Equitably Transforming Colorado's Schools

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ABSTRACT

Energy efficiency in buildings is critical to address the climate crisis. Within the building sector, schools present incredible opportunities for energy and emissions reductions, while also directly supporting more equitable benefits for all communities. And, as these school districts are challenged with bond passage for capital improvements, strategic energy management (SEM) has proven to be a solid offering to deliver direct low-cost savings while also helping to align the districts around energy plans.

To address school district challenges across Colorado, Xcel Energy partnered with the Colorado Association of School District Energy Managers (CASDEM) to deliver an SEM cohort that would benefit schools across the state, equitably bringing solutions both within and outside of Xcel Energy territory. The program provided school district energy managers with training on energy modeling, change management, and numerous other topics to support their energy/emissions efforts as well as to help them address new energy/emissions requirements in Colorado. The audience of this paper will learn about findings from this multi-jurisdictional approach to addressing schools, as well as takeaways they may apply in their own states.

State of United States Public Schools

According to the National Center for Education Statistics (NCES) there are 130,930 recorded K-12 schools in the United States; out of this number 97,568 are public schools (NCES 2023). Public schools represent about 5% of commercial building energy consumption and spend $8 billion on utility bills annually (CBECS 2018). In many communities, schools are also places to vote, shelter during emergencies, and gather as a community. This often means school facilities are operational during weeknights and weekends. Unfortunately, public spending on schools is grossly underspent. According to the Government Accountability Office (GAO) 2020 report, 50% of public-school districts are struggling to upgrade and maintain key building systems that ensure facilities are free from health hazards. This report also indicated that 41% of school districts need to upgrade or replace heating, ventilation, and air conditioning systems (Nowiski 2020). Additionally, about half of the school districts visited by the GAO, had moisture related problems including leakage, floor and ceiling damage. These types of problems are more than just structural, they impact the health and effectiveness of staff and students (Bink 2020). Several studies found breathing fresh air is critical for students to stay alert and healthy. These studies also found that low ventilation rates are associated with lower average daily attendance, slower speeds to complete tasks, and higher rates of suspension (Boese 2005). These health and safety issues disproportionately affect schools in disadvantaged communities. Disadvantaged

communities typically contend with dirtier air and are less likely to have a dedicated facility manager to spearhead facility improvements (Sheets 2009).

Schools are in critical need of energy efficiency support and strategic energy management (SEM) provides a platform and framework that is feasible for nearly all districts to implement with support (i.e. organizational and technical coaching support). SEM is a comprehensive approach to managing energy that focuses on low to no cost operations, maintenance, and behavioral projects. Core to SEM is developing an energy policy, implementing energy efficiency projects, and engaging employees, staff and students and continually improving through measured energy results. As schools continue to operate in complex landscapes from macro-economic factors, to shifting district priorities, legislative impacts and a growing need for climate resilience, SEM is the pathway to support schools in their journey to decarbonize. SEM drives schools to become more energy efficient and resilient in a cost-effective way. Successful SEM reduces operational costs and can have a direct and positive impact on teaching quality – in addition to improvements in learning environment through better ventilation and lighting.

Colorado Public Schools

In Colorado, there are 179 school districts, broken down into 1,927 schools that provide services to 883,264 public school students (CO Dept of Education 2024). Xcel Energy's territory spans most of these school districts, servicing the Denver metro area, much of the Front Range and Grand Junction. K-12 Schools represented large energy savings opportunities for Xcel Energy. Xcel recognized this opportunity and market need that could be addressed through implementing an SEM program. With market analysis completed, Xcel Energy collaborated closely with an established and trusted entity in the K-12 schools' sector, the Colorado Association of School District Energy Mangers (CASDEM) to socialize an SEM offering. CASDEM was established in 1998 by a handful of school district energy managers from across the state of Colorado as an informal networking group. Since its inception, CASDEM has grown to include fifty members from schools across the state. This group meets regularly to discuss key topics such as utility offerings, federal and state funding opportunities, and benchmarking requirements (CASDEM 2017). The energy managers in CASDEM represent districts from across a variety of utility territories and providers. The map below illustrates the patchwork of Colorado energy providers.

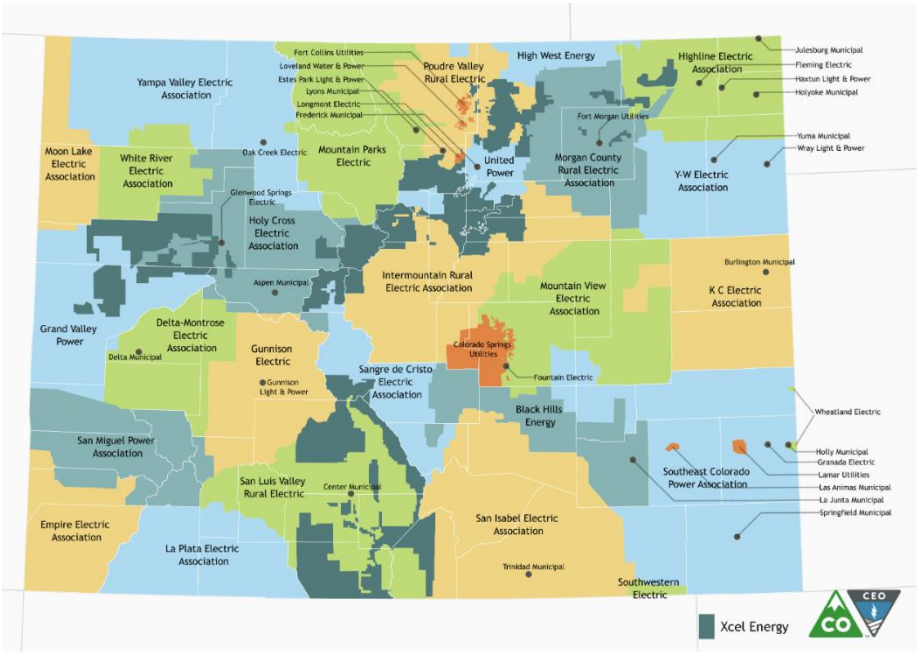

Figure 1: Colorado Electric Utilities Service Territories. *Source*: U.S Energy Information Administration: Colorado State Energy Profile.

After a year of program design conversations, CASDEM and Xcel with support from Stillwater identified a shared value proposition to deliver a Community SEM cohort offering to the energy managers who participate in CASDEM regardless of their utility provider.

- For CASDEM members, an SEM cohort program would formalize energy management practices, provide energy training and tools to track energy use and build upon relationships within the CASDEM community.
- For Xcel, an SEM cohort program created a pathway for Xcel to provide services to customers in their territory, claim energy savings, share energy efficiency incentives, program initiatives, and build relationships between Xcel account managers and their customers.

CASDEM Strategic Energy Management Program Design

Community strategic energy management cohort design incorporates both peer to peer learning and one on one training while delivering energy savings for Xcel. For Xcel's CASDEM SEM program, the following key elements included:

- SEM Training Workshops – SEM Workshops are an excellent place to leverage the knowledge across school districts and share best practices, lessons learned and deploy training in key energy management topic areas. School districts are prime candidates for a cohort program as they are often collaborative and enjoy working with other districts. In this way, SEM Workshops complemented existing CASDEM meetings with additional training and information. Workshop content was designed for energy

managers and their energy teams to understand and analyze energy data, engage students, staff, and faculty, and develop strategies to optimize operations.

To support districts across utility territories, Stillwater included Account Managers from additional utilities to join workshops and connect with their customers. Stillwater leveraged break out room functionality to give energy champions a chance to meet with their account representatives in a one-on-one setting.

- Partner Peer Coaching Calls – Stillwater held monthly coaching calls with all cohort participants. Often participants paired up during calls to foster peer to peer learning and sharing. Throughout the program year, participants shared shutdown, startup checklists, best practices with EV buses, COVID operational challenges, and energy/sustainability policies, etc. with the rest of the cohort.

- Energy Management Assessments (EMA) – EMAs for the CASDEM SEM program were held in a virtual format using Northwest Energy Efficiency Alliance's (NEEA) EMA tool. EMAs were conducted with school representatives (i.e. facilities team members, energy champion, executive sponsor) to assess current energy management practices and develop an action plan to improve upon existing practices.

  For School Districts that were not in Xcel's territory, schools were given the opportunity to join a fellow Xcel-territory school district's EMA and listen in on their discussion and consider applying these concepts to their own sites. EMA results were also reviewed in aggregate during the following workshop. This analysis helped guide EMA discussion and focus across all districts. Additional details are below.

- Control Scans/Energy Scans – Stillwater conducted building control scans for all school districts. Each school district selected two schools to conduct a building controls scan at. This activity was an innovation Stillwater started implementing during COVID to overcome challenges with going onsite. This innovation led to great success in identifying opportunities while keeping implementation costs low.

  These were one-hour virtual building control scans at select sites. Each school district selected two sites to conduct a virtual controls scan. Virtual controls scans were attended by school district energy team members and Stillwater's controls expert.

  Like most commercial buildings, Stillwater found most opportunities were related to HVAC. During the program implementation period, most districts were operating under COVID guidelines (night flushes, high levels of outside air, etc.) For school districts, changing these set points meant gaining school board approval to do so. This was a common discussion point during workshops and coaching calls.

For schools in Xcel's territory, Stillwater conducted half day energy walkthroughs in addition to their virtual control scan. Onsite energy walkthroughs were with site staff and account representatives to identify energy efficiency opportunities at their schools.

Schools' outside of Xcel's territory, completed an energy walkthrough checklist with their energy team to identify energy efficiency opportunities, this checklist was then reviewed by a Stillwater coach and Stillwater developed a common opportunity register to support implementation of energy efficiency projects. The opportunity register was used as a discussion point during coaching calls and cohort workshops.

- Energy Models – Each school district in Xcel's territory that also had access to 15-minute interval data received a facility wide energy model for two to three of their school sites. Stillwater collaborated closely with each school district to identify sites using the following criteria: energy consumption, energy use intensity (EUI) and ease of SEM implementation (i.e., the presence of a student led green team, openness to energy efficiency practices).

  Stillwater has found working with established Green Teams is an excellent way to engage students and ensure long term success of energy management practices. Typically, Green Teams are led by a faculty or administrative advisor and made up of students interested in sustainability, energy, and science types of activities. We have found Career in Technical Education (CTE), and Science, Technology, Engineering and Math (STEM) students are interested and engaged in SEM activities. This is an excellent group of students to engage with for energy scans, modeling, and staff engagement. In some cases, Stillwater will support Green Teams by attending their meetings or walking the school with these student lead teams to identify energy efficiency opportunities. Sophistication of these teams depends on the age of the students and support from faculty/staff.

  For schools outside of Xcel's territory, Stillwater worked with each school to gather monthly energy data and build an energy model. These models were less granular but provided enough data to identify high-level trends and ask questions. Stillwater delivered energy modeling training during one of the six cohort workshops, to empower energy managers to build their own energy models or use tools like Department of Energy's Energy Performance Indicator (EnPI).

- Community hub to share information – To facilitate collaboration, Stillwater hosted a Colorado Schools SEM SharePoint site to house information for each school district and to encourage interaction across districts. Site specific information like energy models, opportunity registers and EMA results were stored in a secure location for each school district to access. In addition to site specific pages, there were community pages where energy champions could share helpful information and resources with each other.

- Energy Star Portfolio Manager Support for Building Performance Standards (BPS) - Colorado passed building performance standards that impacted many school districts in the CASDEM SEM Program. House Bill 21-1286 required Colorado Energy Office (CEO) to develop a statewide benchmarking program that requires commercial buildings of 50,000 square feet or larger to report their annual energy use to CEO (Energy Performance for Buildings 2022). Stillwater supported school districts to meet these requirements through troubleshooting issues around Energy Star Portfolio Manager, setting up the automatic data port over from the utility side, and reminding energy champions of upcoming data deadlines.

SEM & Disadvantaged Communities

Almost 40% of school districts enrolled in the CASDEM SEM program qualified as disadvantaged communities and several of these schools were Title 1 schools (NCES). In the state of Colorado, the Colorado Department of Public Health and Environment (CDPHE) defines disadvantaged communities as meeting one of the following metrics (CDPHE 2021):

- Median Household Income (MHI) - Data that divides county households into two parts with half earning more than the median income and the other half earning less.
- Median House Value (MHV) - Data that divides the value distribution into two parts with half of the houses falling below the median value and half above.
- County 24-month Unemployment - 24-month average of those who are jobless, actively seeking work and available to take a job as compared to the total labor force.

Anecdotally, across these school districts:

- More energy efficiency opportunities were found during the energy scan (includes both in-person and virtual controls scan) as compared to the non-disadvantaged SEM schools.
- Schools were chronically understaffed.
- Facilities team were at odds with teachers and administrative staff. Typically, this was illustrated through the increased use of personal appliances in classrooms and hot and cold calls.
- Often these sites were aware and applying for federal funding to support energy efficiency and emissions reduction activities.

SEM For CASDEM Program Results

The program supported eight school districts across the state of Colorado over a twelve-month period, of these eight districts five of them were within Xcel Energy territory while the other three were not. Recruitment for this program was primarily conducted through the existing partnership with CASDEM and because of this Stillwater anticipated a larger number of organizations to enroll in the program. However, many school district energy managers were contending with high levels of district turnover and continued challenges from the COVID-19 Pandemic. As stated above, school districts participated in bi-monthly workshops, partner peer coaching calls, Energy Management Assessments (EMAs), Energy Scans and developed Energy

Models. Most school districts in the CASDEM for SEM Cohort would be considered first year SEM participants. We aggregated results from the first year Energy Management Assessments, Energy Scans and Energy Models and found the following:

Energy Management Assessments

We analyzed the top EMA priorities across each school district by taking individual results from each EMA and aggregating them together across the cohort. For schools in the CASDEM for SEM program, the top three EMA priorities were to:

- Develop key performance indicators (KPIs) and targets. Stillwater observed that school districts in the CASDEM SEM program often had access to 15-minute interval data through the installation of e-gauges but did not have KPIs or targets associated with the data. In the chart below, Monitoring and Analysis scored low as a priority level because most schools have submetering systems in place. This illustrates the need to not only have access to high quality data but to also develop meaningful metrics with this data. Developing KPIs and targets helped school districts to identify if they are on track or not. KPIs are also easier for an energy champion to report on across their district.

- Allocate sufficient resources to support energy management. Not surprisingly, school district staff identified the common challenge of being under-resourced. School district energy champions described recent turnover throughout their district from teachers to facilities teams to administrators. Transitions made buy-in from district stakeholders a challenge to gain and maintain.

- Develop holistic action plans that included capital, operations, and maintenance opportunities. Stillwater found that school districts often did not have up to date project lists that included capital and low to no cost energy efficiency measures. Energy champions pointed to the lack of funding as a cause of not having updated project lists. Most school district funding for capital projects come from the passage of bonds. This further emphasizes the value of SEM, where identifying low to no cost energy savings can have a large impact on schools.

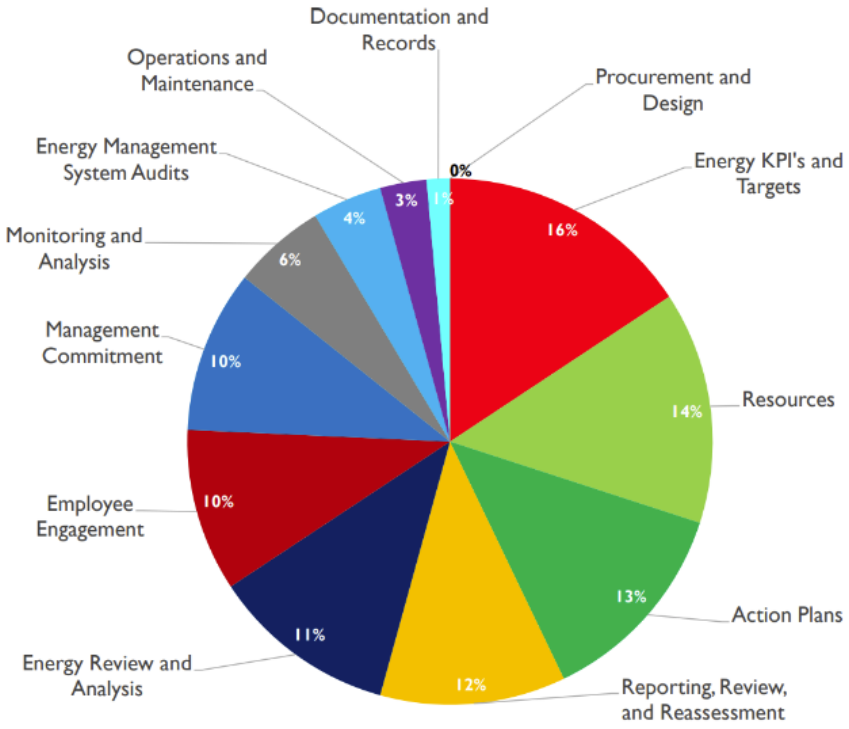

Figure 2: Aggregate energy management assessment topic levels by priority. *Source:* SEM for CASDEM Workshop 3

Stillwater reviewed the aggregate output of EMA results across the cohort with district Energy Champions during cohort Workshop 3. Energy Champions were surprised and relieved to see fellow cohort members who dealt with the same challenges. This further highlighted the importance of sharing challenges in a collaborative cohort setting can leave people feeling uplifted and drive action and negate the feeling of 'going it alone.'

Energy Scans

Each school district enrolled in the program, received at minimum a virtual controls scan. Five out of eight or 63% of the school districts received an in-person energy scan. The following chart breaks down energy opportunity type across the districts.

- Far and away the most common opportunities were found in the Heating Ventilation Air Condition (HVAC) systems. After reviewing schools sequencing and schedules it became clear that almost all schools were operating under COVID guidelines. Despite program implementation running from 2022-2023, Stillwater observed school districts were very conservative in their approach to "return to normal" operating conditions. Districts often had to seek school board approval to update their COVID operating procedures. COVID operations significantly impacted energy use as schools conducted night flushes and were conditioning nearly 100% outside air.

During the cohort program, through school board approval, per SEM cohort program recommendations alongside American Society of Heating Refrigeration and Air conditioning Engineers (ASHRAE) guidelines, school districts slowly began to return to pre-COVID operations.

- The second largest energy saving opportunity was updating lighting to LEDs. Despite incentives from Xcel existing, many schools had significant opportunities for lighting upgrades. Stillwater attributes this to budget constraints, limited awareness, resistance to change and prioritizing other projects. To support increased awareness and potential adoption of LEDs, Stillwater conducted a lighting strategy session during a cohort workshop and invited Account Managers from Xcel and other territories to share their lighting incentive and rebate programs.

- The third largest opportunity for schools were behavioral opportunities. For school districts, they often battle the use of classroom appliances from additional lighting, microwaves, fans, etc. to make a classroom feel more comfortable for students and teachers. Through conversations with energy champions, one effective way to manage this is to avoid banning personal appliances but instead create an approved personal appliance list. This is often easier for facilities teams to enforce and easier for administrators to abide by.

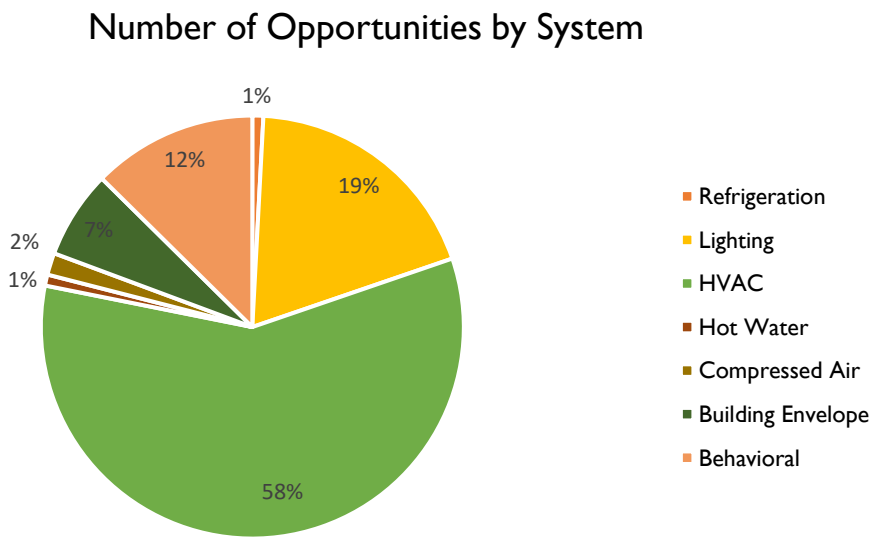

Figure 3: Breakdown of Opportunity Type across School Districts from both virtual and in-person energy scans. *Source*: SEM for CASDEM Opportunity Registers.

Energy Savings

Through the first year of the SEM program, each site saved on average 2.4% annual normalized energy savings. These savings results align with similar SEM program which typically anticipate

annual savings ranging between 2% - 5%. Additionally, the increased savings realized in the second year of site participation generally supports the expectation that annual savings will remain constant or increase in the second year of participation. The expectation of increased savings is driven by the continued growth of the participants' SEM knowledge and sophistication as they spend more time in the program (North American Strategic Energy Management Collaborative, 2021). The table below illustrates first year SEM savings in the SEM for CASDEM program. Due to availability of specific required utility data only six sites in the cohort were assessed for savings. We acknowledge that this is only a subset of the cohort, and we'd expect the results indicated here to be conservative.

Site	Year 1		
	Total Modeled Energy Savings (kWh)	**Percent Annual Savings (%)**	**Avoided Energy Cost* (used an average kWh cost in the US)**
District 1 – School 1	25,616	1.1%	$4,354.72
District 1 – School 2	36,095	2.3%	$6,136.15
District 1 – School 3	17,459	1.3%	$2,968.03
District 2 – School 1	107,075	4.4%	$18,202.75
District 2 – School 2	16,315	3.4%	$2,773.55
District 2 – School 3	19,015	1.7%	$3,232.55
Total	**221,575**	**2.4%**	**$37,667.55**

Figure 4: Energy savings, percent annual savings and avoided energy cost per school district. Please note due to availability of specific required utility data, only six sites in the cohort were assessed for savings. We acknowledge this is only a subset of the cohort and we expect the results indicated here to be conservative. *Source:* SEM for CASDEM Energy Models.

Cohort Success

To wrap up the cohort program, Stillwater facilitated a celebration workshop that gave district energy champions and their teams a chance to tell their energy management story to other cohort members. The goal of a celebration workshop is two-fold: one to ensure cohort members celebrate their successes individually and as a cohort as they have accomplished the program together and two to provide information and ideas for energy managers to share back with management at their school districts. Sharing successes is a core component to drive continued SEM success. Energy champions across the districts described the following success:

- Optimized mechanical systems that led to large energy savings.
- Developed cross functional meetings with electrical and mechanical departmental leads; Energy management is a team activity.
- Cohort model created a great sanity check as to what others were focusing on and where they are finding successes.
- Cohort model helped districts achieve higher level of interdepartmental collaboration.
- Use energy models to drive decision-making and share with key staff.

- Shared an updated 2023 Energy Policy and Sustainability Plan that was approved across the district.
- Initiated LED lighting upgrade projects across the district.
- Training, knowledge gaps, and Standard Operating Procedures are a big way to have long-term success from the people side of things.

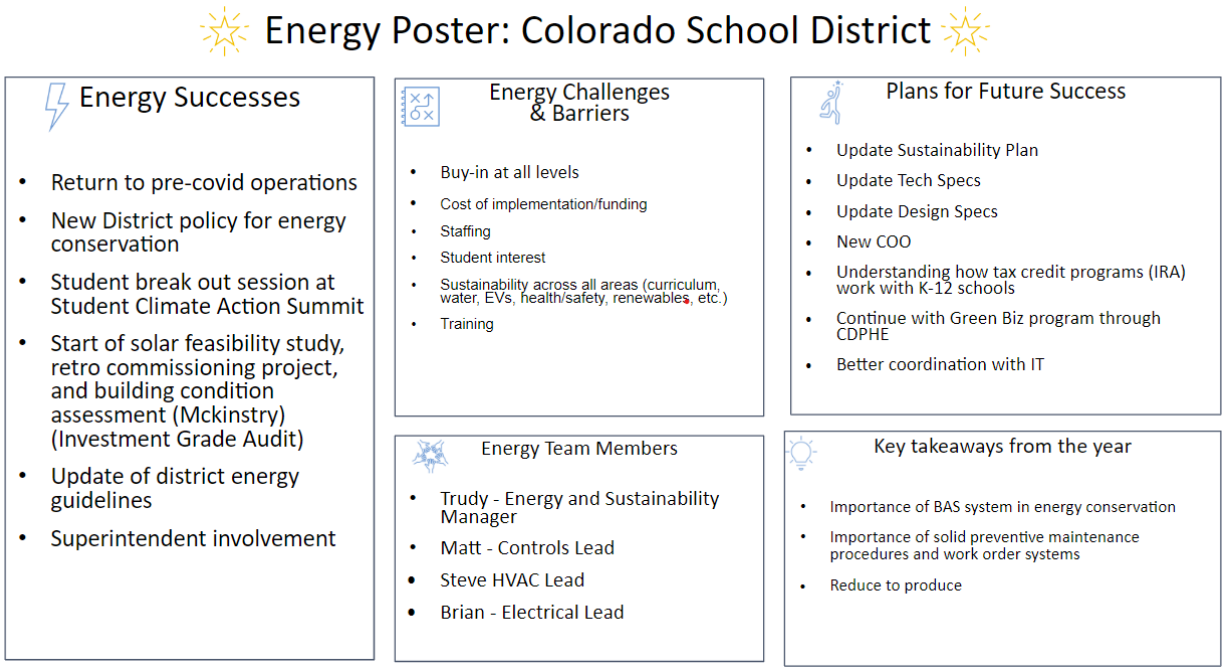

Figure 5: Anonymized School district energy poster developed and presented at celebration workshop. *Source:* SEM for CASDEM Workshop 6

Conclusion

What's next for Colorado

Xcel Energy put out a Request for Proposal (RFP) based on successes from the pilot Strategic Energy Management Cohort Program last summer. Stillwater successfully bid on the SEM cohort program is awaiting next steps. Stillwater is hopeful that the successes from the CASDEM for SEM program will lead to broader adoption of SEM in school districts within Xcel's territory as well as continuing to consider community SEM an approach to claim energy savings through innovative avenues.

Applying Methodology Beyond Colorado

SEM gives schools the tools they need to implement energy management practices at low to no cost. This proven framework can support schools and communities to create healthier environments for students, staff, and administrators to work in and benefit from, while shifting operational funds from building operations to teaching. A community SEM cohort approach leverages the cohort model to deliver training to customers in utility territories without an SEM offering. Recommendations to deliver a Community SEM program:

- **Socialize SEM with organizations in your community and leverage existing relationships.** These organizations include energy providers, state agencies and community-based organizations. Working directly with community-based organizations can lead to more successful recruitment and a more equitable approach to energy efficiency.
- **Developing a Community SEM program/offering takes time**. Designing a program like this takes time because there are many partners to convene and gain insights and feedback from. This is a critical component in thoughtful design of an SEM program offering.
- **Schools need implementation support.** There is no shortage of available resources for schools to review however most of these guides require significant amount of time to digest and implement. Working with local agencies to implement an SEM program provides schools with technical support they need to prioritize energy savings and act on energy saving opportunities, apply for grants/rebates, etc.
- **Schools are excellent candidates for Community Cohorts**. Schools are typically very collaborative in nature; they enjoy learning from each other and are not concerned about sharing proprietary information.
- **Disadvantaged Communities greatly benefit from programs like SEM**. Investing in energy efficiency through SEM improves air quality, creates healthier homes, reduces energy costs, creates jobs, and increases budgets available for teaching.
- **Utilities maybe keen to supporting schools through an SEM Cohort to complement existing energy services company efforts (ESCO)**. Community SEM provides a platform to claim savings.

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