The Impact of CHP on CO_2 Emissions in Heavy Coal-Burning Regions of the United States

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Table of Contents

Introduction

Combined heat and power (CHP) is the sequential generation of electric and thermal or mechanical energy from a common energy source. CHP captures energy that is normally discarded from conventional power generation and uses this energy for process or space heating, cooling or other end uses. Typically, two-thirds of the energy in a conventional power plant is lost when waste steam is condensed in a cooling tower or disposed of in a body of water. By recovering this energy, CHP systems achieve much higher efficiency than conventional separate electric and thermal generation. For example, a CHP system can reach 80% efficiency while central stations are only 30-40% efficient.

CHP is recognized as a highly efficient and environmentally beneficial technology. It has been specifically singled out for encouragement by the United States Department of Energy and Environmental Protection Agency, which have committed to increasing U.S. CHP capacity to 92 GW between 2000 and 2010. CHP was also highlighted in the Presidential National Energy Policy Document in 2003.

One of the many benefits of CHP is its ability to reduce greenhouse gas emissions because of its high efficiency. As the amount of useful energy harnessed in the burning of a fuel increases, the efficiency of the system increases. High efficiency technologies are environmentally superior because they burn less fuel to get the same energy output and therefore release fewer greenhouse gas emissions into the environment. CHP is an important technology option in the fight to reduce greenhouse gas emissions in order to mitigate climate change. This is due to the immense size of the emissions that can be saved through just recovering energy that is currently thrown away. This concept of "recycling energy" can allow large emissions savings with little or no change to the lifestyle of average Americans.

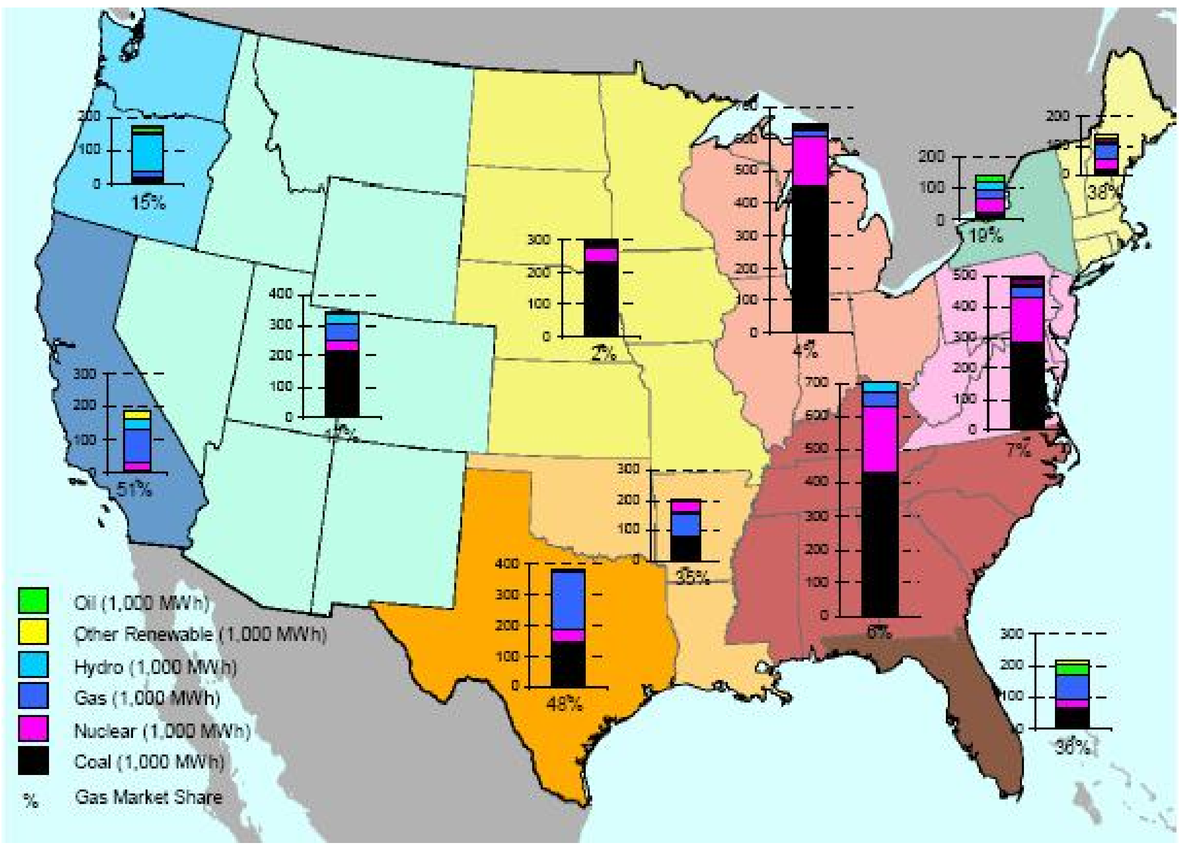
As concerns about the impacts of climate change grow, options are being sought for ways to reduce greenhouse gas emissions throughout the world. The most notable attempt at this is the Kyoto Protocol. Even though the United States did not ratify the protocol, many groups and local or state governments are beginning to set goals for the reduction of greenhouse gas emissions. Many of these goals involve the utilization of new renewable energy technologies; however they fail to highlight the current technologies that can easily be implemented to recycle wasted energy. The United States currently wastes more energy than many countries even produce; if this energy could be harnessed, more significant greenhouse gas emissions savings could be achieved than widespread use of some renewable technologies.

The focus of this project deals with identifying areas of the United States that could provide the most emissions reduction benefits from increased deployment of CHP. Since the greenhouse gas most commonly associated with power generation is carbon dioxide, this report quantifies the amount of carbon dioxide that could be displaced though the use of CHP. This report identifies regions of the country that should be targeted for increased CHP deployment, and how the policy actions that states like California and

New York have used to be frontrunners in terms of promoting CHP could be utilized in these regions.

Power Generation and Existing CHP in the United States

The largest fossil fuel contributor to power generation in the United States is coal. It accounts for 49.7% of the country's total generation capacity or 2,013,179 GWh a year for 2005. The breakdown of electricity generation by fuel mix and region is shown in Figure 1. It can be seen that the majority of electricity is generated in three regions of the country, the Mid-Atlantic, Eastern Midwest, and Southeast. Even more noteworthy than just the amount of generation in these regions is the percentage of it that comes from coal fired generation.



Source: National Commission on Energy Policy Report, compiled by EEA

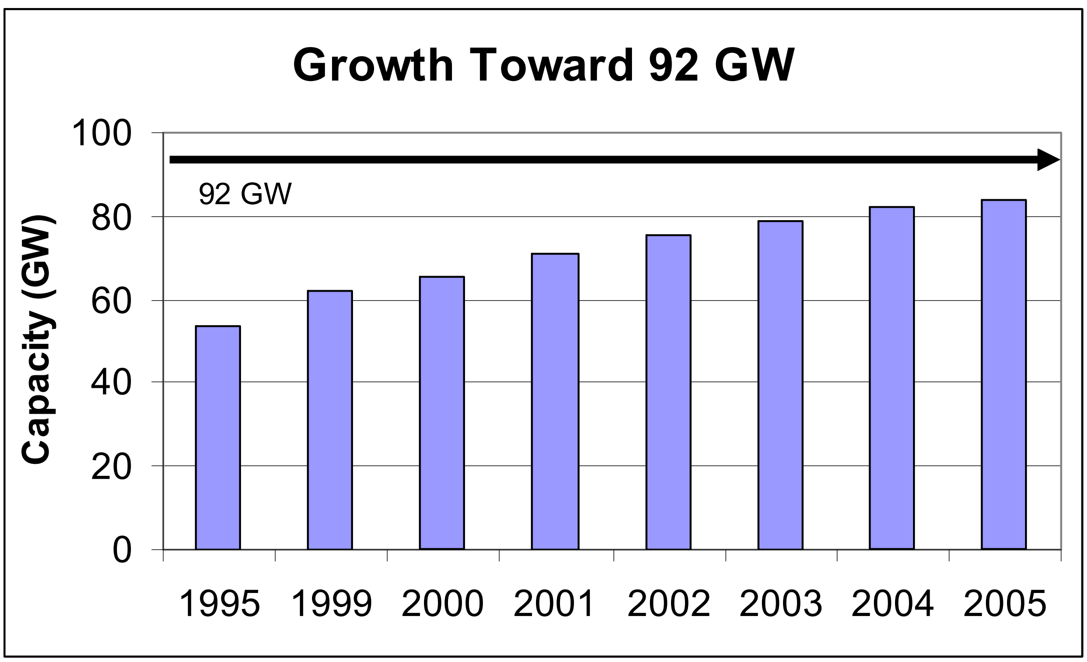
Figure 1 2004 Electricity Generation and Fuel Mix by Region

Coal is by far the "dirtiest" fossil fuel, because it releases the largest amount of harmful emissions per unit of energy it provides. It is not only high in the criteria pollutants that are currently regulated under the Clean Air Act, such as NO_x, SO_x, and particulate matter, but it is also the largest contributor to carbon dioxide greenhouse gas emissions. In fact coal has almost double the CO_2 emission factor of natural gas on a lb/MMBtu basis (205 lb/MMBtu for coal vs. 117 lb/MMBtu for natural gas).

Since the three regions identified above (Mid-Atlantic, Eastern Midwest, Southeast) are the largest users of coal based power generation, the rest of the report focuses specifically on these regions.

Existing CHP

According to Energy and Environmental Analysis, Inc., there are currently 3,168 CHP sites throughout the United States that account for 83,532 MW of capacity. Traditionally, CHP systems have served mostly industrial facilities due to the high electric and thermal needs at these sites. Starting in the mid 1980s the number of CHP sites and capacity began to grow considerably due to an increased number of systems put into commercial facilities. Industry and government came together in 1998 and set a CHP Challenge Goal to reach 92 GW of installed CHP capacity by 2010. The goal was to be met by raising CHP awareness, eliminating regulatory and institutional barriers, developing markets, and supporting advanced technologies. Significant progress has been made towards this goal; however, as Figure 2 shows, the growth of CHP capacity has slowed in recent years

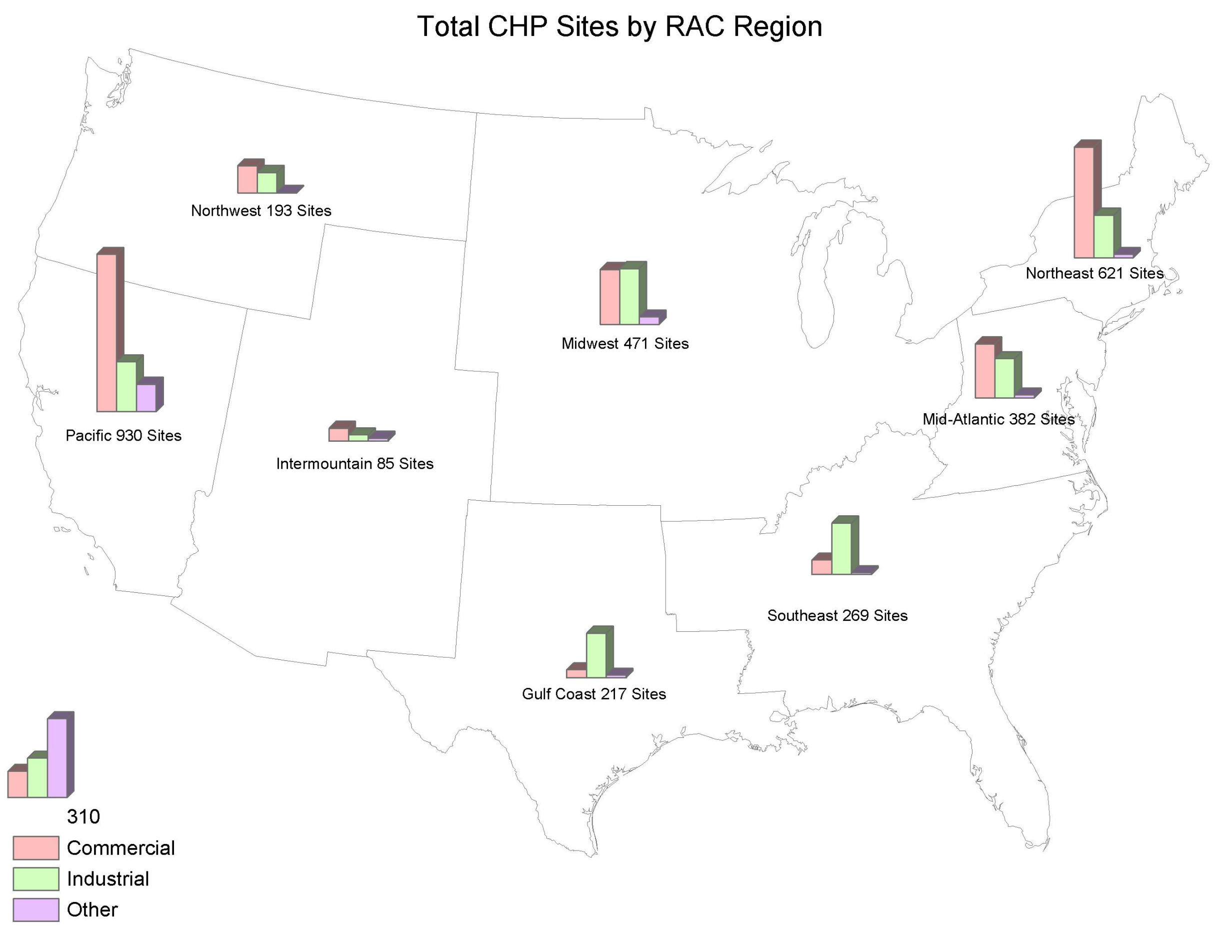


Source: EEA, *Profile of Existing CHP in the United States – 2005*

Figure 2 CHP Capacity Growth Toward the Goal of 92 GW

Some of the slow-down in growth that has been observed over the past few years may be partially caused by regulatory barriers to new installations. Most of the large industrial facilities that can easily utilize CHP are already doing so, and a large shift to growth in the commercial sector has taken place. CHP systems serving commercial facilities tend to be smaller because their energy loads are not as large as industrial facilities. The key to achieving growth in the commercial sector is having a regulatory environment that enables a streamlined approach to putting systems into large numbers of facilities. This is not currently the case, which makes it increasingly important to reduce regulatory barriers.

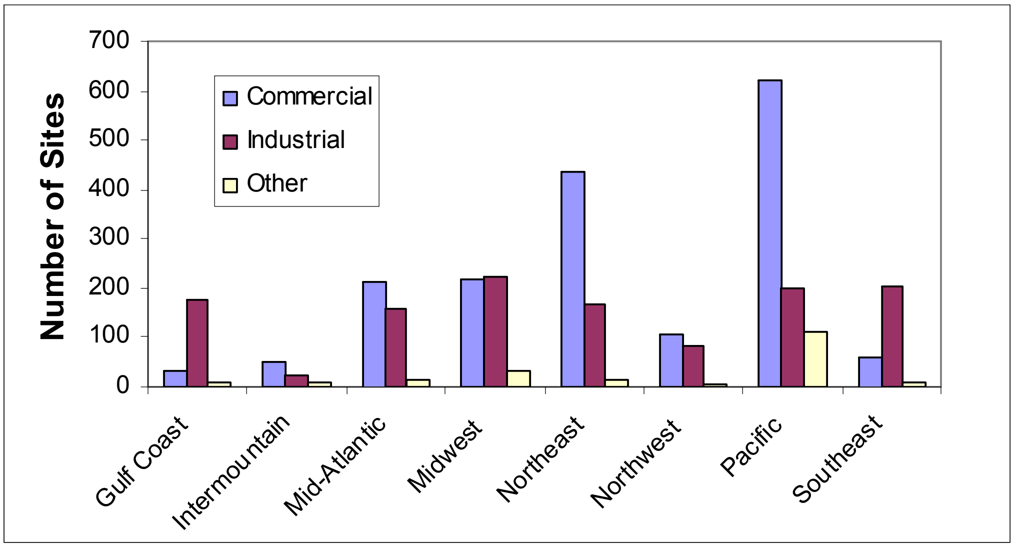
Existing CHP systems are not uniformly distributed throughout the country. There are certain states and whole regions that are far ahead of the pack in terms of installed systems. Figure 3 demonstrates the breakdown of existing CHP sites by region of the country and applications class.



Source: EEA, *Profile of Existing CHP in the United States – 2005*

Figure 3 CHP Sites by RAC Region for All Application Classes

The existing CHP sites displayed above are divided by RAC region, which are the Regional Application Center areas designated by the Department of Energy. Even though these regions do not perfectly match with the regions in Figure 1, it can still be seen that the target regions for this report (Mid-Atlantic, Eastern Midwest, and Southeast) fall short of the progress being made in the Pacific and Northeast regions. These two regions are led by California and New York in progress toward a wide utilization of CHP. The following figure shows these differences more clearly. Even though most of the regions have a similar number of industrial CHP sites, there is a vast difference in the amount of commercial facilities.



Source: EEA, *Profile of Existing CHP in the United States –2005*

Figure 4 Number of CHP Sites by Application Class and Region

The Southeast is the lowest target region in commercial CHP sites because the regulatory environment in most southern states does not promote energy efficiency. There is vast room for improvement in all of the targeted regions however, since these regions produce and consume such a large amount of the electricity in the country.

Methodology

Data for the technical potential for CHP installations in each state of the country was obtained from a report compiled by Onsite Sycom Energy Corporation for the Energy Information Administration. The technical potential figures they calculated are shown in Table 1 and Table 2. The analysis behind this data considered estimates of current power and thermal consumption at existing facilities. For example, existing industrial and commercial facilities were identified along with their energy consumption patterns. These consumption patterns enabled a CHP system size to be calculated that could meet that facility's needs. The technical market potential is an estimation of market size constrained only by technological limits—the ability of CHP technologies to fit existing customer energy needs. Economic considerations were not incorporated into the analysis.

Table 1 Industrial CHP Potential by Region and Size

Industrial	50 to 500 kW		500 kw to 1 MW		1 MW to 5 MW		5 MW to 20 MW		> 20 MW		Total	
	Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW
Mid-Atlantic												
Delaware	152	12.8	41	19.3	46	94.1	28	304.4	11	750.0	278	1,180.6
Maryland	910	70.7	142	69.5	132	197.3	23	221.3	6	251.3	1,213	810.0
New Jersey	2,869	236.1	376	190.1	327	597.5	47	460.6	3	225.0	3,622	1,709.3
Pennsylvania	4,472	302.4	703	268.3	815	1,156.6	143	1,096.9	34	1,481.3	6,167	4,305.4
Virginia	1,037	64.9	189	70.1	221	318.9	68	580.6	4	112.5	1,519	1,147.0
West Virginia	263	14.6	60	18.7	60	86.3	10	80.6	11	543.8	404	743.9
Eastern Midwest												
Illinois	5,059	334.1	856	334.7	848	1,197.5	143	1,168.1	40	1,815.0	6,946	4,849.4
Indiana	2,550	145.3	559	180.3	693	789.1	132	774.4	41	1,770.0	3,975	3,659.1
Michigan	4,942	275.3	799	257.9	789	864.3	126	776.9	35	1,192.5	6,691	3,366.9
Ohio	5,475	325.6	1060	366.6	1295	1,615.4	255	1,751.9	66	2,988.8	8,151	7,048.2
Wisconsin	2,733	173.4	513	203.1	551	742.0	94	689.4	29	1,597.5	3,920	3,405.3
Southeast												
Alabama	1,383	83.7	284	98.0	406	493.0	141	1,147.5	31	1,173.8	2,245	2,995.9
Georgia	2,119	155.6	403	177.9	608	955.8	152	1,382.5	20	1,158.8	3,302	3,830.5
Kentucky	957	51.5	225	78.6	416	504.8	135	918.1	38	1,837.5	1,771	3,390.5
Mississippi	609	34.8	161	55.4	259	315.3	59	476.3	4	135.0	1,092	1,016.7
North Carolina	2,644	177.5	574	232.5	748	1,132.6	131	1,118.8	5	168.8	4,102	2,830.1
South Carolina	983	62.7	201	79.2	399	575.1	136	1,145.6	28	1,391.3	1,747	3,253.8
Tennessee	1,785	108.5	395	142.2	589	774.6	170	1,190.0	19	888.8	2,958	3,104.0
Total	40,942	2,629.4	7,541	2,842.2	9,202	12,410.0	1,993	15,283.8	425	19,481.3	60,103	52,646.6

Source: Onsite Sycom Energy Corporation

Table 2 Commercial CHP Potential by Region and Size

Commercial	50 to 500 kW		500 kw to 1 MW		1 MW to 5 MW		5 MW to 20 MW		> 20 MW		Total	
	Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW
Mid-Atlantic												
Delaware	408	61.2	169	126.8	37	92.5	4	50.0	0	0.0	618	330.5
Maryland	2,542	381.3	973	729.8	301	752.5	37	462.5	2	100.0	3,855	2,426.1
New Jersey	3,099	303.2	1167	603.9	371	803.8	49	531.3	3	150.0	4,689	2,392.1
Pennsylvania	5,141	517.8	1742	999.4	541	1,248.8	46	543.8	3	150.0	7,473	3,459.7
Virginia	3,461	519.2	1111	833.3	330	825.0	31	387.5	2	100.0	4,935	2,664.9
West Virginia	877	131.6	282	211.5	68	170.0	5	62.5	0	0.0	1,232	575.6
Eastern Midwest												
Illinois	4,831	724.7	1323	992.3	489	1,222.5	51	637.5	2	100.0	6,696	3,676.9
Indiana	3,031	454.7	776	582.0	204	510.0	27	337.5	4	200.0	4,042	2,084.2
Michigan	4,713	707.0	1231	923.3	349	872.5	35	437.5	1	50.0	6,329	2,990.2
Ohio	5,395	809.3	1650	1,237.5	386	965.0	44	550.0	2	100.0	7,477	3,661.8
Wisconsin	2,893	434.0	650	487.5	200	500.0	19	237.5	0	0.0	3,762	1,659.0
Southeast												
Alabama	1,985	297.8	506	379.5	127	317.5	11	137.5	1	50.0	2,630	1,182.3
Georgia	4,390	658.5	1590	1,192.5	328	820.0	51	637.5	3	150.0	6,362	3,458.5
Kentucky	1,828	274.2	412	309.0	104	260.0	13	162.5	1	50.0	2,358	1,055.7
Mississippi	1,316	197.4	277	207.8	73	182.5	9	112.5	1	50.0	1,676	750.2
North Carolina	4,816	722.4	1552	1,164.0	337	842.5	45	562.5	3	150.0	6,753	3,441.4
South Carolina	2,598	389.7	852	639.0	193	482.5	10	125.0	1	50.0	3,654	1,686.2
Tennessee	1,933	290.0	468	351.0	143	357.5	22	275.0	1	50.0	2,567	1,323.5
Total	55,257	7,873.5	16,731	11,969.8	4,581	11,225.0	509	6,250.0	30	1,500.0	77,108	38,818.4

Source: Onsite Sycom Energy Corporation

In the original report by Onsite Sycom Energy Corporation, the industrial and commercial sectors were broken down by specific application, however for the purposes of this report, only size and state were considered necessary. The industrial applications included food processing, paper, chemicals, petroleum refining, primary and fabricated metals, and manufacturing. The commercial applications included lodging, apartment buildings, hospitals, colleges/universities, prisons, schools, and several others.

In order to calculate the amount of CO_2 emissions that could be reduced by deploying the entire technical potential for CHP illustrated above, emissions rates needed to be identified. The United States Environmental Protection Agency has a program called the CHP Partnership that offers many useful tools for facilities interested in installing CHP systems. One of these tools is the CHP Emissions Calculator, which is available on the

Partnership website (http://www.epa.gov/chp/). The emissions calculator is a program that allows users to enter information about a potential CHP project, including size, operating hours per year, fuel, and thermal energy usage, to find out the emissions that would be displaced by the system.

An important feature of the CHP Emissions Calculator is that it allows users to calculate the offset emissions based on the emissions of their particular state. For instance, states that are heavy users of coal would have more emissions displaced by a CHP system because the system would be displacing mostly coal-fired generation. Whereas, states that use more natural gas-fired generation would have a smaller amount of CO_2 emissions displaced. Table 3 shows the amount of CO_2 emissions that would be displaced from state generation profiles by installing a megawatt (MW) of CHP capacity.

Table 3 CO_2 Emissions Reductions by State for Every MW of CHP Capacity Installed

Region	Industrial CO2 Emissions Reduction per MW (tons/yr)	Commercial CO2 Emissions Reduction per MW (tons/yr)
Mid-Atlantic		
Delaware	5,022	3,767
Maryland	4,785	3,589
New Jersey	3,043	2,282
Pennsylvania	4,866	3,650
Virginia	4,863	3,647
West Virginia	4,975	3,731
Eastern Midwest		
Illinois	5,742	4,307
Indiana	5,427	4,070
Michigan	4,724	3,543
Ohio	5,146	3,859
Wisconsin	5,915	4,436
Southeast		
Alabama	5,447	4,085
Georgia	4,992	3,744
Kentucky	5,821	4,366
Mississippi	4,710	3,533
North Carolina	4,904	3,678
South Carolina	4,021	3,016
Tennessee	5,049	3,787

This analysis assumes that natural gas is the fuel used for all new CHP plants. This is not realistic since many new installations would use biomass or simply the waste heat off of industrial processes. Therefore, these results actually understate the amount of CO_2 emissions that would be displaced. The difference between the industrial and commercial reductions has to do with the number of hours the CHP system would operate in a year. Industrial facilities operate for a larger amount of hours since they tend to operate in shifts, which keep demand for both electricity and thermal energy consistently high throughout the day. The industrial systems are assumed to operate for 5,840 hours/year which is equivalent to operating 7 days a week for 16 hours a day. The commercial systems are assumed to operate for 4,380 hours/year which is equivalent to operating 7 days a week for 12 hours a day.

Results

The results of the analysis are presented in Table 4 and Table 5. The technical potential values for each state and size range were multiplied by the amount of emissions that would be reduced in that state. As can be seen in the "Total" column of the tables, the results are staggering in the amount of CO_2 emissions that could be reduced by CHP installations

Table 4 Industrial CO_2 Emissions Reductions in Tons per Year

Industrial	50 to 500 kW CO2 (tons/yr)	500 kw to 1 MW CO2 (tons/yr)	1 MW to 5 MW CO2 (tons/yr)	5 MW to 20 MW CO2 (tons/yr)	> 20 MW CO2 (tons/yr)	Total CO2 (tons/yr)
Mid-Atlantic						
Delaware	64,332	96,987	472,696	1,528,571	3,766,500	5,929,086
Maryland	338,240	332,677	943,841	1,058,681	1,202,231	3,875,671
New Jersey	718,384	578,322	1,818,193	1,401,682	684,675	5,201,255
Pennsylvania	1,471,588	1,305,426	5,628,137	5,337,394	7,207,763	20,950,308
Virginia	315,779	340,836	1,550,689	2,823,579	547,088	5,577,970
West Virginia	72,386	93,095	429,094	401,109	2,705,156	3,700,840
Eastern Midwest						
Illinois	1,918,589	1,921,560	6,876,045	6,707,374	10,421,730	27,845,298
Indiana	788,448	978,488	4,282,581	4,202,533	9,605,790	19,857,841
Michigan	1,300,635	1,218,438	4,082,717	3,669,958	5,633,370	15,905,118
Ohio	1,675,641	1,886,524	8,312,720	9,015,149	15,380,108	36,270,140
Wisconsin	1,025,439	1,201,115	4,388,930	4,077,653	9,449,213	20,142,350
Southeast						
Alabama	455,914	533,738	2,685,371	6,250,433	6,393,416	16,318,872
Georgia	776,655	888,077	4,771,104	6,901,440	5,784,480	19,121,756
Kentucky	299,971	457,312	2,938,150	5,344,406	10,696,088	19,735,926
Mississippi	164,014	260,875	1,484,828	2,243,138	635,850	4,788,704
North Carolina	870,252	1,140,180	5,554,393	5,486,350	827,550	13,878,725
South Carolina	251,966	318,312	2,312,578	4,606,558	5,594,216	13,083,630
Tennessee	547,564	717,968	3,911,082	6,008,310	4,487,299	15,672,222
Total	13,055,796	14,269,930	62,443,147	77,064,317	101,022,521	267,855,711

Table 5 Commercial CO_2 Emissions Reductions in Tons per Year

Commercial	50 to 500 kW CO2 (tons/yr)	500 kw to 1 MW CO2 (tons/yr)	1 MW to 5 MW CO2 (tons/yr)	5 MW to 20 MW CO2 (tons/yr)	> 20 MW CO2 (tons/yr)	Total CO2 (tons/yr)
Mid-Atlantic						
Delaware	230,540	477,467	348,448	188,350	0	1,244,805
Maryland	1,368,486	2,619,073	2,700,723	1,659,913	358,900	8,707,093
New Jersey	691,874	1,378,185	1,834,158	1,212,313	342,300	5,458,829
Pennsylvania	1,889,970	3,647,719	4,557,938	1,984,688	547,500	12,627,814
Virginia	1,893,340	3,038,863	3,008,775	1,413,213	364,700	9,718,890
West Virginia	490,813	789,107	634,270	233,188	0	2,147,377
Eastern Midwest						
Illinois	3,121,068	4,273,621	5,265,308	2,745,713	430,700	15,836,408
Indiana	1,850,426	2,368,740	2,075,700	1,373,625	814,000	8,482,491
Michigan	2,504,724	3,271,075	3,091,268	1,550,063	177,150	10,594,279
Ohio	3,122,896	4,775,513	3,723,935	2,122,450	385,900	14,130,693
Wisconsin	1,925,002	2,162,550	2,218,000	1,053,550	0	7,359,102
Southeast						
Alabama	1,216,309	1,550,258	1,296,988	561,688	204,250	4,829,491
Georgia	2,465,424	4,464,720	3,070,080	2,386,800	561,600	12,948,624
Kentucky	1,197,157	1,349,094	1,135,160	709,475	218,300	4,609,186
Mississippi	697,414	733,981	644,773	397,463	176,650	2,650,280
North Carolina	2,656,987	4,281,192	3,098,715	2,068,875	551,700	12,657,469
South Carolina	1,175,335	1,927,224	1,455,220	377,000	150,800	5,085,579
Tennessee	1,098,041	1,329,237	1,353,853	1,041,425	189,350	5,011,905
Total	29,595,805	44,437,617	41,513,308	23,079,788	5,473,800	144,100,317

Since economic considerations were not taken into account in the analysis, it is not currently plausible that all of the facilities would actually implement CHP. However, as electric prices around the country continue to rise, an increasing number of facilities will find CHP to be not only environmentally beneficial, but economically beneficial as well. One key way to change the negative economic situation that CHP runs into is through federal and state incentives, as well as removing barriers such as transaction costs that tend to make the budgets of small projects swell. These issues will be covered in the following section.

Policy Actions

There are many types of policy actions that can encourage the growth of CHP and other renewable and efficient technologies in a state. These policies include:

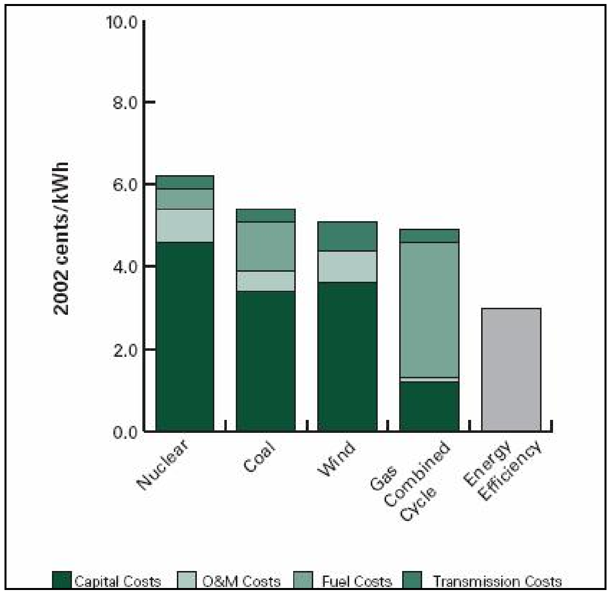
- Leading by example,
- Offering funding and incentives,
- Setting up energy efficiency and renewable energy portfolio standards,
- Creating a public benefits fund for energy efficiency, and
- Removing barriers to interconnection and permitting.

There are some states in the country that have done a very good job at creating an atmosphere where clean energy technologies, including CHP, are able to flourish. For CHP, these states are California and New York, because they have seen the most growth in CHP installations and have therefore been able to make the most progress toward benefiting the environment. This section will cover the necessary policy actions that would bring the targeted regions from the previous section into the kind of CHP environment experienced in California and New York. The successful nature of the policy programs in those states will be highlighted along with how these programs could be transferred to the targeted regions.

The policy actions that will be described would benefit all types of clean technologies. In their Clean Energy-Environment Guide to Action, the EPA defines “clean energy” as energy efficiency and clean energy supply, which refers to clean distributed generation, combined heat and power, and renewable energy.

Before discussing the policy actions, it is necessary to point out that many opponents of clean energy technologies often cite the high cost of these technologies as a reason why they should not be supported. This view is false however because states are finding clean energy to be cost-competitive with traditional sources of generation[1]. Figure 5 shows that when compared to the cost of new generation from power plants, clean technologies can be less expensive.

[1] EPA, 2006



Source: ACEEE 2004

Figure 5 Comparative Cost of Electricity from Various Sources

Lead by Example

Lead-by-example initiatives are the practice of implementing programs and policies that advance the use of clean energy technologies within state and local government facilities, fleets, and operations. These initiatives help governments achieve substantial energy cost savings while providing an example to the public and private sectors on the adoption of clean energy technologies.

California has several lead-by-example programs that are administered by the California Energy Commission (CEC). These include *California Executive Order S-20-04* that requires state agencies and departments to reduce their energy consumption by 20% from 2003 levels by 2015. The *Energy Efficiency Financing Program* provides low-interest loans for public schools, public hospitals, and local governments to install energy efficiency measures. The *Energy Partnership Program* helps cities, counties, hospitals, and other facilities target energy efficiency options for new and existing facilities. There are also several other local programs that have been enacted by local governments in the state to support clean energy.

New York also utilizes lead-by-example programs. The *Executive Order 111* set aggressive targets for reducing energy use in state buildings and vehicles, by purchasing green power and energy efficient products. This executive order has been mentioned as the basis for strong state support of CHP, even though CHP is not specifically addressed. The *Energy $mart Loan Program* provides reduced interest loans for renewable energy and energy efficiency projects, including CHP. New York City has even taken steps to codify its practice of buying energy efficient products in *New York City Local Law 30.*

Based on the examples of California and New York, states in the targeted regions of the country could start slowly in their progress toward using clean technologies. They can set targets for using clean technologies to power state and local facilities, including exploring options for using CHP at state facilities. Since many of the targeted states have utilities that are unfriendly toward CHP, the state and local governments may have an easier time installing systems that can pave the way for more installations.

Funding and Incentives

States can achieve substantial energy and cost savings through well-designed funding and incentive programs for clean energy technologies. These programs usually offer incentives in the form of loans, tax credits, grants, generation incentives, energy performance contracting and nitrogen oxide set asides. Funding and incentives can stimulate private-sector investment as well as reduce market barriers by subsidizing higher "first costs" of installing a CHP system. California and New York both provide financial incentives to CHP installations. More information on incentives can be accessed in the Database of State Incentives for Renewables & Efficiency.

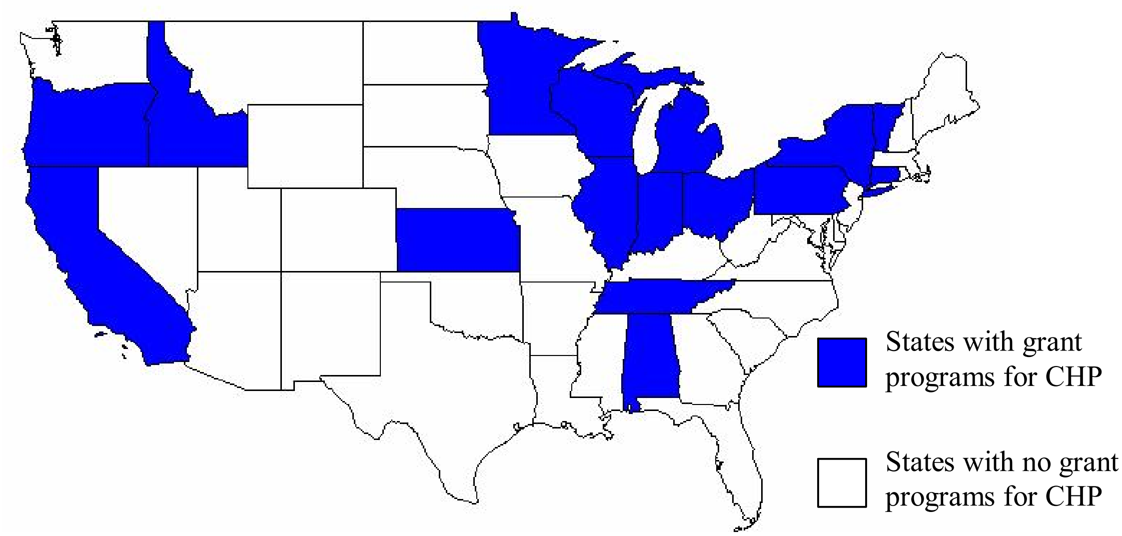


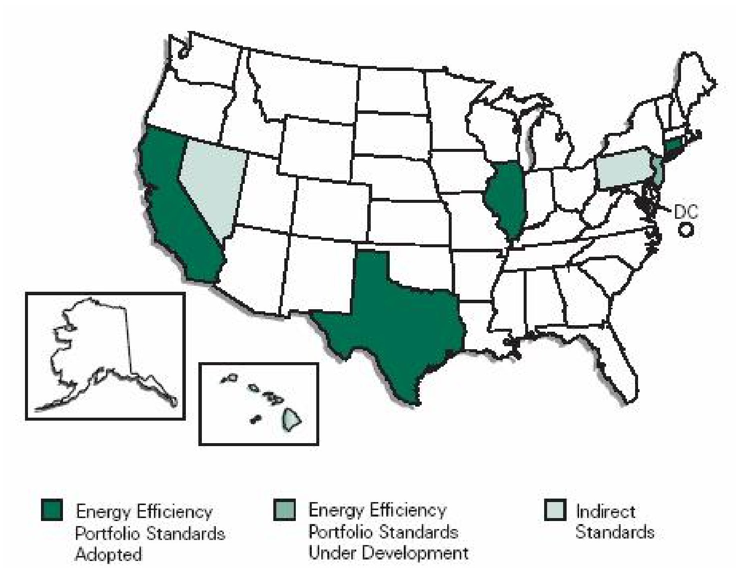
Figure 6 States with Grant Programs Applicable for CHP

As seen in Figure 6, there are several states throughout the country that have funding and incentive programs in place that are available to CHP projects. Some of these programs specify that the system must use biomass fuel sources, while others just require waste heat utilization. Some of the states in the targeted regions already have incentive programs, however, since these states do not have significant amounts of CHP it is evident that the programs could be strengthened.

States that decide to create or expand clean energy funding can do so by designing a program based on best practices developed by other states. California's *Self-Generation Incentive Program* and New York's *CHP Performance PON* are both successful programs that could be imitated.

Energy Efficiency and Renewable Energy Portfolio Standards

Since saving energy through energy efficiency can cost less than generating energy from power plants (see Figure 5), some states are beginning to adopt energy efficiency portfolio standards (EEPS). These programs remove key market, regulatory, and institutional barriers that hinder investment in energy efficiency, including CHP. EEPS are similar to renewable portfolio standards in that they require that energy providers meet a specific portion of their electricity demand through energy efficiency. Some studies predict that energy efficiency could meet up to 20% of the nation's demand[2]. Figure 7 presents the states that have already enacted or are in the process of enacting EEPS programs.



Source: EPA

Figure 7 States with Energy Efficiency Portfolio Standards

EEPS programs are extremely important in the fight to grow the market for CHP. Since CHP can provide large amounts of energy efficiency gains, states that implement an EEPS will be able to save large amounts of fuel that would otherwise be burned in power plants. This reduction in the amount of fuel required would contribute heavily to the emissions reductions needed to mitigate climate change.

Some states already recognize CHP in their renewable portfolio standards (RPS), see Table 6. However, these states often put other clean technologies ahead of CHP in the goals.

[2] EPA, 2006

Table 6 States with RPS Including CHP

State	RPS Total Goal
Arizona*	15% by 2024
Connecticut	10% by 2010 (7% Tier 1)
Hawaii	20% by 2020
Maine	30% by 2000
Nevada**	20% by 2015
Pennsylvania	18% by 2020

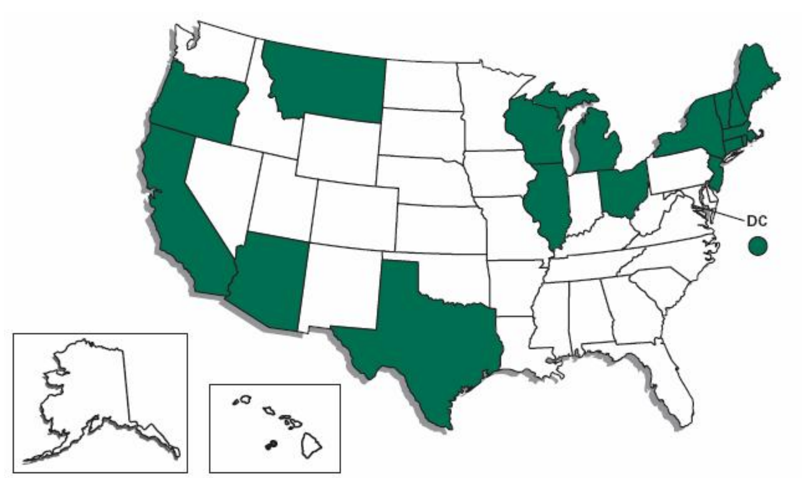
* proposed RPS would include CHP

**Power generation from heat recovery only

If states in the targeted areas were to enact EEPS programs, large amounts of energy and emissions could be saved. These programs have mostly come out of states that are restructuring their electricity markets; however traditional utility markets can successfully operate under EEPS as well. In the targeted areas, this concept of supporting energy efficiency may not be very popular, especially in the Southeast. This may be an area that could be worked on for Federal preemption of energy efficiency standards that all states must meet.

Public Benefits Fund for Energy Efficiency

Public Benefits Funds (PBFs) are an effective mechanism for securing investment in cost-effective energy efficiency technologies. They are also known as system benefits charges, which are small charges on every customer's electricity bill that go into a fund to promote clean energy technologies. PBFs in 17 states and the District of Columbia provide nearly $1 billion annually for energy efficiency programs. The states with PBF programs currently in place are shown in
Figure 8. PBFs have been credited with lowering energy costs for utility customers, limiting future energy price increases, improving the reliability of the grid, and reducing emissions.



Source: ACEEE

Figure 8 States with Public Benefits Funds for Energy Efficiency

The PBF program in New York is a highly successful example of a well designed program. The program is administered by the New York State Energy Research and Development Authority (NYSERDA) and has leveraged $350 million in funds to bring about $1.2 billion in public and private sector energy and efficiency related investments. This program has done an extremely good job at promoting CHP and is a prime model for other states. The targeted regions could use a very similar approach to leverage funds from ratepayer bills to encourage CHP installations. This tactic would be particularly apt for the southern states as the current cost of electricity is so low in these states that a small extra charge on ratepayer bills will raise costs markedly.

Removing Barriers to Interconnection and Permitting

A primary barrier to the installation of CHP projects are the high transaction costs that projects tend to face in the interconnection and permitting processes. In order to get a CHP system permitted and interconnected with the grid, the procedural and technical requirements of the local utility must be met. This often involves a lengthy study and application process to address issues like grid stability and public safety. These procedures can be a barrier to CHP projects because small-scale systems are often subject to the same lengthy interconnection dealings as larger systems, even though their impact is substantially less. When permitting and interconnection procedures are overly expensive in proportion to the size of the project, they can devastate project economics.

Standardized interconnection requirements are a way for states to promote fair treatment of CHP installations, by establishing uniform processes and technical requirements that apply to utilities within the state. The states with standardized interconnection requirements are listed in Table 7. The most beneficial standards are those with no maximum size limit. These standards allow large CHP systems that can contribute the most to carbon dioxide emissions to fall under the standard rules.

Table 7 State Streamlined Interconnection Standards Applicable to CHP

State	Maximum System Size	State	Maximum System Size
California	None	New Hampshire	25 kW
Connecticut	65 MW	New Jersey	2 MW
Delaware	1 MW	New Mexico	10 kW
Hawaii	None	New York	2 MW
Massachusetts	None	Ohio	None
Michigan	None	Texas	10 MW
Minnesota	10 MW	Wisconsin	15 MW
North Carolina	100 kW		

Source: DSIRE

CHP projects in the targeted regions would rise dramatically if the transaction costs associated with permitting and interconnection were not so damaging to project economics. Interconnection standards are a critical complementary policy to many other clean energy programs, since even with added incentives or the other programs listed above, projects can not be installed if they are charged significant amounts of money to interconnect. Therefore, interconnection and permitting standards should be a primary target for lobbying action in the targeted regions.

Conclusion

The policy actions that are recommended in this report as ways to encourage the growth of CHP in the Mid-Atlantic, Eastern Midwest, and Southeast regions of the country are first steps towards promoting more aggressive measures in these states. It is not a coincidence that the areas of the country with the starkest environment for CHP are the regions that use the most coal-fired generation. Coal technologies are entrenched in these regions and they provide very low cost power that is a barrier to installing more efficient CHP systems. Since most state governments are resistant to drastic change, these small steps of leading by example, providing funding and incentives, enacting energy efficiency portfolio standards, charging public benefits funds, and removing barriers are prime candidates for actions to change the environment for CHP. These actions do not all need to be done at once, and some may fit better with particular states than others, however they are an important starting point for enabling CHP to grow in the region. Significant reductions of greenhouse gas emissions can be made by progress in these regions, therefore it is important that pressure be put on these states to start the ball rolling toward greater energy efficiency.

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