Municipal Solid Waste to Energy for Southeast Alaska

Prepared by Southeast Conference

August 2022

Southeast Alaska Solid Waste Overview

Management of municipal solid waste (MSW) in Southeast Alaska is made more difficult than other areas of the state and US due to a number of well-known reasons. Landfills, the most common destination for MSW in the United States (over 50% of waste generated), are particularly suboptimal for the region due to relatively small population centers sparsely located in challenging geographies. Southeast Alaska has extremely limited availability and high-cost commercial land that is suitable for landfill construction. This, coupled with low amounts of waste generation, makes landfill construction and operation financially undesirable for many of the region's communities. As a result of this, many of the region's communities have turned to shipping their MSW south for disposal in landfills in Washington or Oregon. This includes Sitka, Petersburg, and Wrangell, which are the third, fourth, and fifth most populated communities respectively in Southeast Alaska. Many of the smaller communities also ship their waste.

Communities that ship their waste do so via Alaska Marine Lines (AML) barges. They also commonly contract Republic Services for transport of waste from the barge to its final disposal destination. Total MSW disposal costs for Southeast Alaska communities who ship waste south are often over $150 per ton. The recent increases in fuel prices and thus freight costs will only increase this expense. Additionally, due to a number of fires in MSW containers on AML's barges in the past few years, the shipping service has started to put in place stricter requirements for shipping MSW. AML announced that as of June 2021, it would begin refusing transport of open-top shipping containers carrying MSW. There are also concerns that AML will require MSW to be baled prior to shipment as well. This stricter practice by the service comes at a costly burden to Southeast communities previously using open-top containers who will need to make the switch. Waste baling equipment is also expensive, especially from the view of small, rural communities. For communities that are able to sufficiently manage waste locally, the associated costs would like be preventative for their participation in a regional program.

Southeast Alaska's two largest communities, Juneau and Ketchikan, account for nearly 64 percent of the region's total population. Both of these cities as well as sixth largest Haines have operating landfills. In 2021, the Environmental Research and Education foundation estimated the average landfill tipping cost in Alaska to be $142.33 per ton, significantly higher than the national average of $53.72 per ton. Haines and Ketchikan's landfills are managed by the municipality, while Juneau's entire MSW management scheme is privately run. In Juneau, Alaska Waste (formerly Arrow Refuse) is the collection service. It tips municipal solid waste at the Capitol Landfill, which is owned and operated by Waste Management, Inc. The 2022 tipping fee at Juneau's landfill for MSW was $180 per ton, though Alaska Waste's contract with Waste Management likely stipulates a slightly lower cost that is applicable to the majority of Juneau's waste. There have been numerous reports of the past decade or so that Juneau's landfill is within 20 years of its lifespan end. It and other communities whose landfills will eventually need to close, must begin preparing the future of their MSW management.

MSW Generation

Southeast Alaska has just over 72,000 residents (2020 US Census) that generate municipal solid waste year-round, with the five largest communities accounting for nearly 90% of the total population. In 2018, the EPA estimated an average MSW generation rate of 4.9 lbs. per person, per day. A municipal landfill specialist at the Alaska Department of Environmental Conservation (ADEC) believed 5.0 lbs. is a close estimate for Southeast Alaska. Limited available tonnage data from a few communities suggests the figure could be even higher, close to 5.5 lbs. per person, per day. In total, if the 5.0 lbs./person/day estimate is accurate, all of SE Alaska generates 66,000 tons of MSW annually, or approximately 180 tons per day.

Community	Population (2020 Census)	daily MSW generation (tons)	annual MSW generation (tons)
Juneau	32255	80.6	29433
Ketchikan	13948	34.9	12728
Sitka	8458	21.1	7718
Petersburg	3398	8.5	3101
Wrangell	2127	5.3	1941
Haines	2080	5.2	1898
Metlakatla	1454	3.6	1327
Skagway	1240	3.1	1132
Craig	1036	2.6	945
Hoonah	931	2.3	850
Klawock	720	1.8	657
Yakutat	662	1.7	604
Gustavus	655	1.6	598
Kake	543	1.4	495
Thorne Bay	476	1.2	434
Hydaburg	380	1.0	347
Angoon	357	0.9	326
Nuakati Bay	142	0.4	130
Coffman Cove	127	0.3	116
Tanakee Springs	116	0.3	106
Remainder (<100 ea.)	1181	3.0	1078
Totals	72286	181	65961

Figure 1. Municipal Solid Waste generation in Southeast Alaska.

Waste to Energy Technology

In light of the high costs of shipping MSW and aging landfills in Southeast Alaska, municipal solid waste to energy (WTE) technology could offer a convenient solution for managing the region's waste. Energy recovery from solid waste is listed as more preferred than landfilling in the EPA's waste management hierarchy. There are a few different technologies that are considered WTE. Thermal conversation methods include incineration and gasification/pyrolysis, and non-thermal conversion technologies such as anaerobic digestion. Thermal conversion WTE technologies generally rely on the energy content stored in MSW to generate heat which can be converted to electricity by boilers and steam turbines. Non-thermal processes are typically aimed at generated organic gases. For Southeast Alaska, thermal WTE might prolong landfill lifespans and offer a desirable alternative to shipping waste to the Lower 48.

Figure 2. EPA waste management hierarchy.

Incineration:

Municipal solid waste incineration is a relatively simple process from a technical standpoint. Waste is trucked to the facility and tipped into a loading pit. Crane operators remove any materials that aren't suitable for incineration (large and metal objects), and load the MSW into the incinerator. More advance materials sorting processes can also be employed. Excess air or oxygen is typically pumped into the incinerator to help ensure complete combustion of the waste at temperatures generally ranging from 900-1200°C (1600-2200°F). Hot flue gases from the combustion process are routed through a boiler system and the resulting high-pressure steam is used to drive a turbine to generate power. Many facilities directly sell the steam for commercial process or residential heating usage. The flue gases are routed through a series of pollution controls before being release from the facility. Ash from the combustion process is temporarily stored on site and can sometimes be converted into a construction aggregate, otherwise it must be disposed of in a landfill. Total mass reduction from incineration rang es from around 75-85 percent. Volume reduction ranges from 85-95 percent.

Environmental controls from WTE facilities have improved significantly in the 21st century. Today, the EPA regulates emissions of nine pollutants under a revision of the Clean Air Act. The nine pollutants regulated under the New Source Performance Standards are: particulate matter, carbon monoxide, dioxins/furans, sulfur dioxide, nitrogen oxides, hydrogen chloride, lead, mercury, and cadmium. In order to control these pollutants, modern WTE facilities employ various chemical treatments and bag filtering. Stack emissions are monitored daily to ensure compliance with federal standards. In the US, 23 states classify municipal solid waste incineration with energy recovery as a form of renewable energy, though Alaska is not one of those states.

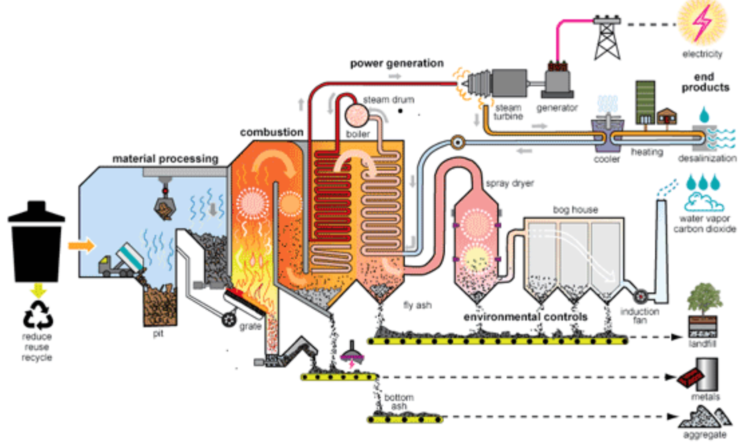

Figure 3. Schematic of a typically moving grate incineration facility.

As of 2020, there were around 70-80 operational incineration-based waste-to-energy facilities in the United States, and about 800 across the globe (DOD 2020). The majority of the US facilities came online in the late 1980s and early 1990s and have operated since. Municipal solid waste incineration is most commonly done using moving grate mass burn where the moving grate agitates the waste as it is loaded into the combustion chamber. This helps mix the feedstock with pumped-in oxygen and improve combustion efficiency. In addition to mass burn, there are also modular, rotary kiln, and fluidized bed facilities. Modular, pre-fabricated WTE plants typically employ the same general technology at a smaller scale. The cutoff range between modular and conventional facilities is around 200 tons per day (tpd), though this is not a technical requirement. Rotary kiln incinerators are most common for destruction of hazardous medical waste, and don’t often employ energy recovery. Fluidized bed technology heats sand or another granular material to incinerate the waste. It is also not common in municipal solid waste to energy facilities.

Waste to energy facilities for municipal solid waste are generally decreasing in usage in the United States. Only one new facility has been constructed in this century, a 3000 tpd plant in Palm Beach, Florida. The nearly $700 Million facility uses state of the art incineration, energy recover, and environmental control technologies to generate 100 megawatts (MW) of electricity. Other facilities in the US are aging and have had to invest additional capital to improve energy recovery or pollution control systems. The associated costs to adapt older generation facilities to modern standards has caused many to decide to cease operations. Around 20 US facilities have shut down since 2000. The overall economics of WTE facilities in the US are generally negative given low energy prices in most of the US and an average landfill tipping fee of only $54 per ton. In order to be economically feasible, WTE facilities typically need to have much higher tipping fees than those at landfills. Further, the high capital expense and depreciating nature of WTE plants makes them a very risky investment for most areas of the US.

As mentioned previously, many of these challenges for the success of WTE in the Lower 48 are mitigated by the unique MSW management landscape in Southeast Alaska. The average cost of electricity in Alaska is over 50 percent greater than the national average (22.75 cents/KWH vs. 14.77 cents/KWH), though Juneau has particular inexpensive energy prices at around 12 cents/KWH. Landfill tipping fees are also much higher in Southeast Alaska, as is the cost of shipping waste to the Lower 48. Combined with the general management convenience WTE could provide for Southeast Alaska, the unique economic situation makes incineration particularly intriguing.

Facility Overviews

As of 2018, there were five waste to energy incineration facilities in the United States processing less than 200 tons per day of municipal solid waste. None of these plant's exclusively output electricity and the most recent was commissioned in 1988, so comparison to a modern facility in Southeast Alaska may be only marginally applicable.

Ames, IA

The Arnold O. Chantland Resource Recovery Plant was opened in 1975 in the city of Ames, Iowa. Rather than directly incinerating the waste to generate electricity, the plant instead sorts and processes incoming waste into resource derived fuel (RDF). This RDF is then pneumatically piped to the nearby electric utility, where it is mixed with natural gas and burned for power production. Of the 37,000 tons (101 tpd) of waste it receives annually from Ames and surrounding cities and counties, 28,000 is processed into RDF and sent to the electric utility. The remaining amount is either recycled, composted, or sent to a nearby landfill. Revenue primarily comes from three avenues: a per capita service fee, the tipping fee, and sale of RDF to the utility. The $10.50 per capita service fee is billed the municipalities the plant serves, with combined population of 78,815. The current tipping fee is $58.75 per ton and the utility pays $50 per ton for RDF. In total, the plant generates approximate $4 million in revenue per year with steady growth and similar expenditures. Around have of the expense of the plant comes from salaries. Though exact employment data could not be found, based on the approximate salary expense of $2 million, the plant likely employs between 20 and 40. Over the past 20 years, revenue at the recovery facility totaled $81,791,136 and expense was $81,754,038.

Polk County, MN

The Polk County Resource Recovery Facility in Fosston, Minnesota receives approximately 30,000 tons (82 tpd) of MSW annually. The attached Material Recovery Facility (MRF) sorts this waste and removes around 8,000 tons for recycling and the remaining waste is incinerated. Rather than using turbines to produce electricity, the plant primarily sells the steam it generates to nearby commercial customers.

Perham, MN

The Perham Resource Recovery Facility began operations in 1986 and was expanded in 2014 to process 62,000 tons annually (170 tpd) of MSW. The incineration facility is operated by the Prairie Lakes Solid Waste Authority and receives waste from five counties. The plant has a MRF to remove recyclable and hazardous items before the waste is incinerated in one of two burn units at 1,800°F. The facility sells the around 1,000,000 lbs per day of steam to two local businesses, and also has an electric turbine for any excess steam. The plant utilizes 33 full time workers for its operations.

Oswego County, NY

The Oswego County Energy Recovery Facility was commission in 1985 and currently processes around 200 tons of MSW each day. The steam produced from waste incineration is sold to a next-door business and also used to generate power for the facility's operations. Any excess steam is used to create electricity that is sold to the local utility. In total, the outputs of the incineration facility equate to approximate 3.6 MW of energy.

Barron County, WI

The Barron County Waste to Energy Facility processes around 80 tpd of MSW. Tipping fees at the facility are $72 per ton for waste from Barron County and $85 per ton for out of county waste. The steam generated is sold to a local cheese plant and also used to power the facility.

Gasification:

Interest in using non-combustion thermal conversion technologies including gasification, pyrolysis, and plasma arc gasification for MSW energy recovery has been around since the 1990s. The processes use high heat in an oxygen starved environment to chemical break down waste material. The desired end production is a synthetic gas containing mostly H_2 gas and CO, along with lower amounts of CO_2, methane, and other hydrocarbons. This syngas can be converted into a liquid fuel or immediately burned to generate electricity via steam turbines. The process also generates a hardened slag material rather than ash, which can be also be used as construction aggregate. Overall, the facility required for gasification is largely the same as an incineration plant, the main differences being in the heating chamber and how the syngas is routed. Environmental controls are mostly the same as incineration as well.

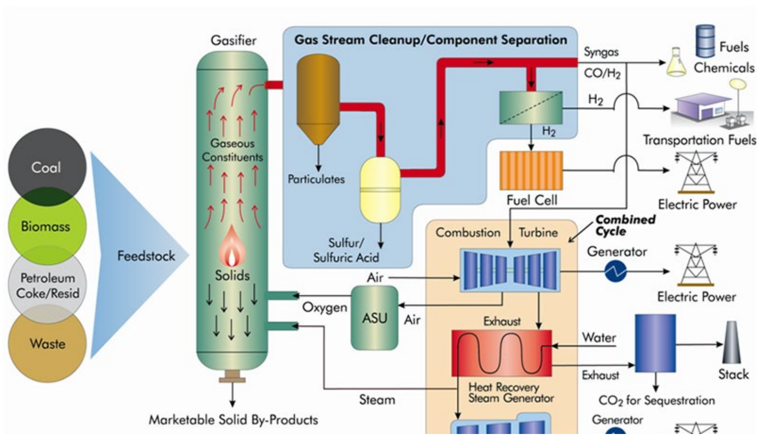

Figure 4. General gasification facility schematic.

Attempts at commercializing gasification technology for use in waste to energy systems have been made since the late 90s. To date, none of these projects have shown long term success, and the vast majority of planned facilities were never built or never operated. Below are summaries of the planning and operation of a handful of facilities in Japan and the United States since 1999.

Facility Overviews

Yoshi and Utashinai, Japan

Around the turn of the century, two MSW to energy plasma arc gasification facilities were built and operated in Japan through the collaborative effort of Hitachi Metals and Westinghouse Plasma Corporation. Of the two plants constructed, one was a small-scale demonstration facility capable of processing 25 tpd of MSW feedstock that operated for one year after construction in 1999. That plant was taken offline after the demonstration period ended. Another plant in Utashinai, Japan, a direct scaleup of the Yoshi plant, was constructed and operated between 2002 and 2013. The facility was designed to process 165 metric tonnes per day of a 50/50 mix of MSW and auto-shredder residue (ASR), and could produce up to 1.5 MW of net electricity when operating at full capacity. Electricity was produced by a turbine generator powered by steam from the heat of the gasification process as well as combusted syngas. The facility, named "Eco-Valley," had numerous issues and for the large majority of its life span was either nonoperational or below capacity. These issues covered both fundamental design specifications as well as material choices, and took over seven years and likely considerable capital to resolve. Additionally, the methods employed to resolve the issues decreased the efficiency of the facility. Due to the long downtime, the plant lost feedstock supply contracts and was only able to operate at half capacity in 2010, before ultimately shutting down in 2013. The Eco-Valley plant represents the largest and longest operational non-combustion WTE facility for MSW to date.

St. Lucie County, FL

In 2006, St. Lucie County made an agreement with GeoPlasma Inc. for the latter to develop a plasma arc gasification WtE facility in the county by 2009. Plans were made for a $120 million plant that could process 600 tpd of MSW and generate up to 25 MW of electricity. However, GeoPlasma was unable to secure financing for the project, reportedly due to Westinghouse Plasma

Corp's inability to guarantee the technology's effectiveness. St. Lucie County terminated the contract with GeoPlasma in 2012.

St. Lucie County, FL

A second attempt at developing a gasifcation WtE facility in St. Lucie County was made between 2015-2017. This time, a company called Green3Power Inc. made a deal with the county to fund and build a $175 million facility that would process 1000 tpd of MSW to generate 80,000 gallons each year of synthetic diesel fuel. Ultimately, the project never broke ground, with Green3Power claiming just one day before their deadline with the county that a rise in oil prices made it impossible for Green3Power to finance the project.

Port Hope, Canada

In 2008, Sunbay Energy Corp began planning a $85 to $110 million CA plasma gasification facility to operate in Port Hope, Canada. The claimed 26 MW, 400 tpd plant was originally set to begin operations in 2010. The project was met with huge public resistance and stalled for multiple years, during which Sunbay was acquired and re-organized as Entech-REM. In 2014, the Port Hope council declined to alter its zoning code to allow for the plant, and a 2015 appeal of the decision by Entech-REM was unsuccessful.

Numerous other proposed gasification or plasma arc gasification facilities have had a similar life cycle to these over the past two decades. Generally speaking, a new company will form touting the technology to municipalities and begin negotiations and planning. In every case so far in the US, the company ultimately fails to demonstrate efficacy, acquire funding, or complete other critical project milestones. In many cases, by the official termination of the project, multiple companies have come and gone and virtually none of the companies remain operational today.

<u>Facility Parameter Estimates</u>

Daily Feedstock

While all of Southeast Alaska's produces around 180 tons of MSW each day, it is unlikely that all of that waste could be diverted to a regional waste to energy facility. Many of the smaller communities produce waste in low enough quantities that they likely would not be incentivized to invest in the necessary infrastructure to transport waste to a regional facility. Additionally, depending on the location of a regional waste to energy facility, the distance from a community to the facility location would be an important factor in utilization. For example, if the plant is located in Juneau, communities far enough south of Juneau such as Wrangell would need to determine the relative costs of transport and tipping fees in Juneau versus those for landfill disposal in Oregon or Washington. Despite transport distances being longer for shipment to the Lower 48, tipping fees for a WTE facility in Juneau would likely be at least twice those in Washington, which could make disposal in Juneau overall more costly. This is one factor that would need to be addressed when setting a tipping fee for a WTE facility.

Assuming Juneau as the most likely position for a WTE facility to be constructed, a rough estimate can be made for the amount of daily feedstock. Juneau's daily waste stream is around 80.6 tpd and the next for largest communities north of Juneau combine to 12.3 tpd, or around 93 tpd total for the five communities. Sitka's 21.1 tpd and which sits only slightly south of Juneau, would get the total to around 114 tpd. Additionally, Juneau's municipally-operated wastewater treatment plant produces 3.4 tpd of high energy content dry sludge which could also be used as feedstock for a WTE facility. Therefore, a range for daily feedstock for a potential Juneau-based facility lies around 90 to 120 tons per day. Future work to evaluate the feasibility and approach engineers for such a facility should use this range as a starting point.

Energy Content

In order to get a better idea of potential energy production from a facility, the energy content of the feedstock should be evaluated. In the pacific northwest, the higher heating value (HHV) of MSW if often in the range of 5,000 to 5,500 British thermal units per pound. The dry sludge at the Juneau wastewater treatment plant was measured to contain between 7500 to 8455 btu/lb. The figure of 5,000 btu/lb. should then be a very conservative estimate for the energy content in feedstock to a Southeast Alaska WTE facility.

Production Efficiencies

For an incineration facility, energy stored in the solid waste is lost during the combustion process, heating of the boilers, and in the turbine itself. In gasification, these loses occur during the chemical conversion process, and if the syngas is directly combusted for energy, during that process as well as in the boilers and turbine. In conventional mass burn incineration facilities, the overall efficiency is generally around 22 to 25 percent. Gasification is frequently stated to be more efficient than incineration, though lack of commercial operation data leaves this figure uncertain.

Parasitic Energy Consumption

There are a variety of systems that require energy for a WTE facility including the chamber start-up process, environmental controls, and general electricity needed for the facility. This parasitic load typically ranges between 11-15 percent of the gross energy production for incineration facilities. The figure for gasification plants could not be determined.

Operation Time

It is typical for modern waste to energy facilities to operate around the clock with limited planned downtime for cleaning and maintenance throughout the year. Usually, this downtime comes from one, one month period or two, two-week periods each year. Overall, this puts the plant in operation for around 92 percent of the year. It is common for facilities to be contractually bound by waste suppliers to have a minimum availability of 85 percent.

Energy Production

Based on the above assumptions for a Juneau-based waste to energy facility, gross and net energy production can be estimated. As reliable information for gasification is not available and the technology itself is commercially unproven, the following figures assume a modern incineration facility. A 100 tpd incineration plant with 23% overall conversion efficiency and 90% annual

btu	5000								
tpd	90			100			110		
efficiency %	20	23	25	20	23	25	20	23	25
net MW	1.72	**1.98**	**2.15**	1.91	2.20	**2.39**	2.10	2.42	**2.63**
btu	5250								
tpd	90			100			110		
efficiency %	20	23	25	20	23	25	20	23	25
net MW	1.81	2.08	**2.26**	2.01	2.31	**2.51**	2.21	2.54	**2.76**
btu	5500								
tpd	90			100			110		
efficiency %	20	23	25	20	23	25	20	23	25
net MW	1.89	2.18	**2.37**	2.10	2.42	**2.63**	2.31	2.66	**2.89**

Figure 5. Net energy output of an incineration facility with 90% operation time and 13% parasitic load.

operation of waste with 5,000 btu/lb. could produce 22,143,000 KWH of electricity annually. With 13% parasitic load, the net production becomes 19,264,000 KWH or around 2.2 megawatts (MW) annually. Using the retail tariff price for Juneau's electric utility of around 12 cents/KWH, this could translate into about $2.3 million in annual revenue.

Tipping Fees

The greatest percentage of revenue for WTE facilities typically comes from tipping fees; this would likely be the case for Southeast Alaska. Waste Management, Inc. states the 2022 tipping fee at Capitol Landfill in Juneau as $180 per ton for the retail customer. Alaska Waste, the collection service for Juneau, likely pays less than this amount. In 2008 the fee for Alaska Waste was $120 per ton. This means that the majority of MSW disposed of at the Capitol Landfill today is tipped at a cost between $120 and $180 per ton. Additionally, the average landfill tipping fee in Alaska is about $150 per ton.

		daily tonnage			
		90	100	110	120
tipping fee ($)	100	2956500	3285000	3613500	3942000
	120	3547800	3942000	4336200	4730400
	140	4139100	4599000	5058900	5518800
	160	4730400	5256000	5781600	6307200

Figure 6. Annual revenue of incineration WTE facility from tipping fees

It is difficult to put a firm estimate on the tipping fee for a regional waste to energy facility in Southeast Alaska. This is primarily because of the non-uniform waste sourcing for a regional facility. In order to secure contracts feedstock, the facility must be financially advantageous for the communities supplying the waste. If Juneau was the sole source of MSW, this would simply mean having a lower tipping fee than the Capitol Landfill. However, for communities that would need to barge waste to a regional facility, this becomes more complicated due to the added cost of shipping waste. This cost needs to be determined and is important for the pricing of tipping fees for a regional incinerator. In order to be financially viable for other communities, the cost of shipping plus tipping fees needs to be the most competitive financial option. This likely necessitates lower tipping fees at the WTE facility than if waste was only coming locally via truck. In this scenario, there would ideally be multiple tipping fees based on location (you could charge higher for Juneau because its transport costs are lower). However, a tiered tipping fee structure where Juneau waste is billed higher than other communities might not be appropriate or possible. The result is that tipping fees for the incineration facility would likely need to be lower, negatively affecting revenues. Further analysis and determination of appropriate tipping fees for a Southeast Alaska WTE facility is critical to assessing the economic feasibility of such a facility.

Additionally, the residual ash as well as materials that aren't able to be processed need to be disposed of alternatively. Ideally the facility will have some space or area to temporarily store this waste. However, the ash will ultimately need to be transferred to a landfill on a regular basis. This presents an additional cost to the facility and requires that the Capitol Landfill in Juneau remain operating. Since the primary goal of a WTE facility is to replace the aging Capitol Landfill, it may be the case that the landfill is closed. In this scenario, either a small ash landfill would need to be constructed in conjunction with the WTE facility, or the ash will need to be shipped south. Ultimately, it is likely that the ash disposal mechanism will be more involved and more costly than the average US WTE facility.

Capital Costs

At this stage, it is very difficult to determine how much a waste to energy facility was cost to build in Southeast Alaska for a variety of reasons. Waste to energy plant specifications vary widely, from pre-incineration materials processing to how ash is handled. For a Juneau-based plant, if the Capitol Landfill is closed by the time the plant is operational, ash will either need to be shipped south or an ash landfill will need to be constructed in conjunction with the facility. This and many other choices about plant specifics can drastically change the cost of a WTE facility. Waste to Energy International estimates that a 90 tpd incineration plant would cost $35 million and a 120 tpd facility would cost $44 million. However, this is a very rough estimate based on existing facilities and does not account for the uniqueness of building in Southeast Alaska or a variety of design specification.

Operational Costs

Operational costs are also very difficult to determine at this stage for many of the same reasons as capital costs. Much of these costs will come from facility worker salaries, though without know the sizing of a facility and its design specifics, it is difficult to put a number on how many workers a facility might need. There a many additional costs including waste disposal and pollution control equipment and materials that without plant specifics are impossible to estimate. Further feasibility studies by an engineering firm with WTE experience might help reveal the operation specifications and costs for a Southeast Alaska WTE facility.

Recommendations

1) Explore incineration as a waste to energy solution for Southeast Alaska

The current climate of municipal solid waste management strategy in Southeast Alaska is increasingly to ship waste south to Washington or Oregon as landfills continue to close. This is a costly practice that neglects the potential to use MSW as a resource within the region. A regional waste to energy facility would create jobs in Southeast Alaska and energy produced could be useful to off-grid businesses and residents. Based on the findings of this report, it is clear that if waste to energy is further explored for Southeast Alaska, it should be for an incineration facility. Gasification and other emerging technologies have not shown any commercial success over the course of multiple decades. Due to this, these technologies cannot be seriously considered for a waste to energy facility in Southeast. Incineration with energy recovery has a proven track record since the 1970s and modern environmental controls significantly reduce pollution. Although incineration is generally declining in the United States, the unique waste management situation in Southeast Alaska makes WTE a potentially compelling strategy, both financially and logistically. To better assess the financial feasibility and necessary facility specifications for a WTE incineration facility in Southeast Alaska, an engineering firm with WTE experience should be contracted for a study. CDM Smith and Geosyntec Consultants are two firms that have experience in WTE feasibility studies and who have worked with clients in Alaska.

2) Better classify the region's municipal solid waste

To help determine the operational feasibility of a WTE incineration facility, better knowledge of Southeast Alaska's waste is important. Tests should be done to determine the makeup and energy content of the region's MSW. Additionally, to help determine how much feedstock a plant would need to process, evaluation of communities' participation should be completed.

This will require estimates of the cost for each of the region's communities to send waste to the facility and comparison to their current management costs. The revival of the Southeast Alaska Solid Waste Authority would be a prudent first step to take in organizing these efforts.

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