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Table 2.
Energy Supply Technical Work Group
Summary Table of Policy Options

| Option Number | Policy Name | Estimated 2012 GHG Reduction (MMtCO ₂ e) | Estimated 2020 GHG Reduction (MMtCO ₂ e) | Cumulative 2007-2020 GHG Reduction (MMtCO ₂ e) | Estimated Cost or Cost Saving (\$/tCO ₂ e) | Level of CCAG Support |
|---------------|--|---|---|---|---|-----------------------|
| ES-1 | Mandate(s) for Renewable Energy (RPS, etc.) | | | | | <i>Pending</i> |
| | ES-1a: 10% in 2011, 0.5% increase/year to 2021 | 1.0 | 1.7 | 13.2 | \$4 | |
| | ES-1b: 10% in 2011, 1% increase/year to 2021 | 1.1 | 2.6 | 17.8 | \$6 | |
| | ES-1c: 10% in 2011, 2% increase/year to 2021 | <i>See ES-4 below</i> | | | | |
| ES-2 | Financial Incentives for Distributed Renewables | | | | | <i>Pending</i> |
| | ES-2b: Payback 25 years; PV, wind & biomass; all utilities | 0.02 | 0.4 | 1.6 | \$105 | |
| ES-3 | Renewable Energy Transmission and Storage | <i>Not quantified</i> | | | | <i>Pending</i> |

| Option Number | Policy Name | Estimated 2012 GHG Reduction (MMtCO ₂ e) | Estimated 2020 GHG Reduction (MMtCO ₂ e) | Cumulative 2007-2020 GHG Reduction (MMtCO ₂ e) | Estimated Cost or Cost Saving (\$/tCO ₂ e) | Level of CCAG Support |
|---------------|---|---|---|---|---|--|
| ES-4 | RPS to 30% by 2021 with Financial Incentives for Centralized Renewables | 1.2 | 4.2 | 26.0 | \$8 | <i>Pending</i> |
| ES-5 | R&D including Energy Storage | <i>Not Quantified</i> | | | | <i>Pending</i> |
| ES-6 | Advanced Coal/Fossil Technologies (e.g., IGCC with carbon capture) | | | | | <i>Pending</i> |
| | ES-6a: All new coal plants would be IGCC with 60% capture | <i>Not Quantified (lack of data)</i> | | | | |
| | ES-6b: All new coal plants would be IGCC with 90% capture | 0.8 | 4.3 | 22.7 | \$29 | |
| ES-7 | Nuclear Power | <i>Not Quantified</i> | | | | <i>Pending</i> |
| ES-8 | Incentives and Barrier Reductions for Combined Heat & Power (CHP) | 0.3 | 0.9 | 6.1 | \$4 | <i>Pending</i> |
| ES-9 | Demand-Side Management, Energy Efficiency, and Integrated Resource Planning (IRP) | 0.2 | 1.0 | 5.5 | -\$18 | <i>Unanimous Consent (Quantified as RCI-1)</i> |
| ES-10 | Transmission Capacity and Corridors | <i>Not Quantified</i> | | | | <i>Pending</i> |
| ES-11 | CO ₂ Capture and Storage or Reuse (CCSR) in Oil and Gas Operations (A and B) | 1.6 | 3.0 | 25.1 | <i>Not Estimated</i> | <i>Pending</i> |

| Option Number | Policy Name | Estimated 2012 GHG Reduction (MMtCO ₂ e) | Estimated 2020 GHG Reduction (MMtCO ₂ e) | Cumulative 2007-2020 GHG Reduction (MMtCO ₂ e) | Estimated Cost or Cost Saving (\$/tCO ₂ e) | Level of CCAG Support |
|---------------|--|---|---|---|---|-----------------------|
| ES-12 | Methane Reduction in Oil and Gas Operations: BMPs and PROs | 2.7 | 3.4 | 35.3 | <i>Not Estimated</i> | <i>Pending</i> |
| ES-13 | CO₂ Reduction from Fuel Combustion in Oil and Gas Operations (A and B) | 0.6 | 1.4 | 10.6 | <i>Not Estimated</i> | <i>Pending</i> |
| ES-14 | GHG Cap and Trade | <i>Quantifications below are for illustration only.</i> | | | | <i>Pending</i> |
| | National/NEMS: 2.4%–2.8% Carbon Intensity (CI) improvement per year, with a \$6.16–\$9.86 safety valve | -0.1 | 1.0 | 3.6 | \$7 | |
| | National/NEMS: 2.6%–3.0% CI, \$8.83–\$14.13 safety valve | 0.1 | 1.0 | 4.2 | \$10 | |
| | National/NEMS: 2.8%–3.5% CI, \$22.09–\$35.34 safety valve | -0.1 | 8.1 | 31.3 | \$17 | |
| | National/NEMS: 3.0%–4.0% CI, \$30.92–\$49.47 safety valve | 0.1 | 9.1 | 43.5 | \$19 | |
| | Rose: 11-State Economy-wide C&T; 5% costless | 6.7 ¹ | 10.9 ² | 90.6 ³ | \$3 | |
| | Rose: 11-State Economy-wide C&T; 15% costless | 10.3 ⁴ | 14.9 ⁵ | 132.0 | -\$4 | |

¹ See Adam Rose spreadsheet “S_5% Case NPV1” – “Emission Reduction” Table

² See Adam Rose spreadsheet “S_5% Case NPV1” – “Emission Reduction” Table

³ Per Adam Rose’s 8/6/06 email of S/5%/2020 with 2006 NPV. See spreadsheet “S_5% Case NPV1”

⁴ TABLE AS/15%/2012, page 7.

⁵ TABLE BS/15%/2020, page 9.

| Option Number | Policy Name | Estimated 2012 GHG Reduction (MMtCO ₂ e) | Estimated 2020 GHG Reduction (MMtCO ₂ e) | Cumulative 2007-2020 GHG Reduction (MMtCO ₂ e) | Estimated Cost or Cost Saving (\$/tCO ₂ e) | Level of CCAG Support |
|---|--|---|---|---|---|-----------------------|
| | Rose: 11-State Power-Sector C&T; 5% costless | 2.96 | 5.47 | 42.5 | \$8 | |
| | Rose: 4-State Economy-wide C&T; 5% costless | 5.78 | 9.49 | 78.1 | \$5 | |
| ES-15 | Generation Performance Standard | 1.2 | 3.8 | 24.3 | \$21 | <i>Pending</i> |
| ES-16 | Regulatory Reform for Electric Cooperatives | <i>Non-quantified enabling policy</i> | | | | <i>Pending</i> |
| Net Total All Options (Accounting for Overlap Among Other ES Options and RCI Options) | | 6.6 | 14.2 | 109.5 | \$7 | |
| Additional Emissions Savings from Recent Actions (not included in forecast or in policy options above) | | | | | | |
| Net Total All Options Plus Recent Actions | | | | | | |

6 TABLE AP/5%/2012, page 11.

7 TABLE BP/5%/2020, page 12.

8 TABLE A'S/5%/2012, page 13.

9 TABLE B'S/5%/2020, page 14.

Methodology for the Estimation of Emissions Reductions from Electricity Policies

The CCAG process has discussed two accounting approaches for estimating electricity emissions: (a) the consumption-basis approach, which aims to reflect the emissions associated with electricity sources used to deliver electricity to consumers in the state; and (b) the production-basis approach, which considers the emissions from New Mexico power plants, regardless of where the electricity is delivered. The emissions impact of Energy Supply (ES) policy options will differ depending on which approach/perspective is taken. For instance, an RPS (ES-1) will result in the increased delivery of renewable electricity to NM consumers, thereby directly displacing the delivery of fossil fuel-based electricity (i.e., a consumption-based impact). The impacts of an RPS from a production-based perspective are more uncertain. An RPS might well avoid or delay the construction of new fossil-fired power plants in NM, to the extent these plants might otherwise be sited in NM and contracted to meet NM demands. Its effect on the operation of existing coal plants is less clear, since these plants could well continue to generate and sell more electricity to other states. Given these uncertainties, the limits of this process, and CCAG preferences, we focus here on estimating emission reductions from the consumption-based accounting approach (i.e., the impact on the mix of electricity resources used to meet NM electricity needs). In addition, for the purposes of this analysis, RPS plans are assumed to apply to all retail electricity sales from all sources (e.g., investor-owned utilities, tribally owned facilities, electric cooperatives, etc.).

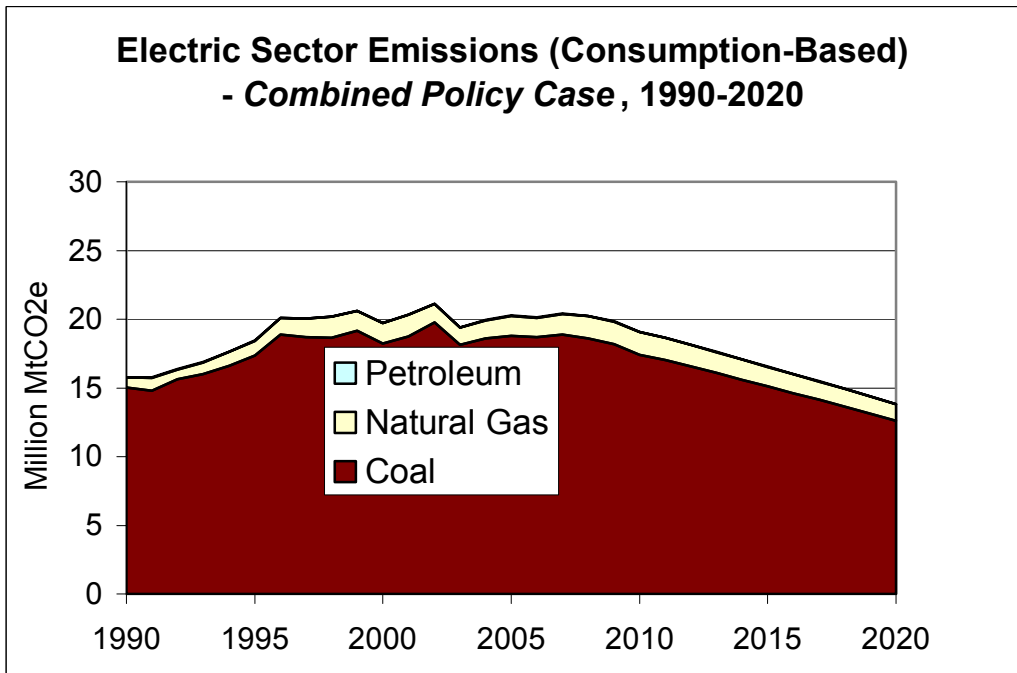
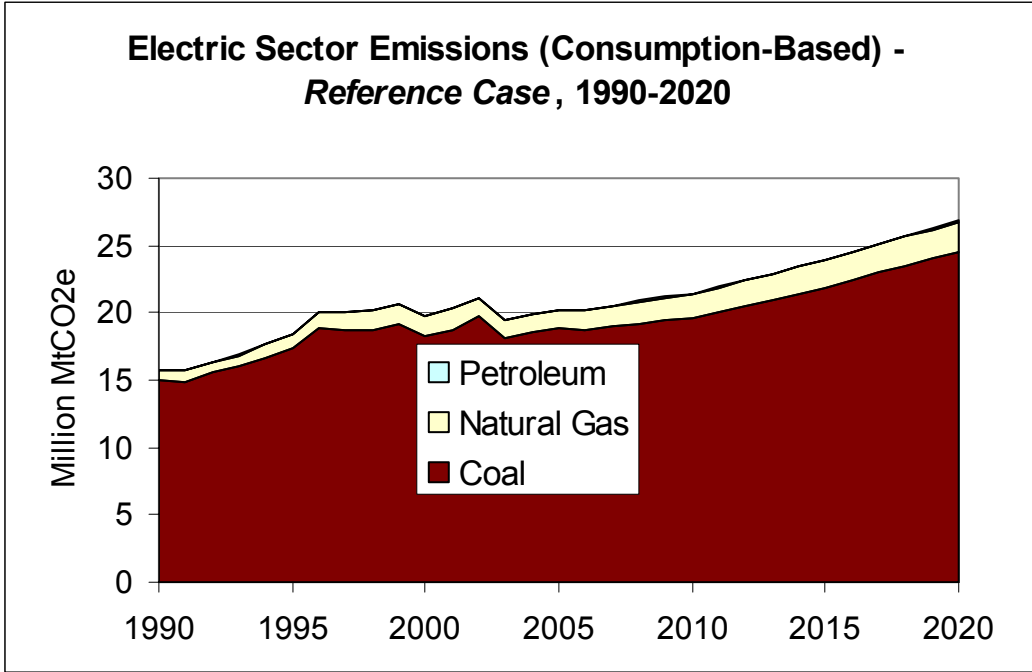
To estimate emissions reductions from policy options that are expected to displace conventional grid-supplied electricity (i.e., those that reduce grid demand such as DSM or CHP, or increase renewable electricity generation) a simple, straightforward approach is used. Through 2010, we assume that these policy options would displace generation from the then-current mix of fuel-based electricity sources. (We assume that sources without significant fuel costs would not be displaced, e.g., hydro or other renewable generation). After 2010, we assume that the policy options under consideration here are likely to avoid new capacity additions first, then generation from existing power plants.

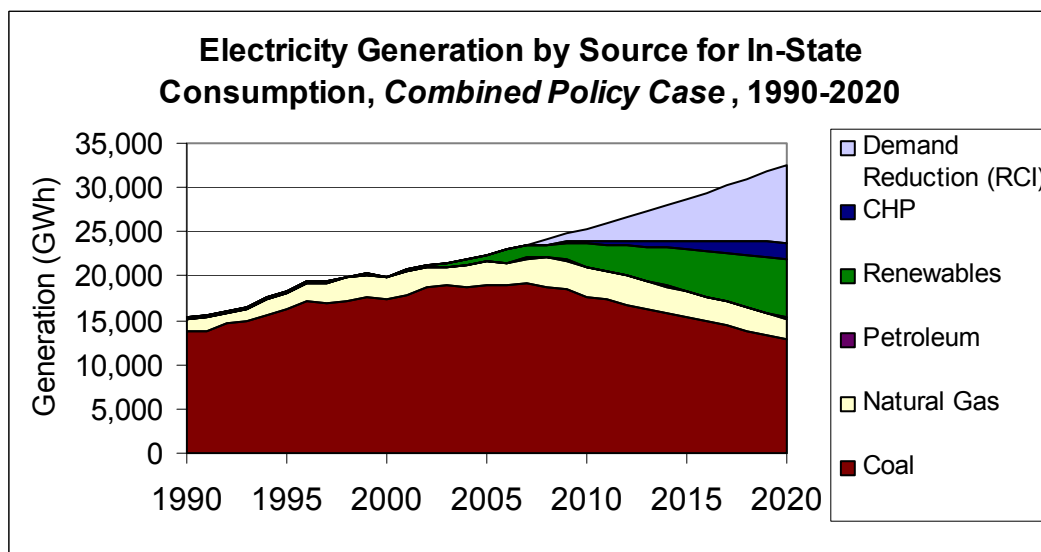
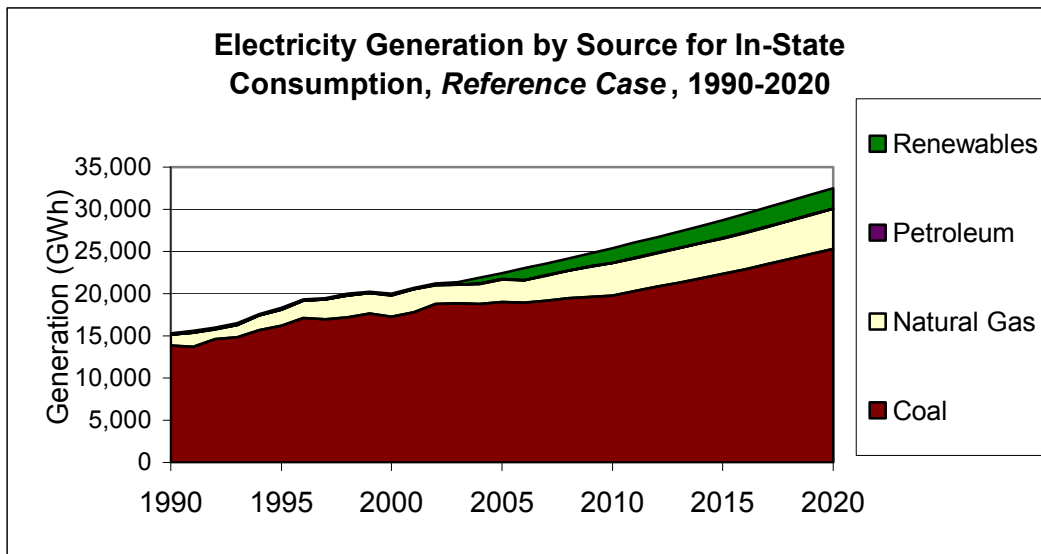
This approach provides a transparent way to estimate emissions reductions and to avoid double counting (by ensuring that the same MWh from a fossil fuel source is not “avoided” more than once). It also yields results that are consistent with the state-level inventory and forecast developed as part of the CCAG process. It can be considered a “first-order” approach; it does not attempt capture a number of factors such as the distinction between peak, intermediate, and baseload generation; issues in system dispatch and control; impacts of non-dispatchable and intermittent sources such as wind and solar; or the dynamics of regional electricity markets. These relationships are complex and could mean that policy options affect generation and emissions (as well as costs) in a manner somewhat different than estimated here, but this approach provides reasonable first-order approximations of emissions impacts and offers the advantages of simplicity and transparency that are important for stakeholder processes.

The emissions reduction estimates shown for each option (as well as the economic analyses) presume that each option is implemented alone. Many options, particularly for electricity supply, are related in so far as they target the displacement of the same reference case resources (e.g., growth in emissions from new coal plants), or otherwise have interactive effects. Therefore, if multiple options are implemented, the results will not simply be the sum of each individual option result. For this reason, as illustrated in the figures below, we also conduct a “combined policies” assessment to estimate total emission reductions if all policies were to be implemented together.

The combined assessment considers actions on both sides of the electricity meter. Demand reduction (RCI) and customer-sited renewable energy (ES-2) reduce requirements for grid electricity; as a result, fewer MWh from renewables are needed to meet the targets described in options ES-1 and ES-4, and the amount of new coal generation that would be addressed by the carbon capture and storage option (ES-6) and the generation performance standard (ES-15) is reduced. These interactions are captured in the graphs below.

Estimation of Results from Combined Electricity Policies





ES-1 Mandate(s) for Renewable Energy (RPS, etc.)

Policy Description:

CCAG Summary: A renewable portfolio standard (RPS) is a requirement that utilities must supply a certain percentage of electricity from renewable energy sources. Utilities can meet this requirement by purchasing or generating renewable-based electricity or by purchasing renewable energy certificates (RECs). By providing this flexibility, a market in RECs is created, which incentivizes companies that are best able to develop the most economical renewable energy resources. 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. Utilities can meet their requirements by purchasing or generating renewable-based electricity or by purchasing renewable energy certificates (RECs) from eligible renewable energy projects. RECs are tradable certificates that are typically part of an RPS policy. RECs are created for every kWh of verified renewable electricity produced.

Anyone can build an eligible renewable facility and earn RECs for the electricity that it generates. Anyone with RECs can sell them to a utility that needs to meet its RPS requirement. In this way, utilities themselves may not need to build and operate renewable generating facilities. By providing this flexibility, a market in these credits would be created, which would provide an incentive to companies with expertise and financial backing to develop renewable energy projects.

Policy Designs:

The CCAG recommends that New Mexico ramp up the existing 10% RPS by increasing it annually during the period 2011-2021. These requirements would apply to all investor-owned and publicly-owned electricity suppliers in New Mexico. The State should consider at least three scenarios reflecting the three annual increments shown below:

- **Goal levels:**
 - a. 0.5 % per year.
 - b. 1% per year.
 - c. 2% per year. (This RPS level is modeled as ES-4: Financial Incentives for Centralized Renewables. See that option for discussion and results.)
- **Timing:** As noted above.
- **Parties:** Investor-owned and publicly-owned utilities.

- **Other:** The new RPS policy will allow different renewable technologies to earn the same number of renewable credits per kWh as the existing New Mexico RPS policy.

Implementation method(s):

- Codes and standards – An RPS is usually implemented through a legislative and/or regulatory requirement (mandate) on the applicable utilities.
- Market-based mechanisms – Most state RPS programs allow REC trading among states. A “safety valve” can be put in place that limits the price of RECs at a specified level by allowing utilities to purchase RECs from the state at the “safety valve” price.

Related Policies/Programs in place:

New Mexico currently has a 5% renewables requirement by 2006, and a 10% requirement by 2011, wherein:

- One kilowatt-hour of electricity generated by wind or hydroelectric technologies is worth one kilowatt-hour toward compliance with the RPS;
- One kilowatt-hour of biomass, geothermal, landfill gas, or fuel cell power is worth two kilowatt-hours toward the RPS; and
- One kilowatt-hour of solar power is worth three kilowatt-hours toward the RPS,

Type(s) of GHG Benefit(s):

- CO₂: By creating a substantial market in renewable generation, an RPS can reduce fossil fuel use in power generation and thus reduce CO₂ emissions.
- Black Carbon: To the extent that generation from coal and oil would be displaced by renewables, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

| # | Policy | Scenario | Reductions (MMTCO ₂ e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO ₂ |
|-------|---|--------------------------|-----------------------------------|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007 - 2020) | | |
| ES-1a | Mandate(s) for Renewable Energy (RPS, etc.) | 0.5 % per year 2011-2021 | 1.0 | 1.7 | 13.2 | \$53 | \$4 |
| ES-1b | Mandate(s) for Renewable Energy (RPS, etc.) | 1% per year 2011-2021 | 1.1 | 2.6 | 17.8 | \$102 | \$6 |

| | | | |
|-------|---|--------------------------|----------|
| ES-1c | Mandate(s) for Renewable Energy (RPS, etc.) | 2% per year 2011-2021 | See ES-4 |
|-------|---|--------------------------|----------|

Data Sources, Methods and Assumptions:

- **Data Sources:** CDEAC, WECC, EIA, EPA, NREL.
- **Quantification Methods:** The analysis uses a spreadsheet tool to compare the costs and CO₂ emissions of RPS scenarios with the costs and CO₂ emissions of the reference case. It involves the following steps: (1) identify the type of renewable generation that would most likely be used to meet the RPS in 2012 and 2020; (2) estimate the costs associated with each type of renewable technology; (3) estimate the extent to which the cost of the renewables exceed the cost of conventional generation; and (4) estimate the amount of CO₂ emissions that are expected to be avoided by the renewables, relative to the reference case. The primary scenario assumes that the current New Mexico RPS is increased by 1% per year. Two sensitivity scenarios investigate the effect of increasing the New Mexico RPS by 0.5% and 2% per year. The latter sensitivity will be modeled along with financial incentives for centralized renewables, and thus is modeled and discussed under policy option ES-4.
- **Key Assumptions:** It is assumed that the NM RPS would be met with a combination of wind, biomass and concentrating solar power (CSP). Wind provides a large majority of the resources, with CSP increasing in later years as the economics of that technology improve. For ES-1a it is assumed that in 2010 the renewable mix is made up of 100% wind; and that by 2020 the renewable mix is made up of 80% wind, 15% biomass and 5% CSP. For ES-1b it is assumed that in 2010 the renewable mix is made up of 100% wind; and that by 2020 the renewable mix is made up of 75% wind, 20% biomass and 5% CSP. These renewables mixes are roughly based on an assessment of renewable potential and cost identified in the 2006 CDEAC study, as well as input from the Technical Working Group on the potential for renewable generation. The costs of the new renewable systems are based on those used in the EIA Annual Energy Outlook for 2006, except where better (e.g., updated or more local) data are available. The cost of renewable generation include costs associated with connecting renewable technologies to the electric grid, and transmitting the renewable generation to loads, based on information from the 2006 CDEAC study. The cost of wind generation also includes costs associated with integrating large amounts of wind onto the system, where integration costs increase with increasing amounts of wind capacity. These wind integration costs are based on a review of the relevant literature, including a recent study by Xcel Energy. The benefits of this policy are the avoided costs of generation as estimated based on past avoided cost studies. Additional detail on key assumptions is provided in Attachment A below.

Key Uncertainties:

- As with any assessment of the future, this analysis has many uncertainties. Key uncertainties are those related directly to the assumptions and quantification methods noted above. If those assumptions are incorrect, then the results would change. Other uncertainties include the forecast of the price of fossil fuels and the growth in the demand for electricity.

Contributing Issues, if applicable:

- Reductions in overall energy consumption and the shift from fossil fuel generation as a result of an RPS would lead to reductions in criteria air pollutants and, consequently, health costs associated with those pollutants.
- Renewables can provide a fuel price hedge effect against fossil fuel price volatility, particularly natural gas.
- The operating costs of renewable generation, primarily maintenance, are generally spent locally and can provide a direct boost to local and state economies.
- Water use may be reduced through renewable versus combustion technologies.

Feasibility Issues, if applicable:

- Issues of regulatory approval for recovery of the additional costs.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus:

TBD.

ES-2 Financial Incentives for Distributed Renewables

Policy Description:

CCAG Summary: This policy option reflects a suite of financial incentives to encourage investment in distributed renewables. Financial incentives for distributed renewables could include: (1) direct subsidies for purchasing/selling distributed renewable technologies given to the buyer/seller; (2) tax credits or exemptions for purchasing/selling distributed renewable technologies given to the buyer/seller; (3) tax credits or exemptions for operating distributed renewable energy facilities; (4) feed-in tariffs, which provide direct payments to distributed renewable generators for each kWh of electricity generated from a qualifying renewable facility; (5) tax credits for each kWh generated from a qualifying renewable facility; (6) R&D funding to support development of distributed renewable technologies; (7) net metering; (8) financial incentives or assurance of cost recovery for regulated utilities that make reasonable and prudent investments in utility-owned or customer-owned distributed renewable energy resources and (9) a clean energy grants program. New Mexico has been striving toward capital buy downs and production incentives such that there is full payback over 25-30 years to those who install distributed renewable options.

This policy option reflects financial incentives to encourage investment in distributed renewables. These financial incentives for distributed renewables include (1) direct subsidies for purchasing/selling distributed renewable technologies given to the buyer;¹⁰ (2) tax credits or exemptions for purchasing distributed renewable technologies given to the buyer, and (3) regulatory policies that provide incentives and/or assurance of cost recovery for utilities that invest in customer-owned renewable energy systems. The policy also includes R&D funding to support development of distributed renewable technologies.

R&D funding could 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. R&D funding could 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.

New Mexico has been striving toward capital buy downs and production incentives such that there is full payback over 25-30 years to those who install distributed renewable options. Additionally, Albuquerque is considering tax incentives for distributed renewables.

¹⁰ Any direct subsidies or incentives would need to be cleared through the New Mexico Attorney General's Office to ensure that they comport with the anti-donation clause of the New Mexico Constitution.

Policy Design:

The CCAG recommends that New Mexico offer incentives for distributed solar photovoltaic technologies in order to reduce their payback period. The State should consider scenarios reflecting at least the following options:

- **Goal levels:**
 - a. 25 years (PNM only)
 - b. 25 years (all utilities) – (Modeled scenario)
 - c. 10 years (all utilities)
 - d. 3 years (all utilities)
- **Timing:** Adopted ASAP; accomplished per above.
- **Parties:** Financial incentives would be administered by a state agency and provided to individuals, commercial enterprises, and industrial enterprises.
- **Other:** A source of funds to cover these financial incentives would need to be determined. It may be possible to link incentives to (or condition them upon) the manufacture within New Mexico of associated equipment.

Implementation method(s):

- Funding mechanisms and or incentives.
- Regulatory policies that support utility investments in distributed renewable energy.
- Pilots and demonstration projects.
- Research and development.

Related Policies/Programs in place:

- New Mexico has a personal income tax credit for photovoltaic (PV) and solar thermal systems amounting to 30% of the cost of installation up to a maximum of \$9,000.
- PNM has implemented a program in which it purchases RECs from customers with solar PV systems at a rate of 13 cents per kWh, which produces approximately a 25-year payback on such systems.

Type(s) of GHG Benefit(s):

- CO₂: By providing a financial incentive for renewable generation, more renewable facilities would be installed and more electricity from renewables would be generated. This very-low-carbon generation would displace generation from fossil fuels and thus lower carbon emissions more than otherwise would be the case. By funding R&D, new or improved renewable technologies would be developed or commercialized, leading to even more installation of renewables and further reducing carbon emissions in the long term.

- Black Carbon: To the extent that generation from coal and oil would be displaced by renewables, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

| # | Policy | Scenario | Reductions (MMTCO2e) | | | NPV (2007– 2020) \$ millions | Cost- Effective- ness \$/tCO2 |
|-------|---|---|----------------------|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007 - 2020) | | |
| ES-2b | Financial Incentives for Distributed Renewables | Payback = 25 years; PV, wind and biomass; all utilities | 0.02 | 0.4 | 1.6 ¹¹ | \$164 | \$105 |

See Attachment B for results for other scenarios. Under a higher capital cost scenario, the NPV and cost-effectiveness rise to \$217 million and \$139/tCO2 respectively; and under a lower capital cost scenario, they fall to \$137 million and \$88/tCO2. If limited just to PNM service territory, the results are about 64% lower for emission reductions and NPV costs.

Data Sources, Methods and Assumptions (for quantified actions):

Printouts of portions of the worksheet used to prepare the analysis of this option are provided at the end of these Policy Descriptions. These printouts provide more details on data sources and assumptions, which are summarized here:

- **Data Sources:** The Southwest Energy Efficiency Project's Report *Increasing Energy Efficiency in New Buildings in the Southwest: Energy Codes and Best Practices* for residential housing units and commercial floor space data and projections for NM; AEO2006 for solar PV capital cost and O&M costs projections, as well as R/C electricity costs and marginal CO2 emission factor for the NERC region where NM is located.
- **Quantification Methods:** We use a simple spreadsheet analysis in which the magnitude of the incentive required to yield positive cash flow for the consumer post 10 years (and the other payback periods) is calculated. The incentive is the percentage of the capital cost that is subsidized by a funding source. The size of the incentive diminishes over time consistent with projected capital cost reduction assumptions. Final results are reported in terms of total PV capacity installed and annual generation avoided.

¹¹ The emission reductions in the 2020 timeframe for this measure are modest; its justification is that it can reduce costs and build local installation and manufacturing capacity for distributed renewables enabling significant contributions in the post-2020 timeframe.

- **Key Assumptions:** Avoided electricity costs are assumed consistent with ES-1 above, also accounting for avoided transmission and distribution costs. Average capacity factor of PV systems is conservatively assumed to be 25%.

Key Uncertainties:

- As with any assessment of the future, this analysis has many uncertainties. Key uncertainties are those related directly to the assumptions and quantification methods noted above. If those assumptions are incorrect, then the results would change. Other uncertainties include the forecast of the price of fossil fuels and the growth in the demand for electricity.

Contributing Issues, if applicable:

- Reductions in overall electricity consumption and the shift from fossil fuel generation as a result of new renewables would lead to reductions in criteria air pollutants and, consequently, health costs associated with those pollutants.
- Renewables can provide a fuel price hedge effect against fossil fuel price volatility, particularly natural gas.
- The operating costs of renewable generation, primarily maintenance, are generally spent locally and can provide a direct boost to local and state economies.
- Distributed renewables can reduce the need for incremental transmission and distribution infrastructure and its associated costs.
- Water use may be reduced through renewable versus combustion technologies.

Feasibility Issues, if applicable:

- Any direct subsidies or incentives would need to be cleared through the New Mexico Attorney General's Office to ensure that they comport with the anti-donation clause of the New Mexico Constitution.
- Issues of regulatory approval for recovery of the additional costs.

Status of Group Approval:

Pending.

Level of Group Support:

TBD

Barriers to consensus (if less than unanimous consent):

TBD

ES-3 Renewable Energy Transmission and Storage

Policy Description:

CCAG Summary: Renewable energy from wind and solar is intermittent by nature, while fossil fuel technologies can be called upon to meet demand as needed. A renewable energy transmission authority (RETA) could be created to assist in the development of energy storage technologies and to foster the development of transmission capacity necessary to take advantage of renewable resources.

Renewable energy from wind and solar is intermittent by nature, while fossil fuel technologies can be called upon to meet demand as needed. A maximum amount of intermittent renewable capacity can be added to an electricity system before reliability is compromised – unless energy storage technologies are developed and deployed that allow renewable energy to be dispatched as needed.

Also, the best renewable resources may not be near existing transmission lines. New transmission, as well as upgrades to existing transmission lines, may be needed to accommodate extensive deployment of renewable generation capacity. The National Renewable Energy Laboratory (NREL) estimates that wind resources in New Mexico would support between 4,000 and 8,000 MW of new wind capacity in the near future, provided that transmission lines were built to accommodate it.

A renewable energy transmission and storage authority (RETA) could be created to assist in the development of energy storage technologies and to foster the development of transmission capacity necessary to take advantage of renewable resources. The authority could, for example, fund energy storage research and development and demonstration projects.

HB111 was introduced in the New Mexico Legislature in 2006 to create a Renewable Energy Transmission Authority in order to: (1) diversify and expand the New Mexico economy through improvements in the electric transmission infrastructure and the development of energy storage technologies; (2) facilitate the transmission and use of New Mexico renewable energy by financing or planning, acquiring, maintaining and operating electric transmission facilities, storage facilities and related supporting infrastructure and interests therein; and (3) provide for the creation of the New Mexico renewable energy transmission authority to facilitate the financing, planning, acquiring, maintaining and operating of electric transmission and storage facilities.

Policy Design:

The CCAG recommends that New Mexico adopt legislation establishing a Renewable Energy Transmission Authority similar to HB-111 introduced in the New Mexico Legislature in 2006.

- **Goal levels:** Not applicable.
- **Timing:** Not applicable.
- **Parties:** Legislation would create a RETA as an independent entity, which work with utilities to build new transmission capacity as well as with private companies to develop and deploy storage technologies.

Implementation method(s):

- Funding mechanisms and or incentives.
- Pilots and demonstration projects.
- Research and development.

Related Policies/Programs in place:

- Existing transmission lines can serve some new renewable energy capacity, but may not be sufficient for a full-scale deployment of renewable energy.
- No agency charged with developing and deploying renewable energy storage technologies is currently in place in New Mexico.

Type(s) of GHG Benefit(s):

- **CO2:** By providing transmission capacity and storage, renewable energy could be more fully exploited in New Mexico, resulting in the displacement of fossil fuel resources and, therefore, a reduction in CO2 emissions. In particular, energy storage would allow intermittent renewable resources to displace coal-fired generation, providing a greater reduction in CO2 emissions than renewables would otherwise provide.
- **Black Carbon:** To the extent that generation from coal and oil would be displaced by renewables, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

- This option is an enabling strategy for achieving reductions estimated for other options, and is not quantified directly.

Data Sources, Methods and Assumptions (for quantified actions):

- Not applicable.

Key Uncertainties:

- Not applicable.

Contributing Issues, if applicable:

- Reductions in overall electricity consumption and the shift from fossil fuel generation as a result of new renewables would lead to reductions in criteria air pollutants and, consequently, reduce health costs associated with those pollutants.

- Renewables can provide a fuel price hedge effect against fossil fuel price volatility, particularly natural gas.
- The operating costs of renewable generation, primarily maintenance, are generally spent locally and can provide a direct boost to local and state economies.
- Water use may be reduced through renewable versus combustion technologies.

Feasibility Issues, if applicable:

None cited.

Status of Group Approval:

Pending.

Level of Group Support:

TBD

Barriers to consensus (if less than unanimous consent):

TBD

ES-4 RPS to 30% by 2021 with Financial Incentives for Centralized Renewables

Policy Description:

CCAG Summary: This policy option reflects a suite of financial incentives to encourage investment in centralized renewables. Financial incentives for centralized renewables could include: (1) direct subsidies for purchasing/selling centralized renewable technologies given to the buyer/seller;¹² (2) tax credits or exemptions for purchasing/selling centralized renewable technologies given to the buyer/seller; (3) tax credits or exemptions for operating centralized renewable energy facilities; (4) feed-in tariff, which is a direct payment to centralized renewable generators for each kWh of electricity generated from a qualifying renewable facility; (5) tax credits for each kWh generated from a qualifying renewable facility; (6) regulatory policies that provide financial incentives through favorable rate treatment to regulated utilities for reasonable and prudent investments in centralized merchant-built or utility-built renewable energy projects, (7) R&D funding to support development of centralized renewable technologies.

This policy option reflects a suite of financial incentives to encourage investment in centralized renewables. Financial incentives for centralized renewables could include: (1) direct subsidies for purchasing/selling centralized renewable technologies given to the buyer/seller; (2) tax credits or exemptions for purchasing/selling centralized renewable technologies given to the buyer/seller; (3) tax credits or exemptions for operating centralized renewable energy facilities; (4) feed-in tariff, which is a direct payment to centralized renewable generators for each kWh of electricity generated from a qualifying renewable facility; (5) tax credits for each kWh generated from a qualifying renewable facility; (6) regulatory policies that provide financial incentives through favorable rate treatment to regulated utilities that invest in centralized merchant or utility-built renewable energy projects (7) R&D funding to support development of centralized renewable technologies. Incentives could also be linked to or made conditional upon in-state manufacturing of equipment.

This policy could also be linked with other carbon policies in order to make them more effective. For example, financial incentives could be provided in conjunction with an RPS in order to (a) provide long-term financial support for renewable developers, (b) help ensure that aggressive levels of renewable generation can be achieved in practice, and (c) provide financial support for certain renewable technologies that would not otherwise be developed.

Policy Design:

The CCAG recommends that New Mexico implement the production tax incentives presented

¹² Any direct subsidies or incentives would need to be cleared through the New Mexico Attorney General's Office to ensure that they comport with the anti-donation clause of the New Mexico Constitution.

below. These incentives would be provided in conjunction with an RPS that increases the existing New Mexico RPS targets by 2% per year from 2010 to 2020. In other words, these financial incentives are combined with the 2% RPS case mentioned in option ES-1c above.

The State should also eliminate the existing 2 million MWH/year cap for this incentive; lower the facility size threshold from 10 MW to 1 MW, and extend the tax credit to apply to personal income taxes as well as corporate income taxes.

- **Goal levels:**
 - Solar (including PV and Concentrating Solar Power) = 4 cents per kWh
 - Biomass = 2 cents per kWh
 - Wind = 1 cent per kWh
- **Timing:** ASAP
- **Parties:** A state agency would administer or supervise the financial incentives, and utilities, commercial enterprises, industrial enterprises would receive them.
- **Other:** A source of funds to cover these financial incentives would need to be determined. It may be possible to link incentives to (or condition them upon) the manufacture within New Mexico of associated equipment.

Implementation method(s):

- Funding mechanisms and or incentives.
- Regulatory policies
- Pilots and demonstration projects.
- Research and development.

Related Policies/Programs in place:

- New Mexico has a corporate tax credit of 1 cent per kWh for wind, solar or biomass facilities larger than 10 MW; available only for the first 400,000 MWHs of generation per year. Tax credits for total generation from all participants are available only for the first 2 million MWHs per year.

Type(s) of GHG Benefit(s):

- **CO₂:** By providing a financial incentive for renewable generation, more renewable facilities would be installed and more electricity from renewables would be generated. This very-low-carbon generation would displace generation from fossil fuels and lower carbon emissions more than otherwise would be the case. By funding R&D, new or improved renewable technologies would be developed or commercialized, leading to even more installation of renewables and further reducing carbon emissions in the long term.
- **Black Carbon:** To the extent that generation from coal and oil would be displaced by renewables, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

| # | Policy | Scenario | Reductions (MMTCO2e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO2 |
|------|---|---|----------------------|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| ES-4 | RPS to 30% by 2021 with Financial Incentives for Centralized Renewables | Eliminate 2 million MWH cap; drop from 10 MW to 1 MW; 4¢ PV PTC; 2¢ biomass PTC; 1¢ wind PTC. | 1.2 | 4.2 | 26.0 | \$215 | \$8 |

Note on results: The costs presented above are the total direct costs required to achieve the goals of this policy irrespective of who pays: New Mexico taxpayers or electricity ratepayers. The analysis suggests that, on an NPV basis, the costs of this policy would be covered entirely by the tax incentives at the rates noted above (i.e., the NPV of the incentives is approximately equal to NPV of the overall policy shown above). As a result, electricity rates would be largely unaffected.

The NPV cost analysis for individual policy options does not consider their potentially significant indirect and macroeconomic impacts (or externalities). For instance, the cost estimates shown in the tables below do not consider the potential rural economic development, job creation or added tax receipts that might result from increased renewable energy development in the State. They also do not account for the non-climate environmental co-benefits of reduced local and regional air pollution, or indirect impacts of tax or rate changes, that might result from these policies.

Data Sources, Methods and Assumptions (for quantified actions):

- **Data Sources:** CDEAC, WECC, EIA, EPA, NREL.
- **Quantification Methods:** The analysis uses a spreadsheet tool to assess the impact that financial incentives for centralized renewables would have on the 2% RPS case (described above in option ES-1). We expect that the introduction of these financial incentives will alter the mix of renewable resources used to meet the 2% RPS case. (Because solar and biomass technologies would earn added credits per kWh towards the RPS target, providing the increased incentives to these technologies results in slightly less overall renewable generation to meet the goal.). The analysis involves the following steps: (1) identify the type of

renewable generation that would most likely be developed as a result of the 2% RPS case combined with the financial incentives; (2) estimate the costs associated with each type of renewable technology; (3) estimate the extent to which the cost of the renewables exceed the cost of conventional generation; and (4) estimate the amount of CO₂ emissions that are expected to be avoided by the renewables, relative to the reference case.

- **Key Assumptions:** Where applicable, the key assumptions are the same as those used in assessing the RPS (ES-1). Ideally, we would undertake a full economic modeling exercise to assess how the proposed incentive amounts might alter the mix and amount of renewable energy generation; however, such a modeling exercise would be both time-consuming and subject to very large uncertainties. Instead, we make some indicative assumptions. For example, given the incentive structure proposed, it is assumed that biomass and solar would play a greater role in providing renewable generation under the RPS than would be the case without incentives. It is assumed that the renewables mixes developed above for the RPS would be modified such that in 2010 the renewables mix is made up of 95% wind and 5% biomass; and that by 2020 the renewables mix is made up of 70% wind, 20% biomass, and 10% CSP. The actual increase in total renewable generation will depend upon the cost-competitiveness of these resources after the subsidies. The costs of the new renewable systems are the same as those described above for ES-1. Additional detail on key assumptions is provided in Attachment A below.

Key Uncertainties:

- As with any assessment of the future, this analysis has many uncertainties. Key uncertainties are those related directly to the assumptions and quantification methods noted above. If those assumptions are incorrect, then the results would change. Other uncertainties include the forecast of the price of fossil fuels and the growth in the demand for electricity.

Contributing Issues, if applicable:

- Reductions in overall electricity consumption and the shift from fossil fuel generation as a result of new renewables would lead to reductions in criteria air pollutants and, consequently, health costs associated with those pollutants.
- Renewables can provide a fuel price hedge effect against fossil fuel price volatility, particularly natural gas.
- The operating costs of renewable generation, primarily maintenance, are generally spent locally and can provide a direct boost to local and state economies.
- Water use may be reduced through renewable versus combustion technologies.

Feasibility Issues, if applicable:

- Issues of regulatory approval for recovery of the additional costs regulated utilities may incur.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-5 Research & Development (R&D)

Policy Description:

CCAG Summary: 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. Funding can also be given for demonstration projects to help commercialize technologies that have already been developed but are not yet in widespread use.

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.

Policy Design:

The CCAG recommends that New Mexico establish an R&D program tasked with the development and deployment of concentrating solar energy technologies, hydrogen-based energy storage technologies, and other energy storage technologies such as compressed air storage, molten salt storage, and cavern storage. In as much as GHG reductions and costs (or cost savings) of R&D programs are difficult to quantify, this is a non-quantified enabling policy to assist in the achievement of GHG emission reductions through other CCAG-recommended policy options.

- **Goal levels:** As noted above.
- **Timing:** In parallel with forecasted electricity demand growth.
- **Parties:** The State of New Mexico would implement an R&D program in conjunction with private companies in a public-private partnership model.

Implementation method(s):

- Funding mechanisms and or incentives.
- Pilots and demonstration projects.
- Research and development.

Related Policies/Programs in place:

- No dedicated R&D program for developing and deploying solar energy and energy storage technologies is in place in New Mexico.

Type(s) of GHG Benefit(s):

- CO₂: By funding R&D for renewables, more renewable energy would eventually come on-line and displace fossil fuel resources and, thereby reduce CO₂ emissions.
- Black Carbon: To the extent that generation from coal and oil would be displaced by renewables, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

- This option is an enabling strategy for achieving reductions estimated for other options, and is not quantified directly.

Data Sources, Methods and Assumptions (for quantified actions):

- Not applicable.

Key Uncertainties:

- Not applicable.

Contributing Issues, if applicable:

- Reductions in overall electricity consumption and the shift from fossil fuel generation as a result of new renewables would lead to reductions in criteria air pollutants and, consequently, reduce health costs associated with those pollutants.
- Renewables can provide a fuel price hedge effect against fossil fuel price volatility, particularly natural gas.
- The operating costs of renewable generation, primarily maintenance, are generally spent locally and can provide a direct boost to local and state economies.
- Water use may be reduced through renewable versus combustion technologies.

Feasibility Issues, if applicable:

None cited.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-6 Advanced Coal/Fossil Technologies (e.g., IGCC with carbon capture)

Policy Description:

CCAG Summary: Advanced fossil technologies may be more efficient than conventional fossil technologies and, therefore, may have lower CO₂ emission rates. Advanced fossil technologies combined with carbon capture and sequestration or reuse (CCSR) could achieve significantly lower CO₂ emissions. However, advanced fossil technologies involve risks and uncertainties that inhibit rapid commercialization, and may also have higher capital costs than traditional baseload pulverized coal plants. Policies to promote advanced fossil technologies for new coal plants may include mandates, incentives, or a combination of the two.

Advanced fossil technologies may be more efficient than conventional fossil technologies and, therefore, may have lower CO₂ emission rates. Advanced fossil technologies combined with carbon capture and sequestration or reuse (CCSR) could achieve significantly lower CO₂ emissions. Advanced fossil technologies with CCSR may contribute to the development of New Mexico's oil resources through CO₂-enhanced oil recovery techniques. However, advanced fossil technologies involve risks and uncertainties that inhibit rapid commercialization, and may have higher capital costs than traditional baseload pulverized coal plants. Also, Integrated Gasification Combined Cycle (IGCC) plants have not been demonstrated at higher altitudes, or burning subbituminous coal, conditions relevant to recommending IGCC in the state of New Mexico. Finally, the cost and performance of CCSR technologies at commercial-scale capture volumes is unproven.

Policies to promote advanced fossil technologies may include mandates or incentives, or a combination of mandates and incentives. A mandate might require that new coal plants achieve a certain CO₂ emission rate that is only achievable with advanced technology. Alternatively, a mandate might require that a fraction or all new coal plants be of a certain type, e.g., Integrated Gasification Combined Cycle (IGCC).

Incentives may take the form of full recovery for prudently incurred utility investments in IGCC with CCSR via a separate rate adjustment clause, current recovery for expenditures on an IGCC project during the construction, startup, and implementation phases of the IGCC project, or an increase in the allowable weighted average cost of capital for costs prudently incurred to develop an IGCC project.

Policy Design:

The CCAG recommends that the State encourage all new coal plants in New Mexico, or serving customers in New Mexico, to be built as IGCC with CCSR. Because development of an IGCC

plant involves risks and uncertainties that have inhibited rapid commercialization, the CCAG recommends an incentive-based approach rather than a mandate. Accordingly, the CCAG recommends that the state develop an incentive package to encourage utilities to develop IGCC with CCSR. The CCAG also recommends that New Mexico task a state agency (e.g., OCD, which has this regulatory authority) to provide technical resources for carbon sequestration, including an evaluation of suitable storage sites, and possibly the administration of incentives.

- **Goal levels:**

- a. The CCAG recommends that the State encourage utilities and independent power producers (IPPs) build any new coal plants in New Mexico, or serving customers in New Mexico, as carbon capture-ready IGCC. The CCAG further recommends that the state create incentives for the construction of IGCC with some level of CCSR. The appropriate level of CCSR should be determined based on technical feasibility, cost, options for management of any carbon dioxide captured, and other factors. The recovery for prudent utility investments in IGCC with CCSR shall be structured to fully compensate utilities for the cost and technology risk and avoid any regulatory lag associated with an IGCC with CCSR project. The State should also encourage that new coal plants developed by independent power producers in New Mexico or serving customers in New Mexico be built as carbon capture-ready IGCC with some level, to be determined through further investigation, of CCSR.
- b. The CCAG further recommends that the State strive to encourage all new coal plants in New Mexico, or serving customers in New Mexico, be built as IGCC equipped with CCSR, with net CO₂ emission rates no higher than those of a state-of-the-art natural gas combined-cycle generation facility. Because the additional risks, costs, and uncertainties of higher rates of CCSR discourage investment in IGCC with higher rates of CCSR, the CCAG recommends that the State of New Mexico encourage achievement of this goal through additional incentives, such as an enhanced rate of return, severance or other tax reduction, beyond the recovery provisions of Goal Level (a) above. The incentive should be structured to encourage high rates of CCSR. The State should also encourage that new coal plants developed by independent power producers in New Mexico or serving customers in New Mexico be built as IGCC equipped with CCSR, with net CO₂ emission rates no higher than those of a state-of-the-art natural gas combined-cycle generation facility.

- **Timing:** As new baseload power is needed.
- **Parties:** Utilities would meet the IGCC requirement.

Implementation method(s):

Pending an evaluation of the costs, likely implementation methods could include:

- Funding mechanisms and or incentives
- Pilots and demos
- Research and development

Related Policies/Programs in place:

- No state program to encourage or require advanced coal/fossil technologies on new fossil plants is currently in place in New Mexico.

Type(s) of GHG Benefit(s):

- CO2: Reductions in CO2 emissions can be achieved by encouraging IGCC with CCSR rather than conventional fossil technologies without carbon dioxide mitigation technologies. IGCC equipped with CCSR can emit significantly less carbon dioxide than conventional coal generation without CCSR.
- Black Carbon: Because coal is not combusted directly in an IGCC plant, black carbon emissions from IGCC with CCSR are zero. To the extent that IGCC would displace existing generation from coal and oil, black carbon emissions would also decrease.

Estimated GHG Savings and Costs Per Ton:

| # | Policy | Scenario | Reductions (MMTCO2e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO2 |
|-------|-----------------------------------|--|---|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| ES-6a | Advanced Coal/Fossil Technologies | All new coal plants would be IGCC with CCSR at 60% | <i>Not Quantified (due to limited available data)</i> | | | | |
| ES-6b | Advanced Coal/Fossil Technologies | All new coal plants would be IGCC with CCSR at 90% | 0.8 | 4.3 | 22.7 | \$650 | \$29 |

Data Sources, Methods and Assumptions (for quantified actions):

Printouts of portions of the worksheet used to prepare the analysis of this option are provided at the end of these Policy Descriptions. These printouts provide more details on data sources and assumptions, which are summarized here:

- **Data Sources:** The principal source of data for this analysis is the recent EPA report, "Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies," July 2006, which contains cost and performance estimates for various coal plant types and CO2 capture. The IPCC Special Report on Carbon

Dioxide Capture and Storage (2006) is used as a cross-check on these estimates, and to develop rough estimates of the costs of CO₂ transport and storage.

- **Quantification Methods:** We assume that all new coal generation in the reference case projections in the reference case from 2010 onwards would be provided by IGCC with CCSR instead of pulverized coal plants with no CO₂ controls. This amounts to about 5800 GWh (870 MW at 85% capacity factor), assuming no increase from current levels in generation from currently existing coal units in New Mexico. We estimate the incremental cost of IGCC with CCS and the difference in emissions relative to a supercritical pulverized coal plant, using a simple spreadsheet analysis that accounts for the additional energy needed to power the capture and storage processes. We estimate costs from two perspectives: (a) a bottom-up assessment of estimated CO₂ pipeline, storage, and monitoring costs; (b) comparison with widely-reviewed CCS analyses by the IPCC on a cost per ton basis. We conduct quantitative analysis of only the 90% capture case, as this is the case analyzed in much of the available literature.
- **Key Assumptions:** The key assumptions are that 870 MW of coal generation would be added 2010-2020 (this is consistent with the inventory/forecast, but is highly uncertain) and that mature CCS technology can be successfully installed within the timeframe of analysis. It is assumed that redundant gasifiers would not be necessary because utilities could successfully manage reliability through other plants in the system rather than by building-in extra reliability for individual plants with redundant gasifiers.

Key Uncertainties:

- Key uncertainties are those related directly to the assumptions and noted above. In particular, it is highly uncertain how much coal capacity is likely to be sited within New Mexico, both in the reference case and in the case that this policy is pursued. Another key uncertainty is the location and type of storage reservoir used; for instance, use of captured CO₂ for enhanced oil recovery could significantly lower effective CCSR costs.

Contributing Issues, if applicable:

- IGCC with CCSR may have lower criteria air pollutant emissions than new conventional coal, so this policy could lead to reductions in criteria air pollutants and, consequently, reduce health costs associated with these pollutants.
- IGCC with CCSR may contribute to the development of New Mexico's oil resources through CO₂-enhanced oil recovery techniques.

Feasibility Issues, if applicable:

- IGCC has not been demonstrated at commercial scale at high altitude.
- IGCC has not been demonstrated at commercial scale burning subbituminous coal.
- IGCC has not been demonstrated with CCSR technology at commercial scale.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-7 Nuclear Power

Policy Description:

The production of electric power in nuclear fission reactors creates little direct GHG emissions. In states with existing nuclear facilities, relicensing can extend their productive life, and uprating can enable more power to be generated, typically by improvements to the steam side of the operation. New Mexico has no existing commercial nuclear power plants to relicense or uprate, however, so its nuclear options are limited to whether or not new nuclear generation capacity should be built.

In evaluating nuclear power options, it is important to consider costs beyond the direct costs for generation, operation, waste storage, and decommissioning. The costs of the unusual risks associated with nuclear power, including taxpayer assumption of reinsurance liability under the Price-Anderson Act and new security costs, should also be considered. At the same time, in the interest of completeness, it is important to include new nuclear capacity as an option. To do otherwise could suggest that the CCAG was inadequately comprehensive in its consideration of alternatives.

Policy Design:

The CCAG recommends that New Mexico consider whether new nuclear generation capacity is advisable for the State, following a qualitative but comprehensive review of all direct and indirect benefits and costs associated with nuclear power.

- **Goal levels:** Not applicable.
- **Timing:** Not applicable.
- **Parties:** Utilities and other interested parties.

Implementation method(s):

- Information and education

Related Policies/Programs in place:

- There is currently no concerted state involvement in nuclear uprate or relicensing proceedings in other states.

Type(s) of GHG Benefit(s):

- Not applicable.

Estimated GHG Savings and Costs Per Ton:

- Not quantified

Data Sources, Methods and Assumptions (for quantified actions):

- Not applicable.

Key Uncertainties:

- Not applicable.

Contributing Issues, if applicable:

In the United States, fission-based nuclear power is highly controversial. No new nuclear power plants have been built or licensed in the US since the Three Mile Island accident decades ago, and the Navajo Nation has banned uranium mining on Navajo land in New Mexico due to past health and environmental impacts. Nevertheless, nuclear power plants have continued to be built apace in several other countries. Fusion nuclear power, which would ameliorate several concerns, remains a distant hope.

Concerns regarding fission nuclear power, that would need to be considered before expanded use of nuclear power, include:

1. Uranium miner safety.
2. Environmental contamination from uranium mining.
3. Internal nuclear power plant safety and security,
4. Safety of surrounding communities in the event of an accidental release of radioactive materials.
5. Environmental contamination from accidental release of radioactive materials.
6. Environmental contamination from both on-site and permanent storage of nuclear waste.
7. Environmental contamination from possible reprocessing of nuclear waste.
8. Enhanced nuclear weapon proliferation risk due to exercise of the nuclear power option in the U.S.

It should be noted that, with the exception of concern 8, analogous concerns exist for coal-fired and other means of power generation as well. It should also be noted that the growing mass of existing nuclear waste generated largely during the cold war will continue to pose a nuclear proliferation risk independent of whether the US chooses to go forward with additional nuclear fission power plants or not.

Also note that if nuclear plants were to be built in large numbers, replacing many coal-fired power plants world-wide, the nuclear fuel cycle that is now commonly used would consume easily-available uranium ores over a period of just a few decades. Hence, an alternate nuclear fuel cycle would need to be considered, which would involve reprocessing, that provides many

times more energy from uranium ore. This option, if successfully managed worldwide, could greatly reduce inventories of potential weapons materials that otherwise would continue to accumulate no matter whether the US goes forward with nuclear power or not. This alternative approach could also greatly reduce nuclear waste storage problems. On the other hand, spent fuel rods contain plutonium. Widespread independent development of reprocessing could also increase the access of many nations to and expertise with plutonium.

Feasibility Issues, if applicable:

None cited.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-8 Incentives and Barrier Reductions for Combined Heat & Power (CHP)

Policy Description:

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

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

There are also numerous barriers to combined heat and power (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, 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; financing packages and bonding programs; power procurement policies; education and outreach; etc.

Policy Design:

Although establishing an empirical linkage between barrier removal and CHP penetration is complex and beyond the scope of the CCAG's effort, the CCAG recommends that New Mexico

undertake a concerted effort to revise its regulatory policies and remove institutional barriers in order to allow CHP and the recovery and use waste energy to compete on a level playing field with other sources of electric and thermal energy.¹³ Accordingly, quantify GHG reductions and costs associated with the following scenarios:

- **Goal levels:** Assume 2-3% of the estimated CHP potential is achieved each year from 2008 onward.
- **Timing:** As noted above.
- **Parties:** Depends on specific barrier(s).

Implementation method(s):

- Information and education.
- Technical assistance.
- Financial incentives.
- Regulatory policies.
- Codes and standards.

Related Policies/Programs in place:

- No concerted state program or effort to encourage CHP or reduce barriers to CHP has been undertaken in New Mexico.

Type(s) of GHG Benefit(s):

- **CO2:** By removing barriers to CHP, more clean generation can come into the energy supply mix and would displace less efficient fossil fuels, thereby reducing CO2 emissions.
- **Black Carbon:** To the extent that removing barriers to CHP would lead to displacement of generation from coal and oil, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

| # | Policy | Scenario | Reductions (MMTCO2e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO2 |
|---|--------|----------|----------------------|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| | | | | | | | |

¹³ New Mexico may wish to review similar policy changes recently enacted in Connecticut, Vermont, Pennsylvania, and Rhode Island.

| | | | | | | | |
|------|---|---|-----|-----|-----|------|-----|
| ES-8 | Incentives and Barrier Reductions for CHP | CHP penetration ramps up based on assumptions of achievable penetration rates | 0.3 | 0.9 | 6.1 | \$26 | \$4 |
|------|---|---|-----|-----|-----|------|-----|

Data Sources, Methods and Assumptions (for quantified actions):

Printouts of portions of the worksheet used to prepare the analysis of this option are provided in the Attachments following the Policy Descriptions. These printouts provide more details on data sources and assumptions, which are summarized here:

- **Data Sources:** The *Combined Heat and Power White Paper*, dated January, 2006, to the Clean and Diversified Energy Initiative of the Western Governors Association; and the *2003 Commercial Buildings Energy Consumption Survey Detailed Tables*, published by the US Department of Energy's Energy Information Administration.
- **Quantification Methods:** Starting with an estimate for New Mexico's share of CHP potential in the West, as provided in the "CHP White Paper" referenced above, assumptions regarding the penetration of and fuel shares for new CHP systems, and estimates of future capacity of CHP developed under the policy, are generated. Estimates of CHP cost and performance for different kinds of systems are then used to estimate the overall net GHG emissions reduction and net cost of the policy. The avoided GHG emissions are estimated in a manner consistent with the analysis of demand reduction options in RCI (a mix
- **Key Assumptions:** A key assumptions is that CHP potential is 649 MW (per the WGA/CDEAC source above), grows with loads, and can be realized at a rate of about 2-3% of total potential per year (15 MW/year in 2010; 32 MW/year in 2020). Gas-fired systems are assumed to dominate new CHP in New Mexico, but some biomass- and coal-fired capacity is also included. Systems are assumed to operate an average of 5000 hours per year (at full capacity), and 90 percent of co-generated heat is assumed to be usable (and displaces heat from purchased fuels).

Key Uncertainties:

- As with any assessment of the future, this analysis has many uncertainties. Key uncertainties are those related directly to the assumptions and quantification methods noted above. If those assumptions are incorrect, then the results would change. Other uncertainties include the forecast of the price of fossil fuels and the growth in the demand for electricity.

Contributing Issues, if applicable:

- CHP reduces or eliminates the need to burn fuel to meet separate power and steam loads, which would significantly lower associated criteria air pollutant emissions and consequently reduce health costs associated with these pollutants.

Feasibility Issues, if applicable:

None cited.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-9 Demand-Side Management, Energy Efficiency, and Integrated Resource Planning

Policy Description:

CCAG Summary: This policy option involves increasing the efficiency of electricity use in New Mexico through programs, funds, and/or requirements. This option focuses on what are typically termed DSM activities, and is designed to work in tandem with other strategies under consideration by the RCI and ES TWGs that can also encourage efficiency gains.

This policy option involves increasing the efficiency of electricity use in New Mexico through public policies that support sufficient, timely, and stable program funding for acquisition of cost-effective energy efficiency resources, modifying ratemaking practices to promote utility energy efficiency investments, public information and education campaigns, and/or energy efficiency performance standards or goals. This option focuses on what are typically termed DSM activities, and is designed to work in tandem with other strategies under consideration by the RCI and ES TWGs that can also encourage efficiency gains.

Many different policy configurations are possible,¹⁴ including various combinations of energy savings targets, utility spending targets, public benefit charges,¹⁵ adopting ratemaking practices that support utility investments in cost-effective energy efficiency resources, e.g., assurance of cost recovery through tariff riders, performance incentives, or enhanced rate of return; enabling legislation, such as the recently enacted Efficient Use of Energy Act, that is intended to remove regulatory barriers and financial disincentives to increased investments in energy efficiency; and incorporation of energy efficiency in integrated resource planning (IRP) processes, among others.

Integrated Resource Planning (IRP) is a process that diverges from traditional utility least-cost planning. Rather than simply focusing on conventional supply-side options to meet a forecasted growth in electricity demand IRP considers the full range of energy supply options including energy efficiency, conservation, renewable energy, distributed generation technologies and conventional generation technologies. IRP process evaluates these options on a consistent and comparable basis and identifies a least-cost resource portfolio(s) balanced for economic, reliability, operational and environmental performance. IRP take into account a broader array of costs, including risks and uncertainty associated with fuel price volatility, fuel supply,

¹⁴ For an overview of activity in other states, see USDOE/DSIRE summary tables <http://www.dsireusa.org/summarytables/>

¹⁵ Public benefit charge funds are in place in about 15 states, typically adopted as part of electricity restructuring policy/legislation. These funds are collected as surcharge on utility bills, and are typically directed to a mix of energy efficiency, renewable energy, and low-income programs.

environmental regulations such as greenhouse gas regulations, and changing market structures and trends.

Policy Design:

Note: *This policy option echoes RCI option RCI-1, Demand-Side Management and Energy Efficiency Programs. Its CCAG recommendation and quantification is included under RCI-1.*

The CCAG also recommends that New Mexico's DSM/EE policies should go beyond what is currently cost-effective to include measures that would be cost-effective when an appropriate value for carbon (i.e., a "carbon adder") is included, which would presumably lead to larger GHG emission reductions.

- **Goal levels:** *See RCI-1, Demand-Side Management and Energy Efficiency Programs.*
- **Timing:** *See RCI-1, Demand-Side Management and Energy Efficiency Programs.*
- **Parties:** *See RCI-1, Demand-Side Management and Energy Efficiency Programs.*

Implementation method(s):

- *See RCI-1, Demand-Side Management and Energy Efficiency Programs.*

Related Policies/Programs in place:

- The Efficient Use of Energy Act (SB 644), signed into law in 2005, directs public electric and gas utilities to develop, fund and implement comprehensive, cost-effective energy efficiency programs to reduce utility-related expenditures for citizens and businesses; declares that utility expenditures on cost-effective energy efficiency measures are an acceptable use of ratepayer monies; requires a utility to obtain prior approval for its energy efficiency programs and expenditures; provides for a tariff rider (not to exceed the lesser of 1.5% of a customer's bill or \$75,000/year) for a utility to recover its energy efficiency expenditures; provides for monitoring, verification, and periodic reporting by the utility on its energy efficiency expenditures and overall program effectiveness.
- The Efficient Use of Energy Act directs public utilities, pursuant to rulemaking, to periodically file an integrated resource plan with the New Mexico Public Regulation Commission (PRC). An IRP rule has been drafted through a collaborative workshop process hosted by the PRC. The rule is waiting for final commission approval at the time this report was written.

Type(s) of GHG Benefit(s):

- CO₂: Significant reductions in GHG emissions (largely CO₂) would result from avoided electricity production and avoided on-site fuel combustion.
- CH₄: Less significant are the reduction in CH₄ emissions from avoided fuel combustion and avoided pipeline leakage.
- N₂O: Reductions are conceivable, but are likely to be small and/or very difficult to estimate (materials use, life cycle, market leakage, etc.)

- Black Carbon: Reductions are conceivable, but are likely to be small and/or very difficult to estimate (e.g., materials use, life cycle, market leakage, etc.)

Estimated GHG Savings and Costs Per Ton:

- *This option is quantified under RCI-1, Demand-Side Management and Energy Efficiency Programs.*

Data Sources, Methods and Assumptions (for quantified actions):

- *See RCI-1, Demand-Side Management and Energy Efficiency Programs.*

Key Uncertainties:

- *See RCI-1, Demand-Side Management and Energy Efficiency Programs.*

Contributing Issues, if applicable:

- The WGA CDEAC EE report cites the following benefits (p. 2):
 - Saving consumers and businesses money on their energy bills;
 - Reducing dependence on imported fuel sources;
 - Reducing vulnerability to energy price spikes;
 - Reducing peak demand and improving the utilization of the electricity system;
 - Reducing the risk of power shortages;
 - Supporting local businesses and stimulating economic development;
 - Enabling avoidance of the most controversial energy supply projects;
 - Reducing water consumption by power plants; and
 - Reducing pollutant emissions by power plants and improving public health.

Feasibility Issues, if applicable:

None cited.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-10 Transmission Capacity and Corridors

Policy Description:

Satisfying the long-term demand for electricity requires not only new generating capacity, along with demand-side measures, but also measures to improve transmission to reduce line losses, diminish bottlenecks, and enhance throughput. Advanced composite conductor technologies, capacitance technologies, grid management software, and other technologies may soon become available to increase transmission line carrying capacity as much as threefold. Entirely new transmission lines may also be necessary, although siting new transmission lines can be difficult due to their cost and their actual or perceived impact on health, environment, and the use, enjoyment, and value of property.

Policy Design:

The CCAG recommends that when new construction, repairs and upgrades of existing transmission and distribution infrastructure in New Mexico are undertaken, transmission-owning entities should evaluate the cost-effectiveness of incorporating advanced composite conductor technologies, capacitance technologies, grid management software, and other technologies to increase throughput capacity on the grid. The CCAG further recommends that the analysis also take into account reductions in GHG emissions that would result from energy saved due to lower line losses.

- **Goal levels:** As noted above.
- **Timing:** Paralleling forecast load growth.
- **Parties:** Transmission and distribution utilities.

Implementation method(s):

- Funding mechanisms and or incentives.
- Pilots and demonstration projects.
- Assurance of cost recovery for above market costs.
- Research and development.
- Codes and standards.

Related Policies/Programs in place:

- None cited.

Type(s) of GHG Benefit(s):

- CO₂: To the extent that avoiding line losses would reduce generation from coal and oil, CO₂ emissions would decrease.
- Black Carbon: To the extent that avoiding line losses would reduce generation from coal and oil, black carbon emissions would decrease.

Estimated GHG Savings and Costs Per Ton:

- Not quantified due to significant cost uncertainties and uncertain applicability of advanced transmission technologies to New Mexico's electric grid.

Data Sources, Methods and Assumptions (for quantified actions):

- **Data Sources:** EIA, "Upgrading transmission capacity for wholesale electric power trade" (http://www.eia.doe.gov/cneaf/pubs_html/feat_trans_capacity/w_sale.html); information on the current PNM transmission system and plans for expansion obtained by interview conducted by Lorna Greening on August 23, 2006; and price forecasts of generated electricity and transmission for the region from the NEMS reference case run for the NM ES TWG by Eric Williams.
- **Quantification Methods:** A spreadsheet costing model for one of the specified technologies (composite core conductors) that is currently commercially available.
- **Key Assumptions:**
 - 1) Composite core conductors were selected as a technology representative of a new generation of technologies for transmission upgrades and new construction. Other technologies such as super-conductivity are at least ten years if not longer from commercial availability. Further, in general, these technologies are special purpose and not designed for 'long-line' transmission such as is found in New Mexico. For example, composite core conductors have the greatest benefit for retrofit of lines that are thermally constrained or where congestion is an issue. Because of these attributes, this technology can be used to re-string existing transmission lines (and upgrade to the next voltage level) without extensive rework of tower infrastructure or the filing of new or amended Environmental Impact Statements. As a result, a retrofit is roughly 30% less costly than new construction of transmission line of the next higher voltage class (on a per mile basis without right-of-way), but for new construction the line cost component of the total cost of construction is approximately 40 per cent more.
 - 2) Discussions with Dr. Phil Overholt (DOE/Office of Transmission and Distribution Efficiency) and the two vendors of composite core technologies indicate that the primary purpose of this technology will be to transport more power (e.g., reduce congestion) rather than reduce line loss. Based on these discussions, line loss avoided was set at 13% of the stated line loss from transmission (i.e., the maximum that could be gained). This figure was assumed to be constant throughout the year, although this figure will fluctuate with line loading, and to a lesser extent with other conditions such as temperature.

- 3) For purposes of this analysis, due to the limited availability of cost and system characteristic information, a retrofit of PNM lines (as representative of the State) assuming re-stringing with composite core conductors was used to develop the numbers presented here. As part of a re-stringing operation, it is assumed that substation upgrades would be required. Full assumptions and calculations are provided on the supporting spreadsheet. (Lorna Greening, ES-10 spreadsheet)
- 4) Over-all loss (from distribution, transmission, generation) in the PNM system is between 5 and 10% depending on system load. It should be noted that this estimate is lower than the estimated constant 10% used in the GHG emissions inventory for the State. For transmission lines alone (without distribution, transformers, HVDC converter stations, shunt reactors, or similar equipment), the estimated loss averaged 3.82% or 52 MW in 2005.
- 5) In order to re-string a line, a transmission line must be removed from service. Based on reliability (e.g., inspection of a system map indicates that the transmission system in New Mexico is very linear) and service obligation considerations, only approximately 30% of PNM transmission can be removed from service for retrofit. Based on these characteristics, it was assumed that two segments of 345 kV (150 miles per segment), one segment of 230 kV (150 miles), and 10 segments of 115 kV (50 miles per segment) could be retrofitted. Costs were estimated for each type of retrofit, and increases in capacity and system losses were allocated along with any potential gains from upgrading. Further, it is assumed that only one segment can be retrofit in a given year, and that retro-fit would start in 2007.
- 6) Based on electricity demand growth in the state, the PNM transmission capacity plan filed with the New Mexico State Public Regulatory Commission, and an interview with PNM transmission planning staff, it is assumed that the next major construction of new 345 kV transmission will not be required until the timeframe of 2010 to 2012. However, other needs exist, particularly at the 115 kV level, that require a certain amount of line retrofits and/or new line construction on an on-going basis. Currently, where thermal constraints do exist on portions of the PNM system, those needs are addressed by various other means including replacement of terminal equipment, increasing ground clearance, and in some cases re-conductoring using the most-cost effective, best-available technology.
- 7) Based on the current deep discount of the OATT (Open Access Transportation Tariff) indicating excess capacity on the system, cost recovery through an increase in transmission revenues from expanded capacity are not assumed to start until 2010. Capital costs for retrofit are offset by the saved electricity applied in the year of retrofit. It should be noted that this assumption overlooks the locational aspects of generation and loads, and their impacts on cost recovery. That is, additional revenues will only be possible if additional generation can be connected to expanded transmission capacity to serve an increased demand.

- 8) Other costs such as the costs of replacement electricity (i.e., more expensive electricity generated by gas-turbines within Albuquerque), and similar costs during the three to six month period during which a line would be out of service for retrofit were not included in the cost calculations. Inclusion of these types of costs could result in higher costs of implementation.

Key Uncertainties:

- TBD.

Contributing Issues, if applicable:

- Reductions in overall electricity generation through avoided line losses would lead to reductions in criteria air pollutants and, consequently, reduce health costs associated with those pollutants.
- Water use would also be lowered as a result of lower line losses, either through the avoidance of the need to construct new power plants or the reduction of generation demand at existing power plants.
- Increased efficiency in existing transmission lines may avoid the need to construct additional lines and their associated impacts.
- Increased line capacity could also benefit homeland security.

Feasibility Issues, if applicable:

- Flexibility of a system to accept and adapt to changes in technology.
- Reliability and system operation considerations for the implementation of a new technology in a 'long-line' transmission setting.
- Issues of regulatory approval for recovery of the additional costs.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-11 CO₂ Capture and Storage or Reuse (CCSR) in Oil and Gas Operations

Policy Description:

CCAG Summary: Carbon capture and storage or reuse (CCSR) involves capturing carbon and either (1) sequestering it in a geologically sound reservoir or (2) reusing the carbon to aid in natural 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. Carbon can and is captured in natural gas extraction; natural gas can have only up to 2.5% CO₂, and some gas fields have a much higher concentration. Excess CO₂ is removed and is currently typically emitted to the atmosphere. 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:

The CCAG recommends that New Mexico task a state agency (e.g., OCD, which has this regulatory authority) to provide technical resources for carbon sequestration, including an evaluation of suitable storage sites, evaluating the technical and economic feasibility of capture and storage, and possibly the administration of financial incentives. Implementation could include financial incentives; mandatory measures – coupled with technical feasibility and cost and investment recovery mechanisms, if appropriate; or both.

The CCAG recommends further evaluation to identify regulatory, technical, and economic factors affecting the use of acid gas injection (i.e., acid gas streams containing both H₂S and CO₂) in New Mexico. The CCAG suggests focusing on capturing the CO₂ currently being vented at natural gas processing plants, and on acid gas injection at sour gas processing plants. In addition, carbon emissions from fluid catalytic cracking units at oil refineries should be evaluated.

The CO₂ reduction goals stated below are being provided for the sole purpose of partially meeting the targets set by Governor Richardson's directive and are not necessarily confirmed or validated by any current study or analysis regarding economic or technical feasibility. It is the intent of the CCAG to require further study and analysis of CCSR by the NMOCD and other appropriate agencies, and that from this study and analysis, changes in goals and determinations

regarding the economic and technical feasibility of CCSR may result. This study should consider sour gas processing facilities (i.e., facilities with sulfur recovery units (SRUs)) separately from natural gas processing facilities.

- **Goal levels:** Starting in 2007, use acid gas injection for 100% of all sour gas processing by 2020. Capture, store, and/or reuse 7% of CO₂ emissions from natural gas processing every year (calculated as 7% of the prior year's emissions).
- **Timing:** Acid gas injection by 2020; CCSR for natural gas processing to 2050.
- **Parties:** As noted above.

Implementation method(s):

Likely mechanisms that could be used include:

- Education and information.
- Funding mechanisms and or incentives.
- Pilots and demonstration projects.
- Research and development.
- Voluntary and or negotiated agreements.
- Codes and standards – Identification and elimination of regulatory obstacles; and/or development of regulatory mandates – coupled with technical feasibility and cost and investment recovery mechanisms, if appropriate.

Related Policies/Programs in place:

- New Mexico currently does not have any written policy encouraging the use of CCSR. However, New Mexico does have a regulation authorizing acid gas injection for the oil and gas industry, and has permitted acid gas injection wells in the Permian Basin.

Type(s) of GHG Benefit(s):

- CO₂: If carbon were successfully stored in appropriate geological reservoirs, the net emission of carbon would be substantially reduced, if zero-carbon energy is used for the storage operations. If carbon were reused to make liquid fuels, then when those fuels were combusted, there would be carbon emissions at a rate comparable to natural gas, if large sources of zero-carbon energy are available for the reforming processes. Reforming of CO₂ to liquid fuels is a theoretical technology at this time and no estimate of timing for potential commercial deployment is available.

Estimated GHG Savings and Costs Per Ton:

GHG reductions based on the specified goal level are noted below. Limited experience to date with CCSR and current uncertainties regarding its costs inhibit comprehensive and thorough estimation of GHG savings and costs per ton at this time. These shortcomings will be addressed by the NMOCD-led study referenced in the policy design for ES-11. A preliminary analysis of

GHG savings and costs per ton, developed to assist in the Energy Supply Technical Work Group's consideration of ES-11, can be found in [Attachment X1](#).

| # | Policy | Scenario | Reductions (MMTCO2e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO2 |
|-------|---|---|----------------------|-------------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| ES-11 | CO2 Capture and Storage or Reuse (CCSR) | A. Use acid gas injection for all sour gas processing by 2020. | .22 | .52 | 3.87 | <i>Not Estimated</i> | <i>Not Estimated</i> |
| ES-11 | CO2 Capture and Storage or Reuse (CCSR) | B. Capture, store, and/or reuse CO2 emissions from natural gas processing at a rate of 7% every year. | 1.36 | 2.45 | 21.24 | <i>Not Estimated</i> | <i>Not Estimated</i> |
| ES-11 | CO2 Capture, Storage, and Reuse | Combination of A and B above. | 1.58 | 2.97 | 25.11 | <i>Not Estimated</i> | <i>Not Estimated</i> |

Data Sources, Methods and Assumptions (for quantified actions):

- **Data Sources:** To be determined by the NMOCD-led study specified in the ES-11 policy design.
- **Quantification Methods:** To be determined by the NMOCD-led study specified in the ES-11 policy design.
- **Key Assumptions:** To be determined by the NMOCD-led study specified in the ES-11 policy design.

Key Uncertainties:

- Uncertainties exist as to the length of time CO2 will remain in storage in suitable geologic formations. Uncertainties exist as to the availability of suitable geologic formations in New Mexico as such data was not available at the time of this assessment. Natural gas production and processing rates may also vary over time.
- Other uncertainties to be determined by the NMOCD-led study specified in the ES-11 policy design.

Contributing Issues, if applicable:

- Implementing CCSR technology could lead to economic development within New Mexico, especially if New Mexico were to become a leader in these technologies and could export this expertise to other states and countries. Development of CCSR technologies in New Mexico should build on the existing body of work and not be redundant with various efforts being led by DOE and others.
- The reuse of carbon dioxide through enhanced oil and coalbed methane recovery could lead to increased production and increased economic development. Enhanced oil production and its feasibility will depend on available reservoirs which would respond to CO₂ enhanced recovery. Although theoretically feasible, enhancement of coalbed methane recovery has not been demonstrated as viable in studies on two pilots conducted thus far; additional studies are underway at this time.
- Acid gas injection is already being used in New Mexico and is widely used in Canada.
- Reusing carbon by reforming it into liquid fuels could provide New Mexico with an alternative industry to natural gas extraction as gas fields are depleted. In order to be carbon-positive (i.e., to lower overall carbon emissions) or carbon-neutral, reforming would depend on large sources of zero-carbon energy being available for use in the reforming processes. Reforming of CO₂ to liquid fuels is a theoretical technology at this time and no estimate of timing for potential commercial deployment is available.
- During the process of gasification, many of the criteria air pollutants that would have resulted from direct combustion of coal could be eliminated, lowering health impacts and associated health costs.
- Acid gas injection can entirely eliminate the emission of sulfur dioxide and hydrogen sulfide removed from field gas.
- Acid gas injection can replace or reduce the capital and O&M costs associated with sulfur control equipment at sour gas processing plants for “green field” applications or where replacement of sulfur recovery units is necessary. For retrofit applications, acid gas injection would represent significant incremental capital investment and roughly equal O&M costs. For acid gas streams with significant H₂S content, use for enhanced recovery is not available.
- Storing carbon in geological reservoirs carries with it a risk that the carbon would eventually leak out. If this were to happen, carbon storage would serve only to delay carbon emissions. There is also a risk, though perhaps small, of a sudden release of carbon from reservoirs. If near populated areas, a sudden substantial release could be dangerous.
- If carbon dioxide could eventually be cost-effectively captured from the atmosphere for reuse as a fuel feedstock, in the very long term, this process could free all countries from the threat of fossil carbon resource depletion. This carbon recycling process would, of course, require an external non-carbon energy source.

Feasibility Issues, if applicable:

- Capture of CO₂ and subsequent storage in geological formations is a known technology that has been demonstrated and is currently used in select instances. Considerable work and study is underway to broaden potential application. Broad application in New Mexico will require detailed cost and feasibility analysis of available opportunities in New Mexico.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-12 Methane Reduction in Oil & Gas Operations (BMPs & PROs)

Policy Description:

CCAG Summary: There are a number of ways in which methane emissions in the oil and gas industry can be reduced. Natural gas consists primarily of methane, so any leaks during production, processing, and transportation/distribution should be addressed. In addition to reducing potent 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).¹⁶

There are a number of ways in which methane 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: Reduces emissions by improving the overall efficiency of the gas production and distribution system; minimizes the chance of leaks.

Reduce flashing losses: As the pressure on the liquid hydrocarbons in a storage tank, well, compressor station, or gas plant drops, some of the lighter compounds dissolved in the liquid are released or “flashed.” Some of the compounds that are liquids at the initial pressure/temperature transform from a liquid into a gas/vapor and may be released or “flashed” to the atmosphere. The flashed gas can be captured rather than vented to the atmosphere.

Replace wet seals with dry seals on centrifugal compressors: 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.

Compressor rod & ring replacement on reciprocating compressors: Replacing worn compressor rod packing rings and rods results in operational benefits, reduced methane emissions, and cost

¹⁶ For a complete list, see <http://www.epa.gov/gasstar/techprac.htm#tabnav>

savings. Gas leaks from compressor rods may represent one of the largest sources of emissions at natural gas compressor stations.

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.

Pump-down techniques prior to maintenance: Using fixed and portable compressors to lower pipeline pressure prior to maintenance and repair may significantly reduce methane emissions and save 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.

Policy Design:

The CCAG recommends that:

- (a) New Mexico implement, on a voluntary basis, all BMPs, PROs, and available technologies starting in 2007 to reduce overall CO₂e emissions by ~20% by 2020;
 - (b) New Mexico actively promote participation by oil and gas operators in EPA's Natural Gas Star program and New Mexico's San Juan VISTAS program; and
 - (c) As voluntary measures are implemented, if the State determines that oil and gas operators are not on track to achieve the above goal, the State should implement mandatory approaches where appropriate.
- **Goal levels:** As noted above.
 - **Timing:** As noted above.
 - **Parties:** Oil and gas production, processing, and transportation/distribution companies

Implementation method(s):

Policies to implement these practices could include:

- Information and education.
- Technical assistance.
- Funding mechanisms and/or incentives.
- Voluntary and or negotiated agreements.
- Codes and standards – coupled with cost and investment recovery mechanisms, if appropriate.

Related Policies/Programs in place:

- Some companies practice the measures outlined above, but currently there is no state or federal requirement for any company to implement any of these practices.

Type(s) of GHG Benefit(s):

- CH4: This policy could result in substantial reductions of methane emissions in the oil and gas industry.

Estimated GHG Savings and Costs Per Ton:

GHG reductions based on the specified goal level are noted below. BMPs, PROs, and other technologies and practices cover a wide variety of options, the costs of which vary significantly by site and application, and are thus difficult to consolidate. Capital cost and other information for individual technologies and practices is available at EPA’s Natural Gas Star website, <http://www.epa.gov/gasstar/techprac.htm#tabnav>

An initial consolidation analysis of GHG savings and costs per ton was developed by Dr. Lorna Greening to assist in the Energy Supply Technical Work Group’s consideration of ES-12. A summary of this spreadsheet can be found in **Attachment X2**.

| # | Policy | Scenario | Reductions (MMTCO2e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO2 |
|-------|--|--|----------------------|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| ES-12 | Methane reductions in oil and gas operations through BMPs and PROs | Reduce overall CO2e by ~20% over 2007-2020 | 2.71 | 3.43 | 35.34 | <i>Not Estimated</i> | <i>Not Estimated</i> |

See the EPA Natural Gas Star website (www.epa.gov/gasstar/techprac.htm#tabnav) and Dr. Lorna Greening’s spreadsheet analysis for additional information regarding GHG savings, costs, and cost-effectiveness.

Data Sources, Methods and Assumptions (for quantified actions):

- **Data Sources:** See the EPA Natural Gas Star website (www.epa.gov/gasstar/techprac.htm#tabnav) and Dr. Lorna Greening’s spreadsheet analysis for information concerning data sources.
- **Quantification Methods:** See the EPA Natural Gas Star website (www.epa.gov/gasstar/techprac.htm#tabnav) and Dr. Lorna Greening’s spreadsheet analysis for additional information.
- **Key Assumptions:** See the EPA Natural Gas Star website (www.epa.gov/gasstar/techprac.htm#tabnav) and Dr. Lorna Greening’s spreadsheet analysis for additional information regarding assumptions.

Key Uncertainties:

- See the EPA Natural Gas Star website (www.epa.gov/gasstar/techprac.htm#tabnav) and Dr. Lorna Greening's spreadsheet analysis for additional information regarding uncertainties.

Contributing Issues, if applicable:

- Proportionally more natural gas would get to market rather than being consumed or lost in the production and distribution process.
- Companies increase their sales, and possibly their profits, by selling rather than wasting valuable product.

Feasibility Issues, if applicable:

TBD.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-13 CO₂ Reduction from Fuel Combustion in Oil & Gas Operations

Policy Description:

CCAG Summary: There are a number of ways in which CO₂ emissions in the oil and gas industry can be reduced, 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 to encourage these practices include education and information exchange, financial incentives, and mandates or standards – coupled with cost and investment recovery mechanisms, if appropriate – that require certain practices.

There are a number of ways in which CO₂ emissions in the oil and gas industry can be reduced, 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.

Given the wide range of costs and technologies involved the CCAG identified three key categories: (1) compressor efficiency improvements, (2) waste heat recovery for compressors and boilers, and (3) replacement of gas-driven compressors with electrical generators. Of these three categories, the focus should be efficiency improvements and waste heat recovery. Compressor replacement was considered a less fruitful area for analysis because (a) new compressors present high costs relative to the GHG reduction potential they provide, and (b) because switching the compressor fuel from gas to electricity simply moves the GHG production – at least in part – to another locale, and evidence indicates that compared to grid average CO₂ emissions per kWh at this time, natural gas fueled compressors may emit less CO₂ per kWh.¹⁷

Policy Design:

The CCAG recommends that New Mexico focus attention on reducing GHG emissions from fuel combustion in the oil and gas industry through education, financial incentives, or mandates or standards – coupled with cost and investment recovery mechanisms, if appropriate – to: (1) improve the efficiency of compressors; (2) boost waste heat recovery for compressors and boilers including the deployment of CHP systems that could sell excess power back to the grid; and to a lesser extent, (3) replace gas-driven compressors with electrical compressors when doing so reduces CO₂ emissions.

The CO₂ reduction goals stated below are being provided for the sole purpose of partially meeting the targets set by Governor Richardson's directive and are not necessarily confirmed or validated by any current study or analysis regarding economic or technical feasibility. It is the

¹⁷ See [Attachment X4](#).

intent of the CCAG to require further study and analysis of the approaches recommended above by the NMED and other appropriate agencies, and that from this study and analysis, changes in goals and determinations regarding the economic and technical feasibility of these approaches may result.

- **Goal levels:** Reduce CO₂ emissions from fuel combustion by 75% by 2020 starting in 2007.
- **Timing:** As noted above.
- **Parties:** Oil and gas production, processing, and transportation/distribution companies

Implementation method(s):

Policies to implement these practices could include:

- Information and education.
- Technical assistance.
- Funding mechanisms and/or incentives.
- Voluntary and or negotiated agreements.
- Codes and standards – coupled with cost and investment recovery mechanisms, if appropriate.

Related Policies/Programs in place:

- Some companies may practice the measures outlined above, but there is currently no state or federal requirement for any company to implement any of these measures.

Type(s) of GHG Benefit(s):

- CO₂: CO₂ emissions would be reduced directly through the implementation of these measures. Methane emissions would also be reduced, but these are addressed in ES-12.

Estimated GHG Savings and Costs Per Ton:

GHG reductions based on the specified goal level are noted below. Current uncertainties regarding costs and emission reduction benefits of these approaches inhibit comprehensive and thorough estimation of GHG savings and costs per ton at this time. These shortcomings will be addressed by the NMED-led study referenced in the policy design for ES-13. A preliminary analysis of GHG savings and costs per ton, developed to assist in the Energy Supply Technical Work Group’s consideration of ES-13, can be found in [Attachment X3](#).

| # | Policy | Scenario | Reductions (MMTCO ₂ e) | | | NPV (2007– 2020) | Cost- Effective- ness \$/tCO ₂ |
|---|--------|----------|-----------------------------------|------|---|------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| | | | | | | | |

| | | | | | | \$ Millions | |
|-------|---|---|-------------|-------------|--------------|----------------------|----------------------|
| ES-13 | CO2 reduction from fuel combustion in oil & gas operations | A. Reduce CO2 emissions by 20% through the use of automated air/fuel ratio controllers on natural gas compressor engines greater than 600 horsepower by 2020. | .27 | .63 | 4.73 | <i>Not Estimated</i> | <i>Not Estimated</i> |
| ES-13 | CO2 reduction from fuel combustion in oil & gas operations | B. Reduce CO2 emissions by 25% using organic Rankine cycle CHP systems at natural gas compressor stations. | .34 | .79 | 5.90 | <i>Not Estimated</i> | <i>Not Estimated</i> |
| ES-13 | CO2 reduction from fuel combustion in oil & gas operations | C. Reduce CO2 emissions by 30% by replacing natural gas fired compressor engines with electric compressor motors (assuming zero-carbon electricity). | .41 | .95 | 7.09 | <i>Not Estimated</i> | <i>Not Estimated</i> |
| ES-13 | CO2 reduction from fuel combustion in oil & gas operations | Combination of A, B, and C technology options above. | 1.01 | 2.36 | 17.72 | <i>Not Estimated</i> | <i>Not Estimated</i> |
| ES-13 | CO2 reduction from fuel combustion in oil & gas operations | Combination of A and B technology options above.¹⁸ | .61 | 1.42 | 10.63 | <i>Not Estimated</i> | <i>Not Estimated</i> |

Data Sources, Methods and Assumptions (for quantified actions):

- **Data Sources:** To be determined by the NMED-led study specified in the ES-13 policy design.

¹⁸ Omission of ES-13 Scenario C from this total reflects the concern raised in **Attachment X4** that replacing natural gas fueled compressors at this time may not reduce CO2 emissions because of the current carbon intensity of grid average electricity in New Mexico.

- **Quantification Methods:** To be determined by the NMED-led study specified in the ES-13 policy design.
- **Key Assumptions:** To be determined by the NMED-led study specified in the ES-13 policy design.

Key Uncertainties:

- Data regarding the horsepower, type, location, and grouping of internal combustion engines in New Mexico was not available in time for this analysis. Also, significant uncertainties exist regarding the cost, applicability, and GHG reduction benefits achievable, particularly with respect to grid access (i.e., access to electricity at compressor sites) and cost, as well as the relative CO₂ emissions associated with electric vs. natural gas fueled compressors.
- These and other uncertainties are to be identified, determined, and addressed by the NMED-led study specified in the ES-13 policy design.

Contributing Issues, if applicable:

- Proportionally more natural gas may get to market rather than being consumed or lost in the production and distribution process. This could yield a net payback for producers, and negative cost/ton results (i.e., savings).
- Some of the criteria air pollutant emissions that would have resulted from less efficient compressors may be eliminated, lowering health impacts and associated health costs.
- Decreased emissions of criteria pollutants could lead to relaxation of throughput and production limits that may exist in permits, possibly enabling increased production and profits.
- Operation and maintenance costs may be reduced through the use of electric compressors and automated air/fuel ratio controllers may result.
- Power generation using ORC CHP systems could yield a payback through the sale of electricity and provide additional power for electric compressor engines where grid connections and power purchase opportunities are available.
- Organic Rankine cycle CHP systems do not require water for steam generation and generate no waste, limiting these indirect environmental impacts. Organic Rankine cycle CHP systems may be more feasible than steam driven CHP systems.

Feasibility Issues, if applicable:

- Available data suggests that installation and operation of all scenarios may be feasible to varying degrees. Additional, more detailed, analysis is necessary to quantify the feasibility of these options.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-14 GHG Cap & Trade

Policy Description:

CCAG Summary: 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 CO₂). By allowing trading, participants with lower costs of compliance can 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.¹⁹ Among the important considerations for New Mexico with respect to a cap and trade program are the sources and sectors to which it would apply, which GHGs would be covered, the level of the cap, how allowances would be distributed, what offsets would be allowed, and over what region the program would be implemented (e.g., nationally, regionally, etc.), and whether the cap could be achieved under a regional program given leakage from non-participating states and emissions from generation facilities on tribal lands not subject to state air quality regulations.

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 CO₂). By allowing trading, participants with lower costs of compliance can 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 CO₂ 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 according to any one of many different criteria to those participating in the cap and trade system (or even to those who are not), auction them, or some combination of the two.

Participants can range from a small group within a single sector to the entire economy, and the compliance obligation can be implemented “upstream” (at the fuel extraction or import level) or “downstream” at points of fuel consumption.

Among the important considerations for New Mexico 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.);

¹⁹ The Climate Action Team in California recently assembled a good discussion of cap and trade design issues. It can be referenced at: http://www.climatechange.ca.gov/climate_action_team/reports/2005-12-08_CAP+TRADE_REPORT.PDF

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; and what if any incentive opportunities (e.g., interaction with other pollution regulations like Pennsylvania's EDGE program) may be included.

Policy Design:

The CCAG recommends that any cap and trade program applicable to New Mexico sources be preferentially implemented on a national or regional (i.e., multi-state) basis.

The CCAG further recommends that the State of New Mexico should lead or participate in a regional collaborative to investigate market-based mechanisms, such as cap and trade and other state policies, that would limit and reduce greenhouse gas emissions in the West and in the Nation. This will be valuable for the region and inform and help shape national legislation to regulate GHG emissions.

- **Goal levels:** Not quantified.²⁰
- **Timing:** Not applicable.
- **Parties:** Not applicable.

Implementation method(s):

- Market based mechanism with underlying regulatory obligation.

Related Policies/Programs in place:

- No GHG cap and trade program is currently in place in New Mexico or the WECC region.

Type(s) of GHG Benefit(s):

- CO₂: A cap and trade system is likely to be implemented – at least initially – as a direct limit on CO₂ emissions. The level at which the cap is set and how effectively the program addresses leakage risks would determine CO₂ reductions.
- CH₄, N₂O, HFC's, and SFC's could also be reduced under a cap and trade program, which covers multiple GHGs.
- Black Carbon: To the extent that generation from coal and oil would decline under a cap and trade system, black carbon emissions would also decrease.

²⁰ Several cap and trade scenarios were modeled for the purpose of gaining insight into potential impacts on the State, and are detailed in the remainder of the policy description and in supporting materials. However, because New Mexico cannot unilaterally implement a national or regional policy option, no scenario reductions and costs (or savings) have been counted as contributing to the Governor's GHG reduction goals. Further, potential overlap with other ES policy options would need to be addressed to avoid possible double counting of reductions.

Estimated GHG Savings and Costs Per Ton:

Economic modeling was conducted for several national and regional cap and trade scenarios as examples for the purpose of gaining understanding regarding the potential impacts of a national or regional cap and trade program on New Mexico.

Note: Quantifications below are for illustrative example purposes only, because New Mexico cannot unilaterally implement a national or regional cap and trade program.

| # | Policy | Example Scenario | Reductions (MMTCO ₂ e) | | | NPV (2007–2020) \$ Millions | Cost-Effectiveness \$/tCO ₂ |
|-------|---------------------------|--|-----------------------------------|--------------------|-----------------------------------|--------------------------------|---|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| ES-14 | GHG Cap and Trade Program | National/NEMS: 2.4%–2.8% Carbon Intensity (CI) improvement per year, with a \$6.16–\$9.86 safety valve | -0.1 | 1.0 | 3.6 | \$25 | \$7 |
| ES-14 | GHG Cap and Trade Program | National/NEMS: 2.6%–3.0% CI, \$8.83–\$14.13 safety valve | 0.1 | 1.0 | 4.2 | \$42 | \$10 |
| ES-14 | GHG Cap and Trade Program | National/NEMS: 2.8%–3.5% CI, \$22.09–\$35.34 safety valve | -0.1 | 8.1 | 31.3 | \$541 | \$17 |
| ES-14 | GHG Cap and Trade Program | National/NEMS: 3.0%–4.0% CI, \$30.92–\$49.47 safety valve | 0.1 | 9.1 | 43.5 | \$804 | \$19 |
| ES-14 | GHG Cap and Trade Program | Rose: 11-State Economy-wide C&T; 5% costless | 6.7 ²¹ | 10.9 ²² | 90.6 ²³ | \$280 ²⁴ | \$3 |
| ES-14 | GHG Cap and Trade Program | Rose: 11-State Economy-wide C&T; 15% costless | 10.3 ²⁵ | 14.9 ²⁶ | 132.0 | -\$488 | -\$4 |

²¹ See Adam Rose spreadsheet “S_5% Case NPV1” – “Emission Reduction” Table

²² See Adam Rose spreadsheet “S_5% Case NPV1” – “Emission Reduction” Table

²³ Per Adam Rose’s 8/6/06 email of S/5%/2020 with 2006 NPV. See spreadsheet “S_5% Case NPV1”

²⁴ Per Adam Rose’s 8/6/06 email of S/5%/2020 with 2006 NPV. See spreadsheet “S_5% Case NPV1”

²⁵ TABLE AS/15%/2012, page 7.

²⁶ TABLE BS/15%/2020, page 9.

| | | | | | | | |
|-------|---------------------------|--|-------|-------|------|-------|-----|
| ES-14 | GHG Cap and Trade Program | Rose: 11-State Power-Sector C&T; 5% costless | 2.927 | 5.428 | 42.5 | \$328 | \$8 |
| ES-14 | GHG Cap and Trade Program | Rose: 4-State Economy-wide C&T; 5% costless | 5.729 | 9.430 | 78.1 | \$413 | \$5 |

Data Sources, Methods and Assumptions (for quantified actions):

- Note: Explanation of the data, methods, and assumptions utilized in quantifying the WECC-area and WECC-subset geographical scenarios is contained in an accompanying paper, *Economic Analysis of a Cap and Trade System for Carbon Dioxide Emission Reduction in the Western States*, by Adam Rose and Dan Wei, Preliminary Draft, August 4, 2006.
- **Data Sources:** Data for the national electricity modeling done in this analysis comes from the US Energy Information Administration (EIA) and can be found within the National Energy Modeling System (NEMS). Data in NEMS includes representation of the existing generation, transmission and distribution system down to the unit level. NEMS also includes data that characterizes new plants that the model can choose to build to meet projected demand growth. EIA publishes Assumptions to the Annual Energy Outlook that details key assumptions in the current version of the model. EIA also publishes NEMS model documentation.
- **Quantification Methods:** The national modeling presented here was done by the Energy Information Administration in a Congressional Service Report from March 2006 entitled “Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals.” The scenarios listed are for four national cap and trade policies. We scaled the impacts to approximate results in New Mexico for the four scenarios presented here in the same way that we analyzed the NEMS modeling done specifically for this process. For the first four sample cap and trade scenarios, we approximated the cost of the policies by multiplying CO2 reductions by one-half of the market price for CO2 allowances. (The allowance price is the marginal price of allowances needed to produce the reported emission reductions; the actual cost of each ton of reductions ranges from zero up to the price of allowances. For simplicity, we assume that the actual cost is an average of the high (market clearing price) and low (zero) cost of reductions, which equals one-half of the market clearing price). We report costs as a net present value of the stream of costs from 2006 – 2020. We found the number of tons reduced by taking the difference between the emissions in the policy case and a reference case NEMS run. Because the NEMS model is a national model with multi-state

²⁷ TABLE AP/5%/2012, page 11.
²⁸ TABLE BP/5%/2020, page 12.
²⁹ TABLE A’S/5%/2012, page 13.
³⁰ TABLE B’S/5%/2020, page 14.

regions (New Mexico is within the Rocky Mountain Power Area), the results for New Mexico were derived from results in the region. We shared out the regional emission and cost results according to the share of New Mexico generation within the region.

Regional economic modeling was conducted within the CCAG process to consider potential GHG reductions and cost ramifications for New Mexico relative to other states under several regional scenarios. This modeling was done for the purpose of understanding the impacts of a cap and trade program, not to define the details of a prospective cap and trade regulatory program. This modeling was conducted by Rose and Wei and is described in **Attachment X5 (insert Rose paper & spreadsheet)**. Using the Governor's targets as the cap, several cap and trade options were assessed, including the four quantified above, applying varying geographic scenarios and power-sector only vs. economy-wide approaches. Specifically, the CCAG considered this option: (a) on a national basis; (b) over the Western Electric Coordinating Council (WECC) states (subject to minor variations as needed to facilitate analysis); and (c) a sub region of the WECC states selected so as to minimize leakage. Further, the CCAG considered alternative programs covering: (1) all sectors (i.e., an economy-wide approach), and (2) the power sector alone.

- **Key Assumptions:** Any analysis of state-level policies using the National Energy Modeling System (NEMS) from the US Energy Information Administration should be weighed carefully. NEMS is a national model that consists of 13 regions. State policies cannot be implemented explicitly within NEMS, and the state-specific impacts cannot be known explicitly. We must make assumptions about the impact of policies at the state level by sharing out regional results.
- Economic modeling was conducted to consider potential GHG reductions and cost ramifications for New Mexico relative to other states under several regional scenarios. This modeling was conducted for the purpose of understanding the impacts of a cap and trade program, not to define the details of a prospective cap and trade regulatory program.

Key Uncertainties:

- As with any assessment of the future, this analysis has many uncertainties. Key uncertainties are those related directly to the assumptions and quantification methods noted above. If those assumptions are incorrect, then the results would change. Other uncertainties include the forecast of the price of fossil fuels and the growth in the demand for electricity.

Contributing Issues, if applicable:

- The shift from fossil fuel generation which could result from a GHG cap and trade program would lead to reductions in criteria air pollutants and, consequently, reduce health impacts and associated health costs.
- Allowing "offsets" from outside the capped sector(s) would create an incentive to quantify and reduce GHG emissions from sources in other sectors and potentially lower the costs of compliance.

Feasibility Issues, if applicable:

- The CCAG has consistently expressed grave feasibility concerns about a cap and trade program implemented solely within New Mexico.
- Any cap and trade program for New Mexico should account for and incorporate sources that are currently not subject to state utility or environmental regulatory authority (e.g., tribally operated facilities and co-ops).

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

ES-15 Generation Performance Standard

Policy Description:

CCAG Summary: A generation performance standard (GPS) is typically a requirement that electricity utilities or load serving entities (LSE) sell electricity with an average emission rate below a specified mandatory standard. Utilities must take action to ensure that their generation mix meets the standard.

A generation performance standard (GPS) is a mandate that requires electricity utilities or load serving entities (LSE) to acquire electricity with an average emission rate below a specified mandatory standard. Utilities must take action to ensure that their generation mix meets the standard.

A market-based variation of a GPS would be to 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:

The CCAG recommends that New Mexico develop a GPS applicable only to new generation (both to meet demand growth as well as to replace retiring generation capacity). The GPS level would be equivalent to GHG emissions from a new natural gas combined cycle plant.

- **Goal levels:** Set a GPS equivalent to a new natural gas combined cycle plant applicable to new supply, whether generated in New Mexico or imported.
- **Timing:** As new generation capacity is built in New Mexico or utilities seek permission to invest in new generation capacity to serve jurisdictional load in the State.
- **Parties:** Utilities (electricity generators).

Implementation method(s):

- Codes and standards.
- Market-based mechanisms with underlying regulatory obligation.

Related Policies/Programs in place:

- No GPS system is in place in New Mexico.

Type(s) of GHG Benefit(s):

- CO₂: A GPS program is typically a direct limit on CO₂ emissions. The level of the standard would determine CO₂ reductions.
- CH₄, N₂O, HFC's, and SFC's could also be reduced under a GPS program, which covers multiple GHGs.
- Black Carbon: To the extent that generation from coal and oil would decline under a GPS program, black carbon emissions would also decrease.

Estimated GHG Savings and Costs Per Ton:

| # | Policy | Scenario | Reductions (MMTCO ₂ e) | | | NPV (2007– 2020) \$ Millions | Cost- Effective- ness \$/tCO ₂ |
|-------|---------------------------------|---|-----------------------------------|------|---|---------------------------------------|--|
| | | | 2012 | 2020 | Cumulative Reductions (2007-2020) | | |
| ES-15 | Generation Performance Standard | All new supply (generated or imported) must be as clean as NGCC | 1.2 | 3.8 | 24.3 | \$522 | \$21 |

Data Sources, Methods and Assumptions (for quantified actions):

- **Data Sources:** CDEAC, WECC, EIA, EPA, NREL.
- **Quantification Methods:** The analysis uses a spreadsheet tool to compare the costs and CO₂ emissions of compliance with the GPS with the costs and CO₂ emissions of the reference case. It involves the following steps: (1) estimate the amount of new coal generation expected in the reference case; (2) calculate the amount of CO₂ emissions from the new coal generation that would exceed the generation performance standard; (3) identify the type and amount of gas and renewable generation that would be needed to offset those coal CO₂ emissions; and (4) estimate the extent to which the cost of the gas and renewable generation exceeds the cost of conventional generation.

Assessment of this option should consider that new electricity demand might be served, at least in part, by out-of-state resources.

- **Key Assumptions:** Where applicable, the key assumptions are the same as those used in assessing the RPS (ES-1). The type of replacement resources needed to comply with the GPS are based on the mix of renewable generation that is assumed for the RPS analysis, modified to account for the role that gas can play in meeting the GPS. It is assumed that in

2010 the replacement resource mix is 50% gas and 50% wind, and that in 2020 the replacement mix is 50% gas, 40% wind and 10% biomass. The cost assumptions for the new renewable systems are the same as those described above for ES-1. The avoided costs associated with this policy are equal to the levelized cost of a new coal power plant, which is estimated to be \$41/MWh using assumptions from a recent EPA report, as described for ES-6.³¹ Additional detail on key assumptions is provided in Attachments A and B below.

Key Uncertainties:

- As with any assessment of the future, this analysis has many uncertainties. Key uncertainties are those related directly to the assumptions and quantification methods noted above. If those assumptions are incorrect, then the results would change. Other uncertainties include the forecast of the price of fossil fuels and the growth in the demand for electricity.

Contributing Issues, if applicable:

- TBD

Feasibility Issues, if applicable:

- TBD

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.

³¹ Environmental Protection Agency, *Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies*, July 2006.

ES-16 Regulatory Reform for Electric Cooperatives

Policy Description:

As member-owned entities, electric cooperatives are often not considered to be bound by the same regulatory bargain as investor-owned utilities (IOUs). The latter enjoy monopoly status in the marketplace along with a guaranteed rate of return in exchange for close regulatory oversight to protect customers from undue market power. Electric cooperatives are not seen as requiring similar regulatory oversight because their customers (coop members) are also owners and thus have an alternative regulatory mechanism available, i.e., election of their Boards of Directors.

As a result of this key regulatory difference, electric cooperatives are often not subject to the same regulations as IOUs, including state environmental regulations. (They are subject to federal environmental regulations.) Accordingly, the CCAG believes that it is worth considering limited reform of these provisions so that electric cooperatives face equivalent GHG reduction requirements as IOUs.

Policy Design:

Unless otherwise indicated, the analysis of all ES policy options addresses generation statewide, and thus includes electricity generated at tribally owned or operated facilities and at electric cooperatives. While the CCAG remains cognizant that final implementation of ES policy options is likely to vary among IOUs, tribal facilities, and cooperatives, this approach allows policy options to be considered equally across the board. Accordingly, the CCAG recommends this policy option as a non-quantified *enabling policy* for the electric cooperative-related GHG emission reductions and costs that are already quantified in the ES policy options. To include GHG reductions and costs under specific ES policy options as well as under this generic enabling policy would double-count the associated GHG reductions and costs.

- **Goal levels:** Not applicable to an enabling policy.
- **Timing:** Efforts to implement this enabling policy should proceed as rapidly as possible.
- **Parties:** Electric cooperatives.

Implementation method(s):

- Legislation – Regulatory reform of electric cooperatives with respect to environmental issues is likely to require statutory change.

Related Policies/Programs in place:

- Electric cooperatives in New Mexico are currently subject to less or no PRC oversight as compared to investor-owned utilities.

Type(s) of GHG Benefit(s):

- CO2: To the extent that generation from coal and oil would decline as a result of regulatory reform of electric cooperatives, CO2 emissions would decrease.
- Black Carbon: To the extent that generation from coal and oil would decline as a result of regulatory reform of electric cooperatives, black carbon emissions would also decrease.

Estimated GHG Savings and Costs Per Ton:

Not applicable.

Data Sources, Methods and Assumptions (for quantified actions):

Not applicable.

Key Uncertainties:

- Specific reforms necessary to enable full implementation of the CCAG's selected policies will require a thorough legal review and investigation after the CCAG's policy recommendations are finalized.

Contributing Issues, if applicable:

- Any shift from fossil fuel generation that would result from regulatory reform of electric cooperatives would lead to reductions in criteria air pollutants and, consequently, health impacts and costs associated with those pollutants.

Feasibility Issues, if applicable:

Not applicable.

Status of Group Approval:

Pending.

Level of Group Support:

TBD.

Barriers to consensus (if less than unanimous consent):

TBD.