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DEVELOPING A 21ST CENTURY ENERGY FROM WASTE FACILITY IN AMERICAN SAMOA

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ABSTRACT

American Samoa is an unincorporated territory of the U.S. The largest and most populated island in American Samoa is Tutuila, which is located in the territory's historic capitol of Pago Pago. The territory is home to the world's largest tuna cannery. Population growth has been dramatic and the island's energy costs have increased substantially in recent years. The American Samoa Power Authority (ASPA) is responsible for solid waste collection and disposal in the territory with landfilling being the primary mode of waste disposal. However, limited available land on the main island due to volcanic topography limits the long-term use of landfilling as the island's sole waste management tool. The relative isolated location of American Samoa and the instability of world oil markets have prompted ASPA to look at more environmentally and economically sustainable means of solid waste management. As an outgrowth of its research, ASPA submitted and received a technical assistance grant from the U.s. Department of the Interior to conduct an extensive waste composition study and EfW feasibility study to examine the advantages and disadvantages of efW for American Samoa. The results of these studies have been completed by SCS on behalf of ASPA, which is currently taking steps to permit and procure a 2.0 megawatt, modular efW facility that will go online in 2012 as part of a public private partnership. The lessons learned by SCs and ASPA during the course of the investigations are illustrative of the types of long-term, waste management and energy decision-making that many small communities will have to undertake to attain viable and sustainable alternatives.

INTRODUCTION

American Samoa is a territory of the U.S. and part of the Samoan archipelago, a group of volcanic islands in the South Pacific. The main islands are Aunu'u, Ofu, Olosega, Ta'u, and Tutuila, which are located approximately 2,300 miles southwest of Hawaii and about 2,700 miles northeast of Australia (Figure 1). The largest and most populated island in American Samoa is Tutuila, on which are located the territory's historic capital (Pago Pago), the seat of its legislature, judiciary, and the office of the Governor. This article addresses solid waste management issues on this main island.

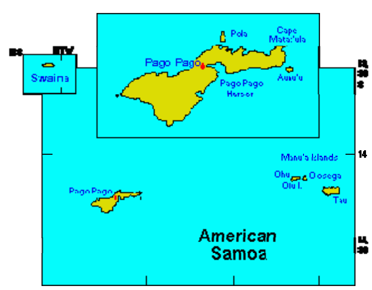

Figure 1. Location Map of American Samoa

The American Samoa Power Authority (ASPA) is the territory's publicly-run municipal utility that provides electric, water, wastewater, and solid waste services to the residents of American Samoa. Under its enabling legislation, ASPA is mandated to operate self-sufficiently at full-cost recovery.

ASPA possesses the ability and the mandate to charge fees in return for its services. This power to assess rates, charges and fees to its customers provides ASPA with a mechanism to fund solid waste management projects, which could not otherwise be funded under a tax subsidized program.

ASPA also receives an annual capital improvement grant from the U.S. Department of Interior (DOI). Grant funds are used to purchase new and replacement equipment such as bins, containers, collection trucks, and equipment for ASPA's Futiga Landfill and scrap metal yard.

In 2009, ASPA applied DOI funds to reestablish control of solid waste collection services from private haulers, which resulted in a substantial drop in SW expenses as projected on several cost benefit analysis conducted in the past. Furthermore, services reached more consumers compared to when it was under the private haulers.

In 2008, ASPA was awarded a technical assistance grant from DOI to conduct a waste composition study to quantify and characterize the composition of waste disposed of at the Futiga Landfill. The overall objectives of the project were to develop reliable estimates of the quantity and composition of wastes disposed by key generator groups. The data were then used to identify potential energy-from-waste (EfW) options for American Samoa, including the types of processing facilities potentially suitable for island conditions, facility costs, and energy generation. Current power costs for ASPA are in the range of $0.26 per kilowatt-hour, more than triple that of a typical city on the mainland USA.

PAST SOLID WASTE PLANNING

Over the past 20 years, a number of solid waste consultants have been engaged by the territorial government, EPA and DOI to study solid waste management conditions on the island and make recommendations for improvements. These studies provided conceptual evaluations of possible changes to the solid waste system in American Samoa with respect to collection, transfer, recycling, volume reduction via incineration, and disposal. The territorial government, and, later ASPA, has implemented some of these projects as part of the DOI grant process, but the territory as a whole, up until the present time, has not progressed much beyond basic landfilling of solid waste and recycling of some scrap metals. The objective of this study was to enable ASPA to extend and maximize capacity and extend the life of the Futiga Landfill due to volumetric reductions obtained by waste through incineration.

With respect to waste incineration, all of the former studies came to the same basic conclusion. That is, waste incineration with energy recovery appeared promising for the main island, given ASPA's high costs to produce power from conventional technologies. These costs have escalated dramatically in recent years due to reliance on increasingly expensive, imported diesel fuel. Recommendations included the construction and operation of a dual, modular solid waste incineration system, either on a single site or on two sites optimally spaced across the main island.

HOW MUCH WASTE IS AVAILABLE FOR EFW?

The SCS study team conducted a waste volume and composition assessment program at the Futiga Landfill over a period of several weeks. Data from this program were extrapolated to forecast the amount of waste delivered to the island's only disposal site each year. Since there are no working scales installed at that time at the landfill all haulers, residents, and businesses were asked to weigh in and out at a weigh scale at the scrap yard during the term of this study. The raw data were corrected for observed anomalies then converted to approximate the municipal solid waste (MSW) stream that would be typically disposed of at the landfill, and thus available for feedstock to a future EfW plant. Typical EfW facilities are run continuously on a 24-hour, seven day a week operational pattern. Thus, to estimate the island's waste stream available for this proposed facility, these data were converted using to a seven-day average for plant sizing purposes. As shown in Table 1, the weigh data appear to show that approximately 62 tons per day of MSW, tires, and waste oil would be initially available as feedstock/fuel for the plant.

TABLE 1 EFW PLANT SIZING ASSUMPTIONS

Assumptions	Year										
	0	1	2	3	4	5	6	7	8	9	10
Waste/ Population Growth (1.5%/Year)	62	63	64	65	66	67	68	69	70	71	72
WTE Downtime @ 10%	69	70	71	72	73	74	75	76	78	79	80
WTE Downtime @15%	73	74	75	76	77	79	80	81	82	83	85

CONDUCTING AN ISLAND WASTE COMPOSITION STUDY

The waste composition sampling was critical to help EfW plant designers to obtain a clear picture on the heating value to the incoming waste stream. To accomplish this objective, data gathered were obtained during two week-long waste sampling seasons (wet and dry), was used to provide a more complete picture of waste composition and heating value of the waste stream.

The sorting crew hand-sorted approximately six to eight samples daily for each weeks' sampling program (Figure 2).

Samples were manually sorted into 53 material categories, and the material in each category was weighed. The largest component of the overall waste stream is paper and related material, as shown in Figure 3. Organics and metals comprised the next largest components, at 20% and 18%, respectively. The remaining waste types together accounted for about 46% of the landfill's waste stream.

Figure 2. Photo of Waste Collection Sort

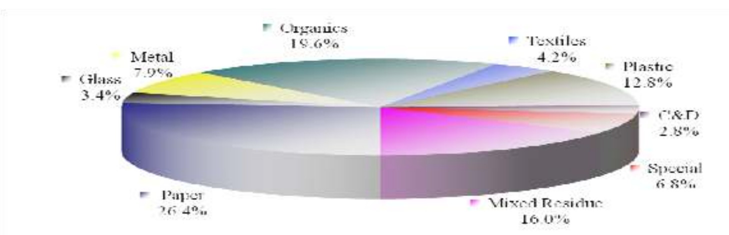

Figure 3. Average Waste Composition for Composite Sampling Program

Since the sale of energy plays an important role in the economic feasibility of an EfW project, the heating value of the waste stream is a key design factor. The heating value of solid waste is typically measured by Btus per pound of MSW in the USA, and is well documented. Using published Btu values of waste, combined with the waste composition data and moisture content obtained from this study, the team calculated the projected energy content of the overall waste stream. Waste oil and tires are potential additional waste-sourced fuels available in the territory.

EFW FEASIBILITY

Results of this initial feasibility study indicate that EfW is a viable solid waste management alternative for American Samoa. Given current waste composition and generation trends, a modular-type EfW system, somewhere in the range of 70 to 85 tons per day capacity, would provide roughly 2.0 megawatts of electrical power for the territory's total energy production of 29 megawatts Given the limited flat land available for construction (due to the island's volcanic terrain), it appears that the best site for this facility would be a three acre parcel adjacent to ASPA's existing Tafuna Power Plant, near the island's airport and only industrial park. The site has access to electric power, the island's grid, potable water and wastewater services.

As part of the feasibility analysis, a Pro Forma Economic Model was developed to explore the projected costs and revenues of a EfW facility. These results indicate that the projected tipping fees, if any, revenues from energy sales and carbon credits should be adequate to pay for the facility's operating and maintenance expenses and debt service/loan payments. Further scenarios examined the impact of a 30% capital cost savings potentially available to the project under the recently enacted U.S. Department of the Treasury grant program, pursuant to the American Recovery and Reinvestment Act of 2009.

ASPA'S NEXT STEPS

The implementation of an EfW facility would require a significant capital investment by ASPA for planning, engineering, permitting, equipment, and construction, perhaps constituting one of the largest public works/utility projects in the territory. Nevertheless, this EfW project would result in an improved, long-term solid waste management solution for American Samoa, as well as providing much-needed base load power resources for electric generation.

At the outset of the overall program, ASPA appointed an internal Project Team to help guide the project through all of the critical steps. This Team consists of government officials and outside consultants, representing engineering and environmental, management, financial, public involvement, and legal expertise.

Initial efforts have begun to craft an inclusive Request for Proposal (RFP), which will include technical specifications for the project, define the roles and responsibilities for the parties (vendor and ASPA), basic contractual requirements, a financing plan, and the method that will be used by ASPA to evaluate vendor proposals. In concert with the development of the RFP, ASPA has engaged the services of an experienced permitting professional to initiate the air quality permit application for the EfW facility with the U.S. EPA., the permitting agency for this matter

At the same time, ASPA has begun an analysis of available land at the current landfill for design, permitting, and construction of a lined cell for disposal of ash residues from the proposed EfW plant. While recycling of the plant's ash stream is possible over the long-term, the prudent course of action is to design and construct a landfill cell for ash residues.

Lastly**,** in concert with the procurement and permitting steps, ASPA has undertaken a proactive public involvement and outreach program to inform territory citizens about the project's aims to provide for long-term solutions for solid waste management issues, while providing an alternative, renewable energy supply for the territory. This public outreach program will involve periodic media information releases on the project, development of a project brochure, and ASPA staff interviews. This approach will assure a large majority of the public that the project has been prudently developed.

REFERENCES

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2. Rogoff, Marc J. *How to Implement Waste-to-Energy Projects*, Noyes Publications: Park Ridge, NJ, 1987.

TABLE 2 PROJECTED BTU VALUE OF WASTE COMPONENTS

Material Type	Portion of Overall Wastestream	Inherent Energy (Btu/lb)	Moisture Content	Revised Energy (Btu/lb)	Total Energy Contribution (Btu/lb)
Food	3.5%	2,000	92.5%	151	5
Paper (without cardboard)	6.7%	7,200	23.5%	5,508	371
Cardboard	17.6%	7,000	52.5%	3,325	586
Plastics	11.8%	14,000	23.0%	10,780	1,272
Textiles	3.9%	7,500	23.5%	5,738	221
Rubber	0.0%	10,000		10,000	5
Leather	0.0%	7,500		7,500	0
Garden trimmings	10.6%	2,800	66.5%	938	99
Wood (clean, painted, treated)	1.2%	8,000		8,000	93
Glass	3.2%	60		60	2
Tin cans	4.7%	300		300	14
Nonferrous metals	1.3%	0		0	0
Ferrous metals	0.5%	300		300	1
Dirt, ashes, brick, etc.	0.0%	3,000		3,000	1
Municipal solid wastes	15.0%	4,500	70.0%	1,350	202
Waste Oil	2.2%	21,000	92.5%	21,000	472
Tires	5.3%	13,500	23.5%	13,500	713
Total	87.4%				4,058