

ALTERNATIVES IN COLORADO



In his 2006 State of the Union address, President George W. Bush famously announced that “America is addicted to oil” and pledged a 22% increase in clean-energy investments. Soon afterwards, the National Renewable Energy Laboratory (NREL) in Golden, Colorado, fell victim to a bungled budget cut, resulting in the elimination of 32 staff positions, including eight researchers. On the eve of Bush’s visit to the labs to promote his energy plan, the Department of Energy hastily moved funds around to reinstate the jobs. The president blamed a mix-up in funding allocation.

Such mixed signals are indicative of the predicament faced by many researchers in Colorado. A handful of prestigious national labs and universities clustered along the foot of the Rockies between Denver and Fort Collins are leading the way in atmospheric research, geosciences and sustainable-energy research and development. And recent initiatives to pool resources and build strong links between the various institutes are promising to create new jobs and produce intellectual ferment.

But much of the region’s science and technology depends on federal dollars. And although the US political climate has swung decidedly in favour of weaning the nation from its dependence on fossil fuels, Congressional haggling over federal spending has resulted in flat budgets and funding cuts to the very institutes that are fuelling the progress.

“It’s a roller coaster, and it has been for the whole time that I’ve been here,” says a senior research scientist who’s been at the NREL for more than 15 years, and who prefers not to be named. “We’ve been almost

Despite tight government budgets, Colorado is brimming with alternative-energy jobs potential. **Amanda Haag** reports.



CSU and Solix research on a photo-bioreactor.

zeroed out and then had budgets put back in.” Yet because of the NREL’s commitment to the mission of energy independence, he says, many scientists who went there “would forgo larger salaries elsewhere and come to jobs that were less stable and more subject to the vagaries of change”.

The NREL, home to the nation’s only large-scale pilot plant for the production of ethanol from biomass, is now experiencing a swell in the number of job openings, particularly in the areas of biomass and photovoltaic research. The lab currently employs some 900 engineers and scientists in R&D on biomass, wind, solar, hydrogen and other alternative-energy technologies. Its growth is directly attributable to the president’s energy initiatives and renewable-fuels standard alongside the current ethanol boom, says Andy Aden, an engineer in the biomass group. Research and engineering jobs at the NREL range from entry level with a bachelor’s degree up to a PhD requirement with at least 10 years’ experience. But although the biomass group’s funding has gone up, the overall budget took a 3% cut. “That means other programmes here are decreasing, which is sad,” Aden says.

Under the resolution for the 2007 budget, \$300 million is to be appropriated to energy-efficiency and renewable-energy programmes within the Department of Energy. The NREL has been promised \$107 million when the funds get divided up, on top of the \$200 million it was already set to receive. The first priority will be scaling up the pilot cellulosic ethanol biofuels refinery. Currently, the lab can handle about 1 tonne of biomass per day, which translates to production of some 265 litres (70 gallons)

of ethanol a day. The new building would allow for increased storage capacity and would enable testing of new processing technologies.

Uncertain budgets seem to be the norm for the Boulder laboratories run by the National Oceanic and Atmospheric Administration (NOAA) as well. During the past 18 months, federal funding in NOAA's Earth System Research Laboratory has been reduced by some 10%. In mid-January, the chemical-sciences division effectively lost more than 10% of its budget when its \$2.6-million participation in a long-term air-quality study was dropped. As a result, the jobs of 16 researchers are in jeopardy, and their fate and the agency's funding remain undetermined. NOAA officials say the money was put back in NOAA's hands. It remains to be seen how it will be allocated. Steven Brown, a NOAA atmospheric scientist who works in the division where the layoffs could occur, says that the budgetary fluctuations are taking a toll on morale. "It really clouds the outlook for the future in terms of not just 'will I have a job or not next year,' but 'what will I be able to do careerwise or scientifically if the resources are going to be far more limited,'" Brown says. Projects that involve expensive field work, for example, could be put on hold.

Still, Brown and others are optimistic that the surge in public awareness regarding climate change and sustainable energy will have positive effects on budget priorities. Tom Hamill, a meteorologist in NOAA's Earth System Research Laboratory, notes that although "there's a fair amount of nervousness," the returns on investment are significant. For instance, upfront investment in weather-prediction capabilities pay off tenfold when it comes to forecasting hurricanes and other events affecting commerce and daily life, says Hamill. "I think and hope that we have a good cause to make, and that regardless of what administration we have we'll be able to justify our existence," Hamill says. Bush's 2008 budget could make possible new initiatives, including a drought-information system and sending unmanned aircraft into hurricanes.

Collaboratory colleagues

Although some of the region's R&D seems contingent on the whims of Congress, there are other collaborative opportunities springing up among various institutes. The University of Colorado (CU) at Boulder, Colorado School of Mines and Colorado State University (CSU) have just partnered with the NREL in what's dubbed a 'collaboratory'. Launched this month, it aims to harness the strengths of each institute in order to position Colorado as the nation's leader in renewable and sustainable energy innovation. "It is allowing us to compete for much bigger projects than we could do individually," says Susan Avery, graduate-school dean and vice chancellor for research at CU, Boulder.

The collaboratory is vying for a \$21.8-million grant from the Department of Energy to establish a centre for 'revolutionary photoconversion' and to invest in research geared towards solar-cell efficiency. Another project just unveiled this month is a large-scale programme in new biofuels and biorefining. Initially, most of the jobs will go to existing faculty. But many opportunities will arise as technologies are developed and deployed a few years down the road, Avery says.

An exciting collaboration on the horizon for CU is a \$60-million supercomputing data centre to be built in Cheyenne, Wyoming. A joint venture by CU, the



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Maura Hagan: foresees strong opportunities for collaboration.

National Center for Atmospheric Research (NCAR) in Boulder, the University of Wyoming and the state of Wyoming, this is expected to generate a host of unique opportunities for collaboration with other parts of the research community. Simulations produced on the supercomputers will enable extensive studies in global and regional climate, weather, space physics, oceanography, Earth-system processes and related geosciences. Due to open by early 2011, the centre will need 40–50 employees, including some new hires.

Colorado competed with Wyoming to house the facility but lost the bid, as the state of Wyoming offered greater financial support. Although some Boulder-area jobs are likely to be relocated to Wyoming to run the centre, most people see it as an intellectual boon for both research communities. "In terms of local Boulder jobs, there may be some disappointment," says Maura Hagan, director of the Advanced Study Program at NCAR. "But in terms of opportunities for collaboration with the universities and NCAR, that's still very strong and joint appointments are viable."

Top dollar for atmosphere funding

Research at NCAR is going strong, with more buildings and staff than ever before. NCAR and its managing organization, the University Corporation for Atmospheric Research, employ some 225 scientists and 170 engineers, with an annual budget of around \$222 million. The centre, whose primary funding sponsor is the National Science Foundation (NSF), brings a steady flow of atmospheric-sciences funding into the region. Between 2003 and 2006, Colorado led the nation in atmospheric-research dollars from NSF, receiving \$463 million, with California trailing behind at \$110 million. Funding to NCAR accounts for the disparity. Each year, NCAR offers between four and six scientist I/research I positions and 10 postdoctoral appointments in its Advanced Studies Program. "We would not shut down our hires even in the most difficult of times," Hagan says. "What we would do is make fewer appointments."

Private firms also promise to energize the region with job growth and technical innovation in coming years. A garage-based start-up called Solix Biofuels is teaming with CSU and the 'green' microbrewery New Belgium to convert algal scum into biodiesel, diverting heat-trapping carbon dioxide in the process. In addition, a New York-based firm, Prism Solar, recently announced its hope of planting a 9,000-square-metre manufacturing facility for photovoltaic technology in Pueblo, about two hours' drive south of Denver. The company forecasts that it could bring 300 permanent jobs to the region. And in December, SkyFuel, a New York-based start-up company, announced plans to construct a \$2-billion solar-energy park — the world's largest — in Colorado's San Luis Valley. The project, with construction due to begin in 2010, would power 300,000 homes and businesses.

Where the government fails to come up with funds, perhaps private enterprise will increasingly step into the breach. Endowed with some 300 days of sunshine per year and enough wind potential to power about eight states its own size, Colorado continues to at least have the potential to become the nation's boomtown of renewable-energy and geosciences innovation.

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