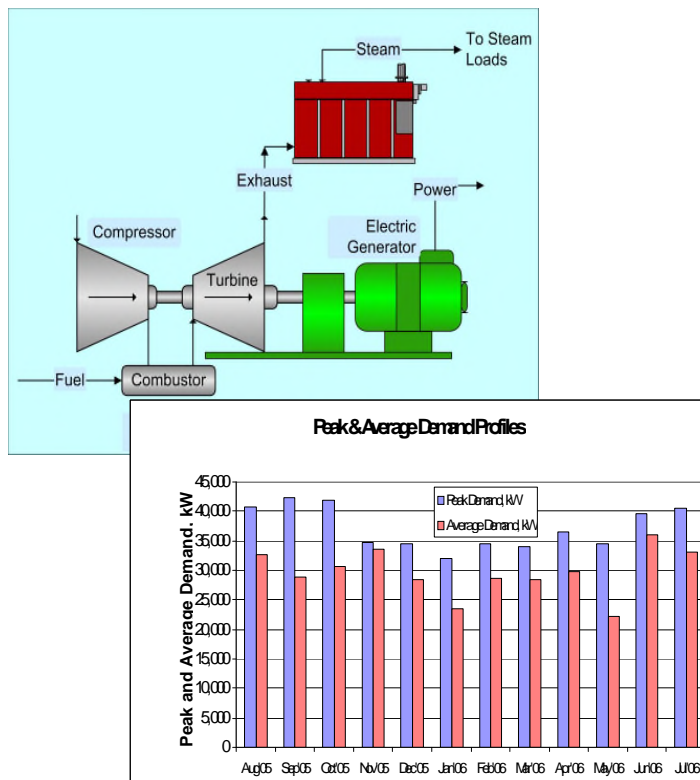




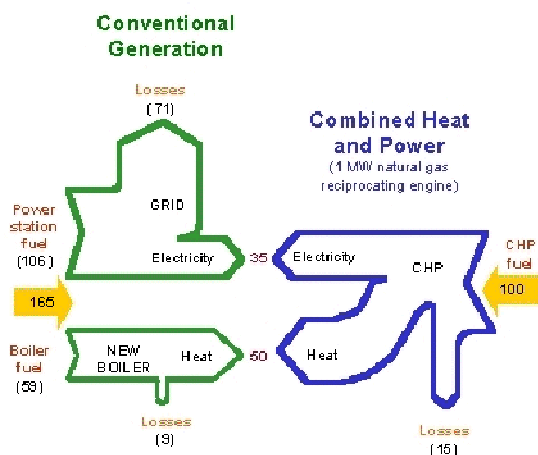
Combined Heat & Power Consulting Services



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Combined Heat & Power

Combined heat and power (CHP), also known as cogeneration, is the concurrent production of electricity or mechanical power and useful thermal energy (for heating and/or cooling) from a single source of energy. CHP is a type of distributed generation, which, unlike central station generation (located in remote areas), is located at or near the point of consumption. Instead of purchasing electricity from a local utility and then burning fuel in a furnace or boiler to produce thermal energy, consumers use CHP to provide electricity and recycle waste heat from electricity generation for providing useful thermal energy. As a result, CHP improves energy efficiency and reduces greenhouse gas (GHG) emissions.



CHP is not a single technology but a suite of power generation technologies (engines, combustion turbines, microturbines, steam turbines, sterling engines and fuel cells) that can use a variety of fuels to generate electricity or mechanical power at the point of use, and allow utilization of the thermal energy from the power generation equipment, for providing heating and/or cooling needs of the facility by using a variety of heating and cooling equipment.

Which combination and capacities of power generation, heating and cooling technologies is optimum for a specific

application depends on several factors including: the annual number of hours when there is simultaneous need for electricity and thermal energy, typical weather conditions of the facility location, real-time market cost of purchasing electric and gas energies.

Our Services

Avalon Consulting, Inc. (Avalon) provides consulting services to commercial, industrial and institutional facility owners, energy service companies, and design and engineering contractors. The scope of our services includes technical and economic analyses of alternative technologies, system optimization, developing bid specifications, evaluating bids, technical support through detailed design, construction and commissioning, performance test evaluation.

Our Experience

Avalon has been providing energy consulting services since 1996 and has successfully performed projects in the U.S. as well as many other countries, including, Australia, Canada, India, Korea, Saudi Arabia and U.A.E. The founder and principal consultant at Avalon Consulting, Dharam (Don) Punwani, has over 40 years of experience in energy systems. A list of some of his CHP publications and presentations he has authored or coauthored is shown on the next two pages.

Contact Us

For more information on CHP, our services or your specific needs, please contact:
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Avalon's CHP Publications & Presentations

1. "Benefits of Turbine Inlet Cooling and Thermal Energy Storage for CHP and Cogeneration Systems," Midwest Cogeneration Conference, "Implementing Winning Cogeneration/CHP Projects," Elgin (Chicago Area), IL, October 11, 2011
2. "Turbine Inlet Cooling Technologies and Applications for Optimizing Cogeneration / CHP Systems," A Webinar Presentation Cosponsored by the Midwest Cogeneration Association and the U.S. DOE Midwest Clean Energy Application Center, August 25, 2011
3. "Zero-Emission Electricity (ZEE) Generation from Fossil-Fuel Systems," Electric Power 2011, Rosemont (Chicago Area), IL, May 10-12, 2011
4. "Optimizing Clean Energy Systems with Thermal Energy Storage and/or Turbine Inlet Cooling," U.S. Clean Heat & Power Association, Washington, DC, May 5-6, 2011
5. "Turbine Inlet Cooling: Increased Energy Efficiency & Reduced Carbon Footprint Aspects for District Energy Systems," International District Energy Association (IDEA) Conference, Indianapolis, IN, June 14, 2010
6. "Carbon Footprint, Environmental Benefits and Emission Controls," Chapter 7 in "Sustainable On-Site CHP Systems: Design, Construction and Operations", a McGraw Hill publication, January 2010
7. "CHP System at the Janesville Wastewater Treatment Facility, Janesville, WI," a project profile developed for the U.S. DOE's Midwest CHP Application Center, March 2009.
8. "CHP System at the Rochester Wastewater Reclamation Plant, Rochester, MN," a project profile developed for the U.S. DOE's Midwest CHP Application Center, August 2008.
9. "Technologies and Economics of Turbine Inlet Cooling Application in Cogeneration," Midwest Cogeneration Association Conference, Countryside, IL, May 6, 2008
10. "*Combined Heat and Power Resource Guide for Hospital Applications*," developed for and published by the U.S. Department of Energy, March 2008.
11. "Turbine Inlet Cooling for Power Augmentation in Combined Heat & Power (CHP) Systems," presented at POWER-GEN International 2005, Las Vegas, NV, December 6-9, 2005

12. "Distributed Generation and Cogeneration," a short course presented for the staff and customers of The Southern California Gas Company, October 2005
13. "Natural Gas-Fired Cooling," a short course presented for the staff and customers of The Southern California Gas Company, October 2005.
14. "Building Energy Analyzer Software," a short course presented for the staff and customers of The Southern California Gas Company, October 2005.
15. "*Combined Heat and Power Resource Guide*," developed for and published by the U.S. Department of Energy, September 2005.
16. "Cogeneration Systems," a chapter co-authored for the *Natural Gas-Fired Cooling Technologies and Economic*, a textbook developed for the Gas Technology Institute, June 2005.
17. "Building Energy Analyzer," a chapter co-authored for the *Natural Gas-Fired Cooling Technologies and Economic*, a textbook developed for the Gas Technology Institute, June 2005.
18. The *Natural Gas-Fired Cooling Technologies and Economic*, a textbook, co-edited and developed for the Gas Technology Institute, June 2005.
19. "Combined Heat and Power Systems Training Course," developed for the Gas Technology Institute, November 2004.
20. "Database of U.S. Combined Heat & Power Installations Incorporating Thermal Energy Storage and/or Turbine Inlet Cooling," a report prepared for the U.S. Department of Energy, September 2004.
21. "Gas Cooling and Desiccant Dehumidification Systems," Web-based tutorials developed for the Cooling Solutions Fund members of the Gas Technology Institute, April 2000-2004.
22. "Gas Cooling Application Savings Calculators," Web-based calculators developed for 14 members of the Cooling Solution Fund of the Gas Technology Institute, April 2000-2004
23. "CHP System at the University of Texas at Austin, TX" a case study developed for the Gas Technology Institute, October 2003.
24. "*Combined Heat and Power Resource Guide*," developed for and published by the U.S. Department of Energy, September 2003.
25. "Building Energy Analyzer Training Seminar," a Web caste developed and presented to the members of the Cooling Solutions Fund members of the Gas Technology Institute, June 2003
26. "Absorption Chiller Application for Power Generation: A Case Study for a 316-MW Cogeneration Plant in Pasadena, Texas (USA)," presented at the International Gas Research Conference, Amsterdam, The Netherlands, November 2001.

27. "A Hybrid System for Combustion Turbine Inlet Cooling at a Cogeneration Plant in Pasadena, Texas," presented at the ASHRAE Symposium on Combustion Turbine Inlet Cooling, Atlanta, GA, January 2001