*Office of the Governor of Guahan*

P.O. Box 2950 Hagåtña, GU 96932
Tel: (671) 472-8931 • Fax: (671) 477-4826 • Email: governor@guam.gov

Felix P. Camacho
*Governor*

Michael W. Cruz, M.D.
*Lieutenant Governor*

2010 MAY 19 PM 3:42

MAY 19 2010

The Honorable Judith T. Won Pat, Ed.D.
Speaker
*Mina' Trenta Na Liheslaturan Guåhan*
155 Hessler Street
Hagåtña, Guam 96910

Dear Speaker Won Pat:

Transmitted herewith is Bill No. 310-30 (COR) "**AN ACT TO ADD A NEW §51120 TO CHAPTER 51 OF TITLE 10, GUAM CODE ANNOTATED, RELATIVE TO THE AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM AT ALL GUAM LANDFILLS**", which I signed into law on March 12, 2010 as Public Law 30-110.

Please note that the Environmental Protection Agency is conducting a similar study funded by a grant from USEPA.

*Sinseru yan Magåhet,*

**MICHAEL W. CRUZ, M.D.**
*I Maga'låhen Guahan para pa'go*
Acting Governor of Guahan

30-10-0469

Attachment: copy of Bill

5/19/10

1923

*I MINA'TRENTA NA LIHESLATURAN GUÅHAN*
**2010 (SECOND) Regular Session**

**CERTIFICATION OF PASSAGE OF AN ACT TO *I MAGA'LAHEN GUÅHAN***

This is to certify that **Substitute Bill No. 310-30 (COR), "AN ACT TO *ADD* A NEW §51120 TO CHAPTER 51 OF TITLE 10, GUAM CODE ANNOTATED, RELATIVE TO THE AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM AT ALL GUAM LANDFILLS,"** was on the 26th day of February, 2010, duly and regularly passed.

**Judith T. Won Pat, Ed. D.**
**Speaker**

Attested:

**Tina Rose Muña Barnes**
**Legislative Secretary**

---

This Act was received by *I Maga'lahen Guåhan* this 1 day of March, 2010, at 5:40 o'clock P.M.

Assistant Staff Officer
*Maga'lahi's* Office

APPROVED:

MIKE W. CRUZ, MD
GOVERNOR OF GUAM ACTING

Date: MAR 12 2010

Public Law No. P.L. 30-110

*I MINA'TRENTA NA LIHESLATURAN GUÅHAN*
**2010 (SECOND) Regular Session**

**Bill No. 310-30 (COR)**
As substituted by the Committee on Utilities,
Transportation, Public Works & Veterans Affairs,
and amended.

Introduced by: Telo Taitague
T. C. Ada
R. J. Respicio
F. B. Aguon, Jr.
B. J.F. Cruz
F. F. Blas, Jr.
E. J.B. Calvo
J. V. Espaldon
Judith P. Guthertz, DPA
T. R. Muña Barnes
Adolpho B. Palacios, Sr.
v. c. pangelinan
Ray Tenorio
Judith T. Won Pat, Ed.D

**AN ACT TO *ADD* A NEW §51120 TO CHAPTER 51 OF TITLE 10, GUAM CODE ANNOTATED, RELATIVE TO THE AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM AT ALL GUAM LANDFILLS.**

**BE IT ENACTED BY THE PEOPLE OF GUAM:**

**Section 1.** A new §51120 is *added* to Chapter 51 of Title 10, Guam Code Annotated to read as follows:

"**§51120. Commercial Methane Recovery System Feasibility Study.** The Department of Public Works *shall* conduct a feasibility study on the commercial applications of methane recovery systems for the *Layon* Landfill. The study *shall* include, but *not be limited* to, alternatives such as, (1) the return on investment on government-built and operated methane recovery systems; (2) private-public partnerships; and (3) the use of methane for electrical power generation.

Any funding request for the study, including justification for such funding, *shall* be submitted to *I Liheslaturan Guåhan* for its consideration within one hundred eighty (180) days of the enactment of this Section. Prior to submitting a funding request to *I Liheslaturan Guåhan*, the Department of Public Works *shall* consider and apply for Federal Grants to cover the cost of the study."

# *I MINA' TRENTA NA LIHESLATURAN GUÅHAN*

## 2010 (SECOND) Regular Session

Date: 2/26/10

## VOTING SHEET

S Bill No. 316

Resolution No. _____

Question: _____

_____

| NAME | YEAS | NAYS | NOT VOTING/ ABSTAINED | OUT DURING ROLL CALL | ABSENT |
|---|---|---|---|---|---|
| ADA, Thomas C. | | ✓ | | | |
| AGUON, Frank B., Jr. | ✓ | | | | |
| BLAS, Frank F., Jr. | ✓ | | | | |
| CALVO, Edward J.B. | ✓ | | | | |
| CRUZ, Benjamin J. F. | ✓ | | | | |
| ESPALDON, James V. | ✓ | | | | |
| GUTHERTZ, Judith Paulette | ✓ | | | | |
| MUNA-BARNES, Tina Rose | ✓ | | | | |
| PALACIOS, Adolpho Borja, Sr. | ✓ | | | | |
| PANGELINAN, vicente (ben) cabrera | ✓ | | | | |
| RESPICIO, Rory J. | ✓ | | | | |
| TAITAGUE, Telo | ✓ | | | | |
| TENORIO, Ray | ✓ | | | | |
| WON PAT, Judith T. | ✓ | | | | |
| **TOTAL** | 13 | 1 | _____ | _____ | _____ |

CERTIFIED TRUE AND CORRECT:

_____

Clerk of the Legislature

*3 Passes = No vote

EA = Excused Absence

# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affairs
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 23, 2010

**The Honorable Judith T. Won Pat, Ed.D.**
Speaker
I Mina'Trenta Na Liheslaturan Guåhan
155 Hesler Place
Hagåtña, Guam 96910

**VIA: The Honorable Rory J. Respicio**
Chairperson, Committee on Rules

**RE: Committee Report on Bill No. 310-30 (COR) As Substituted**

The Committee on Utilities, Transportation, Public Works, and Veterans Affairs, to which was referred **Bill No. 310-30 (COR)** – "An Act to add a new §51120 to Chapter 51 of 10GCA relative to authorization to create a feasibility plan for the installation of a commercial methane recovery system of the Layon Landfill" hereby recommends **TO PASS** Bill No. 310-30 as substituted.

Transmitted herewith for your consideration and action is our committee report on the above subject matter.

The voting record is as follows:

7 To Pass

_____ Not to Pass

1 To Report Out Of Committee

_____ Abstain

_____ Inactive File

Copies of the Committee Report and other pertinent documents are attached. Thank you for your attention on this matter.

Si Yu'us Ma'ase

Thomas C. Ada


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

**Senator Thomas C. Ada**
CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affairs
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan

# Committee Report

## Bill No. 310-30 (COR)
## As Substituted

An Act to add a new §51120 to Chapter 51 of 10GCA relative to authorization to create a feasibility plan for the installation of a commercial methane recovery system of the Layon Landfill.

Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
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# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affairs
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 22, 2010

**MEMORANDUM**

**To:** **Members, Committee on Utilities, Transportation, Public Works, and Veterans Affairs**

From: Chairperson, Committee on Utilities, Transportation, Public Works, and Veterans Affairs

Subject: Voting Sheet regarding Substitute Bill No. 310-30 (COR)

Included herewith for your information and action is the Committee Report on:

**Substitute Bill No. 310-30 (COR) – T. Taitague**
An Act to add a new §51120 to Chapter 51 of 10GCA relative to authorization to create a feasibility plan for the installation of a commercial methane recovery system of the Layon Landfill.

Please take the appropriate action on the voting sheet. Should you have questions regarding the report or accompanying documents, please do not hesitate to contact me. Your attention and cooperation on this matter is greatly appreciated.

Si Yu'us Ma'ase,

Thomas C. Ada

Attachments: Committee Voting Sheet
Committee Report
Bill No. 310-30 (COR)
Substitute Bill No. 310-30 (COR)
Public Hearing Sign-In Sheet
Testimony
Notice of Public Hearing
Submitted Testimony & Supporting Documents
Public Hearing Agenda


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
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# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affairs
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


## VOTING RECORD

**Substitute Bill No. 310-30 (COR) – T. Taitague**
An Act to add a new §51120 to Chapter 51 of 10GCA relative to authorization to create a feasibility plan for the installation of a commercial methane recovery system of the Layon Landfill.

| Committee Members | SIGNATURE | TO PASS | NOT TO PASS | TO REPORT OUT OF COMMITTEE | ABSTAIN | INACTIVE FILE |
|---|---|---|---|---|---|---|
| Senator Thomas C. Ada, Chairman | | ✓ | | | | |
| Senator Adolpho B. Palacios, Sr., Vice Chairman | | 2/22/10 ✓ | | | | |
| Senator Frank B. Aguon, Jr. | 2/22/10 | ✓ | | | | |
| Vice Speaker Benjamin J. F. Cruz | | | | ✓ | | |
| Senator Tina Rose Muña-Barnes | | ✓ | | | | |
| Senator Rory J. Respicio | | | | | | |
| Senator James V. Espaldon | | | | | | |
| Senator Telo Taitague | | ✓ | | | | |
| Senator Ray Tenorio | | ✓ | | | | |


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

## Committee Report

Bill No. 310-30 (LS) – T. Taitague
An Act to add a new §51120 to Chapter 51 of 10GCA relative to authorization to create a feasibility plan for the installation of a commercial methane recovery system of the Layon Landfill.

### I. Findings and Recommendation

The Committee finds that several years after the solid waste has been deposited into a landfill, methane-producing bacteria decompose the organic waste and produce landfill gases (LFG), which is a natural byproduct of the decomposition of organic material in municipal solid waste in anaerobic conditions (without oxygen). Approximately 50% of LFG are methane, 49.99% carbon dioxide, and less than 1% non-methane organic compounds. Methane is a potent heat trapping greenhouse gas that contributes to global warming and air pollution.

The Committee finds that the Guam Environmental Protection Agency (GEPA) has issued a Solid Waste Management Permit and Air Permit for the operation of the Layon Municipal Solid Waste Landfill in Inarajan. The Air Permit requires the Permittee to operate a landfill gas collection system that meets Guam's air emissions regulations/requirement inclusive of designing a LFG collection system to achieve a capture efficiency of 90% of LFG, and allows for collected gas to be routed to an open flare for disposal.

The Committee on Utilities, Transportation, Public Works, and Veterans Affairs, to which was referred Bill No. 310-30, hereby submits its findings and recommendation to *I Mina' Trenta Na Liheslaturan Guåhan* **TO PASS** Bill No. 310-30 as substituted.

### II. Overview

The Committee on Utilities, Transportation, Public Works, and Veterans Affairs convened on February 10 at 9:00 a.m. to hold a public hearing that included Bill No. 310-30 (COR). Notice of the hearing was disseminated to all local media outlets via facsimile and email on February 2 and February 8 of 2010, thus meeting the requirements of the Open Government Law. Notice of the hearing was also posted on the Guam Legislature's website.

Committee Members present:

| | |
|---|---|
| Senator Thomas C. Ada | Chairman |
| Senator Adolpho B. Palacios, Sr. | Vice Chairman |
| Senator Ben Pangelinan | Member |
| Senator Telo Taitague | Member, Sponsor of Bill |
| Senator James Espaldon | Member |

Testimony submitted by:

| | |
|---|---|
| Mohammad H. Golabi, PhD | UOG, College of Natural and Applied Sciences |
| Ms. Conchita Taitano | GEPA, Acting Administrator |
| Mr. Cole Herndon | Private Citizen |

## III. Summary of Testimonies

Dr. Mohammad Golabi

*Provided oral and written testimony (written testimony attached)*

Dr. Golabi, Associate Professor for the College of Natural and Applied Sciences University of Guam, testified in support of Bill No. 310-30. Dr. Golabi participated in a research project, which revealed that more than 60% of waste deposited at Ordot is organic matter which indicates Ordot is a producer of methane gas. Dr. Golabi made a presentation which included a high level overview of a methane capturing system, how the UOG Yigo Research Lab is experimenting with small scale methane capturing system, and a summary of a visit to a facility in Japan which is currently testing a waste to energy plant that captures methane which is converted to electricity. Dr. Golabi also added that the byproducts from the waste to energy (WTE) plant are used for composting.

Ms. Conchita Taitano

*Provided oral and written testimony (written testimony attached)*

Ms. Taitano, Acting Administrator for GEPA, testified in support of Bill No. 310-30. Ms. Taitano testified that 50% of landfill gases released into the atmosphere are methane gas which is a greenhouse heat trapping gas contributing to global warming and air pollution. In her written testimony, Ms. Taitano stated that GEPA had issued an Air Permit for the operation of the Layon Landfill which requires a landfill gas collection system be designed to achieve a capture efficiency of 90% of all landfill gases generated at the site and to be disposed of through an open flare. Ms. Taitano also recommended that the bill include other landfill facilities on Guam such as the Ordot Dump, and the Andersen Air Force Base and Navy Municipal solid waste land disposal units.

Mr. Cole Herndon

*Provided oral and written testimony (written testimony attached)*

Mr. Herndon, private citizen, provided testimony in support of Bill No. 310-30 and provided internet links for different technologies and methods being used to capture landfill gases in the United States.

Mr. Andy Leon Guerrero

*Provided oral and written testimony (written testimony attached)*

Mr. Leon Guerrero, Acting Director of the Department of Public Works (DPW), testified in support of Bill No. 310-30. Mr. Leon Guerrero testified that DPW desires to develop a modern, dependable, and efficient waste management system that would help protect the environment, improve the standard of public health in Guam, and foster participation of private sector in a structured manner. Mr. Leon Guerrero further recommended that a Waste to Energy (WTE) plan be an integral part of Guam's overall solid waste management strategy. A copy of a draft Request For Proposal for the Guam Integrated Waste Management Program (GIWMP) was submitted as part of DPW's testimony.

Gershman, Brickner, Bratton, Inc. (GBB)

*Provided written testimony (written testimony attached)*

GBB, Receiver, submitted written testimony on Bill No. 310-30. In their written testimony, GBB proffered that managing the methane gas at Layon and Ordot is a requirement and that the design for the Layon Landfill includes a methane capturing system. GBB also indicated that it would be several years before Layon produces a sufficient amount of methane gas.

GBB also indicated that the design of the closure plan for Ordot will include a methane recovery system. While it is likely that the Ordot Dump produces a significant amount of LFG, its commercial value and the cost to harvest the methane is still unknown; GBB is working with consultants to provide insight to these issues. GBB has had very preliminary discussions with GPA concerning the commercial use of methane and will have future discussions with interested parties.

GBB indicated in their testimony that the 180-day timeframe was not feasible since the work that will be needed to make an informed recommendation in this matter will be part of a comprehensive examination of the issues surrounding the Ordot Dump and the design of a closure plan. The procurement work for this phase will occur during 2010, but the schedule has not been finalized.

**Question and Answer**

Senator Taitague: asks Dr. Golabi with his experience in gas recovery, why he chose this type of recovery system over the many types of recovery systems available?

Dr. Golabi: responded that using a landfill takes years before the methane gas can be produced and harvested and that only a small amount of the gases can be captured. Dr. Golabi believes the recovery method in his presentation (using a sorting facility) is the better method because it allows more control, with nearly 100% of gases captured. In addition, the organic waste can be reused for composting.

Senator Espaldon: asked Dr. Golabi if the facility in Japan was a landfill facility.

Dr. Golabi: answered no and that the Okayama facility is a test facility for the University of Okayama. He furthered stated that this type of facility is feasible if the separation facility were located near a landfill.

Senator Espaldon: the bill calls for a study for Layon but really the study would be more appropriate for the Ordot Dump where there is a high concentration of biodegradable trash.

Dr. Golabi: responded yes.

Senator Espaldon: asked if we don't have a separation facility and all trash sent to Layon, how much volume is needed and how long it would take for buried material to produce enough methane gas to generate capacity.

Dr. Golabi: answered methane gas will be produced immediately from the time organic material is dumped and if the appropriate ingredients (oxygen, water, carbon, and nitrogen from food) are present.

Senator Espaldon: stated that if we directed all trash to Layon and not to a separation facility, the study would be to determine how much methane gas can be produced and what is necessary to run generators to reach a certain capacity.

Dr. Golabi: responded his guess is there would be enough methane collected to run a small generator at the Layon facility.

Senator Espaldon: asked if historically the way methane gas was handled was to burn it.

Dr. Golabi: responded burning is one method of handling methane. It can also be released into the atmosphere, which is not recommended because it contributes to global warming. The best solution would be to capture it and use it.

Senator Espaldon: recalled in a presentation by the Receiver, their plan was to burn the captured methane gas.

Dr. Golabi: responded that it was cheaper to burn it rather than to invest in equipment to capture the methane.

Senator Taitague: asked Dr. Golabi if methane could only be capture by the method shown in his presentation.

Dr. Golabi: responded methane gas will be produced no matter what. The benefit to the method in his presentation is you have more control. Methane gas can be captured, stored, and used.

Senator Taitague: asked Dr. Golabi approximately how many types of methane capturing systems are out there?

Dr. Golabi: answered about 3. Recently, capture systems are included as part of a new landfill's design.

Senator Pangelinan: commented we may already be too late for Layon if we want to capture methane gas up front.

Dr. Golabi: answered it can always be captured if there is organic material present. However, it will always be more expensive if you don't do it from start of landfill design.

Senator Pangelinan: agreed. Traditionally, landfills flared the captured methane. The WTE plant in his presentation was more a methane production system rather than a methane capturing system. The intent of the plant is to take the garbage, process it and make methane and that the by-product can be used for composting.

Senator Pangelinan: noted that the Receiver has designed a methane capturing system for Layon and will include Ordot. Preliminary discussions indicate that flaring would be the most cost effective way to dispose of methane.

Senator Taitague: mentioned that DPW would contact GEPA when they move forward with the study.

Senator Pangelinan: asked why you would need a study when a recovery system is already being designed.

Conchita Taitano: clarified that the studies conducted by US EPA were for Ordot. GEPA has requested US EPA to prepare a whitepaper for the Ordot study.

Senator Taitague: commented she hoped to the include Ordot in the bill. It could be more dangerous to harvest methane at the Ordot Dump rather than any benefits that could be derived.

Senator Espaldon: asked Ms. Taitano if it was her understanding that the Receiver's plan for solid waste was going to include 1 or 2 separation facilities.

Conchita Taitano: responded that it was her understanding that the Receiver's plan is in line with the Integrated Solidwaste Management Plan. Ms. Taitano also mentioned that green waste was prohibited at Ordot, and that Layon would follow suit. The intent of such measures is to extend the lifespan of the dumps.

Senator Espaldon: asked where green organic waste would go after the separation facility.

Conchita Taitano: answered there are about 2 private facilities that process green waste.

Senator Espaldon: going into the future, asked if Ms. Taitano saw this as the norm.

Conchita Taitano: responded she hoped so. Especially in light of the clearing and grading that is expected with the community build up. She didn't look at the organic material as waste but as a particular resource.

Senator Espaldon: agreed. Senator further asked if we are going to divert organic material to private land for processing, it is outside our purview to conduct a study.

Conchita Taitano: agreed.

Senator Espaldon: GEPA recommended the inclusion of a methane study at the Navy and Air Force landfills. Senator Espaldon inquired if GovGuam has jurisdiction?

Conchita Taitano: responded that GEPA has Title 5 authority granted by US EPA. In this particular instance, there are no specifics that mandate a feasibility study for methane capturing. But, the Title 5 authority applies for landfill citing or operations.

Senator Espaldon: asked if we have jurisdiction to mandate a study to be provided on federal government property.

Conchita Taitano: believed GovGuam does have jurisdiction. There is no exemption in Guam law for the Department of Defense. GEPA was granted Title 5 authority from USEPA for the permitting of all municipal Solid waste landfills. This certainly can be a provision that can be included. To get authorization, you have to be at a minimum consistent with federal requirements. You can be broader or more stringent is scope. But the enabling legislating is required to give GEPA the authority to do other things or require other things. Department of Defense is still a community member.

Senator Espaldon: I just want to ensure we are within our purview. Maybe you need to ask US EPA to determine if we can pass local law that will apply federal property.

Conchita Taitano: concurred and would inquire with US EPA.

End of Question and Answer Session.

**I MINA' TRENTA NA LIHESLATURAN GUÅHAN**
**2010 (SECOND) Regular Session**

Bill No. 310-30(cor)

Introduced by:

Telo Taitague
T. C. Ada
R. J. Respicio

**AN ACT TO ADD A NEW §51120 TO CHAPTER 54 OF 10GCA RELATIVE TO AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM OF THE LEYON LANDFILL.**

**BE IT ENACTED BY THE PEOPLE OF GUAM:**

**Section 1.** A new §51120 is *added* to Chapter 51 of 10GCA to read as follows:

**§51120. Commercial Methane Recovery System Feasibility Study.** The Department of Public Works shall conduct a feasibility study on the commercial applications of methane recovery systems for the Leyon Landfill. The study shall include, but not be limited to, alternatives such as (1) the return on investment on a government built and operated methane recover systems, (2) private public partnerships and (3) and the use of methane for electrical power generation.

The study shall be submitted to *I Liheslaturan Guåhan* for its consideration within one hundred eighty (180) of the enactment of this Section.

Clerk of the Legislature
ACKNOWLEDGEMENT RECEIPT
Received by: NIEVES
Time: 2:39 P.M.
Date: 1/6/10

**I MINA' TRENTA NA LIHESLATURAN GUÅHAN**
**2010 (SECOND) Regular Session**

Bill No. 310-30 (COR)
As Substituted by the
Committee on Utilities, Transportation,
Public Works & Veterans Affairs

Introduced by: Telo Taitague
T. C. Ada
R. J. Respicio

**AN ACT TO ADD A NEW §51120 TO CHAPTER 51 OF 10GCA RELATIVE TO AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM ~~OF THE LEYON LANDFILL~~ ALL GUAM LANDFILLS.**

**BE IT ENACTED BY THE PEOPLE OF GUAM:**

**Section 1.** A new §51120 is *added* to Chapter 51 of 10GCA to read as follows:

**§51120. Commercial Methane Recovery System Feasibility Study.** The Department of Public Works shall conduct a feasibility study on the commercial applications of methane recovery systems for the Leyon Landfill, the Ordot Dump and, to the extent allowable under Public Law, Federal Law, and local and federal regulations, the landfills on military bases. The study shall include, but not be limited to, alternatives such as (1) the return on investment on a government built and operated methane recover systems, (2) private public partnerships and (3) and the use of methane for electrical power generation.

~~The~~ Any funding request for the study, including justification for such funding, shall be submitted to *I Liheslaturan Guåhan* for its consideration within one hundred eighty (180) days of the enactment of this Section. Prior to submitting a funding request to *I Liheslaturan Guåhan*, the Department of Public Works shall consider and apply for Federal Grants to cover the cost of the study.

Committee on Utilities, Transportation, Public Works and Veterans Affairs
Public Hearing
February 10, 2010
9:00 am
*I Liheslaturan Guåhan, Hagåtña*

**Bill No. 310-30 (COR)** – Telo Taitague / T.C. Ada / R.J. Respicio
An act to add a new §51120 to Chapter ~~54~~ 51 of 10GCA relative to authorization to create a Feasibility Plan for the installation of a commercial methane recovery system of the Leayon Landfill.

| NAME (please print) | AGENCY/ ORGANIZATION | ORAL TESTIMONY | WRITTEN TESTIMONY | IN FAVOR | NOT IN FAVOR | CONTACT NUMBER |
|---|---|---|---|---|---|---|
| Donchita Taitano | Guam EPA | ✓ | ✓ | ✓ | | 4751658 |
| ~~Cole~~ | | | | | | |
| Cole Herndon | | ✓ | ✓ | ✓ | | guamdiving.is-gr8@yahoo.com |
| Dr. Golabi | WERI | ✓ | | | | |
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GBB

SOLID WASTE
MANAGEMENT
CONSULTANTS
RECEIVER

February 4, 2010

Senator Telo Taitague
238 Archbishop Flores Street
Suite 501, DNA Building
Hagatna, Guam 96910

Dear Senator Taitague:

Thank you for your call and for sharing copies of the proposed legislation concerning a host community fee and legislation regarding the feasibility for installation of a commercial methane recovery system for the Layon Landfill. I would like to take this opportunity to share with you our thoughts on these two bills.

With respect to Bill 303-30(COR) providing for "Host Community Benefits," this is a common benefit provided for many communities who host landfills when the landfill serves a broader community than their own jurisdiction. Your bill's inclusion of the Ordot community is also understandable, given the history of this issue.

The bill would set an annual amount to be funded from a premium to be established by the Public Utilities Commission and assessed against each residential and commercial customer of the landfill. The aggregate host community premium would be $150,000 per year for the village of Inarajan, and $100,000 per year for the village of Ordot. These amounts would be subject to adjustment each year by the amount of the change in the Guam Consumer Price index.

Based on current scale data measuring the amount of waste being deposited into the Ordot Dump, plus estimates of the amount of waste that will be deposited at the new Layon Landfill by the Military, should they become a customer of the new landfill, we can estimate the amount of premium which would be required per ton should your bill become law. The data used to make this estimate is from our Quarterly Report to the District Court dated January 14, 2010. The full Report is available on our website at www.guamsolidwastereceiver.org. The following table represents our best estimate of the premium that would be required:

Government of Guam
Department of Public Works, Solid Waste Management Division
542 North Marine Corps Drive, Tamuning, Guam 96913
Phone: (671) 646-4379, Ext. 201 or 212
www.GuamSolidWasteReceiver.org
www.gbbinc.com

| Estimated Premium Required to Produce $250,000 Annually Layon Landfill | | |
|---|---|---|
| Waste / Premium | With Military Participation | No Military Participation |
| Estimated Tons | 135,849 | 80,971 |
| Premium Required Per Ton | $1.84 | $3.09 |

Given the range of premiums seen in other communities, the amounts shown in the table appear to be reasonable. The amount of any such premium and its allocation between communities is an appropriate decision for the Governor and Legislature of Guam.

You have also asked for our comments concerning Bill 310-30(COR) to create a feasibility plan for the installation of a commercial methane recovery system for the Layon Landfill. Managing the methane gas that is a byproduct of all landfills is a requirement for both the Layon Landfill and the Ordot Dump. The design of the Layon Landfill already includes a system for capturing the methane gas that will be produced. It should be noted, however, that it will be several years before the Layon Landfill produces a sufficient quantity of methane gas to consider any commercial application. This is true because the methane gas is a byproduct of the waste; therefore, a new landfill with little waste in its early years produces little methane gas.

You may also be interested to know that as we design a final closure plan for the Ordot Dump, it will also include a gas recovery system. We will carefully consider any commercial uses that the methane gas may have and evaluate the cost-effectiveness of any additional investment required to clean and commercially use the gas. While the Ordot Dump likely produces a significant quantity of gas, its commercial value is uncertain since neither the actual quantity nor the quality, including the methane content, is known at this time. Our work with design and other consultants will provide insight into these issues, to allow for an informed decision on how best to effectively manage the gas from the Ordot Dump.

We have had some very preliminary discussion with the Guam Power Authority concerning this matter and look forward to further exploration of the matter with them for both the Layon Landfill and the Ordot Dump. We will also consider potential partnerships with other organizations if our work indicates such a partnership may produce a better result for Guam. We will work closely with the Government of Guam and under the supervision of the District Court in making any decisions about this important matter.

Unfortunately, we do not believe that the 180 day time-frame envisioned by your bill is feasible since the work that will be needed to make an informed recommendation in this matter will be a part of a comprehensive examination of the issues surrounding the closure of the Ordot Dump and the design of a specific closure plan. We envision beginning the procurement work for this phase of our work during 2010, but it is not possible to establish a more specific schedule at this time.

We hope this information is helpful. We have also been asked to comment on your proposed legislation by Senator Ada and the Bureau of Budget and Management Research so we are providing them with copies of this letter. Please let us know if we can be of further assistance.

Sincerely,

David L. Manning
GBB's Receiver Representative

c.c. Senator Thomas C. Ada
Director Bertha Duenas

Government of Guam
Department of Public Works, Solid Waste Management Division
542 North Marine Corps Drive, Tamuning, Guam 96913
Phone: (671) 646-4379, Ext. 201 or 212
www.GuamSolidWasteReceiver.org
www.gbbinc.com

*The Honorable*
**Felix P. Camacho**
*Governor*

*The Honorable*
**Michael W. Cruz, M.D.**
*Lieutenant Governor*

**public works**
DIPATTAMENTON CHE'CHO' PUPBLEKO
Lawrence P. Perez
Director
Andrew S. Leon Guerrero
Deputy Director

Senator Thomas Ada
30th Guam Legislature
Chairman
Committee on Utilities, Transportation, Public Works & Veterans Affairs

**REF:** Bill No: 310-30 (COR)
Introduced by: Telo Taitague
T.C.Ada
R. J. Respicio

**AN ACT TO ADD A NEW §51120 TO CHAPTER 54 OF 10GCA RELATIVE TO AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM OF THE LEYON LANDFILL.**

*Hafa Adai Yan Buenas!*

Please find attached ten (10) copies of Department of Public Works (DPW) testimony submitted for and in support of the aforementioned reference.

Should you have any concerns, I can be contacted at 646-3131 or via my e-mail address: andrew.leonguerrero@dpw.guam.gov.

Respectfully submitted;

2/18/10

**Andrew Leon Guerrero – Acting Director DPW**

2/19/10
RECEIVED by the
Office of Senator 10:40AM
Thomas C. Ada

The Honorable
Felix P. Camacho
Governor

The Honorable
Michael W. Cruz, M.D.
Lieutenant Governor

**OFFICIAL**

public works
DIPATTAMENTON CHE'CHO' PUPBLEKO
Lawrence P. Perez
Director
Andrew Leon Guerrero
Deputy Director

February 9, 2010

To: Honorable Thomas C. Ada
Senator
30th Guam Legislature
Hagatna, Guam

**Subject: DPW TESTIMONY ON BILL No. 310-30- An Act to Add a New §51120 to Chapter 54 of 10 GCA Relative to Authorization to Create a Feasibility Plan for the Installation of a Commercial Methane Recovery System of the Layon Landfill.**

For a Small Island Developing States (SIDS) like Guam the disposal of waste poses a serious constraint to sustainable development. The limited land area and resources of a safe disposal, growing population, military build-up, unsustainable consumption patterns and increasing imports of polluting and hazardous substances combine to make pollution prevention and the management of waste critical issue, post closure of Ordot Landfill (Consent Decree), Opening of Layon Landfill, long –term disposal options limited.

It is the desire of the Department of Public Works to develop a modern dependable and efficient waste management system which would be accessible to all citizens, which would protect the environment, improve the standard of public health in Guam and foster participation of private sector in a structured manner.

Government of Guam recommends that a Waste to Energy (WTE) plan be an integral part of the Guam's overall solid waste management strategy. Plant operations must be responsive enough to be able to meet the local and federal future emissions requirements through the application of maximum achievable controls technology in a manner that is deemed cost effective and affordable.

The Department of Public Works (DPW) is envisioning establishing a minimum waste diversion of ninety five percent (95%) and five (5%) land filling by 2015 and securing at least fifty (50) years of sustainable processing and disposal capacity.

By 2011, the Government of Guam will be in compliance with the Clean Water Act as set forth in the Consent Decree and Implementation of Consent Decree Projects, with the

help from Gershman, Brickner, Bratton, Inc. (GBB) the appointed Federal Receivership for the DPW Solid Waste Management Division.

To facilitate reaching these goals, DPW desires to have a Guam Integrated Waste Management Program (GIWMP) and it is desirable to have highly qualified contractor (s) and enter into agreement for next forty (40) years. The contractor should finance, develop, construct, operate and manage the programs of the Guam Integrated Waste Management Program (GWIMP), a municipal leaseback project (FDBMOML) or build operate transfer (BOT) or public private partnership (PPP).Attached herewith is Exhibit "A"- Request For Proposal for Guam's Integrated Waste Management Program (GIWMP)- Finance, Design, Build, Operate, Maintain & Leaseback (FDBOML), a draft copy and some reference materials for your information and use.

The Desired Proposed RFP Scope of Work for the Guam Integrated Waste Management Program (GIWMP) is the following:

1. *Develop a Comprehensive Solid Waste Management Plan*

   In an integrated waste management center the concept of "waste" is replaced by a concept of 'resource', combined with a well-organized and controlled waste stream. The policy must be based on a combination of waste prevention and avoidance, maximized recycling of use goods, waste re-use, sorting and separating of waste collection. A concept which automatically results in minimized land filling leaving a final amount of municipal solid waste (MSW) for further treatment.

2. *Conversion of Layon Landfill into a Layon Integrated Waste Management Center (LIWMC) shall consist of the following structures/buildings, mechanical technologies to attain 95% waste diversification and 5% land filling*:

   a. Waste pre-treatment and sorting
   b. Composting and digestion (aerobic/unaerobic)
   c. Waste to Energy Power Plant such as:

      aa. Thermal Treatment Plant- RDF through advance processes becomes electricity.
      bb. Biological Treatment- biogas

3. *Construction and Demolition Treatment such as:*

      aa. Upgrading of Existing DPW Solid Waste Transfer Station
      bb. Need of Additional Transfer Stations
      cc. Establish locations for emergency staging and temporary storage of debris generated by natural disasters

4. *Operations and Management of Guam Integrated Waste Management Program , DPW Solid Waste Division.*

Should you have any question or need additional information please call Mr. Ramon B. Padua, P.E.,Chief of Engineer- Division of Capital Improvement Projects at telephone no. 646-4381/3126 or Ms. Liberty A. Perez, Engineer Supervisor at telephone no. 646-4382.

Respectfully yours,

2/12/10

Andrew Leon Guerrero
Acting Director

# REQUEST FOR PROPOSAL

## GUAM INTEGRATED WASTE MANAGEMENT PROGRAM (GIWMP)
## FINANCE, DESIGN, BUILD, OPERATE, MAINTAIN & LEASEBACK (FDBOML)
## PROJECT NO. 220-5-1022-L-TER

## I. SCOPE OF WORK

The Department of Public Works (DPW) has envision to established a minimum waste diversion of ninety five (95%) and five (5%) landfilling by 2015 and securing at least fifty (50) years of sustainable processing and disposal capacity. To facilitate reaching these goals DPW desires to have a Guam Integrated Waste Management Program (GIWMP) and desire to have one (1) highly qualified Contractor and enter into agreement, who can finance, develop, construct, operate, manage, program of the GIWMP-FDBOML.

### *A. Scope of Work for Part II- Technical Specifications and Operations*

The Technical Specifications is a part of the criteria in which all proposals submitted will be base on. This section will be scored based on assigned weights as indicated in Evaluation Form. The technical specification is Part II and the scope of work shall consist of the following:

*1. Compliance to Consent Decree and Court Orders*

Full compliance with the Consent Decree of February 11, 2004 and they are as follows:

- Ordot Dump closure and post closure as required by the Consent Decree
- Construct and open new landfill in Layon, Inarajan that meets all applicable laws and regulations
- Minimize additional waste to Ordot and properly size new landfill with appropriate waste diversion goals and program to achieve those goals
- Implement the supplemental Environmental Project for a comprehensive waste diversion strategy for household waste

And link on...● http://www.gud.uscourts.gov/

*2. Develop Comprehensive Solid Waste Management Plan*

from the sale of the recovered energy help offset the cost of the overall waste management system and allows for the subsequent disposal of solid waste, must be in a manner that less harmful to our environment.

The Government of Guam recommends consideration be given for additional waste processing on the receiving side in order to remove more material that is not burnable and to increase the recovery of recyclable materials. Similarly the Government of Guam recommends the pursuit of post processing technologies for the substantial amount of residual ash that is a byproduct of the component of non-structural fill for roads, parking lots, and building sites. Possible uses for the fly ash might be component in cementitious construction of materials as a substitute for cement. Additional waste processing at Layon landfill and the system transfer stations can further increase recycling rates and improve the overall performance for waste diversion system.

Layon Integrated Waste Management Center, waste must be as a resource must not only converted into valuable electricity and heating. It must be a total and sustainable solution turning each waste fraction into the most valuable resource; sustainable solution when it comes to combining waste treatment and alternative, green energy production.

Layon Integrated Waste Management Center must be developed with a keen understanding of environmental concerns and as a result must be linked with an overarching objective to reduce the contribution to greenhouse gases (GHG) by solid waste management. The design of the waste management center, the choice of building materials and waste processing technologies can all contribute to GHG reduction.

Growing volumes of waste, soaring energy prices and Guam has strong commitment to help counter global warming by making Layon Integrated Waste Management Center concept a leading solution for a cleaner and less fossil-fuel-dependent future for the island.

The GIWMP-FDBMOL Center shall consists of the following Structures/Buildings/, Mechanical Technologies to attain 95% waste diversification and 5% landfilling:

1. Waste pre-treatment and sorting
2. Composting and digestion (aerobic/unaerobic)
3. Waste to Energy Power Plant such as:

from the sale of the recovered energy help offset the cost of the overall waste management system and allows for the subsequent disposal of solid waste, must be in a manner that less harmful to our environment.

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2. Composting and digestion (aerobic/unaerobic)
3. Waste to Energy Power Plant such as:

a. Thermal Treatment Plant -RDF through advance thermal processes becomes electricity.

b. Biological Treatment - biogas

4. Construction and Demolition waste treatment
5. Landfill Area
6. Wastewater treatment plant.

## 3.1 Waste Reception

The waste enters the facility through the waste reception area and is stored in a bunker, sized to allow for adequate storage during peak delivery times. Waste is then transferred via overhead crane to be treated mechanically through several size and density sorting processes.

## 3.2 Exploiting technological synergies

The strength of an integrated waste management concept is the combination of several technologies in one installation. This combination of pre-processing, mechanical and organic recycling and power- generating technologies offers as synergy which would be unattainable if each technology was employed individually. This synergy leads to more energy and material recovery and maximum landfill diversion of up 95%.

At the heart of any integrated waste management concept is the pre-processing of the waste received by the waste management center. Through this pre-processing step, the material most suitable for each process is selected ad transferred. Therefore, each process allowed to achieve the highest performance, getting the maximum value out of each specific waste fraction, is in the form of green energy or recycled materials.

## 3.3 Pre-processing for optimal recycling and energy capture

The principal objectives and benefits of waste recovery are to maximize recyclable materials, energy and landfill diversion rate.

## 3.4 Recycling

The waste must be separated into two principal waste flows: wet (organic) and dry. The wet flow must be taken to the organic treatment area. The dry fraction undergoes further sorting processes (manual, optical and magnetic) designed to recover the highest amount recyclable materials.

## 3.5 Maximum recovery materials

Up to 30% of the incoming materials must be recycled through an integrated waste management center (IWMC). This recycling represents a significant amount to materials to be recycled into recovery markets, thereby saving primary natural resources and preventing the emission of large quantities of greenhouse gases (GHG).

The types of materials that must be typically recovered during the different treatment processes of an IWMC for distribution to recycling markets include:

- Paper, cardboard and plastics
- Ferrous and non-ferrous metals, both from pre-processing and bottom ash treatment
- Compost obtained from anaerobic digestion process, which when maturated can be used as agricultural or forestry fertilizer.
- Bottom ash from thermal process, can be used as roadway base as well as aggregate material in concrete manufacturing processes.
- Post-treated ash from thermal conversion which can be used as an aggregate material in the manufacturing of cement bricks and concrete paving blocks.

To maximize material recovery, the emphasis of the IWMC design is towards the implementation of recovery processes and utilizing automatic sorting equipment that significantly increases the overall recycling rate, compared to traditional facilities.

## 3.6 Energy Recovery, Organic Treatment, Advanced Thermal Treatment

Specific material streams that cannot be recycled must be used by the LIWMC as fuel source. The residual fraction of the municipal solid waste must be converted into so called refuse-derived fuel (RDF). RDF can be used for heat and/or electricity generation through advanced thermal production processes.

To facilitate energy recovery, a fully integrated waste management center must incorporate both thermal and biological treatment. The thermal treatment is the waste-to-energy technology, which processes the RDF to produce high temperature flue gases, whose energy is extracted via steam, which is then used to generate electricity or heat.

The biological process anaerobically digests the organic fraction of municipal solid waste. This anaerobic digestion produces biogas that powers internal engines of the LIWMC.

LIWMC must adhere to a strict policy of maintaining the separation of waste streams. Therefore both the non-marketable bottom ash and the residual fraction of the gas-cleaning-by-products will be kept separate and must require disposal at a designated landfill.

'Green" power generation replaces an equivalent amount of electricity which would otherwise have been produced from fossil fuels. And it makes optimal use of the residual municipal solid waste fraction (RDF), which would have otherwise been disposed of at a landfill. For each ton of municipal solid waste received by the integrated waste management center, up to 600KWh of green electricity must be generated. Each 1000 tons of municipal solid waste must have a potential to generate enough electric power to supply a city of well over 30,000 inhabitants.

## 3.7 Landfill diversion solution

The landfill diversion rate resulting from an integrated waste management center must be as high as 95% reducing the residual landfill to only 5% after integrated cycle of recycling and energy recovery.

### 3.8 Minimal community impacts

Layon Integrated Waste Management concept must specifically addresses concerns regarding potential odors, disease carriers such as rats and flies, liter derived from delivery vehicles and waste processing and noise. The design of the concept must such that delivered waste is immediately covered and surrounded by enclosed buildings.

As a result negative visual impacts can be avoided by isolating the waste from the surrounding neighborhoods. The processing systems and buildings must be kept under negative air pressure with all facility process air being subjected to biologic filtration aimed at the elimination of substances that produces odors such as mercaptans, amines andamides. Maintaining waste processes within closed buildings also minimizes facility noise to the site surroundings.

### 3.9 Water and Air Control

In order to accomplish an overall control of all air and water emissions, both wastewater and odor-treatment systems must be an integrated part of the waste management center. The wastewater treatment plant receives and must treats the entire facility's contaminated water and returns clean water to the various modules that require process water. As a result of the waste treatment process, a small amount of left over solids will be generated and require landfill disposal. It should point out that LIWMC must never discharges any wastewater into the surrounding sanitary sewer system or surface waters.

## 4. *Upgrading of DPW Solid Waste Transfer Stations*

Transfer stations are conveniently located facilities where solid waste, delivered by collection companies and citizens, is consolidated, temporarily stored, and loaded into semi-trailers for transport. The solid waste then is delivered to a processing facility or a disposal site. Transfer stations lower overall solid waste disposal costs because they accept deliveries from local solid waste and recycling generators, avoiding the need for individual long-distance trips to final processing and disposal facilities. Transfer stations become cost effective when hauling distance to a disposal facility exceeds a certain distance.

The solid waste transfer system in Guam is designed to complement all other elements of its solid waste management plan. The transfer system goal, "to provide for efficient collection and transfer of MSW and recyclables", is the same as the collection goal and, therefore, some objectives are shared:

- Locate recycling facilities and System transfer stations to optimize service levels and transportation efficiencies.

- Recycle prior to waste to energy (WTE) processing or landfill disposal

DPW Solid Waste Transfer Stations are the following:

A. Dededo Transfer Station
B. Agat Transfer Station
C. Malojloj Transfer Station
D. Operations at Transfer Station

Waste transfer stations an important role in Guam solid waste management system, serving as a link between local waste and recycling collection programs and the final disposal or processing facilities. The primary reason for using a transfer station is to reduce the cost of transporting solid waste to disposal or processing facilities. Consolidating smaller loads from collection vehicles into larger transfer vehicles enables collection crews to spend less time traveling to and from distant disposal sites and processor facilities and more time collecting waste and recyclables. Transfer stations reduce overall transportation costs, air emissions, energy use, truck traffic, and road water and tear.

The following should be included in the proposal, for more efficient operation of Guam Integrated Waste Management Program:

a. Upgrading of Existing Transfer Stations.

The facilities are aged and the needs for solid waste service change, the transfer system require upgrade to maintain operational efficiency. The system should establish a mechanism for assessing the transfer station system and determining actions for the future.

b. Needs for additional transfer stations.

A general rule for evaluating the need for collection vehicle transfer is

based on hauling distance. Although cost-effectiveness will vary, transfer station generally become economically viable when the one-way hauling distance to the disposal facility is greater than 15 to 20 miles. However it should be noted that transportation conditions (i.e. traffic, road quality, size of vehicles used, collection routing, and volume of material delivered) would impact the benefit of direct -haul versus consolidating refuse at a transfer station.

Transfer stations also provide increased conveniences for residential and non-residential self-haulers, who might otherwise have to travel long distances to reach a disposal site. Increased conveniences help reduce the amount of illegal dumping, illegal burning, and other inappropriate forms of disposal.

The System currently operates three (3) transfer stations as well as transfer operations at the Ordot Dump facility. Reasons for adding an additional transfer station include:

- With the Upcoming Military build up, especially in the northern area, existing stations are being utilized and upgrades are sufficient to alleviate resulting issues.

- Economic Growth, Closure of Ordot Dump. There may also a need to build an additional transfer station particularly in the central area, may cause the waste stream to grow to a point where a small transfer station may become feasible. Drive times from this part of the island would be significantly reduced and convenience for residents would be great.

The benefit of building a new transfer station must be weighed against the cost of adding new facilities.

The System must evaluate the long- term need for additional transfer stations must be based on the following:

- Population growth and projected growth patterns.
- Availability of suitable sites
- Under utilized capacity of existing transfer stations.
- Customer usage, of existing transfers stations.
- Effect on transfer system costs

Sufficient time will be allowed for Contractor/Developer/ Financier to build, construct the new transfer station (s) as warranted.

c. Establish locations for emergency staging and temporary storage of debris generated by natural disasters

Major natural disasters can generate enormous volumes of debris in short period of time.

Government of Guam should identify the potential sites to be sued as an emergency staging temporary sites to be used in the event of natural disaster.

5. *Operations and Management of Guam Integrated Waste Management Program, DPW Solid Waste Division.*

The DPW Solid Waste Division intends that the Contractor provide full operations and maintenance services for the Project including, but not limited to:

a. Build on the work that has already been done to the maximum extent feasible.

b. Collection and Transportation of Household Waste

*Technologies:* DPW Solid Waste Management Division is adopting new technologies such as RFID tags, GPS and integrated software packages which enable better quality data to be collected without the use of estimation or manual data entry.

- Technologies like RFID tags will be use to collect data on presentation rates for curb-side pick-ups which is useful when examining the usage of recycling bins or similar.
- GPS tracking benefit is particularly evident when considering the efficiency of ad hoc pick-ups (like skip bins or dumpsters) where the collection is done on a consumer request basis.
- Integrated software packages will be adopted and will be

useful in aggregating data for use in optimizations for waste collection operations.

c. Assume all of the responsibilities, functions, duties, powers, and authority of the Guam Solid Waste Management Division of the Department of Public Works

d. Solid Waste Management: Planned and organized handling of Solid Waste and Recyclable materials in an environmentally and economically sound manner, encompassing the generation storage, collection, transfer, transportation, processing, resource Recovery, Reuse, and disposal of solid Waste and Recyclable Materials and including all administrative, financial, educational, environmental, legal, planning, marketing and operational aspects thereof.

e. Work with and through the current staff of the Solid Waste Division to the maximum extent practically and always maintained administration office on site.

f. Develop a strategy for simultaneous planning and construction activity.

g. Develop waste diversion programs.

h. Develop a financial management strategy. Improve household wastes collection fees, tipping fees etc.

i. Develop measurable standards for determining when the Receivership can end

j. Facilitate partnership with the current and planned military organizations in Guam.

k. Areas Requiring a Capital Funding

- Acquisition of land for new landfill and access road
- Bridge improvements on roads to Layon, if not already funded.
- Final Designs and procurement for new landfill and Ordot Dump closure
- Post- closure activities at Ordot Dump

j. Facilitate partnership with the current and planned military organizations in Guam.

k. Areas Requiring a Capital Funding

- Acquisition of land for new landfill and access road
- Bridge improvements on roads to Layon, if not already funded.
- Final Designs and procurement for new landfill and Ordot Dump closure
- Post- closure activities at Ordot Dump
- Updating the equipment and establishing proper systems for Solid Waste Division
- Upgrade transfer station (s)
- Construction of interim waste diversion /processing facilities, household hazardous waste facility and Layon Integrated Waste Management Waste Center

l. Comprehensive Programs and Services Needed:

- Curbside Collection
- Yard Waste Diversion
- Construction and Demolition
- Commercial and Institutional, Military Diversion
- Multi-use Transfer Stations
- Reuse Facilities (non-profit)
- Bulk Waste Diversion
- Education

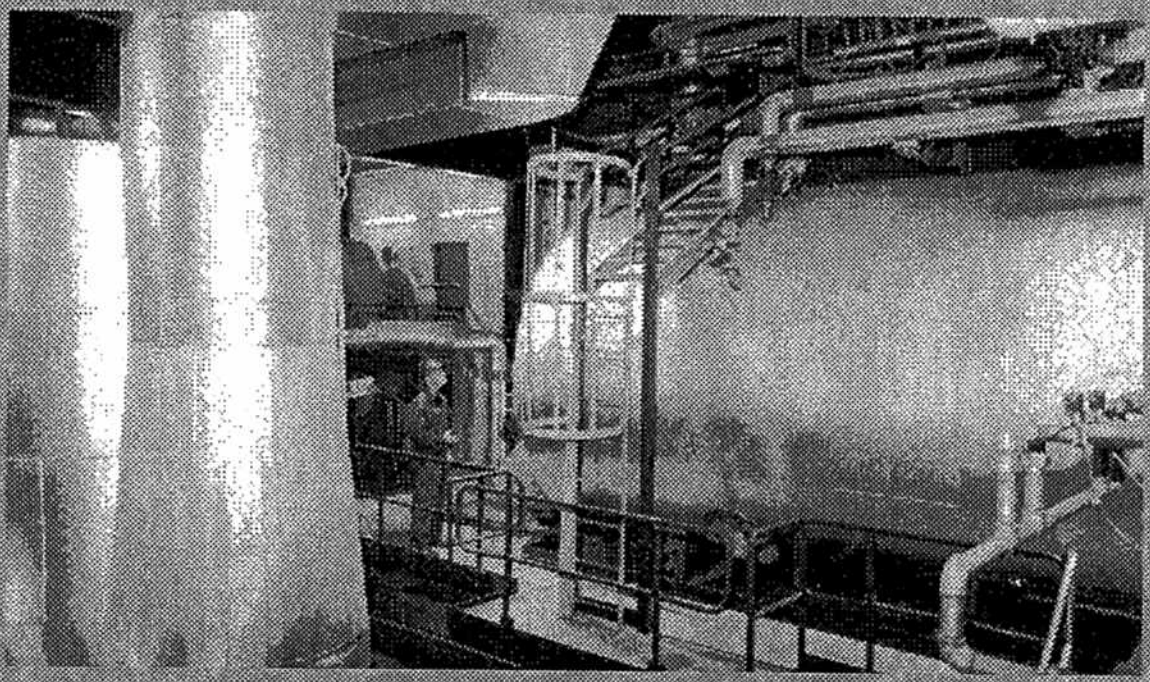
m. Maintain a reliable operations schedule consistent with the needs of the DPW Solid Waste Division and the public;

n. Adhere to all safety, environmental, labor and other relevant regulations;

o. Provide and operate an education center

p. Meet the 95% waste diversion goal.

# Advanced Thermal Treatment of Municipal Solid Waste



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Department for Environment, Food and Rural Affairs

# 1. Introduction

Municipal Solid Waste (MSW) is waste collected by or on behalf of a local authority. It comprises mostly household waste and it may include some commercial and industrial wastes. Historically, nationally the quantity of MSW has risen year on year[1], presenting a growing problem for local authorities particularly as legislation, now limits (by implication[2]) the amount of mixed MSW that can be sent to landfill, becomes more stringent over time.

One of the guiding principles for European and UK waste management has been the concept of a hierarchy of waste management options, where the most desirable option is not to produce the waste in the first place (waste prevention) and the least desirable option is to dispose of the waste to landfill with no recovery of either materials and/or energy. Between these two extremes there are a wide variety of waste treatment options that may be used as part of a waste management strategy to recover materials (for example furniture reuse, glass recycling or organic waste composting) or generate energy from the wastes (for example through incineration, or digesting biodegradable wastes to produce usable gases).

At present more than 62% of all MSW generated in England is disposed of in landfills[3]. However, European and UK legislation has been put in place to limit the amount of biodegradable municipal waste (BMW) sent for disposal in landfills[4]. A key driver for this focus on biodegradable waste is to reduce the uncontrolled release of greenhouse gas emissions to atmosphere. The Landfill Directive also requires waste to be pre-treated prior to disposal. The diversion of this material is one of the most significant challenges facing the management of Municipal Solid Waste in the UK.

There are a wide variety of alternative waste management options and strategies available for dealing with Municipal Solid Waste to limit the residual amount left for disposal to landfill. The aim of this guide is to provide impartial information about the range of technologies referred to as Advanced Thermal Treatment (ATT) – the principle ones being gasification and pyrolysis. These technologies are designed to recover energy (in the form of heat, electricity or fuel) and can contribute to the diversion of BMW from landfill. They are part of a range of new alternatives currently being assessed and investigated through the New Technologies work stream of Defra. Further details about the new technologies featured in this report are available from Defra's Waste Technology Data Centre: http://www.environment-agency.gov.uk/wtd

The technologies described in this Brief – Advanced Thermal Treatment - have a limited track record in the UK (and indeed internationally) on MSW. There are many examples of ATT processes that are established are viable and bankable on various waste streams (e.g. biomass, industrial wastes, tyres etc) but a lesser number proven on municipal wastes. The aim of this document is to raise awareness of the technologies available and help remove barriers to the development of appropriate ATT processes in England.

This guide is designed to be read in conjunction with the other Waste Management Technology Briefs in this series and with the case studies provided on Waste Technology Data Centre. Other relevant sources of information are identified throughout the document.

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[1] This is now showing signs of slowing and in some areas waste arisings are falling, and indeed in 2005/6 there was a 3% fall nationally. However this may be partly explained by other factors occurring in that particular financial year

[2] Targets pertain to the biodegradable fraction

[3] Results from WasteDataFlow for 2005/6 http://www.defra.gov.uk/environment/statistics/wastats/bulletin.htm

[4] The Landfill Directive, Waste and Emissions Trading Act 2003 and Landfill Allowances Trading Scheme Regulations 2004

# 2. How it works

This section comprises an overview of the principles of Advanced Thermal Treatment processes.

## 2.1 Advanced Thermal Treatment

Advanced Thermal Treatment technologies are primarily those that employ pyrolysis and/or gasification to process municipal solid waste (MSW). It excludes incineration[5] of wastes which is already a mature and well established technology.

The gasification and pyrolysis of solid materials is not a new concept. It has been used extensively to produce fuels such as charcoal, coke and town or producer gas. Charcoal and coke are produced by pyrolysing wood and coal respectively and producer gas is a combustible gas produced by the gasification of coke in the presence of air and steam.

It is only in recent years that such pyrolysis and gasification have been commercially applied to the treatment of MSW. The development of pyrolysis and gasification technologies is in its infancy in the UK but large scale plants have been built and are in operation in Europe, North America and Japan.

## 2.2 Difference between Pyrolysis, Gasification and Incineration

There are a variety of differences promoted to differentiate Advanced Thermal Treatment from traditional Incineration technologies. One distinction is that smaller scale facilities are being marketed for treatment of MSW with some ATT processes than that typical of incineration. It is the difference in scale and size that can make it easier to find local markets for both heat and electricity produced. While incineration plants are typically centralised operations, the modular design of ATT operations allows a greater degree of flexibility in terms of location. Sections 6 and 7 discuss planning and public perception aspects of ATT and the process differences are described below.

Established Thermal Treatment – Incineration

Incineration usually involves the combustion of unprepared (raw or residual) MSW. To allow the combustion to take place a sufficient quantity of oxygen is required to fully oxidise the fuel. Typically, incineration plant combustion (flame) temperatures are in excess of 850°C and the waste is converted into carbon dioxide and water. Any non-combustible materials (e.g. metals, glass) remain as a solid, known as Bottom Ash, that contains a small amount of residual carbon.

Advanced Thermal Treatment - Pyrolysis

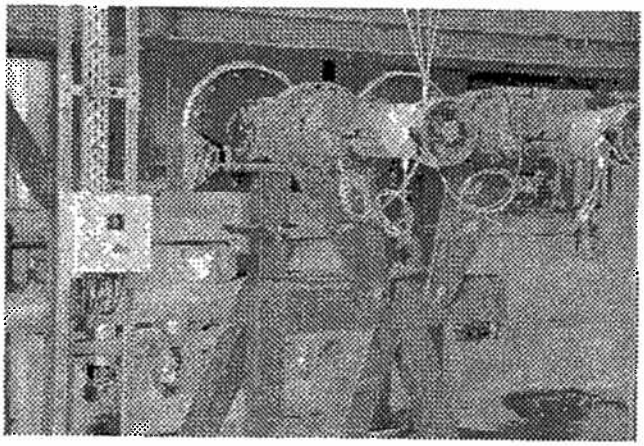
In contrast to combustion, pyrolysis is the thermal degradation of a substance in the absence of oxygen. This process requires an external heat source to maintain the temperature required. Typically, relatively low temperatures of between 300°C to 850°C are used during pyrolysis of materials such as MSW. The products produced from pyrolysing materials are a solid residue and a synthetic gas (syngas). The solid residue (sometimes described as a char) is a combination of non-combustible materials and carbon. The syngas is a mixture of gases (combustible constituents include carbon monoxide, hydrogen, methane and a broad range of other VOCs). A proportion of these can be condensed to produce oils, waxes and tars. The syngas typically has a net calorific value (NCV) of between 10 and 20 MJ/Nm$^3$. If required, the condensable fraction can be collected by cooling the syngas, potentially for use as a liquid fuel.

[5] Incineration of MSW in the UK always involves some form of energy recovery, either in the form of electricity generation and/or heat recovery. As such it is also commonly termed Energy from Waste. In this document we will refer to 'incineration' to distinguish from Advanced Thermal Treatment

# 2. How it works

Advanced Thermal Treatment - Gasification

Gasification can be seen as between pyrolysis and combustion in that it involves the partial oxidation of a substance. This means that oxygen is added but the amounts are not sufficient to allow the fuel to be completely oxidised and full combustion to occur. The temperatures employed are typically above 650°C. The process is largely exothermic but some heat may be required to initialise and sustain the gasification process. The main product is a syngas, which contains carbon monoxide, hydrogen and methane. Typically, the gas generated from gasification will have a net calorific value (NCV) of 4 - 10 MJ/Nm$^3$. The other main product produced by gasification is a solid residue of non-combustible materials (ash) which contains a relatively low level of carbon. For reference, the calorific value of syngas from pyrolysis and gasification is far lower than natural gas, which has a NCV of around 38 MJ/Nm$^3$.



## 2.3 Waste Incineration Directive (WID)

In the UK, all waste incineration plant and ATT plant treating waste must comply with the Waste Incineration Directive (WID). The Directive sets the most stringent emissions controls for any thermal processes regulated in the European Union. The objectives of WID are to minimise the impact from emissions to air, soil, surface and ground water on the environment and human health resulting from the incineration and co-incineration of waste. WID also covers the combustion of syngas produced from ATT processes treating MSW.

The key requirements in the WID for the operation of a facility are:

- A minimum combustion temperature and residence time of the resulting combustion products. For MSW this is a minimum requirement of 850°C for 2 seconds
- Specific emission limits for the release to atmosphere of the following:
  - Sulphur Dioxide (SO2)
  - Nitrogen Oxides (NOx)
  - Hydrogen Chloride (HCl)
  - Volatile Organic Compounds (VOCs)
  - Carbon Monoxide (CO)
  - Particulate (fly ash)
  - Heavy Metals
  - Dioxins
- a requirement that the resulting bottom ash that is produced has a total organic carbon content of less than 3%.

## 2.4 ATT Technology Overview

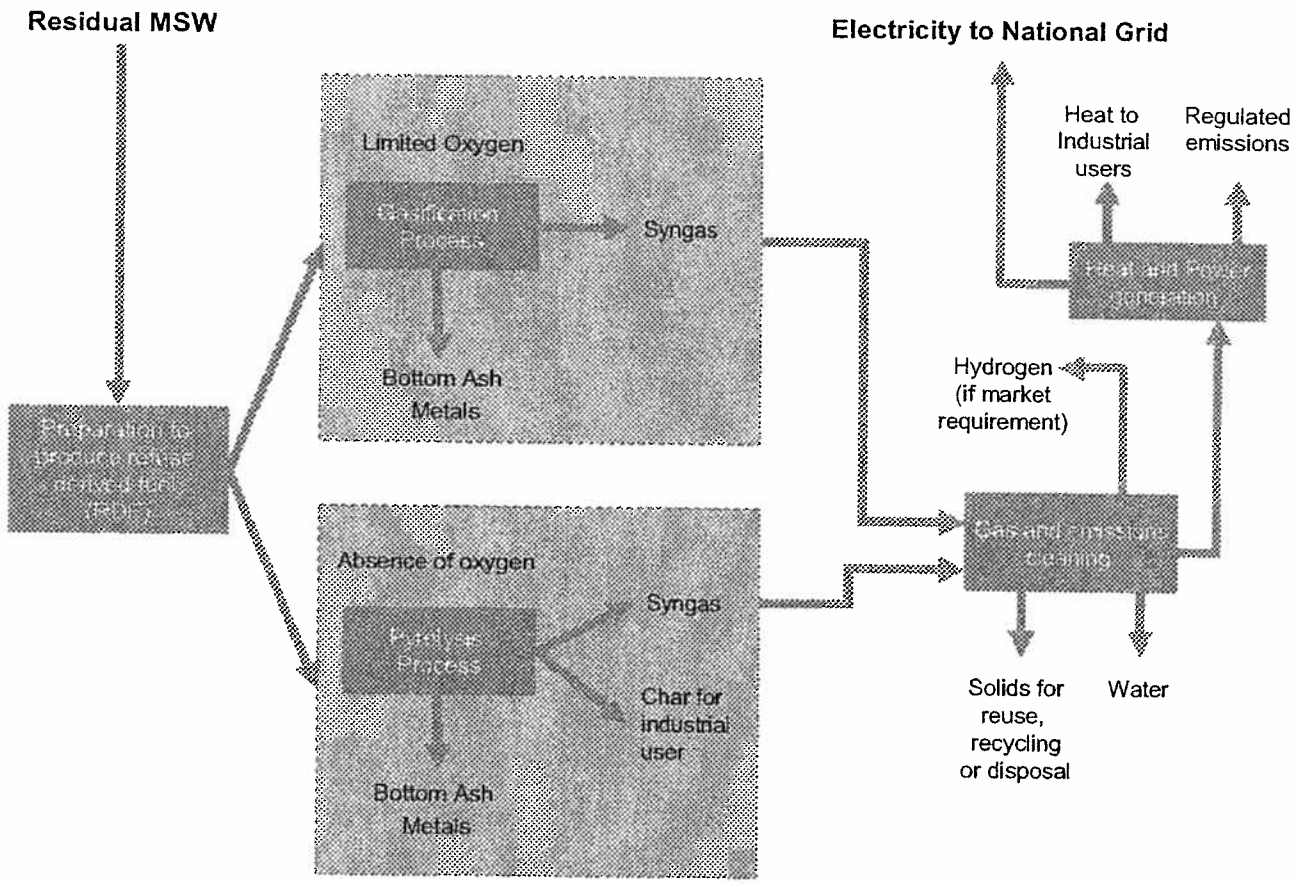
The actual plant design and configuration of ATT facilities will differ considerably between technology providers. However, an ATT plant will typically consist of the following key elements:

- Waste reception, handling and pre-treatment;
- Thermal treatment reactor;
- Gas and residue treatment plant (optional);
- Energy recovery plant (optional); and
- Emissions clean-up.

Figure 1 describes the generic process flows for ATT technologies.

# 2. How it works

Figure 1: ATT generic process flows



# 2. How it works

## Waste Reception, Handling and Pre-treatment

The pyrolysis and gasification process is focused on treating the biodegradable based materials present in MSW (e.g. paper,card, putrescible waste, green waste, wood), as well as plastics. Therefore, it is common to remove non combustible materials and recyclables, (typically metals and glass) prior to the primary treatment reactor stage (2.3.2). In addition, depending on the technology employed, the feed material might require processing to remove excess moisture and shredding to reduce the size.

It is the preference (for most ATT processes) to treat only pre-processed residual MSW that makes these systems appropriate to be integrated into a wider municipal waste management strategy. ATT processes may be used in conjunction with other waste treatment technologies such as Mechanical Biological Treatment (MBT) and Mechanical Heat Treatment (MHT). Many MBT/MHT plant are designed to produce a fuel stream (primarily composed of paper, card and plastics) as one of the outputs from the process. This is commonly referred to as Refuse Derived Fuel or RDF (see Box 1). This may be more amenable to processing in an ATT plant rather than raw MSW. ATT facilities are identified as one of the 6 potential outlets identified by Defra as suitable for RDF. For more information on MBT, MHT and the potential outlets for RDF see the separate technology briefs in this series.

### Box 1: Fuel from mixed waste processing operations

The current prevalent term used for a fuel produced from combustible waste is Refuse Derived Fuel (RDF). The types of technologies used to prepare or segregate a fuel fraction from MSW include the Mechanical Biological Treatment (MBT) and Mechanical Heat Treatment (MHT), described in separate Technology Briefs in this series.

A CEN Technical Committee (TC 343) is currently progressing standardisation work on fuels prepared from wastes, classifying a Solid Recovered Fuel (SRF). Preliminary standards have been published in June 2006 and are following an evaluation process, during which the functioning of the specifications will be verified. The technical specifications classify the SRF by thermal value, chlorine content and mercury content. For example, the thermal value class will be based on the number of megajoules one kilogram of recovered fuel contains. In addition, there are many characteristics for which no specific values have been determined. Instead, they can be agreed upon between the producer and the purchaser of SRF.

Along with the standardisation process, a validation project called QUOVADIS (http://quovadis.cesi.it/) on solid recovered fuels is currently being implemented.

It is anticipated that once standards are developed and become accepted by users, then SRF will become the terminology used by the waste management industry. Other terminology has also been introduced to the industry as various fuel compositions may be prepared from waste by different processes. Examples include 'Biodegradable Fuel Product' (BFP) and 'Refined Renewable Biomass Fuel' (RRBF).

European standards for SRF are important for the facilitation of trans-boundary shipments and access to permits for the use of recovered fuels. There may also be cost savings for re-incineration plants as a result of reduced measurements (e.g. for heavy metals) of incoming fuels. Standards will aid the rationalisation of design criteria for combustion units, and consequently cost savings for equipment manufacturers. Importantly, standards will guarantee the quality of fuel for energy producers.

# 2. How it works

## Thermal Treatment Reactor

The thermal treatment process, whether pyrolysis or gasification, will produce syngas and solid residue. The composition of the syngas and solid residue will depend on the process conditions employed, which include operating temperature, oxygen level, heating rate and residence time in the reactor. The main types of thermal treatment units available, their application and operating conditions are summarised in Table 1. There are also other factors influencing the process such as direction of gas flow (e.g. horizontally or vertically).

Table 1: Treatment Reactors

| Reactor | Typical Application | Operating Conditions |
|---|---|---|
| Rotating Kiln | Pyrolysis | Typically operate at temperatures of between 300 – 850oC. Unit can accommodate large size feed material (200 mm). Kiln is heated externally and waste is fed in from one end of the kiln which slowly rotates creating a tumbling action. This mixes the waste and ensures contact with the heating surface and gases inside the kiln. |
| Heated Tube | Pyrolysis | The tubes are heated externally and temperatures as high as 800oC are used. The process can accommodate large size feed material. The waste passes through the tube at a set speed to ensure the pyrolysis process is complete. |
| Surface Contact | Pyrolysis | Small size feed material required and therefore significant pre-treatment is necessary. Process operates at high temperatures and the small size of the feed gives high heating rates. The application of this technology is to maximise the rate of pyrolysis. |
| Fluidised Bed | Gasification | Fluidised bed technology may be used for gasification or combustion processes. The bed is a mass of particles (typically alumina) that has similar characteristics to a moving fluid. This is achieved by blowing hot gases through the bed of particles. This system provides good mixing and heat transfer to the incoming waste. Waste is pre-treated to remove large sized material. This technology is well suited to the gasification of refuse derived fuels. |
| Fixed Bed | Gasification | There are a range of different reactor types that come under this heading. A typical example is a grate system where the feed passes along the grate and hot gases pass through the bed of waste heating it. |

# 2. How it works

Gas and Residue Treatment Stages

Solids will inevitably be discharged from the process. These solids include metals together with carbon. In the case of gasification, the level of carbon is small; in pyrolysis it is significant. Larger particles of solids in the thermal treatment reactor are usually discharged as bottom ash and slag. Lighter ash is usually collected when the gas is separated with the use of cyclones and ultimately filters. In addition, volatile metals such as lead, tin, cadmium and mercury will be carried in the gas until such point that the gas is cooled for them to be sufficiently condensed.

Pollution control strategies for ATT plants will typically be on a smaller scale than for incineration technologies, hence less costly, due to the reduction in the volume of process air required however compliance with the Waste Incineration Directive would still be mandatory.

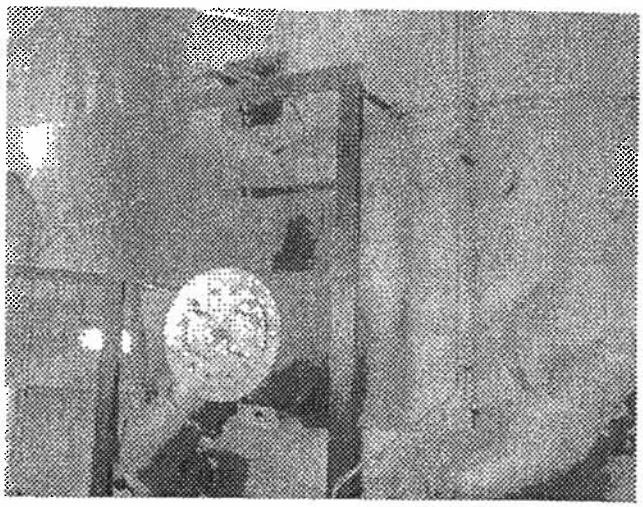
Energy Recovery/Utilisation of Syngas

One of the potential benefits of pyrolysis and gasification is that the syngas can be used in a number of different ways.

In terms of producing energy, the most common configuration is to burn the syngas in a boiler to generate steam. The steam can then be used to generate electricity by passing it through a steam turbine and, if there is a demand local to the plant, for heating. Using the heat in addition to generating electricity improves the overall energy efficiency of the system significantly.

The syngas can also be used to fuel a dedicated gas engine. A syngas from a very well run gasifier, or further processed for example by reforming, may be suitable for use in a gas turbine. Running these types of plant on syngas is still in its infancy and would require cleaning and cooling prior to use. However, using a gas engine or gas turbine could increase efficiencies for electricity generation. This is of particular relevance if a Combined Cycle Gas Turbine (CCGT) or Combined Heat and Power (CHP) configuration is used (see table 2). Whilst high efficiencies can be achieved using gas engines, the highest efficiencies can only be reached using a high calorific value gas. Efficiencies should be checked if using a lower calorific value gas.

To minimise costs for energy generation the ATT plant could be located adjacent to an existing power plant and the syngas transferred to it. This would also provide benefits if the existing plant has a higher efficiency than a standalone unit. The power plant may require upgrading to comply with the Waste Incineration Directive, to improve the abatement system for controlling emissions from the combustion of the syngas, which could incur additional costs.



In addition to using the syngas to produce energy, it could also be used as a chemical feedstock. This offers a further option for utilising the syngas but would require the treatment plant to be local to the end user, in order to be a practical solution. This would

# 2. How it works

require very high gas cleanliness; pollutants, notably sulphur and halogens, may need to be removed prior to combustion of the gas. The reduced gas volumes involved in cleaning the combusted gas rather than the combustion gas gives a financial advantage to the process. Alkalis such as lime and sodium hydroxide are the favoured reagents for removal of the halogen streams. Sulphur can be removed by a variety of routes, largely dependant on the initial concentration (ranging from absorption to the Klaus reaction).

For reference a summary of the potential net electrical generating efficiencies for new build thermal treatment plant employing various energy recovery options is presented in Table 2. For comparison the performance of a new incinerator is also provided. Significantly greater efficiencies are possible by recovering useable heat as well as power.

Table 2: Potential net electrical generating efficiencies

| Energy System | Efficiencies of Pyrolysis/ Gasification Treatment Plant | Efficiencies of Incinerator |
|---|---|---|
| Steam Boiler and Turbine | 10% - 20% | 14% - 27%[6] |
| Gas Engine | 13% - 28% | n/a |
| Combined Cycle Gas Turbine | 30% | n/a |
| Co-firing in existing power plant | Up to 27% | n/a |

Syngas from waste has also been identified as a potential source of hydrogen, which could have applications in both power generation and as a vehicle fuel. There are predicted carbon dioxide reduction benefits of the hydrogen from waste route, compared with the current use of natural gas and electrolysis to produce the gas. There would however be significant purification and reforming required before the gas would be of an appropriate quality for power generation (in turbines) or transport (in fuel cells)[7].

The advantages of using ATT plants to produce the syngas would arise from their relatively small scale, flexibility to different inputs and modular development. Producing syngas to serve multiple end uses could complicate delivery of the plants but it could provide a higher degree of financial security than building the entire business case around customer. Although the national grid could take all of the electricity output these prices do fluctuate.

## 2.5 Examples of ATT technologies

Some descriptive examples of ATT processes are included here to illustrate the different technologies being promoted for MSW management. The technical details of these and other examples, including mass and energy balances and an analysis of the Strengths, Weaknesses, Opportunities and Threats are included on the Waste Technology Data Centre.

Waste Gen (Tech Trade) Hamm Germany

This is a pyrolysis plant that processes a pre-prepared RDF to produce a syngas that is immediately burnt in a dedicated burner in an otherwise coal fired power station boiler. The resulting char after recovery of metals using magnets and aggregate, using a

[6] Typical incinerator efficiencies range from 14% to 24%. A recent report (Carbon Balances and Energy Impacts of the Management of UK Wastes, ERM and Golder Associates report for Defra, March 2006 www.defra.gov.uk/science/project_data/DocumentLibrary/WR0602/WR0602_4750_FRP.pdf) states an efficiency range for electricity only of between 20-27%

[7] The Potential for Hydrogen Production from Waste in London; The London Hydrogen Partnership http://www.lhp.org.uk/content/images/articles/LHPReportFinal3LR(1).pdf

# 2. How it works

ballistic separator, is fed into the station coalbunkers. Fuel is delivered to the plant in bales or bulk form, from a range of RDF producers. The fuel is conveyed to the two rotary kiln, pyrolyser, units (20m in length x 2.8m in diameter). Natural gas burners heat the pyrolysis drums. The two pyrolysis drums replace 10% of the fuel input to a coal fired 330Mwe generating set.

KBI Waste & Energy Solutions GmbH

This is a Mechanical & Biological Treatment (MBT) plant followed by an oxygen blown 'down draught' gasifier. The purpose of the waste pre-treatment and the gasifier is to produce a gas of a quality and consistency such that the power plant can safely and reliably operate to a defined efficiency and emission limits.

Received waste is dried in a rotating compost drum and recyclates are removed. The waste then passes to a feed preparation area where additives such as coke, (typically 17%) and limestone are introduced prior to gasification.

In the gasifier oxygen is added at several points down the gasifier progressively raising the temperature towards the maximum, normally 1500°C. Additional feeds of steam and natural gas are used so as to control the composition of the produced gas. The gas is to be used for power generation via a gas turbine set. The gas is burned in a conventional gas turbine set and the exhaust gas from the turbine is used to raise steam. Some of the steam / electricity is used by the process with the excess available for export.

GEM, Graveson Energy Management, Port Talbot, UK

This process uses fast pyrolysis of a Refuse Derived Fuel (RDF see box 1) to produce a gas suitable for burning or powering an engine.

The essential principle behind the process is to rapidly heat the feed to around 820oC, in the absence of oxygen and hence induce rapid pyrolysis. To do this conventional RDF has to be ground such that one major dimension of each RDF particle is less than 2mm. The ground floc then has to be dried to 5% moisture prior to feeding into the pyrolyser. The Pyrolyser consists of a large vertical steel cylinder heated on its outside surface. A close fitting cylindrical drum is suspended and rotated within this cylinder. The RDF is fed at the top of the cylinder and by falling through the gap between the cylinder and drum is rapidly heated. Within a couple of seconds the RDF has been pyrolysed. Char is separated from the gas in a cyclone. The gas stream is cooled and scrubbed to remove acid gases. The cleaned gas is then fed to a spark ignition engine generator set. Waste heat from the pyrolyser heater, the engine exhaust, engine cooling and the produced gas cooler is collected and integrated with the local heat requirements which may be parasitic loads or potentially offsite heat demands, hence giving a combined heat and power system.

## 2.6 Summary

This section explains that Advanced Thermal Treatment processes are primarily pyrolysis and/or gasification based. ATT are capital intensive facilities and have a design life of 15 – 25 years. Rigorous evaluation of the technology is essential to reduce any operational risks when processing the anticipated feedstock. Over this timescale the composition of waste is likely to alter and the process selected should be robust or flexible enough to treat varying calorific values and compositions of waste feedstock.

# 3. Markets and outlets for the outputs

ATT processes will all produce a gas (usually for energy recovery) and a solid residue (slag, ash or char). Some facilities are also designed with mechanical preparation and sorting equipment to extract recyclables. Table 3 summarises the key outputs from ATT processes and the following sections address materials and energy recovery.

Table 3: Examples of outputs from ATT processes

| Outputs | State | Potential Markets |
|---|---|---|
| Slag (from gasification) | Solid, fused | Aggregate |
| Ash (from gasification) | Un-fused residue | Aggregate replacement, metals can be separated |
| Flue Gas Treatment residue | Solid, powder/ sludge. Invariably a hazardous waste; some potential for neutralising waste acids | Specialist Disposal or treatment potential use in Chemical treatment works (e.g. neutralising acid waste) |
| Syngas | Gaseous | Heat or power generation/fuel/ some chemical application |
| Condensate | Liquid | Fuel/chemical application. Care needs to be taken with the chemical composition of this and the hazards associated with it |
| Char (from pyrolysis) | Solid | Hazardous waste but could be used as coal replacement in certain combustion applications or as a gasifier feedstock |

The following section summarises some key issues with regard to these outputs.

## 3.1 Recovery from ATT

Materials Recycling

Recyclables derived from either the front end preparation stage of an ATT plant or metals extracted from the back end of the process (i.e. out of the ash) are typically of a lower quality than those derived from a separate household recyclate collection system, and generally have a lower value accordingly. The types of materials recovered from ATT processes almost always include metals (ferrous and non-ferrous), usually from the front end of the process. Metal removal can help enhance overall recycling levels and enable recovery of certain constituent parts that would not otherwise be collected in household systems (e.g. steel coat hangers, scrap metal etc.).

Pyrolysis plants produce a bottom residue that contains significant amounts of carbon. This will need to be disposed of to landfill, or treated further to reduce the carbon content for example by gasification or combustion. If treated further the final bottom residue could then be recycled as a secondary aggregate. Gasification tends to produce a bottom residue which has a lower carbon content and has usually been melted or fused, and this could therefore be recycled as aggregate. The recycling of bottom ash would need to be undertaken in accordance with relevant legislation but is likely to be of equivalent or potentially better quality than incinerator bottom ash, which is currently recycled in aggregate applications.

# 3. Markets and outlets for the outputs

For more information on the contribution of ATT to Best Value Performance Indicators and recycling see section 9, and for the latest developments see the local authority performance pages on the Defra website http://www.defra.gov.uk/environment/waste/localauth/perform-manage/index.htm and http://www.wastedataflow.org/Documents/BVPI%20FAQs.pdf. The Defra New Technologies Demonstrator also includes ATT facilities, more information on which is available through the Defra website or from Wastetech@enviros.com.

Energy Recovery

ATT processes are designed to recover energy from the waste processed either in the form of fuel production (liquid or gas) or combusting the syngas to generate electricity and/or heat for use on site and export off site. There is also potential for the syngas to be utilised in vehicles, after reforming to produce hydrogen. It is envisaged that the initial market for the hydrogen would be public transport fleets using fuel cell vehicles.

Examples of energy recovery from case studies are included on the Waste Technology Data Centre. Electricity generated from the biomass fraction of waste in gasification and pyrolysis plants is eligible for support under the Renewables Obligation.

It should be noted that the processes using RDF will have already incurred energy usage in the preparation of the fuel and this prepared material will have a higher calorific value than raw MSW.

# 4. Track record

Whilst ATT technologies are established technologies for the treatment of certain specific waste streams, it is only in recent years that pyrolysis and gasification have been commercially applied to the treatment of MSW.

The prime drivers in the UK for the development of these technologies are increasing landfill costs and the implementation of the Landfill Directive. The development of pyrolysis and gasification technologies for MSW is in its infancy in the UK but commercial scale plant have been built and are in operation in Europe, North America and Japan. Table 4 provides examples of ATT facilities in the UK and overseas, treating MSW and other types of waste.

Table 4: ATT facilities

| Operator/Type | Primary Technology | Country | Operational | Capacity tpd | Feed |
|---|---|---|---|---|---|
| Compact Power | Tube Pyrolysis | UK - Avonmouth | 2001 | 8,000 | Clinical Waste |
| Energos | Grate Gasification | Norway | 1997 | 10,000 | Industrial & Paper Wastes |
| Energos | Grate Gasification | Norway | 2000 | 34,000 | MSW |
| Energos | Grate Gasification | Norway | 2001 | 36,000 | MSW & industrial waste |
| Energos | Grate Gasification | Norway | 2002 | 70,000 | MSW & industrial waste |
| Energos | Grate Gasification | Norway | 2002 | 37,000 | MSW |
| Energos | Grate Gasification | Germany | 2002 | 37,000 | MSW & industrial waste |
| Energos | Grate Gasification | Germany | 2005 | 80,000 | MSW, Commercial, Industrial |
| Energos | Grate Gasification | Sweden | 2005 | 80,000 | Municipal & Industrial Waste |
| Enerkem/Novera | Fluidised Bed Gasification | Spain | 2002 | 25,000 | Plastics |
| FERCO | Fluidised Bed Gasification | USA | 1997 | 165,000 | Biomass |
| Foster Wheeler | Fast (ablative) Pyrolysis | Finland | 1998 | 80,000 | Mix waste |
| Mitsui Babcock | Rotary Kiln Pyrolysis | Japan | 2000 | 80,000 | MSW |
| Mitsui Babcock | Rotary Kiln Pyrolysis | Japan | 2002 | 150,000 | MSW |
| Mitsui Babcock | Rotary Kiln Pyrolysis | Japan | 2002 | 50,000 | MSW |
| Mitsui Babcock | Rotary Kiln Pyrolysis | Japan | 2003 | 95,000 | MSW |
| Mitsui Babcock | Rotary Kiln Pyrolysis | Japan | 2003 | 75,000 | MSW |
| Mitsui Babcock | Rotary Kiln Pyrolysis | Japan | 2003 | 60,000 | MSW |
| Thermoselect | Tube Pyrolysis | Germany | 1999 | 225,000 | Domestic & Industrial Wastes |
| Thermoselect | Tube Pyrolysis | Japan | 1999 | 100,000 | Domestic & Industrial Wastes |
| Thermoselect | Tube Pyrolysis | Japan | 2003 | 50,000 | Industrial Wastes |
| Techtrade/ Wastegen | Rotary Kiln Pyrolysis | Germany | 1984 | 35,000 | RDF |
| Techtrade/ Wastegen | Rotary Kiln Pyrolysis | Germany | 2002 | 100,000 | Domestic & Industrial Wastes |

# CHAPTER 4

# BIOLOGICAL TREATMENT OF SOLID WASTE

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# 4 BIOLOGICAL TREATMENT OF SOLID WASTE

## 4.1 METHODOLOGICAL ISSUES

Composting and anaerobic digestion of organic waste, such as food waste, garden (yard) and park waste and sludge, is common both in developed and developing countries. Advantages of the biological treatment include: reduced volume in the waste material, stabilisation of the waste, destruction of pathogens in the waste material, and production of biogas for energy use. The end products of the biological treatment can, depending on its quality, be recycled as fertiliser and soil amendment, or be disposed in SWDS.

Anaerobic treatment is usually linked with methane ($CH_4$) recovery and combustion for energy, and thus the greenhouse gas emissions from the process should be reported in the Energy Sector. Anaerobic sludge treatment at wastewater treatment facilities is addressed in Chapter 6, Wastewater Treatment and Discharge, and emissions should be reported under the categories of Wastewater. However, when sludge from wastewater treatment is transferred to an anaerobic facility which is co-digesting sludge with solid municipal or other waste, any related $CH_4$ and nitrous oxide ($N_2O$) emissions should be reported under this category, biological treatment of solid waste. Where these gases are used for energy, then associated emissions should be reported in the Energy Sector.

**Composting** is an aerobic process and a large fraction of the degradable organic carbon (DOC) in the waste material is converted into carbon dioxide ($CO_2$). $CH_4$ is formed in anaerobic sections of the compost, but it is oxidised to a large extent in the aerobic sections of the compost. The estimated $CH_4$ released into the atmosphere ranges from less than 1 percent to a few per cent of the initial carbon content in the material (Beck-Friis, 2001; Detzel *et al.*, 2003; Arnold, 2005).

Composting can also produce emissions of $N_2O$. The range of the estimated emissions varies from less than 0.5 percent to 5 percent of the initial nitrogen content of the material (Petersen *et al.*, 1998; Hellebrand 1998; Vesterinen, 1996; Beck-Friis, 2001; Detzel *et al.*, 2003). Poorly working composts are likely to produce more both of $CH_4$ and $N_2O$ (e.g., Vesterinen, 1996).

**Anaerobic digestion of organic waste** expedites the natural decomposition of organic material without oxygen by maintaining the temperature, moisture content and pH close to their optimum values. Generated $CH_4$ can be used to produce heat and/or electricity, wherefore reporting of emissions from the process is usually done in the Energy Sector. The $CO_2$ emissions are of biogenic origin, and should be reported only as an information item in the Energy Sector. Emissions of $CH_4$ from such facilities due to unintentional leakages during process disturbances or other unexpected events will generally be between 0 and 10 percent of the amount of $CH_4$ generated. In the absence of further information, use 5 percent as a default value for the $CH_4$ emissions. Where technical standards for biogas plants ensure that unintentional $CH_4$ emissions are flared, $CH_4$ emissions are likely to be close to zero. $N_2O$ emissions from the process are assumed to be negligible, however, the data on these emissions are very scarce.

**Mechanical-biological (MB) treatment** of waste is becoming popular in Europe. In MB treatment, the waste material undergoes a series of mechanical and biological operations that aim to reduce the volume of the waste as well as stabilise it to reduce emissions from final disposal. The operations vary by application. Typically, the mechanical operations separate the waste material into fractions that will under go further treatment (composting, anaerobic digestion, combustion, recycling). These may include separation, shredding and crushing of the material. The biological operations include composting and anaerobic digestion. The composting can take place in heaps or in composting facilities with optimisation of the conditions of the process as well as filtering of the produced gas. The possibilities to reduce the amount of organic material to be disposed at landfills are large, 40 - 60 percent (Kaartinen, 2004). Due to the reduced amount in material, organic content and biological activity, the MB-treated waste will produce up to 95 percent less $CH_4$ than untreated waste when disposed in SWDS. The practical reductions have been smaller and depend on the type and duration of MB treatments in question (see e.g., Binner, 2002). $CH_4$ and $N_2O$ emissions during the different phases of the MB treatment depend on the specific operations and the duration of the biological treatment.

Overall, biological treatment of waste affects the amount and composition of waste that will be deposited in SWDS. Waste stream analyses (see example in Box 3.1) are recommended methodologies for estimating the impact of the biological treatment on emissions from SWDS.

The estimation of $CH_4$ and $N_2O$ emissions from biological treatment of solid waste involves following steps:

**Step 1:** Collect data on the amount and type of solid waste which is treated biologically. Data on composting and anaerobic treatment should be collected separately, where possible. Regional default data on composting are provided in Table 2.1 in Chapter 2, and country-specific data for some countries can be found in Annex 2A.1 of this Volume. Anaerobic digestion of solid waste can be assumed to be zero where no data are available. The default data should be used only when country-specific data are not available (see also Section 4.1.2).

**Step 2:** Estimate the $CH_4$ and $N_2O$ emissions from biological treatment of solid waste using Equations 4.1 and 4.2. Use default or country-specific emission factors in accordance with the guidance as provided in Sections 4.1.1, 4.1.2 and 4.1.3.

**Step 3:** Subtract the amount of recovered gas from the amount of $CH_4$ generated to estimate net annual $CH_4$ emissions, when $CH_4$ emissions from anaerobic digestion are recovered.

Consistency between $CH_4$ and $N_2O$ emissions from composting or anaerobic treatment of sludge and emissions from treatment of sludge reported in the Wastewater Treatment and Discharge category should be checked. Also, if emissions from anaerobic digestion are reported under Biological Treatment of Solid Waste, the inventory compilers should check that these emissions are not also included under the Energy Sector.

Relevant information on activity data collection, choice of emission factor and method used in estimating the emissions should be documented following the guidance in Section 4.6.

## 4.1.1 Choice of method

The $CH_4$ and $N_2O$ emissions of biological treatment can be estimated using the default method given in Equations 4.1 and 4.2 shown below:

**EQUATION 4.1**
**$CH_4$ EMISSIONS FROM BIOLOGICAL TREATMENT**

$$CH_4\ Emissions = \sum_i (M_i \bullet EF_i) \bullet 10^{-3} - R$$

Where:

$CH_4$ Emissions = total $CH_4$ emissions in inventory year, Gg $CH_4$

$M_i$ = mass of organic waste treated by biological treatment type *i*, Gg

EF = emission factor for treatment *i*, g $CH_4$/kg waste treated

i = composting or anaerobic digestion

R = total amount of $CH_4$ recovered in inventory year, Gg $CH_4$

When $CH_4$ emissions from anaerobic digestion are reported, the amount of recovered gas should be subtracted from the amount $CH_4$ generated. The recovered gas can be combusted in a flare or energy device. The amount of $CH_4$ which is recovered is expressed as R in Equation 4.1. If the recovered gas is used for energy, then also the resulting greenhouse gas emissions from the combustion of the gas should be reported under Energy Sector. The emissions from combustion of the recovered gas are however not significant, as the $CO_2$ emissions are of biogenic origin, and the $CH_4$ and $N_2O$ emissions are very small so *good practice* in the Waste Sector does not require their estimation. However, if it is wished to estimate such emissions, the emissions from flaring should be reported under the Waste Sector. A discussion of emissions from flaring and more detailed information are given in Volume 2, Energy, Chapter 4.2. Emissions from flaring are not treated at Tier 1.

**EQUATION 4.2**
**$N_2O$ EMISSIONS FROM BIOLOGICAL TREATMENT**

$$N_2O\ Emissions = \sum_i (M_i \bullet EF_i) \bullet 10^{-3}$$

Where:

$N_2O$ Emissions = total $N_2O$ emissions in inventory year, Gg $N_2O$

$M_i$ = mass of organic waste treated by biological treatment type *i*, Gg

EF = emission factor for treatment *i*, g $N_2O$/kg waste treated

i = composting or anaerobic digestion

Three tiers for this category are summarised below.

**Tier 1:** Tier 1 uses the IPCC default emission factors.

**Tier 2:** Country-specific emission factors based on representative measurements are used for Tier 2.

**Tier 3:** Tier 3 methods would be based on facility or site-specific measurements (on-line or periodic).

## 4.1.2 Choice of activity data

Activity data on biological treatment can be based on national statistics. Data on biological treatment can be collected from municipal or regional authorities responsible for waste management, or from waste management companies. Table 2.1 in Chapter 2, Waste Generation, Composition and Management Data, gives regional default values on biological treatment. Country-specific default values for some countries can be found in Annex 2A.1 of this Volume. These data can be used as a starting point. It is *good practice* that countries use national, annually or periodically collected data, where available.

## 4.1.3 Choice of emission factors

### 4.1.3.1 TIER 1

The emissions from composting, and anaerobic digestion in biogas facilities, will depend on factors such as type of waste composted, amount and type of supporting material (such as wood chips and peat) used, temperature, moisture content and aeration during the process.

Table 4.1 gives default factors for $CH_4$ and $N_2O$ emissions from biological treatment for Tier 1 method.

TABLE 4.1
DEFAULT EMISSION FACTORS FOR $CH_4$ AND $N_2O$ EMISSIONS FROM BIOLOGICAL TREATMENT OF WASTE

| Type of biological treatment | $CH_4$ Emission Factors (g $CH_4$/kg waste treated) | | $N_2O$ Emission Factors (g $N_2O$/kg waste treated) | | Remarks |
|---|---|---|---|---|---|
| | on a dry weight basis | on a wet weight basis | on a dry weight basis | on a wet weight basis | |
| **Composting** | 10 (0.08 - 20) | 4 (0.03 - 8) | 0.6 (0.2 - 1.6) | 0.3 (0.06 - 0.6) | Assumptions on the waste treated: 25-50% DOC in dry matter, 2% N in dry matter, moisture content 60%. The emission factors for dry waste are estimated from those for wet waste assuming a moisture content of 60% in wet waste. |
| **Anaerobic digestion at biogas facilities** | 2 (0 - 20) | 1 (0 - 8) | Assumed negligible | Assumed negligible | |

Sources: Arnold, M.(2005) Personal communication; Beck-Friis (2002); Detzel *et al.* (2003); Petersen *et al.* 1998; Hellebrand 1998; Hogg, D. (2002); Vesterinen (1996).

Emission from MB treatment can be estimated using the default values in Table 4.1 for the biological treatment. Emissions during mechanical operations can be assumed negligible.

### 4.1.3.2 TIER 2 AND TIER 3

In Tier 2, the emissions factors should be based on representative measurements that cover relevant biological treatment options applied in the country. In Tier 3, emission factors would be based on facility/site-specific measurements (on-line or periodic).

## 4.2 COMPLETENESS

Reporting on $CH_4$ and $N_2O$ emissions from biological treatment, where present, will complement the reporting of emissions from SWDS and burning of waste and contribute to full coverage of all sources in the Waste Sector. This will be particularly important in countries for which biological treatment is, or is becoming, significant.

## 4.3 DEVELOPING A CONSISTENT TIME SERIES

As the methodological guidance for estimating and reporting of emissions from biological treatment was not included in the previous *IPCC Guidelines*, it is recommended that the whole time series is estimated using the same methodology. The activity data for earlier years may not be available in all countries. Also current data on biological treatment may not be collected on an annual basis. The methods for obtaining missing data are described in Volume 1, Chapter 5, Time Series Consistency.

The default emission factors are based on limited amount of studies. The data availability is expected to improve in coming years. It is *good practice* to use updated scientific information to improve emission factors when it becomes available. Then, the estimates for the whole times series should be recalculated accordingly.

## 4.4 UNCERTAINTY ASSESSMENT

The uncertainty in activity data will depend on how the data are collected. The uncertainty estimates for waste generation and the fraction of waste treated biologically can be estimated in the same manner as for MSW disposed at SWDS (see Table 3.5). The uncertainties will depend on the quality of data collection in the country.

Uncertainties in the default emission factors can be estimated using the ranges given in Table 4.1. Uncertainties in country-specific emission factors will depend on the sampling design and measurement techniques used to determine the emission factors.

## 4.5 QA/QC

The requirements on QA/QC addressed in Section 3. 8 in Chapter 3, Solid Waste Disposal, are also applicable for biological treatment of waste.

## 4.6 REPORTING AND DOCUMENTATION

It is *good practice* to document and archive all information required to produce the national greenhouse gas inventory as outlined in Section 6.11 of Chapter 6, QA/QC and Verification, in Volume 1 of these *Guidelines*. A few examples of specific documentation and reporting relevant to this category are outlined in the following paragraphs.

- The sources of activity data should be described and referenced. The information on the collection frequency and coverage (e.g., whether composting at households is included or not) should be given.
- Information on types of waste (e.g., food waste, garden and park waste) composted or treated anaerobically should be provided, if available.
- Country-specific emission factors should be justified and referenced.
- In cases where reporting of biological treatment will be split under several sectors and/or categories, the reporting should be clarified under all relevant sectors/categories, to avoid double counting or omissions.

The worksheets developed for the estimation of the greenhouse gas emissions from biological treatment are included at the end of this Volume. These worksheets include information on activity data and emission factors used to calculate the estimates.

## References

Arnold, M. (2005). Espoo: VTT Processes: Unpublished material from measurements from biowaste composts. (Personal communication).

Beck-Friis, B.G. (2001). *Emissions of ammonia, nitrous oxide and methane during composting of organic household waste*. Uppsala: Swedish University of Agricultural Sciences. 331 p. (Doctoral Thesis).

Binner, E. (2002). *The impact of Mechanical-Biological Pretreatment on the Landfill Behaviour of Solid Wastes.* Workshop Biowaste. Brussels, 8-10.04.2002. 16 p.

Detzel, A., Vogt, R., Fehrenbach, H., Knappe, F. and Gromke, U. (2003). *Anpassung der deutschen Methodik zur rechnerischen Emissionsermittlung und internationale Richtlinien: Teilbericht Abfall/Abwasser*. IFEU Institut - Öko-Institut e.V. 77 p.

Hellebrand, H.J. (1998). 'Emissions of nitrous oxide and other trace gases during composting of grass and green waste', *J. agric*, Engng Res., 69:365-375.

Hogg, D., Favoino, E., Nielsen, N.,Thompson, J., Wood, K., Penschke, A., Economides, D. and Papageorgiou, S., (2002). *Economic analysis of options for managing biodegradable municipal waste*, Final Report to the European Commission, Eunomia Research & Consulting, Bristol, UK.

Kaartinen, T. (2004). *Sustainable disposal of residual fractions of MSW to future landfills*. Espoo: Technical University of Helsinki. (Master of Science Thesis). In Finnish.

Petersen, S.O., Lind, A.M. and sommer, S.G. (1998). 'Nitrogen and organic matter losses during storage of cattle and pig manure', *J. Agric. Sci.*, 130: 69-79.

Vesterinen, R. (1996): *Impact of waste management alternatives on greenhouse gas emissions: Greenhouse gas emissions from composting*. Jyväskylä: VTT Energy. Research report ENE38/T0018/96. (In Finnish). 30p.

# GUAM ENVIRONMENTAL PROTECTION AGENCY

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LT. GOVERNOR OF GUAM




**Testimony of**
**Conchita San Nicolas Taitano**
***Acting* Administrator, Guam Environmental Protection Agency**
**Before the Committee on Utilities, Transportation, Public Works, and Veterans**

**Hearing on Bill No. 310-30 (COR): AN ACT TO ADD A NEW §51120 TO CHAPTER 54 OF 10 GCA RELATIVE TO AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM OF THE LAYON LANDFILL.**

**February 10, 2010**

The Guam Environmental Protection Agency (Guam EPA) values this opportunity to present its support of 310-30 (COR), authorizing the creation of a Feasibility Plan for the installation of a commercial methane recovery system for the Layon Municipal Solid Waste Landfill.

Background

Landfill gas (LFG) is a natural byproduct of the decomposition of organic material in municipal solid waste (MSW) in anaerobic conditions. LFG contains roughly 50 percent methane and 49.99 percent carbon dioxide, with less than 1 percent non-methane organic compounds and trace amounts of inorganic compounds. When waste is first deposited in a landfill, it undergoes an aerobic (i.e., with oxygen) decomposition stage during which little methane is generated. Then, typically with less than a year, anaerobic (i.e., without oxygen) conditions are established and methane-producing bacteria decompose the waste and produce methane and carbon dioxide.

Methane is a potent greenhouse gas – over 20 times more potent than carbon dioxide. Landfills are the second largest human-caused source of methane in the United States, accounting for nearly 23 percent of U.S. methane emissions in 2006.

Status of Landfill Gas (LFG) Management at the Layon Municipal Solid Waste Landfill

On November 23, 2009, aside from the Solid Waste Management Permit, Guam EPA also issued an Air Permit for the operation of the Layon Municipal Solid Waste Landfill located at the Municipality of Inarajan. This permit requires the *Permittee* to operate a landfill gas collection system that meets Guam's air emissions regulations/requirement, inclusive of designing a landfill gas collection system to achieve a capture efficiency of 90% of all landfill gas generated at the site. Although the current permit allows the routing of collected gas to an open flare, Guam EPA is supportive of any amendments to the permit that would promote resource recovery and pollution prevention.

Status of Landfill Gas (LFG) Management at the Ordot Dump

Although the proposed Bill addresses the Layon Municipal Solid Waste Landfill, Guam EPA also supports the inclusion of the Ordot Dump for resource recovery opportunities. There are no existing fixed monitoring or control devices at the Ordot Dump. Therefore, any methane gas generated is vented to the atmosphere. Landfill gas monitoring probes, barriers to prevent lateral migration, and active collection and flare system are to be installed at closure of the Dump.

Potential for Beneficial Use of Gas

In 2005, URS used available data to estimate the LFG yield using and established model. The model assumed that LFG generation would peak at closure, then decay in relation to the remaining organic waste fraction in the dump. The conclusion of the model was that the higher temperature and high rainfall are likely to result in very rapid reduction of gas generation after closure. Gas generation which could support a gas-to-energy system was predicted to extend only over a period of approximately 5 years following closure. This was

seen as not long enough to recoup the initial capital investment. However, the conclusions also state that low permeability capping and good diversion of stormwater may reduce the degradation rates of organics in the refuse, which would extend the period over which as gas-to-energy system could be used.

In February 2009, the USEPA Landfill Methane Outreach Program (LMOP) generated an LFG generation recovery curve for the Ordot Dump. Similar to the 2005 modeling results, the 2009 result show a prediction for the peak methane generation at 75 percent collection efficiency of approximately 325 million cubic feet (mcf) per year. However, the LMOP modeling predicts a more gradual decay of methane production following landfill closure. When translated to a 2010 closure, the URS modeling predicts only 25 mcf/year remaining in 2020, while the LMOP predicts 130 mcf/year.

The 2009 prediction for extended duration of gas production indicates that a landfill gas-to-energy program may be more viable than previously thought. To maximize beneficial use of the gas production at Ordot, a gas collection system should be installed as soon as practicable, as gas production is expected to decrease quickly following landfill closure.

Guam EPA would like to assist in developing a LMOP to help protect the environment and build a sustainable future by promoting the recovery and beneficial use of landfill gas (LFG). By finding ways to use this gas, LMOP helps prevent global warming and air pollution, encourages development of a renewable energy source, and promotes local economic development.

Summary and Conclusions

In conclusion, more than 325 LFG energy projects are operational in the United States. Together these projects have achieved significant reductions in the emission of methane, a potent heat trapping gas. They also have prevented emissions of carbon dioxide and harmful air pollutants such as sulfur dioxide, since using LFG for energy offsets the need to use nonrenewable resources such as coal and oil.

In 2001, operational LFG energy projects in the United States prevented the release of approximately 14 million metric tons of carbon equivalent. Emissions reductions achieved from these projects provided the same climate benefits as eliminating the emissions of 12 million cars for one year; offsetting 132 million barrels of oil; or producing enough energy to power 1 million homes for one year.

In closing, Guam EPA recommends that the Bill consider including other existing facilities on Guam, such as the Ordot Dump, and the Andersen Air Force Base and Navy municipal solid waste land disposal units. In addition, Guam EPA recommends that the legislature consider placing this amendment under 10 GCA Chapter 51 (Solid Waste Management and Litter Control Act) instead of 10 GCA Chapter 54 (Environmental Pollution Control Act) for consistency purposes. Furthermore, Guam EPA requests that this Bill provide the flexibility and resources needed during the transition period when Guam looks to new, innovative ways to meet all the goals and legal intent of this proposed legislation.

Guam EPA recognizes and appreciates the visionary leadership of its oversight Chairman, Senator Rory Respicio; the Chairman of this Committee, Senator Tom Ada; the primary author of this Bill, Senator Telo Taitague; and the honorable members of this Committee. We thank you again for the opportunity to comment on this proposed legislation. Dångkolo na Si Yu'us Ma'åse'.

CONCHITA SN TAITANO
Acting Administrator

# Summary of Findings: Landfill Gas Management and Potential for Reuse at Ordot

TO: Karen Ueno/EPA

COPIES: Janet Goodrich/CH2M HILL
Shannon Wright/CH2M HILL
Project file

FROM: Cory Hinds

DATE: May 20, 2009

PROJECT NUMBER: 388524

## Status of Current LFG Management

There are no existing fixed monitoring or control devices at the Ordot Landfill. Landfill gas is currently venting to the atmosphere. Surface airborne gas testing is conducted monthly using hand-held monitoring instruments. No monitoring of subsurface landfill gas migration is being conducted. Landfill gas monitoring probes, barriers to prevent lateral migration, and an active collection and flare system are to be installed at closure per the July 2005 Ordot continued use application[1].

## Regulatory Control

The Clean Air Act 1990, Title V requires all major sources and some minor sources of air pollution to obtain an operating permit. The Title V operating permit for landfills is based on size and emissions. There are two triggers: 1) 100 tons per year (tpy) of criteria pollutants (CO, NOx, and VOCs), or 2) 25 tpy of hazardous air pollutants (e.g. benzene). Since Ordot does not yet have an active gas collection system, they likely do not exceed either of these triggers. On this basis, a Title V Operating Permit may not be needed at this time. With the installation of a flare, or if an LFG-to-energy system is installed, this permit may be required.

## Potential for Beneficial Use of Gas

In 2005 URS used available data to estimate LFG yield using an established model[2]. The model assumed that LFG generation would peak at closure, then decay in relation to the remaining organic waste fraction in the landfill. The conclusion of the model was that the higher tropical temperatures and high rainfall are likely to result in very rapid reduction of gas generation after closure. Gas generation which could support a gas-to-energy system was predicted to extend only over a period of approximately 5 years following closure. This

[1] Solid Waste Management Facility Application for Authorization of Continued Use, Ordot, Final. Duenas & Associates Project Team, July 2005.

[2] Estimation of Potential Landfill Gas Yields, Ordot Dump, included as Volume II, Attachment 1 of Environmental Baseline Study, Ordot Dump, Final. Duenas & Associates Project Team, July 2005.

was seen as not long enough to recoup the initial capital investment. However, the conclusions also state that low permeability capping and good diversion of storm water may reduce the degradation rates of organics in the refuse, which would extend the period over which as gas-to-energy system could be used.

In February 2009, the EPA Landfill Methane Outreach Program (LMOP) generated an LFG generation and recovery curve for Ordot. Similar to the 2005 modelling results, the 2009 results show a prediction for the peak methane generation at 75% collection efficiency of approximately 325 million cubic feet (mcf)/year. However, the LMOP modeling predicts a more gradual decay of methane production following landfill closure. When translated to a 2010 closure, the URS modeling predicts only 25 mcf/year remaining in 2020, while the LMOP predicts 130 mcf/yr.

The 2009 prediction for extended duration of gas production indicates that a landfill gas-to-energy program may be more viable than previously thought. To maximize beneficial use of the gas production at Ordot, a gas collection system should be installed as soon as practicable, as gas production is expected to decrease quickly following landfill closure.

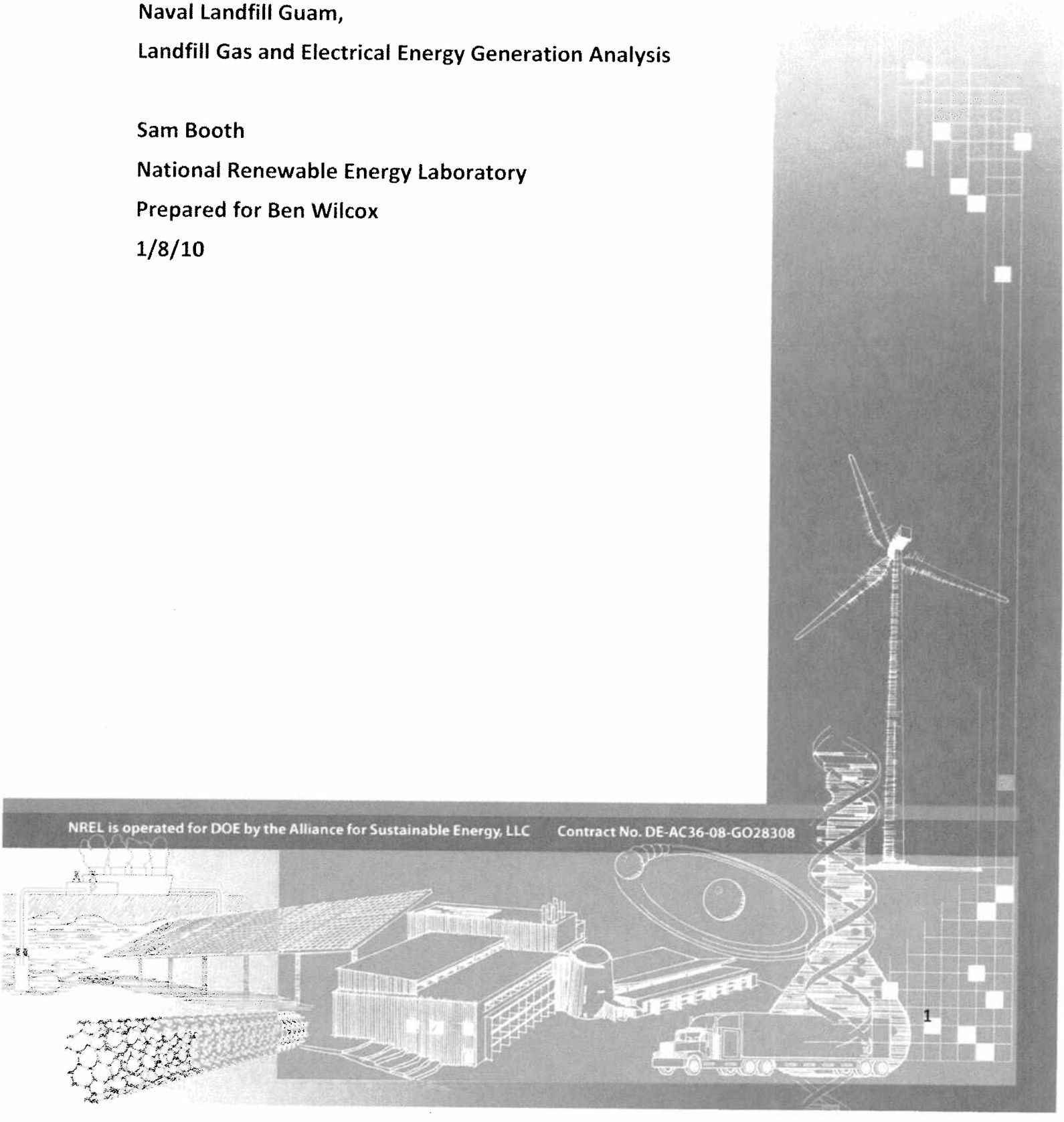
National Renewable Energy Laboratory

# Naval Landfill Guam,
# Landfill Gas and Electrical Energy Generation Analysis

Sam Booth
National Renewable Energy Laboratory

Prepared for Ben Wilcox

1/8/10



NREL is operated for DOE by the Alliance for Sustainable Energy, LLC Contract No. DE-AC36-08-GO28308

## Executive Summary

NREL analyzed the potential for a landfill gas collection system on Guam to produce electrical energy. The Navy asked NREL to analyze three potential scenarios for waste disposal: 1) 12,914 tons per year; 2) 25,493 tons per year; and, 3) a ramp up of disposal rates ending at 45,643 tons per year. At a landfilling rate of 12,914 tons per year a project does not appear to be financially viable. At a rate of 25,493 tons per year a project appears to be marginally financially viable. Using a ramp up of landfill rates to a value of 45,643 tons per year a landfill gas to energy project appears to be financially viable with a positive net present value in most scenarios.

## Introduction

NREL analyzed the potential for a landfill gas collection system on Guam to produce electrical energy. The Navy asked NREL to analyze three potential scenarios for waste : 1) 12,914 tons per year; 2) 25,493 tons per year; and, 3) a ramp up of disposal rates ending at 45,643 tons per year.. These three scenarios were utilized because the future amount of waste to be disposed of at the landfill remains unclear and is dependent on the troop levels at Guam. In beginning the analysis, several assumptions were made

1. The landfill gas collection project would begin operation in 2013.
2. The desired project analysis lifetime was 20 years.
3. The landfill will be open and able to operate until at least 2033.
4. The waste already in place at the landfill was disposed of according to the estimates in the Landfill Management Plan provided to NREL. The estimated previous disposal rates are show in the table below.

| Timeframe | Waste Disposed Per Year (tons) |
|---|---|
| 1965-1988 | 3,443 |
| 1989-1994 | 5,983 |
| 1996-2006 | 7,665 |
| 2007 | 12,915 |

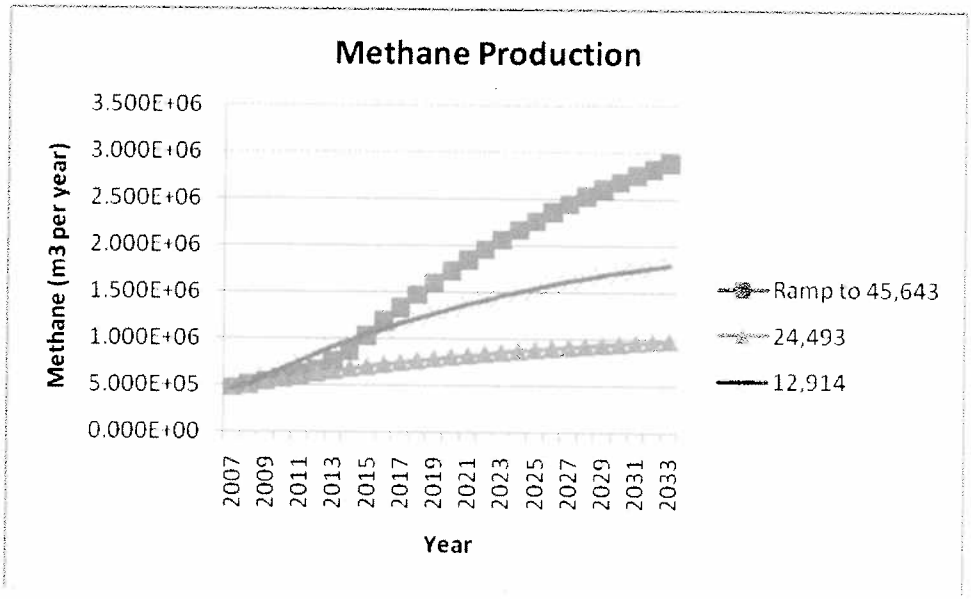
## Landfill Gas Methane Production Modeling

The EPA's Land Gas Emission Model, version 3.02 was utilized to estimate the potential methane production from the landfill. Methane production is estimated in the model by utilizing a first order rate decay equation. Common parameters were utilized in the model for each of the three scenarios. The common parameters are shown in the table below. The rate decay equation and information on the source of the model parameters can be found in Appendix A.

| Model Parameters | Value | Source |
|---|---|---|
| Methane Generation Rate, k (year-1) | 0.05 | CAA Conventional |
| Potential Methane Generation Capacity, Lo (m3/Mg) | 100 | Inventory Conventional |
| Methane Content (% by volume) | 50 | CAA Conventional |

The rate equation is particularly sensitive to the value used for the methane generation rate, k. This term represents how fast the waste would decay and is a function of parameters such as temperature and moisture. Lo represents the methane content of the waste in the landfill. This is an unknown factor and the energy production potential is depended on the organic content of the waste. Should the Navy decide to further pursue a landfill gas energy project, these parameters should be investigated further to determine site specific values for the landfill on Guam.

The annual methane production for the three scenarios is shown in the chart below.




The results from the LandGem model were used to conduct a financial analysis of the three scenarios.

**Financial Model**

A financial analysis was conducted of the three possible scenarios to determine project feasibility. A common set of assumptions were used for each scenario based on input received from the Navy and from the EPA Landfill Gas Project Development Handbook.[1] These assumptions are shown below.

1. Power price in Guam is $0.286 per kWh in 2013. This was found by taking the current rate of $0.262 in 2010 and multiplying by the energy cost escalation rate given by the Navy of 3% annually.
2. The Navy cost adjustment rate in Guam is 2.64. All capital costs will be multiplied by this factor.
3. Energy cost escalation rate will be 3% per year.
4. Labor inflation rate will be 2% per year.
5. A discount rate of 5% will be used.
6. Project will be analyzed over a 20 year financial lifetime.
7. No additional tipping fee will be added to improve financial viability.

[1] http://www.epa.gov/lmop/res/handbook.htm

8. It is assumed that the landfill has adopted management practices that will allow it to operate until at least 2033.
9. There is no use for the thermal energy generated during the landfill gas combustion.
10. The landfill at Guam is 60 acres in size. A coverage ratio of 90% will be used. Thus the size of the landfill gas generation project will be 54 acres.
11. A landfill gas collection efficiency of 75% was used.
12. The Navy would like to oversize the engine to average approximately 80% of its rated capacity.
13. Gas collection system costs are $24,000 per acre. With a project size of 54 acres the total costs will be $1,296,000.[2] This value is multiplied by the Navy factor for construction on Guam of 2.64 for a total of $3,421,440.
14. Collection system O&M is $4,100 per acre annually for a total cost of $221,400 per year. This value is multiplied by the Navy factor for construction on Guam of 2.64 for a total cost of $584,496 and projected to increase by the rate of inflation each year.
15. The capital costs for the engine are $2,300 per kw.[3] This value is multiplied by the Navy factor for construction on Guam of 2.64 to calculate total costs.
16. Engine O&M is $210 per kw annually. This value is multiplied by the Navy factor for construction on Guam of 2.64 to calculate total costs and projected to increase by the rate of inflation.
17. The engine electrical energy conversion efficiency is 33%.
18. The methane produced in the LandGem model that was given in terms of volume per year was at standard temperature (60 deg F) and pressure (14.7 psi).
19. There are 1,000 BTU per standard cubic foot of methane.

**Scenario 1: 12,914 Tons per Year**

At this collection rate a landfill gas to energy project does not appear financially viable. The net present value from this scenario is negative $4.3 M. The estimated project capital and O&M costs are shown below.

| **Capital Costs** | |
|---|---|
| Gas Collection System | $ 3,421,440 |
| Engine | $ 2,428,800 |
| | |
| **O&M** | |
| Gas Collection | $ 584,496 |
| Engine | $ 221,760 |

Engine size has a large impact on the financial viability of a project due to the large capital costs for the engine. The engine size for this scenario is 400 kw. The engine would have an average capacity utilization of 83% over the lifetime of this project. A summary of the financial analysis is shown below.

[2] EPA Landfill Gas Project Development Handbook. Average for a medium sized project.
[3] EPA Landfill Gas Project Development Handbook. Small Internal Combustion Engine of less than 1 MW.

| Year | Disposal Rate (tons per year) | Methane Captured (m^3 per year) | Potential kWh | O&M | Electrical Generation Revenue | Cashflow |
|---|---|---|---|---|---|---|
| 2013 | 12,915 | 444,733 | 2,250,083 | $ (806,256) | $ 643,524 | $ (6,012,972) |
| 2014 | 12,915 | 461,791 | 2,336,386 | $ (822,381) | $ 688,253 | $ (134,128) |
| 2015 | 12,915 | 478,017 | 2,418,481 | $ (838,829) | $ 733,809 | $ (105,020) |
| 2016 | 12,915 | 493,452 | 2,496,571 | $ (855,605) | $ 780,228 | $ (75,377) |
| 2017 | 12,915 | 508,134 | 2,570,853 | $ (872,717) | $ 827,546 | $ (45,171) |
| 2018 | 12,915 | 522,100 | 2,641,513 | $ (890,172) | $ 875,800 | $ (14,372) |
| 2019 | 12,915 | 535,385 | 2,708,726 | $ (907,975) | $ 925,027 | $ 17,052 |
| 2020 | 12,915 | 548,022 | 2,772,661 | $ (926,135) | $ 975,267 | $ 49,132 |
| 2021 | 12,915 | 560,042 | 2,833,478 | $ (944,657) | $ 1,026,558 | $ 81,901 |
| 2022 | 12,915 | 571,477 | 2,891,329 | $ (963,551) | $ 1,078,943 | $ 115,393 |
| 2023 | 12,915 | 582,354 | 2,946,358 | $ (982,822) | $ 1,132,463 | $ 149,641 |
| 2024 | 12,915 | 592,700 | 2,998,704 | $(1,002,478) | $ 1,187,160 | $ 184,682 |
| 2025 | 12,915 | 602,541 | 3,048,497 | $(1,022,528) | $ 1,243,078 | $ 220,551 |
| 2026 | 12,915 | 611,903 | 3,095,861 | $(1,042,978) | $ 1,300,264 | $ 257,286 |
| 2027 | 12,915 | 620,808 | 3,140,916 | $(1,063,838) | $ 1,358,762 | $ 294,924 |
| 2028 | 12,915 | 629,279 | 3,183,773 | $(1,085,114) | $ 1,418,621 | $ 333,507 |
| 2029 | 12,915 | 637,337 | 3,224,539 | $(1,106,817) | $ 1,479,890 | $ 373,073 |
| 2030 | 12,915 | 645,001 | 3,263,318 | $(1,128,953) | $ 1,542,618 | $ 413,664 |
| 2031 | 12,915 | 652,292 | 3,300,205 | $(1,151,532) | $ 1,606,856 | $ 455,324 |
| 2032 | 12,915 | 659,227 | 3,335,294 | $(1,174,563) | $ 1,672,659 | $ 498,096 |
| 2033 | 12,915 | 665,824 | 3,368,671 | $(1,198,054) | $ 1,740,080 | $ 542,026 |
| NPV | ($4,249,128) | | | | | |

**Scenario 2: 25,493 Tons per Year**

At this collection rate a landfill gas to energy project appears to be marginally financially viable. The net present value from this scenario is positive $0.57 M. The estimated project capital and O&M costs are shown below.

| **Capital Costs** | |
|---|---|
| Gas Collection System | $ 3,421,440 |
| Engine | $ 4,250,400 |
| | |
| **O&M** | |
| Gas Collection | $ 584,496 |
| Engine | $ 388,080 |

The engine size for this scenario is 700 kw. The engine would have an average capacity utilization of 80% over the lifetime of this project. Optimizing the engine to maximize net present value in this scenario

can increase the financial viability of the project. In this scenario the engine would be undersized for the amount of gas produced in 2025 and beyond. An engine size of 600 kw operated at a maximum capacity factor of 97% would yield an NPV of $0.84 M. A summary of data from this scenario with a 700 kw engine is shown below.

| Year | Disposal Rate (tons per year) | Methane Captured (m^3 per year) | Potential kWh | O&M | Electrical Generation Revenue | Cashflow |
|---|---|---|---|---|---|---|
| 2013 | 25,497 | 615,944 | 3,116,304 | $ (972,576) | $ 891,263 | $ (7,753,153) |
| 2014 | 25,497 | 662,400 | 3,351,347 | $ (992,028) | $ 987,240 | $ (4,788) |
| 2015 | 25,497 | 706,592 | 3,574,928 | $ (1,011,868) | $ 1,084,695 | $ 72,827 |
| 2016 | 25,497 | 748,628 | 3,787,605 | $ (1,032,105) | $ 1,183,702 | $ 151,596 |
| 2017 | 25,497 | 788,613 | 3,989,909 | $ (1,052,748) | $ 1,284,334 | $ 231,586 |
| 2018 | 25,497 | 826,649 | 4,182,346 | $ (1,073,802) | $ 1,386,667 | $ 312,864 |
| 2019 | 25,497 | 862,830 | 4,365,399 | $ (1,095,279) | $ 1,490,779 | $ 395,501 |
| 2020 | 25,497 | 897,246 | 4,539,524 | $ (1,117,184) | $ 1,596,750 | $ 479,566 |
| 2021 | 25,497 | 929,983 | 4,705,156 | $ (1,139,528) | $ 1,704,660 | $ 565,133 |
| 2022 | 25,497 | 961,124 | 4,862,711 | $ (1,162,318) | $ 1,814,594 | $ 652,276 |
| 2023 | 25,497 | 990,747 | 5,012,582 | $ (1,185,565) | $ 1,926,636 | $ 741,072 |
| 2024 | 25,497 | 1,018,924 | 5,155,143 | $ (1,209,276) | $ 2,040,874 | $ 831,598 |
| 2025 | 25,497 | 1,045,727 | 5,290,752 | $ (1,233,462) | $ 2,157,397 | $ 923,936 |
| 2026 | 25,497 | 1,071,224 | 5,419,746 | $ (1,258,131) | $ 2,276,297 | $ 1,018,166 |
| 2027 | 25,497 | 1,095,476 | 5,542,450 | $ (1,283,293) | $ 2,397,668 | $ 1,114,374 |
| 2028 | 25,497 | 1,118,546 | 5,659,169 | $ (1,308,959) | $ 2,521,605 | $ 1,212,646 |
| 2029 | 25,497 | 1,140,491 | 5,770,196 | $ (1,335,138) | $ 2,648,209 | $ 1,313,070 |
| 2030 | 25,497 | 1,161,365 | 5,875,808 | $ (1,361,841) | $ 2,777,579 | $ 1,415,738 |
| 2031 | 25,497 | 1,181,221 | 5,976,270 | $ (1,389,078) | $ 2,909,821 | $ 1,520,743 |
| 2032 | 25,497 | 1,200,109 | 6,071,831 | $ (1,416,860) | $ 3,045,040 | $ 1,628,180 |
| 2033 | 25,497 | 1,218,076 | 6,162,732 | $ (1,445,197) | $ 3,167,471 | $ 1,722,274 |
| NPV | $571,592 | | | | | |

**Scenario 3: Ramp Up to 45,643 Tons per Year**

At this collection rate a landfill gas to energy project appears financially viable. The net present value of the project is positive under most conditions. The ramp up in waste disposal utilized is shown below.

| Timeframe | Tons Per Year |
|---|---|
| 2008 | 12,915 |
| 2009 | 14,682 |
| 2010-2011 | 16,810 |

| | |
|---|---|
| 2012 | 26,385 |
| 2013 | 35,958 |
| 2014-2033 | 45,643 |

The estimated project capital and O&M costs are shown below.

| **Capital Costs** | |
|---|---|
| Gas Collection System | $ 3,421,440 |
| Engine | $ 6,072,000 |
| | |
| **O&M** | |
| Gas Collection | $ 584,496 |
| Engine | $ 554,400 |

Using the Navy's desired engine sizing of approximately 80% capacity, the engine size for this scenario would be 1,000 kw for a 77% average capacity utilization. However under this scenario the engine would be undersized for the annual amount of methane produced in each year after 2029. In these years not all of the methane produced could be utilized in the 1,000 kw engine and some would need to be flared. For this scenario electrical generation was capped at 100% capacity utilization for the engine. In this scenario the net present value of the project is positive $3.8 M. Reducing engine electrical generation capacity to a 97% factor to account for downtime reduces the project net present value to $3.6 M. However if the engine size is adjusted to never be undersized then a 1,200 kw engine is required and the net present value is $1.6 M. A summary of data from the scenario with a 1000 kw engine operating at a maximum of a 97% capacity factor is shown below.

| Year | Disposal Rate (tons per year) | Methane Captured (m^3 per year) | Potential kWh | O&M | Electrical Generation Revenue | Cashflow |
|---|---|---|---|---|---|---|
| 2013 | 35,958 | 757,628 | 2,587,372 | $ (1,138,896) | $ 740,750 | $ (9,891,586) |
| 2014 | 45,643 | 880,504 | 3,007,003 | $ (1,161,674) | $ 886,715 | $ (274,959) |
| 2015 | 45,643 | 1,040,434 | 3,553,181 | $ (1,184,907) | $ 1,079,207 | $ (105,700) |
| 2016 | 45,643 | 1,192,565 | 4,072,721 | $ (1,208,606) | $ 1,274,117 | $ 65,511 |
| 2017 | 45,643 | 1,337,276 | 4,566,923 | $ (1,232,778) | $ 1,471,586 | $ 238,808 |
| 2018 | 45,643 | 1,474,930 | 5,037,023 | $ (1,257,433) | $ 1,671,756 | $ 414,323 |
| 2019 | 45,643 | 1,605,870 | 5,484,195 | $ (1,282,582) | $ 1,874,775 | $ 592,193 |
| 2020 | 45,643 | 1,730,424 | 5,909,559 | $ (1,308,234) | $ 2,080,792 | $ 772,558 |
| 2021 | 45,643 | 1,848,903 | 6,314,177 | $ (1,334,398) | $ 2,289,958 | $ 955,560 |
| 2022 | 45,643 | 1,961,604 | 6,699,062 | $ (1,361,086) | $ 2,502,430 | $ 1,141,344 |
| 2023 | 45,643 | 2,068,809 | 7,065,176 | $ (1,388,308) | $ 2,718,368 | $ 1,330,060 |
| 2024 | 45,643 | 2,170,785 | 7,413,434 | $ (1,416,074) | $ 2,937,933 | $ 1,521,859 |
| 2025 | 45,643 | 2,267,788 | 7,744,708 | $ (1,444,396) | $ 3,161,293 | $ 1,716,897 |
| 2026 | 45,643 | 2,360,060 | 8,059,825 | $ (1,473,283) | $ 3,388,617 | $ 1,915,334 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2027 | 45,643 | 2,447,831 | 8,359,574 | $ (1,502,749) | $ 3,620,081 | $ 2,117,331 |
| 2028 | 45,643 | 2,531,322 | 8,644,703 | $ (1,532,804) | $ 3,855,862 | $ 2,323,057 |
| 2029 | 45,643 | 2,610,742 | 8,497,200 | $ (1,563,460) | $ 3,903,772 | $ 2,340,311 |
| 2030 | 45,643 | 2,686,287 | 8,497,200 | $ (1,594,729) | $ 4,020,885 | $ 2,426,155 |
| 2031 | 45,643 | 2,758,149 | 8,497,200 | $ (1,626,624) | $ 4,141,511 | $ 2,514,887 |
| 2032 | 45,643 | 2,826,505 | 8,497,200 | $ (1,659,156) | $ 4,265,757 | $ 2,606,600 |
| 2033 | 45,643 | 2,891,528 | 8,497,200 | $ (1,692,340) | $ 4,393,729 | $ 2,701,390 |
| NPV | $3,611,446 | | | | | |

The NPV of a landfill gas to energy project is sensitive to the energy inflation rate for electrical energy on Guam. This rate was given as 3% by the Naval personnel on Guam. The electrical energy rate on Guam is highly dependent on the price of oil which has been very volatile in the last few years. A sensitivity analysis of several electrical energy escalation rates for the ramp up scenario with a 1000 kw engine operated at a maximum capacity of 97% was performed. The range of NPV values for different rates can be seen in the table below. These energy escalation rates are based on the current price of $0.262 per kWh in 2010 and a project start date in 2013.

| Energy Inflation Rate | NPV ($ M) |
|---|---|
| 0% | $ (6.3) |
| 1% | $ (3.5) |
| 2% | $ (0.2) |
| 3% | $ 3.6 |
| 4% | $ 8.0 |
| 5% | $ 13.2 |
| 6% | $ 19.2 |

An additional sensitivity analysis was conducted based on the discount rate used for analysis in this project. The rate used for this project was 5%. The sensitivity analysis below shows the change in NPV based on discount rates from 0%-10%.

| Discount Rate | NPV ($ M) |
|---|---|
| 0% | $ 17.4 |
| 1% | $ 13.6 |
| 2% | $ 10.4 |
| 3% | $ 7.8 |
| 4% | $ 5.5 |
| 5% | $ 3.6 |
| 6% | $ 2.0 |
| 7% | $ 0.6 |
| 8% | $ (0.5) |
| 9% | $ (1.5) |
| 10% | $ (2.3) |

**Conclusion**

Three scenarios for the generation of electricity at the landfill in Guam were analyzed. At a landfilling rate of 12,914 tons per year a project does not appear to be financially viable. At a rate of 25,493 tons per year, a project appears marginally financially viable. Using a ramp up of landfill rates to a value of 45,643 tons per year, a landfill gas to energy project appears to be financially viable. If the Navy remains interested in a landfill gas to energy project on Guam further analysis should be conducted to more accurately determine the rate of waste disposal and site specific coefficients for modeling. Using these values a more detailed financial analysis should be conducted.

**Appendix A: LandGEM Information**[4]

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10}\right) e^{-kt_{ij}}$$

QCH4 = annual methane generation in the year of the calculation (m3/year)
i = 1 year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1 year time increment
*k* = methane generation rate (year-1)
*Lo* = potential methane generation capacity (m3/Mg)
Mi = mass of waste accepted in the ith year (Mg)
tij = age of the jth section of waste mass Mi accepted in the ith year (decimal years, e.g., 3.2 years)

**CAA Defaults**—The CAA defaults are based on requirements for MSW landfills laid out by the Clean Air Act (CAA), including the NSPS/EG and NESHAP. This set of default parameters yields conservative emission estimates and can be used for determining whether a landfill is subject to the control requirements of the NSPS/EG or NESHAP.

**Inventory Defaults**—With the exception of wet landfill defaults, the inventory defaults are based on emission factors in the U.S. Environmental Protection Agency's (EPA's) *Compilation of Air Pollutant Emission Factors* (*AP-42*). This set of defaults yields average emissions and can be used to generate emission estimates for use in emission inventories and air permits in the absence of site-specific test data.

[4] EPA LandGEM Users Guide. http://www.epa.gov/ttncatc1/dir1/landgem-v302-guide.pdf

LANDFILL METHANE OUTREACH PROGRAM

# Memo

**Date:** February 23, 2009

**To:** Chris Lund, GBB, Inc.

**From:** Tom Frankiewicz, U.S. EPA Landfill Methane Outreach Program

**Subject:** **REVISED** - Summary of Landfill Gas Energy Potential for the Ordot Dump

## INTRODUCTION

The U.S. EPA Landfill Methane Outreach Program (LMOP) is working with Mr. Chris Lund of GBB, Inc. in determining the feasibility of establishing a landfill gas to energy project at the Ordot Dump in Guam. Using specific landfill site data provided by Mr. Lund LMOP produced a desktop summary of the potential for this site. This revised memo provides an updated landfill gas generation and recovery curve based on closer examination of the model that was originally developed.

Working face of the Ordot Dump in Guam

adjustments were made. The LandGEM model assumes a waste composition of 20% construction and demolition (C&D) waste. However, 25% of the waste accepted by the Ordot Dump is C&D waste. To adjust for this difference in composition, LMOP discounted the methane generation potential (Lo) by 25%. In addition, because this site is characterized as a dumpsite, an additional 20% discount was added to Lo as a methane correction factor to account for the aerobic decay of waste at the site. Finally, because Guam is located in a very wet climate the methane generation rate constant (k) was adjusted to 0.100 1/year.

It should be noted that actual Lo and k values for individual landfills vary widely depending on several site-specific characteristics. Although the model parameters were tailored to this specific site, the results and projections cannot be guaranteed. Therefore, LFG production estimates determined using the values outlined above should be viewed as a preliminary guideline. The actual amount of LFG generated from the landfill could differ significantly from the estimates provided in this report.

## LFG GENERATION AND RECOVERY MODEL RESULTS

Given these adjustments to the LandGEM model, projected LFG generation and recovery for the Ordot Dump is shown in Figure 1. LFG recovery for 2011 is estimated at 635 standard cubic feet per minute (scfm).

# COMMITTEE ON RULES
*I Mina'Trenta na Liheslaturan Guåhan* • 30th Guam Legislature
155 Hesler Place, Hagatña, Guam 96910 • tel: (671)472-7679 • fax: (671)472-3547 • roryforguam@gmail.com




January 7, 2010

MEMORANDUM

**To:** **Pat Santos**
*Clerk of the Legislature*

**Attorney Therese M. Terlaje**
*Legislative Legal Counsel*

**From:** **Senator Rory J. Respicio**
*Chairperson, Committee on Rules*

**Subject:** **Referral of Bill Nos. 309-30 (COR) through 311-30 (COR)**

As Chairperson of the Committee on Rules, I am forwarding my referral of Bill Nos. 309-30 (COR) through 311-30 (COR).

Please ensure that the subject bills are referred, in my name, to the respective committees, as shown on the attachment. I also request that the same be forwarded to all Senators of *I Mina' Trenta Na Liheslaturan Guåhan*.

Should you have any questions, please contact Stephanie Mendiola or Elaine Tajalle at 472-7679.

*Si Yu'os Ma'åse'!*

*(1) Attachment*

Clerk of the Legislature
ACKNOWLEDGEMENT RECEIPT
Received by: [illegible]
Time: 9:05 am
Date: 1-11-10

*I Mina'Trenta Na Liheslaturan Guåhan*

# Bill Log Sheet



| Bill No. | Sponsor(s) | Title | Date Introduced | Date Referred | Committee Referred | Public Hearing Date | Date Committee Report Filed | Status (Date) |
|---|---|---|---|---|---|---|---|---|
| B309-30 (COR) | E.J.B.Calvo Ray Tenorio, Telo Taitague | An act to add a new Chapter 91 entitled "Child's Right to Live Act" to Title 9 of the Guam Code Annotated relative to the protection of infants born alive as a result of an abortion. | 1/6/09 1:25 p.m. | 1/7/10 | Committee on Economic Development, Health and Human Services, and Judiciary | | | |
| B310-30 (COR) | Telo Taitague, T. C. Ada, R. J. Respicio | An act to add a new §51120 to Chapter 54 of 10 GCA relative to authorization to create a feasibility plan for the installation of a commercial methane recovery system of the Leyon Landfill | 1/6/09 2:39 p.m. | 1/7/10 | Committee on Utilities, Transportation, Public Works, and Veterans Affairs | | | |

# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affairs
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 2, 2010

MEMORANDUM

To: All Stakeholders

From: Senator Thomas C. Ada, Chairperson, Committee on Utilities, Transportation, Public Works and Veterans Affairs

Subject: **Public Hearing Notice: February 10, 2010 at 9:00 am**

Please be advised that the Committee on Utilities, Transportation, Public Works and Veterans Affairs is holding a public hearing on February 10, 2010 at 9:00 am. This meeting will take place in the Public Hearing Room of *I Liheslatura.*

The agenda is as follows:

9:00 am – 12:00 pm

**Bill No. 310-30 (COR)**
An act to add a new §51120 to Chapter 54 of 10GCA relative to authorization to create a Feasibility Plan for the installation of a commercial methane recovery system of the Leyon Landfill.

**Bill No. 320-30 (COR)**
An act to amend §8501, §8502(2)(c) and §8312 of Chapter 8, 12 Guam Code Annotated relative to net metering.

1:00 pm – 3:00 pm

**Status Report: Department of Public Works**
Bridges slated for repair/upgrade in the next 24 months

3:00 pm – 5:00 pm

**Status Report: Department of Public Works**
Roads slated for repair/upgrade in the next 24 months

Testimonies should be addressed to Senator Thomas C. Ada, Chairperson, and will be accepted via hand delivery to our office or our mailbox at the Main Legislature Building at 155 Hesler Place, Hagatña, Guam 96932, via email to office@senatorada.org, or via facsimile to (671) 473-3303 until February 20, 2010, 5pm. Individuals requiring special accommodations, auxiliary aids, or services should submit their request to our office. Copies of Bill No. 310-30 and Bill No. 320-30 may be found on the official Guam Legislature website (www.guamlegislature.com). Please feel free to contact our office should you have any questions or concerns.

Senseramente,

Thomas C. Ada


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affair
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 2, 2010

MEMORANDUM

To: All Senators

From: Senator Thomas C. Ada, Chairperson, Committee on Utilities, Transportation, Public Works and Veterans Affairs

Subject: **Public Hearing Notice: February 10, 2010 at 9:00 am**

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Senseramente,

Thomas C. Ada

cc: Clerk of the Legislature
Sergeant-at-Arms/ Protocol/ A/V
MIS


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

Senator Tom Ada

Jimmy Camacho <jcamacho@senatorada.org>

# Notice of Public Hearing: February 10, 2010

**Jimmy Camacho <jcamacho@senatorada.org>** **Tue, Feb 2, 2010 at 3:04 PM**
To: news@k57.com, editor@mvguam.com, ksto@ite.net, news@guampdn.com, gdumat-ol@guampdn.com, bmkelman@guampdn.com, sabrina@kuam.com, nick.delgado@kuam.com, kevin@spbguam.com
Bcc: Jimmy Camacho <jcamacho@senatorada.org>, Tom Camacho <tcamacho@senatorada.org>, Jay Sunga <ajsunga@senatorada.org>

Hafa Adai,

Please find the attached memo from the Committee on Utilities, Transportation, Public Works, and Veterans Affairs for a Public Hearing on Wednesday, February 10, 2010 at 9:00 am.

Should you have questions and/or difficulty opening the file please feel free to contact our office at 473-3301.

Thank you,

Jimmy T. Camacho

**PH FEB 10 ALL Media .pdf**
82K

Senator Tom Ada

**Jimmy Camacho <jcamacho@senatorada.org>**

# Notice of Public Hearing: February 10, 2010

**Jimmy Camacho <jcamacho@senatorada.org>** **Tue, Feb 2, 2010 at 3:14 PM**

To: judiguthertz@pticom.com, senadotbjcruz@aol.com, senjim@ite.net, "Adolpho B. Palacios" <senabpalacios@gmail.com>, Ben Pangelinan <senbenp@guam.net>, Benjamin JF Cruz <senadotbjcruz@gmail.com>, "Edward J.B. Calvo" <sencalvo@gmail.com>, "Frank B. Aguon, Jr." <aguon4guam@gmail.com>, "Frank F. Blas, Jr." <frank.blasjr@gmail.com>, Jimmy Espaldon <senator@espaldon.com>, Judi Won Pat <info@judiwonpat.com>, Matt Rector <matt@mattrector.com>, Ray Tenorio <ray@raytenorio.com>, "Rory J. Respicio" <roryforguam@gmail.com>, Telo Taitague <senatortelo@gmail.com>, Tina Muna Barnes <tinamunabarnes@gmail.com>, alfredduenas@guamlegislature.org, andrasgrandma@yahoo.com, aokada@guamlegislature.org, bfartero@guamlegislature.org, bruce.lloyd.media@gmail.com, chris.budasi@guamlegislature.org, cory@mattrector.com, coy@senatorada.org, cyrus@senatorada.org, dcchaco@guamlegislature.org, doc.wyttenbachsantos@gmail.com, ed@raytenorio.com, edpocaigue@judiwonpat.com, edpocaigue@yahoo.com, epgogue@guamlegislature.org, epgogue@hotmail.com, fba_irenem@yahoo.com, fbtorres@yahoo.com, geraldine@mattrector.com, gtmarcos612@yahoo.com, herbie@judiwonpat.com, hmcruz55@guam.net, irish@mattrector.com, jameleng_91@yahoo.com, jamespcastro@gmail.com, jcamacho@senatorada.org, jennifer@mattrector.com, jessica@raytenorio.com, joe_kamudo@yahoo.com, jonbdiaz@gmail.com, josie.mendiola@gmail.com, joyunpingco@guamlegislature.org, juliette@senatorada.org, legislativesecretary1@gmail.com, len@mattrector.com, lizama.frances@gmail.com, mark@judiwonpat.com, markaflague@gmail.com, maryfejeran@gmail.com, mcarlson@ite.net, mermae@raytenorio.com, mjperez48@yahoo.com, mona.duenas@gmail.com, natashaguon@hotmail.com, nenamillondaga@yahoo.com, patrickcepeda@hotmail.com, paul@raytenorio.com, peterlg@gmail.com, pjtcruz@yahoo.com, remytaijeron@yahoo.com, rhad@mattrector.com, rlikeke05@gmail.com, rob.tupaz@gmail.com, roberto.phil@gmail.com, roeann@raytenorio.com, roland@judiwonpat.com, rsmuna45@gmail.com, rsmuna@yahoo.com, sahara@judiwonpat.com, santos222@gmail.com, sayama01@yahoo.com, smendiola@guamlegislature.org, sonedera-salas@guamlegislature.org, stefcepeda@yahoo.com, tcamacho@senatorada.org, teddytaz_222@yahoo.com, therese@mattrector.com, tpmatanane@yahoo.com, trespicio@gmail.com, typhoonjvr@yahoo.com, vel.komiyama@yahoo.com, victoria.phillips@live.com, vqd@teleguam.net, vquenga@judiwonpat.com, wndycruz@gmail.com, zunior0831@hotmail.com, anaaleah <anaaleah@yahoo.com>, bill phillips <phillipsguam@gmail.com>, Chelsa Muna-Brecht <chelsamunabrecht@yahoo.com>, Derick Hills <derickhills@live.com>, Ed LeonGuerrero <edleonguerrero@gmail.com>, Elaine Tajalle <elainevtll@gmail.com>, Frank Torres <fbtorres@judiwonpat.com>, Fred Burgos <feaburgos@gmail.com>, Gina Tabonares <aguonmedia@gmail.com>, Jay Sunga <ajsunga@senatorada.org>, Jose Cruz <josecruzjr17@yahoo.com>, Joy Unpingco <joyunpingco@gmail.com>, Lisa Cipollone <cipo@guamlegislature.org>, Mary Lou Wheeler <mlwheeler2000@yahoo.com>, Maya Alonso <maya@guamlegislature.org>, Mike Lidia <mike.lidia9@gmail.com>, Nicole Santos <nsantos@senatorada.org>, Phillip Leon Guerrero <phill@raytenorio.com>, Ron Taitague <ez2plez57@yahoo.com>, ron teehan <rfteehan@yahoo.com>, "teddytaz@ite.net" <teddytaz@ite.net>, tinaokada <tinaokada@gmail.com>, Toby Castro <tcastro@guam.net>, Tony Quitugua <tq@guamlegislature.org>, sem@guamlegislature.org

Hafa Adai,

Please find the attached memo from the Committee on Utilities, Transportation, Public Works, and Veterans Affairs for a Public Hearing on Wednesday, February 10, 2010 at 9:00 am.

Should you have questions and/or difficulty opening the file please feel free to contact our office at 473-3301.

Senator Tom Ada

Jimmy Camacho <jcamacho@senatorada.org>

# Public Hearing Notice: February 10, 2010 at 9:00 am

**Jimmy Camacho <jcamacho@senatorada.org>** **Tue, Feb 2, 2010 at 4:49 PM**
Bcc: s.hagen@guampestcontrol.com, dmanninggbb@gmail.com, dleddy@guamchamber.com.gu

Hafa Adai,

Please find the attached memo from the Committee on Utilities, Transportation, Public Works, and Veterans Affairs for a Public Hearing on Wednesday, February 10, 2010 at 9:00 am.

I believe the items that will be discussed are of interest to your organization. Please view the attached document.

Should you have questions and/or difficulty opening the file please feel free to contact our office at 473-3301.

Thank you,

Jimmy T. Camacho

**PH FEB 10 - All Stakeholders.pdf**
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# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affair
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 8, 2010

MEMORANDUM

To: All Media

From: Senator Thomas C. Ada, Chairperson, Committee on Utilities, Transportation, Public Works and Veterans Affairs

Subject: **Public Hearing Notice: February 10, 2010 at 9:00 am**

Please be advised that the Committee on Utilities, Transportation, Public Works and Veterans Affairs is holding a public hearing on February 10, 2010 at 9:00 am. This meeting will take place in the Public Hearing Room of *I Liheslatura*.

The agenda is as follows:

9:00 am – 12:00 pm

**Bill No. 320-30 (COR)**
An act to amend §8501, §8502(2)(c) and §8312 of Chapter 8, 12 Guam Code Annotated relative to net metering.

**Bill No. 310-30 (COR)**
An act to add a new §51120 to Chapter 54 of 10GCA relative to authorization to create a Feasibility Plan for the installation of a commercial methane recovery system of the Leyon Landfill.

1:00 pm – 4:00 pm

**Status Report: Department of Public Works**

a. Bridges slated for repair/upgrade in the next 24 months

b. Roads slated for repair/upgrade in the next 24 months

Testimonies should be addressed to Senator Thomas C. Ada, Chairperson, and will be accepted via hand delivery to our office or our mailbox at the Main Legislature Building at 155 Hesler Place, Hagatña, Guam 96932, via email to office@senatorada.org, or via facsimile to (671) 473-3303 until February 20, 2010, 5pm. Individuals requiring special accommodations, auxiliary aids, or services should submit their request to our office. Copies of Bill No. 310-30 and Bill No. 320-30 may be found on the official Guam Legislature website (www.guamlegislature.com). Please feel free to contact our office should you have any questions or concerns.

Senseramente,

Thomas C. Ada


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affair
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 8, 2010

MEMORANDUM

To: All Senators

From: Senator Thomas C. Ada, Chairperson, Committee on Utilities, Transportation, Public Works and Veterans Affairs

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Senseramente,

Thomas C. Ada

cc: Clerk of the Legislature
Sergeant-at-Arms/ Protocol/ A/V
MIS


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affair
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


February 8, 2010

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To: All Stakeholders

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Senseramente,

Thomas C. Ada


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

Senator Tom Ada

Jimmy Camacho <jcamacho@senatorada.org>

# Second Notice of Public Hearing: February 10, 2010

**Jimmy Camacho <jcamacho@senatorada.org>** **Mon, Feb 8, 2010 at 9:00 AM**
To: news@k57.com, editor@mvguam.com, ksto@ite.net, sabrina@kuam.com, nick.delgado@kuam.com, kevin@spbguam.com, dondi@galaidegroup.com

Hafa Adai,

Please find the attached memo from the Committee on Utilities, Transportation, Public Works, and Veterans Affairs for a Public Hearing on Wednesday, February 10, 2010 at 9:00 am.

Changes have been made to the previous notice sent on February 2, 2010. Note, Bill No. 320-30 will be heard prior to Bill No. 310-20, and DPW will provide a status report on bridges and roads slated for repair/upgrade in the next 24 months between 1:00 and 4:00.

Should you have questions and/or difficulty opening the file please feel free to contact our office at 473-3301.

Jimmy Taitano Camacho
Staff Analyst
Office of Senator Thomas C. Ada
I Mina' Trenta na Liheslaturan Guåhan - 30th Guam Legislature

**Public Hearing Notice - ALL Media.pdf**
80K

Senator Tom Ada

Jimmy Camacho <jcamacho@senatorada.org>

# Second Notice of Public Hearing: February 10, 2010

**Jimmy Camacho <jcamacho@senatorada.org>** **Mon, Feb 8, 2010 at 9:02 AM**
To: judiguthertz@pticom.com, senadotbjcruz@aol.com, senjim@ite.net, "Adolpho B. Palacios" <senabpalacios@gmail.com>, Ben Pangelinan <senbenp@guam.net>, Benjamin JF Cruz <senadotbjcruz@gmail.com>, "Edward J.B. Calvo" <sencalvo@gmail.com>, "Frank B. Aguon, Jr." <aguon4guam@gmail.com>, "Frank F. Blas, Jr." <frank.blasjr@gmail.com>, Jimmy Espaldon <senator@espaldon.com>, Judi Won Pat <info@judiwonpat.com>, Matt Rector <matt@mattrector.com>, Ray Tenorio <ray@raytenorio.com>, "Rory J. Respicio" <roryforguam@gmail.com>, Telo Taitague <senatortelo@gmail.com>, Tina Muna Barnes <tinamunabarnes@gmail.com>, alfredduenas@guamlegislature.org, andrasgrandma@yahoo.com, aokada@guamlegislature.org, bfartero@guamlegislature.org, bruce.lloyd.media@gmail.com, chris.budasi@guamlegislature.org, cory@mattrector.com, coy@senatorada.org, cyrus@senatorada.org, dcchaco@guamlegislature.org, doc.wyttenbachsantos@gmail.com, ed@raytenorio.com, edpocaigue@judiwonpat.com, edpocaigue@yahoo.com, epgogue@guamlegislature.org, epgogue@hotmail.com, fba_irenem@yahoo.com, fbtorres@yahoo.com, geraldine@mattrector.com, gtmarcos612@yahoo.com, herbie@judiwonpat.com, hmcruz55@guam.net, irish@mattrector.com, jameleng_91@yahoo.com, jamespcastro@gmail.com, jcamacho@senatorada.org, jennifer@mattrector.com, jessica@raytenorio.com, joe_kamudo@yahoo.com, jonbdiaz@gmail.com, josie.mendiola@gmail.com, joyunpingco@guamlegislature.org, juliette@senatorada.org, legislativesecretary1@gmail.com, len@mattrector.com, lizama.frances@gmail.com, mark@judiwonpat.com, markaflague@gmail.com, maryfejeran@gmail.com, mcarlson@ite.net, mermae@raytenorio.com, mjperez48@yahoo.com, mona.duenas@gmail.com, natashaguon@hotmail.com, nenamillondaga@yahoo.com, patrickcepeda@hotmail.com, paul@raytenorio.com, peterlg@gmail.com, pjtcruz@yahoo.com, remytaijeron@yahoo.com, rhad@mattrector.com, rlikeke05@gmail.com, rob.tupaz@gmail.com, roberto.phil@gmail.com, roeann@raytenorio.com, roland@judiwonpat.com, rsmuna45@gmail.com, rsmuna@yahoo.com, sahara@judiwonpat.com, santos222@gmail.com, sayama01@yahoo.com, smendiola@guamlegislature.org, sonedera-salas@guamlegislature.org, stefcepeda@yahoo.com, tcamacho@senatorada.org, teddytaz_222@yahoo.com, therese@mattrector.com, tpmatanane@yahoo.com, trespicio@gmail.com, typhoonjvr@yahoo.com, vel.komiyama@yahoo.com, victoria.phillips@live.com, vqd@teleguam.net, vquenga@judiwonpat.com, wndycruz@gmail.com, zunior0831@hotmail.com, anaaleah <anaaleah@yahoo.com>, bill phillips <phillipsguam@gmail.com>, Chelsa Muna-Brecht <chelsamunabrecht@yahoo.com>, Derick Hills <derickhills@live.com>, Ed LeonGuerrero <edleonguerrero@gmail.com>, Elaine Tajalle <elainevtll@gmail.com>, Frank Torres <fbtorres@judiwonpat.com>, Fred Burgos <feaburgos@gmail.com>, Gina Tabonares <aguonmedia@gmail.com>, Jay Sunga <ajsunga@senatorada.org>, Jose Cruz <josecruzjr17@yahoo.com>, Joy Unpingco <joyunpingco@gmail.com>, Lisa Cipollone <cipo@guamlegislature.org>, Mary Lou Wheeler <mlwheeler2000@yahoo.com>, Maya Alonso <maya@guamlegislature.org>, Mike Lidia <mike.lidia9@gmail.com>, Nicole Santos <nsantos@senatorada.org>, Phillip Leon Guerrero <phill@raytenorio.com>, Ron Taitague <ez2plez57@yahoo.com>, ron teehan <rfteehan@yahoo.com>, "teddytaz@ite.net" <teddytaz@ite.net>, tinaokada <tinaokada@gmail.com>, Toby Castro <tcastro@guam.net>, Tony Quitugua <tq@guamlegislature.org>, sem@guamlegislature.org

Hafa Adai,

Please find the attached updated from the Committee on Utilities, Transportation, Public Works, and Veterans Affairs for a Public Hearing on Wednesday, February 10, 2010 at 9:00 am.

Changes have been made to the previous notice sent on February 2, 2010. Note, Bill No. 320-30 will be heard prior to Bill No. 310-20, and DPW will provide a status report on bridges and roads slated for repair/upgrade in the next 24 months between 1:00 and 4:00.

Should you have questions and/or difficulty opening the file please

Senator Tom Ada

Jimmy Camacho <jcamacho@senatorada.org>

# Second Notice of Public Hearing Notice: February 10, 2010

**Jimmy Camacho <jcamacho@senatorada.org>** **Mon, Feb 8, 2010 at 9:00 AM**
To: news@guampdn.com, gdumat-ol@guampdn.com, bmkelman@guampdn.com

Hafa adai,

Please find the attached PDF regarding a Public Hearing on February 10, 2010 at 9am - Bill 310-30 and Bill 320-30. We kindly request that you place this information in your Governmental Notices Section.

Changes have been made to the previous notice sent on February 2, 2010. Note, Bill No. 320-30 will be heard prior to Bill No. 310-20, and DPW will provide a status report on bridges and roads slated for repair/upgrade in the next 24 months between 1:00 and 4:00.

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Thank you,

Jimmy T. Camacho

--
Jimmy Taitano Camacho
Staff Analyst
Office of Senator Thomas C. Ada
I Mina' Trenta na Liheslaturan Guahan - 30th Guam Legislature

**Public Hearing Notice - ALL Media.pdf**
80K

WorkCentre 7232

# Transmission Report

G3 ID 6714733303 Date/Time:02/08/2010;11:39AM
Page:1 (Last Page)

Local Name SENATOR THOMAS ADA
Logo

Document has been sent.
Document Size 8.5X11"SEF


***I Mina' trenta Na Liheslaturan Guahan***
**The 30th Guam Legislature**

155 Hesler Place
Hagatna, Guam 96910
Office (671) 473-3301 • Fax (671) 473-3303

**Senator Thomas C. Ada**


Facsimile

**Date:** February 8, 2010 **No. of Pages**: 2 (including coversheet)

**Attn:** Bartley Jackson, Director/Administration, All Stakeholders

**From:** The Office of Senator Thomas C. Ada

**Re:** **Public Hearing – 1st Notice – February 10, 2010**

9:00 am – 12:00 pm
**Bill No. 320-30 (COR)**
An act to amend §8501, §8502(2)(c) and §8312 of Chapter 8, 12 Guam Code Annotated relative to net metering.

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1:00 pm – 4:00 pm
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**Note:**

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Total Pages Scanned: 2 Total Pages Sent : 2

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| 1 | 3577 | 6482474 | 2- 8;11:38AM | 21s | 2/ 2 | SG3 | | CP |

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SA: Send Again EN: Engaged AS: Auto Send TM: Terminated

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Hagatna, Guam 96910
Office (671) 473-3301 • Fax (671) 473-3303

**Senator Thomas C. Ada**


Facsimile

**Date:** February 8, 2010 **No. of Pages**: 2 (including coversheet)

**Attn:** Andy Leon Guerrero, Director/Administration, All Stakeholders

**From:** The Office of Senator Thomas C. Ada

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| 1 | 3578 | 6496178 | 2- 8:11:37AM | 20s | 2/ 2 | SG3 | | CP |

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SA: Send Again EN: Engaged AS: Auto Send TM: Terminated

WorkCentre 7232

# Transmission Report

G3 ID 6714733303 Date/Time:02/08/2010;11:37AM
Page:1 (Last Page)

Local Name SENATOR THOMAS ADA
Logo

Document has been sent.
Document Size 8.5X11"SEF


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**The 30th Guam Legislature**

155 Hesler Place
Hagatna, Guam 96910
Office (671) 473-3301 • Fax (671) 473-3303

**Senator Thomas C. Ada**


Facsimile

**Date:** February 8, 2010 **No. of Pages:** 2 (including coversheet)

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Total Pages Scanned: 2 Total Pages Sent : 2

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|---|---|---|---|---|---|---|---|---|
| 1 | 3575 | 8324111 | 2- 8;11:36AM | 21s | 2/ 2 | SG3 | | CP |

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**BUREAU OF BUDGET & MANAGEMENT RESEARCH**
OFFICE OF THE GOVERNOR
Post Office Box 2950, Hagåtña Guam 96932

**FELIX PEREZ CAMACHO**
GOVERNOR

**MICHAEL W. CRUZ, M.D.**
LIEUTENANT GOVERNOR

**BERTHA M. DUENAS**
DIRECTOR

FEB 17 2010

The Bureau requests that Bill No(s). 310-30(COR) be granted a waiver pursuant to Public Law 12-229 as amended for the following reason(s):

The Bill proposes to add a new §51120 to Chapter 54 of 10 GCA relative to authorization to create a Feasibility Plan for the installation of a Commercial Methane Recovery System of the Leyon Landfill.

The intent of the Bill is administrative in nature, as submitted for Legislative consideration.

BERTHA M. DUENAS
Director

WorkCentre 7232

# Transmission Report

G3 ID 6714733303 Date/Time: 02/05/2010 11:32AM
Page: 1 (Last Page)

Local Name SENATOR THOMAS ADA
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Document has been sent.
Document Size 8.5X11"SEF


***I Mina' trenta Na Liheslaturan Guahan***
**The 30th Guam Legislature**

155 Hesler Place
Hagatna, Guam 96910
Office (671) 473-3301 • Fax (671) 473-3303

**Senator Thomas C. Ada**


Facsimile

**Date:** February 5, 2010 **No. of Pages:** 3 (including coversheet)

**Attn:** Conchita Taitano, Director/Administration, All Stakeholders

**From:** The Office of Senator Thomas C. Ada

**Re:** **Public Hearing – 1st Notice – February 10, 2010**

**Bill No. 310-30 (COR)**
An act to add a new §51120 to Chapter 54 of 10GCA relative to authorization to create a Feasibility Plan for the installation of a commercial methane recovery system of the Layon Landfill.

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Total Pages Scanned: 3 Total Pages Sent : 3

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| 1 | 3512 | 6714758007 | 2- 5;11:31AM | 30s | 3/ 3 | SG3 | | CP |

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**I Mina' trenta Na Liheslaturan Guahan**
**The 30th Guam Legislature**

155 Hesler Place
Hagatna, Guam 96910
Office (671) 473-3301 • Fax (671) 473-3303

**Senator Thomas C. Ada**

# Facsimile

**Date:** February 5, 2010 **No. of Pages**: 3 (including coversheet)

**Attn:** Conchita Taitano, Director/Administration, All Stakeholders

**From:** The Office of Senator Thomas C. Ada

**Re:** **Public Hearing – 1st Notice – February 10, 2010**

**Bill No. 310-30 (COR)**
An act to add a new §51120 to Chapter 54 of 10GCA relative to authorization to create a Feasibility Plan for the installation of a commercial methane recovery system of the Layon Landfill.

**Note:**

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COPY

**Senator Thomas C. Ada**
CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affai
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan

February 2, 2010

**Bertha M. Duenas**
**Director**
**Bureau of Budget and Management Research**
P.O. Box 2950
Hagåtña, Guam 96910

RECEIVED
FEB 03 2010
Bureau of Budget & Mgmt. Research.

**Subject: Fiscal Notes for Bill 310-30**

**Dear Director Duenas:**

In accordance with Chapter 9 of Title 2 Guam Code Annotated, I am requesting for a fiscal note for Bill 310-30. A copy of subject bill is attached for your reference.

If you should have any questions, please feel free to contact my Staff Analyst, Mr. Jimmy Camacho, at 473-3301.

Thank you,

**THOMAS C. ADA**

Attachments (1)

Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910

# *BUREAU OF BUDGET & MANAGEMENT RESEARCH*

OFFICE OF THE GOVERNOR
Post Office Box 2950, Hagåtña Guam 96932

**FELIX PEREZ CAMACHO**
GOVERNOR

**MICHAEL W. CRUZ, M.D.**
LIEUTENANT GOVERNOR

**BERTHA M. DUENAS**
DIRECTOR

FEB 17 2010

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BERTHA M. DUENAS
Director

2/19/10 2:50 pm
RECEIVED by the
Office of Senator
Thomas C. Ada

# Senator Thomas C. Ada

CHAIRMAN - Committee on Utilities, Transportation, Public Works, and Veterans Affairs
30th Guam Legislature • I Mina' Trenta Na Liheslaturan Guåhan


## AGENDA
**PUBLIC HEARING**
**WEDNESDAY, FEBRUARY 10, 2010**
**Public Hearing Room, *I Liheslaturan Guahån***

The agenda is as follows:

9:00 am – 12:00 pm

**Bill No. 320-30 (COR)**
An act to amend §8501, §8502~~(2)(c)~~(c)(2) and §8312 of Chapter 8, 12 Guam Code Annotated relative to net metering.

**Bill No. 310-30 (COR)**
An act to add a new §51120 to Chapter ~~54~~ 51 of 10GCA relative to authorization to create a Feasibility Plan for the installation of a commercial methane recovery system of the Leayon Landfill.

1:00 pm – 4:00 pm

**Status Report: Department of Public Works**

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B. Roads slated for repair/upgrade in the next 24 months

Testimonies should be addressed to Senator Thomas C. Ada, Chairperson, and will be accepted via hand delivery to our office or our mailbox at the Main Legislature Building at 155 Hesler Place, Hagatña, Guam 96932, via email to office@senatorada.org, or via facsimile to (671) 473-3303 until FEBRUARY 20, 2010, 5pm. Individuals requiring special accommodations, auxiliary aids, or services should submit their request to our office. Copies of agenda items can be found on the official Guam Legislature website (www.guamlegislature.com). Please contact our office should you have any questions or concerns.


Ada Plaza Center, Ste. 207 • 173 Aspinall Avenue • Hagåtña, Guam 96910
Phone: (671) 473-3301 • Fax: (671) 473-3303 • Email: Tom@SenatorAda.org • www.SenatorAda.org

**I MINA' TRENTA NA LIHESLATURAN GUÅHAN**
**2010 (SECOND) Regular Session**

Bill No. 310-30(cor)

Introduced by: Telo Taitague
T. C. Ada
R. J. Respicio

**AN ACT TO ADD A NEW §51120 TO CHAPTER 54 OF 10GCA RELATIVE TO AUTHORIZATION TO CREATE A FEASIBILITY PLAN FOR THE INSTALLATION OF A COMMERCIAL METHANE RECOVERY SYSTEM OF THE LEYON LANDFILL.**

**BE IT ENACTED BY THE PEOPLE OF GUAM:**

**Section 1.** A new §51120 is *added* to Chapter 51 of 10GCA to read as follows:

**§51120. Commercial Methane Recovery System Feasibility Study.** The Department of Public Works shall conduct a feasibility study on the commercial applications of methane recovery systems for the Leyon Landfill. The study shall include, but not be limited to, alternatives such as (1) the return on investment on a government built and operated methane recover systems, (2) private public partnerships and (3) and the use of methane for electrical power generation.

The study shall be submitted to *I Liheslaturan Guåhan* for its consideration within one hundred eighty (180) of the enactment of this Section.

Clerk of the Legislature
ACKNOWLEDGEMENT RECEIPT
Received by: NIEVES
Time: 2:39 p.m.
Date: 11/6/10