Brief Descriptions of State Climate Actions: Energy Supply

(Note: This is a listing of Energy Supply (ES) policy options considered by numerous states as part of their climate change planning process with the Center for Climate Strategies (CCS). In a CCS-facilitated planning process, Technical Work Group (TWG) members provide input to modify these policies and add new ideas to craft a unique program for their state. CCS works with states to incorporate their own recent actions or existing programs related these topics.)

ES-1 EMISSIONS POLICIES AND OVERARCHING ITEMS

1.1 GHG Cap-and-Trade

A cap-and-trade system is a market mechanism by which greenhouse gas (GHG) emissions are limited or capped at a specified level, and those participating in the system are required to hold permits for each unit of emissions. Through trading, participants with lower costs of compliance can choose to over-comply and sell their additional reductions to participants for whom compliance costs are higher. In this fashion, overall costs of compliance are lower than they would otherwise be.

The initial allocation of the allowances is a crucial policy decision. They can be auctioned (with the proceeds used to benefit consumers who will pay higher costs) or allocated to existing sources, or some combination of the two. Participants can range from a small group within a single sector to the entire economy. As with carbon taxes, the compliance obligation can be imposed upstream (at the fuel extraction or import level) or downstream at points of fuel consumption.

The following are among the important considerations with respect to a cap-and-trade program: the sources and sectors to which it would apply, the level and timing of the cap, how allowances would be distributed (e.g., whether load-based or generation-based, how new market entrants are accommodated, how leakage is addressed), and what if any offsets would be allowed. Among other issues to be considered are which GHGs are covered, whether there is linkage to other trading programs, banking and borrowing, early reduction credit, what if any incentive opportunities may be included, use of any revenue accrued from permit auctions, and provisions for encouraging energy efficiency.

The principal example of a GHG cap-and-trade system in the United States today is the Northeast States Regional Greenhouse Gas Initiative (http://www.rggi.org/).

1.2 Carbon (GHG) Tax

A GHG tax would be a tax on each ton of carbon dioxide (CO_2) equivalent emitted from certain sources. The tax could be imposed upstream on the basis of the carbon content of fuels (e.g., fossil fuel suppliers) or at the point of combustion and emission. Although taxed entities would pass some or all of the cost on to consumers, there would be competitive pressure to find cost-effective ways to lower (or offset) emissions. Consumers who see the implicit cost of GHG emissions in products and services could adjust their behavior to lower emissions and reduce cost. The program can be designed to be "revenue neutral" (not a net tax increase) by offsetting with an income tax reduction, can fund programs to assist with reducing GHG emissions, or can be directed to specific industries to aid their competitiveness, or assisting communities affected by the tax.

1.3 Generation Performance Standards and/or Mitigation Requirements for Electricity

A generation performance standard (GPS) is a mandate that requires load-serving entities (LSEs) to acquire electricity or power plant developers to build and operate new generation with a per-unit emission rate below a specified mandatory standard. In some cases, GHG offsets or credits can be used to mitigate emissions and achieve compliance. A market-based variation of a GPS would allow generators with emission rates lower than the GPS to sell their extra credits to generators with emission rates higher than the standard.

1.4 Integrated Resource Planning

Integrated resource planning (IRP) is a planning process that strives to meet needs for electricity services in a manner that satisfies multiple objectives, such as least cost, meeting emissions standards, fuel diversity, and renewable portfolio standard (RPS) requirements. An IRP process should include evaluation of all options, from both the supply and demand sides, in a fair and consistent manner, building in flexibility to account for future uncertainties. While originally targeted primarily toward cost minimization, IRP processes have increasingly considered the environmental risks and the potential costs associated with future regulation of GHGs.

1.5 Voluntary GHG Commitments

Numerous U.S. companies and organizations, including many utilities, have made voluntary GHG reduction commitments. Some of these are organized through the U.S. Environmental Protection Agency's (EPA's) Climate Leaders program. These commitments can be based on total GHG emissions in a given year or can be defined on an intensity basis (metric tons of carbon dioxide equivalent [tCO_2e] per megawatt-hour [MWh] generated or delivered). Some entities with voluntary commitments also transact through the Chicago Climate Exchange (CCX), a self-regulating pilot program for reducing and trading GHG emissions in North America.

1.6 Technology Research & Development

Research and Development (R&D) funding can be targeted toward a particular technology or group of technologies as part of a state initiative to build an industry around that technology in the state or to set the stage for adoption of the technology for use in the state. For example, an agency can be established with a mission to help develop and deploy energy storage technologies. R&D funding can also be made available to any renewable or other advanced technology through an open bidding procedure (i.e., driven by bids received rather than by a focused strategy to develop a particular technology). Funding can also be given for demonstration projects to help commercialize technologies that have already been developed but which are not yet in widespread use. Finally, funding could be targeted to increase collaboration among existing institutions in the state for R&D.

ES-2 RENEWABLE ENERGY AND ENERGY EFFICIENCY

2.1 Renewable and/or Environmental Portfolio Standard (RPS/EPS)

A renewable portfolio standard (RPS) is a requirement that utilities must supply a certain, generally fixed percentage of electricity from eligible renewable energy sources. An environmental portfolio standard (EPS) expands that notion to include energy efficiency or other GHG emissions-reducing technologies as an eligible resource. About 20 states currently have an RPS in place, while a handful have implemented an EPS. In some cases, utilities can also meet their portfolio requirements by purchasing Renewable Energy Certificates (RECs) from eligible renewable energy projects.

2.2 Grid-Based Renewable Energy Incentives and/or Barrier Removal

This policy option reflects financial incentives to encourage investment in renewable energy resources. Examples include (1) direct subsidies for purchasing or selling renewable technologies; (2) tax credits or exemptions for purchasing renewable technologies; (3) feed-in tariffs, which provide direct payments to renewable generators for each kilowatt-hour (kWh) of electricity generated from a qualifying renewable facility; (4) tax credits for each kWh generated from a qualifying renewable facility; and (5) regulatory policies that provide incentives or assurance of cost recovery for utilities that invest in central station renewable energy systems. In addition, this policy option would make it a priority for the Legislature, the Public Service Commission, and other relevant state agencies to identify and rectify barriers that are impeding the development of renewable resources in the state.

2.3 Distributed Renewable Energy Incentives and/or Barrier Removal

This option is analogous to option 2.2 but focuses on providing incentives for and removing barriers to distributed renewable resources throughout the state.

2.4 Green Power Purchases and Marketing

Green power refers to electricity produced by environmentally benign sources such as wind, solar, biomass, tidal, and hydroelectric generating resources. These programs allow consumers to purchase "green tags" along with their electricity ensuring that a quantity of electricity equal to their purchase contributed to the development and support of renewable resources. Generally voluntary, these programs can be implemented on a statewide or regional basis.

2.5 Combined Heat and Power Standards, Incentives, and/or Barrier Removal

Combined heat and power (CHP) can reduce GHG emissions by increasing the overall efficiency of fuel use. However, there are numerous barriers to CHP, including inadequate information, institutional barriers, high transaction costs because of small projects, high financing costs because of lender unfamiliarity and perceived risk, "split incentives" between building owners and tenants, and utility-related policies like interconnection requirement, high standby rates, and exit fees. The lack of standard offer or long-term contracts, payment at avoided cost levels, and lack of recognition for emissions reduction value provided also create obstacles. Barriers could be removed by:

- Improving interconnections,
- Reducing rates and fees,
- Streamlining the permitting process,
- Recognizing the value of emission reductions provided by CHP and clean distributed generation (DG),
- Making financing packages and bonding programs more readily available,
- Creating policies that encourage reduced rates for power procurement, and
- Providing better education and outreach programs.]

Financial incentives for CHP could include:

- Direct subsidies given to the buyer or seller for purchasing or selling CHP systems;
- Tax credits or exemptions given to the buyer or seller for purchasing or selling CHP systems;
- Tax credits or exemptions for operating CHP systems;
- Feed-in tariff, which is a direct payment to CHP owners for each kWh of electricity or British thermal unit (Btu) of heat generated from a qualifying CHP system; and
- Tax credits for each kWh or BTU generated from a qualifying CHP system.

2.6 Pricing Strategies To Promote Renewable Energy and/or CHP (e.g., Net Metering)

Pricing and metering strategies can provide price signals and revenue streams to support investment in and optimal operation of CHP and renewable energy systems. Net metering is a policy that allows owners of grid-connected DG (generating units on the customer side of the meter, often limited to some maximum kW level) that generate excess electricity to sell it back to the grid, effectively "turning the meter backward."

Net metering provides several incentives for renewable DG by reducing transaction costs (e.g., no need to negotiate contracts for the sale of electricity back to the utility) and increasing revenue by setting compensation at retail electricity rates rather than at utility avoided costs.

In addition to net metering, pricing strategies of relevance to CHP and distributed renewable energy systems can include "time-of-use" rates—fixed rates for different times of the day and/or for different seasons that reflect the time-varying value of electricity.

2.7 Renewable Energy Development Issues (e.g., Zoning or Siting)

Policies can be developed to help overcome barriers for renewable energy development. Institutional and market barriers include price distortions, failure of the market to value the public benefits of renewables and the social cost of fossil fuel technologies, inadequate information, institutional barriers to grid interconnection, high transaction costs because of small projects, and high financing costs because of lender unfamiliarity and perceived risk. These can be overcome through a suite of financial and regulatory redresses as well as through information and public education campaigns.

Financial obstacles can be addressed through property tax exemptions, exclusions, and credits; personal income tax credits or deductions to cover the expense of purchasing and installing renewable energy equipment; loan programs to aid in financing the purchase of renewable energy equipment; and grant programs designed for R&D or to help a project achieve commercialization.

Regulatory policies can include solar or wind easements of access rights, development guidelines at the local level to enhance renewable energy generation (e.g., requiring proper street orientation), and requirements that utilities provide information and utility leasing programs for renewable energy production to customers in remote regions.

2.8 Technology-Focused Initiatives (e.g., Biomass Co-Firing, Energy Storage, and Fuel Cells)

States can undertake initiatives that focus on developing, promoting, and implementing one or more specific technologies that have the potential to reduce GHG emissions. Technologies could include hydrogen production and fuel cells for electricity storage, compressed air energy storage systems (to enable greater penetration of intermittent renewable technologies such as wind), or biomass co-firing. Biomass co-firing can be a low-cost, near-term means of converting biomass to electricity and displacing a fraction of coal use by adding up to 15% biomass in high-efficiency coal boilers.

2.9 Public Benefits Charge

A public benefits charge (sometimes called systems benefits charge) is a fee that utility customers pay on the basis of their energy use, which is to be spent on public goods such as energy efficiency. In many deregulated states, the utility commissions are no longer able to require electric utilities to have efficiency programs, so the public benefits charge has been introduced as a non-bypassable charge on electric bills. The collected funds are then given to a third party to provide energy efficiency programming.

ES-3 FOSSIL FUEL AND NUCLEAR ELECTRICITY

3.1 Advanced Fossil Fuel Technology Incentives, Support, or Requirements

Advanced fossil technologies include more efficient and thus lower-emitting generation technologies. Advanced fossil technologies combined with carbon capture and sequestration or reuse (CCSR) may have the potential to significantly lower CO_2 emissions associated with fossil-fuel based electricity generation.

Policies that encourage the development of these technologies may include mandates or incentives to use advanced coal technologies for new coal plants (e.g., a mandate that requires new fossil fuel–fired power plants to achieve a specific low net CO_2 emission rate). Alternatively, a mandate might require that all or a portion of new coal plants be of a certain type, such as integrated gasification combined cycle (IGCC). Incentives may take the form of direct subsidies or assistance in securing financing and/or off-take agreements. A combination of mandates and incentives is also possible.

Policies to encourage CCSR could include tasking a state agency or department within an agency with promoting CCSR, performing evaluation studies to identify geologically sound reservoirs, providing R&D funding to improve CCSR technologies, and providing financial incentives or mandates to capture and store carbon or to capture and reuse it.

3.2 New Nuclear Power

Nuclear power has historically presented a low-GHG source of electricity. However, no new commercial reactor has come on line in the United States since 1996 because of extremely high capital costs, the absence of any plan or technology for permanent disposal of nuclear waste, and risks to public safety exemplified by high-profile accidents at Three Mile Island and Chernobyl. The current Administration has been supportive of nuclear expansion, emphasizing its importance in maintaining a diverse energy supply and its reputation for producing electricity with negligible pollutant emissions during operation. Congress has also offered significant financial subsidies for new nuclear plants in an effort to jump-start the industry, including limitations on liability for nuclear accidents.

3.3 Relicensing/Uprating Existing Nuclear Power

Nuclear plant relicensing allows a nuclear power plant to extend the life of the facility for 20 years past its original 40-year license term. This is considered a low-cost and low-emissions source of energy because there is limited additional capital cost or additional embodied emissions associated with extending the life of fully depreciated and operating nuclear plants. The Nuclear Regulatory Commission (NRC), the nation’s regulatory authority for nuclear power, considers the relicensing program one of the major cornerstones of its current regulatory activity. A nuclear power plant uprating is a process whereby a licensee receives approval from the NRC to operate a plant at a higher power level than the level authorized in the original license.

3.4 Efficiency Improvements and Repowering Existing Plants

Efficiency improvements refer to increasing generation efficiency at power stations through incremental improvements at existing plants (e.g., more efficient boilers and turbines, improved control systems, or combined cycle/IGGC technology). Repowering existing power plants refers to switching to lower- or zero-emitting fuels (e.g., using biomass or natural gas in place of coal or oil) at existing plants or building additions to existing plants to increase their capacity. Policies that encourage efficiency improvements and repowering of existing plants could include incentives or regulations as described in other options, with adjustments for financing opportunities and emission rates of existing plants.

3.5 Technology-Focused Initiatives

States can undertake initiatives that focus on developing, promoting, or implementing one or more specific fossil fuel or nuclear technologies that show promise for reducing GHG emissions. Technologies could include carbon capture and storage (to sequester carbon dioxide emissions from power plants, oil and gas operations, and refineries), biomass blending in coal power plants, and installing equipment in oil and gas operations to increase efficiency and reduce losses (e.g., remote sensors of leaks).

ES-4 FUEL PRODUCTION, PROCESSING, AND DELIVERY

4.1 Oil and Gas Production: GHG Emission Reduction Incentives, Support, or Requirements

Emissions of both methane (CH_4) and CO_2 can be reduced during the production of oil and gas. Natural gas consists primarily of methane, a potent GHG; any reduction in leaks during production, processing, transportation, and distribution avoids GHG emissions. Stopping these leaks is economically beneficial because it prevents valuable product from being wasted. EPA's Natural Gas STAR program offers a variety of methods for preventing leaks, including preventive maintenance (improving the overall efficiency of the gas production and distribution system), reducing flashing losses (releases when pressure drops at storage tanks, wells, compressor stations, or gas plants), and changing or replacing parts and devices to reduce leaks and improve efficiency.

4.2 Natural Gas Transmission and Distribution

As with methane leaks in oil and gas operations, any reduction of leaks during production, processing, transportation, and distribution avoids GHGs being emitted to the atmosphere and prevents wasting valuable product.

4.3 Oil Refining: GHG Emission Reduction Incentives, Support, or Requirements

Options for reducing CH_4 and CO_2 emissions during the production of liquid fuels at oil refineries include various efficiency measures: enhanced CHP along with carbon capture and storage. Regulations, incentives, or support programs can be applied to achieve these reductions.

4.4 Coal Production: GHG Emission Reduction Incentives, Support, or Requirements

There are a number of ways in which CH_4 and CO_2 emissions can be reduced and CH_4 can be recovered in the production of coal: various efficiency measures, use of CHP for operations, carbon capture and storage, and capture and use (or at least flaring) of methane that would otherwise be vented to the atmosphere. Regulations, incentives, and support programs can be applied to achieve these goals.

4.5 Coal-to-Liquids Production: GHG Emission Reduction Incentives, Support, or Requirements

Coal-to-liquids (CTL) plants are energy-intensive and produce about 10 times more CO_2 emissions than conventional oil refineries in the production of liquid fuels. However, with carbon capture and storage and co-production of electricity and liquid fuels, such emissions can be substantially reduced.[1] Regulations, incentives, and support programs can be applied to achieve these goals.

4.6 Low-GHG Hydrogen Production Incentives and Support

Hydrogen is not an energy source, but rather an energy carrier. It must be produced from other energy resources, such as fossil fuels (coal, oil, gas), renewable electricity (wind, solar), renewable fuels (biofuels, landfill gas [LFG]), or nuclear power. However, hydrogen may facilitate the avoidance of GHG emissions by storing energy produced when and where available to be used when needed. The net GHG implications of producing hydrogen depend on the energy resource from which it is produced. To produce hydrogen from fossil fuels with low GHG emissions, it would be necessary to do it in conjunction with carbon capture and storage. Policies that support this option would provide incentives to projects that develop or deploy low-GHG hydrogen production technologies and that advance the technology of efficiently storing electric energy as hydrogen and converting it back to electricity.

ES-5 CARBON CAPTURE AND STORAGE OR REUSE

5.1 CCSR Incentives, Requirements, and Enabling Policies (Administration, Regulation, Liability, Incentives)

CCSR is a process that includes separation of CO_2 from industrial and energy-related sources, transport to a storage location, and permanent or long-term storage in isolation from the atmosphere. Ideally, the CO_2 from large point sources such as power plants can be compressed and transported for storage in geological formations, in the ocean, in mineral carbonates, or for use in industrial processes. Captured carbon can also be used for enhanced recovery of oil and gas. The net reduction of emissions to the atmosphere through CCSR depends on the fraction of CO_2 captured, the relative increase in CO_2 production resulting from loss in overall efficiency of power plants that capture carbon, energy used for transport and storage, any leakage from transport, and the fraction of CO_2 retained in storage over the long term.

Policies to encourage development of CCSR technology could include tasking a state agency or department within an agency with promoting CCSR, providing financial incentives to capture and store carbon or to capture and reuse it, and creating mandates—coupled with technical feasibility and cost and investment recovery mechanisms, if appropriate—to capture and store or reuse carbon dioxide from power plants.

5.2 R&D for CCSR

Technological as well as financial barriers exist to implementation of CCSR. While separation, capture, and transport of CO_2 are themselves mature technologies, only three industrial-scale storage projects are currently in operation: the Sleipner project in an offshore saline formation in Norway, the Weyburn EOR project in Canada, and the In Salah project in a gas field in Algeria. Further R&D funding to improve CCSR technologies and evaluation studies to identify

[1] International Energy Agency, 2006. *Energy Technology Perspectives.* Well-to-wheel GHG emissions from coal liquids are approximately twice those of conventional oil products. Cogeneration and carbon capture and storage can reduce those emissions to levels similar to, or slightly below, those of conventional oil products.

geologically sound reservoirs will be needed before this technology can play a significant role in reducing GHG emissions.

ES-6 OTHER ENERGY SUPPLY OPTIONS

6.1 Transmission System Upgrading

Measures for improving transmission systems to reduce bottlenecks and enhance throughput may be required to satisfy long-term electricity demands and improve the efficiency of operations system-wide. There may be opportunities for substantially increasing transmission line carrying capacity by implementing new construction and retrofit activities on the transmission grid (e.g., incorporating advanced composite conductor technologies, capacitance technologies, and grid management software). Siting new transmission lines can be a difficult process, given their cost, their impact on the local environment, and their impact on the use, enjoyment, and value of property. Policy measures that support this option could provide incentives to utilities to upgrade transmission systems and reduce barriers to the siting of new transmission lines.

6.2 Reduction of Transmission and Distribution Line Losses

There are several energy efficiency measures that can be implemented to reduce the transmission and distribution line losses of electricity.

Utilities use a variety of components throughout the transmission and distribution system to manage losses. Increasing the efficiency of these components can further reduce losses and associated GHG emissions. For example, the State of Vermont offers a rebate to encourage the installation of energy efficient transformers. Regulations, incentives, and support programs can be applied to achieve greater efficiency of transmission and distribution system components.

6.3 Distributed Generation Support (e.g., Interconnection Rules, Net Metering)

Well-designed interconnection rules will ensure that distributed power products meet minimum requirements for performance, safety, and maintenance and, at the same time, will significantly advance the commercialization of these technologies. Such rules, generally developed and administered by a state's public utility commission, establish clear and uniform processes and technical requirements for connecting DG systems to the electric utility grid. Interconnection standards will reduce barriers to connection of DG systems to the grid. Connecting to the grid enables the facility to

- Purchase power from the grid to supply supplemental power as needed, for example, during periods of planned system maintenance;
- Sell excess power to the utility; and
- Maintain grid frequency and voltage stability, as well as utility worker safety.

This topic is of particular interest because the Energy Policy Act of 2005 (EPAct 2005) directs states to consider upgrading their standards for interconnecting small generators within one year of enactment (http://www.epa.gov/chp/pdf/interconnection_factsheet.pdf).

6.4 Environmental GHG Emissions Disclosure

Emissions disclosure consists of establishing requirements that GHG emitters publish their estimated GHG emissions on a regular (e.g., annual) basis. Disclosure can also include an accounting of business risks due to climate change, such as assets in danger of weather-related damage, threats to market share, and risks of future regulation. Environmental disclosure allows investors and consumers to obtain information regarding a firm's GHG emissions and climate risks so they can make better purchasing and investment decisions. Disclosure also provides an incentive for firms to reduce risk in these areas by reducing their CO_2 footprints. In the case of energy supply, environmental disclosure would provide consumers and stockholders with information on carbon emissions per kWh in a way that would help them make decisions about electricity purchases and consumption and help them evaluate investment risks. Disclosure is especially effective in areas where consumers have an opportunity select their electricity provider.

6.5 Landfill Gas Recovery

Capture methane gas from landfills to reduce direct emissions and to produce electricity. This option could be structured as either a mandate or an incentive program. (This topic is also covered in the waste section of Agriculture, Forestry and Waste [AFW] in CCS's catalog and brief descriptions for those sectors.)

6.6 Waste to Energy

Certain components of municipal waste can be used as a non-fossil combustion resource for generating electricity. (See also CCS's AFW catalog and brief descriptions.)

6.7 N_2O Reduction Co-Benefit

Nitrous oxide (N_2O), a minor component of total nitrogen oxides (NO_x) emissions from fossil fuel combustion, is one the most powerful GHGs. Each ton of N_2O represents more than 250 tons of CO_2 equivalents. Emissions policies further reducing NO_x emissions from power plants would have the additional benefit of reducing the release of N_2O into the atmosphere.

6.8 Smart Grid

Smart Grid systems promote efficiency through improvements in system stability and better control technology and systems integration.