

Memo

To: David O'Conner
CC:
From: Tim Holmes,
Date: June 17, 2021
Subject: Addendum to two Memos

This Addendum updates the tables that were included in:

1. Memo-THUSD-EMP-180219-Amended, dated March 1, 2018
2. Memo-TUHSD-Pool Solar Heat-150630, dated June 30, 2015

Each of these original memos is included as attachments 1 and 2 to this Amendment.
The results of each has been updated to account for:

- Updated Installation Costs
- Updated Utility Costs
- Updated Utility time-of-use periods

The updates above resulted to changes in Table 1, Table 3, and Table 4 of Memo #1, above, and to the Summary Table in Memo #2, above. Kenwood Energy was asked to exclude updates to lighting cost and savings at this time.

Highlights

1. Changes to costs were minimal except related to Solar Hot Water for Pools.
2. Savings values changed due to significant changes in rate costs and structure.

Table 1 - Project Summary

	Lighting	Cogen	PV	HVAC	Total
Cost		\$1,222,754	\$2,124,235	\$1,164,170	\$4,511,159
Rebate		\$97,500	\$0.00	\$0.00	\$97,500
CEJA Funding		0	0	0	0
Net Cost		\$1,105,754	\$2,124,235	\$1,164,170	\$4,394,159
Added Maintenance \$		\$23,260	\$21,242	0	\$44,502
Annual Savings		\$235,047	\$158,174	\$13,115	\$406,336
IRR		21%	10%	-5%	10.4%
Equipment Life		15	25	20	
NPV		\$2,177,294	\$2,399,047	\$(748,353)	\$7,221,692

Table 3 – Cogeneration Summary

	Tam HS	Redwood	Drake	Total
Rated kW	65	65	65	195
Installed Cost	\$398,426	\$398,426	\$425,903	\$1,222,754
SGIP Rebate	\$32,500	\$32,500	\$32,500	\$97,500
Net Cost	\$365,926	\$365,926	\$393,403	\$1,125,254
kWh Generated	516,881	516,881	516,881	1,550,643
Net Savings	\$69,924	\$95,198	\$69,924	\$235,047
Annual Maintenance	\$18,091	\$18,091	\$18,091	\$23,260
Internal Rate of Return	16%	24%	15%	21%
Net Present Value	\$524,749	\$914,526	\$497,272	\$2,177,294

Table 4 – Solar PV Summary

	Tam HS	Redwood	Drake	Total
Net Installed Cost	\$802,660	\$175,875	\$1,145,700	\$2,124,235
kW DC	200.67	70.35	286.43	557.44
Annual Energy - kWh	300,154	105,229	428,434	833,818
Value of Energy	\$49,497	\$25,730	\$82,947	\$158,174
BAU Energy Costs	\$78,859	\$168,737	\$226,244	\$473,840
Non By-Passable Charges	\$17,180	\$44	\$60,369	\$77,592
Max Savings	\$61,679	\$168,693	\$165,875	\$396,247
% of Max offset	80%	15%	50%	40%
Internal Rate of Return	5.4%	16.4%	7.1%	7.4%
Net Present Value	\$260,764	\$434,833	\$684,246	\$1,379,843

Table – Solar Water Heating

	Redwood	Drake	Tam	Total
Square Feet of Panels	2,976	2,160	960	6,096
Therms Saved	9,707	7,045	3,131	19,883
kWh Saved (Used)	(2,633)	(2,633)	(2,633)	(7,899)
Cost Savings	\$10,256	\$7,328	\$3,023	\$20,607
Installation Cost	\$80,910	\$58,725	\$26,100	\$165,735
Estimated Rebate				
Net Cost	\$80,910	\$58,725	\$26,100	\$165,735
SPB	7.9	8.0	8.6	\$8.04
IRR	13.0%	12.8%	11.5%	12.7%
NPV	\$77,867	\$54,723	\$20,700	\$153,290

Attachment 1

Memo-THUSD-EMP-180219-Amended

Dated March 1, 2018

To: Lars Christensen
CC: David O'Conner, Dana Armanino, Pete Silveira
From: Tim Holmes, Donna Boysen
Date: March 1, 2018
Subject: Energy Management Project

Tamalpais Union High School District (District) has implemented a number of energy cost reduction projects over the past several years, including the installation of a large photovoltaic (PV) system and the installation of high efficiency LED lighting at Redwood High School. The projects were funded by the California Clean Energy Jobs Act (CEJA), which was created by the passing of Proposition 39 in 2013.

The District has about \$570,000 remaining of the total \$861,000 CEJA allocation. The District needs to spend these funds by June 30, 2020 on energy projects that pay for themselves through energy savings, or forfeit the funds. The District is considering leveraging the CEJA funds by combining additional funds from a lease or bond, or by entering into a Power Purchase Agreement (PPA), so that a more comprehensive project can be implemented.

The goal of this analysis is to develop an Energy Management Plan (EMP) that results in a preliminary budget and cash flow analysis to help the District decide which energy projects make economic sense, and to identify preliminary funding mechanisms to implement the projects.

Kenwood Energy considered four projects for this analysis:

Lighting: The District has analyses completed by the Smart Lights Program and Graybar Powersmart.

Cogeneration: The District has previously completed the installation of foundations and piping in preparation for the installation of cogeneration at the three high schools.

Heating, Ventilation and Air Conditioning (HVAC): The District has identified a number of HVAC units that are old and past their useful lives.

Renewable Energy: Kenwood Energy identified PV opportunities at each of the high schools.

Each of these projects is discussed in detail in the following sections.

Table 1 summarizes estimated installation costs and the results of the life cycle cost (LCC) analysis for each project, and the total for the projects combined.

Table 1

	Lighting	Cogen	PV	HVAC	Total
Cost	\$572,662	\$1,222,754	\$2,158,740	\$1,164,170	\$5,118,326
Rebate	\$14,855	\$117,000	\$0.00	\$0.00	\$131,855
CEJA Funding	\$518,893	\$0.00	\$0.00	\$68,509	\$587,402
Net Cost	\$38,914	\$1,105,754	\$2,158,740	\$1,164,170	\$4,467,578
Added Maintenance \$	\$0.00	\$23,260	\$32,381	\$0.00	\$55,641
Annual Savings	\$82,706	\$231,860	\$149,112	\$13,115	\$476,794
IRR¹	44%	23%	6%	-4%	11.5%
Equipment Life	12	15	25	18	
NPV²	\$1,929,504	\$5,593,345	\$1,661,102	\$(679,844)	\$8,504,107

Note: All Table Headings are defined in Exhibit 6.

The table above shows that the investment in each of the projects above results in significant life-cycle cost savings to the District, except for the HVAC project. The HVAC project is included due to pending maintenance and end-of-useful-life issues with some of the District's HVAC equipment. The "Total" column shows that when all projects are combined together, they still create a significant savings to the District.

There are a number of strategies that the District can use to pay for these projects. A general overview of the three most common are:

Capital Purchase: The District uses district funds to pay for the equipment. This requires a large out-of-pocket expense and the District is responsible for the operations and maintenance (O&M) of all of the equipment.

Finance: The District can finance the purchase of the equipment through a Lease, Bond, or standard financing tool. This spreads out the cost, often resulting in a positive cash flow from year one, but the District is still responsible for the O&M.

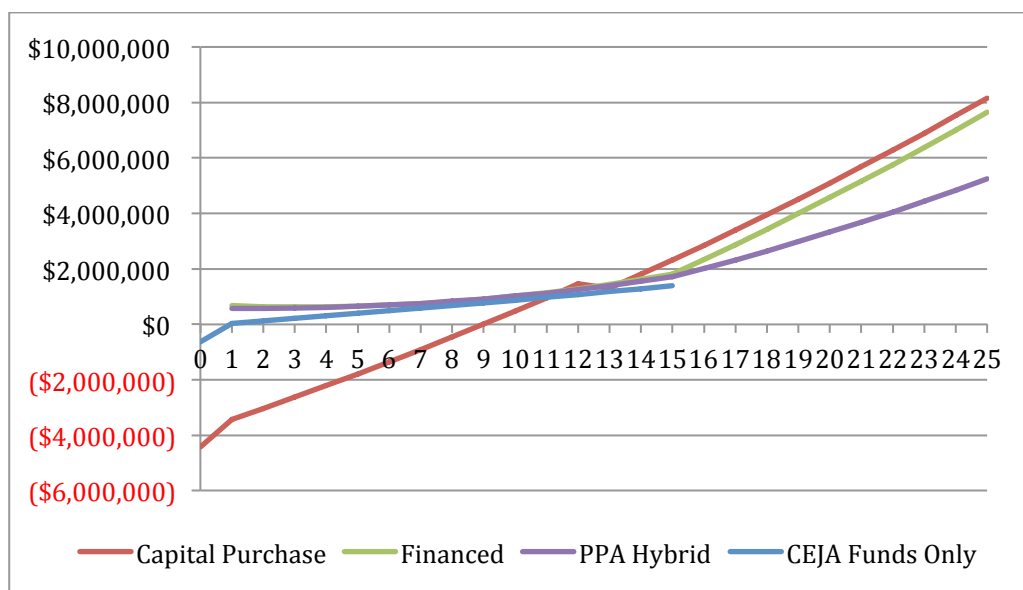
Power Purchase Agreement: A third-party builds, owns, operates and maintains the equipment and charges the District for the energy that is generated. There are no up-front costs to the District and no O&M obligations.

Each of these is discussed in detail below. Chart 1 shows the results of the LCC analysis for the Total column from Table 1. It also includes results for CEJA only projects, which consist of the lighting projects and a few of the HVAC projects.

¹ **Internal Rate of Return (IRR):** The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project.

² **Net Present Value (NPV):** The NPV estimates today's value of an investment, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. A positive NPV indicates that the investment made money in today's dollars.

Chart 1



The Capital purchase strategy (red) results in the highest upfront cost shown by the negative value at the left of the chart, but it also results in the greatest NPV, shown on the right of the chart. The financed strategy (green) has a positive cash flow starting in the first year, and also has a high NPV. The PPA option has a positive cash flow in the first year, but a lower overall NPV (note that the PPA Options is actually a hybrid of a PPA and financing, as discussed below), but the PPA removes the responsibility of maintenance and operations of the generation equipment from the District. Detailed LCCs for this Chart are included in Exhibit 5.

Each of these purchasing strategies offers the District a viable option for implementing an EMP that saves the District a significant amount of money on energy costs over the next 25 years.

Also included in the analysis are:

- Section 1: Discussion of the Energy Management Strategies.
- Section 2: Discussion of the Purchasing and Financing Strategies.
- Section 3: Conclusion and Next Steps
- Section 4: The discussion of additional energy management strategies that could be added this plan.

1. Energy Management Strategies

Each of the energy management strategies is discussed below. Each has a different expected life: Lighting = 12 years, Cogeneration = 15 years, HVAC = 18 years, and PV = 25 years. We have normalized the cash flow to 25 years for all strategies.

It is important to acknowledge that the equipment included in this analysis is not necessarily all of the equipment that the District will want to install or replace in an EMP.

For example, the lighting surveys were completed over a year ago, and technologies have changed and improved, which may result in additional items being added to the EMP.

- Lighting

The District had several lighting retrofit surveys completed in 2016. The most recent and most accurate was completed by Graybar Powersmart. Energy savings result from the replacement of high-pressure sodium, metal halide, mercury vapor fixtures, and fluorescent lighting with high efficiency LED. A complete list of the lighting recommendations is included in Exhibit 1.

There are a total of 527 fixtures identified for replacement. Costs are estimates included in the Smart Lights report. Table 2 summarizes the results of the LCC analysis by school, which is included in Exhibit 2.

Table 2

	Tam HS	Redwood	Drake	Total
Installed Cost	\$245,823	\$68,575	\$258,264	\$572,662
kWh Saved	127,611	39,875	129,613	297,100
Rebate	\$6,381	\$1,994	\$6,481	\$14,855
Prop 39 Funds	\$222,742	\$62,137	\$234,014	\$518,893
Net Cost	\$16,701	\$4,445	\$17,769	\$38,914
Annual Saved	\$36,278	\$8,103	\$38,325	\$82,706
IRR	45%	39%	45%	44%
NPV	\$850,205	\$173,439	\$899,715	\$1,923,359

The lighting LCC includes a second purchase of equipment in year 13 and no maintenance costs since the District would have maintenance related to the lighting regardless of whether the project is implemented or not. In fact, the lighting project will reduce maintenance costs.

- Cogeneration

Cogeneration refers to generating two sources of energy from one source of fuel. In this case, natural gas is used as a fuel for an engine that generates electricity, and the waste heat-energy from the engine is used to heat the pool.

Most cogeneration engines are small turbines, called micro-turbines, although there are versions that are standard reciprocating engines. A sample data sheet for a typical Microturbine is included as Exhibit 3. In the case of each high school, natural gas will be used to fire the turbine. The turbine will generate electricity and the waste heat that is generated by the operation of the turbine will be used to heat the pool. The systems are optimally sized so that the maximum amount of the waste heat can be captured and used for pool heating, which results in the highest efficiency and the greatest return on investment. Table 3 shows the estimated costs and savings of the three cogeneration projects.

Table 3

	Tam HS	Redwood	Drake	Total
Rated kW	65	65	65	195
Installed Cost	\$398,426	\$398,426	\$425,903	\$1,222,754
SGIP³ Rebate	\$39,000	\$39,000	\$39,000	\$117,000
Net Cost	\$359,426	\$359,426	\$386,903	\$1,105,754
kWh Generated	431,226	516,881	516,881	1,464,988
Net Savings	\$42,933	\$97,101	\$62,000	\$202,034
Annual Maintenance	\$6,468	\$7,753	\$7,753	\$21,975
Internal Rate of Return	10%	27%	15%	20%
Net Present Value	\$249,067	\$1,076,704	\$507,903	\$4,683,701

All of the cogeneration projects result in a good return on investment.

The installation of the cogeneration system at Redwood High School results in a better return on investment than for the other two schools because Redwood is on a PG&E A6 Rate, which creates more value for each unit of energy generated. An overview of PG&E rate information is included in Exhibit 4. The other two schools do not have the option of changing to the A6 rate due to changes in PG&E's tariff rules.

Tam HS presents a challenge because the school has many PG&E services. To make the project cost effective, the cogeneration system will need to be connected to PG&E account number 5918428056 because it is the account with the greatest amount of electricity use, which will maximize the projects return on investment. The actual location of this PG&E connection was not identified during the analysis.

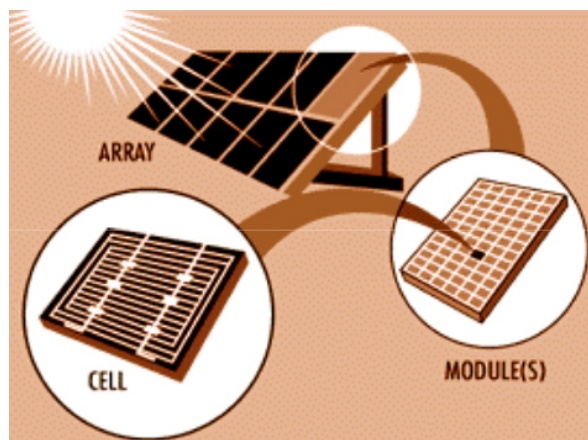
The installation at Drake is projected to cost more because of the location of the cogeneration unit and the challenges of interconnecting to the pool system water piping.

- Solar Photovoltaic Energy:

Photovoltaic (PV) arrays are made up of numerous PV modules, which in turn consist of several individual PV cells. Most PV systems have no moving parts. Sunlight is converted directly to useful energy within the PV cell.

A PV system is made up of the array, the mounting structure, one or more inverters that convert the PV system's DC voltage to AC, and a transformer to convert the voltage to the facility's operating voltage.

Grid-tied PV systems work in parallel with the utility's distribution system. This



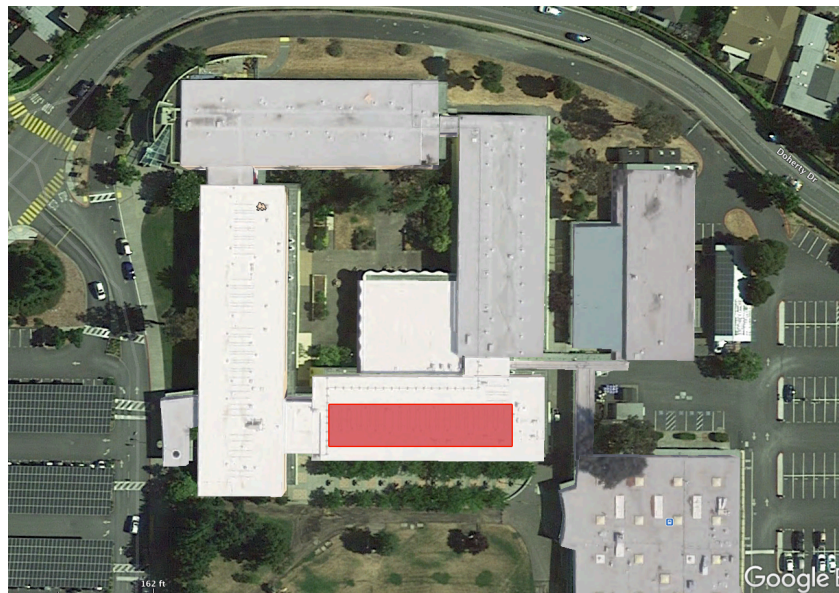
³ SGIP – Self Generation Incentive Program: provides rebates for onsite generation that meets the Programs efficiency standards. See: https://www.pge.com/pge_global/common/pdfs/solar-and-vehicles/your-options/solar-programs/self-generation-incentive-program/SGIP-Handbook.pdf

means that the voltage and current are synchronized to match that of the utility, and if the utility has a power outage, the PV system will not operate (for safety reasons).

The utility program that can make the installation of solar systems feasible is Net-Energy-Metering (NEM)⁴. Under NEM, when the system generates more energy than the facility needs, the utility meter “spins” backwards, and the facility receives the full retail value of the electricity. The retail value ranges from \$0.18 to \$0.28 per kWh, depending on the electric rate and how energy is used at the facility. The NEM program has changed recently and is now referred to as NEM2. The value of the energy on NEM2 is slightly reduced due to the introduction of “non-by-passable” charges.

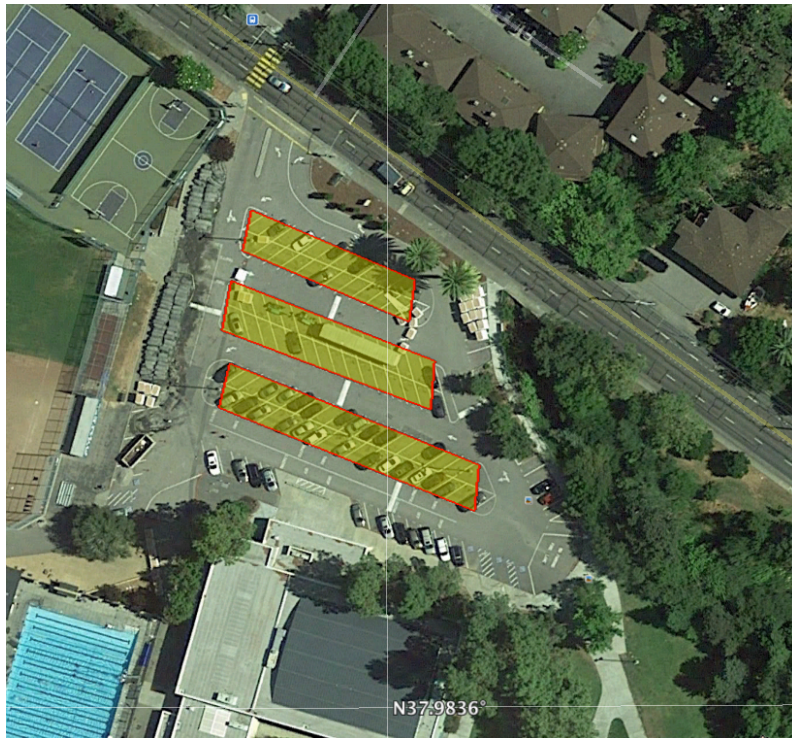
Redwood High School already has a fairly large PV system, which is on the original NEM program. As a result, the PV system size can only be increased by 10%, or 70.4 kW, without forcing the school to change to the new NEM2 program.

The following images show the proposed location of the PV systems at each facility. The Redwood addition is relatively small, and the roof is already prepped for the installation of solar. The Drake and Tam systems are proposed to be parking structures.



Redwood Roof Mounted

⁴ https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_SCHEDS_NEM2.pdf



Drake Parking Structures



Tam Paring Structures

Table 4 shows the results of the PV analysis.

Table 4

	Tam HS	Redwood	Drake	Total
Net Installed Cost	\$801,990	\$211,050	\$1,145,700	2,158,740
kW DC	200.5	70.4	286.4	557.3
Annual Energy - kWh	295,450	103,652	422,071	821,172
Value of Energy	\$47,606	\$25,171	\$76,336	\$149,112
BAU Energy Costs	\$68,082	\$242,884	\$194,347	\$505,313
Non By-Passable Charges	\$20,396	\$22,899	\$52,592	\$95,887
Max Savings	\$47,686	\$219,985	\$141,755	\$409,426
% of Max offset	99.8%	11.4%	53.9%	36.4%
Internal Rate of Return	2.0%	10.3%	3.2%	6.5%
Net Present Value	\$213,610	\$377,036	\$516,476	\$1,107,122

All three PV systems result in savings for the District. We have attempted to be conservative in the cost and savings estimates. Redwood High School has a better return on investment because it is on the PG&E A6 rate. Redwood is “grandfathered” in to the A6 rate, and that rate is not available to the other high schools.

- Heating, Ventilation, and Air Conditioning:

The District has a number of HVAC systems that are old and outdated. Kenwood Energy worked with the District Staff to identify equipment that is old and in need of replacement or upgrade at each school site. Exhibit 7 includes a list of the equipment included in this analysis. Table 5 shows the estimated costs and savings from the replacement of the equipment.

Table 5

	AC with Furnaces	Furnaces Only	Heat Pumps	Total
# of Units	20	28	22	70
Total Tons	72.5		80.5	153
BTU/Hr	1,705,000	1,988,000	-	3,693,000
Installed Cost	\$374,500	\$427,420	\$362,250	\$1,164,170
Estimated Savings	\$4,676	\$4,302	\$4,137	\$13,115
IRR	0%	0%	0%	-4%
NPV	\$(408,780)	\$(336,602)	\$(274,917)	\$(679,844)

HVAC projects do not result in a positive return on investment when considered from an investment-to-energy-savings perspective, but when they are combined with other EMP projects, the EMP can be used as a tool to replace problematic HVAC equipment, and still result in an overall economic benefit to the District.

- Systems Interaction:

Each of the technologies discussed above is considered as a stand-alone project, but the reality is that if they are implemented together the overall impact on each facility will be affected.

- Drake used about 1,065,000 kWh in 2017. The combination of energy efficiency, cogeneration, and PV will offset 100% of that use.
- Redwood used approximately 670,000 kWh of electricity in 2017. The combination of energy savings, cogeneration electricity, and PV electricity will offset 99% of that energy use.
- Tamalpais is unique in that there are seven electric accounts at the facility that use about 1,360,000 kWh annually in total. The PV system will offset 100% of the energy use for the account that serves the lower auditorium, and the cogeneration system will offset close to 100% of the energy at the PG&E service it is attached to, but in total the energy savings and generation will only offset 63% of the total energy use at the facility.

2. Purchasing and Financing Options

This project was initiated because the District still has about \$570,000 in CEJA funds that have not been spent. The funds have been secured through a combination of proposed lighting and HVAC projects. As discussed, the District is considering a more comprehensive EMP that can leverage the CEJA funds in combination with financing and or a PPA.

The analysis was completed for three common purchasing options for renewable energy systems:

- Capital Purchase
- Financing (Bonds, Leases, Loans, etc.)
- Power Purchase Agreement
- Capital Purchase

A Capital Purchase means the purchase of equipment through a capital project budget, just as the District would purchase any other piece of operating equipment. There is a significant initial cost, the District will own the system, and be responsible for operating and maintaining the equipment throughout its life, but this will typically result in the greatest economic return to the District.

- Financing

There are countless methods of financing energy management strategies, including: bonds, leases, government backed low interest loans, and other third party financing. For energy management projects, the District can often identify a funding mechanism that will result in payments that are lower than the energy savings that result from the project implementation.

- Power Purchase Agreement

A Power Purchase Agreement (PPA) is a method of “buying” equipment without having any out-of-pocket expenses. The selected vendor implements the project at no cost to the District, and charges the District for the energy produced. The vendor can take advantage of tax credits and accelerated depreciation, and pass the savings along to the

District. The advantages to the District are that payments to the vendor can be less than what the District is currently paying to the utility, the District has no out of pocket expenses, thus allowing the District to install equipment that it may not have otherwise had the funds to install. The challenge is that the PPA is a complex long-term contract that must be reviewed in detail by experts in the energy and legal sectors.

In this case we have considered a hybrid of a PPA and financing approach. PV and Cogeneration are conducive to a PPA structure, but lighting and HVAC retrofits are not. Therefore the analysis considers a PPA for the two generation sources, but financing for the lighting and HVAC replacements.

Table 6 shows the cumulative net present value of the investment for the basic CEJA project, and for the comprehensive EMP using each of the purchase options. The Capital Purchase and Financed options include costs for maintenance. The detailed cash flows are included in Exhibit 5.

Table 6

Year	CEJA Funded Projects	Capital Purchase	Financed	PPA Hybrid
0	(\$626,316)	(\$4,413,809)		
1	\$44,564	(\$3,433,796)	\$673,928	\$575,445
2	\$129,644	(\$3,033,115)	\$645,429	\$575,423
3	\$216,358	(\$2,624,202)	\$633,744	\$587,436
4	\$304,737	(\$2,206,896)	\$638,865	\$611,589
5	\$394,813	(\$1,781,029)	\$660,790	\$647,990
6	\$486,618	(\$1,346,433)	\$699,524	\$696,754
7	\$580,186	(\$902,934)	\$755,077	\$757,998
8	\$675,550	(\$450,357)	\$827,467	\$831,844
9	\$772,745	\$11,478	\$916,720	\$918,421
10	\$871,807	\$482,755	\$1,022,866	\$1,017,860
11	\$972,771	\$963,660	\$1,145,942	\$1,130,298
12	\$1,075,673	\$1,454,383	\$1,285,993	\$1,255,877
13	\$1,180,550	\$1,295,193	\$1,443,070	\$1,394,743
14	\$1,287,442	\$1,806,138	\$1,617,230	\$1,547,047
15	\$1,396,385	\$2,327,496	\$1,808,537	\$1,712,945
16		\$2,859,470	\$2,340,512	\$2,012,042
17		\$3,402,272	\$2,883,313	\$2,322,673
18		\$3,956,113	\$3,437,155	\$2,645,055
19		\$4,521,214	\$4,002,255	\$2,979,413
20		\$5,097,794	\$4,578,836	\$3,325,974
21		\$5,686,081	\$5,167,123	\$3,684,970
22		\$6,286,306	\$5,767,348	\$4,056,637
23		\$6,898,703	\$6,379,745	\$4,441,217
24		\$7,523,513	\$7,004,555	\$4,838,955
25		\$8,160,980	\$7,642,022	\$5,250,101

The CEJA-only projects are considered at a 15-year life, and do not include reinvestment for the lighting project in year 13. The total listing in the final year is the NPV of the investment.

3. Conclusions and Next Steps

The CEJA funds offer the District the opportunity to implement some energy reduction projects that have a very quick, nearly instant, payback. However, leveraging the CEJA funds with financing or a PPA allows the District to consider a much more comprehensive approach to energy management, and offset 100% of the energy use at two high schools and more than 60% of energy use at the other.

This analysis was completed as the first step in developing a preliminary scope for a comprehensive EMP. There are a number of steps that are required to take this analysis from concept to a completed plan that saves the District money on its energy costs.

- **Approve the Plan:** The District needs to weigh the advantages and disadvantages of implementing a plan that includes CEJA projects only, or is more comprehensive, and obtain Board approval of the general concept of an EMP, and to obtain direction on the next steps by the Board.
- **Determine the Appropriate Bidding Strategy:** EMPs can fall under California Government Code 4217.10 (Exhibit 8), which is often used by public agencies to implement EMPs through a Request for Qualifications (RFQ) process in which the District would select a preferred vendor to finalize the projects, develop the costs, and implement the project. However, Proposition 39 requires that the District go through a price competitive process in order to qualify for the funding, which would be a Request for Bid (RFB) or Request for Proposal (RFP) process. Kenwood Energy recommends the RFP process for the District because it provides cost information, and other proposal features that will allow the District to identify the best vendor for the project. This is the process that was used to implement the PV project at Redwood
- **Select the Vendor:** The vendor can be selected based on the results of their response to the District's RFQ / RFB / RFP process and on in-person interviews to ensure that the responses are complete and accurate.
- **Board Update #1:** The Board should be presented with a summary of the results of the competitive process, and a specific vendor should be recommended for the Board's approval. This step will typically include the need to sign a letter-of-intent with the selected vendor.
- **Updated Survey:** Once the vendor has been selected, the vendor should complete a detailed survey of each of the District's facilities and update the project scope based on the survey results and discussions with District Staff.
- **Update the EMP and Life Cycle Cost:** Based on the results of the updated survey, an updated LCCs analysis should be completed for consideration by the District.
- **Update Purchase Strategies:** The vendor and District staff should obtain firm proposal from different financing institutions that include Leases, Bonds, PPAs, etc., so that the best solution for the District can be identified.
- **Board Update #2:** At this point, Staff should update the Board and recommend a final project scope and funding strategy for approval.

- Implement the Plan: A project of this scope will likely take a year to implement and will require a significant amount of time and effort by District Staff.

4. Additional Energy Management Strategies

The scope of this analysis only includes lighting, HVAC, cogeneration, and PV, and Section 3 discusses the selection of the contractor. If the District is implementing a comprehensive EMP, the selected vendor should update this analysis to ensure that all viable projects are included. Following is a list of some additional strategies to consider.

- Theater Lighting: Theater lighting is usually a very high wattage incandescent light, which is very inefficient and gives off a great deal of heat. New theater lighting systems have been developed that use LED technologies that provide the same lighting without giving off the heat, savings both in lighting and in air conditioning.
- Boilers: The District has a number of boilers that are used for heating domestic hot water and pool heating. New boilers are available that have much higher efficiencies, although they typically require some additional maintenance.
- Classroom Lighting: Classroom lighting is typically a modern fluorescent light that is reasonably efficient. However, LED technologies have made significant improvements over the last few years and LED classroom lighting may be a feasible technology at this time.
- Additional HVAC: District staff may identify some additional units that are problematic or at the end of their useful lives.
- Controls: HVAC and Lighting controls can be installed to provide additional comfort and control of equipment, and may result in energy savings too.
- Battery Storage: Storage of energy is being a viable option for EMP, but the economic return must be evaluated on a case by case basis, and due-diligence of the battery control system is key to ensuring savings are achieved.
- Marin Clean Energy: Marin Clean Energy is a local energy supplier that the District can choose to provide its energy. The energy is typically a little less expensive than PG&E, and it has lower greenhouse gas emissions. The energy will still be transmitted and distributed to the District by PG&E lines, and will have the same reliability as all other PG&E service in the territory.

Exhibit 1
Lighting Retrofits

Existing Fixture Type	Tam Fixtures	Drake Fixtures	Redwood Fixtures
2 lamp F32 Vapor tight Fixture	0	8	32
1000W 20' pole light Redwood HS	0	0	10
150W MH Full Cut off	5	0	0
150W Pole light	0	0	5
2 foot F17 single lamp retrofit	0	0	6
250W Full Cut Off Wall Pack	57	16	0
250W MH Parking Pole	23	17	20
3 lamp T8 2x4 fixture	0	36	0
400W Flood	3	3	0
400W Full Cut off Wall Pack	4	34	0
70W MH cut off wall pack	6	15	0
70W MH Lamp	6	75	0
Gym 250W MH High Bay	20	0	0
Gyms 400W MH High bay	44	38	0
Pool Pole Lights 1000W Drake and TAM	16	16	0
Student Center 250W MH Lamp Replacement	0	12	0
Total	184	270	73

Exhibit 2
Life Cycle Costs

Exhibit 3
Micro Turbine Data Sheet

EXHIBIT 4

PG&E RATE INFORMATION

Renewable Energy systems often generate energy at a time that coincides with high utility rates. PG&E has several rates that may apply to a customer class. In some cases the rates are mandatory, depending on the building size and the facility's power demand. In other cases there may be as many as four rate options.

PG&E has two types of electric rates: time-of-use (TOU) rates and flat rates. On a flat rate, the cost for each unit of energy (kWh) and/or demand (kW) that the facility requires remains the same regardless of what time of day the energy is used. The only variation in price occurs during seasonal changes, i.e. costs are lower in the winter months as compared to the summer months. Flat rates are best suited for facilities that operate during standard weekday hours. In PG&E's service territory, flat rates include the A1 and A10 rates.

Time-of-use rates charge different amounts based on the time of the day the energy is used. Higher costs are incurred during the peak period of the day when the demand on the utility's electric system is highest (i.e., noon to 6:00 p.m. summer weekdays). These rates are best suited for facilities that can shift a large portion of their load to the off-peak hours, are already using a significant amount of energy at night and on weekends, or have a 24-hour operation. TOU rates include the A6, A10SX, E19, and E20 rates.

Another notable variation in rates is that rates for smaller facilities only charge for energy (kWh), while rates for larger facilities also have power charges (kW). A1 and A6 are rates that only have energy charges, while A10 and E19 also have demand charges. The best rate for a specific facility depends on how much power and energy demand it has, and when the power and energy are used.

Investor owned utilities, such as PG&E, are regulated by the California Public Utilities Commission. Each utility will apply for changes to their rates several times per year. PG&E has changed its rates an average of four times per year over the last 15 years. Occasionally, the changes will result in lower rates, but the majority of the changes result in increase rates. The rates that the District Facilities are on have increased by an average of ~5% per year.

EXHIBIT 5
Cash Flows

EXHIBIT 6
Table Headings

Table 1	
Installed Cost	Gross estimated cost
Rebate	Financial incentives to offset initial costs, from PG&E or the CEC Self Generation Incentive Program
CEJA Funding	Funds from the Clean Energy Jobs Act that are designated for the project.
Net Cost	The Gross costs less any incentives
Added Maintenance \$	Projected annual maintenance costs
Annual Savings	Annual cost savings
IRR	The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project.
Equipment Life	The industry-accepted life of the equipment
NPV	The NPV estimates today's value of an investment, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. A positive NPV indicates that the investment made money in today's dollars.

Table 2	
Installed Cost	Gross estimated cost
kWh Saved	Estimated annual energy savings in kWh
Rebate	Financial incentives to offset initial costs, from PG&E or the CEC Self Generation Incentive Program
Prop 39 Funds	Funds from the Clean Energy Jobs Act that are designated for the project.
Net Cost	The Gross costs less any incentives
Annual Saved	Annual cost savings
IRR	The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project.
NPV	The NPV estimates today's value of an investment, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. A positive NPV indicates that the investment made money in today's dollars.

Table 3

Rated kW	Rated kW of the Cogeneration systems that was analyzed
Gross Cost	Gross estimated cost
SGIP	Self Generation Incentive Program rebate
Net Cost	The Gross costs less any incentives
kWh Generated	Annual Energy Generated
Net Savings	Net savings includes the electricity savings, pool heating savings, less the cost of the natural gas
Annual Maintenance	Projected annual maintenance costs
Internal Rate of Return	The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project.
Net Present Value	The NPV estimates today's value of an investment, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. A positive NPV indicates that the investment made money in today's dollars.

Table 4

Net Installed Cost	Net Cost of the system
kW DC	Rated output of the PV panels
Annual Energy - kWh	The annual energy generated
Value of Energy	Annual savings that the School will realize
BAU Energy Costs	Business as Usual Energy Costs - What the District would have paid without the installation of PV
Non By-Passable Charges	PG&E charges that cannot be offset by the installation of solar energy.
Max Savings	The BAU energy cost less the NBCs
% of Max offset	The percent of Max Savings that are offset by the Value of the Energy
Internal Rate of Return	The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project.
Net Present Value	The NPV estimates today's value of an investment, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. A positive NPV indicates that the investment made money in today's dollars.

Table 5	
# of Units	The quantity of the specified type of equipment that is identified for replacement
Total Tons	This is a rating system for air conditioning the specifies the size of a piece of equipment
BTU/Hr	The rating system of heating equipment
Installed Cost	Net Cost of the system
Estimated Savings	Annual cost savings
IRR	The IRR represents the annualized return that will be realized from making an investment, taking into account inflation rates, depreciation, loan payments, and the life of the project.
NPV	The NPV estimates today's value of an investment, taking into account estimates for the inflation in the cost of electricity, loan payments, inflation, and the life of the project. A positive NPV indicates that the investment made money in today's dollars.

EXHIBIT 7
HVAC Equipment

EXHIBIT 8
California Code 4217.10

CALIFORNIA CODES
GOVERNMENT CODE
SECTION 4217.10-4217.18

4217.10. To help implement the policy set forth in Section 25008 of the Public Resources **Code**, and to extend that policy to facilities of local governments, public agencies may develop energy conservation, cogeneration, and alternate energy supply sources at the facilities of public agencies in accordance with this chapter.

4217.11. The following terms, whenever used in this chapter, have the meanings given in this section, except where the context clearly indicates otherwise: (a) "Alternate energy equipment" means equipment for the production or conversion of energy from alternate sources as its primary fuel source, such as solar, biomass, wind, geothermal, hydroelectricity under 30 megawatts, remote natural gas of less than one billion cubic feet estimated reserves per mile from an existing gas gathering line, natural gas containing 850 or fewer British Thermal Units per standard cubic foot, or any other source of energy, the efficient use of which will reduce the use of fossil or nuclear fuels.

(b) "Cogeneration equipment" means equipment for cogeneration, as defined in Section 218.5 of the Public Utilities **Code**.

(c) "Conservation measures" means equipment, maintenance, load management techniques and equipment, or other measures to reduce energy use or make for a more efficient use of energy.

(d) "Conservation services" means the electrical, thermal, or other energy savings resulting from conservation measures, which shall be treated as a supply of such energy.

(e) "Energy conservation facility" means alternate energy equipment, cogeneration equipment, or conservation measures located in public buildings or on land owned by public agencies.

(f) "Energy service contract" means a contract entered into by a public agency with any person, pursuant to which the person will provide electrical or thermal energy or conservation services to a public agency from an energy conservation facility.

(g) "Facility financing contract" means a contract entered into by a public agency with any person whereby the person provides financing for an energy conservation facility in exchange for repayment of the financing and all costs and expenses related thereto by the public agency. A facility financing contract may provide for the person with whom the public agency contracts to provide any combination of feasibility studies for, and design and construction of, all or part of the energy conservation facility in addition to the financing and other related services, and may provide for an installment sale purchase, another form of purchase, or amortized lease of the energy conservation facility by the public agency.

(h) "Facility ground lease" means a lease of all, or any portion of, land or a public building owned by, or under lease to, a public agency to a person in conjunction with an energy service contract or a facility financing contract. A facility ground lease may include, in addition to the land on which energy conservation facilities will be located, easements, rights-of-way, licenses, and rights of access, for the construction, use, or ownership by the person of the facility and all related utility lines not owned or controlled by the interconnecting utility, and offsite improvements related thereto. A facility ground lease may also include the addition or improvement of utility lines and equipment owned by the interconnecting utility which are necessary to permit interconnection between that utility and an energy conservation facility.

(i) "Person" means, but is not limited to, any individual, company, corporation, partnership, limited liability company, public agency, association, proprietorship, trust, joint venture, or other entity or group of entities.

(j) "Public agency" means the state, a county, city and county, city, district, community college district, school district, joint powers authority or other entity designated or created by a political subdivision relating to energy development projects, and any other political subdivision or public corporation in the state.

(k) "Public building" includes any structure, building, facility, or work which a public agency is authorized to construct or use, and automobile parking lots, landscaping, and other facilities, including furnishings and equipment, incidental to the use of any structure, building, facility, or work, and also includes the site thereof, and any easements, rights-of-way appurtenant thereto, or necessary for its full use.

4217.12. (a) Notwithstanding any other provision of law, a public agency may enter into an energy service contract and any necessarily related facility ground lease on terms that its governing body determines are in the best interests of the public agency if the determination is made at a regularly scheduled public hearing, public notice of which is given at least two weeks in advance, and if the governing body finds:

(1) That the anticipated cost to the public agency for thermal or electrical energy or conservation services provided by the energy conservation facility under the contract will be less than the anticipated marginal cost to the public agency of thermal, electrical, or other energy that would have been consumed by the public agency in the absence of those purchases.

(2) That the difference, if any, between the fair rental value for the real property subject to the facility ground lease and the agreed rent, is anticipated to be offset by below-market energy purchases or other benefits provided under the energy service contract.

(b) State agency heads may make these findings without holding a public hearing.

4217.13. Notwithstanding any other provision of law, a public agency may enter into a facility financing contract and a facility ground lease on terms that its governing body determines are in the best interest of the public agency if the determination is made at a regularly scheduled public hearing, public notice of which is given at least two weeks in advance, and if the governing body finds that funds for the repayment of the financing or the cost of design, construction, and operation of the energy conservation facility, or both, as required by the contract, are projected to be available from revenues resulting from sales of electricity or thermal energy from the facility or from funding that otherwise would have been used for purchase of electrical, thermal, or other energy required by the public agency in the absence of the energy conservation facility, or both. State agency heads may make these findings without holding a public hearing.

4217.14. Notwithstanding any other provision of law, the public agency may enter into contracts for the sale of electricity, electrical generating capacity, or thermal energy produced by the energy conservation facility at such rates and on such terms as are approved by its governing body. Any such contract may provide for a commitment of firm electrical capacity.

4217.15. The public agency may, but is not required to, base the findings required under Sections **4217.12** and **4217.13** on projections for electrical and thermal energy rates from the following sources:

(a) The public utility which provides thermal or electrical energy to the public agency.

(b) The Public Utilities Commission.

(c) The State Energy Resources Conservation and Development Commission.

(d) The projections used by the Department of General Services for evaluating the feasibility of energy conservation facilities at state facilities located within the same public utility service area as the public agency.

4217.16. Prior to awarding or entering into an agreement or lease, the public agency may request proposals from qualified persons. After evaluating the proposals, the public agency may award the contract on the basis of the experience of the contractor, the type of technology employed by the contractor, the cost to the local agency, and any other relevant considerations.

The public agency may utilize the pool of qualified energy service companies established pursuant to Section 388 of the Public Utilities **Code** and the procedures contained in that section in awarding the contract.

4217.17. This chapter does not limit the authority of any public agency to construct energy conservation projects or to enter into other leases or contracts relating to the financing construction, operation, or use of alternate energy type facilities in any manner authorized under existing law. This chapter shall not be construed to abrogate Section 14671.6.

4217.18. The provisions of this chapter shall be construed to provide the greatest possible flexibility to public agencies in structuring agreements entered into hereunder so that economic benefits may be maximized and financing and other costs associated with the design and construction of alternate energy projects may be minimized. To this end, public agencies and the entities with whom they contract under this chapter should have great latitude in characterizing components of energy conservation facilities as personal or real property and in granting security interests in leasehold interests and components of the alternate energy facilities to project lenders.

Attachment 1

Memo-TUHSD-Pool Solar Heat-150630

Dated June 30, 2015

Memo

To: David O'Connor
CC: Omar Pena
From: Tim Holmes
Date: June 30, 2015
Subject: Solar Pool Heating

Hi David,

Following are the results of the analysis for solar pool heating at each school. The analysis takes advantage of roof space that is directly over, or adjacent to, the pool equipment rooms. For Redwood and Drake, there appears to be enough space to make a significant impact on the heating costs. At Tam, the roof space is limited, so the impact on cost is relatively small.

	Redwood HS Solar Hot Water	Drake HS Solar Hot Water	Tam HS Solar Hot Water
Square Feet of Panels	2,976	2,160	960
Therms Saved	9,707	7,045	3,131
KwH Saved (Used)	(2,633)	(2,633)	(2,633)
Cost Savings	\$10,256	\$7,328	\$3,023
Installation Cost	\$49,600	\$36,000	\$16,000
Estimated Rebate	\$9,707	\$7,045	\$3,131
Net Cost	\$39,893	\$28,955	\$12,869
SPB	3.89	3.95	4.26
IRR	27.0%	26.5%	24.2%
NPV	\$118,316	\$83,673	\$32,729
GHG Savings (lbs)	111,648	80,674	35,124

Additional solar would be beneficial in all cases, so the Proposition 39 Expenditure plan should include a significant cost contingency to allow for increased system size, if possible.

Following are images of each of the pools with the proposed installation areas identified. Please let me know if you have any questions.



