



**Oil and Gas Technical Work Group  
Brief Description of Mitigation Options**

June 25, 2008

*(Note: This listing is incomplete and will be fleshed out during the Technical Work Group process. Technical Work Group members are encouraged to provide input to the Technical Work Group facilitators on existing policies and programs, where relevant. Recently enacted policies and programs in Alaska will be listed where relevant in the policy options catalog notes. Additional details will be added to this document under each of the option descriptions, as they are developed.)*

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## **OG-1 Overarching Policies**

### **1.1 Research and Development (R&D), Including R&D for Advanced Fossil Fuel Technologies**

R&D funding can be targeted toward a particular technology or group of technologies as part of a state program with a mission to build an industry around that technology in the state and/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 specific energy production 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 are not yet in widespread use. Funding could be provided to increase collaboration between existing institutions for R&D on technologies.

### **1.2 Incentives for Advanced Fossil Fuel Production**

Advanced fossil technologies produce fewer CO<sub>2</sub> emissions per unit output as the result of more efficient generating technologies and in this case refer to technologies that are not fully commercial. Incentives may be in the form of direct subsidies, tax credits, or assistance in securing financing and/or off-take agreements.

### **1.3 Market-Based Mechanisms to Establish a Price Signal for GHG Emissions (GHG Cap-and-Trade or Tax)**

Establishing a price on greenhouse gas emissions (or carbon dioxide specifically) is considered essential in order to reduce greenhouse gas emissions. Presently the cost of emitting carbon dioxide into the atmosphere is free. With a cost attached to carbon emissions, emitters would have a strong incentive to modify their practices and economic inefficiencies inherent in the present system would be addressed, leading to a reduction in GHG emissions.

There are two principal ways to place a value on carbon: a carbon tax or a cap and trade system.

A GHG tax, or specifically a tax on CO<sub>2</sub>, would be a tax on each ton of CO<sub>2</sub> (equivalents) emitted from an emissions source covered by the tax. A CO<sub>2</sub> tax could be imposed upstream based on carbon content of fuels (e.g., fossil fuel suppliers) or at the point of combustion and emission (e.g., typically large point sources such as power plants or refineries). Taxed entities would pass some or all of the cost on to consumers, change production to lower emissions, or a combination of the two. As the suppliers respond to the tax, consumers would see the implicit cost of CO<sub>2</sub> emissions in products and services, and would adjust their behavior to purchase substitute goods and services that result in lower CO<sub>2</sub> emissions. CO<sub>2</sub> tax revenue could be used in a variety of ways such as payroll or income tax reductions or policies and programs to assist in decreasing CO<sub>2</sub> emissions. CO<sub>2</sub> tax revenue could also be directed to helping the competitiveness of industries or assisting communities most affected by the tax.

A cap and trade system utilizes a more indirect approach to placing a value on carbon. It is a market mechanism in which GHG emissions are limited or capped at a specified level, and those participating in the system can trade allowances (an allowance is a permit to emit one ton of CO<sub>2</sub>). By allowing 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.

For every ton of CO<sub>2</sub> released, an emitter must hold an allowance. The total number of allowances issued or allocated is the cap. The government can assign a certain amount of allowances to emission sources, hold back allowances for distribution to developing sources (e.g., new entrants), auction some or all of them or provide a combination of these options. Participants can range from a small group within a single sector to the entire economy. The compliance obligation can be imposed “upstream” (at the fuel extraction or import level) or “downstream” at points of fuel consumption.

Among the important considerations with respect to a cap-and-trade program are: the sources and sectors to which it would apply; the level and timing of the cap; how the level of the cap may change over time, if at all (e.g., through a specifically declining cap); how allowances would be distributed; how new market entrants are accommodated, how “leakage”<sup>1</sup> is addressed, etc. Further emissions reductions are achieved by decreasing the number of allowances over time. Other questions include what if any offsets would be allowed; over what region the program would be implemented (e.g., nationally, regionally, etc.); and whether compliance with the cap could be achieved given “leakage” from non-participating states and facilities located on tribal lands not subject to the cap. Thus, the effectiveness of a cap-and-trade system is correlated with the extent and scope of its coverage. Further issues to consider include which GHGs are covered; whether there is linkage to other trading programs; banking and borrowing of allowances; credit for early reductions; what, if any, incentive opportunities may be included; use of revenue accrued from permit auctions, if any; and provisions for encouraging energy efficiency.

The Western Climate Initiative, (WCI) is an effort by 7 states (Washington, California, Oregon, Arizona, New Mexico, Utah, and Montana) and three Canadian provinces (British Columbia, Manitoba, and Quebec), that aims to design “a regional market-based multi-sector mechanism, such as a load-based cap and trade program, to achieve the regional GHG reduction goal.” The Western Climate Initiative is designed to be economy-wide (not just electricity sector). Final design of the WCI is due in August 2008, with current recommendations included on the website, <http://www.westernclimateinitiative.org/>. Alaska is an observer of the WCI.

There is one regional GHG cap-and-trade system in the US in the process of being implemented in the United States, and another under likely development. The cap-and-trade system designed by the Northeast States’ Regional Greenhouse Gas Initiative (RGGI), an effort by the states of

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<sup>1</sup> Emissions “leakage” can occur, for instance, if production is shifted to higher-emitting sources not included within the cap.

Connecticut, Delaware, Maine, Maryland, New Hampshire, New Jersey, New York, Rhode Island, and Vermont, will begin operation in 2009 and is limited to power plant emissions.<sup>2</sup>

## **OG-2 Carbon Capture and Storage or Reuse in Operations: Incentives, Support or Regulation**

### **2.1 CO<sub>2</sub> capture and storage or reuse (CCSR) in O&G operations**

Carbon capture and storage or reuse (CCSR) involves capturing carbon dioxide and either (1) sequestering it permanently in a geologically sound reservoir or (2) reusing it to aid in oil and gas extraction or as a feedstock for industrial processes, and perhaps eventually as a feedstock that when combined with water can be reformed into liquid fuels. The process of carbon capture is well established in the chemical industry and forms the basis for Integrated Gasification Combined Cycle electricity generating plants; however, carbon sequestration has yet to be proven as a large-scale solution to GHG emissions.

Policies to encourage CCSR could include a state agency or department within an existing agency tasked with promoting CCSR, evaluation studies to identify geologically sound reservoirs, R&D funding to improve CCSR technologies, financial incentives to capture and store carbon or to capture and reuse it, and/or mandates – coupled with technical feasibility and cost and investment recovery mechanisms, if appropriate – to capture and store carbon or capture and reuse it.

### **2.2 CO<sub>2</sub> capture and storage or reuse (CCSR) in O&G refineries**

There are a number of ways in which CH<sub>4</sub> and CO<sub>2</sub> emissions can be reduced in the production of liquid fuels at oil refineries. These options include various efficiency measures including enhanced combined heat and power along with carbon capture and storage. Policy choices are the same as option 2.1.

### **2.3 CO<sub>2</sub> use for Enhance Oil Recovery (EOR)**

Captured carbon dioxide can be compressed and injected into an oil reservoir to increase the pressure of the reservoir and produce more oil.

Policies to encourage EOR could include a state agency or department within an existing agency tasked with promoting EOR, evaluation studies to identify candidate reservoirs, R&D funding to improve EOR technologies, financial incentives to capture CO<sub>2</sub> for EOR – coupled with technical feasibility and cost and investment recovery mechanisms, if appropriate. A policy would also consider financing and cost recovery mechanisms for the pipeline network.

## **OG-3 Fuel Production and Processing**

### **3.1 Oil and Gas Production: GHG Emission Reduction Incentives, Support, or Requirements**

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<sup>2</sup> <http://www.rggi.org/>

There are a number of ways in which methane (CH<sub>4</sub>) and CO<sub>2</sub> emissions can be reduced in the oil and gas production. Natural gas consists primarily of methane, a potent greenhouse gas; therefore, any reducing leaks during production and processing leads to direct GHG emissions savings (see section 4 below for options on reducing leaks during transmission and distribution). In addition to reducing GHG emissions, stopping these leaks may be economically beneficial because it can prevent the waste of valuable product.

There are a number of ways in which CO<sub>2</sub> emissions in the oil and gas industry can be reduced, through existing technologies including (1) new efficient compressors, (2) optimize gas flow to improve compressor efficiency, (3) improve performance of compressor cylinder ends, (4) capture compressor waste heat, (5) replace compressor driver engines, and (6) waste heat recovery boilers.

Policies for such technologies can include regulations or incentives to promote advanced technologies for new or existing processing plants or refineries. A technology regulation might require that new processing plants or refineries achieve a certain CO<sub>2</sub> emission rate per unit of output. Incentives may be in the form of direct subsidies, tax credits, or assistance in securing financing and/or off-take agreements. Technical assistance to companies looking to evaluate best options could also be provided through a state policy.

### **3.2 Low-GHG Hydrogen production incentives and support**

Hydrogen is not an energy source, but rather an energy carrier (like electricity). It must be produced from other energy resources, such as fossil fuels (coal, oil, gas), renewable electricity (wind, solar), renewable fuels (biofuels, LFG), or nuclear power. The net greenhouse gas implications of producing hydrogen depend on the energy resource from which it is produced.

Hydrogen can be produced from renewable fuels or nuclear energy with low greenhouse gas emissions. In order to produce hydrogen from fossil fuels with low greenhouse gas emissions, it would be necessary to do it in conjunction with CCS. Policies in support of this option would provide incentives to projects that help develop or deploy low-GHG hydrogen production.

### **3.3 Low-GHG fuels in refineries**

Refineries that currently consume coal or oil as fuel inputs can reduce emissions by transitioning to consumption of natural gas or other fuels with lower GHG emissions. Policies include financial incentives or disincentives on particular fuels, technical assistances, or financial incentives for technology changes.

### **3.4 Reduce flaring**

Gas facilities that flare on a routine basis could be required to only flare on a very limited basis. For example, clean-up operations may be subject to a maximum duration of flaring; subject wells could be tested “in-line” (i.e. where gas flows directly into the pipeline); and flaring during completion operations could be prohibited.

Where new technologies are required, incentives and technical support could offset the cost of adopting new technologies.

**OG-4 Fuel Delivery****4.1 Natural Gas Transmission and Distribution: Incentives, Support or Regulations to Reduce Leaks**

There are a number of ways in which natural gas emissions during transmission and distribution can be reduced. Natural gas consists primarily of methane, a potent greenhouse gas; therefore, any reduction of leaks during production, processing, and transportation/distribution leads to direct GHG emissions savings. In addition to reducing GHG emissions, stopping these leaks may be economically beneficial because it can prevent the waste of valuable product.

The EPA Natural Gas STAR program offers numerous methods of 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 and replacing parts and devices to reduce leaks and improve efficiency, among others.

**4.2 Natural Gas Transmission and Distribution: Incentives, Support or Regulations to Improve Efficiency**

Key types of technologies to improve energy efficiency include: (1) compressor efficiency improvements, (2) waste heat recovery for compressors and boilers, and (3) replacement of gas-driven compressors with electrical generators.