

# *Exploiting Biogas for Cost Savings*

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**Biogas Conversion to Electricity Allows Two Major Wastewater Utilities In Texas to Meet State Mandated Energy Measures and Reduce Their Grid Derived Electricity Costs**



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San Antonio Water System

## **Outline**

- ◆ Background information
  - ◆ Texas Senate Bill 5
  - ◆ Texas Senate Bill 7
- ◆ Leveraging these bills for cost savings
- ◆ What is biogas?
- ◆ What is the value of a city's biogas?
- ◆ The Southside and Dos Rios WWTP Biogas Capitalization Projects

## Texas Senate Bill 5 (2001) - Background



Federal Clean Air Act Amended - 1990

- Requires State Implementation Plans (SIPs)
- Grants Enforcement Power to US EPA



US EPA Establishes National Air Quality Standards

- DFW Classified "Moderate" Ozone Non-Attainment Area – 1990
- DFW Reclassified "Serious" Ozone Non-Attainment Area – 1998
- San Antonio Classified "Near" Ozone Non-Attainment Area



TNRCC (Now TCEQ) Adopts SIP Revisions to Address Ozone Non-Attainment Areas

- Includes Numerous Control Strategies to Reduce Emissions from Electricity Generating Facilities (EGFs)



SB 5 Legislated to Provide Tools to Assist the TNRCC in Reducing EGF Emissions - 2001

- Includes Legislation for the Mandatory Reduction of Energy Use by Political Subdivisions of the State



Cost Saving Opportunities

## Texas Senate Bill 7 (1999) - Background



Energy Policy Act Enacted - 1992

- Promote Greater Competition in Bulk Power Markets
- Ensure Wholesale Purchaser Access to Alternative Power Supplies



Wholesale Electricity Market Deregulated - 1996

- Provided for the Open Access and Use of Privately Developed Transmission Systems
- Established the Rules for Wholesale Wheeling of Electricity



SB 7 Legislated to Deregulate the Retail Electricity Market - 1999

- Prevent Domination of Electrical Markets
- Set Goals for Electricity Generation From Renewable Energy Resources
- Require Older Plants to Reduce Air Pollution
- Ensure Reliability and Protect Consumers



Texas PUC Issues Rules for Buying & Selling Renewable Energy Credits (REC) - 2000

- Establishes Renewable Resource Requirements for All REPs
- Defines Penalties for Non-Compliance
- Describes Process for Registering Renewable Energy Facilities and Creating Renewable Energy Accounts



Cost Saving Opportunities

## Leveraging the Features of Both Bills for Cost Savings

### TEXAS SENATE BILL 5 REQUIRES:

*Political Subdivisions of the State to:*

1. Undertake All Cost Effective Energy Efficiency Projects on Existing Facilities that will Result in a Reduction in the Use of Electricity
2. Adopt a Goal to Reduce Electricity Use by 5% Per Year for Five Years Beginning in 2002
3. Report the Results of their Progress in Meeting this Goal on a Yearly Basis



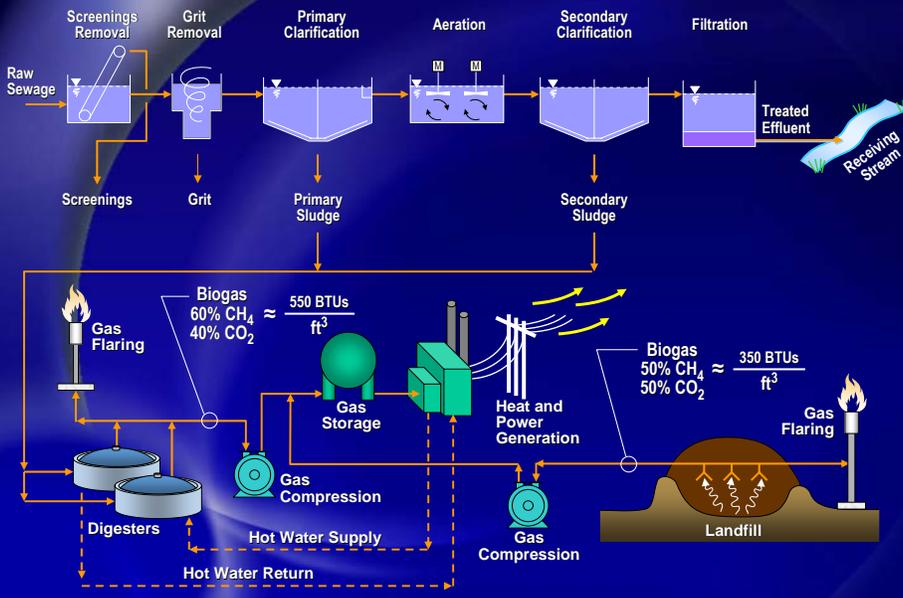
### TEXAS SENATE BILL 7 ALLOWS:

Energy Produced by a Renewable Resource to be Bought and Sold in the Texas Wholesale Market or to Retail Customers in Texas and Marketed as Renewable Energy if it is Generated From a Qualifying Resource



**Cost Savings By Capitalizing on the Energy Value of Biogas**

## What Is Biogas?



## Gas Production / Heating Value Relationships



Dallas' Southside WWTP

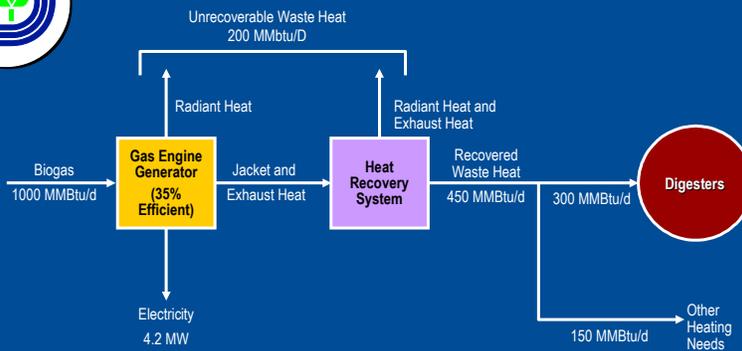
Fraction of Biosolids that are Volatile (%)	Volatile Fraction Destroyed Through Digestion (%)	Biogas Production Rate (ft <sup>3</sup> gas/lb Volatile Solids Destroyed)	Calorific Value of Biogas (Btu per ft <sup>3</sup> )
78	55	15	550



San Antonio's Dos Rios WRC

Fraction of Biosolids that are Volatile (%)	Volatile Fraction Destroyed Through Digestion (%)	Biogas Production Rate (ft <sup>3</sup> gas/lb Volatile Solids Destroyed)	Calorific Value of Biogas (Btu per ft <sup>3</sup> )
70	55	15	580

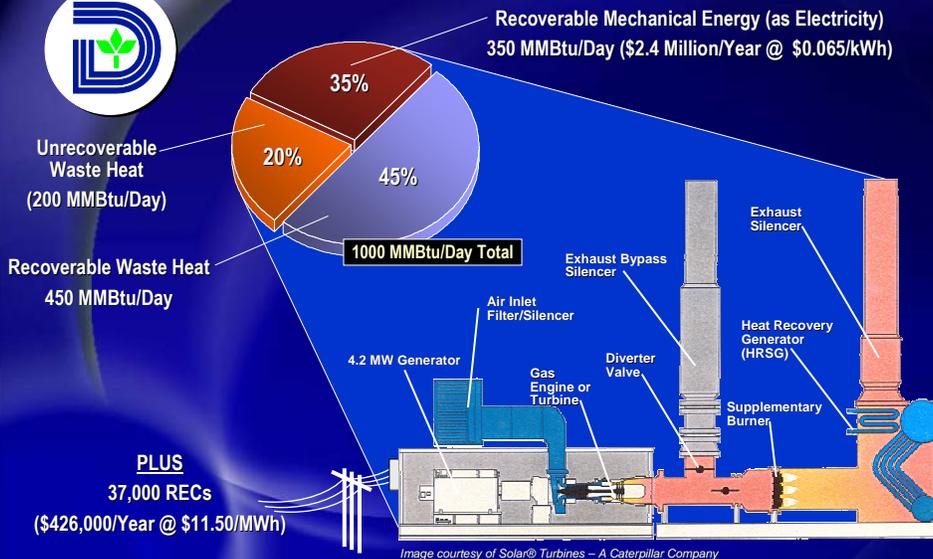
## Southside WWTP Energy Balance - Year 2005 Probable Electricity and Waste Heat Production



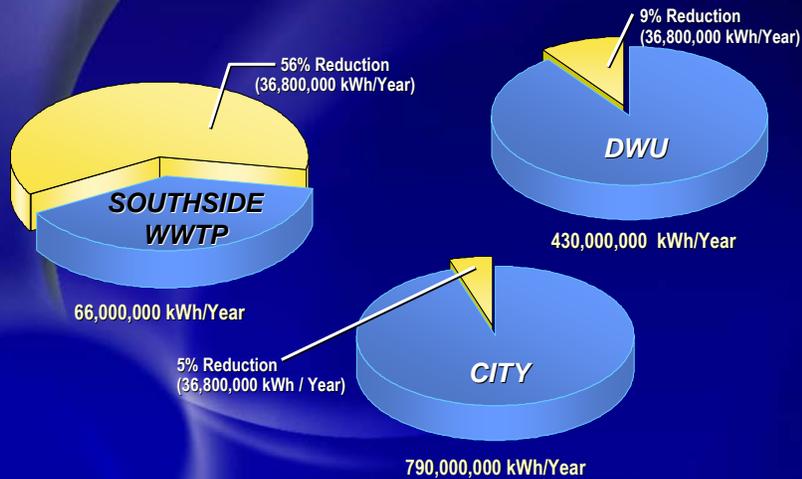
*NOTE*

1 MMBtu = 1 Million Btu

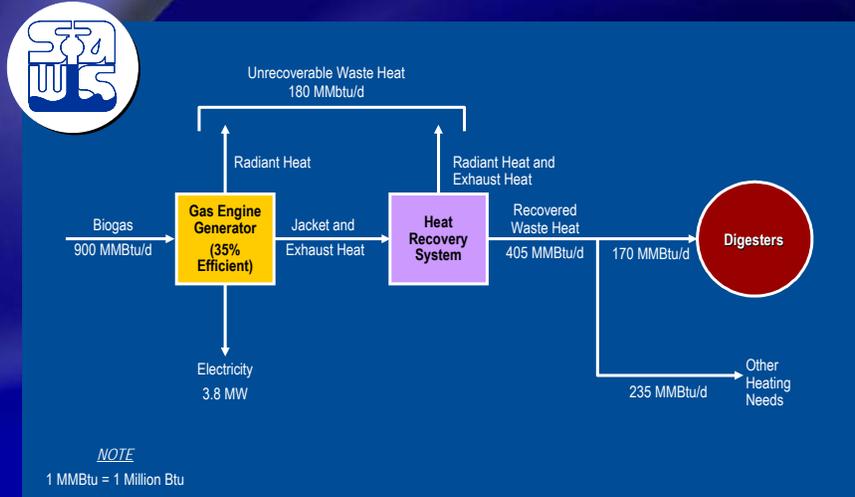
## As a Renewable Energy, DWU's Biogas has a Potential Value Over \$2,800,000/Year



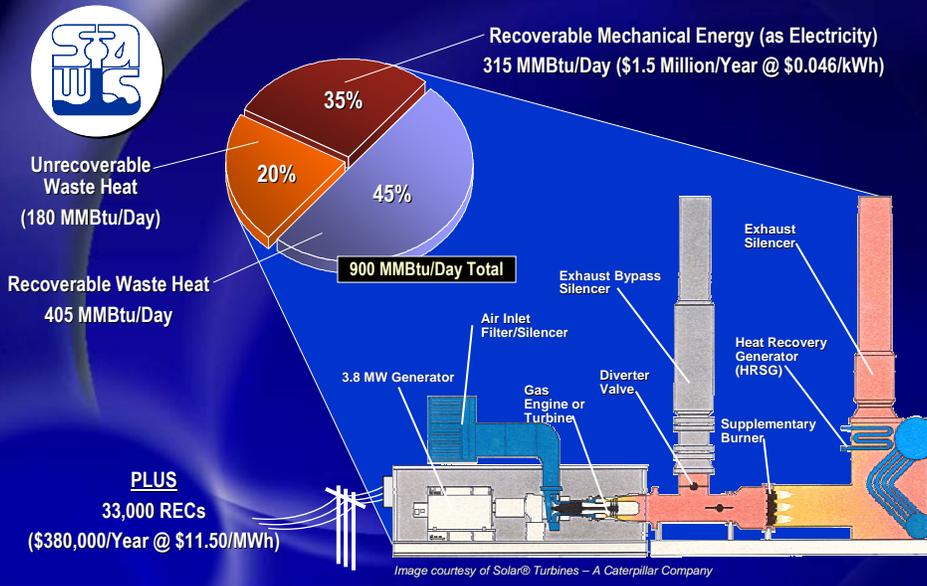
## As a Fuel to Generate Electricity, DWU's Biogas has the Potential to Reduce the City's Aggregate Electricity Consumption by More Than 5% (1 Year of Senate Bill 5 Compliance)



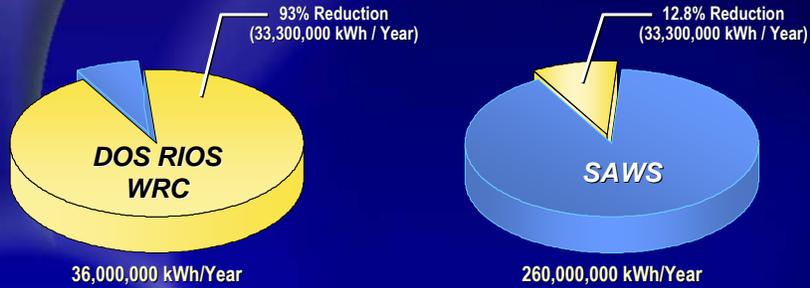
## Dos Rios WRC Energy Balance - Year 2005 Probable Electricity and Waste Heat Production



## As a Renewable Energy, SAWS' Biogas has a Potential Value Over \$1,800,000/Year



**As a Fuel to Generate Electricity, SAWS Biogas has the Potential to Reduce the Utility's Aggregate Electricity Consumption by Nearly 13%, (More Than Two Years of Senate Bill 5 Compliance)**



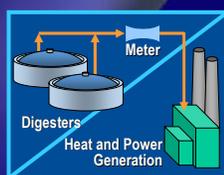
**SB7 Establishes a Goal of 2000 Additional Megawatts of Renewable Electricity Generating Capacity in Texas by 2009**



## More on RECs

- ◆ The PUCT requires all REPs, as part of their licensing, to have a percentage of their generating capacity derived from renewable energy sources
- ◆ This percentage is in proportion to the REPs load share (e.g. if REP “X” serves 10% of the total Texas generating load in 2003, they need to have  $0.10 \times 1280$  MW or 128 MW of renewable energy derived electricity generating capacity for that year in their portfolio
- ◆ The ERCOT administered REC trading program allows REPs to buy RECs from third party renewable energy generators and “bank” them to their individual REC accounts
- ◆ After registering with the PUC, owners or operators of renewable energy generation facilities can create their own REC accounts from which ERCOT accounted REC trades can be transacted

## TDSP Incentives Provide “Seed” Money for Energy and Demand Reduction Projects



### SOUTHSIDE WWTP COGENERATION PROJECT

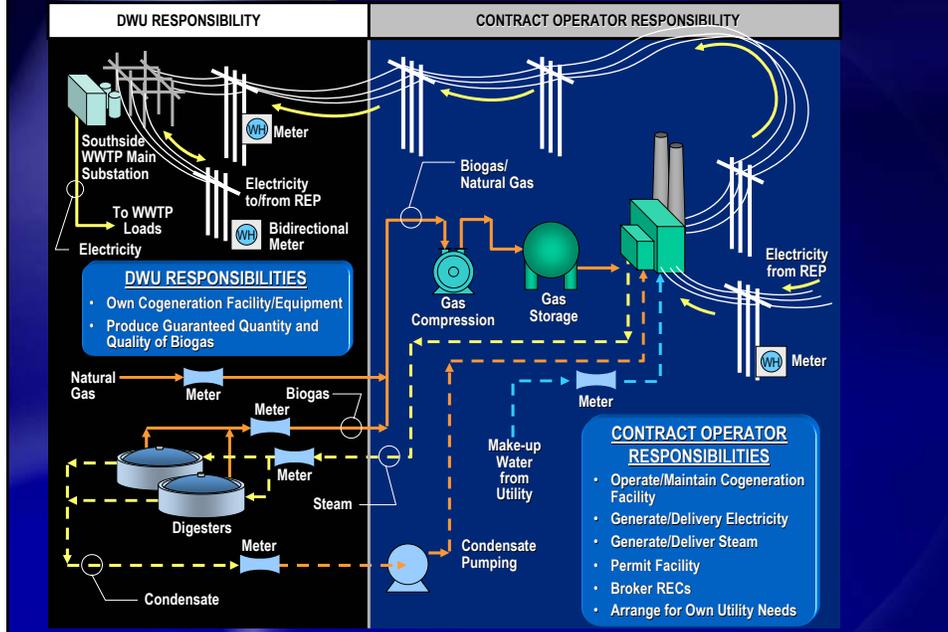
- Demand Reduction = 4.2 MW @ \$189/kW
- Energy Reduction = 36,800 MWh/Year @ \$0.065
- *MAXIMUM INCENTIVE FROM TXU ELECTRIC DELIVERY = \$3.2 MILLION*



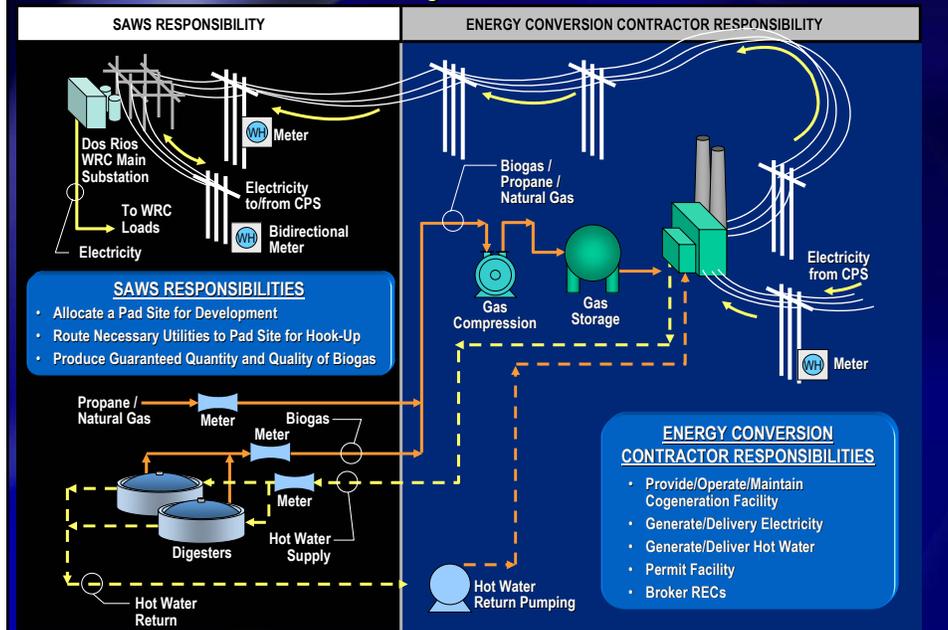
### SOUTHSIDE WWTP DIFFUSED AERATION PROJECT

- Demand Reduction = 2.3 MW @ \$189/kW
- Energy Reduction 20,100 MWh/Year @ \$0.065
- *MAXIMUM INCENTIVE FROM TXU ELECTRIC DELIVERY = \$1.7 MILLION*

## The Southside WWTP Cogeneration Project



## The Dos Rios WRC Combined Heat and Power Production Project



## Framework of Southside WWTP Biogas Cogeneration Project Award

- ◆ Contract operator submitting the lowest rate for biogas produced electricity (a 4.2 MW facility should be operable with a reasonable profit at \$640,000 per year or \$0.017/kWh assuming no fuel costs, no capital costs and no consideration to leveraged income from REC sales)
- ◆ Contract operator submitting the best value operations and maintenance plan (flexibility, PM, reporting, uptime response, etc.)
- ◆ Contract operator submitting the least exceptions to required commercial terms (indemnification, insurance, bonds, force majeure, etc.)
- ◆ 8-12 year term to allow at least two major overhauls to be performed on each machine

## Economics of Southside Cogeneration Project

Current Grid Derived Electricity Use = 66,000,000 kWh/Year OR \$4,290,000/Year (A) @ \$0.065/kWh  
 — Offset Grid Derived Electricity Use as a Result of Cogen Project = 36,800,000 kWh/Year

Post Cogen Project Grid Derived Electricity Use = 29,200,000 kWh/Year OR \$1,898,000/Year (B) @ \$0.065/kWh

Gross Annual Savings Available for Cogen Project Investment = (A) — (B) = \$2,400,000/Year

Estimated Capital Cost of 4.2 MW Cogeneration Project = \$10,500,000  
 — DTSP Incentive = \$3,200,000

Net Capital Cost for Payback Analysis Purposes = \$7,300,000

Gross Annual Savings Available for Cogen Project Investment = \$2,400,000/Year  
 — Estimated Annual O&M Cost of Cogen Facility (Assuming No Fuel and Capital Costs) = \$640,000/Year @ \$0.017/kWh/Year  
 = \$1,760,000/Year

+ REC Income (Assuming 50/50 Split With Cogen Operator) = \$210,000/Year

Total Adjusted Annual Savings Available for Net Cost Payback = \$1,970,000/Year

PAYBACK ON NET CAPITAL COST =  $\frac{\$7,300,000}{\$1,970,000/\text{YEAR}}$  = 3.7 YEARS

## Framework of Dos Rios WRC Cogeneration Project Award

- ◆ Energy conversion contractor submitting the lowest rate for biogas produced electricity (a 3.8 MW facility should be operable with a reasonable profit at \$440,000 per year or \$0.013/kWh assuming no fuel costs, and no leveraged income from REC sales; a 3.8 MW facility should be constructible and operable with a reasonable profit over a 15 year term for \$0.039/kWh under the same assumptions)
- ◆ Energy conversion contractor submitting the best value operations and maintenance plan (flexibility, PM, reporting, uptime response, etc.)
- ◆ Energy conversion contractor submitting the least exceptions to required commercial terms (indemnification, insurance, bonds, force majeure, etc.)
- ◆ 15 + year term to allow for capital investment retirement

## Economics of Dos Rios Cogeneration Project

Current Grid Derived Electricity Use	=	36,000,000 kWh/Year	OR	\$1,660,000/Year (A)	@	\$0.046/kWh
— Offset Grid Derived Electricity Use as a Result of Cogen Project	=	33,300,000 kWh/Year				
Post Cogen Project Grid Derived Electricity Use	=	2,700,000 kWh/Year	OR	\$124,000/Year (B)	@	\$0.046/kWh
Gross Annual Savings Available for Cogen Project Investment = (A) — (B) = \$1,540,000/Year (C)						
Estimated Annual O&M Cost of Cogen Facility (Assuming No Fuel Costs) = \$440,000/Year OR \$0.013/kWh						
— Estimated Annual REC Income (Assuming 50/50 REC Sales Split) = \$190,000/Year OR \$0.005/kWh						
Adjusted Annual O&M Cost of Cogen Facility = \$250,000/Year (D) OR \$0.008/kWh						
Adjusted Annual Savings Available For Capital Investment Retirement = (C) — (D) = \$1,290,000/Year (E)						
Estimated Annual Debt Service Costs on \$9,400,000 of Capital Investment @ 6% Interest, 15-Year Term, and 10% Salvage Value = \$870,000/Year (F) OR \$0.026/kWh						
Net Annual Savings Resulting from Cogen Project = (E) — (F) = \$420,000 OR \$0.013/kWh						
Post Cogen Project Grid Derived Electricity Cost	=	2,700,000 kWh/Year @ \$0.046/kWh	=	\$124,000/Year		
+ Cogen Project Electricity Cost	=	33,300,000 kWh/Year @ \$0.034/kWh	=	\$1,136,000/Year		
Post Cogen Project Total Electricity Cost	=	36,000,000 kWh/Year @ \$0.035/kWh	=	\$1,260,000/Year		

