2005 CHP ACTION AGENDA: INNOVATING, ADVOCATING, RAISING AWARENESS, AND DELIVERING SOLUTIONS

Prepared for the 6th Annual CHP Roadmap Workshop
New York, NY

October 2005

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Department of Energy United States of America
ENERGETICS

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Introduction

Recognizing the pivotal role Combined Heat and Power (CHP) could have in our country's energy policy, the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), the United States Combined Heat and Power Association (USCHPA) and others issued the CHP Challenge and signed the CHP Compact setting the goal of increasing CHP capacity to 92 GW by the year 2010. Achieving this goal would require the commitment of a wide array of stakeholders in a coordinated public-private partnership. Companies and individuals organized themselves into the USCHPA in 1999 to enable the private side of this partnership. Over the course of the next two years, the process to set the course for meeting the challenge was completed. It culminated in the 2001 release of the National CHP Roadmap.

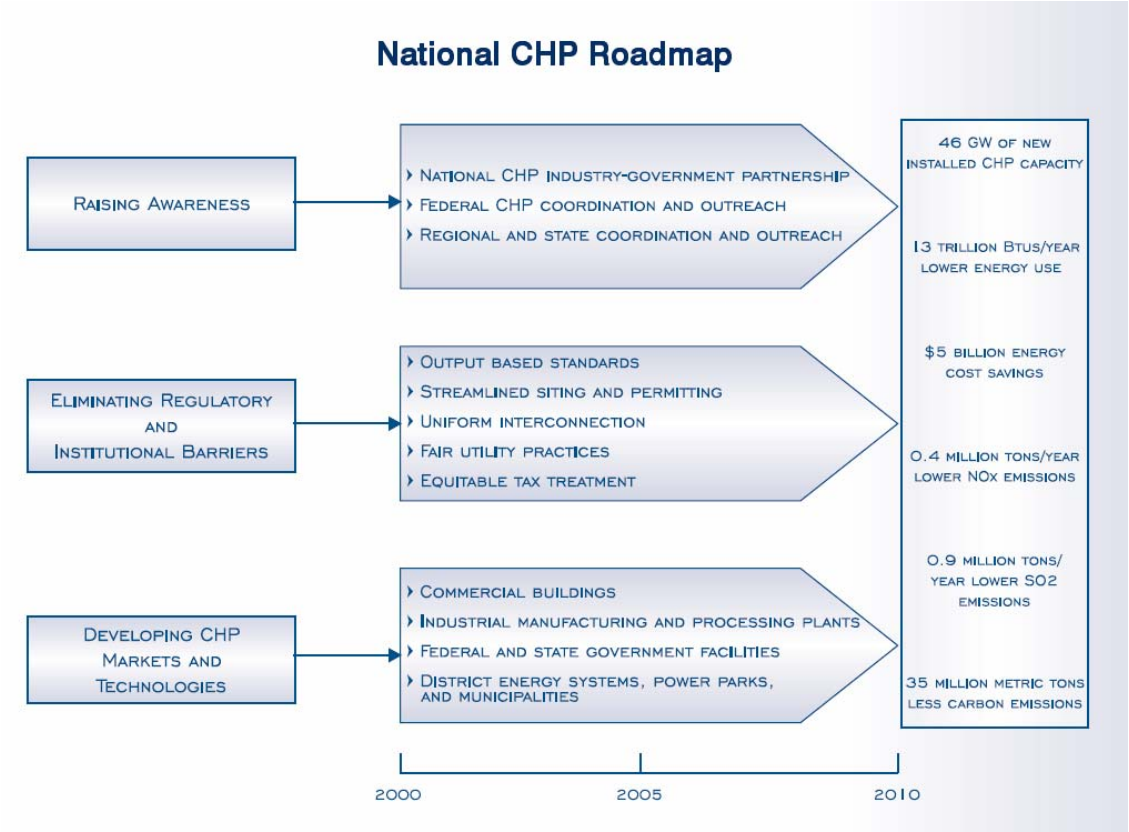
Each year since the publication of the National CHP Roadmap annual roadmap workshops have been held to revisit the progress and to identify needed additional action items. *At the 2004 roadmap workshop in Austin, TX the need to provide participants with a situational analysis document was clearly articulated. This analysis should describe what we have done to date to enhance CHP, the actions identified at the prior roadmap workshops to achieve goals, the status of those actions items, and a possible reprioritization of action items given the current and expected market conditions between now and 2010. The goal is to take a clear view of where there has been success and focus on the opportunities with the highest potential for progress and the greatest impact in removing remaining barriers to CHP, and provide the 2005 Roadmap workshop in New York with the raw material for much more coherent and achievable strategy for actions.*

This document is intended to provide the situational context in which we will set our priorities for upcoming year and complete our goals. It has been more than five years since the CHP Challenge and Industry Roadmap have been released. The CHP community has accomplished many notable achievements in that time and the ultimate goal 92 GW of CHP capacity is in sight. In these final stages of our journey, we find ourselves in a different set of market conditions than when we embarked in 2000. We have experienced the good and bad of industry deregulation and "re-regulation," a major regional grid failure, substantial increases and volatility in fuel prices, dramatic changes in our energy supply and security, an economic recession and recovery, the impacts of natural disasters, and a multi-year effort to produce comprehensive federal energy policy legislation. Moving forward as we develop our collaborative action agenda, we have to position CHP as a compelling solution to our most pressing national energy issues.

National CHP Roadmap Priorities

The National CHP Roadmap set the course for achieving 92 GW of CHP capacity in the U.S. This goal is expected to result in estimated energy savings of 2.4 quadrillion Btu per year and a reduction of 276 million tons of CO_2 per year compared to separate electricity and thermal energy generation.[1]

The 2001 National Roadmap and the 2004 Austin Roadmap Results breakdown action items into the categories of "Raising CHP Awareness", "Eliminate Regulatory and Institutional Barriers", and "Technology and Market Development" (the Austin report separates technology and market development). Figure 1 from the Roadmap illustrates CHP industry's priorities from the 2001 National Roadmap.



Source: National CHP Roadmap

Figure 1: 2001 National Roadmap Priorities

[1] The estimated annual energy and emissions benefits resulting from 92 GW of CHP capacity were calculated using the same methodology used by the 2001 National CHP Roadmap authors to calculate the benefits stated in the 2001 National CHP Roadmap document with some different assumptions. The proportional split between industrial and commercial CHP capacity is assumed to be the same in 2010 as it is in 2005 (82% industrial and 18% commercial). Industrial capacity factors are calculated based on 6500 hours per year utilization at an average of 85% rated capacity. Commercial capacity factors are calculated based on 6500 hours per year at an average of 60% rated capacity. Natural gas is the assumed fuel with CO_2 emissions based on 117 lbs. per MMBtu fuel input. CHP efficiency is assumed to be 70%. Electric utility efficiency is assumed to be 31%. Displaced boiler efficiency is assumed to be 80%.

Raising Awareness Goals from 2001 Roadmap

Raising awareness goals and actions laid out in the National Roadmap by 2010:

- Implement industry coalitions
    1. Form formal multi-trade group CHP coalition
    2. Expand USCHPA product and service offerings to include outreach activities to states
    3. Develop unified points of view on issues related to development and deployment of CHP
    4. Continue active support for industry-government RD&D partnerships in development of next generation CHP systems
- Implement federal coordination
    1. Expand DOE RD&D programs (EERE) that effect CHP (advanced turbines, microturbines, reciprocating engines, fuel cells, TAT, interconnection systems, power electronics, advanced materials, and communication and controls)
    2. Continue DOE CHP education and outreach (CHP website, CHP registry)
    3. Through the DOE FEMP expand efforts to identify candidate CHP installations at federal facilities and obtain funding for projects
    4. Continue EPA efforts to promote output-based BACT standards and develop state guidance
    5. Implement an EPA outreach program to facilitate CHP project development (CHP Partnership) by offering technical assistance, permitting guidance and public recognition
    6. Provide support to EPA to develop and disseminate information on CHP environmental benefits relative to other energy supply options
    7. Promote and encourage potential candidates for EPA/DOE CHP EnergyStar Awards
- Implement regional and state coordination
    1. Build state and regional information exchange networks on CHP issues
    2. Obtain financial assistance from state and federal sources for CHP education and awareness activities
    3. Address top priority regulatory and institutional barriers

Regulatory/Institutional Barriers Goals from 2001 Roadmap

Eliminating barriers goals and actions laid out in the National Roadmap by 2010:

- Implement uniform grid interconnection standards
    1. Support streamlined interconnection procedures instate restructuring implementation
    2. Propose federal legislation for interconnection of DE and CHP

3. Support IEEE uniform interconnection standards that cover CHP

- Implement fair and competitive utility practices
    1. Develop standard commercial practices and business terms between utilities and DE/CHP developers
    2. Develop and disseminate model utility principles, tariffs and legislative provisions for DE and CHP
    3. Develop analysis tools, data and case studies of value of CHP to electric and natural gas utilities
    4. Establish dispute resolution processes and capabilities for CHP projects
- Implement output-based emissions standards
    1. Analyze alternative technical approaches to output-based standards and their impact on CHP
    2. Provide technical assistance and information to EPA to encourage use of output-based standards for Clean Air Act compliance
    3. Provide technical assistance and information to states to develop and use output-based standards in SIP's
- Implement streamlined siting and permitting
    1. Develop CHP permitting guidance and protocols for state environmental officials (including pre-certification)
    2. Conduct national campaign to develop code changes for model code agencies
    3. Develop siting and permitting guidelines and tool kits for CHP designers, developers and installers on a state-by-state basis
    4. Develop pre-certification and permits-by-rule provisions for certain small facilities
- Implement Equitable tax treatment
    1. Support efforts to revise U.S. tax code and define accelerated deprecation schedule for CHP systems

Market and Technology Development Goals from 2001 Roadmap

Market development goals and actions laid out in the National Roadmap by 2010:

- New CHP Capacity Industrial Markets
    1. Demonstrate CHP and energy efficiency best practices in most promising industrial sectors
    2. Promote output-based emissions standards in key states
    3. Develop fair model utility access and exit fees
    4. Conduct cost-shared industrial CHP RD&D projects (black liquor/biomass gasification, materials, combustion, power electronics, sensors and controls)
- New CHP Capacity in Buildings Markets
    1. Conduct an outreach campaign (architects, building designers, engineering firms)

2. Support standards development for buildings CHP(address state and local codes)
3. Conduct const-shared RD&D (packaged systems, communications/controls, prime movers, TAT)

- New CHP Capacity in District Energy Markets
  1. Launch an outreach campaign (municipal and community governments, colleges/universities, military bases)
  2. Expand technical assistance to potential CHP users on assessment and implementation
  3. Conduct more demonstrations of CHP (brownfield, redevelopment, public housing, and power parks)
- New CHP capacity in Federal Facilities Markets
  1. Develop new funding sources for CHP installation and operation
  2. Compile an inventory of potential federal CHP sites
  3. Establish requirement for assessment of CHP before facility modifications
  4. Engage DOE FEMP in providing CHP technical assistance
  5. Develop case studies of CHP at federal facilities

Review of 2004 Austin Workshop Action Items

The Austin workshop represented the halfway point in our CHP Challenge. One of the objectives of the workshop was to "zero-in" on those action items not accomplished and discuss their importance and urgency moving forward with the remainder of the challenge rather than re-hashing barriers and opportunities.

The action plan developed at the Austin workshop consisted of the following items:

CHP Utility and Regulatory Issues

- Identify and promote fair and equitable rate structures for CHP
- Adopt model approaches to address regulatory and utility barriers
- Create CHP "Recycled Energy" portfolio standard
- Incorporate CO_2 benefits into policy position
- Develop negotiation strategy to bring utilities to the table

CHP Education and Outreach

- Integrate CHP into the LEED process
- Strengthen USCHPA presence
- Develop quantifiable database on CHP benefits beyond lower utility bills
- Develop web-based CHP-specific search engine with frequently asked questions
- Develop CHP marketing strategy for specific market subgroups

CHP Technologies

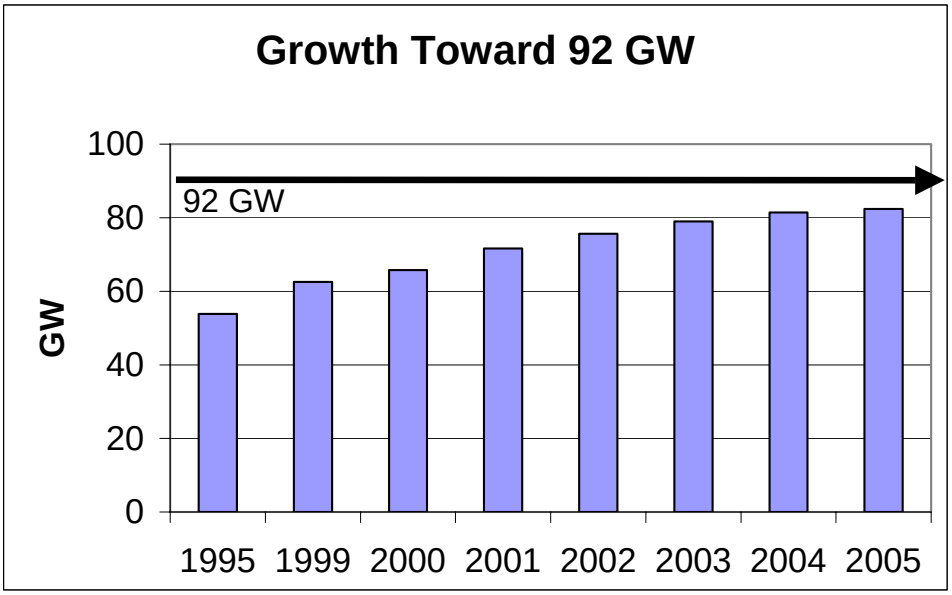
- Install projects in each target vertical market identified
- Define best practices for CHP project implementation
- Develop CHP codes and standards in collaboration with standard writing organizations
- Expand modular integrated and packaged systems (IES) with regard to both technologies and market applications

CHP Markets

- Develop strategy for niche mid-sized industrial markets
- Create industrial CHP Partners Group
- Address CHP opportunities in municipal wastewater facilities
- Monetize utility-related benefits of CHP
- Establish process for linking to LEED and Green Buildings Council

Accomplishments and Progress

The DOE-supported EEA CHP Installation Database has been the primary source for tracking progress to the 92 GW goal. The EEA database currently has 2,960 operating sites representing over 82 GW of capacity. Figure 2 highlights the growth of CHP in the U.S. from 1999 to 2005. Since the development of the Roadmap, the most significant growth period was in the 2000-2003 timeframe. The past two years have seen a relatively low growth rate in CHP additions.

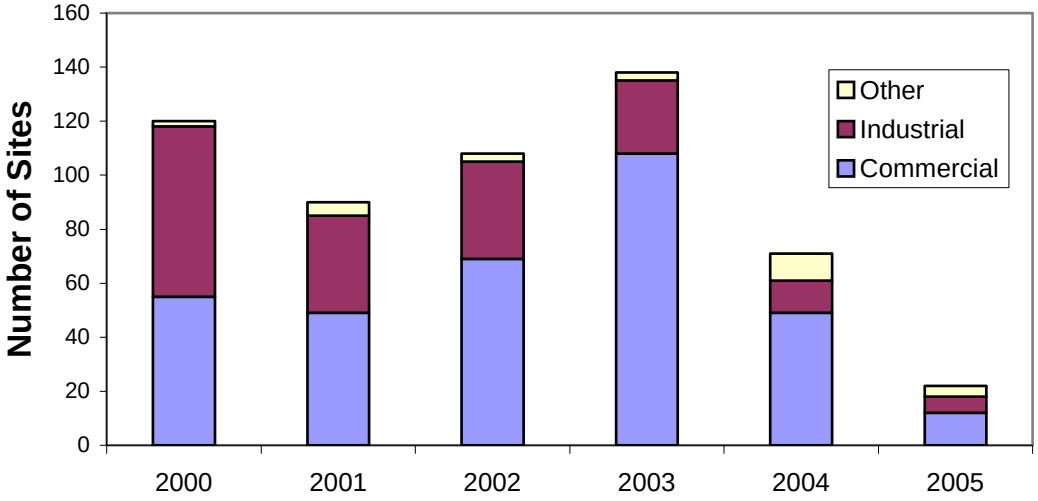


Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

Figure 2: Progress to 92 GW of CHP Capacity

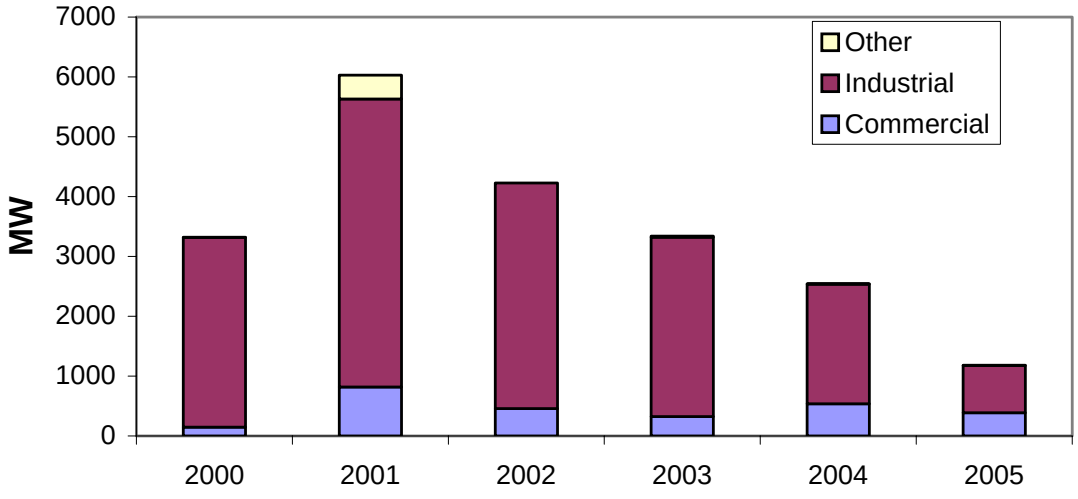
CHP Growth Trends

Between 2000 and 2005, 549 sites representing 20.6 GW were actually installed. During the same timeframe 152 sites representing 0.8 GW were retired, leaving a net addition to the database of 397 sites and 19.8 GW. Figures 3 and 4 illustrate growth in the 2000-2005 timeframe by commercial, industrial, and other applications by both site and capacity additions. The "other" applications pertain primarily to agricultural and mining applications (non-manufacturing and non-commercial market sectors). Annual CHP site additions increased from 2001 to 2003 and then have decreased in 2004 and 2005. There has been a decrease in CHP capacity additions every year since 2001. While commercial applications make up the majority of new CHP sites, capacity (MW) additions are dominated by industrial applications.



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

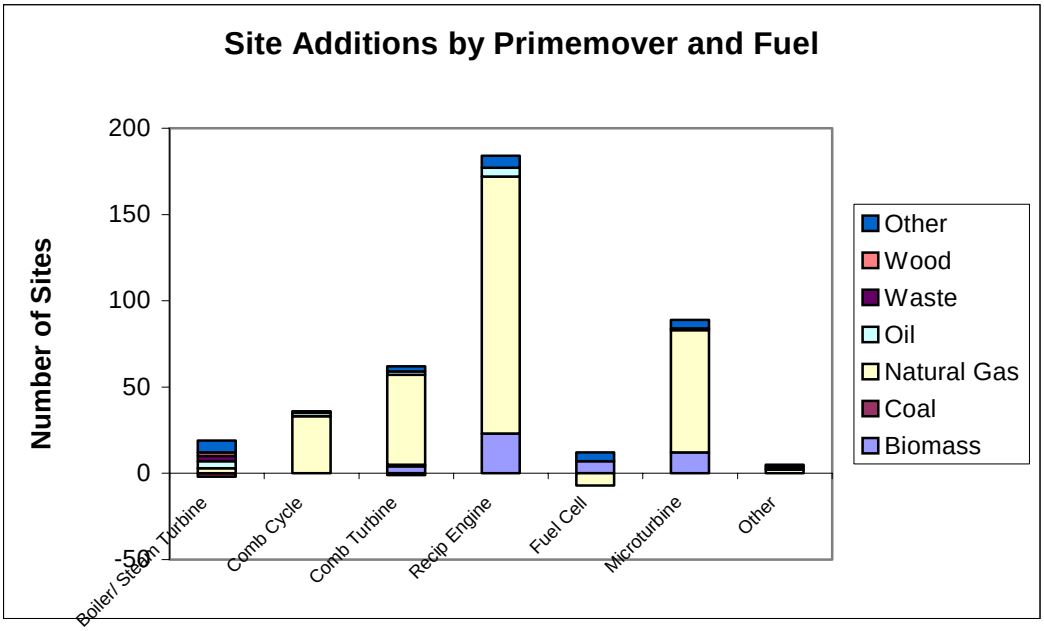
Figure 3: New CHP Site Additions 2000-2005



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

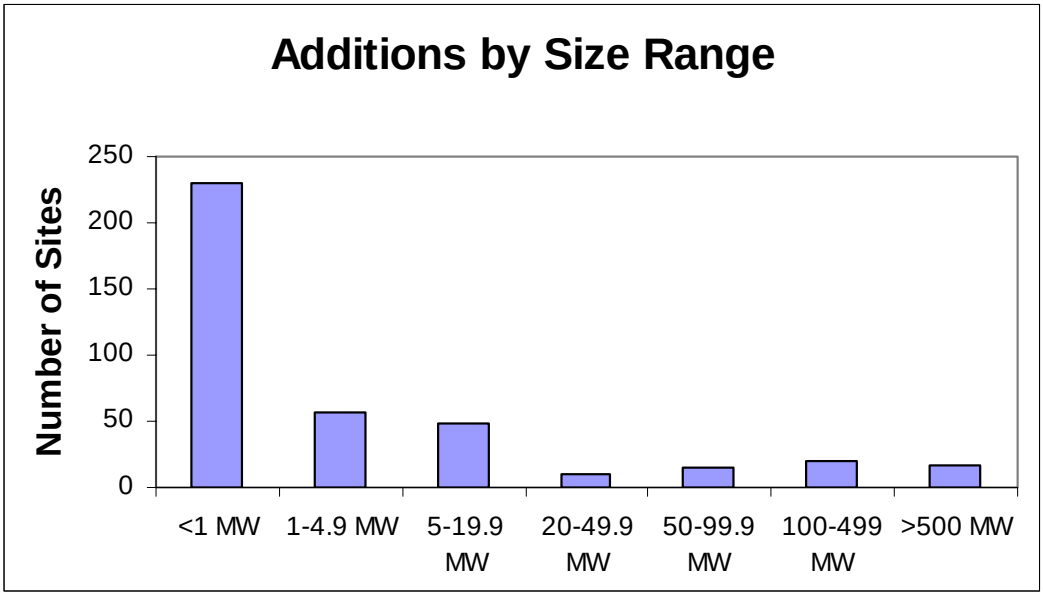
Figure 4: New CHP Capacity Additions 2000-2005

The majority of site additions in the 2000-2005 timeframe have been natural gas-fired reciprocating engines less than 1 MW. Figures 5 and 6 show the breakdown of new 2000-2005 CHP sites by prime mover, fuel and size.



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

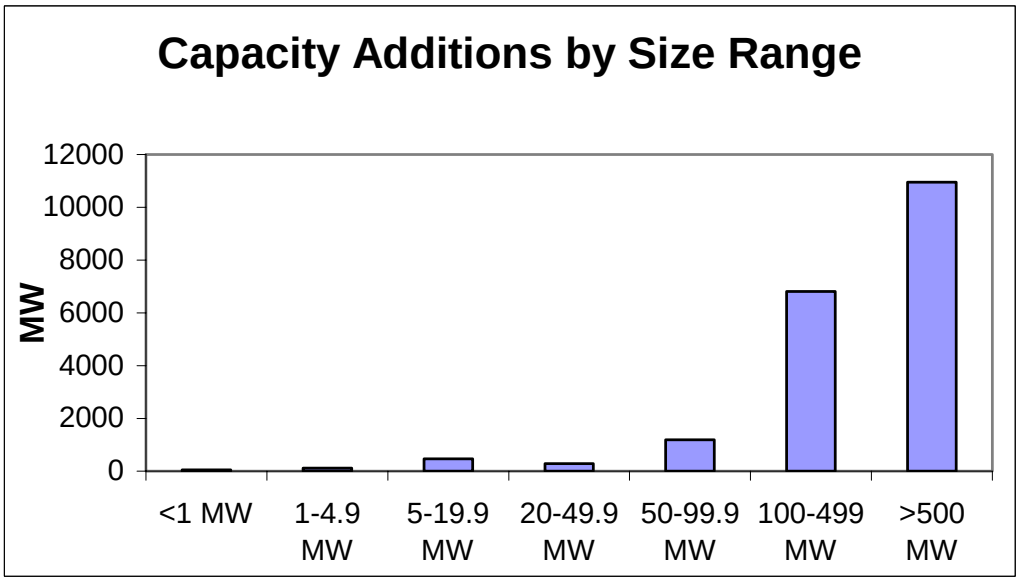
Figure 5: New CHP Site Additions 2000-2005 by Prime Mover and Fuel



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

Figure 6: New CHP Site Additions 2000-2005 by Size Range

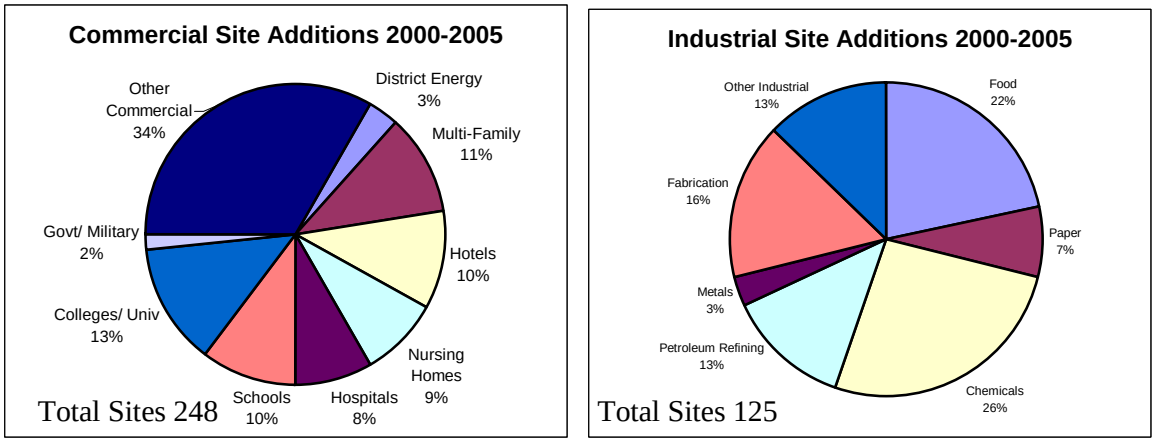
The distribution of newly added CHP capacity by size range is shown in Figure 7. It shows that the vast majority of CHP capacity additions have come from very large projects.



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

Figure 7: New CHP Capacity Additions 2000-2005 by Size Range

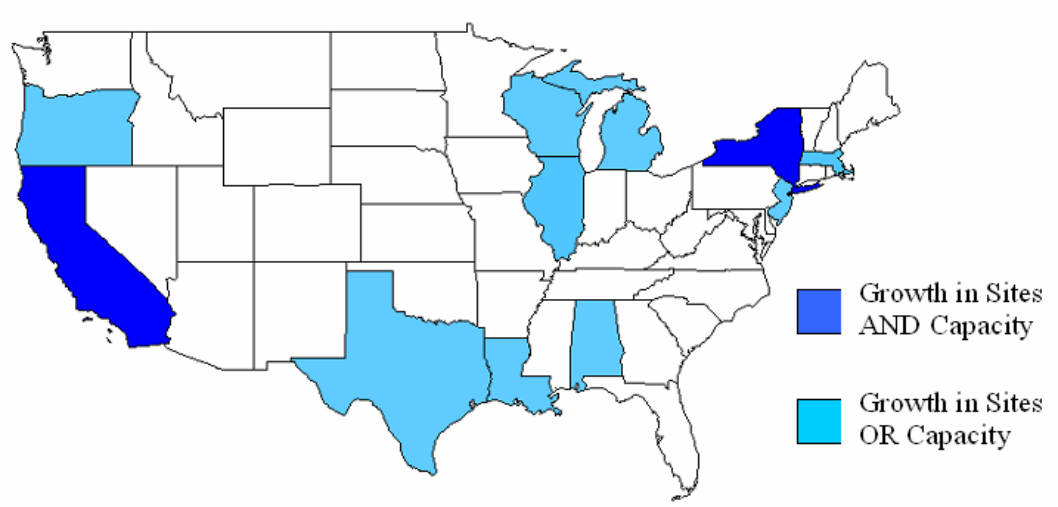
Figure 8 illustrates the breakdown on new site additions by market sector for both commercial and industrial applications.



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

Figure 8: New CHP Commercial and Industrial Site Additions 2000-2005 by Market Sector

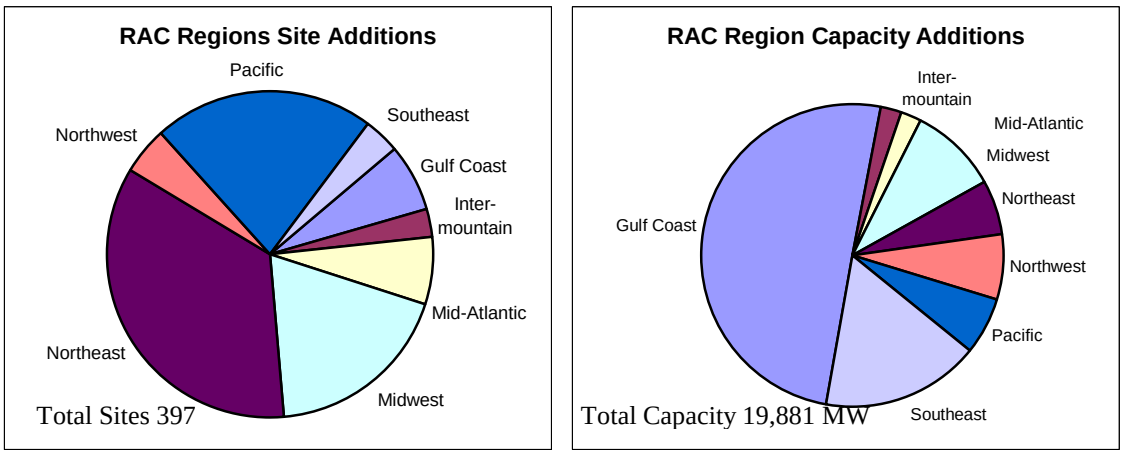
With regard to geographical trends in new CHP, growth tends to be concentrated in the Northeast, Midwest, Gulf Coast, and West Coast. Figure 9 illustrated states with growth in CHP. Favorable spark spreads and incentives for CHP have facilitated growth in California and New York.



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

Figure 9: 2000-2005 CHP Growth by State

CHP site additions and capacity additions by region are shown in Figure 10. This clearly shows the high project activity in the Midwest, Northeast, and Pacific regions and the large share of capacity additions due to very large CHP projects in the Gulf Coast.



Source: *"Profile of Existing CHP in the United States – 2005"*, Energy and Environmental Analysis, Inc, Draft report to Oak Ridge National Laboratory, September, 2005.

Figure 10: 2000-2005 CHP Growth by Region

Top CHP Achievements

In the 2004-2005 timeframe, the collaborative efforts of CHP community resulted in the successful completion of numerous accomplishments that are consistent with the CHP Vision and Roadmap and will help enable us to achieve our goal of 92 GW of CHP capacity. The following sections highlight the major achievements of the past year in the following areas:

- Innovating
- Advocating
- Raising Awareness
- Delivering Solutions

For more a detailed compilation of completed action items, please refer to the documents identified in the reference section at the end of this Action Agenda.

Innovating - Technology Development and Commercialization

Installation, Startup and Operation of DOE Cost-Shared Packaged IES

In partnership with ORNL, three packaged IES projects have been installed and began operation. Last year Austin Energy commissioned modular CHP plant at the Domain High Tech Park in north Austin. The Domain IES plant incorporates a 4.5 MW Solar combustion turbine that directly fires a 2,600 RT Broad absorption chiller. A critical aspect of this IES plant is the fact that it uses pre-manufactured or off-the-shelf components. This is expected to significantly lower the cost of replicating similar on-site generation systems (called distributed generation). The U.S. Army completed a new "packaged integrated energy system" at Fort Bragg, NC. The project will reduce operating costs while improving energy efficiency and enhancing the base's security. The IES system includes a Solar 5.5 MW gas turbine with dual fuel capability. It can switch, on the fly, from base operations using natural gas to #2 fuel oil in the event of an emergency. Part of the turbine exhaust directly fires a Broad absorption chiller that produces up to 1,000 tons of chilled water and also fires a heat recovery steam generator that can produce up to 80,000 pounds of steam per hour. A new A&P supermarket located in Mt Kisco, NY has installed a UTC Power PureComfort IES system which was commissioned in January of 2005. The system is pre-engineered to properly combine four 60 kW microturbines and a double-effect absorption chiller driven by the microturbine exhaust heat. In addition to providing summertime air conditioning, the chilled water is also used to subcool the refrigerant for the store display cases and the warm air exiting the chiller is used to regenerate a desiccant wheel provided by Munters.

Test and Verification of Integrated Energy Systems in Targeted End-Use Markets

Previous roadmap workshops identified the need to demonstrate the performance and installation experience of packaged IES in a wide set of commercial market sectors. Eight projects were awarded as a result of an ORNL/DOE solicitation for packaged IES in targeted market applications. The target sectors were Healthcare, Lodging, Education,

and Energy Operations. Healthcare projects include Butler Hospital, Eastern Maine Medical Center, and Madera Community Hospital. Lodging projects include Ritz Carlton Hotel and Wingate Hotel. Education projects include Utica College and Pepperell High School. Energy operations project include Basin Electric Power Cooperative/Northern Border Pipeline

Commercial Availability of Packaged IES

Packaged IES products resulting from the original IES Phase I became commercially available. United Technology Research Center and UTC Power collaborations with DOE and ORNL has resulted in the family of PureComfort products - PureComfort 240, PureComfort 300, PureComfort 360, PureThermal, and PureCycle. These products are pre-engineered IES systems that include sets of 60-kW microturbines to produce power, an exhaust-gas driven, double-effect absorption chiller/heater, and the controls to ensure safe and reliable steady state and transient operation. The full product range is suitable for commercial customers in applications such as hotels, healthcare, supermarkets, education, and retail.

Transfer of Advanced Prime Mover Technology to Commercial CHP Products

DOE continued its engine development projects under the Advanced Reciprocating Engine Systems (ARES) program and performance goals of the engine developers continue to be met. Component, controls and materials technology which enable significant improvements in both efficiency and emissions have been demonstrated in the development programs and continue to be successfully transferred to commercial engine products of Caterpillar, Cummins, and Waukesha. Current gas engines incorporating ARES technology have achieved thermally efficiencies in the range of 42-44%.

Advocating for CHP

The Energy Policy Act of 2005

After more than six years of hearings and votes, Congress finally completed a comprehensive energy policy act (EPACT) in July, 2005, and President Bush signed it into law. The USCHPA was integrally involved in the process seeking pro-CHP provisions, and was able to secure enactment of a number of helpful provisions. These include requirements that states consider upgrading interconnection policies, a federal study of the benefits of CHP/DG that can support future actions, and revisions of law that clarify the role of cogenerator-utility relationships. A 10% investment tax credit that had twice previously passed both houses of Congress was left out at the last minute, disappointing the CHP community and demonstrating that the fight for appropriate policies must continue even as the new law is implemented, and the authorized tax credits and program budgets meet current fiscal realities. EPACT did include tax credits for capital costs of fuel cells and microturbines used in a business. The basic credit is 10% of the capital costs (30% in the case of qualified fuel-cell projects), subject to additional conditions identified in the act. The incentives apply to equipment placed in service during 2006-2007. There is a provision in the EPACT amending the Public Utility Regulatory Policy Act (PURPA) to include net metering and smart metering and

providing for waiver of Qualified Facility (QF) purchase requirements if Federal Energy Regulatory Commission (FERC) finds the service territory of the utility seeking exemption to be competitive. EPACT authorizes an Advanced Power Systems Technology Incentive Program which provides payments to qualified advanced power system technology facilities and qualified security and assured power facilities. EPACT did not, however, represent the end of CHP policy making. It set in motion dozens of regulatory and administrative processes and studies that are intended to change policy or inform policymakers over coming months. USCHPA's and the CHP community's advocacy resources will be tested as they seek to participate in these processes.

Federal Energy Regulatory Commission Small Generator Interconnection

The USCHPA led a coalition of stakeholders in small generation over a four-year period to come to an agreement in May 2005 regarding small generator interconnection. The Federal Energy Regulatory Commission (FERC) adopted most of the consensus language on interconnection and issued standard procedures for interconnection (Order No. 2006). FERC's ruling requires public utilities to include non-discriminatory, standardized interconnection service for small generators in their FERC tariffs, and established rules and procedures for both the utilities and generators to implement. Now the primary venue for further action on interconnection issues shifts to the states and regions, where USCHPA and the Regional CHP Initiatives are gearing up to engage.

Regional CHP Initiatives

Regional CHP Initiatives have been established in many regions in the country. An advocacy/outreach partner to the DOE Regional Application Centers (RACs), the Initiatives support the implementation of the CHP Roadmap goals. They do this by operating at the regional and state level to create their own CHP roadmaps mirroring the goals of the national roadmap but adding a region-specific advantage. Because the Initiatives are largely private sector driven and non-federally funded, they are able to operate more directly to influence the regulatory processes in the individual states. As the focus turns steadily toward making progress in the regions and states, these operations are going to become more active in meeting the challenge of increasing CHP in the US.

Air Quality Regulations Recognizing Efficiency Benefits of CHP

EPA and the Regional Initiatives continued to advocate and promote output-based emissions and the inclusion of thermal credit (total energy output) in the calculation of emissions rates of CHP systems to state environmental regulators. EPA produced *Output-based Regulations: A Handbook for Air Regulators* and *EPA State Implementation Plan (SIP) Guidance* which includes guidance for electric-sector projects, initiatives, or measures that result in quantifiable emission reductions at fossil-fuel-fired electric generating units and improve air quality in non-attainment areas. Both of these are on the EPA CHP Partnership website. Several Northeastern states have adopted emission rules applying to distributed generation. Both Connecticut and Maine developed standards that are output-based. Connecticut's new DG regulations went into effect on January 1, 2005 and give credit for the thermal output of CHP systems. The language follows the RAP Model Rule. The NE Regional CHP Initiative has repeatedly

met with the Massachusetts Department of Environmental Protection (MADEP) on thermal credits and output-based standards in the development of MADEP's New Turbine and Small Engine regulations.

EPA Clean Energy-Environment Guide to Action

The EPA Clean Energy-Environment State Partnership program has developed a Clean Energy-Environment Guide to Action for partner states. The Guide to Action provides information on 16 policies and programs that are delivering economic and environmental results for states. The Guide to Action will help states develop an action plan to promote cost-effective clean energy policies that meet their environmental, energy, and economic goals, as well as to demonstrate the set of most effective, lowest cost state policies/activities that promote clean energy. The EPA CHP Partnership led the development of the Energy Supply Actions section of the Guide, which addresses the top policies and programs available to states to promote CHP and Renewables. This section includes: Interconnection Standards, Utility Rates, Public Benefit Funds to Maximize Clean Energy, Renewable Portfolio Standards, Output-Based Regulations and Fostering Green Power Markets. The EPA CHP Partnership plans to utilize the Guide to Action and associated materials to assist state utility and environmental regulators in creating and implementing policies and programs that promote CHP.

Western Governors Clean and Diversified Energy Program

The Western Governors Association (WGA) is developing a Clean and Diversified Energy Initiative. Western Governors have agreed to collaborate in the exploration of opportunities to develop a clean, secure, and diversified energy system for the West and to capitalize on the region's immense energy resources. The WGA are examining clean energy supply options, energy efficiency, and electric generation and transmission needs. The RACs and Regional Initiatives have helped form a CHP Task Force and are part of overall development process. A CHP White Paper was drafted by the Task Force and a WGA letter to the congressional nation energy policy conference committee supportive of CHP was submitted.

Northwest Electric Power and Conservation Plan

The Fifth Northwest Electric Power and Conservation Plan has now been adopted and published by the Northwest Power and Conservation Council. For the first time, CHP is included and supported in the plan. The federal enabling legislation for the Northwest Power and Conservation Council is an interstate compact. This enabling legislation provides a priority order of electrical resource acquisition as follows: 1) Conservation; 2) Renewable resources; 3) Cogeneration; and 4) Central power plants.

USCHPA Regulatory Toolbox

USCHPA has developed a Regulatory Toolbox that members and advocates can use to inform state utility commissioners and their staffs in order to encourage better pro-CHP decisions, and thereby encourage CHP deployment in their jurisdiction. The Toolbox is organized in a modular format consisting of five principal sections, each of which can be taken as a stand-alone document for maximum flexibility. The sections include an overview of the regulatory obstacles that have historically slowed the penetration of CHP

technology; a summary of the major policy arguments in support of greater CHP deployment; a summary of the major legal arguments in support of greater CHP deployment; an overview of the likely objections that commissions hear to pro-CHP positions, and responses thereto incorporating the policy and legal arguments outlined in the prior two sections, and a compendium of issue summaries on specific proceedings – from interconnection policy to standby rates – that are likely to come up before utility Commissioners, and how commissions can respond to these arguments in a way that maximally supports the deployment of CHP technology. The Toolbox is a "living document", and its usefulness is driven entirely by its ability to be responsive to the challenges that commissioners and their staffs face on a daily basis.

Pennsylvania Alternative Energy Portfolio Standard

The Pennsylvania Alternative Energy Portfolio Standard requires electric distribution companies and electric generation suppliers selling retail electricity in Pennsylvania to include "alternative" energy sources in the mix of energy that they sell. Certain sources of electricity are identified as Tier I or Tier II alternative energy sources. Retail electric suppliers are required to meet various thresholds of Tier I and Tier II generation in their portfolios. The Pennsylvania standard varies from other portfolio standards in that it promotes not only traditional renewable resources but other "clean" energy resources. Tier I sources of alternative energy that may apply to CHP include biologically derived methane gas, fuel cells, and biomass energy. Other Tier I sources include solar photovoltaic, wind power, low impact hydropower, geothermal energy, and coal mine methane. Included in Tier II sources of alternative energy are "distributed generation systems," which are defined as small-scale generation of electricity and useful thermal energy.

Raising Awareness – Industry, Government, Regulatory Participants

CHP Compact

At the sixth Annual Policy Summit held in Washington, D.C., in May 2005, the U.S. Department of Energy, the Environmental Protection Agency, the USCHPA, CHP Recycling Energy Communications Council, and the International District Energy Association re-signed the CHP Compact, committing to follow through for a second five-year period on their original pledges to take actions to achieve the CHP Challenge. By doing so, the signatories re-established their support for the CHP industry and their commitment to the goal of creating 92GW of CHP capability by 2010.

DOE CHP Regional Application Centers

Regional application centers (RAC) have been established in all regions of the country, covering all 50 states, to facilitate deployment of CHP technologies. The eight RAC regions are Intermountain, Mid-Atlantic, Midwest, Northeast, Northwest, Pacific, Gulf Coast, and Southeast. With regional-specific strategies, each RAC is providing technical support, focused on the technology transfer and deployment of advanced CHP technologies. The RACs will achieve this objective through a strategy of targeted education and outreach as well as project technical assistance.

Regulatory Education and Regional Power Planning

Efforts by the RACs and Regional CHP Initiatives have resulted in an improved awareness of the benefits of CHP by regulators and the inclusion of CHP in many state and Regional planning efforts. The Midwest RAC and Initiative continued their series of Utility Commission Staff Workshops with a focus on Regional Economic and Job Benefits of CHP. As a result of PUC forums and other interactions, utility commissioners and commission staff from Utah, New Jersey, Pennsylvania, Maryland, Delaware, Virginia, District of Columbia, Arizona, Illinois, Wisconsin, Michigan, Ohio, Missouri, Minnesota, Indiana, Iowa, Massachusetts, New York, Connecticut, Idaho, Montana, Oregon, Washington, Hawaii, California, and Nevada have been engaged and informed of the benefits of CHP.

CHP ENERGY STAR® Awards and CHP Certificates

EPA and DOE recognize highly efficient CHP projects that achieve fuel and emissions savings over comparable state-of-the-art separate heat and power. Projects can receive an ENERGY STAR® CHP Award, a CHP Certificate of Recognition, or both. 2005 ENERGY STAR ® Award winners include Middlebury College, University of Maryland, and Weyerhaeuser Albany Containerboard Mill. 2005 CHP Certificate winners include NiSource Energy Technologies, Utilimaster Corporation, Manchester Tank, GSA Federal Research Center, VA La Jolla Medical Center, and Equity Office Partners. Since 1999 there heave been 22 awards and 39 certificates awarded.

Initiated Steps to Ensure LEED Credit for CHP

International District Energy Association (IDEA) and ORNL/DOE are active participants on the LEED CHP subcommittee, which is ensuring that appropriate LEED credit is awarded for on-site power generation CHP. ORNL is participating in reviews, and modeling and evaluating CHP applications for incorporation into guidance issued by LEED. In addition, IDEA/ORNL participation is encouraging development of LEED 3.0 to more fully incorporate benefits of CHP such as reduced air emissions and improved efficiency of fossil fuels. ORNL developed a model and analyzed three example cases for how the calculation methodology, developed by the committee, would be applied. ORNL is continuing to refine the model by using data from specific installations including the advanced, packaged on-site power systems such as the Integrated Energy System at Dell Children's Hospital in Austin, Texas.

Delivering Solutions – Market Development and Project Implementation

NYSERDA CHP Demonstration Program

The NYSERDA Distributed Generation and Combined Heat & Power (DG-CHP) supports the development and demonstration of distributed generation (DG) systems, components and related power systems technologies, and combined heat and power (CHP) application in industrial, municipal, commercial and residential sectors. The DG-CHP program has resulted in extensive characterization of the New York State CHP market, the development and demonstration of clean and efficient CHP technologies in

innovative applications, the verification and documentation of the actual performance and practical lessons learned from an extremely broad set of CHP projects in various end-user sectors.

California Self Generation Incentive Program

The Self-Generation Incentive Program (SGIP) offers financial incentives to customers who install certain clean and efficient self-generation systems to meet all or a portion of their energy needs. Program incentives are based on system type, size, fuel source and out-of-pocket costs. Non-renewable projects must be CHP to be eligible. Projects up to 5 MW are eligible with the incentive applied only to a maximum of 1 MW. Incentives range from $600 to $2500 per kW for CHP projects. Incentives are determined by the technology used. CHP projects include reciprocating engines, microturbines, fuel cells and gas turbines. Since 2001, the program has resulted in over 200 reciprocating engine projects, more than 100 microturbine projects, and nearly 15 gas turbine and fuel cell projects.

EPA Strategic Markets for CHP: Ethanol

The EPA CHP Partnership continued market transformation efforts with the ethanol industry. Having achieved penetration in awareness of the benefits of CHP for ethanol facilities with the corn growers and coops as well as the states, this year's efforts have been targeted primarily at the consultants, engineering firms and contractors who build these facilities. There has been some reluctance on the part of the major providers of ethanol facilities to incorporate CHP into their "cookie cutter" designs, but other emerging companies have been eager to consider CHP as a value added service to help them gain traction in the market. The EPA CHP Partnership has provided technical assistance to 10 planned ethanol facilities to help them integrate CHP into their designs and has heard back from some CHP Industry Partners that activity in this market is ramping up. Given the incentives within the Energy Act, ethanol production capacity is expected in double within the next ten years. The EPA CHP Partnership will continue to promote the inclusion of CHP as a best practice for new ethanol facilities.

Targeted Market and Stakeholder Workshops

The RACs, EPA CHP Partnership, ORNL and IDEA led several target market and A/E firm workshops that have heightened awareness among selected end-user sectors and engineering firms. Targeted end-user outreach activities and workshops were conducted for Landfills and Wastewater Treatment Plants, Ethanol Plants, Healthcare Facilities (in coordination with ASHE and regional industry associations), Dairy and Agriculture Operations, Education Facilities, and Food and Beverage Processing. Concurrent with the targeted market sector outreach activities held throughout the year, workshops were also held in coordination with regional A/E firms, state energy agencies, and gas utility user groups.

DOE Regional Project Development Support and Tool Development

By providing support to specific project sites, RACs have helped projects get equipment in the ground. Tool development by the RACs and ORNL, such as the Midwest RACs CHP Resource Guide and ORNL's Building Cooling Heating and Power (BCHP)

Application Evaluation Tool, have served to increase the effectiveness of site support. The Midwest RAC CHP Resource Guide has been downloaded over 10,000 times. To date the RACs have supported approximately 200 projects with the direct potential of over 200 MW. In addition, RACs have to date performed over 40 detailed project profiles on CHP installations in their regions. DOE has compiled all known CHP case studies into a National Case Study Database.

EPA CHP Outreach and Assistance to Candidate Sites

End-user outreach and technical assistance to candidate sites was a major focus of the EPA CHP Partnership this year. A complete revamp of the EPA CHP Partnership website provided an opportunity to develop new tools which help interested end-users become CHP Champions and encourage streamlined project development. The new tools include an overview of the project development process, a funding database of state, local and federal incentives for CHP and renewably fueled CHP, a Level 1 feasibility analysis data request worksheet, a CHP procurement guide and a Level 2 analysis review checklist/ sample scope of work. In addition to the web tools, the EPA CHP Partnership provided direct technical assistance to over 40 potential projects in diverse regions of the country and in a large variety of markets including pharmaceutical, hospitals, agriculture, casinos, ethanol, food processing, waste water treatment, forest products and chemical refineries.

Development of Regional Initiative Project Development Tool Kit

The Northeast CHP Initiative led the creation of a “toolkit” for CHP in the Northeast, allowing sellers, buyers, and other stakeholders to clearly understand the market for CHP, market drivers and opportunities, the CHP industry, and application of technology, policy, and financial risks and benefits. Such a toolkit would standardize and simplify the CHP design and construction process so as to move the market forward.

Situational Analysis & Setting Priorities to Reach 92 GW

Situation 2005-2010

Key signposts and indicators show we are well on our way to arriving at the 92 GW challenge destination presented in the National CHP Roadmap. Like so many journeys, the last steps often seem the most challenging. Conditions often require changes in both strategy and tactics. In 2005, we find the energy industry and CHP market conditions quite different from 2000. Table 1 summarizes the key distinctions between the energy market of 2000 and today.

Table 1: Market Conditions

1998-2000	2005-2010
"Deregulation" inevitable	California experience slows "deregulation," and continuation of individual state-by-state regulatory structure distinctions appears inevitable. FERC's Standard market design is first attacked by states, then in Congress, and then withdrawn by FERC.
Stable, low natural gas prices	Natural gas prices projected to remain high and supply tight
New generation of generation technology	Mixed commercialization success and operating experience
Anticipated demand for high reliability power	Major blackouts illustrate deficiencies of electric grid Weather events resulting in notable blackouts (ice storms and hurricanes)
Major disruptions due to natural disaster or act of terrorism considered an extremely low probability event,	Need for a coordinated national security strategy and disaster response plans increasingly focus on need to sustain electricity grid and reliability September 11 attacks demonstrate that intentional disruptions of grid must be within scope of contingency planning
Digital equipment and e-commerce driving projected need for increased power quality	Still the case, but accompanied by growing public awareness of unreliability of grid and desire to preserve value despite potential disruptions, generally leading to installation of back-up generation and UPS (uninterruptible power systems) rather than base-load CHP
Projected replacement of major capital-intensive energy equipment	Regulatory uncertainty delaying investment in infrastructure Transmission system needs upgrades but lack of incentives for investment Baseload generation capacity currently sufficient

	Localized needs for more capacity to meet peak and installed capacity requirements
Localized rising energy prices	Multiple years of energy price volatility and high prices nationwide impacting spark spreads and risk allocation. Regional differences widen. Electricity rate increases lag fuel price increases due to local rate freezes, cost-of-service ratemaking, and influence of relatively unaffected coal, nuclear, and hydro generation, creating poor "spark spread" economic conditions for CHP.
Natural gas fueled combined cycle boom	Energy supply and capacity adequacy concerns promise to motivate fuel diversity/flexibility, renewable portfolio standards, energy efficiency/conservation and demand response programs; actual responses few and weak in light of excess gas-fired capacity
Lower electricity prices due to "deregulation" widely projected	Utility tariffs and rates likely to be increased after period of being frozen
Air quality concerns	Still the case Output-based standards adopted in some states
Interconnection requirements and open access issues for non-utility entities	Improved interconnection processes available in numerous states, with promising standardized models emerging for faster procedures. IEEE 1547 passed and being implemented for standardized and authoritative technical guidance. FERC small generator interconnection rules adopted to apply in FERC-jurisdictional areas such as RTOs

Our country faces several energy issues, constraints, and opportunities that will affect CHP market development and industry's ability to reach 92 GW of CHP capacities by 2010. Several are summarized below.

Industry Restructuring and Market Design

At the time of the development of the National CHP Roadmap, electric utility restructuring had been initiated and was expected to spread from high electricity price regions to eventually cover most of the country. Restructuring was intended to remedy the problem of relatively high electricity costs in the Northeast and California, encourage customer choice, foster the development of non-utility energy service providers in competitive electricity markets, and eliminate undesirable regulatory incentives – all seemingly favorable for CHP. The track record of restructuring has not been entirely positive. Most prominently there was the California electricity crisis that caused many states to delay and/or cancel their restructuring plans. Other issues such as price volatility, low number of retail customers switching to non-utility providers, and the Enron scandal has made substantial restructuring efforts politically difficult.

Competition has been introduced into wholesale power markets, with positive, discernible impacts on efficiency of central power generation. There remains virtually no

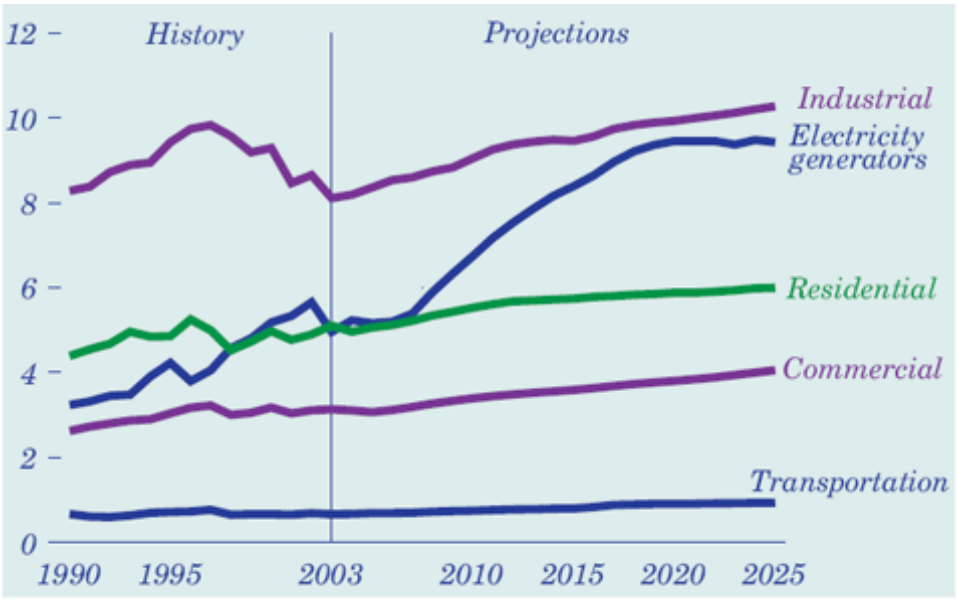
competition at the retail level, where distribution utilities still maintain monopoly control over the "last mile". Moreover, these distribution utilities cannot use efficient investments like CHP to boost their profits, since cost-plus rate-making protocols give them a direct penalty to their return on investment to the extent they lose load to customer efficiency or self-generation in addition to depriving them of growth to the extent they do not themselves make new system investments.

Restructuring has resulted in the development of the Independent System Operator (ISO, also called Regional Transmission Operator) - an organization approved by FERC that oversees, and controls the operation of generators, transmission companies and wholesale markets within the ISO's area. ISO's are a critical feature of standard market design. They influence transmission system interconnection standards that could affect mid-size and large CHP and typically manage demand response programs that could affect commercial sized onsite generation.

As we proceed forward, market designs are needed that allow energy customers to be aware of and react to the true price and availability of energy and reflect an equitable balance of end user, utility and societal interests. A critical factor will be the extent to which utilities are deemed to require protection from competition, and thus entitled to full cost recovery despite competitive self-generation and efficiency, or are deemed to be competitors, and thus free to set their own rates to customers with competitive self-generation or efficiency options, but not to exercise undue market power or to shift costs to other customers without such options.

Volatility and Increase of Natural Gas Prices

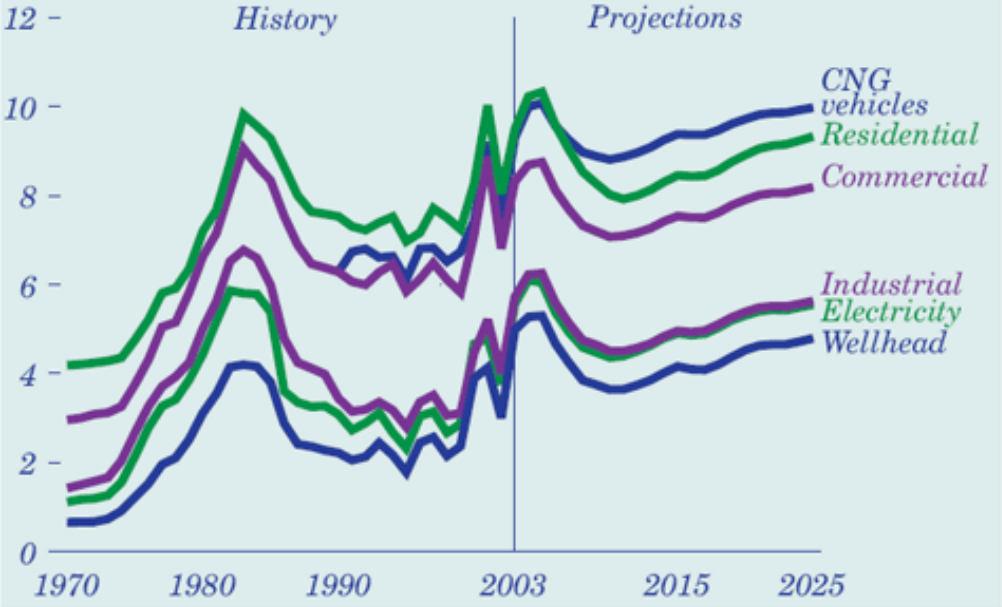
There will be continued growing dependency on natural gas as a fuel for electricity generation. Figure 11 shows EIA projected natural gas consumption by sector in its 2005 Annual Energy Outlook. Total natural gas consumption increases from 22.0 trillion cubic feet in 2003 to 30.7 trillion cubic feet in 2025. In the electric power sector, natural gas consumption increases from 5.0 trillion cubic feet in 2003 to 9.4 trillion cubic feet in 2025, accounting for 31 percent of total demand for natural gas in 2025 as compared with 23 percent in 2003.



Source: EIA

Figure 11: Projected Natural Gas Consumption by Sector in Trillion Cubic Feet

During this period of continued increased use of natural gas for power generation, there has been significant price volatility coupled with the general expectation that the price of natural gas will remain relatively high. Figure 12 shows the EIA natural gas price projections by sector (in 2003 dollars) from the 2005 Annual Energy Outlook. In regions that depend heavily on natural gas fueled power generation, the price of electricity will be closely link to natural gas prices and the difference in price between electricity generated from the marginally dispatched natural gas power plant and a natural gas fueled CHP system may remain the same. However, in regions where there is significant coal, nuclear and hydro generation resources the spark spreads for CHP which has been predominantly fueled by natural gas will continue to be an issue.



Source: EIA

Figure 12: Historical and Projected Natural Gas Prices by Sector in 2003 Dollars per MCF

High energy prices may also provide incentive to implement renewable and alternative fueled technologies that have typically been too expensive. Rapid fluctuations in energy prices over recent years have stimulated many energy users to evaluate additional fuel supply options.

Distributed Generation and Thermally Activated Technology Development

It is technology development that has helped enable CHP to have the impact it has had. CHP utilizes a range of distributed energy technologies including gas turbines, fuel cells, microturbines, reciprocating engines. In addition to clean and efficient generation technologies, CHP also involves power electronic interfaces, communications and control devices for efficient dispatch and operation of single generating units, multiple system packages, and aggregated blocks of power. Heat recovery and utilization technologies such as thermally activated absorption cooling and desiccant dehumidification are also critical in achieving the high energy efficiency that CHP has to offer.

The primary fuel for many CHP systems has been natural gas, but high prices and tight supplies have stimulated increased interest in fuel flexibility and opportunity fuels. Renewable fuels such as biomass and landfill gas are becoming increasingly economic and emissions control technology is improving the emissions signature of waste and biomass projects. In the long term, hydrogen may play an important role in the future.

Continued research, development and commercialization of CHP technologies with private industry, federal and state government agencies, and our colleges and universities is needed ensure the energy and environmental benefits of CHP are realized.

Grid Reliability, Energy Security, and Business Continuity

Reliable energy supply and delivery are critical to the health, security, and prosperity of American businesses and citizens. The 2003 Northeast blackout, interruptions in service due to natural disasters, and the threat of terrorist attack have underscored the vulnerability and complexity of our power delivery system. The electric transmission and distribution system has been in need of substantial upgrade, but current market structure and uncertainty provides little incentive for power companies to make capital investments in power delivery infrastructure. Onsite generation alternatives such as CHP can serve as both an energy efficiency and demand response tool to manage loads and relieve a stressed electric grid. Energy management systems and integrated distributed generation on the demand side and improved smart supervisory control and data acquisition systems on the supply side are potential solutions that may limit the frequency and sizable cost impacts of interrupted service.

Air Quality and Emissions Regulations

As was the case in 2000, air quality is and will continue to be a major concern. Several states have or are in the process of modifying air quality regulations for small generators that would apply to a wide range of CHP projects. In many cases there has been the adoption of output-based emissions standards that give credit for the high total energy efficiency of CHP. The continued adoption of output-based is beneficial to CHP.

In some regions of the country, streamlining the permitting process for CHP systems would create a more favorable economic case for CHP by reducing project development and installation costs and accelerating project timelines.

State and Regional Activity

State and regional efforts to address regulatory and institutional barriers are becoming increasingly important. RACs are now established to assess market opportunities and support project applications. Regional CHP Initiatives and USCHPA are making state advocacy a priority. State level activities involve rapidly responding to public utility commissions (PUC) as issues, rate cases, and filings develop on their agendas. Typically, specific individuals or organizations have taken it upon themselves to respond to PUC requests and ensure interests of the CHP community are represented in hearings.

A coordinated approach among CHP stakeholders will be needed to more effectively respond to state interconnection requirements, utility tariffs, and Renewable Portfolio Standard (RPS) issues and ensure CHP interests are addressed during key hearings. Using approaches, supporting materials, case studies, expert testimony, position papers and analysis that have proven to be successful is one part of that coordination. As an example, the Regional CHP Initiatives and the RACs have led and coordinated interactions with PUCs to develop standardized interconnection rules in several states. These states include Massachusetts, Connecticut, New Jersey, New York (revision), Illinois, and Arizona. Some of these efforts originated from regional involvement and requests of the PUCs. They were very intensive with extremely short turnaround times. There are lessons and best practices that can be shared among the CHP community as other states move forward with their interconnection rules. A guide to assist regional efforts implement state interconnection rules is still a high priority need of the industry.

CHP Market Trends

2001-2005 CHP market trends can be summarized as follows:

- Annual CHP site additions increased from 2001 to 2003 and then decreased in 2004 and 2005.
- There has been a decrease in CHP capacity (MW) additions every year since 2001.
- While commercial applications make up the majority of new CHP sites, capacity (MW) additions are dominated by industrial applications.
- Natural gas has continued to be the dominant fuel for CHP.
- The majority of site additions in the 2000-2005 timeframe have been natural gas-fired reciprocating engines less than 1 MW.
- The vast majority of recent CHP capacity additions have come from very large projects.
- With regard to geographical trends in new CHP, growth tends to be concentrated in the Northeast, Midwest, Gulf Coast, and West Coast. There has been high project activity in the Midwest, Northeast, and Pacific regions and the large capacity additions due to very large CHP projects in the Gulf Coast.

As the CHP community develops priority action items to achieve the 92 GW goal, these trends need to considered. Small commercial installations make up the majority of recent CHP activity but comprise just a small contribution to capacity additions. What is the appropriate balance between commercial, institutional and industrial markets? What is the appropriate balance between small and large CHP applications? The price of natural gas is typically viewed as the primary contributor to the decrease in CHP market activity. What customer sectors or geographical markets provide the best opportunities to mitigate fuel price risk? States with historically favorable spark spreads and incentive programs for CHP, e.g., California and New York have experienced growth in both projects and capacity additions. What can be done to promote and accelerate the development and implementation of incentive programs in other states? What can be done to with regard to incentives in EPACT to improve CHP economics?

Action Agenda and Roadmap Workshop Context

Of course, a complete repositioning is probably not necessary but a new prioritized set of actions presented as how they relate to current market conditions and energy policy priorities should be the focus of the October workshop.

In preparation for the CHP Roadmap Workshop, review what the CHP industry has accomplished to date in our continuing journey to 92 GW by 2010. Consider the energy market conditions we face as we proceed forward.

- Energy delivery reliability
- Energy price stabilization
- Load management/demand response
- Energy efficiency/conservation
- Energy supply
- Energy security
- Business continuity/disaster response
- Fuel diversity
- Renewable/alternative energy sources
- Competitive market design
- Air quality and emissions regulations
- Climate change/greenhouse gas emissions

Which energy needs do you feel CHP offers the most compelling value proposition? Why? Are there other issues? What can the industry do to see that the potential of CHP is fulfilled? How?

2005 Roadmap Workshop Format

This year's workshop will be conducted in a slightly different format than those of previous years. Breakout groups will consider and discuss several questions intended to stimulate discussion, share perspectives and collaboratively develop insights on the priorities actions of the CHP industry

The "questions that matter" are likely to address some of the following issues:

1. *How do we address the projected tight fuel supply and continued high fuel price scenarios (specifically for natural gas)? What are the best ways that a properly developed CHP project manages fuel risks? How can we best position CHP to help fuel diversity efforts? Are there specific market applications and technology development efforts to be pursued? Where CHP dramatically improves the effective useful output of natural gas now used for thermal purposes only, deriving significant electricity, why do not high gas prices already encourage conversion to CHP? What explains the market's failure to capitalize on such a gas-conserving technology in the face of record high gas prices?*

2. *What is the role of CHP/DE in electricity transmission and distribution reliability, homeland security, disaster response, and business continuity? Do we have quantifiable reliability and T&D system benefits value propositions? Are we doing all we can to effectively communicate this value?*

3. *What specific RD&D needs to be done in the next year, five years, and ten years? What can federal and states do to ensure effective collaboration? Are we doing all we can to commercialize the technologies that have been technically proven?*

4. *What are the top CHP advocacy priorities? Does an electric utility/CHP "win-win" set of circumstances exist? Will utilities and state regulatory commissioners respond positively to this scenario? What are the key provisions we should be recommending as states continue development of interconnection rules? Do the same air quality regulations and permitting issues (output-based regulations and permitting process streamlining) of 2000 exist and continue to impact project development? A wealth of knowledge and work exist, what have we learned about the best means to ensure the people that need it most have it? Who or where is the repository (central/distributed)? What is the best format and channel?*

References

Supporting Documents

National CHP Roadmap - http://uschpa.admgt.com/CHProadmap.pdf

2004 CHP Action Agenda: A Status Report - http://www.energetics.com/5thchpworkshop/pdfs/action_agenda.pdf

5th Annual CHP Roadmap Workshop Breakout Group Reports - http://www.eere.energy.gov/de/pdfs/conf-05_chp_roadmap_wkshp/roadmap_results.pdf

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CHP Regional Application Centers - http://www.eere.energy.gov/de/chp/chp_applications/chp_application_centers.html

DOE Distributed Energy Program - http://www.eere.energy.gov/de/

DOE National CHP Case Study Database - http://www.eere.doe.gov/de/case_studies_ir.html

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