

**Rancho Bernardo High School  
&  
Bernardo Heights Middle School**

**Cost Savings Analysis for HVAC System  
Modernization**

prepared for:



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## 1. Executive Summary

The purpose of this report is to document the findings of a cost savings analysis for the proposed HVAC modernization project at Rancho Bernardo High School and Bernardo Heights Middle School.

The HVAC system consists of a central plant that provides chilled water and hot water to air handling units serving each building at the high school and middle school. Most of the existing air handling units are approximately 20 years old and some are over 30 years old. Based on site observations and American Society of Heating, Refrigerating, and Air-Conditioning (ASHRAE) data for this kind of HVAC equipment, these units are near the end of their service life.

The chilled water system has several operational deficiencies, especially at the high school. These deficiencies include leaks in the underground chilled water distribution piping, which lead to loss of chilled water and increased water treatment costs. As a result, not only is energy being wasted through the chilled water, but the system cannot effectively provide cooling as needed.

The existing central plant is currently outfitted with the original equipment, which is over 30 years old. Due to the majority of this equipment being non-functional, an air-cooled chiller is currently being rented and employed to augment the available cooling capacity. This rental equipment imposes a significant cost on the district.

The proposed HVAC modernization project consists of the following major scope items:

- Install a new chiller plant that provides high efficiency and redundancy
- Install a new boiler plant that provides high efficiency and redundancy
- Remove the existing non-functional thermal energy storage system
- Replace leaking underground piping with new above-ground piping (DSA approved design)
- Install packaged DX (direct-expansion) rooftop HVAC units for about 80% of the middle school buildings

Based on this information, we developed spreadsheet-based energy calculations to estimate the reduction in operating cost that will reduce from the HVAC modernization. The two key cost savings are (1) significantly improved efficiency for the central chilled water plant, and (2) elimination of the monthly cost for the rental chiller, which we have been informed is \$22,000 per month.

The total annual cost savings for the HVAC modernization project is estimated to be approximately \$610,000 per year. This savings is comprised of:

- \$264,000 per year saved due to elimination of the rental chiller
- \$346,000 per year in energy cost savings due to improved energy efficiency

## 2. Overview of Project Site

Founded in 1962, the Poway Unified School District (PUSD) includes 41 schools serving nearly 35,000 students. PUSD is the third largest school district in San Diego County and serves students from an area of approximately 100 square miles.



Rancho Bernardo High School (RBHS) first opened in 1991. Enrollment during the 2023-2024 school year was 2,278 students, supported by a teaching staff of 89 FTEs.

Bernardo Heights Middle School (BHMS) began as a trailer campus in 1988 during construction of the current campus. The permanent campus opened in 1990. Current enrollment is about 1,500 students between Grades 6-8, supported by a student-teacher ratio of 23:1. The middle school shares a central driveway with RBHS.

Both schools are served by a central plant that provides chilled water and hot water for space conditioning. Chilled and hot water is distributed through underground pipes to individual air handling units (AHUs) serving each building.

A Thermal Energy Storage (TES) system is installed but has not functioned for many years and is essentially abandoned in place. Due to changes in SDG&E time-of-use (TOU) rate periods, the most expensive energy cost now occurs between 4 PM and 9 PM, which does not align with peak HVAC use in either school. As a result, the implementation of a TES system has lost significant value.

### 3. Analysis Methodology

#### 3.1 Baseline Information

The following baseline information was used in the cost savings analysis:

- RBHS building area = 220,000 SF
- BHMS building area = 110,000 SF
- Average electrical cost = \$0.40 per kWh
- Average natural gas cost = \$0.80 per therm
- The baseline (current conditions) chiller plant efficiency accounts for the rental chiller
- The rental cost for the temporary air-cooled chiller is \$22,000/month (\$264,000/year)
- While maintenance costs for HVAC systems are significant, and more so for aging equipment, we have not accounted for maintenance cost savings in the analysis.

#### 3.2 Calculation Methods

Spreadsheet-based calculations based on Equivalent Full Load Hours (EFLH) for cooling equipment and annual operating hours for fan systems have been used. This calculation method is consistent with the methods taught by the Association of Energy Engineers (AEE) as part of their Certified Energy Manager (CEM) training. Electrical power requirements for baseline and proposed chillers, air handling units, and rooftop packaged units are based on typical load densities for education facilities in this climate, industry experience for efficiency of existing systems, and our design experience for the efficiency of new systems. Average energy costs are used to calculate cost savings.

#### 3.3 Savings

- The total annual cost savings for the HVAC modernization project is estimated to be approximately \$610,000 per year. This savings is comprised of:
  - \$264,000 per year saved due to elimination of the rental chiller
  - \$346,000 per year in energy cost savings due to improved energy efficiency

#### 3.4 Additional/Non-Quantified Savings

- The following sources of additional savings have not been quantified, but likely would add significantly to the annual cost savings:
  - Loss of chilled water due to pipe leaks
  - Increased water treatment costs due to pipe leaks
  - Increased maintenance for aging, existing equipment
  - Reduced thermal comfort and associated productivity impact for students and staff

# 4. Appendices

## 4.1 Cost Savings Analysis

Rancho Bernardo High School/Middle School  
 Economic Comparison: Existing HVAC Systems vs. Propose Modernization  
 Prepared by MA Engineers

<b>Buildings</b>			<b>HVAC Assumptions</b>	
RB High School	220,000	SF	1,750	Equivalent Full Load Hours for HVAC (cooling @ high school)
RB Middle School	110,000	SF	1,250	Equivalent Full Load Hours for HVAC (cooling @ middle school)
Average Electrical Cost	\$ 0.40	per kWh	2,500	hours per year for fan operation (high school)
Average NG Cost	\$ 0.90	per therm	2,125	hours per year for fan operation (middle school)
<b>Existing HVAC</b>			400	SF/ton cooling load density
CHW/HHW AHUs for HS and MS			1.50	W/CFM Baseline
Chiller Plant + Temp Chiller			1.50	W/CFM Proposed (same as baseline, as no new AHUs are included under this project.)
Central Boiler Plant			1.00	CFM/SF (Baseline and Proposed)

<b>Existing HVAC Issues</b>	<b>Notes</b>
Leaking underground CHW pipes	1 Baseline chiller plant efficiency accounts for mix of water-cooled and air-cooled chillers
AHUs are 15+ years old	2 Estimate for rental chiller is \$3K/month
Temporary (rental) air-cooled chiller required	3 Monthly rental charge for temporary chiller is \$22,000 per month

**Proposed HVAC System**  
 Replace CHW piping with above-ground  
 New 3 x 300T (N+1) Water-Cooled Chiller Plant  
 Existing AHUs to remain, except for RTUs below  
 New Rooftop Packaged Units to serve 80% of MS (20.0% served by central plant)

<b>Existing Costs</b>											
Rental Cost, Air-Cooled Chiller	\$ 264,000	per year									
Existing AHU Energy Cost	\$ 469,755	per year	330,000 SF @	1 CFM/SF	330,000 CFM @	1.5 W/CFM =	495 kW x	2,373 hrs/yr =	1,174,388 kWh/year x	\$ 0.40	
Existing Chiller Plant Cost	\$ 606,375	per year	330,000 SF @	400 SF/ton =	825 tons @	1.1 kWh/ton-hr =	866 kW x	1,750 EFLH =	1,515,938 kWh/year x	\$ 0.40	
<b>Baseline TOTAL</b>	<b>\$ 1,340,130</b>										

<b>Proposed Costs</b>											
MS Rooftop Unit Energy Cost	\$ 132,000	per year	88,000 SF @	400 SF/ton =	220 tons @	1.2 kWh/ton-hr =	264 kW x	1,250 EFLH =	330,000 kWh/year x	\$ 0.40	
Proposed AHU Energy Cost	\$ 344,487	per year	242,000 SF @	1 CFM/SF	242,000 CFM @	1.5 W/CFM =	363 kW x	2,373 hrs/yr =	861,218 kWh/year x	\$ 0.40	
New Chiller Plant Cost	\$ 254,100	per year	242,000 SF @	400 SF/ton =	605 tons @	0.6 kWh/ton-hr =	363 kW x	1,750 EFLH =	635,250 kWh/year x	\$ 0.40	
<b>Proposed TOTAL</b>	<b>730,587</b>										

<b>ANNUAL COST SAVINGS \$ 609,543</b> (energy + rental chiller cost savings)
<b>Other economic factors not included above:</b>
Loss of chilled water due to pipe leaks
Increased water treatment costs due to pipe leaks
Reduced thermal comfort and associated reduction in student and staff productivity
Increased maintenance for aging equipment
Aging equipment will require replacement in next ~5-7 years

## 4.2 SDG&E Utility History

Note: Electrical consumption values below are total consumption, without impact of PV, for each meter serving the two campuses. Data extracted from 15-minute interval data provided by client.

<b>SDG&amp;E Meter # 06561874</b>		
<b>Date Start</b>	<b>Date End</b>	<b>Elec. Cons (kWh)</b>
9/1/2024	9/30/2024	120,393
10/1/2024	10/31/2024	243,550
11/1/2024	11/30/2024	229,435
12/1/2024	12/31/2024	265,015
1/1/2025	1/31/2025	179,152
2/1/2025	2/28/2025	134,016
3/1/2025	3/31/2025	152,350
4/1/2025	4/30/2025	140,590
5/1/2025	5/31/2025	166,476
6/1/2025	6/30/2025	163,200
7/1/2025	7/31/2025	134,442
8/1/2025	8/31/2025	233,598
9/1/2025	9/30/2025	112,060
<b>TOTAL (12-Month)</b>		<b>2,274,277</b>

<b>SDG&amp;E Meter # 06696973</b>		
<b>Date Start</b>	<b>Date End</b>	<b>Elec. Cons (kWh)</b>
9/15/2024	9/30/2024	10,682
10/1/2024	10/31/2024	22,551
11/1/2024	11/30/2024	18,211
12/1/2024	12/31/2024	20,228
1/1/2025	1/31/2025	21,238
2/1/2025	2/28/2025	19,655
3/1/2025	3/31/2025	20,236
4/1/2025	4/30/2025	16,412
5/1/2025	5/31/2025	16,997
6/1/2025	6/30/2025	14,543
7/1/2025	7/31/2025	13,616
8/1/2025	8/31/2025	16,829
9/1/2025	9/14/2025	8,380
<b>TOTAL (12-Month)</b>		<b>219,578</b>

Note: Electrical consumption values below are total consumption, on-site generation from PV, and net consumption (consumption - PV generation) for each meter serving the two campuses. Data extracted from 15-minute interval data provided by client.

<b>Meter #</b>	<b>Elec. Cons. (kWh/yr)</b>	<b>PV Gen (kWh/yr)</b>	<b>Net Cons. (kWh/yr)</b>
06696973	219,578	87,349	132,229
06561874	2,274,277	1,001,375	1,272,902
<b>TOTAL (kWh/Yr)</b>	<b>2,493,855</b>	<b>1,088,724</b>	<b>1,405,131</b>