Bolder Boulder: A city's quest to meet Kyoto when federal policies fail

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Abstract

Shortly after George Bush declared that the U.S. would not adopt the Kyoto Protocols, the City Council of Boulder, Colorado declared that the City would. Since then, a number of activities have taken place to achieve the aims of the Kyoto Protocols. A committee called the Boulder Renewable Energy and Energy Efficiency (BREEE) Working Group was formed of energy professionals, City officials, and concerned citizens. This committee developed information about current patterns of energy use and environmental pollution by sector (residential, commercial, industrial, and transportation) and began developing strategies for diminishing consumption, primarily via raising energy efficiency.

Boulder initiated programs in each of these sectors. Activities included energy audits for residential and commercial buildings and community education on a small scale. However, these efforts were hampered by a modest budget. Meanwhile, City staff, under direction from the City Council and working closely with committed Boulder residents, developed a detailed "Climate Action Plan," the CAP. A blueprint for reducing greenhouse gas emissions, it was suggested that the CAP be funded by a tax on the consumption of electricity usage—greater consumption, higher tax. In August 2006, the City Council voted unanimously to put this measure on the November ballot, and the voters passed it by over 60 %. This marks the first time a municipality in the U.S. has passed an energy (carbon) tax to fund programs to reduce greenhouse gas emissions. A host of civic, business, and environmental organizations have come together over this pioneering initiative, which will raise over 5.1 million Euros for measures aimed at reducing GHG emissions 19 % (relative to 2005 figures) by 2012. Efforts to continue to reduce GHG emissions through energy efficiency and increasingly using renewable rather than fossil-fuel based energy sources will undoubtedly continue well beyond 2012.

Introduction

Shortly after George W. Bush became President of the United States, he announced that the U.S. would no longer participate in the process to develop international agreements known as the Kyoto Protocols, because to do so "would cause serious harm to the U.S. economy" (Bush 2001). This decision met with widespread disenchantment from many quarters, including a great number of citizens and civic leaders of Boulder, Colorado.

Boulder is a vibrant Rocky Mountain community of some 103,000 residents, many of whom count themselves as environmentalists. The City is home to both Colorado's major research university and a number of national laboratories dedicated to advancing the science of climate study, renewable energy, and related fields.

In May of 2002, Boulder's City Council passed a resolution to adopt the Kyoto Protocols. The resolution commits the City to a 7 % reduction of overall greenhouse gasses referenced to1990 levels by 2012, through implementation of "cost effective" actions (Climate Action Plan 2006).

It is far from routine for municipalities in the U.S. to undertake actions like these since many people view such matters to be uniquely the purview of the federal government. Some

Table 1. GHG emissions in Boulder by sector and energy type between 1990 and 2000. The unit of measure is metric tons of CO2 emissions equivalent (mtCO2e). (Source: BREEE 2003)

Sector	1990	2000	Change	Type	1990	2000	Change
Commercial	506,142	701,162	38.5%	Electricity	867,565	1,029,821	18.7%
Transportation	436,112	497,877	14.2%	Vehicle Fuel	437,142	505,564	15.7%
Residential	266,831	322,857	21.0%	Natural Gas	344,064	446,835	29.9%
Industrial	317,282	285,926	-9.9%	Other	44,904	44,904	0.0%
Other	32,601	46,835	-42.6%				
Totals	1,558,968	2,022,949	17.2%				

citizens expressed this point of view in public forums like the daily newspaper; many others applauded the City for adopting the Kyoto Protocol goals. While it is a matter of debate as to whether Boulder was the first City to take this action, in recent years an effort headed by the City of Seattle, Washington and the U.S. Conference of Mayors has seen 418 mayors representing over 60 million people sign the "Mayors Climate Protection Agreement," a resolution that commits these cities to meeting the Kyoto goals (U.S. Mayors Climate Protection Agreement 2007).

Initial Efforts at Implementation

Shortly after Boulder's City Council voted to adopt Kyoto Protocols, a voluntary team of local energy and environmental experts, staff from nonprofit organizations, students, City staff members, council members, and concerned citizens formed what became known as the Boulder Renewable Energy and Energy Efficiency (BREEE) Working Group. The aim of BREEE was to develop practical strategies to aid Boulder's efforts to achieve a more sustainable future.

At its peak, the group had 65 members and met regularly for several years beginning on May 27, 2002. Members and a number of others stay in contact via a list serve maintained by one of its founders, Ken Regelson (Regelson 2007). In mid 2003, BREEE published a report and associated presentations, sharing the results of the group's findings and recommendations with City leaders and local media (BREEE 2003).

The report accomplished two key goals: quantifying the problem and outlining a number of potential options for its solution. First, it quantified the patterns of consumption of energy and the production of greenhouse gases (GHG) in the City. It thus allowed for identifying areas where energy consumption and the associated production of greenhouse gases are particularly large (and growing), and thereby established target levels for diminishing both by 2012. Second, the report made a number of recommendations about activities the City and its citizens should pursue that the BREEE team viewed as having a strong likelihood of saving energy (thereby decreasing GHG emissions) cost effectively. As a result of the production of the BREEE report and its subsequent promulgation within the community, a good deal of awareness of the extent of Boulder's energy and environmental problems was achieved—and a number of concrete actions were begun.

PATTERNS OF ENERGY USE AND ENVIRONMENTAL CONSEQUENCE

From 1990 to 2000, Boulder's population grew 15.3 %. As a result, the number of residential units increased by approximately 19 % and the amount of space in commercial buildings expanded by 41 %. Vehicle distances traveled rose by 19 %. As a result, greenhouse gas emissions in Boulder increased over this same period (Table 1).

It is quite clear that commercial buildings are not only the largest producers of GHG, but also the fastest growing, primarily because of a building boom between 1990 and 2000.

Of course, patterns of CO_2 emissions in Boulder follow patterns of energy consumption. The primary energy source is electricity, 91 % of which is produced by coal-burning power plants. Annual electricity use for all reasons in the City in 2000 was 1,169 GWh; average peak demand was about 133 MW.

Figure 1 shows actual GHG emissions from 1990 through 2004 with projected emissions until 2012 under a business-as-usual scenario.

Since the actual emissions in Boulder increased 19.7 percent from 1990 to 2000, in order to reduce emissions to 7 % below 1990 levels by 2012 will require reducing GHG emissions to 22.3 percent below 2000 levels. A downward turn is already apparent; a decrease of 19 % from 2005 levels will meet the 2012 target. These figures establish benchmarks from which future patterns of consumption may be compared. They also clearly indicate where to look for waste—and thereby identify opportunities for substantial savings. Finally, the data strongly suggest that the task of meeting Kyoto Protocol goals is sure to be daunting.

Initial City Actions

With input from a number of parties, including members of BREEE, the City's Office of Environmental Affairs both augmented a handful of existing programs and initiated new ones aimed at reducing Boulder's GHG emissions, primarily through energy efficiency.

The City began by being a role model for its residents and businesses by performing energy audits on City-owned buildings, undertaking energy conservation work on them, pursuing renewable energy at City facilities, and upgrading the fuel efficiency of the City's fleet of vehicles through the purchase of hybrid-electric vehicles and the use of biodiesel and ethanol.

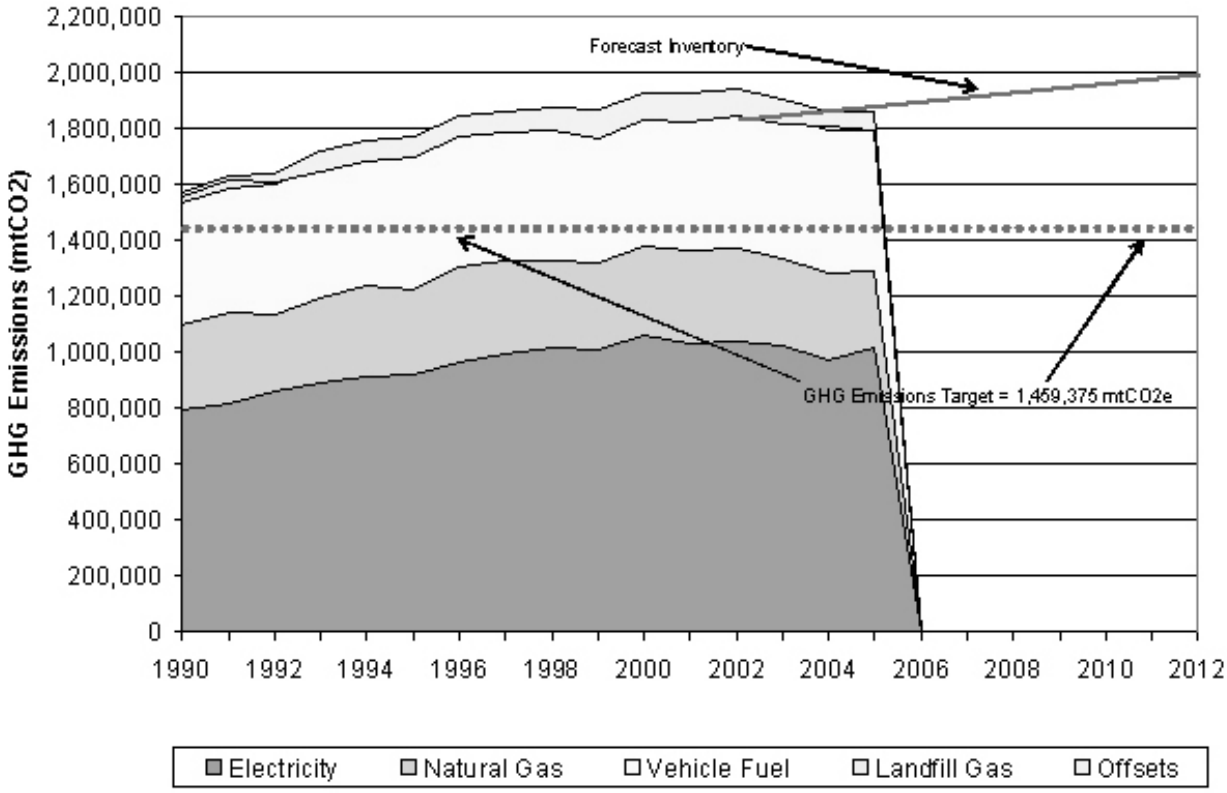

Figure 1. Actual GHG emissions in Boulder 1990 through 2004. The "business as usual" case is projected until 2012, showing the Kyoto target of 1,571,236 mtCO2e/year by 2012. (Source: Climate Action Plan 2006)

Adopting and implementing building energy codes is a particularly cost effective strategy for governments to improve energy efficiency in buildings. For example, Boulder conducts a unique "Green Points" program which requires new homes and large rehabilitations to meet (and preferably exceed) a number of environmental and energy efficiency standards in order to secure a building permit (Vasatka *et al*, 2004). This program includes incentives for energy efficiency, water efficiency, and renewables like solar, and rewards the use of recycled material in the construction of new buildings. The standards are geared to the size of the homes, so larger structures must be particularly energy efficient and environmentally sound in order to obtain building permits. The City is currently upgrading the Green Points program to set its standards higher and to simplify a number of procedures. This will include establishing targets for all new dwellings to be carbon neutral by a target date advocates hope will be only several years hence.

In addition to upgrading its Green Points program for new and retrofit residential construction, the City has adopted and is implementing the most modern of international energy conservation codes in the commercial sector. Boulder has also initiated a handful of pilot projects such as performing energy audits and retrofitting residential and commercial buildings for energy efficiency.

In addition, the City has undertaken a number of community education activities aimed at ensuring that both building professionals and the public at large are aware of the seriousness of the energy and environmental problems facing our planet in general and the Boulder area in particular. This information is always accompanied by recommendations for concrete actions to minimize waste and lower GHG emissions.

The City has funded at modest levels the Boulder-based not-for-profit Center for Resource Conservation (www.conservationcenter.org) to conduct energy audits and public education, and spearheaded the founding and development of the Boulder Green Building Guild (www.bgbg.org), an organization that provides technical and organizational support to the emerging green building community and which engages in public education as well.

Climate Action Plan Development

A constant characteristic of each of these activities is to leverage Boulder's efforts in the efficiency arena to maximize effectiveness while keeping costs as moderate as practical. The dilemma, of course, is that there is much more work that needs doing than available budget to support it.

In order to address this dilemma and take Boulder's actions to the level necessary to meet the Kyoto target, the City developed an ambitious "Climate Action Plan." The CAP is based in part on work by BREEE volunteers and Evan Evans of Econergy International, a clean energy company headquartered in Boulder. The CAP builds on the City's findings from the work outlined above. Developed over a year with blessings and suggestions from the City Council and input from a number of professionals and concerned citizens, Boulder's Climate Action Plan:

- Describes climate change in Colorado and outlines a vision for achieving a sustainable energy future;

Figure 2. "Climate Smart, Doing our Part" yard sign.

- Provides a picture of patterns of energy consumption in Boulder and outlines an inventory of Greenhouse Gas emissions by sector and source;
- Details strategies for undertaking energy efficiency in commercial, industrial, residential, and City-owned buildings;
- Outlines strategies for renewables and emission offsets in each of these sectors;
- Describes plans for saving energy in the transportation sector, saving water, recycling and reducing waste, and urban forest carbon sequestration; and
- Includes cost estimates for the activities to be undertaken and investment strategies.

A key element of the City's work is the method by which its implementation is to be funded. Boulder's City Council and staff spent many months examining options and finally decided on a modest tax on the consumption of electricity usage—greater consumption, higher tax. As all taxes in Colorado must be approved by a vote of the people, in August 2006, the City Council voted unanimously to place "Measure 202" on the November ballot.

A campaign committee to promote passing the measure was formed under the leadership of Boulder's Mayor, Mark Ruzzin. Called "ClimateSmart," committee members were united in their enthusiasm for taking concrete action in support of environmental measures. Most members were also very experienced in running election campaigns. In short order, a web site was established (www.ClimateSmartBoulder.org), a finance committee to seek donations and track funds was formed, a logo was designed, and campaign literature and yard signs were produced and widely distributed (Figure 2). In addition, a host of fundraising, information-sharing, and media events were planned and executed. A variety of organizations and people seen as influential in the community were asked to endorse Measure 202, and endorsers' names were added to advertisements in local newspapers. As Election Day approached, it was expected that the tax would pass. Nonetheless, the Climate Smart Campaign team continued to educate voters on what the tax would be used for and how important local efforts will be. There was no organized opposition to the Measure, and the Chamber of Commerce and all local papers endorsed it.

On November 7, 2006, the Climate Action Plan measure passed by a margin of over 60 %. Boulder thus became the first City in the U.S. to pass an energy tax to fund programs to help meet the Kyoto Protocols.

Over 90 percent of the electricity used in Boulder comes from coal-burning power plants, so this initiative is very much a carbon tax. Boulder is presently served by an investor-owned utility, Xcel Energy, which provides electricity in large portions of 11 states in the Midwest of the United States. Xcel has agreed to modify its billing software for its residential, commercial, and industrial customers in the City, collecting the tax on electricity use that is not "green," or utility-provided wind power. Table 2 shows the scheduled magnitude of the tax on electricity by sector.

The average household will pay 1.04 Euros ($ 1.33) per month and an average business about 2.96 Euros ($ 3.80) per month, although the tax is based on actual energy used. The measure is estimated to produce over 5.1 million Euros ($ 6.5 million) to support the Climate Action Plan between April 2007 and its expiration in March 2013.

MEDIA REACTION TO BOULDER'S INITIATIVE

Media coverage of Measure 202 increased quickly as Election Day approached, then surged after the measure passed by over 60 percent of the vote. Queries from all over the globe streamed in, requesting interviews with City staff and Boulder's mayor. The widespread coverage in the local and regional papers was outdone by broad-reaching international interest from Australia to England. Radio media from ABC Canberra, Australia to the BBC covered the election results. Phone interviews led to articles in publications as diverse as "Chemistry World" and "Governing Magazine." Over thirty U.S. newspapers featured the carbon tax story, from the New York Times to the Los Angeles Times.

Media inquiries are ongoing and hopefully will continue during the implementation of the Climate Action Plan. The community and world will be watching Boulder's progress in reducing GHG emissions. It is critical that local initiatives and ballot measures to address climate change achieve this level of media status, to help educate other local and state governments on the possibilities of grassroots level action.

Implementation

Collecting of the Climate Action Plan tax began in April, 2007, slightly after the writing of this paper. Nonetheless, implementation efforts are underway. The 5.1 million Euros budget over the six year period is scheduled to ramp up slightly each year from 671,000 Euros in 2007.

Substantial education, marketing, and outreach efforts will be directed to each of the target sectors. Energy audits will be undertaken in each sector, coordinated with developing an infrastructure in the professional community to perform retrofit services in both the residential and commercial building sectors. Retrofit services will emphasize improving energy efficiency while also including renewables such as solar thermal, daylighting, solar electric, and wind—all with the constraints of cost effectiveness and practicality. Outreach efforts will include give-away or retailer buy-down programs to provide impetus to market transformation in compact fluorescent (CFL) lighting.

Table 2. Tax rate by sector and estimated percent of revenue collected for the Climate Action Plan

Sector	Tax rate (Euros/kWh)	Tax Rate ($/kWh)	Estimated % of Revenue for Climate Action Plan
Residential	€ 0.0017	$ 0.0022	58%
Commercial	€ 0.00031	$ 0.0004	39%
Industrial	€ 0.00015	$ 0.0002	3%

Table 3. First year program areas and percent budget allocation.

COMMERCIAL (22% of budget)	RESIDENTIAL (36% of budget)
Building Performance with ENERGY STAR	CFL and LED Lighting
Energy efficiency workshops	CFL giveaway and discounts
Energy efficiency outreach and marketing	Neighborhood sweep for low to mid income
	Home Performance with ENERGY STAR
INDUSTRIAL (2%)	Multifamily audits
Building Performance with ENERGY STAR	Home energy audits
	City weatherization for low to mid income
RENEWABLE AND EDUCATION (22%)	Refrigerator round-up
Wind Challenge	
Solar rebate (sales and use tax)	TRANSPORTATION (8%)
City renewable energy purchases	
Educational campaign & marketing	ADMINISTRATION & CONTINGENCY (10%)

In addition, weatherization services to lower-income residents will be subsidized to allow local service delivery agencies to serve more households and expand the range of energy efficiency services offered.

Table 3 shows the program areas to be served under the first year of the Climate Action Plan.

ILLUSTRATION OF A PROGRAM: HOME ENERGY AUDITS

Boulder's residential housing stock of some 50,000 units is quite varied, running the gamut from mobile homes to large multifamily structures. About 48 percent of the housing stock is rental, owing to the presence of the University of Colorado, where nearly 30,000 undergraduate and graduate students are enrolled. Through the CAP, Boulder is conducting energy audit programs for both single family and multifamily housing.

The single-family energy audit program is a key element in the residential portion of the Climate Action Plan and production is ramping up. The aim of the program is to identify elements of dwellings which need to be retrofitted—fixed, modified, replaced, adjusted—in order to raise energy efficiency, increase comfort, or increase the safety of the home. Under the residential energy audit program, the City of Boulder pays about 40 % of the 250 Euros cost of each audit, with the homeowner and County of Boulder paying the rest

Recommendations flowing from audits can be particularly thorny in the case of the 1,100 or so homes in Boulder's historic districts, since major surgery on facades or elements like windows carry the risk of not being completely true to the historic character of a building even though such retrofits may indeed save energy cost effectively. Juggling these potentially conflicting agendas has been a matter of both public debate and technical analysis over the last several years. In truth, many older (and some newer) homes in Boulder are quite wasteful, and audits reveal that a number of retrofit measures can be implemented cost effectively that will save energy and improve comfort without deleterious effects on their aesthetic charm or historic authenticity.

By way of illustration, Figure 3 shows a recently-audited home located in one of Boulder's historic districts.

Like many older homes, this one has had rooms and porches added over the years. Often the interstices between old and new parts are quite leaky, and this home was no exception. A blower door test revealed large total leakage areas as well as subtle leaks. Further, the home's "conditioned envelope" was not well established and there are substantial bypasses around insulation, making it largely ineffective. As a consequence the energy bills are quite high.

Figure 4 illustrates two kinds of air leakage that are hard to identify without using a combination of a blower door, digital manometer, and infrared temperature sensor, tools employed by energy auditors that help to extend vision. Many homes in the U.S. now employ recessed light fixtures ("can lights"), which usually use inefficient incandescent lights. The light from these fixtures is not very attractive, and the inefficient bulbs waste electricity. However, in many cases, can lights also penetrate attic insulation and cause air leakage, thereby wasting energy used for space heating, in this case natural gas from a boiler in the basement. The figure also shows testing to see if the large front porch is connected to the conditioned envelope of the building. The answer is yes, and as the porch is uninsulated, it is the cause of considerable energy waste and discomfort.

Retrofit measures recommended on this home are to decide exactly where the conditioned envelope should be, air seal it using a variety of measures, and insulating thoroughly, including

Figure 3. The front of this home faces west toward Boulder's mountains, the back, east. Note patterns of snow melting, suggesting voids in attic insulation.

high-density cellulose in the ceilings of the porches. It is also important to replace the can fixtures with lighting that does not penetrate the envelope and which employs fluorescent lighting that uses one-quarter the energy of incandescents to produce similar light levels while lasting 10 times longer. A key safety measure is to cure a major source of carbon monoxide that comes into the kitchen whenever the broiler of the new kitchen stove is operated.

Experience shows that a careful, instrumented audit is a necessary condition for being able to recommend a set of specific measures that make sense for a given building. Many times, audits reveal areas that do not need attention in order to solve an energy problem. For example, Figure 5 shows another 100 year-old historic Boulder home which has high energy bills, is quite leaky, yet whose porches are not connected to the home's conditioned envelope. In the case of first home, little work on windows is called for; in the second, retrofit work should be undertaken to limit conductive and convective losses on a number of double-hung windows.

ENERGY AUDIT PROGRAM OBSERVATIONS AND PLANS

The key to success for an energy audit program is not a report in the hands of a homeowner or a landlord, but rather concrete actions taken to improve efficiency and perhaps add renewable energy sources, both of which frequently improve comfort. A variety of actions are underway to enhance getting effective work done. This ranges from formative evaluation of the existing programs, providing training and technical assistance to local contractors to ensure they can accomplish thorough retrofits, and extensive marketing of auditing and retrofit services.

By the time this paper is presented, the City hopes to have in place a program aimed at small to medium-size commercial buildings which combines the audit, retrofit, commissioning, and evaluation processes. The idea is to ensure that appropriate measures are indeed undertaken and that they save energy cost effectively. Through the CAP, the City will play a key role in designing and managing the program, as well as underwriting substantial portions of the audits and evaluations of effectiveness. Since the building owners will be able to avoid a number of complications, while being assured that cost-effective energy improvements are accomplished, it is expected that the program will be widely accepted. Indeed, since energy use in the commercial sector represents almost 40 % of the GHG emissions in Boulder, success in this program will be pivotal to the overall success of the CAP.

ILLUSTRATION OF NEW HOUSING: SOLAR HARVEST HOME

Promoting the building of new homes that are as close to negative energy use as possible is a high priority of the Climate Action Plan. Recently, Ecofutures Building, Inc., a "Green" design/build/remodel firm in Boulder, completed construction of a 440 square meter residence that is a net negative user of fossil energy (Figure 6).

Figure 4. A technician measures leakage from can lights and checks pressure differences between the outside and the porch ceiling when the blower door is depressurizing the home's envelope.

Figure 5. This home is quite leaky as shown by the blower door (right photo), but needs no porch insulation.

Figure 6. South elevation and solar space in "Solar Harvest" home in Boulder

Dubbed "Solar Harvest," the home, which doubles as a community center, has a number of features, many of which show promise for being useful in other buildings, both new and retrofit. These include:

- Salvaged materials like hardwood flooring, interior and exterior doors, tubs, and sinks;
- Heavy insulation that achieves R-6 $m^{2*}K/W$ in walls and R-10.6 in the ceiling; basement walls are insulating concrete forms rated at R-5.3;
- Very efficient fiberglass-framed windows, R value of 1.47;
- Passive solar heating that uses double 16 mm sheet rock in most of home to enhance thermal mass;
- Natural daylighting, energy-efficient electric lighting, minimal "phantom" loads, efficient appliances;
- Heat recovery ventilation that makes use of the earth to preheat (winter) or pre-cool (summer) incoming fresh air;
- Twelve solar thermal flat plate, drain-back collectors feeding a 22,700 litre storage tank; heats hot water for bathing and wintertime heating, the latter through pipes in floors for radiant heat; and
- A power grid-tied 6.84 kW photovoltaic array that produces more electricity than the home uses most of the time, so the utility pays the owner for net power generated.

On the design day (the coldest day of the winter), thermal losses of the home are only 7.3 kWh/hr.

Solar Harvest is the first home in the City of Boulder that code officials have allowed to be built without conventional back-up heating system—it has no furnace or boiler. It will not be the last.

ILLUSTRATION OF RETROFIT OF INSTITUTIONAL BUILDING: THE NORTH BOULDER RECREATION CENTER

The City of Boulder continually strives to be a municipal leader, and a recent renovation of one of its three public recreation centers provided a unique opportunity for the City to demonstrate its commitment to environmental sustainability. Using City funds, Boulder accomplished this by renovating and expanding the North Boulder Recreation Center into the first silver-level U.S. Green Building Council LEED-certified building in the state of Colorado (Figures 7 and 8). The Leadership in

Figure 7. A modified bitumen cool roof with a white reflective coating was installed on the flat sections of the building's roof.

Figure 8. The North Boulder Recreation Center uses557 m^2 of solar panels to pre-heat the water for the center's two swimming pools.

Energy and Environmental Design (LEED) Green Building Rating System™ is a benchmark for the design, construction, and operation of high-performance green buildings in the U.S. LEED provides a framework for assessing building performance and meeting sustainability goals by emphasizing state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

The North Boulder Recreation Center project received LEED points for its accessibility by public transit, its use of drought-tolerant and native landscaping to reduce irrigation water needs, and its use of non-CFC-based refrigerant HVAC systems. In addition, construction waste was recycled or reused. Salvaged, refurbished, and reused materials or products were used in the building's construction.

Examples of environmentally sustainable design include the re-use of overhauled air conditioning units, doors, and flooring materials; the use of recycled-content building materials, lockers and benches made of recycled plastic; and inclusion of low-flow showerheads and toilets throughout the building.

The re-designed building was made as energy efficient as possible, starting at the top. A modified bitumen cool roof with a white reflective coating was installed on the flat sections of the building's roof. The North Boulder Recreation Center uses 557 square meters of solar panels to pre-heat the water for the center's two swimming pools, reducing natural gas consumption by an estimated 50 percent. New boilers are 90 percent efficient, and the building employs a carbon dioxide monitoring system that adjusts the amount of ventilation air to ensure maintaining good indoor quality in the facility while keeping air exchange rates as low as possible to limit energy waste.

The project incorporates daylighting techniques throughout to reduce electricity needs. Dimmers and occupancy sensors are employed, as are low-energy lighting fixtures. Double-paned, low-E insulating glass is used to reduce thermal losses through windows, and the windows were engineered specifically for their orientation to optimize their performance in all seasons.

Lastly, the entire renovation was constructed to exceed 2000 International Energy Conservation Code requirements. The building meets 50 percent of its electricity needs through the purchase of renewable wind power.

Evaluation and Metrics

Tracking progress in diminishing GHG emissions is critical to managing all elements of the Climate Action Plan and to making mid-course corrections as necessary. This means keeping good track of actions flowing from CAP programs. The City's Greenhouse Gas inventory (and associated patterns of fossil fuel consumption) is the key measure of progress toward the goal. The inventory is comprised of electricity and natural gas used by residents and businesses within the City limits; wind power purchases from Xcel Energy, the electric utility; transportation data (vehicle miles traveled) measured by the City's Transportation Division; and data on solid waste collected from private trash haulers. An inventory-tracking system initially developed by Econergy International yields reports that have been updated annually since 2004, and plans call for reporting to continue throughout the program.

A key parameter in these reports is an estimate of the cost per metric ton of CO_2 equivalent reduced. As the program matures, this and related indices of cost effectiveness will be employed to emphasize certain program measures, de-emphasize others, and undertake new measures which analysis suggests will be cost effective and practical. The information will also be employed in preparing grant requests from various foundations and governmental sources to expand Boulder's climate action initiatives into other quarters.

A committee has been formed to seek input as various CAP programs are rolled out and mature. The Climate Action Plan advisory group is convened on a regular basis to review program results as well as plans for new or expanded services and programs. The intent is to convene professionals with expertise in the areas of energy efficiency, renewable energy, commercial property ownership, and public policy to provide high-level guidance on program design aimed at maximizing greenhouse gas reductions and voluntary community investments in actions that reduce emissions. The City is also convening key groups to review program results and plans to keep interested parties informed and engaged in program implementation.

Conclusions

When the people lead, sooner or later the federal government will follow. The recent election of a somewhat more progressive Congress—along with polls suggesting that a large number of voters regard environmental matters as of increasing concern—lends hope that federal energy and environmental policies may be adjusted to reflect the fact that our fragile planet is in trouble

and that the U.S. is very much part of the problem. However, with communities such as Boulder taking the lead, what is learned locally may be useful in policy making and program implementation at other levels of government.

The Executive Summary of Boulder's Climate Action Plan concludes as follows:

Achieving the Kyoto Protocol Goal requires not only a substantial financial commitment, but also the dedication of staff resources and political will. While the City recognizes that Boulder's actions are far too small to impact global greenhouse gas emissions trends and the progression of global warming, Boulder seeks to encourage other communities around the country and world to implement strong greenhouse gas emissions reduction programs….

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