ANAEROBIC DIGESTER METHANE TO ENERGY

A STATEWIDE ASSESSMENT

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The power is within you.

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A STATEWIDE ASSESSMENT

Prepared For

Focus On Energy

Prepared By

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I. INTRODUCTION

Approximately 85 communities in Wisconsin use anaerobic digesters at the wastewater treatment plant to process biosolids. Digester gas (60% to 65% methane) is a byproduct of this process. With proper treatment, this methane can be used in an internal combustion engine to drive a generator and make electricity for internal plant use or sale back to the utility.

The purpose of this study is to determine the technical and economic feasibility of generating electricity from the methane using a packaged generation system that includes an engine, generator, gas treatment system and heat recovery system. The study would determine which size communities and treatment plants this technology makes economic and practical sense and would develop a priority list and implementation plan for those communities.

McMahon Associates, Inc. was awarded a grant from Focus on Energy, which was matched by McMahon Associates, Inc. to undertake this assessment.

II. OBJECTIVES

A. Identify feasible sites for generation of electricity from digester gas.

B. Determine the capital cost, operating cost and savings by generating electricity from digester gas for a selected range of project size.

C. Graph payback by project size.

D. Develop a project priority list on the basis of payback (most rapid payback is the highest priority).

E. Develop an Implementation Plan that could be followed by each priority site.

F. Prepare fact sheets citing the benefits of this project to assist in convincing decision makers to implement the project.

III. DETAILED SCOPE OF WORK

McMahon Associates, Inc. proposed the following detailed Scope of Work to Focus On Energy:

A. Develop an accurate list of municipal wastewater treatment facilities in Wisconsin that utilize anaerobic digestion for biosolids processing.

B. Contact each facility by telephone or site visit to determine the following:

   1. Current and design quantities of biosolids processed.
   2. Current and design methane production quantities.
   3. Current uses of methane.
   4. Size, configuration and condition of digesters and equipment.

C. Place each facility into a size category by plant capacity.

D. Estimate methane production based upon plant size. Compare estimate to data received. Recommend digester gas production optimization or digester upgrade measures if appropriate.

E. Estimate electricity generation potential for each plant size category.

F. Estimate typical capital cost to design, furnish and install a packaged cogeneration system fueled by methane for each size category. Packaged system would include a methane driven engine, generator, gas treatment system and heat recovery system to send waste heat back to the digester for sludge heating purposes. Microturbines will be considered and evaluated as an option for generating electricity and for heat recovery.

G. Calculate payback for each size category system evaluated considering O&M costs of the generation system and savings from generating electricity and from heat recovery.

H. Graphically illustrate the economic benefit of implementing a cogeneration project of this nature.

I. Prepare project summary sheets that illustrate the benefit of implementing a cogeneration project and furnish these to all communities in Wisconsin using anaerobic digestion. Develop an implementation plan that could be followed by each community to install a cogeneration system.

J. Prepare a technical report that summarizes and documents the work effort undertaken. Place the document on the internet. Present the technical paper at wastewater and renewable energy conferences in Wisconsin and the Midwest. Furnish each Municipal Wastewater Treatment Facility Superintendent with a copy of the technical report.

K. Based upon the communities contacted and their situation, prepare a priority list of feasible projects for implementation of cogeneration along with the economics for each, making the projects with the most rapid payback the highest priority.

IV. ANAEROBIC DIGESTION SURVEY

An anaerobic digestion survey (See Appendix A) was mailed to each wastewater treatment plant in Wisconsin that used anaerobic digestion to process biosolids. The purpose of the survey was to determine:

A. Current and future loadings to the anaerobic digester.

B. Gas production or volatile solids destruction, if known.

C. Current uses of the digester gas.

D. Electric usage and cost for electricity.

If digester gas production data was unavailable, an estimate of gas production was made based on the digester loading, volatile solids destruction and an assumed gas production value of 15 cubic feet of gas (at 65% methane) per pound of volatile solids destroyed.

Methane production and kilowatt generation potential shown in Table 1 is based upon data obtained from the wastewater treatment plants surveyed. Example calculations along with assumptions made are shown below.

Example 1 - Known Biosolids Quantities

Community - Village of Grafton

Primary Sludge to Digester	2,580 lb/day
Secondary Sludge to Digester	1,193 lb/day
Total	3,773 lb/day

Assume Volatiles are 75%

Volatile Solids to Digestion	=	3,773 lb/day x 0.75
	=	2,829 lb/day

Assume 50% VSS reduction through digestion

VSS Destroyed	=	2,829 lb/day x 0.50

= 1,415 lb/day

Assume 15-C.F. of digester gas produced per pound of volatile solids destroyed.

Gas Production	=	1,415 lb/day VSS destroyed x 15 C.F./lb
	=	21,225 C.F./day

$$\text{Gas Production (cfm)} = \frac{21{,}225 \text{ C.F./day}}{24 \text{ hr/day} \times 60 \text{ min/hr}} = 14.7 \text{ cfm}$$

Each microturbine will generate 30 KW at a digester gas feed rate of 13.13 cfm.

$$\text{KW Generation Potential} = \frac{14.7 \text{ cfm}}{13.13 \text{ cfm}} \times 30\text{KW} = 34\text{KW}$$

Calculate value of electricity generated at 90% utilization and $0.04/KWH, using a 30KW microturbine

30KW x 24 hrs/day x 365 days/yr x 0.90 x $0.04/KWH = $9,461 (use $9,500)

Calculate value of heat recovered while operating the microturbine

$$200{,}000 \text{ BTU/hr} \times 24 \text{ hrs/day} \times 365 \text{ days/yr} \times 0.90 \times \frac{\$6.00}{1{,}000{,}000 \text{ BTU}} = \$9{,}461 \text{ (use \$9,500)}$$

Annual O&M costs of operating a microturbine:

30KW x 24hrs/day x 365 days/yr x 0.9 x $0.025 KWH = $5,913 (use $5,900)

Payback Calculation:

$$\frac{\$100{,}000}{\$9{,}500 + \$9{,}500 - \$5{,}900} = 7.6 \text{ years}$$

Example 2 - Unknown Biosolids Quantities (none given in survey)

Raw Wastewater BOD	=	3,958 lb/day
Raw Wastewater TSS	=	3,500 lb/day

Assume primary clarifiers remove 50% of the TSS and 30% of the BOD

Primary Sludge = 3,500 lb/day x 0.50

	=	1,750 lb/day
Assume VSS	=	75%
VSS	=	1,750 lb/day x 0.75
	=	1,313 lb/day
BOD to Secondary System	=	3,958 lb/day x 0.70
	=	2,771 lb/day
Assume secondary sludge prod.	=	0.9 lb/lb BOD
Secondary Sludge	=	2,771 lb/day x 0.9
	=	2,494 lb/day
Assume VSS	=	70%
VSS	=	2,494 lb/day x 0.70
	=	1,746 lb/day
Total VSS to digester	=	1,313 lb/day + 1,746 lb/day
	=	3059 lb/day

Assume 50% VSS destruction in the digester

VSS Destroyed	=	3,059 lb/day x 0.50
	=	1,530 lb/day

Assume 15-C.F. of digester gas produced per pound of volatile solids destroyed.

Gas Production	=	1,530 lb/day VSS destroyed x 15 C.F./lb
	=	22,950 C.F./day

$$\text{Gas Production (cfm)} = \frac{22{,}950 \text{ C.F./day}}{24 \text{ hr/day} \times 60 \text{ min/hr}} = 15.9 \text{ cfm}$$

Each microturbine will generate 30 KW at a digester gas feed rate of 13.13 cfm.

$$\text{KW Generation Potential} = \frac{15.9 \text{ cfm}}{13.13 \text{ cfm}} \times 30\text{KW} = 36\text{KW}$$

Calculate value of electricity generated at 90% utilization and \$0.04/KWH, using a 30KW microturbine

30KW x 24 hrs/day x 365 days/yr x 0.90 x \$0.04/KWH = \$9,461 (use \$9,500)

Calculate value of heat recovered while operating the microturbine

$$200{,}000 \text{ BTU/hr} \times 24 \text{ hrs/day} \times 365 \text{ days/yr} \times 0.90 \times \frac{\$6.00}{1{,}000{,}000 \text{ BTU}} = \$9{,}461 \text{ (use \$9,500)}$$

Annual O&M costs of operating a microturbine:

30KW x 24hrs/day x 365 days/yr x 0.9 x \$0.025 KWH = \$5,913 (use \$5,900)

Payback Calculation:

$$\frac{\$100{,}000}{\$9{,}500 + \$9{,}500 - \$5{,}900} = 7.6 \text{ years}$$

The results of the digester survey are summarized in Table #1 and are as follows:

A. There are approximately 85 wastewater treatment plants in Wisconsin that use anaerobic digesters. Sixty plants responded to the survey. The 25 remaining plants are too small for cogeneration to be cost effective.

B. The potential to generate 27 KW or more of electricity from digester gas exists at 39 of the 85 facilities. The remaining facilities do not generate enough methane for cogeneration to be cost effective.

C. Of the 39 facilities noted above, enough digester gas is generated at current digester loadings, to generate 6,686 KW of electricity. The annual value of this is \$2,343,000 at \$0.04/KWH. Currently, electricity is generated by 8 of these facilities, or about 3,500 KW, about 50% of the potential available. Ten additional facilities use digester gas to power blowers or pumps. These facilities remove about 1,075 KW from the electric grid when operating on digester gas.

D. There are 27 facilities of the 39 that use digester gas to heat the digester, plant buildings or just flare the gas. The total electrical generation potential at these facilities is 2,437 KW.

E. Current power costs for those providing that information range from \$0.04/KWH to \$0.055/KWH.

V. ELECTRICITY GENERATION OPTIONS

The digester gas can be used as fuel in reciprocating engines or in a microturbine. Each of these prime movers can power a generator to create electricity. Figure 1 shows a typical system to generate electricity from digester gas, with heat recovery.

Typically, digester gas has 600 to 650 BTU/CF. A special carburetor is needed for the reciprocating engine. Also, hydrogen sulfide levels in the gas should be less than 1,000 ppm to prevent corrosion of the engine intervals. Levels above this amount can be removed with an H_2S scrubber. Free moisture from the gas is removed with drip traps in the gas handling system at the wastewater treatment plant. A filter on the gas feed is used to remove particles. Gas pressure to the engine is typically 12 to 15-inches water column.

To minimize maintenance on the engines, it may be necessary to remove siloxanes from the digester gas. Siloxanes are found in the residue of shampoo, hair conditioners and stick deodorants. In the digester, the siloxanes are volatized and go into the digester gas. When combusted in the engines, the siloxane forms into silica dust that clogs and damages the engines' moving parts. Applied Filter Technologies has a commercially available filter to remove the siloxanes from the digester gas. This, plus moisture and particulate removal, should make up a typical gas handling skid prior to the engine. Appendix B contains information on siloxanes and Applied Filter Technology.

A microturbine uses a compressor, recuperator, combustor, turbine and permanent magnet generator. The turbine spins at 96,000 rpm and uses air bearings. Digester gas needs to be compressed to about 15 psig and must be conditioned prior to use via drying and siloxane removal.
Each cogeneration option should be provided with a heat recovery system to recover waste heat from burning the digester gas. Each engine option is about 30% efficient, resulting in 70% of the available energy in the digester gas being rejected as heat. A heat recovery system can recover about 1/3 of the waste heat for use to heat the anaerobic digester.

The microturbines are available in 30 KW units. Multiple units are used to create higher output. Reciprocating engines are available for 100 KW applications or greater. Appendix C contains a cut sheet on the microturbines considered in this report.

VI. PAYBACK ANALYSIS

A payback analysis was undertaken to determine the cost effectiveness of generating electricity from digester gas. The following assumptions form the basis of the analysis:

A. Electricity generated would be used at each wastewater treatment plant to offset energy purchased.

B. Each generating unit would be operated at 90% utilization.

C. Space is available at each wastewater treatment plant to house the generating unit.

D. Heat from the generating unit would be recovered and used to heat the anaerobic digester. A value of $6/mm BTU was assumed. A preliminary heat mass balance shows the heat recovered should be adequate to heat the digester. A detailed heat mass balance would be required at each facility prior to detailed design.

E. Annual O&M for the microturbine was estimated to be $0.025/KWH and for the reciprocating engines $0.015/KWH. These figures were obtained from the respective manufacturers of this equipment and include gas conditioning O&M.

F. Capital costs were obtained from Capstone and Caterpillar for the microturbine and reciprocating engines, respectively. Costs include the generating unit, gas treatment, compressor, heat recovery and installation. Reciprocating engines were used for generators greater than 120KW. All others are based on microturbines.

G. The payback calculation is based upon the following equation:

$$\frac{\text{Capital Cost of Cogeneration + Gas Handling}}{\text{Electricity Savings + Heat Recovery Value - O\&M Costs to Cogenerate \& Scrub Gas}}$$

Payback was calculated at an electric rate savings at $0.04/KWH. Appendix C shows payback for different size generator options. As expected, the payback time is shorter as more electricity is generated due to economy of scale.

The longest payback period was 8 years at $0.04/KWH and one 30 KW unit.

The shortest payback period was 4.8 years at $0.04/KWH and generating 613 KW.

VII. CONCLUSIONS

Based upon the results of the Statewide Digester Survey and the payback analysis using methane to generate electricity, we conclude the following:

A. Eighty-five (85) Municipal Wastewater Treatment Plants use anaerobic digestion to process their biosoilds. Methane, at about 650 BTU/CF is a byproduct of this process.

B. A payback period of 8 years is possible by generating 30 KW of electricity with a microturbine at 90% utilization and an energy cost savings of $0.04/KWH including heat recovery at $6/mm BTU. If heat were not recovered to heat the digester while the engine is operating, the payback would increase to 16 years. Heat recovery is essential to making cogeneration cost effective.

C. Cogeneration is cost effective, with heat recovery, for communities treating wastewater from a minimum population equivalent of 12,000 or about 1 MGD wastewater treatment plant or greater. Communities smaller than this would experience a payback of 10 years or greater if cogeneration were implemented.

D. The payback period for cogeneration is sensitive to the value of the energy saved. If electricity costs were to double to $0.08/KWH, the payback periods noted above would be halved.

E. There are 23 communities that could potentially use digester gas for cogeneration with a payback of 8 years or less. This list is in Appendix D. Together, these plants could generate 2,315 kW of electricity. A project summary sheet for each of these communities is in Appendix E.

VIII. IMPLEMENTATION

Based upon the results of this study, we recommend the following actions be taken by communities' desirous of implementing cogeneration at their wastewater treatment plant:

A. Retain an engineer to develop a more detailed design concept for cogeneration, gas conditioning and heat recovery, specific to the wastewater treatment plant under consideration. Refine capital, O&M costs and energy savings at that time.

B. Prepare plans and specifications for the procurement and installation of a cogeneration system. These documents will require Wisconsin DNR review and approval to obtain a construction permit.

C. Contact the local energy provider to determine financial incentives that may be available to assist with the engineering, construction and installation costs.

D. Become a partner with Focus on Energy to develop an energy management plan for the wastewater utility and to provide funding assistance for the cogeneration project.

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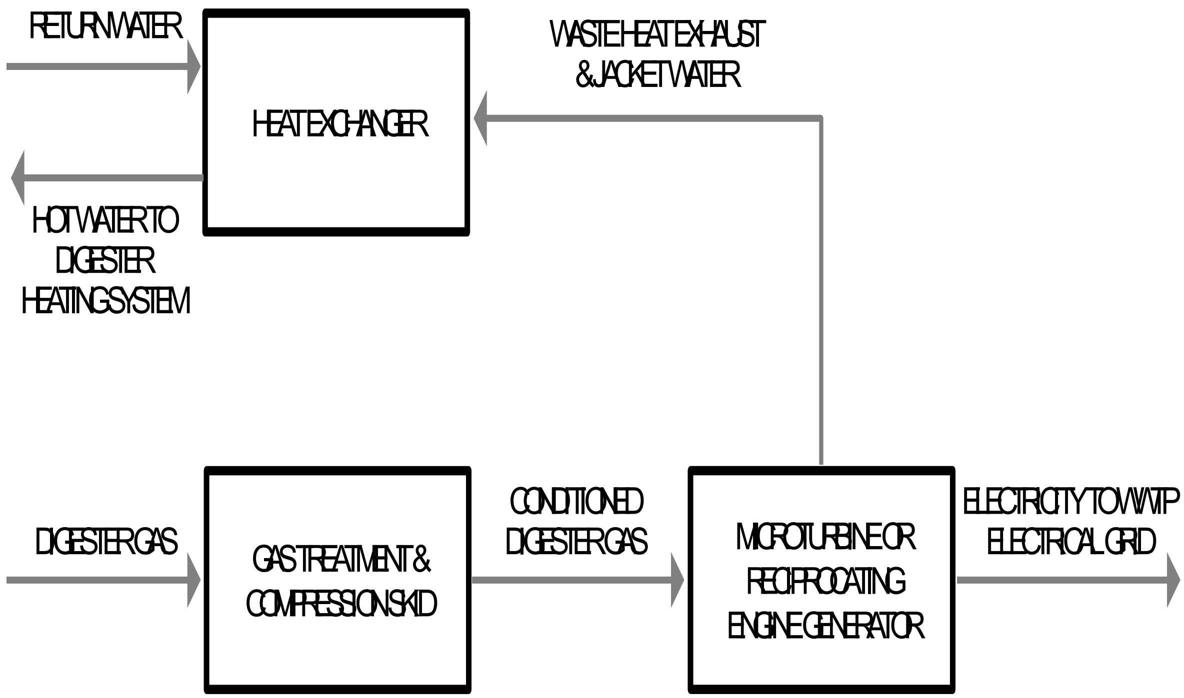

Typical Cogeneration System
With Heat Recovery Utilizing Digester Gas

McMAHON
ASSOCIATES, INC.
ENGINEERS ■ ARCHITECTS
PROJ. MGRS. ■ SURVEYORS

FIGURE 1
ANAEROBIC DIGESTER METHANE TO ENERGY
FOR
WISCONSIN FOCUS ON ENERGY
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Table 1

Summary of Methane Generation Potential

Community	Current Flow MGD	Methane Production CF/Day	Methane Production CFM	KW Generation Potential
1. Milwaukee - South Shore Plant*	100	1,260,500	875	2000
2. Madison*	42	595,000	413.2	944
3. Appleton	14.9	386,200	268.2	613
4. Kenosha**	24	167,400	116.3	266
5. Racine**	29	148,000	102.8	235
6. LaCrosse	10	135,000	93.8	214
7. Neenah-Menasha*	9	130,000	90.3	200
8. Waukesha	9	129,600	90	200
9. Oshkosh	12	116,663	81	185
10. Sheboygan**	12	107,460	74.6	171
11. Beloit	6	101,250	70.3	161
12. Brookfield	8	79,770	55.8	127
13. Wausau**	5	75,000	52	119
14. Manitowoc	7.5	58,740	40.8	93
15. Sturgeon Bay	1.5	57,600	40	90
16. HOVMSD*	5	52,122	36.2	83
17. Eau Claire*	7	49,770	34.6	79
18. Beaver Dam**	3	40,200	27.9	64
19. South Milwaukee	3.5	39,540	27	63
20. Monroe	2.0	33,100	23.0	52
21. Richland Center	1	35,205	24.1	56
22. Stevens Point	3.1	30,240	21	48
23. Rib Mountain	2.4	29,625	21	47
24. Watertown	3.5	29,423	20.4	47
25. Superior	3.28	29,900	20.8	47
26. Menominee	1.6	29,800	20.7	47
27. Burlington*	3.25	27,900	19.4	44
28. West Bend	5	27,368	19	43
29. Oconomowoc	2.1	22,940	15.9	36
30. Sun Prairie*	2.3	22,600	15.7	36
31. Waupaca**	1.1	22,000	15.2	35
32. Chippewa Falls **	2.35	21,200	14.7	34
33. Grafton	1.278	20,940	14.5	33
34. Walcomet **	4.24	19,700	13.7	31
35. Waupun	1.5	19,500	13.5	31
36. Heartland Delafield *	1.85	18,900	13.1	30
37. Jefferson	1.5	17,600	12.2	28
38. Whitewater	1.4	16,939	11.8	27
39. Port Washington **	1.5	17,000	11.8	26
40. Two Rivers**	2	16,900	11.7	27
41. Rice Lake *	1.5	16,400	11.3	26
42. Stoughton	1.5	15,300	10.6	24
43. Merrill	1.2	14,400	10	23
44. Platteville	1.0	13,500	9.4	21
45. Plymouth	1.6	13,000	9	21
46. Marinette	2.3	12,000	8.3	19
47. Jackson	0.9	11,200	7.8	18
48. Algoma	1.0	10,900	7.6	17
49. Portage	1.5	9,850	6.8	16
50. New London	1.2	9,600	6.7	15
51. Hudson	1.3	9,200	6.4	14
52. Black Creek	0.5	7,500	5.2	12
53. Rhinelander	1.1	6,568	4.6	11
54. Mukwanago	0.7	6,700	4.6	11
55. Berlin	0.7	5,200	3.6	8
56. Kiel	0.6	5,600	3.9	9
57. Nekoosa	0.35	2,868	2	4
58. Cashton	0.10	1,800	1.3	3
59. Marathon	0.25	1,320	0.9	2
60. Augusta	0.23	1,250	0.9	2

* Currently Generating Electricity
** Engines on Methane

TABLE 2

SUMMARY OF DIGESTER GAS USAGE

PLANT	DIGESTER GAS HEAT DIGESTER	USAGE HEAT BUILDING	MAKE ELECTRICITY	POWER PUMP OR BLOWER
Algoma	X	X	No	No
Appleton	No	No	No	No
Augusta	No	No	No	No
Beaver Dam	X	X	No	Yes 1-75 HP Blower 1-150HP Blower
Beloit	X	No	No	No
Brookfield	X	X	No	No
Burlington	X	?	Yes	No 1-100KW Generator Currently Not Used
Chippewa Falls	X	X	No	Yes 1 Blower 3,000cfm, 8,000 cf gas/day
Eau Claire	X	x	Yes	No 1-400KW Generator Runs 125HP Blower
Grafton	X	X	No	No
Hartland Delafield	X	X	Yes - 60 KW	No
HOVMSD			No	
Jackson	X	X	No	No
Kenosha	X	X	No	Yes 1-4,900 scfm Blower
LaCrosse	X	?	No	No
Madison	X	X	Yes	1-11800 gpm Pump at 41' TDH
Madison	X	X	Yes	2-475KW Generator 1-Blower 514,000KWH/year Generator 580 BHP Blower
Manitowoc	X	X	No	No
Marathon	X	No	No	No
Marinette	X	X	No	No
Menominee	X	x	No	No
Merrill	X	X	No	No
Mukwanago	X	No	No	No
Neenah-Menasha	X	X	Yes	Yes 1-250KW Genset
New London	X	X	No	No
Oconomowoc	X	No	No	No
Oshkosh	X	X	No	No
Portage	X	X	No	No
Port Washington	X	X	No	Yes 1-300 HP Blower
Plymouth	X	X	No	No
Racine	X	X	No	Yes Blowers 16--/day 1 at 15,000 cfm, 1 at 11,000 1 at 9,000 cfm
Rice Lake	X	X	Yes - 150 KW	No
Richland Center	No	No	No	No
Sheboygan	X	X	No	Yes 1-20" Raw Pump, 500HP Cat----
South Milwaukee	X	No	No	No
Stevens Point	X	No	No	No
Sun Prairie	X	X	Yes-Microturbine 30 KW 1-60 KW Genset	No 1-60KW Genset 1440 KWH/day 30,000 to 43,400 KWH/mo
Two Rivers	No	No	No	Yes - 1-100HP Blower When Gas is Available
Walcomet	X	X	No	Yes - 2-40HP, 1-30HP Pump
Watertown	No	No	No	No
Waupaca	X	X	No	Yes-Blower
Waupun	X	X	No	No
Wausau	X	X	No	Yes - 1-250HP Blower
West Bend	X	X	No	No
Whitewater	X	No	No	No

X = Yes

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APPENDIX A

Anaerobic Digestion Survey

First Name	Last Name	Company Name	Address Line 1	Address Line 2	City	State	ZIP Code
Butch	Boris	Abbotsford WWTF	504 East Linden		Abbotsford	WI	54405
Pat	Zastrow	Algoma WWTF	179 North 6th Street		Algoma	WI	54201
Jeff	Gaede	Alma Center, Village of	200 North Church Street		Alma Center	WI	54611
Jessica	Garrat	Appleton WWTP	2006 East Newberry Street		Appleton	WI	54915
Kim	Krueger	Augusta WWTP	P.O. Box		Augusta	WI	54722
Don	Quarford	Beaver Dam WWTP	108 Myrtle Road		Beaver Dam	WI	53916
Emil	Benz	Beloit WPCF	2301 State Line Road		Beloit	WI	53511
Richard	Keller	Berlin Municipal WWTP	City Hall, 108 North Capron Street	P.O. Box 272	Berlin	WI	54923
Michael	Kwiatkowski	Black Creek WWTP	P.O. Box 277		Black Creek	WI	54106
Ron	Eifler	Brookfield Fox River WPCC	21225 Enterprise Avenue		Brookfield	WI	53045
Connie	Wilson	Burlington WWTP	City Hall, 300 North Pine Street		Burlington	WI	53105
Robert	Schye	Cashton WWTP	811 Main Street	P.O. Box 188	Cashton	WI	54619
Mike	McGinnis	Chetek Wastewater Plant	210 Water Street		Chetek	WI	54728
John	Allen	Chippewa Falls WWTP	30 West Central Street		Chippewa Falls	WI	54729
Bob	Hyde	Delafield-Hartland WPCF	416 Butler Drive	P.O. Box 180107	Delafield	WI	53018
James	Krueger	Denmark WWTP	400 Mahlik Lane		Denmark	WI	54208
Dale	Neis	Dickeyville WPCF	400 Rita Avenue		Dickeyville	WI	53808
Gary	Sweeney	Durand WWTP	104 East Main Street	P.O. Box 202	Durand	WI	54736
Craig	Hendrickson	Eau Claire WWTP	1000 Ferry Street		Eau Claire	WI	54703
Roger	Oren	Edgerton WWTP	12 Albion Street		Edgerton	WI	53534
Wilber	Salzwedel	Ettrick WWTF	22864 North Main Street		Ettrick	WI	54627
Tony	Rosemeyer	Fennimore WWTP	860 Lincoln Avenue		Fennimore	WI	53809
Dean	Donner	Fontana-Walworth Water Pollution Control	P.O. Box 850		Walworth	WI	53184
Ronald	Childs	Footville WWTP	156 Depot Street	P.O. Box 445	Footville	WI	53537
Tom	Krueger	Grafton Water and Wastewater	1900 9th Avenue		Grafton	WI	53024
Glen	Geurts	Heart of the Valley MSD	801 Thilmany Road		Kaukauna	WI	54130
James	Schreiber	Hudson Sewage Treatment Plant	City Hall	505 3rd Street	Hudson	WI	54016

First Name	Last Name	Company Name	Address Line 1	Address Line 2	City	State	ZIP Code
Jeff	Deitsch	Jackson Sewage Treatment Plant	W194 N16658 Eagle Drive		Jackson	WI	53037
Michael	Kelly	Jefferson WWTP	221 East Henry Street		Jefferson	WI	53549
Kerry	Gloss	Kenosha, City of, Water Utility	4401 Green Bay Road		Kenosha	WI	53140
Michael	Geurts	Kiel WWTF	100 Park Street		Kiel	WI	53042
Greg	Paul	La Crosse Wastewater Utility	905 Houska Park Drive		La Crosse	WI	54601
Randy	Herwig	Lodi WPCF	113 South Main Street		Lodi	WI	53555
Paul	Nehm	Madison MSD	1610 Moorland Road		Madison	WI	53713
Ronald	Clish	Manitowoc WWTF	P.O. Box 1597		Manitowoc	WI	53713
Larry	Heindl	Marathon WWTP	104 Chestnut Street	P.O. Box 487	Marathon	WI	54448
Warren	Howard	Marinete WWTP	1905 Hall Avenue	P.O. Box 135	Marinette	WI	54143
Edward	Jenson	Menomonie WWTP	City Hall	800 Wilson Street	Menomonie	WI	54751
Thomas	Rein	Merrill WWTF	1004 East First Street		Merrill	WI	54452
Forrest	Perry	Milton, City of	402 North Street		Milton	WI	53563
Frank	Munsey	Milwaukee MSD	8500 South Fifth Avenue		Oak Creek	WI	53154
Gerald	Ellefson	Monroe WWTF	1224 10th Avenue West		Monroe	WI	53566
Ronald	Oblinski	Mukwonago WWTP	1200 Holz Drive	P.O. Box 96	Mukwonago	WI	53149
Randall	Much	Neenah-Menasha Sewerage Commission	101 Garfield Avenue		Menasha	WI	54956
Mark	Schraeder	Nekoosa WWTP	1348 Point Basse Avenue		Nekoosa	WI	54457
Robert	Yarrock	New Lisbon WWTF	218 East Bridge Street		New Lisbon	WI	53950
Louis	Dresen	New London Wastewater Plant	215 North Shawano Street		New London	WI	54961
Stephen	Zigman	Niagara WWTF	1029 Roosevelt Road		Niagara	WI	54151
Tom	Steinbach	Oconomowoc WWTP	900 South Worthington Street		Oconomowoc	WI	53066
Bob	Peiterson	Oconto Falls Sewage Disposal Commission	104 South Franklin Street	P.O. Box 70	Oconto Falls	WI	54154
Tom	Konrad	Oshkosh WWTP	P.O. Box 1130		Oshkosh	WI	54903-1130
David	Knetter	Platteville WWTF	West Greenwood Avenue		Platteville	WI	53818
Larry	Zickert	Plymouth Utilities Commission	12 South Milwaukee Street	P.O. Box 277	Plymouth	WI	53073

First Name	Last Name	Company Name	Address Line 1	Address Line 2	City	State	ZIP Code
Joseph	Mueller	Port Washington WWTP	450 North Lake Street		Port Washington	WI	53074
Skip	Poster	Portage WWTF	1600 East Wisconsin Street		Portage	WI	53901
Joe	Mandala	Racine WWTP	2101 South Wisconsin Avenue		Racine	WI	53403
Thomas	Scanlon	Reesdburg WWTP	802 Division Street		Reedsburg	WI	53959
John	Zatopa	Rhinelander WWTP	City Hall	P.O. Box658	Rhinelander	WI	54501
Ken	Johnson	Rib Mountain MSD	2001 Aster Road		Wausau	WI	54403
Wally	Thom	Rice Lake WWTP	1112 South Wsconsin Avenue		Rice Lake	WI	54868
Michael	Meyer	Richland Center WWTP	P.O. Box 312		Richland Center	WI	53581
Michael	Bryant	Saint Croix Falls WWTP	710 Hwy 35 South		Saint Croix Falls	WI	54024
Bradley	Zautcke	Salem Utility Districts	28733 Wilmot Road		Trervor	WI	53179
Dale	Doerr	Sheboygan WWTP	3333 Lake Shore Drive		Sheboygan	WI	53081
Ed	Rymer	Sheldon WWTP	W5011 Co. V		Sheldon	WI	54766
Duane	DeBoer	South Milwaukee WWTF	3003 Fifth Avenue		South Milwaukee	WI	53172
Bob	Bronecki	South Shore WWTP	8500 South 5th Avenue		Oak Creek	WI	53154
Tom	Adams	Sparta WWTF	201 West Oak Street		Sparta	WI	54656
Tim	Howe	Spring Valley, Village of	P.O. Box 276		Spring Valley	WI	54767
Don	Ceplina	Stevens Point WWTP	301 Bliss Avenue		Stevens Point	WI	54481
John	Lynch	Stoughon Municipal Wastewater	P.O. Box 383		Stoughton	WI	53589
Roy	LaViolette	Sturgeon Bay Utilities	230 East Vine Street	P.O. Box 259	Sturgeon Bay	WI	54235
William	Mattke	Sullivan WWTF	624 Bakertown Drive		Sullivan	WI	53178
John	Krug	Sun Prarie WPCF	300 East Main Street		Sun Prarie	WI	53590
Mark	Drake	Superior Sewage Disposal System	1407 Hammond		Superior	WI	54880
Michael	Thiel	Tigerton WWTP	221 Birch Street		Tigerton	WI	54486
Robert	Coey	Tomahawk WWTF	N9183 Ct. S		Tomahawk	WI	54487
Lawrence	Lambries	Two Rivers WWTF	1415 Lake Street		Two Rivers	WI	54241
Alan	Budworth	Viroqua Sewage Treatment Plant	City Hall	202 North Main Street	Viroqua	WI	54665
Stephen	Miller	Walworth County MSD	975 West Walworth Avenue		Delevan	WI	53115
Paul	Lange	Watertown WWTP	800 Hoffmann Drive	P.O. Box 477	Watertown	WI	53094

First Name	Last Name	Company Name	Address Line 1	Address Line 2	City	State	ZIP Code
Pete	Conine	Waukesha, City of	600 Sentry Drive		Waukesha	WI	53186
Paul	Springsteen	Waupaca Regional WWTP	111 South Main Street		Wupaca	WI	54981
Glen	McCarty	Waupun Public Utilties	220 North Forest		Waupun	WI	53963
Gus	Strehlo	Wausau Sewage Utility	City Hall	407 Grant Street	Wausau	WI	54401
James	Hron	West Bend, City of	512 Municipal Drive		West Bend	WI	53095
Brad	Tuttle	Whitewater Wastewater Division	P.O. Box 178		Whitewater	WI	53190
Jeffrey	Schiegel	Whiting WWTP	3600 Church Street		Whiting	WI	54481
Tom	Zager	Wisconsin Rapids Wastewater Utility	2540 First Street South		Wisconsin Rapids	WI	54494

June 17, 2002

Re: Anaerobic Digestion
Methane to Energy
McM. No. W0937-920459

Dear Mike:

Wisconsin Focus On Energy has contracted with McMahon Associates, Inc. to assess the cost effectiveness of generating electricity from anaerobic digesters located at municipal wastewater treatment plants. This assessment will consider the use of packaged congeneration systems consisting of a generator, driven by a reciprocating engine or micro turbine, with gas treatment and heat recovery systems. The study will determine where this technology makes economic sense, and will develop a priority list of projects and implementation plan for each community where economics favor these systems.

The implementation plan will consider financial incentives from Focus On Energy and local electric utilities in the form of grants, buy down dollars and favorable power purchase rates. At the completion of this project, we will furnish all project participants with a final report and a project summary sheet specific to your community where economics are feasible.

In order for us to make this assessment, we need your help in the form of furnishing us with information on your wastewater treatment plant. Enclosed is a survey we request you fill out and return to us. Call me if you have questions or would like me to visit your site to obtain and pick up the data. We request you furnish us with the completed survey by July 31, 2002.

I look forward to working with you on this exciting opportunity. Please contact me if you have any questions.

Very truly yours,
McMahon Associates, Inc.

Thomas E. Vik, P.E., DEE
Vice President

TEV:als
cc: Charlie Higley - Wisconsin Focus On Energy

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STATE-WIDE SURVEY
ANAEROBIC DIGESTION – METHANE TO ENERGY
WISCONSIN FOCUS ON ENERGY

I. GENERAL INFORMATION

Wastewater Treatment Plant Address: ______________________________

____

____

____

Wastewater Treatment Plant Superintendent: ______________________________

Person Answering Survey: ______________________________

Telephone Number: ______________________________

Fax Number (if applicable): ______________________________

E-Mail Address (if applicable): ______________________________

Director Of Public Works: ______________________________

Address Of Director Of Public Works: ______________________________

____

____

Mayor / Village President: ______________________________

City Hall / Village Hall Address: ______________________________

____

____

Electric Utility: ______________________________

Telephone Number: ______________________________

(Please attach a photocopy of one month's electricity bill to this survey.)

II. PLANT DATA

	Current	Design
Average Flow, mgd		
Average BOD, lbs./day		
Average TSS, lbs./day		

(Please attach Year 2001 CMAR to this survey.)

Unit Processes:
(Please attach a flow schematic of the plant to this survey.)

Effluent Limits:
(Please attach a photocopy of the WPDES permit page, which indicates effluent limits.)

Current Sludge Data:

Primary Sludge To Digester:

Average Flow, gpd: __________
Average Percent Solids: __________
Average lbs./day: __________
VSS, %: __________
Is WAS wasted to the primaries: ☐ Yes ☐ No
If YES, do the values above include WAS: ☐ Yes ☐ No

WAS To Digester:

Average Flow, gpd: __________
Average Percent Solids: __________
Average lbs./day: __________
Is the WAS pre-thickened? ☐ Yes ☐ No
If YES, how? __________

Total Sludge To Digester:

Average Flow, gpd: __________
Average Percent Solids: __________
Average lbs./day: __________
VSS, %:
Is total flow to digester measured? ☐ Yes ☐ No
If YES, how? __________

Anaerobic Digester Data:

Number Of Primary Digesters: ______________________
Dimensions Each Unit, feet: ______________________
Diameter: ______________________
Sidewater Depth: ______________________
Cone Depth: ______________________
Volume, each unit, gallons: ______________________
Type Of Mixing System: ______________________
Operating Temperature, ºF: ______________________

Boiler Name: ______________________
Capacity, Btu/Hour: ______________________
Fuel:
Digester Gas? ☐ Yes ☐ No
Natural Gas? ☐ Yes ☐ No

Is Natural Gas Used To Heat The Digester? ☐ Yes ☐ No
If YES, *attach a photocopy 2001 of natural gas bills.*

Is Digester Gas Metered? ☐ Yes ☐ No
If YES, *supply volume on a monthly basis for 2001.*

Is Digester Gas Tested For Methane/CO_2/'H_2S Content? ☐ Yes ☐ No
If YES, *attach a photocopy of test results*.

Is Digester Gas Used For Other Purposes? ☐ Yes ☐ No
Building Heat? ☐ Yes ☐ No
Power A Blower? ☐ Yes ☐ No
Power A Pump? ☐ Yes ☐ No
Generate Electricity? ☐ Yes ☐ No

If YES to any of the above, *please provide the size of the blower or pump operated, hours/day of operation on digester gas, size of generator, kWh produced per day and month, and whether waste heat is recovered and reused*.

Secondary Digesters:

Number Of Units: ______________________

Dimensions, each unit:

Diameter: ______________________

Sidewater Depth: ______________________

Cone Depth: ______________________

Volume, each unit, gallons: ______________________

Mixing System ☐ Yes ☐ No

If YES, type? ______________________

Heated Or Unheated? ☐ Yes ☐ No

Digested Sludge Characteristics:

Volume, gpd: ______________________

Mass, lbs./day: ______________________

Percent Solids: ______________________

Percent VSS: ______________________

Class A? ☐ Yes ☐ No

Class B? ☐ Yes ☐ No

Total Volume Land Applied, mg/year ______________________

If Dewatered, cubic yards/year: ______________________

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APPENDIX B

Siloxane Removal Information

Refer to web site: *http://www.appliedfiltertechnology.com/SAGTech.htm*
http://www.*applied*filtertechnology.com/Siloxane_basics.htm
http://www.appliedfiltertechnology.com/Siloxane_problems.htm
http://www.appliedfiltertechnology.com/Products.htm

APPENDIX C

Capstone MicroTurbine

Refer to web site: *http://www.microturbine*.com

APPENDIX D

Communities That Should Consider
Electrical Generation From Digester Gas

APPENDIX D

COMMUNITIES THAT SHOULD CONSIDER ELECTRICAL GENERATION FROM DIGESTER GAS

COMMUNITY	KW GENERATION POTENTIAL	CAPITAL COST	ANNUAL SAVINGS	PAYBACK
Appleton	613	$1,500,000	$330,200	4.8
LaCrosse	214	$710,000	$109,700	6.7
Waukesha*	200	$663,000	$99,300	6.7
Oshkosh	185	$610,000	$92,300	6.6
Beloit	161	$400,000	$62,100	6.4
Brookfield	127	$325,000	$51,900	6.3
Manitowoc	93	$250,000	$37,500	7.0
Sturgeon Bay	90	$250,000	$37,500	7.0
South Milwaukee	63	$250,000	$36,500	6.8
Richland Center	56	$175,000	$25,000	7.0
Monroe	52	$175,000	$25,000	7.0
Stevens Point	48	$100,000	$12,500	8.0
Rib Mountain	47	$175,000	$25,000	7.0
Superior	47	$175,000	$25,000	7.0
Watertown	47	$100,000	$12,500	8.0
Menomonie	47	$100,000	$12,500	8.0
West Bend	43	$100,000	$12,500	8.0
Oconomowoc	36	$175,000	$25,000	7.0
Grafton	33	$100,000	$12,500	8.0
Waupun	31	$100,000	$12,500	8.0
Platteville	30	$100,000	$12,500	8.0
Stoughton	30	$100,000	$12,500	8.0
Jefferson	28	$100,000	$12,500	8.0
Two Rivers	27	$100,000	$11,250	8.9
Whitewater	27	$100,000	$11,250	8.9

* Cost opinion and annual savings are based on a Focus On Energy study dated September 19, 2002.

APPENDIX E

Project Summary Sheets

COMMUNITY: APPLETON

Current Loadings	Current
Flow, MGD	14.9
BOD, lb/day	24,193
TSS, lb/day	53,672
Solids To Digester, lb/day	85,620
Methane Generation	
Volatile Solids Destroyed, lb/day	23,400
Gas Produced, cf/day	386,200
Cogeneration Potential	
Continuous KW Generation Capacity	613
Heat Recovery Potential, BTU/hr	4,100,000
Cost Issues	
Annual Energy Cost Savings	$193,300
Annual Recovered Heat Value	$193,300
Annual O&M Cogeneration Costs	$56,400
Net Annual Savings	$330,200
Cogeneration Capital Cost Estimate	$1,500,000
Project Payback, years	4.5

Contact: Jessica Garrat
Address: 2006 E. Newberry Street
Appleton, WI 54915
Telephone No. (920) 832-5945

COMMUNITY: BELOIT

Current Loadings	Current
Flow, MGD	6
BOD, lb/day	16,360
TSS, lb/day	9,498
Solids To Digester, lb/day	18,000
Methane Generation	
Volatile Solids Destroyed, lb/day	6,750
Gas Produced, cf/day	101,250
Cogeneration Potential	
Continuous KW Generation Capacity	161
Heat Recovery Potential, BTU/hr	1,000,000
Cost Issues	
Annual Energy Cost Savings	$47,300
Annual Recovered Heat Value	$47,300
Annual O&M Cogeneration Costs	$32,500
Net Annual Savings	$62,100
Cogeneration Capital Cost Estimate	$400,000
Project Payback, years	6.4

Contact: Howard Hemmer
Address: 3629 S. Walters Road
Beloit, WI 53511
Telephone No. (608) 364-2982

COMMUNITY: BROOKFIELD

Current Loadings	Current
Flow, MGD	8
BOD, lb/day	9,875
TSS, lb/day	12,210
Solids To Digester, lb/day	14,500
Methane Generation	
Volatile Solids Destroyed, lb/day	5,300
Gas Produced, cf/day	79,500
Cogeneration Potential	
Continuous KW Generation Capacity	127
Heat Recovery Potential, BTU/hr	800,000
Cost Issues	
Annual Energy Cost Savings	$37,800
Annual Recovered Heat Value	$37,800
Annual O&M Cogeneration Costs	$23,700
Net Annual Savings	$51,900
Cogeneration Capital Cost Estimate	$325,000
Project Payback, years	6.3

Contact: Ron Eifler
Address: P.O. Box 1296
Brookfield, WI 53008-1296
Telephone No. (262) 798-8631

COMMUNITY: GRAFTON

Current Loadings	Current
Flow, MGD	1.278
BOD, lb/day	2,333
TSS, lb/day	2,918
Solids To Digester, lb/day	3,773
Methane Generation	
Volatile Solids Destroyed, lb/day	1,400
Gas Produced, cf/day	21,000
Cogeneration Potential	
Continuous KW Generation Capacity	33
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$5,900
Net Annual Savings	$13,100
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	7.6

Contact: Tom Krueger
Address: 1900 9th Avenue
Grafton, WI 53024
Telephone No. (262) 375-5330

COMMUNITY: LACROSSE

Current Loadings	Current
Flow, MGD	10
BOD, lb/day	20,564
TSS, lb/day	14,300
Solids To Digester, lb/day	19,000
Methane Generation	
Volatile Solids Destroyed, lb/day	9,500
Gas Produced, cf/day	142,500
Cogeneration Potential	
Continuous KW Generation Capacity	214
Heat Recovery Potential, BTU/hr	1,426,700
Cost Issues	
Annual Energy Cost Savings	$67,500
Annual Recovered Heat Value	$67,500
Annual O&M Cogeneration Costs	$25,300
Net Annual Savings	$109,700
Cogeneration Capital Cost Estimate	$710,000
Project Payback, years	6.7

Contact: Greg Paul
Address: 905 Houska Park Drive
LaCrosse, WI 54601
Telephone No. (608) 789-7322

COMMUNITY: MANITOWOC

Current Loadings	Current
Flow, MGD	7.5
BOD, lb/day	17,419
TSS, lb/day	11,068
Solids To Digester, lb/day	11,200
Methane Generation	
Volatile Solids Destroyed, lb/day	3,900
Gas Produced, cf/day	58,700
Cogeneration Potential	
Continuous KW Generation Capacity	90
Heat Recovery Potential, BTU/hr	600,000
Cost Issues	
Annual Energy Cost Savings	$28,500
Annual Recovered Heat Value	$28,500
Annual O&M Cogeneration Costs	$19,500
Net Annual Savings	$37,500
Cogeneration Capital Cost Estimate	$250,000
Project Payback, years	6.7

Contact: Ronald Clish
Address: P.O. Box 1597
Manitowoc,WI 54221
Telephone No. (920) 683-4516

COMMUNITY: MENOMONIE

Current Loadings	Current
Flow, MGD	1.6
BOD, lb/day	4,670
TSS, lb/day	4,670
Solids To Digester, lb/day	5,300
Methane Generation	
Volatile Solids Destroyed, lb/day	2,000
Gas Produced, cf/day	30,000
Cogeneration Potential	
Continuous KW Generation Capacity	30
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$6,500
Net Annual Savings	$12,500
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8

Contact: Edward Jenson
Address: City Hall, 800 Wilson Street
Menomonie, WI 54751
Telephone No. (715) 232-2175

COMMUNITY: MONROE

Current Loadings	Current
Flow, MGD	2.0
BOD, lb/day	7,000
TSS, lb/day	2,800
Solids To Digester, lb/day	5,900
Methane Generation	
Volatile Solids Destroyed, lb/day	2,200
Gas Produced, cf/day	33,000
Cogeneration Potential	
Continuous KW Generation Capacity	60
Heat Recovery Potential, BTU/hr	400,000
Cost Issues	
Annual Energy Cost Savings	$19,000
Annual Recovered Heat Value	$19,000
Annual O&M Cogeneration Costs	$13,000
Net Annual Savings	$25,000
Cogeneration Capital Cost Estimate	$175,000
Project Payback, years	7

Contact: Gerald Ellefson
Address: 1224 10th Avenue West
Monroe, WI 53566
Telephone No. (608) 329-2590

COMMUNITY: OCONOMOWOC

Current Loadings	Current
Flow, MGD	2.1
BOD, lb/day	3,958
TSS, lb/day	3,500
Solids To Digester, lb/day	4,250
Methane Generation	
Volatile Solids Destroyed, lb/day	1,529
Gas Produced, cf/day	22,940
Cogeneration Potential	
Continuous KW Generation Capacity	36
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$6,500
Net Annual Savings	$12,500
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8

Contact: Tom Steinbach
Address: 900 S. Worthington Street
Oconomowoc, WI 53066
Telephone No. (262) 569-2192

COMMUNITY: OSHKOSH

Current Loadings	Current
Flow, MGD	12
BOD, lb/day	17,200
TSS, lb/day	17,300
Solids To Digester, lb/day	20,700
Methane Generation	
Volatile Solids Destroyed, lb/day	7,800
Gas Produced, cf/day	117,000
Cogeneration Potential	
Continuous KW Generation Capacity	185
Heat Recovery Potential, BTU/hr	1,230,000
Cost Issues	
Annual Energy Cost Savings	$58,300
Annual Recovered Heat Value	$58,300
Annual O&M Cogeneration Costs	$24,300
Net Annual Savings	$92,300
Cogeneration Capital Cost Estimate	$610,000
Project Payback, years	6.6

Contact: Thomas J. Konrad
Address: P.O. Box 1130
Oshkosh, WI 54903-1130
Telephone No. (920) 232-5365

COMMUNITY: RIB MOUNTAIN

Current Loadings	Current
Flow, MGD	2.4
BOD, lb/day	5,500
TSS, lb/day	-
Solids To Digester, lb/day	5,450
Methane Generation	
Volatile Solids Destroyed, lb/day	2,000
Gas Produced, cf/day	30,000
Cogeneration Potential	
Continuous KW Generation Capacity	60
Heat Recovery Potential, BTU/hr	400,000
Cost Issues	
Annual Energy Cost Savings	$19,000
Annual Recovered Heat Value	$19,000
Annual O&M Cogeneration Costs	$13,000
Net Annual Savings	$25,000
Cogeneration Capital Cost Estimate	$175,000
Project Payback, years	7

Contact: Ken Johnson
Address: 2001 Aster Road
Wausau, WI 54403
Telephone No. (715) 359-7852

COMMUNITY: RICHLAND CENTER

Current Loadings	Current
Flow, MGD	1.0
BOD, lb/day	5,194
TSS, lb/day	3,294
Solids To Digester, lb/day	7,200
Methane Generation	
Volatile Solids Destroyed, lb/day	2,300
Gas Produced, cf/day	34,500
Cogeneration Potential	
Continuous KW Generation Capacity	50
Heat Recovery Potential, BTU/hr	
Cost Issues	
Annual Energy Cost Savings	$19,000
Annual Recovered Heat Value	$19,000
Annual O&M Cogeneration Costs	$13,000
Net Annual Savings	$25,000
Cogeneration Capital Cost Estimate	$175,000
Project Payback, years	7

Contact: Michael Meyer
Address: P.O. Box 312
Richland Center, WI 53581
Telephone No. (608) 647-3917

COMMUNITY: SOUTH MILWAUKEE

Current Loadings	Current
Flow, MGD	3.5
BOD, lb/day	6,130
TSS, lb/day	6,860
Solids To Digester, lb/day	7,292
Methane Generation	
Volatile Solids Destroyed, lb/day	2,636
Gas Produced, cf/day	39,540
Cogeneration Potential	
Continuous KW Generation Capacity	63
Heat Recovery Potential, BTU/hr	400,000
Cost Issues	
Annual Energy Cost Savings	$19,000
Annual Recovered Heat Value	$19,000
Annual O&M Cogeneration Costs	$13,000
Net Annual Savings	$25,000
Cogeneration Capital Cost Estimate	$175,000
Project Payback, years	7

Contact: Duane DeBoer
Address: 3003 Fifth Avenue
South Milwaukee, WI 53172
Telephone No. (414) 768-8180

COMMUNITY: STEVENS POINT

Current Loadings	Current
Flow, MGD	3.1
BOD, lb/day	7,538
TSS, lb/day	6,683
Solids To Digester, lb/day	7,200
Methane Generation	
Volatile Solids Destroyed, lb/day	2,000
Gas Produced, cf/day	30,000
Cogeneration Potential	
Continuous KW Generation Capacity	30
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$6,500
Net Annual Savings	$12,500
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8

Contact: Don Ceplina
Address: 301 Bliss Avenue
Stevens Point, WI 54481
Telephone No. (715) 345-5262

COMMUNITY: STURGEON BAY UTILITIES

Current Loadings	Current
Flow, MGD	
BOD, lb/day	
TSS, lb/day	
Solids To Digester, lb/day	
Methane Generation	
Volatile Solids Destroyed, lb/day	
Gas Produced, cf/day	57,600
Cogeneration Potential	
Continuous KW Generation Capacity	91
Heat Recovery Potential, BTU/hr	600,000
Cost Issues	
Annual Energy Cost Savings	$28,500
Annual Recovered Heat Value	$28,500
Annual O&M Cogeneration Costs	$19,500
Net Annual Savings	$37,500
Cogeneration Capital Cost Estimate	$250,000
Project Payback, years	6.7

Contact: Roy LaViolette
Address: 230 E. Vine Street / P.O. Box 259
Sturgeon Bay, WI 54235
Telephone No. (920) 746-2820

COMMUNITY: SUPERIOR

Current Loadings	Current
Flow, MGD	3.28
BOD, lb/day	3,487
TSS, lb/day	5,608
Solids To Digester, lb/day	6,230
Methane Generation	
Volatile Solids Destroyed, lb/day	2,000
Gas Produced, cf/day	30,000
Cogeneration Potential	
Continuous KW Generation Capacity	60
Heat Recovery Potential, BTU/hr	400,000
Cost Issues	
Annual Energy Cost Savings	$19,000
Annual Recovered Heat Value	$19,000
Annual O&M Cogeneration Costs	$13,000
Net Annual Savings	$25,000
Cogeneration Capital Cost Estimate	$175,000
Project Payback, years	7

Contact: Mark Drake
Address: 1407 Hammond
Superior, WI 54880
Telephone No. (715) 394-0251

COMMUNITY: TWO RIVERS

Current Loadings	Current
Flow, MGD	2.0
BOD, lb/day	2,669
TSS, lb/day	3,002
Solids To Digester, lb/day	3,000
Methane Generation	
Volatile Solids Destroyed, lb/day	1,125
Gas Produced, cf/day	16,900
Cogeneration Potential	
Continuous KW Generation Capacity	27
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$8,550
Annual Recovered Heat Value	$8,550
Annual O&M Cogeneration Costs	$5,850
Net Annual Savings	$11,250
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8.9

Contact: Lawrence L. Lambries
Address: 1415 Lake Street
Two Rivers, WI 54241
Telephone No. (920) 793-5558

COMMUNITY: WATERTOWN

Current Loadings	Current
Flow, MGD	3.5
BOD, lb/day	3,800
TSS, lb/day	3,900
Solids To Digester, lb/day	4,700
Methane Generation	
Volatile Solids Destroyed, lb/day	2,000
Gas Produced, cf/day	30,000
Cogeneration Potential	
Continuous KW Generation Capacity	30
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$6,500
Net Annual Savings	$12,500
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8

Contact: Paul A. Lange
Address: 800 Hoffmann Drive / Box 477
Watertown, WI 53094
Telephone No. (920) 262-4085

COMMUNITY: WAUPUN

Current Loadings	Current
Flow, MGD	1.5
BOD, lb/day	3,300
TSS, lb/day	-
Solids To Digester, lb/day	3,500
Methane Generation	
Volatile Solids Destroyed, lb/day	1,300
Gas Produced, cf/day	19,500
Cogeneration Potential	
Continuous KW Generation Capacity	30
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$6,500
Net Annual Savings	$12,500
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8

Contact: Glen McCarty
Address: 220 North Forest
Waupun, WI 53963
Telephone No. (920) 324-7920

COMMUNITY: WEST BEND

Current Loadings	Current
Flow, MGD	5
BOD, lb/day	4,706
TSS, lb/day	7,095
Solids To Digester, lb/day	5,200
Methane Generation	
Volatile Solids Destroyed, lb/day	1,800
Gas Produced, cf/day	27,200
Cogeneration Potential	
Continuous KW Generation Capacity	43
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$9,500
Annual Recovered Heat Value	$9,500
Annual O&M Cogeneration Costs	$6,500
Net Annual Savings	$12,500
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8

Contact: James Hron
Address: 512 Municipal Drive
West Bend, WI 53095
Telephone No. (262) 334-3925

COMMUNITY: WHITEWATER

Current Loadings	Current
Flow, MGD	1.4
BOD, lb/day	2,802
TSS, lb/day	4,192
Solids To Digester, lb/day	
Methane Generation	
Volatile Solids Destroyed, lb/day	1,129
Gas Produced, cf/day	16,939
Cogeneration Potential	
Continuous KW Generation Capacity	27
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$8,550
Annual Recovered Heat Value	$8,550
Annual O&M Cogeneration Costs	$5,850
Net Annual Savings	$11,250
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8.9

Contact: Brad Tuttle
Address: P.O. Box 178
Whitewater, WI 53190
Telephone No. (262) 473-5920

COMMUNITY: WAUKESHA

Current Loadings	Current
Flow, MGD	1.4
BOD, lb/day	2,802
TSS, lb/day	4,192
Solids To Digester, lb/day	
Methane Generation	
Volatile Solids Destroyed, lb/day	1,129
Gas Produced, cf/day	16,939
Cogeneration Potential	
Continuous KW Generation Capacity	27
Heat Recovery Potential, BTU/hr	200,000
Cost Issues	
Annual Energy Cost Savings	$8,550
Annual Recovered Heat Value	$8,550
Annual O&M Cogeneration Costs	$5,850
Net Annual Savings	$11,250
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8.9

Contact: Peter Conine
Address: 600 Sentry Drive
Waukesha, WI 53186
Telephone No. (262) 524-3626

COMMUNITY: JEFFERSON

Current Loadings	Current
Flow, MGD	1.5
BOD, lb/day	4,000
TSS, lb/day	2,100
Solids To Digester, lb/day	3,000
Methane Generation	
Volatile Solids Destroyed, lb/day	1,170
Gas Produced, cf/day	17,550
Cogeneration Potential	
Continuous KW Generation Capacity	28
Heat Recovery Potential, BTU/hr	207,400
Cost Issues	
Annual Energy Cost Savings	$8,906
Annual Recovered Heat Value	$8,900
Annual O&M Cogeneration Costs	$5,850
Net Annual Savings	$950
Cogeneration Capital Cost Estimate	$100,000
Project Payback, years	8.4

Contact:	Michael Kelly
Address:	Jefferson Wastewater Treatment Plant 221 East Henry Street Jefferson, WI 53549
Telephone No.	(920) 674-7705