



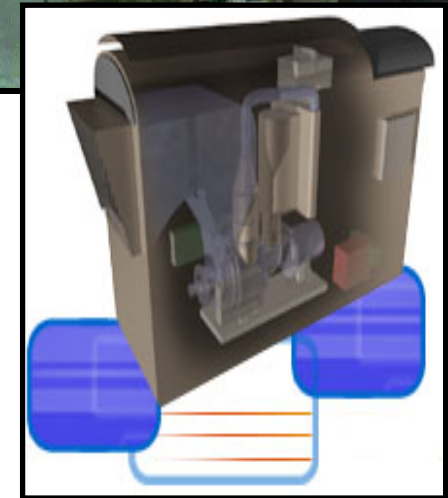
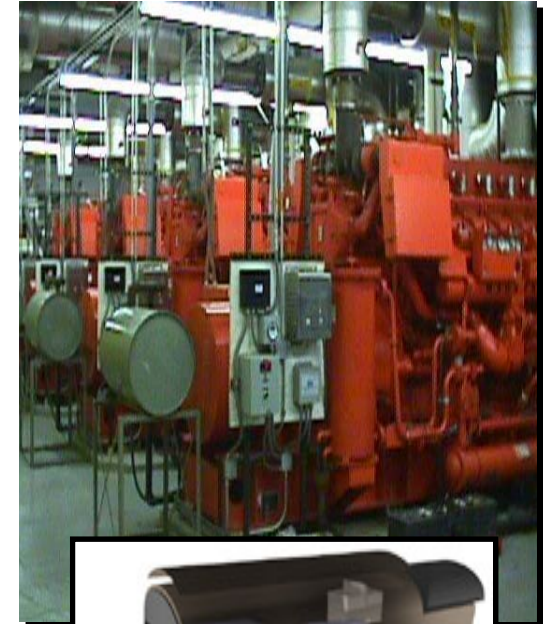
Regional Application Centers: US DOE's Program to Advance Combined Heat and Power Applications

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January 8, 2009

What Is Combined Heat and Power?

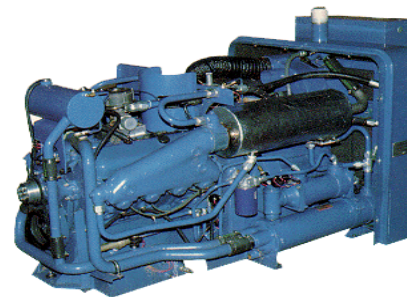
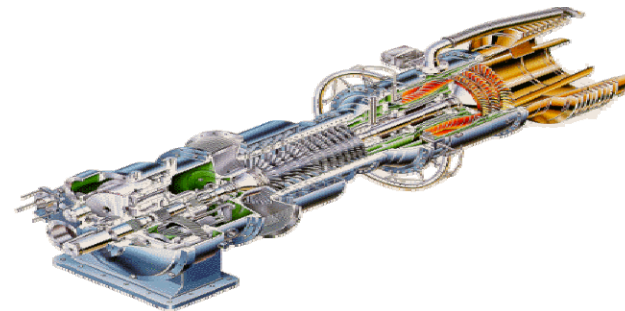
CHP is:

- An integrated system
- Provides electricity
- Recycles the waste heat to provide:
 - Heating
 - Cooling
 - Dehumidification
- Located at or near a building/facility
- Uses multiple technologies and fuels



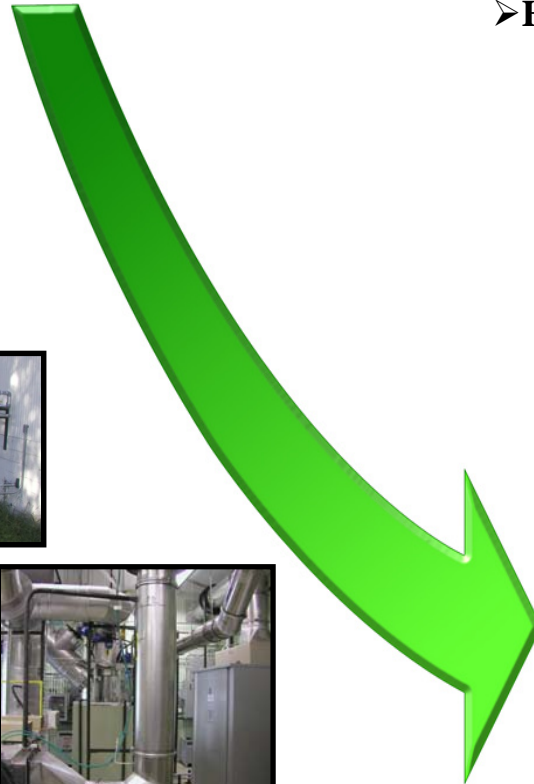
CHP Technologies

- Electric Generation Equipment
 - Gas Turbines
 - Backpressure Steam Turbines
 - Reciprocating Engines
 - Microturbines / Fuel Cells
 - Renewable Resources
- Heat Recovery Systems
 - Hot Water
 - Steam
 - Exhaust Gases
- Thermally Activated Technologies
 - Absorption Chillers
 - Desiccant Dehumidification
 - Thermal Storage

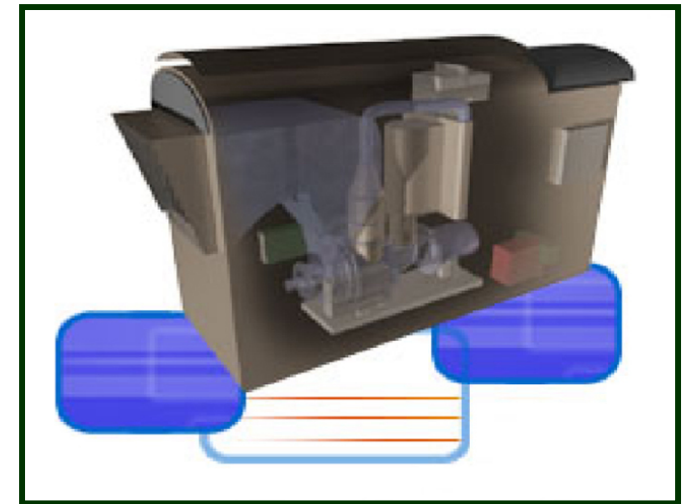


IES Vision: Packaged System Integration

Present: Individually optimized products combined on-site



- **Integrated or Modular Packages**
- **Less or Little Onsite Engineering**
- **More Cost Effective (including installation)**
- **Higher Overall Efficiency**



IES – single optimized package from manufacturer

CHP – An Integral Part of U.S. Energy Policy

- Benefits of CHP
 - Energy Efficiency 70-85%
 - Energy Security
 - Energy Reliability and Quality
 - Climate Change / Environmental Stewardship
 - Economic Development
- Major component of National Energy Policy in 2001 (over 20 recommendations)
- Major component of EPACT 2005 and EISA 2007
- 2nd ranked opportunity for energy savings at industrial facilities (ITP Energy Analysis)

U.S. DOE National CHP Roadmap

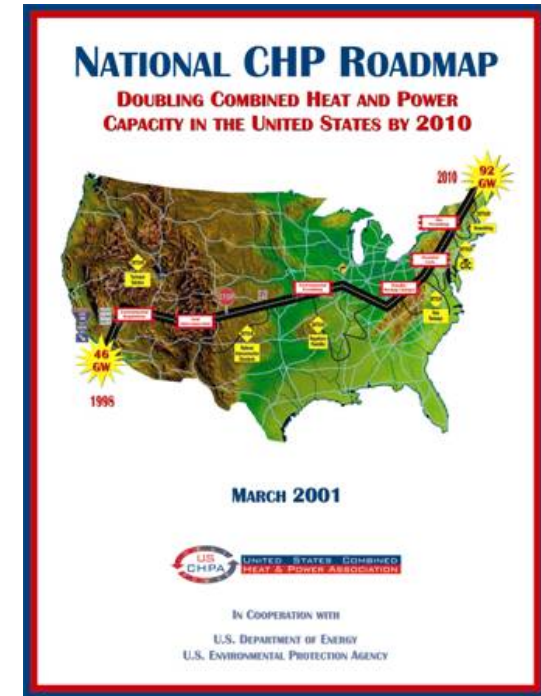
Over 50 companies contributed to National Roadmap:

- Technology
- Deployment

Determined technology deployment needed a stronger regional focus

DOE/ORNL Working Group develops concept of local “SWAT Teams”

**US DOE EERE’s Approach:
Regional CHP Application
Centers**



DOE Headquarters' Objectives

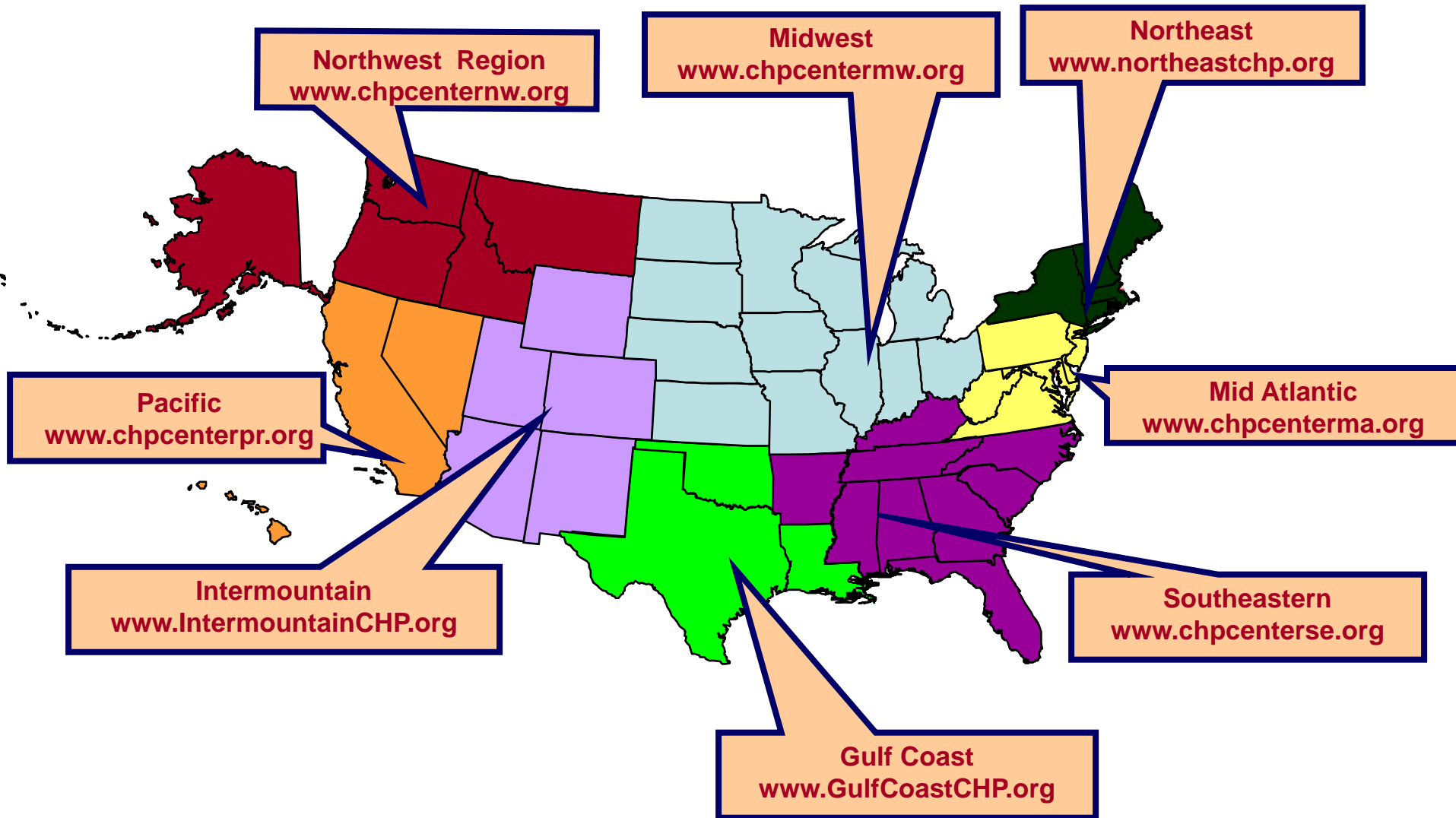
Regional Centers to Lead Deployment of CHP by

- Educating regional players on benefits to reduce perceived risk
 - End-Users
 - Policy Makers
- Providing project specific support
- Providing feedback to DOE and industry regarding future R&D program needs

RAC Evolution

- 2001: Pilot Project started in Midwest at University of Illinois at Chicago in partnership with Oak Ridge National Laboratory:
- 2003/4: DOE solicitations resulted in seven new Regional CHP Application Centers:
 - Northeast (UMass, Pace, NYSERDA)
 - Mid-Atlantic (UMaryland)
 - Intermountain (etc Group, SWEEP)
 - Northwest (Washington State U)
 - Pacific (UCal-Berkeley, UCal-Irvine, SD State)
 - Gulf Coast (Houston Advanced Research Center)
 - Southeast (Mississippi St, North Carolina St.)
- 8 Regional Application Centers Now Serve All 50 States!

Regional Application Centers



RAC Mission and Strategy

- RAC Mission
 - Inform prospective CHP users on the benefits, business model, and resources available for their specific application.
 - Support CHP project development
 - Promote CHP as an effective clean energy policy solution to state policymakers and regulators
- RAC Strategy
 - Services
 - Focus
 - Collaboration

RAC Strategy – Services

Services offered by all RACs:

- Education and Outreach / Market Transformation
 - Websites
 - Focused Training and Education
 - Targeted End User Market Workshops
 - Regulatory / Policymaker Education
 - Project Profiles / Case Studies
- Project Support
 - Site Evaluations / Screening
 - Application Analysis (Tech / Financial); Third party reviews
 - Technical Assistance

RAC Regional Focus

- RACs focus on leading opportunities for their region:
 - Midwest – Hospitals, Ethanol, Livestock, A/Es, Municipal Utilities, Regulatory, Waste Water Treatment, Food Processing
 - Intermountain – Waste Water Treatment and Landfills, Regulatory
 - Mid-Atlantic – Government facilities, opportunity fuels
 - Northeast – Commercial Office Buildings, HUD, Grid Congestion Relief, Wood Products, Hospitals, A/Es
 - Northwest – Livestock, Dairy, Waste Heat to Power, District Energy, Forest Products
 - Pacific – Ultra Clean Technologies, Premium Power, Waste Heat to Power
 - Gulf Coast – Hurricane Recovery Efforts, Cooling and Dehumidification Technologies, Hospitals
 - Southeast - Hurricane Recovery Efforts, Cooling and Dehumidification Technologies, Agriculture

RAC Accomplishments

- Target Market Workshops
 - Coordinated over 120 workshops
 - Over 9000 attendees educated on benefits for their specific application
 - Target Markets
 - Hospitals and Healthcare
 - Manufacturing
 - Forest Products
 - Waste Water Treatment
 - Multi-family housing
 - Municipalities
 - Gas Utility Clients
 - Waste Heat to Power
 - Food Processing
 - Livestock
 - Energy Assurance
 - Federal Facilities
 - Premium Power

RAC Accomplishments

- Policy Maker Education has resulted in
 - New State CHP incentive programs
 - Connecticut Distributed Energy Incentive Program
 - Inclusion of CHP in energy efficiency, renewable portfolio standards, and regional power planning efforts
 - Western Governor's Association's Clean and Diversified Energy Initiative
 - North Carolina RPS
 - Improved State interconnection standards

RAC Accomplishments

- Project Support
 - Supported over 350 projects representing over 1.3 GWs CHP installed or in development:
 - Avoids 7.7 million tons of CO₂, equivalent to
 - Adding 1.9 million acres of trees
 - Removing 1.2 million cars from the road

A Few Examples Of RAC Activity and Assisted Installations



Conant High School

- 450,000 sq. ft., 2,600 student high school located in Illinois
- Technical assessment conducted in 2002
- Two 400 kW engine generators with heat recycling



Ethan Allen Furniture Factory

- Furniture manufacturer since 1889

Employs 550 people in VT & NH

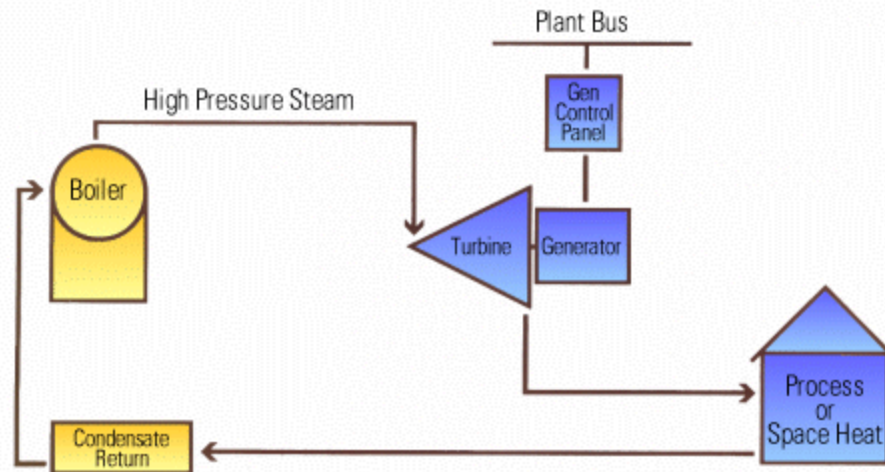
Annual Energy Costs of \$1,500,000

Factory was planning on closing and moving off shore



Ethan Allen Furniture Factory

- Center Recommendation:
Replace steam engine with steam turbine using biomass fired boiler yielding under 3 year payback and saving over 10% of energy costs.
- Coalition of States of VT, NH and VT Electric Co-op jointly funded project with Ethan Allen purchasing power from the project. Plant has stayed on shore.



*BP Series in a simple pressure reducing application
Power production is proportionate to process steam demand*

Seaman Paper Company

- Tissue Paper mfg. with \$55MM/year sales and over \$3.2 MM/year energy costs.
- Application Center Recommendation with under 3 yr. payback
Replace oil fired boiler with biomass boiler.
Use steam turbine to generate power.
- Boilers have been replaced and steam turbine will be added in next budget cycle.



Disaster Mitigation - Value of CHP

Mississippi Baptist Medical Center

- Remained open and treated a high volume of patients
- Provided clothing, food, and housing for displaced patients during the first night of the disaster
- Opened a round-the-clock day care to allow employees to focus on patient care

Memorial Herman Baptist Hospital

- Provided no medical services during or after the storm
- Remained closed for seven days due to lack of power and water
- Lost operating revenues and suffered damages of over \$30M primarily from humidity infiltration

Approach to Target Market Workshops



RAC Target Market Workshop

- Purpose:
 - Educate potential end-users of the benefits of CHP applications for their specific market
 - Reach project decision-making personnel (technical and financial)
 - Motivate attendees to follow-up actions
 - Website tools
 - Site Assessments

RAC Target Market Workshop

- Planning with Partners
 - State Energy Offices
 - Identify target markets for state
 - Identify key industry players and associations
 - Key Industry Associations
 - Provides endorsement for workshop within their industry
 - Assists in providing continuing education credits
 - Co-sponsorship of workshop
 - Gas Utilities / Municipalities
 - Identify high potential end-users
 - Co-sponsorship of workshop

RAC Target Market Workshop

- Workshop Execution
 - Presentation Themes
 - CHP “The Concept”
 - CHP “The Business Case”
 - Speakers
 - Industry
 - Technology
 - Project Profiles / Case Studies
 - Follow-up with Attendees
 - Website tools
 - Site Assessments

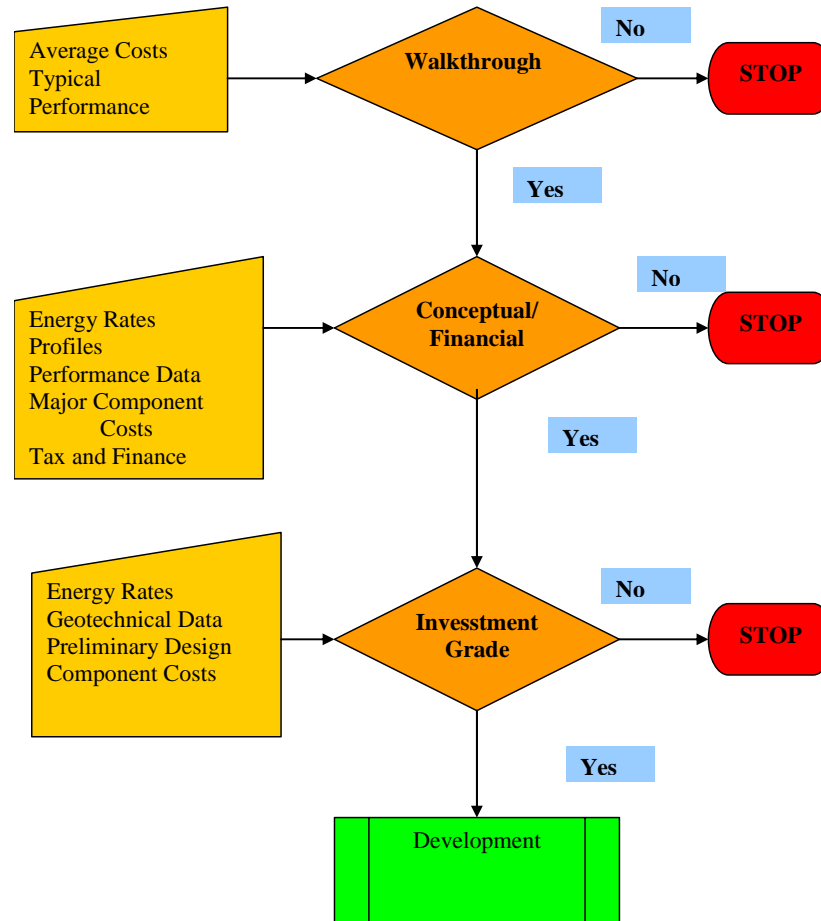
Considerations for RAC Site Assessments



RAC Site Assessments

- Levels of CHP Assessments:
 - Questionnaire (Energy End User or RACs)
 - Level 1 Screening/Walkthrough Analysis (RACs)
 - Level 2 Conceptual / Financial Analysis (RAC or Engineering Company)
 - Level 3 Investment Grade (Engineering Company)

Decision Making Process



RAC Site Assessments

- Questionnaire
 - To provide a rough “rule of thumb” indication of the potential for a viable CHP installation at a facility through initial discussions with site owner; sometimes performed with web tool.
 - No or minimal calculations
 - Tool: EPA Ten Question Qualifier – “Is my facility a good candidate for CHP?”
(http://www.chpcentermw.org/10-01_tools.htm)

RAC Site Assessments

- Level 1 Screening/Walkthrough Analysis
 - Intended to establish if a site has the potential to be a good candidate for CHP. Relatively simple analysis requiring a 1 to 2 day effort. Relies on “rules of thumb” to size project, project performance and costs.
 - Accuracy of output is 30% to 50% and normally includes estimated savings, installed costs, and simple paybacks
 - Tools:
 - “RETScreen Combined Heat and Power (CHP) Project Model”. Available from Natural Resources Canada at www.retscreen.net/ang/g_combine.php
 - Spreadsheet for Evaluating the Economics of CHP Systems”. Developed by the Midwest CHP Application Center (Farrar / Haefke). Available at www.chpcentermw.org/html/10_library.html#tools

RAC Site Assessments

- Level 2 Conceptual / Financial Analysis
 - Intended to extend and refine screening analysis by expanding technical performance, cost and financial analyses. Requires 40 to 120 hour professional effort.
 - Performance analysis utilizes a detailed engineering model that preferably employs hourly load profiles and equipment specific performance data.
 - Cost analysis utilizes actual rate and cost data for site. Local energy cost forecasts incorporated into cash flow analysis.
 - Financial analysis uses financing, tax and decision making criteria specific to facility owner. Includes analysis of ownership structure.
 - Accuracy of output is 10% to 20% with detailed report on savings, installation costs, simple paybacks, cash flow, rates of return, conceptual one-line design including equipment sizing
 - A minimum of 50% cost share is expected for RAC services.
 - Tools:
 - “Building Energy Analyzer (BEA)” Developed by GTI. Available (for fee)
 - “BCHP Screening Tool” Developed by ORNL. Available (no fee)
 - D-Gen Pro (for fee)
 - Heatmap CHP (for fee)

RAC Site Assessments

- Level 3 Investment Grade
 - Intended to develop and design an actual CHP system
 - Develop detailed engineering design and installation /construction drawings
 - Develop procurement specifications
 - Establish detailed project capital budget
 - Conducted by a Qualified Engineering Firm Providing a Firm Quote for the Project
 - RACs can provide assistance (service) in preparing a solicitation, reviewing proposals, and providing technical support for the site owner.

Summary

- RACs have proven to be a cost effective DOE tool in CHP program in leading technology deployment
 - RAC Program one of top rated programs in 2005 DOE Peer Review
- If interested in a target market workshop or site assessment, please contact RAC director per contact list on next slide.

For Further Information

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