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***PAY-AS-YOU-THROW / VARIABLE RATES / RECYCLE
& SAVE FOR TRASH COLLECTION
REGION 9 GRANT REPORT EPA GRANT X100T11601 PAYT***

***PAY-AS-YOU-THROW POTENTIAL IN GUAM
WHITE PAPER FOR REGION 9 GRANT REPORT***

VOLUME 2 of 2

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February 2015

1.0 EXECUTIVE SUMMARY

As described in the Guam Zero Waste Plan White Paper C (Pay-As-You-Throw Trash Pricing Policy)¹, in 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste Plan for Guam. Zero Waste cannot be achieved through the implementation of a single initiative, alternative or strategy; instead, multiple initiatives are needed to achieve an effective Zero Waste system. On-island stakeholder working sessions explored a variety of options to achieve Zero Waste on Guam, and fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam

Pay-As-You-Throw “Pay as you throw” (PAYT) systems, also known as variable rates programs or user pay, ask households to pay more if they put out more garbage for collection. This simple concept – akin to paying a water or electricity bill –has been adopted by 8,700 communities across the US, and more than 40% of the US population has access to some kind of PAYT option in the United States. Generally, PAYT rates are determined by garbage bin sizes and the smaller the bin size, the lower the cost.

PAYT has been proven to reduce residential waste production (source reduction) and increase recycling rates without significant, long-lasting increases in illegal dumping.

Currently there is no policy requiring variable rates for residential trash collection on Guam. However, the Guam Solid Waste Authority (GSWA) currently operates facilities and programs that would be important precursors to a successful PAYT program on Guam. Pay As You Throw (PAYT) or Variable rate pricing is in place for other residential utility services provided on Guam including electricity and water (Guam Power Authority, Guam Water Works).

In the spring of 2014, Guam began its curbside recycling program (cart delivery conducted from October to March 2014), resulting in just under 10% curbside recycling. This study examines the impacts that a PAYT program could have on recycling and costs in Guam.

Two stages of work comprise the scenario analysis for Guam. We estimate the tonnage flows and changes, and the cost changes. This allows computation of the new recycling rate, as well as the costs for the new system and the new rates that must be charged to the households to cover costs. The rate computations derive from several key inputs:

- The new net per-household average monthly costs after PAYT
- The assumptions about the distribution of households on various can sizes – the can size distribution.
- The PAYT rate structure to be implemented. We assume options with both 80% differentials between the 32 and 64-gallon container sizes, and 50% differential scenario.
- The relationship between recycling revenues and landfill costs.

¹Guam Zero Waste Plan, “White Paper C: Pay-As-You-Throw Trash Pricing Policy,” June 2013. The description of current solid waste operations on Guam draws heavily on this document. <http://www.one.guam.gov/zero-waste/plan.html>

Our analysis found:

- Because the avoided landfill costs are quite high, Guam is likely to be able to implement PAYT at a fairly low cost (perhaps only \$0.25 per household per month) – assuming the up-front cost of containers is allowed a 10-year recovery through the rates customers pay.
- Substantial numbers of customers would pay less than they do currently, provided they select smaller containers.
- Recycling would increase from its current 9.8% to perhaps 16%, and nearly 12% less material would be delivered to the landfill.

Figure 1.1: Tonnage and Cost Computations for Guam – Pre and Post PAYT, 2016

	NO PAYT				Total or per average household	WITH PAYT				Total, or per average Household
	Trash / Landfilling	Recycled	Generated tons			Trash / Landfilling	Recycled	Source Red'n	Generated Tons	
Served Households	16955	15500				16955	15500			
Starting tons per month	1,360	148	1,508			1,360	148		1,508	
Add 6% recycling						-90	90			
Divert 5% to source red'n						-75		75		
Resulting Tons per Month	1,360	148	1,508			1,194	238	75	1,508	
Recycling Percent	90%	10%				79%	16%	5%		
COSTS - PER HOUSEHOLD PER MONTH										
Starting costs per HH/Mo	\$13.75	\$13.75			\$31.00					\$31.00
Add education and CSRs spread over 2 years										\$0.06
Add container costs amortized spread 10 years - LOW (50% replaced)									\$1.00	
Add container costs amortized spread 10 years - HIGH (80% replaced)									\$1.60	\$1.30
New Revenues for recycling							\$100.00			\$0.58
Avoided landfilling cost						-\$175.00				-\$1.71
New stopping charges										\$0.00
GHG						-\$2.50				\$0.02
Total New Bills for Customers after PAYT										\$31.26
Net Job creation								2.6 jobs		

The conclusions from the study are that:

- Recycling would increase from the current 9.8% to 16% (or 2,850 tons or more per year).
- Source reduction would divert another 900 tons per year (5%).
- Landfilled tons would decrease to 14,328 tons per year, reduced from the current 16,320 tons per year (12.2%).
- The net cost of the new PAYT system, including new costs, would be about an average of \$31.25 per households per year (about \$0.25 per household per month increase), or new costs of less than \$60,000 net per year across the system. The percent increase in costs nets less than 1%.²

² The scenario analysis assumes a revenue of about \$100 per ton, per the previous Guam study. However, applying the per-ton revenue values per material from the previous Guam study, but multiplying by the material mix actually being recovered by Guam’s residential program, leads to a weighted average per-ton revenue value of \$217/ton. This would improve the cost-effectiveness of the PAYT program. Weighted average per-ton revenues for the mix of materials being recovered by the program range from \$225-300 per ton between 2013 and 2015. Therefore, using \$100 per ton may be a more conservative assumption and financial performance is likely to be better than the figures shown. .

- There would be substantial up-front container cost investment, probably between \$1 million to \$1.4 million. We have spread these costs over 10 years embedded in the customer rates.

The range for likely rates that would result from scenarios we modeled are shown in Figure 1.2 below. The figure lists the assumptions at the top of each of the four scenarios, and in the rows provides the assumed percent of customers subscribed to each container size (the white boxes), and the calculated rates (in the grey boxes) that result from the combination of assumptions. In each case, new rates are assumed to increase \$0.25 per household per month over current costs (assuming several cost categories are recovered over multiple years).

Figure 1.2: Per Household Monthly Rates for Guam Residents after PAYT

		1. Smaller Cans, 80% Rate Differential		2: Smaller Cans, 50% Rate Differential		3: Larger Cans, 80% Rate Differential		4: Larger Cans, 50% Rate Differential	
Rate diff=> for mini percent of 1 can=> CAN SIZE and AVERAGE BILL level=>		80% Differential	21% red'n	80% Differential	21% red'n	80% Differential	21% red'n	80% Differential	21% red'n
24	0.38	\$14.97	5%	\$17.67	5%	\$13.30	0%	\$16.13	0%
32	1.00	\$18.71	35%	\$22.08	35%	\$16.62	25%	\$20.16	25%
64	2.00	\$33.68	35%	\$33.13	35%	\$29.92	40%	\$30.24	40%
96	3.00	\$48.65	25%	\$44.17	25%	\$43.22	35%	\$40.32	35%
192	6.00	\$93.56	0%	\$77.30	0%	\$83.11	0%	\$70.56	0%
300	9.38	\$144.09	0%	\$114.56	0%	\$127.99	0%	\$104.59	0%
Avg 30-g Can Equivs			1.82		1.82		2.10		2.10
Gals/hh (calc)			58.2		58.2		67.2		67.2
Goal Bill Level (from above)		\$31.25	1.84	\$31.25	1.84	\$31.25	2.10	\$31.25	2.10
Check bill (ignore)		\$31.25	Above is cans/hh	\$31.25	Above is cans/hh	\$31.25	Above is cans/hh	\$31.25	Above is cans/hh

The rates scenarios show that a share of customers would pay more than they do currently, and others would pay less – based on their selection of container sizes.

- In scenarios 1 and 2 (Smaller cans, 80-50% rate differentials), 40% of the households would pay less than their current \$31 bills, and those on cans sized 64 or larger would pay more than they currently do.
- In scenarios 3 and 4 (35% of households remaining on 96 gallon containers, 80-50% rate differentials), 65% of households would pay less than they currently do.

Recommendations for Refining these Estimates:

- Set out survey: A set out survey to identify the distribution of weights of trash currently set out by Guam households. Collecting data from a statistical sample of households would allow a much more refined estimate of the impacts from two effects: diversion to recycling and source reduction, and the “stomping” impact. From these figures (the starting distribution and these two adjustments) we would be able to generate an improved estimate of the percent of customers likely to select 32, 64, and 96 gallon trash service levels.
- Waste composition study of disposed household tonnage to confirm the availability of materials for recovery, and the mix of materials to allow refined estimates of net revenues based on the likely materials percentages recovered.
- Customers survey to help estimate the expected container sizes to be selected.
- Refinement of cost information / estimates.

Overall, it looks as though PAYT would make sense for Guam. There are divertible tons available at virtually the same cost as the current system, and the life of the landfill would be extended.

2.0 OVERVIEW OF PAYT

Over the last 20 years, a growing number of communities across North America have been using the user-pay principle used commonly for water, electricity, and other services. User-Pay, Variable-rate pricing, or “Pay As You Throw” (PAYT) is a strategy in which customers are provided an economic signal to reduce the waste they throw away, because garbage bills increase with the volume or weight of waste they dispose. PAYT is being adopted in thousands of communities to create incentives for additional recycling and waste reduction in the residential sector.

PAYT has become relatively common. Recent research (Skumatz et. al., 2015), indicates PAYT is available in more than 8,700 communities across the US, and more than 40% of the US population has access to some kind of PAYT option.³

2.1 Types of PAYT Options

PAYT programs are very flexible and have been implemented by communities in many forms. The most common types of PAYT programs are can programs, bag programs, tag and sticker programs, and hybrid programs. Other less common programs include are weight-based rates. Each program type – can, bag, sticker/tag, hybrid, and weight-based – is briefly summarized below.⁴

- **Variable Can or Subscribed Can.** In this program, customers select the appropriate number or size of containers (one can, two cans, etc., or 30–35 gallons, 60–65 gallons, etc.) for their standard weekly disposal amount. Rates for customers signed up for two- or three-can service are higher than rates for one-can customers. Some communities also have introduced mini-can (13–20 gallons) or micro-can (10 gallons) service levels to provide incentives for aggressive recyclers. These programs are becoming more and more common because they work very well with full-automated collection trucks.
- **Bag Program.** In this program, customers purchase bags imprinted with a particular city or hauler logo, and any waste they want collected must be put in the appropriately marked bags. Bags holding from 30 to 35 gallons are most common; some are smaller. Sales through community centers; or grocery and convenience stores are most common (sometimes with commission) and minimize inventory and invoicing issues. The bag cost incorporates the cost of the collection, transportation, and disposal of the waste in the bag. Some communities charge all costs in the bag price; others charge a separate customer charge to reduce risks in recovering fixed system costs. These programs are more common in locations with barriers to fully-automated collection (on-street parking barriers, hills, overhead wires, alleys / narrow streets, etc.).
- **Tag or Sticker Programs.** These are almost identical to bag programs, except instead of a special bag, customers affix a special logo sticker or tag to the waste they want collected. The tags need to be visible to collection staff to signal that the waste has been paid for. Like the bag program, tags

³ Skumatz, Lisa A., Ph.D., Dana D’Souza, and Dawn BeMent, 2015, “PAYT / Variable Rates for Trash Collection: 2015 Update”, Econservation Institute, Superior CO, prepared for US EPA Region 9, February.

⁴ Skumatz, Lisa A., Ph.D., and David J. Freeman, 2006, Skumatz Economic Research Associates, Inc., Superior CO, prepared for SERA and USEPA Headquarters, December.

are usually good for 30-gallon increments of service. Pricing and distribution options are identical to bag programs.

- **Hybrid System.** This system is a hybrid of the current collection system and a new incentive-based system. Instead of receiving unlimited collection for payment of the monthly fee or tax bill, the customer gets only a smaller, limited volume of service for the fee (typically 1 or 2 cans or bags). Disposal of extra bags / cans beyond the approved base service requires use of bags or stickers, as described above. This system is attractive to communities as it requires no change in billing system, containers, or collection system, and the base service can be tailored to suit the community. Many customers see no change in bills; large disposers are provided an incentive to reduce. These programs are sometimes an end in themselves; other communities implement this program as a transition to a fully-variable program.
- **Weight-based System.** Called “Garbage by the Pound” (GBTP) in its earliest US test (Skumatz, 1989⁵), this system uses truck-based scales to weigh garbage containers and charge customers based on the actual pounds of garbage set out for disposal. On-board computers record weights by household, and customers are billed on this basis. Radio frequency (RF) tags, are affixed to the containers to identify households associated with the can weight for billing. These programs have been pilot-tested in the U.S., and implemented overseas. Certified scale systems are now available in the US; however, despite multiple pilot tests in North America, they are not in full scale use in US or Canadian communities (except one community charging by GBTP for commercial businesses).
- **Other Variations.** Some communities or haulers offer PAYT as an option along with their standard unlimited system. Waste drop-off programs, charging by the bag or using punch cards or other customer tracking systems, are also in place in some communities, especially in rural areas.

2.2 Pros and Cons of PAYT

Why are communities implementing PAYT? Well, certainly, strong diversion results have been reported by hundreds of communities across the US (Seattle, Portland Metro, San Jose, San Francisco, and many more). In addition, a study in Colorado to identify what strategies might be most fruitful for improving the state’s recycling rate (Skumatz and Freeman, 2008)⁶, the researchers found that PAYT is one of the top three features to which the leading states say they attribute their state’s strong recycling performance.

However, rather than relying on case studies alone, it is important for communities to have access to “transferable” data – statistically realistic information to provide expectations about what will happen if they implement PAYT. Data from more than 1,000 communities around the country was used to identify the impacts of PAYT above and beyond any other recycling or yard waste program differences, demographics, and other factors. The research showed the following impacts on residential solid waste:⁷

- Household disposal decreases by 16%-17%

⁵ Skumatz, Lisa A., Ph.D., “Garbage by the Pound”, Resource Recycling, 1989.

⁶ Skumatz, Lisa A., Ph.D. and Juri Freeman, “Colorado Roadmap...”, Skumatz Economic Research Associates, Superior, CO, prepared for Colorado CDPHE, 2008.

⁷ Skumatz, Resource Recycling 9/1996, 8/2000, updated 2001, 2006, 2010, 2015.

- Increases in recycling of 5-6 percentage points or 5-6% of residential waste generation (usually about a 50% increase in current recycling)⁸ .⁹
- Increases in yard waste diversion of about 4-5 percentage points
- Source reduction of about 6% of generation¹⁰

The results indicate that, overall, a town with 100,000 tons of residential disposal could expect to see a reduction to about 84,000 tons. Recycling tonnage would increase by about 5,500 tons, and yard waste programs would see an additional 4,500 tons. About 6,000 tons would be avoided through waste prevention, based on the study's estimates.

Other impacts are also realized when installing PAYT.¹¹

- **Cost impacts:** Based on detailed interviews, communities report that long term system costs are reduced; and the majority of communities in state surveys report short term system costs did not increase either. In two state surveys¹² (WI, IA), about two-thirds of the communities reported that short-term system costs were lower or stayed the same after PAYT was implemented. Only one-third reported increases. These results show you can make “sensible” choices in PAYT that minimize costs and “fit” well with the community.
- **Disposal Savings:** Don't forget that in addition to savings in disposal tipping fees (perhaps 16%, but net out the recycling and yard waste program cost impacts), the programs can also allow communities to delay building a new landfill, and this results in real financial savings. Reducing 16% of the disposal extends the lifetime of the facility by one-sixth – and similarly decreases the money that needs to be set aside for a new facility and for closure costs because the funds can be accumulated over a longer period.
- **Buying habits:** Reported results of customer survey research indicated 76% have purchasing decision-making affected by PAYT, and that PAYT has a demonstrable effect on waste-generation and buying habits.¹³
- **Bins set out:** Households put out fewer garbage bins for collection after PAYT is implemented – partly because of declines in tonnage, and partly because cans are “stuffed”. (dubbed the “Seattle Stomp”). Seattle (WA) cans reduced from 3.5 30-gallon cans to 1.0 with PAYT and new programs;



⁸ Analyzing Iowa communities, Frable, 1994, found an increase of 30% to 100% with an average of 50% increase in recycling tonnages.

⁹ Interestingly, the SERA research shows the PAYT program provides similar diversion incentives for both curbside and convenient drop-off recycling arrangements, although most of the latter are in smaller communities.

¹⁰ Skumatz, Lisa A., Ph.D., 2001, “Source Reduction Can Be Measured...”, Skumatz Economic Research Associates, in Resource Recycling, 2001, and on websites (EPA, www.paytnow.org, etc.)

¹¹ From Skumatz, Lisa A., Ph.D., 2008, “Frequently Asked Questions about PAYT”, Skumatz Economic Research Associates, Superior, CO., also available on www.paytnow.org website.

¹² Frable, 1994 for Iowa, and Wisconsin DNR studies (citation to be completed)

¹³ Skumatz 1993, “Variable Rates for Municipal Solid Waste...”, for the Reason Foundation, Los Angeles.

Hoffman Estates (IL), decreased from 3.1 units to 1.3 stickered bags. Many communities report 1-1.5 30-gallon equivalents after a variable rates program -- important for setting rate levels.¹⁴

- **Customer Satisfaction:** Multiple community surveys indicate more than 90% of customers are pleased with systems after they are implemented – and they don't want to return to the old system because PAYT is fairer.¹⁵ However, the challenge is getting the systems accepted prior to implementation. Change is always difficult.

The research indicates that adding a PAYT program is the single most effective change a community can make to increase recycling. According to the research, PAYT increases recycling more than adding a new material, changing collection frequency, or many other potential program design or collection changes.

PAYT or variable rates programs provide a number of advantages for communities and residents:

- **Equity.** PAYT programs are fair: customers who use more service pay more.
- **Economic Signal.** Under PAYT, *behavior* now affects a bill, regardless of what disposal choices a household made. Without PAYT, avid recyclers paid the same as large disposers. PAYT provide a recurring economic signal to modify behavior, and allows small disposers to save money compared to those who use more service (and cost the system more).
- **Lack of Restrictions.** PAYT does not restrict customer choices. Customers are not banned from putting out additional garbage; but those who want to put out more will pay more.
- **Efficiency.** Variable-rate programs are generally inexpensive to implement and, unlike recycling programs, do not require additional pick-up trucks. They also help prevent overuse of solid-waste services. Rather than fixed buffet-style charges, which encourage overuse of the service, volume-based rates encourage customers to use only the amount of service they need.
- **Waste Reduction.** Unlike recycling programs alone, which only encourage recycling, PAYT reward all behaviors—recycling, composting, and source reduction—that reduce the amount of garbage thrown away. Source reduction is the cheapest waste management strategy and thus of the highest priority—and it is not directly encouraged by recycling and yard waste programs.
- **Speed of Implementation:** Pay-as-you-throw programs can be very quickly put in place—one community installed a PAYT program in less than three months (although most take longer).
- **Flexibility.** “Pay-as-you-throw” programs can be implemented in a variety of sizes and types of communities, with a broad range of collection arrangements.
- **Environmental Benefits.** Because they encourage increased recycling and waste reduction, PAYT programs are broadly beneficial to the environment. Considerable attention has been paid to this issue. One study¹⁶ estimated the tons of emissions reduced through PAYT programs, and then computed the dollar value of these greenhouse gas (GHG) reductions using valuations from

¹⁴ *Ibid.*

¹⁵ *Ibid.*

¹⁶ Skumatz and Freeman 2006, “2006 PAYT Update...”, SERA / EPA.

the environmental literature. The study estimated that these environmental benefits were worth an additional \$1 to \$6 per ton. An especially important point to realize is that solid waste programs can be both cheaper, and quicker to implement than other methods of achieving GHG reduction goals – even though energy and transportation receive the most attention for GHG goals. One community found that fully 40% of the first couple years of progress they had made in reaching sustainability goals had been attributed to their solid waste programs.¹⁷

- **Self-funding:** perhaps the greatest advantage of PAYT is that is ultimately self-funding. Users pay, and the community does not incur any substantial on-going costs that it does not choose to.

However, there are also concerns about PAYT programs. The most frequently mentioned include:

- **Illegal dumping:** Research¹⁸ shows illegal dumping is a bigger fear than reality¹⁹, and is a problem in about 20% of communities – a problem that lasts about 3 months or less. Further, analysis of the composition of illegally dumped material finds only about 15% is household in origin and that the largest household component is bulky items or appliances (or “white goods”). Enforcement of illegal dumping ordinances usually keeps the problem at bay. PAYT programs should make sure to introduce methods for getting rid of occasional bulky materials through stickers, payments, appointments, or other methods.
- **Concerns about large families or the poor:** Large families pay more for groceries, water, and other services they use more than other households, and PAYT basically extends this to trash service. Note that large families have opportunities to reduce trash through recycling – opportunities that are not as readily provided in the use of food and other utilities. In some cases, communities provide “lifeline” discount rates for essential services like energy and telephone, etc., and these types of discounts can be extended to garbage fees through discounts or allocations of some free bins or bags.. Special arrangements for poor or infirm are made in fewer than 10% of the communities with PAYT, but are included in communities with policies for other subsidized utility services (historically, e.g., “lifeline” or discounted rates for phone, electricity, etc.).²⁰
- **Revenue uncertainties:** The number of bags or cans of trash set out decreases dramatically with PAYT – due to reduced disposal AND stomping or compaction. Communities and haulers implementing PAYT need to adjust their expectations about the number of set outs in order to assure they cover the fixed costs of collecting solid waste. In addition, rate structures that are very aggressive can exacerbate the revenue risk issue, so “can is a can” rates can make it riskier

¹⁷ Skumatz, Lisa A., Ph.D., and Juri Freeman, 2006, “PAYT in the US: 2006 Update”, Skumatz Economic Research Associates, Inc., Superior, CO, December.

¹⁸ Skumatz, Lisa A., Ph.D., Hans Van Dusen, and Jennie Carton, 1994. “Illegal Dumping: Incidence, Drivers, and Strategies”, Research Report Number 9431-1, Skumatz Economic Research Associates, Inc., Seattle WA / Superior, CO, November.

¹⁹ It scores much higher as “concern” than real effect after the fact. For more information see Skumatz, Lisa A., Ph.D., 2001 “PAYT: Frequently Asked Questions”, Skumatz Economic Research Associates, Inc., website, www.serainc.com, Superior, CO.

²⁰ Skumatz, Lisa A., Ph.D., 1995. “How Can Low Income Programs Work? Addressing Special Populations Under Variable Rates Systems”, Research report 9508-1, Skumatz Economic Research Associates, Inc., Seattle WA / Superior CO.

to recover costs. Research indicates most of the recycling incentive is maintained even if the full cost differentials are 80% more for double the service.²¹

- **Administrative burdens / workloads:** Studies in Wisconsin and Iowa²² indicate that workloads stayed the same or decreased in 60-70% of the communities implementing PAYT. Workloads during implementation will be increased (including calls) and temporary staff are likely to be needed.
- **Multifamily buildings:** PAYT is most tested in single family situations up to perhaps 8-unit apartment complexes. They are not widely tested in large multifamily buildings (with chutes), although some technologies are being developed.²³ However, multifamily buildings serviced by dumpsters receive a better volume-based building-wide incentive for recycling than single family household with a non-PAYT system. The lesson is that PAYT should not be held up because it doesn't yet apply well to the multifamily sector.

Figure 2.1: Key Facts about PAYT / User Pay

- *PAYT programs are in place in thousands of communities – including those with a few hundred population as well as a majority of the largest cities in the US.*
- *PAYT is fairer than tax-based systems – and after implementation more than 95-98% of households prefer the new system.*
- *PAYT reduces residential trash disposal by one-sixth (about 17%). Analysis shows about one-third (6%) shows up as increased recycling, about one-third (5%) as increased composting, and one-third (6%) is “source reduced” or avoided generation (buying in bulk, etc.) (Skumatz Economic Research Associates, 1996, 2001, 2006, 2015)*
- *Implementing PAYT is the single most effective thing a community can do to increase the diversion from curb-side OR drop-off programs.*
- *Concerns about illegal dumping seem more fear than reality. Problems arise in fewer than 1 in 5 communities, and usually last less than 3 months.*
- *While significant differentials in rates between different can sizes are an important incentive, twice as much service does not need to cost twice as much in order to provide an incentive – a differential of 80% seems to generate most of the diversion impacts associated with more aggressive rates. .*
- *Political issues are the main barrier in PAYT – technical issues (litter, equipment, administration, haulers, etc.) are rarely a bother and have solutions from around the nation.*
- *Bags / tags and hybrid systems take the least capital investment; can-based programs*

Source: Skumatz Economic Research Associates, Inc. (SERA) research

Ultimately, it is anticipated that using PAYT to reduce the burden on the disposal system will lead to more efficient use of services, reduced burden on the disposal system, improved environmental and resource use, and lower long-run solid waste system management costs.

²¹ Low differentials don't provide a noticeable incentive, and if higher differentials won't be supported, then the PAYT system should not be implemented. For more information see Skumatz, Lisa A., Ph.D., 2001. "PAYT: Frequently Asked Questions", Skumatz Economic Research Associates, Inc., website, www.serainc.com, Superior, CO.

²² Garth W. Frable and Michael Berkshire, "Pay-As-You-Waste: State of Iowa Implementation Guide for Unit-Based Pricing" East Central Iowa Council of Governments and Iowa Department of Natural Resources, Cedar Rapids, Iowa, January 1995.

²³ Skumatz, Lisa A., Ph.D., 1999. "Reaching for recycling in multi-family housing", (analyzing suggestions for incentives and progress in getting past collection barriers in MF), *Resource Recycling*, October.

2.3 Choosing the Appropriate PAYT System

There are many system design choices related to PAYT; two key ones are:

- Bin vs. bag / tag / hybrid options
- Rate differentials or incentive levels to be provided.

System choice is driven by a number of factors. Relative amount of tonnage diversion caused by the different options is one of those factors. In early research, the consulting firm SERA used statistical approaches and data from large number of communities to examine the recycling and diversion resulting from can vs. bag vs. tag vs. hybrid programs. The study²⁴ found that bag programs actually led to slightly higher diversion tonnages – all other factors held equivalent (community demographics, other programs in place, etc.). The authors speculated that this may result because a bag program charges for the amount (volume) of service actually used, and the can program charges based on a volume subscribed, whether or not that container is filled on a weekly basis. Therefore, if households have less garbage than a full can, they may not feel as strong an incentive to divert all their recyclables, since they are paying for that extra space anyway.

Reusable bins reduce the costs and waste generation associated with purchasing plastic bags.

2.4 Existing Research on Optimizing PAYT Design

It might be conjectured that the greater the financial incentive for decreasing trash can size (or the greater the penalty for higher service levels), the greater the recycling achieved. Even if this is true, there is considerable financial risk to a rate structure that becomes very “aggressive”. Rates are designed to raise revenues sufficient to cover the cost of providing collection service. The cost structure for providing trash service is a high fixed cost and low marginal cost (or a low cost for collecting an extra pound or can of trash at a household). If a system is to provide a substantial financial incentive to reduce trash volumes, then some of the cost of basic collection for low subscription levels ends up being subsidized – and the only place to get that subsidy is to assign higher costs to the large trash subscribers. The greater the price differential, the greater the transfer, and the greater the risk of not recovering all the revenues needed to fund basic collection.²⁵ We analyzed whether there is an optimum.

Balancing Incentive, Performance, and Risk²⁶

Rate incentives and specifically, PAYT rate differentials can be a driver for successfully increasing diversion. In previous quantitative research²⁷ (Skumatz 2001, 2013 and others), it was found that a

²⁴ Skumatz, Lisa A., “PAYT Rate Design...”, Resource Recycling, 2003.

²⁵ There can be a concern about “subsidies” and paying fair shares. The residential sector as a whole is not necessarily subsidized under a PAYT system (unless a community *chooses* to subsidize it from general fund, commercial customers, or elsewhere). However, there are usually some subsidies of low users by high subscribers in order to create a more effective financial incentive under the PAYT system.

²⁶ This section relies heavily on a nationwide study by Skumatz, “Recycling Best Practices Study: Practical and Effective Methods to Move Recycling Forward”, Skumatz Economic Research Associates, November 2013.

²⁷ Skumatz, “Maximizing Vr/Payt Impacts – Policies, Rate Designs And Progress”, Resource Recycling, June 2001, and Skumatz, “Recycling Best Practices Study: Practical and Effective Methods to Move Recycling Forward”, Skumatz Economic Research Associates, November 2013.

community can achieve the same recycling or diversion levels from a PAYT rate differential of 80% more for double the service. Less than this achieves less recycling – and the research indicates that an incentive or differential of less than 50% for double the service volume -- is much less effective. That implies a goal for effective PAYT price differentials is between 50% and 80% for double the service, with a bias toward higher levels.

The study assess a community's incentives by comparing rates for 64 to 32-gallon service levels (including embedded recycling costs).

The study used data from a large nationwide database collected by the authors²⁸ and statistically analyzed a wide range of PAYT factors that might affect recycling, including system type, variations in incentive levels (differentials), and container sizes. One key factor that was systematically important to reaching higher levels of diversion was whether the community offered a mini- or micro-can option in a PAYT program – a 10 or 20 gallon container at a lower price. Mini-cans apparently work.

PAYT Rate differentials – How much is enough?

The study also investigated the break points at which PAYT incentive levels become effective. The question of how much rate incentive / percent increment is “enough” vs. potentially “too much” in a PAYT system is an important one. Having too little incentive leads to a lot of administrative and political effort for barely any recycling impacts compared to a flat rate, and a shortfall in the diversion potential and equity benefits associated with PAYT. But there are difficulties associated with too high an incentive as well. There were those early on (specifically in California) that expected to “more than double” the rates for double the (gallons of trash) service, arguing for the strongest possible diversion incentive. The two main areas of difficulty from this kind of “too high” rate incentive are:

- Potential to anger residents, leading them to increase litter / illegal dumping, and complain.
- Revenue certainty problems.

To explain the balancing act on the second issue, consider the following. Communities (and haulers) set rates to recover revenue requirements²⁹, and the cost of service is, in the largest proportion, the cost of getting trucks to the door, not the tonnage collected.³⁰ If too much of the cost of (collection) service is loaded onto the larger cans (which it must be if incentive-based rates are charged),³¹ and the incentive is too successful, the system may mis-predict the number of customers signing up for larger cans, and the system runs a risk of not covering the basic costs of door-to-door service. The funds for the subsidy for lower cans do not materialize. The farther that the rate design deviates from strict cost of service by size, the greater is the risk of under-recovery of costs.

It is best to find the rate optimum: high enough to provide a recycling incentive, but not so high that the system's economics are in jeopardy.

²⁸ Data collected by Skumatz Economic Research Associates (SERA), Superior Colorado, including programmatic, cost, demographics, and other data from more than 1,000 communities nationwide.

²⁹ Plus profit, for a hauler, or plus an allowed net income in some communities.

³⁰ The literature often suggests the collection cost is 80-90% of the rates charged for service. Obviously, this varies depending on labor rates and tipping fees. The inverse is that 10-20% of the cost of collection [is the tip fee / disposal part.

³¹ PAYT are still rates that cover the cost of service for the class appropriately.

As a consequence, we conducted statistical work to analyze the impacts of different levels of incentives. The data from the PAYT communities around the country were used in regressions to assess the two ends: the cost at which rate incentives seem to “kick in” (increase recycling), and the differential at which no additional diversion incentive seems to result. We tested both dollar value differentials (between the 30 and 60 gallon containers), and the percentage differences (same container sizes – the percent extra charged for this “double the service” option).

Dollar differences of greater than \$5-6 / month for moving from 30 to 60 gallon container sizes were significant and positive, adding substantial diversion (about 4-7 percentage points to recycling beyond those programs that charge less). The impacts did not increase a great deal with larger rate differentials, but the study did find that differentials in the \$8-10 range were solidly at the high end of the range. The analysis of percentage differentials showed that the greatest additional recycling is achieved when the price for the 60 gallon container is between 50% and 80% more than the price of the 30 gallon container. This added nearly 9 percentage points of diversion. The recycling results were smaller for rate differentials outside this range.

The study notes that the analysis is based on “all together” rates – defined as no separate fees broken out – the total that the household sees. The study also assumes that, once the rate differential for 30 and 60 gallons is “set” (defined by dollars, or by percentage, but then translated into dollars), the same dollar differential is used for moving from 60 to 90 gallons – for each 30 gallon increment, excluding the setting of rates for a mini or micro can (about 20 or 10 gallons, respectively).

Communities with stalled recycling and PAYT should consider checking whether the rate differentials should be revised to be consistent with the research; higher recycling can be achieved if 50-80% differentials are charged for double the service (assuming small container sizes like 32 gallons are available).

Figure 2.2: PAYT Program Design Results (Source: Skumatz, Lisa A. Skumatz Economic Research Associates, statistical research, 2012-2013)

PAYT Program / Policy Factors	Range of Impact on Recycling Percentage (percentage points ADDED to existing recycling rate in town) ³²
Mini- or Micro trash can offered (10-20 gal)	Substantial increase
Optimal rate differentials moving from 30-60 gallons (dollar differentials)	Minimum \$7; strong impacts \$7-\$12 ³³
Optimal rate differentials moving from 30-60 gallons (percentage incentives)	50%-80% of 30 gallon rate ³⁴
Socio-demographic factors	
Low tipping fees	Less recycling
Large community	Less recycling

³² The only other indicative finding was that hybrid programs may lead to higher recycling than bag or tag systems or can systems. This result is inconsistent, however. This is different from earlier results that indicated bag systems delivered higher recycling levels than can-based programs (Skumatz, Lisa A., SERA 2000).

³³ Differentials smaller than this value were less effective than \$7 differentials, which tended to have negative signs, indicating the incentive was too small to be effective in increasing recycling rates. Similarly, the impact on recycling diversion decreased for dollar differentials higher than \$11 or \$12.

³⁴ This range had the highest recycling incentive, adding substantial percentage points of PAYT recycling performance; other differentials had lower impacts, controlling for additional impacts of mini/micro cans, low tipping fees, and large communities.

One-Part or Two-Part Pricing

The research above is based on analysis of the full price that the consumer sees – no matter how it constructed. Communities have designed their rates in two main ways:

- calculating rates in a combination fashion (with a selection of possible incremental fees for higher volumes as mentioned above), or
- calculating a “stopping fee” or a base program fee (for recyclables, etc.), and then adding a separate price “per 32 gallons” of trash service (a base fee plus a fixed adder of a “bin is a bin”—or 32 gallons is 32 gallons -- for increments of trash service).

Whichever mechanism underlies the price that households see, the final result should be total rates that conform to the recommendations from the statistical study above – total rate differentials should aim to be 50-80% more for the total cost of the increment from 30-60 gallons, and that same dollar increment should be assigned to each 30 gallons above that. Increments should not be less than \$7-12 for 32 gallons, according to the statistical research, if strong diversion is the goal.

Research on Typical Pricing for Bin and Bag PAYT Programs

Recent research was also conducted on can subscriptions and pricing differentials (Skumatz, et.al. 2013).³⁵ This study used data from national community surveys on solid waste and recycling conducted by the authors. The study focused on PAYT communities, and provided summary statistics on:

- average prices charged for various subscribed can service levels (Figure 6.2); and
- average prices charged for bag-based programs (Figure 6.3).

Figure 2.3: Average Prices Charged for Subscribed Can Service (From Skumatz, et.al, 2013)

PAYT w/ cans	Minican ³⁶ (15-23 gal)	30-35 gallon	60-65 gallon	90-96 gallon	Add'l Can	Per "Bag" or "Tag" in addition
Count	29	55	57	60	5	19
Average	\$18.15	\$19.36	\$29.49	\$37.16	\$9.61	\$3.13
Min	\$2.75	\$5.50	\$7.56	\$10.80	\$6.90	\$0.50
Max	\$28.23	\$33.45	\$65.00	\$98.44	\$15.00	\$6.19
Ratio of average price compared to 32 gallon	94%	100%	152%	192%	50% (small sample)	16% (one- time, not 4.3 times)

The differentials between average prices (bottom row) are less than the recommended values for highest performance, but still show substantial variation for increases in volumes.

Figure 2.4 shows the results for respondents that answered that their community uses only bags for PAYT-based residential trash.

³⁵ Skumatz, D’Souza, and BeMent, (2013), “Can Subscriptions and Price Differentials in PAYT – White Paper”, Skumatz Economic Research Associates, Inc., Superior, CO, 80027.

³⁶ Note there were not enough observations to publish results for microcan service levels.

Figure 2.4: Average Prices Charged for Bag-Based PAYT Programs

PAYT w/ bags only	Bag (15-23 gal)	30-35 gallon	Per "Bag" or "Tag" in addition
Average	\$1.17	\$1.96	\$2.33
Min	\$0.60	\$1.20	\$1.00
Max	\$2.50	\$2.50	\$3.30

Choosing the Best PAYT Option:

From an overall point of view, the research indicates that:

- Considering the perspective of maximizing diverted tonnages:
 - small PAYT containers enhance the diversion to recycling and organics containers (less than 30 gallons for a system with both recycling and organics collection)
 - In communities in which it is feasible to provide collection for organics, adding this collection will divert significantly more tons.
 - Assuring the price increment between container sizes is at least 80% (no less than 50%) for doubling the volume in a 30 vs. 60 gallon container, and making sure the cost differential is at least in the range of \$7-12 per month.
 - Consider bag programs for slightly higher diversion, all else held equal

- From a cost-effectiveness point of view:
 - Consider every other week recycling collection; the savings from one fewer collection per week can be allocated instead to an organics collection program, adding on the order of 6 percentage point more diversion.
 - Consider every other week trash collection to further decrease costs, potentially reduce the inventory of containers needed, and reduce blow-overs of containers (larger containers collected less frequently will be stockier in design).
 - Going to every other week trash will provide additional collection cost (truck stopping by) savings, and also drive more food waste to the organics collection.
 - Save money on containers by recycling large trash carts into recycling (or organics) bins through switches in the color of lids, or the use of decals.
 - Consider bag or hybrid options to eliminate the issue of financing new containers.

- Overall design elements include:
- Incorporate the cost of recycling into the trash bill and offer recycling at no additional fee – a basic design outcome; consider incorporating the cost of organics in the bill, if maximum diversion from the landfill is the goal. .

However, factors like the types of collection vehicles, whether there are already containers in place, capital cost barriers to purchase of new containers, presence of a billing system / mechanism, and other factors will affect the choice as well. The next chapter assesses which options may make most sense given Guam’s unique situation.

2.5 Implementing PAYT -- Tips for Success

The amount of time it takes to implement PAYT programs varies from as little as 3 months to communities that are still studying the system after several years. Frankly, although billing system delays or technical issues are sometimes a factor, technical issues are seldom the problem in implementing PAYT. PAYT programs have tremendous flexibility in their design and can usually be tailored to accommodate most concerns. Instead, political will is usually the largest stumbling block and source of delay for implementing PAYT programs. Recall, however, that once these programs are in place, more than 90% of residents prefer the new system. Many manuals available that provide steps, timelines, and tips for implementing PAYT.

Based on interviews with hundreds of communities nationwide what have implemented PAYT, published work by the consulting firm SERA has assembled the following tips.³⁷

- ▶▶ **Pilot test:** Consider implementing the program in one area of the city first, and then spread to other areas. Learning lessons about subscriptions, set outs, containers, and other problems in ¼ of your town are much less expensive than making a mistake citywide.
- ▶▶ **Billing:** billing jointly with water service, if possible, can provide strong advantages. If the ordinance is arranged so that partial payments are assigned to solid waste first, then non-payments can lead to shutoffs of water service, a strong payment incentive. Bad debt is quite low under these systems.
- ▶▶ **Involve others in design:** Assembling a citizen or stakeholder committee to help assess and design the program can help sell the program to elected officials, and can make sure that the program addresses concerns of major stakeholders. Although this process may appear to slow down the decision-making, it can often speed it in later steps and can bring support for the program when it most needs it. Don't forget to meet with related city departments, including financial, billing, enforcement, customer service, police, and others that may be affected by PAYT changes.
- ▶▶ **Don't pile on other costs:** If you are just implementing PAYT, try not to pick that year to do a major renovation to transfer stations or other upgrades that are not visible to residents. The increased costs, whether or not they are due to PAYT will be blamed on PAYT and will undermine the buy-in for the program.
- ▶▶ **Determine whether to make changes at once or more slowly and design education accordingly:** Some communities argue that implementing many changes at one time confuses citizens and makes the education process difficult. Others argue that customers don't want to have to make decisions about solid waste in a piecemeal manner, and want to "deal with it once".
- ▶▶ **Education and outreach:** None of the town interviewed wished they had done less education. This is a crucial component of a successful PAYT program.

³⁷ Skumatz, *Resource Recycling*, 8/97; multiple manuals

3.0 Can PAYT Work in Guam?

3.1 Guam's Solid Waste Collection System / Context

As described in the Guam White Paper C (Pay-As-You-Throw Trash Pricing Policy)³⁸, in 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste Plan for the island of Guam. Zero Waste cannot be achieved through the implementation of a single initiative, alternative or strategy; instead, multiple initiatives are needed to achieve an effective Zero Waste system. Stakeholder working sessions explored a variety of options to achieve Zero Waste on Guam, and fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam

Currently there is no policy requiring variable rates for residential trash collection on Guam. However, the Guam Solid Waste Authority (GSWA) currently operates facilities and programs that would be important precursors to a successful PAYT program on Guam. Variable rate pricing is in place for other residential utility services provided on Guam including electricity and water (Guam Power Authority, Guam Water Works).

GSWA Services and Operations

There are approximately 44,000 civilian residents in Guam. GSWA provides weekly curbside trash collection to approximately 17,000 single-family homes (the remaining 61% of multi-family, residential as well as commercial and military trash is collected by private haulers). Curbside trash collection service is not mandatory, and many residents have delayed paying for the service provided (although GSWA has reduced delinquencies in this and the commercial sector to a few percent a few years ago). Other residents drop off trash at island convenience centers for fees that begin at \$7.50 for three cubic yards and are limited to 6 cubic yards per day (cy/day) (recyclables are accepted for free). The following program components form an existing foundation for a new PAYT system (Anderson, 2012):

Comprehensive database of residential accounts throughout the island

- Weekly curbside trash collection - including collection vehicles and 96-gallon trash carts (GSWA's existing cart vendor contract can be extended to include new carts for a PAYT program)
- Private sector processing of pilot and convenience center recyclables, and introduction of a new curbside recycling program for the vast majority of residents in 2014 (90% of these receiving trash service).
- Trash collection/disposal based on a monthly per-household fee of \$30

³⁸ Guam Zero Waste Plan, "White Paper C: Pay-As-You-Throw Trash Pricing Policy," June 2013. The description of current solid waste operations on Guam draws heavily on this document. <http://www.one.guam.gov/zero-waste/plan.html>

- Additional carts are available for \$15 (although few residents require) or extra trash can be bagged and tagged with a \$4 sticker - making this a quasi-hybrid PAYT system, except that trash volume unit choices are not available to residents and the waste diversion potential is not maximized
- Fees cover the cost of collection, disposal and construction/debt service of the Layon Landfill

GSWA also provides services and conducts operations not directly related to a future PAYT program (bulky/metal waste collections, special waste management, commercial transfer station and municipal solid waste landfill operations). Commercial trash collection service on Guam is provided by private haulers, who are required to deliver all materials to the commercial transfer station in Harmon.

GSWA Curbside Recycling Program

GSWA conducted a pilot curbside recycling study with 1,000 households in 2010/2011, using 96-gallon carts identical to those used for trash collection only with green instead of brown lids. Results from households with twice-monthly collection included a 16% diversion rate by weight and projected capture of nearly 2,000 tons/year of recyclables from their current 17,000 single-family residential accounts (GBB, 2012). As mentioned, GSWA rolled out the collection of single-stream recyclables from residences that also receive trash collection service in spring 2014.

The new full-scale recycling program began operations in spring 2014, without any embedded PAYT incentives, with service delivered to 90% of the customers receiving trash service; 10% have difficult-to-serve households.

This study examines the potential effects that PAYT might have on operations and economics of the new trash and recycling system.

Updated System Context – After Adding Recycling

As a result of the new system, trash collection moved from five to four days per week (Monday through Thursday), the number of routes decreased from 7 to 6, and the collection workday moved from 8 to 10 hours (4-10s).

- Recycling carts were purchased and some existing carts were repurposed to recycling by changing the colors of the lids. In total, 15,500 carts were needed, and after repurposing, 12,000 new recycling carts were needed at a cost of about \$100 each (\$1.22 million). This represents about 90% of those with trash service.
- Every other week collection for recyclables was implemented. This is consistent with studies indicating the program is most cost-effective if delivered in this way³⁹, and Guam's pilot test citizen survey showed every other week was the preferred option.

³⁹ Skumatz, Lisa A., 2012, "Every Other Week Collection...", *Resource Recycling*; see also Skumatz *Resource Recycling*, 2008.

- Recycling⁴⁰ cart delivery was completed in March 2014 for full implementation of the program, and the average number of monthly recycling tons diverted is just under 148 tons per month (April–June 2014). Trash and recycling tons for April–June 2014 totaled, respectively, 4080 tons of trash, and 445 tons of recyclables (9.8% diverted). Each GSWA customer household generates about 42 pounds of trash each week or six pounds per day.
- The collected material was 22% plastic, 32% cardboard, 34% paper, 5% bimetal cans, and 6% aluminum cans. Contamination levels were reported to be 11%, and participation for the four collection days averaged just over 50% (50.5%, ranging from a low of 44% on Thursday routes, and a high of 57% on Wednesday, in different neighborhoods).
- The costs per ton were reported as follows:
 - Landfilling: \$171.60 per ton. Given the number of tons and household served, the cost of service estimate is about \$13.76 per household per month.⁴¹
 - Recycling: \$144.02 per ton. Given the number of tons collected and the households served, the cost of service is the same - about \$13.78 per household per month at current collection levels.⁴²
 - The residential customer billings (October 2013–June 2014) were \$4,629,480, and the revenues collected from the class were \$4,837,295. Divided by 9 months and 16,955 trash collection households, this averages about \$31.00 per household per month. The total of the calculated trash and recycling collection based on the per-service costs above is about \$27.50 per month, or about 89% of this value. We are not certain if the missing is rounding error, the cost of transfer stations and drop-offs, administrative costs, or other items.⁴³
- Residential landfilled tons at Layon Landfill fell from 14,787 in FY 2013 (October to June) to 13,760 in in FY 2014 (a 6.9%, or 1,027 decline. It may be speculated that 445 of this is the newly recycled tons collected at the curb from April to June. These figures imply a substantial decline if the FY 2013 figures are indeed only for 9 months.
- Substantial growth is expected in the population covered by the collection programs. Although the households covered in 2014 are about 16,955 for trash, and 15,500 for recycling, they are expected to increase by about 5.3–6% by 2020 (about 900 households, covering civilian military workers and dependents, and off-island construction workers and dependents). Population figures for 2013 in total are about 165,000.

⁴⁰ From presentation “Guam Solid Waste Receiver, Recycling Tons by Month...”, by GBB.

www.guamsolidwastereceiver.org, Status Hearing Quarterly Report.

⁴¹ \$171.60/ton times 1360 tons per month landfilled (4080 for April–June 2014 divided by 3) divided by 16,955 households is \$13.76 per household for trash service.

⁴² \$144.02/ton times 148 tons per month recycled (445 divided by 3) divided by 15,500 households is \$13.78 per household per month for recycling service.

⁴³ It cannot be collection costs, as collection costs would be expected to be at least \$6–10 per household per service based on data from our previous studies, and from an assumption that perhaps 80–90% of household costs is collection (which would be about \$11 per service for the month).

3.2 PAYT Considerations in Guam

Containerization Choice:

Collection is currently carried out via carts, and the most sensible option going forward for a full PAYT system is via cart. The recycling program indicates that 90% of the trash households can be collected via semi-automated cart system. As noted in the Anderson White Paper, the extra fee for service above 90 gallons provides a minimal form of a hybrid program; however, \$15 for an extra 90-gallon cart or \$4 for a one-time sticker (similar pricing) does not approach the threshold for strong PAYT program design discussed earlier in this report (\$7-12 for 30 gallons extra). We assume the current system would favor development of a PAYT system based on automated, covered wheelie carts as the most sensible approach for Guam.

Billing and Customer Service:

Guam is currently able to bill for service through an existing utility billing system. If this type of option is not in place, communities often must default to bag, tag, or hybrid options, which do not require household-level billing systems (beyond whatever billing already exists).⁴⁴ The new billing requirements are far less complicated than billing for water or other utilities. The amount billed to each household is a recurring, constant value for a household, and there are only three or four possible charge levels (for 32, 64, or 96 gallon service, for example), and the only complexity is the initial assignment of container size. Temporary extra customer service staff will be needed for at least 3 months during the period during which container sizes are assigned and billing questions arise.

Container Purchase / Delivery:

Containers are expensive on Guam. To support the change in programs, Guam would need to procure (or repurpose) about 17,000 new trash carts in the near term (some through new purchase, potentially under extension of the current procurement agreement).. Certainly the cost of the containers (about \$100 each) would be expected to be recovered through rates (at about \$1.50-\$2 per new container per household per month). However, the up-front purchase costs of \$1.7 million can cause havoc as an up-front item in the budget. There are several options to help minimize this significant cost:

- Some of the existing 96 gallon carts would remain as trash carts for the share of households selecting 96 gallon service. They may not need to be updated for service; if they do need refreshing, replacement of lids with a new color (price not available), or a decal (very inexpensive) can be used. We discuss the range for the share of households that could be expected to choose the 96 gallon cart later.
- A share of households would expect to reduce their trash – from a combination of being oversubscribed currently (not filling their allocated 96 gallons), and from the diversion incentive introduced by a PAYT system. Options for the levels of these distributions are also discussed below. These carts would need to be ordered and distributed at a cost of about \$100 each. There will potentially be many 96-gallon containers that are “extra” – not needed for trash. Some can be replacement recycling containers, but that will not be a very large share of the extra carts.

⁴⁴ Billing for bag / tag or the extra service levels (bags) for hybrid programs is usually accomplished by invoices to grocery and convenience stores, or payments at city hall. No household-level billing is needed, as they are purchased individually, but not assigned to a household.

- Some optimization of containerization could be achieved if Guam considered introducing an organics collection program at the same time – potentially allowing both yard waste and food waste collection curbside. This takes advantage of the extra incentive that PAYT provides for composting. If this option were to be introduced, then the current trash containers would become organics containers (decals or just a ‘reassignment’ without marker can be used to “re-brand” them to organics). A whole new fleet of multi-sized trash containers would be needed, at a full cost of about \$1.7 million. No delivery / redelivery would be needed for the organics carts; they would stay where they are.

Outreach / Education and Feedback on Container Choices:

Outreach is an important part of a successful PAYT system. We assume some education is already happening, but we allow for an additional \$1.50 per household for the first year, which we spread over several years in our calculations.

Bin Size Distribution Projections:

Projecting container choice distributions in Guam is complicated. In most PAYT communities around the US, the household size is substantially lower than Guam’s persons per household number (about 3.9 in Guam, vs. substantially less than 3 elsewhere). This may make it hard to use information on container choices from other communities, and makes it more important to consider conducting a waste set out survey for a statistically-valid number of households in Guam. However, in the scenario analysis below we use numbers adapted from other communities, keeping Guam’s household size and generation rate (6 pounds per person per day) in mind.

Changes in Tonnage Flows:

The quantitative literature on PAYT indicates that incorporating PAYT in Guam would lead to an increase of recycling of 6% (or measured in other terms, a 50% increase in current recycling), and an additional decrease in residential landfilled tonnage of another 6%. However, the current diversion of about 10% through Guam’s recycling program is a bit below estimates we find from basic recycling programs elsewhere (more common levels are 12-15% diversion). There should be plenty of recycling remaining in the waste stream to allow for these additional diversion levels.⁴⁵ We assume we will be able to recover the additional materials projected in the PAYT estimates in the scenario analysis.

Note that if curbside composting service is also added, that could increase tons diverted from the landfill to perhaps 20% (about 15% for a standard yard waste program, increased by another 6% or so from the PAYT initiative). This could significantly improve the cost-effectiveness of the PAYT program – depending on the cost per ton for diversion to an organics facility on-island.

Revenues and Net Costs:

Market revenues are difficult to project. We use figures from the White Paper prepared by Anderson:

- the estimated revenues per ton for additional recycling included in this study incorporate the negative value of the “sale” of recyclable of about \$100 per ton⁴⁶ – a negative revenue, or a cost.
- The cost per ton for avoided landfilling is \$175 per ton.

⁴⁵ Table WP-C1 in the 2013 Guam PAYT White Paper by Anderson projects 2,000 TPY available in 2015 (but also projects 1,000-2,000 tons of paper only), but page C-17 projects 34,000 tons times 0.3, with recovery rates of 10-80% by material, leading to a projection of somewhere between 1,000 and 9,000 available tons per year.

⁴⁶ A rough estimate of negative \$144K net costs in 2015, (page C19 of White Paper C: Guam PAYT, by Anderson), divided by about 1500 tons of recycling.

- Therefore, the “net” savings for new recycling is \$75 per ton, and the net savings for source reduction from PAYT is the full \$175 per ton.

Other effects:

A very low estimate for the greenhouse gas value of the tons diverted from landfill is \$1-\$4 per ton. The job creation benefits, based on figures from the Institute for Local Self Reliance is:

- Net job creation of 9 jobs per 10,000 tons of materials diverted from landfill to recycling, and
- Net job creation of 3 jobs per 10,000 tons of materials diverted from landfill to organics.

3.3 Scenario Analysis for PAYT in Guam

Two stages of work comprise the scenario analysis for Guam. We estimate the tonnage flows and changes, and the cost changes. This allows computation of the new recycling rate, as well as the costs for the new system and the new rates that must be charged to the households to cover costs. The rate computations derive from several key inputs:

- The new net per-household average monthly costs after PAYT
- The assumptions about the distribution of households on various can sizes – the can size distribution.
- The PAYT rate structure to be implemented. We assume options with both 80% differentials between the 32 and 64-gallon container sizes, and 50% differential scenario.
- Recycling revenues compared to landfilling costs.⁴⁷

The new monthly costs are computed in Figure 3.2 below.

⁴⁷ The scenario analysis assumes a revenue of about \$100 per ton, per the previous Guam study. However, applying the per-ton revenue values per material from the previous Guam study, but multiplying by the material mix actually being recovered by Guam’s residential program, leads to a weighted average per-ton revenue value of \$217/ton. This would improve the cost-effectiveness of the PAYT program. Weighted average per-ton revenues for the mix of materials being recovered by the program range from \$225-300 per ton between 2013 and 2015. Therefore, using \$100 per ton may be a more conservative assumption and financial performance is likely to be better than the figures shown. .

Figure 3.2: Tonnage and Cost Computations for Guam – Pre and Post PAYT, 2016

	NO PAYT			Total or per average household	WITH PAYT				Total, or per average Household
	Trash / Landfilling	Recycled	Generated tons		Trash / Landfilling	Recycled	Source Red'n	Generated Tons	
Served Households	16955	15500			16955	15500			
Starting tons per month	1,360	148	1,508		1,360	148		1,508	
Add 6% recycling					-90	90			
Divert 5% to source red'n					-75		75		
Resulting Tons per Month	1,360	148	1,508		1,194	238	75	1,508	
Recycling Percent	90%	10%			79%	16%	5%		
COSTS - PER HOUSEHOLD PER MONTH									
Starting costs per HH/Mo	\$13.75	\$13.75		\$31.00					\$31.00
Add education and CSRs spread over 2 years									\$0.06
Add container costs amortized spread 10 years - LOW (50% replaced)								\$1.00	
Add container costs amortized spread 10 years - HIGH (80% replaced)								\$1.60	\$1.30
New Revenues for recycling						\$100.00			\$0.58
Avoided landfilling cost					-\$175.00				-\$1.71
New stopping charges									\$0.00
GHG					-\$2.50				\$0.02
Total New Bills for Customers after PAYT									\$31.26
Net Job creation							2.6 jobs		

Based on a review of set outs experienced by communities that do not have organics diversion programs, we “bound” our estimates for Guam with the two distributions included in Figure 3.3.

Figure 3.3: Assumed Values for Can Size Distributions in Guam

(from EI and SERA surveys of container selections in other jurisdictions)

Percent of Households selecting...	Higher Compaction (smaller cans)	Lower compaction (larger cans)
Minican	5%	0%
32-gallon	35%	25%
64-gallon	35%	40%
96-gallon	25%	35%
More than 96-gallons	0%	0%

Finally, we craft two rate design scenarios for Guam – 50% extra for 64-gallon vs. 32-gallon container, and 80% extra for 64-gallon vs. 32-gallon container.

3.4 Conclusions and Recommendations for PAYT in Guam

The conclusions from the study are that:

- Recycling would increase from the current 9.8% to 16% (or 2,850 tons or more per year).
- Source reduction would divert another 900 tons per year (5%).
- Landfilled tons would decrease to 14,328 tons per year, reduced from the current 16,320 tons per year.
- The net cost of the new PAYT system, including new costs, would be about an average of \$31.25 per households per year (about \$0.25 per household per month increase), or new costs of less than \$60,000 net per year across the system. The percent increase in costs nets less than 1%.

- There would be substantial up-front container cost investment, probably between \$1 million to \$1.4 million. We have spread these costs over 10 years embedded in the customer rates.

The range for likely rates that would result from scenarios we modeled are shown in Figure 3.4 below. The figure lists the assumptions at the top of each of the four scenarios, and in the rows provides the assumed percent of customers subscribed to each container size (the white boxes), and the calculated rates (in the grey boxes) that result from the combination of assumptions. In each case, new rates are assumed to increase \$0.25 per household per month over current costs (assuming several cost categories are recovered over multiple years).

Figure 3.4: Per Household Monthly Rates for Guam Residents after PAYT

		1. Smaller Cans, 80% Rate Differential		2: Smaller Cans, 50% Rate Differential		3: Larger Cans, 80% Rate Differential		4: Larger Cans, 50% Rate Differential	
		80% Differential	21% red'n	80% Differential	21% red'n	80% Differential	21% red'n	80% Differential	21% red'n
Rate diff ¹ => for mini percent of 1 can=>		\$31.25		\$31.25		\$31.25		\$31.25	
CAN SIZE ² al AVERAGE BILL level=>									
24	0.38	\$14.97	5%	\$17.67	5%	\$13.30	0%	\$16.13	0%
32	1.00	\$18.71	35%	\$22.08	35%	\$16.62	25%	\$20.16	25%
64	2.00	\$33.68	35%	\$33.13	35%	\$29.92	40%	\$30.24	40%
96	3.00	\$48.65	25%	\$44.17	25%	\$43.22	35%	\$40.32	35%
192	6.00	\$93.56	0%	\$77.30	0%	\$83.11	0%	\$70.56	0%
300	9.38	\$144.09	0%	\$114.56	0%	\$127.99	0%	\$104.59	0%
Avg 30-g Can Equivs			1.82		1.82		2.10		2.10
Gals/hh (calc)			58.2		58.2		67.2		67.2
Goal Bill Level (from above)		\$31.25	1.84	\$31.25	1.84	\$31.25	2.10	\$31.25	2.10
Check bill (ignore)		\$31.25	Above is cans/hh	\$31.25	Above is cans/hh	\$31.25	Above is cans/hh	\$31.25	Above is cans/hh

The rates scenarios show that a share of customers would pay more than they do currently, and others would pay less – based on their selection of container sizes.

- In scenarios 1 and 2 (Smaller cans, 80-50% rate differentials), 40% of the households would pay less than their current \$31 bills, and those on cans sized 64 or larger would pay more than they currently do.
- In scenarios 3 and 4 (35% of households remaining on 96 gallon containers, 80-50% rate differentials), 65% of households would pay less than they currently do.

Recommendations for Refining these Estimates:

- Set out survey: A set out survey to identify the distribution of weights of trash currently set out by Guam households. Collecting data from a statistical sample of households would allow a much more refined estimate of the impacts from two effects: diversion to recycling and source reduction, and the “stomping” impact. From these figures (the starting distribution and these two adjustments) we would be able to generate an improved estimate of the percent of customers likely to select 32, 64, and 96 gallon trash service levels.
- Waste composition study of disposed household tonnage to confirm the availability of materials for recovery, and the mix of materials to allow refined estimates of net revenues based on the likely materials percentages recovered.
- Customers survey to help estimate the expected container sizes to be selected.
- Refinement of cost information / estimates.

Overall, it looks as though PAYT would make sense for Guam. There are divertible tons available at virtually the same cost as the current system, and the life of the landfill would be extended.