

3/8/16 GEN FILE C 3c's

2016 MAR - 8 P 1: 22

March 8, 2016

HAND DELIVER

The Honorable Chair and Members of the Hawaii Public Utilities Commission 465 South King Street Kekuanoa Building, Room 103 Honolulu, Hawaii 96813

Re: Hawaii Revised Statutes (HRS) § 269-45, Gas Utility Companies Renewable Energy Report

To the Honorable Public Utilities Commission of the State of Hawaii:

In accordance with HRS § 269-45, The Gas Company, LLC doing business as Hawaii Gas, hereby files its Annual Renewable Energy Report for 2015. Portions of the report have been redacted in accordance with HRS § 269-45(a).¹

Sincerely,

Lori Y. Sun Associate General Counsel Hawaii Gas

¹ HRS § 269-45(a) states in part, "Due to the proprietary nature of the information required by paragraphs (3) and (4), that information shall be held in confidence by the commission; provided that any information obtained by the commission under this section, including confidential information, shall be made available to the department of business, economic development, and tourism or its authorized representative, which shall safeguard the confidentiality of that information."

Hawaii Gas 2015 Renewable Energy Report

The Gas Company, LLC, doing business as Hawaii Gas (Hawaii Gas), has prepared this Annual Renewable Energy Report for the Hawaii Public Utilities Commission in accordance with Hawaii Revised Statutes (HRS) § 269-45.

Hawaii Gas manufactures synthetic natural gas (SNG) for its utility customers on Oahu, and distributes propane through utility and nonutility systems throughout the State's six main islands. SNG and propane are clean-burning fuels that produce lower levels of carbon emissions than other hydrocarbon fuels such as oil and coal. SNG and propane provide a safe, reliable, and economical source of energy to approximately 70,000 residential and commercial customers throughout the State, with almost half of those customers served by the SNG utility system on Oahu.

SNG is produced using naphtha, a byproduct of the existing oil refining process in Hawaii. The production process is approximately 85% efficient as compared to electricity generation from oil-derived fuels, which is approximately 32% efficient. As a result, SNG delivers nearly three times more energy to the customer per barrel of oil as compared to electricity produced from oil. Had customers on Oahu used electricity instead of gas energy, an additional 860,792¹ barrels of oil would have been needed. This amounts to a savings of \$50,795,361 based on an average cost of \$59.01 per barrel of low sulfur fuel oil.²

Renewable Energy Data and Information

Hawaii Gas produces SNG using a blend of naphtha and hydrogen, along with other feedstocks. Since 2000, approximately 50% of the hydrogen used to produce SNG has been from recycled water from the Honouliuli Wastewater Treatment Plant (WWTP). Recycled water from the WWTP is combined with methane and other gases to produce hydrogen and additional methane in Hawaii Gas' utility processes. In 2015, hydrogen produced from reclaimed water accounted for 2.8%³ of the total feedstock used to produce SNG.

¹ See Attachment 1.

² <u>Id.</u>

³ <u>Id.</u>

Renewable Natural Gas (RNG)

Hawaii Gas is committed to increasing the use of renewable natural gas (RNG) in Hawaii.

- **Renewable Natural Gas Plant**: In 2011, Hawaii Gas constructed a Renewable Natural Gas Pilot Plant⁴ to produce renewable gas energy using renewable fats and oils. Results demonstrated that while it is possible to produce renewable gas from fats and oils, the process could not meet the efficiency, reliability, and quality standards needed to sustain large scale production. Challenges included low feedstock conversion rates, the presence of byproducts that could not be effectively separated from the feedstock stream and additional capital investments and chemical treatments. Hawaii Gas is considering alternative uses for the Pilot Plant equipment.
- **Industry Collaboration:** Hawaii Gas is working with large land owners to assess the cost and risks associated with converting agricultural crops into biogas, and is engaged with a separate entity to convert landfill waste into biogas.
- **City and County of Honolulu**: In October 2015, Hawaii Gas responded to the City and County of Honolulu's Request for Proposals to purchase biogas from the Honoluliuli Wastewater Treatment Plant. While the RFP is still pending, if the City were to award Hawaii Gas the contract to purchase biogas, Hawaii Gas could potentially displace up to 3% of its current SNG supply with RNG.
- **Request for Proposals**: In January 2016, Hawaii Gas released a Request for Proposals to obtain bids for the supply of biogas or bio-methane. Proposals are due in March 2016.

Summary

Hawaii Gas plays a vital role in Hawaii's energy portfolio by providing clean and costeffective energy to commercial and residential customers. We are committed to Hawaii's clean energy goals, and will continue to look toward new, innovative, and economical ways to generate renewable energy, while also reducing greenhouse gas emissions and aiding in waste diversion.

⁴ See Docket No 2010-0334, Decision and Order No. 30096, issued on January 9, 2012.

Attachment 1: Renewable Energy Report Summary Confidential - Pursuant to HRS § 269-45(a)

Date: March 1, 2016 Date: March 1, 2016 Submitted by: The Gas Company, ULC dba Hawaii Gas 745 Fort Street, Suite 1800 745 Fort Street, Suite 1800 Honolulu, Hawaii 96813 Anolulu, Hawaii 96813 Requested Information Fercentage of total feedstock comprised of petroleum feedstock Percentage of total feedstock comprised of non-petroleum feedstock (therms/ year) The energy quantity in therms produced from non-petroleum feedstock (therms/ year) The energy quantity in therms produced from non-petroleum feedstock (therms/ year) Total (therms/ year) Total (therms/ year) The energy quantity in therms produced from non-petroleum feedstock (therms/ year) Total (therms/ year) Total (therms/ year) The energy quantity in therms produced from non-petroleum feedstock (therms/ year) ² Total (therms/ year) Total (therms/ year) <th>nnual Report to</th> <th>o the Hawail Public Utilities Commission</th> <th></th> <th></th>	nnual Report to	o the Hawail Public Utilities Commission		
Date: March 1, 2016 Submitted by: The Gas Company, LLC dba Hawaii Gas Submitted by: 745 Fort Street, Suite 1800 Honolulu, Hawaii 96813 Honolulu, Hawaii 96813 Requested Information Percentage of total feeds tock comprised of petroleum feeds tock Percentage of total feeds tock comprised of non-petroleum feeds tock * The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) * The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) * The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) * Total (therms/ year) * * Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ * Savings to Hawail from the use of Synthetic Natural Gas (SNG) ³ * Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ * Savings to Hawail from the use of Synthetic Natural Gas (SNG) ³ * Intel (therms/ year) * * Savings to Hawail from the use of SNG instead of electricity (barrels/ year) ⁴ * Savings to Hawail from the use of Synthetic Natural Gas (SNG) ³ *				
Submitted by: The Gas Company, LLC dba Hawaii Gas 745 Fort Street, Suite 1800 745 Fort Street, Suite 1800 Requested Information 745 Fort Street, Suite 1800 Requested Information 745 Fort Street, Suite 1800 Recentage of total feeds tock comprised of pertoleum feeds tock. 745 Fort Street, Suite 1800 Recentage of total feeds tock comprised of non-petroleum feeds tock. 745 Fort Street, Year) Recentage of total feeds tock comprised of non-petroleum feeds tock. 745 Fort Street, Year) Readings to Hawaii Fort the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii From the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii From the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii From the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii From the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii From the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii From the use of Synthetic Natural Gas (SNG) ³ 70al (therms/ year). Savings to Hawaii In thermacy Inter Internation (Total Case) (Total	late:	March 1, 2016		
745 Fort Street, Suite 1800 Honolulu, Hawaii 96813 Honolulu, Hawaii 96813 Requested Information Percentage of total feedstock comprised of petroleum feedstock Percentage of total feedstock comprised of non-petroleum feedstock (therms/year) The energy quantity in therms produced from non-petroleum feedstock (therms/year) Total (therms/year) Total (therms/year) Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ² Sawings to Hawaii from the use of Symthetic Natural Gas (SNG) ³ Savings to Hawaii from the use of Symthetic Natural Gas (SNG) ³ Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ² Savings to Hawaii from the use of Symthetic Natural Gas (SNG) ³ Savings to Hawaii from the use of Symthetic Natural Gas (SNG) ³ Solar I (therms/year) Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil for the Hawaiian economy ³ Percentage Dollars saved on imported oil for the medivalent of SNG instead of electricity (barrels/year) ⁴ Percensing na the net or net of net reform reclaired vasicy for therm - use of recycled wai - As an	ubmitted by:	The Gas Company, LC dba Hawaii Gas		
Honolulu, Hawaii 96813 Requested Information Percentage of total feedstock comprised of non-petroleum feedstock Percentage of total feedstock comprised of non-petroleum feedstock (therms/ year) The energy quantity in therms produced from non-petroleum feedstock (therms/ year) Total (therms/ year) Total (therms/ year) Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ² Savings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Sovings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Sovings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Footal (therms/ year) Into the use of Synthetic Natural Gas (SNG) ³ Sovings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Sovings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Sovings to Hawail from the use of Synthetic Natural Gas (SNG) instead of electricity (barrels/ year) ² Sovings to Hawail from the use of Synthetic Natural Gas (SNG) ³ Sovings to Hawail from the use of Synthetic Natural Gas (SNG) Internet of Barrels of oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - For every one (1) barrel of therm equivale		745 Fort Street, Suite 1800		
Requested Information Requested Information Percentage of total feeds tock comprised of non-petroleum feeds tock Percentage of total feeds tock comprised of non-petroleum feeds tock (therms/ year) The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) Total (therms/ year) Total (therms/ year) Savings to Hawaii from the use of Synthetic Natural Gas (SNG) ³ Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ Obliats saved on imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ Sovings to Hawaii In unber of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ Sovings to Hawaii In unber of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ Sovings to Hawaii In unber of barrels of inthe Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG in stead of electricity (barrels/ year) ⁴ Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wai ² Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wai ³ SNG is made using naphtha, a by-produced at a neighboring refinery, and does not requi ³		Honolulu, Hawaii 96813		
Requested Information Requested Information Percentage of total feeds tock comprised of non-petroleum feeds tock therms/ year) Percentage of total feeds tock comprised of non-petroleum feeds tock (therms/ year) The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) Total (therms/ year) Total (therms/ year) * Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ * * Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ * * Solution Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ * Dollars saved on imported oil for the Hawaiian economy ⁵ * * * Dollars saved on imported oil for the Hawaiian economy ⁵ * * * Dollars saved on imported oil for the Hawaiian economy ⁵ * * * Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wait * * * * Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wait * * * * Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wait *				
Percentage of total feeds tock comprised of petroleum feeds tock Percentage of total feeds tock comprised of non-petroleum feeds tock (therms/ year) The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) Total (therms/ year) Total (therms/ year) Total (therms/ year) Total (therms/ year) Savings to Hawall from the use of Synthetic Matural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Matural Gas (SNG) ³ Solution to the use of Synthetic Matural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Matural Gas (SNG) ³ Dollars saved on imported oil for the Hawaiian economy ⁵ For every one (1) barrel of therm equivalent of SNG instead of electricity (barrels/ year) ⁴ Profect - For every one (1) barrel of therm equivalent of SNG it would be \$100, the SNG cost would be \$35 Profect - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Profect - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote 1	lequested infor	mation	Value	Barrel of Oil Equivalent (80E)
Percentage of total feeds tock comprised of non-petroleum feeds tock (therms/year) The energy quantity in therms produced from non-petroleum feeds tock (therms/year) ² Total (therms/year) Rowning to Hawaii from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawaii from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawaii from the use of Synthetic Natural Gas (SNG) ³ Souther of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Souther of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost		Percentage of total feeds tock comprised of petroleum feeds tock	97.2%	
The energy quantity in therms produced from petroleum feedstock (therms/ year) ² Total (therms/ year) Total (therms/ year) Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Solution to the use of Synthetic Natural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Solution to the use of Synthetic Natural Gas (SNG) ³ Solution to the use of Synthetic Natural Gas (SNG) ³ Solution to the use of Synthetic Natural Gas (SNG) ³ Dollars saved on imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electricial cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electricial cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electricial cost would be \$100, the SNG cost would be \$35 - As an example for heating water shift reactor from reclaimed wastewater - therm quart stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled water a sing and using naphtha, a by-producet produced at a neighboring refinery, and does not requi <th></th> <td>Percentage of total feeds tock comprised of non-petroleum feeds tock¹</td> <td>2.8%</td> <td></td>		Percentage of total feeds tock comprised of non-petroleum feeds tock ¹	2.8%	
The energy quantity in therms produced from non-petroleum feeds tock (therms/ year) ² Total (therms/ year) Iotal (therms/ year) Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawali from the use of stored oil for the Hawaiian economy ⁵ Pollars saved on imported oil for the Hawaiian economy ⁵ Pollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if reactor from reclaimed wastewater - therm quarts in the reformer and water shift reactor from reclaimed wastewater - therm quarts ³ Footnote - Blant stolchiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled walts ³ * Plant stolchiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled walts ³ * Blant stolchiometr		The energy quantity in therms produced from petroleum feedstock (therms/ year)		
Total (therms/year) Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawall from the use of Synthetic Natural Gas (SNG) ³ Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 I Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ¹ Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ³ SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi SNG is made using naphtha, a by-produced at a neighboring refinery, and does not requi SNG is made using naphtha, a by-produced at a neighboring refinery. SNG is made using naphtha, a by-product produced at a neighboring reflorence. <t< td=""><th></th><td>The energy quantity in therms produced from non-petroleum feedstock (therms/ year)²</td><td></td><td></td></t<>		The energy quantity in therms produced from non-petroleum feedstock (therms/ year) ²		
Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Savings to Hawali from the use of Synthetic Natural Gas (SNG) ³ Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴ Dollars saved on imported oil for the Hawailan economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ¹ Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ³ SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi ³ SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi ⁵ Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.		Total (therms/year)		
Savings to Hawaii from the use of Synthetic Natural Gas (SNG) ³ Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote 1 Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat 2 Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quadres and the using maphtha, a by-product produced at a neighboring refinery, and does not requi 3 SNG is made using maphtha, a by-product produced at a neighboring refinery, and does not requi 5 Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.				
Number of barrels of imported oil saved by using SNG instead of electricity (barrels/year) ⁴ Dollars saved on imported oil for the Hawaiian economy ⁵ Dollars saved on imported oil for the Hawaiian economy ⁵ For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ¹ Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ³ SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi ⁴ Calculated from plant conversion efficiencies with hot water production. ⁵ Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.	avings to Hawa	li from the use of Synthetic Natural Gas (SNG) ³		
Dollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 - As an example for the reformer and water shift reactor from reclaimed wastewater - therm quater - Bord is made using naphtha, a by-product produced at a neighboring refinery, and does not require - Calculated from plant conversion efficiencies with hot water production. - S Average \$59,01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.		Number of barrels of imported oil saved by using SNG instead of electricity (barrels/ year) ⁴		860,792
Dollars saved on imported oil for the Hawaiian economy ⁵ - For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote 1 Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat 2 Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quadits made using mapthta , a by-product produced at a neighboring refinery, and does not requi 3 SNG is made using mapthta , a by-product produced at a neighboring refinery, and does not requi 5 Average \$59.01/ L5FO barrel from HECO Monthly reports Jan thru Dec 2015.			\$/ barrel	
 For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quater SNG is made using naphtha, a by-produced at a neighboring refinery, and does not require Calculated from plant conversion efficiencies with hot water production. Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015. 		Dollars saved on imported oil for the Hawaiian economy ⁵	\$59.01	\$50,795,361
 - As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35 Footnote Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ¹ Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm qi SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi ⁴ Calculated from plant conversion efficiencies with hot water production. ⁵ Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015. 		- For every one (1) barrel of therm equivalent of SNG it would require 2.8125 barrels of oil for generator fuel ⁶		
Footnote1Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat2Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quant3SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi4Calculated from plant conversion efficiencies with hot water production.5Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.		- As an example for heating water, if electrical cost would be \$100, the SNG cost would be \$35.54 (higher conversion	efficiency)	
Footnote1Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat2Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm qu3SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requi4Calculated from plant conversion efficienies with hot water production.5Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.				
¹ Plant stolchiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled wat ² Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quastewater - stole in the reformer and water shift reactor from reclaimed wastewater - therm quastewater - therm quaster - therm quastewater - therm quaster - the quaster - therm quaster - the - th	ootnote			
 ² Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quants ³ SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requit ⁴ Calculated from plant conversion efficiencies with hot water production. ⁵ Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015. 	1	Plant stoichiometric basis (HHV) - R-hydrogen therm/ Plant Feedstock therm - use of recycled water from Honouliuli Wa	stewater Treatr	nent Plant.
 SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not requinated from plant conversion efficiencies with hot water production. Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015. 	2	Hydrogen produced in the reformer and water shift reactor from reclaimed wastewater - therm quantity based on feedst	ock flow.	
 Calculated from plant conversion efficiencies with hot water production. Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015. 	¢	SNG is made using naphtha, a by-product produced at a neighboring refinery, and does not require any additional oil to	be imported to	i Hawaii.
⁵ Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.	4	Calculated from plant conversion efficienties with hot water production.		
	Ś	Average \$59.01/ LSFO barrel from HECO Monthly reports Jan thru Dec 2015.		
For every Barrel Therm Equivalent of SNG produced there is a savings of 1.728 barrels of oil save	υ	For every Barrel Therm Equivalent of SNG produced there is a savings of 1.728 barrels of oil saved (54.4614 therms/ bar	rel).	

CONFIDENTIAL Pursuant to HRS § 269-45(a)

3 | P a g e