



MIDWEST
CHP
APPLICATION
CENTER

CHP

Regional Application Center

Guidebook

January 2003

Revision 2

Combined Heat and Power (CHP)
 Cooling, Heating, and Power (CHP)
 Cooling, Heating, and Power for Buildings (CHPB)
 Buildings Cooling, Heating, and Power (BCHP)
Cogeneration (Cogen)
 Total Energy Systems (TES)
Tri-generation (Trigen)
 Integrated Energy Systems (IES)

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EXECUTIVE SUMMARY

The Regional Application Center (RAC) concept, brought forth as a result of a Department of Energy (DOE) sponsored road map session, is being developed to facilitate the technology transfer and deployment of advanced CHP technologies. The purpose of this Guidebook is to specify the work scope for each application center and provide standards for developing and implementing each Application Center. The Guidebook will ensure some consistency in structure and operation as the concept grows throughout the country.

The Department of Energy – Office of Distributed Energy and Electric Reliability (ODEER) through Oak Ridge National Laboratory (ORNL), established the Midwest CHP Regional Application Center in April of 2001. The pilot Application Center was established as a partnership between the University of Illinois in Chicago (UIC) and the Gas Technology Institute (GTI) to develop and proof the Regional Application Center processes. It is the intent of DOE-ODEER to establish additional RACs. This Guidebook describes the processes and procedures for the start-up and operation of RACs across the country.

Input to this Guidebook has come from:

- ◆ Department of Energy – Office of Distributed Energy and Electric Reliability (ODEER)
- ◆ Oak Ridge National Laboratory (ORNL) Energy Services Technology Division (ESTD)
- ◆ Exergy Partners (Consultant to the program)
- ◆ University of Illinois at Chicago (UIC) and
- ◆ Gas Technology Institute (GTI)

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OBJECTIVES

In 1999 the Department of Energy set out to develop a “Roadmap” to focus their activities in distributed energy (DE) and the role CHP would have in the deployment of DE. The DOE “CHP Challenge Goal” which was established in 1999 as:

“Doubling the nation’s CHP capacity from an estimated 46 GW to 92 GW, by 2010.”

In the Midwest, based on the CHP Challenge Goal, an objective was established to double the amount of CHP installed capacity in the Midwest by the year 2010. In the four of the Midwest States (Illinois, Michigan, Indiana, and Wisconsin) in 1999 there was an estimated 4189 MW of installed CHP capacity. This translates to installing over 8 gigawatts of new CHP capacity by 2010 in the Midwest.

Therefore the objective of each Regional Application Center will be to provide essential and appropriate applied research and development support, focused on the technology transfer and deployment of advanced CHP technologies in order to support the overall Vision. The Regional Application Centers will achieve this objective through a strategy of targeted education and outreach as well as project assistance using the information in this Guidebook to provide overall direction.

BACKGROUND

The DOE and industry partners have and will continue to invest hundreds of millions of dollars in new energy efficient CHP technologies, with the intent of meeting growing electrical demand with – clean, reliable, and secure energy choices. Many of these technologies and systems are commercially available today. The intent of creating Regional Application Centers is to ensure that these technologies are deployed by working on a State-by-State basis to educate market players on the benefits of CHP technologies while reducing the perceived risk. In addition, these RACs will provide a valuable feedback loop to DOE and industry regarding future R&D program needs.

We define CHP as an integrated energy system located at or near the point of use at a facility to provide at least a portion of the electrical load while utilizing the waste/reject heat from the electrical generation to provide heating, process steam, cooling, and/or dehumidification.

CHP systems can provide peak electric power reductions, fuel utilization efficiencies generally between 60% to 70%, and air emission reductions of up to 45% compared to conventional electrical generation at centralized power plants. If accepted by electric utilities, CHP systems can be utilized to increase grid reliability, defer costly grid updates, and can provide electric price stability in a deregulated market.

CHP includes such technologies as:

On-Site Power Generation:

- ◆ Reciprocating Engines
- ◆ Gas Turbines
- ◆ Microturbines
- ◆ Fuel Cells

Heat Recovery:

- ◆ Absorption Chiller/Heaters
- ◆ Desiccant Dehumidification
(Solid and Liquid)
- ◆ Enthalpy Recovery

The use of system integration controls is also highlighted as part of the overall CHP initiative, as they provide increased energy control that translates into enhanced overall system operational efficiencies and reduced energy costs.

STRATEGY

In order to achieve the objective outlined above, the RACs will implement a strategy of targeted education and outreach, while providing support to those projects assessed with high potential for being technically and financially viable projects that can be replicated with minimal changes in similar applications.

The first step is to create an organization in the region (the Application Center) that can work closely with existing organizations and companies in the region who are already familiar with and promoting CHP (Local Project Champions) in order to facilitate the deployment of CHP by educating policy makers, building designers, and building owners, as well as energy professionals on CHP.

The second step is to provide outreach and education to potential CHP users. Outreach should include the RACs promoting their existence and mission by attending and presenting at conferences and meeting with organizations and companies associated with distributed generation and building engineering and design. Education is to be provided in a targeted approach, based on the results of initial State baseline assessments that are designed to identify specific State opportunities and threats to deployment of CHP technologies. The RACs will work to reduce and remove any perceived risks (technical and financial) associated with the use of CHP technologies in those States.

The third step is to identify and facilitate high impact CHP projects; projects that have the potential to be replicated, open up new markets, and have the potential for large market impact. The projects considered for technical assistance should have the potential either now or in the future to be economically viable.

GOALS/METRICS

Each RAC shall develop a set of measurable objectives (metrics) that support the objective and strategy discussed above. The goals shall be quantifiable and have specific time periods to be completed or met. The goals should support the DOE CHP Challenge of:

“Doubling the nation’s CHP capacity from an estimated 46 GW to 92 GW, by 2010.”

Each Center shall develop metrics that provide a means for tracking progress toward this ultimate goal. The metrics should include:

- ◆ Education and Outreach Assistance Rendered: This would include such activities as workshops and conference presentations; one-on-one meetings with clients to provide general information on CHP; and answering direct inquiries on CHP technologies, application suitability, financing, etc.;
- ◆ Technical Assistance Team Support (*a.k.a. SWAT, as described in the Section “Identification and Facilitation of High Impact Projects”*): This would include any projects where SWAT Team assistance is provided. This type of assistance could include the service of a Project Team Leader and or a Focus Expert.

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- ◆ Projects Initiated (MW_e): The total potential capacity in MW_e related to CHP projects that the RAC can demonstrate some involvement with, either in terms of education and outreach assistance or SWAT Team Support.
 - ◆ Capacity Added (MW_e): The total capacity in MW_e installed and operating, related to CHP projects that the RAC can demonstrate some involvement with, either in terms of education and outreach assistance or SWAT Team Support.

Each RAC shall develop, review and finalize goals/metrics within the first 3 months of RAC operation and provide monthly status toward these metrics. See APPENDIX A for an example of a set of metrics to be used to establish the RACs goals and APPENDIX B for an example of a Monthly Activity Report.

ORGANIZATION AND STRUCTURE

There are four core organizational elements to be considered as the Regional Application Center concept is developed and implemented:

1. Regional Core Team,
2. Regional CHP Coalition,
3. Local Project Champions, and
4. Technical Assistance Team (a.k.a. SWAT Team)
 - Project Team Leaders
 - Focus Experts.

Regional Core Team

Each RAC will establish a Core Team that will be responsible for carrying out the education and outreach activities as well as identifying and facilitating high impact projects within the Region.

Each RAC will designate an Executive Director that will have responsibility for managing the activities of the Core Team.

Regional CHP Coalition

Each RAC shall establish or align itself with a regional coalition of industry, environmental, and government entities committed to the development of the regional CHP market, and execution of action items from the DOE's roadmapping sessions. The RAC's Regional Core Team will interface with the Regional CHP Coalition (RCC) on a regular basis to provide input into overall RAC activities, including idea generation and CHP barrier resolution. If such a coalition needs to be established, the RAC shall appoint a Chairman to lead these efforts.

Local Project Champions

Each Regional Application Center will establish a team of nominally 10 to 20 Local Project Champions that will assist the RAC with project facilitation and contact activities. This includes but is not limited to participating in workshops, conducting site visits, and identifying projects. Local Project Champions are not compensated by the RAC, but are not restricted from bidding and being compensated for working on projects identified through the RAC.

Local Project Champions are ambassadors of the Application Center. They use their day-to-day contacts to heighten awareness and provide information on CHP. They are individuals who are knowledgeable about CHP applications and work in fields associated with CHP such as manufacturer distributors, energy companies, system packagers, engineering firms, architectural firms, electrical installation companies, HVAC installation companies, Universities, and related professional associations.

Technical Assistance Team (SWAT Team)

The SWAT Team concept is where the RAC can have the most influence to make viable CHP installations a reality. The SWAT Team represents the composite of the applied technical knowledge available to the RAC. The purpose of the SWAT Team is to foster the completion of high impact projects. A more completed description of the Swat Team is available in the Technical Assistance Program document (APPENDIX D).

Although each RAC is both expected and encouraged to utilize the SWAT Team concept, the present plan is to only fund SWAT Team members (Project Team Leaders and Focus Experts) through contracts issued by the Midwest Application Center. It is the responsibility of the MAC to coordinate the SWAT Team resources for all of the RACs as the concept is formulated and implemented.

Project Team Leaders

Once a high impact project is identified and is in need of a Regional Application Center support, a SWAT Team is created and a Project Team Leader (PTL) is assigned. The PTL provides oversight assistance and support to the project. They will likely be required to visit the site and interact on a regular basis with site engineering and/or architectural personnel. The Project Team Leaders will be funded to work with clients.

PTLs are selected based on their knowledge and experience in the application of CHP technologies for a particular market sector and/or geographical location. Each RAC will utilize the Project Team Leader selection criteria included in the Technical Assistance Program (APPENDIX D) to interview and select Project Team Leaders. Each RAC will maintain a list of PTLs.

Focus Experts

Focus Experts (FEs) are made available through the SWAT Team if special considerations or issues arise during the development of an installation. Normally their services are requested by the PTL and they will be directed by the PTL to provide input on specific technical issues within their area of expertise. In order to minimize SWAT Team costs, in most cases the FEs are not expected to visit the site in order to render their services. They will be funded on an on-call and as-needed basis.

Focus Experts will be chosen based on their particular depth of knowledge for a given area of technical expertise. Examples of such areas of expertise might be: indoor air quality control systems, reciprocating engines, grid interconnections, etc. The FEs will be selected by the RAC based on the selection criteria included in the Technical Assistance Program (APPENDIX D). A national list of FEs will be maintained.

SCOPE OF WORK

Each Regional Application Center will be responsible (at a minimum) for performing the following tasks:

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- Education and Outreach
 - Education and Outreach Activities
 - State Baseline Assessments
 - Case Studies
 - Outreach Communication Information
 - Website and Database Development and Maintenance
 - Regional CHP Coalition
 - Identification and Facilitation of High Impact Projects
 - Project Screening and Documentation
 - Project Support/SWAT Team Assistance
 - Management and Operation

Education and Outreach

One of the main functions or groups of activities performed by the RACs is to provide information (general, technical, and economic) on the concept of CHP to the appropriate target audiences. The type, format, and depth of information required, as well as the specific target audiences in need of information regarding CHP, will most likely vary from State to State and from Region to Region. The variances will depend on such local conditions as the status of electric deregulation, the general acceptance or resistance to the concept of CHP, local electric and natural gas rates, interconnect regulations, and many other issues. Therefore, to develop an effective Education and Outreach program, each RAC must first understand the CHP issues within each state in their designated region.

Education and Outreach Activities

Each Regional Application Center will conduct education and outreach activities to stimulate market development as guided by each of the State Baseline Assessment action plan (discussed below). This includes targeted presentations, workshops, and site visits to those key organizations identified by the baseline assessments, as well as emerging activities that are determined to be essential to the promotion of CHP in the State. Education and outreach will also include the development of the baseline assessments and case studies.

The Regional Application Center is also to facilitate partnerships between those interested in CHP technologies. This includes identifying and contacting various companies, organizations, and consultants to identify Local Project Champions. The Regional Application Center shall maintain a list of these contacts. The list of contacts will be made available through the Website. These contacts represent engineering firms, product suppliers, professional organizations, energy service companies, architectural firms, government agencies, and others who are proponents of CHP. The intent of maintaining these contacts is to facilitate partnerships in order to identify and facilitate projects.

Continuing Education Credits/Training is to be developed and provided to Local Project Champions and Project Team Leaders to familiarize them with the RAC and the information and services available. In the future, the Midwest Application Center intends to develop courses that can be offered for continuing education credits for personnel involved in the CHP industry and may be utilized by other RACs.

State Baseline Assessments

A baseline assessment is to be performed for each State in the Region to develop an understanding of the existing CHP market, identify the key organizations, assess the market potential, and develop an action plan for facilitating the deployment of CHP in that State. The Assessment should be updated at least annually. APPENDIX H describes the content that should be contained in the Baseline Assessment.

Case Studies

The RAC will develop case studies in accordance with the Case Study Protocol contained in APPENDIX I. Case studies will provide building designers and owners with a glimpse of the benefits of CHP and concrete evidence of the successes within their State. Case studies will be provided for selected installations. Case studies will be available for the various target market segments. Over time, they will cover the span of the target market for CHP. The case studies will provide a comprehensive description of the installation, as well as technical and financial analyses in a comprehensive and readily interpretable format. Case studies will be available in three formats: a Fact Sheet (single sheet double sided), Case Study brochure (4 to 6 page open-fold brochure), and a Site Report (10 to 20 page report). The Fact Sheet and Case Study brochure shall be in a format that is suitable for widespread distribution. All three of these formats will be available for hardcopy distribution to interested parties as well as in electronic format on the website.

Outreach Communication Information

A set of written and oral presentation materials utilized to execute education and outreach activities will be developed and made available through the RAC website. The Regional Application Centers will actively acquire and maintain information related to CHP in electronic and hardcopy format. The information will include such items as studies, journal articles, presentations, photographs, and reference material. Information that is in electronic format will be made available on the website. The Midwest Application Center will serve as the national repository for this type of information, setting up databases that are accessible to all RACs.

Website and Database Development and Maintenance

Each RAC should develop a website for disseminating information on CHP, focusing on the States associated with their Regional Application Center. APPENDIX C provides the protocol for the development of the RAC website.

Each RAC website should complement the information available at the existing DOE national website for CHP (www.eren.doe.gov/der/chp). In addition the RAC website will provide links to other websites that would be of interest to those considering CHP. The website will also provide on-line versions of the screening tool, case studies, database of installations, and other information that is available in electronic format. An area will be provided for individuals affiliated directly with the RAC to share information.

Regional CHP Coalition

The Regional Application Center will participate in or establish a Regional CHP Coalition/Initiative, if one has not already been established, that includes the Regional DOE, EPA (National, Regional, and State), State Energy Offices, Gas and/or Electric Utility Advocates, regional industry groups, and Public Utility Commissioners. The Regional CHP Coalition will be responsible for establishing a Regional CHP action plan

and the resources necessary for implementing this action plan. Their focus should be on influencing policy efforts in the areas of interconnection, permitting, and market development. The intent of this coalition is to present a unified front in effecting statewide and regional changes to support the deployment of CHP.

The Regional CHP Coalition should bring together technology experts, environmental experts, and regulatory experts from various states to work on CHP issues and promote solutions to market barriers. The activities of the RAC and the Regional Coalition group complement each other, and together they provide the comprehensive resources necessary to grow CHP in their region.

Identification and Facilitation of High Impact Projects

A second main function or group of activities performed by the RACs is to identify both existing and potential CHP sites within their region, and for a limited number of specific potential sites provide technical assistance to architects, engineers, specifiers, manufacturers, and/or owners as required. The number of sites considered for this technical assistance is limited by both resources available to the RACs and by the screening criteria defined in the Technical Assistance Plan (APPENDIX D). This scope of work includes:

Project Screening and Documentation

Each RAC will need the ability to quickly evaluate the potential for CHP at specific sites and determine if further project assistance is warranted. Each RAC should utilize a computer based screening tool and make the tool available on their website. RACs should not develop these tools, but utilize those that are already available. Each RAC will maintain a list of potential CHP projects and associated contacts for that project, such as architectural firms, engineering firms, and building owners/operators. This information is to be entered on the national website based CHP Site/Contact Database.

Project Support/SWAT Team Assistance

For those “High Impact Projects,” defined as such by the screening criteria outlined in the Technical Assistance Plan (APPENDIX D), the RAC can implement a SWAT team to assist in assuring the CHP project is specified, built, and operated. Though limited to the amount of resources available, the SWAT Team concept brings a designated Project Team Leader, experienced with CHP technologies, systems, and installations to the project. The PTL will assist in overall management and implementation of a designated project (possibly assisting in the detailed engineering study). The PTL will also have available for use on the project, the Focus Experts, who bring specialized expertise and knowledge to technical issues that otherwise would not be resolved. Again, the Technical Assistance Plan (APPENDIX D) provides the details associated with the SWAT Team concept.

This assistance might include:

- Project Justification - Often times building owners are in need of presenting project justification to their Board of Directors, financial institutions, or to others in order to obtain approval capital for a CHP project. The RAC can provide information on the status of CHP technologies, the operation (case studies) of similar CHP sites, and assist in developing the financials for the project by running available computer programs such as the screening tool. The type information provided by the RAC is not intended to replace the need for a detailed engineering and cost analysis, but rather a first cut justification.

- Site Assessment Visits - The RACs may arrange for site walkthroughs to assist in determining the suitability of CHP for that particular site. The extent of the walkthrough will vary from project to project depending on size, time available, resources available, etc. These walkthroughs are not meant to be a substitute for an engineering analysis, but rather as a precursor to help determine if the engineering analysis is warranted.

Management and Operation

A Regional Core Team as described in the Organizational Section of this Guidebook should be established for each RAC. Each RAC should develop an annual strategic plan that includes specific goals/metrics for the upcoming year and projected goals/metrics out to the year 2015. A monthly report should be prepared to describe and document the activities and accomplishments of the RAC. provides guidance on the content of the monthly report.

TOOLKIT

The following items are provided as guides for each of the Regional Application Centers. The table provides a status and cross-reference to location for each of the items.

Description	Location
Site and Contact Database	Protected Area of Website
Equipment Intelligence Report	Database At GTI
Baseline Assessment Guideline	APPENDIX H
Baseline Assessments	Website
Presentations	Website
Screening Tools	
GARD Analytics Screening Tool	In Development
GTI Building Analyzer	GTI
UIC CHP Engineering Tool	UIC/ERC
Case Study Protocol	APPENDIX I
Case Studies	Website
Technical Assistance Program	APPENDIX D
Project Team Leader Selection Criteria	APPENDIX G
Focus Expert Selection Criteria	APPENDIX G
Information Repository	Website

APPENDIX A REGIONAL APPLICATION CENTER GOALS

	Outreach (#/yr)	SWAT Team Support (#/yr)	Projects Initiated (MWe/yr)	Capacity Added (MWe/yr)
Year	Goal	Goal	Goal	Goal
2001	25	1	2	0
2002	50	5	15	45
2003	100	15	50	150
2004	200	30	100	300
2005	300	60	200	600
2006 - 2015	300	125	300	900
Total	3,675	1361	3,367	10,095

APPENDIX B MONTHLY REPORT

Monthly reports shall contain as a minimum the following areas and appropriate details.

Accomplishments

Provides a brief summary of deliverables completed, education and outreach activities, and project support activities.

Results

Figure 1: Current Performance

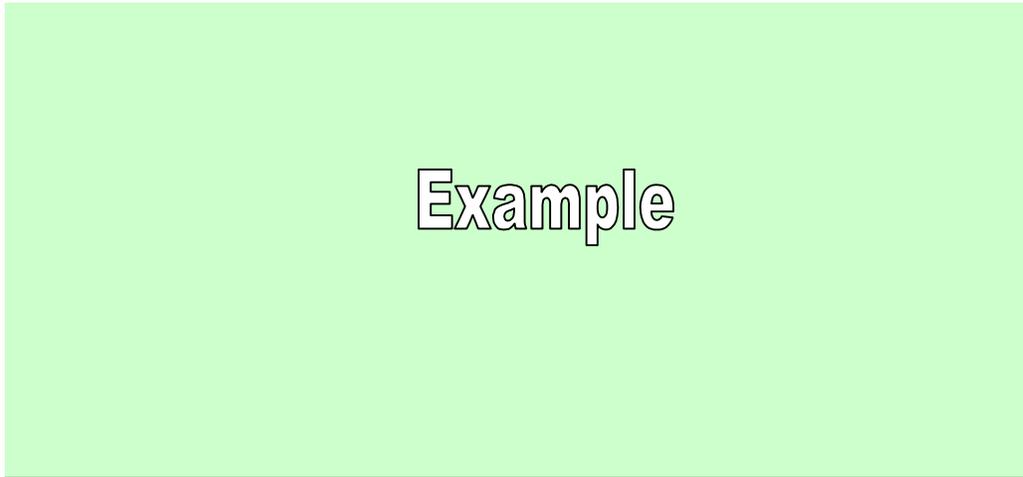


Table 1.1-1 Actual Performance to Goals

Year	Outreach (#/yr)		SWAT Team Support (#/yr)		Projects Initiated (MWe/yr)		Capacity Added (MWe/yr)	
	Goal	Actual	Goal	Actual	Goal	Actual	Goal	Actual
2001	25	12	1	1	2	2	0	0
2002	50	16	5	2	15	0	45	0
2003	100	13	13	6	60	0	150	0
2004	200	30	30	10	100	0	300	0
2005	300	30	60	10	200	0	600	0
2006 - 2015	300	30	125	10	300	0	900	0
Total	3,675	28	1361	3	3,367	2	10,095	0

Budget/Deliverables

Provide status per Contract Task Schedule.

APPENDIX C WEBSITE PROTOCOL

All appropriate information available at the existing DOE national website for CHP (www.eren.doe.gov/der/chp) will be used and reference links provided in the development of the website. In addition, any information developed, or planned to be developed, for DOE for its national website for CHP will not be included in the development of the RAC website.

The Table below lists the subject areas that will be covered by each of the RAC website.

Table Primary Level Information Organization for the MAC Web Site

<p>1.0 News & Events</p> <ul style="list-style-type: none"> 1.1 News stories/Press releases 1.2 Events calendar 1.3 News archives <p>2.0 Technical Professionals (National)</p> <ul style="list-style-type: none"> 2.1 CHP basics 2.2 CHP benefits 2.3 Technology status 2.4 Installations 2.5 Technical and Financial Assessments 2.6 Equipment guide 2.7 Applications manual 2.8 Design tips 2.9 Market potential 2.10 Emissions 2.11 Financing 2.12 Contacts <p>3.0 Building Owners (National)</p> <ul style="list-style-type: none"> 3.1 CHP basics 3.2 CHP benefits 3.3 Technology status 3.4 Installations 3.5 Technical and Financial Assessments 3.6 Equipment guide 3.7 Financing 3.8 Contacts <p>4.0 Policy Makers/Planners (National)</p> <ul style="list-style-type: none"> 4.1 CHP basics 4.2 CHP benefits 4.3 Success stories 4.4 Program partners 4.5 Policies and regulations 4.6 Energy pricing 4.7 Emissions 4.8 Market potential 	<p>5.0 Financial Institutions (National)</p> <ul style="list-style-type: none"> 5.1 CHP basics 5.2 CHP benefits 5.3 Technology status 5.4 Installations 5.5 Economics 5.6 Market potential 5.7 Program partners 5.8 Opportunities and risks 5.9 Policies and regulations <p>6.0 General Public (National)</p> <ul style="list-style-type: none"> 6.1 CHP basics 6.2 CHP benefits 6.3 Technology and status 6.4 Installation 6.5 Contacts <p>7.0 Regional & State Information</p> <ul style="list-style-type: none"> 7.1 Regional Information 7.2 State Information <p>8.0 RAC Outreach</p> <ul style="list-style-type: none"> 8.1 Services 8.2 Contacts <p>9.0 RAC Partners</p> <ul style="list-style-type: none"> 9.1 Organizations 9.2 Contacts <p>10.0 Library</p> <ul style="list-style-type: none"> 10.1 Glossary 10.2 Publication 10.3 Installation database 10.4 FAQs 10.5 Installation documents 10.6 User input form <p>11.0 Links to Relevant DOE Sites</p> <ul style="list-style-type: none"> 7.1 State 7.2 Federal 7.3 Manufacturers/Distributors 7.4 Engineering Firms 7.5 Architectural firms 7.6 Professional Societies 7.7 Others
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The RAC website will provide links to other websites that would be of interest to those considering CHP; such as the CHP national website (www.eren.doe.gov/der/chp), the national CHP for Buildings website (www.CHPB.net), the Midwest CHP Application Center website (www.CHPCenterMW.org), the CHP Initiative website (www.nemw.org/USCHPA/regional.htm - midw) and any other Regional CHP Initiatives websites, the America Gas Cooling Center (www.agcc.org and www.gascooling.org/home.asp), the USCHPA Website (www.nemw.org/USCHPA), the US Environmental Protection Agency CHP Partnership website (www.epa.gov/chp/) and Interstate Renewable Energy Council (www.irecusa.org/connect). Links will also be provided to State government sites that have information that may pertain to CHP such as the Illinois Commerce Commission (www.icc.state.il.us/icc/ec), or the Indiana Utility Regulatory Commission (www.ai.iurc/energy/power/power_index.html).

The website will also provide on-line versions of the screening tool, case studies, and other information that is available to the RAC in electronic format.

A national web-based database of sites with CHP installations will be available for access. This database provides information regarding the site installation such as, the type and size of the electrical generation equipment, the thermal recovery equipment installed, and contact information. This database will be updated monthly by each of the Regional Application Centers. Database management will be provided by the Midwest Regional Application Center.

An administrative area will be provided for individuals affiliated directly with the RAC to share information. This area will allow for cross-communication and updating of information.

APPENDIX D TECHNICAL ASSISTANCE PROGRAM

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The information provided herein is general guidance. Each installation should be assessed on a case-by-case basis, since special situations merit special considerations.

PURPOSE

The purpose of the Technical Assistance Program (TAP) is to describe the process for the Regional Assessment Center (RAC) to provide assistance to interested parties to help them overcome perceived barriers and to provide technical solutions to foster the installation of Cooling, Heating, and Power (CHP) systems into the target market of commercial, institutional, multi-unit residential and light industrial applications. Support may be in the form of technical information, education, or assistance.

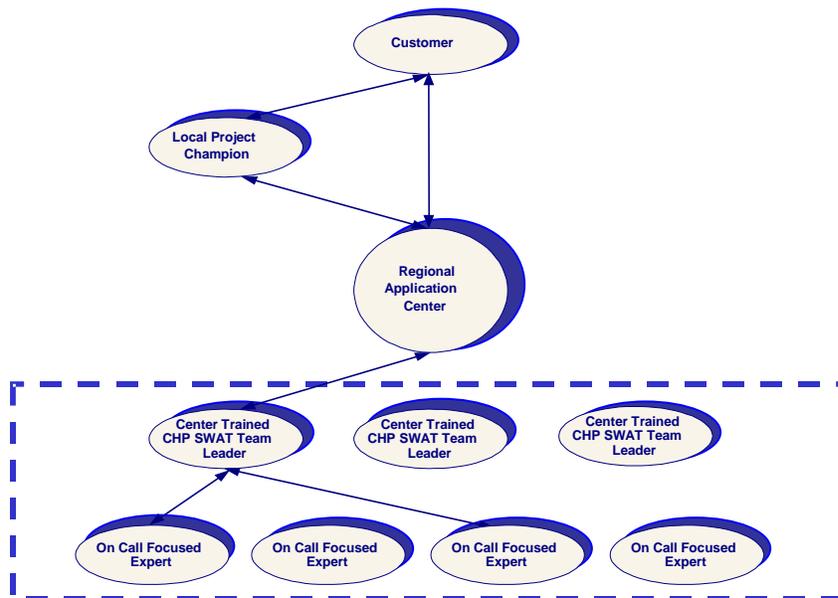
SWAT TEAM

Concept Overview

Key to the TAP is the SWAT Team; it is where the RAC has the most influence to make viable CHP installations a reality. The SWAT Team represents the composite of the applied technical knowledge available to the RAC. The SWAT Team provides assistance to remove perceived risk and to identify technical solutions for those installations where CHP would be well suited. The purpose of the SWAT Team is to foster the completion of CHP projects assessed as being High Impact Projects.

A graphical representation of the SWAT Team concept is depicted in Figure 2 below.

Figure 2 SWAT Team Concept



An overview of the Technical Assessment Program is provided in APPENDIX E.

Potential projects are screened to assess their overall impact on fostering the CHP market. This assessment is made on a case-by-case evaluation of the proposed

project based largely on the application of the screening criteria as described in Section on Screening Process and APPENDIX F. In general, a project would be considered to be a “High Impact Project” if it was:

- ◆ Well suited for the application for CHP, (thermal loads matched to recovery heat available from generation source);
- ◆ There were current or potential financial benefits that could be achieved from the application of CHP,
- ◆ The size of the application was reasonable, and
- ◆ There was the potential for repeatability or large market impact from the installation (could be applied to a class of similar installation sites).

Project Team Leaders (PTLs)

Once a High Impact Project is identified and is in need of the RACs support, a SWAT Team is created and a Project Team Leader (PTL) is assigned. The PTL provides oversight assistance and support to the project. They will likely be required to visit the site and interact on a regular basis with site engineering and/or architectural personnel. Funding will be available for Project Team Leaders to work with clients.

PTLs are selected based on their knowledge and experience in the application of CHP technologies for a particular market sector and/or geographical location. Selection criteria for PTLs are explained in APPENDIX G. The RAC will maintain a list of PTLs, and be responsible for assigning them to projects.

Focus Experts (FEs)

Focus Experts (FEs) are made available through the SWAT Team if special considerations or issues arise during the development of a CHP installation. Normally their services are requested by the PTL and they will be directed by the PTL to provide input on specific technical issues within their area of expertise. In order to minimize SWAT Team costs, in most cases the FEs are not expected to visit the site in order to render their services. Funding for FE assistance on an on-call and as needed basis will be available through the Midwest Application Center.

Focus Experts will be chosen based on their particular depth of knowledge for a given area of technical expertise. Examples of such areas of expertise might be: indoor air quality control systems, reciprocating engines, grid interconnections, etc. The Midwest Application Center will select FEs based on the selection criteria given in APPENDIX G. The Midwest Application Center will maintain a national list of FEs.

LEVELS OF ASSISTANCE

Overview

The TAP is designed to facilitate technical support based on the overall impact of the project relative to mainstreaming CHP into the target market. The TAP is graduated into four general phases of assistance:

1. Standard Outreach
2. Investigation
3. Design-Bid, and

4. Post Commission.

Requests for assistance may come into the RAC through various means, such as through the website, a personal contact, a phone call, or more likely from Local Project Champions (LPCs). All requests and inquires that come into the RAC that are related to commercial, institutional, multi-unit residential, or light industrial projects are provided access to any information available on CHP that the RAC has and to general assistance from the RAC regarding CHP installation. This type of support is included in the Standard Outreach phase.

If the request represents a potential installation where CHP might be a viable option, it would be evaluated for thermal compatibility, financial feasibility, and its overall impact in the development of the CHP market. If the project meets the screening threshold (described in the Section on Screening Criteria) and project assistance is desired, then a SWAT Team would be created and the project would progress into the other phases. The number of sites considered for technical assistance will be limited by the screening process and by the resources available to the RAC.

A general overview of the TAP is provided below and is discussed in more detail in APPENDIX D:

Standard Outreach

The criteria for eligibility for support during this phase would be for the project to be preferably in one of the CHP target market segments.

Standard outreach assistance includes:

- ◆ An initial consultation with a Core Team member to discuss the feasibility of a CHP installation,
- ◆ A general technical and financial assessment for an potential CHP installation based on general assumptions, such as site type and size, electric profile, geographical location, and utility rate structure for the applicable service area, and
- ◆ Access to information available at the RAC, such as: brochures, case studies, prepared presentations, a screening tool for self-assessment, and access to the Midwest Application Center Information Repository.

This phase of support is estimated to encompass less than 5 hours of RAC personnel's time per site.

Investigation Phase

The criteria for eligibility for support during this phase would be to meet the threshold value given by the screening criteria for this phase as described in the Section on Screening Criteria. In addition, either an architect or an engineering firm would need to be involved or being sought. Projects that enter into this phase are considered to be "High Impact Projects."

The Investigation Phase represents the first phase in which a SWAT Team would be created. In this phase, assistance would be provided in terms of the following:

- ◆ A Project Team Leader would be assigned,
- ◆ A site assessment/walkthrough may be conducted,

- ◆ An estimated technical assessment based on readily available site-specific information would be performed,
- ◆ An estimated financial assessment based on readily available site-specific information would be performed (*A payback analysis would be performed and a rate of return would be calculated.*), and
- ◆ Project justification assistance in order to obtain funding would be provided.

The information used during this phase to perform the technical assessment would be any readily available site-specific information pertaining to electric and thermal load profiles. The actual utilities rate structure for the application would be applied to perform the financial assessment. The assessments performed by the RAC during this phase are not intended to be a substitute for an engineering analysis, but rather a precursor to help determine if an engineering analysis is warranted.

This phase of support is estimated to encompass up to 20 hours of RAC personnel's time.

Design - Bid Phase

The criteria for eligibility for support during this phase would be to meet the threshold value given by the screening criteria for this phase as described in the Section on Screening Criteria, in addition to that in the Investigation Phase. In addition an architect and/or an engineering firm would need to be involved in the project, as well as proof that capital would be available to go forward with the project.

In the Design-Bid Phase, assistance would be provided in terms of the following:

- ◆ Focus Experts (FEs) would be available to the PTLs to address specific issues,
- ◆ A site-specific technical assessment based on the best site-specific information obtainable would be performed,
- ◆ A site-specific financial assessment including a payback analysis, a calculated net rate of return, and a present value analysis, would be performed,
- ◆ A standard bid specification would be drafted, and
- ◆ Bid evaluation support would be provided.

The information used during this phase to make the technical assessment would be the best available site-specific information pertaining to electric load and profile, and thermal load and profile as could reasonably be obtained. The actual utilities rate structure for the application would be applied to perform the financial assessment, in addition a client specified rate-of-return and discount rate would be applied. The type of assessments provided during this phase by the RAC are not intended to replace the need for a detailed engineering and cost analysis, but rather a first-cut justification to either go forward with the project or not.

This phase of support is estimated to encompass up to 50 hours of RAC personnel's time.

Post Commission Phase

The Post-Commission Phase applies to those CHP installations in which the RAC has had any influence in the installation of a CHP system; it does not exclude those installations where SWAT Team assistance has not been previously provided. This phase will encompass the time period of approximately one-year post commission of

the installation. During this phase the RAC will perform a Case Study of the installation using as much actual information as available. It is estimated to take up to about 20 hours of the RAC personnel's time.

SCREENING PROCESS

Screening Software

The RAC needs to be able to quickly assess the viability of a CHP installation in a particular site and to determine if further project assistance is warranted. There are a variety of screen tools available. Information on tools can be obtained from both MAC and Oak Ridge National Laboratory if needed.

Screening Criteria

The screening criteria provide direction for the preliminary allocation of the limited resources of the RAC. The criteria are identified as applied to each phase of assistance in the screening evaluation sheets in provided in APPENDIX F.

The criteria are developed with the intent to be flexible so that they can be adjusted as the market conditions change to shift the focus of the projects chosen by the RAC to market sectors that are viable but have not been penetrated. This is necessary so that when there are sufficient applications in one market segment, the RAC resources will not continue to be allocated to that segment, or if a more desirable market segment is identified, resources can be redirected to pursue that market.

The criteria provide a general assessment guideline, however each installation should be assessed on a case-by-case basis, since special situations merit special consideration with some discretion.

Screening Assessment

Each project that is considered viable by RAC personnel or a LPC is screened using the screening evaluation sheets in APPENDIX F. The screening tool provides information for thermal and electric compatibility (Technical Assessment) and payback (Financial Assessment) that is to be used in the evaluation. The more thermally and electrically compatible a project is, and the shorter the payback period, the higher the evaluation values. The screening threshold increases as the project progresses through the phases outlined in the Section on Screening Criteria.

APPENDIX E TECHNICAL ASSISTANCE PROGRAM OVERVIEW

STANDARD OUTREACH

Standard Outreach Phase

- 1) Criteria:
 - a) One of the following market segments and evaluated by an Application Center Team Member to be consistent with the Recommendations and Action Plan given in that State's Baseline Analysis:

◆ Commercial	◆ Multi-Unit Residential
◆ Institutional	◆ Industrial
- 2) Assumptions:
 - a) General assumptions about building type (such as small hospital, large office, etc.) and size, and geographical location,
 - b) General utilities rate structure for applicable service area.
- 3) Services Provided:
 - a) Initial consultation.
 - b) General technical assessment (electric and thermal load compatibility).
 - c) General financial assessment (cost differential and payback period).
 - d) General information about CHP such as provided by the RAC on their website, in their brochures, case studies, and prepared presentations, as well as a screening tool for self-assessment, and information in the RAC repository.
- 4) Estimated Center effort -- < 5 hours of Center personnel's time.

Investigation Phase

SWAT TEAM

- 1) Criteria: (See screening criteria in APPENDIX F for specific evaluation criteria.)
 - a) Selected building types (adjust points or exclude based on desired market penetration for that particular building type),
 - b) General Technical Assessment (more compatible gets higher points),
 - c) General Financial Assessment (more favorable gets higher points), and
 - d) Architect/Engineering firm involved or Architect/Engineering firm is being sought.
- 2) Assumptions:
 - a) Use as much site specific information readily available pertaining to:
 - i) Electric load and profile,
 - ii) Thermal load and profile, and
 - b) Actual utility rate structures.
- 3) Services Provided:
 - a) Project Team Leader assigned,
 - b) Site Assessment/Walkthrough,
 - c) Estimated Technical Assessment based on available site specific information,
 - d) Estimated Financial Assessment based available site specific information, and
 - i) Payback
 - ii) Rate of Return
 - e) Project justification assistance.
- 4) Estimated Center effort – up to 20 hours.

SWAT TEAM

Design/Bid/Bid Evaluation Phase

- 1) Criteria: (See screening criteria in APPENDIX F for specific evaluation criteria.)
 - a) Initial CHP Assessment Report completed by PTL recommends project goes forward,
 - b) Client willing to go forward with full engineering evaluation for project installation,
 - c) Architect/Engineering Firm involved, and
 - d) Capital available to finance project.
- 2) Assumptions:
 - a) Obtain as much site specific information readily available pertaining to:
 - i) Electric load and profile
 - ii) Thermal load and profile
 - b) Actual utility rate structures,
 - c) Client specified rate of return, and
 - d) Client specified discount rate.
- 3) Services Provided:
 - a) Focus Experts available, as needed, to address specific issues,
 - b) Site specific technical assessment,
 - c) Site specific financial assessment including:
 - i) Payback,
 - ii) Rate of Return Net,
 - iii) Present Value Analysis,
 - d) Standard Bid Specification, and
 - e) Bid evaluation (estimated 10 hours)
- 4) Estimated Center effort – up to 50+ hours.

Post Commission Phase

- 1) Criteria: Any installation that has been influence by the Regional Application Center.
- 2) Assumptions:

As much real information as available should be used, per Case Study Protocol.
- 3) Services Provided:
 - a) Case Study.
- 4) Estimated Center effort – up to 20 hours.

APPENDIX F SCREENING EVALUATION

Note: Assignment of points for the Technical and Financial Assessments will be developed based on the screening tool output. Threshold values for the various phases of support will be established based on the development of the point assignments.

The evaluation criteria should be considered for each phase of assistance as indicated.

General Information Phase

One of the following market segments:

- ◆ Commercial
- ◆ Multi-Unit Residential
- ◆ Institutional
- ◆ Industrial

AND

Evaluated by an Application Center Team Member to be consistent with the Recommendations and Action Plan given in that State's Baseline Analysis.

Investigation Phase (High Impact Projects)

Criteria	Weight*	Rating	Total
Selected building types: <i>(* Adjust weight based on desired market penetration for that particular market sector as provided in the Recommendations and Action Plan given in that State's Baseline Analysis)</i>			
Hospital	TBD		
Large Hotel	TBD		
Small Hotel	TBD		
Office Building, High Rise	TBD		
Office Building, Low Rise	TBD		
School	TBD		
Nursing Home	TBD		
Supermarket	TBD		
Restaurant, Full Service	TBD		
Restaurant, Quick Service	TBD		
Retail Store	TBD		
Refrigerated Warehouse	TBD		
Theater	TBD		
Ice Arena	TBD		
Data Center	TBD		
General Technical Assessment <i>(More compatible gets higher points)</i>	TBD		
General Financial Assessment <i>(Shorter payback gets higher points)</i>	TBD		
Total			
Threshold:	TBD		
Architect/Engineering firm involved or Architect/Engineering firm is being sought	Go or No Go		

Design-Bid Phase

Criteria	Weight	Rating	Total
Initial CHP Assessment Report completed by PTL recommends project goes forward	Go or No Go		
Client willing to go forward with full engineering evaluation for project installation	Go or No Go		
Architect/Engineering firm involved.	Go or No Go		
Capital Available to finance project	Go or No Go		

APPENDIX G SUPPORT PERSONNEL SELECTION CRITERIA

Selection Criteria for Project Team Lead (PTL)

- Individual should be familiar with the design of CHP systems and have experience with the applied technologies, equipment selection and sizing, and installation of CHP systems.
- Individual should be selected from universities, engineering firms, or other professional service firms that have experience with the installation of CHP systems.
- Individual should be employed by firms or universities within the State of the project and should be familiar with local codes and standards applicable to the project.
- Individual should be familiar with applicable utility and energy service rates that apply to the project.
- Individual should understand the costing and financing associated with the project and should be able to communicate critical financial information.
- Individual should be acceptable to the owner of the building (or the individual responsible for the project).

Selection Criteria for Subject Matter Experts (SMEs)

- Individuals should be known experts within their area.
- SMEs should be acceptable to the PTL and the owner of the building (or the individual responsible for the project).

APPENDIX H BASELINE ASSESSMENT DETAILED OUTLINE

I. Key Organizations

Identify organizations and establish contacts within the following areas in order to promote the application of CHP.

- A. Contacts
 - 1. Federal/State EPA
 - 2. Distributors
 - 3. State Energy Offices
 - 4. Engineering Firms
 - 5. Manufacturers/Distributors
 - 6. Professional Associations
 - 7. PUCs
 - 8. Architect Engineers
 - 9. Local Energy Suppliers
 - (i) ESCos
 - (ii) Utilities
 - 10. Building Owners/Operators

II. Existing CHP Market

Determine the existing CHP market by identifying:

- A. Existing Installations (By SIC)
- B. Pending Installations (By SIC)

III. Current Policy and Pricing (Electric & Gas)

Obtain documentation describing the current policies impacting CHP and pricing associated with the gas and electric industries that pertain to the installation of CHP.

IV. Acceptance/Opposition to CHP

Identify and document acceptance and opposition to CHP that currently exists.

V. Barriers/Incentives

Identify incentives and barriers experienced by those who have installed CHP or where issues either encourage or discouraged the installation of CHP.

- A. Regulations
- B. Technical
 - 1. Equipment
 - 2. Design/Installation
- C. Economics
- D. Utilities
- E. Grant/Rebates

VI. Existing Information

Obtain existing information applicable to CHP and store in a readily retrievable form, preferably accessible through the Application Centers website.

- A. Studies
 - 1. DOE
 - 2. GTI
 - 3. Universities
 - 4. Industry
- B. Guides
- C. Websites
- D. Equipment Specifications

VII. Partnerships

Identify synergistic partnerships between those involved with promoting and utilizing CHP.

VIII. Market Potential

Assess and evaluate the market for CHP over the next 5 years.

- A. Identify Market Trends
- B. Validate Target Market
 - 1. Commercial
 - 2. Residential
 - 3. Institutional Energy Districts
 - 4. Industrial
- C. Identify High Impact Sectors
 - 1. SIC
 - 2. Building Type
 - 3. Locations

IX. Target Customers

Based on the market potential, identify and contact those customers in the high impact sectors that would benefit the most from CHP.

APPENDIX I SITE REPORT, CASE STUDY, AND FACT SHEET PROTOCOL

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HOW TO USE THIS PROTOCOL

There are 3 Sections to this protocol, the Site Report, the Case Study, and a Fact Sheet.

The first Section, the Site Report, represents the type of information that should be collected and documented in order to create as complete as possible characterization of the installation. Information should be collected and follow the protocol included herein as much as reasonably achievable from records and interviews that can be reasonably obtained. The intent is not necessarily to obtain all of the information, but to obtain enough information to be able to perform both an energy and a financial analysis between the CHP system and the original and/or more conventional system. The document included herein provides the recommended content of information and desired outline format.

The second Section, the Case Study, should represent the most significant information ascertained from the Site Report. It is a document that will be used to showcase the facility and as such it should be a high level document that provides concise and pertinent information, widely utilizing visual information; such as, tables, graphs and photographs to succinctly convey information. The document included herein represents an example and provides some guidance on the information and desired layout. This document should be no more than 4 pages long, and should be printed in a double sided layout suitable for wide spread dissemination.

The final Section, the Fact Sheet, represents highlights of the installation. It should contain key technical and financial information concluded from the site report, primarily graphical information. It should be no more than 2 pages, and should be printed in a double sided layout suitable for wide spread dissemination.

SECTION A: SITE REPORT

Preparing Institution's Name

Phone: XXX.XXX.XXXX

Preparing Institution's Address

Fax: XXX.XXX.XXXX

www.CHPCenterXX.org

Name of Facility

Midwest Regional CHP Application Center

Site Report MAC # **YEAR-###**

Month Year

Table of Contents

[Provide Table of Contents for Site Report]

1. SITE DESCRIPTION

[Provide general information about site.]

1.1. General

Provide a general description about the site and how it came being. Include any information available relating to the reasons for installing a CHP system. Include the building type.

1.1.1. Site Location

Provide a general description of the location of the site and any special site characteristics.

1.1.2. Site Characteristics

Include the number of buildings and how much square footage is covered by CHP system. Include general occupancy/operating schedule and how the CHP system is operated to meet that schedule. If there is a difference between what is serviced by the BHP system verse conventional equipment describe those differences. Other items that should be included if they add relevance are: the building age, general construction, and any special usages or considerations that would impact the CHP system.

2. MARKET SEGMENT EVALUATION

[Discuss the potential market for CHP in the particular sector for this building use. Include market penetration and an overview of other installations if information is available. Discuss any regional benefits or concerns. This section should be similar in each report (boilerplate) for each building sector type. For example, for all schools it should read the same with adjustments made for regional specific considerations.]

3. TECHNICAL DESCRIPTION

3.1. Overview of CHP to Baseline/Original Installation

[Provide a brief discussion of the comparison of the CHP system to the Baseline and/or original system. Include a table if it would enhance the discussion. Include operating philosophy (peak shaving, back-up power, match thermal loads or electrical loads, and/or to meet reliability and/or power quality issues. Provide a simple one line drawing showing the CHP system. Label components and provide input and output parameters where they provide relevant information, such as: heat or temperature outputs for generation equipment, type and pressure of fuel supplies, rating of equipment, and how many of each piece of equipment there is.]

3.2. CHP System Design

[If there are more than one component for each type of equipment (generation or thermal recovery) provide a separate description of each of the components.]

3.2.1. Electrical Parameters

3.2.1.1. Overview

[Discuss the buildings electrical energy requirements describing the amount of electricity that will be provided by the electric generation equipment verses that provided from the grid, whether the generation capacity will be supplied to the grid and when, if there are special metering requirements, and if there is any special requirements, such as high reliability or the need for back-up power. Explain what happens with excesses or shortages of electricity.]

3.2.1.2. Electrical Generation Prime Mover

[Provide the manufacture and the type of power supply equipment such as a microturbine, gas turbine, diesel engine, or fuel cell and.]

3.2.1.2.1 Generator (Type/Size)

[Provide the electrical ratings for the generator.]

- Fuel Type

[Provide the type(s) of fuel used by the engine.]

- Waste Heat Profile

[Provide a description of the amount and quality of the waste heat. If available provide a chart or table indicating the manufactures exhaust parameters.]

3.2.1.2.2 Backup/Standby Power

[If back-up power is needed, describe the back-up power source (grid, diesel engine, batteries, etc.,) ratings (kilowatts, KVA, amps etc.) and the manufacturer or supplier].

3.2.1.2.3 Grid Supply

[This section should include information such as the size of the service drop (KVA), the type of metering, applicable rate types, and if the service is three-phase. Describe any net metering if installed.]

3.2.1.2.4 Interconnection Requirements

[Discuss interconnection equipment required and why it is installed.]

3.2.1.3. Fuel Supply Description

[Provide a general overview of the fuel used by the facility including that used for generation and/or supplemental heating/cooling.]

3.2.1.4. Thermal Recovery Systems

3.2.1.4.1 Steam

[Describe the steam system(s) in place if waste heat is recovered to make process steam.]

3.2.1.4.2 Hot Water

[Describe the hot water system(s) in place if waste heat is recovered for building hot water heating or other uses such as laundry, pool heating, or some other heating process.]

3.2.1.4.3 Compression Chiller (Type/Size/Manufacturer)

[Describe the chiller system(s) in place if waste heat is recovered to drive a compression chiller.]

3.2.1.4.4 Absorption Cooling (Type/Size/Manufacturer)

[Describe the absorption cooling system(s) in place if waste heat is recovered for use in an absorption chiller.]

3.2.1.4.5 Desiccant (Type/Size/Manufacturer)

[Describe the desiccant (or enthalpy recovery) system(s) in place if waste heat is recovered to dry (or preheat) a desiccant wheel (or enthalpy wheel).]

3.2.1.5. Non-Recovery Thermal Systems

[Provide a description of any supplemental or redundant thermal systems to the CHP systems described above, if applicable.]

3.3. **Original/Baseline System Configuration**

[If a there was a previously installed heating and cooling system this section should discuss the previously installed system and a new conventional type system that would be normally installed in this building application in this area. If this building is new construction, this section should describe a conventional type system that would be normally installed in this building application in this area. Provide a simple one line drawing showing the CHP system. Label components and provide input and output parameters where they provide relevant information, such as: heat or temperature outputs for generation equipment, type and pressure of fuel supplies, rating of equipment, and how many of each piece of equipment there is.]

3.3.1. Energy Supply Parameters

3.3.1.1. Electrical Supply Description

[This section should include information such as the size of the service drop (KVA), the type of metering, applicable rate types, and if the service is three-phase.]

3.3.1.2. Fuel Supply Description

[This section should include information such as the type of fuel used, the pressure of the fuel, and the rating on the supply.]

3.3.2. Thermal Systems

3.3.2.1. Heating

[If there are special thermal heating loads in the building beyond general area heating, such as a pool or laundry, include a separate description of each.]

3.3.2.1.1 System Description

- System Type
- Energy Source (Fuel Type/Electric/Other)

3.3.2.2. Cooling

[If there are special thermal cooling loads in the building beyond general area cooling, such as ice rink or computer equipment, include a separate description of each.]

3.3.2.2.1 System Description

- System Type
- Energy Source (Fuel Type/Electric/Other)

4. ENERGY ANALYSIS (BASELINE VERSES CHP)

[For all analysis, if the CHP system was a complete replacement of a previous installation 2 baseline cases should be developed, one for the previous installation and the second for a conventional replacement of the previous system. In this situation, there would be three cases depicted for each section; one for the original system, one for a conventional replacement, and one for a the CHP installation. In cases where only components of a previous system are replaced or CHP equipment added, only 1 baseline case, showing the previous installation, need be made.]

4.1. Electrical Parameters

[The information in this section provides for the results of a comparison of the electrical requirements focusing on the reduction from the offsite electrical grid. This section should provide written, tabular and graphical representations of the various parameters in the subsections depicting the reduction effected by the CHP generation and thermal recovery equipment verses the baseline case(s) with no power generation. It is important in this section not only to show how the generation reduces the demand on the offsite power source, but also how the thermal recovery system(s) also reduce the demand on the grid. If there are any electric grid or supply problems, they should be described in this section.] [At minimum monthly information should be included. Suggested tables and figures include:]

Table 4.1-1 Electrical Parameters

Description	Units	Baseline	CHP
Electric Load	kw		
Electric Peak	kw		
Annual Electrical Consumption	kw-hr		

Figure 3.1-1 Peak Load Day – Summer (or Winter)

[Insert graphical profile of typical peak load for facility.]

Figure 4.1-2 Average Summer Day Load Profile

[Insert graphical profile of typical average summer day load for facility.]

Figure 4.1-3 Average Winter Day Load Profile

[Insert graphical profile of typical average winter day load for facility.]

4.2. Thermal Requirements

[The information in this section provides for the results of a comparison of the thermal requirements focusing on the utilization of waste heat. This section should provide written, tabular and graphical representation of the various parameters in the subsections depicting the thermal energy produced by the CHP generation equipment and the use of the waste heat by the thermal recovery equipment verses the baseline case(s) with no power generation. This section should reiterate how the thermal recovery equipment reduces the demand from the offsite grid.]

4.2.1. Thermal Loads

[Suggested tables and figures include:]

Table 4.2-1 Thermal Parameters

Description	Units	Baseline	CHP
Thermal Capacity	BTU		
Heating	BTU		
Cooling			
Sensible	BTU		
Latent*	BTU		
Annual Thermal Use	BTU		

** [Latent heat should be consider and discussed for all applications, but must be discussed when Indoor Air Quality (IAQ) is important (such as in schools, ice rinks, hospitals, or in high humidity areas) or when a desiccant system is being used.]*

Table 4.2-2 Annual Thermal Energy Provided (YEAR) [MMBTU]
(CHP and Baseline Case)

	Recovered	Supplemental	Delivered
Jan			
Feb			
Mar			
Apr			
May			
Jun			
Jul			
Aug			
Sep			
Oct			
Nov			
Dec			
TOTAL			

4.3. **Fuel Usage**

[The information in this section provides for the results of a comparison of the fuel requirements acknowledging the increased use due to the inclusion of power generation. Discussion should include the availability of various fuels to the site and the reasons for the fuel type(s) chosen. This section will provide written, tabular and graphical representation of the various parameters in the subsections depicting the fuel consumed by the CHP generation equipment and if any, in the thermal recovery equipment verses the baseline case(s) with no power generation. This section should address any problems associated with the use of this fuel, such as safety, regulatory, or availability issues.] [At a minimum annual fuel consumption should be addressed.]

Table 4.3-1 Fuel Usage Parameters

Description	Units	Baseline	CHP
(Fuel Type 1)			
Average Daily Fuel Consumption			
Winter			
Summer			
Peak Daily Fuel Consumption			
Annual Fuel Consumption			
Annual Fuel Consumption	BTU		
(Fuel Type 2)			
Average Daily Fuel Consumption			
Winter			
Summer			
Peak Daily Fuel Consumption			
Annual Fuel Consumption			
Annual Fuel Consumption	BTU		
(Fuel Type 3)			
Average Daily Fuel Consumption			
Winter			
Summer			
Peak Daily Fuel Consumption			
Annual Fuel Consumption			
Annual Fuel Consumption	BTU		
TOTAL Annual Fuel Consumption	BTU		

5. FINANCIAL ANALYSIS (BASELINE VERSES CHP)

[For all analysis, if the CHP system was a complete replacement of a previous installation 2 baseline cases should be developed, one for the previous installation and the second for a conventional replacement of the previous system. In this situation, there would be three cases depicted for each section; one for the original system, one for a conventional replacement, and one for a the CHP installation. In cases where only components of a previous system are replaced or CHP equipment added, only 1 baseline case, showing the previous installation, need be made.]

5.1. Assumptions

*[List any assumptions, such as inflation rates, interest rates, tax rates, or escalation factors. Assume a service life of **TBD** years.]*

5.1.1. Project Cost (Estimated/Actual)

[The information in this section may be better summarized and enhanced in tabular and/or graphic format to more concisely convey the information.]

5.1.1.1. Equipment

[The information in this section provides for the results of a comparison of the costs associated with the equipment of the CHP system verses a conventional system. It should also include a comparison between the actual cost for the equipment for the CHP system and the estimated cost. This section should describe the costs associated with purchase of the actual physical equipment. It should include any instrumentation, protective equipment (interconnect relaying), and controls for the system as well as shipping and delivery charges.] [At a minimum the cost for the entire project should be included.]

Table 5.1-1 Equipment Costs

Equipment	Equipment Cost		Instrumentation/Controls		Shipping & Delivery		TOTAL	
	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual
Power Generation Equipment	\$0	\$0	\$0	\$0	\$0		\$0	\$0
Cooling Equipment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Desiccant	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Heating Equipment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
System Instrumentation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
System Controls	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL COSTS - Estimated	\$0		\$0		\$0		\$0	
TOTAL COSTS - Actual		\$0		\$0		\$0		\$0

5.1.1.2. Engineering/Installation

[The information in this section provides for the results of a comparison of the costs associated with the engineering and installation of the CHP system verses a

conventional system. It should also include a comparison between the actual engineering/installation cost for the equipment for the CHP system and the estimated cost. This section should describe the costs associated with engineering, design and installation of the CHP system. It should include any special testing requirements.]

Table 5.1-2 Engineering and Installation Costs

	CHP System		Conventional
	Actual	Estimated	Estimated
Design			
Drawing			
Labor			
Site Preparation/Modification			
TOTAL COST	\$0	\$0	\$0

5.1.1.3. One-Time Fees

[The information in this section provides for the results of a comparison of the one-time fees associated with installation of the CHP system verses a conventional system. It should also include a comparison between the actual one-time fees for the installation of the CHP system and the estimated fees. This section should describe the costs associated with interconnect, exit, permitting and sitting fees.]

Table 5.1-3 One Time Fees

	CHP System		Conventional
	Actual	Estimated	Estimated
Sitting Fees			
Construction Permit			
Exit Fee			
Interconnection Fee			
TOTAL COST	\$0	\$0	\$0

5.2. Annual Costs (Estimated/Actual)

[The information in this section may be better summarized and enhanced in tabular and/or graphic format to more concisely convey the information.]

5.2.1. Maintenance Costs

[The information in this section provides for the results of a comparison of the maintenance costs associated with installation of the CHP system verses the baseline system(s). It should also include a comparison between the estimated maintenance

costs for the CHP system and the actual maintenance costs. This section should describe the actual and anticipated maintenance costs associated with each of the systems over the service life when annualized. If a maintenance contract is in force, describe the financial requirements and terms of the contract.]

Table 5.2-1 Maintenance Costs

	CHP System		Conventional
	Actual	Estimated	Estimated
Service Contract			
Routine Maintenance			
Monthly			
Quarterly			
Yearly			
Special Maintenance (yearly average cost)			
Overhaul			
Replacements			
TOTAL COST	\$0	\$0	\$0

5.2.2. Operating Costs

5.2.2.1. Electrical Costs

[The information in this section provides for the results of a comparison of the annual electrical costs associated with installation of the CHP system verses the baseline system(s). It should also include a comparison between the estimated electrical costs assumed for the CHP system and the actual electrical costs. This section should describe the actual and anticipated electrical costs and savings depicted on a monthly basis for the first year, then summarized by year for subsequent years.]

5.2.2.2. Fuel Costs

[The information in this section provides for the results of a comparison of the annual fuel costs associated with installation of the CHP system verses the baseline system(s). It should also include a comparison between the estimated fuel costs associated with the CHP system and the actual cost. This section should describe the actual and anticipated fuel costs and savings depicted on a monthly basis for the first year, then summarized by year for subsequent years.]

5.2.2.3. Operator Costs

[The information in this section provides for the results of a comparison of the annual electrical operations personnel costs associated with installation of the CHP system verses the baseline system(s). It should also include a comparison between the actual

operator costs for the CHP system and the estimated cost. This section should describe the actual and anticipated operator costs and savings depicted on a monthly basis for the first year, then summarized by year for subsequent years.]

Table 5.2-2 Operating Costs

	CHP System		Conventional
	Actual	Estimated	Estimated
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
TOTAL			

5.2.3. Total Costs

[The information in this section should summarize the results of a comparison of all costs associated with installation of the CHP system versus the baseline system(s). It should also include a comparison between the actual total costs for the CHP system and the estimated cost. This section should describe the actual and anticipated costs and savings depicted on a monthly basis for the first year, then summarized by year for subsequent years.]

Table 5.2-3 Total Annual Costs

	CHP Plant	Baseline
INCOME		
<i>[Identify any Income from sales of power or heat to others.]</i>		
GENERAL EXPENSES		
Salaries		
ELECTRICAL EXPENSES		
Wages		
Fuel Oil		
Gas		
Utility Electricity		
Water/Sewer		
Maintenance		
HEATING & COOLING EXPENSES		
Wages		
Fuel Oil		
Gas		
Water/Sewer		
Maintenance		
TOTAL		

6. FINANCIAL CONSIDERATIONS

[If the system has been operating for several years, it would be more informative to discuss the actual performance than to perform the analysis and calculations described below.]

6.1. Net Present Value Analysis

[This section provides the results of a net present value associated with installation of the CHP system versus the baseline system(s). It should also include a comparison between the actual net present value for the CHP system and the estimated net present value. The net present value shall be evaluated for the expected service life of the system.]

6.2. Payback Period

[This section provides the payback periods associated with installation of the CHP system versus the baseline system(s). It should also include a comparison between the actual payback period for the CHP system and the estimated payback period.]

6.3. Internal Rate of Return

[This section provides the internal rate of return associated with installation of the CHP system versus the baseline system(s). It should also include a comparison between the actual internal rate of return for the CHP system and the estimated internal rate of return.]

7. OPERABILITY ANALYSIS (BASELINE VERSES CHP)

[This section provides the overall performance parameters associated with installation of the CHP system versus the baseline system(s). It should also include a comparison between the actual performance parameters for the CHP system and the estimated performance parameters. This section should include the differences including the effects from the generation source.]

- 7.1. Efficiency**
- 7.2. Reliability**
- 7.3. % Downtime**

8. INSTALLATION ANALYSIS (BASELINE VERSES CHP)

8.1. Location Requirements for Installation

[This section provides the comparison of the area and sitting requirements associated with installation of the CHP system verses the baseline system(s).]

8.2. Time to Install (Estimated/Actual)

[This section provides the comparison of the time required to install the CHP system verses the baseline system(s). It should also include a comparison between the actual time to install the CHP system and the estimated time. It should address each time period separately in order to provide insight as to where delays are encountered and where enhancements might be made. If there is significant delays (>20%) describe any known reasons for delay.]

8.2.1. Design Started

8.2.2. Equipment Ordered

8.2.3. Installation Started

8.2.4. Installation Completed

9. ENVIRONMENTAL CONSIDERATIONS

[Discuss any environmental controls or restrictions that exist on the CHP system. This section provides the comparison of the effluents released from the CHP system versus the baseline system(s). It should also include a comparison between the actual effluents from the CHP system and the estimated effluents. This section should also describe the differences in effluents displaced by the reduction in electricity due to the thermally activated technologies (absorption chiller and desiccants).]

- NO_x
- SO_2
- CO_2
- VOx
- Mercury

10. BARRIERS/INCENTIVES/LESSONS LEARNED

[This section should provide descriptions of the various barriers, incentives, and lessons learned as indicated by the various parties involved in the installation and operation of the CHP system. This information can be obtained from interviews conducted and ascertained from comments and information obtained during data gathering.]

10.1. Regulatory**10.2. Technical****10.3. Financial****10.4. Business Practices**

SECTION B: CASE STUDY



[Name of Facility]

Cooling, Heating, and Power Plant

Site Description

[Provide an overview summarizing the facility and any other relevant information that would portray the characteristics of the site and the application of the CHP facility to that site. Such as:

- *Building use market sector*
- *Square feet or number of buildings served*
- *Cit, part of State if not well know city, and State*
- *Any special considerations or applications regarding the site.]*



Figure 4: Provide a photo of the plant or a photo portraying a characteristic piece of equipment at the facility.

Cooling, Heating, and Power (CHP) Configuration

[Provide a bulleted list describing the number and types of each piece of equipment that comprises the CHP system. Such as:

- ◆ *The number and type of primary generation equipment including power rating and fuel type,*
- ◆ *The number and type of heat recovery and/or thermally activated equipment including manufacturer and size or equipment rating,*
- ◆ *The number and type of any supplemental conventional heating and or cooling equipment.]*

Financial Statistics

[Provide a summary of the cost of the CHP installation and the financial performance information. Include:]

Total Cost: \$_____

Original Goal: Payback in ___ years

Actual Performance: Payback in ___ years

Operating Savings: Approximately \$____/yr

Internal Rate of Return: ____%

Energy/Financial Analysis Overview

[Provide a summary of the results of the Energy and Financial Analysis from the Case Study. List and identify key assumptions that answer such questions as:

Assumptions:

- ◆ *What is the normal operating schedule of the plant?*
- ◆ *How much of the electric consumption/demand is met by the generation system?*
- ◆ *What happens with excess or shortages of electricity?*
- ◆ *How much of the thermal load is met by the system?*
- ◆ *If the system does not meet building thermal loads, how are shortages made up?*
- ◆ *Are there any special operating conditions or times when components of the CHP system were not available?*
- ◆ *What are the differences between the CHP plant and the Baseline plant?]*

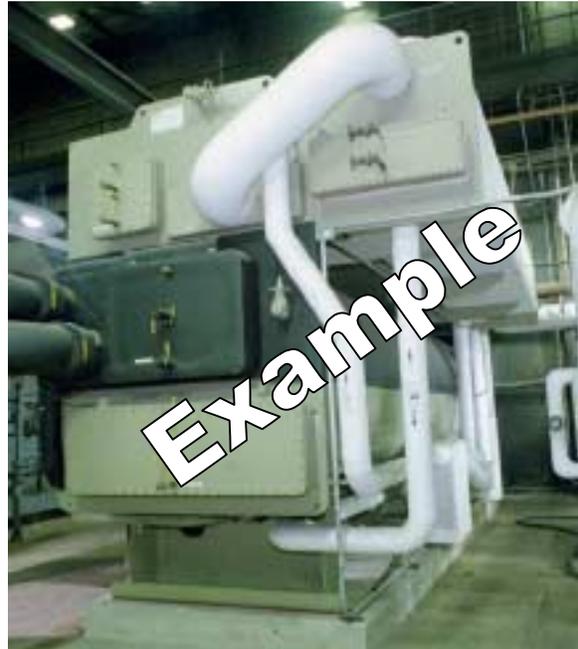


Figure 1: *[Provide a picture portraying a characteristic piece of equipment at the facility.]*

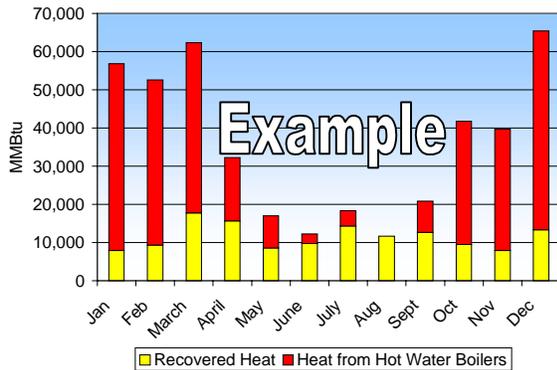


Figure 2: Annual Thermal Energy Provided (Example)

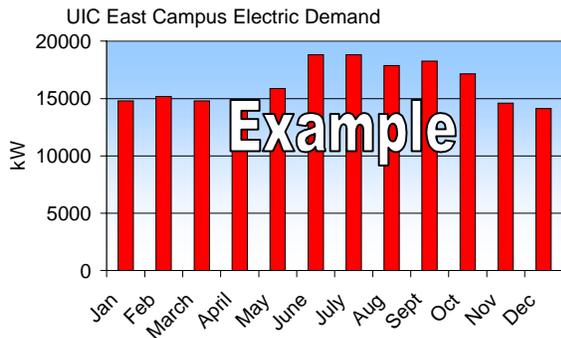


Figure 3: Peak Electric Demand Profile (Example)

	CHP Plant	Baseline Plant
Natural Gas	1,179,356 MMBTU	3,383,945 MMBTU
#2 Fuel Oil	169,517 gallons	0

Table 1: Annual Total Fuel Usage (Example)

	Generated On-Site	Sold Back to the Utility	Purchased from the Utility	Total Delivered to Campus
Jan	4,303		3,408	7,711
Feb	4,442		2,412	6,854
March	3,991		3,871	7,862
April	6,050		1,191	7,241
May	2,337		26	9,463
June	7,626			5,578
July	10,512		2,301	12,813
Aug	10,043	-1,924		8,119
Sept	9,917	-2,935		6,982
Oct	8,214	-454		7,760
Nov	8,432	-1,335		7,097
Dec	7,428	-359		7,069
Total	83,295	-9,055	20,309	94,549

Table 2: Annual Electric Generation and Use in MWhr (Example)

	CHP Plant	Baseline
INCOME		
Sold electricity	\$ 135,858	N/A
St Ignatius School	\$ 70,827	N/A
GENERAL EXPENSES		
Salaries	\$ 204,619	\$ 204,619
ELECTRICAL EXPENSES		
Electricity Wages	\$ 481,400	N/A
Electricity Fuel Oil	177,477	N/A
Electricity Gas	3,804,883	N/A
Com Ed Electricity	\$ 1,131,845	\$ 6,710,545
Electricity Water/Sewer (a)	\$ 57,723	N/A
Maintenance	\$ 120,000	N/A
HEATING & COOLING EXPENSES		
Heating & Cooling Wages	\$ 886,600	\$ 886,600
Heating & Cooling Fuel Oil	\$ -	\$ -
Heating & Cooling Gas	\$ 1,674,764	\$ 2,462,380
Heating & Cooling Water/Sewer (b)	\$ 52,437	\$ 52,437
Maintenance	\$ 58,200	\$ 58,200
TOTAL	\$ 8,443,263	\$ 10,374,782

Table 3: Economic Comparison Details Between Baseline and CHP Plant (Example)

Results

[Provide information that summarizes the results that can be ascertained from the case study.]

Additional Considerations

[Provide any other information such as overall source energy reductions, or reductions in effluents.

Provide information from the Barriers, Incentives, or Lessons Learned section of the case study that would be of interest.]

For further information contact:



Address:

[Address of CHP Application Center responsible for Fact Sheet]

Phone: (XXX) XXX-XXXX

Fax: (XXX) XXX-XXXX

www.CHPCenterXX.org

SECTION C: FACT SHEET



FACT SHEET

[Site Name]

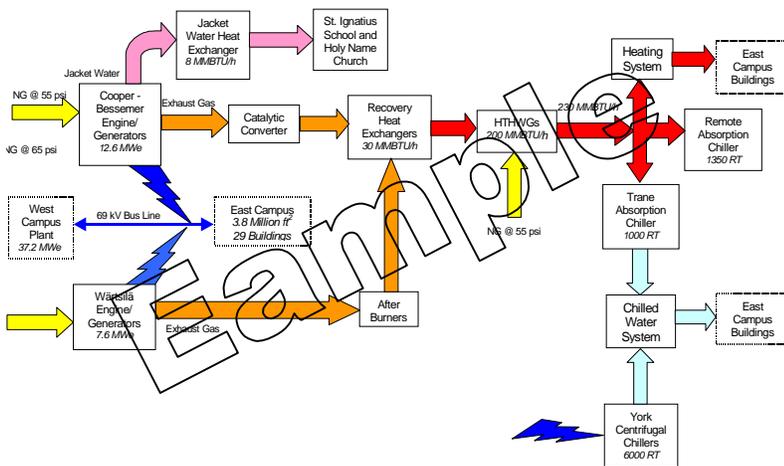
Cooling, Heating, and Power Plant

Site Description

[Provide a brief description of the site including, the name of the site, the market sector that it is in, the electrical generation capacity, the amount of heat recovered, the number of square feet or buildings serviced, and any other highlights particular to the site.]

Cooling, Heating, and Power (CHP) Configuration

BCHP System



BCHP System (YEAR)	
Total Cost:	\$XXM
Original Goal:	Payback in XX years
Actual Performance:	Payback in XX years
Operating Savings:	Approximately \$XM/yr
Internal Rate of Return:	XX%

Energy/Financial Statistics

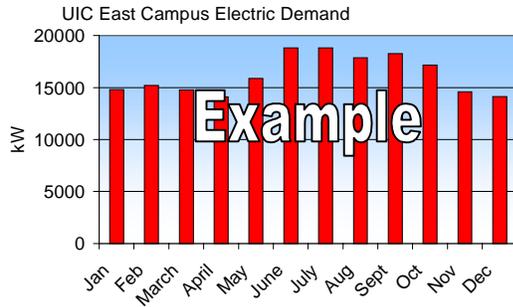


Figure 1: Monthly Electric Demand

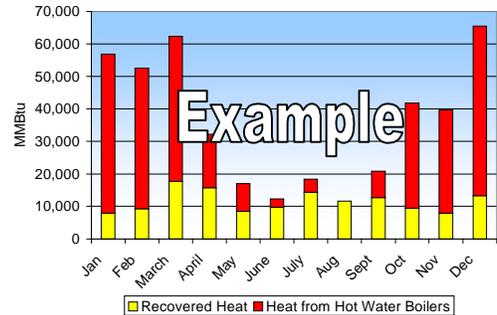


Figure 2: Annual Energy Provided

	BCHP Plant	Baseline
INCOME		
Sold electricity	\$ 135,858	N/A
St Ignatius School	\$ 70,827	N/A
GENERAL EXPENSES		
Salaries	\$ 204,619	\$ 204,619
ELECTRICAL EXPENSES		
Electricity Wages	\$ 481,400	N/A
Electricity Fuel Oil	\$ 7,477	N/A
Electricity Gas	\$ 1,680	N/A
ComEd Electricity	\$ 6,710,545	N/A
Electricity Water/Sewer (a)	\$ 57,723	N/A
Maintenance	\$ 120,000	N/A
HEATING & COOLING EXPENSES		
Heating & Cooling Wages	\$ 886,600	\$ 886,600
Heating & Cooling Fuel Oil	\$ -	\$ -
Heating & Cooling Gas	\$ 1,674,764	\$ 2,462,380
Heating & Cooling Water/Sewer (b)	\$ 52,437	\$ 52,437
Maintenance	\$ 58,200	\$ 58,200
TOTAL	\$ 8,443,263	\$ 10,374,782

Financial Comparison Baseline and CHP Plant

For further information contact:



Address:

[Address of CHP Application Center responsible for Fact Sheet]

Phone: (XXX) XXX-XXXX

Fax: (XXX) XXX-XXXX

www.CHPCenterXX.org

Additional Considerations

[Provide a description of other elements of the CHP installation that might be of interest. Include such things as source energy and emissions reductions, special funding or financing considerations, and issues with fuel or electricity costs.]