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Energy Supply (ES) Sector GHG Reduction Policy Options

Prepared for Technical Working Group (TWG) Call #5, December 21, 2005, 9:00-10:30 AM

Potential Emission Reductions 1/	Potential Cost or Cost Savings 1/ 2/
High (H): At least 1 Million Metric Tons (MMT) carbon dioxide equivalent (CO_2e) per year by 2020 (~1% of current NM emissions), at least 10 MMT CO2e by 2050	**High (H)**: \$50 per Metric Ton CO_2e ($MTCO_2e$) or above
Medium (M): From 0.1 to 1 MMT CO_2e per year by 2020, or 1-10 MMT CO2e by 2050	**Medium (M):** \$5-50/$MTCO_2e$
Low (L): Less than 0.1 MMT CO_2e per year by 2020, or 1 MMT CO2e by 2050	**Low (L):** Less than \$5/$MTCO_2e$
Uncertain (U): Not able to estimate at this time	**Uncertain (U):** Not able to estimate at this time

1/ Several measures may overlap in terms of emissions reductions and/or cost impacts. Estimates assume measures would be implemented independently from other measures.
2/ Costs are denoted by a positive number. Cost savings (i.e., "negative costs") are denoted by a negative number.

Definition of Priorities for Analysis:

- **High:** High priority options will be analyzed first.
- **Medium:** Medium priority options will be analyzed next, time and resources permitting.
- **Low**: Low priority options will be analyzed last, time and resources permitting.

**** Options marked with a double asterisk (**) indicate options that are at least partially "base case" policies, i.e., that have been or will be implemented at some level in New Mexico.**

Option No.	GHG Reduction Policy Option	Priority for Analysis (TWG #3)	Potential GHG Emissions Reduction	Potential Cost or Savings	Description	Ancillary Impacts; Feasibility Considerations	Notes
1.	**Electricity, Renewable and Low Emitting Energy**						
1.1	Renewable Portfolio Standard** / Environmental Portfolio Standard	H	L - H	L - H	Requirement that utilities procure as part of their energy supply mix a minimum percentage of electricity from eligible renewable technologies.		• Options: (1) raise existing 10% to 15-20; (2) have RPS apply to munis and coops; (3) include a solar "set-aside" to develop RE that matches up well with load. • 1% every year from 10% in 2010 to 50% in 2050.
1.2	Tax Credits and Incentives (for any renewable, including sales tax exemptions, production incentives including feed-in tariffs)**	H	L/M	M	Financial incentives to purchase or operate renewable energy technologies in order to increase the amount of renewable energy and lower GHG emissions from the sector. Such incentives may also be used to encourage the development of specific renewable energy technologies, to lower their costs, and/or to gain experience with those technologies in the state		• Production and investment tax credit for solar electric (PV and Concentrating).
1.3	Research and Development (R&D)*	TBD	U (L in short term, L in medium & long-term)	U	Funding or other assistance to research, develop, or deploy advanced renewable energy technologies. Advanced technologies could include but are not limited to solar PV, concentrating solar thermal, building integrated PV, biomass, biodigesters, methane capture, hydrogen production from renewables, distributed renewables, and wind		•

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1.4	Distributed renewable energy development issues (zoning, siting, etc.)	TBD	U	U	Ensuring that distributed renewable energy technologies (technologies that are located at or near the point of consumption, typically owned by a utility customer, and can be connected to the existing electricity grid or independent of it) do not face legal barriers to development.		•
1.5	Biomass/Waste	H	M/H – depends on availability of biomass	L/M	Specific support for biomass/waste technologies in order to encourage the adoption and use of these specific technologies.		• Forest biomass • MSW • Methane capture • Ag biomass • Advanced biomass tech support
1.6	Renewable feed-in tariff	TBD			A production incentive paid to owners of renewable energy technologies on a per kilowatt hour (kwh) production basis in order to encourage the production of renewable energy in the state. Differs from investment incentives because payments are made based on actual production of electricity.	Political feasibility of a substantive feed-in tariff amount is questionable.	•
1.7	Green Power Purchases and Marketing **	H	L/M – depends on technology & purchase level	L/M – depends on tech-nology & purchas e level	State, utility or other programs that either require purchases of green power (electricity generated by renewable energy) or provide the framework to allow consumers to choose green power versus the standard default mix of power available to the consumer		• Mandatory (state) • Voluntary
1.8	Landfill Gas Recovery (see also Waste)	TBD	L	L	Support for landfill gas recovery and use in generating electricity.		•

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1.9	Renewable Energy Transmission and Storage Authority	H			Create state agency/entity tasked with overseeing and developing renewable storage technologies. Storage of renewable energy from intermittent sources is important to allow for dispatch of power at any time, not just when the wind blows or the sun shines, to meet varying demand. Any utility system can accommodate intermittent resources up to a point without storage. That point depends on the particular system and is generally within the range of 20% - 35% of renewable resources as a share of total capacity in the system. The agency would also ensure that the electricity system can fully utilize renewable resources while maintaining reliability.		•
1.10	Renewables-Linked Hydrogen Technology Incentives	H			Specific incentives to assist with using renewables to produce hydrogen, which, in effect, is a way to store the energy in a form that can be used later to generate electricity with fuel cells. Applications can be stationary (utility scale fuel cells for generating electricity or small fuel cells for generating electricity and providing space heating and cooling in buildings) and mobile (used in fuel cell vehicles).		•

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2.	**Electricity, Advanced Fossil Fuel Strategies**						
2.1	Advanced fossil (including IGCC)	H	H		Assistance, incentives and/or requirements for the development and implementation of advanced fossil fuel technologies, including Integrated Gasification Combined Cycle (IGCC), supercritical pulverized coal, and supercritical fluidized bed combustion		• Include "polygeneration" production of synfuels and/or marketable chemicals along with electricity production (requires 2 gasifiers).
2.2	Carbon Capture and Sequestration (CCS)	H			Assistance, incentives, and/or requirements for the development and implementation of carbon capture from fossil fuel combustion and sequestration (storage) in geologic formations.		•
2.3	Recycling of CO2 and fuel synthesis				Captured CO2 is used in the production of fuel. Bernie Zak will be providing additional information on this technology.		•
3.	**Electricity, Other Electricity Measures**						
3.1	Efficiency Improvements and Repowering Existing Plants	TBD	U	U	Assistance, incentives and/or requirements to improve the efficiency of existing power plants that reduce fuel use and related emissions.		• Include consideration of a solar component to repowering plants that use steam -- RPS.

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3.2	Nuclear Plant Relicensing and Uprating	TBD			Nuclear relicensing allows for continued operation of nuclear energy generation facilities, typically for a longer period of time. Uprating allows expanded use of the exising capacity of nuclear power plants, typically through non-nuclear improvements such as better steam turbines, etc.		•
4.	**Electricity, CHP and Waste Energy Capture**						
4.1	Combined Heat and Power Incentive Policies and Barrier Reduction	H	M/H	L	Assistance or incentives for implementation of combined heat and power technologies (CHP technologies allow for the production of electricity and the capture of waste heat from the process to be used for heating or cooling); removing or mitigating barriers such as prohibitive interconnection requirements (procedures for connecting CHP or other distributed generation to the electricity grid) established by utilities or regulators that are unnecessarily burdensome, high utility standby rates, which customers who own CHP may have to pay in order to access grid electricity in the event that their CHP unit is not working or demand exceeds its capacity, siting and zoning barriers.		• Feed-in rate

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5.	**Electricity, Grid & Utility Policies**						
5.1	Remove Transmission and Other Barriers for Renewable and other Clean DG*		U	U	Removing barriers such as prohibitive interconnection requirements (procedures for connecting distributed generation to the electricity grid) established by utilities or regulators that may be unnecessarily burdensome, high utility standby rates, which customers who own DG may have to pay in order to access grid electricity in the event that their CHP unit is not working or demand exceeds its capacity, siting and zoning barriers.		•
5.2	Net Metering		U	U	Allows utility customers to generate electricity on-site; every kwh generated runs the electricity meter back; on-site electricity is implicitly valued at the full cost per kwh of electricity the customer is paying to the utility. This policy makes it much easier for customers to install distributed generation and can lead to GHG reductions as long as requirements are in place that ensure that only renewable or CHP or other clean DG are allowed to use net metering.		•

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5.3	Transmission System Upgrading		U	U	Assistance, incentives and/or requirements to upgrade the electric power transmission system to accommodate increases in distributed generation and intermittent renewable energy resources. Without transmission upgrades, the full potential for distributed generation and intermittent resources may not be achieved. By upgrading the transmission system, more DG and intermittent renewable capacity can be installed, thereby lowering GHG emissions.		•
5.4	Interconnection Rules for clean, distributed generation*		U	U	Utility rules for interconnecting distributed generation (DG) with the grid can limit DG resources because only larger customers with the financial and engineering resources can comply with the rules (the cost of complying is a small portion of the total cost of the DG unit); the cost of complying with interconnection rules can be high enough that it is a significant portion of total costs for smaller DG systems and can tip the scale so that a DG system is not profitable (but would have been profitable with simpler interconnection procedures).		•

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5.5	Pricing and metering strategies				Advanced metering, which is a meter that can provide real time pricing information and can control demand according to user defined criteria, can enable such demand reduction actions as radio controlled load shedding. Pricing strategies like time-of-use rates (see 5.7) could deliver more accurate price signals to consumers.		•
5.6	Reduce Transmission and Distribution Line Loss		U	U	Assistance, incentives, or requirements that the transmission and distribution system for electric power be upgraded in order to reduce line losses and improve efficiency for the entire system, thereby reducing overall fuel use.		•

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5.7	Time-of-Use Rates		U	U	At peak demand, all lower cost units are already dispatched, so higher cost, often less efficient units that generate more GHG emissions and other pollutants are called upon to meet demand. Residential and most commercial customers pay an average rate. They pay the same amount per kwh of electricity consumed at the most expensive (and polluting) time of the day as they do at the least expensive. Time of use rates reflect the cost of electricity as it varies by time segments. Seeing higher costs at peak times, customers may change their consumption patterns, which in turn will reduce usage of the most expensive (and polluting) resources.		• Whether time-of-use rates actually lower emissions depends largely on the particular mix of generating resources and the demand response. If demand shifts to baseload coal, then emissions may not go down or may even go up. Only a modeling analysis can determine the impact on emissions. Time of use rates, particularly when combined with net metering, will provide an added incentive to distributed solar power because the peak output of solar coincides with the peak demand of the system and, therefore, the highest costs.
5.8	Advanced Metering				See description of Time-of-Use rates for context. Advanced metering provides real-time information to customers about the actual rate they are paying at all times. The rate is directly tied to actual costs (not a fixed rate). Please refer to notes for real-time metering for a discussion of how advanced metering may reduce emissions		• Notes for time-of-use rates apply to advanced metering as well
5.9	Load Management (no clear GHG savings)		U	U	Demand response programs can lower peak supply requirements and costs. See notes under 5.7 for an explanation of how load management may reduce emissions.		•

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5.10	Seasonal and Residential Increasing Block Rates				Rate per kwh increases with greater consumption rather than decreasing with greater volume. The first number of kwhs are at a certain price. As electricity is consumed during the month, the price goes up according to a tier or block structure. This increasing price encourages consumers to use less electricity, which leads to lower GHG emissions.		•
6.	**Education & Awareness**						
6.1	Public Education		U	U	Educating the public about how their choices in electricity service (green power or not, utility or self-generation) and how consumption affect GHG emissions and climate change.		•
6.2	Environmental (emissions) Disclosure		U	U	Disclosing the GHG emissions generated in the production of electricity or the delivery of fuels to each customer in the state. Enables consumers to make more informed decisions about their energy purchases and voluntarily reduce emissions		•
7.	**Fuels, Natural Gas & Oil Measures**						
7.1	New efficient compressors				Reduces emissions by reducing the fuel consumed by operating compressors.		•
7.2	Optimize gas flow to improve compressor efficiency				Reduces emissions by reducing the fuel consumed by operating compressors.		•

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7.3	Preventive maintenance				Reduces emissions by improving the overall efficiency of the gas production and distribution system; minimizes the chance of leaks.		•
7.4	Collection and re-injection or storage of flared gas				Rather than flaring gas, gas is collected and re-injected or stored for productive use.		•
7.5	Reduce flashing losses				As the pressure on the liquid natural gas in a storage tank or well or compressor station or gas plant drops, some of the lighter compounds dissolved in the liquid are released or "flashed" and some of the compounds that are liquids at the initial pressure/temperature transform from a liquid into a gas/vapor and are also released or "flashed" from the liquid. The flashed gas can be captured rather than vented to the atmosphere.		•
7.6	Improve performance of compressor cylinder ends				Reduces emissions by reducing the fuel consumed by operating compressors.		•
7.7	Capture compressor waste heat				Reduces emissions by reducing the fuel consumed by operating compressors.		•
7.8	Replace compressor driver engines				Reduces emissions by reducing the fuel consumed by operating compressors.		•

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7.9	Replace wet seals with dry seals				Dry seals lead to fewer leaks than wet seals. Dry seals use high-pressure gas to seal the compressor and emit less methane, have lower power requirements, improve compressor and pipeline operating efficiency and performance, enhance compressor reliability, and require significantly less maintenance		•
7.10	Compressor rod & ring replacement				Replacing worn compressor rod packing rings and rods results in operational benefits, reduced methane emissions, and cost savings. Gas leaks from compressor rods represent one of the largest sources of emissions at natural gas compressor stations.		•
7.11	Low-bleed, air-based pneumatic devices				Replacing high-bleed devices with low-bleed devices, retrofitting, and improving the maintenance of high-bleed pneumatic devices are proven approaches to profitably reducing methane emissions. Natural gas emissions from pneumatic control devices are one of the largest sources of methane emissions in the natural gas industry		•

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7.12	Pump-down techniques prior to maintenance				Using fixed and portable compressors to lower pipeline pressure prior to maintenance and repair significantly reduces methane emissions and saves money. Pipeline pump-down techniques remove product from the section of pipeline under repair, thereby reducing the volume of natural gas vented to the atmosphere.		•
7.13	Venting deliquification				Venting deliquifification occurs when natural gas is decompressed from liquid to gas. Some gas escapes to the atmosphere.		•
7.14	Coalbed methane capture				Capture and combustion or storage of coalbed methane from coal mines that would otherwise be vented to the atmosphere.		•
8.	**Fuels, Natural Gas & Oil Mechanisms**						
8.1	Incentives for pollution prevention				Assistance or incentives to reduce GHG emissions in the fuels sector by the means listed in the preceding section		•
8.2	Regulations to ensure best practices				Requirements that certain practices be done to reduce GHG emissions.		•
8.3	Information and technology exchange				State program and assistance in providing a framework for the sharing of information and technology related to GHG reduction in the fuels sector.		•

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9.	**Fuels, Coal**						
9.1	Re-injection or storage of CO2 stripped from coalbed methane				Coalbed methane contains CO2. In order to use the methane, CO2 must be stripped from it. Rather than releasing the CO2 to the atmosphere, it can be captured and reinjected into the coalbed.		•
10.	**Fuels, Hydrogen**						
10.1	Incentives for hydrogen development				Specific incentives for developing hydrogen production and infrastructure. Hydrogen can be stored or transported and can be used to generate electricity with fuel cells at very high efficiency. Applications can be stationary (utility scale fuel cells for generating electricity or small fuel cells for generating electricity and providing space heating and cooling in buildings) and mobile (used in fuel cell vehicles). Many foresee that hydrogen will become the core of a new energy system. Hydrogen can be made from renewables or from fossil fuels.		• Need to stress that the source of the hydrogen determines the degree of CO2 reductions (e.g. made from coal-fired electricity vs. wind turbines).
10.2	Fuel Cell Development Incentives		L		Specific incentives for the research and development of fuel cells to take advantage of their high efficiency and to pave the way toward a hydrogen energy system.		•
10.3	Convert O&G to hydrogen prior to export from New Mexico				Policies to encourage the conversion of oil and gas to hydrogen so that the carbon can be captured, then export the hydrogen out of state as a carbon free fuel		•

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11.	**Energy Supply, Emission Policies**						
11.1	CO2 Tax		L to H	L to H – depends on tax level	A tax on CO2 or GHG emissions that can be applied to utilities and to direct emissions of natural gas, oil, and coal producers (referred to as a downstream application of the tax because it is applied where fuel is combusted and CO2 is emitted) or to natural gas, oil and coal producers and importers based on the embodied CO2 content of fuels (the CO2 that would be emitted if the fuel is combusted). Note that this is a mechanism that would provide an incentive for other direct actions such as improvements in the efficiency of existing facilities, increased use of renewable resources, the capture and storage of carbon, and the investment in demand-side efficiency to lower demand and, consequently, production of electricity or fuels.		•

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11.2	GHG Offset/mitigation requirements for new power plants/fossil fuel production facilities				Requirement that owners of new power plants or fossil fuel production facilities/wells acquire GHG offsets (a reduction in GHG emissions by another party equal to the emissions generated by the new power plant or well, typically through forest or agricultural sequestration, that can be purchased directly from the party making the reductions or can be purchased through an existing CO2 trading system like the European Union GHG Trading Scheme or a mechanism like the Clean Development Mechanism). Offsets could, in effect, mean that no new GHG emissions result from the new power plant.		• Examples: OR, MA.
11.3	GHG Offset/mitigation requirements for existing power plants/wells				Same as above except for existing power plants.		•

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11.4	GHG Cap and Trade		H	U	A cap on emissions is set. Emission credits are allocated to participants in the trading system equal to the number of tons of emissions allowable. For every ton that a participant emits, it must have an allowance. Participants who make significant reductions have a surplus of credits and can sell them to participants who were not able to make reductions. A variation is to auction a portion or all allowances rather than giving them away. The revenue from the auction can then be recycled back to the participants or can be used to offset income or other taxes in the state. Different allocation schemes can affect outcomes. Note that the standard can be based on production or consumption and must cover a defined region and pool of emissions		•

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11.5	Electricity Generation Performance Standards		H	U	There are several variations. One is a requirement that utilities produce electricity that meets a certain emissions standard (no more than x tons per unit of output). Another variation is that if a utility does not meet the standard, it can pay an equivalent of a CO2 tax on the difference. Another variation is that allowances in a trading system can be distributed on the basis of how a utility stands relative to a performance standard (cleaner units that are better than the standard receive more allowances; units that do not meet the standard receive fewer).		•
11.6	Carbon Intensity Target		H	U	A carbon intensity target can apply to a sector or a state overall. It can be mandatory or voluntary. The essential idea is that rather than an absolute carbon cap, the target would be carbon emissions per unit of output (i.e., electricity or natural gas) or carbon emissions per $ of output value. As production increases, so can carbon emissions. A declining intensity target will lead to a more carbon-efficient sector or economy and, depending on the specific level of the target and the growth in production, can result in an increase or decrease in absolute carbon emissions.		•

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11.7	Voluntary CO2 Targets and/or Trading		U	U (typically L)	Similar to a carbon cap and trade system, except that everything is voluntary, not mandatory. No cap is established. Potentially tradable credits may be generated when a verifiable reduction in emissions occurs, depending on the recognition of other programs seeking acceptable credits.		• Voluntary targets are limited in effectiveness. • Example: CCX