient temperature	35.1 °C
Minimum ambient conditions	
Minimum ambient air temperature	24.8 °C
Relative humidity at minimum ambient temperature	70%
Wet bulb temperature at minimum ambient temperature	20.8 °C



4 Respondent Information

The Government of Aruba is requesting qualified and established Local and/or International companies and organizations that are interested to participate in this RFI, to submit the RFI Respondent Form (Appendix A) as specified below. Completion and submission of a RFI Respondent Form (Appendix A) is a requirement to participate in this non-committal RFI process.

Respondents should complete the form and return as an attachment via email to **rfi-SWTF2018@arubarfi.com** as per section 4.3.

Submission deadline and other instructions

The RFI Respondent Form (Appendix A) must be received no later than **March 16th, 2018 at 11:59PM Eastern Time.**

- The Subject line of your email should be titled: "RFI 18-1106 - "***Company Name***"
- The Email address may be used for questions, queries and clarifications.
- Receipt of all submittals will be confirmed electronically.
- The respondent answers should be as concise as possible.

4.1 Respondent Approach

Respondent should clearly communicate their interest, subject to chapter 1 (Disclaimer and Conditions) and chapter 3 (RFI Scope).

4.2 Project Timing

Table 4 illustrates the anticipated milestones for this project.



Table 4 - Anticipated milestones.

Activity	Completion
RFI published by the Government of Aruba	February 8, 2018
RFI Closing date	March 16, 2018
Initiate tendering process	3rd Quarter 2018*
Contract signing	4th Quarter 2018*

4.3 RFI format and Submission

4.3.1 RFI Submission

- The respondent should complete the Appendix A **RFI Respondent Form** and submit same as an email attachment in both PDF and Word Format.
- It is recommended that attachments with file sizes exceeding 10MB be compressed (e.g. zipped) to ensure message delivery.
- RFI responses reaching later than the cut-off time and date specified above may, in the Government of Aruba's sole discretion, be rejected without further consideration.
- RFI responses may be submitted prior to the cut-off time and date specified above, however only complete RFI responses will receive attention.
- All costs if any incurred by a Respondent in connection with this Document and the preparation of its RFI responses shall be for the account of the Respondent.

4.3.2 Language of the RFI Response

The RFI response and all documents forming part of it shall be in English.

* subject to change or cancellation without notice.



4.3.3 Confirmation of the RFI Response

The Government of Aruba reserves the right to seek additional information from the Respondent regarding its RFI response, and may require the respondent for clarification purposes to present supplementary information, in respect to the RFI response if so required by the Government of Aruba.

4.4 Additional Information

- The conditions of contract for a possible SWTF implementation will be determined in the subsequent feasibility study.
- The Government of Aruba deems it desirable that economic benefits are, where possible, retained locally in order to maximize the added value to the local economy. Respondents are therefore encouraged to maximize the use of local materials and/or labor.
- Refer to Appendix B for information on demographics and current waste management in Aruba.



APPENDIX A - RFI Respondent Form

The Respondent should complete and submit the Respondent Form (including all supporting documents), inserting additional pages as is necessary.

CATEGORY 1: The Project

The project is for the establishment of a Solid Waste Treatment Facility (SWTF) on Aruba. The intention is to perform materials recovery for recycling purposes, energy recovery, and residual waste handling. Respondents are requested to provide detailed proposals based on the solid waste information provided in Appendix B.

The facility shall be designed to incorporate a MRF and a WTEF based on thermo-chemical (e.g. combustion, gasification or pyrolysis) processes. The WTEF shall be connected to the utility company's existing gas line and/or electrical grid.

Information about Serlimar Sui Generis

Serlimar Sui Generis (Serlimar) is the largest waste management company in Aruba, with the Aruban Government as the only shareholder. Serlimar provides refuse collection services to residential and commercial customers. Currently the waste collected by Serlimar is brought directly to the Parkietenbos Landfill & Containerpark, also operated by Serlimar. The facility has been Aruba's official public refuse dumping-site since the 1960s and is organized in two main deposit sections, the container park and the landfill. The container park is a residential Public Transfer Station (PTS) intended for waste materials separation with the purpose of materials recycling. Materials such as wood, tires, cardboard, paper, glass, green & yard waste, construction waste and metals can be brought to the container park. Hazardous or flammable materials such as car batteries, waste oil, asbestos containing materials, acid containing materials, and animal carcasses are not accepted with household waste; and need to be transported separately to the container park at Parkietenbos. The envisioned future of Serlimar is to achieve a modernized waste management solution that is sustainable from both an environmental and economic point of view.



Information about W.E.B. Aruba N.V.

Water- en Energiebedrijf Aruba N.V. (WEB) is one of the pillars of Utilities Aruba N.V. Utilities Aruba N.V. is a holding company, with the Aruban Government as the only shareholder. WEB is responsible for the production and distribution of water and generation of electricity that is delivered to N.V. ELMAR, the national electricity distribution company. The envisioned future of WEB is to be cleaner, greener and fuel oil free by 2020. To achieve this goal WEB needs to engage in cleaner and greener technologies (renewables) for a more sustainable energy and water supply. Cleaner technologies will lead to less emissions and therefore reduce carbon foot print and have a positive impact on the environment.

Aruba's current average demand is 106 MW with an average peak demand of 135 MW. The installed power generation capacity is approximately 280 MW and consists of the following components including the respective feedstock as per Table 5

Table 5 - Current installed capacity at WEB.

Method	Installed capacity	Feedstock
Steam turbines	136 MW	Steam from HFO fired boilers
Reciprocating (RECIP) engines	92 MW	Heavy Fuel Oil (HFO)
Gas Turbines	22 MW	Light Fuel Oil (LFO)
Wind Turbines	30 MW	Wind

If the SWTF produces steam as an output product, then the steam conditions should be specified. For reference, the steam process conditions at WEB are as per Table 6.

Table 6 - WEB steam requirement

Item	Data
Pressure	61 Bar (a)
Temperature	480 °C



If the SWTF produces electricity as an output product, then the following Electrical Output Quality should be considered: 13.8 kV, 60 Hz and a step-up transformer 13.8 kV- 60kV, for the transmission voltage level. The facility could be tied-in on the WEB 13.8 kV switch gear. The Respondent shall supply and install the electrical system necessary for the electrical tie-in, including switchgears, transformer(s), MCC, VFDs, filters, cabling and wiring.

If the SWTF produces syngas as an output product, Respondent shall supply the syngas specification.

CATEGORY 2: Characterizing Respondent

1. Name and Contact Details of Respondent:
 - a. First Name
 - b. Last Name
 - c. Company Name
 - d. Business Address
 - e. Telephone Number
 - f. Email Address

2. Submit your company/ organization profile.
3. Specify the locations where you do most of your work.
4. Please provide the following information regarding your previously executed Waste to Energy project(s) in Table 7 . You may provide information of up to three (3) representative projects.

Table 7 - Past Projects

Description	Project #1	Project #2	Project #3
a. Project name			
b. Facility location			
c. Solid waste treated annually (ton)			
d. Overall facility gross power output (MW)			



Description	Project #1	Project #2	Project #3
e. Project duration - months			
f. Project cost - USD/MW			
g. Project cost - USD/MT			
h. Facility cost estimate - USD/MW			
i. Facility cost - USD/MT			
j. Facility Technology Life Cycle - years			
k. Facility Economic Life Cycle - years			
l. Type of contracting strategy			
m. Project financing strategy			
n. Project reference person contact information			

CATEGORY 3: Technical information

Input requirements

5. What are the utilities (i.e. water, steam, fuel, electricity etc.) that need to be supplied to the solid waste separation facility?
6. What are the utilities (i.e. water, steam, fuel, electricity etc.) that need to be supplied to the waste to energy conversion facility?
7. What are the quantities and main characteristics of these required utilities?
8. What are the waste characterization information that you need for a detailed SWTF design?
9. Which types of materials are not accepted for processing in your SWTF?
10. How would you perform an in-depth analysis of the solid waste and a feasibility study based on this analysis?
11. Provide other preliminary requirements that must be in place for facility detailed design and construction.



Materials recovery and RDF

12. What are your options and typical steps in the solid waste separation process for materials recovery?
13. Based on the given solid waste profile, what is your estimated percentage (range) of solid waste that could be recycled?
14. What are the typical separated recyclable and non-recyclable products (streams) obtained from your solid waste separation process in successfully completed projects? Please indicate the typical destinations for these separated recyclable and non-recyclable products.
15. What is the percentage of the given solid waste profile that would be suitable for a thermo-chemical energy recovery process?
16. What are your typical RDF quantity, composition, and form factor for the given solid waste profile?
17. Provide technical waste separation limitations (and efficiency reduction %) details as well as related operational conditions.
18. What are your experiences on the international markets of solid waste and recyclable materials import/export?

Waste To Energy Conversion

19. What are the typical energy recovery units used for the given solid waste profile?
20. Provide details of the types of options and operating ranges available per energy conversion unit.
21. Provide technical energy conversion limitations (and efficiency reduction %) details as well as related operational conditions.
22. What is the minimum amount and composition of solid waste (in ton per day) needed for your waste to energy solutions?
23. What are the types of energy streams produced by your thermo-chemical process?
24. What are the typical quantities and main characteristics of these produced energy streams based on the provided solid waste profile? What is the expected generation of electrical energy in kWh/ton for the given solid waste profile?



25. What is the optimal heat rate (Btu/kWh) achieved and on which size/class/frame size of machine?
26. Heat production for household heating systems is not required in Aruba. How will excess heat be recovered to produce useful energy streams? Provide a typical facility heat balance for the given solid waste profile.
27. What are your solutions for the dissipation of energy produced by the WTEF in situations where there the demand is insufficient or zero?
28. What are possible solutions in case of structural local over- or underproduction of RDF as compared to the energy conversion capacity of the WTEF?

Other Facility characteristics

29. Provide a typical plot plan layout, configuration, PFD.
30. What are your common process configuration experiences for a facility that entails both recyclable materials recovery and energy recovery?
31. Provide a typical control system architecture showing all components for a typical solid waste to energy facility, including solid waste separation units, energy recovery units and auxiliary units.
32. List what typical equipment is used to create your DCS e.g. PLC, servers, HMI, etc.
33. Are there any communication limitations of your equipment interfacing with other/different equipment control systems? Provide previous interface successes.
34. Indicate your experience with design and construction in tropical, marine, saline, corrosive and high UV environment. Provide references.
35. What are your typical stack height and contour area dimensions (including clearance zone) for the given solid waste profile?
36. Provide details about design considerations or improvements that come standard as part of the product portfolio.
37. Provide sufficient details of design aspects unique to your solution offering.
38. Provide typical Reliability, Availability, Maintainability (RAM) figures (proven by operation) for the various machine classes/sizes.



39. What are the safety mechanisms built in your SWTF against destructive incidents and permanent damage (e.g. due to overheating, short circuit, flooding, overpressure, control failure, etc.)?
40. What are the scalability characteristics (capability to be changed in size or scale based on future supply/demand developments) of the facility?

Environmental aspects

41. What are the environmental laws, regulations, conditions of operation and other compliances (e.g. vibration, odor, etc.) that are valid for your SWTF? According to which environmental standards is your WTEF designed?
42. Indicate possible environmental impacts.
43. What is the percentage of waste reduction (residual vs input solid waste) that can be expected from your SWTF, based on the provided solid waste profile?
44. How will the residual waste resulting from the processes be handled?
45. How does your handling of residual waste comply with the best environmental practices and standards?
46. What are the area/environment characterization information that you need for a detailed SWTF design?
47. What technologies do your WTEF utilize to conform to best practice emission requirements and standards, e.g. particulate matter, NO_x, SO_x, etc.

Operation and maintenance

48. Provide details on the operating philosophy possible for your products e.g. base load, peaking etc.
49. Provide your predictive and preventive maintenance guidelines.
50. Provide a typical Operation & Maintenance organization requirement to operate the facility.
51. What is the estimated number of personnel required to operate the SWTF for the given solid waste profile?



52. What are the training and competence requirements for personnel to operate the facility? Please indicate how the required skills and competencies can be developed.
53. What are your guidelines and solutions regarding occupational health and safety for personnel working in the facilities? Please specify the applied international standards.
54. How does the operation of your WTEF support grid stability?
55. Provide a typical start up support structure required from client.
56. Provide details of the failure mechanisms that drive the necessity for the intervals in the above-mentioned question.
57. What are your maintenance and outages schedules/intervals for a typical MRF and WTEF?

Economics related data

58. What is the estimate average capital cost per annual ton of capacity (USD/annual ton) for the given solid waste profile, location and a 24-hour operation?
59. What is the estimate average capital cost per power output (USD/MW) for the given solid waste profile, location and a 24-hour operation?
60. What are the operational costs (in USD/annual ton) of the SWTF for the given solid waste profile?
61. What are the estimate amount, composition and potential economic value of the recyclable materials and residual waste resulting from the waste to energy process?

Technical data

62. Provide the requested data/values as per Table 8 below:

Table 8 -Technical data

Item	Query	Materials Recovery Facility (MRF)	Waste To Energy Facility (WTEF)
a.	Facility Foot print – m2		
b.	Economical Facility Life cycle – years		
c.	Technical Facility Life cycle – years		
d.	Facility availability - %		



Item	Query	Materials Recovery Facility (MRF)	Waste To Energy Facility (WTEF)
e.	Cold start-up time requirement (to full load) – min		
f.	Start-up time requirement (after trip) – min		
g.	Shutdown time – min		
h.	Unit efficiency at minimum turndown - %		
i.	Unit efficiency heat rate – BTU/kWh		
j.	Net electric efficiency - %		
k.	Provide ramp up and ramp down capability – MW/Sec		
l.	Total facility equipment weight – kg		
m.	Operation & Maintenance cost – USD/MW/Year		
n.	Parasitic load/auxiliary – kWh		
o.	Plant air – scfh		
p.	Instrument air – scfh		
q.	Other		

CATEGORY 4: Project Management & Contracting Strategy

63. What is the typical completion period for the project; from Engineering to completion of construction?
64. What are the typical bottlenecks and how can they be eliminated?
65. Does your company perform Hazard and Operability assessments of the units?
66. What are the guarantees, warranties that you offer for your SWTF?
67. What contracting strategy do you recommend?
68. Indicate the budgetary estimated cost per the following contracting strategies:



- a. Engineering, Procurement, Construction (EPC).
- b. Engineering, Procurement, and Construction by the Government of Aruba (EP).
- c. Build Own Operate (BOO).
- d. Build Operate Transfer (BOT), with estimates to cover transfer period after 4, 8, 12 years.

Contracting Strategy	Transfer periods		
	4 years	8 years	12 years
BOT			

- e. Build Lease Transfer (BLT); design & build the SWTF and lease it to the Government of Aruba who will operate and maintain the SWTF. At expiry of lease agreement, the SWTF will be transferred to the Government of Aruba.

CATEGORY 5: Financial Aspect of Project

69. The Government of Aruba is currently exploring multiple financing options and is therefore requesting respondents to clearly provide capital financing options your company can provide and proposals regarding financing possibilities. Financing options should include percentage of interest rate for each option.

70. Respondents to include a recommendation on a Lease to Purchase option whereby Respondent finances, designs & constructs the SWTF and the Government of Aruba leases the facility from the respondent. The Government of Aruba will operate and maintain the facility.

71. Provide a general background on how you intend to finance this project if chosen for the finance option:

- a. Company Profile, financial and management capacity to handle a project as described above.
- b. What local government support do you anticipate being required to optimize the financing for the Project?

CATEGORY 6: Other Considerations

72. Provide the economic benefits (e.g. value creation through energy, recyclable materials, carbon credits) of your proposed solutions.



73. Provide the environmental benefits of your proposed solutions versus other waste management solutions and energy production solutions (e.g. HFO-based power plants).
74. Provide the economic and/or environmental challenges resulting from your proposed solutions.
75. Provide any novel or alternative technology that may benefit this project.
76. Propose an integral waste management plan that includes the end-to-end value chain for cost recovery.
77. For waste separation at the source, propose a solution that may facilitate or improve the treatment of Municipal Solid Waste (MSW), Commercial Waste (CW), and Construction and Demolition Waste (C&D) further in the value chain.
78. How can your company support the development of a business model and financing structure that validates the proposed integral waste management plan and value chain?
79. How will your company provide a socio-economic, public health and environmental impact assessment?

CATEGORY 7: Alternative proposal

80. Please provide any comments on other creative project scope ideas, procurement options, technical considerations, etc. that have proven to be successful and that would be of interest to The Government of Aruba.



APPENDIX B – Fact sheet waste management Aruba

Demographics

The population size of Aruba in 2016 was 110,300. The expected population size in 2026 is 114,085. The expected annual growth rates are based on the United Nations World Population Prospects (0.4% for 2015-2020, 0.3% for 2020-2025 and 0.23% for 2025-2030).

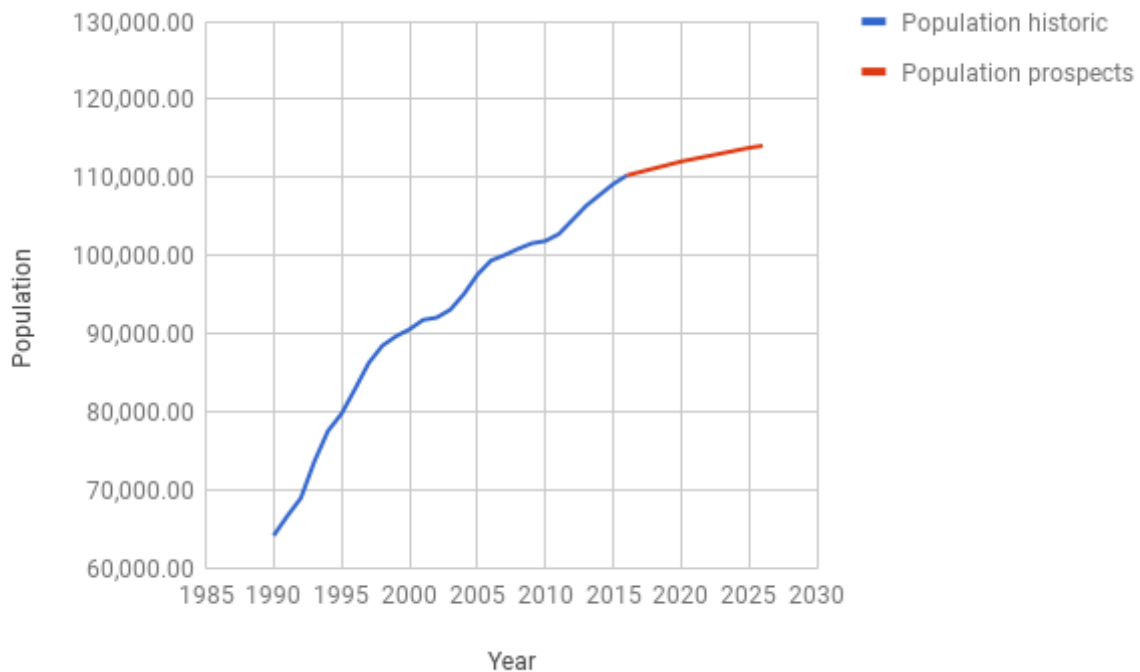


Figure B-1. Population of Aruba. Source: Central Bank of Aruba and United Nations World Population Prospects.

Baseline solid waste volume and composition in Aruba

The most recent data indicates that the amount of waste landfilled at Parkietenbos recorded for 2016 is 112,174 metric ton. Table B-1 and Figure B-2 show the waste composition[†]. The specific fractions consist of waste that was received at the landfill in separate fractions. No separation was done at the landfill. Common fractions such as glass,

[†] The classification applied for the Aruban waste can be found in the international standards (e.g. USA-EPA standards, European- EC standards).



plastic, and organic waste are not included in the table because either they were not registered or received in separate fraction.

Table B-1. Waste fractions 2014-2016 in metric tons

	Fractions	2014 [T]	2015 [T]	2016 [T]	2016 [%]
1	Paper and cardboard (incl. classified papers)	235	28	-	0
2	Metal	88	1444	6	0.01
3	Chemical and hazardous waste	46	270	174	0.16
4	(Bio) medical and infectious waste	134	125	215	0.19
5	Plant/Yard waste	13304	7802	1334	1.19
6	Sand	11169	13668	1719	1.53
7	Construction and demolition waste	-	-	5754	5.13
8	Sludge (sewage, kitchen, hotels)	7606	5276	4952	4.41
9	Tires	42	275	194	0.17
10	Household (HH), Commercial Waste (CW), Public Transfer Station (PTS) and residual waste	139436	104947	97822	87.21
	Total	172060	133835	112174	100

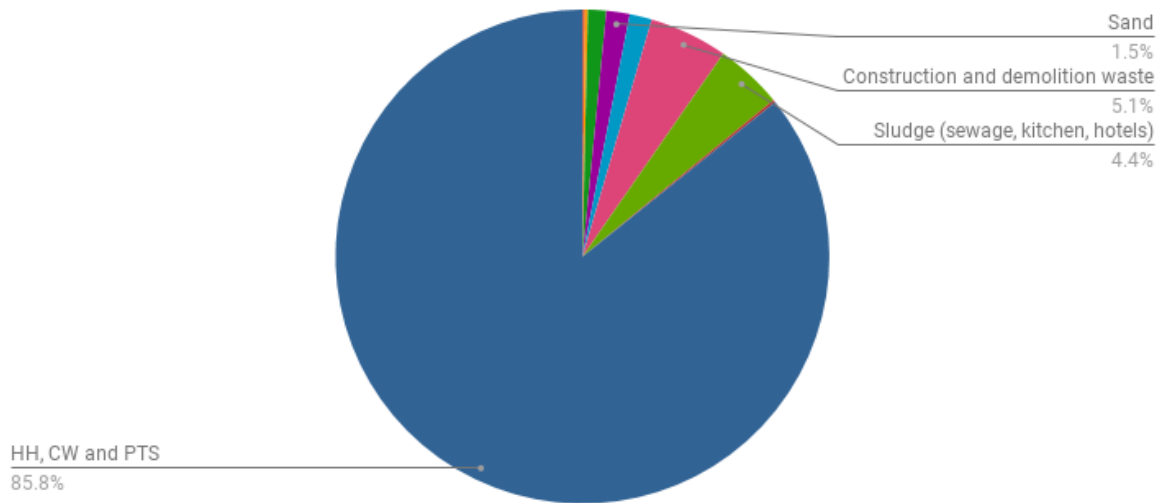


Figure B-2. Distribution of waste fractions in 2016. Source: Government of Aruba.

In 2016, the fraction of HH/CW/PTS counts for over 85% of the waste at Parkietenbos (Figure B-2). Although the fraction plastic was not registered, the plastic production by the tourism sector and by the local population is very high, which is also related to the fact that 90% of the consumables are imported. The amount of plant and yard waste is also relatively large as a result of the removal of vegetation due to the expansion of household area, maintenance of the roadsides and green areas.

Historic trends

The waste landfilled at Parkietenbos from 2003 to 2016 in total was 1,507,544 metric ton. The amount of waste per year fluctuated over the years, with its lowest peak in 2009 of 84,964 metric ton and its highest peak on 2014 of 172,060 metric ton (Figure B-3). These fluctuations respond to the following historical events:

- 2005: Introduction of the tipping fee.
- 2009: Closure of the refinery, an important driver of the Aruban economy.
- 2005 - 2014: Collection of waste (recyclable fractions and non-recyclable) from commercial businesses and some households by private companies. After processing



the waste, the remaining waste of the process, which corresponds to 80% of the collected waste, was landfilled at Parkietenbos (23,611 tons in 2013).

- In 2014, recycling activities carried out by private companies were ceased.

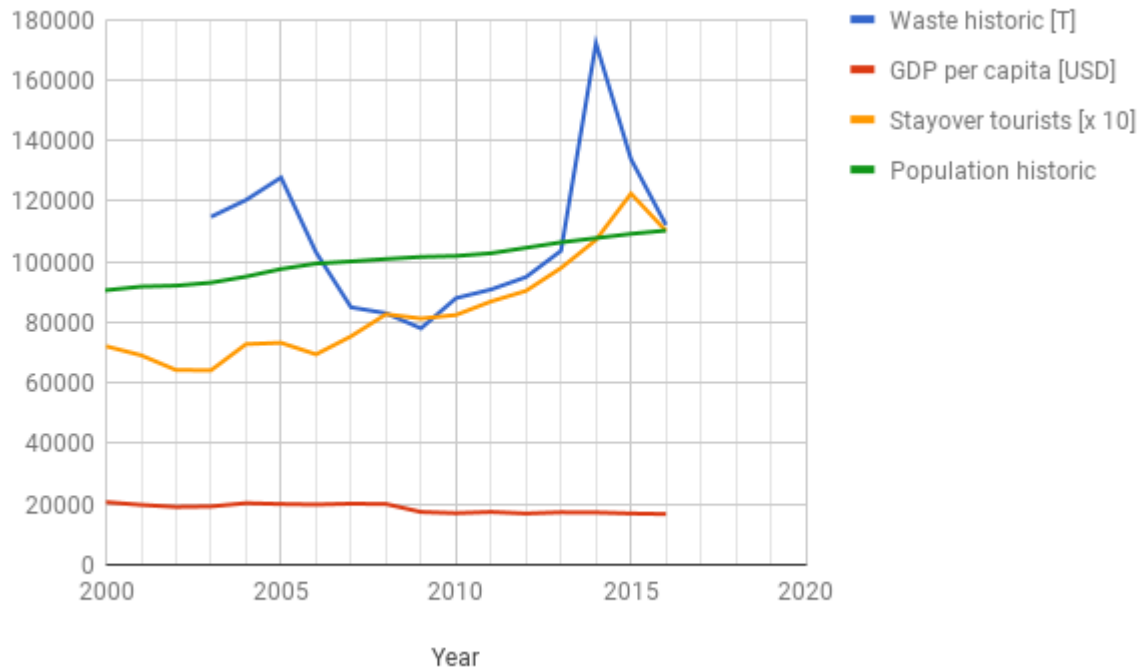


Figure B-3. Waste stream and economic indicators. Source: Government of Aruba, Central Bank of Aruba.

Based on a population of 110,300 in 2016, the 1,102,000 stay-over tourists have a share of around 15% in the total amount of waste produced on Aruba. The 656,000 cruise passengers account for only 0,5%. Furthermore, the direct impact of GDP will be between 2% and 4,5% on the total growth of the waste streams. On average Aruba citizens generate approximately 3 kg per person per day and tourists 2.5 kg per person per day. This may vary, since it is depending on the development of the GDP.

Future trends

The waste production by 2026 cannot be exactly estimated due several uncertain factors. However, based on the annual growth rate of the United Nations World Population



Prospects (0.4% for 2015-2020, 0.3% for 2020-2025 and 0.23% for 2025-2030) and the potential annual increase in tourism of 1%, an estimation of the future waste stream is presented hereby. The assumption is made that tourists and citizens produce similar amounts of waste per day. However, tourists only stay for approximately one week.

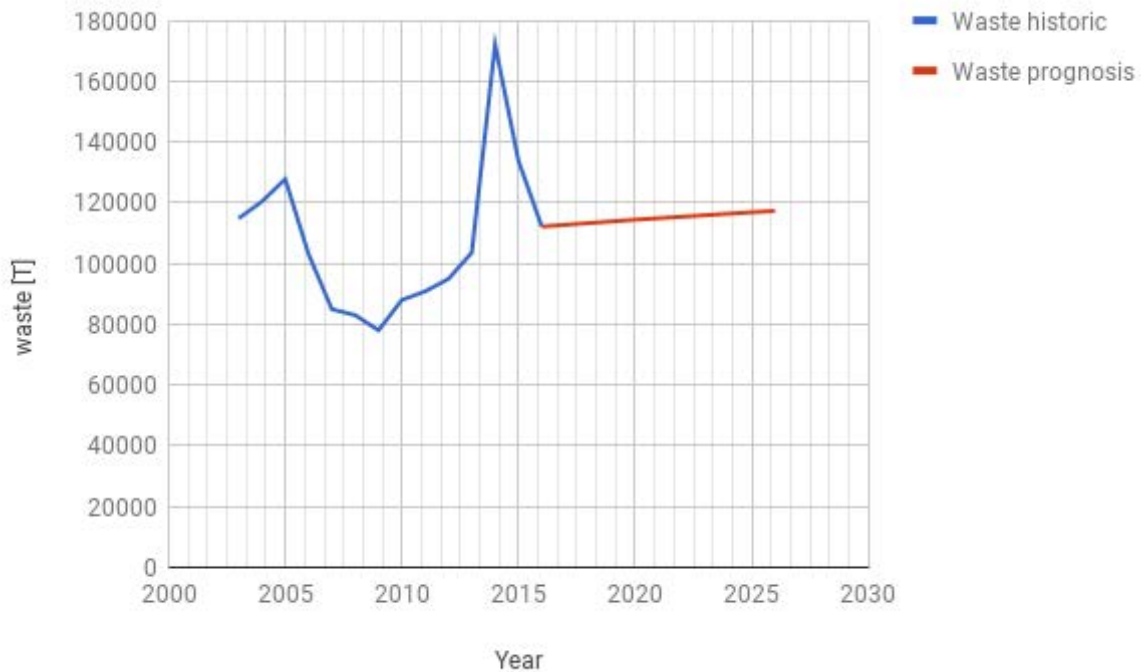


Figure B-4. Waste production prognosis for 2026. Source: Government of Aruba.

Remarks and issues

The following issues were identified:

- Currently the Department of Nature and Environment ('Directie Natuur en Milieu') is working on a policy plan for waste and on legislation regarding waste management. Until now there is a limited regulatory framework that controls waste management on Aruba.
- The landfill at Parkietenbos is close to its maximum capacity. Only vertical extension is possible, but this involves risks. At the same time the landscape will be deteriorating further (visual pollution);
- The current landfill has no facilities for capturing and utilizing gas from the waste;



- Aside from the lack of extension possibilities, fires regularly occur on the landfill as a result from the physical and chemical processes in the waste;
- Between 2005-2010 an estimate of 30.000 to 40.000 metric ton per year was dumped at illegal dump sites;
- Until now there is no installation on Aruba for the incineration of (bio) medical and infectious waste. This waste is landfilled and burned;
- Chemical and hazardous substances are landfilled without any processing;
- Aruba has no harbor waste collection facility[‡], the waste from ships is being disposed at Parkietenbos without further processing or separation into fractions.

Serlimar has introduced a standard waste container called the 'clico' a few years ago. However, separated collection is not a common practice and there are no other dedicated containers in the city or neighborhoods.

[‡] Although the waste from ships is being collected in Aruba's harbor, it does not mean that there is a proper harbor waste collection facility. The waste from ships is dumped without any separation into open containers that are emptied on dumping ground Parkietenbos. A similar situation can be found on other islands where waste from ships is collected.



Acronyms

BAT	Best Available Technologies
BLT	Build Lease Transfer
BOO	Build Own Operate
BOT	Build Operate Transfer
CW	Commercial Waste
C&D	Construction and Demolition Waste
DCS	Distributed Control System
EP	Engineering, Procurement (Construction by the Government of Aruba)
EPC	Engineering, Procurement, Construction
GDP	Gross Domestic Product.
HFO	Heavy Fuel Oil
HMI	Human Machine Interface
MCC	Motor Control Center
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
PFD	Process Flow Diagram
PLC	Programmable Logic Controllers
RDF	Refuse Derived Fuel
RECIP	Reciprocating Internal Combustion Engines
SCADA	Supervisory Control & Data Acquisition
SWTF	Solid Waste Treatment Facility
VFD	Variable Frequency Drive
WTEF	Waste To Energy Facility