

# REQUEST FOR EXPRESSIONS OF INTEREST 19-0631

**MATANUSKA-SUSITNA BOROUGH  
PURCHASING DIVISION  
PALMER, ALASKA**



**WASTE AND SEPTAGE WASTE MANAGEMENT  
TECHNOLOGIES**

**CLOSING DATE & TIME: March 5, 2019 @ 4:00 PM**

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# 1 Introduction

The Matanuska-Susitna Borough (MSB) is issuing this Request for Expressions of Interest (RFEOI) as a first step in the MSB's exploration of waste management options. Specifically, the MSB desires to better understand the current market capabilities for waste management technology solution to manage residues from the Borough's existing solid and future liquid waste management facilities which could generate energy/revenues and/or produce byproducts of value compared to current landfill disposal methods.

The MSB would like to demonstrate leadership and find a solution that places them at the leading edge of resource recovery, broadening the search for technologies to those that could manage all or some of these materials in an integrated approach to the extent possible.

**Any information provided in response to this RFEOI may be included in public report(s) and will be considered public record.**

# 2 Background

Solid and liquid waste management within the MSB are currently driven by different regulatory and governance requirements. The MSB is seeking a solution or solutions to manage some or all of the following materials, all of which is continuing to grow in time due to increased population:

1. Approximately 80,000 or more tons per year of solid waste consisting of approximately 60,000 tons per year of municipal solid waste (MSW) from residential and commercial generators and approximately 20,000 tons per year of Construction and Demolition (C&D) waste.
2. Approximately 13 million gallons of septage per year.

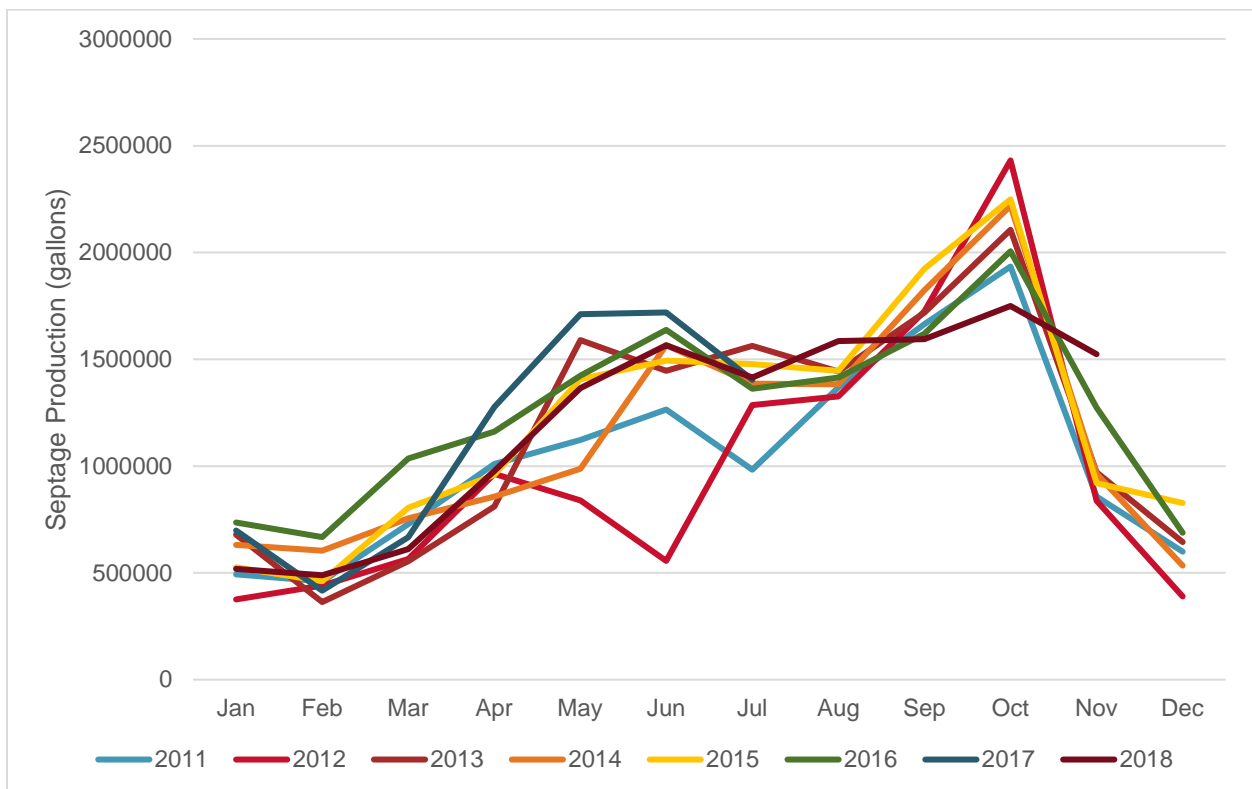
The MSB does not have flow control of commercial or industrial MSW within the Borough. There are no mandatory collection requirements and no source separated collection programs for recyclables for waste generators in the Borough. All MSW collected in the Borough is landfilled at the MSB landfill. All reference to tonnages for respective feedstock is understood as being an estimate of future volumes based on currently generated quantities. The table below summarizes the approximate makeup of the septage.

**Table 2-1. Composition Data of Septage**

Constituent	Units	Septage
Flow	MG/yr	15
Flow	Gpd	41,096
COD	mg/L	3,490
BOD	mg/L	1,850
TSS	mg/L	2,380
TS	mg/L	3,680
TDS	mg/L	1,300
TKN	mg/L	217

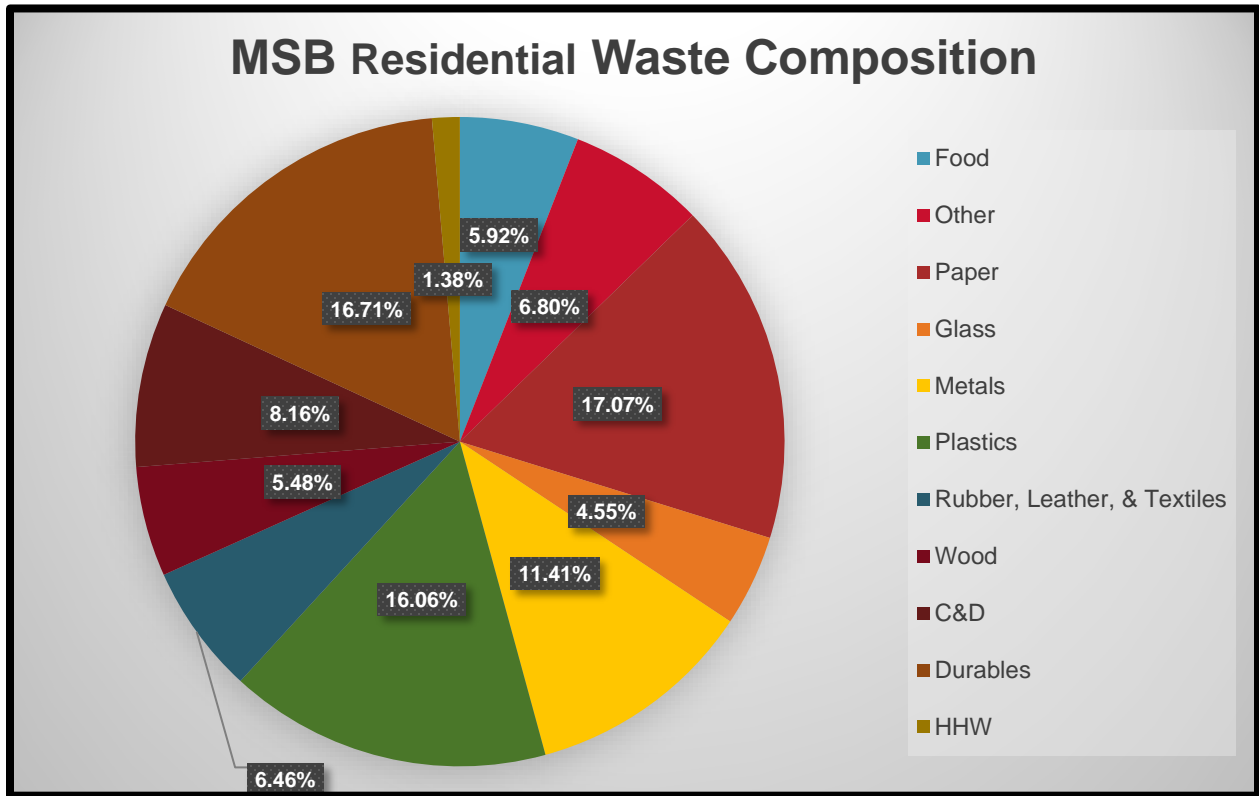
The septage quantities produced vary significantly throughout the year. Figure 1 below provides a graphical representation of the septage production per month from 2011-2018 and shows a typical sharp increase in the septage pumping activities and volume in the month of October.

**Figure 2-1. Monthly Variation of MSB Septage Production (2011-2018)**



The Borough has performed an initial waste composition analysis of both Residential and Construction & Demolition materials. The following analysis of the data from an initial waste composition study performed in September through December, 2018, data reveals the MSB waste is comprised of the following materials by source of generator:

Figure 2-2. Total Residential MSW Generation (by Material) Collected by MSB during 2018 Initial Waste Composition Study



Note: 2,141 Tons of Residential MSW were analyzed during the study.

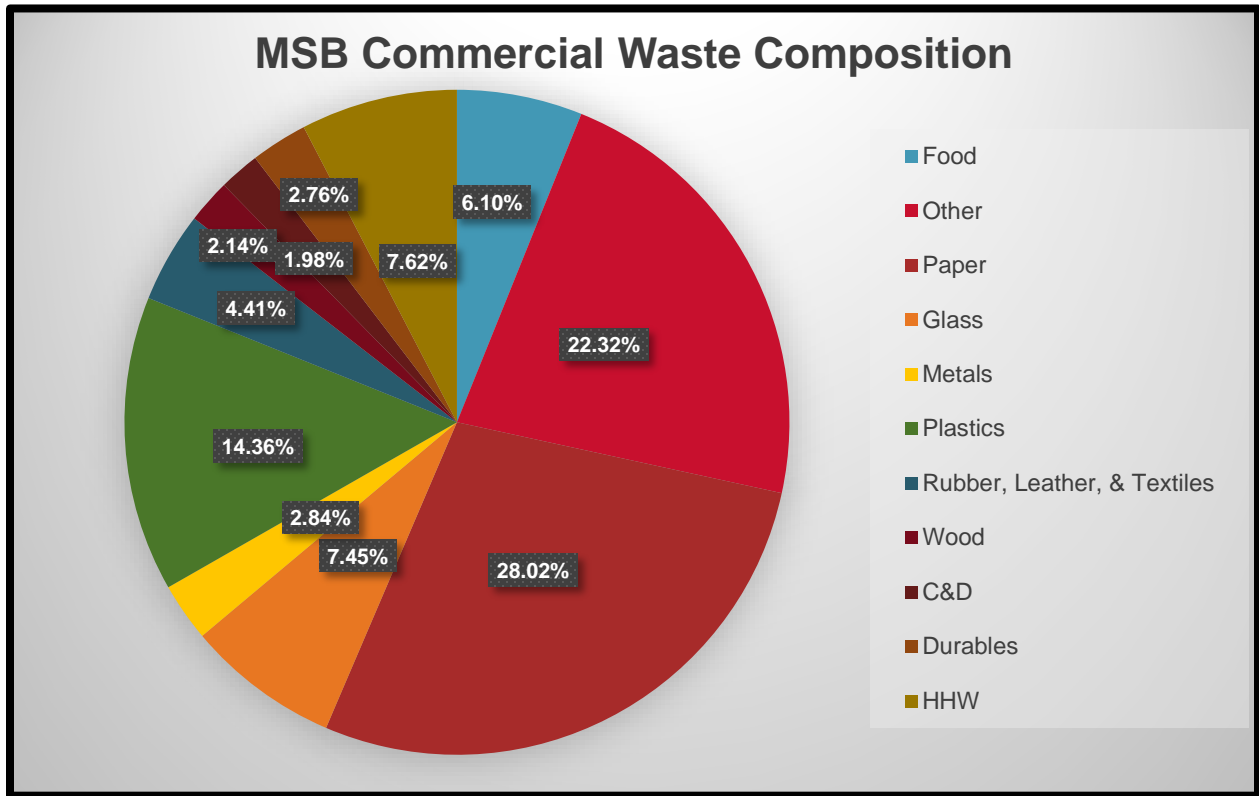
The Residential MSW composition is also illustrated in tabular form in the table below.

Table 2-2. Total Residential MSW Generation (by Material) Collected by MSB during 2018 Initial Waste Composition Study

Material	Composition (Percent of Total by Weight)
Food	5.9%
Other	6.8%
Paper	17.1%
Glass	4.5%
Metals	11.4%
Plastics	16.1%
Rubber, Leather, & Textiles	6.5%
Wood	5.5%
C&D	8.16%
Durables	16.71%
HHW	1.38%
Yard Waste	0.0%



Figure 2-3. Total Commercial MSW Generation (by Material) Collected by MSB during 2018 Initial Waste Collection Study



Note: 1,117 tons of Commercial MSW were analyzed during the study.

The Commercial MSW composition is also illustrated in tabular form in the table below.

Table 2-3. Total Commercial MSW Generation (by Material) Collected by MSB during 2018 Initial Waste Collection Study

Material	Composition (Percent of Total by Weight)
Food	6.10%
Other	22.32%
Paper	28.02%
Glass	7.45%
Metals	2.84%
Plastics	14.36%
Rubber, Leather, & Textiles	4.41%
Wood	2.14%
C&D	1.98%
Durables	2.76%
HHW	7.62%
Yard Waste	0.0%

Data was collected from 12 rear-load trucks throughout the sampling period. Nine trucks containing residential waste were analyzed between October and December, and four trucks containing commercial and institutional waste were analyzed between December 11th and December 15th. The main components for Commercial MSW in the “Other” category include Fines/Super Mix (20.72%). It should be noted that additional waste composition information will be provided as the MSB continues to perform waste sampling and analysis in the future.

MSW generated in the MSB is managed at the Central Mat Su Landfill which is owned and operated by the MSB. The Central Mat Su Landfill is located at 1201 N. 49th State Street approximately three miles west of Palmer. At the current rate of fill, the Central landfill has over 162 years of life remaining. As of 2018 the charge for general refuse is currently \$131/ton. The landfill is not equipped with a landfill gas collection and control system. C&D wastes generated in the MSB are allowed to be placed in non-lined C&D monofills which are regulated by the Alaska Department of Environmental Control. The MSB does not own or operate any C&D monofills or landfills.

The MSB has a vision to extend the life of the Central Landfill or possibly replace the landfill with a process that beneficially uses the MSW, converting them to energy or useful products. Central to this vision is the development of an integrated waste management solution to manage solid waste in lieu of direct landfilling. On a preliminary basis, the MSB has identified approximately a portion of the Central Landfill site property that could be available for siting and development of some form of future integrated waste management solution.

Respondents to this RFEOI should note that it is the intent of the MSB to engage an integrated waste management solution that at minimum would allow for management of both the MSW and the septage liquid streams. Although MSB prefers responses that address all of the waste streams, MSB is also open to solutions that only address specific waste streams.

### 3 Purpose

The purpose of this RFEOI is to gather information on potentially viable alternatives for processing of the existing solid and future liquid waste materials that are/will be managed by the MSB. These alternatives will be considered, and the information will be used to support decision making on the ultimate feedstock, resource/waste processing system configuration and the future procurement steps. The goal of the MSB is to put in place a full scale integrated solution that provides a long term environmentally and economically sustainable system to manage all of the waste streams identified above and generate energy/revenues or byproduct of value.

This RFEOI includes solicitation of information regarding the Respondents experience with full-scale solutions capable of processing feedstock similar to that being proposed to meet the needs of MSB. One aspect of this RFEOI is to obtain information from Respondents that will permit MSB to determine whether or not achieving the goal of a full scale integrated system will require a Pilot program(s) for specific combinations of feedstock and technology prior to making the significant investment associated with implementation of a commercial scale system. Depending on the track record of the

application of specific technologies to the type of feedstock being proposed, MSB will assess whether or not a Pilot initiative is warranted. As part of this RFEOI, MSB is seeking interested vendors to confirm:

1. the capability of the vendors to provide a full scale integrated solution to manage the MSB solid and liquid waste streams as identified;
2. the need for a Pilot program (based in part on the status of reference facilities) to demonstrate capability to manage some or all of the MSB solid and liquid waste streams;
3. the level of interest in and viability of the private sector undertaking a pilot program if it would be needed to provide critical data related to the management of MSB's solid and future liquid waste materials; and,
4. a description of specific value added assets/support that the Respondents can bring to a Pilot initiative.

## 4 General Terms and Conditions

Issuance of the RFEOI, and/or the decision not to proceed with the RFQ or RFP, will not cause the MSB to be liable for any costs incurred by Respondents.

The MSB may, in its sole and absolute discretion, independently verify any information in any submission. The MSB reserves the right to debrief Respondents regarding the outcome of the RFEOI.

This RFEOI does not create a tender or RFP process. This RFEOI is not an offer to contract made by the MSB. By this RFEOI, the MSB reserves to itself the right to review, consider and analyze the RFEOI's, select short-listed respondents, and sign a future agreement with one or multiple respondents. Without limiting the generality of the foregoing, the MSB reserves the right to:

1. reject any RFEOI response, whether or not complete and whether or not it contains all the requested information;
2. require clarification of any RFEOI response;
3. request additional information on any RFEOI respondent;
4. reject any or all RFEOI responses without any obligation, or any compensation or reimbursement to the Respondents;
5. refuse to proceed with the RFQ, RFP , pilot or commercial facility;
6. modify this RFEOI at any time;
7. proceed with the project in some other manner separate from this RFEOI; and
8. re-advertise for new submissions for this work or for work of a similar nature or cease the effort.

## 5 Part A – Processing Technologies

The primary goal of this RFEOI is to identify technologies which could be implemented at the MSB landfill or elsewhere in the MSB as part of a waste management strategy for the Borough's current solid and future liquid residue waste streams. Minimization of technology, operational and commercial risk is a core concern for the MSB, and therefore the field of potential solutions for consideration under this RFEOI should be focused on technologies that are (at least individually in the case of combination schemes) proven at a commercial scale on similar feedstock(s). Proposed solutions should in particular demonstrate proven ability to meet the scope of MSB's waste management needs and goals including:

1. **Technical and commercial maturity**, integrate at scale robust and proven systems for feedstock pre-treatment, emission control and safe handling and disposal of processing residues;
2. **Process and feedstock flexibility**, provide a high degree of integration with other resource opportunities within the Borough;
3. Maximum **energy output flexibility**, including but not limited to:
  - a. direct use of raw conversion products (e.g. synthesis gas, biogas, methane or other off-gasses and char residues if produced) for the generation of power and heat on site, or
  - b. their upgrading into high-order energy carriers or products (such as substitute natural gas or hydrogen, renewable natural gas, compressed natural gas, diesel, bunker fuels, or equivalent products, etc.) that can be used for transport fleets and/or delivered off-site;
4. **Cost-effectiveness**, providing lowest overall net cost to the MSB, with the goal to establish a long-term least cost solution to integrate resource management needs across the Borough (to clarify, MSB will not participate in the cost of capital improvements for any offerings or pilot project costs);
5. **Sustainability**, ensuring the least impact to the public and the environment;
6. **Maximize** beneficial reuse opportunities to recover resources from waste; and,
7. **GHG emission** reduction potential and minimization or avoidance of future costs of landfill gas collection.

### 5.1 Part A Technology Details

Respondents should provide sufficient information to determine if their technology and concept has the potential to address the needs of the Borough to manage some or all of its solid and liquid wastes, based on technical information, existing reference facilities and experience. For this purpose, respondents are requested to provide with their responses the following key **technology verification details**:

1. a **technical overview** of the proposed technology (or technologies for combination schemes), including details of the core technology, key processing subsystems, acceptable feedstock materials, products, scalability and other details pertinent to the

application of this technology as an integrated full-scale solution to manage MSB materials.

2. a list of **reference facilities** with details regarding the development and financing approach for the facility, feedstock managed and operational track record as well as indicative costs.

Respondents are requested to indicate their interest and approach to exploring and implementing solutions for managing MSB materials in **Attachment A**, Respondent Preference Summary. Respondents are requested to provide an overview of the elements that they have found in their experience to result in successful implementation of a project including (but not limited to):

1. Preferred contractual model and long term relationship expectations (DB, DBOM, DBFOM, DBOOM);
2. Preference to siting a facility (site provided by MSB, site provided by respondent);
3. Ability to secure capital funding applicable to the preferred contracting/financing model;
4. Ability to secure regulatory approval, permits, etc.;
5. Willingness to offer performance guarantees;
6. Willingness to take responsibility for establishing/entering into required offtake agreements; and,
7. The allocation of other areas of responsibility associated with design, construction, operation and maintenance of a facility(ies).

## 6 Part B – Pilot Program

As part of the evaluation process instructed under this RFEOI, MSB is interested in:

1. Assessing whether the need exists for a Pilot program to demonstrate the efficacy of their proposed technology;
2. Identifying the types of assets that the Respondents bring to the opportunity; and,
3. Determining the Respondents willingness to engage with the MSB in carrying out a Pilot program to demonstrate the ability of their proposed technology to effectively upcycle applicable feedstock(s) for those feedstock materials which lack a reference facility at the scale required.

The MSB understands and acknowledges that the facility where the pilot could be carried out may be at a designated site within the MSB or might be at an existing site out of the Borough commercial or demonstration facility. In order to be considered for the commercial scale project, respondents will need to clearly demonstrate that the key conversion technology (or technologies) have the commercial maturity, scalability, demonstrated ability to handle the feedstock(s) and product flexibility required to meet the Borough's current and future integrated resource management needs. A Pilot program will be considered in those instances where the applicable technology has not been demonstrated within a reasonable scale on the feedstock proposed. Respondents

are requested to identify potential pilot program candidates in **Attachment B**, Potential Pilot Program Candidates.

Available information regarding material composition is provided in **Attachment C**. Respondents should note for the MSB any specific analyses that they would find necessary to determine if a pilot is reasonable/required for their technology.

Respondents are requested to provide data regarding what elements of a pilot project they are able to provide, including any details regarding the location and size of the Pilot, feedstock preparation, Product marketing, and Residuals management.

## 7 Submission Requirements

The following information is requested but Respondents may provide any portion or all of the information requested below, at their discretion. Respondents should be aware that the more information that is provided the better able the MSB will be to assess the Respondents potential added value in meeting the MSB's needs.

The purpose of the RFEOI process is to gather as much information as possible ensuring the MSB is an informed customer and that our eventual RFPQ and/or RFP documents and evaluation criteria consider all key aspects in a procurement of this nature – including various technology options. There will be no contract awarded as a result of this RFEOI process. This is an information gathering exercise only and does not preclude any interested party from participation in any subsequent procurement opportunity. Your response to this RFEOI should include detailed information about your company, previous experience, your technology and your place in the market. Interviews/presentations may be scheduled as part of this process.

To assist with the review of submissions, information should be provided in five sections as noted below.

### 7.1 Section 1 - General Corporate Information

Provide an overview of your corporation or entity including information about your structure, year, and jurisdiction of incorporation or establishment and primary lines of business. Information should include:

1. legal name
2. address
3. business e-mail address
4. business phone number
5. contact name
6. contact e-mail address
7. contact phone number

## 7.2 Section 2 – Processing Technology

Provide a **technical overview** of the proposed technology (or technologies for combination schemes), including:

1. an overview of the core technology with details of the range of designs and processing capacities available;
2. an overall process schematic diagram illustrating waste and auxiliary inputs, conversion outputs and processing residues;
3. a detailed list of key processing subsystems and components;
4. details of acceptable feedstock composition and quantity and typical feedstock pre-processing requirements (e.g. feedstock sorting/separation, moisture and size reduction requirements) necessary the proposed technology;
5. information regarding the scalability of the technology and capability to provide a full-scale integrated solution to manage the MSB solid and liquid waste streams;
6. identification of potential site size and siting requirements (e.g. access to key infrastructure);
7. ability to meet environmental standards (e.g. air, noise and wastewater emissions); and,
8. any other information that would be pertinent for the application of the proposed technology for the MSB which could include (but not be limited to):
  - a. Typical energy balance;
  - b. GHG emission reduction potential;
  - c. Potential markets for recovered materials.

## 7.3 Section 3 – Reference Facilities

Provide a list of **reference facilities** with details regarding:

1. site and location (including type of setting e.g. rural / urban);
2. owner/operator (including reference contact details and ability to visit);
3. year of entry into service and current status (under construction/commissioning/operational/ decommissioned);
4. type of feedstock and throughput capacity (in tons per day);
5. average annual plant availability;
6. average annual product and residue yields;
7. indicative capital costs (noting the timeframe the capital investment was made) and annual operating and maintenance costs (total or on a per ton-year basis);
8. land area requirements (including waste storage and all auxiliaries);
9. general mass and energy balances for the reference facilities, noting all energy and other inputs; to the process as well as all outputs; and

10. a description of financing sources and uses.
11. A description of the regulatory approval/permit process

## 7.4 Section 4 – Preferred Project Arrangements

Provide information as outlined in **Attachment A**, Respondent Preferred Project Arrangements including:

1. A.1 Preferred Project Business/Contract Structure; and,
2. A.2 Preferred Allocation of Responsibilities.

Respondents can include additional detail in this section as it relates to their preferred project arrangements, beyond that outlined in **Attachment A**.

## 7.5 Section 5 – Pilot Program

Provide information as outlined in **Attachment B**, Potential Pilot Program Candidates. Please complete the table summarizing your planned approach to managing MSB materials and whether or not a pilot would be appropriate based on your preferred feedstock(s) and proposed technology solution. Respondents can include additional detail in this section as it relates to the potential role of a pilot program in the implementation of a pilot program related to their specific technology.

# 8 Submission Review

The MSB will review and analyze the RFEOI submissions seeking to identify those that demonstrate proven ability to meet in full the scope of MSB's waste management needs and goals. The MSB reserves the right to retain additional expertise to support the submission review process. Key aspects of the submissions that will be assessed in the review process will include:

1. The capability of the technology to provide a comprehensive integrated resource management solution based on the technology overview;
2. The responses to **Attachment A**, particularly as it relates to potential risks and allocation of risk;
3. Whether the technology represents a proven technology for managing the MSB's solid and liquid waste streams based on the reference facility information;
4. The range of costs as identified for the reference facilities; and,
5. GHG emission reduction potential and carbon neutrality.



## 9 Conflict of Interest

A Respondent must disclose in their Response any actual or potential conflicts of interest and existing business relationships it may have with the MSB, its elected or appointed officials or employees.

## 10 Limitation of Liability and No Claim

The MSB and its directors, officers, employees, agents, consultants and advisors are not liable or responsible for any oral, verbal or written information, or any advice, or any errors or omissions, which may be contained in this RFEOI or otherwise provided to a Respondent pursuant to this RFEOI. The MSB and its representatives, agents, consultants and advisors will not be liable to any Respondent for any claims, whether for costs, expenses, losses or damages, or loss of anticipated profits, or for any other types of change whatsoever, incurred by a Respondent in preparing or making a submission, or participating in any discussions or negotiations or any other activity related to or arising out of this RFEOI.

By responding to this RFEOI a Respondent agrees that it will conduct its own independent investigations and interpretations and will not rely on the MSB with respect to information, advice, or documentation provided by the MSB.

For certainty, no contractual relations shall exist between the MSB and any Respondent to this RFEOI, except that by submitting a response to this RFEOI a Respondent acknowledges and accepts the provisions of this section, General Terms and Conditions.

## 11 Ownership of Submissions/Confidentiality

All documents submitted to the MSB, including all RFEOI response documents, any drawings, plans and models (as applicable), become the property of the MSB and will not be returned to the Respondent. They will be received and held in confidence by the MSB, subject to the provisions of the Alaska Public Records Act (APRA).

APRA governs the collection, use, retention, security, and disclosure of personal information managed by public organizations, including the MSB. APRA also applies to all electronic information accessed or submitted by Respondents. If the Respondents believes the RFEOI and any related documents contain protected, proprietary or confidential information, Respondents should identify the specific issue that the Respondent believes is confidential or information and provide supporting reasons why the MSB should not release this information if requested by a Public Records Request.

## 12 Future Process

Participation in this RFEOI and the submission of a response to this RFEOI is not a pre-condition to participation in a subsequent commercial process, if any. If the MSB decides, at its sole and absolute discretion, to implement a subsequent commercial

process, the MSB may invite respondents who did not participate in this RFEOI to participate in such subsequent process.

## 13 Form of Submission and Address

Respondents are to submit five (5) complete hard copies of their submission along with one electronically readable copy of the submission on a USB stick; both shall be enclosed in a sealed envelope, addressed, marked, and delivered to the following address:

Matanuska-Susitna Borough  
Purchasing Division  
350 E. Dahlia Avenue  
Palmer, Alaska 99645

Responses submitted by facsimile communication equipment (FAX) or email will not be considered.

## 14 Closing Date and Time: March 5, 2019 @ 4:00 PM.

Late responses may be considered at the sole and absolute discretion of the MSB. However, the MSB is not obligated to consider late responses.

Respondents must register with the MSB Purchasing Division to be included on the Registered Respondents List and in order to receive any further communications regarding this RFEOI issued by the Owner.

All communications regarding this RFEOI shall be directed to MSB Purchasing at (907) 861-8601, or e-mail [purchasing@matsugov.us](mailto:purchasing@matsugov.us).



# Attachment A

## Respondent Preference Summary

**A.1 Respondent Preferred Project Arrangements**

<b>Key Project Element</b>	<b>Respondent Preference</b>	<b>Rationale</b>
Term of Agreement		
Deal Structure (ie. Design-Build (DB), DBOM (Design Build Operate Maintain) , DBOOM (Design Build Own Operate Maintain) DBFOM (Design Build Finance Operate Maintain)		

**A.2 Preferred Allocation of Responsibilities**

<b>Key Project Element</b>	<b>MSB Responsibility</b>	<b>Respondent Responsibility</b>	<b>Shared</b>	<b>Comment/Rationale</b>
Provide Site				
Provide financing				
Arrange Offtake Agreements for Output				
Manage Residuals/Provide Disposal Site				
Own the Facility				
Provide Feedstocks				
Obtain Permits/Licenses				
Site Utilities				

**Waste and Septage Waste Management Technologies  
Request for Expressions of Interest**

Geotechnical Risk				
Stakeholder Outreach/Interface				
Performance Guarantees				
Construction Schedule				
Construction Deficiencies				
Compliance with Emission Standards/Regulations				
Sourcing Merchant Waste				
Energy/Commodity Price Risk				



## Attachment B

# Potential Pilot Program Candidates



**Waste and Septage Waste Management Technologies  
Request for Expressions of Interest**

Please complete the following table summarizing your planned approach to managing MSB materials and whether or not a pilot would be appropriate based on your preferred feedstock(s) and proposed technology solution.

**B.1 Pilot Recommendations**

<b>Feedstock</b>	<b>Proposed Technology Solution</b>	<b>Demonstrated at Commercial Scale at our reference facility</b>	<b>Recommend Pilot Program</b>	<b>Comment</b>
MSW (Residential and commercial waste )				
Septage				

## Attachment C

### Material Stream Information for MSW

**MSB Waste Characterization Study**  
**Material Categorization - Residential Haul**

		December 07 2018	December 13 2018		December 13 2018		December 14 2018		December 14 2018		November 14 2018		October 14 2018		January 15 2018		December 15 2018		TOTAL	%	
		Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)			
Paper	Newsprint	5		0		0		0		0		0		0		0	21	1.3125	6.3125	0.29%	
	Magazines	7.2		0		0		0		0		0		0		0	36	2.25	9.45	0.44%	
	High Grade Office Paper	2.4		0		0		0		0		0		0		0	22	1.375	3.775	0.18%	
	OCC and Kraft Bags		88	5.5	95	5.9375	151	9.4375	201	12.5625	545	34.0625	616	38.5	343	21.4375	723	45.1875	172.625	8.06%	
	Mixed Recyclable Paper	6	59	3.6875	155	9.6875	70	4.375		0		0		0	45	2.8125	193	12.0625	38.625	1.80%	
	Non-Recyclable Paper	8	39	2.4375	37	2.3125	30	1.875		0		0		0		0	41	2.5625	17.1875	0.80%	
	Compostable Paper	5.4	427	26.6875	327	20.4375	126	7.875		0	485	30.3125		0	188	11.75	241	15.0625	117.525	5.49%	
Plastics	#1 PET Beverage Containers	19.3	46	2.875	111	6.9375	130	8.125	95	5.9375		0	208	13	86	5.375	251	15.6875	77.2375	3.61%	
	#2 HDPE Containers	8.5	24	1.5	40	2.5	156	9.75	57	3.5625		0		0	107	6.6875	199	12.4375	44.9375	2.10%	
	Other Plastic Containers	4.2	69	4.3125	56	3.5	70	4.375		0		0	145	9.0625	49	3.0625	51	3.1875	31.7	1.48%	
	Other Plastic Products	16.4	150	9.375	305	19.0625	377	23.5625	620	38.75		0		0	341	21.3125	296	18.5	146.9625	6.86%	
	Film/Wrap/Bags	3.2	172	10.75	163	10.1875	70	4.375	57	3.5625	55	3.4375		0	77	4.8125	42	2.625	42.95	2.01%	
Metals	Aluminum Beverage Containers	11.7	36	2.25	97	6.0625	234	14.625	91	5.6875	23	1.4375		0	334	20.875	190	11.875	74.5125	3.48%	
	Ferrous Food and Beverage	2.2	81	5.0625	20	1.25	73	4.5625		0		0		0		0	131	8.1875	21.2625	0.99%	
	Other Ferrous Metals	3.3	37	2.3125	287	17.9375	80	5	698	43.625		0		0	101	6.3125	205	12.8125	91.3	4.26%	
	Other Non-Ferrous Scrap	1.1	4	0.25	1	0.0625	0	0	36	2.25		0		0	736	46	122	7.625	57.2875	2.68%	
Glass	Clear Glass	2.3	193	12.0625	161	10.0625	70	4.375		0		0	430	26.875	32	2	121	7.5625	65.2375	3.05%	
	Colored Glass	3.5	57	3.5625	123	7.6875	90	5.625		0		0		0	15	0.9375	140	8.75	30.0625	1.40%	
	Other Mixed Cullet	2.1		0		0		0		0		0		0		0		0	2.1	0.10%	
Yard Waste	Grass and Leaves			0		0		0		0		0		0		0		0	0	0	0.00%
	Brush and Trees			0		0		0		0		0		0		0		0	0	0	0.00%
Wood	Non-Treated Wood	3	13	0.8125		0		0		0		0	669	41.8125	80	5	74	4.625	55.25	2.58%	
	Treated Wood			0		0		0	445	27.8125	482	30.125		0		0	66	4.125	62.0625	2.90%	
Durables	Electrical and Household Appliances	1.4	2	0.125	17	1.0625	588	36.75	1123	70.1875	1031	64.4375		0	23	1.4375	32	2	177.4	8.29%	
	Computers, CPUs/Peripherals, TVs			0		0		0		0		0	764	47.75	296	18.5	970	60.625	126.875	5.93%	
	Cell Phones and Chargers	0.4		0		0		0		0		0		0		0		0	0.4	0.02%	

		December 07 2018	December 13 2018		December 13 2018		December 14 2018		December 14 2018		November 14 2018		October 14 2018		January 15 2018		December 15 2018		TOTAL	%
		Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)		
	Other Durables			0		0		0		0		0		0	850	53.125		0	53.125	2.48%
HHW	Liquid HHW	5.7	13	0.8125		0		0		0		0		0		0	15	0.9375	7.45	0.35%
	Automotive and Lead Acid Batteries			0		0		0		0		0		0		0		0	0	0.00%
	Other Batteries			0	2	0.125		0	3	0.1875	227	14.1875		0		0	14	0.875	15.375	0.72%
	Mercury Containing Products			0		0		0		0		0		0		0		0	0	0.00%
	Other HHW		27	1.6875	14	0.875		0		0		0		0	23	1.4375	42	2.625	6.625	0.31%
Other	Food Waste	7.3	219	13.6875	902	56.375		0	124	7.75		0	460	28.75	80	5	127	7.9375	126.8	5.92%
	C&D	12.7	574	35.875	260	16.25	903	56.4375	281	17.5625		0	470	29.375		0	105	6.5625	174.7625	8.16%
	Textiles and Leathers	9.2	690	43.125	8	0.5	729	45.5625	30	1.875		0		0		0	206	12.875	113.1375	5.28%
	Diapers	3.7	89	5.5625	19	1.1875		0		0		0		0		0	71	4.4375	14.8875	0.70%
	Rubber			0		0		0	47	2.9375		0		0	320	20	37	2.3125	25.25	1.18%
	Tires			0		0		0		0		0		0		0		0	0	0.00%
	Sharps			0		0		0		0		0		0		0	22	1.375	1.375	0.06%
	Other Organic	1.3	28	1.75	180	11.25	46	2.875		0		0		0		0		0	17.175	0.80%
	Other Inorganic	2.4		0		0		0		0		0		0		0		0	2.4	0.11%
	Fines/Super Mix	1	314	19.625	555	34.6875	80	5		0	530	33.125		0	42	2.625	142	8.875	104.9375	4.90%
Other			0	77	4.8125		0		0		0		0		0		0	4.8125	0.22%	
WEIGHTS	Sum of all Individual Weights	159.9	3451	215.6875	4012	250.75	4073	254.5625	3908	244.25	3378	211.125	3762	235.125	4168	260.5	4948	309.25	2141.15	100.00%
	Initial Pre-Sort Weight	160	3200	200	3840	240	3840	240	3840	240	3328	208	3728	233	3520	220	4800	300		
	Difference	0.1	-251	-15.6875	-172	-10.75	-233	-14.5625	-68	-4.25	-50	-3.125	-34	-2.125	-648	-40.5	-148	-9.25		

**MSB Waste Characterization Study**  
**Material Categorization - Commercial Haul**

Hauler:		Commercial		Institutional		Commercial		Institutional		TOTAL	%
		December 11 2018		December 11 2018		December 14 2018		December 15 2018			
		Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)		
Paper	Newsprint	62	3.875		0		0	80	5	8.875	0.79%
	Magazines	151	9.4375	20	1.25		0	50	3.125	13.8125	1.24%
	High Grade Office Paper	88	5.5	31	1.9375		0	150	9.375	16.8125	1.51%
	OCC and Kraft Bags	242	15.125	124	7.75	791	49.4375	245	15.3125	87.625	7.85%
	Mixed Recyclable Paper	124	7.75	484	30.25		0	100	6.25	44.25	3.96%
	Non-Recyclable Paper	10	0.625	3	0.1875		0		0	0.8125	0.07%
	Compostable Paper	427	26.6875	648	40.5	160	10	1017	63.5625	140.75	12.60%
Plastics	#1 PET Beverage Containers	170	10.625	297	18.5625		0	203	12.6875	41.875	3.75%
	#2 HDPE Containers	85	5.3125		0	113	7.0625	40	2.5	14.875	1.33%
	Other Plastic Containers	133	8.3125	2	0.125	56	3.5		0	11.9375	1.07%
	Other Plastic Products	72	4.5	222	13.875	81	5.0625	110	6.875	30.3125	2.71%
	Film/Wrap/Bags	210	13.125	612	38.25	20	1.25	140	8.75	61.375	5.49%
Metals	Aluminum Beverage Containers	112	7	29	1.8125		0	10	0.625	9.4375	0.84%
	Ferrous Food and Beverage	94	5.875	130	8.125		0		0	14	1.25%
	Other Ferrous Metals	17	1.0625	4	0.25	53	3.3125		0	4.625	0.41%
	Other Non-Ferrous Scrap	19	1.1875	40	2.5		0		0	3.6875	0.33%
Glass	Clear Glass	190	11.875		0	655	40.9375		0	52.8125	4.73%
	Colored Glass	456	28.5	8	0.5		0		0	29	2.60%
	Other Mixed Cullet	8	0.5	15	0.9375		0		0	1.4375	0.13%
Yard Waste	Grass and Leaves		0		0		0		0	0	0.00%
	Brush and Trees		0		0		0		0	0	0.00%
Wood	Non-Treated Wood		0	4	0.25	41	2.5625	22	1.375	4.1875	0.37%
	Treated Wood	25	1.5625		0	290	18.125		0	19.6875	1.76%
Durables	Electrical and Household Appliances	90	5.625		0		0		0	5.625	0.50%
	Computers, CPUs/Peripherals, TVs		0		0	403	25.1875		0	25.1875	2.26%
	Cell Phones and Chargers		0		0		0		0	0	0.00%
	Other Durables		0		0		0		0	0	0.00%
HHW	Liquid HHW	57	3.5625		0		0	1014	63.375	66.9375	5.99%
	Automotive and Lead Acid Batteries		0		0		0	168	10.5	10.5	0.94%
	Other Batteries		0		0		0		0	0	0.00%
	Mercury Containing Products		0		0		0		0	0	0.00%
	Other HHW	102	6.375		0	21	1.3125		0	7.6875	0.69%
Other	Food Waste	362	22.625	729	45.5625		0		0	68.1875	6.10%
	C&D	14	0.875	113	7.0625	227	14.1875		0	22.125	1.98%

Hauler:

	Commercial		Institutional		Commercial		Institutional		TOTAL	%
	December 11 2018		December 11 2018		December 14 2018		December 15 2018			
	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)	Weights (oz)	Weights (lb)		
Textiles and Leathers	425	26.5625	52	3.25	243	15.1875		0	45	4.03%
Diapers	101	6.3125	3	0.1875		0		0	6.5	0.58%
Rubber		0	8	0.5	60	3.75		0	4.25	0.38%
Tires		0		0		0		0	0	0.00%
Sharps		0		0	1	0.0625		0	0.0625	0.01%
Other Organic	174	10.875		0		0		0	10.875	0.97%
Other Inorganic		0		0		0		0	0	0.00%
Fines/Super Mix	3053	190.8125	521	32.5625	38	2.375	90	5.625	231.375	20.72%
Other	7	0.4375		0		0		0	0.4375	0.04%
<b>WEIGHTS</b>										
Sum of all Individual Weights	7080	442.5	4099	256.1875	3253	203.3125	3439	214.9375	1116.938	100.00%
Initial Pre-Sort Weight	6080	380	3200	200	3200	200	3200	200		
Difference	-1000*	-62.5*	-899*	-56.1875*	-53	-3.3125	-239	-14.9375		

\* Something mixed with load on deck of truck



# Attachment D

## Focused Market Analysis





# Technical Memorandum



Date: January 15, 2019

Project: Matanuska-Susitna Borough, Waste and Septage Planning Assistance

To: Matanuska-Susitna Borough

From: HDR, Inc.

Subject: Focused Market Analysis – Products from Waste Digestion

## Introduction

The Matanuska-Susitna Borough (MSB), located in the state of Alaska just north of the Municipality of Anchorage, is exploring alternatives in managing the waste produced by its residents and businesses. As a part of this exploration process, the MSB desires to better understand the current market capabilities for an integrated waste management solution to manage residues from the MSB's existing solid and future liquid waste management facilities. In preparing to engage the private sector in the exploration of alternatives, the MSB wishes to understand the values of potential byproducts that could be produced from the waste materials. The MSB requested HDR, Inc., to evaluate the following commodities:

- Heating Oil;
- Diesel;
- Electric Energy;
- Fertilizer and Compost;
- Natural Gas; and
- Recycled Glass.

This memo presents market data on the selected products that may be produced as by-products from possible waste management processes and serves to provide insight and understanding of the current market value of these byproducts locally and nationwide. Where available, Alaska-specific data was utilized, however, nationwide data better articulates the existence, or lack thereof, of available markets. A nationwide market indicated a reliable supply/demand for these commodities thereby helping to establish a solidified dataset. Commodities can be affected by a variety of factors such as local supply/demand, state/local regulations, taxes, climate, volume of purchase, and location of production.

This market analysis develops reasonable values for pure forms of the described commodities. Cost considerations to generate or purify the described commodities for market sales are not considered. Volume-metric data is not available at this time but, typically, products generated in higher volumes (full truck loads) are more valuable to buyers because of a decrease in overhead to retrieve the commodity. Cost factors not included in this analysis include:

- Regulatory compliance; e.g., does the manufacture or use of diesel fuel require site-specific air permit amendments.
- Maintenance and engine life variance; e.g., does biodiesel with a higher acidity decrease the life of equipment used by the organization.

- Cost associated with manufacturing or refining a pure, certified product.

As an analogy, diesel fuel may be valued at \$3.20 per gallon, but this value is to the consumer putting diesel in their vehicle; the cost per gallon has certain tax implications, profit margins, liability insurances, and corporate overhead rates involved in providing a commodity that is publicly trusted with a corporate backing.

## Heating Oil

Heating oil in the U.S. is defined by ASTM Standard D396 and often referred to as heating oil No. 2. It is most similar to a blend of diesel and kerosene. Heating oil is produced by a refiner and can be made from industrial feedstock as well as from byproducts of the oil refining process. This oil is used in an atomized burner, where the oil is sprayed into a combustion chamber, and often has a low sulfur requirement associated with its consumption (ASTM D396 2018). Heating oil with up to 20 percent biofuels blends are used in the U.S. The U.S. Department of Agriculture published information emphasizing these biofuels are typically manufactured from homogenous industrial feed stocks of corn, soy beans, or cellulosic (wood) material (Radich 2016).

For the winter of 2017–2018, heating oil in the United States averaged \$2.78 per gallon during the winter months as sold to the consumer. The U.S. Energy Information Administration (U.S. EIA) estimates that for the winter of 2018–2019 heating oil will cost approximately \$3.17 per gallon, and due to forecasted winter temperatures, the average U.S. household will increase consumption of heating oil 1.3 percent. Wholesale heating oil prices hover around \$2.00 per gallon and the value of industrial feedstock is approximately \$0.70 per gallon (U.S. EIA, November 2018).

In Massachusetts, the Green Energy Consumer Alliance sells a heating oil blended with 20 percent biodiesel provided by a third party blender. The Green Energy Consumer Alliance advertises this product as costing consumers 15 cents per gallon less than traditional heating oil. Using winter 2018 estimates, this is valued at \$3.02 per gallon.

Based on this information, it is estimated that industrial feed stock sold to a refiner is valued at less than \$0.70 per gallon, and heating oil refined on-site and sold wholesale is valued at \$2.00 per gallon. Biodiesel blended with heating oil will have a cost savings of approximately \$0.15 per gallon (based on estimated value of \$3.02 per gallon). Please note there may be additional regulatory and maintenance issues associated with the consumption of uncertified heating oil in installation boilers.

Local commodity providers include Crowley Maritime Corporation who sells heating oil, natural gas, diesel fuel, propane and other fuel sources in the Anchorage and MSB area. An 8 January 2019 telephone call with a Crowley sales associate confirmed the following information:

- Heating oil is not a common commodity sold in the region as most commercial and residential buildings are now heated with natural gas.
- When heating oil is sold it is delivered in a minimum volume of 300-gals on a regularly scheduled route. This heating oil is sold at \$2.95 per gallon.
- Customers who were considered on call customers would pay \$3.05 per gallon with a minimum of 100 gallons purchased.

This price information is based on the delivered price of heating oil which fluctuates regularly, and cannot be relied upon for the actual expected value of heating oil derived from a bio-blending fuels process.

## Diesel Fuel

Diesel fuel or Grade No. 1 fuel oil is a light- to middleweight distillate fuel used in engines requiring fuel with a higher volatility. Diesel engines typically burn at varying loads and speeds, and can be used in low operating temperatures. According to ASTM, diesel fuel contains no bio-blends (ASTM D-975 2018). Since the ability to produce diesel in accordance with ASTM D-975 standards is not feasible, biodiesel markets were also evaluated to better reflect the type of commodity produced.

ASTM D6751 defines the properties of biodiesel. Biodiesel is produced by a reaction of a vegetable oil or animal fat with an alcohol in the presence of a catalyst. The finished biodiesel derives approximately 10 percent of its mass from the reacted alcohol. Biodiesel has a higher acidity than diesel fuel and can lead to an increase in engine corrosion. Components of biodiesel may come out of solution when exposed to low temperature; additional research is being conducted to determine whether filtration or additives can prevent this from occurring (ASTM D651 2016). Any biofuel generated would need to be refined to be usable; when produced it will be high in impurities.

According to the U.S. EIA, diesel fuel in the U.S. is valued currently at **\$3.28** per gallon, running a market spot check of consumer diesel fuel prices in Anchorage, Alaska, confirmed this diesel value at the consumer level. Wholesale prices for diesel in Anchorage are currently **\$1.86** per gallon. Based on this information, it is estimated that diesel fuel sold will be valued less than **\$1.86** per gallon, and diesel fuel used on site will be valued at **\$3.28** per gallon in cost savings for the commodity itself. There may be additional regulatory and maintenance issues associated with the consumption of uncertified diesel fuel in installation engines (U.S. EIA, November 2018).

## Electric Energy

Electrical energy is valued at an average of **\$0.1046** per kilowatt hour nationwide. In Alaska, electricity has an average value of **\$0.201** per kilowatt hour (U.S. EIA, October 2018). Locally, the MSB purchases electricity from the Matanuska Electric Association (MEA) at a value of approximately **\$0.13** per kilowatt hour. MEA offers a net metering program in accordance with 3 AAC 50.900 of the Alaska regulations. Under the current system, renewable energy systems with a capacity up to 25 kilowatts (kW) are eligible for net metering on MEA's system with a non-firm purchased power rate (buyback rate) of approximately **\$0.08** per kilowatt hour per a January 9, 2019 telephone call with an MEA sales associate. The buyback rate is adjusted on a quarterly basis in conjunction with MEA's quarterly rate filings to the Regulatory Commission of Alaska (RCA). Facilities generating more than 100 KW negotiate a rate and contract with MEA, also to be approved by the RCA.

Additional coordination between the MSB and MEA would be required to set specific terms based on the size of the MSB system, but it can be assumed that following capital investments to produce electricity and infrastructure upgrades to sell electricity, any electricity produced and used at the facility will result in a cost savings of approximately \$0.13 per kilowatt hour, and electricity can be sold back to the utility/community at a rate of approximately **\$0.08** per kilowatt hour.

## Fertilizer and Compost

Fertilizer consists of chemical nutrients including nitrogen, phosphorus, potassium, calcium magnesium, sulfur, copper, iron, and other micro-elemental nutrients. Fertilizers are typically lab tested and may be augmented with ammonia, potassium minerals or other compounds (U.S. EPA, N.D.). Fertilizer in Alaska may include specific formulation for growth in Alaska. Fertilizer is typically sold in concentrated amounts to feed or treat plants in soil; it is valued at **\$2.97** per pound.

Composting is a process that decomposes plant and other organic waste under controlled conditions. A composting program may include yard wastes only (leaves and grass clippings) or may be a compostable municipal solid waste program that includes yard wastes, food wastes, and other degradable organic matter. Composting procedures include collecting wastes, forming wastes into piles, and aerating the material until an organic-rich material is produced. It can be conducted with little or low-technology equipment. The finished organic-rich material may be lab tested to inform the consumer on the nutrients in the material, or may be sold to the consumer without analysis. Compost may also be heat treated to prevent the spread of noxious weeds. Compost is valued at about **\$100** per cubic yard of compost in Anchorage, Alaska (Alaska Compost Pricing 2018).

## Natural Gas

Natural gas consists mainly of methane, a compound with one carbon atom and four hydrogen atoms. Natural gas also contains small amounts of hydrocarbon gas liquids and non-hydrocarbon gases. Natural gas can be used as a fuel. Anaerobic bacteria—bacteria that can live without the presence of free oxygen—decompose organic waste to produce a gas called referred to as *biogas*. Biogas is 40–60 percent methane. The rest is mostly carbon dioxide and small amounts of other gases.

Biogas can be used for on-site energy generation (whether to make electricity or to power the process itself). Biogas generally measures between 500-700 BTU per square foot of gas which is approximately half the heat content of pipeline-quality natural gas. Biogas is also usually acidic, reducing the lifespan of the boiler or engine burning it. Finally, there may be hydrogen sulfide issues when burning biogas which might require filtering, treatment or possible additional air permitting. It was found that pure natural gas is valued at **\$11.02** per thousand cubic feet in Alaska (U.S. EIA, October 2018). Based on the above information, it is the conclusion of this market analysis that biogas is estimated to be valued at **\$6.38** per thousand cubic feet.

## Recycled Container Glass

Container glass manufacturers require recycled glass be segregated by color (clear, amber, green, etc.) and free of impurities (grit, metals, ceramics, etc.) to be of value for re-manufacturing container glass products. The process of segregating glass by color is can be accomplished using optical sorting equipment, however this equipment is expensive. Segregating glass manually can be accomplished but is labor intensive. 100 percent pure glass cullet sorted by color is valued at **\$75** per metric ton, delivered to the glass manufacture. Glass with 80 percent purity may cost (a negative value) up to **-\$50** per metric ton to find a buyer (Mongeon 2017). In addition to glass manufacturers, recycled glass can be used as aggregate in road base and pavement products. The value for glass as a feedstock for these construction related materials is zero or possibly a negative value depending on the extent of impurities. While container glass recycling is currently available in Anchorage Alaska, the recycled container glass market for manufacturing glass products is saturated. Currently the municipality is stockpiling glass to be recycled, and while some is used in the construction process, the City takes in more glass for recycling than it is able to process out. At this time it is determined that there is no market for glass in the region as there is already a large amount of the commodity unused (Caldwell, 2017).

## Summary

With the possible exception of recycled container glass, there is a market for the selected commodities evaluated. As noted above, the purpose of this study is to inform MSB of the market

values of potential byproducts that could be produced from the waste materials. The market for petroleum and the energy-based products of diesel, electricity, fertilizer, and natural gas are generally on-par with the remainder of the US. The outlier is recycled glass, which generally has a range of value from low to a negative value, based mostly on the cost to transport glass to the recycled glass market. Table 1 below provides a visualization of the commodity market observed in the Anchorage and MSB area as compared to the national average. Summarizing, HDR finds the commodities explored have commercial value and recommends MSB proceed with the engagement of prospective private sector proponents to offer expressions of interest.

**Table 1 Price comparison of commodities**

Commodity	National Average Price	Alaska Local Price
<b>Heating Oil</b>	\$3.17 per gallon	\$2.95 per gallon
<b>Diesel</b>	\$3.28 per gallon	\$3.28 per gallon
<b>Electric Energy</b>	\$0.1056 per kilowatt hour	\$0.13 per kilowatt hour**
<b>Fertilizer and Compost</b>	N/A	\$2.97 per pound and \$100/yd <sup>3</sup>
<b>Natural Gas</b>	\$12.26 per thousand cubic feet	\$11.02 per thousand cubic feet
<b>Recycled Container Glass</b>	-\$50 per metric ton	N/A

\*\* - The buyback rate through MEA is currently approx. \$0.08 per kilowatt hour for systems up to 25 kW

## References

Alaska Compost Pricing. Susitna Organics. Humidified Compost. (April 2018). Accessed from: [http://www.susitnaorganics.com/Order\\_Compost\\_and\\_pricing.html](http://www.susitnaorganics.com/Order_Compost_and_pricing.html).

ASTM Standard D396, 2018, "Standard Specification for Fuel Oil," ASTM International, West Conshohocken, Pennsylvania, 2003. [www.astm.org](http://www.astm.org).

ASTM Standard D6751, 2016, "Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels," ASTM International, West Conshohocken, Pennsylvania, 2003. [www.astm.org](http://www.astm.org).

ASTM Standard D975, 2018, "Standard Specification for Diesel Fuel Oil," ASTM International, West Conshohocken, Pennsylvania, 2003. [www.astm.org](http://www.astm.org).

Caldwell, Suzanna. "After 4 Years, Anchorage Is Still Working to Make Glass Recycling Worth the Effort." Anchorage Daily News, Anchorage Daily News, [www.adn.com/alaska-news/2017/01/02/4-years-in-anchorage-is-still-working-to-make-glass-recycling-pencil-out/](http://www.adn.com/alaska-news/2017/01/02/4-years-in-anchorage-is-still-working-to-make-glass-recycling-pencil-out/).

Crowley Maritime Corporation. Accessed via phone interview. 8 January 2019.

Matanuska Electric Association. Accessed via phone interview. 9 January 2019 and from: <https://www.mea.coop/>.

Green Energy Consumers Alliance. (2018). Accessed from: <https://www.greenenergyconsumers.org/heatingoil/considerbiodiesel#how>.

Radich, Tony. USDA Agricultural Economist. (13 July 2016). Biofuels in diesel and heating oil. Presentation. Accessed from: [https://www.eia.gov/petroleum/heatingoilpropane/workshop/2016/pdf/2016\\_shopp\\_workshop\\_radich.pdf](https://www.eia.gov/petroleum/heatingoilpropane/workshop/2016/pdf/2016_shopp_workshop_radich.pdf).

Mongeon, Pierre-Andre. (2017). Recycling Product News. Breaking down the factors behind scrap glass prices. Accessed from: <https://www.recyclingproductnews.com/article/27088/breaking-down-the-factors-behind-scrap-glass-prices>

U.S. Energy Information Administration (2018). Accessed from: <https://www.eia.gov/>.

U.S. Environmental Protection Agency. Composting Basics (N.D.). Accessed from: <https://www.epa.gov/recycle/composting-home>.