Chapter 1. Introduction and Background

Summary

Across the nation, many states and regions have shown strong leadership and innovation in creating and implementing energy efficiency, renewable energy, and combined heat and power (CHP) policies, programs, and measures over the last two decades. The *Energy and Environment Guide to Action* is based on state experience; it documents the best practices for designing and implementing these state policies and demonstrates how the policies have helped states save money, reduce air pollution, enhance economic development, and maintain energy reliability and resiliency. With the *Guide to Action*, states can learn from and build upon each other's successes to achieve their energy efficiency, renewable energy, and CHP policy goals.

The *Guide to Action* explains many state best practice strategies used across the United States, ranging from direct regulations and financial incentives to leading by example. State energy, economic, and environmental policy-makers should specifically use it to:

- Develop a comprehensive state strategy to increase energy efficiency, renewable energy, and CHP tailored to the policy-makers' circumstances and priorities.
- Identify and evaluate energy efficiency, renewable energy, and CHP options they could implement in their states.
- Enhance their existing efforts to achieve a cleaner, more efficient energy system by learning about best practice policies in other states.
- Understand the roles and responsibilities of key decision-makers, such as environmental regulators, state legislatures, public utility commissions (PUCs), and state energy offices.
- Access and apply technical assistance resources, funding, and tools available for state-specific analyses and program implementation.

What Are Energy Efficiency, Renewable Energy, and CHP?

The policies discussed in this document include demand- and supply-side strategies to meet customer demand for energy services in a clean, reliable, and cost-effective manner. The strategies covered in this document generally fall within the following categories:

Energy efficiency refers to technologies and practices that reduce the amount of energy needed to produce products, provide services, or perform various activities. Energy efficiency provides the same or improved level of service while using less overall energy.

Renewable energy comes from sources that replenish themselves over time. Renewable energy definitions vary by state, but usually include solar, wind, geothermal, biomass, biogas, and low-impact hydroelectric power.

CHP, also known as cogeneration, is a clean, efficient approach to generating electric and thermal energy from a single fuel source.

The *Guide to Action* was originally released in 2006. Since then, there has been a lot of momentum by states to implement and learn from policies and programs that support energy efficiency, renewable energy, and CHP. The 2015 release reflects:

- Updated information about state adoption of policies, including drivers and refined best practice approaches for design, implementation, and evaluation.
- New state case studies and examples.
- New resources available to help states design and implement policies.

- New funding instruments, such as green banks, which are now available for energy efficiency, renewable energy, and CHP.
- Utility policies, such as interconnection, net metering, and utility rates, which the original *Guide to Action* described in relation to CHP but now apply to onsite renewable energy, including solar panels.
- Increased state adoption of long-term electricity resource planning and new utility policies to maximize energy efficiency, renewable energy, and CHP as part of electricity delivery infrastructure investments.

The *Guide to Action* focuses on energy associated with electricity, heating and cooling for homes, buildings, and industry. It does not address transportation decisions, although they play an important role in both reducing fossil fuel use and the associated environmental impacts, and can potentially affect electricity demand.[2]

Information for Energy Efficiency, Renewable Energy, and CHP Options

The *Guide to Action* provides the following information for each of the included energy efficiency, renewable energy, and CHP options:

- The objectives and benefits of the policy.
- Examples of states that have implemented the policy.
- Responsibilities of key players at the state level, including typical roles of the main stakeholders.
- Opportunities to coordinate implementation with other federal and state policies, partnerships, and technical assistance resources.
- Best practices for policy design, implementation, and evaluation, including state examples.
- Action steps for states to take when adopting or modifying their clean energy policies, based on established state programs.
- Resources for additional information on individual state policies, legislation and regulations, and analytical tools and methods to quantify emission reductions and estimate energy and cost savings.

Why Should States Encourage Energy Efficiency, Renewable Energy, and CHP?

Many states are leaders in tackling public health, environmental, economic, and related challenges. States have found the benefits of energy efficiency, renewable energy, and CHP offer a cost-effective way to meet these challenges, while also meeting the nation's growing demand for electricity. The benefits include:

- Reduced greenhouse gas (GHG) emissions and other air pollutants.
- Lower customer energy bills.
- Enhanced economic development and job creation.
- Improved reliability and resiliency of the energy system.

A more detailed discussion of state challenges, and ways energy efficiency, renewable energy, and CHP can help address those challenges, follows.

Public Health and Environmental Issues

Fossil fuel-based electricity generation is a major source of GHGs and other air pollutants, which pose serious risks to people's health and the environment. States have found that reducing their reliance on fossil fuel-based electricity generation can lower these emissions and their negative impacts. Specific pollutants that can be reduced include:

[2] Transportation is acknowledged only in the context of electric vehicles. Electric vehicles are mentioned as grid storage options in Chapter 7, "Electric Utility Policies." Section 7.4, "Customer Rates and Data Access," considers electric vehicle rate design.

- *Fine particle pollution ($PM_{2.5}$)* may aggravate respiratory and cardiovascular disease, cause decreased lung function, and make allergies worse. People with heart or lung diseases, children, and older adults are the most likely to be affected by $PM_{2.5}$, but even healthy people may experience temporary symptoms. A growing number of scientific studies suggest that $PM_{2.5}$ exposure may be related to low birth weight and increased infant mortality (EPA 2009).
- *Ground-level ozone* can cause health problems even at relatively low levels. Breathing ozone can trigger chest pain, coughing, throat irritation, shortness of breath, and congestion. It can worsen bronchitis, emphysema, and asthma, and also make people's lungs more susceptible to infection.
- *GHGs* contribute to climate change. Climate change will impact people's health and wellbeing through changes in temperature, extreme weather (i.e., flooding, heat-waves, storms, fires, and droughts), agricultural production, the distribution of infectious diseases, and the seasonal distribution of allergenic pollen species (IPCC 2007). Climate change also poses risks to infrastructure critical to homes, roads, and cities, and the ecosystems that support life.

While some climate change impacts are global in scale, no two states are experiencing climate change in precisely the same way. State governments are well positioned to implement strategic adaptive measures to protect infrastructure, plan for sea-level rise, and increase their resiliency to extreme weather. Many states are already preparing for future climate change impacts with adaptation plans, many of which include energy efficiency and renewable energy recommendations.

Economic Issues

Energy is essential to everyday life. Electricity, heat, and other energy sources are needed to run homes, offices, stores, and industry. Changes in energy bills can therefore have a very real impact on individuals and businesses. For example, on average, households spent $1,945 on heating, cooling, appliances, electronics, and lighting in 2012. Low income households spent an average of 6 percent of their pre-tax income on energy bills in 2012 (EIA 2013). Reducing energy bills can have a significant impact on household expenses, particularly low-income families.

States have found that energy efficiency and CHP can help households and businesses use less energy and lower their bills. Tapping into cost-effective renewable energy expands the available supply of energy, helping utilities meet demand in a cleaner way while keeping utility rates lower. It also brings diversity to the energy supply mix, helping to buffer against large swings in energy prices. Further, states have found that energy efficiency, renewable energy, and CHP also contribute to economic development through job growth. There were more than 566,000 jobs in U.S. energy efficiency and renewable energy sectors in 2010, with job growth rates exceeding 2.5 percent annually from 2003 to 2010 (Muro et al. 2011).

Potential Energy Savings from State Energy Efficiency and Renewable Energy Programs

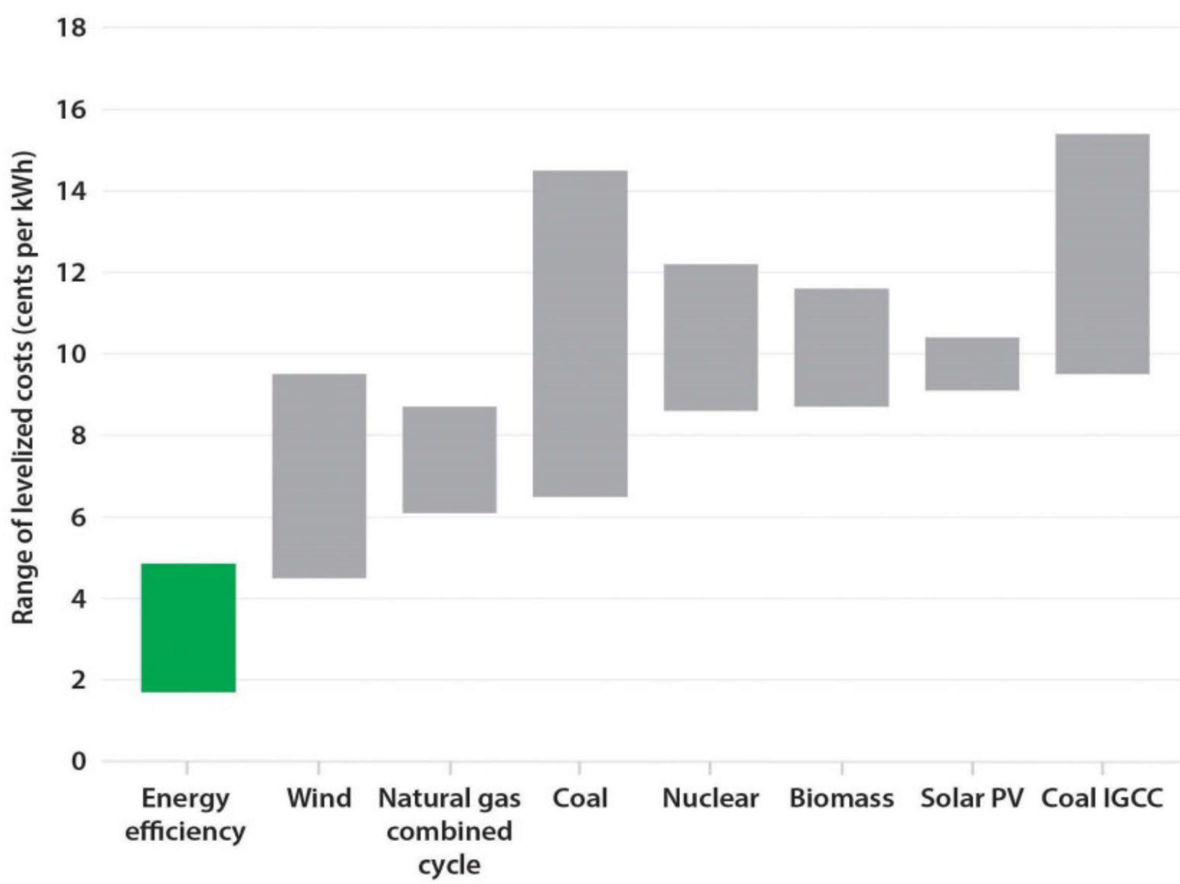
The potential energy savings achievable through energy efficiency are significant. A 2012 American Council for an Energy-Efficient Economy report suggests that more aggressive energy efficiency efforts in the residential, commercial, industrial, and transportation sectors could reduce U.S. energy consumption by up to 60 percent in 2050. These efforts could also add 2 million jobs nationwide (compared with a base case) and save the equivalent of $2,600 per household in annual energy costs (ACEEE 2012).

Meanwhile, a 2012 report by the National Renewable Energy Laboratory estimates that there is the technical potential to generate 481,800 terawatt-hours (TWh) from renewable sources in the United States (NREL 2012), which is higher than total U.S. electricity sales in 2010 (3,754 TWh).

Well-crafted energy policies can help states tap into this impressive savings potential, dramatically reducing energy needs and meeting the remaining need with a much cleaner energy mix.

State policies and programs are successfully expanding the role of energy efficiency, renewable energy, and CHP in the U.S. energy system, and are finding these resources to be cost-competitive with fossil fuel-based generation. Figure 1.1 illustrates the comparative cost of electricity from a range of sources, including energy efficiency and renewable energy, under typical assumptions.

Figure 1.1: Levelized Costs of Electricity Resource Options



IGCC= integrated gasification combined cycle; kWh= kilowatt-hour; PV= photovoltaic

Source: ACEEE 2014d

Energy Infrastructure Issues

States have found that meeting increased demand for energy involves challenges beyond just procuring more energy sources. For example:

- Transmission systems are overburdened in some places. This limits the flow of economical electricity and, in some cases, affects reliability of the electricity delivery.[3] States have found that this can cause reliability problems and high electricity prices in or near areas with congested transmission systems.
- Many existing power plants are aging. Significant retrofits may be needed to ensure older generating units meet current and future emissions regulations.

[3] See Chapter 7, "Electric Utility Policies," for an overview of the electricity grid.

- When new energy supply and delivery infrastructure needs to be built to meet increasing demand, there are many challenges involved in siting new facilities, including community opposition and concerns about the health and environmental impacts of these facilities.
- Energy reliability, resiliency, and security are crucial. Transmission and distribution congestion can limit delivery of electricity when demand for it is high, resulting in brownouts. Furthermore, concerns associated with certain fuel types—such as year-to-year uncertainty about the availability of hydro resources—can be partly eased by investing in more diverse energy sources. Owners of energy generation, transmission, and distribution systems, and all levels of government, are paying more attention to the need to build resilience in the face of extreme weather, ensure energy security, and address emerging risks such as climate change that affect critical energy infrastructure.

Energy efficiency and CHP can help reduce a state's need for new energy infrastructure, saving money and avoiding community concerns about siting fossil-fueled power plants. They also help relieve transmission congestion. When generating electricity close to where it is consumed, renewable energy and CHP help improve the reliability and resilience of the electricity system and contribute toward modernizing the electricity grid. Such onsite electricity generation may also be operated independent of the grid in the event of a disruption to central systems. They can also be targeted to areas that suffer from limited electricity generation, high growth, and/or congested transmission lines (known as load pockets) to reduce grid congestion, potentially deferring or displacing more expensive transmission and distribution infrastructure investments.

State Projections of Energy Savings from Energy Efficiency and Renewable Energy

EPA estimates that state policies promoting energy efficiency could save 57,000 gigawatt-hours during the peak hour by 2018—a savings equivalent to an entire year's total electricity sales in the state of Massachusetts. Maryland and Indiana have the greatest share of these savings, with 11 percent and 10 percent respectively (EPA 2013b).

Energy Efficiency, Renewable Energy, and CHP Can Help States Meet Energy Demand Cleanly and Cost-Effectively

Energy efficiency can make a significant dent in our future energy demand. Study estimates vary, but most show achievable potential on the order of 15 to 20 percent of U.S. electricity demand that could be met through energy efficiency over the next 10 to 15 years (ACEEE 2008, 2014b; Sreedharan 2013).

As an example, since the 1970s, California's energy efficiency programs have helped to save more than $65 billion, lower residential electricity bills to 25 percent below the national average, avoid the need for at least 30 power plants, and prevent climate-warming carbon pollution equivalent to the emissions of 5 million cars annually. The state's planned 2015 energy efficiency programs are estimated to save enough energy in California's homes and businesses to lower energy bills by $200 million after accounting for the cost of the programs, reduce emissions equivalent to more than 100,000 cars, and avoid the need for a medium-sized power plant (NRDC 2014).

Meanwhile, renewable energy costs have decreased significantly in recent years, and in some cases are competitive with traditional fuel sources, greatly expanding our options for cost-effectively meeting our energy needs.

The almost 83 gigawatts of CHP operating in the United States as of late 2013 represent over 8 percent of total U.S. power generation capacity. This CHP avoids more than 1.8 quadrillion British thermal units of fuel consumption annually, along with an estimated 241 million metric tons of carbon dioxide (equivalent to the emissions of over 40 million cars) compared to separate production of heat and power (ICF 2014).

System reliability also benefits from energy efficiency and renewable energy strategies by reducing spikes in energy demand, and decreases the likelihood of or power failures.

Opportunities for State Action

To capture the many benefits of a diverse energy portfolio, many states have implemented policies and programs to increase the use of energy efficiency, renewable energy, and CHP. For example:

- As of 2014, at least 27 states have set some sort of energy efficiency goal.
- By 2015, Twenty-nine states and Washington, D.C., have adopted renewable portfolio standards (RPSs) to increase the amount of wind, solar, biomass, and other renewable resources in their energy portfolios. Notably, 67 percent of all non-hydro renewable energy capacity additions between 1998 and 2012 were in states with existing or impending RPSs. Existing RPS requirements are estimated to achieve a total of 94 gigawatts (GW) of new renewable energy by 2035 (LBNL 2013a). That is roughly equivalent to the current total capacity of all power plants in New York and Illinois combined (EIA 2014b).
- Nineteen states and Washington, D.C., have adopted public benefits funds (PBFs) that support cost-effective energy efficiency, renewable energy, and CHP (C2ES 2014).
- In 2012, approximately 82 GW of CHP were operational in the United States (DOE and EPA 2012), roughly equivalent to the current total capacity of all power plants in Pennsylvania and Michigan combined (EIA 2014b).

Nevertheless, significant opportunities remain for states to reap the benefits of implementing policies and programs that spur greater investment in energy efficiency, renewable energy, and CHP. This section provides an overview of opportunities for state action in each of these areas.

Energy Efficiency

States have shown that well-designed and administered energy efficiency programs can cost-effectively offset a significant portion of expected growth in energy demand. Over the last decade, state energy efficiency programs have contributed to a dramatic flattening of national electricity demand growth (ACEEE 2014e). Furthermore, each dollar invested in electric energy efficiency measures yields $1.24 to $4.00 in total benefits for all customers. These benefits include avoided energy and capacity costs, lower energy costs during peak demand periods like heat waves, avoided costs from building new power lines, and reduced pollution (ACEEE 2014d).

Studies continue to find great potential for achievable energy savings from energy efficiency, on the order of meeting 15 to 20 percent of U.S. electricity demand over the next 10 to 15 years (ACEEE 2008, 2014b; Sreedharan 2013). State- and regional-level studies have also proliferated: a $17 billion investment in best-practice energy efficiency programs in Southwest states was projected to create $37 billion in utility system and other public benefits, and to create up to 28,000 jobs over 10 years (SWEEP 2012). These analyses indicate that there is an abundance of state-level energy efficiency resource potential.

Chapter 2, “Developing a State Strategy,” presents more information about state clean energy potential studies and links to individual state analyses. These studies build on more than a decade of state experience showing that well-designed energy efficiency efforts cost less than traditional sources of generation while offering environmental and economic benefits that continue to accrue year after year. State energy efficiency programs are saving energy at a levelized life-cycle cost of less than $0.03/kilowatt-hour (kWh) saved, which has stayed relatively constant for more than a decade, and is an increasingly small fraction of the typical cost of new power sources and of the average retail price of electricity (ACEEE 2004, 2014c; EIA 2005).

Approximately $4.8 billion was spent in 2010 on state electric and gas energy efficiency programs (LBNL 2013c). This funding is provided both through state PBF programs and through programs planned and funded by utilities. These programs are reducing electricity sales by more than 1 percent per year in leading states with comprehensive energy efficiency programs (ACEEE 2014c).

Many studies have found that more energy efficiency potential exists, which could be captured through expanding energy efficiency programs.[4] Across the 50 states, 2013 spending on energy efficiency programs as a percentage of utility revenues averaged 1.09 percent (ACEEE 2014c). This was up from 0.5 percent in 2003 (ACEEE 2005). The top 10 states (shown in Table 1.1) are spending between 2.83 and 8.55 percent of utility revenues on energy efficiency (ACEEE 2014c).

Table 1.1: 2013 Energy Efficiency Spending as Percentage of Utility Revenues

Top 10 States	Spending as a Percent of Annual Total Revenues
Rhode Island	8.55
Massachusetts	6.42
Vermont	5.32
Washington	4.60
Oregon	4.32
New Jersey	3.88
Connecticut	3.28
California	3.18
Maryland	2.85
Iowa	2.83
U.S. Average	1.09

Source: ACEEE 2014c

Renewable Energy

Renewable energy comes from sources that replenish themselves over time. Definitions of renewable energy vary by state but usually include wind, solar, biomass, and geothermal energy; some states also include low-impact or small hydro, biogas, waste-to-energy, and CHP.

Use of renewable energy technologies continues to grow rapidly in the United States. Total non-hydro renewable capacity was around 13,000 megawatts (MW) in 1998. In 2012, total installed capacity was over five times higher with 80,000 MW of non-hydro renewable capacity (LBNL 2013b). This was more than the total electric generation capacity of Florida and Washington, D.C., combined (EIA 2014b). In particular, there has been substantial growth in the wind and photovoltaic (PV) markets in the past decade.

The market for renewable technologies is growing for several reasons. First, the cost of renewable energy technologies has fallen significantly over time. The average production cost of wind has ranged between $0.05 and $0.09 per kWh since 1996, falling from over $0.55/kWh in 1980 (NREL 2013). Solar prices have also fallen dramatically over a short period of time; average costs per watt have decreased from over $9.00/watt in 2000 to $4.50/watt in 2013 (NREL 2013).

While many state policies have propelled the development of renewable energy, there are several that have been particularly important. Mandatory RPSs in 29 states and Washington, D.C., are important motivators of utility renewable energy installations. About two-thirds of all installations since 1998 are in states with a mandatory RPS (LBNL 2013b); by 2025, RPS targets will account for just under 10 percent of U.S. retail electric sales (EIA 2014a). Many state incentives are also encouraging onsite renewable energy installations, primarily solar PV. As of March 2015, 20 states have at least one state tax credit or rebate for solar installations (DSIRE 2015a), and 44 states (as well as Washington, D.C., and four territories) have rules or provisions for net

[4] See McKinsey (2009) and discussion of additional state potential studies in Chapter 2 of the *Guide to Action*.

metering, which allows owners of solar installations to receive credit for electricity generated on site that is exported to the utility grid (DSIRE 2015b). In effect, the customer can bank exported generation to offset future electricity use that the customer would otherwise have to purchase at the utility's full retail rate.

Combined Heat and Power

CHP, also known as cogeneration, is the simultaneous generation of electric and thermal energy from a single fuel source. Instead of purchasing electricity from the distribution grid and also burning fuel in an onsite furnace or boiler to produce thermal energy, an industrial or commercial facility can use CHP to provide both energy services in one energy-efficient step (DOE and EPA 2012). CHP is not a specific technology, but an efficient application of technologies to meet an energy user's needs.

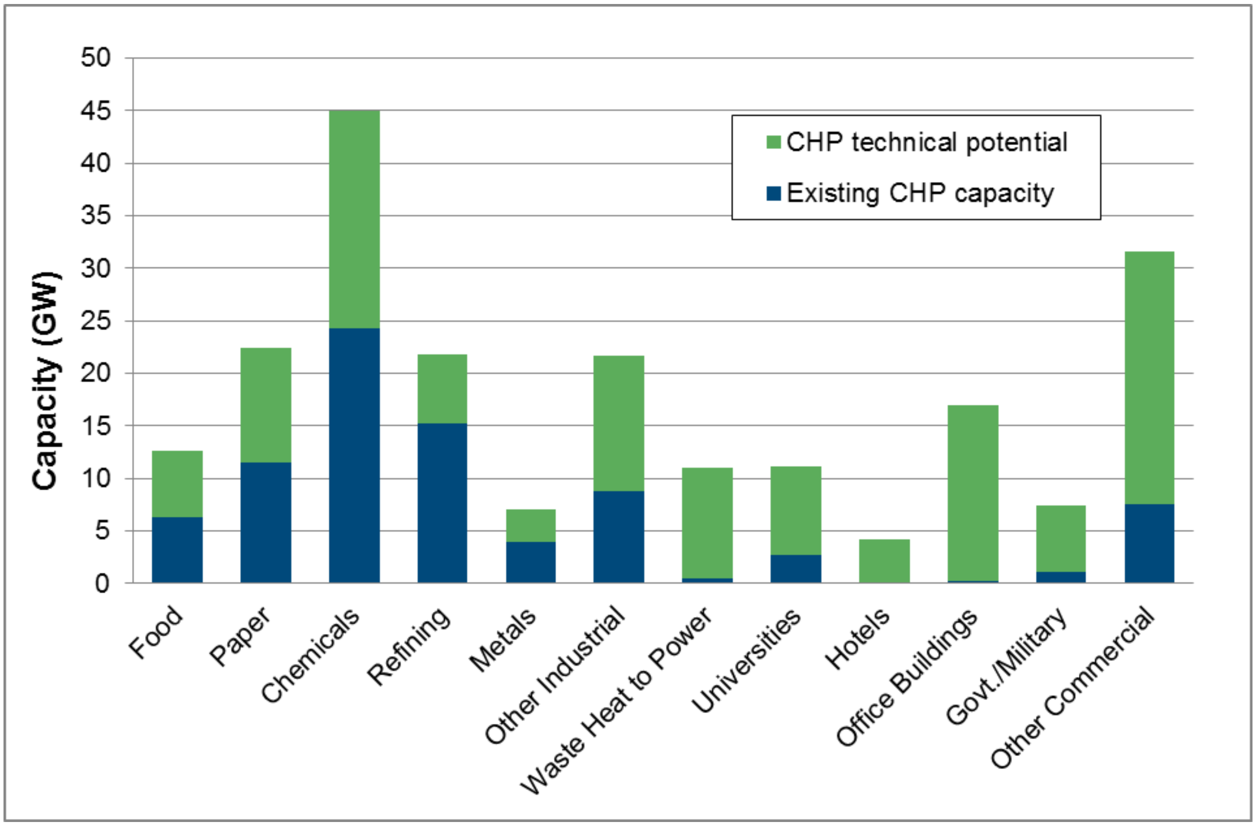
Typically, close to two-thirds of the energy in a conventional power plant is lost when the waste heat is not recovered. CHP captures and uses the waste heat to meet the thermal needs (e.g., process heat, space heating, cooling hot water) of commercial and industrial facilities. A CHP system is substantially more efficient than purchasing electricity from the grid and meeting thermal needs with a boiler or process heater. Typical CHP system fuel use efficiencies range between 65 and 75 percent, and can reach as high as 80 percent, a significant improvement over the average efficiency of separate heat and power (ACEEE 2014a; DOE and EPA 2012). This improvement in efficiency is an effective pollution prevention strategy that reduces air pollution as well as fuel costs.

As of the end of 2013, approximately 82.7 GW of CHP were operational in the United States at over 4,300 industrial and commercial facilities, up from less than 10 GW in 1980 (ICF 2013). This represents over 8 percent of total U.S. power generation capacity. It avoids more than 1.8 quadrillion British thermal units (Btus) of fuel consumption annually and an estimated 241 million metric tons of carbon dioxide (equivalent to the emissions of over 40 million cars) compared to separate production of heat and power (ICF 2014). In addition, CHP can lower energy costs by displacing higher priced electricity and boiler fuel with lower cost, self-generated power and recovered thermal energy (DOE and EPA 2012). Until recently, most CHP capacity (86 percent) has been located at industrial manufacturing facilities. Since 2010, there has been noteworthy growth in the commercial and institutional CHP markets – rising from 14 percent of historic installed capacity to 38 percent of new installed capacity between 2010 and 2013 (ICF 2014).

There is potential to add more CHP to a variety of applications, including district energy at universities and downtown areas, large-scale CHP in many industry sectors (e.g., chemicals, paper, and food manufacturing), and in commercial buildings such as hotels and casinos. ICF International estimates that there is approximately 130 GW of technical potential[5] for CHP systems to serve existing onsite electric loads at facilities conducive to CHP. Estimated CHP technical potential by sector is shown in Figure 1.2.

[5] Technical potential represents the amount of capacity that could serve the electric and thermal needs of target sites and does not consider economic factors or other issues impacting the likelihood of CHP system investments.

Figure 1.2: Existing CHP vs. Estimated Technical Potential



Source: ICF 2013

The *Guide to Action*: An Overview

The *Guide to Action* is intended for state energy, economic, and environmental policy-makers, and is based on state-level experience and policy innovation. State staff can use the *Guide to Action* to learn about proven energy efficiency, renewable energy, and CHP policies and best practices in other states so they can:

- Identify and evaluate energy efficiency, renewable energy, and CHP options they could apply in their states.
- Explore best practices, key features, and examples of effective implementation.
- Understand the roles and responsibilities of key decision-makers, such as environmental regulators, state legislatures, PUCs, and state energy offices.
- Access and apply technical assistance resources, models, and tools available for state-specific analyses and program implementation.

Using the *Guide to Action*

Many states have significant experience with the policies included in the *Guide to Action*. Some of these policies represent different paths to a goal or can be used in combination to achieve a goal. States can select the appropriate combination of policies to achieve their goals. For example, Kentucky's 2011 Climate Action Plan includes 46 specific recommendations (including actions to promote cost-effective GHG emissions reduction through greater use of energy efficiency, renewable energy, CHP, improving transmission efficiency, and other activities).

Policy-makers can use the *Guide to Action* to develop a state strategy that will help them meet their state energy and environmental goals. Chapter 2 describes the process for creating a state strategy.

Policy-makers can review Table 1.2 to see a list of energy policies and programs that have been successful in other states. More details on each of these policies are provided throughout the rest of the *Guide to Action*.

- Learn from each other as they develop or enhance their own energy efficiency, renewable energy, and CHP programs and policies.

The *Guide to Action* is organized in the following chapters:

Chapter 2: "Developing a State Strategy." This chapter describes a series of steps states have taken to successfully develop programs or strategies that provide clean, low-cost, reliable energy while achieving state energy, environmental, and/or economic goals.

Chapter 3: "Funding and Financial Incentive Policies." This chapter demonstrates how states are using targeted funding and incentive programs to increase investment in energy efficiency, renewable energy, and CHP technologies and services by residents, industries, and businesses.

Chapter 4: "Energy Efficiency Policies." This chapter describes how states are promoting improvements in energy efficiency through the use of programs, standards, and codes.

Chapter 5: "Renewable Portfolio Standards." This chapter offers a range of strategies and approaches that states are using to increase the use of renewable energy.

Chapter 6: "Policy Considerations for Combined Heat and Power." This chapter describes state policy options to capture CHP's environmental, energy, economic, and reliability benefits, either by providing CHP-specific incentives or incentivizing CHP with other similar technologies or fuel types.

Chapter 7: "Electric Utility Policies." This chapter offers details on many strategies that states can use to further promote energy efficiency, renewable energy, and CHP. These strategies include electricity planning and resource procurement, utility incentives, interconnection and net metering standards, customer rates and data access, and maximizing grid investments to increase transmission and distribution system efficiency and support renewable integration.

Table 1.2 presents a summary and additional details about energy efficiency, renewable energy, and CHP strategies. It includes specific approaches states can use to implement each policy, key design issues and resources, and state examples of each policy. (Note that many other states have also implemented these policies; for more information, see the individual policy chapters in the *Guide to Action*.)

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Chapter 3: Funding and Financial Incentive Policies				
Funding and financing programs, as well as direct financial incentives that enable residents and businesses to increase energy efficiency, renewable energy, and CHP.	o Direct cash incentives (grants, rebates, performance-based incentives). o Tax incentives. o Loans and financing programs. o Green banking.	o Select specific target markets and technologies based on technical and economic analyses of clean energy markets and technologies. o Create conditions for long-term market stability and growth—i.e., be predictable and stable. o Eligibility clearly defined. o Used in conjunction with complementary policies, in support of broader goals. o Track outcomes and costs to allow for program evaluation.	AK, CA, CO, CT, HI, MI, NC, NJ, NY, TX, WA	o Description and key considerations of various options for providing funding and financial incentives. o Discussion of barriers addressed by each type of program. o Examples of how other states have implemented policies.
Chapter 4. Energy Efficiency Policies				
Section 4.1: Energy Efficiency Resource Standards				
EERSs encourage or require that energy suppliers in their state meet a certain percentage of their demand forecast through energy efficiency measures.	o EERSs can be mandatory or voluntary. o Utilities often have flexibility in how they meet their EERS targets.	o Determine which entities would be subject to the EERS. o EERS target can either be a percentage of load (or load growth) or a fixed number of energy units. When setting the target, conduct analysis to determine realistic potential for energy efficiency, as well as the benefits of different energy efficiency levels. o Consider timing and duration of the EERS. States have found that energy efficiency benefits are usually realized over the course of many years. o Need to consider the interaction with federal and state policies. Complementary policies can help achieve the EERS targets.	AR, AZ, CA, IL, VT	o Information about state experiences. o Information about measurement and verification. Examples of legislation and PUC rulemakings.

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Section 4.2: Energy Efficiency Programs				
Energy efficiency programs can contribute to EERSs, help reduce demand, or achieve other state goals.	o Program specifics can vary widely, but funding might be used to provide rebates for energy-efficient appliances, encourage building retrofits, or provide upstream incentives to increase availability of energy efficiency technologies in the market.	o Determine who will administer energy efficiency programs. o States have found that it is usually beneficial to establish a portfolio of programs, and any single program may not be sufficient to meet goals.	MA, MO, MS, VT	o Discussion about identifying key players and establishing funding sources. o Information about evaluating the cost-effectiveness of programs. o Overview of program evaluation, measurement, and verification.
Section 4.3: Building Codes for Energy Efficiency				
Building energy codes establish minimum energy efficiency requirements for residential and commercial buildings, thereby setting a minimum level of energy efficiency.	o Minimum energy efficiency requirements for residential and commercial buildings. o Periodic review and updates to existing codes. o Code implementation, compliance, and evaluation assistance.	o Develop effective program implementation, compliance, and evaluation approaches. o Work collaboratively with builders, developers, and building owners to ensure compliance. o Establish requirements and process for periodically reviewing and updating codes to reflect changes in building technology and design. o Promote “beyond code” building programs to achieve additional cost-effective energy efficiency.	AZ, CA, IL, MA, TX	o Information about individual state codes. o Best practices for energy code implementation.

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Section 4.4: State Appliance Efficiency Standards				
State appliance efficiency standards set minimum energy efficiency standards for equipment and appliances not covered by federal efficiency standards.	o Minimum energy efficiency levels for consumer products and commercial equipment. o Periodic evaluation and review of standards, markets, and product applications.	o Identify products not covered by federal law that have potential for notable efficiency improvements. o Use established test methods to set efficiency levels for the state appliance standards. o Consider implementation issues, including product certification, labeling requirements, and enforcement.	CA, CT, OR	o General and state-specific information about standards. o Information on products covered under some state standards. o Examples of enabling legislation and state rulemakings.
Section 4.5: Lead by Example				
Lead by example programs support a range of activities designed to lower energy costs within state operations, buildings, and fleets, and to demonstrate the feasibility and benefits of energy efficiency, renewable energy, and CHP to the larger market.	o Energy savings targets for public buildings. o Energy efficiency and renewable energy purchase commitments for state facilities.	o Collaborate across public agencies, local governments, schools, and private sector and nonprofit organizations. o Measure, verify, and communicate energy savings.	CA, NH, TX	o Information on program evaluation. o Description of how state lead by example efforts interact with federal programs.
Chapter 5: Renewable Portfolio Standards				
RPSs establish requirements for electric utilities and other retail electric providers to serve a specified percentage or amount of customer load with eligible renewable sources.	o Promoting specified technologies through technology tiers and credit multipliers. o Allowing alternative compliance payments. o Allowing trading of renewable energy certificates.	o Develop broad support for an RPS, including top-level offices of the state government, by performing studies that analyze job creation, economic development, and customer bill impacts. o Specify which renewable energy technologies will be eligible. o Allow utility cost recovery, establish cost caps, and consider flexible compliance mechanisms.	CA, MA, NJ, RI, WI	o Example state RPS requirements and eligible technologies. o Information on program design, including compliance mechanisms.

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Chapter 6: Policy Considerations for Combined Heat and Power				
CHP, also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source with commercially proven technology.	o Bond o Commercial PACE o Feed-in tariff o Grant o Interconnection standard o Loan o Net metering o Portfolio standard o Production incentive o Public benefits fund o Rebate o State climate change plan o State energy plan o State utility rate policy o Tax o Utility rate	o Assess local CHP potential. o Review and select approaches for project development. o Enter maintenance contracts. o Involve local planning departments. o Sell excess energy.	IA, KY, NY, RI	o Discussion of various policy options for encouraging CHP.

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Chapter 7: Electric Utility Policies				
Section 7.1: Electricity Resource Planning and Procurement				
Longer term planning and procurement decisions related to electricity provide opportunities to incorporate energy efficiency, renewable energy, and CHP.	o Integrated resource planning. o Certificate of Public Convenience and Necessity. o Planning for electricity supply in states with restructured electricity markets.	o Develop a load forecast, including both peak demand and energy. o Address existing and anticipated environmental regulations. o Consider both supply options and demand-side resources. o Electricity system plans require some form of electricity system modeling.	CT, GA, NJ, NV, OR	o Description and key considerations of the main types of state electricity resource planning. o Policy options for fully integrating energy efficiency, renewable energy, and CHP in planning. o Descriptions of how states incorporate energy efficiency, renewable energy, and CHP in planning.
Section 7.2: Policies That Sustain Utility Financial Health				
Financial incentive structures help align utility profit goals with the delivery of cost-effective demand-side resources such as energy efficiency, distributed renewable energy, and CHP.	o Decoupling o Lost revenue adjustment mechanisms o Alternate rate structure	o How to compensate utilities for energy efficiency programs so they are incentivized to maximize energy saved and, in turn, sell less electricity. o Designing shareholder incentives to include features related to performance, energy efficiency, and renewable energy.	AZ, CA, NV, NY	o Explanation of how rates can be structured to incentivize energy efficiency, distributed renewable energy, and CHP. o Discussion of how to align shareholder incentives with state energy and environmental goals.

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Section 7.3: Interconnection and Net Metering Standards				
Standard interconnection rules establish processes and technical requirements that reduce uncertainty and delays when projects seek grid connection.	o Standard interconnection rules for onsite generation systems through defined application processes and technical requirements. o Net metering, which defines application processes and technical requirements, typically for smaller projects.	o Develop standards that cover the scope of the desired onsite generation technologies, generator types, sizes, and distribution system types. o Address all components of the interconnection process, including issues related to the application process and technical requirements. o Create a streamlined process for generators that are certified compliant with technical standards. o Consider adopting portions of national models and successful programs in other states.	MA, OR, UT	o State-by-state assessment and references. o Information on federal and other resources. o National standards organizations. o Examples of standard interconnection rules.
Section 7.4: Customer Rates and Data Access				
The design of customer rates can incentivize adoption of energy efficiency, renewable energy, and CHP. Providing customers, utilities, and others access to energy data can also incentivize adoption.	o Energy consumption rates o Flat rates o Inclining block rates o Time-varying rates o Demand charges o Data access o Technology-targeted rates o Standby rates o Exit fees o Net metering o Buyback rates o Electric vehicle rates	o Determine whether it is voluntary or mandatory for customers to move to the new rate structure, which provides greater incentives for energy efficiency. o Determine how and with whom customer data may be shared. o Determine how to fairly compensate customers for investments in distributed renewable energy. o Monitor utility implementation.	CA, CT, GA, HI, IL, NY	o Overview of the different rate structures. o Information on different users for energy data.

Table 1.2: Summary of Policies Covered in This Document

Policy Description	Specific Approaches	State Policy Considerations	State Examples in the *Guide to Action*	Key Resources in the *Guide to Action*
Section 7.5: Maximizing Grid Investments to Achieve Energy Efficiency and Improve Renewable Energy Integration				
Electricity grid technologies can be deployed to achieve energy efficiency and improve renewable energy integration.	o Improved voltage and reactive power management. o Strategic use of customer data. o Renewable energy integration opportunities. o Complementary role of demand response and storage.	o Environmental considerations are an important factor in grid modernization efforts. o Gaining operational experience through pilot initiatives helps inform the business case. o Broad deployment may require stakeholder input and state review to ensure utility actions maximize energy efficiency and renewable energy.	CA, IN, MA, MD, Pacific Northwest	o Detailed discussion on how to reduce line losses from electricity distribution systems. o Policy options for grid modernization investments support end-use energy efficiency. o Technology and policy options to support the integration of renewable energy, including storage.

The policies discussed in the *Guide to Action* are relevant to a wide range of energy efficiency, renewable energy, and CHP technologies. Some states may be interested in advancing a particular technology or end-use. Table 1.3 provides examples of energy technologies organized by specific demand- and supply-side options. It also lists references to relevant chapters that states can explore for additional information.

Table 1.3: Sample of Energy Technologies Covered in the *Guide to Action*

Energy Technology	Demand Side Options			Supply Side and Electricity Delivery Options	Relevant Chapter
	Residential	Commercial	Industrial		
Energy Efficiency					
Heating, ventilating, and air conditioning equipment (inclusive of heat pumps)	✓	✓	✓		3, 4.1, 4.2, 7.1, 7.2, 7.4, 7.5
Lighting	✓	✓	✓		3, 4.1, 4.2, 4.3, 4.5, 7.1, 7.2, 7.4, 7.5
Plug loads (appliances and electronics)	✓	✓	✓		3, 4.1, 4.2, 4.4, 4.5, 7.1, 7.2, 7.4, 7.5
Water heating	✓	✓	✓		3, 4.1, 4.2, 4.5, 7.1, 7.2, 7.4
Windows/skylights/doors	✓	✓	✓		3, 4.1, 4.2, 4.5, 7.1, 7.2, 7.4
Insulation/building envelope improvements	✓	✓	✓		3, 4.1, 4.2, 4.3, 7.1, 7.2, 7.4
Whole-house energy efficiency	✓				3, 4.1, 4.2, 4.3, 4.4, 7.1, 7.2, 7.4
Whole-commercial building energy efficiency		✓			3, 4.1, 4.2, 4.3, 4.4, 7.1, 7.2, 7.4
Whole-industrial facility energy efficiency (inclusive of agriculture)			✓		3, 4.1, 4.2, 4.4, 7.1, 7.2, 7.4
Building energy management systems	✓	✓	✓		4.1, 4.2, 4.5, 7.1, 7.2, 7.4, 7.5
Occupant behavior	✓	✓	✓		4.1, 4.2, 4.5, 7.1, 7.2, 7.4, 7.5
Distribution system efficiency (conservation voltage reduction)				✓	4.1, 4.2, 7.1, 7.2, 7.5
CHP					
CHP	✓	✓	✓	✓	3, 4.1, 5, 6, 7.1, 7.2, 7.4
Waste energy recovery			✓	✓	3, 4.1, 5, 6, 7.4

Table 1.3: Sample of Energy Technologies Covered in the *Guide to Action*

Energy Technology	Demand Side Options			Supply Side and Electricity Delivery Options	Relevant Chapter
	Residential	Commercial	Industrial		
Renewable Energy					
Wind turbines				✓	3, 5, 7.5
Distributed solar (including community solar)	✓	✓	✓	✓	3, 5, 7.3, 7.4, 7.5
Concentrated solar (utility scale)				✓	3, 5, 7.5
Geothermal				✓	3, 5, 7.5
Biomass and biomethane (includes landfill gas and biofuels)				✓	3, 5, 7.3, 7.4, 7.5
Waste to energy (inclusive of municipal solid waste)				✓	3, 5, 7.3, 7.4, 7.5
Clean onsite generation	✓	✓	✓	✓	3, 5, 7.1, 7.2, 7.3, 7.4, 7.5
Anaerobic digestion				✓	3, 5, 7.4, 7.5
District energy				✓	3, 5
Other Clean Technologies					
Distributed solar	✓	✓	✓	✓	3, 5, 7.1, 7.2, 7.3, 7.4
Thermal energy				✓	5, 7.1
Storage				✓	5, 7.1, 7.4, 7.5
Demand response	✓	✓	✓		4.2, 7.1, 7.2, 7.4, 7.5
Fuel cells				✓	5, 7.1, 7.3
Microgrids				✓	5, 7.1, 7.3, 7.4, 7.5
Electric vehicles	✓				7.1, 7.4, 7.5
Advanced metering infrastructure				✓	7.5

The policies discussed in the *Guide to Action* often complement or relate to one another and may be touched on to some extent in multiple chapters, beyond just the primary chapter devoted to it. States can use Table 1.4 to identify relationships between policies and determine additional chapters where a policy is mentioned, so that they can acquire a full understanding of how the policies can interact and maximize the impact of their efforts.

Table 1.4: Crosswalk of *Guide to Action* State Policies

Policies	Chapter 3: Funding/Financial Incentives	Chapter 4: Energy Efficiency					Chapter 5: Renewable Energy	Chapter 6: CHP	Chapter 7: Utility Level Planning				
	Funding/Financial Incentives	EERS	Energy Efficiency Programs	Building Codes	Appliance Standards	Lead by Example	RPS	CHP	Electricity Resource Planning and Procurement	Policies that Sustain Utility Financial Health	Interconnection and Net Metering Standards	Customer Rates and Data Access	Grid Investments
Funding/financial incentives	★	●	●				●	●	●	●	●	●	●
EERS	●	★	●				●	●	●	●	●	●	●
Energy efficiency programs	●	●	★	●	●	●	●	●	●	●		●	●
Building codes			●	★					●				
Appliance standards			●		★				●				
Lead by example			●			★		●	●				
RPS	●	●	●			●	★	●	●		●	●	●
CHP	●	●	●				●	★	●		●	●	
Electricity resource planning and procurement	●	●	●	●	●	●	●	●	★	●	●	●	●
Policies that Sustain Utility Financial Health	●	●	●						●	★	●	●	●
Interconnection and net metering standards	●	●					●	●	●	●	★	●	●
Customer rates and data access	●	●	●				●	●	●	●	●	★	●
Grid investments	●	●	●				●		●	●	●	●	★

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