

# **BCHP Baseline Analysis for the Wisconsin Market**

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## **Table of Contents**

Executive Summary.....	1
1. Introduction and Purpose .....	1
2. BCHP Contacts in Wisconsin .....	2
2.1 Key Wisconsin Firms with BCHP Project Experience or Capabilities .....	2
2.2 Associations and Organizations Involved with BCHP Deployment .....	3
3. Survey of BCHP Installations and BCHP Targets in Wisconsin .....	5
3.1 Survey Summary.....	5
3.2 Sector Analysis of the Survey Data .....	5
4. Current Pricing Issues .....	8
4.1 Equipment and Maintenance Costs .....	8
4.2 Electric Pricing .....	9
5. Summary and Status of BCHP Policy Issues .....	11
5.1 PSC Report to the Legislature, December 2000 .....	11
5.2 Wisconsin Distributed Generation Interconnection Guidelines .....	13
6. The Market Capacity Potential of BCHP in Wisconsin .....	16
6.1 Industrial and Commercial Market .....	16
6.2 Multi-Family Residential Market.....	17
7. Conclusions and Recommendations .....	18
7.1 Conclusions.....	18
7.1.1 Interest Level .....	18
7.1.2 Installation Status.....	18
7.1.3 Barriers .....	18
7.1.4 Favorable Characteristics.....	19
7.2 Recommendations.....	19
Appendix A Architect Firms with Sustainable Design/BCHP Capabilities .....	21
Appendix B Engineering and Consulting Firms.....	24
Appendix C Equipment Distributors/Manufactures That Promote BCHP Technologies in Wisconsin .....	28
Appendix D Property Management Organizations and Firms in Wisconsin .....	31
Appendix E Energy Supply and Service Companies in Wisconsin.....	34
Appendix F Energy Service Companies .....	38
Appendix G Associations/Organizations Associated with BCHP Deployment in Wisconsin.....	39
Appendix H Distributed Generation – Commercial/Light Industrial Facilities in Wisconsin .....	42



## Executive Summary

The purpose of this baseline analysis is to assess the prevailing environment for Building Combined Heat and Power (BCHP) electric generation from a regulatory, private-market and technology perspective in Wisconsin. This information will be used to develop educational and market transformation programs, which will foster BCHP applications in Wisconsin.

Wisconsin's vast agricultural resources constitute an inexpensive fuel source and ample opportunities for biomass fired BCHP. In fact Wisconsin Governor Scott MacCallum stated it as one of the goals to increase the use of cost-effective renewable resources in Wisconsin. As such Wisconsin Act 9 requires that renewable energy make up 2.2 percent of each retail electric provider's sales by 2012. These requirements can be used to support BCHP development in the state. Furthermore the state has established a Public Benefits Fund to support biomass development with \$3,800,000 available funding per year.

Programs by the Department of Administration (DOA) constitute further support for BCHP systems. The DOA compiled the "Wisconsin's Renewable Energy Yellow Pages," which contain information on firms active in the field of renewable energy development in the state.

BCHP development in Wisconsin may also benefit significantly from the (federal) 2002 Farm Bill, since BCHP systems might qualify as an energy efficiency improvement on farm and ranches.

One of the biggest government driven efforts in the State, which will ultimately support the development of BCHP applications, pertains to the development of standardized interconnection guidelines. This effort is led by the Public Service Commission of Wisconsin and a multi-interest coalition, called the Wisconsin Interconnection Collaborative. Draft 5.9 of the statewide interconnection guidelines has just been completed and the final rules are expected to be in place by April 15, 2003. The guidelines provide for net metering for installations based on renewables with capacities less than 20 kWe in size. However, the guidelines will only be mandatory for Wisconsin's large investor owned utilities and will not apply to the many municipally owned and cooperative electric suppliers in Wisconsin.

On the commercial/industrial side the Wisconsin Public Service Commission is currently conducting a study of power-park concepts, which could include BCHP systems. Weston Solutions has been hired to perform a feasibility study for this concept.

In Wisconsin there are several key organizations and companies, which support BCHP development. FOCUS ON ENERGY is a public private partnership offering energy information and services to residential, business and industrial customers in the state of Wisconsin. The partnership is comprised of the Wisconsin Department of Administration, Wisconsin Energy Conservation Corporation, Milwaukee School of Engineering, Energy Center of Wisconsin, PA Consulting and Hoffman York. FOCUS ON ENERGY can provide expert advice, project assistance and financial support for energy savings and efficiency projects. Also, three of the main manufacturers of BCHP technologies are headquartered in Wisconsin: Waukeshaw Engine, Kohler Engine and

Trane. Minergy, a subsidiary of Wisconsin Electric has developed a process, which converts wastewater solids into glass aggregate using an integrated B CHP process.

Wisconsin at this point has not introduced deregulation legislation. As such the state is currently not deregulated and will not be deregulated in the near future. In many states deregulation encourages the installation of B CHP systems since generation companies other than the traditional utilities are encouraged to sell and resell electricity into the marketplace. This is particularly important, since the incumbent utilities in many states are less supportive of B CHP technologies. However, some Wisconsin utilities and most notably Alliant Energy Corporation (Alliant) actively foster B CHP installations. Alliant is one of the main distributors of Capstone Microturbines and develops B CHP applications in several midwestern states.

Focusing on B CHP systems in non-industrial installations, the Midwest CHP Application Center (MAC) identified a total of 19 B CHP systems, producing a little over 89,000 kWe in Wisconsin. Wastewater Treatment facilities constitute the biggest installed B CHP market segment in Wisconsin (36,000 kWe) followed by landfill installations (34,000 kWe).

Capital costs as well as operating costs are generally viewed as some of the major hurdles to utilize B CHP technologies. The predominant technologies in B CHP power generation are natural gas. They range in size from reciprocating engines and microturbines in the tens of kilowatts to gas turbines in the tens of megawatts range. The least expensive technologies (large natural gas turbines) installed start around \$600/kWe and increase in cost up to fuel cell technologies that run around \$5,000/kWe. Natural gas reciprocating engines are the predominate technology, and can range in price from \$1,000 to \$1,800/kWe. Although prices of all of these technologies are expected to decrease as the technologies and system designs become more common. For smaller generating capacity units, this initial cost can have a long payback period unless electric costs are very high and thermal loads well matched.

For most B CHP systems natural gas constitutes the majority of the variable/operating cost. High natural gas prices, such as those experienced in the winter of 2000/2001, could have negative affects on the B CHP market development, but these high gas prices are not anticipated to reoccur. The Energy Information Administration expects natural gas prices to be around \$3 per MMBTU by 2020. The average price paid by commercial customers for natural gas in Wisconsin was \$7.60 per MMBtu (2001), which is below the average of \$8.10 per MMBtu; the average price of electricity charged by utilities to commercial customers was 6.03 cents per kWh, which is significantly below the average of 7.36 cents per kWh (in 2000).

ONSITE Energy Corporation in January 2000 prepared a study for the Energy Information Administration titled "The Market and Technical Potential for Combined Heat and Power in the Commercial/Institutional Sector." For Wisconsin's commercial/institutional sector, ONSITE estimated a total market potential for electric production to be in the range of 1,300 to 2,400 MWe. This potential may only be realized if the regulatory and policy environment becomes more supportive of B CHP installations. Also, if incentives are provided and the use of thermal technologies is considered, additional market potential capacity could be realized.

Besides commercial and industrial applications B CHP systems also have potential market viability for multi-unit residences (those with 2 or more units). The MAC estimated the Wisconsin market potential for B CHP installations in the multi-unit residential sector for 2001 to be about 19,000 units.

This report concludes with recommendations, which address the need to educate regulators and private market participants on B CHP benefits. Case studies are needed which show the economic and environmental benefits of B CHP systems. As mentioned above alliances have to be formed with already influential companies in the B CHP field such as Alliant, FOCUS ON ENERGY, and others to develop synergies between these companies and the Midwest CHP Application Center to promote the use of B CHP. Finally, the Midwest CHP Application Center should partner with the Public Service Commission of Wisconsin to reduce or remove regulatory barriers.

## **1. Introduction and Purpose**

The purpose of this analysis is to assess the current status of the BCHP sector in Wisconsin and identify current hurdles that prevent the widespread use of BCHP systems. This information will be used to identify target markets for BCHP systems as well as development of education and market transformation programs, which will foster BCHP applications. Finally, an action plan will be developed to further BCHP deployment in Wisconsin.

Cooling, Heating, and Power for Buildings (BCHP) refers to technologies which generate electricity at or near the point of use, such as a building or building complexes, while simultaneously recovering up to 80% of the waste heat for heating, cooling and/or dehumidification purposes.

In order to assess the current state of BCHP in Wisconsin, a comprehensive survey of key players involved with this technology was conducted. Key engineering firms, manufacturers, distributors, architectural firms, energy suppliers and federal, state and local agencies were identified. Furthermore a survey of existing and pending BCHP installations was conducted. Also identified in this survey were distributed generating installations that do not recover the waste heat; these installations represent relatively good candidate sites for conversion to BCHP systems because only heat recovery equipment needs to be provided and therefore the cost differential is minimal and easier to justify.

In this report, the initial cost of current BCHP related technologies and financial incentives were evaluated to assess their impact on the marketability of BCHP. A status assessment of policy related issues' pertaining to the interconnection of BCHP was conducted.

The market capacity potential for BCHP in Wisconsin was evaluated to identify the best target sectors for deployment.

This report concludes with recommendations to effectively promote the deployment of BCHP in Wisconsin.

## **2. BCHP Contacts in Wisconsin**

### **2.1 Key Wisconsin Firms with BCHP Project Experience or Capabilities**

One of the major methods to promoting market acceptability of BCHP technologies is to engage the efforts of commercial firms that can promote the installation of BCHP technologies. Besides those that can benefit directly through profits and savings from BCHP, there are other firms which have the interest and capability to get involved with BCHP applications either because they promote energy efficiency, green building technologies, or have other BCHP supporting missions. The purpose of this section is to identify those key firms that currently exist in that can be allied with the Midwest CHP Application Center to promote the deployment of BCHP in Wisconsin.

Besides electricity providers, there are about 70 companies in Wisconsin that are engaged in BCHP system applications or have BCHP system capabilities. Hopefully in the near future interest in BCHP applications will increase through the activities of a multitude of local and regional organizations that are involved with the promotion of BCHP applications.

Architectural and Engineering firms are important to promoting BCHP technologies because the most economical time to install a BCHP system is during the construction of a new building or during an extensive renovation, when the central heating and cooling plant is being initially installed or completely replaced. This is because the payback period associated with the cost to install a BCHP system need only be justified on the cost differential between the BCHP system and a conventional central cooling/heating system which otherwise would have to be installed. Architectural and engineering firms are generally engaged in the design and installation of such facilities in commercial and light industrial applications. Appendix A and Appendix B respectively provide information on architectural firms and engineering firms that are potential allies in the promotion of BCHP installation in Wisconsin. There are currently 50 architectural and engineering firms that are able to develop and deploy BCHP systems in Wisconsin.

Manufacturers of power generation equipment, absorption chillers, and desiccant dehumidification equipment, and their sales representatives are important to promoting BCHP technologies for obvious reasons, to sell their equipment. In most cases these manufacturers have established a market presence and have built relationships with those most likely to install BCHP technologies. Appendix C provides information on manufacturers that promote BCHP installations in Wisconsin. There are currently 20 manufacturers/sales offices involved in deployment of BCHP related technologies in Wisconsin.

Property management firms are important to promoting BCHP technologies because they are the operators of most commercial buildings in which BCHP technologies would be suitable and therefore are interested in reducing energy costs. They often are the decision makers as to what type of central service systems are installed. In many of the buildings that they operate, they are already required by newer building codes to provide some sort of emergency generation electric power generation equipment. Since they are already required to install generation equipment, the cost differential to install BCHP over a conventional central heating/cooling system is again smaller and easier to justify. In addition, it provides them the ability to provide more reliable power to tenants, which is becoming an important issue to many business operators. The two main organizations,



which represent property management firms in Wisconsin are BOMA (Building Owners and Managers Association) and IREM (Institute of Real Estate Management), which accredits recognized real estate management organizations. Information on the Wisconsin BOMA chapter and IREM accredited Wisconsin property management companies can be found in Appendix D.

Local energy suppliers are also important to promoting BCHP. Many have formed subsidiary companies to promote distributed generation, especially the gas supply companies, however they are not necessarily considering BCHP because they often can justify cost based on the peak shaving savings of electrical generation and because BCHP can provide heat in winter it can also reduce the gas consumption for boilers/furnaces used for heating. A list of energy supply companies in Wisconsin is provided in Appendix E.

In the case of energy supply companies, distributed generation may be viewed as a threat to the parent company which may have rate structures that pose a disincentive to the installation of distributed and therefore to BCHP. In these cases, distributed generation is viewed as more acceptable if it is on the electric suppliers side of the meter, which makes BCHP a difficult option to promote since the electric generation source may be at some distance from the customer making the use of waste heat impractical. Energy Services companies (ESCOs) are just beginning to become interested in BCHP technologies. In the past they have not been interested because it is easier for them to find other cost saving measures like lighting retrofits and energy control systems in commercial and light industrial applications, and in many cases regulations and siting requirements served as a disincentive for them to install BCHP. Appendix F lists ESCO's which are active in Wisconsin.

## **2.2 Associations and Organizations Involved with BCHP Deployment**

Federal, State, and regional governmental entities are becoming interested in BCHP energy because of the energy savings and reduced emissions it provides. This creates opportunities to make BCHP systems an important part of the generation mix.

While the Federal government, through the Department of Energy, Office of Power Technologies, has provided substantial support, the most effective deployment of BCHP technology will come from regional and local activities. This is true because most of the barriers are due to local issues, such as site permitting, interconnection requirements and studies, local utility pricing, and local building codes and standards. These barriers can be overcome with support from regional and local entities.

The Midwest is home to many non-profit organizations and associations that have come forward to support the deployment of BCHP, in fact the Midwest appears to be leading the way in promoting the deployment of BCHP. Within the State of Wisconsin, FOCUS ON ENERGY has the potential to be a strong ally in the deployment of BCHP. FOCUS ON ENERGY is a public private partnership offering energy information and services to residential, business and industrial customers in the state of Wisconsin. The partnership is comprised of the Wisconsin Department of Administration, Wisconsin Energy Conservation Corporation, Milwaukee School of Engineering, Energy Center of Wisconsin, PA Consulting and Hoffman York. FOCUS ON ENERGY can provide expert advice, project assistance and financial support for energy savings and efficiency

projects. A list of these associations and organizations and their web-addresses, where available, is provided in Appendix G.

### 3. Survey of BCHP Installations and BCHP Targets in Wisconsin

#### 3.1 Survey Summary

This survey was conducted to identify existing and pending BCHP installations in order to assess the current state of BCHP in Wisconsin; to establish a baseline and to identify those facility types where BCHP was most prevalent.

The information in this section is based on input from various sources including; personal interviews, manufactures and distributors, websites, associated organizations, and journals. The survey of BCHP installations and potential BCHP targets is primarily based on personal interviews as well as the use of published data. Published data consisted of the Energy Information Administration's "Inventory of Nonutility Electric Power Plants in the United States" dated November 2000 (Source: <http://tonto.eia.doe.gov/FTP/ROOT/electricity/0095992.pdf>).

Sites that are greater than 1 MWe are easier to identify because they must file yearly reports with the Environmental Protection Agency (EPA). However sites less than 1 MWe may or may not have a to file with the EPA. The sites identified represent the best efforts of the Midwest CHP Application Center to identify actual and potential BCHP installations in Wisconsin at the time of this report. Other existing or potential BCHP sites may exist; they will be added to the database and will be available over the website in the future as they are identified.

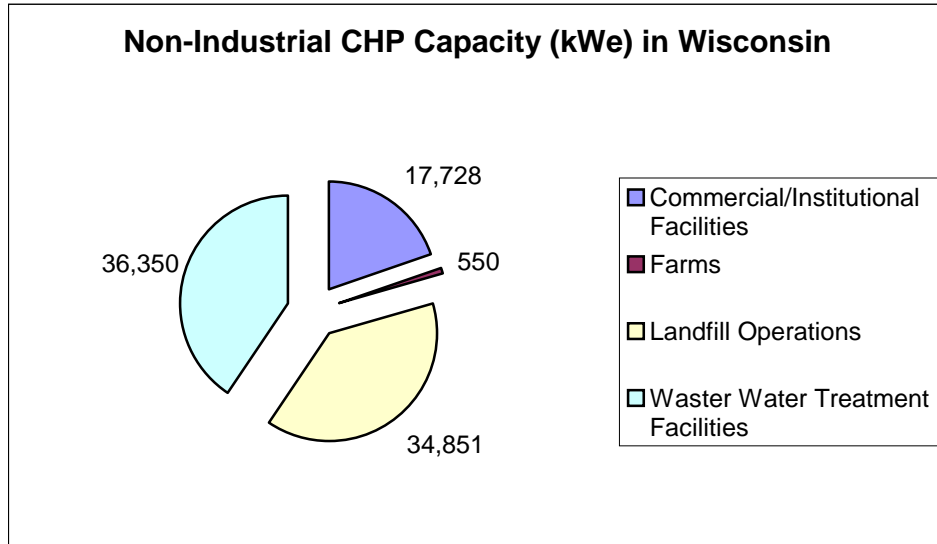
A total of 19 BCHP systems, producing a little over 89,000 kWe, are known to be in operation in Wisconsin. Appendix H categorizes and lists the known distributed generation installations based on the facility type in which the system is installed and provides the size of the installed generation capacity. Where it is known, thermal heat recovery has been noted. Where additional information is available about the installation configuration, it is provided. This report focuses primarily on BCHP applications for buildings, which, for the purpose of this report includes landfills, wastewater treatment facilities and farms.

#### 3.2 Sector Analysis of the Survey Data

The sites identified during the survey represent the best efforts of the Midwest CHP Application Center to identify the BCHP installations in Wisconsin. Other existing or candidate BCHP sites may exist. An analysis of the survey information for the commercial and light industrial sectors is provided in Table 3-1 and Figure 3-1 below.

	Capacity (kW)	Capacity (%)
Commercial/Institutional Facilities	17,728	20
Farms	550	1
Landfill Operations	34,851	39
Waster Water Treatment Facilities	36,350	41
<b>Total:</b>	<b>89,479</b>	

**Table 3-1 BCHP Capacity Installed by Sector in Wisconsin**



**Figure 3-1 B CHP Capacity Installed by Sector in Wisconsin**

As can be seen wastewater treatment facilities constitute the biggest installed B CHP market segment in Wisconsin followed by installations at landfills.



#### 4. Current Pricing Issues

Capital costs as well as operating costs are generally viewed as some of the major hurdles to utilize BCHP technologies. This section will address these issues.

##### 4.1 Equipment and Maintenance Costs

The predominant prime mover technologies in BCHP applications are reciprocating engines, combustion turbines, and microturbines. In the near future fuel cell technology is expected to become a prevalent BCHP technology as well. Absorption chillers convert the waste heat stream from prime movers into cooling.

Each technology operates at different efficiency and capacity size levels. The following table compiled by the Midwest CHP Application Center indicates the cost and other relevant technical data for the various equipment types.

**Table 4-1 CHP Technologies**

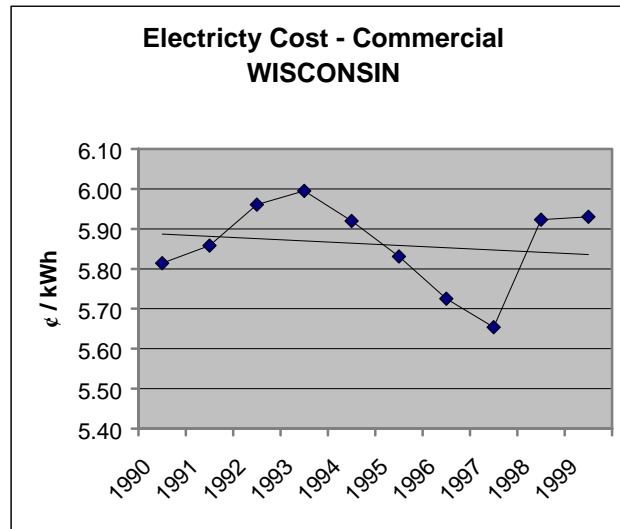
Size Range (kWe)	Gas Engine		Gas Turbine - Simple Cycle		Micoturbines	Fuel Cells
	100 - 500	500 - 2,000	1,000 - 10,000	10,000 - 50,000	100 - 500	30 - 3,000
Efficiency (LHV) Btu/kWh %	12,000 - 14,000 24 - 28	10,000 - 12,000 28 - 34	12,000 - 14,000 24 - 28	9,500 - 11,000 31 - 36	14 - 40	40 - 57
Installed Cost (\$/kWe)* (with Heat Recovery)	\$1,400 - \$1,800	\$1,000 - \$1,500	\$1,000 - \$1,500	\$600 - \$1,000	\$1,000 - \$1,500	\$2,000 - \$5,000
O & M Costs (\$/kWh)	\$0.012 - \$0.015	\$0.010 - \$0.012	\$0.003 - \$0.006	\$0.003 - \$0.006	\$0.005 - \$0.010	\$0.002 - \$0.05
Recoverable Heat Steam (lb/h/kWe) Hot Water (Btu/kWe/h)	4 - 5 (15 - 30 psi) 4,000 - 4,500	4 - 5 (15 - 30 psi) 4,000 - 4,500	5 - 6 (300 - 600 psi) 4,500 - 5,00	5 - 6 (300 - 600 psi) 4,500 - 5,00		
Absorption Cooling						
Single (\$/RT)	\$500 - \$1,000	\$250 - \$500	\$200 - \$250	\$200 - \$250		
Double (\$/RT)	N/A	N/A	\$400 - \$500	\$350 - \$400		
RT/kWe	0.22 - 0.28	0.22 - 0.28	0.28 - 0.33	0.28 - 0.33		
Electric Chillers (\$/RT)	\$200 - \$300	\$200 - \$300	\$180 - \$250	\$180 - \$250		

\* Costs can vary significantly due to interconnection and other siting requirements.

## 4.2 Electric Pricing

In the annual Energy Information Administration report titled “Annual Energy Outlook 2002 with Projections to 2020” ([www.eia.doe.gov/oiaf/aeo/pdf/0383\(2002\).pdf](http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2002).pdf)), the EIA projects that the average electricity prices will decline from 6.9 cents per kilowatt-hour in 2000 to 6.5 cents per kilowatt-hour in 2020. Electricity industry restructuring is expected to contribute to declining prices on a national level through reductions in operating and maintenance costs, administrative costs, and other costs. Electricity prices are projected to decline to 6.3 cents per kilowatt-hour by 2006 then rise in the last 5 years of the forecast as natural gas prices rise.

In Wisconsin the cost of electricity for commercial customers has shown relative stability over the last recorded 10 year period (1990-1999) based on information from the EIA’s State Energy Price and Expenditure Report 1999 (<http://eia.doe.gov/pub/state.prices/pdf/seper.pdf>). The cost of electricity to the commercial consumer has gone from \$17.04/MMbtu in 1990 to \$17.38/MMbtu in 1999. However there have been fluctuations in pricing over that period.



*Source: State Energy Price and Expenditure Report 1999, Table 307: Commercial Sector Energy Price and Expenditure Estimates, Selected Years 1970-1999, Wisconsin; Prices in Nominal Dollars.*  
(<http://www.eia.doe.gov/emeu/seper/contents.html>)

Wisconsin ranked 39<sup>th</sup> highest in electricity costs at 5.53¢/kWh for average cost to the customer across all customer classes (Source: EIA State Electricity Profiles 2001 – Wisconsin). The average price paid by commercial customers for natural gas in Wisconsin was \$7.60 per MMBtu (2001), which is below the average of \$8.10 per MMBtu; the average price of electricity charged by utilities to commercial customers was 6.03 cents per kWh, which is significantly below the average of 7.36 cents per kWh (Sources: Energy Information Administration  
[http://www.eia.doe.gov/pub/oil\\_gas/natural\\_gas/data\\_publications/natural\\_gas\\_monthly/current/pdf/table\\_22.pdf](http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_monthly/current/pdf/table_22.pdf) and <http://www.eia.doe.gov/cneaf/electricity/esr/esrt12p1.html>).

The five major electricity suppliers in Wisconsin are shown below in Table 4-2. Wisconsin, however is host to over 100 Co-op and municipally owned electric suppliers.

**Table 4-2 Five Largest Utilities by Retail Sales within the State, 1999 (Megawatthours)**

<i>Utility</i>	<i>All Sectors</i>	<i>Residential</i>	<i>Commercial</i>	<i>Industrial</i>	<i>Other</i>
<i>Wisconsin Electric Power Co.</i>	23,953,896	7,192,564	7,890,496	8,704,240	166,596
<i>Wisconsin Public Service Corp.</i>	9,656,015	2,685,451	3,070,397	3,866,051	34,116
<i>Wisconsin Power &amp; Light Co.</i>	9,504,473	3,050,032	1,944,452	4,456,959	53,030
<i>Northern States Power Company</i>	5,295,629	1,677,848	923,344	2,657,675	36,762
<i>Madison Gas and Electric Company</i>	2,916,533	770,153	1,524,641	315,238	306,501
<b>Total</b>	<b>51,326,546</b>	<b>15,376,048</b>	<b>15,353,330</b>	<b>20,000,163</b>	<b>597,005</b>
<i>Percentage of Utility Sales</i>	<b>81</b>	<b>79</b>	<b>87</b>	<b>78</b>	<b>80</b>

(Source: Energy Information Administration Website  
[http://www.eia.doe.gov/cneaf/electricity/st\\_profiles/wisconsin.pdf](http://www.eia.doe.gov/cneaf/electricity/st_profiles/wisconsin.pdf))



## **5. Summary and Status of BCHP Policy Issues**

One of the biggest efforts in support of BCHP development in Wisconsin pertains to the development of standardized interconnection guidelines. The Public Service Commission of Wisconsin and a multi-interest coalition, called the Distributed Resources Coalition, are leading this effort. The legislative process and current provisions of the interconnection guidelines will be detailed in the following.

### **5.1 PSC Report to the Legislature, December 2000**

In October 1999 the Wisconsin Legislature passed Wisconsin Act 9. Wisconsin Act 9 (Wis. Stat. 196.025(4)) requires the Public Service Commission to “study the establishment of a program for providing incentives for the development of high-efficiency, small-scale electric generating facilities [...]” This clause shows that this policy can support BCHP. In response the Public Service Commission submitted a report titled “Report to the Legislature on the Development of Distributed Electric Generation in the State of Wisconsin.” The report was issued in December 2000. The scope of the report included “small-scale, high efficiency generating technologies” including combined heat and power systems, photovoltaic, wind power, fuel cells, microturbines, and internal combustion generators. The report reviewed each of these technologies, compares emissions, and summarized barriers and economic incentives for these technologies. The major findings of the report were as follows:

- The lack of statewide uniform technical standards can constitute a barrier for interconnecting DG to the utility grid.
- Uniform procedures for testing and certification of interconnection equipment are needed.
- Complex interconnection contracts can add unnecessary cost and time to the installation of small-scale distributed generation. A detailed contract that may be appropriate for large customer-owned generators can create an unnecessary burden for a small-scale generator.
- A barrier to market entry is created by interconnection rules and practices that vary from one utility service territory to the next.
- Impediments to interconnection are created by outright prohibition of parallel generation, study fees, engineering review fees, additional metering fees, Transmission and Distribution charges, and standby fees.
- Unreasonable insurance or indemnification requirements can unduly increase the cost of non-utility DG.
- The current limitation that net energy billing is applicable only to units of less than 20 kW is too restrictive.
- The existing rate structure includes a number of disincentives to non-utility scale generation.
- The individual and cumulative effect of small-scale diesel generators could lead to air quality degradation in certain areas.

Based on its findings, the PSC concluded as follows:

- Any incentive program to encourage greater use of high efficiency, small scale DG in the state of Wisconsin should include the updating of statutes, administrative rules, and utility tariffs.
- Establish a working group made up of stakeholders, such as equipment installers and manufacturers, customers, energy advocacy groups, environmental groups, gas and electric utilities, and staff from the Wisconsin PSC, DNR, DOA, and DOR to develop additional recommendations as needed.
- Establish uniform, simplified standards based on IEEE P1547 for DG systems.
- Establish statewide pre-certification and testing.
- Establish a state-wide standardized contract for high-efficiency, small-scale DG systems that include a) a utility interconnection fee appropriate for the size of the installation and b) a standard formula for determining the cost of distribution upgrades associated with DG interconnection.
- Establish a tariff to cover a) an expansion of the “Net Energy Billing” tariff availability for customers with service from the current 20 kW maximum to a maximum based on the manufacturer’s equipment rating, b) buy-back rates that vary depending on the environmental and grid benefits and dispatchability, and c) rules that provide for the utility to cover all or a portion of interconnection costs where there is a demonstrated benefit to the distribution grid.
- Owners of DG units that provide a benefit to society at large, such as improved “environmental performance” could be granted a production based tax credit.
- Provide state assistance to local units of government in siting DG technologies under existing planning and zoning authorities.
- Revision of Wis. Admin. Code 113.0207, “Requirements for utility rules for interconnection of small customer-owned generation facilities with the utility system.”

The interest group, “RENEW Wisconsin,” funded by the Joyce Foundation lead the initial process to come up with recommendations to the interconnection standards. RENEW Wisconsin recommended updates to Wis Admin. Code 113.0207, which had been developed in 1982 to “protect the safety of utility personnel and the integrity of the electrical system.” RENEW Wisconsin’s efforts were concentrated on the development of a standardized interconnection agreement and the interconnection of facilities of 20 kWe and less in size.

On May 18, 2001 the Joint Finance Committee of the Wisconsin Legislature voted unanimously to include some distributed generation resources provisions in the state budget, including the requirement that the PSC promulgate rules regarding interconnection standards, safety and reliability issues, tariffs, net metering, real time pricing fees, etc. It also required the PSC to complete draft rules within six months of the effective date of the budget. The standards would apply to utilities with a connected load of 1200 MWe or more.

## 5.2 Wisconsin Distributed Generation Interconnection Guidelines

RENEW Wisconsin and the Wisconsin Interconnection Collaborative developed Interconnection Guidelines (Guidelines) in Draft form. Draft 5.9 of the guidelines has just been completed. Work on promulgating the rules takes now place at the Wisconsin Public Service Commission. The goal is that the final rules will be in place by April 15, 2003. The Guidelines do not apply to cooperative electric utilities. However, according to the Guidelines, “Cooperative Electric Utilities are encouraged to adopt these guidelines.” Draft 5.9 of the Draft Interconnection Agreement contains the following provisions:

- Facility Categories

The Guidelines establish 4 categories of DG facility sizes:

Category 1:	20 kW or less
Category 2:	Greater than 20 kW to 200 kW
Category 3:	Greater than 200 kW to 1 MW
Category 4:	Greater than 1 MW to 15 MW

- Insurance Requirements

Applicants interconnecting a DG facility have to provide liability insurance in the following amounts:

Category 1:	\$300,000
Category 2:	\$1,000,000
Category 3:	\$2,000,000
Category 4:	Negotiated

- Application Forms

Applicants for a Category 1 DG facility file a Standard Application Form, called PSC Form 6027 whereas applicants for a Category 2 through 4 file a different form (Form PSC 6028). Upon filing of the Application Form the electric provider performs an Application Review and determines whether or not an Engineering Review and/or a Distribution System Study needs to be performed.

- Response Timelines

The timelines for the studies according to DRAFT 5.9 are listed below:

Step	Business day response periods			
	Category 1 20 kW or less	Category 2 Greater than 20 kW to 200 kW	Category 3 Greater than 200 kW to 1 MW	Category 4 Greater than 1 MW to 15 MW
1. Electric provider provides material to applicant (upon receiving a Standard Application Form request).	5	5	5	5
2. Electric provider responds that they have received the Standard Application Form materials and states if they are complete. Any deficiencies are stated.	10	10	10	10
3. Once the Standard Application Form is deemed complete, the electric provider completes an Application Review, provides any Engineering Review and Distribution System Study costs, if needed, and notifies applicant.	10	10	10	10
4. Applicant responds, asking electric provider to go forward with an Engineering Review.	1 year (if required)	1 year	1 year	Negotiated: not more than 1 year
5. The applicant is notified of the results of the Engineering Review	10 (if required)	15	20	Project specific
6. Applicant responds, asking electric provider to go forward with Distribution System Study.	1 year (if required)	1 year	1 year	Negotiated: Not more than 1 year
7. The applicant is notified of the results of the Distribution System Study.	10 (if required)	15	20	Project specific
8. Applicants commits to paying for the distribution system modifications.	1 year (if required)	45	45	45
9. The applicant executes the Standard Interconnection Agreement.				
10. Time period to complete distribution system upgrades and install DG Facility.	Negotiated with applicant			

11. Electric provider completes DG Facility testing.	10	10	20	20
12. Final acceptance, cost reconciliation, and issuance of a formal letter of acceptance.	5	10	10	10

- Study Fees

The respective fees for the Application Review, the Engineering Review and the Distribution System Study are as follows:

	Application Review Fee	Engineering Review Fee	Distribution System Study Fee
Category 1:	None	None	
Category 2:	\$250	Max \$500	Max \$500
Category 3:	\$500	Cost Based	Cost Based
Category 4:	\$1000	Cost Based	Cost Based

- Precertified Equipment

The Guidelines provide for acceptance of pre-certified equipment such as anti-islanding protection and power quality related distribution interfaces. The Guidelines state that pre-certified equipment if certified to national standards “does not need the design scrutiny by the electric provider that non-certified equipment typically requires.”

- Net Metering

The Guidelines also refer to the fact that DG facilities using renewable resources with a capacity of 20 kWe or less are eligible for net energy metering. This means that DG facilities can offset their associated load consumption and are compensated for any extra energy delivered to the electric provider at the rate as specified by the electric provider’s tariff. What constitutes a renewable resource is defined by the individual electric provider. In general, natural gas fired cogeneration systems do not qualify as renewable resources, however, biomass fired cogeneration systems are generally considered a renewable resource.

## 6. The Market Capacity Potential of BCHP in Wisconsin

The previous sections identified the key parties currently involved with BCHP technology and detailed some of the areas preventing market transformation. However, market transformation in favor of BCHP technologies is only viable if the market potential exists. Therefore the market potential for each BCHP category, industrial, commercial and multi-unit residential is discussed in the following.

Estimates for the Institutional/Commercial Sector were derived from a previous study conducted by ONSITE-SYCOM Energy Corporation (ONSITE). Estimates for the Multi-family Residential Sector are based on Midwest CHP Application Center research.

### 6.1 Industrial and Commercial Market

ONSITE Energy Corporation in January 2000 prepared a study for the Energy Information Administration titled “The Market and Technical Potential for Combined Heat and Power in the Commercial/Institutional Sector.” This study identified potential BCHP application sites using the iMarket, Inc. MarketPlace Database to select commercial/industrial building types based on SIC codes.

The potential buildings were: hotels/motels, nursing homes, hospitals, schools, colleges, commercial laundries, car washes, health clubs, golf clubs, museums, correctional facilities, water treatment plants, extended service restaurants, supermarkets and refrigerated warehouses. The buildings were divided into different groups based on their electric demand. The electric demand was estimated using data from Wharton Economic Forecasting. As a result ONSITE selected 1,431,805 buildings in the United States as suitable for BCHP applications requiring a capacity of 77,281 MWe.

There study focused on applications where thermal energy load was in the form of steam or hot water usage. It did not take into consideration the use of thermal activated technologies such as absorption chillers or desiccant dehumidifiers as potential candidates for thermal load. Taking into consideration these technologies will likely increase the market potential from their estimates.

On a state-by-state basis, ONSITE estimated the following potential:



For Wisconsin, ONSITE estimated a total market potential for electric production to be in the range of 1,300 to 2,400 MWe. This represents 3 to 5% of the projected DOE long-term goal of 47 gigawatts of installed BCHP capacity that was developed as part of the BCHP Roadmap Workshop. This potential may only be realized if the regulatory and policy issues become more supportive of BCHP installations. Also if incentives are provided, additional market potential capacity could be realized.

## **6.2 Multi-Family Residential Market**

Besides commercial and industrial applications BCHP systems also have potential market viability for multi-unit residences (those with 2 or more units). Compared to conventional HVAC systems, the installation of BCHP systems are particularly competitive when it comes to new construction or complete replacement of old HVAC systems.

Since all new and replacement HVAC systems need to be permitted in Wisconsin, permitting data provides a good estimate of buildings where BCHP systems may be a potential alternative. Applying the following assumptions the potential market for BCHP applications for multi-unit residences can be estimated:

- New construction remains at or near the same level as in the year 2001 (12,993 units),
- HVAC systems need to be replaced every 20 years, therefore units installed in 1981 would need to be replaced in the year 2001, and
- The number of HVAC units replaced in 2001 is consistent with the number of units installed in 1981 (6,398 units).

Applying these assumptions the new building permit data was obtained for 1981 and 2001 (Source: <http://www.census.gov/const/C40/Table2/tb2u8099.txt>), those with less than 2 units were not considered. Therefore the market potential for multi-unit residential BCHP installation in Wisconsin for 2001 is estimated to be about 19,000 units.

## **7. Conclusions and Recommendations**

### **7.1 Conclusions**

#### **7.1.1 Interest Level**

On the policy side, Wisconsin seems very supportive of renewable/biomass based energy generation, which could also promote CHP technologies. The current governor stated the importance to foster renewable resource development in the state and a Public Benefits Fund provides financial support for these technologies. Furthermore, there are 70 well-known engineering firms, as well as equipment manufacturers and distributors who are pursuing the BCHP market. With respect to equipment manufacturers, three of the most prominent CHP suppliers in the country are based in Wisconsin: Waukesha Engine, Kohler Engine and Trane.

The Midwest is home to many non-profit organizations and associations that have come forward to support the deployment of BCHP, in fact the Midwest appears to be leading the way in promoting the deployment of BCHP with such organizations as the Midwest CHP Initiative.

#### **7.1.2 Installation Status**

There is not a significant amount of installed BCHP in Wisconsin; the Midwest Application Center (MAC) identified a total of 19 BCHP systems, producing a little over 89,000 kWe in Wisconsin. Wastewater treatment facilities constitute the biggest installed BCHP market segment in Wisconsin (36,000 kWe) followed by installations at landfills (34,000 kWe).

#### **7.1.3 Barriers**

*Net Metering* provisions allow BCHP facilities to resell excess electricity to the local utility at a predetermined rate. In Wisconsin, the proposed statewide interconnection guidelines provide net metering only for renewables facilities less than 20 kWe in size. Furthermore, natural gas fired cogeneration systems are not considered renewable despite their high efficiencies and low emission rates. Also the proposed interconnection guidelines only apply to public utilities with a load in excess of 1200 MWe, which excludes municipal owned systems, coops, Madison Gas and Electric Company and Xcel Energy.

*Capital costs and payback time frames* are of concern. The least expensive electric generating technologies (large natural gas turbines) installed start around \$600/kWe and increase up in cost to fuel cell technologies that run around \$5,000/kWe. Additional costs, associated with thermal recovery equipment and engineering costs further add to the cost of the project. Prices are expected to decrease as the technologies and system designs become more common. For smaller generating capacity units, this initial cost can have a long payback period unless electric costs are very high and thermal loads well matched.

*Operating costs* due to fluctuating gas prices as seen in the winter of 2000/2001 may be perceived as a concern, even though prices have returned to previous levels. The EIA expects natural gas prices to be around \$3 per MMBTU by 2020. The average price paid for natural gas by commercial customers in Wisconsin was \$7.60 in 2001, slightly below the national average.



*Standby charges* and *Electricity rates* are also a factor in BCHP because they affect the payback period. Standby rates in Wisconsin differ from utility to utility. This means BCHP developers in the state face a cumbersome set of tariffs to comply with.

The average price of electricity charged by utilities to commercial customers in Wisconsin was 6.03 cents per kWh (in 2000), which is significantly below the national average of 7.36 cents per kWh. Low prevailing electricity prices, however, reduce the economic competitiveness of BCHP systems.

#### **7.1.4 Favorable Characteristics**

A *Favorable political climate* for energy efficient technologies and particularly renewable energy appears to exist in Wisconsin. Wisconsin Governor Scott MacCallum stated as one of the goals to increase the use of cost-effective renewable resources in Wisconsin. As such Wisconsin Act 9 requires that renewable energy make up 2.2 percent of each retail electric provider's sales by 2012. (Strategic Directions for Wisconsin's Energy and Economic Future, June 2001, p. 3). These requirements can be used to support BCHP development in the state. Furthermore the state has established a Public Benefits Fund to support biomass development with \$3,800,000 available funding per year.

*Statewide Interconnection Guidelines* for distributed generation will most likely be established by April 2003. These guidelines include standardized fees, standardized insurance requirements and timelines for interconnection with the local utility. The guidelines also include net metering provisions for certain renewable facilities.

*Favorable alliances* exist in Wisconsin. The Midwest appears to be leading the way in promoting the deployment of BCHP with such organizations as FOCUS ON ENERGY. FOCUS ON ENERGY is a public private partnership offering energy information and services to residential, business and industrial customers in the state of Wisconsin. The partnership is comprised of the Wisconsin Department of Administration, Wisconsin Energy Conservation Corporation, Milwaukee School of Engineering, Energy Center of Wisconsin, PA Consulting and Hoffman York. FOCUS ON ENERGY can provide expert advice, project assistance and financial support for BCHP projects.

*Market potential* appears to be reasonable for BCHP. ONSITE Energy Corporation estimates for Wisconsin a total market potential of between 1,300 to 2,400 MWe. Besides commercial and institutional estimates by ONSITE the MAC estimated that the potential Wisconsin market for BCHP installations in the multi-unit residential sector to be about 19,000 units.

#### **7.2 Recommendations**

##### **1) Increase Interest and Market Penetration**

Develop a higher level of interest in BCHP by providing information and education to Architects, Engineers, Property Management Firms on the

- Technical and financial benefits of BCHP.
- Siting and permitting process.
- Successful BCHP installations (Case Studies).

- Technical and financial assessments tools and resources available.

2) Influence the Removal of Regulatory Barriers

Support the Public Service Commission of Wisconsin and State Regulators with their ongoing efforts on

- Promoting the energy, environmental, and financial benefits of BCHP.
- Preparation of uniform interconnection standards and fees, which would be binding for all energy service companies in the state not just the major utilities.
- Need to consider appropriate incentives for BCHP such as tax incentives and subsidies such as is being done with renewable energy technologies.

3) Build Alliances

Build alliances with potential partners such as:

- Large Architect/Engineering Firms with BCHP capabilities
- FOCUS ON ENERGY
- Department of Administration (DOA)
- RENEW Wisconsin
- Wisconsin Interconnection Collaborative
- Wisconsin Energy Center
- Alliant Energy Corporation

## **Appendix A Architect Firms with Sustainable Design/BCHP Capabilities**

AIA Wisconsin  
321 South Hamilton Street  
Madison , WI 53703-4000  
Phone: 608-257-8477  
Fax: 608-257-0242  
aiaw@aiaw.org

Architectural Design Group  
393 Red Cedar St. #3  
Menomonie, WI 54751-2267  
Phone: (715) 235-4848  
Fax: (715) 235-4898  
E-mail: adg@adg-architects.com  
<http://www.adg-architects.com>

Architecture Network, Inc.  
116 East Dayton St.  
Madison, WI 53703-2114  
Phone: (608) 251-7515  
Fax: (608) 251-7566  
E-mail: ani\_archnet@tds.net  
<http://www.archnetwork.com>

Dimension IV  
PO Box 12585  
Green Bay, WI 54307-2585  
Phone: (920) 499-6873  
Fax: (920) 499-6873  
E-mail: djroarty@dimension-iv  
<http://www.dimension-iv.com>

ECOME  
507 Main Street  
La Crosse, WI 54601

Engberg Anderson Design Partnership Inc.  
611 North Broadway #517  
Milwaukee, WI 53202-5004  
Phone: (414) 944-9000  
Fax: (414) 944-9100  
E-mail: info@eadp.com  
<http://www.eadp.com/>

Eppstein Uhen Architects, Inc.  
333 East Chicago St.  
Milwaukee, WI 53202-5809  
Phone: (414) 271-5350  
Fax: (414) 298-2251  
E-mail: richt@eppsteinuhen.com  
<http://www.eppsteinuhen.com>

Flad & Associates, Inc.  
644 Science Dr.  
Madison, WI 53711-1072  
Phone: (608) 238-2661  
Fax: (608) 238-6727  
E-mail: flad@flad.com  
<http://www.flad.com>

Hoffman Corporation  
N434 Greenville Center  
PO Box 8034  
Appleton, WI 54912-8034  
Phone: (920) 731-2322  
Fax: (920) 731-4236  
E-mail: info@hoffman.net  
<http://www.hoffman.net>

Kahler Slater  
111 West Wisconsin Ave.  
Milwaukee, WI 53203-2501  
Phone: (414) 272-2000  
Fax: (414) 272-2001  
E-mail: ks@kahlerslater.com  
<http://kahlerslater.com>

The Kubala Washatko Architects, Inc.  
W61N617 Mequon Ave.  
Cedarburg, WI 53012-2017  
Phone: (262) 377-6039  
E-mail: zkron@tkwa.com

Potter Lawson, Inc.  
15 Ellis Potter Court  
PO Box 44964  
Madison, WI 53711-2456  
Phone: (608) 274-2741  
Fax: (608) 274-3674  
E-mail: [bethp@potterlawson.com](mailto:bethp@potterlawson.com)  
<http://www.potterlawson.com>

Louis Wasserman & Associates  
1726 North 1st St.  
Milwaukee, WI 53212-3969  
Phone: (414) 562-6474  
Fax: (414) 562-6425  
E-mail: [lwasserman@ticon.net](mailto:lwasserman@ticon.net)  
<http://www.ticon.net/~lwasserman>

The Zimmerman Design Group, Inc.  
7707 Harwood Ave.  
Milwaukee, WI 53213-2610  
Phone: (414) 476-9500  
Fax: (414) 476-8582  
E-mail: [info@zdg.com](mailto:info@zdg.com)  
<http://www.zdg.com>

**NOTE:** *This list represents only those firms that the MW BCHP Application Center was able to identify at the time of this report. Other firms may exist that promote BCHP; they will be added to the database and will be available over the website in the future as they are identified.*

## **Appendix B Engineering and Consulting Firms**

Charles Equipment Co.  
N15W22120 Jericho Drive Unit 6  
Waukesha, WI 53186  
Capabilities: BCHP Turnkey Installations

Cummins NPower LLC  
9401 South 13<sup>th</sup> Street  
Oak Creek, WI 53154  
Capabilities: BCHP Turnkey Installations

Microgy Cogeneration Systems, Inc.  
1009 W Glen Oaks Lane, Suite 209  
Mequon WI 53092  
Capabilities: Developer of anaerobic digester systems dairy, swine and poultry operations producing renewable electric power

GHD, Inc.  
PO Box 69  
Chilton WI 53014  
Capabilities: Design and install anaerobic digestors, installation of gen-set units for heat production.

Robert E. Lee & Associates  
2825 S. Webster St.  
Green Bay WI 54306  
*Website* [www.releeinc.com](http://www.releeinc.com)  
Capabilities: A full-service consulting firm specializing in and environmental engineering, planning, surveying and comprehensive laboratory testing.

Crane Engineering Sales Inc.  
PO Box 38 707 Ford Street  
Kimberly WI 54136-0038  
*Website* <http://www.crane-eng.com>  
Capabilities: Process equipment design and equipment supply, including piping, metering, filters, valves, and design of piping

Energy Integration Corp.  
2988 Gruenwald Rd  
Mosinee WI 54455-7640

American Resource Recovery  
1020 N Broadway  
Milwaukee WI 53202-3157

Applied Technologies, Inc.  
16815 W Wisconsin Ave  
Brookfield WI 53005  
*Website* [www.itiae.com](http://www.itiae.com)

Camp Dresser & Mckee  
312 E Wisconsin Ave., Ste 500  
Milwaukee WI 53202-4305

Dorgan Associates, Inc.  
7601 Ganser Way Madison WI 53719 *Phone:* 608-837-6880  
Capabilities: Consulting engineers and scientists in energy modeling, commissioning, buildings, HVAC, and fuel cells.

Emcon/OWT Solid Waste Services  
17 Park Place, Suite 400  
Appleton WI 54914-8232  
*Website* [www.emconinc.com](http://www.emconinc.com)  
Capabilities:  
Site analysis for energy recovery projects,  
landfill gas-to-electric projects, small  
engine/generator sets for on-site electric  
consumption

Environmental Technology Associates  
1400 Cty Rd Z Blue Mounds WI 53517

Graef Anhalt Schloemer  
125 S 84th St #401 Milwaukee WI 53214-1469

R J Miller Associates, Inc.  
12745 W Capitol Dr  
Brookfield WI

Foth & Van Dyke  
PO Box 19012, 2737 S Ridge Rd  
Green Bay WI 54301

Montgomery Watson, Inc.  
1 Science Court  
Madison WI 53711

R W Beck, Inc.  
555 D'Onofrio Dr #103  
Madison WI 53719  
Capabilities: Consultant Engineers

Triad Engineering  
325 E Chicago St  
Milwaukee WI 53202

WD Meadows & Associates  
901 Platt St.  
Eau Claire WI 54703-5145

Residential Energy Services  
416 E. Court Street  
Viroqua WI 54665  
Capabilities: Efficient design retrofit.

Community Builders  
4280 Algoma Rd  
Capabilities: Products and services for solar heat and electricity, high performance homes, indoor air quality and energy conservation. Energy design and building science analysis.

La Salle Associates  
3700 North Southport  
Chicago, IL 60613  
Capabilities: BCHP Turnkey Installations

Stanley Consultants, Inc.  
225 Iowa Avenue  
Muscatine, IA 52761  
(563) 264-6457  
Capabilities: BCHP Engineering, Environmental and Construction Services

Ballard Engineering  
3555 Electric Avenue  
Rockford, IL 61125  
(815) 229-1800  
Capabilities: BCHP Turnkey Systems

GKC-EME  
205 W. Wacker Drive  
Chicago, IL 60606  
Capabilities: BCHP Turnkey Installations



Primera Engineering  
25 E. Washington St.  
Suite 510  
Chicago, IL 60602  
Capabilities: HVAC Engineering, BCHP Potential

GLHN A&Es  
Capabilities: HVAC Engineering, BCHP Potential

Cuh2a, Inc.  
Capabilities: HVAC Engineering, BCHP Potential

Epstein and Sons International, Inc.  
Capabilities: HVAC Engineering, BCHP Potential

Jacobs Facilities, Inc.  
Capabilities: HVAC Engineering, BCHP Potential

General Energy Corp  
Capabilities: HVAC Engineering, BCHP Potential

Globetrotters Engineering Corporation  
Capabilities: HVAC Engineering, BCHP Potential

Patrick Engineering, Inc.  
Capabilities: HVAC Engineering, BCHP Potential

Sebesta Blomberg & Associates, Inc.  
2381 Rosegate  
Roseville, MN 55113  
651-634-0775  
Capabilities: HVAC Engineering, BCHP Potential

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**Appendix C Equipment Distributors/Manufactures That Promote BHP  
Technologies in Wisconsin**

Waukesha  
Eastern Regional Office  
1000 West St. Paul Avenue  
Waukesha, WI 53188  
Capabilities: Recip. Engines

Kohler Engines  
444 Highland Drive  
Kohler, WI 53044  
Customer Service: 800.544.2444 or 920.457.4441  
Literature: 800.544.2444

Trane  
4801 Voges Road, Suite A  
Madison, WI 53718  
Phone: 608-838-8200  
Or  
11400 W. Theodore Trecker Way  
West Allis, WI 53214  
Phone: 414-266-5200  
Capabilities: HVAC systems, Air Handling Products

Caterpillar  
FABCO Equipment, INC.  
11200 W Silver Spring Rd.  
Milwaukee, WI 53225-3198  
Or  
1111 Applegate Rd  
Madison, WI 53713  
Capabilities: Electric Generation Equipment Manufacturer

Solar Turbines Incorporated  
40 Shuman Blvd. Suite 350  
Naperville, IL 60563  
(630) 527-1700  
Capabilities: Electric Generation Equipment Manufacturer

Generac Power Systems  
Hwy. 59 & Hillside Road  
P.O. Box 8  
Waukesha, WI 53187  
Capabilities: Power Generators

Detroit Diesel  
Inland Diesel Inc.  
13015 W. Custer Ave  
(Milwaukee)  
P.O. Box 916  
Butler, WI 53007-0916  
Phone: 262-781-7100 or 800-236-6667  
or  
Interstate Diesel, Inc.  
322 Winter Street  
Superior, WI 54880  
Phone: 715-394-5398

Hess Microgen  
12 Industrial Parkway, Unit B-1  
Carson City, NV 89706  
(775) 884-1000  
Capabilities: Generators with Heat Recovery

Eisenmann  
150 E. Dartmoor Dr.  
Crystal Lake, IL 60014  
Contact: Mark West  
(815) 455-4100  
Capabilities: Air Purification

ADA Systems  
955 North Lively Boulevard  
Wood Dale, IL 60191  
Capabilities: Evaporative Cooling Systems, Energy Recovery

Huntington Environmental Systems, Inc.  
707C West Algonquin Road  
Arlington Heights, IL 60005  
Capabilities: Emissions Control Equipment

Munters  
Capabilities: Desiccant Dehumidification Products

GE Power Systems  
Capabilities: Combustion Turbine Products

Ingersoll Rand  
Capabilities: Microturbines

International Fuel Cells, Inc.  
Capabilities: Fuel Cells

Yazaki  
Capabilities: Thermally Activated Chillers

Wartsilla  
Power Plants  
201 Defense Highway, Suite 100  
Annapolis, Maryland, 21401  
Tel: 410 573 21 00  
Capabilities: Recip. Engines

York  
Capabilities: HVAC Systems

Honeywell  
Capabilities: Microturbines

Broad  
Capabilities: Thermally Activated Chillers

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## **Appendix D Property Management Organizations and Firms in Wisconsin**

BOMA Milwaukee  
710 N. Plankinton Ave.  
Suite 207  
Milwaukee, WI 53203  
414-278-7557

### Institute for Real Estate Management (IREM) Accredited Real Estate Management Firms:

Affiliated Capital Corp.,  
21150 W. Capitol Dr., No. 5,  
Pewaukee, WI 53072  
Phone: 262/790-9828  
Web: [www.affiliatedcapital.com](http://www.affiliatedcapital.com)

Property Type(s):  
Conventional apartments, Condominiums,  
Federally assisted housing

Dominium Management Services, Inc.,  
112 Stimpson St.,  
Watertown, WI 53094  
Phone: 920/262-0304  
Property Type(s):  
Conventional apartments  
Federally assisted housing

Farmer Management and Development Co.,  
714 S. Barstow St.,  
P.O. Box 246,  
Eau Claire, WI 54701-0246  
Phone: 715/834-2691  
Property Type(s):  
Conventional apartments, Condominiums, Federally assisted housing  
Office buildings,

National Realty Management, Inc.,  
1155 Quail Ct.,  
Pewaukee, WI 53072  
Phone: 262/695-1400  
Web: [www.national-realty.net](http://www.national-realty.net)  
Property Type(s): Conventional apartments,  
Condominiums, Office buildings, Retail Properties and shopping centers,  
Single family homes, Warehouses and miniwarehouses

Oakbrook Corp.,  
111 E. Water St. No. 300,  
Appleton, WI 54911  
Phone: 920/731-7242  
Property Type(s):  
Conventional apartments  
Federally assisted housing

Oakbrook Corp.,  
626 E. Kilbourn Ave.,  
Milwaukee, WI 53202  
Phone: 414/274-6684  
Property Type(s):  
Conventional apartments  
Federally assisted housing

Oakbrook Corp.,  
2 Science Ct.,  
Madison, WI 53711  
Phone: 608/238-2600  
Property Type(s): Conventional apartments, Federally assisted housing,  
Office buildings, Retail Properties and shopping centers,  
Ogden & Co., Inc.,  
1665 N. Water St.,  
Milwaukee, WI 53202  
Phone: 414/276-5285  
FAX: 414/276-4207  
Web: [www.ogdenrealty.com](http://www.ogdenrealty.com)  
Property Type(s): Conventional apartments,  
Condominiums, Federally assisted housing, Cooperative housing,  
Industrial parks, Office buildings, Retail Properties and shopping centers,  
Single family homes, Warehouses and miniwarehouses

Optimum Property Management,  
2120 W. Clybourn St.,  
Milwaukee, WI 53233-2510  
Phone: 414/342-2218  
FAX: 414/342-9077  
Property Type(s): Conventional apartments,  
Condominiums, Cooperative housing, Industrial parks, Office buildings  
Retail Properties and shopping centers, Single family homes  
Hotels and motels, Warehouses and miniwarehouses

Polacheck Property Management Corp.,  
250 N. Sunny Slope Rd., Ste. 150,  
Brookfield, WI 53005  
Phone: 262/641-7000  
FAX: 262/641-7020  
Web: [www.polacheckmgmt.com](http://www.polacheckmgmt.com)  
Property Type(s): Industrial parks, Office buildings  
Retail Properties and shopping centers

Trammell Crow Co./Central Division,  
100 E. Milwaukee Ave., Ste. 1000,  
Milwaukee, WI 53202  
Phone: 414/289-9030  
FAX: 414/289-0372  
Property Type(s): Industrial parks, Office buildings, Warehouses and miniwarehouses

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## **Appendix E Energy Supply and Service Companies in Wisconsin**

### **Natural Gas Providers:**

WE Energies (Wisconsin Gas Company)  
231 W. Michigan  
Milwaukee, WI 53290  
Website: [www.we-energies.com](http://www.we-energies.com)

Wisconsin Public Service Corp. (Wisconsin Fuel and Light)  
PO Box 19001  
Green Bay WI 54307  
*Website* [www.wpsr.com](http://www.wpsr.com)

Alliant Energy, Wisconsin Power and Light  
222 W Washington Ave  
Madison WI 53703  
*Website* Products or Services:

Madison Gas and Electric  
PO Box 1231  
Madison WI 53701  
*Website* [www.mge.com](http://www.mge.com)

Northern States Power Co.  
PO Box 8 1414 W Hamilton Ave.  
Eau Claire WI 54702-0008

### **Electricity Providers:**

#### ***Investor Owned Electric Utilities***

WE Energies  
231 W. Michigan  
Milwaukee, WI 53290  
Website: [www.we-energies.com](http://www.we-energies.com)

Wisconsin Public Service Corp.  
PO Box 19001  
Green Bay WI 54307  
*Website* [www.wpsr.com](http://www.wpsr.com)

Alliant Energy, Wisconsin Power and Light  
222 W Washington Ave  
Madison WI 53703



Madison Gas and Electric  
PO Box 1231  
Madison WI 53701  
*Website* www.mge.com

Northern States Power Co.  
PO Box 8 1414 W Hamilton Ave.  
Eau Claire WI 54702-0008

***Cooperative Electric Utilities***

*[National Rural Elect Cooperative Association (NRECA) Members only]*

Adams-Columbia Electric Co-op Friendship  
Badger Unified Co-op Services Friendship  
Barron Electric Cooperative Barron  
Bayfield Electric Co-op, Inc. Iron River  
Central Wisconsin Electric Co-op Iola  
Chippewa Valley Electric Co-op Cornell  
Clark Electric Co-op Greenwood  
Dairyland Power La Crosse  
Dunn Electric Co-op Menomonie  
Eau Claire Energy Co-op Fall Creek  
GEN~SYS Energy La Crosse  
Head of the Lakes Electric Co-op Superior  
Jackson Electric Co-op Black River Falls  
Jump River Electric Co-op Ladysmith  
Mid-Wisconsin DBS, LLC Iola  
Oakdale Electric Co-op Oakdale  
Oconto Electric Co-op Oconto Falls  
Pierce-Pepin Cooperative Services Ellsworth  
Polk-Burnett Electric Co-op Centuria  
PowerPlus Engineering, LLC La Crosse  
Price Electric Co-op, Inc. Phillips  
Richland Electric Co-op Richland Center  
Riverland Energy Cooperative Arcadia  
Rock County Electric Co-op Assn. Janesville  
Rural Electric Supply Co-op Madison  
Scenic Rivers Energy Co-op Lancaster  
Skyview DBS Boscobel  
St. Croix Electric Co-op Hammond  
Taylor Electric Cooperative Medford  
Vernon Electric Co-op Westby  
Washington Island Elec. Co-op, Inc. Washington Island  
Western Wisc. Communications Co-op Independence  
Wisconsin Federation of Co-ops

***Municipal Electric Utilities***

Municipal Electric Utilities of Wisconsin (MEUW) is an association of the 82 municipal electric utilities in the state. MEUW can be contacted at the following address:

MEUW

725 Lois Drive

Sun Prairie, WI 53590

Tele.: 608-837-2263

FAX: 608-837-0206

MEUW Members:

Algoma Utility Commission  
Arcadia Electric Utility  
Argyle Utility  
Bangor Municipal Utility  
Barron Light and Water Commission  
Belmont Municipal Light & Water Utility  
Benton Electric and Water Utility  
Black Earth Electric Utilities  
Black River Falls Municipal Utilities  
Bloomer Electric and Water Utility  
Boscobel Utilities  
Brodhead Water & Light Commission  
Cadott Light & Water Department  
Cashton Municipal Light & Water Plant  
Cedarburg Light & Water Commission  
Centuria Municipal Electric Utility  
Clintonville Water & Electric Utility  
Columbus Water & Light Department  
Cornell Municipal Lighting Department  
Cuba City Light and Water Plant  
Cumberland Municipal Utility  
Eagle River Light & Water Department  
Elkhorn Light & Water  
Elroy Electric and Water Utility  
Evansville Water & Light Department  
Fennimore Municipal Utilities  
Florence Water & Light Commission  
Gresham Municipal Water & Electric  
Hartford Utility Department  
Hazel Green Light & Water Utility  
Hustisford Utilities  
Jefferson Water & Light Department  
Juneau Utility Commission  
Kaukauna Electric & Water Department  
Kiel Utilities  
La Farge Municipal Utilities

Lake Mills Light & Water Department  
Lodi Utilities  
Manitowoc Public Utilities  
Marshfield Electric & Water Department  
Mazomanie Electric Utility  
Medford Electric Utility  
Menasha Utilities  
Merrillan Electric & Water Utility  
Mount Horeb Utilities  
Muscodda Light & Water Commission  
New Glarus Municipal Light & Water  
New Holstein Utilities  
New Lisbon Municipal Light & Water  
New London Utility Commission  
New Richmond City Utilities  
Oconomowoc Utilities  
Oconto Falls Water & Light Commission  
Pardeeville Public Utilities  
Plymouth Utilities  
Prairie du Sac Electric Department  
Princeton Light & Water Department  
Reedsburg Utility Commission  
Rice Lake Utilities  
Richland Center Municipal Utility  
River Falls Municipal Utility  
Sauk City Utilities  
Shawano Municipal Utilities  
Sheboygan Falls Utilities  
Shullsburg Electric Utility  
Slinger Electric Utilities  
Spooner Municipal Electric Utility  
Stoughton Electric & Water Utilities  
Stratford Water & Electric Department  
Sturgeon Bay Utilities  
Sun Prairie Water & Light Commission  
Trempealeau Electric Committee  
Two Rivers Water & Light Department  
Viola Municipal Electric Utility  
Waterloo Water & Light Commission  
Waunakee Water & Light Commission  
Waupun Public Utilities  
Westby Electric & Water Utility  
Whitehall Municipal Electric Utility  
Wisconsin Dells Water & Light  
Wisconsin Rapids Water Works & Lighting Commission  
Wonewoc Municipal Water & Light Dept.

## **Appendix F Energy Service Companies**

The following list includes only companies accredited by the National Association of Energy Service Companies (NAESCO):

Johnson Controls, Inc.  
Paul von Paumgarten  
Director, Energy & Environmental Affairs  
Milwaukee, WI

Siemens Building Technologies  
Milwaukee  
135 W. Wells  
Suite 110  
Milwaukee WI 53203

***NOTE:** This list represents only those firms that the MW BCHP Application Center was able to identify at the time of this report. Other firms may exist that promote BCHP; they will be added to the database and will be available over the website in the future as they are identified.*

## Appendix G Associations/Organizations Associated with BCHP Deployment in Wisconsin

### Wisconsin/Regional Organizations

	Organization	Website
1.	American Institute of Architects	<a href="http://www.aia.org">http://www.aia.org</a>
2.	BOMA Building Owners and Managers Association	<a href="http://www.boma.org">http://www.boma.org</a>
3.	FOCUS ON ENERGY	<a href="http://focusonenergy.com">http://focusonenergy.com</a>
4.	Center for Neighborhood Technology	<a href="http://www.cnt.org">http://www.cnt.org</a>
5.	Delta Institute	<a href="http://www.delta-institute.org">http://www.delta-institute.org</a>
6.	RENEW Wisconsin	<a href="http://Renewwisconsin.org">http://Renewwisconsin.org</a>
7.	Energy Center of Wisconsin	<a href="http://www.ecw.org">http://www.ecw.org</a>
8.	Energy Resources Center – University of Illinois at Chicago	<a href="http://www.erc.uic.edu">http://www.erc.uic.edu</a>
9.	Environmental Law and Policy Center	<a href="http://www.elpc.org">http://www.elpc.org</a>
10.	Gas Technology Institute	<a href="http://www.gastechnology.org">http://www.gastechnology.org</a>
11.	Interstate Renewable Energy Council (IREC)	<a href="http://www.eren.doe.gov/cro">http://www.eren.doe.gov/cro</a>
12.	Manufacturing Extension Program (MEP)	<a href="http://www.mep.nist.gov/index3.html">http://www.mep.nist.gov/index3.html</a>
13.	Wisconsin Department of Natural Resources	<a href="http://www.dnr.state.wi.us/">www.dnr.state.wi.us/</a>
14.	University of Wisconsin Center for Cooperatives - Utilities	<a href="http://www.wisc.edu/uwcc/">http://www.wisc.edu/uwcc/</a>
15.	Wisconsin Public Service Commission	<a href="http://psc.wi.gov/">http://psc.wi.gov/</a>
16.	Midwest CHP for Buildings Application Center	Contact through Gas Technology Institute or Energy Resources Center
17.	Midwest CHP Initiative	<a href="http://www.nemw.org/usBCHPa/regional.htm#midw">http://www.nemw.org/usBCHPa/regional.htm#midw</a>
18.	Midwest Cogeneration Association	<a href="http://www.cogeneration.org">http://www.cogeneration.org</a>
19.	Midwest Energy Efficiency Alliance (MEEA)	<a href="http://www.elpc.org/energy/index.htm">http://www.elpc.org/energy/index.htm</a>
20.	Citizens Utility Board	<a href="http://www.wiscub.org">http://www.wiscub.org</a>
21.	Wisconsin Department of Administration – Division of Energy	<a href="http://www.doa.state.wi.us/depb/index.asp">http://www.doa.state.wi.us/depb/index.asp</a>

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## **Federal Government Agencies**

	<b>Agency</b>	<b>Website/Contact Information</b>
1.	DOE Combined Heat and Power (BCHP) Initiative	<a href="http://www.eren.doe.gov/der/BCHP/">http://www.eren.doe.gov/der/BCHP/</a>
2.	DOE Distributed Energy Resources (DER) Taskforce	<a href="http://www.eren.doe.gov/der/">http://www.eren.doe.gov/der/</a>
3.	DOE Distributed Power (DP) Program	<a href="http://www.eren.doe.gov/distributedpower/">http://www.eren.doe.gov/distributedpower/</a>
4.	DOE Energy Efficiency and Renewable Energy Network (EREN)	<a href="http://www.eren.doe.gov/">http://www.eren.doe.gov/</a>
5.	DOE Energy Information Administration	<a href="http://www.eia.doe.gov/">http://www.eia.doe.gov/</a>
6.	DOE Industries of the Future (IOF)	<a href="http://www.oit.doe.gov/industries.shtml">http://www.oit.doe.gov/industries.shtml</a>
7.	DOE Inventions & Innovation Program (I&I)	<a href="http://www.oit.doe.gov/inventions/">http://www.oit.doe.gov/inventions/</a>
8.	DOE Office of Energy Efficiency and Renewable Energy (EERE)	<a href="http://www.eren.doe.gov/ee.html">http://www.eren.doe.gov/ee.html</a>
9.	DOE Office of Industrial Technologies	<a href="http://www.oit.doe.gov/">http://www.oit.doe.gov/</a>
10.	DOE Office of Power Technologies (OPT)	<a href="http://www.eren.doe.gov/power/">http://www.eren.doe.gov/power/</a>
11.	EPA Climate Protection Division (CPD)	<a href="http://www.epa.gov/cpd.html">http://www.epa.gov/cpd.html</a>
12.	EPA Office of Air & Radiation	<a href="http://www.epa.gov/oar/">http://www.epa.gov/oar/</a>
13.	EPA Office of Air Quality Planning and Standards	<a href="http://www.epa.gov/oar/oaqps/">http://www.epa.gov/oar/oaqps/</a>
14.	EPA-DOE Energy Star Program	<a href="http://www.energystar.gov">http://www.energystar.gov</a>
15.	Federal Energy Management Program (FEMP)	<a href="http://www.eren.doe.gov/femp/">http://www.eren.doe.gov/femp/</a>
16.	Federal Laboratory Consortium for Technology Transfer	<a href="http://www.fedlabs.org">http://www.fedlabs.org</a>
17.	Manufacturing Extension Partnership (MEP)	<a href="http://www.mep.nist.gov/">http://www.mep.nist.gov/</a>
18.	US Department of Energy (DOE)	<a href="http://www.energy.gov">http://www.energy.gov</a>
19.	US Department of Housing & Urban Development (HUD)	<a href="http://www.hud.gov/">http://www.hud.gov/</a>
20.	US Environmental Protection Agency (EPA)	<a href="http://www.epa.gov">http://www.epa.gov</a>

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## **Others Associations and Organizations**

	<b>Organization/Association</b>	<b>Website/Contact Information</b>
1.	Alliance to Save Energy	<a href="http://www.ase.org">http://www.ase.org</a>
2.	American Council for an Energy-Efficient Economy (ACEEE)	<a href="http://aceee.org">http://aceee.org</a>
3.	American Planning Organization (APA)	<a href="http://www.apa.org">http://www.apa.org</a>
4.	Brookhaven National Laboratory	<a href="http://www.bnl.gov">http://www.bnl.gov</a>
5.	Consortium for Energy Efficiency (CEE)	<a href="http://www.ceeformt.org/">http://www.ceeformt.org/</a>
6.	Distributed Power Coalition of America (DPCA)	<a href="http://www.dpc.org">http://www.dpc.org</a>
7.	Electric Power Research Institute (EPRI)	<a href="http://www.epri.com">http://www.epri.com</a>
8.	Electric Power Supply Association (EPSA)	<a href="http://www.epsa.org">http://www.epsa.org</a>
9.	International District Energy Association (IDEA)	<a href="http://www.districtenergy.org/">http://www.districtenergy.org/</a>
10.	National Association of Regulatory Utility Commissioners (NARUC)	<a href="http://www.naruc.org">http://www.naruc.org</a>
11.	National Association of State Energy Officials (NASEO)	<a href="http://www.naseo.org">http://www.naseo.org</a>
12.	National Energy Technology Laboratory	<a href="http://www.netl.doe.gov">http://www.netl.doe.gov</a>
13.	National Renewable Energy Laboratory	<a href="http://www.nrel.gov">http://www.nrel.gov</a>
14.	Natural Resources Defense Council (NRDC)	<a href="http://www.nrdc.org">http://www.nrdc.org</a>
15.	Northeast Midwest Institute	<a href="http://www.nemw.org">http://www.nemw.org</a>
16.	Oak Ridge National Laboratory	<a href="http://www.ornl.gov">http://www.ornl.gov</a>
17.	Regulatory Assistance Project	<a href="http://www.rapmaine.org">http://www.rapmaine.org</a>
18.	U.S. Combined Heat and Power Association (USBCHPA)	<a href="http://www.nemw.org/usBCHPa/">http://www.nemw.org/usBCHPa/</a>

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**Appendix H Distributed Generation – Commercial/Light Industrial Facilities in Wisconsin**

<b>Project Name</b>	<b>Generator Capacity (MWe)</b>	<b>Generator Type</b>	<b>Primary Energy Source</b>	<b>Generating Unit Status</b>	<b>Heat Recovery</b>
<b>Commercial/Institutional Facilities</b>					
St. Mary's Hospital, Madison, WI		Turbine	Natural Gas	Operating	Yes
Beloit Memorial Hospital, Beloit WI	3000	Recip Engines	Natural Gas	Operating	Yes
Burleigh Elementary School, Elm Grove, WI	28	Capstone Microturbine	Natural Gas	Operating	Yes
State of Wisconsin, Capitol Heat and Power Plant, Madison, WI	3000	Turbines	Gas/Coal		Yes
State of Wisconsin Department of Administration, UW Madison Power Plant	9700	Steam Turbine	Coal	Operating	Yes
State of Wisconsin, Waupun Correctional Institution	2000	Steam Turbine	Coal		Yes



<b>Project Name</b>	<b>Generator Capacity (MWe)</b>	<b>Generator Type</b>	<b>Primary Energy Source</b>	<b>Generating Unit Status</b>	<b>Heat Recovery</b>
<b>Anaerobic Digesters</b>					Yes
Duck Farm, Southeastern WI	200	Recip Engine	Digester Gas	Operating	Yes
Deere Ridge Dairy, Amhurst, WI	150	Caterpillar Recip	Ag Digester	Operating	Yes
Double S Dairy, Alto, WI	200	Hess Recip	Ag Digester	Operating	Yes
<b>Landfill Operations</b>					
Pheasant Run, Bristol, WI	5600	Recip Engine	Landfill Gas	Operating	Yes
Metro Gas Recovery	9000	Gas Turbine	Landfill Gas	Operating	Yes
Outagamie County Landfill Cogeneration Facility, Appleton, WI	2700	Recip Engine	Landfill Gas	Operating	Yes
Winnebago County Landfill Gas Recovery, Oshkosh, WI	6111		Landfill Gas		Yes
Metro Gas Recovery, Franklin, WI	9200		Gas	Operating	Yes
Superior Glacier Ridge Landfill, Haricon, WI	2000	Waukesha Recip	Landfill Gas	Operating	Yes
Sauk County Landfill, Reedsburg, WI	240	Capstone Micro Turbine	Landfill Gas	Fall 2000	Yes

<b>Project Name</b>	<b>Generator Capacity (MWe)</b>	<b>Generator Type</b>	<b>Primary Energy Source</b>	<b>Generating Unit Status</b>	<b>Heat Recovery</b>
<b>Waster Water Treatment Facilities</b>					
Waste Water Treatment Plant, Janesville, WI	400	Recip Engines	Digester Gas	Operating	Yes
Kaukanna, WI	750	Recip Engines	Digester Gas	Operating	Yes
MMSD Jones Island Wastewater Treatment Plant, Milwaukee Metro Sewerage District	35200	Gas Turbine	Gas	Operating	Yes
<b>Industrial Facilities</b>					
National By-Products, Inc., Berlin, WI	2400	Caterpillar Recip	Landfill Gas	Operating	
Industrial Facility, Neenah, WI	70	Honeywell Microturbine	Natural Gas	Operating	
Whitewater Cogeneration Facility, Whitewater, WI	315000	Turbine	Natural Gas	Operating	
Marathon Electric Co.	3600	Recip Engine			
MGE - Backup Generation Service, Madison, WI	50000	About 50 Distributed Generators		Operating	No

<b>Project Name</b>	<b>Generator Capacity (MWe)</b>	<b>Generator Type</b>	<b>Primary Energy Source</b>	<b>Generating Unit Status</b>	<b>Heat Recovery</b>
A host of major paper companies in Wisconsin operate CHP facilities including Fox River Paper Co., Wasau Mosinee Paper Corp., Weyerhaeuser Co, International Paper Co., Fraser Paper Inc., Stora Enso North America.	> 250,000		Coal, Black Liquor Biomass	Operating	Some