

FACTS COLORADO

A M E R I C A N S E C U R I T Y P R O J E C T

Pay Now, Pay Later: Colorado

Climate change will seriously jeopardize the vast natural resources that underpin Colorado's \$11 billion recreation and tourism industry; a lack of snow is predicted to seriously damage the Aspen ski area by 2100.¹

Cattle ranching accounts for almost half of Colorado's \$5.5 billion agricultural industry; temperature increases will likely make the Eastern Plains' grazing areas unsuitable, driving this important industry out of the state.²

Average job growth in Colorado's clean energy sector from 1998-2007 was 18.2%, compared with an 8.2% overall job growth rate in the state during the same period.³

According to a new study, a failure to mitigate the effects of climate change could begin to cause serious gross domestic product and job losses as early as 2010 through 2050. In the short-term, Colorado is projected to flourish despite the effects of climate change, but the state could begin to suffer from a declining water supply in the later years. Ultimately, Coloradans could gain \$1.2 billion in GDP and over 22,000 jobs by 2050.*

**Possibly eclipsing the positive projections, the study's calculations do not include snowfall and icepack melt, which Coloradans depend on for much of the water supply and recreation. GDP numbers are based on a 0% discount rate. Job losses are measured in labor years, or entire years of fulltime employment. Backus, George et al., "Assessing the Near-Term Risk of Climate Uncertainty: Interdependencies among the U.S. States," Sandia Report (Sandia National Laboratories, May 2010), 137, 141. https://cfwebprod.sandia.gov/cfdocs/CCIM/docs/Climate_Risk_Assessment.pdf (accessed March 23, 2011).*

Admittedly, the effects of climate change, a complex and intricate phenomenon, are difficult to predict with precision. Informed scientific and economic projections, as we have used in our research, however, allow us to see that Colorado faces significant losses in industries crucial to its economy if no action is taken.

Moreover, data shows Colorado is poised to benefit from the research, development, and distribution of renewable energy technologies. Colorado is ranked 4th in the nation for solar and geothermal resources and 11th for potential wind power generation. It also has biofuel and hydroelectric potential⁴—and the capacity to become a leader in the green economy. Should we fail to take action against

climate change, Coloradans have much to lose.

Pay Later: The Cost of Inaction

Rising temperatures and water shortages in Colorado are likely to cause major losses to agriculture, recreation, and tourism, which rely heavily on water levels and snowfall. Temperatures are expected to rise 4-10°F by the end of the century (higher than average U.S. or global estimates),⁵ with greater temperature increases at higher altitudes.⁶ A decrease in overall rainfall could cause water shortages and a decline in water quality.⁷ Dry, hot conditions will increase the weakening of trees by

providing an environment especially hospitable to already flourishing pests and diseases.⁸

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Water Shortages

Approximately three-quarters of the annual water flow in major rivers in the Rockies comes from spring snowmelt, and with some snowpack areas projected to lose as much as 80% of their current levels, water shortages could become a regular occurrence throughout the state.⁹

In 2002, droughts caused reservoirs to drop to 48% of their average levels, causing the state's economy to lose an estimated \$1 billion dollars, mainly in the tourism and agriculture sectors.¹⁰ Winter snowpack will continue to decrease with rising temperatures, potentially leading to more water shortages throughout the year. Much of the winter precipitation will fall as rain due to the warmer temperatures. Rain will more frequently fall in severe downpours that will cause floods across the state and hinder water

storage, exacerbating future water shortages.¹¹ One estimate forecasts an 18% reduction in runoff from 2040-2069.¹²

Costs to Agriculture and Wildlife

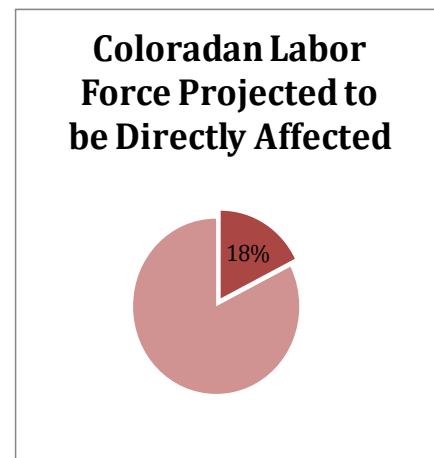
Corn and wheat yields are projected to decrease by 8-33% as a result of water shortages.¹³ In 2008, the agriculture, forestry, fishing, and hunting sectors employed over 14,000 people;¹⁴ and in 2009, agriculture was worth over \$5.5 billion.¹⁵ Colorado's primary agricultural commodity is cattle, yielding 47% of the state's agriculture valued at over \$2.6 billion in 2009. The agricultural value of cattle is followed by corn (\$505 million), wheat (\$411 million), hay (\$408 million), and dairy products (\$358 million).¹⁶ Damaging this sector, the most desirable cattle grazing lands on the Eastern Plains "may no longer be suitable with a temperature increase of 3-4 degrees Fahrenheit," as one author put it, and may require ranchers to move grazing activity northward.¹⁷

Fires

Warmer temperatures and drier summers will lead to more fires throughout the state. The 2002 Hayman fire, the largest in Colorado's history, cost \$39 million to suppress.¹⁸ If private property damage increases by only 2% each year, by 2019, forest fires will cost an estimated \$8 million annually¹⁹ and wipe out much of the state's prized biodiversity. An increase in new pests will kill more trees, thus creating fuel for these catastrophic fires—further increasing their severity.²⁰

Colorado's ecosystem will change as temperatures continue to increase. The distinctive alpine forests will move

farther up in elevation by as much as 350 feet per one degree Fahrenheit increase in temperature.²¹ The cold-water trout population, namely the endangered greenback cutthroat trout, could more than halve as a result of increasing water temperatures and competition from invasive species.²² The hunting, fishing, and wildlife viewing industries, which generated nearly \$2.5 billion in 2006, may also see a decrease in profitability as ecosystems become less hospitable to anglers, hunters, and wildlife alike.²³



Source: Colorado Department of Labor²⁴

Costs to Tourism and Recreation

Moreover, as ecosystems are damaged, revenue from across the outdoor recreation and tourism sector—and, potentially, industries linked to it—become threatened.²⁵ Tourism accounts for roughly 4.5% of gross state product (GSP), \$11 billion, and 10.2% of jobs.²⁶ The industry represents an important part of the economy in many rural areas,²⁷ as Colorado is home to several ski resorts, national forests, and national parks.²⁸

Colorado's \$1.9 billion ski industry—which employs 31,000 people²⁹—may become unprofitable as decreasing snowpacks will shorten the winter sports season by an estimated 30 days.³⁰ Increased

snowmaking requirements will be more expensive and further strain water supplies.³¹ The ski season for Aspen Mountain is predicted to begin approximately one week later by 2030, and 1.5-4.5 weeks later by 2100,³² having a detrimental effect on the state's ski industry. Most ski resorts require 100-105 days to earn a 6.5-7% (the industry's average) profit margin.³³ From 2020-2040, Aspen's snow depth at lower elevations is expected to decline 12-15%, with a 6-7% reduction at higher elevations. Poor skiing conditions and a shorter season could result in losses of \$16-56 million by 2030 for the skiing industry.³⁴ Higher emissions scenarios would cause a lack of snow that would limit skiing on Aspen Mountain to the top third by 2100, thus bankrupting resorts further down the mountain. Melting could begin five weeks earlier than at present by 2100, further cutting profits.³⁵ The industry may already be experiencing the effects of climate change: compared to 2007 profits, as a result of less snowfall, the Vail Ski Resort lost \$2 million in just the second quarter of 2008.³⁶

The \$31.5 billion real estate industry, which makes up 12.7% of GSP,³⁷ and the finance and insurance sector (\$14.7 billion and 5.9% of 2008 GSP, respectively)³⁸ would also be negatively affected by a drop in tourism and recreation, given the interest in buying, renting, and insuring property and homes near the outdoor attractions.³⁹ Those employed in these sectors will likely be directly affected.

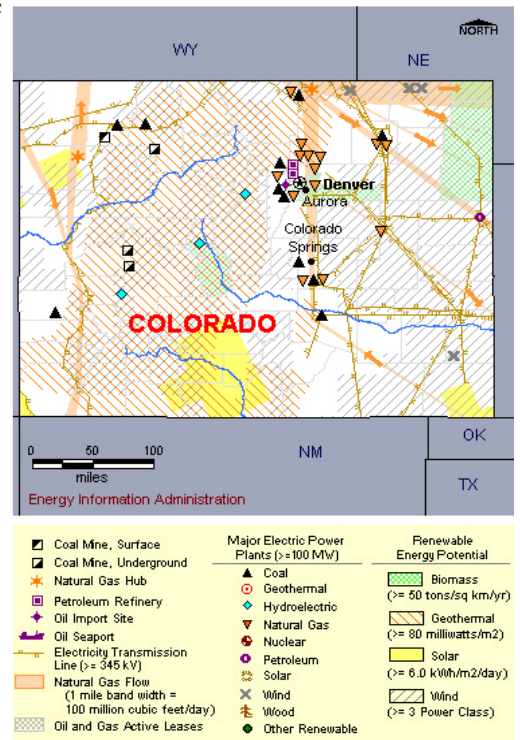
Pay Now: The Benefits of Taking Action

Jobs in Colorado's clean energy economy are growing faster than both the national and state averages.

More than 17,000 clean jobs were created in Colorado during 2007,⁴⁰ and average clean job growth from 1998-2007 was 18.2%, compared with an 8.2% overall state job growth rate during that period.⁴¹ An anticipated \$2.6 billion in energy efficiency investments from 2012-2019—combined with the results of clean energy legislation—would create an estimated 11,000-30,000 jobs and contribute to direct energy savings of over \$7.5 billion, equating to \$1,500 for each Coloradan.⁴²

Colorado's legislature has been forward thinking in its requirements for utility companies to switch to renewable sources of energy. In March 2010, Colorado legislators increased the state's renewable portfolio standard (RPS) to require, by 2020, private utility companies to generate 30% of electricity with renewable sources.⁴³ **According to the Union of Concerned Scientists, the generation of 20% of electricity from renewable sources by 2020 will lead to the creation of 4,100 new jobs; \$331 million in income to farmers, ranchers, and rural landowners; an increase of \$2.5 billion in capital investment; \$62 million in new local tax revenues; and, \$1 billion in energy savings by 2030—\$200 for every state resident.**⁴⁴ Since 2004, when Colorado became the first state to establish RPS by voter referendum—10% by 2015, the number of solar companies in Colorado has increased fourfold to roughly 450.⁴⁵

Colorado also has great potential to produce energy from geothermal and wind sources. According to the National Wildlife Federation, Colorado has the potential to generate more than 35% of its electricity needs from geothermal energy. Its wind energy potential is even greater; the state could generate 1,100% of its current electricity use by employing this renewable source.⁴⁶ Vestas Wind Systems opened its first North American plant in Colorado in 2008—creating 650 jobs.⁴⁷



Conclusion

Colorado must consider action on climate change not just in terms of cost, but also in terms of opportunities. If we give Colorado's population, businesses, and investors clear and consistent signals by properly offering initiatives and cultivating demand, investment and innovation in renewable technologies will follow.

Coloradans will have to pay for the effects of climate change. The only remaining question is whether they will pay now, or pay later and run the risk of paying significantly more.

(Endnotes)

- 1 Based on combining 2008 data for the art/entertainment/recreation and accommodation/food services industries. Bureau of Economic Analysis, *Gross Domestic Product by State*. <http://www.bea.gov/regional/gsp/> (accessed June 29, 2010); Aspen Global Change Institute, *Climate Change and Aspen: An Assessment of Impacts and Potential Responses*, July 2006, 37. http://www.agci.org/dB/PDFs/Publications/2006_CCA.pdf (accessed June 29, 2010).
- 2 U.S. Department of Agriculture, *State Fact Sheets: Colorado*, September 10, 2010. <http://www.ers.usda.gov/statefacts/co.htm> (accessed September 27, 2010). Kim Ross, Matthias Ruth, Daraius Irania, and Sean Williamson, *Economic Impacts of Climate Change on Colorado*, Center for Integrative Environmental Research, University of Maryland, July 2008, 11. <http://www.cier.umd.edu/climateadaptation/Colorado%20Economic%20Impacts%20of%20Climate%20Change.pdf> (accessed June 23, 2010).
- 3 Pew Charitable Trusts, *The Clean Energy Economy: Colorado*, May 2009. http://www.pewglobalwarming.org/cleanenergyeconomy/factsheets/Clean_Economy_Factsheet_Colorado.pdf (accessed June 23, 2010).

- 4 Andrew Burger, "Colorado Renewable Energy Profile, Part One," *Renewable Energy World*, October 2, 2008. <http://www.renewableenergyworld.com/rea/news/article/2008/10/colorado-renewable-energy-profile-part-one-53727> (accessed June 23, 2010).
- 5 Union of Concerned Scientists, *Backgrounder: Southwest*, 1, 3. http://www.ucsusa.org/assets/documents/global_warming/us-global-climate-change-report-southwest.pdf (accessed June 23, 2010).
- 6 Ross et al., 6.
- 7 Union of Concerned Scientists, *Climate Change in the United States: The Prohibitive Costs of Inaction*, 5, 8. http://www.ucsusa.org/assets/documents/global_warming/interactive-us-costs-of-climate-inaction.pdf (accessed June 23, 2010).
- 8 Aspen Global Change Institute, 44.
- 9 Council of State Legislatures, *Colorado: Assessing the Cost of Climate Change*, Center for Integrative Environmental Research, 2008, 3. <http://www.cier.umd.edu/climateadaptation/Climate%20change--COLORADO.pdf> (accessed August 19, 2010).
- 10 Ross et al, 10.
- 11 Union of Concerned Scientists, *Backgrounder: Southwest*, 1, 2
- 12 Niklas S. Christensen et al., "The Effects Of Climate Change On The Hydrology And Water Resources Of The Colorado River Basin," *Climatic Change* 62 (2004), 337-363. https://portal.azoah.com/oedf/documents/08A-AWS001-DWR/Supplemental_Beverly_et_al/20040000%20Christensen%20et%20al%20Effects%20of%20Climate%22Change%20on%20Hydrology%20and%20Water%20Resources_Colorado%20River%20B.pdf (accessed September 28, 2010).
- 13 National Wildlife Federation, *Global Warming Factsheet: Global Warming and Colorado*, January 29, 2009, 2. <http://www.nwf.org/Global-Warming/-/media/PDFs/Global%20Warming/Global%20Warming%20State%20Fact%20Sheets/Colorado.ashx> (accessed June 23, 2010).
- 14 Based on 2010 employment estimates. Colorado Department of Labor, *Labor Market Information*, LMI gateway, June 2010. http://lmi.gateway.coworkforce.com/lmi/gateway/analyzer/searchAnalyzer.asp?cat=HST_EMP_WAGE_IND&session=IND202&session=99&areaname=&step=2 (accessed October 5, 2010).
- 15 U.S. Department of Agriculture.
- 16 Ibid.
- 17 Ross et al., 11.
- 18 Ibid., 9.
- 19 Ibid.,10
- 20 Aspen Global Change Institute, 44.
- 21 Ross et al.,10.
- 22 Ibid.,10; National Wildlife Federation, *Global Warming Factsheet: Global Warming and Colorado*, 1.
- 23 National Wildlife Federation, *Global Warming Factsheet*.
- 24 Affected sectors include tourism, defined as combined art/entertainment/recreation and accommodation/food services, real estate, finance and insurance and agriculture and forestry industries. Based on 2010 employment projections.
- 25 Aspen Global Change Institute, 78-79.
- 26 Based on combining 2008 data for the art/entertainment/recreation and accommodation/food services industries. Bureau of Economic Analysis, *Gross Domestic Product by State*; Bureau of Economic Analysis, *State Annual Personal Income*, September 20, 2010. <http://www.bea.gov/regional/spi/default.cfm?selTable=SA25N&selSeries=NAICS> (accessed September 29, 2010).
- 27 "Colorado Economy to Stabilize but Still Lose Jobs in 2010, CU-Boulder Economic Forecast Predicts," December 7, 2009. <http://www.colorado.edu/news/r/bce38f8ce8be095263806e5664d70939.html> (accessed June 23, 2010).
- 28 Ross et al., 7-8.

- 29 Colorado's ski industry was worth \$1.9 billion in 2007. Auden Schendler, "Towards a Clean Energy Future: Energy Policy and Climate Change on Public Lands," *Testimony to the U.S. House of Representatives Committee on Natural Resources, Subcommittee on Energy and Mineral Resources Oversight Hearing*, March 15, 2007, 1. http://www.aspensnowmass.com/environment/images/ASC_House_Climate_Testimony.pdf (accessed June 29, 2010).
- 30 Ross et al., 7-8.
- 31 Jim Erickson, "Bleak Forecast for Ski Industry: Warmer Temps May Put Resorts in Deep Freeze," *Rocky Mountain News*, March 19, 2005. <http://www.rockymountainnews.com/news/2005/mar/19/part-3-bleak-forecast-for-ski-industry/> (accessed June 29, 2010).
- 32 Aspen Global Change Institute, 31.
- 33 Ross et al., 8.
- 34 Aspen Global Change Institute, 78.
- 35 Aspen Global Change Institute, 31, 40.
- 36 Ross et al., 8.
- 37 Tucker Hart Adams, "What's the most important industry in Colorado?" *ColoradoBiz*, August 2009. <http://www.entrepreneur.com/tradejournals/article/206119314.html> (accessed October 4, 2010).
- 38 Bureau of Economic Analysis, *Gross Domestic Product by State*.
- 39 Ross et al., 8.
- 40 Pew Center on the States, *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*, June 2009, 28, 29. http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf (accessed September 29, 2010).
- 41 Pew Charitable Trusts, *The Clean Energy Economy: Colorado*.
- 42 Environment Northeast, *Colorado Energy Efficiency Funding/Allocations in ACES*, July 2009. http://www.env-ne.org/public/resources/pdf/ENE_ACES_EE_funding_Colorado.pdf (accessed June 23, 2010); Environmental Entrepreneurs et al., *Clean Energy and Climate Policies Lead to Economic Growth in Colorado*. <http://www.e2.org/ext/doc/State%20Fact%20Sheet%20Colorado.pdf?jsessionid=33857BD6F1CF247DFA5CD15DDE37D3A1> (accessed June 23, 2010); U.S. Energy Information Administration.
- 43 Jessica Fender, "Colo. legislature's 2010 session best yet for renewable-energy," *The Denver Post*, May 31, 2010. http://www.denverpost.com/politics/ci_15195830 (accessed June 23, 2010).
- 44 U.S. Energy Information Administration, *State Energy Profiles: Colorado*, September 23, 2010. http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=CO (accessed October 4, 2010); Union of Concerned Scientists, *Cashing in on Clean Energy: A National Renewable Electricity Standard Will Benefit Colorado's Economy and the Environment*, 7.
- 45 Kevin Eber and Ernie Tucker, "Colorado Boosts its RPS to 30% by 2020," *Renewable Energy World*, March 26, 2010. <http://www.renewableenergyworld.com/rea/news/article/2010/03/colorado-boosts-its-rps-to-30-by-2020> (accessed June 23, 2010); National Wildlife Federation, *Global Warming Factsheet: Global Warming and Colorado*; Fender, "Colo. Legislature's 2010 session best yet."
- 46 National Wildlife Federation, *Global Warming Factsheet: Global Warming and Colorado*, 2.
- 47 Steve Raabe, "Big blades in Windsor could boost eco-energy," *The Denver Post*, March 2, 2008. http://www.denverpost.com/headlines/ci_8414944 (accessed June 24, 2010).