Coalbed Methane Capture at Elk Creek: Encouraging Methane Capture as an Energy Source

for

Master of Applied Science

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Abstract

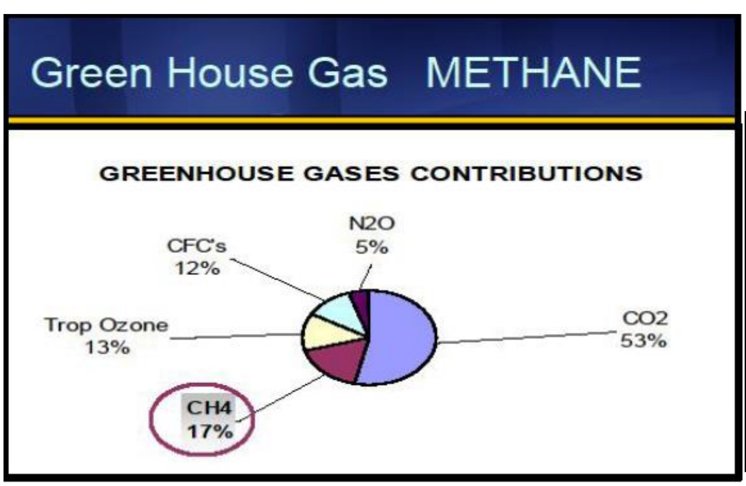
Coal mines release methane into the atmosphere. Mining causes subsidence which releases the gas from the coal and surrounding rock. The methane released is 23 times more potent than carbon dioxide as a greenhouse gas. Additionally, coalbed methane accounts for almost 7 percent of the total global methane emissions. This methane that is released can be burned to produce electricity and, in fact, burns much cleaner than coal. This method prevents methane entering the atmosphere. However, the generation is not the most cost effective form of electricity, resulting in the continuation of the methane emissions contributing to greenhouse gas pollution. With the proper incentives, coalbed methane capture can become a viable source of electrical generation thus reducing greenhouse gas emissions.

Project Definition

Background and Context Summary

Methane is a colorless, odorless, and naturally occurring gas made up of 1 part carbon to 4 parts hydrogen thus represented by the chemical compound CH_4. This gas is also combustible. In fact, mixtures of 5 percent-15 percent in the air are explosive (U.S. Environmental Protection Agency 2009). Additionally, methane is the main component in Natural Gas. While methane is a minor element of the earth's atmosphere, it is a major contributor to greenhouse gas (GHG). Greenhouse gasses prevent heat from escaping into space by trapping the earth's heat in (Greenhouse Gas Emissions 2012). This process is the driving factor of what is known as global warming.

Methane is a significant contributor to greenhouse gas emissions. This gas makes up 17 percent of all greenhouse gas contributions worldwide (Vessels Coal Gas, Inc. 2012). Additionally, methane emissions are 23 times more potent than carbon dioxide as a greenhouse gas over a 100 year



Legend:

CFC – chlorofluorocarbon
CH4 - Methane
CO2- Carbon Dioxide
N2O – Nitrous Oxide
Trop Ozone – Troposhperic Ozone

Figure 1. Greenhouse Gas Emissions by Source *Vessels Coal Gas Inc.*

period (Greenhouse Gas Emissions 2012). While methane exists as a naturally occurring gas, 60 percent of methane emissions come from human activities (Greenhouse Gas Emissions 2012). As evidence to the problems with emissions of this gas, the United States Environmental Protection Agency has identified several programs to assist in the reduction of methane emissions from human sources. These programs are listed and briefly described in Figure 2.

Examples of Reduction Opportunities for Methane	
Emissions Source	**How Emissions Can be Reduced**
Industry	Upgrading the equipment used to produce, store, and transport oil and gas can reduce many of the leaks that contribute to CH_4 emissions. Methane from coal mines can also be captured and used for energy. Learn more about the EPA's Natural Gas STAR Program and Coalbed Methane Outreach Program.
Agriculture	Methane can be reduced and captured by altering manure management strategies at livestock operations or animal feeding practices. Learn more about these strategies and EPA's AgSTAR Program.
Waste from Homes and Businesses	Because CH_4 emissions from landfill gas are a major source of CH_4 emissions in the United States, emission controls that capture landfill CH_4 are an effective reduction strategy. Learn more about these opportunities and the EPA's Landfill Methane Outreach Program.

Figure 2.EPA Methane Reduction Programs *Greenhouse Gas Emissions 2012*

The Coalbed Methane Outreach Program (CMOP) is a voluntary program for those entities involved in the coalmining process. "CMOP's mission is to promote the profitable recovery and utilization of coal mine methane (CMM). Coal mine methane is a potent greenhouse gas that contributes to climate change if emitted to the atmosphere…if CMM is recovered safely and used for energy, it is a valuable, clean-burning fuel source" (Coalbed Methane Outreach Program 2012). The EPA goes on to say,

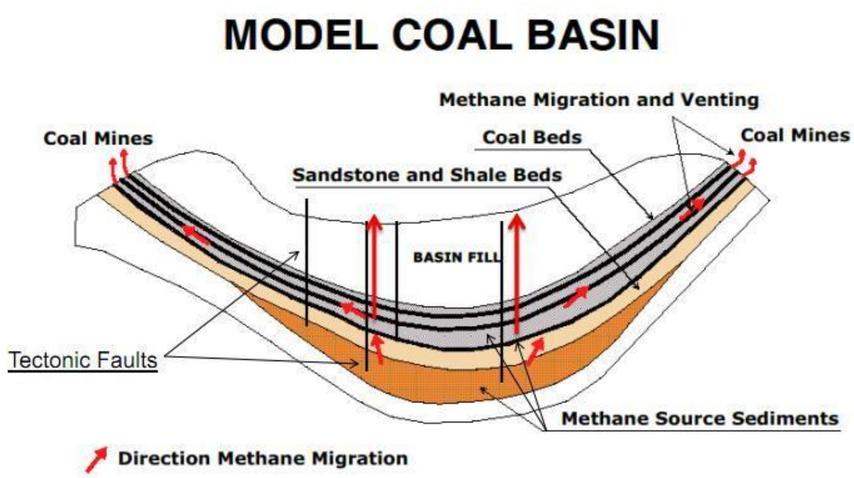


Figure 3. Model Coal Basin *Vessels Coal Gas Inc.*

"By helping to identify and implement methods to recover and use CMM instead of emitting it to the atmosphere, CMOP has played a key role in the United States' efforts to reduce greenhouse gas emissions and address global climate change" (Coalbed Methane Outreach Program 2012). Coal mine methane comes not only from active coal mines, but continues to vent from inactive coal mines as well. This methane is contributing to greenhouse gasses which have been a driving force in the rise of global temperature. Alternatively to simply allowing the methane to emit to the atmosphere, it can be burned to reduce a tremendous amount of the emissions. Additionally, methane can be tapped as a viable source of clean energy. The methane that is vented from coalmines can be captured and used as fuel for electrical generation. In doing so, the methane is not released into the atmosphere, but is instead burned, similar to natural gas.

Problem Statement

The main challenge posed to the use of coalmine methane for electrical generation is cost. Because it is a new technology and generation at mine sites is relatively small in scale, coal mine methane generation is more costly than the traditional mix of coal, natural gas, and nuclear mostly due to economies of scale, but also because the technology is young. As a result, electric utilities, particularly rural electric co-ops are hesitant to add it to their generation. However, when compared to other clean, renewable energy sources, coal mine methane capture is cost competitive. To encourage the development and use of wind, solar, and even biomass, these methods of clean energy production have typically been incentivized through rebates, grants, and RPS requirements. Through the use of proper similar incentives, coalbed methane capture would be a cost-effective, attractive method of generating electricity while reducing greenhouse gas pollutants emitted from active and abandoned coal mines.

Project Foundations

According to the EPA, methane is the second most prevalent greenhouse gas in the United States, making up 10 percent of US greenhouse gas emissions (Greenhouse Gas Emissions 2012).Although methane is the second to carbon dioxide in terms of emissions, it is the more powerful driver of global warming of the two gasses. While methane's direct effects make up much of its warming effects, it is also harmful as a greenhouse gas due to fact that methane creates ozone (O3), another powerful greenhouse gas. Additionally, at any one time, there is nearly 100 times more methane than carbon dioxide which, then, ultimately turns into 2.75 times as much carbon dioxide by mass. As a result of this, while carbon dioxide is the primary contributor to global warming, methane has contributed more than half of that contributed by CO_2. However, methane has a much shorter atmospheric lifetime when compared to carbon dioxide (Smith 2008). As a result of this fact, effects from reducing this greenhouse gas can be seen in a much shorter time period. A study published in the January 13, 2012 issue of *Science* found that reducing methane and black carbon (soot) would impact global warming the most in terms of significance, immediacy, and cost. (Shindell et. al 2012). "The analytic analysis shows that the measures substantially reduce the global mean temperature increase over the next few decades by reducing tropospheric ozone, CH_4, and BC (Black Carbon, soot)" (Shindell et. al 2012). The article finds that reducing CH_4 and BC, along with CO_2 emissions would likely result in limiting the rise of the global mean temperature to less than 2 degrees. This is a feat "that neither set of emissions reductions achieves on its own" (Shindell et. al 2012). Additionally, "(t)he CH_4 measures contribute more than half of the estimated warming mitigation and have the smallest relative uncertainty" (Shindell et. al 2012). It is estimated that CH_4 abatement alone could avoid up to 0.5 degrees Celsius in warming by 2050 (Shindell et. al 2012).

The anthropogenic sources of methane can be broken into three categories: Agriculture, Waste, and Industry. Ruminant livestock produce methane as part of their natural digestive processes. Also, the storage of animal manure causes methane emissions as well. Because the majority of this population of animals is raised as a food source, the methane emitted is contributed to human contributions. During decomposition, trash and waste also contribute to methane emissions. Landfills make up 16 percent of human sources of methane emissions (Greenhouse Gas Emissions 2012). Lastly, industry, primarily energy generation, makes up nearly half of all human sources of methane emissions. Because methane is the main component in natural gas, the increased use of this source for electrical generation causes increase incidence of methane emissions. Additionally, as coal is one of the primary sources of electricity generation in the world, coal is constantly being mined. Methane is not only trapped in the coal, but also in the surrounding rock as well (Coalbed Methane Outreach Program 2012). Due to these mining activities, a significant amount of methane is released.

This methane is, by federal requirements, vented from the mines to prevent pressure build up and toxicity. After a mine is abandoned, the methane continues to build up and must continue to be vented for quite some time. The result is a tremendous amount of methane emissions. The EPA projected methane emissions for 2010 was 186,000,000 metric tons Carbon Equivalent (tCO2e) (Greenhouse Gas Emissions 2012). Based on these estimates in Figure 4, coalbed methane would account for 12,266,000 CE tons of global methane emissions in the same year (Smith 2008). This is the carbon equivalent to the emissions from nearly 2,280,000 passenger vehicles (Clean Energy 2012).

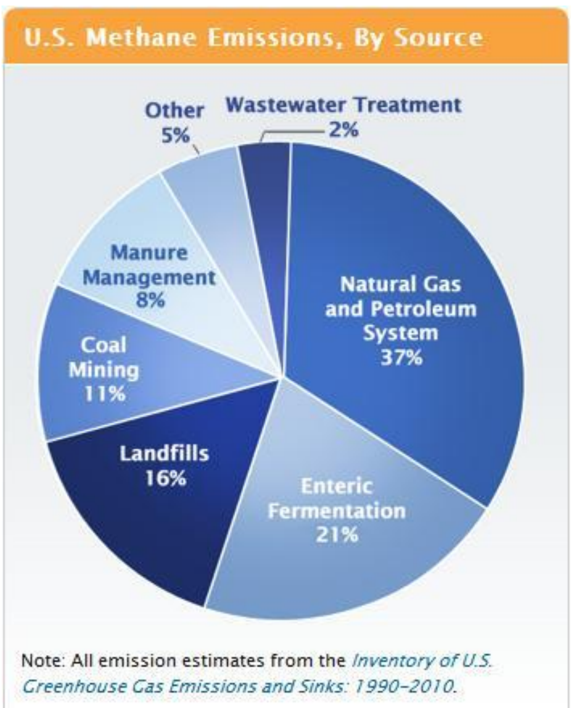


Figure 4. U.S. Methane Emissions, by Source *Greenhouse Gas Emissions 2012*

The process of capturing coalmine methane and burning it for electrical generation provides the opportunity for significant emissions savings. Producing energy from Waste Mine Methane results in 3.89 CE tons in savings per Megawatt hour (MWh) of electricity generated. The current

Colorado electrical grid mix, made up largely of coal and natural gas, produces 0.86 CE tons of emissions per MWh.

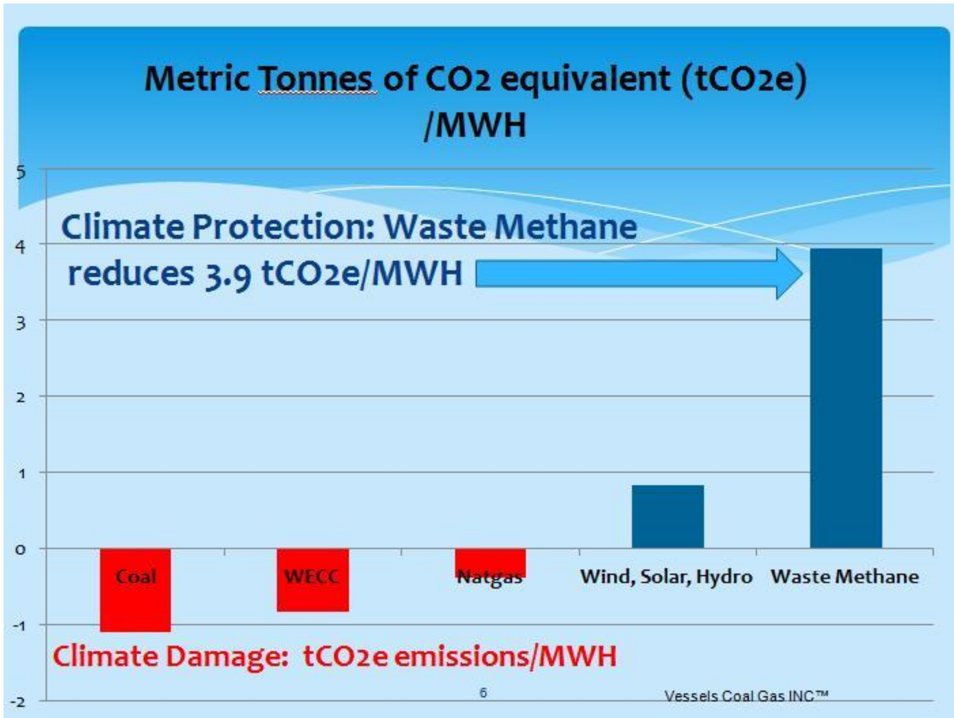


Figure 5. Emissions Avoidance, by Source Vessels Coal Gas inc. 2012

Because wind and solar offset the use of these fuels, each of these energy sources produce the same amount in savings: – 0.86 CE tons. Capturing and destroying coalmine methane prevents 3.7 tCO2e of emissions per MWh while causing 0.67 tCO2e of emissions per MWh during combustion. This technology, though, also offsets the 0.86 tCO2e of grid mix emissions per MWh as well (Vessels Coal Gas, Inc. 2012). This results in 0.67 (Combustion) - 0.86 (grid mix avoidance) – 3.7 (destruction) = - 3.89 tCO2e of emissions per MWh. Because this number is negative, it represents a savings in emissions. Based on these numbers, over 4.5 MWh of electricity from coalmine methane produces the same emissions as just 1 MWh produced from the traditional grid mix. This is energy that is, literally, being wasted each and every day as coal mines vent this methane to simply get rid of it.

While coalmine methane provides environmental benefits above and beyond those from wind and solar generation, there are additional benefits to using coalmine methane as a clean energy source as well. First, one of the main concerns with wind and solar energy is the intermittence of generation. "On average wind energy is best at night, when the atmosphere is stable. While there are times when the wind does blow during daylight hours, wind energy tends to produce less during the day when the atmosphere is unstable due to solar heating" (Pattison 2010). This means that during the day, the electricity produced is considerable less than at night as well as intermittent and unpredictable. Solar energy relies on the sun. Both nighttime and cloudy periods produce an interruption in production. As a result, solar energy cannot be produced during the night without storage and, like wind can be unpredictable during the day. While there is growing potential for limited solar storage, there is no way to store wind energy at this time. These two resources are best used while they are immediately available. This does, however, pose a problem when the resource is not available. If the wind is not blowing there is no power generation. If the sun doesn't shine the same problem is encountered.

Conversely, coalmine methane generation can be modeled and predictable (Aminian et al 2004). Also, the production of the gas is nearly constant (Vessels 2013). Additionally, there is potential for storage of the resource using abandoned coal mines by allowing pressure to build up within the mine and then sucking the methane out during periods of high demand (Vessels 2013). Another benefit of coalmine methane generation has to do with location. Coalmines are located, in general, closer to the existing transmission, in part due to the need for electricity at coal mining sites.

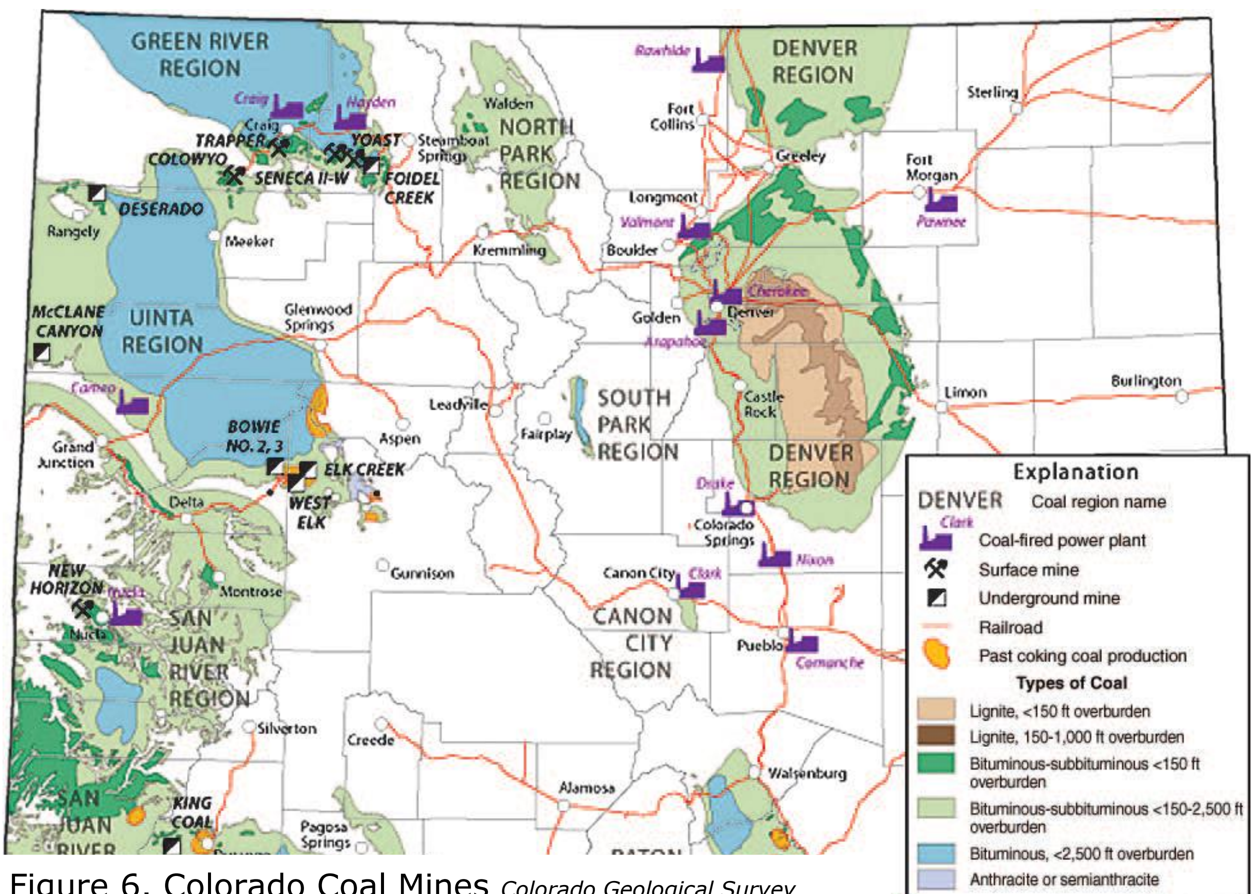


Figure 6. Colorado Coal Mines *Colorado Geological Survey*

Because of this, it is much easier to get coalmine methane electricity onto the grid. Both wind and solar are abundant in Colorado, but the ideal location for generation is usually remote. Wind generation potential is highest on the eastern plains of the state. Solar energy production is strongest in south-central Colorado. This means as wind or solar installations are made, a significant amount of transmission must be built or upgraded to get the electricity to those who need it.

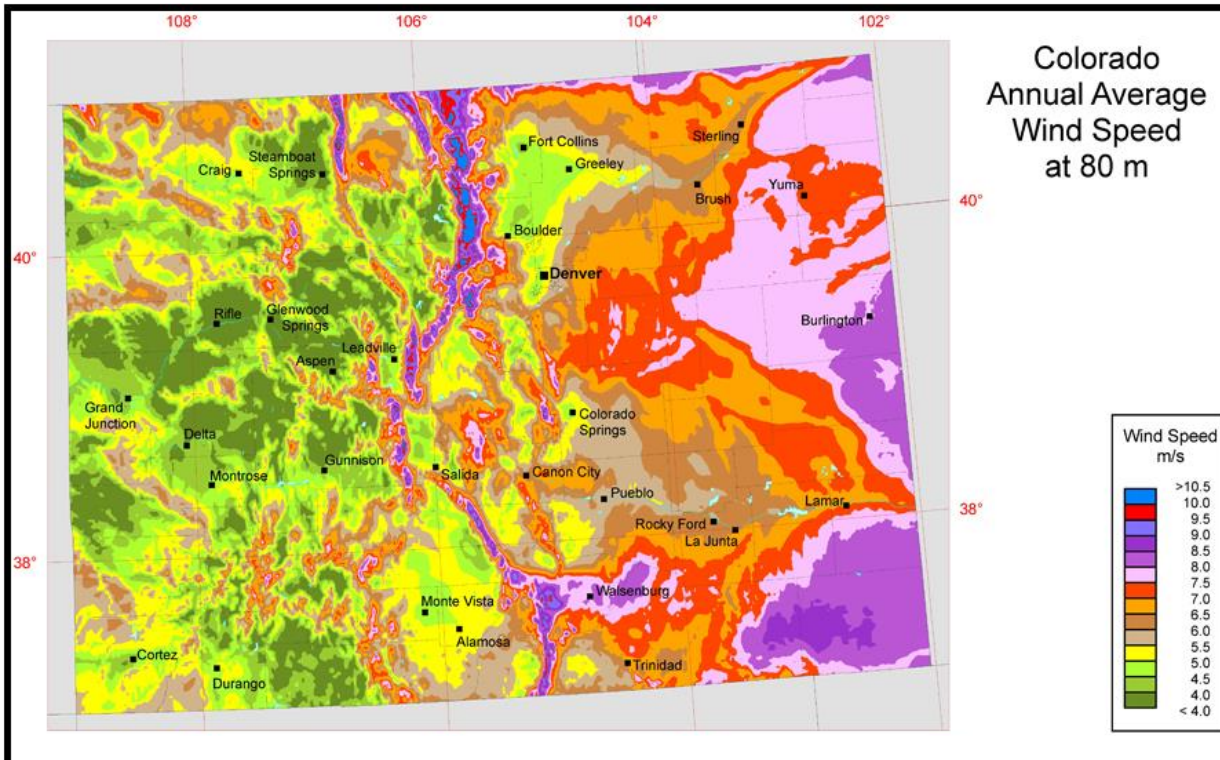


Figure 7. Colorado Wind Potential 80 Meter Map *United States EPA*

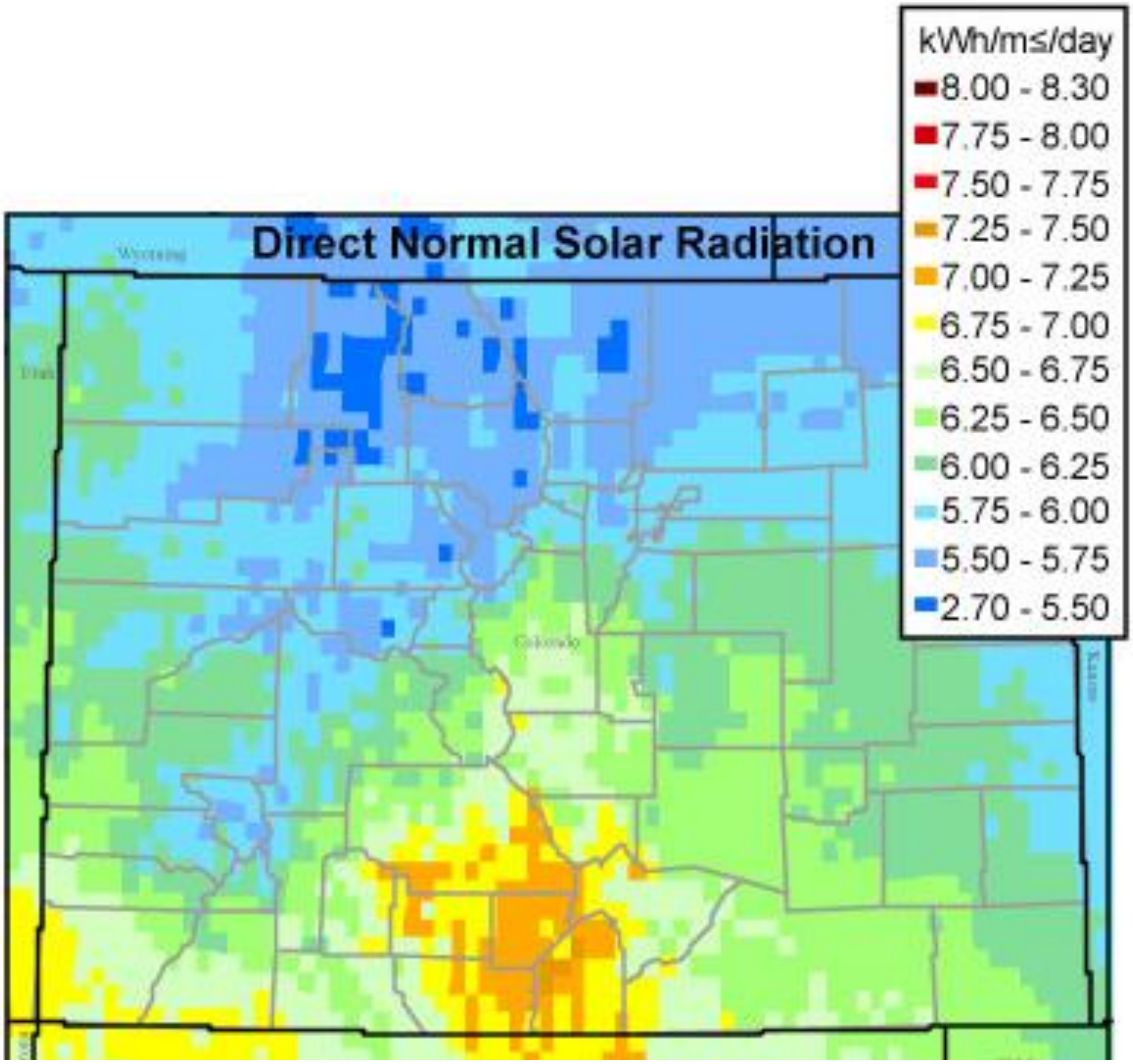


Figure 8. Colorado Direct Normal Solar Radiation *United States EPA*

Not only is this prohibitive to the realization of a project, but it also adds to the cost of generation. Coalmine methane can be sold as low as $0.055 per kwh (Vessels 2013). In comparison, wind costs $0.08 per kwh and solar costs $0.22 per kwh (Morgan 2010). Compared to these two resources, coalmine methane provides an opportunity for cost savings. Additionally, the capital cost per CE ton of emissions avoided for a coalmine methane plant is significantly lower than a wind or solar installation as shown in Figure 9.

1 Mega Watt of Electricity Estimates by Source			
	CH4	Wind	Solar
Capital Cost	$2.0M	$2.0M	$4.0M
Annual tCO2e avoided	30,000	3,000	1,500
Capital Cost per tCO23 avoided	$3	$33	$133
Capacity Factor	90%	40%	20%
MWH per annum	8,000	3,500	1,800

Figure 9. 1 MW Estimates, by Source *Vessels Coal Gas Inc.*

Colorado is estimated to have between 75 MW and 150 MW of coalmine methane capture potential. Of this, it is estimated that approximately half could be developed in the next 10 years (Northfork Valley Project 2012). Elk Creek Mine, located near Somerset in Gunnison County, Colorado, has the potential to produce 19 MW of electricity. However, currently, only 3 MW of this potential has been tapped while 16 MW is vented and burned off daily. Because Holy Cross Energy has committed to purchase the electricity generated, the 3MW project was able to move forward.

Holy Cross Energy is a non-profit electric co-op serving 55,000 customers in Western Colorado including Eagle County, Pitkin county, Mesa County, Garfield County, and Gunnison County. Because its members value renewable energy and want to increase its prevalence in their grid mix, Holy Cross Energy looks for opportunities to purchase these sources of electricity. The 3MW project was one such project. However, as alluded to above, electricity from these types of projects costs more than the traditional grid mix. Fortunately, in addition to wanting renewable energy sources, members of Holy Cross Energy are also willing to pay up to 5 percent more for it. This gives Holy Cross Energy the flexibility to balance a growing number of renewable energy sources with the slight rise in rates that their members are willing to pay (Worley 2013).

Holy Cross is on target to reach a Renewable Portfolio Standard (RPS) of 20 percent by 2020. Essentially, this means that 20 percent of Holy Cross's electrical grid mix will come from renewable energy sources. This far surpasses the 10 percent RPS set by Colorado state statute to be achieved by 2020. The 3 MW of coalbed methane capture generation represents an additional 3 percent of Holy Cross's grid mix. However, this does not count toward the state mandated 10 percent RPS because coal mine methane is not included in the definition of eligible energy resources. Many other rural electric co-ops have not had the same success in growing their Renewable Portfolio Standards.

Electric co-ops are member driven organizations. These electric co-ops often times exist in rural America and are member owned and member driven. Therefore, the ultimate goal and directive of an electric co-op is to keep its members' costs down. As a result, the mandate for these co-ops becomes the purchasing of the lowest-cost electricity. Typically, this has been coal and natural gas in Colorado. Purchasing wind, solar, and other renewable energy causes rates to rise, so these types of energy are not particularly attractive to the electric co-ops.

The coal mines that are imperative to this process are typically located in rural parts of Colorado. This would allow for fairly simple transmission of coal mine methane electricity to rural customers. Additionally, the development and growth of such generation plants would provide many jobs and significant economic development in the rural parts of Colorado as well. Despite these benefits, the cost of coalmine methane is simply too high. At this time, wholesale electric, which reflects the current grid mix of coal and natural gas, is about $0.03 per kwh. Coalmine methane costs approximately $0.055 per kwh making it unaffordable for most electric co-ops who must purchase the cheapest energy for their customers (Vessels 2013).

In comparison to wind and solar, however, coalmine methane becomes quite cost competitive. In this light, coalmine methane becomes a low cost, clean generation energy source. While renewable energy is important for energy independence, more important is the reduction of greenhouse gas emissions through the use of these energy sources. Not only does coalmine methane reduce greenhouse gas emissions more than wind or solar by a factor of 4, but it is also more cost-effective to produce. By incentivizing coalmine methane in a manner similar to other renewable energy sources, this industry could be encouraged to grow while significantly reducing greenhouse gas emissions and providing a cheaper clean energy alternative for electric users.

Project Solution

Approach

By using Holy Cross Energy as a case study for the implementation of coalmine methane capture electricity generation, this paper will examine the steps necessary to expand this technology to a statewide deployment specific to electrical co-ops. Holy Cross has been able to purchase this source of electricity despite its cost. Because of this, analysis of the effects of using this resource over the traditional grid mix or the other renewable resources available is possible. This analysis can then be used and applied to additional Colorado electrical co-ops. Additionally, this paper will use this analysis to address the political implications of resource incentives.

Recommended Solution

To incentivize the use of coalmine methane capture, it is recommended that this energy resource is added to definition of eligible renewable energy resources in Colorado Revised Statute (C.R.S.) 40-2-124. C.R.S. 40-2-124 outlines the Renewable Energy Standard set forth for Colorado. It defines renewable energy sources as wind, solar, geothermal, small hydroelectric, and biomass (Renewable Energy Standard – Definitions 2012). Additionally, C.R.S. 40-2-124 (1)(c)(III) also allows for counting each "kilowatt-hour of electricity generated from eligible energy resources in Colorado, other than retail distributed generation, [to] be counted as one and one-quarter kilowatt-hours for the purposes of compliance with this standard" (Renewable Energy Standard – Definitions 2012).

Discussion and Recommendations

Holy Cross Energy purchases and uses the electricity generated from the 3MW project at Elk Creek Mine. This project uses 3 MW of the 19 MW of methane that escape from the coal mine every day to produce electricity. The additional 16 MW are vented and flared (burned off). The total of the gas that is vented from the Elk Creek mine each day is enough gas to heat every home and office in Grand Junction, Co (Gunnison Energy Corporation). Because this coal mine methane is more expensive than the wholesale price of the traditional grid mix, Vessels Oil and Gas cannot sell anymore than the 3 MW of electricity at this point, despite the ability to grow the nameplate capacity of the plant to 19 MW fairly seamlessly.

Holy Cross is able to, however, purchase this electricity due to its customer base. In a survey of customers, Holy Cross's rate payer identified a want to pursue carbon emissions reducing energy sources as well as a willingness to pay up to 5 percent more in rates in order to do so (Worley 2013). As a result, Holy Cross is constantly on the lookout for new, clean energy sources. The 3MW project was an ideal energy source to add to Holy Cross's portfolio because of its proximity and its environmental benefits. Additionally, Holy Cross is able to purchase the electricity without a significant impact to its rates. The 3MW project translates to approximately 23,652,000 kwh of electricity each year. This is about 2 percent of Holy Cross Energy's generation needs (Worley 2013).

The current residential rate for electricity in the Holy Cross co-op is $0.0953 per kwh. Prior to the addition of the 3MW project it was $0.0942 per kwh. The addition of 2 percent coal mine methane generation added 0.53 percent to the kwh electricity rate. Appendix B examines the effects of the addition of 2 percent RPS of various clean energy sources. Using wind to gain 2 percent in clean energy would add over 1 percent to Holy Cross Energy's rates. The addition of 2 percent generation through solar would increase rates by over 4 percent. Using a typical mix of wind and solar generation for the same 2 percent would bring rates up 1.18 percent. Keep in mind, however, that the rise in rates, in this instance is entirely voluntary. Because coal mine methane is not an eligible renewable energy source, it does not count toward the 10 percent RPS requirement set forth in Colorado state statute. Allowing for the inclusion of coal methane capture in C.R.S. 124, along with the 1.25 multiplier, would grow Holy Cross's RPS factor even more. Even without the 3MW project at Elk Creek, Holy Cross is set to reach an RPS threshold that will far surpass the state mandated level. This requirement was originally set in 2004, but raised in 2010. Even if the RPS is once again raised before 2020, Holy Cross should be able to reach, if not surpass, the new target.

Adding coal mine methane to the list of eligible renewable energy sources would not only help out Holy Cross to increase its RPS more rapidly, but it had the potential to reduce methane emissions significantly across Colorado while providing Colorado electric coop customers significant monetary savings. When the purchase of such electricity is state mandated, there is a greater incentive to do grow the industry. Additionally, purchasing renewable energy from in-state sources results in a 20 percent savings per kwh of electricity purchased as each kwh hour purchased counts as 1.25 kwh toward the RPS. With these incentives, Colorado co-ops have been adding renewable energy sources such as wind and solar to their RPS with the goal of reaching 10 percent RPS by 2020.

Solution Benefits and Costs

Colorado's RPS for electric coops must reach 10 percent by the year 2020. Adding coal mine methane to C.R.S. 40-2-124 would give Colorado electric coops an additional choice in clean energy sources to add to reach the RPS mandate. The cost of coal mine methane is around $0.055 per kwh (Vessels 2013). Wind can cost about $0.08 per kwh and solar is even more expensive at $0.22 per kwh (Morgan 2010). Coal mine methane is, therefore, a cheaper alternative to traditional renewable energy generation in Colorado as well. Appendixes D, E, and F show the potential cost savings, for a sample of Colorado electric coops, that could be achieved if coops were able to incorporate 2 percent-6 percent of coal mine methane into their generation sources. These calculations compare the cost of coalmine methane generation to the generation of Colorado's average wind and solar mix (2011 Owned and Purchased Energy 2013). At the 2 percent threshold, this sample of coops would enjoy anywhere from $72,694 in savings for Sangre De Cristo Electric Association Inc., to an impressive $733,212 for Holy Cross Energy. At a 6 percent coal mine methane threshold, a savings of $247,395 to nearly $2,500,000 would be achieved by the same coops, respectively. This money is an important savings to customers in these rural areas of Colorado. These savings represent dollars that can be pumped into other areas of the local economy. Also, because electric coops work hard to keep rates low for their members, coal mine methane is a justifiable tool electric coops can use to add clean electricity generation sources to their grid mix while maintaining low electricity rates.

Addition of this clean energy source to RPS eligible renewable energy sources also provides an incredible opportunity for greenhouse gas emissions savings. Appendixes G, H, and I explore the potential for these savings in the same sampling of Colorado electric coops. The calculations look at the tCO2e avoided through the use of coal mine methane and compares this to the tCO2e avoided through the generation of Colorado's average mix of wind and solar power (2011 Owned and Purchased Energy 2012). The extrapolation of these numbers shows that Poudre Valley Rural Electric Association Inc. could save an additional 67,400 tCO2e each year by adding 2 percent coal mine methane generation to its grid mix instead of the wind and solar mix they would typically use under the current C.R.S. 40-2-124 requirements. This is equivalent in emissions reduction to removing approximately 44,000 passenger cars from the road each year. At the same 2 percent threshold, Gunnison County Electric Association could reduce 7600 tCO2e annually, the equivalent of planting nearly 640,000 trees. By growing the threshold to 6 percent coal mine methane, Poudre Valley Rural Electric Association could save 202,199 tCO2e per year over the use of the same amount of wind and solar. This would grow the emissions savings to the equivalent of removing 140,000 cars from the roads. Similarly, in Gunnison, utilizing 6 percent coal mine methane instead of wind and solar would result in almost 23,000 tCO2e in savings per year. This grows the forest of trees planted by Gunnison to 195,500.

Solution Strengths and Weaknesses

The addition of coal mine methane to C.R.S. 40-2-124 has the potential to grow the industry. Through the incentivizing of wind and solar power, these industries have enjoyed a significant boost in generation. Additionally, the increased use and demand for these renewable energy sources have helped the industries to grow and reduce the cost of the electricity they produce. Not only can the Elk Creek mines bring an additional 16 MW online fairly quickly and easily, there are mines all over Colorado where the same technology could be deployed. This would help to grow the industry and, potentially, lower the cost of generation as well.

Colorado Revised Statute 40-2-124 is familiar to all utilities. Eligible resources already include landfill and agricultural methane capture. Because the scientific makeup of these sources of methane is precisely the same as the chemical compound in coal mine methane – CH_4, this would put this source of methane on par with its exact counterparts. Additionally, while coal mine methane is not a naturally occurring source of methane, landfill and agricultural methane are anthropomorphic sources as well, according to the EPA (Greenhouse Gas Emissions 2012). As all utilities are familiar with C.R.S. 40-2-124, this is a simple way to integrate and incentive to the use of the resource. Coal mine methane, then, becomes a money saving way for electric coops to grow their RPS to the mandated 10 percent by 2020.

There are a few weaknesses to this evaluation of coal mine methane use for electric coops. First, as utility data is extremely complicated and often guarded, the mathematical evaluations should be regarded as guides and not exact analysis. While public data and estimates were used in those calculations to the best ability possible, it cannot be expected that these numbers would represent the exact industry. These calculations are further complicated by the guarding of business transactions between electricity generations and utilities, the constant fluctuation in electricity prices, and the valuation of generation costs for different energy resources.

Solution Risks and Implications

Additionally, while the solution presented is simple and straightforward, there are many political implications that may arise. Many from the environmental community are concerned about the addition of coal mine methane to the list of eligible renewable energy sources in C.R.S. 40-2-124. The first concern is that coal mine methane does not represent a renewable source in the truest sense of the definition. Because coal mine methane is the result of coal mining, the resource is not eternally renewable as well as the product of a fossil fuel. As a result, one political alternative is to create a new standard under C.R.S. 40-2-124.5 to carve out a new standard for coal mine methane. However, as mentioned above, landfill and agricultural methane are included in the definition under 124 and these also represent human-caused emissions. Additionally, coal mining will not be ramping down any time soon. As long as coal is mined, coal mine methane will result in an enormous amount of greenhouse gas emissions. One goal of renewable energy sources is independence, but, perhaps the more important goal is emissions reduction. Under this premise, coal mine methane is on par with the second goal. It could, therefore, be argued that coal mine methane is an eligible renewable energy resource. Additionally, the eligible renewable energy resources under C.R.S. Section 124 not only enjoy 1 credit for every

1 MW of generation, but also qualify for 1.5 credits for each 1 MW of generation from an eligible renewable resource. Creating a new section under 124.5 identifies coal mine methane differently than other renewable energy resources. This could, potentially, result in less than 1 full credit for each 1 MW of coal mine methane generation. Worse yet, the in-state coal mine methane could be excluded from the 1.25 credit multiplier.

Another political concern related to the proposed solution is specific, it seems, to the wind and solar industry. This could be, in part due to the fact that these two industries have fought so hard over the years to grow and thrive. The previous RPS mandates have grown wind and solar energy generation tremendously. Currently, these industries stand to grow ever further as electric coops work to grow their RPS to 10 percent by 2020. The addition of other resources to C.R.S. 40-2-124 would shrink the market share of wind and solar, thus potentially hindering their expected growth. As a result, these groups think it is important to discuss and increase in the overall RPS requirements if the potential choices are growing. This fairly strong argument, however, begins to fall apart as one examines the potential impact of coal mine methane on Colorado's generation needs. Colorado has the potential to grow to 75 MW – 150 MW in nameplate capacity, however, only about half of this is reasonable to expect in the next 10 years (Gunnison Energy Corporation 2012). At a cap of 50 MW, this would represent around 394,000,000 kwh of coal mine methane generated electricity. In 2010, Colorado experienced 4,500,000,000 in electrical generation demand. The 50 MW nameplate capacity, therefore, represents less than 1 percent of total generation for the state of Colorado. It then must be evaluated whether it can be justified to increase RPS mandates to account for a less than 1 percent growth in potential generation. Due to the very small amount of generation that coalmine methane would produce under this statute change, in comparison to the state-wide generation totals, it appears that coalmine methane is being used as a political bargaining chip to grow RPS standards. Any RPS increase greater than 1 percent would be excessive to simply offset the addition of coalmine to the RPS eligible definition. In this light, it appears that opposition is using coalmine methane as an excuse to increase current RPS requirements further and, ultimately, grow the wind and solar industries by doing so.

Recommendations

It appears that, politically, coal mine methane is a smaller fighter in the overall RPS battle and as a result, may have to make many compromises to become an incentivized energy source. Through the evaluation of Holy Cross Energy's use of coal mine methane from Elk Creek mine it becomes easier to distinguish how this technology can be deployed to electric coops in Colorado as a whole. While electric coops may want to incorporate coal mine methane electrical generation into their current portfolios, it is difficult, if not impossible, for these coops to do so as member mandates require the purchase of the lowest cost energy. Using the same incentive for coal mine methane that is currently used for energy sources such as wind and solar would allow for these coops to utilize coal mine methane to decrease greenhouse gas emissions from electricity generation while realizing a significant cost savings as well. The recommendation, therefore, is to add coal mine methane to C.R.S. 40-2-124 (1)(a)(IV) and capping it at 50 MW nameplate capacity to read:

> (IV)"Renewable energy resources" means solar, wind, geothermal, biomass, new hydroelectricity with a nameplate rating of ten megawatts or less, and hydroelectricity in existence on January 1, 2005, with a nameplate rating of thirty megawatts or less, *coal mine methane with a total state-wide nameplate capacity of 50 MW or less.*

This is a solution that is beneficial to reducing greenhouse gas emissions, cost-effective, and politically feasible.

As mentioned, it is important that coal mine methane be included in 124, not a newly created 124.5. The reasons for this are two-fold. Because anthropomorphic methane is already included in the 124 definition (biomass), coal mine methane should enjoy the same treatment. Both sources of methane produce the same chemical compound, CH_4, and, as a result, the use of both sources of methane gas result in the same environmental benefits. Also, creating a new definition under 124.5 opens the door to methane from coal mine methane being treated differently than other renewable energy sources. This has the potential to result in fewer incentives for the use of coal mine methane, which, in turn, may result in the slowed growth of the industry.

Conclusion

A tremendous amount of methane emissions could be avoided in Colorado with the use of coalmine methane. (NEEDS MORE WORK)

References

2011 Owned and Purchased Energy. 2013. "Public Service Company of Colorado power supply mix." Xcel Energy, http://www.xcelenergy.com/About_Us/Our_Company/Power_Generation/Power_Generation_Fuel_Mix_-_PSCo (accessed February 3, 2013).

Aminian, K. et al. 2004. Type Curves for Coalbed Methane Production Prediction. Paper presented at the 2004 SPE Eastern Regional Meeting September 15-17, in Charleston, West Virginia.

Clean Energy. 2012. "Greenhouse gas Equivalency Calculator." U.S. Environmental Protection Agency, http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results (accessed February 19, 2013).

Coalbed Methane Outreach Program. 2012. "Basic Information." U.S. Environmental Protection Agency, http://www.epa.gov/cmop/basic.html (accessed February 4, 2013).

Delta-Montrose Electric Association. 2013. "Full Financials." Delta-Montrose Electric Association, http://www.dmea.com/images/stories/PDF/Newsletters/AR.pdf (accessed February 3, 2013).

Delta-Montrose Electric Association. 2013. "Rates." Delta-Montrose Electric Association, http://www.dmea.com/index.php?option=com_content&view=article&id=95&Itemid=72 (accessed February 3, 2013).

Electric Power Monthly. 2013. "Average Retail Price of Electricity to Ultimate Customers By End-Use Sector, by State." U.S. Energy Information Association, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a (accessed February 25, 2013).

Energy Efficiency & Renewable Energy. 2012. "Colorado Reseidential Energy Consumption." U.S. Department of Energy, http://apps1.eere.energy.gov/states/residential.cfm/state=CO (accessed February 4, 2013).

Greenhouse Gas Emissions. 2012. "Methane Emissions." U.S. Environmental Protection Agency, http://epa.gov/climatechange/ghgemissions/gases/ch4.html (accessed February 4, 2013).

Gunnison County Electric Association, Inc. 2013. “Annual Report.” Gunnison County Electric Association, Inc., http://www.gcea.coop/documents/GCEA_AR2011_web.pdf (accessed February 3, 2013).

Gunnison County Electric Association, Inc. 2013. “Rates.” Gunnison County Electric Association, Inc., http://www.gcea.coop/Services/rates.cfm (accessed February 3, 2013).

Gunnison Energy Corporation. 2012. “3MW LLC Coal Mine Methane Electricity Project.” Northfork Valley Project, www.-northforkvalleyproject.com/wp-content/uploads/Fact-Sheet-on-the-Coal-Mine-Methane-Electricity-FINAL-11-8.doc (accessed January 23, 2013).

Morgan, Jason. 2010. Comparing Energy Costs of Nuclear, Coal, Gas, Wind, and Solar. Nuclear Fissionary (April 2), http://nuclearfissionary.com/2010/04/02/comparing-energy-costs-of-nuclear-coal-gas-wind-and-solar/ (accessed February 3, 2013).

Northfork Valley Project. 2012. “Fact Sheet on the Coal Mine Methane Electricity.” Northfork Valley Project, http://nothforkvalleyproject.com/Fact-Sheet-on-the-Coal-Mine-Methane-Electricity-FINAL-11-8.doc (accessed February 3, 2013).

Pattison, Chris. 2010. Solar Support for Wind Energy. Wind Systems, http://windsystemsmag.com/article/detail/98/solar-support-for-wind-energy (accessed March 7, 2013).

Poudre Valley Rural Electric Association, Inc. 2013. “2012 Annual Report.” Poudre Valley Rural Electric Association, Inc., http://www.pvrea.com/members/PVREA%202012%20annual%20report%20web.pdf (accessed February 3, 2013).

Poudre Valley Rural Electric Association, Inc. 2013. “Rates – Index.” Poudre Valley Rural Electric Association, Inc., http://www.pvrea.com/members/Rates%202013%20-%20All%20in%20One%20Document%20-%20Final.pdf (accessed February 3, 2013).

Renewable Energy Standard – Definitions. Colorado Revised Statute 40-2-124. Colorado Revised Statute 124 (2012). http://www.lexisnexis.com/hottopics/colorado/ (accesses January 17, 2013).

Sangre De Cristo Electric Association, Inc. 2012. "2011 Annual Report." Sangre De Cristo Electric Association, Inc., http://www.myelectric.coop/mo/PDF/Rates%20(4-8-13).pdf (accessed February 3, 2013).

Sangre De Cristo Electric Association, Inc. 2013. "Rate Schedules." Sangre De Cristo Electric Association, Inc., http://www.myelectric.coop/mo/PDF/Rates%20(4-8-13).pdf (accessed February 3, 2013).

Shindell, Drew et al. 2012. "Simultaneously Mitigation Near-Term Climate Change and Improving Human Health and Food Security." SCIENCE 335: 183-89.

Smith, Kirk R. 2008. "Carbon on Steroids: The Untold Story of Methane, Climate, and Health." *California Air Resources Board.* Power Point 2000. 10 November 2008.

State of Colorado. Colorado Governor's Energy Office. 2010. *2010 Colorado Utilities Report.* Denver, Co.

State Profile and Energy Estimates. 2012. "Profile Overview – Colorado." U.S. Energy Information Administration, http://www.eia.gov/beta/state/?sid=CO (accessed February 6, 2013.)

United States Census Bureau. 2013. "State and County QuickFacts – Colorado." U.S. Department of Commerce, http://quickfacts.census.gov/qfd/states/08000.html (accessed February 4, 2013).

U.S. Environmental Protection Agency. Coalbed Methane Outreach Program. 2009. *Coalmine Methane Recovery: A Primer*. Washington, D.C.

U.S. Environmental Protection Agency. Office of Air and Radiation. 1999. *U.S. Methane Emissions 1990 – 2020: Inventories, Projections, and Opportunities for Reductions*. Washington, D.C.

Vessels Coal Gas, Inc. 2012. "Concerning the Capture of Waste Mine Methane." Vessels Coal Gas, Inc*.,* http://www.vesselscoalgas.com/Concerning%20Capture%20of%20Waste%20Mine%20Methane%207.20.12.pdf (accessed January 12, 2013).

Vessels, Tom. Interview by Amy Crowfoot, Vessels Coal Gas, Inc., Denver, Co, 21 February 2013.

Williams, David O. 2012. Aspen Skiing's coal-mine methane power project sparks clean-energy debate. *Aspen Business Journal*, November 27, 2012, Business Section.

Worley, Del. Interview by Amy Crowfoot by telephone, 17 January 2013.

Appendixes

Appendix A. Average Cost of Wind/Solar Mix: Based on Xcel Reported Mix (2011 Owned and Purchased Energy 2011)

	Percent of State Total	Share	Cost per kwh	Total Cost of Mix
Wind	13.00%	95.73%	0.08	$ 0.077
Solar	0.58%	4.27%	0.22	$ 0.009
Total	14%	100%		$ 0.086

Appendix B. Holy Cross Energy Rate based on Energy Source (Worley 2013)

	Cost	% of whole	Contribution to Rate	Total Rate	Percent Change
Holy Cross Current Rate (Including CMM)	$ 0.0953				
Rate without CMM	$ 0.0942				
CMM	$ 0.0550	2.0%	$ 0.0011	$ 0.0953	0.53%
Grid Mix	$ 0.0300	2.0%	$ 0.0006	$ 0.0948	0.00%
Wind	$ 0.0800	2.0%	$ 0.0016	$ 0.0958	1.05%
Solar	$ 0.2200	2.0%	$ 0.0044	$ 0.0986	4.01%
Wind/Solar Mix	$ 0.0860	2.0%	$ 0.0017	$ 0.0959	1.18%

Appendix C. Metric Tons of Carbon equivalent offsets (Clean Energy 2012)

	1000 tCO2e	2500 tCO2e	7000 tCO2e	10000 tCO2e
Cars	693	1733	5198	6930
Electricity Use of Homes	500	1250	9375	5000
Trees Planted	85,000	212,500	1,593,750	850,000

Appendix D. Potential Cost Savings for CMM v. Traditional Renewable use by Utility at 2% of RPS

2% of total generation				CMM	Wind Solar Mix	Demand	Energy Cost Savings	
Entity	Retail Rate	Electric Cost	Other	Rate	Rate	Demand in kwh	per kwh	Total
Colorado Average Retail Rate	$ 0.1099	$ 0.0687	$ 0.0412	$ 0.1104	$ 0.1110	40,500,000,000	0.56%	$ 25,110,000.00
Delta Montrose Electric Association	$ 0.0941	$ 0.0588	$ 0.0353	$ 0.0946	$ 0.0952	610,000,000	0.66%	$ 378,200.00
Holy Cross Energy	$ 0.0948	$ 0.0593	$ 0.0356	$ 0.0953	$ 0.0959	1,182,600,000	0.65%	$ 733,212.00
Sangre De Cristo Electric Association Inc	$ 0.1124	$ 0.0702	$ 0.0421	$ 0.1129	$ 0.1135	117,249,043	0.55%	$ 72,694.41
Gunnison County Electric Association	$ 0.1185	$ 0.0741	$ 0.0444	$ 0.1190	$ 0.1196	125,400,504	0.52%	$ 77,748.31
Poudre Valley Rural Electric Association, Inc	$ 0.0918	$ 0.0574	$ 0.0344	$ 0.0923	$ 0.0929	1,112,204,894	0.68%	$ 689,567.03

Appendix E. Potential Cost Savings for CMM v. Traditional Renewable use by Utility at 4% of RPS

4% of total generation				CMM	Wind Solar Mix		RPS Savings	
Entity	Retail Rate			Rate	Rate	Demand in kwh	per kwh	annual
Colorado Average Retail Rate	$ 0.1099	$ 0.0687	$ 0.0412	$ 0.1109	$ 0.1121	40,500,000,000	1.13%	$ 50,220,000.00
Delta Montrose Electric Association	$ 0.0941	$ 0.0588	$ 0.0353	$ 0.0951	$ 0.0964	610,000,000	1.32%	$ 756,400.00
Sangre De Cristo Electric Association Inc	$ 0.1124	$ 0.0702	$ 0.0421	$ 0.1134	$ 0.1146	1,182,600,000	1.10%	$ 1,466,424.00
Gunnison County Electric Association	$ 0.1185	$ 0.0741	$ 0.0444	$ 0.1195	$ 0.1208	117,249,043	1.05%	$ 145,388.81
Poudre Valley Rural Electric Association, Inc	$ 0.0918	$ 0.0574	$ 0.0344	$ 0.0928	$ 0.0940	125,400,504	1.35%	$ 155,496.62

Appendix F. Potential Cost Savings for CMM v. Traditional Renewable use by Utility at 6% of RPS

6% of total generation				CMM	Wind Solar Mix		RPS Savings	
Entity	Retail Rate			Rate	Rate	Demand in kwh	per kwh	annual
Colorado Average Retail Rate	$ 0.1099	$ 0.0687	$ 0.0412	$ 0.1112	$ 0.1133	40,500,000,000	1.92%	$ 85,455,000.00
Delta Montrose Electric Association	$ 0.0941	$ 0.0588	$ 0.0353	$ 0.0954	$ 0.0975	610,000,000	2.24%	$ 1,287,100.00
Sangre De Cristo Electric Association Inc	$ 0.1124	$ 0.0702	$ 0.0421	$ 0.1136	$ 0.1157	1,182,600,000	1.88%	$ 2,495,286.00
Gunnison County Electric Association	$ 0.1185	$ 0.0741	$ 0.0444	$ 0.1198	$ 0.1219	117,249,043	1.78%	$ 247,395.48
Poudre Valley Rural Electric Association, Inc	$ 0.0918	$ 0.0574	$ 0.0344	$ 0.0930	$ 0.0951	125,400,504	2.30%	$ 264,595.06

Appendix G. GHG Emissions Savings for CMM v. Traditional Renewable use by Utility at 2% of RPS

2%	Demand	2% of Demand	CMM	Wind/Solar mix	Difference
Entity	kwh		tCO2e		
Colorado Average Retail Rate	40,500,000,000	810,000,000	3,150,900	696,600	2,454,300
Delta Montrose Electric Association	610,000,000	12,200,000	47,458	10,492	36,966
Holy Cross Energy	1,182,600,000	23,652,000	92,006	20,341	71,666
Sangre De Cristo Electric Association Inc	117,249,043	2,344,981	9,122	2,017	7,105
Gunnison County Electric Association	125,400,504	2,508,010	9,756	2,157	7,599
Poudre Valley Rural Electric Association, Inc	1,112,204,894	22,244,098	86,530	19,130	67,400

Appendix H. GHG Emissions Savings for CMM v. Traditional Renewable use by Utility at 4% of RPS

4%	Demand	4% of Demand	CMM	Wind/Solar mix	Difference
Entity	kwh		tCO2e		
Colorado Average Retail Rate	40,500,000,000	1,620,000,000	6,301,800	1,393,200	4,908,600
Delta Montrose Electric Association	610,000,000	24,400,000	94,916	20,984	73,932
Holy Cross Energy	1,182,600,000	47,304,000	184,013	40,681	143,331
Sangre De Cristo Electric Association Inc	117,249,043	4,689,962	18,244	4,033	14,211
Gunnison County Electric Association	125,400,504	5,016,020	19,512	4,314	15,199
Poudre Valley Rural Electric Association, Inc	1,112,204,894	44,488,196	173,059	38,260	134,799

Appendix I. GHG Emissions Savings for CMM v. Traditional Renewable use by Utility at 4% of RPS

6%	Demand	6% of Demand	CMM	Wind/Solar mix	Difference
Entity	kwh		tCO2e		
Colorado Average Retail Rate	40,500,000,000	2,430,000,000	9,452,700	2,089,800	7,362,900
Delta Montrose Electric Association	610,000,000	36,600,000	142,374	31,476	110,898
Holy Cross Energy	1,182,600,000	70,956,000	276,019	61,022	214,997
Sangre De Cristo Electric Association Inc	117,249,043	7,034,943	27,366	6,050	21,316
Gunnison County Electric Association	125,400,504	7,524,030	29,268	6,471	22,798
Poudre Valley Rural Electric Association, Inc	1,112,204,894	66,732,294	259,589	57,390	202,199

Appendix J. Colorado Revised Statute 40-2-124 (co-op specific sections only)

C.R.S. 40-2-124

COLORADO REVISED STATUTES

*** This document reflects changes current through all laws passed at the Second Regular and First Extraordinary Sessions of the Sixty-Eighth General Assembly of the State of Colorado 2012 and Constitutional and Statutory amendments approved at the General Election on November 6, 2012 ***

TITLE 40. UTILITIES
PUBLIC UTILITIES
ARTICLE 2. PUBLIC UTILITIES COMMISSION - RENEWABLE ENERGY STANDARD

C.R.S. **40-2-124** (2012)

40-2-124. Renewable energy standard - definitions - net metering

(1) Each provider of retail electric service in the state of Colorado, other than municipally owned utilities that serve forty thousand customers or fewer, shall be considered a qualifying retail utility. Each qualifying retail utility, with the exception of cooperative electric associations that have voted to exempt themselves from commission jurisdiction pursuant to section 40-9.5-104 and municipally owned utilities, shall be subject to the rules established under this article by the commission. No additional regulatory authority of the commission other than that specifically contained in this section is provided or implied. In accordance with article 4 of title 24, C.R.S., the commission shall revise or clarify existing rules to establish the following:

(a) Definitions of eligible energy resources that can be used to meet the standards. "Eligible energy resources" means recycled energy and renewable energy resources. The commission shall determine, following an evidentiary hearing, the extent to which such electric generation technologies utilized in an optional pricing program may be used to comply with this standard. A fuel cell using hydrogen derived from an eligible energy resource is also an eligible electric generation technology. Fossil and nuclear fuels and their derivatives are not eligible energy resources. For purposes of this section:

(I) "Biomass" means:

(A) Nontoxic plant matter consisting of agricultural crops or their byproducts, urban wood waste, mill residue, slash, or brush;

(B) Animal wastes and products of animal wastes; or

(C) Methane produced at landfills or as a by-product of the treatment of wastewater residuals.

(II) "Distributed renewable electric generation" or "distributed generation" means:

(A) Retail distributed generation; and

(B) Wholesale distributed generation.

(III) "Recycled energy" means energy produced by a generation unit with a nameplate capacity of not more than fifteen megawatts that converts the otherwise lost energy from the heat from exhaust stacks or pipes to electricity and that does not combust additional fossil fuel. "Recycled energy" does not include energy produced by any system that uses energy, lost or otherwise, from a process whose primary purpose is the generation of electricity, including, without limitation, any process involving engine-driven generation or pumped hydroelectricity generation.

(IV) "Renewable energy resources" means solar, wind, geothermal, biomass, new hydroelectricity with a nameplate rating of ten megawatts or less, and hydroelectricity in existence on January 1, 2005, with a nameplate rating of thirty megawatts or less.

(V) "Retail distributed generation" means a renewable energy resource that is located on the site of a customer's facilities and is interconnected on the customer's side of the utility meter. In addition, retail distributed generation shall provide electric energy primarily to serve the customer's load and shall be sized to supply no more than one hundred twenty percent of the average annual consumption of electricity by the customer at that site. For purposes of this subparagraph (V), the customer's "site" includes all contiguous property owned or leased by the customer without regard to interruptions in contiguity caused by easements, public thoroughfares, transportation rights-of-way, or utility rights-of-way.

(VI) "Wholesale distributed generation" means a renewable energy resource in Colorado with a nameplate rating of thirty megawatts or less and that does not qualify as retail distributed generation.

(b) Standards for the design, placement, and management of electric generation technologies that use eligible energy resources to ensure that the environmental impacts of such facilities are minimized.

(c) Electric resource standards:

(I) Except as provided in subparagraph (V) of this paragraph (c), the electric resource standards shall require each qualifying retail utility to generate…

…(V) Notwithstanding any other provision of law but subject to subsection (4) of this section, the electric resource standards shall require each cooperative electric association and municipally owned utility that is a qualifying retail utility to generate, or cause to be generated, electricity from eligible energy resources in the following minimum amounts:

(A) One percent of its retail electricity sales in Colorado for the years 2008 through 2010;

(B) Three percent of retail electricity sales in Colorado for the years 2011 through 2014;

(C) Six percent of retail electricity sales in Colorado for the years 2015 through 2019; and

(D) Ten percent of retail electricity sales in Colorado for the years 2020 and thereafter.

(VI) Each kilowatt-hour of electricity generated from eligible energy resources at a community-based project shall be counted as one and one-half kilowatt-hours. For purposes of this subparagraph (VI), "community-based project" means a project located in Colorado:

(A) That is owned by individual residents of a community, by an organization or cooperative that is controlled by individual residents of the community, or by a local government entity or tribal council;

(B) The generating capacity of which does not exceed thirty megawatts; and

(C) For which there is a resolution of support adopted by the local governing body of each local jurisdiction in which the project is to be located.

(VII) (A) For purposes of compliance with the standards set forth in subparagraph (V) of this paragraph (c), each kilowatt-hour of renewable electricity generated from solar electric generation technologies shall be counted as three kilowatt-hours.

(B) Sub-subparagraph (A) of this subparagraph (VII) applies only to solar electric technologies that begin producing electricity prior to July 1, 2015. For solar electric technologies that begin producing electricity on or after July 1, 2015, each kilowatt-hour of renewable electricity shall be counted as one kilowatt-hour for purposes of compliance with the renewable energy standard.

(VIII) Electricity from eligible energy resources shall be subject to only one of the methods for counting kilowatt-hours set forth in subparagraphs (III), (VI), and (VII) of this paragraph (c).

(IX) For purposes of stimulating rural economic development and for projects up to thirty megawatts of nameplate capacity that have a point of interconnection rated at sixty-nine kilovolts or less, each kilowatt hour of electricity generated from renewable energy resources that interconnects to electric transmission or distribution facilities owned by a cooperative electric association or municipally owned utility may be counted for the life of the project as two kilowatt hours for compliance with the requirements of this paragraph (c) by qualifying retail utilities. This multiplier shall not be claimed for interconnections that first occur after December 31, 2014, and shall not be used in conjunction with another compliance multiplier. For qualifying retail utilities other than investor-owned utilities, the benefits described in this subparagraph (IX) apply only to the aggregate first one hundred megawatts of nameplate capacity of projects statewide that report having achieved commercial operations to the commission pursuant to the procedure described in this subparagraph (IX). To the extent that a qualifying retail utility claims the benefit described in this subparagraph (IX), those kilowatt-hours of electricity do not qualify for satisfaction of the distributed generation requirement of subparagraph (I) of this paragraph (c). The commission shall analyze the implementation of this subparagraph (IX) and submit a report to the senate local government and energy committee and the house of representatives committee on transportation and energy, or their successor committees, by December 31, 2011, regarding implementation of this subparagraph (IX), including how many megawatts of electricity have been installed or are subject to a power purchase agreement pursuant to this subparagraph (IX) and whether the commission recommends that the multiplier established by this subparagraph (IX) should be changed either in magnitude or expiration date. Any entity that owns or develops a project that will take advantage of the benefits of this subparagraph (IX) shall notify the commission within thirty days after signing a power purchase agreement and within thirty days after beginning commercial operations of an applicable project.

(d) A system of tradable renewable energy credits that may be used by a qualifying retail utility to comply with this standard. The commission shall also analyze the effectiveness of utilizing any regional system of renewable energy credits in existence at the time of its rule-making process and determine whether the system is governed by rules that are consistent with the rules established for this article. The commission shall not restrict the qualifying retail utility's ownership of renewable energy credits if the qualifying retail utility complies with the electric resource standard of paragraph (c) of this subsection (1), uses definitions of eligible energy resources that are limited to those identified in paragraph (a) of this subsection (1), as clarified by the commission, and does not exceed the retail rate impact established by paragraph (g) of this subsection (1). Once a qualifying retail utility either receives a permit pursuant to article 7 or 8 of title 25, C.R.S., for a generation facility that relies on or is affected by the definitions of eligible energy resources or enters into a contract that relies on or is affected by the definitions of eligible energy resources, such definitions apply to the contract or facility notwithstanding any subsequent alteration of the definitions, whether by statute or rule. For purposes of compliance with the renewable energy standard, if a generation system uses a combination of fossil fuel and eligible renewable energy resources to generate electricity, a qualified retail utility that is not an investor-owned utility may count as eligible renewable energy only the proportion of the total electric output of the generation system that results from the use of eligible renewable energy resources.

(e) A standard rebate offer program, under which:

(I) (A) Each qualifying retail utility, except for cooperative electric associations and municipally owned utilities
(g) Retail rate impact rule:…

…(IV) (A) For cooperative electric associations, the maximum retail rate impact for this section is one percent of the total electric bill annually for each customer.

(B) Notwithstanding subparagraph (I) of this paragraph (g), the commission may ensure that customers who install distributed generation continue to contribute, in a nondiscriminatory fashion, their fair share to their utility's renewable energy program fund or equivalent renewable energy support mechanism even if such contribution results in a charge that exceeds two percent of such customers' annual electric bills…

...(5.5) Each cooperative electric association that is a qualifying retail utility shall submit an annual compliance report to the commission no later than June 1 of each year in which the cooperative electric association is subject to the renewable energy standard requirements established in this section. The annual compliance report shall describe the steps taken by the cooperative electric association to comply with the renewable energy standards and shall include the same information set forth in the rules of the commission for jurisdictional utilities. Cooperative electric associations shall not be subject to any part of the compliance report review process as provided in the rules for jurisdictional utilities. Cooperative electric associations shall not be required to obtain commission approval of annual compliance reports, and no additional regulatory authority of the commission other than that specifically contained in this subsection (5.5) is created or implied by this subsection (5.5)…

HISTORY: Source: Initiated 2004: Entire section added, see. L. 2005, p. 2337, effective December 1, 2004, proclamation of the Governor issued December 1, 2004.L. 2005: Entire section amended, p. 234, § 1, effective August 8; (6) added by revision, see L. 2005, p. 2340, § 3.L. 2007: Entire section amended, p. 257, § 1, effective March 27.L. 2008: (7) added, p. 190, § 3, effective August 5.L. 2009: (1)(c)(II), (1)(e), and (1)(f)(V) amended and (1.5) added, (SB 09-051), ch. 157, p. 678, § 11, effective September 1.L. 2010: IP(1), (1)(a), (1)(c)(I), (1)(c)(II), (1)(c)(III), (1)(c)(IV), (1)(c)(VIII), (1)(e)(I), (1)(f)(IV), (1)(g)(I), (1)(g)(III), (1)(g)(IV), and (1)(i) amended and (1)(e)(I.5) and (1)(f)(VII) added, (HB 10-1001), ch. 37, pp. 144, 147, 148, § § 1, 2, 3, effective August 11; (1)(c)(VI)(A) amended and (1)(c)(IX) added, (HB 10-1418), ch. 406, p. 2007, § 1, effective August 11; (1)(d) amended, (SB 10-177), ch. 392, p. 1864, § 7, effective August 11.

Editor's note: (1) A declaration of intent was contained in the initiated measure, Amendment 37, and is reproduced below:

SECTION 1.Legislative declaration of intent:

Energy is critically important to Colorado's welfare and development, and its use has a profound impact on the economy and environment. Growth of the state's population and economic base will continue to create a need for new energy resources, and Colorado's renewable energy resources are currently underutilized.

Therefore, in order to save consumers and businesses money, attract new businesses and jobs, promote development of rural economies, minimize water use for electricity generation, diversify Colorado's energy resources, reduce the impact of volatile fuel prices, and improve the natural environment of the state, it is in the best interests of the citizens of Colorado to develop and utilize renewable energy resources to the maximum practicable extent.

(2) This initiated measure was approved by a vote of the registered electors of the state of Colorado on November 2, 2004. The vote count for the measure was as follows:

:u360 FOR: :u1080 1,066,023

:u360 AGAINST: :u1080 922,577