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Energy Supply Technical Working Group
Preliminary Draft Option Descriptions
January 25, 2007

The table below lists the options that the Energy Supply TWG is tasked with developing and analyzing, based on the Energy Supply TWG call on 11/16 and the CCAC meeting on 12/14. Numbers in parentheses in the first column of the table below refer to original Option numbers from the Energy Supply "Catalog of State-Level GHG Reduction Policy Options" (which is available on http://www.mtclimatechange.us/Energy_Supply.cfm under the documents for the 11/16 call). Also included in the Table are the names of those who have volunteered to work with others to prepare descriptions and designs for one or more high-priority options.

Templates for descriptions of each of the Energy Supply Priority Options are provided following the Summary Table. In these descriptions, CCS facilitators have prepared rough draft text for the "Policy Description" section of each of these options, but please note that this text is intended only as a starting point, and changes and edits to the text to reflect the ideas and concerns of the TWG and the CCAC are desired and encouraged.

Volunteers for the options in "Bin A" met by teleconference on January 18, 2007 and discussed options ES-1 and ES-2, with some limited discussion for ES-4. Outcomes of that meeting are summarized with each relevant option, and highlighted in green.

Table X.

Energy Supply Technical Work Group

Summary List of Recommended High Priority Mitigation Options*

#	Name	Drafting Volunteers
Group A	**Renewable Energy and Energy Efficiency**	**C. Magraw, M. Fitzpatrick, T. Gregori, DEQ, K. Thornton, B. Drummond, B. Buchanan, P. Judge**
ES-1 **(old 1.1)**	Environmental portfolio standard (renewables and energy efficiency)	

#	Name	Drafting Volunteers
ES-2 **(old 1.5)**	Renewable energy incentives (biomass, wind, solar, geothermal)	
ES-4 **(old 2.1, 2.4)**	Incentives and barrier removal (including interconnection rules and net metering arrangements) for combined heat and power (CHP) and clean distributed generation (DG)	
ES-7 **(old 5.4)**	Demand-side management (RCI TWG will take lead for analysis, with ES TWG providing review)	
Group B	**Advanced fossil fuel and other technologies**	**C. Magraw, DEQ**
ES-3 **(old 1.8, 1.11, 3.5)**	Research and development (R&D), including R&D for energy storage and advanced fossil fuel technologies	
ES-5 **(old 3.1, 3.4)**	Incentives for advanced fossil fuel generation and carbon capture and storage (CCS), including combined hydrogen and electricity production with carbon sequestration	
ES-6 **(old 5.1)**	Efficiency improvements and repowering of existing plants	
Group C	**Direct GHG policies**	**T. Gregori, C. Magraw, DEQ, M. Fitzpatrick, K. Thornton, B. Drummond, P. Judge**
ES-8 **(old 6.1)**	CO_2 tax (to be considered jointly with RCI TWG)	
ES-9 **(old 6.2)**	GHG cap and trade	
ES-10 **(old 6.3)**	Generation performance standards or GHG mitigation requirements for new (and/or existing) generation facilities, with/without GHG offsets	
Group D	**Fossil fuel production and processing**	**C. Magraw, DEQ, M. Fitzpatrick, S. Dickenson**
ES-11 **(old 8.1, 8.2, 8.4)**	Methane and CO_2 reduction in oil & gas operations, including fuel use and emissions reduction in venting and flaring	
ES-12 **(new option)**	GHG reduction in refinery operations, including in future coal-to-liquids refineries	

#	Name	Drafting Volunteers
ES-13 **(old 8.3)**	CO_2 capture and storage or reuse (CCSR) in O&G operations, including refineries and coal-to-liquids operations	

ES-1 Environmental portfolio standard (renewables and energy efficiency)

Policy Description

A renewable portfolio standard (RPS) is a requirement that utilities must supply a certain percentage of electricity from an eligible renewable energy source(s). For example, an RPS of 5% would mean that for every 100 kWh that a utility or a "load serving entity" (LSE) supplies to end users, 5 kWh must be generated from renewable resources. An environmental portfolio standard (EPS) expands that notion to include energy efficiency as an eligible resource as well, exchangeable or not depending on design. About 20 states currently have an RPS in place (including Montana), while a handful have implemented an EPS (Washington and Nevada among them). In some cases (as in Montana), utilities can also meet their RPS (or EPS) requirements by purchasing certificates from eligible energy projects, typically referred to as Renewable Energy Certificates (RECs) in the case of RPS policies.

Policy Design

The volunteer group discussed adding a higher renewable requirement for 2025 (current RPS levels do not increase after 2015) and including requirements for cost-effective end-use energy conservation.[1]

- Goals: add new requirement of 25% renewable generation by 2025 (and 20% in 2020??)
  - Require each investor-owned utility (IOU) in the State to
    - By 2010, identify its achievable cost-effective energy conservation for the subsequent 10 years
    - Implement a plan to achieve 100% of its cost-effective energy conservation by 2025
    - Update its energy-efficiency assessment and plan regularly, possibly every two years.
  - Require each co-operative utility in the State to
    - By 2015, identify its achievable cost-effective energy conservation for the subsequent 10 years

[1] End-use energy conservation comprises changes at electricity customer sites to both (i) reduce energy used to provide services - such as heating, cooling, illumination, entertainment – through increased energy efficieincy of appliances and other technologies and (ii) reduce demand for these services – for example, by turning off unused lights and televisions, turning down thermostats, etc.

  - Implement a plan to achieve 100% of its cost-effective energy conservation by 2025
  - Update its energy-efficiency assessment and plan regularly, possibly every two years.

- **Timing: see above**
- **Parties Involved:**
- **Other:**

The volunteer group discussed whether this option can be expanded to cover rural electric cooperatives. Several volunteers supported expansion to co-operatives, but there were concerns as to how an RPS could be enforced (since co-operatives are not regulated by the Public Service Commission). Further discussion is needed.

Implementation Mechanisms

Volunteer group had the following concerns, which will need to be discussed further:

- Need a way to make sure that the utilities are not punished, rather rewarded, for pursuing energy efficiency [*CCS note: "decoupling" of utility revenues from the level of utility sales is a strategy for removing this barrier that has been proposed, and in some cases implemented, in other states]*
- May need special consideration for utilities that have no growth, and hold long-term contracts that lock the utilities in to purchases of specific power supply resources
- May need to define what is "cost-effective"
- Consider adjustment of cost cap in existing bill, and
- consider possibility of different standards for cost cap to apply to IOUs and co-operatives

Related Policies/Programs in Place

Montana's renewables portfolio standard (RPS), enacted in April 2005 as part of the Montana Renewable Power Production and Rural Economic Development Act, requires public utilities to obtain a percentage of their retail electricity sales from eligible renewable resources according to the following schedule:

- 5% in 2008 through 2009;
- 10% in 2010 through 2014; and
- 15% in 2015 and thereafter.

Eligible renewable resources include wind, solar, geothermal, existing hydroelectric projects (10 megawatts or less), landfill or farm-based methane gas, wastewater-treatment gas, low-emission, nontoxic biomass, and fuel cells where hydrogen is produced with renewable fuels. Facilities must begin operation after January 1, 2005, and must either (1) be located in Montana or (2) be in another state and delivering electricity to Montana.

Utilities can meet the standard by entering into long-term purchase contracts for electricity bundled with renewable-energy credits (RECs), by purchasing the RECs separately, or a combination of both. The law includes cost caps that limit the additional cost utilities must pay for renewable energy and allows cost recovery from ratepayers for contracts pre-approved by the Montana Public Service Commission (PSC). RECs sold through voluntary utility green power programs may not be used for compliance. The PSC will develop rules to implement the RPS by June 1, 2006.

The RPS includes specific procurement requirements to stimulate rural economic development. For example, the utilities must buy a portion of the required renewable energy (electricity + credits) from community renewable-energy projects with a maximum individual nameplate capacity of 5 megawatts (MW). These include projects in which local owners have a controlling interest and that are interconnected on the utility's side of the meter. In 2015, these projects must provide a total of at least 75 MW of renewable-energy capacity. In addition, public utilities must enter into contracts that include a preference for Montana workers.[2] [text expanded based on suggestion from TWG member]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

[2] http://www.dsireusa.org/library/includes/tabsrch.cfm?state=MT&type=RPS&back=regtab&Sector=S&CurrentPageID=7&EE=1&RE=1

Barriers to Consensus

[Insert text as appropriate]

ES-2 Renewable energy incentives (biomass, wind, solar, geothermal)

Policy Description

This policy option reflects financial incentives to encourage investment in renewable energy sources by businesses that sell power commercially (smaller-scale renewable sources are covered in ES-4). These financial incentives for renewables include (1) direct subsidies for purchasing/selling distributed renewable technologies given to the buyer/seller; (2) tax credits or exemptions for purchasing distributed renewable technologies given to the buyer/seller, (3) feed-in tariffs, which provide direct payments to renewable generators for each kWh of electricity generated from a qualifying renewable facility; (4) tax credits for each kWh generated from a qualifying renewable facility; (5) regulatory policies that provide incentives and/or assurance of cost recovery for utilities that invest in customer-owned renewable energy systems. The policy could also include R&D funding to support development of distributed renewable technologies.

Policy Design

This option is designed to provide additional support to the renewable portion of the renewable and energy-efficiency portfolio standard in ES-1 by providing incentives for utilities and other potential builders/developers/owners of renewable energy supply facilities and local manufacturers of renewable energy technologies. The goal of this option is to increase the supply of renewable energy and reduce its cost. This option is designed to support facilities that sell power commercially (as opposed to, for example, consumer-sited facilities that sell power to the grid via net metering—the latter facilities are covered under ES-4).

- **Goals:** Renewable generation goals are same as ES-1
- **Timing:** Implement in a time frame that best supports ES-1. Since renewable goals for ES-1 will start in 2008, incentives are needed as soon as practicable. Changes to legislation will need to wait until end of 2009.
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

Could include the following:

- Tax policies, production tax credits (federal), PURPA requirements (Montana has mini-PURPA law).

- Recent change in property tax specification for wind projects could be expanded to other renewable forms of generation as appropriate.
- Incentives for locating manufacturing plants in the state for renewable generation, with potential sunset provisions as industries mature in Montana
- Target incentives to community wind projects

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-3 Research and development (R&D), including R&D for energy storage and advanced fossil fuel technologies

Policy Description

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 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 are not yet in widespread use. Funding could be provided to increase collaboration between existing institutions for R&D on technologies.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-4 Incentives and barrier removal (including interconnection rules and net metering arrangements) for combined heat and power (CHP) and clean distributed generation (DG)

Policy Description

This option is focused on CHP and DG located on-site at consumer facilities that do not sell power commercially. There are numerous barriers to CHP and clean DG, 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, exit fees, etc. The lack of standard offer or long-term contracts, payment at avoided cost levels, and lack of recognition for emissions reduction value provided also creates obstacles. Policies to remove these barriers include: improved interconnection policies; improved rates and fees policies; streamlined permitting; recognition of the emission reduction value provided by CHP and clean DG; financing packages and bonding programs; power procurement policies; education and outreach; etc.

Financial incentives for combined heat and power (CHP) and clean distributed generation systems could include: (1) direct subsidies for purchasing/selling systems given to the buyer/seller; (2) tax credits or exemptions for purchasing/selling systems given to the buyer/seller; (3) tax credits or exemptions for operating systems; (4) feed-in tariff, which is a direct payment to owners for each kWh of electricity or BTU of heat generated from a qualifying system; and (5) tax credits for each kWh or BTU generated from a qualifying system.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-5 Incentives for advanced fossil fuel generation and carbon capture and storage (CCS), including combined hydrogen and electricity production with carbon sequestration

Policy Description

Advanced fossil technologies produce few CO2 emissions per kWh as the result of more efficient generating technologies (supercritical coal, integrated gasification combined cycle, etc.) and/or carbon capture and sequestration or reuse (CCSR), either before or after fuel combustion.

Policies for advanced fossil technologies can include regulations or incentives to promote advanced technologies for new coal or natural gas plants. A technology regulation might require that new coal plants achieve a certain CO_2 emission rate. Incentives may be in the form of direct subsidies, assistance in securing financing and/or off-take agreements, or guarantee cost recovery for prudently incurred utility investments.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**

- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-6 Efficiency improvements and repowering of existing plants

Policy Description

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 technology). Repowering existing power plants refers to switching to lower or zero emitting fuels at existing plants, or for new capacity additions. This includes co-firing biomass at coal plants fuels or the use of natural gas in place of coal or oil. Policies to encourage efficiency improvements and repowering of existing plants could include incentives or regulations as described in ES-5 above, with adjustments for financing opportunities and emission rates of existing plants.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-7 Demand-side management

(RCI TWG will take lead for analysis, with ES TWG providing review)

ES-8 CO_2 tax

(to be considered jointly with RCI TWG)

Policy Description

A CO_2 tax would be a tax on each ton of CO_2 emitted from an emissions source covered by the tax. A CO_2 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_2 emissions in products and services, and would adjust their behavior to purchase substitute goods and services that result in lower CO_2 emissions. CO_2 tax revenue could go completely to state revenue and be used in a variety of ways such as income tax reduction or policies and programs to assist with CO_2 reductions. CO_2 tax revenue can also be directed to helping the competitiveness of industries or assisting communities most affected by the tax.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-9 GHG cap and trade

Policy Description

A cap and trade system is a market mechanism in which GHG emissions are limited or capped at a specified level, and those participating in the system can trade permits (a permit is an allowance to emit one ton of CO_2). 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_2 released, an emitter must hold an allowance. Therefore, the number of allowances issued or allocated is, in effect, the cap. The government can give allowances away for free, auction them, or some combination of the two. 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 allowances would be distributed (e.g., whether load-based or generation-based, how new market entrants are accommodated, how leakage is addressed, etc.); 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 coal-fired generation located on tribal lands that would not be subject to the state-imposed cap. Other issues to consider include 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 US today is the Northeast States' Regional Greenhouse Gas Initiative: http://www.rggi.org/

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-10 Generation performance standards or GHG mitigation requirements for new (and/or existing) generation facilities, with/without GHG offsets

Policy Description

A generation performance standard (GPS) is a mandate that requires that load serving entities (LSE) to acquire electricity (e.g. in CA), or that power plant developers to build and operate new generation (e.g. in OR and WA), with an emission rate (e.g. X lbs CO_2/MWh) below a specified mandatory standard. In some cases, GHG offsets or credits can be used for compliance (e.g. OR and WA). GHG offsets are GHG emission savings from project-based activities in sectors or regions not covered by the standard or regulations, which typically need to meet specific criteria laid out in the regulation.

A market-based variation of a GPS would allow generators with emission rates lower than the GPS to sell their extra "credits" to with generators with emission rates higher than the GPS.

A third variation of a GPS is to establish the standard and allocate allowances based on that standard every year. In this variation, as electricity generation increases, plants would receive more permits. Utilities could trade permits in order to achieve the standard, but there would be no fixed cap on emissions. This variation provides a financial incentive (via the trading) for generators to reduce emissions so that they can sell unneeded permits to generators who have high emissions.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-11 Methane and CO_2 reduction in oil & gas operations, including fuel use and emissions reduction in venting and flaring

Policy Description

There are a number of ways in which methane (CH_4) and CO_2 emissions in the oil and gas industry can be reduced. Natural gas consists primarily of methane; therefore, any leaks during production, processing, and transportation/ distribution should be addressed. 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. These methods, called Best Management Practices (BMPs) and Partnership Reduction Opportunities (PROs), are divided by industry sub sector: production, processing, and transportation/ distribution. Among the practices recommended are *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..

There are a number of ways in which CO_2 emissions in the oil and gas industry can be reduced by improving energy efficiency , 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.

Regulations, incentives, and/or support programs can be applied to achieve these reductions (see ES-5 for some examples).

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-12 GHG reduction in refinery operations, including in future coal-to-liquids refineries

Policy Description

There are a number of ways in which methane and CO_2 emissions can be reduced in the production of liquid fuels, at oil refineries or a coal-to-liquids plant. These options include various efficiency measures including enhanced combined heat and power along with carbon capture and storage. Coal-to-liquids plants are energy-intensive, and produce about 10 times more CO_2 emissions as conventional oil refineries in order to produce liquid fuels; however, with carbon capture and storage (and co-production of electricity and liquid fuels) such emissions can be substantially reduced.[3] Regulations, incentives, and/or support programs can be applied to achieve these reductions (see ES-5 for some examples).

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**

[3] 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.

- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

ES-13 CO_2 capture and storage or reuse (CCSR) in O&G operations, including refineries and coal-to-liquids operations

Policy Description

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. Where excess CO_2 is found in some natural gas reservoirs -- pipeline natural gas can contain only up to 2.5% CO_2 by volume, and some gas fields have a higher concentration – it is typically vented to the atmosphere in gas processing plants. Carbon can also be captured in the process of gasifying coal to liquid fuels. This process is well established in the chemical industry and forms the basis for Integrated Gasification Combined Cycle electricity generating plants.

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.

Policy Design

[Insert text as appropriate]

- **Goals:**
- **Timing:**
- **Parties Involved:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Reductions and Costs (or Cost Savings)

[Insert text as appropriate]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]