Combined Heat and Power: Connecting the Gap between Markets and Utility Interconnection and Tariff Practices (Part I)

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EXECUTIVE SUMMARY

The adoption of combined heat and power (CHP) systems by American industries has made substantial strides in the last few years. Viewed on many levels, this progress is most certainly a win for all involved—the industry, the utilities, the consumer, and the environment. Many states have programs in place financially endorsing the adoption of CHP, easing the economic transition, and many utilities are now working with those states in that regard. Some utility companies have begun to optimistically acknowledge the market potential for CHP on their own. But to say that substantial strides have been made is not a convincing reason to ignore that much work is yet to be accomplished. The increased adoption of CHP nationwide still faces major hurdles: stiff barriers to entry from a sluggish utility core; technological, economic, and safety inhibitors; and an industry information gap in regard to varied state and utility policies. In order to expose and explore these issues more broadly, ACEEE embarked on an initial state review of utility company policies and practices focused on distributed energy resources (DER), and CHP more specifically. The results were both heartening and emblematic.

Given the above, the purpose of this report is threefold: one, to expose still existent barriers to entry for proposed CHP facilities; secondarily, to highlight the need for a national interconnect standard; and lastly, to show the hierarchy that currently exits in regard to the progressivism of CHP policies nationwide on a state-by-state and regional basis. That is to say, some regions of the United States have developed policies promoting the adoption of the technology, while other areas have yet to focus on it as a potential market interest. From the initial round of investigation and research, there clearly exists a four-tier stratum with regard to utility operations toward the adoption of CHP:

- Level Four, those actively promoting the adoption of CHP through varied incentives;
- Level Three, those not explicitly promoting the adoption of CHP, but willing to work with industry;
- Level Two, those ambivalent, by choice or regional market trends; or those not in the market, or outside the industrial pockets where the adoption is least likely; and
- Level One, those actively working against the adoption of CHP.

The states comprising the focus of this initial study are as follows:

- California
- Connecticut
- Florida
- Georgia
- Iowa
- Massachusetts
- Minnesota
- Nevada
- North Carolina
- South Carolina
- Tennessee
- Texas
- Utah
- Washington
- Wisconsin

The utilities involved ranged from the largest in relation to service territory, generating capability, or customers served—national symbols such as Xcel Energy and Pacific Gas & Electric (PG&E)—to the small, local, publicly owned municipalities, such as Austin Energy or Seattle City Light (SCL), and the not-so-small Sacramento Municipal Utility District (SMUD). Together, the utilities studied create an intricate fabric of interlaying and disparate

policies, which ultimately emphasize the need for the reduction of barriers and a comprehensive national interconnect standard.

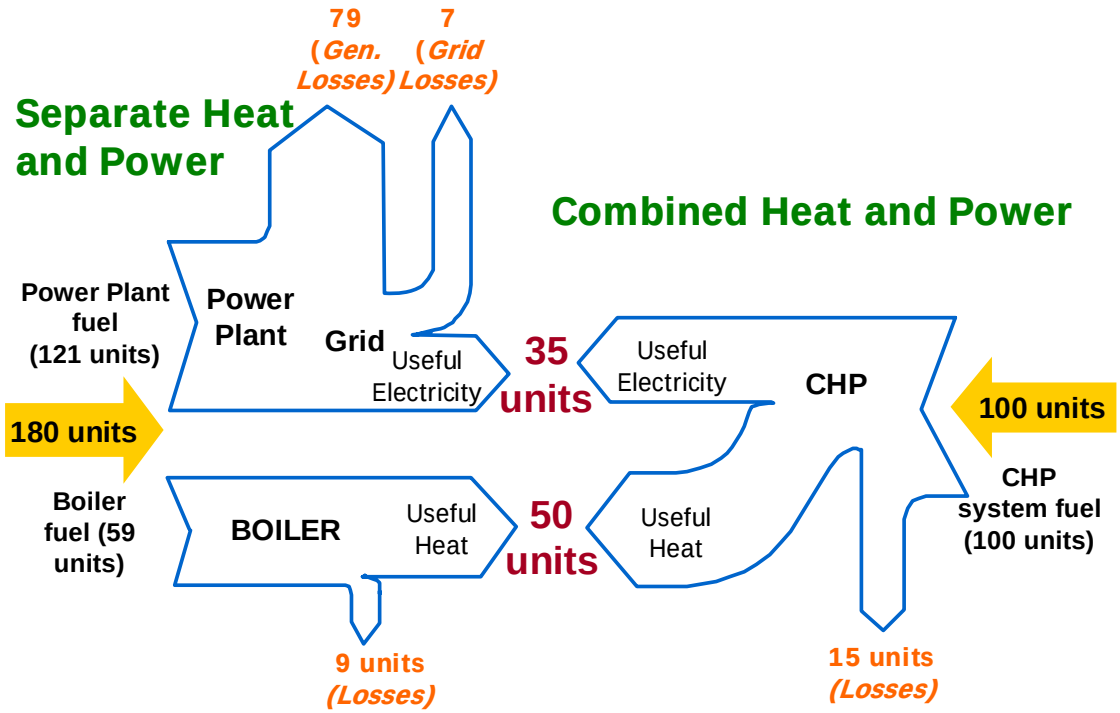
In several regions (the Northeast, Wisconsin, and California), CHP systems are promoted through implicit incentives. Other utilities in the West, South, and Southeast have yet to actively address CHP or take a role in the debate—a government and/or industry push has yet to materialize or is in its infancy. Further complicating matters are the changes of the utility industry in a constantly evolving and expanding condition. At the time of this study's publication, Xcel Energy had a service territory that included no fewer than 13 states; MidAmerican Energy was in the throes of purchasing PacifiCorp; Duke Energy was purchasing Cinergy; and Florida Power and Light and Constellation Energy were merging to create the nation's largest competitive energy supplier and its second largest electric utility. The dynamic nature of the constantly evolving utility sector, we believe, further strengthens the need for a comprehensive national plan easing the adoption of energy efficiency technologies such as CHP. However, while a plan on the national level would be extremely beneficial, experience in recent years has led us to the realization that such a plan is probably not a viable option. Thus there is a necessity to focus on advancing progress in the states, which was our goal in embarking upon this state review and report.

An appendix is provided at the end of the report, highlighting the trends found in particular states and the utilities that operate within and around them. The results of this research show the varied cultures among the nation's states and utilities, their insecurities, operational incentives, preconceived biases, and in some instances, their progressive spirit. Part II of this project is expected to be completed in the spring and will review the remaining states that were not covered in this report. In addition to highlighting barriers, regional trends, and utility culture, the full report (including Parts I and II), should serve as a tool for those interested in bridging the gap between the valued economics of increased efficiency compared with current energy supply and demand.

BACKGROUND

CHP systems, also known as cogeneration, generate electricity and thermal energy in a single, integrated system (Elliott and Spurr 1999). CHP is not a technology, but an approach to applying technologies. CHP is more energy efficient than separate generation of electricity and thermal energy. Heat that is normally wasted in conventional power generation is recovered as useful energy for satisfying an existing thermal demand, the heating and cooling of the building and water supply, thus avoiding the losses that would otherwise be incurred from separate generation of power, as shown in Figure 1 (Elliott and Hedman 2001). CHP systems provide three general categories of benefits—environmental, economic, and transmission and distribution (Shipley et al. 2001). DER is defined as any technology that produces power close to the point of use. About 60% of CHP installations are considered DER—only large central generation CHP that focuses on wholesale power generation is not included. Because this report focuses on smaller CHP, we can consider the barriers for these installations to be largely the same as for other DER.

Figure 1. Schematic Comparing Separate and Combined Heat and Power Systems



Source: Elliott and Hedman (2001)

Increased interest over the past decade in DER and the type of CHP discussed in this report is attributable to multiple changes in the energy market over the last 30 years. Perhaps the most major of these is the competitive restructuring of the energy market that was begun with the *Public Utilities Regulatory Policy Act of 1978* (PURPA) and continued with the *Energy Policy Act of 1992* (see Elliott and Spurr 1999 for a detailed discussion of these enabling pieces of legislation). In theory, these changes opened the market to competing power suppliers, allowing individual power producers and merchant plants to sell their power just as

the large utilities of the past would. This allowed industrial facilities to satisfy existing thermal load while generating electricity. Some generated excess electricity that was sold through non-competitive contracts that resulted from utilities' anticipation of sustained high electricity prices. When actual costs fell, the utilities objected to these contracts and many came to oppose CHP as a result. Unfortunately, the resulting market reality has been that CHP systems have not had uniform access to the electric power transmission and distribution (T&D) system, and there is no standardization in the utility tariffs related to CHP. As a result, a CHP project may find a more or less favorable opportunity depending upon where it is located or what electric utility serves the facility. In addition, state regulations and policies may provide incentives or disincentives to CHP facilities, as was discussed in Brown and Elliott (2003). This report will focus on individual utility practices.

Current Barriers to Increased CHP Capacity

Traditional barriers to CHP derive from a monopoly-oriented electricity grid system based on central station generation. Coupled with the rate design issues within this model, there are both technical and institutional problems with establishing a system of DER for the electric grid. Over time, as interest in DER has increased, these barriers have been approached from a variety of angles. There have been many studies regarding the importance and barriers to CHP and DER, so they will only be summarized here (Elliott and Spurr 1999; Elliott and Hedman 2001; NREL 2000; Shipley and Elliot 2000; Brown and Elliott 2003).

Interconnection

Connecting CHP systems to the utility through the power grid has traditionally been an arduous task. Prohibitively complex rate, tariff, and interconnect standards were often constructed that have had the implicit effect of limiting the increased capacity of CHP on a national scale. Many technical barriers have been reduced or overcome, but utilities have not always updated their rules to keep pace with technological advances or chosen to respond to developments (Brown, Scott, and Elliott 2002).

Tariff Rates

Many utilities currently charge discriminatory backup rates and high fees for interconnection. Facilities that use CHP require standby power for times when the CHP system is unavailable. Utilities justify high back-up rates by arguing that they need to make investments in both generation reserves and T&D. Also, their concern is that the facility will require power during a period of extreme conditions—for example, when electricity is in short supply or highly priced. They claim that the pricing needs to allow them to recover these costs since there is not an ongoing demand for back-up power.

These concerns are valid and there is thus some justification for higher back-up rates. Unfortunately, there has been little consistency in how these rates are set by utilities and they are often set unjustifiably high. First, they are frequently set as though all CHP systems on a given utility system will fail at the same time, during a peak period, which is a highly unlikely scenario. Second, smaller systems do not impose costs that are any different from normal load variability within a given rate class. Finally, back-up rates never take into

account the system benefits that CHP creates for utilities. Many utilities have set these standby charges as well as interconnection charges at levels that will make onsite generation uneconomic. The result is that costs, delays, fees, and pricing strategies have combined to discourage the installation of CHP systems (Elliott and Spurr 1999).

Technical Issues

Several technical issues are frequently cited by utilities as reasons for not supporting expanded installation of CHP systems. As with many negative arguments, a core of truth exists for most of these arguments, though the arguments frequently overstate the negatives while downplaying positive counter arguments.

Safety Issues

Uncontrolled electricity is dangerous both to utility line workers and the public. Utilities have installed extensive protection equipment to de-energize lines when a problem occurs due to accidents or weather that may result in downed lines that would pose a safety hazard.

If a distributed generator continues to operate during an outage without isolating itself from the utility distribution lines, the potential exists to back-feed the grid, energizing a line that the utility thinks is shut down. An unintentionally energized line does pose a risk to utility workers and a potential legal liability for the utility, so the issue does represents a valid concern. However, interconnection gear appropriately installed and maintained to code standards reduces this risk to a minimal level that is not significantly different from performance of the utility's own equipment. There is apparently no record in the United States of a line worker being injured or killed by contact with a line energized by a distributed generator interconnected for continuous synchronous operation. The only instances of such deaths or injuries have occurred with the use of back-up generators unknown to the utilities at all and installed by customers themselves, not electrical engineers. Making interconnection procedures quicker, easier, and more standardized for continuous small generation should reduce the likelihood of such dangerous do-it-yourself practices, as well as increase the reliability of distribution systems so customers feel less need for back-up generators. Utilities are justified, however, in being concerned because they continue to be liable for problems or accidents, but have limited control over their customers and may not have confidence that those customers will implement and maintain the interconnection equipment properly. It is incumbent upon the CHP and distributed energy resources community as well as the utilities to assure good communication and high standards are maintained so that the potential risks do not become a reality.

Spark Spread

One of the reasons for installing CHP is that electricity can be generated cheaper than it can be purchased from the incumbent utility. Since most CHP systems use natural gas, this situation was very much the case during the 1990s when gas prices were low relative to electric prices. The metric used to evaluate this phenomenon is "spark spread"—the difference in the cost to generate electricity from a fuel source and the cost to purchase from the utility.

However, in the past five years natural gas prices have risen to multiples of their prior levels and much more quickly than electricity prices (see Figure 2) for a variety of reasons, making electricity from natural gas-fueled CHP systems less attractive. Utilities frequently employ the argument that CHP generation is not cost-competitive because natural gas prices have increased so dramatically. Yet even in the face of high gas prices, several problems exist with this spark spread argument:

1) While natural gas was the fuel of choice during the late 1990s, other options exist including coal and opportunity fuels such as landfill and digester gas. All of these fuels can be much more cost competitive with grid-produced electricity than natural gas.
2) Natural gas prices have risen more quickly than have electricity prices in part due to the lag between fuel price increase and their manifestation in retail electric rates. The *2006 Annual Energy Outlook* (EIA 2006) projects that we are near a peak in natural gas prices and that electricity prices will catch up in the next year or so, making CHP-generated electricity more cost competitive. The decision to invest should account for the long term and not only the current market situation.
3) The focus on spark spread has traditionally only looked at the electric side of the equation (e.g., a heat-rate of 7,000 Btu/kWh reflects the best electric-only generation, as indicated in Figure 2). Using this heat-rate ignores the reality that at most natural gas fuel plants, steam would need to be produced from gas anyway, so the net-marginal heat-rate (i.e., the fuel over and above that required to produce steam) required to produce electricity from a CHP system is probably closer to 4,500 Btu/kWh. When taking steam into account, electricity produced from a CHP system can be significantly less expensive currently and in the future than grid purchased electricity (see Figure 2). Obviously, national averages may not reflect the situation in all locations, but must be considered carefully in order to assess the economics of an investment.

Utility Awareness of Benefits

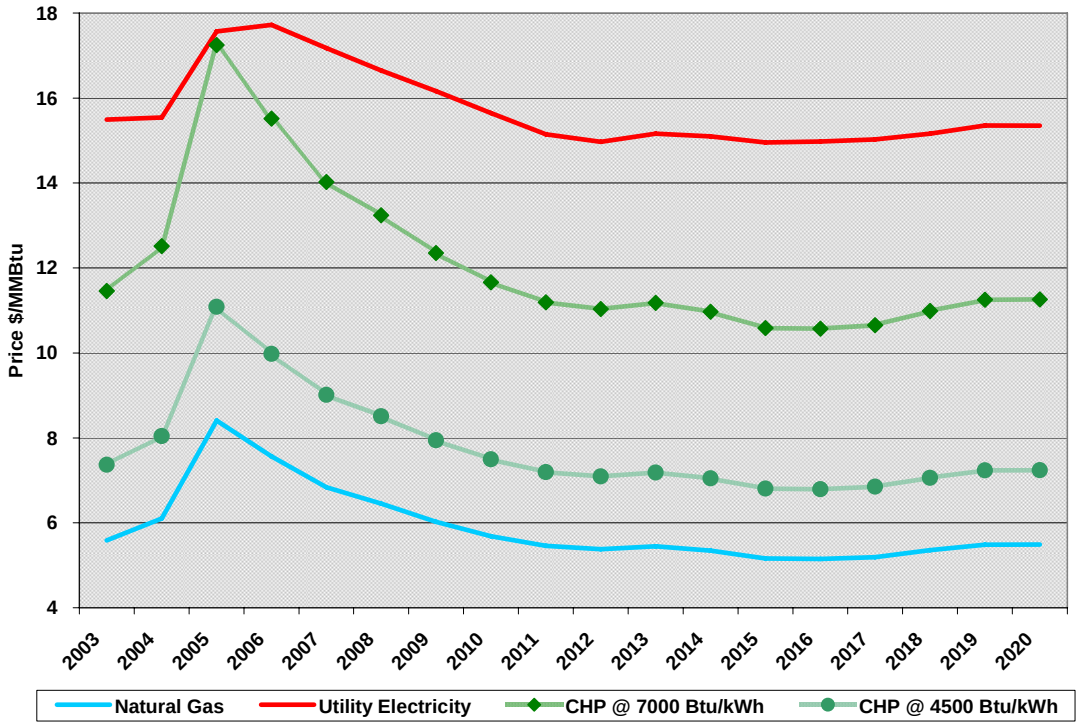
Finally, many utility staff are not aware of the full range of benefits that a CHP system can produce for the customer **and** the utility. Many of these utility benefits fall into the arcane area of ancillary services that can include voltage, frequency, and reactive power support. While these services may offer important benefits to utilities in areas of constrained transmission and distribution, it can be difficult to assess these benefits, even if the utility is aware of them (Elliott and Spurr 1999). For example, if CHP generators had been installed more extensively, they could have proved extremely beneficial during the blackout in August, 2003 that affected many regions including New York City as well as in the aftermath of hurricane Katrina, but such benefits are difficult to quantify. DOE is currently undertaking an assessment of the benefits of DER in response to a provision in the Energy Policy Act of 2005.[1]

In addition, many utility staff may be unaware of the availability of CHP, rebates, incentives, and promotional programs that are offered at the state level that would make CHP more

[1] For additional information about this study, please see http://www.dg1817report.org.

attractive to the customer. Furthermore, utility staff may not know about advances in standards and technical knowledge associated with interconnecting distributed energy resources.[2]

Figure 2. Price of Electricity and Natural Gas Paid by Industry and Generated by Industrial CHP



Source: Derived by ACEEE from 2006 Annual Energy Outlook (EIA 2006)

Disincentives for Utilities Caused by Utility Regulation

One of the primary barriers to the adoption of CHP applications is the lack of incentive for the utilities to support such projects. The structure of the majority of state regulation in the U.S. makes the adoption of distributed energy resources projects unprofitable and thus highly unattractive for the utilities. Any kind of distributed energy resources project on the customer side of the meter translates to less power purchased from the utilities, or a decrease in sales. Since in most cases, utility profit is directly related to sales, there are serious financial disincentives for utilities regarding distributed energy resources projects (Moskovitz 2000).

"How utilities are regulated is the most important determinant of whether they have an incentive to deploy or obstruct cost effective distributed resources," explained David Moskovitz of The Regulatory Assistance Project (Moskovitz 2000). Most of the regulation in this country is traditional cost-of-service regulation and where alternative forms of regulation are employed, the predominant form is price-based regulation (as opposed to revenue-based regulation). This means that prices or cost-of-service are set for a period of time. If we look

[2] EPA maintains a Funding Opportunities database, which includes CHP. Please see http://www.epa.gov/chp/funding_opps.htm.

at how utility profits are calculated, it is obvious where the disincentive stems from. Profits are computed by subtracting costs from revenue. Revenue is computed by multiplying price and quantity—since prices are set and thus a constant, the utility's revenue (and thus its profit) is related directly to quantity, or sales (Moskovitz 2000). Therefore, anything that decreases sales for the utility including distributed energy resources projects are very unappealing and the utility's financial disincentive becomes a serious obstacle to the adoption of distributed energy resources and CHP.

There are several policy options that help to solve this profitability problem for the utilities. First, decoupling, or revenue-based regulation (as opposed to price-based regulation) would set the utility's revenue at a fixed rate (or fixed revenues per customer). This would mean that if sales drop, revenues would stay the same. Since in this scenario, revenue and thus profits are no longer affected by sales, the utility does not suffer when distributed energy resources projects are applied by consumers: "revenue-based approaches make utilities indifferent to customer-side distributed resources" (Moskovitz 2000). However, the downside from the utility's perspective is that it cannot expand revenues if sales happen to increase during that period. In this way, it is still in the utility's interest to oppose distributed energy resources projects until these projects become so widely applied that the utility stands to benefit from revenue-based regulation.

Another type of regulation is lost revenue adjustment. Like the policy option above, this would allow the utility to keep constant revenue even if sales drop, taking away the financial disincentive of distributed energy resources projects. Also, this policy option is very practical for CHP specifically because the energy savings are more easily measured than other distributed energy resources or energy efficiency projects (Moskovitz 2005). It is worth noting that the revenue-based approaches transfer a portion of the utility costs from the CHP owner to other utility customers.

There are several states that have already "undertaken new regulatory approaches that simplify the technical integration of distributed resources into their local distribution networks" (NREL 2003), including Texas, New York, and California. Without new regulation, utilities will most likely continue to oppose CHP projects because of the financial disincentives created by current regulation. It is essential that new policies be implemented in order to help foster the development of CHP in the U.S.[3]

State Policies and Structure of Utility Industry

Since the electricity grid transmission system spans over all 50 states, it could be argued that the federal government is the best candidate for encouraging CHP capacity growth. However, states already have their various offices overseeing connection to the distribution grid and power production. Also, at the state level, legislators and offices know the needs of their states and the condition of the grids very well, so programs can be tailored to the needs of the states. Third, states may already have programs or incentives (typically for photovoltaics or wind) that can act as the groundwork for incentives for CHP. Clearly, state action that works

[3] For additional information, see the RAP Web site at http://www.raponline.org.

in tandem with federal action would be the smoothest and quickest way to encourage increased installation of CHP facilities (Brown, Scott, and Elliott 2002).

One issue facing either the federal or state government policies in regard to the promotion of increased capacity for CHP is the structure of the utility industry itself. In addition to the hundred or so major investor-owned private utilities that control most of the electric grid and sales in the U.S., there are hundreds of rural electric cooperatives with self-regulated mini-grids as well as self-regulating municipal electric utilities of dramatically varying sizes. There are also federal power projects such as the Tennessee Valley Authority and Bonneville Power Administration, and other entities. This variety of institutions, with a regulatory overlay mixing federal, state, and local controls, defies uniform policies and consistent market rules.

Also, apart from the historic barriers erected, the utility companies are undergoing a bout of changing ownerships, altered policies, and a scramble for new energy resource development. One interesting development resulting from these industry changes is that many utilities, while impeding CHP and other DER installations on their own home turf, have spun off non-regulated subsidiaries in order to actively develop and sell DER projects in their competitors' territories. The impact of this dynamic creates a staggered and fragmented approach to sound progressive energy policy development, making it difficult for both potential customers and potential legislation to address specific needs.

EMERGING TRENDS

Interconnection Issues

IEEE 1547

The Institute of Electrical and Electronics Engineers (IEEE), with support and funding from DOE, has developed a national consensus technical interconnection standard. IEEE 1547 is often referred to by utility companies as the "national standard push." In 1999, the working group P1547 was formed to establish common practices for the grid interconnection of distributed energy resources. The working group is comprised of hundreds of representatives from industry trade organizations, electric utilities, distributed energy equipment manufacturers, and national laboratories.

This standard establishes criteria and requirements for interconnection of distributed resources with electric power systems. It also addresses protection requirements at the interface and covers a variety of situations in the installation and interconnection of a distributed energy device to a power system as well as all major distributed energy technologies (CEC 2005).[4] It does not address the procedural or "business practice" aspects of interconnection, such as the timelines, fees, or contractual requirements. While a basic standard for interconnection of small units up to 10 MW has now been agreed to, various follow-on elements of those standards are still in progress.

[4] For additional information, see http://grouper.ieee.org/groups/scc21/1547/1547_index.html.

FERC Interconnection Rule

There has also been some progress on the federal policy level. In May, 2005, the Federal Energy Regulatory Commission issued a *Standardization of Small Generator Interconnection Agreements and Procedures* for generators no larger than 20 megawatts (FERC 2005). This rule is intended to ensure that power markets are non-discriminatory and competitive and to help preserve grid reliability, increase energy supply, and lower wholesale electric costs. The rule applies only to facilities already subject to the jurisdiction of the Commission and complements the final rule it issued in July, 2003 for facilities larger than 20 MW (Order No. 2003) (USCHPA 2006a).[5] While this rule serves as an important model to state and local regulators, the rule in itself is likely to have limited impact because FERC only has jurisdiction over interstate transmission of power or wholesale power transactions. Distribution-level retail authority is clearly reserved to state and local regulatory authorities. Since most small CHP systems will interconnect at the distribution-level, they fall under local jurisdiction.

NARUC

This lack of federal jurisdiction led the National Association of Regulatory Utility Commissioners (NARUC) to take action by adopting a number of principles, policies, and resolutions recognizing the importance of DG to the nation's energy systems. In 2001, after FERC initiated the Advance Notice of Proposed Rulemaking (ANOPR) for the rule described above, representatives from several state commissions realized that this would be an opportune time for the states to develop model interconnection agreements and procedures for small generators to parallel the FERC process. In an effort to harmonize state approaches to DG interconnection, NARUC passed a resolution in February, 2002 supporting the development of two model documents for voluntary adoption by the states addressing interconnection procedures and agreements. In June, 2002, NARUC released these documents for comments and used them to prepare final Model DG Interconnection Documents. NARUC hoped that these documents will help advance the process of adopting uniform interconnection standards in the states and nationwide (NARUC 2003).[6]

SGIWG

A number of regional initiatives have emerged over the past few years to try and address the interconnection issues that have served as one of the primary barriers to the expansion of CHP projects nationwide. One of these is the PJM Small Generation Interconnect Working Group (SGIWG). In early 2004, PJM Interconnection developed a technical standard for interconnection of small distributed generators, focusing on systems under 2 MW in size. The process consisted of comparing utility requirements to those laid out in IEEE 1547. It was determined that most differences were unnecessary and thus eliminated. As a result of this process, a comprehensive technical standard was drafted that was almost identical to IEEE 1547 with a few minor exceptions. This standard was eventually approved by FERC in May, 2005. The working group has since been working on and has almost completed a

[5] A complete copy of the rule is available at: http://elibrary.ferc.gov/idmws/search/fercadvsearch.asp.
[6] See a complete copy of the agreement at: http://www.naruc.org/associations/1773/files/dgiaip_oct03.pdf.

comparable standard for 2–10 MW systems. In addition, the group has started working on a 10–20 MW standard (Moran 2006).

Utility Trends

Multi-State Mergers

The utility industry has entered a period of restructuring with many utilities merging to form multi-state organizations. This process seems to be accelerating as is evidenced by recently announced planned acquisitions of PSE&G of New Jersey by Exelon, Cinergy by Duke Energy, Constellation Energy by Florida Power and Light, and PacifiCorp by MidAmerican. This trend may benefit the CHP community since several of the merging utility companies are attempting to harmonize their policies across their service territories. For example, some utilities are developing common DER policies such as Progress Energy in North Carolina, South Carolina, and Florida. Additionally, states have also begun to synchronize their policies, as seen by the adoption of several regulations discussed below.

Rule 21 in California

California became one of the first states to adopt a standard practice for the interconnection of distributed energy systems to the electric grid when the California Public Utilities Commission (CPUC) issued a rulemaking in October, 1999 that progressed into the rewriting of Rule 21. Rule 21 refers to part of each investor-owned utility's tariff. The California Energy Commission investigated the possibility of expanded development of distributed energy, identifying barriers and proposing solutions to address those barriers. A working group made up of representatives from the California Energy Commission and the state's electric utilities was created to rewrite Rule 21. The new version was approved in December, 2000 by the CPUC and specifies standard interconnection, operating, and metering requirements for distributed energy generators (CEC 2005).[7]

Northeastern States: New York and Connecticut

Several states have adopted more progressive policies and actions to help expand the role of CHP. The discussion below is not meant to be comprehensive, but is intended to provide some good examples of the progress some of the Northeastern states have been making.

In 1999, New York was one of the first states to establish interconnection requirements for distributed energy resources systems. New York also established the New York State Energy Research and Development Authority (NYSERDA) Distributed Energy Resources and Combined Heat and Power Program, which supports the development and expansion of DER systems, technologies, and applications in industrial, municipal, commercial, and residential sectors (WGA CDEI 2006).

[7] See http://www.energy.ca.gov/distgen/interconnection/california_requirements.html for additional information.

The New York Public Service Commission (NYPSC) also instituted a proceeding to develop and implement a renewable portfolio standard for electric energy retailed in the state in order to improve energy security and help diversify the state's electricity generation mix. In addition, the standard is intended to promote economic development.

Finally, the NYPSC voted to approve new standby rates for utilities' standby electric delivery service to customers that produce some of their own electricity through onsite generation in order to ensure that rates are fair and implemented correctly. The purpose is to avoid the disincentive for the use of onsite generation created by unreasonable standby rates (USCHPA 2006b). In addition, the NYPSC within the last few years organized a DER pilot program that required electric utilities to consider the use of DER projects as part of the planning process to expand and renovate the electric grid. The program required utilities to issue requests for proposals to the DER community. Bids would then be submitted for DER projects for the utilities to evaluate. For a variety of reasons, the program was unable to produce any DER projects (NYSERDA has commissioned a study to analyze the program in detail), but it is a testament to the efforts being made in New York State (Levy 2006).

In July, 2005, Connecticut's Governor Rell signed the Connecticut House Bill 7501, *An Act Concerning Energy Independence*. It included several positive policy measures regarding CHP. First, it establishes a New Efficiency and CHP Portfolio Standard that requires electric suppliers to obtain a percentage of their output from energy conservation services and CHP generation. Next, it abolished Back-up Power Rates for customers who develop customer-sited DER projects and whose capacity is less than their maximum metered peak load. Also, the bill established a Natural Gas Distribution Cost Rebate for customer-sited distributed resources that use natural gas. Finally, it established the Renewable Energy Investment Fund that will be administered by Connecticut Innovations (which also administers the Clean Energy Fund) and will provide support to CHP projects.

In addition, Connecticut has been investigating the possibility of developing a standard interconnection policy in the state. The state's Department of Public Utility Control (DPUC) has an open docket for this distributed energy resources interconnect standard, which is based on a DPUC Investigation into Possible Shortages of Electricity in Southwest Connecticut during Summer Periods of Peak Demand (USCHPA 2006b).

"Amendment 37": The Colorado Renewable Energy Standard

This rule establishes a process to implement the renewable energy standard for qualifying retail utilities in Colorado. Growth of the state's population and economy will continue to create a need for new energy resources, and Colorado's renewable energy resources are currently underutilized. Since it is in the best interest of the citizens of Colorado to develop and expand the use of renewable energy resources, Amendment 37 was established to help advance and implement this process. The intent of the amendment is to help save consumers and businesses money, attract new businesses and jobs, promote development of rural economies, minimize water use for electricity generation, diversify Colorado's energy resources, reduce the impact of volatile fuel prices, and improve the natural environment of the state.

The rule will apply to all jurisdictional electric utilities serving over 40,000 customers in the state of Colorado that have not voted to exempt themselves and are subject to the Public Utilities Commission of Colorado's regulatory authority.[8]

There is some debate over the details of how Amendment 37 should be implemented. In the view of the Public Service of Colorado (the state's largest utility), many of the details of the Amendment 37 requirements are best handled on a utility-by-utility basis, rather than through rules of general applicability. Public Service recommends that the Commission establish general principles by rule, but then allow each Qualifying Retail Utility regulated by the Commission to file a plan that provides the specific detail as to how that utility will comply with the statute and with the general rules (Colorado PUC 2005).

The rules implementing Amendment 37 include standards that are almost identical to the FERC rules. It's worth noting that even though Amendment 37 is for renewable resources only, these interconnection standards will apply to all small generating facilities under 10 MW, including non-renewable resources.

The Regional Approach

As with the PJM SGIWG interconnection discussions, we see activities occurring increasingly at the regional level, many of which are focusing on CHP and other distributed energy issues.

MADRI

An important initiative that has developed in recent years is the Mid-Atlantic Distributed Resources Initiative (MADRI). Created in 2004 by public utility commissioners from Mid-Atlantic states, MADRI focuses on the "demand response" types of distributed resources and takes a regional approach (as opposed to focusing on individual state programs). MADRI states its three main goals as:

- Educating stakeholders, especially state officials, on distributed resource opportunities, barriers, and solutions.
- Developing alternative distributed resource solutions for states and others to implement.
- Pursuing regional consensus on preferred solutions.

MADRI has created five sub-working groups that address the issues of Interconnection, Advanced Metering, Regulatory Policy, Business Cases, and Environmental Issues. In conjunction with PJM, MADRI is also looking into the Tradable DR Commodity Market. With regard to interconnection standards, MADRI is focusing on policy and procedural issues. In 2004, as a result of a request from the Pennsylvania PUC, MADRI prepared model

[8] In order to be approved for an exemption, a majority vote is required from the utilities' customers. The customers vote on a one-meter-one vote basis and the exemption is approved provided that at least 25% of the customers vote (Brinker 2006).

small generator interconnection procedures.[9] In 2005, these were used as the foundation for Pennsylvania's Notice of Proposed Rulemaking for new interconnection procedures (Moran 2006).

Northwest Power and Conservation Council

In the Northwest, (Oregon, Washington, Idaho, and Montana), the Northwest Power and Conservation Council is becoming engaged with CHP. The Council is a product of federal legislation that established an interstate agreement that provides a priority order of electrical resource acquisition: conservation, renewable resources, cogeneration, and central power plants. The Council is considered the Northwest's leader in energy planning and seeks to develop and maintain a regional power plan to balance the region's environment and energy needs. The Council published *The Fifth Northwest Electric Power and Conservation Plan*, which has now been adopted and for the first time includes provisions for CHP (NPCC 2006; WGA CDEI 2006).

CHP Regional Application Centers and Initiatives

Finally, DOE has established eight Regional Application Centers (RACs) that facilitate deployment of CHP technologies by:

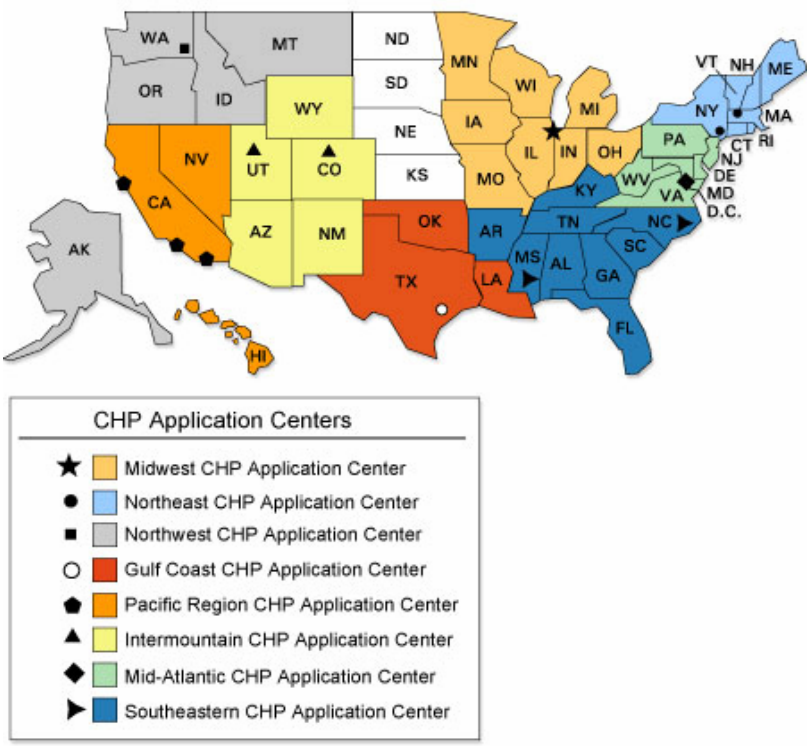
- Educating regional players on benefits of CHP technologies, while reducing perceived risks.
- Providing project-specific support, including site assessments, feasibility studies, and third-party reviews.
- Providing regional coordination and implementation of government programs and projects (EPA 2006).

The Regional Application centers operate in the following regions: Intermountain, Mid-Atlantic, Midwest, Northeast, Northwest, Pacific, Gulf Coast, and Southeastern (see Figure 3). In addition to the roles described above, these RACs provide valuable feedback to DOE and industry regarding future research and development program needs.

Working in conjunction with the RACs are the six Regional CHP Initiatives operating in the following regions: Midwest, Northeast, Southeast, Pacific Northwest, Pacific Southwest, and Intermountain (see Figure 4). The Regional CHP Initiatives began with the support of DOE Regional Offices and work toward building public and private partnerships in an effort to accelerate the deployment of CHP in the regions. The Initiatives are voluntary, ad-hoc coalitions of CHP stakeholders (e.g., industry, environmental, educational, and government organizations) dedicated to expanding CHP projects in their regions by implementing CHP Roadmap Workshop action items, driving state policy change, and advocacy efforts (EPA 2006; USCHPA 2006c).

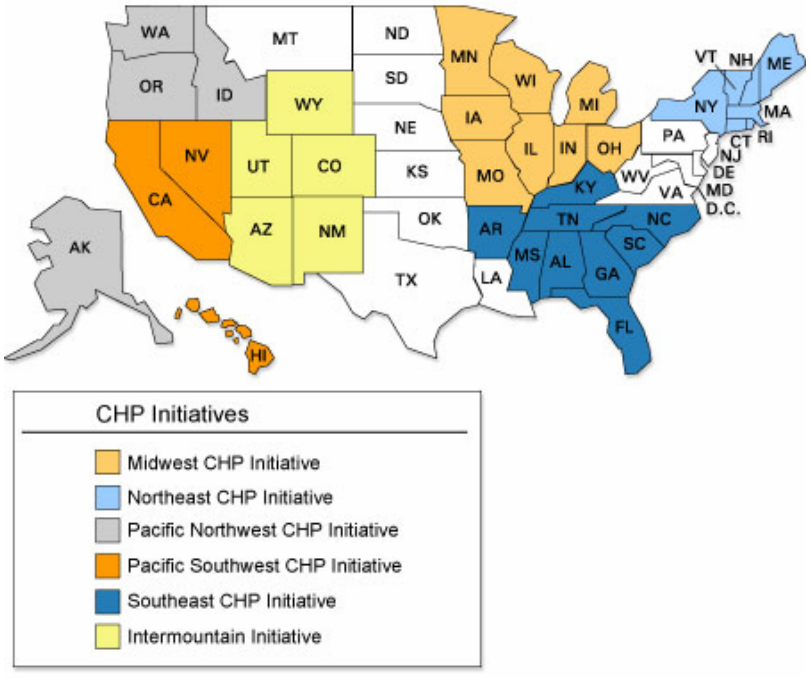
[9] Draft available at http://www.energetics.com/MADRI/pdfs/inter_modelsmallgen.pdf.

Figure 3. CHP Application Centers



Source: EPA (2006)

Figure 4. CHP Initiatives



Source: EPA (2006)

Note: Figures 3 and 4 should be viewed in color. Contact ACEEE for color versions if necessary.

METHODOLOGY

Previous ACEEE Work

ACEEE has compiled a significant amount of work on the subject of CHP previous to this report. Some of these reports include:

- *Distributed Energy Resources and Combined Heat and Power: A Declaration of Terms* (Shipley and Elliott 2000)
- *State Opportunities for Action: Review of States' Combined Heat and Power Activities* (Brown, Scott, and Elliott 2002)
- *State Opportunities for Action: Update of States' Combined Heat and Power Activities* (Brown and Elliott 2003)
- *CHP Five Years Later: Federal State Policies and Programs Update* (Elliott, Shipley, and Brown 2003)

Literature Review

Preceding this examination of utility policies and practices with regard to CHP, ACEEE undertook an assessment of the literature currently available on the subject. Much was learned in terms of perspective and breadth of detail. Significant contributors to this endeavor are highlighted directly below.

Energy and Environmental Analysis, Inc. (EEA) has endeavored to create a database existing as an online data resource organized by state, which provides basic permitting information for DER projects on a continuously updated basis (EEA 2005). Where applicable, it lists interconnection requirements, tariff rates, and economic incentives.

The eight CHP Regional Application Centers described above were set up by active participants in the CHP community in an effort to address and promote increased capacity on a local scale. The centers' Web pages, constituent databases, and analysis all proved to be invaluable in the search of utilities and contacts for the focus of this study.

In deciphering the labyrinthine and monolithic nature of the utility industry, with its ever evolving dynamic, ACEEE was helped by DOE's Energy Information Administration (EIA). Its statistics, data, and analysis on the nation's utilities were an early catalyst in the search for major electricity suppliers with potential capacity for increased CHP on a state-by-state basis (EIA 2006).

The vast community of CHP proponents has published an important body of work.[10] These organizations include—but are not limited to—ACEEE, DOE, EPA, and the USCHPA. This work also proved to be invaluable in that it provided important background details, was the catalyst for this and other works, and has increased the capacity of CHP through its sound analysis and public support.

[10] Some of these Web sites include http://www.aceee.org, http://www.energy.gov, http://www.epa.gov, and http://uschpa.admgt.com.

Review Methodology

ACEEE conducted the review research for this report in order to form a comprehensive reference work for industry, legislators, and others to look for ideas and methods regarding the implementation of CHP projects in their states in order to address barriers impeding the adoption of CHP, but also to assess the need for a national interconnection standard. To gather information from states, the researchers contacted many individuals, including those involved with public utility commissions or state energy offices, individuals working in CHP application centers, colleagues with parallel research expertise, and academics in the field. Once a suitable contact for the utility was found, phone and/or e-mail interviews were conducted using the questions summarized in Table 1.

RESULTS

Based on our analysis we attempted to groups the utilities into four general categories reflecting their friendliness to CHP:

- Level Four, those actively promoting the adoption of CHP through varied incentives;
- Level Three, those not explicitly promoting the adoption of CHP, but willing to work with industry;
- Level Two, those ambivalent, by choice or regional market trends; or those not in the market, or outside the industrial pockets where the adoption is least likely; and
- Level One, those actively working against the adoption of CHP.

These groupings represent qualitative judgments made by ACEEE based on data collected, interviews with utility staff, and interviews with CHP developers and advocates.

Although many of the utilities noted above have published policies specific to CHP interconnection, only a few offer incentives for CHP projects in their territories and three of the five that do are in California. Even fewer utilities are supportive of a national interconnection standard. Despite the fact that only one utility reported that it is in outright opposition to a national standard, there were only three that indicated that they would be supportive. Many of the municipal utilities are especially opposed because of their philosophical opposition to federal government intervention. These findings are generally consistent with what was expected before the interviews took place based on CHP developers' experiences. However, other than the municipal utilities, there does not seem to be any obvious reasons or trends indicating why certain utilities have decided to support or oppose a national standard.

Table 1. Summary of Preliminary Questions for Utilities

Questions for Utility Representative
Published Policies
Does the utility have published policies specific to CHP (interconnection, rates, and tariffs)?
Are those positions the same as those for other DER (renewable energy included)? If not, what are those policies?
Are there any examples of CHP in the area? Where can I get information on them (they may have published case studies) or talk to project managers about them?
Unpublished/Non-Specific Policies
Are there any examples of DER or CHP in the territory? If so, where/what are they?
Interconnection
Does the utility have an interconnection policy for CHP and is it different from a general DER policy?
Does the utility have an official position on the creation of a national interconnection standard?
What sort of policies/structural changes would be necessary for the utility to support CHP in its territory?
Tariffs
Who regulates the utility tariffs?
What is the tariff schedule for DER/CHP? Specifically, what are the rates for supplemental (standby) power, maintenance, and emergency tariffs?
Incentives
Does the utility offer any incentives or work with state agency (e.g., energy office or public utility commission) for CHP or any other form of DER?
Are those positions the same as those for other DER (renewable energy included)?
Is there any report on CHP projects that have received incentives in the area? Where can I get information on them (they may have published case studies) or talk to project managers about them?

Note: The preliminary questions led to follow-up calls and Internet research, leading ACEEE to a wealth of information in most cases.

It is no surprise that several states (California, for example) are significantly more progressive in their policies than others (Florida, for example). Many of these "supportive" states find the fabric of their electric supply infrastructure beginning to fray and CHP offers a path for reducing stress on the system. It is probable that utilities in other states that we have yet to examine, such as New York and Maine, will also be more open to and supportive of CHP while states like Louisiana and Arkansas will lag behind. It is worth noting, however, that one unexpected result of the initial review was that given the South's generally conservative reputation, there seem to be a number of fairly progressive utilities in that region, (for example, in the Carolinas).

It also is worth noting the apparent correlation between local electricity prices and a utility's attitude towards CHP projects (or its position in the category we've assigned it). The idea behind this theory is that utilities are more likely to be active where CHP makes more economic sense. The problem, however, is that prices are very much in flux and there are

many other factors at work—so although there appears to be some kind of correlation, there is little evidence to support a causality. We will continue to explore and examine this theory in Part II of this report as we review the remaining states.

CONCLUSIONS AND RECOMMENDATIONS

Although there has clearly been some significant progress regarding the expansion of CHP projects, technology and applications, there is still much work to be done. Discontinuities in interconnection standards, discriminatory tariff rates, utility disincentives, negative impact on utility profits, lack of awareness of CHP benefits, misconceptions about safety issues and a general lack of education amongst those outside the CHP community remain significant barriers to the expanded adoption of CHP nationally. These barriers are compounded by the current disconnect between natural gas and electricity prices that adds further to uncertainty—a prescription for project paralysis.

The logical federal entity to address these issues, FERC, does not currently have jurisdiction over these issues. For the past few years Congress has been unwilling to expand FERC jurisdiction in these areas due to concerted opposition from public power, some Southern utilities, and a number of utility commissions who have opposed expanded federal oversight on principle. This federal impasse appears unlikely to change in the foreseeable future, so the CHP community will need to continue to be engaged at the state and local level.

Due to an inability at the federal level to move forward on legislative and regulatory solutions, coupled with declining support due to budget constraints, several states and regional initiatives have assumed the lead in the promotion and provision of technical assistance to CHP projects, while also beginning to address the regulatory disincentives that exist for CHP. However, many other states are doing little or nothing, and since utility interests have succeeded in blocking CHP projects in many states, the CHP community must look to other agents such as the National Association of Regulated Utility Commissioners (NARUC) to address these issues in a uniform way on a national level. One potentially positive development is that the series of multi-state utility mergers may prove helpful as some are synchronizing their policies regarding CHP and DER across their service territories.

In addition to federal regulation, expanded federal funding in support of the regional initiatives (that are already proving valuable) would also be extremely useful. A key benefit of CHP is that it increases reliability and security by distributing the energy resource closer to the point of use, taking the pressure off already over-extended utility infrastructure. Since the challenges and major players are at the state level, this sort of localized power structure is best supported by local organizations, which is one reason the CHP Regional Application Centers and Initiatives have proven to be so successful. Working at the local level makes it possible to work with and build relationships with local utilities and regulators. The regional initiatives are uniquely positioned to act as facilitators to promote expanded development of CHP. It would be advantageous if this kind of local support was fueled by expanded federal funding.

Table 2. Utility Policies and Categories

State	Financial Incentives	Published CHP Policies Regarding Interconnection	National Interconnect Standard Position	CHP Category	Notes
California					
SCE	Yes	Yes	No position	3	
PGE	Yes	Yes	No position	3	
LADWP	Yes	Yes	No position	4	
SMUD	No	Yes	Opposes	3	Supportive of CHP in the community
Connecticut					
Northeast Utility Systems–Connecticut Light & Power	No	No	No position	3	Has its own interconnection standard
Florida					
Florida Power & Light	No	No	No position	1	Has been hostile in the past to CHP
Georgia					
Southern Company–Georgia Power	No	No	Supportive	3	
Iowa					
MidAmerican Energy	No	No	No position	2	
Alliant Energy	No	No	No position	3	Policies defined on a contractual basis
Massachusetts					
N-Grid	No	Yes	Supportive	3	Incentives for renewables
Minnesota					
Xcel Energy	Yes	No	No position	2	Distributed generation incentives
North Carolina					
Progress Energy–Carolina Power & Light	Yes	Yes	No position	4	Green Power Initiative
Nevada					
Nevada/Sierra Pacific Power	No	Yes	No position	3	
South Carolina					
Progress Energy–Carolina Power & Light	Yes	Yes	No position	4	Green Power Initiative
Tennessee					
Tennessee Valley Authority	Yes	No	No position	3	Green power incentives
Texas					
Austin Energy	No	No	No position	4	Incentives for conservation; works with the state energy office and DOE's regional application offices
Utah					
PacifiCorp	No	No	No position	3	Financial support to the CHP Intermountain Application Center
Washington					
Seattle City Light	No	No	No position	2	Greenhouse gas neutral policy
Wisconsin					
We Energies	No	Yes	No position	3	Incentives for renewables; worked with the WI PUC to develop interconnection rules and involved with Midwest CHP Application Center
Madison Gas & Electric	No	Yes	Supportive	3	No incentives, but puts a small surcharge into a state fund

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APPENDIX: UTILITY ACTIVITY REGARDING CHP IN SELECTED STATES

California

Los Angeles Department of Water & Power

Published CHP Policies:

LADWP has a number of different programs, including a customer generation rebate program; Rule 21 for interconnection.

Position on National Interconnect Standard:

No official position at this time. Was involved with the creation of Rule 21, which governs the state of California.

Incentives:

Customer generation rebate program (primarily for fuel cells and renewables). Offers incentives through SEMPRA and Southern California Gas Company, and when tenable, points out where funding is available. Will pay up to $1 per W and/or up to 30–40% of installation costs.

Sacramento Municipal Utility District

Published CHP Policies:

Yes, specific to Combined Heat & Power—Rule 21.
http://www.smud.org/commercial/requirements.html

Position on National Interconnect Standard:

SMUD opposes the creation of a national interconnect standard. Publicly owned utilities prefer local control and oppose national regulatory requirements. SMUD sees the value in a standard, but the difficulty is in the tariffs.

Incentives:

No explicit incentives, but fully supports it for the community. SMUD provides electricity but no natural gas. Customers who choose a DER/CHP project are prodded to go through Pacific Gas & Electric for the full Self-Generation Incentive Program (SGIP). However, the CHP portion of the SGIP is set to sunset in 2007 and it is unclear whether it will be reinstated.

Pacific Gas & Electric

Published CHP Policies:

No specific language for CHP installation, but have interconnection rules and policies for any kind of generation. Do have a tariff obligation guide, which has more language for clarification. PG&E conforms to the statewide, uniform policy for CHP—Rule 21.

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Self-Generation Inventive Program for qualifying CHP systems. Standby waivers and installation rebates based on the Wattage of the unit. PG&E also works jointly with CPUC and CEC on these matters.

Southern California Edison

Published CHP Policies:

Have specific tariffs in regard to DER, which covers CHP, but no specific policies regarding CHP alone. Rule 21 governs interconnection issues.
http://www.sce.com/NR/sc3/tm2/pdf/Rule21.pdf

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Self-Generation Incentive Program through CPUC, which provides differential incentives to pay down capital costs for DER products—CHP, renewables, and fuel cells. It is administered primarily by the IOUs in California, and the CEC's Emerging Renewable Program. Also, numerous tariff exemptions exist.
http://www.sce.com/RebatesandSavings/SelfGenerationIncentiveProgram/

Connecticut

Northeast Utility Systems—Connecticut Light & Power

Published CHP Policies:

No published policies specific to CHP. Although the online application does have a question asking if the system is CHP. CHP has been decoupled from the interconnection process. CL&P feels that there is no need to specify.
http://www.cl-p.com/companyinfo/interconnection/inter_app.asp

Position on National Interconnect Standard:

CL&P has its own interconnect standard—Connecticut PUC standard—which they use. The utility states that the above standard meets most of their needs.

Incentives:

CL&P funds some efficiency programs, but no overt incentives for CHP were described.

Florida

Florida Power & Light

Published CHP Policies:

No policies specific to CHP.

Position on National Interconnect Standard:

No official position at this time.

Incentives:

No internal programs. Will direct customers to the Florida Solar Energy Center for assistance.

Georgia

Southern Company—Georgia Power

Published CHP Policies:

No specific policies in regard to CHP, but rate information regarding nonrenewable resources exists, as does an interconnect standard—generic in that it applies to any qualifying facilities. Georgia Power emphasizes rates that encourage the customer to make the right choice regarding its business.
http://www.southerncompany.com/gapower/pricing/gpc-pdf/rnr-2.pdf

Position on National Interconnect Standard:

Georgia Power believes there is value in the guidelines as developed by IEEE, but that application needs to be unique for certain circumstances.

Incentives:

No incentives are given for CHP. Georgia Power works with the Public Service Commission on procedures and processes for qualifying facilities.

Iowa

MidAmerican Energy

Published CHP Policies:

No policies truly specific to CHP. Renewables and wind, for example, are covered, however.

Position on National Interconnect Standard:

Not a question that could be answered at the time of the interview.

Incentives:

Funding is provided to the Iowa Energy Center in support of whatever initiatives it develops, but nothing directly regarding DER or CHP.

Alliant Energy

Published CHP Policies:

Policies are defined on a contractual basis with individual clients.

Position on National Interconnect Standard:

No official position at this time.

Incentives:

If asked, Alliant will work with clients, perhaps through Iowa Economic Development; however, no overt incentives exist.

Massachusetts

N-Grid

Published CHP Policies:

The company has published policies specific to CHP. Also, the IRECusa.org Web site has references to probably the most up-to-date of state interconnection standards.

Position on National Interconnect Standard:

N-Grid is in support of a national standard (a FERC standard). However, it would ultimately depend on the final language of the rule.

Incentives:

No incentives specific to CHP. All incentives are focused on renewables.

Minnesota

Xcel Energy

Published CHP Policies:

No specific policies in regard to CHP.
http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-5_2267_2526-1578-5_538_969-0,00.html

Position on National Interconnect Standard:

No official position at this time.

Incentives:

There are some demonstration programs in Minnesota—SIP funds. "Amendment 37," a state program in Colorado, is the poster child for DER incentives in other states like Minnesota.

Nevada

Nevada/Sierra Pacific Power

Published CHP Policies:

Net-metering rule for projects that fall under 30 kW. Projects over 30 kW fall under stand-by service parameters.

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Nevada/Sierra Pacific states that it does not offer any incentive programs.

North Carolina

Progress Energy—Carolina Power & Light

Published CHP Policies:

Some tariffs specific to CHP, which govern buy-back power rates and the like, as well as a specific interconnect policy.
http://www.progress-energy.com/aboutenergy/rates/NC_Cogeneration_and_Small_Power_Producer.pdf

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Green Power Initiative

South Carolina

Progress Energy—Carolina Power & Light

Published CHP Policies:

Some tariffs specific to CHP, which govern buy-back power rates and the like, as well as a specific interconnect policy.
http://www.progress-energy.com/aboutenergy/rates/SCCogenSchedule.pdf

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Green Power Initiative

Tennessee

Tennessee Valley Authority

Published CHP Policies:

No policies specific to CHP.

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Green Power incentives. This program does not include CHP, only solar, wind, and refuse-derived methane.

Texas

Austin Energy

Published CHP Policies:

There exists an interconnection guide, but nothing specific to CHP.

Position on National Interconnect Standard:

No official position at this time.

Incentives:

No specific incentives for CHP. Incentives do exist for conservation; work is done with the state energy office and the DOE's regional application office, Houston Advanced Research Center (HARC), in this regard.

Utah

PacifiCorp

Published CHP Policies:

No specific policies regarding CHP, but is supported nonetheless. Interconnect policies do exist.

http://www.pacificorp.com/Article/Article2599.html
http://www.pacificorp.com/File/File20414.pdf
http://www.pacificorp.com/New_Auto_Index/New_Auto_Index2572.html

Position on National Interconnect Standard:

No official position at this time.

Incentives:

Financially support the Intermountain CHP Application Center. In-house, account managers work with customers on the promotion of CHP through groups like Questar Corporation.

Washington

Seattle City Light

Published CHP Policies:

SCL's policy is to be greenhouse neutral. If CHP serves that function, then it is applicable, but no specific policies exist in that regard. Most policies are geared toward renewables.

Position on National Interconnect Standard:

No official position at this time. SCL feels that in the future it will align itself with surrounding state and utility policies.

Incentives:

None defined for CHP at this time.

Wisconsin

We Energies

Published CHP Policies:

Yes, CHP is a subset of its distributed energy resources policies, Wisconsin Administrative Code Chapter PSC 119—rules for interconnecting distributed energy resource facilities.
http://www.we-energies.com/business_new/altenergy/custgen.htm

Position on National Interconnect Standard:

No official position at this time. However, helped develop a state standard a couple of years ago. We Energies does have someone following the IEEE 1547 push.

Incentives:

The only incentives are for renewables. Worked with the Wisconsin PUC to come up with interconnection rules, however, and is involved with the Midwest CHP Application Center in a limited capacity.

Madison Gas & Electric

Published CHP Policies:

The utility has interconnection policies and rates specific to CHP for systems below or above 20 kW.
http://mge.com/home/rates/cust_gen.htm;
http://mge.com/images/PDF/ParallelGen_PSC6030.pdf

Position on National Interconnect Standard:

A state standard is in place: PSC 119, as mentioned above. The utility has made a statement that it will support a national standard if and when it becomes widespread (IEEE 1547 or whatever it might be).

Incentives:

Other than a small surcharge that goes into a state fund, there are no explicit CHP incentives at MG&E. Focus on Energy in Wisconsin has a wind energy incentive, but mostly for residential customers.