

BCHP Baseline Analysis for the Ohio Market

**Prepared by:
Midwest CHP Application Center**

**Under
ORNL Contract #40000025560**



**MIDWEST
CHP
APPLICATION
CENTER**

*In Partnership
with the US DOE*

University of Illinois at Chicago – Energy Resources Center

June 2004

(Version: 6/15/2004 2:14 PM)

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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 the state. This information will be used to develop educational and market transformation programs, which will foster BCHP applications.

In Ohio there are close to 50 technical companies capable of BCHP installation. Companies that are leading the way for BCHP in Ohio are PraEis, Ltd. and Cinergy Solutions; both companies are also partners in the EPA CHP Partnership Program.

Focusing on BCHP systems in commercial installations, the Midwest CHP Application Center (MAC) identified a total of 6 BCHP installations producing close to 11,000 kW in Ohio, three of these installations are located at schools (Colleges).

Capital costs as well as operating costs are generally viewed as some of the major hurdles to utilize BCHP technologies. For smaller generating capacity units, the initial cost can have a long payback period unless electric costs are very high and thermal loads well matched. The predominant technologies in BCHP power generation utilize 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/kW and increase in cost up to fuel cell technologies that may cost up to \$5,000/kW. Natural gas reciprocating engines are the predominate technology, and can range in price from \$1,000 to \$1,800/kW (installed). Prices of all of these technologies are expected to decrease as the technologies and system designs become more common. Pre-designed packaged CHP systems are beginning to enter the market. Hopefully these packaged design systems, which have been developed for a wide range of applications, will contribute to the reduction in the cost of installing a BCHP system.

For most BCHP systems natural gas constitutes the majority of the variable/operating cost. Volatile natural gas prices, such as those experienced since late in 2002, could have negative affects on the BCHP market development. However, natural gas prices in Ohio at \$8.34/MMBtu are slightly below the Midwest average of \$8.37/MMBtu (year 2003 data for commercial customers). In contrast, Ohio exhibits relatively high electricity prices at 7.7¢/kWh (year 2003 data for commercial customers) compared to the Midwest average of 6.8¢/kWh.

On the regulatory side Ohio provides for retail electricity competition. CHP facilities with a capacity of less than 300 KW for three-phase service, or 25 kW for single-phase service can qualify for a simplified interconnection process. Furthermore, net metering is available for facilities based on biomass, landfill gas, and microturbines.

High backup/standby-fees by local electric utility companies can be particularly discouraging for CHP installations, since many CHP facilities prefer to remain interconnected to use the electric grid as a backup during equipment maintenance and outages. A study by the Midwest CHP Application Center (full study report forthcoming in June, 2004) shows that in Ohio stand-by power fees can easily reduce the financial savings from a CHP system by 20%.

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 interconnection requirements and interconnection studies, local utility pricing, site permitting, and local building codes and standards. These barriers can be overcome with support from regional and local entities. Some of the entities that the MAC has identified that could assist with the development and/or deployment of BCHP in Ohio are:

- Ohio Department of Development - Office of Energy Efficiency
- Public Utilities Commission of Ohio
- Midwest CHP Initiative

Sara Ward, Chief of the Office of Energy Efficiency, states “it is an essential government function and purpose of the state to promote the efficient utilization of energy” (see www.odod.state.oh.us). This mission is backed by a multitude of financial incentives for renewable energy projects, which are widely applicable for CHP projects. These financial incentives include low interest loans through the Energy Loan Fund program as well as several tax incentives.

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 Ohio, ONSITE estimated a total market potential for BCHP-based electric production to be in the range of 2,410 to 7,480 MW. The market potential for multi-unit residential BCHP installation in Ohio for 2003 is estimated to be about 21,682 units, based on information collected by the UIC/ERC/MAC for this report. These market potentials may only be realized if the regulatory and policy issues become more supportive of BCHP installations.

This report concludes with recommendations, which address the need to work with state regulators to educate private market participants on BCHP benefits. Case studies are needed which show the tremendous economic and environmental benefits of BCHP systems.

1. Introduction and Purpose

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

Cooling, Heating, and Power for Buildings (B CHP) refers to technologies which generate electricity at or near the point of use, such as a building or building complex, while simultaneously recovering up to 80% of the rejected heat from the generating equipment for heating, cooling and/or dehumidification purposes.

In order to assess the current state of B CHP in Ohio, 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 B CHP installations was conducted.

In this report, the initial cost of current B CHP related technologies, the prevailing energy prices in the state, and the available financial incentives for B CHP systems were evaluated to assess their impact on the marketability of B CHP.

A status assessment of policy related issues pertaining to B CHP was conducted. The assessment was performed for several policy areas: CHP interconnection and stand-by rate provisions, net metering, general status of electric deregulation in the state, emerging legislation, and potential partners/advocates of B CHP.

The market capacity potential for B CHP in Ohio was evaluated to identify the best target sectors for deployment. This report concludes with recommendations on how to effectively promote the deployment of B CHP in Ohio.

2. BCHP Contacts in Ohio

2.1 Key Firms in Ohio 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 and that can be allied with the Midwest CHP Application Center to promote the deployment of BCHP in Ohio.

There are about 50 companies in Ohio that are engaged in BCHP system applications or have BCHP system capabilities. Hopefully in the near future interest in BCHP applications will increase even more because of 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 provides information on architectural firms and engineering firms that are potential allies in the promotion of BCHP installation in Ohio. There are currently about 28 architectural and engineering firms that have developed or have the capabilities to develop BCHP systems in Ohio.

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 manufactures have established a market presence and have built relationships with those most likely to install BCHP technologies. Just recently, the manufacturing community, with support from the US DOE, has begun to introduce into the market pre-designed “packaged” CHP systems applicable to a wide variety of applications. These units range in size from 60 kWe to tens of MWe, and are designed so that they can be used in “multiples” to increase their effective size. As packaged type systems become more common place, the initial cost of installing a BCHP system is expected to decrease because of the pre-designed aspects of the systems. In the meantime, it is still important to strive to find technically and financially suitable applications where manufactures can work with engineering and architectural firms to install “custom” systems. Appendix B provides information on manufacturers that promote BCHP installations in Ohio. There are currently approximately 20 manufactures/sales offices involved in deployment of BCHP related technologies in Ohio.

Property management firms are important in promoting BCHP technologies because they are the operators of many commercial buildings for which BCHP technologies are

suitable. Building codes for commercial buildings often times require emergency generation backup-power. Since property management firms are already required to install generation equipment, the cost differential to install BCHP over a conventional central heating/cooling system and backup generation capability is again smaller and easier to justify. The two main organizations that represent property management firms in Ohio are BOMA (Building Owners and Managers Association) and IREM (Institute of Real Estate Managers), which accredits recognized real estate management organizations. Information on the Ohio BOMA chapter and IREM accredited Ohio property management companies can be found in Appendix C.

Local energy suppliers are also important to promoting BCHP. Since Ohio is a deregulated state with retail electric choice, a host of non-utility electricity suppliers actively pursue retail customers in the state. A list of energy supply companies in Ohio is provided in Appendix D. The list can be accessed electronically at the website of the Public Utilities Commission of Ohio (<http://www.puc.state.oh.us>).

Energy Services companies (ESCOs) are also interested in BCHP technologies. In the recent past they have not been that interested in CHP because it was easier for them to find other cost saving measures in commercial and light industrial applications like lighting retrofits and energy control systems. Moreover, in many cases regulations and siting requirements served as a disincentive for them (as a third party) to install BCHP. However, end-user interest in providing high-reliability electric service and overall increased energy efficiency in buildings, coupled with end-user restricted capital has recently piqued interest by ESCO's in BCHP. Appendix E lists ESCO's that are active in Ohio.

2.2 Associations and Organizations Involved with BCHP Deployment

Federal, State, and regional entities are becoming more and more interested in BCHP systems because of the energy savings potential and reduction in emissions from this technology. While the Federal government, through the Department of Energy, 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. In Ohio the Public Utilities Commission and the Office of Energy Efficiency are particularly active in promoting BCHP technology.

The Midwest is also 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. A list of these associations and organizations and their web-addresses, where available, is provided in Appendix F.

3. Survey of BCHP Installations and BCHP Targets in Ohio

3.1 Survey Summary

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

The survey of BCHP installations 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 Non-utility Electric Power Plants in the United States" (<http://tonto.eia.doe.gov/FTPROOT/electricity/0095992.pdf>) as well as a database developed by EEA, Inc. The sites identified during the survey represent the best efforts of the Midwest CHP Application Center to identify actual and potential BCHP installations in Ohio. Other existing or candidate BCHP sites may exist. 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.

3.2 Sector Analysis of the Survey Data

An analysis of the survey information for the commercial and industrial sectors is provided in Appendix G.

In summary, there are approximately 30 combined heat and power facilities installed in Ohio. The majority of these CHP systems are installed at industrial facilities (24 installations) and only six CHP systems are located at commercial facilities. The majority of the commercial CHP systems are installed at schools (3 installations at colleges). The total CHP capacity installed at industrial facilities is 370,000 kW; the total CHP capacity installed at commercial facilities is 11,000 kW.

4. Current Pricing Issues

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

4.1 **Equipment and Maintenance Costs**

The predominant prime mover technologies in B CHP applications are reciprocating engines, combustion turbines, and microturbines. In the near future fuel cell technology is expected to become a prevalent B CHP technology as well.

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.

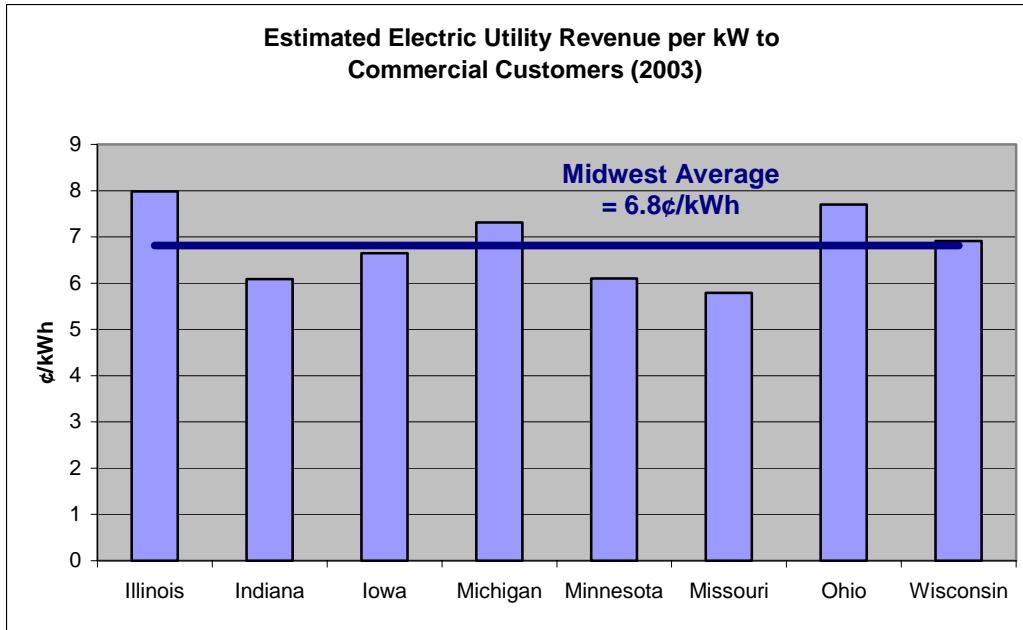
Table 4-1 CHP Technologies

Prime Mover Type	Reciprocating Engines		Gas Turbines – Simple Cycle		Microturbines	Fuel Cell
Capacity Range (<i>kW</i>)	100 – 500	500 – 2,000	1,000 – 10,000	10,000 – 50,000	100 – 500	30 – 3,000
Electric Generation Efficiency						
LHV of Fuel (%)	24 – 28	28 – 38+	24 – 28	31 – 36	25 – 30	40 – 57
Heat Rate (<i>BTU/kWh</i>)	14,000 – 12,000	12,000 – 9,000	14,000 – 12,000	11,000 – 9,500	13,700 – 11,400	
Installed Cost (<i>/kW</i>)* (with Heat Recovery)	\$1,800 – 1,400	\$1,400 – \$1,000	\$1,500 – \$1,000	\$1,000 – \$800	\$2,000 – \$1,000	\$2,000 - \$5,000
O & M Costs (<i>/kWh</i>)	\$0.015 – \$0.012	\$0.012 – \$0.010	\$0.015 – 0.012	\$0.012 – \$0.010	\$0.015 – \$0.012	\$0.002 - \$0.005
Recoverable Useful Heat Hot Water (<i>BTU/h per kW</i>) Steam (<i>lbs/h per kW</i>)	4,000 – 5,000 4 – 5 (15 – 30 <i>psi</i>)	4,000 – 5,000 4-5 (15 – 30 <i>psi</i>)	5,000 – 6,000 5 – 6 (300 – 600 <i>psi</i>)	5,000 – 6,000 5 – 6 (300 – 600 <i>psi</i>)		
Absorption Chiller						
Single (\$/RT)	\$500 - \$1,000	\$250 - \$500	\$200 - \$250	\$200 - \$250		
Double (\$/RT)	N/A	N/A	\$400 - \$500	\$350 - \$400		
Cooling Capacity (RT/kWe)	0.22 - 0.28	0.22 - 0.28	0.28 – 0.33	0.28 – 0.33		
Electric Chiller (\$/RT)	\$200 - \$300	\$200 - \$300	\$180 - \$250	\$180 - \$250		

4.2 **Energy Pricing**

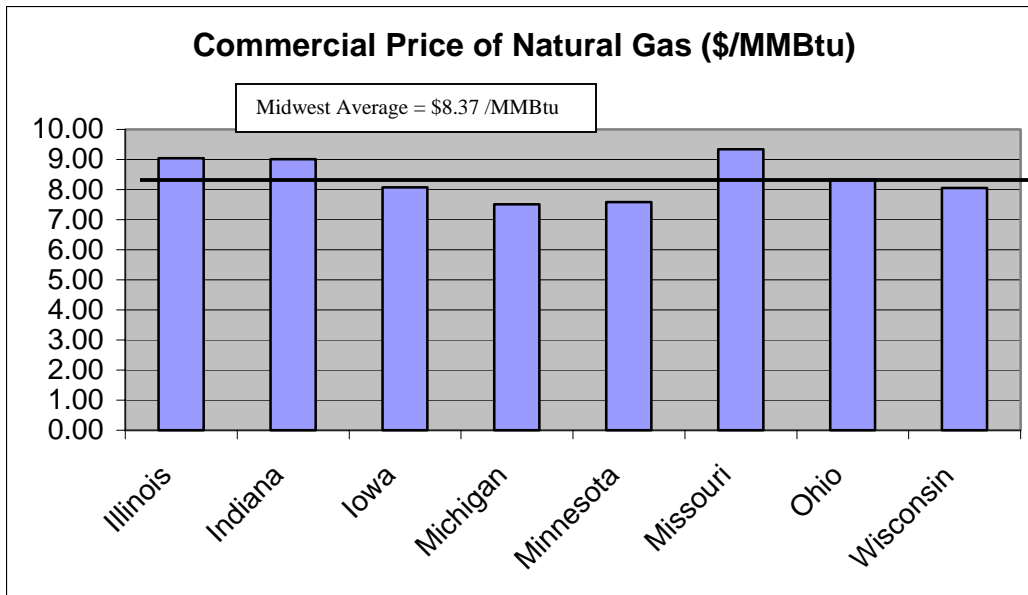
The potential for B CHP in a state depends largely on the prevailing electricity prices as well as on the prevailing natural gas prices, since natural gas is the fuel of choice for many B CHP systems. Relatively high electricity prices and low natural gas prices, for example, result in favorable economics for B CHP.

The following graph shows the electric utility revenue from commercial customers (EIA estimate) for the eight states in the Midwestern Region. As can be seen Ohio exhibits relatively high electricity prices 7.7¢/kWh (year 2003 data) compared to the Midwest average of 6.8¢/kWh.



Source: Energy Information Administration <http://www.eia.doe.gov/cneaf/electricity/epm/epmt53p1.html>

In contrast, natural gas prices in Ohio at \$8.34 /MMBtu are slightly below the Midwest average at \$8.37 /MMBtu (average price sold to commercial consumers in 2003).



*Data not available

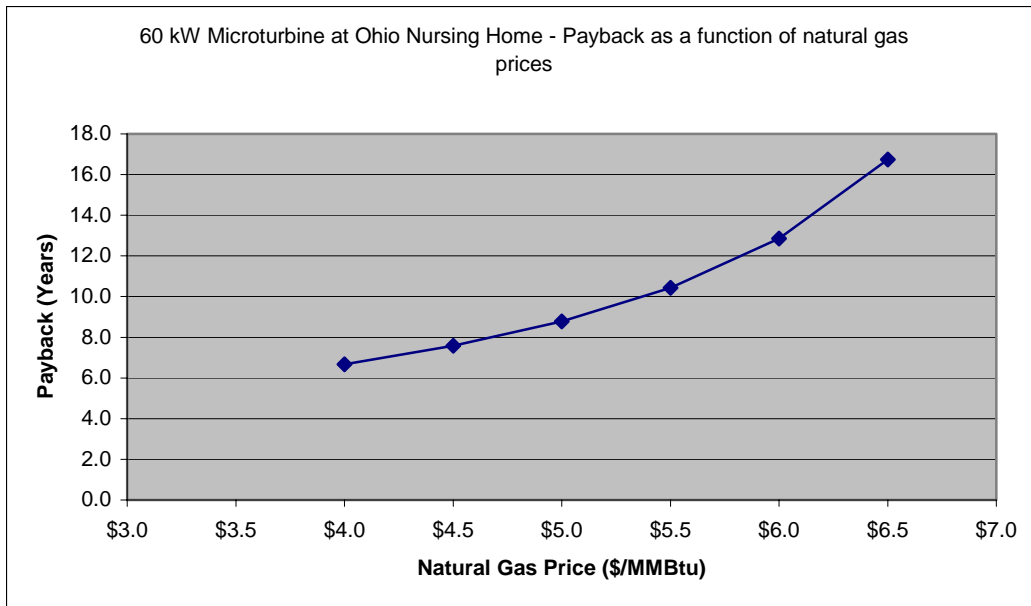
Source: <http://www.eia.doe.gov/neic/historic/hngas2.htm#Price>

Relatively high electricity rates and average natural gas prices in Ohio compared to the other 7 Midwestern states may result in a relatively attractive environment for CHP in Ohio.

CHP is particularly suitable for larger facility sizes based on the high thermal demand of these facilities. Since larger facilities generally have higher natural gas demands, larger

facilities can be expected to incur even lower natural gas cost than the average values cited above.

A study by the Midwest CHP Application Center indicates the strong influence of natural gas prices on energy savings achieved with BCHP. The graph below shows the payback in years as a function of natural gas prices for a 60 kW microturbine installed at a nursing home located within Columbus Southern Power Company's service territory. (The graph is not based on an actual installation but was modeled utilizing an energy analysis software tool). The results are an excerpt from a forthcoming study conducted by the Midwest CHP Application Center; the full report will be available by June 2004.



4.3 Financial Incentives for BCHP Systems

The database of State Incentives for Renewable Energy (DSIRE, www.dsireusa.org) lists several financial incentives that may be applicable for BCHP systems in Ohio. These incentives are as follows:

Conversion Facilities Corporate Tax Exemption: Upon certification from the tax commissioner technologies that replace fossil fuel sources with alternative fuels or technologies such as biomass, municipal solid waste, and CHP technologies are exempt from sales and use tax. Also, such equipment cannot be considered an improvement for property tax assessment purposes.

Energy Efficiency Revolving Loan Fund: Under this program biomass or municipal solid waste based CHP systems may qualify for loans at below market rates. The Ohio Office of Energy Efficiency administers this loan fund.

Ethanol Investment Tax Credit: Taxpayers investing in ethanol plants may claim an investment tax credit equal to 50% of the investment into the plant, not to exceed \$5,000

per taxpayer. Since ethanol plants provide an ideal fit for CHP systems with several CHP facilities already installed at ethanol plants in the country, this investment tax credit may potentially be relevant for CHP facilities.

While fuel cell-based CHP systems are still in the development stage and hence not the focus of this report, it should be noted that Ohio provides a wide range of incentives for fuel cell technologies, including low interest loans up to \$5 million per company and tax exempt financing.

5. Summary and Status of B CHP Policy Issues

Policy issues at the State level play an important role in the deployment of B CHP within a state. The purpose of this section is to provide a summary and status of policy related issues pertaining to the advancement of B CHP in the State of Ohio. The following policy areas are summarized below: Electric interconnection and stand-by tariffs, net-metering provisions, general status on progress of deregulation, emerging legislation and regulations, U.S. EPA CHP partners, and political partners.

5.1 Electric Interconnection

CHP facilities with a capacity less than 300 KW with three-phase power or 25 kW with single-phase power (and which meet certain technical requirements, short circuit contribution criteria, and size limitations on the electric feeders) can qualify for a simplified interconnection process that does not require a detailed system impact and facility study.

The Public Utilities Commission of Ohio has compiled several helpful documents that provide guidance on interconnecting distributed generating equipment with the local utility company. These documents are as follows:

- 1) A sample application interconnection form that lists the minimum amount of information needed by utilities to start the interconnection process.
- 2) A flow chart that allows a customer and a utility to determine whether or not a CHP system qualifies for a simplified interconnection process.
- 3) A detailed list of technical requirements (including voltage and frequency tolerances) for CHP equipment to qualify for simplified interconnection.

While Ohio does not have interconnection standards with statewide fee and interconnection time schedules, the simplified interconnection process and the technical guidelines provided by the Public Services Commission are a significant step towards standardization.

5.2 Stand-by Fees

Stand-by rates can adversely affect the economics for B CHP in Ohio. A study conducted by the Midwest CHP Application Center (full study-report available by June 2004) models the financial impact of stand-by rates for a 60 kW microturbine installation at an Ohio nursing home located within Columbus Southern Power Company's territory. The study utilizes a software program called "Building Energy Analyzer," which assesses the financial impact of various types of on-site energy generation equipment by correlating prevailing energy prices with facility energy consumption characteristics and the prevailing climatic conditions in the area. Assuming natural gas prices of \$5 /MMBtu and Columbus Southern Power Company's stand-by rate of \$3.71 /kW per month, the annual savings with B CHP over traditional electricity supply from the utility company amount to \$13,180. However, without stand-by service, the annual savings with B CHP are \$15,800, or about 20 percent higher.

5.3 Net Metering

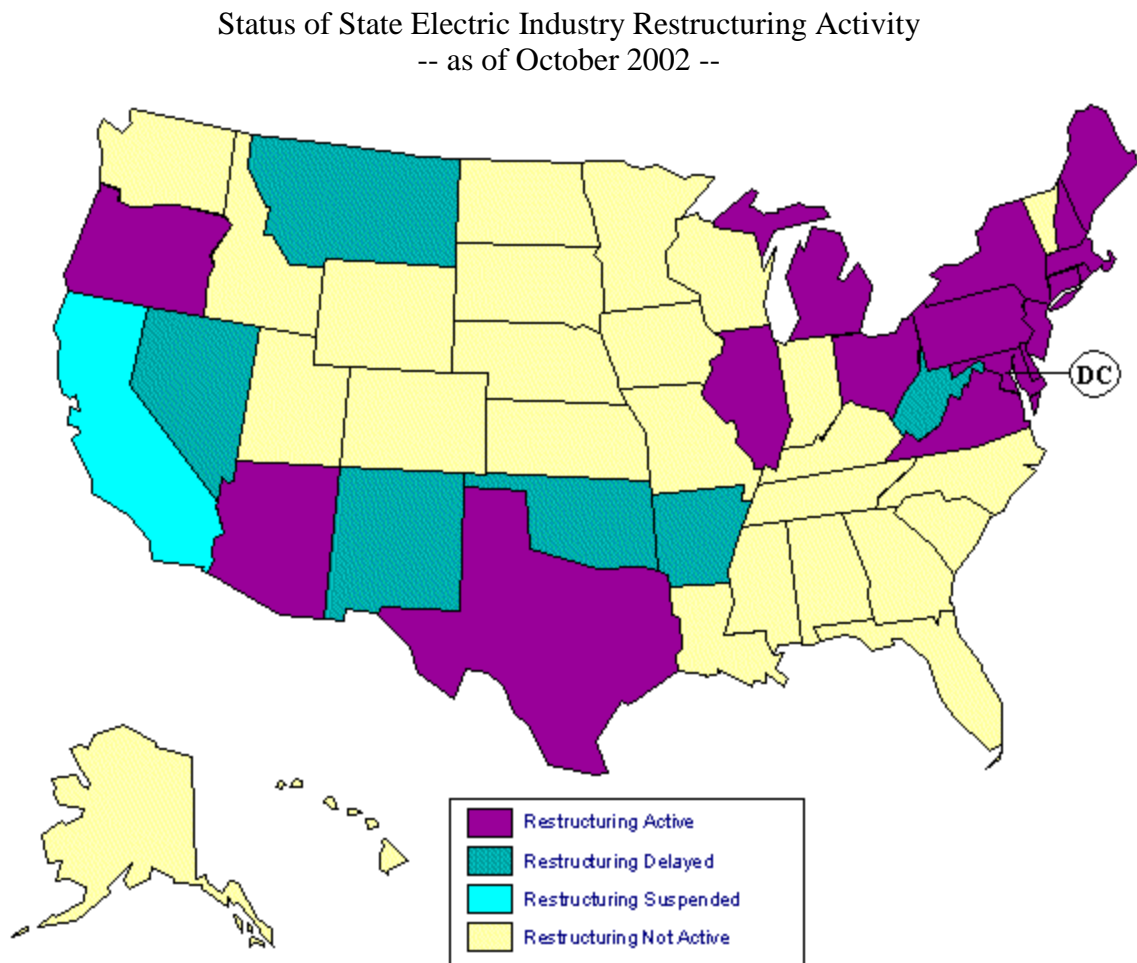
Net metering is provided to qualifying energy facilities, which have to be located at the end-user's premises and be connected in parallel to the utility's system. Qualifying facilities relevant to BCHP technologies include biomass, landfill gas, microturbines (with a capacity less than 100 kW), and fuel cells.

If a facility generates more electricity than it purchases from the electricity provider, then the facility receives a credit towards future charges. A facility that shows credit amounts for three consecutive months can request a cash payment for the total accumulated credit.

Electric suppliers in Ohio are only required to offer net metering service until the total capacity of all net-metered facilities equals one percent of the suppliers' aggregate peak demand in the state.

5.4 General Status of Progress on Deregulation

The following graph shows the state restructuring activities on a state-by-state basis. As can be seen, Ohio is classified "restructuring active" as of October 2002 (Source: EIA; http://www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html):



In July 6, 1999 the governor signed Ohio's restructuring legislation into law. The restructuring law provided for retail choice starting January 1, 2001. A report published by Ohio's Consumers' Council showed that by the end of 2002 approximately 20 percent of all eligible electricity customers had switched their electricity provider.

5.5 Emerging Legislation and Regulations

There are currently no emerging regulations or legislation that directly affect CHP deployment in Ohio.

5.6 U.S. EPA CHP Partnership

The EPA CHP Partnership is a voluntary program designed to foster cost-effective CHP projects. Through the program EPA engages the CHP industry, state and local governments, and other stakeholders in cooperative relationships to expand the use of CHP.

As part of the partnership program, state and local governments agree to host a CHP workshop and review EPA documents detailing state and local regulations that may affect CHP development. Industrial partners agree to work with EPA to evaluate the use of additional CHP at their facilities. Cinergy Solutions from Cincinnati and PraEis in Strongsville, as well as Kent State University in Kent and the Ohio Department of Development – Office of Energy Efficiency in Columbus, are all EPA CHP Partners from the state of Ohio.

5.7 Potential Political Partners or Advocates of BCHP

Below is a list of groups, other than the Midwest Application Center, that could assist with the development and/or deployment of a BCHP in Ohio.

- Ohio Department of Development - Office of Energy Efficiency
- Public Utilities Commission of Ohio
- Midwest CHP Initiative

The Office of Energy Efficiency of Ohio with its administrative responsibility for the Energy Efficiency loan fund is a strong partner in the deployment of CHP in the state. Representatives from the Office of Energy Efficiency have also been regular members of the Midwest CHP Initiative indicating their support for CHP deployment. The Public Utilities Commission can also be viewed as a strong partner since the Commission supports and provides tools for simplified interconnection of CHP systems.

6. The Market Capacity Potential of B CHP in Ohio

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

Estimates for the Industrial/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 B CHP 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 B CHP applications requiring a capacity of 77,281 MW.

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 potential in each of the 48 contiguous states in America. The figure on the following page shows the result of their study.

For Ohio, ONSITE estimated a total market potential for B CHP based electric production to be in the range of 2,410 to 7,480 MW. This represents 5 to 16% of the projected DOE long-term goal of 47 gigawatts of installed B CHP capacity that was developed as part of the B CHP Roadmap Workshop. This potential may only be realized if the regulatory and policy issues become more supportive of B CHP installations. Also if incentives are provided, additional market potential capacity could be realized.



6.2 Multi-Family Residential Market

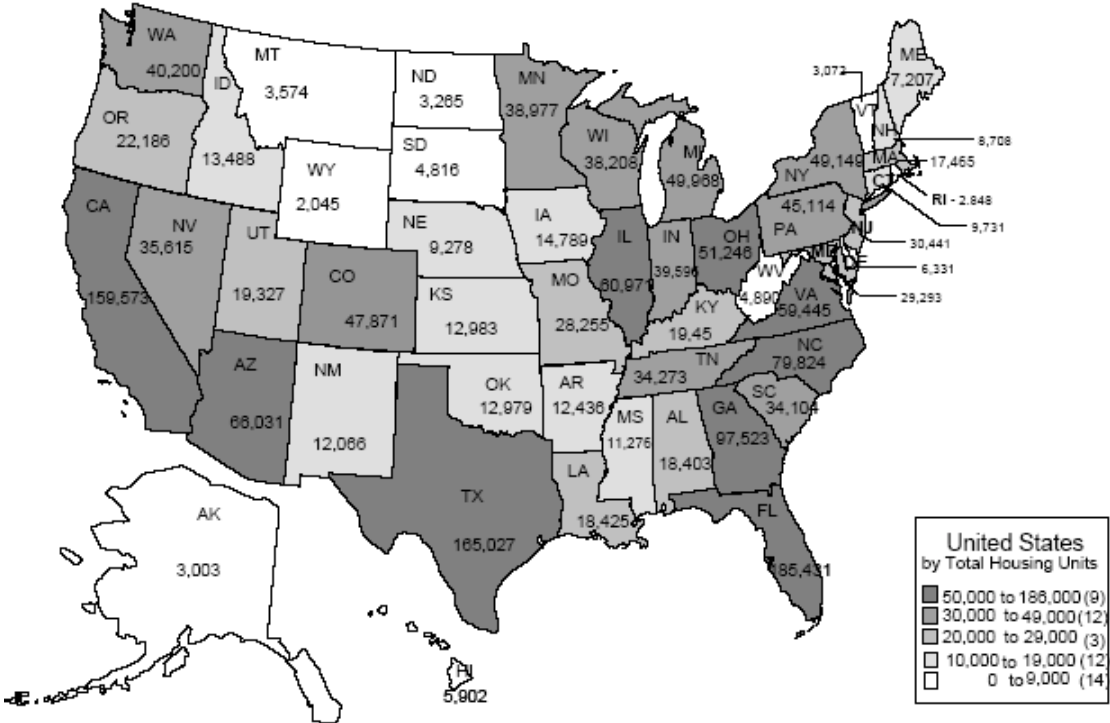
Besides commercial and industrial applications BHP systems also have potential market viability for multi-unit residences (those with 2 or more units). Compared to conventional HVAC systems BHP installations are particularly competitive when it comes to new construction or complete replacement of old HVAC systems. Since all new and replacement HVAC systems need to be permitted in Ohio, permitting data provides a good estimate of buildings where BHP systems may be a potential alternative. As the map on the following page indicates, Ohio ranks in the top 9 states for overall privately owned construction activities (Source: U.S. Census Bureau).

Applying the following assumptions the potential market for BHP applications for multi-unit residences can be estimated:

- New construction remains at or near the same level as in the year 2003 (10,798 units, excludes single-family units),
- HVAC systems need to be replaced every 20 years, therefore units installed in 1983 would need to be replaced in the year 2003, and
- The number of HVAC units replaced in 2003 is consistent with the number of units installed in 1983 (10,884 units).

Applying these assumptions the new building permit data for multi-unit residences was obtained for 1983 and 2003. Therefore the market potential for multi-unit residential BHP installation in Ohio for 2003 is estimated to be about 21,682 units (replacement plus new construction units).

U.S. New Privately Owned Housing Units Authorized by State: 2002



7. Conclusions and Recommendations

7.1 Conclusions

7.1.1 Interest Level

In Ohio approximately 50 technical companies are actively involved or have the capability to pursue BCHP deployment in the State. There are several large well-known engineering firms, as well as equipment manufactures and distributors who are aggressively pursuing the BCHP market in Ohio.

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 Application Center and the Midwest CHP Initiative.

7.1.2 Installation Status

There are currently only about 11,000 kW of BCHP systems installed at commercial facilities in Ohio. Significantly more combined heat and power applications are installed at industrial facilities (370,000 kW).

7.1.3 Barriers

Capital costs and payback time frames are of concern. The least expensive electric generating technologies (large natural gas turbines) installed start around \$600/kW and increase up in cost to fuel cell technologies that run up to \$5,000/kW. Additional costs, associated with thermal recovery equipment and engineering costs further add to the cost of the project. 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. Prices are expected to decrease as the technologies and “packaged” system designs become more common.

Operating costs due to volatile gas prices as seen since late in 2002 may be perceived as a concern. However, natural gas prices in Ohio at \$8.34 /MMBtu are slightly below the Midwest average of \$8.37/MMBtu (year 2003 data for commercial customers).

Stand-by power rates in Ohio are of concern. A study by the Midwest CHP Application Center has shown that stand-by power rates in the studied Ohio utility territory decreased the annual savings from CHP by 20 percent.

7.1.4 Favorable Characteristics

Financial assistance is available in form of low interest loans and tax credits for CHP technologies and CHP host sites (such as municipal waste and ethanol facilities).

Regulatory support exists for CHP in form of a simplified interconnection procedure for smaller CHP systems. The Public Utilities Commission on its website provides a host of tools to navigate through the simplified interconnection process. Additionally, net metering is available in the state for certain CHP technologies.

Favorable partners exist in Ohio with the Ohio Office of Energy Efficiency and the Ohio Public Utilities Commission firmly supporting CHP.

Electricity prices in Ohio are relatively high at 7.7¢/kWh (year 2003 data for commercial customers) compared to the Midwest average of 6.8¢/kWh. Relatively high electricity prices make BCHP-generated electricity more competitive for facilities.

Market potential appears to be good for BCHP. ONSITE Energy Corporation estimates for Ohio a total market potential of up to 7,400 MW. Besides commercial and industrial estimates by ONSITE the MAC estimated that the potential Ohio market for BCHP installations in the multi-unit residential sector to be about 21,600 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), and
- Technical and financial assessments tools and resources available.

2) Influence the Removal of Regulatory Barriers

- Work with the Ohio Public Utilities Commission to reduce stand-by rates.

3) Build Alliances

Build alliances with additional potential partners such as:

- Large Architect/Engineering Firms with BCHP capabilities.
- PraEis, Inc. and Cinergy Solutions.

Appendix A Architect and Engineering Firms Promoting BCHP Technologies in Ohio

- 1) American AIA Ohio
17 South High Street, Suite 200
Columbus, OH 43215-3458
Phone: (614) 221-0338
Capabilities: CHP facility architect contact
- 2) AIA Akron
13152 Sugarbush Ave NW
Mogadore, OH 44260
Phone: (330) 699-9788
Capabilities: CHP facility architect contact
- 3) AIA Cincinnati
Longworth Hall Design Center
700 West Pete Rose Way
Cincinnati, OH 45203
Phone: (513) 421-4661
Capabilities: CHP facility architect contact
- 4) AIA Cleveland
The Park Building
140 Public Square, #502
Cleveland, OH 44114
Phone: (216) 771-1240
Capabilities: CHP facility architect contact
- 5) AIA Columbus
21 W. Broad St. Suite 200
Columbus, OH 43215-4100
Phone: (614) 469-1973
Capabilities: CHP facility architect contact
- 6) AIA Dayton
5816 Daffodil Circle
Dayton, OH 45449
Phone: (937) 291-1913
Capabilities: CHP facility architect contact
- 7) AIA Eastern Ohio
Meadville Office
275 Chestnut St., 2nd Floor
Meadville, PA 16335
Phone: (814) 333-1600
Capabilities: CHP facility architect contact

- 8) AIA Toledo
P.O. Box 4665
Toledo, OH 43610
Phone: (419) 266-2428
Capabilities: CHP facility architect contact
- 9) Acres International
100 Sylvan Parkway
Amherst, NY 14228-1146 USA
E-mail: amherst@acres.com
Phone: (716) 689-3737
Capabilities: CHP engineering/construction
- 10) AlphaMark Inc
P O Box 927, Findlay, OH 45840
Email: jimbalph@aol.com
Phone: (419) 420-1824
Capabilities: Electrical consultants
- 11) Atlantic Projects Company
Gas Turbine Installer
1462 Erie Boulevard
Schenectady, NY 12305 U.S.A.
Email: info@atlanticprojects.com
Phone: (518) 346-1500
Capabilities: Gas turbine installation
- 12) Ballard Engineering
3555 Electric Avenue
Rockford, IL 61125
Phone: (815) 229-1800
Capabilities: BCHP engineering/construction
- 13) Burns & McDonnell
1630 Des Peres Road
St. Louis, MO 63131
Email: bberry@burnsmcd.com
Phone: (314) 821-9016
Capabilities: BCHP engineering/construction
- 14) CAI Commonwealth Associates, Inc.
P.O. Box 1124
Jackson, MI 49204
Phone: (517) 788-3474
Capabilities: Consulting Engineers and Construction Management

- 15) Cambridge Seven Associates
1050 Massachusetts Avenue
Cambridge, MA 02138
Email: marketing@c7a.com
Phone: (617) 492-7000
Capabilities: Design/Build University of Cincinnati CHP Plant

- 16) Cinergy Solutions, Inc.
139 East Fourth Street
Cincinnati, Ohio 45202
Phone: (800) 398-5917
Capabilities: B CHP engineering/development

- 17) Cogentrix
9405 Arrowpoint Boulevard
Charlotte, NC 28273-8110
Capabilities: B CHP engineering

- 18) FirstEnergy Solutions
395 Ghent Road
Akron, Ohio 44333
Phone: (800) 977-0500
Capabilities: Energy Management / Mechanical and Electric contracting

- 19) Frebco
3400 Kettering Blvd.
Dayton, OH 45439
Capabilities: Industrial plumbing (power plant experienced)

- 20) GKC-EME
205 W. Wacker Drive
Chicago, IL 60606
Capabilities: B CHP engineering

- 21) IC Construction
10060 Brecksville Rd.
Brecksville, OH 44141
Phone: (440) 746-9200
Capabilities: B CHP construction

- 22) K & H Energy Services
6161 Cochran Road, Solon, OH 44139
Email: bdonahue@khenergy.com
Phone: (440) 519-2570
Capabilities: Electrical consultants

- 23) La Salle Associates
3700 North Southport
Chicago, IL 60613
Phone: (630) 858-8110
Capabilities: BCHP engineering
- 24) PraEis, Ltd.
Shawana Johnson
15830 Foltz Industrial Parkway, Suite A
Strongsville, OH 44149
Email: shawanajohnson@praeis.com
Phone: (440) 879-4100
Capabilities: BCHP engineering/construction
- 25) Primera Engineering
25 E. Washington St.
Suite 510
Chicago, IL 60602
Phone: (312) 606-0629
Capabilities: BCHP engineering
- 26) Robert H. Fuller
2901 N. High St.
Columbus, Ohio 43202-1196
Email: rhfuller@compuserve.com
Phone: (614) 261-7934
Capabilities: Design/Engineer of Wooster College CHP System, Wooster, OH
- 27) SPGS, Inc.
945 North Trimble Road
Mansfield, OH 44906
Email: groundspgs@aol.com
Phone: (419) 747-7474
Capabilities: Electrical consultants
- 28) Stanley Consultants, Inc.
225 Iowa Avenue
Muscatine, IA 52761
Phone: (563) 264-6457
Capabilities: BCHP Engineering, Environmental and Construction Services

NOTE: *This list represents only those firms that the Midwest 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 Equipment Distributors/Manufactures That Promote BHP Technologies in Ohio

1. ADA Systems
955 North Lively Boulevard
Wood Dale, IL 60191
Capabilities: Evaporative Cooling Systems, Energy Recovery
2. Caterpillar Generator Distributor
Ohio CAT
5252 Walcutt Ct.
Columbus, OH
43228-9489
Email: info@ohiocat.com
Phone: (614) 878-2287
Capabilities: Equipment Distributor
3. Control Transformer Corporation
3701 Warren Meadville Road,
Cortland, OH 44410
Email: sales@control-transformer.com
Phone: (330) 637-6015
Capabilities: Electric transformer manufacturers/vendor
4. Copeland Corporation
Manufacturing Site:
Specialty Scroll Division
1675 W. Campbell Rd.
P.O. Box 669
Sidney, OH 45365-0669
Distributor of Copeland Compressors
5. Allied Supply Co Inc.
1100 East Monument Avenue
Phone: (937) 224-9833
Website: www.alliedsupply.com
Capabilities: Equipment Distributor
6. DG Equipment Co. (Brookville, OH)
40 Robert Wright Dr, Brookville, OH 45309
Email: tperry@dgequipmentco.com
Phone: (937) 833-6255
Capabilities: Equipment Distributor
7. Eisenmann
150 E. Dartmoor Dr.
Crystal Lake, IL 60014
Phone: (815) 455-4100
Capabilities: Air Purification Equipment

8. Electric Service Company
5331 Hetzel Street,
Cincinnati, OH 45227
Email: info@electricservice.com
Phone: (513) 271-1752
Capabilities: Electric transformer manufacturers/vendor
9. Electrical World Industrial Sales Corp.
Post Office Box 5381,
Fairlawn, OH 44334
Email: sales@elecworld.com
Phone: (330) 494-0306
Capabilities: Electric transformer manufacturers/vendor
10. Generac Power Systems
Ultimate Service Dealer
4800 Deramus
Kansas City, MO, 64120-1186
Phone: (816) 245-5400
Capabilities: Electric Generation Equipment Manufacturer
11. Hess Microgen
12 Industrial Parkway, Unit B-1
Carson City, NV 89706
Phone: (775) 884-1000
Capabilities: Generators Equipment with Heat Recovery
12. Huntington Environmental Systems, Inc.
707C West Algonquin Road
Arlington Heights, IL 60005
Capabilities: Emissions Control Equipment
13. Kohler Generator Distributor of Columbus, OH
6850 Commerce Court Drive
P.O. Box 265
Blacklick, Ohio, 43004-0265
Phone: (800) 523-3587
Capabilities: Equipment Distributor

14. Solar Turbines Incorporated
40 Shuman Blvd. Suite 350
Naperville, IL 60563
Phone: (630) 527-1700
Capabilities: Electric Generation Equipment Manufacturer
15. Staco Energy Products CO
301 Gaddis Boulevard,
Dayton, OH 45403
Email: sales@stacoenergy.com
Phone: (937) 253-1191
Capabilities: Electric transformer manufacturers/vendor
16. Superior Electric Supply CO
9445 West Ridge Road, Elyria, OH 44035
Email: info@sescoelyria.com
Phone: (440) 777-1915
Capabilities: Electric transformer manufacturers/vendor
17. Trane
Suite 208
2550 Corporate Exchange Drive
Columbus, OH 43231
Phone: (614) 899-5135 or
Capabilities: HVAC equipment manufacturer
18. Vaporphase Engineering Controls Inc.
600 South Holmes Avenue
Saint Louis, MO 63122
Phone: (314) 821-7900
Capabilities: Waste Heat Recovery Equipment Manufacturer
19. Wagner-Smith
Dayton, OH
Email: jwagner@wagnersmithequipment.com
Phone: (800) 666-6567
Capabilities: Electric Equipment Sales Rental
20. Waukesha Electric Systems
Distributed by: Kraft Power Corporation (ERO)
608 Cleveland Avenue S.W.
Canton, Oh 44702
Website: www.kraftpower.com
Phone: (330) 455-7096
Capabilities: Equipment Distributor

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Appendix C Property Management Organizations and Firms in Ohio

1. BOMA AKRON
521 Key Building
Akron, OH 44308-1300
E-mail: bomaarkon@aol.com
Phone: (330) 374-1813

2. BOMA GREATER CINCINNATI
3337 Kleeman Lake Court
Cincinnati, OH 45211
Phone: (513) 621-8382

3. BOMA GREATER CLEVELAND
Halle Building
1228 Euclid Avenue
Suite 850
Cleveland, OH 44115
Phone: (216) 575-0305

4. BOMA COLUMBUS
50 West Broad Street
Suite 231
Columbus, OH 43215
Phone: (614) 221-2849

5. BOMA DAYTON
PO Box 680
Dayton, Ohio 45409-0680
Phone: (937) 461-7474

6. BOMA TOLEDO
5247 Secor Road, Unit 5
Suite 1530
Toledo, OH 43623
E-mail: bomatol@buckeye-express.com
Phone: (419) 474-1500

IREM Accredited Real Estate Management Firms:

1. AAIMCO
621 Mehring Way, Ste. 415 A,
Cincinnati, OH 45202

2. AIMCO
Island Club Apartments,
2225 Monteg Blvd., Apt. 5500 1-A,
Columbus, OH 43235

3. American Management Service dba Pinnacle
25700 Science Park Dr., Ste. 160,
Beachwood, OH 44122
Phone: (216) 378-9610

4. American Management Services dba Pinnacle
4301 Golden Gate Oval,
Columbus, OH 43224
Phone: (614) 476-3134

5. CB Richard Ellis, Inc.
25 Merchant St., Ste. 130,
Cincinnati, OH 45246
Phone: (513) 672-6366

6. CB Richard Ellis, Inc.
201 E. Fifth St., Ste. 1510,
Cincinnati, OH 45202
Phone: (513) 369-1300

7. CB Richard Ellis, Inc.
200 Public Sq., No. 28-4000,
Cleveland, OH 44114
Phone: (216) 687-1800

8. CB Richard Ellis, Inc.
50 W. Broad St., Ste. 2800,
Columbus, OH 43215
Phone: (614) 224-1492

9. Coldwell Banker Commercial United Realty Services
81 S. Fifth St.,
Columbus, OH 43215
Phone: (614) 228-7900

10. Colliers Turley Martin Tucker
221 E. 4th St. #2700,
Cincinnati, OH 45202-4100
Phone: (513) 421-4884

11. The Community Builders, Inc.
1014 Vine St., Ste. 1850,
Cincinnati, OH 45202
Phone: (513) 977-4000

12. Continental Communities Ltd.
150 E. Broad St.,
Columbus, OH 43215
Phone: (614) 221-1800

13. Eagle Realty Group, LLC
421 E 4th St,
Cincinnati, OH 45202
Phone: (513) 361-7700

14. Edens & Avant Investments Limited Partnership
2855 W. Market St., No. 207,
Akron, OH 44333
Phone: (330) 836-9174

15. Edgewood Management Corp.
77 S. Liberty Rd., Ste. 1B,
Powell, OH 43065
Phone: (614) 880-0709

16. First Realty Property Management, Ltd.
6000 Rockside Woods Blvd., No. 220,
P.O. Box 318085,
Cleveland, OH 44131-8085
Phone: (216) 328-2600

17. First Realty Property Management, Ltd.
127 W. Perry St.,
Port Clinton, OH 43452
Phone: (877) 732-0054

18. Forest City Residential Management, Inc.
Terminal Tower,
50 Public Sq., Ste. 1200,
Cleveland, OH 44113-2204
Phone: (216) 621-6060

19. The Garland Group, Inc., dba Buckeye Real Estate
48 E. 15th Ave.,
Columbus, OH 43201
Phone: (614) 294-4411

20. Grubb & Ellis Management Services, Inc.
600 Vine St., Ste. 2700,
Cincinnati, OH 45202
Phone: (513) 241-9931
21. Grubb & Ellis Management Services, Inc.
1350 Euclid Ave., Ste. 300,
Cleveland, OH 44115
Phone: (216) 861-3040
22. Horizons Real Estate Group, Inc.
20 Northwoods Blvd., Ste. B,
Columbus, OH 43235
Phone: (614) 436-7016
23. Larry Stein Realty Property Services
2 River Pl., Ste. 300,
Dayton, OH 45405
Phone: (937) 222-7884
24. Lincoln Property Co.
8201 Windsor Trail,
Liberty Township, OH 45044
Phone: (513) 775-8452
25. Mark F. Taggart Co.
942A Freeway Dr. North,
Columbus, OH 43229
Phone: (614) 846-2993
26. Michael Realty Services
5247 Secor Rd., Ste. 5,
Toledo, OH 43623
Phone: (419) 474-1500
27. Midland Group
4380 Malsbary Rd., No. 500,
Cincinnati, OH 45242
Phone: (513) 891-2323
28. Miller-Valentine Realty, Inc.
9435 Waterstone Blvd., Ste. 300,
Cincinnati, OH 45249
Phone: (513) 774-8400

29. Miller-Valentine Realty, Inc.
4000 Miller-Valentine Ct.,
Dayton, OH 45439
Phone: (937) 293-0900
30. Nelson & Associates, Inc.
2516 Park Ave.,
Cincinnati, OH 45206
Phone: (513) 961-6011
31. Oakwood Management Co.
6950 Americana Pkwy., Ste. A,
Columbus, OH 43068
Phone: (614) 866-8702
32. OM Partners, LLC dba Colliers
1100 Superior Ave., Eighth Fl.,
Cleveland, OH 44114
Phone: (216) 861-7200
33. Paramount Realty Advisors, LLC
4009 Columbus Rd.,
Granville, OH 43023
Phone: (740) 587-7074
34. Regency Centers Corp.
4380 Malsbary Rd., Ste. 500,
Cincinnati, OH 45242
Phone: (513) 686-1600
35. Riverview Management Co.
1765 Merriman Rd.,
Akron, OH 44313
Phone: (330) 836-0721
36. Royal Estate Corp. dba REM Commercial
4150 Belden Village St., Ste. 305,
Canton, OH 44718
Phone: (330) 491-3700
37. Royal Estate Corp. dba REM Commercial
Millennium Centre, Ste. 90,
200 Market Ave N,
Canton, OH 44702

38. Signature Associates, Inc.
Four Seagate, Ste. 608,
Toledo, OH 43604-2612
Phone: (419) 249-7070

39. Towne Properties Asset Management Co.
1055 St. Paul Pl.,
Cincinnati, OH 45202
Phone: (513) 381-8696

40. US Bank Corporate Real Estate – Columbus
175 South Third St., 4th Floor,
Columbus, OH 43215
Phone: (614) 232-8042

41. Village Green Management Co.
135 Merchant St., Ste. 205,
Cincinnati, OH 45246
Phone: (513) 672-8600

42. Wallace F. Ackley Co.
695 Kenwick Rd.,
Columbus, OH 43209
Phone: (614) 231-3661

43. Wallace F. Ackley Co.
2995 Northwest Blvd.,
Columbus, OH 43221
Phone: (614) 486-2493

44. Wallick Properties Midwest, LLC
P.O. Box 1023,
Columbus, OH 43216
Phone: (614) 868-5500

45. Western Reserve Property Management
1703 Brookpark Rd.,
Cleveland, OH 44109
Phone: (216) 749-6300

NOTE: *This list represents only those firms that the Midwest BCHP Application Center was able to identify at the time of this report.*

Appendix D Energy Supply and Service Companies in Ohio

Natural Gas Marketers:

1. ACN Energy, Inc.
411 Third St.
Marquette, MI 49841
Website: www.acnenergy.com
Phone: (877) 226-5371

2. AEP Ohio Retail Energy, LLC
155 W. Nationwide Blvd.
Columbus, OH 43215
Website: www.aepretailenergy.com
Phone: (877) 401-8552

3. Amerada Hess Corporation
One Hess Plaza
Woodbridge, NJ 07095
Website: www.hess.com
Phone: (800) 437-7872

4. Dominion Field Services, Inc.
140 W. Main St.
Clarksburg, WV 23601
Website: www.dom.com
Phone: (800) 624-3101

5. Dominion Retail, Inc.
1201 Pitt St.
Pittsburgh, PA 15221
Website: www.dom.com
Phone: (800) 990-4090

6. Econnergy Energy Company, Inc.
286 N. Main St.
Spring Valley NY 10977
Website: www.econnergy.com
Phone: (800) 805-8586

7. Energy America, LLC
PMB 371-2000B E. Main St.
Columbus, OH 43209
Website: www.energyamerica.com
Phone: (888) 305-3828

8. Energy Cooperative of Ohio
800 Cross Pointe Rd.
Gahanna, OH 43230
Phone: (888) 541-4646

9. Exelon Energy Ohio, Inc.
125 Dillmont Dr.
Columbus, OH 43235
Website: www.exelonenergy.com
Phone: (800) 860-2764

10. FirstEnergy Solutions Corp.
395 Ghent Rd.
Akron, OH 44333
Website: www.firstenergysolutions.com
Phone: (800) 977-0500

11. H.P. Technologies, Inc.
33648 St. Francis Dr.
Avon, OH 44011
Phone: (877) 512-3170

12. Interstate Gas Supply, Inc.
5020 Bradenton Ave.
Dublin, OH 43017
Website: www.IGSEnergy.com
Phone: (800) 280-4474

13. Metromedia Energy, Inc.
Website: www.metromediaenergy.com
Phone: (877) 750-7046

14. MidAmerican Energy Company
106 E. Second St. Davenport, IA 52801
Website: www.midamerican.com
Phone: (800) 432-8574

15. MxEnergy, Inc.
10010 Junction Dr., Ste 104-S
Annapolis Junction, MD 20701
Website: www.MxEnergy.com
Phone: (800) 785-4373

16. My Choice Energy
187 W. Olentangy Dr., Unit C
Powell, OH 43065
Phone: (888) 505-9104

17. Nicor Energy, LLC
1001 Warrenville Rd., Ste 550
Lisle, IL 60532-4306
Website: www.nicorenergy.com
Phone: (888) 642-6797

18. ONG Marketing, Inc.
P.O. Box 189
Orwell, OH 44076
Phone: (800) 832-6164

19. Plymouth Inventory, Inc.
P.O. Box 24769
Cleveland, OH 44124
Phone: (866) 427-6446

20. Proliance Energy, LLC
111 Monument Circle, Ste 2200
Indianapolis, IN 45342
Website: www.Proliance.com
Phone: (888) 674-2559

21. Shell Energy Services Company, LLC
One Shell Plaza, Ste 4100
910 Louisiana St.
Houston, TX 77002
Website: www.shellenergy.com
Phone: (877) 557-4355

22. Stand Energy Corporation
1077 Celestial St., Ste 110 Cincinnati, OH 45202-1629
Website: www.stand-energy.com
Phone: (800) 598-2046

23. UGI Energy Services, Inc.
d/b/a GASMARK
1100 Berkshire Blvd, Ste 305
Wyomissing, PA 19610
Website: www.ugienergyservices.com
Phone: (800) 427-8545

24. USP&G (Ohio), Ltd
537 Douglas Ave., Ste 17
Dunedin, FL 34698
Website: www.uspowerandgas.com
Phone: (800) 258-7190

25. Vectren Retail, LLC
P.O. Box 3037
Evansville, IN 47730-3037
Website: www.vectrensource.com
Phone: (866) 306-8136

26. Volunteer Energy Services, Inc.
800 Cross Pointe Rd., Ste D
Gahanna, OH 43230
Website: www.veenergy.com
Phone: (800) 977-8374

27. WPS Energy Services, Inc.
Bank One Center,
600 Superior Ave., Ste 1300
Cleveland, OH 44114
Website: www.wpsenergy.com
Phone: (888) 566-1117

Certified Electricity Suppliers:

1. Accent Energy Midwest
Dublin , OH 43016

2. Advantage Energy, Inc.
Hamburg NY 14075
Phone: (888) 326-4977

3. AmerenEnergy Marketing
St. Louis , MO 63102

4. American PowerNet Services
Wyomissing PA 19610
Phone: (610) 372-8500

5. APPI
Salisbury MD 21801
Phone: (800) 520-6685

6. Buckeye Energy Brokers, Inc.
Twinsburg OH 44087
Phone: (877) 251-5381
7. Dominion Retail
Pittsburgh PA 15219
Phone: (877) 796-0716
8. DPL Energy Resources, Inc.
Dayton OH 45432
Phone: (888) 316-2393
9. Eagle Energy
Cincinnati , OH 45238
10. Econnergy Energy Company
Spring Valley, NY 10977
11. Electric AMERICA
Tustin , CA 92780
Phone: (714) 258-0470
12. Energy America
Toronto , Ontario Canada M1B 4X8
Phone: (888) 305-3828
13. FirstEnergy Solutions Corp.
Akron OH 44333
Phone: (877) 524-7283
14. Green Mountain Energy Company
Austin TX 78704
Phone: (877) 682-7794
15. Just Energy Ohio
Houston , TX 77057
16. MidAmerican Energy Company
Urbandale IA 50322
Phone: (800) 342-3346
17. Mirant Americas Retail Energy Marketing
Atlanta , GA 30338
18. Mutual Energy
Columbus OH 43215

19. Nationwide Energy Partners
Columbus , OH 43219
20. New Energy Inc.
Columbus OH 43215
Phone: (888) 638-2210
21. Nordic Marketing of Ohio
Ann Arbor, MI 48105
22. Ohio Farm Bureau Development Corp.
Columbus OH 43216
Phone: (800) 288-1225
23. OMA Service Corporation
Columbus OH 43215
Phone: (800) 662-4463
24. Power Direct
Peoria IL 61602
Phone: (866) 217-6823
25. The Proctor and Gamble Distributing Co.
Cincinnati OH 45224
26. Shell Energy
Houston TX 77010
Phone: (877) 367-4355
27. Solar and Renewable Energy Buyers Cooperative
Findlay , OH 45840
28. Strategic Energy
Pittsburgh PA 15222
Phone: (800) 830-5923
29. US Power and Gas
Dunedin FL 34698
Phone: (800) 258-7190
30. Volunteer Energy Services
Gahanna, OH 43230
31. World Energy Solutions
Worcester , MA 01608

32. WPS Energy Services
Green Bay WI 54304
Phone: (800) 277-2157

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Appendix E Energy Service Companies listed by National Association of Energy Service Companies

1. CitiCapital
Westlake, OH
Phone: (888) 755-3634
2. FirstEnergy Solutions
Akron, OH
Phone: (330) 315-6930
3. GE Lighting
Cleveland, OH
4. Tech Brite, Inc.
Cincinnati, OH
Phone: (800) 246-9977

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Appendix F Associations/Organizations Associated with BCHP Deployment in Ohio

Ohio/Regional Organizations

	Organization	Website
1.	American Institute of Architects	http://www.aia.org
2.	BOMA Building Owners and Managers Association	http://www.boma.org
3.	Center for Neighborhood Technology	http://www.cnt.org
4.	Delta Institute	http://www.delta-institute.org
5.	Energy Resources Center – University of Illinois at Chicago	http://www.erc.uic.edu
6.	Environmental Law and Policy Center	http://www.elpc.org
7.	Gas Technology Institute	http://www.gastechnology.org
8.	Great Lakes Renewable Energy Association	http://glrea.org
9.	Interstate Renewable Energy Council (IREC)	http://www.eren.doe.gov/cro
10.	Ohio Public Utilities Commission	http://www.puc.ohio.gov
11.	Ohio Department of Development – Office of Energy Efficiency	http://odod.state.oh.us
12.	Midwest CHP for Buildings Application Center	http://www.chpcentermw.org
13.	Midwest Cogeneration Association	http://www.cogeneration.org
14.	Midwest Energy Efficiency Alliance (MEEA)	http://www.elpc.org/energy/index.htm

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Federal Government Agencies

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

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Others Associations and Organizations

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

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Appendix G Combined Heat and Power Generation Facilities in Ohio

Commercial Facilities

Facility Name	Location	Capacity (kW)	Prime Mover	Prim. Fuel	Operation Year
Residential Project	Paris	115	Recip. Engine	Natural Gas	1992
Radisson Beachwood Inn	Beachwood	100	Recip. Engine	Natural Gas	1989
Deaconess Hospital	Cleveland	665	Recip. Engine	Natural Gas	1987
Oberlin College	Oberlin	773	Boiler/Steam Turbine	Coal	1984
College of Wooster	Wooster	375	Boiler/Steam Turbine	Coal	1992
Medical College Of Ohio	Toledo	8,900	Combustion Turbine	Natural Gas	1989
Total Capacity (kW):		10,928			

Industrial Facilities

Facility Name	Location	Capacity (kW)	Prime Mover	Prim. Fuel	Operation Year
Sauder Woodworks Plant	Archbold	7,000	Boiler/Steam Turbine	Wood Waste	1993
Hoge Lumber Co	New Knoxville	3,750	Boiler/Steam Turbine	Wood Waste	1985
Mills Pride	Waverly	1,000	Boiler/Steam Turbine	Wood Waste	1991
Hamilton Mill	Hamilton	26,280	Boiler/Steam Turbine	Coal	1991
Sorg Paper Company	Middletown	17,500	Boiler/Steam Turbine	Coal	1990
Mead Corporation	Chillicothe	80,100	Boiler/Steam Turbine	Coal	1962
Packaging Corporation Of America	Rittman	11,060	Boiler/Steam Turbine	Coal	1990
Jefferson Smurfit Corporation	Lockland	8,000	Boiler/Steam Turbine	Coal	1935
Stone Container Corporation	Coshocton	14,500	Boiler/Steam Turbine	Natural Gas	1982
Warmington Road Facility	Massillon	6,850	Combustion Turbine	Natural Gas	1998
Bygen Corporation	Ashtabula	3,300	Recip. Engine	Natural Gas	1991
Synthetic Products Company	Cleveland	650	Recip. Engine	Natural Gas	1986
Millennium Inorganic Chemicals	Ashtabula	28,000	Combustion Turbine	Natural Gas	2000
Ivorydale	Cincinnati	12,500	Boiler/Steam Turbine	Coal	1965
Morton Salt	Rittman	1,875	Boiler/Steam Turbine	Coal	1986
Diamond Crystal Salt Company	Akron	1,100	Boiler/Steam Turbine	Coal	1960
Sunoco Inc	Oregon	6,000	Combustion Turbine	Other	1986
Goodyear Tire & Rubber	Akron	40,000	Boiler/Steam Turbine	Coal	1977
Wheeling-Pittsburgh Steel	Mingo Junction	32,000	Boiler/Steam Turbine	Blast Furnace Gas	1997
LTV Steel Cleveland Works	Cleveland	45,000	Boiler/Steam Turbine	Blast Furnace Gas	1950
Warren Consolidated	Warren	20,500	Boiler/Steam Turbine	Waste Fuel	1955
Empire Industries	Cleveland	700	Recip. Engine	Natural Gas	1987
Clarke Gm Diesel	Cincinnati	75	Recip. Engine	Natural Gas	1990
Akron Recycle Energy Plant	Akron	2,000	Boiler/Steam Turbine	Wood Waste	1979
Total Capacity (kW):		369,740			

NOTE: This list represents only those commercial and light industrial facilities that the Midwest BCHP Application Center was able to identify at the time of this report. Other commercial and light industrial facilities may exist that have distributed generation; they will be added to the database and will be available over the website in the future as they are identified.