PHOTO: AtmosNews/Creative Commons

Cool Breeze

Less Pollution and More Water Savings from Wind Energy in Colorado

NOVEMBER 2012

ENVIRONMENT COLORADO
Clean air. Clean water. Open spaces.

Cool Breeze: Less Pollution and More Water Savings from Wind Energy in Colorado

Authors:

Jeanne Bassett, Environment Colorado

Rob Sargent and Courtney Abrams, Environment America

Acknowledgments:

Thanks to Nathanael Greene and Cai Steger at the Natural Resources Defense Council, Elizabeth Salerno at the America Wind Energy Association (AWEA), and Jeff Deyette at the Union of Concerned Scientists for their review and insightful feedback on drafts of this report. Environment America intern Emily Grand assisted with research and Tony Dutzik at Frontier Group provided editorial support.

Special thanks to Elizabeth Ridlington at Frontier Group for her extensive review of our analysis.

Environment America Research & Policy Center is grateful to the Energy Foundation for making this report possible.

The authors bear responsibility for any factual errors. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or expert reviewers.

Environment Colorado is a statewide, citizen-based environmental advocacy organization. Our professional staff combines independent research, practical ideas and tough-minded advocacy to overcome the opposition of powerful special interests and win real results for Colorado's environment. Environment Colorado draws on 30 years of success in tackling our state's top environmental problems. For more information about Environment Colorado, or for additional copies of this report, please visit www.environmentcolorado.org.

Contents

Executive Summary

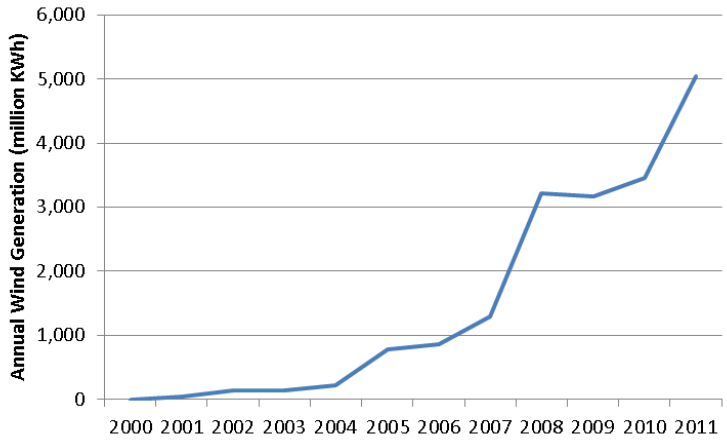
Fossil fuel-fired power plants are major sources of air pollution in Colorado. This air pollution harms our health and contributes to global warming. Fossil fuel power plants also consume significant amounts of the state's precious water supplies.

Wind energy, in contrast, has none of these problems. It produces no air pollution, makes no contribution to global warming, and uses no water.

The rise in the amount of wind power in Colorado has had direct benefits to Colorado's environment. Colorado can and should continue to develop more wind power in the state.

Wind power has been on the rise in Colorado. In 2000, Colorado produced no electricity from wind. Today, Colorado is a national wind-energy leader, generating nearly 10 percent of its electricity from the wind, enough to power almost half a million households. If Colorado stays on track, the state could more than double the amount of wind energy by 2016.

Growth in Electricity Generated from Wind Power in Colorado Since 2000[1]



Wind energy is already delivering immense environmental benefits for Colorado. Existing wind energy in Colorado eliminates about 2.7 million metric tons of global warming pollution annually—equivalent to taking more than half a million of today's passenger vehicles off the road—and saves more than a billion gallons of water per year, enough water to serve the needs of nearly 23,000 people. It avoids 3,680 tons of smog-causing nitrogen oxide pollutants and 1,700 tons of sulfur dioxide pollutants, which cause acid rain and soot that causes respiratory disease.

Projects currently under construction will add to the benefits of wind power in Colorado. Wind power under construction in Colorado would yield an estimated additional 1,564,000 MWh per year of generation. These projects alone will prevent an additional 885,000 metric tons of carbon dioxide pollution per year, the equivalent of taking 174,000 passenger vehicles off the road. Colorado would also expect to save an estimated 340 million gallons of water, enough for more than 7,500 people. Colorado would see an additional reduction of 1,220 tons of smog-causing nitrogen oxide emissions and 560 tons of sulfur dioxide emissions.

If progress on wind energy continues, Colorado will see even greater environmental benefits. If the construction of new wind projects continues from 2013 to 2016 at a pace comparable to that in recent years, Colorado could reduce global warming pollution by an additional 2.3 million metric tons in 2016—equivalent to that produced by more than 450,000 passenger vehicles. These projects would also save nearly 900 million gallons of water, enough to meet the annual water needs of nearly 20,000 people. It would avoid an additional 3,210 tons of smog-causing nitrogen oxide emissions and 1,480 tons of sulfur dioxide emissions.

The programs that have spurred this wind power development in Colorado are under attack. The dramatic growth of wind power in Colorado is the direct result of state and federal policies including Colorado's renewable energy standard and federal incentives. These policies are currently under attack.

Colorado's renewable energy standard (RES) requires investor owned utilities to provide 30 percent of their electricity from renewable resources, including wind power, by 2020. It is currently under attack by coal interests and their allies. The American Traditions Institute, a pro-fossil fuel organization aligned with Americans for Prosperity, is currently challenging Colorado's RES in court and anti-renewable energy interests are likely to propose weakening the standard in the legislature.

The federal renewable electricity production tax credit has been one of the most important tools to help grow the wind industry in the United States and in Colorado. However, it is set to expire at the end of 2012. The loss of the tax credit could cause new construction to drop by 75 percent.

To build upon the wind industry's ability to contribute to a clean environment, Colorado needs to renew and expand key clean energy policies in the following ways:

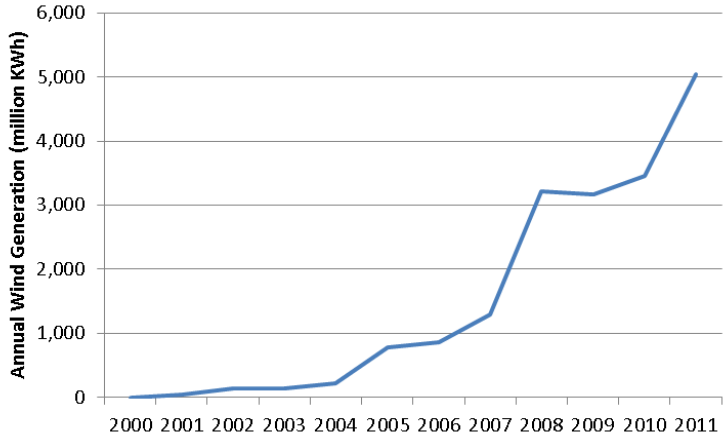
- Maintain and expand Colorado's renewable energy standard.
- Extend federal incentives, particularly the production tax credit, which expires at the end of 2012.
- Set favorable transmission policies that recognize the environmental benefits of wind as sustainable energy resource.

Introduction

There's an energy transformation underway. Every year, renewable energy provides a growing share of electricity in Colorado with a minimal impact on the environment.

Consider wind energy. Twelve years ago, there were no commercial wind turbines spinning in Colorado. Now, Colorado is getting nearly 10 percent of its electricity from the wind, enough to power almost half a million households.[2]

Figure 1. Growth in Electricity Generated from Wind Power in Colorado Since 2000[3]



Colorado's rapid development of its wind resources is yielding tremendous environmental benefits. Wind energy is reducing demand for electricity from fossil fuels such as coal and natural gas—curbing emissions that cause global warming and harm our health while minimizing the use of water for cooling.

The dramatic expansion of wind and other renewable energy resources in Colorado didn't happen by chance. State and federal policymakers acted to create the path for wind and other forms of renewable energy to thrive. With the environmental and economic benefits of wind energy becoming ever more apparent, now is the time for our leaders to renew their commitment to key clean energy policies.

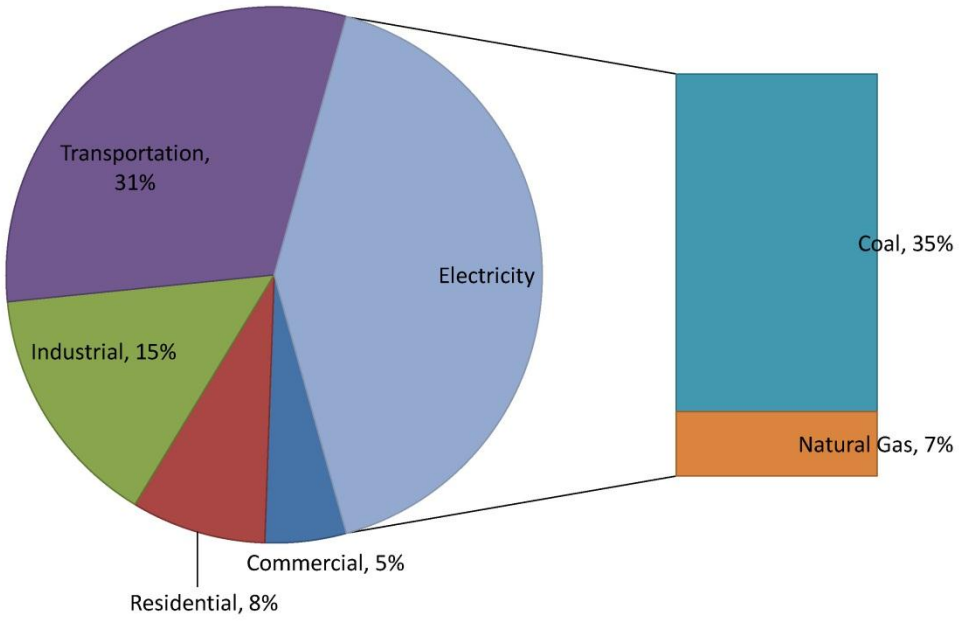
Power Plants Harm Colorado's Environment

Burning coal and natural gas to generate electricity harms the environment by contributing to global warming, creating air pollution, and consuming scarce supplies of water. The extraction of coal and natural gas also leads to substantial environmental destruction.

Power Plants Help Fuel Global Warming

Power plants produce 42 percent of Colorado's energy-related global warming pollution.[4] (See Figure 2.) While coal-fired power plants emit twice as much carbon dioxide as natural gas plants per unit of electricity, natural gas is far from a clean fuel.[5] Leaks during the extraction, storage and transportation of natural can release methane, a particularly potent global warming pollutant.[6] Recent studies suggest that those leaks may make natural gas—especially gas produced through hydraulic fracturing—nearly as damaging to the climate as coal.[7]

Figure 2. Energy-Related Carbon Dioxide Emissions in Colorado 2009, with Electricity Broken Down by Fuel[8]



Colorado is already feeling the impacts of global warming. According to a 2008 study, statewide temperatures increased by 2° Fahrenheit over the 30 year period ending in 2006.[9] This is consistent with findings nationwide. Over the last 50 years the U.S. average annual temperature has risen 2° F and experts project that it will continue rising. By 2100, the United States Global Change Research Program anticipates a temperature increase of 4 to 11° F, depending on the scale of greenhouse gas emissions.[10]

Dry spells between rainfalls will become longer, and snowpack in western states like Colorado will decrease. Combined with high temperatures, these dry spells can lead to drought. Droughts

can wreak havoc in many ways, from lower crop yields for farmers to diminished recreational opportunities and tourism income from skiing, hunting and fishing. Colorado State University climatologists confirmed that this spring 98 percent of Colorado suffered the worst drought the state has seen in years.[11]

A drier climate in the west has contributed to an increase in the frequency and severity of wildfires. This year alone, more than 1,200 wildfires burned more than 230,000 acres in Colorado. In 2002, the previous big drought year, Colorado suffered the largest wildfire in its history. That incident burned 915,000 acres of Colorado forest, left nine firefighters dead, and destroyed nearly 1,000 structures. Overall, the state lost $1.7 billion in tourism revenue because of that devastating event.[12]

Hotter and drier seasons have a significant impact on Colorado's and the region's water supply, affecting drinking water, wildlife habitat, and hunting and fishing opportunities. Because of the drought in the spring of 2012, the primary reservoirs and rivers that provide drinking water to the Denver metro area are at half of their typical averages, according to the National Resources Conservation Service. Scientists predict that the Colorado River Basin and the Colorado River, which supply Denver's water, will continue to be hit hard by drier seasons and hotter temperatures.

Power Plants Consume Lots of Water

More water is withdrawn from U.S. lakes, rivers, streams and aquifers for the purpose of cooling power plants than for any other purpose.[13] Power plants draw water from local sources for cooling, then either release the heated water back into waterways or evaporate it in a cooling tower. Consumption of water by power plants threatens critical ecosystems and reduces the amount available for human use and the protection of wildlife.

Power plants' thirst for water adds to the strain on local water supplies at times and in places where water is scarce. In Georgia in 2007, for example, a severe drought caused fierce competition for water from Lake Lanier, a major drinking water reservoir for Atlanta.[14] Georgia residents needed the water in the lake for domestic use, while a coal-fired power plant in Florida wanted more water released for cooling. At the same time, two endangered species of mussels downstream also required an adequate water flow.

Power plants in arid regions also contribute to the long-term drawdown of critical groundwater supplies. In the Southwest and California, approximately one-third to two-thirds of the water consumed by power plants comes from groundwater.[15] For many of these regions, water withdrawn for electricity generation—combined with water pumped for other purposes—has been causing water levels in aquifers to drop, threatening the long-term viability of those aquifers.

When Water Runs Low, Less Electricity May Be Produced

The dependence of most coal and natural gas-fired power plants on water supplies is not just an environmental problem—it can also threaten the stability of the electric grid. Without sufficient access to cool water, power plants have to reduce their output—often at the times when their electricity is in highest demand.

In 2007, drought and high water temperatures forced Duke Energy to curtail generation at two coal-fired power plants in North Carolina.[16] During the Texas drought in 2011, the cooling water supply serving the Martin Creek Power Plant dropped so much that water had to be piped in from a nearby river to cool the plant.[17] Officials in Texas warned that if the 2011 drought continued unabated into 2012, more power plants would be affected.[18] Thus, during hot summer months—when demand for power to run air conditioners is at its higher—power plants dependent on water for cooling can be forced offline.

Power Plants Create Air Pollution

Coal- and natural gas-fired power plants also produce pollution that contributes to ozone smog, particulate matter and acid rain. This pollution hurts public health and ecosystems.

When inhaled, ozone quickly reacts with airway tissues and produces inflammation similar to sunburn on the inside of the lungs. This inflammation makes lung tissues less elastic, more sensitive to allergens, and less able to ward off infections.[19] Minor exposure to ozone can cause coughing, wheezing and throat irritation. Constant exposure to ozone over time can permanently damage lung tissues, decrease the ability to breathe normally, and exacerbate or potentially even cause chronic diseases like asthma.[20] Children, adults who are active outdoors, and people with existing respiratory system ailments suffer most from ozone's effects.

Particulate matter pollution also contributes to a host of respiratory and cardiovascular ailments. Sulfur dioxide, too, is a respiratory irritant for sensitive populations. In addition, it is a major component of acid rain that has damaged forests across the eastern U.S.

Wind Energy Reduces Pollution and Saves Water

Wind energy is delivering substantial reductions in global warming pollution and water consumption across the U.S. Maintaining and expanding America's commitment to wind energy will produce even greater benefits.

Benefits from Existing Wind Facilities

Wind power is delivering environmental benefits for Colorado by displacing generation from coal and gas plants. In 2011, the Colorado generated 4.7 million megawatt-hours (MWh) of electricity from wind power, or nearly 10 percent of all the electricity generated in Colorado.[21]

Assuming that wind energy displaced generation from natural gas and coal-fired power plants, the environmental benefits of wind power in 2011 included:

- Avoided emissions of more than 2.7 million metric tons of carbon dioxide—as much as would have been emitted by half a million passenger vehicles in a year.
- Water savings of one billion gallons, enough to serve the needs of 23,000 people.
- Reductions in air pollution, including reductions of 3,680 tons of nitrogen oxide emissions and 1,700 tons of sulfur dioxide emissions.

Estimated Benefits of Existing Wind Energy in Colorado, 2011

Current Wind Generation (MWh/year)	Avoided Carbon Dioxide Emissions (metric tons/year)	Water Saved (million gallons/year)	Avoided Nitrogen Oxide Emissions (tons/year)	Avoided Sulfur Dioxide Emissions (tons/year)
4,729,000	2,676,000	1,029	3,680	1,700

The total benefits in 2012 will be greater as projects currently under construction are completed. Projects in progress could save an additional 885,000 metric tons of carbon dioxide emissions per year, equivalent to emissions from 174,000 passenger vehicles in a year. Colorado would also save an estimated additional 340 million gallons of water, enough for more than 7,500 people. We'd see an additional decrease of 1,220 tons of smog-causing nitrogen oxide emissions and 560 tons of sulfur dioxide emissions which causes acid rain and forms soot that causes respiratory disease.

Colorado's Environment Will See Much Greater Gains if Wind Continues on Current Pace for the Next Four Years

If capacity grows from 2013 to 2016 at a pace comparable to that in recent years, wind energy generation in Colorado would grow by an additional 4.1 million MWh of electricity in 2016. This would bring total wind generation to more than more than double the 2011 level.

The additional environmental benefits will be enormous. Colorado could reduce global warming pollution by an additional 2.3 million metric tons in 2016—equivalent to that produced by more than 457,000 passenger vehicles. This volume of wind power generation would also save nearly 900 million gallons of water, enough to meet the annual water needs of nearly 20,000 people. We'd see an additional decrease of 3,210 tons of smog-causing nitrogen oxide emissions and of 1,480 tons of sulfur dioxide emissions which causes acid rain and forms soot that causes respiratory disease.

Estimated Benefits of New Wind by 2016 in Colorado

Wind Generation (MWh/year)	Avoided Carbon Dioxide Emissions (metric tons/year)	Water Saved (million gallons/year)	Avoided Nitrogen Oxide Emissions (tons/year)	Avoided Sulfur Dioxide Emissions (tons/year)
4,115,697	2,329,000	896	3,210	1,480

Colorado and the Nation Should Continue to Invest in Wind Energy

America's clean energy boom is no accident—it is the direct result of strong, forward-thinking policies adopted over the last decade at both the state and federal levels.

As wind energy and other forms of clean, renewable energy take root in the United States—delivering ample benefits for our environment, public health, and the economy—now is not the time to turn our back on further progress. To further reduce global warming pollution, curb smog and soot, move away from fossil fuels, save water, and grow our economy, the federal government and Colorado should continue and expand their commitment to renewable energy.

Extend the Production Tax Credit

One of the most critical tools for growing the wind industry in the United States—and slash global warming pollution and water consumption—is the federal renewable electricity production tax credit (PTC).

The PTC provides a 2.2 cents per kilowatt-hour (kWh) income tax credit for utility-scale wind energy producers, helping them compete effectively with other sources of electricity by guaranteeing low electricity prices for consumers. It is available for electricity generated during the first 10 years of the wind farm's operation. The PTC is set to expire on December 31, 2012.[22]

Policies like the PTC recognize that renewable energy is a key component of an electricity grid that is not only cleaner but less expensive for consumers. Renewable energy sources such as wind are not subject to the volatility of coal and natural gas prices, and can deliver reliable, affordable electricity for decades, making them a smart long-term investment in the nation's energy future.

Policymakers should extend the PTC for at least four years, creating greater certainty for wind developers and allowing plans for larger, multi-year projects. Over the past 13 years, the PTC has been only sporadically available. When the PTC has been renewed by Congress for only for one or two years at a time or even allowed to expire, the environment of economic uncertainty has discouraged wind developers from building new capacity and stunted industry growth. For instance, in 2000, 2002 and 2004—years when the PTC was allowed to expire temporarily—new wind installations dropped by 93 percent, 73 percent and 77 percent, respectively, from the previous year when the PTC had been in force.[23]

The loss of the PTC could cause new construction to fall by 75 percent.[24] Failing to extend the PTC beyond 2012 could result in the loss of $10 billion in investment and 37,000 jobs in 2013, according to an analysis by Navigant Consulting for the American Wind Energy Association.[25]

Maintain and Strengthen Colorado's Renewable Energy Standard

A renewable electricity standard (RES) helps support wind development by requiring utilities to purchase a certain percentage of the electricity they provide to consumers from renewable sources. These standards help ensure that wind energy producers have a market for the electricity they generate, as electricity suppliers seek to reach their required threshold for renewable electricity. This certainty makes it easier for wind developers to finance and build new wind power installations. Today, 29 states have renewable electricity standards.[26] Some of the states

with the strongest standards, such as Colorado, have seen the greatest growth in wind power generation.

Colorado's RES requires investor-owned utilities to obtain 30 percent of their electricity from renewable resources, including wind, by 2020. Over time, it should be increased and should include provisions that encourage or require municipal and rural electric cooperatives to generate more renewable energy.

The Colorado RES is currently under attack by coal interests and their allies. The American Traditions Institute, a pro-fossil fuel organization aligned with Americans for Prosperity, is currently challenging the RES in court and anti-renewable energy interests are likely to propose weakening it in the Colorado Legislature.

Upgrade Transmission Infrastructure

Policymakers should set favorable transmission policies that recognize the environmental benefits of wind as a pollution-free resource that uses no water and the economic benefits of wind as an energy source that has no fuel costs. This should prioritize upgrading and expanding existing electricity transmission infrastructure to connect areas with high electricity demand to areas of high wind energy output. Old and inefficient transmission infrastructure is one of the largest impediments to integrating more wind energy into the grid.

Methodology

We obtained data on annual wind generation in 2011 from Energy Information Administration, *Electric Power Monthly*, February 2012.

To estimate output from wind facilities currently under construction, we obtained data on wind capacity under construction from American Wind Energy Association (AWEA), *Wind Energy Facts* (factsheets), August 2012. We assume a capacity factor of 36 percent based on projects built from 2004-2010 per Ryan Wiser and Mark Bolinger, *2011 Wind Technologies Market Report*, U.S. Department of Energy, August 2012.

Our estimate of future construction is based on a national projection of an additional 34 GW of capacity from 2013 through 2016 in Navigant Consulting, for American Wind Energy Association, *Impact of the Production Tax Credit on the U.S. Wind Market*, 12 December 2011. We apportioned this out to the states according to their share of national wind capacity from existing capacity and capacity under construction, per American Wind Energy Association (AWEA), *Wind Energy Facts* (factsheets), August 2012. We translated this future wind capacity into MWh of generation following the same method as for facilities currently under construction, described above.

Estimating Carbon Dioxide Emissions

When a wind turbine generates electricity, it displaces some other source of electricity on the grid. In the short run, this means that production at another power plant is reduced; in the longer run, it means that fewer fossil fuel-fired plants are built. In our calculations, we assume that 75 percent of the time, the power generator that is no longer producing electricity is a natural gas-powered plant and 25 percent of the time the facility is coal fired. Typically, the plant that is turned off is that with the highest marginal cost of production.

We concluded that a ratio of 75 percent natural gas and 25 percent coal displacement was broadly representative of how wind influences the electricity grid and would be illustrative of the outcomes in Colorado. We obtained a national average emissions rate for coal and natural gas plants from Environmental Protection Agency, *eGRID2012 Version 1.0 Year 2009 GHG Annual Output Emission Rates*, 10 May 2012.

To put carbon dioxide savings in perspective, we calculated how many passenger vehicles would have to be removed from the road in order to produce comparable savings. Data on vehicle emissions rates is from Environmental Protection Agency, *Greenhouse Gas Equivalencies Calculator*, May 2011.

Estimating Water Consumption Avoided

We estimated water savings using freshwater and saltwater consumption rates in coal, natural gas combined cycle and natural gas combustion turbine plants from U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*, July 2008. We used the same assumption

as for carbon dioxide savings that 75 percent of displaced generation is from natural gas and 25 percent is from coal.

We calculated how many individuals' domestic water needs could be met with this amount of saved water. We obtained state-level per capita domestic water use from Joan Kenny, et al., *Estimated Use of Water in the United States in 2005*, U.S. Geological Survey, 2009.

Estimating Avoided Emissions of Nitrogen Oxides and Sulfur Dioxide

We also estimated avoided emissions of nitrogen oxides and sulfur dioxide for Colorado. We calculated an average emissions rate for natural gas and coal generation for Colorado using 2010 nitrogen oxides and sulfur dioxide emission data from Energy Information Administration, *State Historical Tables for 2010* (EIA-767 and EIA-906), December 2011. We divided emissions by generation from natural gas and coal plants in 2010, per Energy Information Administration, *Net Generation by State by Type of Producer by Energy Source, Annual Back to 1990* (EIA-906, EIA-920 and EIA-923). We then created an average emission rate based on a 25 percent coal/75 percent natural gas split. The emission rate for nitrogen oxides was 0.882125 lbs./MWh. For sulfur dioxide, we used an emission rate of 1.723575 lbs./MWh.

Notes

[1] Energy Information Administration, *Annual Energy Review*, 27 September 2012.
[2] American Wind Energy Association, *Colorado State Fact Sheet*, August 2012.
[3] See note 1.
[4] Energy Information Administration, *Emissions of Greenhouse Gases*, 31 March 2011.
[5] United States Environmental Protection Agency, *Clean Energy: Air Emissions*, downloaded from www.epa.gov/cleanenergy, 28 September 2012.
[6] Ibid.
[7] Abrahm Lustgarten, "Climate Benefits of Natural Gas May Be Overstated," *ProPublica*, 25 January 2011.
[8] See note 4.
[9] Kristin Averyt, et al., *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation Background*, 2008.
[10] Thomas R. Karl, et al. (eds.), United States Global Change Research Program, *Global Climate Change Impacts in the United States*, 2009.
[11] Colorado State University, Colorado Climate Center, *Colorado Drought Status Briefings,* downloaded from http://ccc.atmos.colostate.edu/precipitationanalysis.php, 22 October 2012.
[12] http://blogs.denverpost.com/library/2012/06/11/colorados-largest-wildfires-ranked-acres-burned/
[13] Union of Concerned Scientists, *The Energy-Water Collision: Energy and Water Demands Clash During Hot, Dry Summers*, downloaded from www.ucsusa.org/assets/documents/clean_energy/ew3/Infographic-The-Energy-Water-Collision-All-Facts.pdf on 4 October 2012.
[14] Associated Press, "Georgia's Governor Declares Drought Emergency," *NBCNews.com*, 20 October 2007.
[15] Kristen Averyt, et al., *Freshwater Use by U.S. Power Plants: Electricity's Thirst for a Precious Resource*, Union of Concerned Scientists, November 2011.
[16] Erica Beshears, "Obstacle to More Power: Hot Water: River Temperature so High That Duke Energy Curtails Work at Two Plants," *Charlotte Observer*, 12 August 2007.
[17] Angela Ward, "East Texas Drought: Falling Lake Levels Affect Recreational Use," *News-Journal (Longview, TX)*, 27 July 2011.
[18] Kate Galbraith, "Texas Senate Hears Warnings on Drought and Electricity," *The Texas Tribune,* 10 January 2012.
[19] M. Lippman, "Health Effects of Ozone: A Critical Review," *Journal of the Air Pollution Control Association* 39: 672-695, 1989; I. Mudway and F. Kelley, "Ozone and the Lung: A Sensitive Issue," *Molecular Aspects of Medicine* 21: 1-48, 2000; M. Gilmour, et al., "Ozone-Enhanced Pulmonary Infection with *Streptococcus Zooepidemicus* in Mice: The Role of Alveolar Macrophage Function and Capsular Virulence Factors," *American Review of Respiratory Disease* 147: 753-760.
[20] Kendall Powell, "Ozone Exposure Throws Monkey Wrench into Infant Lungs," *Nature Medicine*, 9(5), May 2003; R. McConnell, et al., "Asthma in Exercising Children Exposed to Ozone: A Cohort Study," *The Lancet* 359: 386-391, 2002; N. Kunzli, et al., "Association Between Lifetime Ambient Ozone Exposure and Pulmonary Function in College Freshmen – Results of a Pilot Study," *Environmental Research* 72: 8-16, 1997; I.B. Tager, et al., "Chronic Exposure to Ambient Ozone and Lung Function in Young Adults," *Epidemiology* 16: 751-9, November 2005.
[21] Energy Information Administration, *Annual Energy Review*, 27 September 2012.
[22] U.S. Department of Energy, DSIRE Database of State Incentives for Renewables & Efficiency, *Business Energy Investment Tax Credit,* 18 November 2011, and *Renewable Electricity Production Tax Credit*, 22 May 2012.
[23] American Wind Energy Association, *The American Wind Industry Urges Congress to Take Immediate Action to Pass an Extension of the PTC* (fact sheet), downloaded from www.awea.org/issues/federal_policy/upload/PTC-Fact-Sheet.pdf on 4 October 2012.
[24] Navigant Consulting, for American Wind Energy Association, *Impact of the Production Tax Credit on the U.S. Wind Market*, 12 December 2011.
[25] Brian Bowen, Ceres, *Business Leaders Urge Congress to Extend Renewable Energy Tax Credit* (press release), 18 September 2012.

[26] American Wind Energy Association, *State Policy,* downloaded from www.awea.org/issues/state_policy/index.cfm on 4 October 2012.