Reducing Energy Consumption and Creating a Conservation Culture in Organizations: A Case Study of One Public School District

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Abstract
How can existing schools significantly reduce their energy use? With energy costs rising and school budgets shrinking, energy use is a substantial cost that can be reduced through conservation efforts. Using a case study methodology, the authors compare two public high schools from the same school district, one that has achieved moderate energy savings and another that has reduced its electricity use by 50% over several years. Examining the individual and organizational components of both schools’ efforts, the authors find that the greater success at one school is the result of integrated efforts at all levels within the organization, from district administrators to individual students. Success is based on structural changes, individual behavioral change, and, most important, the weaving of both into a cohesive

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organizational culture emphasizing conservation. This study demonstrates the potential of behavioral change and organizational culture to foster environmental education, conservation, and fiscal savings for other public schools.

**Keywords**

environmentally responsible behavior, environmental education, organizational behavior, energy conservation

Public awareness of climatic change has stimulated organizations to consider strategies for reducing energy consumption for both economic and environmental reasons. In the United States, the average cost of energy use for the 2005-2006 school year was US$1.15/ft², 63% of which was electricity consumption (Kats, 2006). In most U.S. school districts, the cost of energy use is second only to salaries (State of Colorado Governor’s Energy Office, 2007). In American schools, US$6 billion is spent on energy bills annually, which is more than what is being spent on textbooks and computers combined (Energy Star, 2010).

With ever-increasing economic costs and heightened concerns about the environmental effect of energy consumption, public schools are an ideal location for targeted conservation efforts. A long-term strategy for reducing energy consumption is the design and building of “green schools,” which adopt a variety of design components to reduce energy use by an average of 33% from traditional buildings (Kats, 2006). The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council (USGBC), was recently modified in order to develop specific standards for the design and construction of green schools. Currently, there are 250 LEED-certified schools, which is 0.2% of school buildings in the United States (USGBC, 2010a).

Whereas the construction of green schools is an important long-term strategy for containing energy costs and building healthy environments for learning, school districts must also find ways to reduce energy consumption in existing buildings. “With more than 133,000 schools in the United States, the greatest opportunity for school districts and our nation is to transform our existing schools” (USGBC, 2010b). The potential for reducing energy consumption in existing buildings is great; the “top performing ENERGY STAR labeled schools cost forty cents per square foot less to operate than the average performers” (Energy Star, 2010). A total of 40 cents per square foot can translate into tens of thousands of dollars a year for large schools. For existing buildings, two programs—the ENERGY STAR challenge and LEED for
Existing Buildings certification—provide guidance, support, and certification for schools that seek to reduce their energy consumption. Financial savings from energy conservation is a necessity for many school districts and can be used in various ways that benefit the educational system and its students. Despite this necessity, however, few school districts, much less individual schools, have successfully incorporated energy conservation practices into their organizational culture.

This study compares the energy conservation efforts at two public high schools built in the 1960s and 1970s in a school district in Colorado. Over the course of 8 years, Rocky Mountain High School (“Rocky”) was able to reduce its electrical energy consumption (kilowatt hour/square foot; kWh/ft²) by 50%, whereas Poudre High School (“Poudre”) reduced its electrical energy consumption by only 34%. This research asked two questions: (1) What organizational and individual factors contributed to the improvements in electricity conservation at these two high schools? (2) What factors explain the greater conservation of electricity at Rocky? Using quantitative energy data from the school district, qualitative data from focus groups and interviews, and an analysis of school newspapers and newsletters, we sought to understand how behavioral change within an organizational setting takes place.

Environmental Conservation and Behavioral Change in Organizations

Much research has been conducted on the choice to engage in proenvironmental behavior (Axelrod & Lehman, 1993; Bamberg & Schmidt, 2003; Diekman & Preisendörfer, 2003; Guagnano, Stern, & Dietz, 1995; McCalley & Midden, 2002). Some studies examined household decisions (Abrahamse, Steg, Vlek, & Rothengatter, 2005, 2007), whereas others analyzed behaviors within an occupational, organizational, or institutional setting (e.g., Higgs & McMillan, 2006, Siero, Bakker, Dekker, & Van Den Burg, 1996). Some research suggests that there is a strong link between environmental attitudes and environmentally responsible behavior (e.g., Barr, Gilg, & Ford, 2001; Tonglet, Phillips, & Read, 2004; Vining & Ebreo, 1992), whereas others contend that behavioral change can take place without any change in attitudes or beliefs, by clearly expressing expectations and providing subsequent feedback (Siero et al., 1996).

Research on proenvironmental behavior within organizations indicates that change is fostered through integrated efforts at multiple organizational levels, including institutional and structural changes, organizational culture and leadership, and individual attitudes and behaviors (Starik & Rands, 1995;
Tudor, Barr, & Gilg, 2007; Wolf & Primmer, 2006). Both organizational factors (e.g. culture, size, and structure) and individual factors (e.g. attitudes, beliefs, and sociodemographics) influence the behaviors of individuals and the group (Child, 1988; King & Lennox, 2000; Mullins, 1999; Williams, Dobson, & Walters, 1989). Research on environmental management has found that the organizational and individual factors are interrelated and that both influence behavior in dynamic and holistic rather than segregated and discrete ways (Tudor et al., 2008). Comparative feedback—where the performance of one group is compared to another group—produces both the largest change and the best results in long-term studies of behavior modification (Siero et al., 1996). One study of proenvironmental behavior, specifically within a school setting, identified four sources of modeling that shape student perceptions and behavior: (1) individual role models, (2) school facilities and operations, (3) school governance, and (4) school culture. All four help to model environmental concern in the school and influence the success of an environmental education program (Higgs & McMillan, 2006).

Research on charismatic (Conger & Kanungo, 1987; Conger, Kanungo, & Menon, 2000) or transformational (Leithwood & Jantzi, 1999; Leithwood, Tomlinson, & Genge, 1996) leadership indicates that leaders play a key role in empowering and inspiring action within an organization. Max Weber (1935/1968) first discussed charismatic leadership as the ability to lead through perceived ability and extraordinary character rather than through formal authority. Charismatic leaders inspire feelings of empowerment and a heightened perception of collective identity (Conger et al., 2000). Similarly, transformational leadership inspires increased commitment to organizational goals. Relying on Bennis (1959), Dillard (1995) offered a definition: “transformative leadership—the ability of a person to reach the souls of others in a fashion which raises human consciousness, builds meanings and inspires human intent that is the source of power” (p. 560). Transformational leaders need not be formal organizational leaders; in a school setting, transformational leadership can come from persons outside of administrative positions (Leithwood & Jantzi, 1999).

Individual Determinants of Proenvironmental Behavior

One known predictor of proenvironmental behaviors is a sense of efficacy, which has been found to differentiate those who act because of environmental concern and those who do not, both in individual cases (Bamberg & Möser, 2006; Ellen, Wiener, & Cobb-Walgren, 1991; Gamba & Oskamp, 1994) and
group contexts (Lubell, Vedlitz, Zahran, & Alston, 2006; Lubell, Zahran, & Vedlitz, 2007). The theory of planned behavior (TPB) suggests that behavior is directly related to intention, which can be predicted on the basis of attitudes toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). Building on TBP, researchers have developed a theory of collective action (Lubell et al., 2006, 2007; Ostrom, 1998), which highlights the importance of both group and personal efficacy.

Tudor et al. (2008) suggested that the best framework for understanding and changing behavior in an organizational setting incorporates individual and organizational factors as interrelated, integrated, dynamic processes. The current research follows a similar path, integrating quantitative and qualitative research to examine personal, social, and structural factors responsible for the creation of a conservation culture within a public school organization.

The Case Study District and Schools

Poudre School District (PSD) is located in Fort Collins, Colorado, a town with a population of approximately 120,000. The school district has long been a proponent of energy management and environmental stewardship (PSD, 2008). Currently, less than 1% of the more than 130,000 schools in the United States have earned ENERGY STAR labels, whereas 64% of schools in PSD (32 out of 50) have earned ENERGY STAR labels. PSD has about 23,000 students and 4 traditional high schools, each with a capacity for 1,800 students.

Rocky opened in 1973, was renovated in 1994, and another renovation and expansion project was completed in 2004. Built in 1964, Poudre is similar to Rocky in age, size, and square footage. Both have approximately 1,700 students and encompass more than 270,000 square feet. The other two high schools in PSD are Fort Collins High School (FCHS) and LEED-certified Fossil Ridge High School (hereafter “the LEED School”). FCHS was the first public high school in the town, although it relocated to a new building in 1995. FCHS houses approximately 1,200 students, yet has the highest energy expenses of the four schools. Constructed in 2005, the LEED School is the newest high school in the district, with a current enrollment of approximately 1,000 students. The LEED School has numerous built-in energy efficiencies and sustainable design concepts. Despite its pioneering design, the LEED School consumed electricity at a higher rate (6.24 kWh/ft²) than Rocky (4.79 kWh/ft²) in 2007, due to the successful energy conservation efforts at the older school building. Although the LEED school consumed electricity at a higher rate than Rocky, it is more energy efficient overall, using less natural gas and electricity combined
than did Rocky and earning a higher rating on the ENERGY STAR rating scale (87 and 75, respectively).¹

**Study Aims and Research Design**

Much existing research on environmentally responsible behavior has utilized intervention or experimental design (e.g., Abrahamse et al., 2005, 2007; McCalley & Midden, 2002; Siero, et al., 1996). In this study, however, change had already occurred; therefore, a post hoc intrinsic case study was conducted. PSD posed this question to us as researchers, “How did Rocky reduce its electricity consumption to levels below the LEED School, and can that effort be replicated at other schools?” PSD knew that replicating the success of Rocky at the other two conventionally constructed high schools in the district could generate US$240,000 in annual savings. PSD had been working on energy conservation in schools for years but had not been able to translate their goals into educational goals or organizational culture as Rocky did. Thus, the district wished to understand what had occurred at Rocky so that changes could potentially be replicated. As is typical of case studies (Stake, 1995; Yin, 2003), this study utilized multiple sources of both quantitative and qualitative methodologies and data to understand the differences between two schools that achieved moderate versus major reductions in electrical energy consumption.

Using a purposeful sampling strategy (Patton, 2002), Poudre was selected as a comparison school due to its similarity to Rocky in age, size, and student population. At the time of the study (2007-2008), Poudre had not yet initiated building-level efforts to influence energy consumption behaviors. The comparability of the sites and the contrast in the schools’ cultural concern for energy conservation made for an ideal comparison (Creswell, 1998; Stinchcombe, 2005).

**Qualitative Data Collection and Analysis**

Relevant stakeholders (including teachers, administrators, other staff members, and students) from both schools were included in focus groups about individual behavior, school culture, and behavioral expectations regarding energy conservation. Focus groups allow participants to discuss topics on which they may not necessarily agree, such as the importance of energy conservation and environmentally responsible behavior, while allowing them to respond to one another’s ideas. In keeping with the standards of focus group format, this research study attempted to organize homogeneous groups for
each conversation. The goal was to explore knowledge of and regard for energy issues inside and outside of the school.

Nine focus groups were conducted that comprised in all 53 participants. Each focus group session lasted for an hour. The total number of focus group participants included 15 teachers, 15 staff members, and 23 students. Given that the research was taking place within a public school setting, flexibility was required, and not all focus groups adhered to the standard 6 to 12 participants in each group (Krueger & Casey, 2000). In addition, unstructured individual interviews were conducted with the environmental science teachers at both schools and with the principal of Rocky. School and district documents, including e-mails, school papers, newsletters, energy bulletins, and websites were analyzed as part of the assessment.

Energy Use Data & Analysis

Energy data set. Energy use and cost data for the district are collected from utility billing on a weekly basis. In 1994, the district implemented an automated energy management software program, Utility Manager™ Pro 4.5 (LPB Energy Management, 2008). Data are entered into Utility Manager, and this system is used to pay utility bills on a weekly basis and to collect energy data. Utilities managed through this system include electricity, natural gas, water, sewer, trash, and recycling. All PSD schools have web access to this information.

Electrical energy consumption data were analyzed over time and compared across all four high schools in the district to establish the relative significance of the change at Rocky. This study examines data from fiscal years 2000 through 2007 (July 1999 through June 2007). The district augmented their own energy conservation efforts during the 1999-2000 school year (fiscal year 2000), and this year was chosen by the school district as the baseline year for comparisons used for allocating energy savings rebates and other data comparisons. We have also used this as a baseline year for comparisons of yearly kWh/ft².

Taking kWh/ft² for each month of the year, we constructed a data-set that contains one case for each month from July 1999 to June 2007 at each school (except the LEED school, Fossil Ridge High School, which was built in 2005); this assessment included a total of 288 cases. We then calculated the percentage decrease in kWh/ft² for each month at each school, using the percentage decrease from the same month during the previous year (Year_i - Year_{i-1}) / Year_{i-1} × 100, leaving us with a data set of 252 cases to be used in the regression equations and excluding the LEED School (FRHS) that did not have complete data.
**Data analysis.** Given the small sample used and the time-series character of the data, conventional t tests would not necessarily give valid p values. Therefore, we ran permutation tests to obtain a p value for the coefficients. Using the built-in permutation function in Stata, the response variable was randomly permuted across cases of this data set 10,000 times, with the regression model estimated each time. The p value for a regression coefficient, as is conventional, is the proportion of times, across the 10,000 permutations, for which the regression coefficient for a particular term was obtained from a random permutation, exceeded that coefficient’s value for the observed data set.

We ran two regression models testing changes during the two time periods that appear to be significantly larger than other time periods. First, we tested the hypothesis that the mean percentage decrease for 2001 versus 2000 was larger than for any other consecutive pair of years across all schools. Second, we tested the hypothesis that the percentage decrease at Rocky after 2004 was greater than at the other schools during that time period. A regression model was estimated for each of these hypotheses with the percentage decrease in kWh/ft² consumption as the response variable.

**Results**

Our research confirms the work of others on the importance of interrelated, cohesive efforts when seeking to change organizational culture and practices. The themes in the focus groups and interviews at both high schools highlighted distinct differences in leadership, communications, efficacy, and school cultures between Rocky and Poudre and demonstrated the importance of integrating changes in both infrastructure and organizational culture.

**Energy Use and Building Infrastructure**

The energy-use data are presented in Tables 1 and 2 and Figure 1. Between 2000 and 2007, all of the high schools in PSD significantly reduced their rate of electricity consumption (28% at FCHS, 34% at Poudre, and 50% at Rocky). Given that all the high schools reduced their electricity consumption, it is important to know how much of these reductions in electricity use were due to the activities of facilities maintenance and operations and how much can be attributed to behavioral changes. The largest year-to-year reduction occurred in 2001 and is attributable to changes in building operations. In 2000, PSD implemented a system of centralized control over building heating, venting, and air-conditioning (HVAC) systems. In this system, school staff members enter the operating hours of their buildings on the basis of class and
Table 1. Annual Electricity Use (kWh/ft²) and Percentage Decreases by High School and Fiscal Yeara

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Rocky Mountain High School</th>
<th>Poudre High School</th>
<th>FCHS</th>
<th>Fossil Ridge High School LEED Schoolb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Decrease Year-to-Year from 2000</td>
<td>% Decrease Year-to-Year from 2000</td>
<td>% Decrease Year to Year from 2000</td>
<td>% Decrease Year to Year from 2000</td>
</tr>
<tr>
<td>2000</td>
<td>9.62</td>
<td>11.15</td>
<td>10.85</td>
<td>-</td>
</tr>
<tr>
<td>2001</td>
<td>7.80</td>
<td>18.9d</td>
<td>8.76</td>
<td>14.7d</td>
</tr>
<tr>
<td>2002</td>
<td>7.94</td>
<td>(1.7)</td>
<td>8.52</td>
<td>18.34</td>
</tr>
<tr>
<td>2003</td>
<td>7.86</td>
<td>10.8</td>
<td>7.99</td>
<td>23.6</td>
</tr>
<tr>
<td>2004</td>
<td>7.65</td>
<td>2.6</td>
<td>7.94</td>
<td>22.1</td>
</tr>
<tr>
<td>2005</td>
<td>7.11</td>
<td>7.1e</td>
<td>7.62</td>
<td>22.5</td>
</tr>
<tr>
<td>2006</td>
<td>6.58</td>
<td>7.6a</td>
<td>7.44</td>
<td>27.9</td>
</tr>
<tr>
<td>2007</td>
<td>4.79</td>
<td>27.2e</td>
<td>7.36</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Note: FCHS = Fort Collins High School.

a. Fiscal years begin in July of the previous year and end in June of the stated year. (e.g., FY 2000 = July 1, 1999 through June 30, 2000)
b. FRHS not included in any regression tests because of missing data.
c. These data points are compared to first year of operation, fiscal year 2005.
d. Regression-based permutation for all schools tested that the average percentage decrease in 2001 is larger than the average decrease in all other years, p <.001 from a regression-based permutation coefficient (StataCorp. [2005]). Stata Statistical Software: Release 9. College Station, Texas: StataCorp. LP).
e. Regression-based permutation testing that the average percent decrease after 2004 at Rocky was larger than the average percent decrease at FCHS and Poudre, p <.001 from a regression-based permutation coefficient (ibid.).
### Table 2. Average Percent Decrease in Electricity Use (kWh/ft²) in Fiscal Years 2000-2007 by Month and School

<table>
<thead>
<tr>
<th>Month</th>
<th>Rocky Mountain High School</th>
<th>Poudre High School</th>
<th>Fort Collins High School</th>
<th>Fossil Ridge High School LEED School</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>12.23</td>
<td>10.25</td>
<td>10.04</td>
<td><strong>12.41</strong></td>
<td>11.23</td>
</tr>
<tr>
<td>August</td>
<td>6.20</td>
<td>7.15</td>
<td>4.65</td>
<td><strong>14.06</strong></td>
<td>8.02</td>
</tr>
<tr>
<td>September</td>
<td>4.94</td>
<td>5.23</td>
<td>3.87</td>
<td><strong>5.38</strong></td>
<td>4.85</td>
</tr>
<tr>
<td>October</td>
<td><strong>4.61</strong></td>
<td>4.35</td>
<td>2.19</td>
<td>(2.75)</td>
<td>2.10</td>
</tr>
<tr>
<td>November</td>
<td><strong>8.48</strong></td>
<td>3.93</td>
<td>2.97</td>
<td>0.51</td>
<td>3.97</td>
</tr>
<tr>
<td>December</td>
<td><strong>9.22</strong></td>
<td>3.42</td>
<td>2.31</td>
<td>0.85</td>
<td>3.95</td>
</tr>
<tr>
<td>January</td>
<td><strong>8.75</strong></td>
<td>2.37</td>
<td>1.57</td>
<td>0.52</td>
<td>3.30</td>
</tr>
<tr>
<td>February</td>
<td><strong>8.66</strong></td>
<td>3.72</td>
<td>2.03</td>
<td>1.47</td>
<td>3.97</td>
</tr>
<tr>
<td>March</td>
<td><strong>8.49</strong></td>
<td>4.69</td>
<td>2.33</td>
<td>7.62</td>
<td>5.78</td>
</tr>
<tr>
<td>April</td>
<td><strong>9.82</strong></td>
<td>4.50</td>
<td>4.07</td>
<td>5.87</td>
<td>6.07</td>
</tr>
<tr>
<td>May</td>
<td><strong>10.73</strong></td>
<td>6.92</td>
<td>4.45</td>
<td>2.84</td>
<td>6.24</td>
</tr>
<tr>
<td>June</td>
<td><strong>13.52</strong></td>
<td>8.13</td>
<td>8.67</td>
<td>7.84</td>
<td>9.54</td>
</tr>
<tr>
<td>Total</td>
<td><strong>8.80</strong></td>
<td>5.39</td>
<td>4.10</td>
<td>4.72</td>
<td>5.75</td>
</tr>
</tbody>
</table>

Note: FCHS = Fort Collins High School.

- a. Monthly decreases were calculated for each month compared to that month in the previous year’s use = (Year _i - Year _i−1 / Year _i−1) × 100, these values were then averaged across years.
- c. Entries in bold indicate the highest value in each row.

**Figure 1.** Three-month rolling average electricity use reported in kWh/ft² in four high schools, July 2000 to October 2007
activity schedules, and the HVAC systems are turned on and shut off automatically. Electrical energy use was reduced in 2001, as compared to 2000, by 19% at Rocky, 15% at FCHS, and 21% at Poudre (see Table 1). Results of regression-based permutation analysis (StataCorp., 2005) reveal that the decreases in energy consumption in all three schools was substantially greater (about 14%) between 2000 and 2001 when compared to all other years ($p < .0001$).

In the years following 2001, each high school experienced incremental changes in electricity use, with typical annual changes ranging from 4% increases to 6% decreases (see Table 1). Overall, the average, year-to-year, monthly decrease in electricity use (kWh/ft²) across all schools was 5.75% between fiscal year 2000 and fiscal year 2007 (see Table 2). The average monthly decrease in electricity use was largest at Rocky (8.8%), and lowest at FCHS (4.1%). Rocky’s greater annual reductions in electricity use can be seen across an entire year (Table 2). Although all the schools were able to reduce their electricity use by 8% to 12% during the summer months, only Rocky was able to reduce their electricity use by 8% or more from November through May (Table 2). This substantial reduction in electricity use during the school year is indicative of the behavioral and cultural changes unique to Rocky.

Are Rocky’s reductions in electricity use substantially different from the other schools? Rocky began with the lowest rate of electricity use (9.68 kWh/ft²) of the three traditionally built high schools and experienced the greatest decrease (50%) in energy use between 2000 and 2007 (see Table 1). In fiscal year 2000, Rocky used 12% to 14% less electricity than did the other two high schools. By 2007, Rocky was using 35% and 23% less electricity, compared to traditionally built schools and the LEED school, respectively.

Rocky also experienced the single largest year-to-year reduction in electricity use. During fiscal year 2007, when the other schools only experienced minor changes, Rocky decreased its electricity consumption by 27% from the previous year. In comparison, Poudre’s largest year-to-year reduction (21%) occurred in 2001, the year of the implementation of centralized HVAC control (see Table 1). After 2001, Poudre’s yearly decreases ranged from less than 1% to 6% (Table 1). Whereas Rocky had the most dramatic reduction in 2007, it had shown substantial reduction in electricity consumption (at 7%) in the previous two years as well, whereas the other schools had more modest decreases or increases (Table 1). Results from regression-based permutation analysis (StataCorp., 2005) show that electricity use reductions that occurred at Rocky after 2004 were significantly different from changes at other schools during that time period ($p = .003$). In addition to electricity conservation, Rocky has reduced water consumption (using 9,770,117 fewer gallons in 2007 than 2000) and natural gas use (using 81,023 CCF less in 2007 than 2000).
Between 2006 and 2007 (the years of their most substantial savings thus far), Rocky generated US$40,379 in total operations savings. Figure 1 illustrates the rate of electricity use at all four schools reported in Table 1. Prior to the centralization of HVAC systems control, Poudre and Rocky had similar patterns of use, although Rocky used less total electricity, reflecting the older system at Poudre. After implementation of centralized control, Poudre and Rocky were nearly indistinguishable from 2001 until 2004. In 2004, Rocky started a downward trend that increased each year. Fiscal year 2005 (during which the LEED school could fill only one third of its total occupancy) was the only year in which the LEED school used less electricity than all other schools. Since July 2005, Rocky has consistently used electricity at a lower rate (kWh/ft²), compared to the LEED School (see Figure 1 and Table 2).

**From Infrastructure to Organizational Culture**

Building infrastructure and organizational culture may not seem related, but the two elements actually work in an integrated fashion. During the 2004 Rocky remodel, a recycling center was constructed that not only improved the recycling process but also provided a physical space demonstrating the value of recycling in the school. Another example of Rocky’s success in integrating building infrastructure and organizational culture is a motto coined by the principal, “Care and Repair.” Care and Repair is itself a way to reduce consumption; the expectation within the school is to care for existing equipment and repair things when possible rather than buying new products. According to the principal, this code promotes conservation culture more generally and saves the school money. Care and Repair, for the principal, is a way to incorporate expectations regarding use of the building with both educational and conservation goals.

These are just two examples of the integrated efforts at Rocky involving both infrastructural and organizational factors. Throughout the following pages, we demonstrate that in addition to integrating building infrastructure and organizational culture, Rocky has synthesized electricity conservation and other environmentally responsible behaviors into a holistic organizational culture of conservation through the work of charismatic leaders, by communicating expectations and successes, through an enhanced sense of personal and group efficacy, all integrated into a holistic conservation culture.

**Leadership.** This study identified charismatic leaders at various levels in the organizational structure: one at the district level, one in school administration (the principal), and one in direct contact with students (the environmental
Charismatic leaders were identified by participants and were said to have inspired the cultural changes and energy conservation efforts at Rocky in various ways. Furthermore, student leadership associated with the environmental science club marked a substantial difference between Rocky and Poudre.

Leaders in the school district provide an institutional support framework for the conservation efforts within individual schools. In the late 1980s, the school designed prototype green schools (Dulaney Architecture, 1984). In 1999, the school district worked with an integrated design team to design high-performance sustainable schools (RB+B Architects Inc, 2010). In 2005, Fossil Ridge High School received LEED Silver Certification, and in 2008 Bethke Elementary (in PSD) was the first school in the nation to receive the new LEED for Schools Gold certification.

By the mid-1990s, the school district began offering rebates to schools that reduced their energy consumption on the basis of their energy savings, which are spent at the school’s discretion. More recently, the district began offering free energy audits to schools. Currently, the district works in collaboration with the U.S. Department of Energy, ENERGY STAR, and the Colorado Governor’s Energy Office in studies of building performance, design, and energy conservation. The district’s efforts were key to the initial changes in energy consumption across all four high schools, and one particular administrator at the district level was identified as offering essential support and resources to the subsequent efforts made at Rocky.

One key difference between Rocky and Poudre is the presence of charismatic leadership within the school. The principal of Rocky communicated to others both a personal commitment to environmental values and a new set of behavioral expectations. He effectively tied expectations about proenvironmental behaviors to the existing code of conduct called the Lobo Way (the Lobo is the school’s mascot) as well as through “Care and Repair.” As a charismatic leader, the principal empowered the head custodian by asking him to attend meetings and planning sessions, giving him responsibility for decision making and allowing him to set behavioral expectations among his custodial team. Furthermore, the principal communicated the school’s success with the district, the teachers and staff, the students, and the larger community.

Both students and other teachers also viewed the environmental science teacher at Rocky as a charismatic leader. He organized and maintained the recycling program, encouraged student involvement, and enhanced a sense of efficacy in students (Figures 2 & 3). As one student said, “The environmental science teacher is kind of an amazing guy because he’s really enthusiastic about it. He talks to the district or talks to [the principal] about changing
things to help conserve energy.” Teachers said that e-mail reminders about turning off lights and computers sent by the teacher motivated them and that the environmental science teacher at Rocky was a leader by example. Students described the teacher’s commitment and modeling to be exceptionally inspiring.

In contrast, none of the administrators or teachers at Poudre displayed the traits of charismatic leadership with regard to proenvironmental behavior. The principal at Poudre delegated primary responsibility for energy conservation to a temporary administrator. At Poudre, the environmental studies

Figure 2. Students at Rocky Mountain High School bring recycling from homerooms to recycling bins  
Note: Dave Swartz, Rocky Mountain Science Department.
teacher expressed a preference for the administration to create a top-down initiative for conservation: “I’d rather be the second cub scout.”

There was also a difference in student leadership at the two high schools. The environmental science class at Rocky is an Advanced Placement (AP) class, intended for motivated students looking to get college credit. Many of

Figure 3. Students from the Earth Systems Science Class empty the recycling bins into large 4 yard containers
Note: Dave Swartz, Rocky Mountain Science Department.
the students in the class were involved in the environmental club and are in charge of the successful recycling program. Each class room has a recycling bin, and once a week they are brought down to the lunchroom for collection (Figure 2). The students in the Earth Systems Science class coordinate these efforts and empty the recycling bins into large 4-yard collection bins outside (Figure 3), which are picked up weekly and taken to Denver for sorting and recycling. In a typical week, four of these large bins are filled and collected.

The students at Rocky are actively engaged with a variety of other conservation efforts. Each year they help with the hosting an environmental conference for high school students across the state, and they completed an energy audit of the school (in addition to the district’s energy audit). With the support of Fort Collins Utilities, they implemented the “Thanks a Watt” campaign,
where signs were placed over light switches throughout the school, reminding people to turn off the lights when leaving the room.

At Poudre, the environmental science class is a remedial course that satisfied the requirements of a third science credit. The different type of students taking environmental science, and the lack of opportunity for motivated students to become leaders in environmental education at Poudre, was a structural difference in opportunities for student leadership that contributed to the divergence in school cultures. Where teachers, staff, and administrators described students at Rocky as leaders, students at Poudre described past failures to make positive changes at their school, and no one mentioned students as leaders in conservation.

**Communication.** Communication and feedback related to behavioral expectations occurred through multiple levels and channels at Rocky. Operations Services at the district level regularly provided reports to schools on their energy consumption, often including information from all high schools. School administrators could use these reports not just to see their own performance but also to see how their school compared to others and noted that they are motivated to outperform the other high schools. Similarly, administrators, teachers, and students at both schools discussed the motivating role of competition in the school setting. Students at Rocky talked with pride about “beating” the other school in energy conservation, whereas students at Poudre were determined to find a way to “beat Rocky.”

Rocky communicated their success through e-mails, student-written school announcements, newspapers, posters, and parent’s newsletter (see Nelson, 2007). An administrator at Rocky said, “I think that what happened four or five years ago was when we started getting rebates and publicized to our staff, here’s an outcome that’s positive.” Participants expressed the importance of not only receiving feedback about the outcome of their actions but also getting an opportunity to talk about energy in a language that is meaningful to them. One student said, “I think another thing that really helped the school—they started doing a lot of graphs and charts, putting dollar amounts. It made it easier, it made a lot of sense to people when you put a dollar amount to it.”

Some of the data communicated in posters, reports, and other materials include reduction in carbon gases, tons of coal not burned, and dollars saved. An example of this tangible information is displayed in Figure 4. The operations department creates charts like these by translating kWh saved into carbon emissions and other equivalencies on the basis of data from the U.S. Environmental Protection Agency (EPA), which regularly updates emissions.
equivalencies on their website “Greenhouse Gas Equivalencies Calculator” (U.S. Environmental Protection Agency, 2010).

Participants said that effective communication was lacking at Poudre. As one teacher at Poudre said, “It’s almost ironic that we’re in the field of education and what we need is to educate the people about it.” Teachers said that effective communication would include reeducating teachers and students about energy savings and recycling. Teachers also felt that, unlike at Rocky, there was no effort at Poudre to communicate current energy savings or to communicate in meaningful terms. As one teacher said,

I wouldn’t know numbers associated with turning my lights off in my room, and how much it costs to heat. . . . Like, I had a computer projector on for 2 hours this morning. So how much of some easily understandable equivalent amount of energy could I understand? . . . Tell them a certain number of wattage or whatever—they don’t get that, but if you give it to them in some equal format then they’re like, “Oh! that’s equal to 72 peanut butter and jelly sandwiches. I know what those are.”

Communication is not an isolated activity; it works in relation to other aspects of organizational change. Leaders at Rocky used communication to express behavioral expectations and share successes, and communication about successful efforts was reported to enhance efficacy and inspire additional changes. Furthermore, communication occurred at multiple levels, as the school district communicated with schools and teachers, teachers communicated with school administrators and students, and school leaders communicated back to the district, their teachers and staff, and the students.

Efficacy and beliefs. Students and staff at both schools discussed the importance of feeling like their efforts make a difference or perceived efficacy. At Rocky, sense of efficacy was related to having the opportunity for responsibility and decision making. In 2004, the environmental club students at Rocky were allowed to choose how energy rebates would be spent. They chose to purchase wind power during the month of April to promote Earth Day and environmental awareness. Now, wind energy is purchased every April, and for longer blocks of time each year. One student said,

It [thinking about environmental problems] kind of makes you feel helpless, but then [the environmental science teacher] makes you feel
like you can make a difference because of your activity . . . so it makes you feel like this is actively how I can make a difference.

Students themselves described participation as enhancing a sense of group efficacy, and group efficacy was in turn said to inspire action. One student said,

I felt like that at first when I heard all this global warming and stuff; you think about it and it’s such a big problem, there’s nothing I can do. Once you start doing things and seeing the difference it makes, I think that’s just so important.

Another said,

You know, people can have a stereotype of teenagers as being all self-centered, but there’s lots of people in the school who care about it as something that could affect their environment and where they live. And I think people are pulling things together to improve it.

The head custodian at Rocky was empowered to participate in decision-making processes, which he said created new feelings of responsibility and efficacy. Because he attended meetings and was treated like an integral part of the school’s operations, he felt empowered to participate in changing custodial routine. Now, custodians clean using just security lighting before and after school hours, instead of turning the lights on when they first arrive and leaving them on until the end of the evening when cleaning is carried out. When asked what was different about Rocky from other schools he had worked at in the past, the head custodian said,

The environmental science teacher and his recycling program was really well organized, and it was taken more seriously. All the teachers would do their part about getting their recycling paper or whatever down on the first place to the recycling bin. That part just seemed more organized. Probably the big thing was, I wasn’t ever involved in meetings—then I went with [the principal]—and that sort of made me start thinking more about it. So then I went to those meetings and came here and just started evaluating the way the custodial department did things.

The role of personal efficacy, enhanced through empowered participation, was an important component of Rocky’s success. In addition to participation,
communication was also said to influence perceived efficacy. Students described how charts and graphs helped them understand the difference their actions made:

When you actually look at the numbers, it just shows you how big an impact you can have on little things like changing the light can have . . . by showing students, illustrating the difference it can make, it just puts in the back of their head, “Oh! I can do something.” (see Figure 4 for an example)

It is interesting that a sense of personal efficacy influenced behavior at school, even when this behavior was not in line with personal beliefs or behavior at home. This was expressed most frankly among teachers and staff. Some participants engaged in environmentally responsible behavior (such as turning off the lights when leaving the room, shutting down their computer at night, and recycling) at school, even though they did not do that at home and such behavior did not align with their personal beliefs, which were ambivalent regarding environmental concern or responsibility. Among the staff at Rocky, a sense of efficacy was described as more important than personal beliefs for motivating behavioral change in an organization where conservation is a clearly communicated behavioral expectation.

School culture, routines, and expectations. Rocky’s success is attributable to the creation of a holistic school conservation culture that integrated consistent expectations into a new behavioral standard. The first conservation activity at Rocky was the recycling program, launched by the school’s environmental science teacher in 1990. Initially focused on aluminum can recycling using bins in the hallway, each classroom now has its own recycling bin. In the renovation and expansion project completed in 2004, the school constructed a space used exclusively for recycling, and recycled paper, aluminum, glass, cardboard, and all plastics. Students are responsible for the recycling program, and participants described the recycling program as setting a consistent behavioral standard and creating a holistic approach to pro-environmental behavior.

The current principal was hired in the fall of 2001. During the summer of 2002, the new principal commissioned a school energy audit and explicitly communicated the importance of energy conservation. The principal utilized the existing code of behavior—called the Lobo Way—to help communicate cultural expectations. As changes were made throughout the school to reduce energy consumption, this brand began to embody the school’s commitment to environmentally responsible behavior. This motto (along with Care and Repair)
helped maintain a synthetic approach to a conservation culture. According to
the principal, the brands were educational tools that “embellish responsible
behavior in students,” and the ultimate goal was to “integrate the concepts
behind the brand into human existence.”

Part of creating a conservation culture is establishing behavioral routines
consistent with the value of energy conservation. One of the most significant
changes to occur at Rocky was a change in custodial practices, described
previously, which began during the 2002-2003 school year. Participants said
that it was only recently that all of the custodial staff had been trained when
hired to abide by the new routine, which helped to institutionalize and solid-
ify these norms. In 2003, the school’s technology staff also created an auto-
matic shut off system of the school’s computer labs.

Many participants recognized that the change in school culture occurred
gradually over time. One teacher said,

I’m starting my fourth year here, and basically it [being conscious of
energy consumption] started when I came over here because at the other
school it wasn’t something I concerned myself with, but then I came
here and it was something that [Rocky] really stood for, so I started
buying in.

Discussion and Conclusion

As stated earlier, US$6 billion is spent on the energy bills of U.S. public
schools annually, which is more what is spent on purchasing textbooks and
computers combined (Energy Star, 2010). There is great potential for reduc-
ing energy costs in existing buildings as demonstrated by the ENERGY
STAR labeled schools (Energy Star, 2010), yet less than 1% of schools in the
United States are ENERGY STAR certified.

Furthermore, Rocky Mountain High School, a traditionally inefficient,
decades-old public high school, was able to reduce its electricity consump-
tion by 50% between 2000 and 2007. This case demonstrates that older school
buildings can potentially reduce their costs by tens of thousands of dollars
through a comprehensive effort to promote conservation. Between 2006 and
2007 (the years of their most substantial savings thus far), Rocky generated
US$40,379 in total operations savings, above and beyond the substantial sav-
ings that had been generated before 2006. Compared to the baseline year of
2000, in which HVAC controls and other district-wide regulatory practices
were implemented, Rocky has saved more than US$76,000. These savings are
the direct result of behavioral modifications of staff and students across the
school. This suggests that though building new schools to the LEED standards might be one important way to reduce energy consumption, it is not the only way. One possible downside of LEED-certified buildings is the potential for mindlessness—not paying active attention to energy consumption—if the building is expected to “perform” on the basis of its design and construction materials, perhaps users would be less likely to act in environmentally responsible ways. The results of this study illustrate that substantial conservation at Rocky required conscientious effort by administrators, teachers, and students alike in addition to improvements made to facilities and operations. Thousands of existing schools have the potential to improve their performance and reduce costs, but this will likely require behavioral change, not just physical improvements to the buildings systems.

The question originally posed to us was, “What did Rocky do that was different than the other schools, and can we replicate this across the district?” The answer to this question is not just about what happened at Rocky; it’s about what Rocky accomplished in a school district committed to sustainability. Rocky was able to reduce its energy consumption by 50% because it is in a district that made a commitment to energy conservation and sustainability, supported leaders in all organizational levels, and provided policies and incentives in support of schools making a commitment to sustainability. In this context, Rocky made unprecedented change; it reduced its electricity consumption to levels below a newly built and certified LEED school. A set of interconnected efforts at Rocky inspired staff and students to change. Leadership, communication, and a sense of efficacy helped create a culture that values conservation and sustainability through clear behavioral expectations. This culture helped motivate and sustain their energy conservation efforts in the context of support and commitment from all levels of the organization.

This research confirms several findings in other studies, including the importance of charismatic (Conger & Kanungo, 1987; Conger et al., 2000) or transformational (Leithwood et al., 1996) leadership, particularly in organizational settings. This case study is consistent with past research suggesting that charismatic leadership can be effective without corresponding to a traditional leadership role (Leithwood & Jantzi, 1999), as the teacher at Rocky was a clearly identified charismatic leader in the school. This research is also consistent with other work on behavioral change that indicates the importance of efficacy in motivating behavioral change at the individual level (Ajzen, 1991) as well as in a group setting (Lubell et al., 2006, 2007).

In addition, our study supports the work of others (Higgs & McMillan, 2006) on the importance of modeling for environmental education within a school setting. Individual role models (such as the teacher and environmental
student club), as charismatic leaders, inspired behavior change and sustained motivation. School facilities and operations contributed to and supported the school’s efforts, providing structural support for conservation (through audits, the automated energy system, the designated space for recycling, etc.) as well as feedback and a means of participation (through rebates and the choice of how to use them). Individuals in the school, such as the head custodian and the students in the environmental club, were empowered to participate meaningfully in the school decision making, thus modeling participatory school governance and helping to foster a conservation culture (Higgs & McMillan, 2006).

Specifically in the realm of education, this research indicates the potential role of comparative feedback (Siero et al., 1996) in motivating student participation through school rivalry and competition. Emile Durkheim (1961/2002) was perhaps the first social scientist to note the motivating role of competition in education. The district produced a case of comparative feedback accidentally, by including all four high schools in their energy reports, which fed the competitive spirit of administrators, teachers, and students. Competition as a form of comparative feedback seems effective in motivating behavioral change in a school setting.

In this school, perceived efficacy, behavioral expectations, and organizational culture all motivated behavioral change, but no participants described changing their attitudes. Respondents indicated that even without a sense of environmental concern and without engaging in environmentally responsible behaviors at home, they participated in energy conservation and other efforts (such as recycling) within the organizational setting. This suggests that setting new standards is more important than changing environmental values.

Furthermore, different motivational factors were important for different participants. Charismatic leaders were motivated by their personal environmental values, whereas students and staff members were motivated by feelings of efficacy. Participants at all organizational levels responded to communication, particularly comparative feedback, and the district and the school made concerted efforts to communicate both expectations and successes.

Findings from this research suggest that creating comprehensive and lasting behavioral change within an organization requires efforts at multiple organizational levels. Changing organizational culture requires concerted effort from players within the various facets of the institution (Burke, 1994; Tudor et al., 2008). Like others (Tudor et al., 2008), this research demonstrates the complexity of behavioral change in an organizational setting and the interplay of both individual and institutional factors.

Other organizations seeking to create a conservation culture may find these recommendations worthwhile. Organizational change may be most effective
through a complex interplay of infrastructural and organizational factors and the participation of leaders at multiple levels of the organizational structure. Charismatic leadership was important for Rocky, as was communication of both expectations and outcomes. Perceived efficacy, enhanced through participation, inspired students and the custodial staff. Furthermore, proenvironmental behaviors were integrated into a consistent conservation culture. Creating cultural change within an organization may not only be multifaceted and complex but may also be the most effective way of translating new norms into everyday practice.

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Note

1. For the purposes of ENERGY STAR rating, energy performance is compared across similar buildings throughout the nature and scored on a scale of 1 to 100. For example, a rating of 50 indicates that the building performs better, in terms of energy consumption, than 50% of all similar buildings nationwide.

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Bios

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